Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

**CMD 26-H7.39-Ref2**

Date: 2026-08-12

**Reference from the Canadian Environmental Law Association**

In the matter of

**Ontario Power Generation**

Application to refurbish Pickering Nuclear Generating Station and to renew licences for the Pickering Nuclear Generating Station and Waste Management Facility

**Commission Public Hearing Part 2**

October 2026

**Référence de l'Association canadienne du droit de l'environnement**

À l'égard de

**Ontario Power Generation**

Demande concernant la réfection de la centrale nucléaire de Pickering et le renouvellement de ses permis pour la centrale et l'installation de gestion des déchets

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**DURHAM NUCLEAR AWARENESS, SLOVENIAN HOME ASSOCIATION & THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION**

***APPENDIX B: SUPPORTING DOCUMENTS FOR SUBMISSION TITLED:***
"***Comments on the Ontario Power Generation's Application to Refurbish Pickering Nuclear Generating Station Units 5–8 and to Renew the Pickering Nuclear Generating Station and Pickering Waste Management Facility Operating Licences"***

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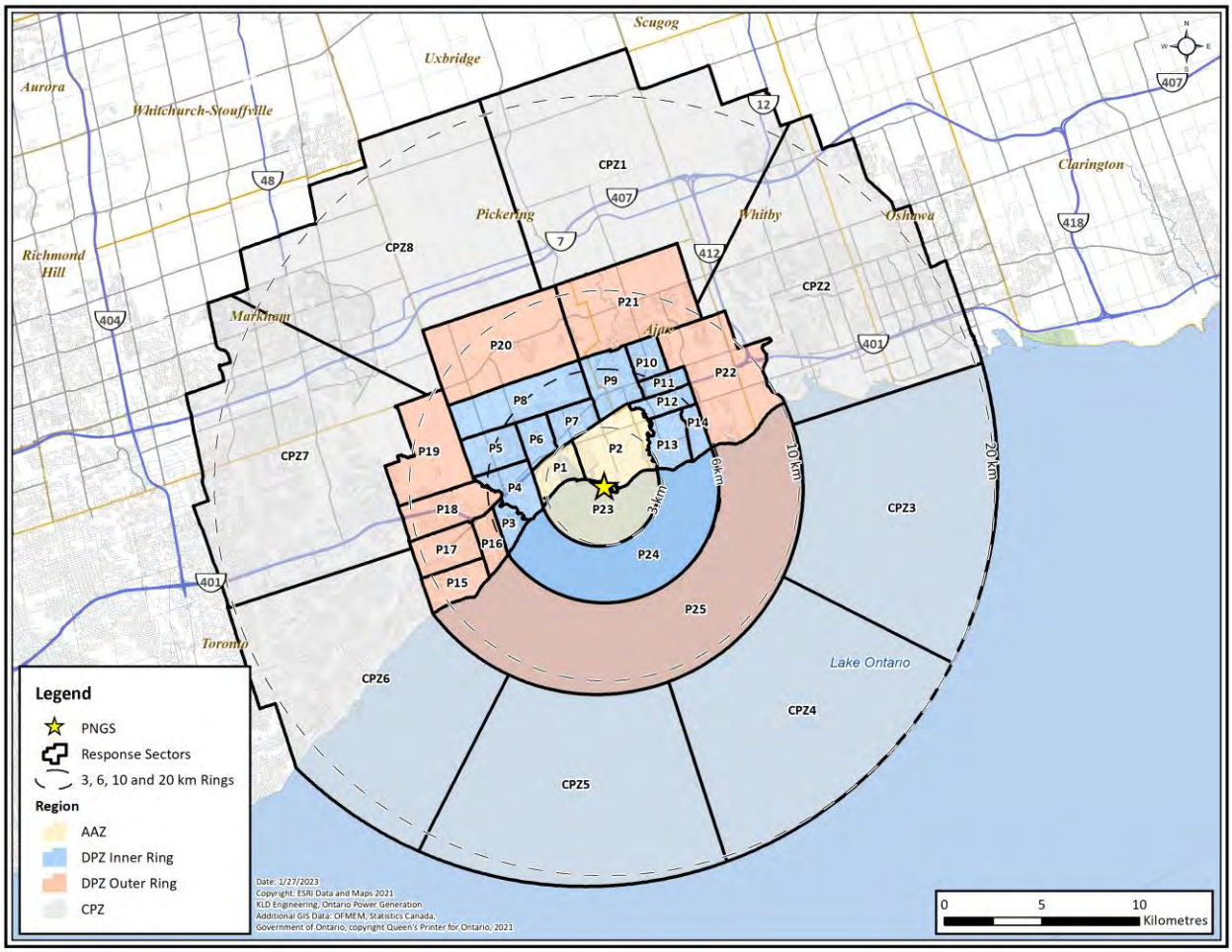
KLD ENGINEERING, P.C.

# *PICKERING NUCLEAR GENERATING STATION*

## *Development of Evacuation Time Estimates*

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**March 24, 2023** **Final Report, Rev. 0** **KLD TR – 1309**

# Table of Contents


1 INTRODUCTION ..... 1-1

1.1 Overview of the ETE Process ..... 1-1
1.2 The Pickering Nuclear Generating Station (PNGS) Location ..... 1-3
1.3 Preliminary Activities ..... 1-3
1.4 Comparison with Prior ETE Study ..... 1-6

2 STUDY ESTIMATES AND ASSUMPTIONS ..... 2-1

2.1 Data Estimates ..... 2-1
2.2 Study Methodological Assumptions ..... 2-3
2.3 Assumptions on Mobilization Times ..... 2-4
2.4 Transit Dependent Assumptions ..... 2-5
2.5 Diversion Traffic and Access Control Assumptions ..... 2-7
2.6 Scenarios and Regions ..... 2-8

3 DEMAND ESTIMATION ..... 3-1

3.1 Permanent Residents ..... 3-2
3.2 Shadow Population ..... 3-3
3.3 Transient Population ..... 3-3
3.4 Employees ..... 3-4
3.5 Special Facilities Population Demand ..... 3-6
3.5.1 Medical Facilities ..... 3-6
3.5.2 Correctional Facilities ..... 3-6
3.6 School, College/University, and Summer Day Camps Population Demand ..... 3-7
3.6.1 Commuter Colleges and Universities ..... 3-8
3.6.2 Summer Day Camps ..... 3-14
3.7 Transit Dependent Population ..... 3-14
3.8 Special Event ..... 3-16
3.9 External Traffic ..... 3-17
3.10 Background Traffic ..... 3-17
3.11 Heavy Vehicles ..... 3-18
3.12 Summary of Demand ..... 3-19

4 ESTIMATION OF HIGHWAY CAPACITY ..... 4-1

4.1 Capacity Estimations on Approaches to Intersections ..... 4-3
4.2 Capacity Estimation along Sections of Highway ..... 4-4
4.3 Application to the PNGS Planning Zone ..... 4-6
4.3.1 Two-Lane Roads ..... 4-6
4.3.2 Multilane Highway ..... 4-6
4.3.3 Freeways ..... 4-7
4.3.4 Intersections ..... 4-8
4.4 Simulation and Capacity Estimation ..... 4-8
4.5 Boundary Conditions ..... 4-9

5 ESTIMATION OF TRIP GENERATION/MOBILIZATION TIME ..... 5-1

5.1 Background ..... 5-1
5.2 Fundamental Considerations ..... 5-3
5.3 Estimated Time Distributions of Activities Preceding Event 5 ..... 5-4
5.4 Calculation of Trip Generation Time Distribution ..... 5-5
5.4.1 Statistical Outliers ..... 5-6
5.4.2 Staged Evacuation Trip Generation ..... 5-8
5.4.3 Trip Generation for Waterways and Recreational Areas ..... 5-10
6 EVACUATION CASES ..... 6-1
7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE) ..... 7-1
7.1 Voluntary Evacuation and Shadow Evacuation ..... 7-1
7.2 Staged Evacuation ..... 7-2
7.3 Patterns of Traffic Congestion during Evacuation of the DPZ ..... 7-2
7.4 Patterns of Traffic Congestion during Evacuation of all Planning Zones ..... 7-4
7.5 Evacuation Rates ..... 7-6
7.6 Evacuation Time Estimate (ETE) Results ..... 7-7
7.7 Staged Evacuation Results ..... 7-9
7.8 Guidance on Using ETE Tables ..... 7-10
8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES ..... 8-1
8.1 ETEs for Schools, Transit-Dependent People, and Special Facilities ..... 8-2
9 TRAFFIC MANAGEMENT STRATEGY ..... 9-1
9.1 Assumptions ..... 9-2
9.2 Additional Considerations ..... 9-2
10 EVACUATION ROUTES ..... 10-1

## List of Appendices

A. GLOSSARY OF TRAFFIC ENGINEERING TERMS ..... A-1
B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL ..... B-1
B.1 Overview of Integrated Distribution and Assignment Model ..... B-1
B.2 Interfacing the DYNEV Simulation Model with DTRAD ..... B-2
B.2.1 DTRAD Description ..... B-2
B.2.2 Network Equilibrium ..... B-4
C. DYNEV TRAFFIC SIMULATION MODEL ..... C-1
C.1 Methodology ..... C-2
C.1.1 The Fundamental Diagram ..... C-2
C.1.2 The Simulation Model ..... C-2
C.1.3 Lane Assignment ..... C-6
C.2 Implementation ..... C-6
C.2.1 Computational Procedure ..... C-6
C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD) ..... C-7
D. DETAILED DESCRIPTION OF STUDY PROCEDURE ..... D-1

E. SPECIAL FACILITY DATA ..... E-1
F. DEMOGRAPHIC SURVEY ..... F-1
F.1 Introduction ..... F-1
F.2 Survey Instrument and Sampling Plan ..... F-1
F.3 Survey Results ..... F-2
F.3.1 Household Demographic Results ..... F-2
F.3.2 Evacuation Response ..... F-4
F.3.3 Time Distribution Results ..... F-5
F.3.4 Emergency Communications ..... F-7
G. TRAFFIC MANAGEMENT PLAN ..... G-1
G.1 Traffic Control Points ..... G-1
G.2 Access Control Points ..... G-1
H. EVACUATION REGIONS ..... H-1
J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM ..... J-1
K. EVACUATION ROADWAY NETWORK ..... K-1
L. RESPONSE SECTOR BOUNDARIES ..... L-1
M. EVACUATION SENSITIVITY STUDIES ..... M-1
M.1 Effect of Changes in Trip Generation Times ..... M-1
M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate ..... M-1
M.3 Effects of Changes in Access Control Establish Time ..... M-2
M.4 Future Year Evacuation Time Estimates ..... M-2
M.4.1 Assumptions ..... M-2
M.4.2 Methodology ..... M-3
M.4.3 Results ..... M-4
M.5 Enhancements in Evacuation Time ..... M-5
N. ETE CRITERIA CHECKLIST ..... N-1

*Note: Appendix I intentionally skipped*

# List of Figures

Figure 1-1. PNGS Location ..... 1-14
Figure 1-2. PNGS Link-Node Analysis Network ..... 1-15
Figure 2-1. Voluntary Evacuation Methodology ..... 2-11
Figure 3-1. Response Sectors Comprising the PNGS PZs ..... 3-49
Figure 3-2. Census Subdivision Boundaries within the PNGS Study Area ..... 3-50
Figure 3-3. Permanent Resident Population within the DPZ by Sector ..... 3-51
Figure 3-4. Permanent Resident Population within the CPZ by Sector ..... 3-52
Figure 3-5. Permanent Resident Vehicles within the DPZ by Sector ..... 3-53
Figure 3-6. Permanent Resident Vehicles within the CPZ by Sector ..... 3-54
Figure 3-7. Transient Population within the DPZ by Sector ..... 3-55
Figure 3-8. Transit Population within the CPZ by Sector ..... 3-56
Figure 3-9. Transient Vehicles within the DPZ by Sector ..... 3-57
Figure 3-10. Transient Vehicles within the CPZ by Sector ..... 3-58
Figure 3-11. Employee Population within the DPZ by Sector ..... 3-59
Figure 3-12. Employee Population within the CPZ by Sector ..... 3-60
Figure 3-13. Employee Vehicles within the DPZ by Sector ..... 3-61
Figure 3-14. Employee Vehicles within the CPZ by Sector ..... 3-62
Figure 4-1. Fundamental Diagrams ..... 4-10
Figure 5-1. Events and Activities Preceding the Evacuation Trip ..... 5-18
Figure 5-2. Time Distributions for Evacuation Mobilization Activities ..... 5-19
Figure 5-3. Comparison of Data Distribution and Normal Distribution ..... 5-20
Figure 5-4. Comparison of Trip Generation Distributions ..... 5-21
Figure 5-5. Comparison of Staged and Un-staged
Trip Generation Distributions in the 3 to 10 km Region ..... 5-22
Figure 6-1. Response Sectors Comprising the PNGS PZs ..... 6-10
Figure 7-1. Voluntary Evacuation Methodology ..... 7-23
Figure 7-2. PNGS Shadow Region ..... 7-24
Figure 7-3. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R03) ..... 7-25
Figure 7-4. Congestion Patterns at 1 Hour after the Emergency Bulletin (R03) ..... 7-26
Figure 7-5. Congestion Patterns at 2 Hours and 30 Minutes after the Emergency Bulletin (R03) ..... 7-27
Figure 7-6. Congestion Patterns at 4 Hours and 30 Minutes after the Emergency Bulletin (R03) ..... 7-28
Figure 7-7. Congestion Patterns at 6 Hours after the Emergency Bulletin (R03) ..... 7-29
Figure 7-8. Congestion Patterns at 7 Hours after the Emergency Bulletin (R03) ..... 7-30
Figure 7-9. Congestion Patterns at 7 Hours and 30 Minutes after the Emergency Bulletin (R03) ..... 7-31
Figure 7-10. Congestion Patterns at 8 Hours and 30 Minutes after the Emergency Bulletin (R03) ..... 7-32
Figure 7-11. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R04) ..... 7-33
Figure 7-12. Congestion Patterns at 2 Hours after the Emergency Bulletin (R04) ..... 7-34
Figure 7-13. Congestion Patterns at 4 Hours after the Emergency Bulletin (R04) ..... 7-35
Figure 7-14. Congestion Patterns at 6 Hours after the Emergency Bulletin (R04) ..... 7-36
Figure 7-15. Congestion Patterns at 8 Hours after the Emergency Bulletin (R04) ..... 7-37
Figure 7-16. Congestion Patterns at 9 Hours and 30 Minutes after the Emergency Bulletin (R04) ..... 7-38
Figure 7-17. Congestion Patterns at 11 Hours after the Emergency Bulletin (R04) ..... 7-39
Figure 7-18. Congestion Patterns at 12 Hours and 30 Minutes after the Emergency Bulletin (R04) ..... 7-40
Figure 7-19. Evacuation Time Estimates - Scenario 1 for Region R03 & R04 ..... 7-41
Figure 7-20. Evacuation Time Estimates - Scenario 2 for Region R03 & R04 ..... 7-41

Figure 7-21. Evacuation Time Estimates - Scenario 3 for Region R03 & R04 ..... 7-42
Figure 7-22. Evacuation Time Estimates - Scenario 4 for Region R03 & R04 ..... 7-42
Figure 7-23. Evacuation Time Estimates - Scenario 5 for Region R03 & R04 ..... 7-43
Figure 7-24. Evacuation Time Estimates - Scenario 6 for Region R03 & R04 ..... 7-43
Figure 7-25. Evacuation Time Estimates - Scenario 7 for Region R03 & R04 ..... 7-44
Figure 7-26. Evacuation Time Estimates - Scenario 8 for Region R03 & R04 ..... 7-44
Figure 7-27. Evacuation Time Estimates - Scenario 9 for Region R03 & R04 ..... 7-45
Figure 7-28. Evacuation Time Estimates - Scenario 10 for Region R03 & R04 ..... 7-45
Figure 7-29. Evacuation Time Estimates - Scenario 11 for Region R03 & R04 ..... 7-46
Figure 7-30. Evacuation Time Estimates - Scenario 12 for Region R03 & R04 ..... 7-46
Figure 7-31. Evacuation Time Estimates - Scenario 13 for Region R03 & R04 ..... 7-47
Figure 7-32. Evacuation Time Estimates - Scenario 14 for Region R03 & R04 ..... 7-47
Figure 8-1. Chronology of Transit Evacuation Operations ..... 8-36
Figure 10-1. Major Evacuation Routes ..... 10-15
Figure 10-2. Durham Region Transit Transit-Dependent Routes (1 of 3) ..... 10-16
Figure 10-3. Durham Region Transit Transit-Dependent Routes (2 of 3) ..... 10-17
Figure 10-4. Durham Region Transit Transit-Dependent Routes (3 of 3) ..... 10-18
Figure 10-5. GO Transit Transit-Dependent Routes ..... 10-19
Figure 10-6. Toronto Transit Commission Transit-Dependent Routes (1 of 3) ..... 10-20
Figure 10-7. Toronto Transit Commission Transit-Dependent Routes (2 of 3) ..... 10-21
Figure 10-8. Toronto Transit Commission Transit-Dependent Routes (3 of 3) ..... 10-22
Figure 10-9. York Region Transit Transit-Dependent Routes (1 of 2) ..... 10-23
Figure 10-10. York Region Transit Transit-Dependent Routes (2 of 2) ..... 10-24
Figure B-1. Flow Diagram of Simulation-DTRAD Interface ..... B-5
Figure C-1. Representative Analysis Network ..... C-12
Figure C-2. Fundamental Diagrams ..... C-13
Figure C-3. A UNIT Problem Configuration with $t_1 > 0$ ..... C-13
Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3) ..... C-14
Figure D-1. Flow Diagram of Activities ..... D-5
Figure E-1. Schools within the PNGS PZ – Overview ..... E-38
Figure E-2. Schools within the Ajax Portion of the PNGS PZ ..... E-39
Figure E-3. Schools within the Markham Portion of the PNGS PZ ..... E-40
Figure E-4. Schools within the Oshawa Portion of the PNGS PZ ..... E-41
Figure E-5. Schools within the Pickering Portion of the PNGS PZ ..... E-42
Figure E-6. Schools within the Toronto Portion of the PNGS PZ (1 of 5) ..... E-43
Figure E-7. Schools within the Toronto Portion of the PNGS PZ (2 of 5) ..... E-44
Figure E-8. Schools within the Toronto Portion of the PNGS PZ (3 of 5) ..... E-45
Figure E-9. Schools within the Toronto Portion of the PNGS PZ (4 of 5) ..... E-46
Figure E-10. Schools within the Toronto Portion of the PNGS PZ (5 of 5) ..... E-47
Figure E-11. Schools within the Whitby Portion of the PNGS PZ ..... E-48
Figure E-12. Colleges and Universities within the PNGS PZ ..... E-49
Figure E-13. Day Camps within the PNGS PZ – Overview ..... E-50
Figure E-14. Day Camps within the Western Portion of the PNGS PZ ..... E-51
Figure E-15. Day Camps within the Eastern Portion of the PNGS PZ ..... E-52
Figure E-16. Medical Facilities within PNGS PZ – Overview ..... E-53
Figure E-17. Medical Facilities within the Western Portion of the PNGS PZ ..... E-54
Figure E-18. Medical Facilities within the Eastern Portion of the PNGS PZ ..... E-55

Figure E-19. Major Employers within the PNGS PZ ..... E-56
Figure E-20. Beaches, Campgrounds and Parks within the PNGS PZ ..... E-57
Figure E-21. Golf Courses within the PNGS PZ ..... E-58
Figure E-22. Historic Sites and Museums within the PNGS PZ ..... E-59
Figure E-23. Marinas and Other Recreational Areas within the PNGS PZ ..... E-60
Figure E-24. Lodging Facilities within the PNGS PZ – Overview ..... E-61
Figure E-25. Lodging Facilities within the Western Portion of the PNGS PZ ..... E-62
Figure E-26. Lodging Facilities within the Eastern Portion of the PNGS PZ ..... E-63
Figure E-27. Correctional Facilities within the PNGS PZ ..... E-64
Figure F-1. Household Size in the Planning Zone ..... F-9
Figure F-2. Household Vehicle Availability ..... F-10
Figure F-3. Vehicle Availability - 1 to 4 Person Households ..... F-10
Figure F-4. Vehicle Availability - 5 to 8 Person Households ..... F-11
Figure F-5. Household Ridesharing Preference ..... F-11
Figure F-6. Commuters in Households in the Planning Zone ..... F-12
Figure F-7. Modes of Travel in the Planning Zone ..... F-12
Figure F-8. Impact to Commuters due to the COVID-19 Pandemic ..... F-13
Figure F-9. People with Functional or Transportation Needs ..... F-13
Figure F-10. Households with Seasonal Residents ..... F-14
Figure F-11. Number of Vehicles Used for Evacuation ..... F-14
Figure F-12. Percent of Households that Await Returning Commuter Before Evacuating ..... F-15
Figure F-13. Shelter then Evacuate Characteristics ..... F-15
Figure F-14. Planning Zone Evacuation Destinations ..... F-16
Figure F-15. Households Evacuating with Pets/Animals ..... F-16
Figure F-16. Time Required to Prepare to Leave Work/College ..... F-17
Figure F-17. Time to Commute Home from Work/College ..... F-17
Figure F-18. Time to Prepare Home for Evacuation ..... F-18
Figure F-19. Time to Clear Driveway of 15-20 cm of Snow ..... F-18
Figure F-20. Cell Phone Signal Reliability (for Phone Call and/or Text Message) ..... F-19
Figure F-21. Resident's Compliance to Given Instruction (by Emergency Management Officials) ..... F-19
Figure F-22. Perception of Public Alert Method ..... F-20
Figure H-1. Region R01 ..... H-4
Figure H-2. Region R02 ..... H-5
Figure H-3. Region R03 ..... H-6
Figure H-4. Region R04 ..... H-7
Figure H-5. Region R05 ..... H-8
Figure H-6. Region R06 ..... H-9
Figure H-7. Region R07 ..... H-10
Figure H-8. Region R08 ..... H-11
Figure H-9. Region R09 ..... H-12
Figure H-10. Region R10 ..... H-13
Figure H-11. Region R11 ..... H-14
Figure H-12. Region R12 ..... H-15
Figure H-13. Region R13 ..... H-16
Figure H-14. Region R14 ..... H-17
Figure H-15. Region R15 ..... H-18
Figure H-16. Region R16 ..... H-19

Figure H-17. Region R17 ..... H-20
Figure H-18. Region R18 ..... H-21
Figure H-19. Region R19 ..... H-22
Figure H-20. Region R20 ..... H-23
Figure H-21. Region R21 ..... H-24
Figure H-22. Region R22 ..... H-25
Figure H-23. Region R23 ..... H-26
Figure H-24. Region R24 ..... H-27
Figure H-25. Region R25 ..... H-28
Figure H-26. Region R26 ..... H-29
Figure H-27. Region R27 ..... H-30
Figure H-28. Region R28 ..... H-31
Figure H-29. Region R29 ..... H-32
Figure H-30. Region R30 ..... H-33
Figure H-31. Region R31 ..... H-34
Figure H-32. Region R32 ..... H-35
Figure H-33. Region R33 ..... H-36
Figure H-34. Region R34 ..... H-37
Figure H-35. Region R35 ..... H-38
Figure H-36. Region R36 ..... H-39
Figure H-37. Region R37 ..... H-40
Figure H-38. Region R38 ..... H-41
Figure H-39. Region R39 ..... H-42
Figure H-40. Region R40 ..... H-43
Figure H-41. Region R41 ..... H-44
Figure H-42. Region R42 ..... H-45
Figure H-43. Region R43 ..... H-46
Figure H-44. Region R44 ..... H-47
Figure H-45. Region R45 ..... H-48
Figure H-46. Region R46 ..... H-49
Figure H-47. Region R47 ..... H-50
Figure H-48. Region R48 ..... H-51
Figure H-49. Region R49 ..... H-52
Figure H-50. Region R50 ..... H-53
Figure H-51. Region R51 ..... H-54
Figure H-52. Region R52 ..... H-55
Figure H-53. Region R53 ..... H-56
Figure J-1. Network Sources/Origins ..... J-7
Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1) ..... J-8
Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2) ..... J-8
Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3) ..... J-9
Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4) ..... J-9
Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5) ..... J-10
Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6) ..... J-10
Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain/Light Snow (Scenario 7) ..... J-11
Figure J-9. ETE and Trip Generation: Winter, Midweek, Midday, Heavy Snow (Scenario 8) ..... J-11

Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9) ..... J-12
Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Rain/Light Snow (Scenario 10)..... J-12
Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Heavy Snow (Scenario 11) ..... J-13
Figure J-13. ETE and Trip Generation: Winter, Midweek,
Weekend, Evening, Good Weather (Scenario 12) ..... J-13
Figure J-14. ETE and Trip Generation: Winter, Weekend,
Midday, Good Weather, Special Event (Scenario 13) ..... J-14
Figure J-15. ETE and Trip Generation: Summer, Midweek,
Midday, Good Weather, Roadway Impact (Scenario 14) ..... J-14
Figure K-1. PNGS Link-Node Analysis Network ..... K-2
Figure K-2. Link-Node Analysis Network – Grid 1 ..... K-3
Figure K-3. Link-Node Analysis Network – Grid 2 ..... K-4
Figure K-4. Link-Node Analysis Network – Grid 3 ..... K-5
Figure K-5. Link-Node Analysis Network – Grid 4 ..... K-6
Figure K-6. Link-Node Analysis Network – Grid 5 ..... K-7
Figure K-7. Link-Node Analysis Network – Grid 6 ..... K-8
Figure K-8. Link-Node Analysis Network – Grid 7 ..... K-9
Figure K-9. Link-Node Analysis Network – Grid 8 ..... K-10
Figure K-10. Link-Node Analysis Network – Grid 9 ..... K-11
Figure K-11. Link-Node Analysis Network – Grid 10 ..... K-12
Figure K-12. Link-Node Analysis Network – Grid 11 ..... K-13
Figure K-13. Link-Node Analysis Network – Grid 12 ..... K-14
Figure K-14. Link-Node Analysis Network – Grid 13 ..... K-15
Figure K-15. Link-Node Analysis Network – Grid 14 ..... K-16
Figure K-16. Link-Node Analysis Network – Grid 15 ..... K-17
Figure K-17. Link-Node Analysis Network – Grid 16 ..... K-18
Figure K-18. Link-Node Analysis Network – Grid 17 ..... K-19
Figure K-19. Link-Node Analysis Network – Grid 18 ..... K-20
Figure K-20. Link-Node Analysis Network – Grid 19 ..... K-21
Figure K-21. Link-Node Analysis Network – Grid 20 ..... K-22
Figure K-22. Link-Node Analysis Network – Grid 21 ..... K-23
Figure K-23. Link-Node Analysis Network – Grid 22 ..... K-24
Figure K-24. Link-Node Analysis Network – Grid 23 ..... K-25
Figure K-25. Link-Node Analysis Network – Grid 24 ..... K-26
Figure K-26. Link-Node Analysis Network – Grid 25 ..... K-27
Figure K-27. Link-Node Analysis Network – Grid 26 ..... K-28
Figure K-28. Link-Node Analysis Network – Grid 27 ..... K-29
Figure K-29. Link-Node Analysis Network – Grid 28 ..... K-30
Figure K-30. Link-Node Analysis Network – Grid 29 ..... K-31
Figure K-31. Link-Node Analysis Network – Grid 30 ..... K-32
Figure K-32. Link-Node Analysis Network – Grid 31 ..... K-33
Figure K-33. Link-Node Analysis Network – Grid 32 ..... K-34
Figure K-34. Link-Node Analysis Network – Grid 33 ..... K-35
Figure K-35. Link-Node Analysis Network – Grid 34 ..... K-36
Figure K-36. Link-Node Analysis Network – Grid 35 ..... K-37
Figure K-37. Link-Node Analysis Network – Grid 36 ..... K-38
Figure K-38. Link-Node Analysis Network – Grid 37 ..... K-39

Figure K-39. Link-Node Analysis Network – Grid 38 ..... K-40
Figure K-40. Link-Node Analysis Network – Grid 39 ..... K-41
Figure K-41. Link-Node Analysis Network – Grid 40 ..... K-42
Figure K-42. Link-Node Analysis Network – Grid 41 ..... K-43
Figure K-43. Link-Node Analysis Network – Grid 42 ..... K-44
Figure K-44. Link-Node Analysis Network – Grid 43 ..... K-45
Figure K-45. Link-Node Analysis Network – Grid 44 ..... K-46
Figure K-46. Link-Node Analysis Network – Grid 45 ..... K-47
Figure K-47. Link-Node Analysis Network – Grid 46 ..... K-48
Figure K-48. Link-Node Analysis Network – Grid 47 ..... K-49
Figure K-49. Link-Node Analysis Network – Grid 48 ..... K-50
Figure K-50. Link-Node Analysis Network – Grid 49 ..... K-51
Figure K-51. Link-Node Analysis Network – Grid 50 ..... K-52
Figure K-52. Link-Node Analysis Network – Grid 51 ..... K-53
Figure K-53. Link-Node Analysis Network – Grid 52 ..... K-54
Figure K-54. Link-Node Analysis Network – Grid 53 ..... K-55
Figure K-55. Link-Node Analysis Network – Grid 54 ..... K-56
Figure K-56. Link-Node Analysis Network – Grid 55 ..... K-57
Figure K-57. Link-Node Analysis Network – Grid 56 ..... K-58
Figure K-58. Link-Node Analysis Network – Grid 57 ..... K-59
Figure K-59. Link-Node Analysis Network – Grid 58 ..... K-60
Figure K-60. Link-Node Analysis Network – Grid 59 ..... K-61
Figure K-61. Link-Node Analysis Network – Grid 60 ..... K-62
Figure K-62. Link-Node Analysis Network – Grid 61 ..... K-63
Figure K-63. Link-Node Analysis Network – Grid 62 ..... K-64
Figure K-64. Link-Node Analysis Network – Grid 63 ..... K-65
Figure K-65. Link-Node Analysis Network – Grid 64 ..... K-66
Figure K-66. Link-Node Analysis Network – Grid 65 ..... K-67
Figure K-67. Link-Node Analysis Network – Grid 66 ..... K-68
Figure K-68. Link-Node Analysis Network – Grid 67 ..... K-69
Figure K-69. Link-Node Analysis Network – Grid 68 ..... K-70
Figure K-70. Link-Node Analysis Network – Grid 69 ..... K-71
Figure K-71. Link-Node Analysis Network – Grid 70 ..... K-72
Figure K-72. Link-Node Analysis Network – Grid 71 ..... K-73
Figure K-73. Link-Node Analysis Network – Grid 72 ..... K-74
Figure K-74. Link-Node Analysis Network – Grid 73 ..... K-75
Figure K-75. Link-Node Analysis Network – Grid 74 ..... K-76
Figure K-76. Link-Node Analysis Network – Grid 75 ..... K-77
Figure K-77. Link-Node Analysis Network – Grid 76 ..... K-78
Figure K-78. Link-Node Analysis Network – Grid 77 ..... K-79
Figure K-79. Link-Node Analysis Network – Grid 78 ..... K-80
Figure K-80. Link-Node Analysis Network – Grid 79 ..... K-81
Figure K-81. Link-Node Analysis Network – Grid 80 ..... K-82
Figure K-82. Link-Node Analysis Network – Grid 81 ..... K-83
Figure K-83. Link-Node Analysis Network – Grid 82 ..... K-84
Figure K-84. Link-Node Analysis Network – Grid 83 ..... K-85
Figure K-85. Link-Node Analysis Network – Grid 84 ..... K-86

Figure K-86. Link-Node Analysis Network – Grid 85 ..... K-87
Figure K-87. Link-Node Analysis Network – Grid 86 ..... K-88
Figure K-88. Link-Node Analysis Network – Grid 87 ..... K-89
Figure K-89. Link-Node Analysis Network – Grid 88 ..... K-90
Figure K-90. Link-Node Analysis Network – Grid 89 ..... K-91
Figure K-91. Link-Node Analysis Network – Grid 90 ..... K-92
Figure K-92. Link-Node Analysis Network – Grid 91 ..... K-93
Figure K-93. Link-Node Analysis Network – Grid 92 ..... K-94
Figure K-94. Link-Node Analysis Network – Grid 93 ..... K-95
Figure K-95. Link-Node Analysis Network – Grid 94 ..... K-96
Figure K-96. Link-Node Analysis Network – Grid 95 ..... K-97
Figure K-97. Link-Node Analysis Network – Grid 96 ..... K-98
Figure K-98. Link-Node Analysis Network – Grid 97 ..... K-99
Figure K-99. Link-Node Analysis Network – Grid 98 ..... K-100
Figure K-100. Link-Node Analysis Network – Grid 99 ..... K-101
Figure K-101. Link-Node Analysis Network – Grid 100 ..... K-102
Figure K-102. Link-Node Analysis Network – Grid 101 ..... K-103
Figure K-103. Link-Node Analysis Network – Grid 102 ..... K-104
Figure K-104. Link-Node Analysis Network – Grid 103 ..... K-105
Figure K-105. Link-Node Analysis Network – Grid 104 ..... K-106
Figure K-106. Link-Node Analysis Network – Grid 105 ..... K-107
Figure K-107. Link-Node Analysis Network – Grid 106 ..... K-108
Figure K-108. Link-Node Analysis Network – Grid 107 ..... K-109
Figure K-109. Link-Node Analysis Network – Grid 108 ..... K-110
Figure K-110. Link-Node Analysis Network – Grid 109 ..... K-111
Figure K-111. Link-Node Analysis Network – Grid 110 ..... K-112
Figure K-112. Link-Node Analysis Network – Grid 111 ..... K-113
Figure K-113. Link-Node Analysis Network – Grid 112 ..... K-114
Figure K-114. Link-Node Analysis Network – Grid 113 ..... K-115
Figure K-115. Link-Node Analysis Network – Grid 114 ..... K-116
Figure K-116. Link-Node Analysis Network – Grid 115 ..... K-117
Figure K-117. Link-Node Analysis Network – Grid 116 ..... K-118
Figure K-118. Link-Node Analysis Network – Grid 117 ..... K-119
Figure K-119. Link-Node Analysis Network – Grid 118 ..... K-120
Figure K-120. Link-Node Analysis Network – Grid 119 ..... K-121
Figure K-121. Link-Node Analysis Network – Grid 120 ..... K-122
Figure K-122. Link-Node Analysis Network – Grid 121 ..... K-123
Figure K-123. Link-Node Analysis Network – Grid 122 ..... K-124
Figure K-124. Link-Node Analysis Network – Grid 123 ..... K-125
Figure K-125. Link-Node Analysis Network – Grid 124 ..... K-126
Figure K-126. Link-Node Analysis Network – Grid 125 ..... K-127
Figure K-127. Link-Node Analysis Network – Grid 126 ..... K-128
Figure K-128. Link-Node Analysis Network – Grid 127 ..... K-129
Figure K-129. Link-Node Analysis Network – Grid 128 ..... K-130

# List of Tables

Table 1-1. Stakeholder Interaction ..... 1-8
Table 1-2. Highway Characteristics ..... 1-8
Table 1-3. ETE Study Comparisons ..... 1-9
Table 2-1. Evacuation Scenario Definitions ..... 2-10
Table 2-2. Model Adjustment for Adverse Weather ..... 2-10
Table 3-1. Municipality Annual Growth Rate from July 1, 2016 to July 1, 2021 ..... 3-20
Table 3-2. PZ Permanent Resident Population ..... 3-21
Table 3-3. PZ Permanent Resident Population and Vehicles by Response Sector ..... 3-22
Table 3-4. Shadow Population and Vehicles by Sector ..... 3-23
Table 3-5. Summary of Transients and Transient Vehicles ..... 3-23
Table 3-6. Summary of Employee Vehicles and Employees Evacuating from GO Transit Stations ..... 3-24
Table 3-7. Summary of Employees and Employee Vehicles Commuting into the PZs ..... 3-25
Table 3-8. Medical Facilities Transit Demand Estimates ..... 3-26
Table 3-9. School Population Demand Estimates ..... 3-31
Table 3-10. College and University Population Demand Estimates ..... 3-43
Table 3-11. Transit-Dependent Population Estimates ..... 3-44
Table 3-12. PNGS PZ External Traffic ..... 3-44
Table 3-13. Summary of Population Demand ..... 3-45
Table 3-14. Summary of Vehicle Demand ..... 3-47
Table 5-1. Event Sequence for Evacuation Activities ..... 5-11
Table 5-2. Time Distribution for Notifying the Public ..... 5-11
Table 5-3. Time Distribution for Employees to Prepare to Leave Work/College ..... 5-11
Table 5-4. Time Distribution for Commuters to Travel Home ..... 5-12
Table 5-5. Time Distribution for Population to Prepare Home to Evacuate ..... 5-13
Table 5-6. Time Distribution for Population to Clear 15-20 cm of Snow ..... 5-13
Table 5-7. Mapping Distributions to Events ..... 5-14
Table 5-8. Description of the Distributions ..... 5-14
Table 5-9. Trip Generation Histograms for the Population for Un-staged Evacuation ..... 5-15
Table 5-10. Trip Generation Histograms for the Planning Zone Population for Staged Evacuation (Non-Snow) ..... 5-16
Table 5-11. Trip Generation Histograms for the Planning Zone Population for Staged Evacuation (Snow) ..... 5-17
Table 6-1. Description of Evacuation Regions (Regions R01-R36) ..... 6-4
Table 6-2. Description of Staged Evacuation Regions (Regions R37-R53) ..... 6-5
Table 6-3. Evacuation Scenario Definitions ..... 6-6
Table 6-4. Percent of Population Groups Evacuating for Various Scenarios ..... 6-7
Table 6-5. DPZ Outer Ring Vehicle Estimates by Scenario ..... 6-8
Table 6-6. PZ Vehicle Estimates by Scenario ..... 6-9
Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population ..... 7-13
Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population ..... 7-15
Table 7-3. Time to Clear *90* Percent of the Automatic Action Zone within the Indicated Region ..... 7-17
Table 7-4. Time to Clear *100* Percent of the Automatic Action Zone within the Indicated Region ..... 7-19
Table 7-5. Description of Evacuation Regions ..... 7-21
Table 7-6. Description of Staged Evacuation Regions ..... 7-22
Table 8-1. Summary of Transportation Resources ..... 8-10

Table 8-2. School Evacuation Time Estimates - Good Weather ..... 8-11
Table 8-3. School Evacuation Time Estimates – Rain/Light Snow ..... 8-13
Table 8-4. School Evacuation Time Estimates – Heavy Snow ..... 8-15
Table 8-5. Transit-Dependent Evacuation Time Estimates - Good Weather ..... 8-17
Table 8-6. Transit-Dependent Evacuation Time Estimates – Rain/Light Snow ..... 8-20
Table 8-7. Transit Dependent Evacuation Time Estimates – Heavy Snow ..... 8-23
Table 8-8. Medical Facility Evacuation Time Estimates - Good Weather ..... 8-26
Table 8-9. Medical Facility Evacuation Time Estimates – Rain/Light Snow ..... 8-29
Table 8-10. Medical Facility Evacuation Time Estimates – Heavy Snow ..... 8-32
Table 8-11. Correctional Facility Evacuation Time Estimates ..... 8-35
Table 10-1. Summary of Transit-Dependent Bus Routes in the DPZ ..... 10-2
Table 10-2. Bus Route Descriptions ..... 10-5
Table A-1. Glossary of Traffic Engineering Terms ..... A-1
Table C-1. Selected Measures of Effectiveness Output by DYNEV II ..... C-8
Table C-2. Input Requirements for the DYNEV II Model ..... C-9
Table C-3. Glossary ..... C-10
Table E-1. Schools within the PNGS PZs ..... E-2
Table E-2. Colleges and Universities within the PNGS PZs ..... E-17
Table E-3. Day Camps within the PNGS PZs ..... E-18
Table E-4. Medical Facilities within the PNGS PZs ..... E-21
Table E-5. Major Employers within the PZs ..... E-25
Table E-6. Beaches, Campgrounds and Parks within the PNGS PZs ..... E-27
Table E-7. Golf Courses within the PNGS PZs ..... E-29
Table E-8. Historic Sites and Museums within the PNGS PZs ..... E-31
Table E-9. Marinas and Other Recreational Areas within the PNGS PZs ..... E-33
Table E-10. Lodging Facilities within the PNGS PZs ..... E-35
Table E-11. Correctional Facilities within the PNGS PZs ..... E-37
Table F-1. Demographic Survey Sampling Plan ..... F-8
Table H-1. Percent of Response Sector Population Evacuating for Each Region ..... H-2
Table H-2. Percent of Response Sector Population Evacuating for Each Staged Region ..... H-3
Table J-1. Sample Simulation Model Input ..... J-2
Table J-2. Selected Model Outputs for the Evacuation of the DPZ (Region R03) ..... J-3
Table J-3. Average Speed (kph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1) ..... J-4
Table J-4. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1 ..... J-5
Table K-1. Summary of Nodes by the Type of Control ..... K-1
Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study ..... M-6
Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study ..... M-6
Table M-3. Evacuation Time Estimates for Access Control Establish Time Sensitivity Study ..... M-6
Table M-4. DPZ Population by Study Year ..... M-7
Table M-5. Employment Growth Rates ..... M-8
Table M-6. Transit Bus Needs ..... M-8
Table M-7. External Traffic Demand Growth ..... M-8
Table M-8. Roadway Improvements ..... M-9
Table M-9. Time to Clear the Indicated Area of 90 Percent of the Affected Population – 2028 ..... M-11
Table M-10. Time to Clear the Indicated Area of *100* Percent of the Affected Population – 2028 ..... M-11
Table N-1. ETE Review Criteria Checklist ..... N-1

## EXECUTIVE SUMMARY

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Pickering Nuclear Generating Station (PNGS) located in the Municipality of Pickering in Durham Region, Ontario. This study provides Ontario Power Generation (OPG), the Province, the Region, and the City of Toronto with the estimated times to evacuate the Planning Zones (PZs) and various subsets of the PZs. Current Provincial Nuclear Emergency Response Plans indicate pre-planned protective actions are to be developed for the Detailed Planning Zone Outer Ring (DPZ Outer Ring) and *contingency* planning and arrangements are to be made for the Contingency Planning Zone (CPZ). As such, this report focuses on the DPZ Outer Ring, but provides information, including data, analyses and results, for the CPZ for contingency planning purposes.

A traffic/evacuation simulation model (Dynamic Evacuation Simulation Model, or DYNEV-II) is used to compute ETE using the procedure shown in Figure ES-1. The supply input to DYNEV-II is in the form of a link-node analysis network – a computerized replica of the roadway system within the study area (see Appendix K). The link-node analysis network is calibrated to include roadway characteristics such as free speed (speed that drivers are comfortable traveling at in the lack of traffic congestion), number of lanes, type of traffic control (signal, stop sign, manned), etc that were collected during a field survey in 2022. Resident population from 2021 Statistics Canada data was extrapolated to 2023. Employee and transient data were obtained from OPG, Statistics Canada, 2021 labour force data and Commuting Flow survey, Regional Municipality of Durham and supplemented by data from the previous ETE study. The supply and demand are input to DYNEV-II. The two main outputs of the DYNEV-II model are ETE for general population (evacuees with personal vehicles) and route-specific evacuation speeds, which are used to compute the ETE for special facilities (schools, medical facilities, correctional facilities, etc.) and the transit-dependent population.

The general population ETE are presented in Table 7-1 and Table 7-2. These data are the times needed to clear the indicated regions of 90 and 100 percent of the population occupying these regions, respectively. For definitions of scenarios (demand changes due to temporal variations) and regions (area to be evacuated varies with wind direction and speed), see Section 6 and Appendix H, respectively. These computed ETE include consideration of mobilization time and of estimated voluntary evacuations from other regions within the PZs (and from the Shadow Region (CPZ) for an evacuation of the AAZ, DPZ Inner Ring, and DPZ Outer Ring).

Critical findings of the study include:

- The ETEs computed for this study are longer than the ETEs computed in the previous study (KLD TR-1058, dated April 25,2019). The residential population inside the PZs has increased by approximately 2%. The external traffic that traverses the study area increased by 100%[1]. Shadow evacuation participation has increased by an additional

[1] The 100% increase in external traffic vehicles is due to access control establish time increasing from 2 hours to 4 hours. Within that extra 2-hour window, the same number of external traffic vehicles traverse the study area compared to the first 2 hours. Thus, doubling the number of external traffic vehicles compared to the previous ETE report.

10%[2]. An increase in evacuating traffic demand, without a comparable increase in roadway capacity, will increase ETE.

- General population ETE were computed for 742 unique cases – a combination of 53 unique Evacuation Regions and 14 unique Evacuation Scenarios. Table 7-1 and Table 7-2 document the ETE for the 90th and 100th percentiles. These ETE range from 3:40 (hr:min) to 12:25 at the 90th percentile.
- Inspection of Table 7-1 and Table 7-2 indicates that the ETE for the 100th percentile are significantly longer than those for the 90th percentile, ranging from 4:30 to 10:15 for Regions R01 through R03 and 11:00 to 17:00 for Region R04. This is the result of significant congestion within the study area. See Section 7.3 and 7.4.
- Inspection of Table 7-3 and Table 7-4 indicates that a staged evacuation protective action strategy could benefit those people evacuating from within the AAZ. Although staged evacuation can be disadvantageous to those people living beyond 3km from the plant, it does expedite the evacuation of those evacuees from within the AAZ under certain circumstances. See Section 7.7 for additional discussion.
- Comparison of Scenarios 9 (winter, weekend, midday) and 13 (winter, weekend, midday) indicates that the special event (a large event at the Toronto Zoo) does not have a significant impact on the 90th and 100th percentile ETE. See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 14 in Table 7-1 indicates that events such as adverse weather or traffic accidents which close a lane on Hwy 401 Express westbound, from the interchange of Brock Road to the interchange with McCowan Road, does not have a significant impact on 90th and 100th percentile ETE. See Section 7.5 for additional discussion.
- The majority of the DPZ is congested during an evacuation of the DPZ Outer Ring. All congestion within the DPZ clears by 7 hours and 45 minutes after the Emergency Bulletin for a winter, midweek, midday, good weather scenario (Scenario 6). All congestion within the study area (DPZ + CPZ) clears by 8 hours and 30 minutes. See Section 7.3 and Figures 7-3 through 7-10 for additional discussion.
- Separate ETE were computed for schools, medical facilities, the correctional facility and transit-dependent persons. See Section 8 for additional discussion.
- Section 8 indicates that based on discussions with local school bus providers, when evacuating schools, local school bus providers will make multiple trips to Temporary Holding Centres (THC), as needed for an evacuation of Region R03. Durham Region Transit (DRT), Toronto Transit Commission (TTC), York Region Transit (YRT) and Go Transit vehicles will be used to evacuate the transit dependent population. Correctional facilities will use their own transportation resources during an evacuation. See Table 8-1 for a summary of transportation resources required to evacuate the DPZ and CPZ.
- The general population ETE at the 90th percentiles are insensitive to changes in the base trip generation time of 4 hours and 15 minutes due to the significant traffic congestion within the DPZ. See Table M-1.

[2] The increase from 20% to 30% was based on discussions with the Ministry of Transportation of Ontario (MTO) and OPG.

- The general population ETE for the DPZ is affected by the voluntary evacuation of vehicles in the Shadow Region (CPZ). See Table M-2.
- The general population ETE for the DPZ is affected by the number of external traffic vehicles that traverse the study area. The number of external vehicles is controlled by the time it takes to establish access control. See Section M.3.
- Projected ETE values for 2028 are provided as a sensitivity study in Appendix M. See Section M.4 for future results.

**Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring, Detailed Planning Zone Outer Ring, and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R02** | 5:25 | 5:55 | 5:15 | 6:05 | 3:45 | 5:35 | 6:05 | 7:15 | 5:10 | 6:00 | 7:00 | 3:45 | 5:20 | 5:50 |
| **R03** | 6:20 | 7:05 | 6:00 | 6:35 | 4:55 | 6:25 | 7:05 | 8:25 | 6:00 | 6:45 | 8:00 | 4:45 | 6:00 | 6:45 |
| **R04** | 9:30 | 10:15 | 8:55 | 9:40 | 8:00 | 9:45 | 10:45 | 12:20 | 8:40 | 9:35 | 11:15 | 8:00 | 8:45 | 9:40 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 9:10 | 10:10 | 8:35 | 9:25 | 7:45 | 9:40 | 10:20 | 12:20 | 8:35 | 9:20 | 11:15 | 8:00 | 8:40 | 9:15 |
| **R06** | 9:00 | 10:05 | 8:40 | 9:20 | 7:50 | 9:30 | 10:30 | 11:55 | 8:25 | 9:05 | 10:50 | 7:35 | 8:35 | 9:20 |
| **R07** | 9:10 | 10:05 | 8:35 | 9:15 | 7:55 | 9:20 | 10:20 | 12:05 | 8:25 | 9:20 | 10:50 | 7:35 | 8:40 | 9:15 |
| **R08** | 7:30 | 8:00 | 6:55 | 7:25 | 6:05 | 7:45 | 8:35 | 9:50 | 6:40 | 7:25 | 8:25 | 6:10 | 6:45 | 7:30 |
| **R09** | 7:20 | 7:55 | 6:45 | 7:30 | 6:00 | 7:35 | 8:20 | 9:20 | 6:35 | 7:25 | 8:25 | 6:05 | 6:40 | 7:20 |
| **R10** | 4:55 | 5:25 | 4:45 | 5:20 | 3:45 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 3:40 | 4:50 | 5:00 |
| **R11** | 4:55 | 5:25 | 4:45 | 5:20 | 3:45 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 3:40 | 4:50 | 5:00 |
| **R12** | 4:55 | 5:25 | 4:50 | 5:20 | 3:40 | 4:55 | 5:20 | 6:25 | 4:50 | 5:20 | 6:25 | 3:45 | 4:50 | 5:00 |
| **R13** | 5:25 | 5:50 | 5:05 | 5:35 | 4:55 | 5:30 | 6:15 | 7:15 | 5:05 | 5:35 | 6:45 | 4:50 | 5:05 | 5:30 |
| **R14** | 5:35 | 6:10 | 5:10 | 5:55 | 5:05 | 5:45 | 6:25 | 7:20 | 5:20 | 5:45 | 6:55 | 5:00 | 5:20 | 5:50 |
| **R15** | 7:40 | 8:15 | 7:10 | 7:40 | 6:50 | 7:50 | 8:35 | 9:45 | 7:05 | 7:40 | 9:05 | 6:45 | 7:10 | 7:45 |
| **R16** | 7:50 | 8:35 | 7:15 | 7:45 | 7:00 | 8:00 | 8:45 | 10:00 | 7:15 | 7:45 | 9:15 | 7:00 | 7:15 | 7:50 |
| **R17** | 8:15 | 8:50 | 7:25 | 8:10 | 7:15 | 8:20 | 9:10 | 10:35 | 7:25 | 8:15 | 9:40 | 7:05 | 7:35 | 8:20 |
| **R18** | 7:00 | 7:35 | 6:25 | 7:05 | 6:00 | 7:05 | 7:45 | 9:10 | 6:25 | 7:00 | 8:10 | 5:50 | 6:30 | 7:10 |
| **R19** | 6:55 | 7:35 | 6:25 | 7:05 | 5:55 | 7:00 | 7:35 | 8:50 | 6:20 | 7:00 | 8:05 | 5:55 | 6:25 | 7:15 |
| **R20** | 4:55 | 5:25 | 4:50 | 5:05 | 3:45 | 5:05 | 5:25 | 6:20 | 4:45 | 5:10 | 5:55 | 3:45 | 4:45 | 5:05 |
| **Evacuate Detailed Planning Zone Outer Ring and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R21** | 9:20 | 10:10 | 8:35 | 9:30 | 7:45 | 9:25 | 10:25 | 11:55 | 8:30 | 9:35 | 11:25 | 7:35 | 8:40 | 9:20 |
| **R22** | 9:20 | 10:00 | 8:40 | 9:30 | 7:40 | 9:30 | 10:25 | 12:10 | 8:30 | 9:10 | 11:20 | 7:55 | 8:30 | 9:25 |
| **R23** | 9:10 | 10:05 | 8:45 | 9:35 | 7:40 | 9:35 | 10:40 | 12:05 | 8:35 | 9:35 | 11:10 | 7:40 | 8:35 | 9:30 |
| **R24** | 7:55 | 8:50 | 7:30 | 8:05 | 6:20 | 8:20 | 9:05 | 10:30 | 7:10 | 7:55 | 9:10 | 6:25 | 7:20 | 8:00 |
| **R25** | 7:55 | 8:50 | 7:30 | 8:05 | 6:20 | 8:15 | 9:05 | 10:25 | 7:10 | 7:50 | 9:10 | 6:25 | 7:20 | 8:00 |
| **R26** | 6:10 | 6:50 | 5:50 | 6:20 | 4:40 | 6:15 | 6:55 | 8:05 | 5:50 | 6:20 | 7:45 | 4:40 | 5:50 | 6:30 |
| **R27** | 6:10 | 6:50 | 5:50 | 6:20 | 4:40 | 6:15 | 6:55 | 8:05 | 5:50 | 6:20 | 7:45 | 4:40 | 5:50 | 6:30 |
| **R28** | 6:15 | 6:50 | 5:50 | 6:30 | 4:45 | 6:15 | 7:00 | 8:15 | 5:45 | 6:30 | 7:35 | 4:40 | 5:55 | 6:35 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R29** | 6:35 | 7:15 | 6:05 | 6:45 | 5:20 | 6:35 | 7:20 | 8:45 | 6:10 | 6:45 | 7:55 | 5:25 | 6:10 | 6:45 |
| **R30** | 6:35 | 7:15 | 6:05 | 6:45 | 5:20 | 6:35 | 7:20 | 8:45 | 6:10 | 6:45 | 7:55 | 5:20 | 6:10 | 6:40 |
| **R31** | 8:00 | 8:50 | 7:25 | 8:05 | 7:00 | 8:20 | 9:00 | 10:30 | 7:25 | 8:15 | 9:40 | 7:10 | 7:30 | 8:10 |
| **R32** | 8:00 | 8:50 | 7:25 | 8:05 | 7:00 | 8:20 | 9:00 | 10:30 | 7:25 | 8:15 | 9:40 | 7:10 | 7:30 | 8:10 |
| **R33** | 8:20 | 9:10 | 7:40 | 8:30 | 7:20 | 8:35 | 9:25 | 10:50 | 7:40 | 8:25 | 9:45 | 7:20 | 7:40 | 8:30 |
| **R34** | 7:25 | 8:05 | 6:50 | 7:35 | 6:15 | 7:35 | 8:20 | 9:35 | 6:45 | 7:35 | 8:45 | 6:15 | 6:55 | 7:35 |
| **R35** | 7:25 | 8:15 | 7:00 | 7:35 | 6:15 | 7:35 | 8:25 | 9:45 | 6:55 | 7:35 | 8:50 | 6:15 | 7:00 | 7:40 |
| **R36** | 6:10 | 6:35 | 5:50 | 6:20 | 4:45 | 6:15 | 6:55 | 8:10 | 5:45 | 6:20 | 7:40 | 4:40 | 5:45 | 6:15 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 9:40 | 10:10 | 9:25 | 10:05 | 8:50 | 9:40 | 10:35 | 12:20 | 9:15 | 10:15 | 11:40 | 8:45 | 9:15 | 9:40 |
| **R38** | 9:40 | 10:15 | 9:35 | 10:10 | 8:50 | 9:45 | 10:50 | 12:20 | 9:10 | 9:40 | 11:50 | 8:45 | 9:10 | 9:40 |
| **R39** | 9:40 | 10:05 | 9:30 | 10:10 | 9:00 | 9:45 | 10:20 | 12:10 | 9:10 | 10:05 | 11:35 | 8:50 | 9:10 | 9:40 |
| **R40** | 8:00 | 8:20 | 7:50 | 8:15 | 7:35 | 8:05 | 8:45 | 10:15 | 7:40 | 8:15 | 9:30 | 7:45 | 7:40 | 8:00 |
| **R41** | 7:55 | 8:25 | 7:50 | 8:10 | 7:30 | 8:00 | 8:40 | 10:00 | 7:40 | 8:10 | 9:30 | 7:35 | 7:40 | 7:55 |
| **R42** | 4:55 | 5:25 | 4:45 | 5:20 | 4:05 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 4:05 | 4:50 | 5:00 |
| **R43** | 4:55 | 5:25 | 4:45 | 5:20 | 4:05 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 4:05 | 4:50 | 5:00 |
| **R44** | 4:55 | 5:25 | 4:50 | 5:20 | 4:00 | 4:55 | 5:20 | 6:25 | 4:50 | 5:20 | 6:25 | 4:05 | 4:50 | 5:00 |
| **R45** | 7:00 | 7:25 | 7:05 | 7:25 | 7:15 | 6:55 | 7:20 | 8:30 | 7:00 | 7:25 | 8:35 | 7:10 | 7:00 | 7:05 |
| **R46** | 7:15 | 7:40 | 7:15 | 7:35 | 7:15 | 7:10 | 7:40 | 8:30 | 7:15 | 7:50 | 8:45 | 7:20 | 7:15 | 7:15 |
| **R47** | 8:30 | 8:55 | 8:30 | 9:00 | 8:30 | 8:25 | 8:55 | 10:20 | 8:30 | 8:55 | 10:20 | 8:25 | 8:30 | 8:30 |
| **R48** | 8:30 | 9:05 | 8:35 | 9:05 | 8:30 | 8:30 | 9:05 | 10:25 | 8:40 | 9:10 | 10:40 | 8:30 | 8:40 | 8:40 |
| **R49** | 8:45 | 9:20 | 8:55 | 9:25 | 8:45 | 8:50 | 9:25 | 10:55 | 8:45 | 9:25 | 10:50 | 8:45 | 8:50 | 8:55 |
| **R50** | 7:55 | 8:20 | 7:55 | 8:25 | 7:50 | 7:50 | 8:20 | 9:35 | 7:55 | 8:30 | 9:45 | 7:45 | 7:55 | 7:55 |
| **R51** | 7:45 | 8:10 | 7:45 | 8:15 | 7:40 | 7:45 | 8:10 | 9:25 | 7:50 | 8:10 | 9:25 | 7:50 | 7:50 | 7:50 |
| **R52** | 6:15 | 6:35 | 6:10 | 6:35 | 6:05 | 6:15 | 6:30 | 7:30 | 6:15 | 6:30 | 7:35 | 6:00 | 6:20 | 6:20 |
| **R53** | 9:40 | 10:25 | 9:40 | 10:10 | 9:15 | 9:50 | 10:45 | 12:25 | 9:30 | 10:15 | 12:00 | 9:15 | 9:30 | 9:50 |

**Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring, Detailed Planning Zone Outer Ring, and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R02** | 7:05 | 7:25 | 6:45 | 7:30 | 5:05 | 6:55 | 7:35 | 9:05 | 6:40 | 7:35 | 8:45 | 5:10 | 6:40 | 7:05 |
| **R03** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R04** | 13:10 | 14:35 | 12:40 | 13:30 | 11:00 | 13:00 | 15:00 | 17:00 | 12:00 | 13:40 | 15:25 | 11:20 | 12:20 | 13:20 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 11:55 | 13:00 | 11:10 | 12:35 | 10:00 | 12:20 | 13:35 | 15:50 | 11:10 | 12:15 | 14:30 | 10:10 | 11:10 | 12:05 |
| **R06** | 11:40 | 13:00 | 10:55 | 12:05 | 10:00 | 12:00 | 13:15 | 14:55 | 10:55 | 11:55 | 14:15 | 9:50 | 10:55 | 11:50 |
| **R07** | 11:40 | 12:50 | 10:55 | 11:40 | 10:00 | 11:45 | 13:10 | 15:10 | 10:50 | 11:55 | 14:05 | 9:45 | 10:50 | 11:40 |
| **R08** | 9:45 | 10:10 | 8:55 | 9:20 | 8:00 | 11:20 | 12:10 | 13:40 | 8:30 | 9:30 | 11:00 | 8:35 | 8:30 | 9:50 |
| **R09** | 9:20 | 10:10 | 8:40 | 9:20 | 7:55 | 11:05 | 11:40 | 12:25 | 8:15 | 9:15 | 10:50 | 8:00 | 8:15 | 9:35 |
| **R10** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R11** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R12** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R13** | 8:25 | 9:05 | 7:35 | 8:15 | 7:45 | 8:30 | 9:25 | 10:50 | 7:35 | 8:25 | 9:30 | 7:40 | 7:35 | 8:25 |
| **R14** | 8:35 | 9:20 | 7:50 | 8:40 | 7:45 | 8:40 | 9:25 | 10:50 | 8:00 | 8:25 | 10:10 | 8:00 | 8:00 | 8:40 |
| **R15** | 10:25 | 10:50 | 9:40 | 10:10 | 9:30 | 10:25 | 11:10 | 12:35 | 9:25 | 10:00 | 11:50 | 9:20 | 9:25 | 10:30 |
| **R16** | 10:35 | 11:05 | 9:40 | 10:15 | 9:40 | 10:45 | 11:25 | 13:25 | 9:35 | 10:10 | 11:50 | 9:40 | 9:35 | 10:35 |
| **R17** | 11:20 | 11:35 | 10:25 | 10:40 | 9:55 | 11:15 | 11:55 | 13:30 | 10:10 | 11:15 | 12:25 | 10:00 | 10:10 | 11:35 |
| **R18** | 10:30 | 10:50 | 9:45 | 10:00 | 9:10 | 10:40 | 11:20 | 13:00 | 9:10 | 9:55 | 11:30 | 9:10 | 9:10 | 10:30 |
| **R19** | 10:35 | 11:20 | 9:40 | 10:10 | 9:35 | 10:30 | 10:55 | 13:10 | 9:25 | 10:00 | 11:40 | 9:20 | 9:25 | 10:55 |
| **R20** | 7:05 | 7:30 | 6:55 | 7:30 | 4:55 | 7:05 | 7:30 | 9:15 | 6:55 | 7:35 | 8:35 | 5:15 | 6:55 | 7:05 |
| **Evacuate Detailed Planning Zone Outer Ring and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R21** | 12:15 | 13:40 | 11:35 | 12:45 | 10:30 | 12:25 | 14:00 | 15:25 | 11:30 | 12:55 | 14:40 | 10:25 | 11:30 | 12:15 |
| **R22** | 12:10 | 13:15 | 11:35 | 12:35 | 10:15 | 12:25 | 13:45 | 15:45 | 11:00 | 12:05 | 14:30 | 10:25 | 11:00 | 12:15 |
| **R23** | 12:10 | 13:15 | 11:35 | 12:35 | 10:15 | 12:25 | 13:45 | 15:55 | 11:00 | 12:05 | 14:30 | 10:25 | 11:00 | 12:15 |
| **R24** | 10:30 | 11:30 | 10:00 | 10:50 | 8:50 | 12:00 | 12:30 | 14:40 | 9:40 | 11:05 | 12:55 | 9:20 | 9:40 | 10:30 |
| **R25** | 10:30 | 11:30 | 10:00 | 10:50 | 8:50 | 12:00 | 12:30 | 14:40 | 9:40 | 11:05 | 12:55 | 9:20 | 9:40 | 10:30 |
| **R26** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R27** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R28** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R29** | 8:50 | 9:30 | 8:20 | 9:05 | 8:15 | 8:40 | 9:55 | 11:15 | 8:10 | 8:55 | 10:10 | 8:15 | 8:10 | 8:50 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R30** | 8:50 | 9:30 | 8:20 | 9:05 | 8:15 | 8:40 | 9:55 | 11:15 | 8:10 | 8:55 | 10:10 | 8:15 | 8:10 | 8:50 |
| **R31** | 10:45 | 11:40 | 9:45 | 10:40 | 9:45 | 10:40 | 11:30 | 13:55 | 9:45 | 10:50 | 12:10 | 9:45 | 9:45 | 11:00 |
| **R32** | 10:45 | 11:40 | 9:45 | 10:40 | 9:45 | 10:40 | 11:30 | 13:55 | 9:45 | 10:50 | 12:10 | 9:45 | 9:45 | 11:00 |
| **R33** | 11:30 | 12:00 | 10:20 | 11:05 | 10:10 | 11:20 | 12:35 | 14:30 | 10:25 | 11:15 | 12:50 | 10:15 | 10:25 | 11:40 |
| **R34** | 10:20 | 11:10 | 9:55 | 10:00 | 9:40 | 11:00 | 11:30 | 13:05 | 9:35 | 9:55 | 11:45 | 9:30 | 10:00 | 10:45 |
| **R35** | 10:20 | 11:30 | 9:55 | 10:20 | 9:40 | 11:10 | 11:45 | 13:05 | 9:35 | 9:55 | 11:45 | 9:30 | 10:00 | 10:45 |
| **R36** | 8:00 | 8:25 | 7:40 | 8:10 | 6:40 | 8:15 | 8:30 | 10:10 | 7:40 | 8:15 | 9:50 | 6:40 | 7:40 | 8:00 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 12:25 | 13:00 | 12:25 | 12:50 | 11:10 | 12:20 | 14:00 | 15:30 | 11:40 | 13:05 | 15:50 | 11:10 | 11:40 | 12:25 |
| **R38** | 12:25 | 13:00 | 12:10 | 12:50 | 11:10 | 12:20 | 13:35 | 15:50 | 11:30 | 12:25 | 14:50 | 10:55 | 11:30 | 12:25 |
| **R39** | 12:25 | 12:50 | 12:10 | 12:50 | 11:10 | 12:20 | 13:35 | 16:30 | 11:25 | 12:25 | 16:00 | 10:55 | 11:25 | 12:25 |
| **R40** | 10:20 | 10:55 | 10:00 | 10:40 | 9:20 | 10:30 | 11:55 | 14:00 | 10:00 | 10:45 | 12:15 | 9:45 | 10:00 | 10:25 |
| **R41** | 10:20 | 10:55 | 10:00 | 10:40 | 9:20 | 10:30 | 11:35 | 13:40 | 10:00 | 10:45 | 12:15 | 9:35 | 10:00 | 10:25 |
| **R42** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R43** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R44** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R45** | 9:30 | 10:05 | 9:40 | 10:10 | 9:40 | 9:40 | 10:15 | 11:40 | 9:30 | 10:10 | 11:35 | 9:30 | 9:30 | 9:45 |
| **R46** | 9:45 | 10:25 | 9:50 | 10:20 | 9:40 | 10:00 | 10:30 | 11:45 | 9:55 | 10:30 | 12:00 | 10:05 | 9:55 | 9:50 |
| **R47** | 11:20 | 11:25 | 11:00 | 11:30 | 10:55 | 11:00 | 11:30 | 13:05 | 11:00 | 11:15 | 13:15 | 11:10 | 11:00 | 11:20 |
| **R48** | 11:20 | 11:30 | 11:15 | 11:45 | 10:55 | 11:00 | 11:40 | 13:40 | 11:25 | 11:35 | 13:35 | 11:20 | 11:25 | 11:20 |
| **R49** | 11:30 | 11:45 | 11:30 | 11:45 | 11:15 | 11:30 | 11:55 | 14:05 | 11:25 | 12:00 | 13:35 | 11:20 | 11:25 | 11:40 |
| **R50** | 10:55 | 11:15 | 11:15 | 11:25 | 10:45 | 11:05 | 11:25 | 12:35 | 10:45 | 11:25 | 13:20 | 10:40 | 10:45 | 10:55 |
| **R51** | 11:00 | 11:40 | 11:10 | 11:30 | 10:55 | 11:00 | 11:30 | 13:00 | 10:55 | 11:15 | 13:15 | 11:05 | 10:55 | 11:00 |
| **R52** | 8:00 | 8:15 | 7:55 | 8:15 | 7:50 | 8:05 | 8:10 | 9:20 | 8:10 | 8:35 | 9:55 | 7:45 | 8:10 | 8:00 |
| **R53** | 12:55 | 14:10 | 12:55 | 13:30 | 11:35 | 13:15 | 14:35 | 17:10 | 12:25 | 13:25 | 15:35 | 11:35 | 12:25 | 13:35 |

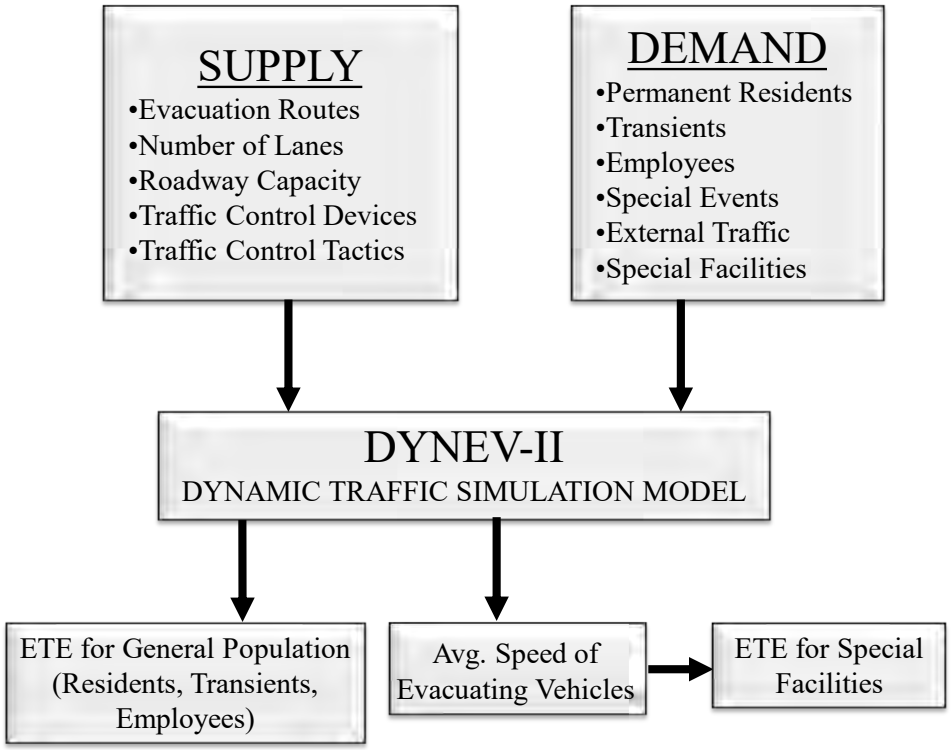



**Figure ES-1. ETE Methodology**

# 1 INTRODUCTION

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Pickering Nuclear Generating Station (PNGS), located in the City of Pickering in Durham Region, Ontario. This ETE study provides Ontario Power Generation (OPG), provincial, regional and municipal governments with site-specific information needed for protective action decision-making.

In the performance of this effort, guidance is provided by documents published by national and international federal governmental agencies. Most important of these are:

- Emergency Management and Fire Protection, Nuclear Emergency Preparedness and Response REGDOC-2.10.1, Version 2, February 2016.
- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, Rev. 1, February 2021.
- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG 0654/Radiological Emergency Preparedness Program Manual, FEMA P-1028, December 2019.
- Provincial Nuclear Emergency Response Plan (PNERP) Implementing Plan for the Pickering Nuclear Generating Station (PNGS), January 2019.

The work effort reported herein was supported and guided by OPG and other major stakeholders who contributed suggestions, critiques, and the local knowledge base required. Table 1-1 presents a summary of stakeholders and interactions. The ETE computed, for this study, is in compliance with NUREG/CR-7002, Rev. 1, February 2021, as shown in the checklist located in Appendix N.

## 1.1 Overview of the ETE Process

The following outline presents a brief description of the work effort in chronological sequence:

1. Information Gathering:
    a. Defined the scope of work in discussions with representatives from OPG.
    b. Attended a project kick-off meeting with personnel from OPG, provincial, regional and municipal emergency management offices to discuss methodology, project assumptions and to identify issues to be addressed and resources available.
    c. Conducted a detailed field survey of the highway system and of the area traffic

conditions within the Planning Zone (PZ)[1] in April 2022.

d. Reviewed the OPG and existing provincial and regional Emergency Operations Plans.

e. Conducted an online demographic survey of PZ residents (See Appendix F).

f. Obtained demographic data from the 2021 Statistics Canada Census. Projected the 2021 Statistics Canada Census data to the base year 2023 (see Section 3.1).

g. Conducted a data collection effort to create the database of special facilities (i.e., schools, summer day camps, colleges/universities, medical and correctional facilities), major employers, transportation providers/resources available, the special event, and other important information.

2. Estimated distributions of trip generation time representing the time required by various population groups (permanent residents, employees, and transients) to prepare (mobilize) for the evacuation trip. These estimates are primarily based upon the online demographic survey.

3. Defined Evacuation Scenarios (See Section 6). These scenarios reflect the variation in demand, in trip generation distribution and in highway capacities, associated with different seasons, day of week, time of day and weather conditions.

4. Reviewed the existing traffic management plan to be implemented by the Durham Region Police in the event of an incident at the plant. All TCPs listed at stop and yield signs inside Nuclear Emergency Pickering Guidebook Annex B2 for Durham Region were not modelled as TCPs based on discussions with emergency management personnel from Durham Region. See Section 9 and Appendix G.

5. According to the 2019 Provincial Nuclear Emergency Response Plan (PNERP) Implementing Plan for the PNGS guidance defined in Section 2.5, Figure 2.2 and Figure 2.3, the DPZ is subdivided into 25 Response Sectors and the CPZ is subdivided into 8 Response Sectors along major roadways and physical landmarks such as streams and Lake Ontario, which were used to define Evacuation Regions. “Regions” are groups of contiguous Response Sectors for which ETE are calculated. The configurations of these Regions reflect wind direction and the radial extent of the impacted area. Each Region, other than those that approximate circular areas, approximates a “key-hole section” within the PZs as recommended by NUREG/CR-7002, Rev. 1.

6. Estimated demand for transit services for persons at schools, summer day cares, colleges/universities, medical and correctional facilities and for transit-dependent persons at home.

7. Prepared the input streams for DYNEV II which computes ETE (see Appendices B and C).

[1] The Planning Zone represents entire study area which includes the Automatic Action Zone, Detailed Planning Zone (Inner and Outer Rings) and the Contingency Planning Zone.

a. Estimated the evacuation traffic demand, based on the available information derived from Statistics Canada, data provided by OPG, the City of Toronto and Durham Region, and from the demographic survey.

b. Applied the procedures specified in the 2022 Highway Capacity Manual (HCM 2022[2]) to the data acquired during the field survey, to estimate the capacity of all highway segments comprising the evacuation routes[3].

c. Updated the link-node representation of the evacuation network using the field survey and aerial imagery, which is used as the basis for the computer analysis that calculates the ETE.

d. Calculated the evacuating traffic demand for each Region and for each Scenario.

e. Specified selected candidate destinations for each "origin" (location of each "source" where evacuation trips are generated over the mobilization time) to support evacuation travel consistent with outbound movement relative to the location of the plant.

8. Executed the DYNEV II model to determine optimal evacuation routing and compute ETE for all residents, transients and employees ("general population") with access to private vehicles. Generated a complete set of ETE for all specified Regions and Scenarios.
9. Documented ETE in formats in accordance with NUREG/CR-7002, Rev. 1.
10. Calculated the ETE for all transit activities including those for special facilities (schools/summer day camps, correctional facilities and medical facilities), and for the transit-dependent population (which includes commuter students without vehicles).

While data was gathered, analyses were conducted, and results were obtained for both the DPZ and CPZ, this report primarily focuses on the DPZ since pre-planned protective actions are implemented in the DPZ and *contingency* planning and arrangements are made for the CPZ according to the PNERP Implementing Plan for the PNGS.

## 1.2 The Pickering Nuclear Generating Station (PNGS) Location

The PNGS is located along the northern shore of Lake Ontario in the City of Pickering, Durham Region, Ontario. The site is approximately 35 kilometres east of Toronto, Ontario. Figure 1-1 shows the location of PNGS relative to Toronto, as well as the communities and roadways in the area.

## 1.3 Preliminary Activities

These activities are described below.

Field Surveys of the Highway Network

[2] Highway Capacity Manual (HCM 2022), Transportation Research Board, National Research Council, 2022.
[3] The 2008 Canadian Capacity Guide was reviewed and considered for the estimation of capacity where applicable. However, the estimates for capacity in this study are based on the HCM 2022 as it is more up to date.

In April 2022, KLD personnel drove the entire highway system within the DPZ and CPZ, which consists of the area between the DPZ outer ring boundary and approximately 20 kilometres radially from the plant. The characteristics of each section of highway were recorded. These characteristics are shown in Table 1-2.

Video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 15-7 in the HCM 2022 indicates that a reduction in lane width from 12 feet (3.66 metres) (the "base" value) to 10 feet (3.05 metres) can reduce free flow speed (FFS) by 1.1 mph (1.77 kph) – not a material difference – for two-lane highways. Exhibit 15-46 in the HCM 2022 shows little sensitivity for the estimates of Service Volumes (SV) at Level of Service (LOS) E (near capacity), with respect to FFS, for two-lane highways.

The data from the audio and video recordings were used to create detailed geographic information systems (GIS) shapefiles and databases of the roadway characteristics and of the traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the DYNEV II System. Roadway types were assigned based on the following criteria:

- Freeway: limited access highway, 2 or more lanes in each direction, high free flow speeds
- Freeway Ramp: ramp on to or off of a limited access highway
- Major Arterial: 3 or more lanes in each direction
- Minor Arterial: 2 lanes in each direction
- Collector: single lane in each direction
- Local Roadway: single lane in each direction, local road with low free flow speeds

As documented on page 15-6 of the HCM 2022, the capacity of a two-lane highway is 1,700 passenger cars per hour in one direction. For freeway sections, a value of 2,250 vehicles per hour per lane is assigned, as per Exhibit 12-37 of the HCM 2022. The road survey has identified several segments which are characterized by adverse geometrics on two-lane highways which are reflected in reduced values for both capacity and speed. These estimates are consistent with the service volumes for LOS E presented in HCM 2022 Exhibit 15-46. Link capacity is an input to DYNEV II which computes the ETE. Further discussion of roadway capacity is provided in Section 4 of this report.

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches) or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide the traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway, or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume. TCPs at locations which have control

devices are represented as actuated signals in the DYNEV II system.

If no detectors were observed, the signal control at the intersection was considered pre-timed and detailed signal timings were gathered for several signal cycles. These signal timings were input to the DYNEV II system used to compute ETE, as per NUREG/CR-7002, Rev. 1 guidance.

Figure 1-2 presents the link-node analysis network that was constructed to model the evacuation roadway network in the PZ. The directional arrows on the links and the node numbers have been removed from Figure 1-2 to clarify the figure. The detailed figures provided in Appendix K depict the analysis network with directional arrows shown and node numbers provided. The observations made during the field survey and aerial imagery was used to calibrate the analysis network.

The link-node analysis network that was used for the previous study was updated to include any roadway improvements based on data collected during the road survey. In addition, the link-node analysis network was expanded to include additional roadways and intersections as needed for an accurate representation of the roadway system. Aerial imagery, the roadway survey and roadway design plans (to the extent available) were used to update the network.

Demographic Survey

An online sample demographic survey was performed to gather information needed for the ETE study. Appendix F presents the survey instrument, the procedures used, and tabulations of data compiled from the survey responses.

The demographic survey results were utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit-dependent residents.

Computing the Evacuation Time Estimates

The overall study procedure is outlined in Appendix D. Demographic data were obtained from several sources, as detailed later in this report. These data were analysed and converted into vehicle demand data. The vehicle demand was loaded onto appropriate “source” links of the analysis network using GIS mapping software. The DYNEV II system was then used to compute ETE for all Regions and Scenarios.

Analytical Tools

The DYNEV II System that was employed for this study is comprised of several integrated computer models. One of these is the DYNEV (DYnamic Network EVacuation) macroscopic simulation model, a new version of the IDYNEV model that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

DYNEV II consists of four sub-models:

- A macroscopic traffic simulation model (for details, see Appendix C).
- A Trip Distribution (TD), model that assigns a set of candidate destination (D) nodes for each “origin” (O) located within the analysis network, where evacuation trips are

"generated" over time. This establishes a set of O-D tables.

- A Dynamic Traffic Assignment (DTA), model which assigns trips to paths of travel (routes) which satisfy the O-D tables, over time. The TD and DTA models are integrated to form the DTRAD (Dynamic Traffic Assignment and Distribution) model, as described in Appendix B.
- A Myopic Traffic Diversion model which diverts traffic to avoid intense, local congestion, if possible.

Another software product developed by KLD, named UNITES (UNIfied Transportation Engineering System), was used to expedite data entry and to automate the production of output tables.

The dynamics of traffic flow over the network are graphically animated using the software product, EVAN (EVacuation ANimator), developed by KLD. EVAN is GIS based, and displays statistics output by the DYNEV II System, such as LOS, vehicles discharged, average speed, and percent of vehicles evacuated. The use of a GIS framework enables the user to zoom in on areas of congestion and query road name, town name and other geographical information.

The procedure for applying the DYNEV II System within the framework of developing ETE is outlined in Appendix D. Appendix A is a glossary of terms.

For the reader interested in an evaluation of the original model, I-DYNEV, the following references are suggested:

- NUREG/CR-4873 – Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code
- NUREG/CR-4874 – The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will expedite their travel from their respective points of origin to points outside the DPZ and/or CPZ.
- Restrict movement toward the plant to the extent practicable and disperse traffic demand so as to avoid focusing demand on a limited number of highways.
- Move traffic in directions that are generally outbound, relative to the location of the plant.

DYNEV II provides a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to represent the behavioural responses of evacuees. The effects of these countermeasures may then be tested with the model.

## 1.4 Comparison with Prior ETE Study

Table 1-3 presents a comparison of the present ETE study with the 2019 ETE study. The 90$^{th}$ percentile ETE for some cases increased by as much as 3 hours and 10 minutes for the DPZ (Region R03) and 1 hour and 30 minutes for all PZs (Region R04) when compared with the 2019

study. The 100th percentile ETE for the Region R03 increased as much as 3 hours and 15 minutes and 2 hours and 25 minutes for Region R04. On average, across all regions and scenarios, the 90th percentile ETE increased by 1 hour and 20 minutes and the 100th percentile ETE increased by 46 minutes.

The major factors contributing to the increases in the ETE values obtained in this study compared to those of the previous study are:

- The permanent resident population was calculated using 2021 Statistics Data projected to 2023 versus the 2016 Census data projected to 2018 in the previous study. The DPZ population grew by approximately 5%, the CPZ population grew by 1% and all PZs population grew by approximately 2% resulting in additional evacuating vehicles, which can increase ETE.
- Note that in the previous study, major employers were considered those with 50 or more total employees, while this study considered employers with 200 or more employees working in a single shift as major employers, as per the NUREG/CR-7002, Rev. 1 guidance. As Such, the employee population decreased by approximately 25% which can increase the 90th percentile ETE but decrease the 100th percentile ETE. Employees mobilize quickly. As a result, a decrease in quickly mobilizing evacuees can actually increase the 90th percentile ETE as it will take longer to reach 90% of evacuated vehicles.
- The transient population increased by approximately 25% which can increase or decrease the 90th percentile ETE and increase the 100th percentile ETE. An increase in evacuating vehicles (demand) can increase ETE.
- The shadow and voluntary evacuation percentage increased from 20% to 30%, as per discussions with the Ministry of Transportation of Ontario (MTO) and OPG. The increased in shadow evacuation percentage increases the evacuating traffic outside of the area being evacuated, thereby reducing the available capacity for evacuees and increasing ETE.
- The time needed to establish access control points at the perimeter of the response sectors doubled, as per discussion with MTO. External traffic vehicles can enter the PZs for 4 hours compared to 2 hours in the 2019 study. As a result, the external traffic along Highway 401, Highway 407 and Highway 404 doubled. An increase in external traffic reduces the available capacity for evacuees and increase ETE.

The various factors, discussed above, that can decrease ETE do not outweigh those that can increase ETE, thereby explaining why the 90th and 100th percentile ETE has significantly increased in this study relative to the 2019 ETE study.

When looking at averages for individual regions (across all scenarios), there are some regions where in the ETE does decrease at the 100th percentile only. These are likely cases with minimal congestion that clear prior to mobilization time. The time to mobilize decreased from the last study, and the ETE for those cases that are dictated by the time to mobilize (rather than the time to clear congestion) will decrease as a result.

**Table 1-1. Stakeholder Interaction**

| Stakeholder | Nature of Stakeholder Interaction |
|---|---|
| Ontario Power Generation (OPG) | Attended kick-off meeting to define project methodology and data requirements. Set up contacts with provincial, regional, and municipal government agencies.<br>Provided existing emergency plans, employment data for PNGS and confirmed and/or updated special facility data. Reviewed and approved all project assumptions and draft report.<br>Attended final meeting where the ETE study results were presented. |
| Durham Region | Attended Kick-off meeting to discuss the project methodology, key project assumptions and to define data needs.<br>Provided special facility data, emergency plans, and traffic control plans. Reviewed and provided comments on all project assumptions. Engaged in the ETE development and informed of the study results.<br>Attended final meeting where the ETE study results were presented[4]. |
| City of Toronto Office of Emergency Management (OEM) | |
| Durham Emergency Management Office (DEMO) | |
| Ministry of Transportation of Ontario (MTO) | |
| Ontario Provincial Police | |
| Darlington Regional Police | |

**Table 1-2. Highway Characteristics**

- Number of lanes
- Lane width
- Shoulder type & width
- Interchange geometries
- Lane channelization & queuing capacity (including turn bays/lanes)
- Geometrics: curves, grades (>4%)
- Posted speed
- Actual free speed
- Abutting land use
- Control devices
- Intersection configuration (including roundabouts where applicable)
- Traffic signal type
- Unusual characteristics: Narrow bridges, sharp curves, poor pavement, flood warning signs, inadequate delineations, toll booths, etc.

[4] This is true for all agencies except for the Government of Ontario Emergency Management Agency, presentation materials and meeting notes were provided.

**Table 1-3. ETE Study Comparisons**

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Resident Population Basis** | 2016 Statistics Canada data projected to 2018; area ratio method used:<br>DPZ Population = 292,024<br>CPZ Population = 964,688<br>PZ Total Population = 1,256,712 | 2021 Statistics Canada data projected to 2023; area ratio method used:<br>DPZ Population = 305,809<br>DPZ Resident Vehicles= 142,003<br>CPZ Population = 974,896<br>CPZ Resident Vehicles= 452,750<br>PZ Total Population = 1,280,705<br>PZ Total Resident Vehicles= 594,753 |
| **Resident Population Vehicle Occupancy** | Based on 2016 Census Data and 2015 telephone survey;<br>Within PNGS only: 2.89 persons/household, 1.23 evacuating vehicles/household yielding: 2.35 persons/vehicle.<br>Within overlap of PNGS and Darlington Nuclear Generating Station (DNGS): 2.8 persons/household, 1.24 evacuating vehicles/household yielding: 2.26 persons/vehicle. | 2.95 persons/household, 1.37 evacuating vehicles/household yielding: 2.15 persons/vehicle. |
| **Employee Population** | Employee estimates based on data provided in 2015, and 2016 Commuting Flow census. Based on the telephone survey, employee vehicle occupancy is 1.12 employees per vehicle.<br>DPZ Employees = 22,925<br>CPZ Employees = 92,739<br>PZ Total Employees = 115,664 | Employee estimates based on data received from OPG, Statistics Canada, and 2021 labour force data and Commuting Flow survey. Based on the demographic survey, employee vehicle occupancy is 1.15 employees per vehicle. Note: For Durham Region, employee occupancy rate of one (1) employee per vehicle are used.<br>DPZ Employees = 19,918<br>DPZ Employee Vehicles= 19,275<br>CPZ Employees = 69,000<br>CPZ Employee Vehicles= 62,118<br>PZ Total Employees = 88,918<br>PZ Total Employee Vehicles= 81,393 |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Transit-Dependent Population** | Estimates based upon 2016 Statistics Canada data projected to 2018 and the results of the 2015 telephone survey.<br>The total of people who do not have access to a vehicle:<br>DPZ = 2,607 people in 87 buses to evacuate.<br>CPZ = 8,612 in 288 buses to evacuate.<br>PZ Total = 11,219 in 375 buses to evacuate. | Estimates based upon 2021 Statistics Canada data projected to 2023 and the results of the demographic survey.<br>The total number of people who do not have access to a vehicle:<br>DPZ = 3,217 people in 108 buses to evacuate.<br>CPZ = 10,253 in 342 buses to evacuate.<br>PZ Total = 13,470 in 450 buses to evacuate. |
| **Transient Population** | Data collected from 2015 ETE study, aerial imagery and internet searches:<br>Transients in DPZ = 17,181<br>Transients in CPZ = 33,822<br>Total Transients in PZ = 51,003 | Transient estimates based upon the data provided by the Regional Municipality of Durham and supplemented by data from the previous ETE study:<br>Transients in DPZ = 20,890<br>Transient Vehicles in DPZ= 8,180<br>Transients in CPZ = 42,997<br>Transient Vehicles in CPZ= 16,551<br>Total Transients in PZ = 63,887<br>Total Transient Vehicles in PZ= 24,731 |
| **Special Facilities (Medical and Detention Centres) Population** | Special facility population based on the 2015 study and provided by OPG.<br>Current DPZ census = 2,334 (Buses Required = 53, Wheelchair Bus Required = 81, Ambulances Required = 215, Vans Required = 1)<br>Current CPZ census = 11,540 (Buses Required = 233, Wheelchair Bus Required = 387, Ambulances Required = 1,153)<br>Current total census = 13,874 (Buses Required = 286, Wheelchair Bus Required = 468, Ambulances Required = 1,368, Vans Required = 1) | Special facility population estimates based on the 2019 ETE study data (reviewed and updated and/or confirmed by OPG).<br>Current DPZ census = 2,334 (Buses Required = 53, Wheelchair Vans Required = 218, Ambulances Required = 215, Vans Required = 1)<br>Current CPZ census = 11,502 (Buses Required = 233, Wheelchair Vans Required = 1,099, Ambulances Required = 1,148)<br>Current total census = 13,836 (Buses Required = 286, Wheelchair Vans Required = 1,317, Ambulances Required = 1,363, Vans Required = 1) |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **School, Summer Day Camps, and College/University Population** | School population based on information provided by local school boards in 2015 and internet searches.<br>School/Day Camps Enrolment in DPZ = 45,178; College Enrolment in DPZ = 22,587;<br>School/Day Camps Enrolment in CPZ = 150,556; College Enrolment in CPZ = 32,228;<br>School/Day Camps Enrolment in PZ = 195,734; College Enrolment in PZ = 54,815; | School population based on the 2019 ETE study data (reviewed and updated and/or confirmed by OPG), supplemented by internet searches and aerial imagery for parking spaces where data is missing.<br>School/Summer Day Camps Enrolment in DPZ = 45,423; College/university Enrolment in DPZ = 16,739;<br>School/Summer Day Camps Enrolment in CPZ = 148,789; College/university Enrolment in CPZ = 34,505;<br>School/Day Camps Enrolment in PZ = 194,812; College/university Enrolment in PZ = 51,244; |
| **Voluntary evacuation from within PZ in areas outside region to be evacuated** | 20% of the population within the PZ, but not within the Evacuation Region (see Figure 2-1) | 30% of the population within the PZ, but not within the Evacuation Region (see Figure 2-1) |
| **Shadow Evacuation & Population** | 20% of people outside of the PZ within the Shadow Region (5 kilometres radially from the DPZ boundary) – only considered for the AAZ, middle ring, and DPZ analyses<br>(see Figure 7-2) | 30% of people between DPZ boundary outer ring to the CPZ boundary (20 km radially from the plant) – only considered for the AAZ, DPZ Inner Ring, and DPZ Outer Ring analyses (see Figure 7-2) |
| **Network Size** | 6,262 links; 4,623 nodes | 6,923 links; 5,035 nodes |
| **External Through Traffic** | External-to-External traffic considered on Hwy 401, Hwy 407 and Hwy 404. Access control points will be established at 120 minutes after the Emergency Bulletin to divert this traffic.<br>Total External Traffic = 65,134 vehicles | External-to-External traffic considered on Hwy 401, Hwy 407 and Hwy 404. Access control points will be established at 240 minutes after the Emergency Bulletin to divert this traffic, as per MTO.<br>Total External Traffic = 128,144 vehicles |
| **Roadway Geometric Data** | Field surveys conducted in June 2018. Roads and intersections were video archived.<br>Road capacities based on 2010 HCM. | Field surveys conducted in April 2022. Roads and intersections were video archived.<br>Road capacities based on 2022 HCM. |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **School Evacuation** | Direct evacuation to designated Temporary Holding Centre (THC) for DPZ evacuation and Reception Centres for the full PZ (DPZ & CPZ) evacuation. | Direct evacuation to designated Temporary Holding Centre (THC) for DPZ evacuation and Reception Centres for the full PZ (DPZ & CPZ) evacuation. |
| **Ridesharing** | 91.3 percent of transit-dependent persons will evacuate with a neighbour or friend, based on the 2015 telephone survey. | 70.6 percent of transit-dependent persons will evacuate with a neighbour or friend, based on the demographic survey. |
| **Trip Generation for Evacuation** | Based on the 2015 residential telephone survey of specific pre-trip mobilization activities:<br>Residents with commuters returning leave between 30 and 345 minutes.<br>Residents without commuters returning leave between 15 and 285 minutes.<br>Employees and transients leave between 15 and 150 minutes.<br>All times measured from the Emergency Bulletin. | Based on the residential household survey of specific pre-trip mobilization activities:<br>Residents with commuters returning leave between 45 and 255 minutes.<br>Residents without commuters returning leave between 30 and 195 minutes.<br>Employees and transients leave between 15 and 75 minutes.<br>All times measured from the Emergency Bulletin. |
| **Weather** | Normal, Rain, or Snow. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain and 20% for snow. | Normal, Rain/Light Snow, or Heavy Snow. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain/light snow. For Heavy Snow scenarios a speed and capacity reduction of 15% and 25% are used, respectively. |
| **Modelling** | DYNEV II System – Version 4.0.19.2 | DYNEV II System – Version 4.0.21.0 |
| **Special Events** | Large Event at the Toronto Zoo | Large Event at the Toronto Zoo |
| **Evacuation Cases** | 53 Regions (central sector wind direction and each adjacent sector technique used) and 14 Scenarios producing 742 unique cases. | 53 Regions (central sector wind direction and each adjacent sector technique used) and 14 Scenarios producing 742 unique cases. |
| **Evacuation Time Estimates Reporting** | ETE reported for 90$^{th}$ and 100$^{th}$ percentile population for the base year of 2018 and projected to 2024 and 2028. Results presented by Region and Scenario. | ETE reported for 90$^{th}$ and 100$^{th}$ percentile population for the base year of 2023 and projected to 2028. Results presented by Region and Scenario. |

| Topic | Previous ETE Study | Current ETE Study |
|---|---|---|
| **Evacuation Time Estimates for the entire DPZ, 90th percentile** | Winter Midweek Midday,<br>Good Weather: 4:30<br><br>Summer Weekend, Midday,<br>Good Weather: 4:10 | Winter Midweek Midday,<br>Good Weather: 6:25<br><br>Summer Weekend, Midday,<br>Good Weather: 6:00 |
| **Evacuation Time Estimates for the entire DPZ, 100th percentile** | Winter Midweek Midday,<br>Good Weather: 5:55<br><br>Summer Weekend, Midday,<br>Good Weather: 5:55 | Winter Midweek Midday,<br>Good Weather: 7:45<br><br>Summer Weekend, Midday,<br>Good Weather: 7:30 |
| **Evacuation Time Estimates for the entire CPZ, 90th percentile** | Winter Midweek Midday,<br>Good Weather: 9:20<br><br>Summer Weekend, Midday,<br>Good Weather: 8:00 | Winter Midweek Midday,<br>Good Weather: 9:45<br><br>Summer Weekend, Midday,<br>Good Weather: 8:55 |
| **Evacuation Time Estimates for the entire CPZ, 100th percentile** | Winter Midweek Midday,<br>Good Weather: 12:40<br><br>Summer Weekend, Midday,<br>Good Weather: 10:50 | Winter Midweek Midday,<br>Good Weather: 13:00<br><br>Summer Weekend, Midday,<br>Good Weather: 12:40 |

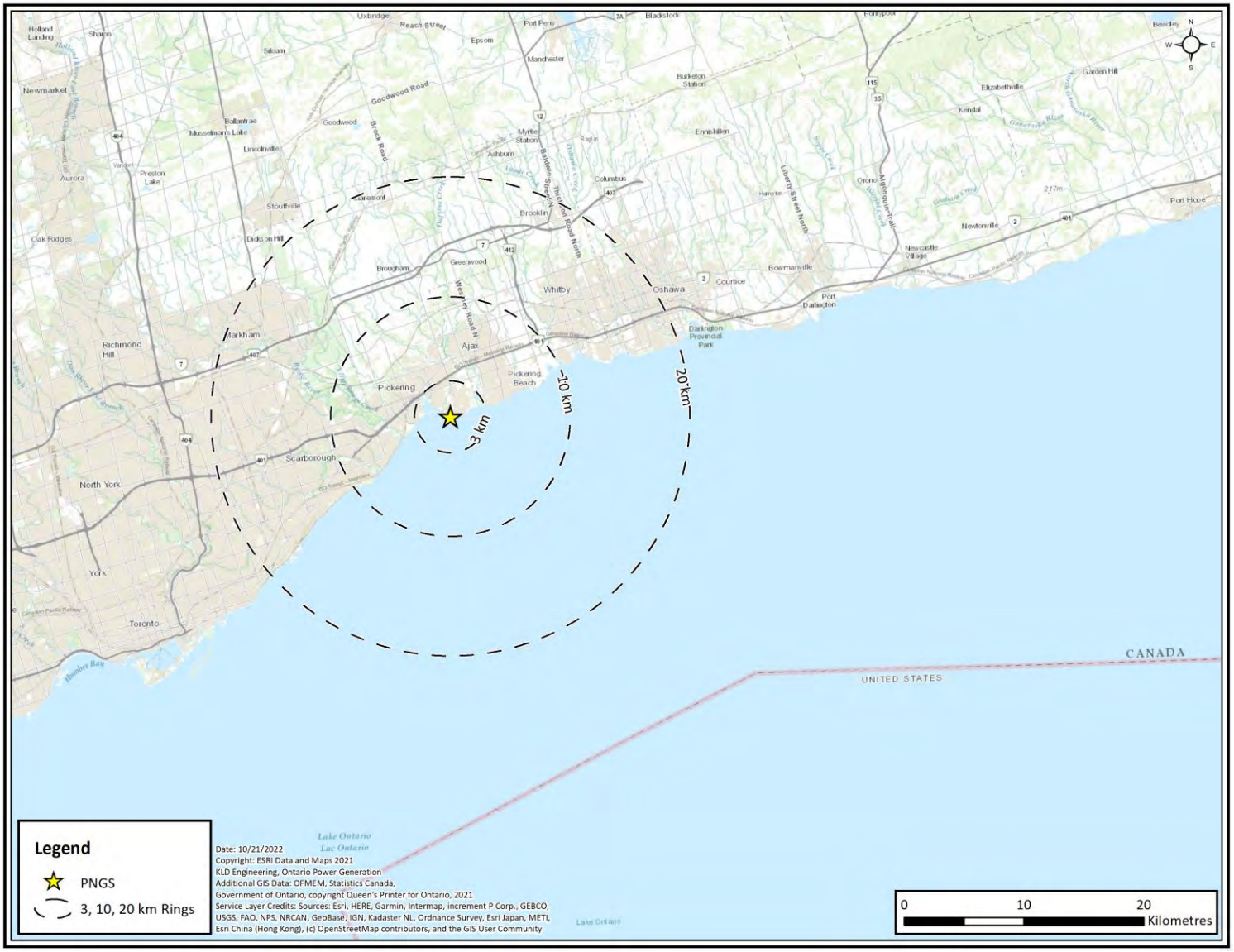



**Figure 1-1. PNGS Location**

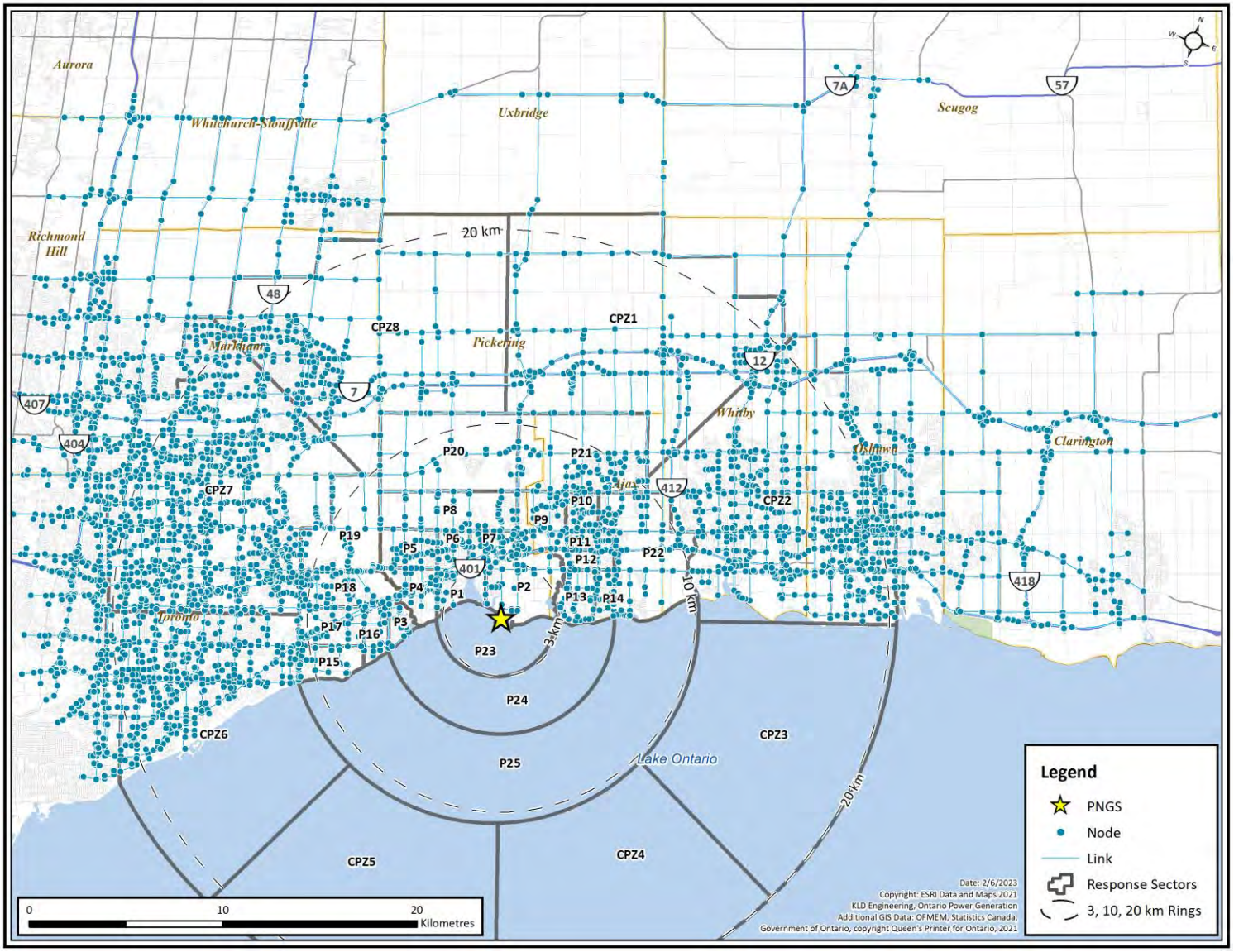



**Figure 1-2. PNGS Link-Node Analysis Network**

## 2 STUDY ESTIMATES AND ASSUMPTIONS

This section presents the estimates and assumptions utilized in the development of the evacuation time estimates (ETE).

### 2.1 Data Estimates

1. The Planning Zone[1] (PZ) permanent resident population are based on the 2021 Statistics Canada population data[2] extrapolated to 2023 as the base year. Population is also projected to 2028[3], as per the CNSC REGDOC 2.10.1 guidance for the Automatic Action Zone (AAZ[4]), Detailed Planning Zone (DPZ[4]), see Section 3.1.
2. Population estimates at major employers are based on data provided by Statistics Canada. The PNGS plant employee estimates are based upon data provided by OPG[5]. The percentage of employees within the PZs that originate from outside the study area are based on the 2021 labour force data and Commuting Flow survey[6] provided by Statistics Canada (released on November 30, 2022), see Section 3.4.
3. Population estimates at transient and special facilities are based on the data provided by the city and region, the previous ETE study, the municipalities within the PZ and emergency plans, supplemented by internet searches and aerial imagery for parking spaces where data is missing. When aerial imagery is used, it is assumed that parking lots are full during peak times.
4. Current census at nursing homes and assisted living centres are assumed to be equal to the capacity of that facility.
5. The relationship between permanent resident population and evacuating vehicles was based on the results of the Census data as well as the 2022 online demographic survey results (see Appendix F). The estimated average household size of the PZ from the Census data is 2.95 persons per household. The results of the demographic survey indicate on average, households will utilize 1.37 vehicles to evacuate. Thus, the Census population estimate of 2.95 people per household and 1.37 evacuating vehicles per household (Figure F-11, sub-section F.3.2) are used for the permanent resident population in the PZ.

[1] The Planning Zone represents entire study area which includes the Automatic Action Zone, Detailed Planning Zone (Inner and Outer) and the Contingency Planning Zone.
[2] https://www.statcan.gc.ca/eng/start
[3] A sensitivity study (KLD TR-1313) has been completed to compute future year ETE from 2028 to 2066 on a per decade basis.
[4] The AAZ represents 0 to 3 km from the plant, the DPZ inner ring represents 0 to 6 km from the plant, the DPZ outer ring represents 0 to 10 km from the plant and the CPZ represents 0 to 20 km from the plant.
[5] Some OPG employees can work from home (WFH) 2 days a week. However, the current WFH agreement might change during the next Collective Agreement and there could be more or less employees who WFH. In addition, there are a number of contractors that are on site that are present at the site every day. The number of contractors fluctuates daily. As such, the percentage of employees who WFH was disregarded and it is conservatively assumed that during peak time, the maximum shift is present at the site on average. Essentially, it is assumed the WFH employees are offset by the additional contractors that are present on site each day.
[6] http://www12.statcan.gc.ca/nhs-enm/index-eng.cfm

6. On average, the relationship between persons and vehicles for transients (see Section 3.3) and the special event (see Section 3.8) are estimated to be as follows:
    a. Beaches: 2.48 people per vehicle
    b. Campgrounds: 2.84 people per vehicle
    c. Golf Courses: 1.94 people per vehicle
    d. Historical Sites: 2.97 people per vehicle
    e. Marinas: 2.18 people per vehicle
    f. Museums: 2.91 people per vehicle
    g. Parks: 2.64 people per vehicle
    h. Lodging Facilities: 2.95 people per vehicle
    i. Other Facilities: 2.98 people per vehicle
    j. Special Event: Transients attending a large event at the Toronto Zoo has an estimated occupancy of 2.95 persons per vehicle.
7. As per the information received from Durham Emergency Management, employee occupancy rate of one (1) employee per vehicle are used for Durham Region. For other areas of the DPZ and CPZ, employee vehicle occupancies are based on the results of the demographic survey. For this study, 1.15 employees per vehicle are used. In addition, it is assumed there are two people per carpool, on average (see Appendix F, sub-section F.3.1 and Figure F-7).
8. The maximum bus speed assumed within the study area is 100 kph based on school bus speed limits for regional routes in Durham and the City of Toronto and average posted speed limits on major roadways within the PZ.
9. Roadway capacity estimates are based on field surveys performed in April 2022 (verified by aerial imagery), and the application of the U.S. Highway Capacity Manual 2022 and Canadian Capacity Guide where applicable.
    a. In accordance with NUREG/CR-7002, Rev. 1, only those roadway construction projects that are completed prior to the finalization of this report are considered in an ETE study. As no roadway projects were identified by OPG or the OROs, no future roadway improvement projects (affecting roadway capacity estimates) are considered in this study.
10. Five percent (5%) heavy vehicle traffic are assumed for all cases.

## 2.2 Study Methodological Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly progressing severe accident that requires evacuation, and includes the following[7] (as per NRC guidance):
    a. The Emergency Bulletin to evacuate is announced coincident with the activation of the notification.
    b. Mobilization of the general population will commence within 15 minutes after notification.
    c. The ETE are measured relative to the Emergency Bulletin to evacuate.
2. The centre-point of the plant is located at the centre of the vacuum building at 43°48' 33.273" N and 79°4' 6.137" W.
3. The DYNEV II[8] (Dynamic Network EVacuation) macroscopic simulation model is used to compute ETE in this study.
4. All actions set forth in provincial, regional, and municipal emergency response plans are assumed to be implemented as described in the plans.
5. Evacuees will drive safely, travel radially away from the plant to the extent practicable given the roadway network, and obey all traffic control devices and traffic guides. All major evacuation routes are used in the analysis.
6. The ETEs are developed for the emergency PZs within the PNGS study area including the AAZ, DPZ, CPZ, and as well as various combinations of the Response Sectors within these PZs. See Figure 3-1.
7. The CPZ is considered as the Shadow Region, for an evacuation of the AAZ or the DPZ. See Figure 7-2. It is assumed that there is no shadow evacuation beyond the CPZ.
8. Evacuation percentages are as follows (see Figure 2-1):
    a. One hundred percent (100%) of the people within the impacted keyhole will evacuate, as indicated in Figure 2-2 of NUREG/CR-7002 Rev. 1 guidance.
    b. A voluntary evacuation of thirty percent (30%) of the people is considered as part of this study to account for people who live within the PZ but outside of the area being evacuated, as shown in Figure 2-1.
    c. A shadow evacuation of 30% of the area between DPZ boundary to the CPZ boundary (20 km radially from the plant) are considered for a full evacuation of

[7] We emphasize that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:
1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various stages of an emergency.

[8] The models of the I-DYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment.

the AAZ and DPZ. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).

9. The CPZ population characteristics (household size, evacuating vehicles per household, and mobilization time) were assumed to be the same as that of the permanent resident population within the AAZ and DPZ.
10. The ETE are presented at the 90th and 100th percentiles for each Region and for each Scenario in graphical and tabular format. The percentile ETE is defined as the elapsed time from the Emergency Bulletin to evacuate issued to a specific Region of the PZ, to the time that Region is clear of the indicated percentile of evacuees.
11. The ETE also includes the consideration of "through" (External-External traffic that originates its trip outside of the study area and has its destination outside of the study area) trips during the time that such traffic is permitted to enter the evacuated Region. External-External traffic is assumed along Highway (Hwy) 401, Hwy 407, Hwy 412, and Hwy 404. The volumes used as External-External traffic are the 30th highest hourly traffic volume of the year, a conservative approach.
12. This study does not assume that roadways are empty at the start of the evacuation. Rather, there is an initialization period (often referred to as "fill time" in traffic simulation) wherein the anticipated traffic volumes from the beginning of the evacuation are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being evacuated.
13. To account for boundary conditions (roadway conditions outside the study area that are not specifically modelled due to the limited radius of the study area) beyond the study area, this study assumed a 25% reduction in capacity on two-lane roads and multilane highways for roadways that have traffic signals downstream. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic volume ("main street") is more significant than the competing ("side street") traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time. There is no reduction in capacity for freeways due to boundary conditions.
14. It is assumed that tolls within the study area would be waived in an evacuation.

## 2.3 Assumptions on Mobilization Times

1. Essentially 100% of the PZ population can be notified within 45 minutes after the Emergency Bulletin to evacuate, based on discussions with Provincial emergency managers and OPG. (This does not include the 50km ingestion pathway zone (IPZ). Current regulations do not define time expectations for notifying the PZ. For the purposes of this study, an assumption of the time required to notify the population in the PZ is necessary to produce ETEs. A value of 45 minutes has been assumed as reasonable to the extent possible, given the use of the sirens and land line telephone

alerting in the DPZ together with NAAD[9] and wireless public alerting in the DPZ, CPZ and IPZ as required.

2. Commuter percentages (and percentage of residents awaiting the return of a commuter) are based on the results of the 2022 demographic survey. According to the survey results, approximately 91% of the households in the PZ have at least 1 commuter (see Appendix F, sub-section F.3.1); 72% of those households with commuters will await the return of a commuter before beginning their evacuation trip (see Appendix F, sub-section F.3.2). Therefore, 66% (91% x 72% = 65.5%, rounded up to 66%) of PZ households will await the return of a commuter, prior to beginning their evacuation trip.
3. According to the results of the demographic survey, approximately 68% of commuters who utilize rail will return to their parked vehicle within the CPZ prior to evacuating. Of those who would return to their car, about 95% indicated they would return home before evacuating. The remaining 5% would evacuate directly from the train station at which their car is parked. These concepts and percentages are applied to the commuters that utilize rail in this analysis.
4. Trip generation time (also known as mobilization time, or the time required by evacuees to prepare for the evacuation) are based upon the results of the online 2022 demographic survey, as per U.S. NRC guidance. It is assumed that stated events take place in sequence such that all preceding events must be completed before the current event can occur. The distributions based on the results of the online 2022 demographic survey are as follows (see Section 5):
    a. Employees/Transients will leave between 5 and 75 minutes after the Emergency Bulletin to evacuate
    b. Permanent resident population with commuters will leave between 30 and 255 minutes after the Emergency Bulletin to evacuate (longer in snow)
    c. Permanent resident population without commuters will leave between 15 and 195 minutes after the Emergency Bulletin to evacuate (longer in snow)

## 2.4 Transit Dependent Assumptions

1. The percentage of transit-dependent people who rideshare with family, neighbours, and friends (reducing the demand for buses) are based on the results of the 2022 demographic survey. According to the survey results, approximately 71% of the transit-dependent population rideshare (see Appendix F, sub-section F.3.1, and Figure F-5).
2. Transit vehicles (buses) are used to transport those without access to private vehicles:
    a. Schools and day care centers
        i. If schools are in session, school (black and yellow buses), provided by various bus contractors in the area, will evacuate students directly to the

[9] https://alerts.pelmorex.com/

designated Temporary Holding Schools (THS). Depending on what buses are available, several buses may be used to make multiple trips to the THS.

ii. It is assumed that parents will pick up children at day care centres prior to evacuation.

iii. No schoolchildren will be picked up by their parents prior to the arrival of the buses, except for day care centres.

iv. Schoolchildren, if school is in session, are given priority in assigning transit vehicles.

b. Medical Facilities

i. Buses, wheelchair vans, and ambulances will evacuate patients at medical facilities (which also includes any senior living facilities) that have these resources or agreements in place for these resources, within the PZ.

ii. Wherein data was not provided, the breakdown of ambulatory, wheelchair bound, and bedridden patients are computed using average percentages from the previous study.

c. Transit-dependent permanent residents:

i. Transit-dependent (those that do not own or have access to a private vehicle) general population who requires radiological treatment are evacuated to reception centres using buses and the pre-existing routes along the Durham Region Transit, Toronto Transit Commission and GO Transit bus and rail lines.

ii. Access and/or functional needs population[10] may require assistance (ambulance, bus, or wheelchair transport) to evacuate. It is assumed that direction on how to get assistance will be provided within the Emergency Bulletin to evacuate[11] and arrangements will be made for a special vehicle to be sent to their home on an on-demand basis .

iii. Households with 3 or more vehicles were assumed to have no need for transit vehicles.

d. Analysis of the number of required round-trips ("waves") of evacuating transit vehicles is presented in Section 8.

3. Transit vehicle capacities:

[10] Access and/or functional needs population refers to those people that need special assistance during an evacuation that do not reside in special facilities.

[11] Durham Region Emergency Management is currently developing a process to ensure individuals in this category are supported through appropriate channels.

a. School buses = 72 students per bus for elementary schools and 60 students per bus for middle schools and 48 students per bus for high schools.
b. Ambulatory transit-dependent persons and medical facility patients = 30 persons per bus[12].
c. Ambulances = 1 bedridden person (includes advanced and basic life support)
d. Wheelchair vans = 4 wheelchair bound persons

4. Transit vehicle mobilization times, which are considered in ETE calculations:
   a. Vehicles for schools and medical facilities without transportation arrive at these facilities to be evacuated within 90 minutes of the Emergency Bulletin to evacuate.
   b. It is likely buses for the transit dependent population are mobilized almost instantaneously. It is assumed there are buses available by the time 90% of residents with no commuters have completed their mobilization at approximately 2 hours after the emergency bulletin to evacuate is issued (see Figure 5-4). If necessary, multiple waves of buses will be utilized to gather transit dependent people who mobilize more slowly.
   e. It is assumed that patients can be mobilized concurrently and within the time it would take vehicles to mobilize.
5. Transit Vehicle loading times:
   a. Concurrent loading on multiple buses/transit vehicles is assumed.
   b. School buses are loaded in 15 minutes.
   c. Transit Dependent buses require 1 minute of loading time per passenger.
   d. Buses for medical facilities require 30 minutes to load ambulatory passengers.
   e. Wheelchair transport vehicles require at least 45 minutes to load passengers.
   f. Ambulances are loaded in 60 minutes.
6. Drivers for all transit vehicles, identified in Table 8-1, are available.

## 2.5 Diversion Traffic and Access Control Assumptions

1. Diversion Traffic Control Points or Access Control Points (ACP) to stop the flow of external traffic through the PZs as defined in the approved regional and provincial emergency plans, are assumed to be staffed within approximately 240 minutes following the Emergency Bulletin, to divert traffic attempting to enter the PZs, as per discussions with the Ministry of Transportation Ontario (MTO) personnel. Earlier evacuation of ACP locations could delay returning commuters, including those using GO

[12] Durham Regional Transit (DRT) indicated that their full-size buses can accommodate 78 passengers at peak times. During an evacuation, however, it is likely that evacuees will carry personal items such as luggage and pets that will take up some of the available seating capacity. Hence, it is conservatively assumed that each bus can carry approximately 30 people.

trains. It is assumed that no through traffic or GO trains will enter the PZs after this 240-minute time period.

2. Evacuation Traffic Points or Traffic Control Points (TCPs) within the PZs are assumed to be staffed within approximately 4 hours, beginning at the Emergency Bulletin to evacuate, as per discussions with MTO personnel. Their number and location will depend on the Region to be evacuated and resources available. TCPs at signalized intersections within Durham Region are assumed to be established immediately[13]. TCPs at unsignalized intersections within Durham Region will not be staffed[14].

## 2.6 Scenarios and Regions

1. A total of 14 "Scenarios" representing different temporal variations (season, time of day, day of week) and weather conditions are considered. Scenarios to be considered are defined in Table 2-1:
    a. A large event at the Toronto Zoo, located in Response Sector P19, is considered as the special event (single or multi-day event that attracts a significant population into the CPZ) for Scenario 13.
    b. One lane outbound on a freeway must be closed for a roadway impact scenario for Scenario 14, as per NUREG/CR-7002, Rev 1 guidance. This study considers the closure of a single lane on Highway 401 Express westbound from the interchange with Brock Road to the interchange with McCowan Road.

2. Two types of adverse weather scenarios are considered. Rain may occur for either winter or summer scenarios; snow occurs in winter scenarios only. It is assumed that the rain or snow begins earlier or at about the same time the evacuation advisory is issued. Thus, no weather-related reduction in the number of transients who may be present in the PZ is assumed. It is further assumed that snow removal equipment is available, the appropriate agencies are clearing/treating the major evacuation routes as they would normally when snowing, and the roads are passable albeit at lower speeds and capacities.

3. Adverse weather scenarios affect roadway capacity and the free flow roadway speeds, based on recent transportation research[15]. In accordance with Table 3-1 of the U.S. NUREG/CR-7002, Rev. 1, this study assumes a 10% reduction in speed and capacity for rain and light snow. The "heavy snow" scenarios considered assume that there was a significant snowfall such that minor roadways and driveways have snow on them. Major roadways have been plowed but still have a coating of snow on them that slow traffic

[13] Durham Region has a Traffic Management Center (TMC) in which almost all traffic signals are wired. As a result, the Region has the ability to instantaneously manipulate signal timings as needed to control the flow of traffic.

[14] Based upon discussions with Durham Region, there may be a shortfall of resources to staff the TCPs at non-signalized intersections within the PZs and officers would be deployed based on the immediate needs of the impacted intersections. As such, it is conservatively assumed that all TCPs at unsignalized intersections will not be staffed.

[15] Agarwal, M. et. al. Impacts of Weather on Urban Freeway Traffic Flow Characteristics and Facility Capacity, Proceedings of the 2005 Mid-Continent Transportation Research Symposium, August, 2005.

down and reduce roadway capacity. During "heavy snow" scenarios a speed and capacity reduction of 15% and 25% are used, respectively.

4. Extreme weather conditions and natural disasters are considered more extraordinary cases of adverse weather. Given the rarity of these events, they are not considered in the ETE study. Rather, extreme weather and natural disasters would be deemed "impediments to evacuation".
5. It is assumed for "heavy snow" scenarios that some evacuees will need additional time to clear their driveway and access the public roadway system. The distribution of time for this activity was gathered through a demographic survey of the public and takes up to 105 minutes (1 hour and 45 minutes) for permanent residents (See Section 5.3 and Table 5-6). It is assumed that the time needed by evacuees to remove snow from their driveways is sufficient time for snow removal crews to mobilize and clear/treat major roadways. There are additional activities that a person will have to do before they actually begin their evacuation trip, which delay their departure time. This allows additional time to plow the minor roads, as needed.
6. Employment is reduced slightly (4% reduction) in the summer for vacations.
7. Mobilization and loading times for transit vehicles are slightly longer in adverse weather. It is assumed that mobilization times are 10 minutes and 20 minutes longer in rain/light snow and heavy snow, respectively. It is assumed that loading times for school/transit buses are 5 minutes and 10 minutes longer in rain/light snow and heavy, respectively.
8. Regions to be considered are based on keyhole logic documented in U.S. guidance and discussions with OPG. These Regions, as defined, display irregular boundaries reflecting the geography of the Sectors included within these underlying configurations. Regions to be considered are defined in Table 6-1 and Table 6-2. It is assumed that everyone within the group of Response Sectors forming a Region that is issued an Emergency Bulletin will, in fact, respond and evacuate in general accord with the planned routes.
9. Each Response Sector that intersects the keyhole is included in the Region. There are instances when a small portion of a Response Sector is within the keyhole and the population within that small portion is low (500 people or 10% of Zone population, whichever is less). Under those circumstances, the Response Sector is not included in the Region.
10. Staged evacuation is considered as defined in NUREG/CR-7002, Rev. 1 – those people beyond the AAZ will shelter-in-place until 90% of the AAZ has evacuated, then they will evacuate. See Regions R37 through R53 in Table 6-2.

**Table 2-1. Evacuation Scenario Definitions**

| Scenarios | Season[16] | Day of Week | Time of Day | Weather | Special |
|---|---|---|---|---|---|
| 1 | Summer | Midweek | Midday | Good | None |
| 2 | Summer | Midweek | Midday | Rain | None |
| 3 | Summer | Weekend | Midday | Good | None |
| 4 | Summer | Weekend | Midday | Rain | None |
| 5 | Summer | Midweek, Weekend | Evening | Good | None |
| 6 | Winter | Midweek | Midday | Good | None |
| 7 | Winter | Midweek | Midday | Rain/Light Snow | None |
| 8 | Winter | Midweek | Midday | Heavy Snow | None |
| 9 | Winter | Weekend | Midday | Good | None |
| 10 | Winter | Weekend | Midday | Rain/Light Snow | None |
| 11 | Winter | Weekend | Midday | Heavy Snow | None |
| 12 | Winter | Midweek, Weekend | Evening | Good | None |
| 13 | Winter | Weekend | Midday | Good | Special Event: Large Event at the Toronto Zoo |
| 14 | Summer | Midweek | Midday | Good | Roadway Impact: Closure of a Single Lane on Highway 401[17] |

**Table 2-2. Model Adjustment for Adverse Weather**

| Scenario | Highway Capacity* | Free Flow Speed* | Mobilization Time for General Population | Mobilization Time for Transit Vehicles | Loading Time for School Buses | Loading Time for Transit Buses |
|---|---|---|---|---|---|---|
| Rain/ Light Snow | 90% | 90% | No Effect | 10-minute increase | 5-minute increase | 5-minute increase |
| Snow | 75% | 85% | Clear driveway before leaving home (See Figure F-19) | 20-minute increase | 10-minute increase | 10-minute increase |

*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.

[16] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).
[17] Closure of a single lane on Highway 401 westbound.

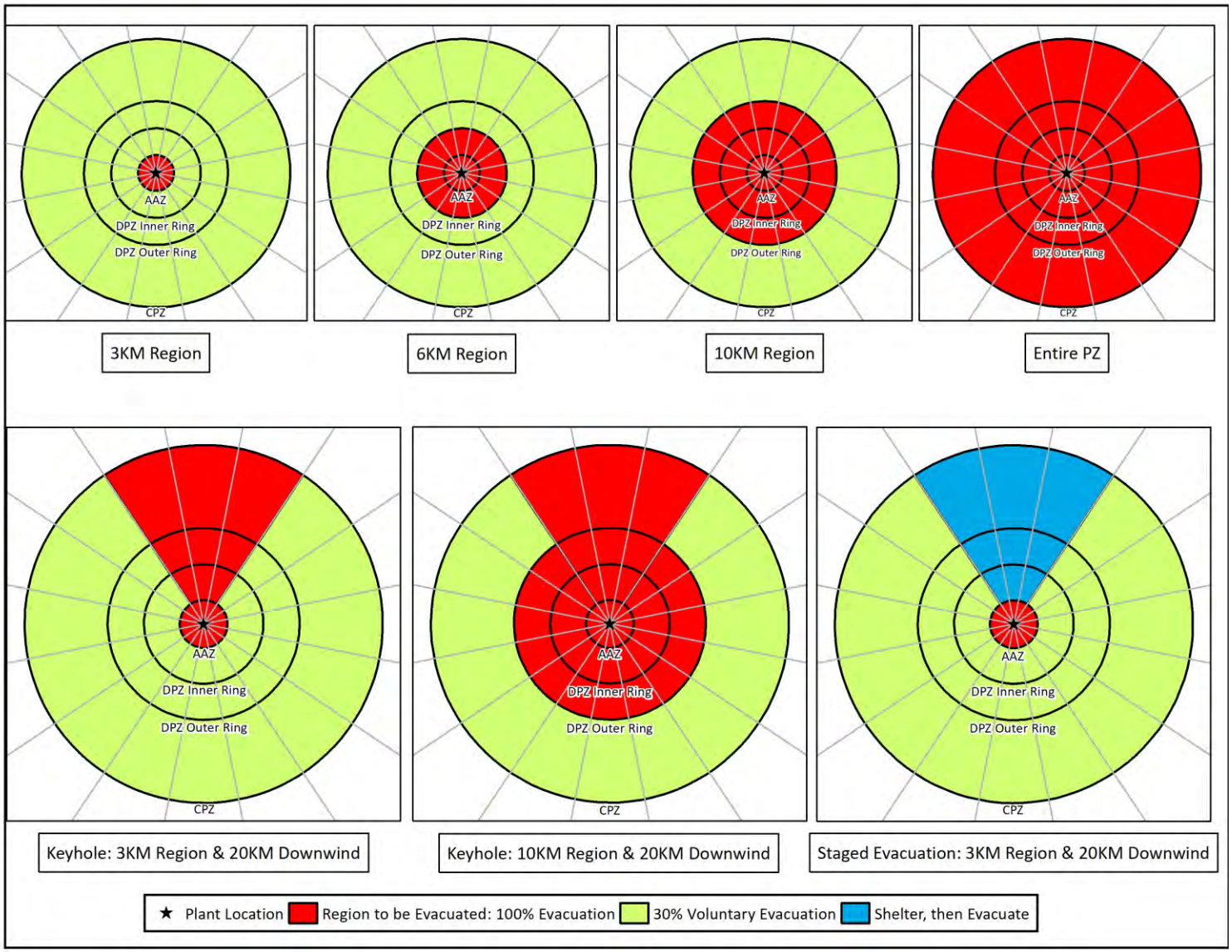



**Figure 2-1. Voluntary Evacuation Methodology**

# 3 DEMAND ESTIMATION

The estimates of demand, expressed in terms of people and vehicles, constitute a critical element in developing an evacuation plan. These estimates consist of three components:

1. An estimate of population within the Planning Zones (PZs), stratified into groups (resident, employee, transient).
2. An estimate, for each population group, of mean occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles.
3. An estimate of potential double-counting of vehicles.

Appendix E presents much of the source material for the population estimates. Our primary source of population data, the 2021 Statistics Canada Census data, however, is not adequate for directly estimating some transient groups.

Throughout the year, vacationers and tourists enter the PZs. These non-residents may dwell within the PZs for a short period (e.g., a few days or one or two weeks), or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of evacuating vehicles can be ascertained.

The potential for double-counting people and vehicles must be addressed. For example:

- A resident who works and shops within the PZs could be counted as a resident, again as an employee and once again as a shopper.
- A visitor who stays at a hotel and spends time at a park, then goes shopping could be counted three times.

Furthermore, the number of vehicles at a location depends on time of day. For example, motel parking lots may be full at dawn and empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn. Estimating counts of vehicles by simply adding up the capacities of different types of parking facilities will tend to overestimate the number of transients and can lead to ETE that are too conservative.

Analysis of the population characteristics of the PNGS PZs indicates the need to identify three distinct general population groups – those with access to their own vehicle:

- Permanent residents – people who are year-round residents of the PZs.
- Transients – people who reside outside of the PZs who enter the area for a specific purpose (shopping, recreation) and then leave the area.
- Employees – people who reside outside of the PZs and commute to businesses within the PZs on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each Response Sector and by polar coordinate representation (population rose). The entire PNGS PZ is subdivided into 33 Response Sectors – 25 Response Sectors in the DPZ and 8 Response Sectors in the CPZ. The PZs are shown in Figure 3-1.

## 3.1 Permanent Residents

The primary source for estimating permanent population is the latest (2021) Statistics Canada[1] Census data. Statistics Canada provides annual population updates for each Census Subdivision[2] (municipality) by Province. The population estimates[3] used for this study are for the time period from July 1, 2016 to July 1, 2021. This data is presented in Table 3-1 by municipality. The Census boundaries for the PNGS study area are shown in Figure 3-2.

Using the compound growth formula (Equation 1), where *g* is the annual growth rate and *XX* is the number of years projected forward from the Year 2021, the permanent resident population was projected to 2023 for the base year of this analysis. The compound growth formula can be solved for g as shown in Equation 2. The data provided in Table 3-1 for the years 2016 and 2021 were used in Equation 2 to compute the annual growth rate for each municipality in the study area (DPZ plus CPZ) using X = 5.00 (5 years from July 1, 2016 to July 1, 2021) and is presented in Table 3-1.

The most detailed data should always be used when forecasting population. In terms of detailed data, the municipal data is the finest level of detail provided by Statistics Canada during an intercensal period. Statistics Canada does not provide population data specific to the boundaries of the study area. As such, the appropriate municipality growth rate was only applied to those census dissemination blocks located within the study area. All other census dissemination blocks outside the study area were not considered as a part of the PZs population, even if they are located within one of the municipalities that intersect the study area.

Using GIS mapping software, the appropriate annual growth rate was applied to each census dissemination block within the study area depending on which municipality the block is located within. The population was then projected to March 1 of 2023 using Equation 1[4].

**Equation 1. Compound Growth Rate**

$$(Compound\ Growth\ for\ XX\ years):$$

$$Population\ 202X\ =\ Population\ 2021\ \times (1\ +\ g)^{(XX-21)}$$

**Equation 2. Annual Growth Rate**

$$(Solving\ for\ the\ annual\ growth\ rate):$$

$$g\ =\ (Population\ 2021\ \div\ Population\ 2016)^{1/(21-16)}\ -\ 1$$

The permanent resident population is estimated by cutting the census dissemination block polygons by the Response Sector and PZs boundaries. A ratio of the original area of each census dissemination block and the updated area (after cutting) is multiplied by the total block population to estimate what the population is within the PZs. This methodology (referred to as

[1] https://www.statcan.gc.ca/eng/start
[2] Source: Statistics Canada, Annual population estimates by age and sex, Census Subdivisions, Ontario, July 1, 2016 to July 1, 2021. Reproduced and distributed on an "as is" basis with the permission of Statistics Canada.
[3] Detailed methodology of intercensal population estimates can be found at the following Statistics Canada webpage: https://www150.statcan.gc.ca/n1/pub/91-214-x/91-214-x2022001-eng.htm
[4] The same methodology was employed for the future year ETE discussed in Appendix M.

the "area ratio method") assumes that the population is evenly distributed across a census dissemination block. Table 3-2 provides the permanent resident population within the PZs, by Response Sector, for 2021 (based on the most recent Canadian Census) and 2023 (based on the methodology discussed above). As shown in Table 3-2, the permanent resident population within the PZs has increased by 2.3% since 2021.

The extrapolated permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household in order to estimate number of vehicles. An average household size of 2.95 persons per household (See Appendix F, Section F.3.1) and a number of 1.37 evacuating vehicles per household (See Appendix F, Sub-Section F.3.2), obtained from the 2022 demographic survey results, were applied to the dissemination blocks within the study area.

Permanent resident population and vehicle estimates are presented in Table 3-3. Figure 3-3 and Figure 3-4 present the permanent resident population within the DPZ and CPZ, respectively, by sector and distance from the PNGS. Figure 3-5 and Figure 3-6 present the permanent resident vehicle estimates within the DPZ and CPZ, respectively, by sector and distance from the PNGS. This "rose" was constructed using GIS software.

## 3.2 Shadow Population

A portion of the population living outside the DPZ extending to 20 kilometres (CPZ boundary) radially from the PNGS may elect to evacuate without having been instructed to do so when the DPZ, or portions of the DPZ, is evacuated. This area is called the Shadow Region. Based upon discussions with OPG and the offsite response agencies, it is assumed that 30 percent of the permanent resident population, based on the extrapolated 2023 Census data, in the Shadow Region will elect to evacuate. No Shadow Region is considered for an evacuation for the CPZ.

The same methodology was used to estimate this population as described in Section 3.1. Table 3-4, Figure 3-4, and Figure 3-6 present estimates of the shadow population and vehicles, by sector. This population is within the CPZ and was assumed to evacuate according to the methodology shown in Figure 2-1 for an evacuation of the full PZ.

## 3.3 Transient Population

Transient population groups are defined as those people (who are not permanent residents, nor commuting employees) who enter the study area for a specific purpose (shopping, recreation). Transients may spend less than one day or stay overnight at camping facilities, hotels or motels. Data for the transient facilities were provided by the Regional Municipality of Durham, supplemented by data from the previous ETE study. The transient facilities within the PNGS PZs are summarized as follows[5]:

- Beaches – 747 transients (312 in the DPZ; 435 in the CPZ); 301 vehicles (156 in the DPZ; 145 in the CPZ)

[5] To avoid double counting, people (and vehicles) who travel from within the PZs to each facility were removed from the values discussed in this section and shown in Table E-6 through Table E-9.

- Glen Rouge Campground (in the DPZ) – 494 transients; 174 vehicles
- Historic Sites and Museums (all in the CPZ) – 4,783 transients; 1,642 vehicles
- Parks and Conservation Areas – 6,974 transients (234 in the DPZ; 6,740 in the CPZ); 2,642 vehicles (117 in the DPZ; 2,525 in the CPZ); (NOTE: Local parks are not included; visitors to these facilities are likely local residents and have already been counted as permanent residents in Section 3.1.)
- Marinas (all in the CPZ) – 2,722 transients; 1,246 vehicles
- Golf Courses – 4,863 transients (1,137 in the DPZ; 3,726 in the CPZ); 2,512 vehicles (561 in the DPZ; 1,951 in the CPZ)
- Casinos – OLG Slots at Ajax Downs and Pickering Casino Resort (both in the DPZ) – 6,917 transients; 4,153 vehicles
- Convention Centres (Markham Convention Centre and Scarborough Convention Centre in the CPZ) – 2,400 transients; 1,539 vehicles
- Toronto Zoo (in the DPZ) – 10,295 transients; 2,500 vehicles; 15% of transients are considered transit dependent and evacuated via 52 bus or 104 passenger vehicles (1 bus is equivalent to 2 passenger vehicles)
- Other Recreational Areas (all in the CPZ) – 12,539 transients; 4,243 vehicles
- Lodging Facilities – 11,153 transients (1,501 in the DPZ; 9,652 in the CPZ); 3,779 vehicles (519 in the DPZ; 3,260 in the CPZ)

The Pan Am Sports Centre was built adjacent to the University of Toronto – Scarborough Campus for the 2015 Pan American Games. This centre is now considered to be a recreational facility for the University students. These students that recreate at this facility have already been included in the study and are discussed in Section 3.6.1. To avoid double counting, the Pan Am Sports Centre is not identified as a transient facility in this study and no transients or transient vehicles are considered at the facility.

Appendix E summarizes the transient data that was gathered for the PZs. Table E-6 through Table E-9 present the number of transients and vehicles at recreational areas, while Table E-10 presents the number of transients and vehicles at lodging facilities within the PZs.

In total, there are 63,887 transients evacuating in 24,731 vehicles (an average of 2.58 transients per vehicle) in the PZs. Table 3-5 presents transient population and transient vehicle estimates by Response Sector. Figure 3-7 through Figure 3-10 present these data by sector and distance from the plant.

## 3.4 Employees

Employees who work within the PZs fall into two categories:

- Those who live and work in the PZs.
- Those who live outside of the PZs and commute to jobs within the PZs.

Those of the first category are already counted as part of the permanent resident population. To avoid double counting, we focus only on those employees commuting from outside the PZs who will evacuate along with the permanent resident population.

The labour force population data[6] obtained from the 2021 Census Profile from Statistics Canada was used to estimate the number of employees commuting into the PZs. The finest level of this data available is dissemination area[7]. In each dissemination area, the number of employees is broken down by 2017 North American Industry Classification System (NAICS)[8] sectors. Since not all employees are working at facilities within the PZs at one time, a maximum shift (Max Shift) reduction was applied. Assuming maximum shift employment occurs Monday through Friday between 9 AM and 5 PM, jobs in the following industry sectors take place outside the typical 9-5 work day:

- Manufacturing – takes place in shifts over 24 hours
- Arts, Entertainment, and Recreation – takes place in evenings and on weekends
- Accommodations and Food Services – peaks in the evenings

The number of employees in remaining industry sectors represents the maximum number of employees present in the PZs at any one time. Using GIS software with the same area ratio methodology that was used for permanent residents (see Section 3.1), the maximum number of employees was estimated within each Response Sector and within the PZs. Note, the dissemination areas with less than 200 employees (during the maximum shift) were considered as small-size employers (employing mostly local residents) and were not included in this study as per NUREG/CR-7002, Rev. 1.

Data obtained from the 2021 Commuting Flow survey provided by Statistics Canada[9] was used to calculate the percent of employees that work within the PZs but live outside. The survey provides the inflow/outflow of commuting employees by Census Subdivision (municipality) for Ajax, Markham, Oshawa, Pickering, Toronto and Whitby. These values – 13.0%, 27.4%, 27.0%, 18.8%, 22.4% and 22.1% – respectively, were applied to the maximum shift employment to compute the number of people commuting into the PZs to work at peak times. Note, the employment data for the PNGS, including the total employment and percent of employees living outside of the PZs, was provided by OPG. The plant employment data is reflected in Table E-5 in Appendix E.

To determine the number of evacuating vehicles, a vehicle occupancy rate of 1 employee per vehicle was used for Durham Region, as per the information provided by Durham Emergency Management (DEM). For the areas outside of Durham Region, a vehicle occupancy rate of 1.15 employees per vehicle was used based on the results of the 2022 demographic survey (see Appendix F, Sub-Section F.3.1).

In addition to the employees discussed above, this study also considered those who work outside of the PZs but commute from a GO Transit station within the PZs. Based on the results from the 2022 demographic survey, 5 percent of commuters (see Appendix F, Sub-Section F.3.1) who work

[6] Total labour force population aged 15 years and over by Industry - NAICS 2017 - 25% sample data. According to Statistics Canada, a sample of approximately 25% of Canadian households received a mandatory long-form questionnaire, which includes employment related questions. All other households received a short-form questionnaire. Additional details about the questionnaire can be found in the following website: http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getMainChange&Id=152274
[7] https://www150.statcan.gc.ca/n1/en/catalogue/92-169-X
[8] https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1181553
[9] https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810045901

outside of the PZs would return to their cars and evacuate in their personal vehicles from a rail station within the PZs without returning homes first. There are fifteen GO Transit stations within the PZs, as listed in Table 3-6. The peak ridership for each rail station is estimated based on parking capacity obtained from GO Transit website[10]. Applying the 5 percent factor and the vehicle occupancy rates discussed above, the estimates of vehicles and employees evacuating from each rail station are summarized in Table 3-6.

Table 3-7 presents employees commuting into the PZs, accounting for those employees who would evacuate directly from the GO Transit station, and their vehicles by Response Sector. Figure 3-11 through Figure 3-14 present these data by sector.

## 3.5 Special Facilities Population Demand

In the PNGS PZ, there are two types of special facilities that will require transit vehicles:

- Medical Facilities
- Correctional Facilities

Section 3.5.1 and Section 3.5.2 below discuss the data in detail at each facility.

### 3.5.1 Medical Facilities

Population estimates at medical facilities from 2019 ETE study were reviewed and updated and/or confirmed to be still accurate by OPG. The capacity data of two newly identified medical facilities within the CPZ were provided by OPG. Since the average number of patients at the medical facilities fluctuates, the percent breakdown (average) of ambulatory, wheelchair bound, and bedridden patients from the previous ETE study was used to estimate the number of ambulatory, wheelchair bound and bedridden patients at the newly identified medical facilities within the CPZ. Table E-4 in Appendix E summarizes the data that was collected. Table 3-8 presents the census of medical facilities in the PZs. As shown in these tables, 13,351 people have been identified as living in, or being treated in, these facilities[11]. This data includes the number of ambulatory, wheelchair-bound, and bedridden patients at each facility.

The transportation requirements for the medical facility population are also presented in Table 3-8. The number and type of evacuating vehicles that need to be provided depend on the patients' state of health. It is estimated that buses can transport up to 30 people; wheelchair vans, up to 4 people; and ambulances, up to 1 person. To evacuate the medical facility population within the study area, 270 bus runs, 1,317 wheelchair van runs and 1,363 ambulance runs are required, as shown in Table 3-8. Buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

### 3.5.2 Correctional Facilities

As shown in Table E-11, there are two correctional facilities[11] within the PZs – Kennedy Detention Centre and Toronto East Detention Centre. The total inmate population at these two facilities is

[10] https://www.gotransit.com/en/stations-stops-parking/find-a-station-or-stop

[11] The Canadian census does not include population from those medical facilities, as stated on their website: https://www12.statcan.gc.ca/census-recensement/2021/ref/98-304/2021001/app-ann1-3-eng.cfm#a1. This was verified this in GIS. Therefore, double counting at special facilities was eliminated.

485 persons. A facility owned 12-passenger van will be used at Kennedy Detention Centre. Sixteen (16) passenger buses would be required at Toronto East Detention Centre to evacuate the inmates, based on a capacity of 30 inmates per bus. The detailed evacuation plans for these facilities are confidential.

### 3.6 School, College/University, and Summer Day Camps Population Demand

School and college/university population and transportation requirements for the direct evacuation of all facilities within the PZ for the 2021-2022 school year are presented in Table 3-9 and Table 3-10. Student enrolment information from previous ETE study were reviewed and updated and/or confirmed to be still accurate by stakeholders, supplemented by internet searches and aerial imagery for parking spaces where data was missing. The column in these tables entitled "Buses Required" specifies the number of buses required for each school or college or university under the following set of assumptions and estimates:

- No students will be picked up by their parents prior to the arrival of the buses, with the exception of small day care centres.
- While many high school students commute to school using private automobiles (as discussed in Section 2.4 of NUREG/CR-7002, Rev.1), the estimate of buses required for school evacuation does not consider the use of these private vehicles.
- Bus capacity, expressed in students per bus, is set to 72 for elementary schools, 60 for middle schools, and 48 for high schools.
- Those staff members who do not accompany the students will evacuate in their private vehicles.
- No allowance is made for student absenteeism, typically 3 percent daily.
- The students present at Trent University – Durham GTA Campus, Durham College – Oshawa Campus, University of Ontario Institute of Technology, University of Toronto – Scarborough, Centennial College – Morningside Campus, Redemptoris Mater Seminary, CDI College – Scarborough, Centennial College – Ashtonbee Campus, Centennial College – Progress Campus, and Durham College – Whitby Campus are commuting students and would evacuate in their personal vehicles.
- It is estimated that 464 of the 1,960 students at Trent University - Durham GTA Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 16 buses would be required to evacuate this population.
- It is estimated that 1,606 of the 8,539 students at Durham College - Oshawa Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 54 buses would be required to evacuate this population.
- It is estimated that 2,242 of the 9,732 students at University of Ontario Institute of Technology would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 75 buses would be required to evacuate this population.
- It is estimated that 3,140 of the 13,075 students at University of Toronto –

Scarborough Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 105 buses would be required to evacuate this population.

- It is estimated 663 of the 3,664 students at Centennial College – Morningside Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 23 buses would be required to evacuate this population.
- It is estimated 213 of the 1,933 students at Centennial College – Ashtonbee Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 8 buses would be required to evacuate this population.
- It is estimated 2,274 of the 10,041 students at Centennial College – Progress Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 76 buses would be required to evacuate this population.
- It is estimated 346 of the 1,839 students at Durham College - Whitby Campus would need transit assistance to evacuate (see Section 3.6.1 for further discussion). Using an occupancy of 30 people per bus, a total of 12 buses would be required to evacuate this population.
- The commuter Colleges/universities listed in Table 3-10 will use TTC, DRT, or GO Transit to evacuate, as these commuters likely utilize these service providers during their normal commuting activities.

The regions or municipalities in the PZs could introduce procedures whereby the schools are contacted prior to the dispatch of buses from the depot, to ascertain the current estimate of students to be evacuated. In this way, the number of buses dispatched to the schools will reflect the actual number needed. The need for buses would be reduced by any high school students who have evacuated using private automobiles (if permitted by school authorities). Those buses originally allocated to evacuate schoolchildren that are not needed due to children being picked up by their parents, can be gainfully assigned to service other facilities or those persons who do not have access to private vehicles or to ride-sharing.

School buses are represented as two vehicles in the ETE simulation due to their larger size and more sluggish operating characteristics.

### 3.6.1 Commuter Colleges and Universities

The college and university enrolment data were obtained from various sources, including the Regional Municipality of Durham, Ontario Government, facility websites, aerial imagery and data from the 2019 ETE study. There are a number of colleges and universities within the PNGS study area, including small-sized colleges, such as polytechnic colleges, where the majority of students are likely to reside within the PZs and are already counted as part of the permanent residents. To avoid double counting, these small-sized colleges are not considered in this study.

In the PNGS DPZ, there are two colleges/university campuses:

University of Toronto – Scarborough Campus:

- Located in Response Sector P17, 9.9 km west-southwest of the PNGS.
- According to the latest university enrolment database maintained by Ontario Government[12], this campus has a total enrolment of 13,075 students.
- Based on the information provided by the university website[13], Scarborough Campus could accommodate 814 students in residence from 2021 to 2022. As such, it is estimated there are 814 on-campus students and 12,261 (13,075 – 814) off-campus students at Scarborough Campus.
- The aerial imagery shows this campus has a total of 2,246 parking spaces for students. Therefore, the maximum number of students that own private vehicles is 2,246, which accounts for 17.18% (2,246 ÷ 13,075) of the total students.
- The university website[14] also indicates both on- and off-campus students are allowed to park their vehicles on campus. Applying the maximum percentage of students with private vehicles (17.18%) to the numbers of on- and off-campus students, resulting in 140 (814 x 17.18%) on-campus students and 2,106 (12,261 x 17.18%) off-campus students having private vehicles.
- According to the 2022 demographic survey, approximately 71% of transit-dependent people would rideshare with a neighbour or friend (see Appendix F, Sub-Section F.3.1) in the event of an emergency. As such, it is assumed that 479 ((814 – 140) x 71%) on-campus students and 7,210 ((12,261 – 2,106) x 71%) off-campus students would rideshare with fellow classmates, leaving a total of 3,140 transit-dependent students, including 195 (814 – 140 – 479) on-campus students and 2,945 (12,261 – 2,106 – 7,210) off-campus students, who have no access to private vehicles and would be evacuated by bus. Using the capacity of 30 people per bus, the total number of transit-dependent buses needed for this campus is 105 (3,140 ÷ 30 = 105, rounded up) or 210 vehicles (1 bus is equivalent to 2 passenger vehicles).
- In summary:
    - 9,935 commuting/ridesharing students, including 619 (140 + 479) on-campus students and 9,316 (2,106 + 7,210) off-campus students, evacuating in 2,246 vehicles
    - 3,140 transit-dependent students evacuating in 105 buses or 210 vehicles

Centennial College – Morningside Campus:

- Located in Response Sector P18, 10.3 km west-southwest of the PNGS, adjacent to the University of Toronto – Scarborough Campus.
- The latest Ontario Government university enrolment database[12] shows Morningside Campus has a total enrolment of 3,664 students. There is no student housing in Morningside Campus, and therefore, all the students are considered commuting students

[12] https://data.ontario.ca/dataset/university-enrolment
[13] https://www.utoronto.ca/about-u-of-t/quick-facts
[14] https://www.utsc.utoronto.ca/parking/student-permits

for this study.

- The aerial imagery shows this campus has approximately 1,378 parking spaces for commuting students. As such, it is estimated there are 1,378 students with private vehicles and 2,286 (3,664 – 1,378) students without private vehicles.
- For those 2,286 students, applying with the same percentage of ridesharing and transit-dependent bus capacity as discussed above, 1,623 (2,286 x 71%) students would be evacuated by ridesharing with fellow classmates, and 663 (3,664 – 1,378 – 1,623) students would be evacuated by 23 buses (663 ÷ 30 = 23, rounded up) or 46 vehicles.
- In summary:
    - 3,001 (1,378 + 1,623) commuting/ridesharing students evacuating in 1,378 vehicles
    - 663 transit-dependent students evacuating in 23 buses or 46 vehicles

In the PNGS CPZ, there are eight college/university campuses:

CDI College - Scarborough:

- Located in Response Sector CPZ6, 19.1 km west-southwest of the PNGS.
- The enrolment data for this college is unavailable. According to aerial imagery, this college has approximately 250 parking spaces. Since this college does not provide on campus housing, all the students are considered commuting students for this study.
- It is conservatively assumed that all students commute from outside the PZs. Applying the average commuter vehicle occupancy rate (1.15) obtained from the 2022 demographic survey, 288 (250 x 1.15) commuting students were assigned to this college.

Centennial College – Ashtonbee Campus:

- Located in Response Sector CPZ6, 19.9 km west-southwest of the PNGS.
- According to the latest college enrolment database maintained by Ontario Government[15], Ashtonbee Campus has a total of 1,933 students. Ashtonbee Campus does not have student housing, similar to Morningside Campus, all the students are considered commuting students for this study.
- Data from the previous study indicates that approximately 62.1% of the students own private vehicles. Assuming this data is still applicable, there are 1,200 (1,933 x 62.1%) evacuating student vehicles.
- Using the same percentage of ridesharing and transit-dependent bus capacity discussed above, an estimated 520 ((1,933 – 1,200) x 71%) students would rideshare with a fellow student and an estimated 213 (1,933 – 1,200 – 520) students would be evacuated by 8 buses (213 ÷ 30 = 8, rounded up) or 16 vehicles.

Centennial College – Progress Campus:

- Located in Response Sector CPZ7, 13.1 km west-southwest of the PNGS.
- The latest college enrolment database from Ontario Government[15] shows this campus has a total enrolment of 10,041 students.

[15] https://data.ontario.ca/dataset/college-enrolment

- According to the college website[16], the on-campus housing can accommodate up to 740 students. As such, it is estimated there are 740 on-campus students and 9,301 (10,041 – 740) off-campus students at Progress Campus.
- The aerial imagery shows the parking lots at Progress Campus can accommodate up to 2,200 vehicles. As such, the maximum number of students have private vehicles is 2,200, accounting for 21.91% (2,200 ÷ 10,041) of the total students.
- Based on the information from the college website[17], both on- and off-campus students are allowed to apply for campus parking permits. Applying the percentage of students with private vehicles (21.91%) to both on- and off-campus student population, there are 162 (740 x 21.91%) on-campus students and 2,038 (9,301 x 21.91%) off-campus students having private vehicles.
- Applying the same estimation approach used for University of Toronto – Scarborough Campus, it is estimated 410 ((740 – 162) x 71%) on-campus students and 5,157 ((9,301 – 2,038) x 71%) off-campus students would evacuate by ridesharing, leaving a total of 2,274 students, including 168 (740 – 162 – 410) on-campus students and 2,106 (9,301 – 2,038 – 5,157) off-campus students, who would evacuate in 76 buses (2,274 ÷ 30 = 76, rounded up) or 152 vehicles.
- In summary:
    - 7,767 commuting/ridesharing students, including 572 (162 + 410) on-campus students and 7,195 (2,038 + 5,157) off-campus students, evacuating in 2,200 vehicles
    - 2,274 transit-dependent students evacuating in 76 buses or 152 vehicles

Durham College – Oshawa Campus:

- Located in Response Sector CPZ2, 20.4 km northeast of the PNGS.
- The latest college enrolment database from Ontario Government[15] shows a total of 8,539 students enrolled in Oshawa Campus.
- As indicated in the college website[18], the on-campus housing can accommodate up to 1,360 students. As such, it is estimated 1,360 students live on campus and 7,179 (8,539 – 1,360) students live off campus.
- As documented in the previous study, the capacity of parking lots at Oshawa Campus is 3,000. As such, the maximum number of students have private vehicles is 3,000, which is 35.13% (3,000 ÷ 8,539) of the total students.
- Applying the same estimation approach as described above, it is estimated 478 (1,360 x 35.13%) on-campus students and 2,522 (7,179 x 35.13%) off-campus students have private vehicles, 626 ((1,360 – 478) x 71%) on-campus students and 3,307 ((7,179 – 2,522) x 71%) off-campus students who have no private vehicles and would evacuate by ridesharing. The remaining 1,606 students, including 256 (1,360 – 478 – 626) on-campus students and 1,350 (7,179 – 2,522 – 3,307) off-campus students, would evacuate in 54

[16] https://www.centennialcollege.ca/about-centennial/college-improvements/campus-developments/centennial-residence-and-culinary-arts-centre#:~:text=Housing%20up%20to%20740%20students,his%20or%20her%20own%20bedroom.
[17] https://www.centennialcollege.ca/student-life/campus-services/parking-services/parking-rates-and-important-information
[18] https://durhamcollege.ca/student-life/student-services/housing/on-campus-housing

buses (1,606 ÷ 30 = 54, rounded up) or 108 vehicles.

- In summary:
  - 6,933 commuting/ridesharing students, including 1,104 (478 + 626) on-campus students and 5,559 (2,522 + 3,307) off-campus students, evacuating in 3,000 vehicles
  - 1,606 transit-dependent students evacuating in 54 buses or 108 vehicles

Durham College – Whitby Campus:

- Located in Response Sector CPZ2, 15.1 km east-northeast of the PNGS.
- The latest college enrolment database from Ontario Government[15] shows Whitby Campus has a total enrolment of 1,839 students.
- Based on the information from college website[19], Whitby Campus has a newly built on-campus housing that can accommodate 68 students. As such, it is estimated there are 68 on-campus students and 1,771 (1,839 – 68) off-campus students in Whitby Campus.
- According to the Regional Municipality of Durham, the parking lot capacity at Whitby Campus is 2,000, which exceeds the total number of students. The percentage of students own private vehicles is unavailable. Assuming the students at Whitby Campus have the same vehicle ownership rate (35.13%) as those at Oshawa Campus, there is an estimated 646 evacuating vehicles for Whitby Campus, including 24 (68 x 35.13%) vehicles for students living on campus and 622 (1,771 x 35.13%) vehicles for students living off campus.
- For the remaining 44 (68 – 24) on-campus students and 1,149 (1,771 – 622) off-campus students without private vehicles, applying with the same percentage of ridesharing and transit-dependent bus capacity discussed above, there are 31 (44 x 71%) on-campus students and 816 (1,149 x 71%) off-campus students evacuating via ridesharing, and a total of 346 students, including 13 (68 – 24 – 31) on-campus students and 333 (1,771 – 622 – 816), evacuating in 12 buses (346 ÷ 30 = 12, rounded up) or 24 vehicles.
- In summary:
  - 1,493 commuting/ridesharing students, including 55 (24 + 31) on-campus students and 1,438 (622 + 816) off-campus students, evacuating in 646 vehicles
  - 346 transit-dependent students evacuating in 12 buses or 24 vehicles

Redemptoris Mater Seminary:

- Located in Response Sector CPZ6, 17.6 km southwest of the PNGS.
- As documented in the previous study, the parking lots at this seminary can accommodate approximately 150 vehicles.
- It is conservatively assumed that all students commute from outside the PZs. Using the average commuters per vehicle (1.15) discussed above, the number of commuting students is estimated to be 173 (150 x 1.15).

Trent University – Durham Greater Toronto Area (Durham GTA) Campus:

- Located in Response Sector CPZ2, 16.8 km east-northeast of the PNGS.

[19] https://durhamresidence.ca/faq-whitby/#1

- The university website[20] shows Durham GTA Campus has a total enrolment of 1,960 students. The university website[21] also shows on-campus housing provide 200 beds. As such, it is estimated there are 200 on-campus students and 1,760 (1,960 – 200) off-campus students.
- The aerial imagery shows there are approximately 360 parking spaces in Durham GTA Campus. As such, the maximum number of students have private vehicles is 360, which is 18.37% (360 ÷ 1,960) of the total students.
- Applying the same estimation approach used for University of Toronto – Scarborough Campus, it is estimated 37 (200 x 18.37%) on-campus students and 323 (1,760 x 18.37%) off-campus students have private vehicles, 116 ((200 – 37) x 71%) on-campus students and 1,020 ((1,760 – 323) x 71%) off-campus students can evacuate via ridesharing, and the remaining 464 students, including 47 (200 – 37 – 116) on-campus students and 417 (1,760 – 323 – 1,020) off-campus students, would evacuate in 16 buses (464 ÷ 30 = 16, rounded up) or 32 vehicles.
- In summary:
    - 1,496 commuting/ridesharing students, including 153 (37 + 116) on-campus students and 1,343 (323 + 1,020) off-campus students, evacuating in 360 vehicles
    - 464 transit-dependent students evacuating in 16 buses or 32 vehicles

University of Ontario Institute of Technology:

- Located in Response Sector CPZ2, 20.4 km northeast of the PNGS.
- Data from the latest university database[12] maintained by Ontario Government shows this university has a total of 9,732 students.
- As shown in the university website[22], over 1,300 students live on campus. As such, it is estimated there are 1,300 on-campus students and 8,432 (9,732 – 1,300) off-campus students.
- According to the Regional Municipality of Durham, the parking lots in this university can accommodate up to 2,000 vehicles. As such, the maximum number of students have private vehicles is 2,000, accounting for 20.56% (2,000 ÷ 9,732) of the total students.
- Applying the same estimation approach discussed above, resulting in 267 (1,300 x 20.56%) on-campus students and 1,734 (8,432 x 20.56%) off-campus students with private vehicles, 733 ((1,300 – 267) x 71%) on-campus students and 4,756 ((8,432 – 1,734) x 71%) off-campus students evacuating via ridesharing, leaving a total of 2,242 students, including 300 (1,300 – 267 – 733) on-campus students and 1,942 (8,432 – 1,734 – 4,756) off-campus students, evacuating in 75 buses (2,242 ÷ 30 = 75, rounded up) or 150 vehicles.

[20] https://www.trentu.ca/about/trent-numbers
[21] https://www.trentu.ca/durham/about-trent/expansion/meet-our-partners/builder-funder-campus-living-centres#:~:text=Trent%20University%20is%20working%20with,on%20the%20Durham%20GTA%20campus.
[22] https://uoit.ca/about/uoit-info/fact-sheet.php

- In summary:
    - 7,490 commuting/ridesharing students, including 1,000 (267 + 733) on-campus students and 6,490 (1,734 + 4,756) off-campus students, evacuating in 2,000 vehicles
    - 2,242 transit-dependent students evacuating in 75 buses or 150 vehicles

In total, there are 40,296 commuting/ridesharing students and 10,948 transit-dependent students evacuating in 13,430 vehicles and 369 buses (738 vehicles). Table E-2 in Appendix E presents the number of commuting/ridesharing students and evacuating vehicles for each college/university.

### 3.6.2 Summer Day Camps

There are 55 schools/facilities with the PZs that serve as a day camp during the summer (See Table E-3). Since summer day camps are not in session during school hours, these students are considered separately from school children even though they may in fact be the same children. Officials estimate the number of children at each facility within the DPZ at approximately 50 during the summer months for a total of 600 children. Each of the summer day camps within the DPZ will evacuate to Temporary Holding Centres (THCs), identical to those of their school counterparts, where they will be subsequently retrieved by their families. A total of 12 buses (one bus per day camp) or 24 vehicles (1 bus is equivalent to 2 passenger vehicles – see Section 8) have been incorporated for day camps within the DPZ. For the summer day camps within the CPZ, it is assumed that parents will pick up their children prior to evacuation due to a potential shortfall of buses. Thus, no transit vehicles are considered for those facilities. The evacuation of the summer day camps is discussed in Section 8.

## 3.7 Transit Dependent Population

The demographic survey (see Appendix F) results were used to estimate the portion of the population requiring transit service:

- Those persons in households that do not have a vehicle available.
- Those persons in households that do have vehicle(s) that would not be available at the time the evacuation is advised.

In the latter group, the vehicle(s) may be used by a commuter(s) who does not return (or is not expected to return) home to evacuate the household.

Table 3-11 presents estimates of transit-dependent people. Note:

- Estimates of persons requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are not reduced when schools are in session.

- It is reasonable and appropriate to consider that many transit-dependent persons will evacuate by ridesharing with neighbors, friends or family. For example, nearly 80 percent of those who evacuated from Mississauga, Ontario[23] who did not use their own cars, shared a ride with neighbors or friends. Other documents report that approximately 70% of transit dependent persons were evacuated via ride sharing. Based on the results of the demographic survey, approximately 71% of the transit-dependent population will rideshare.

The estimated number of bus trips needed to service transit-dependent persons is based on an estimated average bus occupancy of 30 persons[24] at the conclusion of the bus run. Transit vehicle seating capacities typically equal or exceed 60 children (roughly equivalent to 40 adults). If transit vehicle evacuees are two thirds adults and one third children, then the number of "adult seats" taken by 30 persons is 20 + (2/3 x 10) = 27. On this basis, the average load factor anticipated is (27/40) x 100 = 68%. Thus, if the actual demand for service exceeds the estimates of Table 3-11 by 50%, the demand for service can still be accommodated by the available bus seating capacity.

$$\left[20 + \left(\frac{2}{3} \times 10\right)\right] \div 40 \times 1.5 = 1.00$$

Table 3-11 indicates that transportation must be provided for 3,215 people inside the DPZ and 10,248 people in the CPZ. Therefore, a total of 450 bus runs, 108 for the DPZ and 342 for the CPZ, are required from a capacity standpoint. In order to service all of the transit dependent population and have at least one bus drive through each of the Response Sectors to pick up transit dependent people, **462 bus runs**, 117 for the DPZ and 345 for the CPZ, are used in the ETE calculations, see Sections 8.1 and 10 for further discussion. These buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.

To illustrate this estimation procedure, we calculate the number of persons, P, requiring public transit or ride-share, and the number of buses, B, required for the PNGS DPZ:

$$P = No.of\ HH\ \times \sum_{i=0}^{n} \{(\%\ HH\ with\ i\ vehicles) \times [(Average\ HH\ Size) - i]\} \times A^i C^i$$

Where,

A = Percent of households with commuters

C = Percent of households who will not await the return of a commuter

$P = 103{,}664 \times [0.0051 \times 1.0 + 0.195 \times (2.12 - 1) \times 0.909 \times 0.276 + 0.562 \times (3.29 - 2) \times (0.909 \times 0.276)^2] = 10{,}939$

[23] Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The report indicates that 6,600 people of a transit-dependent population of 8,600 people shared rides with other residents; a ride share rate of 77% (Page 5-10).

[24] Durham Regional Transit (DRT) indicated that their full-size buses can accommodate 78 passengers at peak times. During an evacuation, however, it is likely that evacuees will carry personal items such as luggage and pets that will take up some of the available seating capacity. Hence, it is conservatively assumed that each bus can carry approximately 30 people.

$$B = [(1 - 0.706) \times P] \div 30 = [(0.294 \times 10{,}939) \div 30] = (3{,}217 \div 30) \approx 108$$

These calculations based on the demographic survey results are explained as follows:

- The number of households (HH) is computed by dividing the DPZ population by the average household size (305,809 ÷ 2.95) and is 103,664.
- All members (1.00 avg.) of households (HH) with no vehicles (0.51%) will evacuate by public transit or ride-share. The term 103,664 x 0.0051 x 1.00, accounts for these people.
- The members of HH with 1 vehicle away (19.5%), who are at home, equal (2.12 - 1). The number of HH where the commuter will not return home is equal to (103,664 x 0.195 x 1.12 x 0.909 x 0.276), as 90.9% of DPZ households have a commuter, 27.6% of which would not return home in the event of an emergency. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms.
- The members of HH with 2 vehicles that are away (56.2%), who are at home, equal (3.29 – 2). The number of HH where neither commuter will return home is equal to 103,664 x 0.562 x 1.29 x $(0.909 \times 0.276)^2$. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The total number of persons requiring public transit is the sum of such people in HH with no vehicles, or with 1 or 2 vehicles that are away from home.

Data was not provided on those within the PZ that have access and/or functional needs. As such, it is assumed that those with access and/or functional needs who may also need assistance and do not reside in special facilities are included in these calculations. Based on discussions with OROs, it is assumed that direction on how to get assistance will be provided within the Emergency Bulletin to evacuate[25], and arrangements will be made for a special vehicle to be sent to their home on an on-demand basis.

## 3.8 Special Event

A special event can attract large numbers of transients to the DPZ for short periods of time, creating a temporary surge in demand as per Section 2.5.1 of NUREG/CR-7002, Rev. 1. The municipal and regional emergency management agencies were polled regarding potential special events in the DPZ. Multiple special events were identified by municipal and regional emergency management agencies that attracts transients from outside the DPZ and a large event at the Toronto Zoo was identified to attract the largest amount of transients in a single day event. An event at the Toronto Zoo can occur multiple times per year, typically during winter days and on the weekends. The Toronto Zoo is located in Response Sector P19, 8.9 km west of the PNGS.

Based on the previous ETE study, the Toronto Zoo Director of Security and Public Safety stated the peak attendance during a large event is 18,000 people; 85% of visitors are transients (live outside the PZs). Assuming visitors travel to the zoo as a family, it is estimated there are 2.95

[25] Durham Region Emergency Management is currently developing a process to ensure individuals in this category are supported through appropriate channels.

people per vehicle. Additionally, 15% of transient visitors will arrive by public transportation. All parking lots including overflow are open and additional buses are provided by the Toronto Transit Commission (TTC) to accommodate the additional visitors.

This results in 4,409 additional transient vehicles (18,000 x 85% non-PZs = 15,300 transients x 85% in vehicles = 13,005 ÷ 2.95 people per vehicle) and an additional 77 buses or 154 passenger vehicles (15,300 x 15% transit dependent = 2,295 ÷ 30 people per bus) that were added to the simulation originating at the Toronto Zoo during the special event.

There are no temporary road closures used for the event. The special event vehicle trips were generated utilizing the same mobilization distributions for transients. Vehicles were loaded at local streets near the parking lots around Toronto Zoo for this scenario.

## 3.9 External Traffic

Vehicles will be traveling through the PZs (external-external trips) at the time of an accident. After the Emergency Bulletin is announced, these through-travellers will also evacuate. These through vehicles are assumed to travel on the major routes traversing the PZs – Hwy 401, Hwy 407 and Hwy 404. It is assumed that this traffic will continue to enter the PZs during the first 4 hours following the Emergency Bulletin, as per Ministry of Transportation of Ontario (MTO).

Average Annual Daily Traffic (AADT) data was obtained from the MTO[27] and 407 ETR[28] to estimate the number of vehicles per hour on the aforementioned routes. The AADT was multiplied by the K-Factor, which is the proportion of the AADT on a roadway segment or link during the design hour, resulting in the design hour volume (DHV). The design hour is usually the 30$^{th}$ highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split). The resulting values are the directional design hourly volumes (DDHV) and are presented in Table 3-12, for each of the routes considered. The DDHV is then multiplied by 4 hours (when access control points – ACP – are assumed to be activated) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 128,144 vehicles entering the study area as external-external trips prior to the activation of the ACP and the diversion of this traffic. This number is reduced by 60 percent for evening scenarios (Scenarios 5 and 12) as discussed in Section 6.

## 3.10 Background Traffic

Section 5 discusses the time needed for the people in the study area to mobilize and begin their evacuation trips. As shown in Table 5-9 and Table 5-10, there are 14 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people. Note, there is no traffic generated during the 15$^{th}$ time period, as this time period is intended to allow

[27] 2016 Ontario Ministry of Transportation Provincial Highways Annual Average Daily Traffic (AADT); https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Theme.aspx?r=702797&f=files%2FProvincial+Highways+Traffic+Volumes+2016+AADT+Only.pdf&m=resource

[28] https://www.407etr.com/en/highway/corporate/usage-statistics.html

traffic that has already begun evacuating to clear the study area boundaries.

This study does not assume that roadways are empty at the start of Time Period 1. Rather, there is an initialization time period (often referred to as "fill time" in traffic simulation) wherein the traffic volumes from Time Period 1 are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of Time Period 1 depends on the scenario and the region being evacuated (see Section 6). There are 12,771 vehicles on the roadways in the study area at the end of fill time for an evacuation of the entire DPZ (Region R03) under Scenario 1 (summer, midweek, midday, good weather) conditions.

### 3.11 Heavy Vehicles

Roadway grade (slope of the roadway) is only a factor in ETE when there is a significant percentage of heavy vehicles present in the evacuation stream. Heavy vehicles have difficulty climbing grades. As such, for a single lane road, a heavy vehicle climbing a grade could inhibit the egress of all vehicles behind it. If there are multiple lanes, vehicles behind the heavy vehicle can pass.

People are not likely to evacuate in heavy vehicles. The only significant presence of heavy vehicles would be in external traffic – through truck traffic passing through the study area along major highways/freeways – which will be diverted within four hours of the evacuation advisory. Exhibit 7-1(b) of the 2022 HCM shows that grade has a limited impact on service volume (vehicles per hour – veh/h) for a freeway segment in that service volume decreases from 5,100 veh/h at a 2% grade to 4,400 veh/h at a 6% grade – a 14% decrease in service volume for a 200% increase in grade. Most grades observed during the road survey of the study area were 3% or less.

Exhibit 12-7 of the 2022 HCM shows that capacity of a freeway decreases from 2,400 passenger cars per hour per lane (pc/h/ln) at a free flow speed (FFS) of 75mph (121kph) to 2,250 pc/h/ln at 55mph (89kph). As discussed in Section 4.3.3, this study conservatively assumed a capacity of 2,250 pc/h/ln for all freeways, corresponding to a FFS of about 90kph, despite observed FFS well in excess of 100kph on all freeways (see Table K-1) in the study area during the road survey. Any reduction in speed caused by grade and the presence of heavy vehicles on freeways is already accounted for in the conservative capacity estimate of 2,250 pc/h/ln for freeways.

Exhibit 12-8 of the 2022 HCM shows that capacity of a multilane highway decreases from 2,300 pc/h/ln at a FFS of 70mph (113kph) to 1,900 pc/h/ln at a FFS of 45mph (72kph). As discussed in Section 4.3.2, this study conservatively assumed a capacity of 1,900 pc/h/ln for multilane highways, corresponding to a FFS of about 72kph, despite observed FFS in excess of 80kph on most multilane highways in the study area during the road survey.

The presence of heavy vehicles in the evacuating traffic stream is expected to be minimal. The presence of heavy vehicles and grades within the study area are also expected to have minimal impact on roadway capacity and ETE. Nonetheless, 5% heavy vehicle traffic is assumed for all evacuation cases based on discussions with local stakeholders.

## 3.12 Summary of Demand

A summary of population and vehicle demand is provided in Table 3-13 and Table 3-14, respectively. This summary includes all population groups described in this section. A total of 2,014,641 people (722,699 and 1,291,942 people within DPZ, and CPZ, respectively) and 994,527 vehicles (316,222, 550,161 and 128,144 vehicles within DPZ, CPZ, and external-external vehicles, respectively) are considered in this study.

**Table 3-1. Municipality Annual Growth Rate from July 1, 2016 to July 1, 2021**

| Municipality | 2016 Population | 2021 Population | Percent Change | Annual Growth Rate |
|---|---|---|---|---|
| **Ajax** | 123,655 | 134,450 | 8.73% | 1.69% |
| **Markham** | 339,208 | 348,443 | 2.72% | 0.54% |
| **Oshawa** | 164,602 | 181,440 | 10.23% | 1.97% |
| **Pickering** | 94,537 | 103,466 | 9.44% | 1.82% |
| **Toronto** | 2,819,399 | 2,974,293 | 5.49% | 1.08% |
| **Whitby** | 132,268 | 145,108 | 9.71% | 1.87% |

**Table 3-2. PZ Permanent Resident Population**

| Response Sector | 2021 Population | 2023 Extrapolated Population |
|---|---|---|
| **P1** | 10,063 | 10,398 |
| **P2** | 5,080 | 5,250 |
| **P3** | 5,373 | 5,479 |
| **P4** | 8,668 | 8,959 |
| **P5** | 17,450 | 18,040 |
| **P6** | 11,495 | 11,881 |
| **P7** | 15,797 | 16,328 |
| **P8** | 15,502 | 16,023 |
| **P9** | 18,912 | 19,508 |
| **P10** | 16,192 | 16,694 |
| **P11** | 9,163 | 9,448 |
| **P12** | 3,863 | 3,983 |
| **P13** | 9,641 | 9,941 |
| **P14** | 9,745 | 10,052 |
| **P15** | 12,149 | 12,387 |
| **P16** | 11,147 | 11,370 |
| **P17** | 13,840 | 14,110 |
| **P18** | 20,648 | 21,059 |
| **P19** | 9,117 | 9,297 |
| **P20** | 5,297 | 5,476 |
| **P21** | 40,242 | 41,492 |
| **P22** | 27,762 | 28,634 |
| **P23** | 0 | 0 |
| **P24** | 0 | 0 |
| **P25** | 0 | 0 |
| **DPZ Total:** | **297,146** | **305,809** |
| **CPZ1** | 15,017 | 15,530 |
| **CPZ2** | 212,388 | 219,888 |
| **CPZ3** | 405 | 419 |
| **CPZ4** | 0 | 0 |
| **CPZ5** | 0 | 0 |
| **CPZ6** | 232,693 | 237,291 |
| **CPZ7** | 418,031 | 424,770 |
| **CPZ8** | 76,250 | 76,998 |
| **CPZ Total:** | **954,784** | **974,896** |
| **PZ Total:** | **1,251,930** | **1,280,705** |
| **PZ Population Growth (2021-2023):** | | **2.3%** |

**Table 3-3. PZ Permanent Resident Population and Vehicles by Response Sector**

| Response Sector | 2023 Extrapolated Population | 2023 Resident Vehicles |
|---|---|---|
| **P1** | 10,398 | 4,830 |
| **P2** | 5,250 | 2,441 |
| **P3** | 5,479 | 2,547 |
| **P4** | 8,959 | 4,161 |
| **P5** | 18,040 | 8,374 |
| **P6** | 11,881 | 5,514 |
| **P7** | 16,328 | 7,585 |
| **P8** | 16,023 | 7,437 |
| **P9** | 19,508 | 9,061 |
| **P10** | 16,694 | 7,752 |
| **P11** | 9,448 | 4,384 |
| **P12** | 3,983 | 1,848 |
| **P13** | 9,941 | 4,615 |
| **P14** | 10,052 | 4,666 |
| **P15** | 12,387 | 5,754 |
| **P16** | 11,370 | 5,278 |
| **P17** | 14,110 | 6,548 |
| **P18** | 21,059 | 9,782 |
| **P19** | 9,297 | 4,318 |
| **P20** | 5,476 | 2,544 |
| **P21** | 41,492 | 19,271 |
| **P22** | 28,634 | 13,293 |
| **P23** | 0 | 0 |
| **P24** | 0 | 0 |
| **P25** | 0 | 0 |
| **DPZ Total:** | **305,809** | **142,003** |
| **CPZ1** | 15,530 | 7,211 |
| **CPZ2** | 219,888 | 102,114 |
| **CPZ3** | 419 | 195 |
| **CPZ4** | 0 | 0 |
| **CPZ5** | 0 | 0 |
| **CPZ6** | 237,291 | 110,175 |
| **CPZ7** | 424,770 | 197,282 |
| **CPZ8** | 76,998 | 35,773 |
| **CPZ Total:** | **974,896** | **452,750** |
| **PZ Total:** | **1,280,705** | **594,753** |

**Table 3-4. Shadow Population and Vehicles by Sector**

| Sector | 2023 Extrapolated Population | Evacuating Vehicles |
|---|---|---|
| **N** | 1,387 | 644 |
| **NNE** | 33,092 | 15,365 |
| **NE** | 138,268 | 64,212 |
| **ENE** | 61,734 | 28,671 |
| **E** | 0 | 0 |
| **ESE** | 0 | 0 |
| **SE** | 0 | 0 |
| **SSE** | 0 | 0 |
| **S** | 0 | 0 |
| **SSW** | 0 | 0 |
| **SW** | 55,518 | 25,773 |
| **WSW** | 252,216 | 117,119 |
| **W** | 239,884 | 111,406 |
| **WNW** | 165,926 | 77,082 |
| **NW** | 25,207 | 11,709 |
| **NNW** | 1,664 | 769 |
| **TOTAL** | **974,896** | **452,750** |

**Table 3-5. Summary of Transients and Transient Vehicles**

| Response Sector | Transients | Transient Vehicles |
|---|---|---|
| **P1** | 0 | 0 |
| **P2** | 5,923 | 3,656 |
| **P3** | 312 | 156 |
| **P4** | 393 | 136 |
| **P5** | 0 | 0 |
| **P6** | 0 | 0 |
| **P7** | 0 | 0 |
| **P8** | 0 | 0 |
| **P9** | 30 | 15 |
| **P10** | 0 | 0 |
| **P11** | 0 | 0 |
| **P12** | 185 | 64 |
| **P13** | 0 | 0 |
| **P14** | 0 | 0 |
| **P15** | 0 | 0 |
| **P16** | 0 | 0 |
| **P17** | 223 | 77 |
| **P18** | 494 | 174 |
| **P19** | 10,367 | 2,536 |
| **P20** | 76 | 39 |
| **P21** | 521 | 303 |

| Response Sector | Transients | Transient Vehicles |
|---|---|---|
| **P22** | 2,366 | 1,024 |
| **P23** | 0 | 0 |
| **P24** | 0 | 0 |
| **P25** | 0 | 0 |
| **DPZ Total:** | **20,890** | **8,180** |
| **CPZ1** | 1,833 | 867 |
| **CPZ2** | 19,994 | 6,905 |
| **CPZ3** | 0 | 0 |
| **CPZ4** | 0 | 0 |
| **CPZ5** | 0 | 0 |
| **CPZ6** | 4,195 | 1,880 |
| **CPZ7** | 15,260 | 6,249 |
| **CPZ8** | 1,715 | 650 |
| **CPZ Total:** | **42,997** | **16,551** |
| **PZ Total:** | **63,887** | **24,731** |

**Table 3-6. Summary of Employee Vehicles and Employees Evacuating from GO Transit Stations**

| Response Sector | GO Station | Parking Spaces | Employee Vehicles Evacuating from the Station | Employees Evacuating from the Station |
|---|---|---|---|---|
| P3 | GO Station - Rouge Hill | 853 | 43 | 49 |
| P2 | GO Station - Pickering | 3,538 | 177 | 177 |
| P12 | GO Station - Ajax | 3,050 | 152 | 152 |
| CPZ2 | GO Station - Oshawa | 2,390 | 120 | 120 |
| CPZ2 | GO Station - Whitby | 4,230 | 212 | 212 |
| CPZ6 | GO Station - Eglinton | 839 | 42 | 48 |
| CPZ6 | GO Station - Guildwood | 888 | 44 | 51 |
| CPZ6 | GO Station - Kennedy | 199 | 10 | 12 |
| CPZ6 | GO Station - Scarborough | 627 | 31 | 36 |
| CPZ7 | GO Station - Agincourt | 337 | 17 | 20 |
| CPZ7 | GO Station - Centennial | 451 | 23 | 26 |
| CPZ7 | GO Station - Markham | 410 | 20 | 23 |
| CPZ7 | GO Station - Milliken | 661 | 33 | 38 |
| CPZ7 | GO Station - Unionville | 1,614 | 81 | 93 |
| CPZ8 | GO Station - Mount Joy | 1,333 | 67 | 77 |

**Table 3-7. Summary of Employees and Employee Vehicles Commuting into the PZs**

| Response Sector | Employees | Employee Vehicles |
|---|---|---|
| **P1** | 731 | 731 |
| **P2** | 1,946 | 1,946 |
| **P3** | 455 | 395 |
| **P4** | 671 | 671 |
| **P5** | 1,373 | 1,373 |
| **P6** | 781 | 781 |
| **P7** | 1,108 | 1,108 |
| **P8** | 1,072 | 1,072 |
| **P9** | 994 | 994 |
| **P10** | 666 | 666 |
| **P11** | 408 | 408 |
| **P12** | 301 | 301 |
| **P13** | 369 | 369 |
| **P14** | 357 | 357 |
| **P15** | 859 | 747 |
| **P16** | 899 | 781 |
| **P17** | 969 | 844 |
| **P18** | 1,155 | 1,002 |
| **P19** | 563 | 488 |
| **P20** | 360 | 360 |
| **P21** | 2,179 | 2,179 |
| **P22** | 1,702 | 1,702 |
| **P23** | 0 | 0 |
| **P24** | 0 | 0 |
| **P25** | 0 | 0 |
| **DPZ Total:** | **19,918** | **19,275** |
| **CPZ1** | 1,099 | 1,099 |
| **CPZ2** | 15,148 | 15,148 |
| **CPZ3** | 0 | 0 |
| **CPZ4** | 0 | 0 |
| **CPZ5** | 0 | 0 |
| **CPZ6** | 14,389 | 12,509 |
| **CPZ7** | 29,514 | 25,657 |
| **CPZ8** | 8,850 | 7,705 |
| **CPZ Total:** | **69,000** | **62,118** |
| **PZ Total:** | **88,918** | **81,393** |

**Table 3-8. Medical Facilities Transit Demand Estimates**

| Response Sector | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel-chair Van Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | | | | |
| P10 | Chartwell Harwood Retirement Residence | Ajax | 130 | 130 | 66 | 51 | 13 | 3 | 13 | 13 |
| P10 | Ashley Manor | Ajax | 104 | 104 | 53 | 41 | 10 | 2 | 11 | 10 |
| P12 | Chartwell Ballycliffe Retirement & Long Term Care Residence | Ajax | 234 | 150 | 50 | 95 | 5 | 2 | 24 | 5 |
| P13 | Westwood Manor | Ajax | 83 | 83 | 42 | 32 | 9 | 2 | 8 | 9 |
| P13 | Lakeridge Health Ajax Pickering Hospital | Ajax | 172 | 172 | 115 | 20 | 37 | 4 | 5 | 37 |
| P14 | Harwood Manor | Ajax | 128 | 128 | 65 | 50 | 13 | 3 | 13 | 13 |
| P21 | Winbourne Park Long Term Care | Ajax | 110 | 110 | 59 | 41 | 10 | 2 | 11 | 10 |
| *Ajax DPZ Subtotal:* | | | *961* | *877* | *450* | *330* | *97* | *18* | *85* | *97* |
| *Ajax CPZ Subtotal:* | | | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* |
| *Ajax Total:* | | | *961* | *877* | *450* | *330* | *97* | *18* | *85* | *97* |
| **MARKHAM, ONTARIO** | | | | | | | | | | |
| CPZ7 | Markhaven Home for Seniors | Markham | 96 | 96 | 49 | 37 | 10 | 2 | 10 | 10 |
| CPZ7 | Bethany Courts | Unionville | 72 | 72 | 36 | 28 | 8 | 2 | 7 | 8 |
| CPZ7 | Sunrise of Unionville | Unionville | 98 | 98 | 50 | 38 | 10 | 2 | 10 | 10 |
| CPZ7 | Bethany Manor | Unionville | 38 | 38 | 19 | 15 | 4 | 1 | 4 | 4 |
| CPZ7 | Bethany Lodge | Unionville | 128 | 128 | 65 | 50 | 13 | 3 | 13 | 13 |
| CPZ8 | Markham Stouffville Hospital | Markham | 329 | 329 | 167 | 128 | 34 | 6 | 32 | 34 |
| CPZ8 | Chartwell Woodhaven Long Term Care Residence | Markham | 192 | 192 | 97 | 75 | 20 | 4 | 19 | 20 |
| CPZ8 | Markhaven Home for Seniors | Markham | 96 | 96 | 49 | 37 | 10 | 2 | 10 | 10 |
| CPZ8 | Amica at Swan Lake | Markham | 100 | 100 | 51 | 39 | 10 | 2 | 10 | 10 |
| CPZ8 | Chartwell Rouge Valley Retirement Residence | Markham | 89 | 89 | 45 | 35 | 9 | 2 | 9 | 9 |
| *Markham DPZ Subtotal:* | | | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* |
| *Markham CPZ Subtotal:* | | | *1,238* | *1,238* | *628* | *482* | *128* | *26* | *124* | *128* |

| Response Sector | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel-chair Van Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| *Markham Total:* | | | *1,238* | *1,238* | *628* | *482* | *128* | *26* | *124* | *128* |
| **OSHAWA, ONTARIO** | | | | | | | | | | |
| CPZ2 | Revera ThorntonView Long Term Care Home | Oshawa | 154 | 154 | 78 | 60 | 16 | 3 | 15 | 16 |
| CPZ2 | Extendicare Oshawa | Oshawa | 175 | 175 | 89 | 68 | 18 | 3 | 17 | 18 |
| CPZ2 | Park View Place | Oshawa | 60 | 60 | 30 | 24 | 6 | 1 | 6 | 6 |
| CPZ2 | Faith Place | Oshawa | 180 | 180 | 91 | 70 | 19 | 4 | 18 | 19 |
| CPZ2 | Lakeridge Health Oshawa | Oshawa | 363 | 363 | 184 | 141 | 38 | 7 | 36 | 38 |
| CPZ2 | The Carriage House | Oshawa | 30 | 30 | 15 | 12 | 3 | 1 | 3 | 3 |
| CPZ2 | Hillsdale Terrace | Oshawa | 200 | 200 | 101 | 78 | 21 | 4 | 20 | 21 |
| CPZ2 | Hillsdale Estates | Oshawa | 300 | 300 | 152 | 117 | 31 | 6 | 20 | 31 |
| CPZ2 | Livita Centennial Retirement Residence | Oshawa | 20 | 20 | 10 | 8 | 2 | 1 | 2 | 2 |
| *Oshawa DPZ Subtotal:* | | | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* |
| *Oshawa CPZ Subtotal:* | | | *1,482* | *1,482* | *750* | *578* | *154* | *30* | *147* | *154* |
| *Oshawa Total:* | | | *1,482* | *1,482* | *750* | *578* | *154* | *30* | *147* | *154* |
| **PICKERING, ONTARIO** | | | | | | | | | | |
| P1 | St. Martin's Centre | Pickering | 67 | 67 | 34 | 26 | 7 | 2 | 7 | 7 |
| P2 | Fairport Lodge | Pickering | 36 | 36 | 18 | 14 | 4 | 1 | 4 | 4 |
| P2 | Bay Ridges Long Term Care Centre | Pickering | 124 | 124 | 24 | 100 | 0 | 1 | 25 | 0 |
| P4 | Abbeylawn Manor Retirement Home | Pickering | 57 | 54 | 45 | 9 | 0 | 2 | 3 | 0 |
| P7 | Chartwell Pickering City Centre Retirement Residence | Pickering | 117 | 117 | 63 | 44 | 10 | 3 | 11 | 10 |
| P7 | Livita Parkway Retirement Residence | Pickering | 75 | 63 | 63 | 0 | 0 | 3 | 0 | 0 |
| P7 | Viva Pickering | Pickering | 166 | 160 | 158 | 2 | 0 | 6 | 1 | 0 |
| P7 | Villa Valeau | Pickering | 36 | 36 | 18 | 14 | 4 | 1 | 4 | 4 |
| P7 | Orchard Villa Retirement Residence | Pickering | 294 | 280 | 97 | 114 | 69 | 4 | 29 | 69 |
| P8 | Rene Goupil House | Pickering | 25 | 25 | 22 | 2 | 1 | 1 | 1 | 1 |
| CPZ1 | Deer Run Retirement | Claremont | 20 | 20 | 10 | 8 | 2 | 1 | 2 | 2 |

| Response Sector | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel-chair Van Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| *Pickering DPZ Subtotal:* | | | *997* | *962* | *542* | *325* | *95* | *24* | *85* | *95* |
| *Pickering CPZ Subtotal:* | | | *20* | *20* | *10* | *8* | *2* | *1* | *2* | *2* |
| *Pickering Total:* | | | *1,017* | *982* | *552* | *333* | *97* | *25* | *87* | *97* |
| **TORONTO, ONTARIO** | | | | | | | | | | |
| P16 | Altamont Care Community | Toronto | 159 | 159 | 93 | 65 | 1 | 4 | 17 | 1 |
| P17 | Tony Stacey Centre for Veterans Care | Toronto | 100 | 100 | 58 | 40 | 2 | 2 | 10 | 2 |
| P17 | Ehatare Retirement and Nursing Home | Toronto | 32 | 32 | 17 | 12 | 3 | 1 | 3 | 3 |
| P18 | Extendicare Rouge Valley | Toronto | 192 | 192 | 103 | 72 | 17 | 4 | 18 | 17 |
| CPZ6 | Extendicare Scarborough | Scarborough | 150 | 150 | 76 | 58 | 16 | 3 | 15 | 16 |
| CPZ6 | Chartwell Guildwood Retirement Residence | Scarborough | 172 | 172 | 87 | 67 | 18 | 3 | 17 | 18 |
| CPZ6 | Extendicare Guildwood | Scarborough | 169 | 169 | 85 | 66 | 18 | 3 | 17 | 18 |
| CPZ6 | Cedarbrook Lodge Retirement Residence | Scarborough | 200 | 200 | 101 | 78 | 21 | 4 | 20 | 21 |
| CPZ6 | Momiji Health Care Society | Scarborough | 400 | 400 | 202 | 156 | 42 | 7 | 39 | 42 |
| CPZ6 | Scarborough Retirement Residence | Scarborough | 127 | 127 | 64 | 50 | 13 | 3 | 13 | 13 |
| CPZ6 | Rockcliffe Care Community | Scarborough | 204 | 204 | 103 | 80 | 21 | 4 | 20 | 21 |
| CPZ6 | Chartwell Trilogy Long Term Care Residence | Scarborough | 197 | 197 | 100 | 77 | 20 | 4 | 20 | 20 |
| CPZ6 | McCowan Retirement Residence | Scarborough | 142 | 142 | 72 | 55 | 15 | 3 | 14 | 15 |
| CPZ6 | Bendale Acres Long-Term Care Home | Scarborough | 302 | 302 | 152 | 118 | 32 | 6 | 30 | 32 |
| CPZ6 | St David's Village | Scarborough | 179 | 179 | 90 | 70 | 19 | 3 | 18 | 19 |
| CPZ6 | Kennedy Lodge Long Term Care | Scarborough | 289 | 289 | 146 | 113 | 30 | 5 | 29 | 30 |
| CPZ6 | Hellenic Home for the Aged | Scarborough | 128 | 128 | 65 | 50 | 13 | 3 | 13 | 13 |
| CPZ6 | Midland Gardens Retirement Residence | Scarborough | 299 | 299 | 151 | 117 | 31 | 6 | 30 | 31 |
| CPZ6 | Craiglee Nursing Home | Scarborough | 169 | 169 | 85 | 66 | 18 | 3 | 17 | 18 |
| CPZ6 | Retirement Suites By The Lake | Scarborough | 92 | 92 | 46 | 36 | 10 | 2 | 9 | 10 |
| CPZ6 | Ina Grafton Gage Home | Scarborough | 128 | 128 | 65 | 50 | 13 | 3 | 13 | 13 |
| CPZ6 | Cardinal Ambrozic Houses of Providence | Scarborough | 173 | 173 | 88 | 67 | 18 | 3 | 17 | 18 |

| Response Sector | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel-chair Van Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| CPZ6 | Providence Healthcare | Scarborough | 350 | 288 | 146 | 112 | 30 | 5 | 28 | 30 |
| CPZ7 | Scarborough Health Network - Centenary Hospital | Scarborough | 1200 | 1200 | 607 | 468 | 125 | 21 | 117 | 125 |
| CPZ7 | Sts. Peter and Paul Residence | Scarborough | 300 | 300 | 152 | 117 | 31 | 6 | 30 | 31 |
| CPZ7 | Fieldstone Commons Care Community | Scarborough | 224 | 224 | 113 | 88 | 23 | 4 | 22 | 23 |
| CPZ7 | Retirement Living at Shepherd Terrace | Scarborough | 96 | 96 | 49 | 37 | 10 | 2 | 10 | 10 |
| CPZ7 | Mon Sheong Scarborough LTC | Scarborough | 160 | 160 | 81 | 62 | 17 | 3 | 16 | 17 |
| CPZ7 | Scarborough Health Network - Birchmount Hospital | Scarborough | 700 | 700 | 354 | 273 | 73 | 12 | 69 | 73 |
| *Toronto DPZ Subtotal:* | | | *483* | *483* | *271* | *189* | *23* | *11* | *48* | *23* |
| *Toronto CPZ Subtotal:* | | | *6,550* | *6,488* | *3,280* | *2,531* | *677* | *121* | *643* | *677* |
| *Toronto Total:* | | | *7,033* | *6,971* | *3,551* | *2,720* | *700* | *132* | *691* | *700* |
| **WHITBY, ONTARIO** | | | | | | | | | | |
| CPZ2 | Lakeridge Health | Whitby | 74 | 73 | 38 | 28 | 7 | 2 | 7 | 7 |
| CPZ2 | Fairview Lodge | Whitby | 198 | 198 | 100 | 77 | 21 | 4 | 20 | 21 |
| CPZ2 | Centre - DRLHC | Whitby | 16 | 16 | 8 | 6 | 2 | 1 | 2 | 2 |
| CPZ2 | Windsor Place | Whitby | 104 | 104 | 52 | 41 | 11 | 2 | 11 | 11 |
| CPZ2 | Bowling Green Towers | Whitby | 80 | 80 | 41 | 31 | 8 | 2 | 8 | 8 |
| CPZ2 | Chartwell Colonial Retirement Residence | Whitby | 96 | 96 | 49 | 37 | 10 | 2 | 10 | 10 |
| CPZ2 | Aspira Lynde Creek Gardens Retirement Living | Whitby | 94 | 94 | 47 | 37 | 10 | 2 | 10 | 10 |
| CPZ2 | Amica at Whitby | Whitby | 139 | 139 | 70 | 54 | 15 | 3 | 14 | 15 |
| CPZ2 | Oakwood Retirement Communities | Whitby | 125 | 125 | 63 | 49 | 13 | 3 | 13 | 13 |
| CPZ2 | Village of Taunton Mills | Whitby | 184 | 184 | 93 | 72 | 19 | 4 | 18 | 19 |
| CPZ2 | Tekoa Manor | Whitby | 125 | 125 | 63 | 49 | 13 | 3 | 13 | 13 |
| CPZ2 | Glen Hill Terrace | Whitby | 174 | 174 | 88 | 68 | 18 | 3 | 17 | 18 |
| CPZ2 | Bloomsdale Seniors Home | Whitby | 20 | 20 | 10 | 8 | 2 | 1 | 2 | 2 |
| CPZ2 | Sunnycrest Nursing Homes Ltd | Whitby | 136 | 136 | 69 | 53 | 14 | 3 | 14 | 14 |

| Response Sector | Facility Name | Municipality | Capacity | Current Census | Ambu-latory | Wheel-chair Bound | Bed-ridden | Bus Runs | Wheel-chair Van Runs | Ambulance Runs |
|---|---|---|---|---|---|---|---|---|---|---|
| CPZ2 | The Court at Pringle Creek | Whitby | 119 | 119 | 60 | 47 | 12 | 2 | 12 | 12 |
| CPZ2 | The Court at Brooklin | Whitby | 118 | 118 | 60 | 46 | 12 | 2 | 12 | 12 |
| *Whitby DPZ Subtotal:* | | | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* |
| *Whitby CPZ Subtotal:* | | | *1,802* | *1,801* | *911* | *703* | *187* | *39* | *183* | *187* |
| *Whitby Total:* | | | *1,802* | *1,801* | *911* | *703* | *187* | *39* | *183* | *187* |
| **DPZ TOTAL:** | | | **2,441** | **2,322** | **1,263** | **844** | **215** | **53** | **218** | **215** |
| **CPZ TOTAL:** | | | **11,092** | **11,029** | **5,579** | **4,302** | **1,148** | **217** | **1,099** | **1,148** |
| **PZ TOTAL:** | | | **13,533** | **13,351** | **6,842** | **5,146** | **1,363** | **270** | **1,317** | **1,363** |

**Table 3-9. School Population Demand Estimates**

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| | **AJAX, ONTARIO** | | |
| P9 | St. Francis de Sales Catholic School | 171 | 3 |
| P9 | Harwood Montessori School Inc. | 40 | 1 |
| P9 | Blaisdale Montessori Village Campus | 89 | 2 |
| P9 | Lincoln Avenue Public School | 250 | 4 |
| P9 | Lincoln Alexander Public School | 477 | 7 |
| P9 | Pickering High School | 1,984 | 42 |
| P9 | Eagle Ridge Public School | 519 | 8 |
| P9 | St. Patrick Catholic School | 917 | 16 |
| P9 | Alexander Graham Bell Public School | 570 | 8 |
| P10 | Westney Heights Public School | 329 | 5 |
| P10 | St. Jude Catholic School | 255 | 5 |
| P10 | Applecroft Public School | 327 | 5 |
| P10 | Lester B. Pearson Public School | 344 | 5 |
| P10 | Dr. Roberta Bondar Public School | 300 | 5 |
| P10 | St. Catherine of Siena Catholic School | 383 | 7 |
| P11 | Roland Michener Public School | 573 | 8 |
| P11 | École Élémentaire Catholique Notre-dame-de-la-jeunesse | 289 | 5 |
| P11 | Cambridge International Academy | 30 | 1 |
| P11 | Lord Elgin Public School | 200 | 3 |
| P11 | Archbishop Denis O'Connor Catholic High School | 850 | 18 |
| P12 | Blaisdale Montessori Westney Campus | 290 | 5 |
| P12 | Father Donald MacLellan Catholic Secondary School | 235 | 5 |
| P12 | Archbishop Anthony Meagher Catholic Continuing Education Centre | 80 | 0[29] |
| P13 | Lakeside Public School | 315 | 5 |
| P13 | Exceptional Learning Centre - Head Office | 8 | 1 |
| P13 | Duffin's Bay Public School | 276 | 4 |
| P13 | St. James Catholic School | 216 | 4 |
| P14 | Southwood Park Public School | 699 | 10 |
| P14 | Bolton C. Falby Public School | 578 | 9 |
| P14 | St. Bernadette Catholic School | 729 | 13 |
| P14 | Ajax High School | 1,161 | 25 |
| P21 | Vimy Ridge Public School | 593 | 9 |
| P21 | Nottingham Public School | 604 | 9 |
| P21 | St. André Bessette Catholic School | 464 | 7 |
| P21 | Pickering Christian School | 197 | 3 |
| P21 | J. Clarke Richardson Collegiate | 1,630 | 34 |

[29] Off-campus students: Evacuate in personal vehicles.

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| P21 | Notre Dame Catholic Secondary School | 1,226 | 26 |
| P21 | Brackendale Montessori | 150 | 3 |
| P21 | St. Josephine Bakhita Catholic School | 638 | 11 |
| P21 | Da Vinci Public School | 835 | 12 |
| P21 | Faithway Baptist Church School | 97 | 2 |
| P21 | Michaëlle Jean Public School | 633 | 9 |
| P21 | Romeo Dallaire Public School | 517 | 8 |
| P21 | Al Madrasah Al-inamiyyah Private School | 120 | 2 |
| P22 | Carruthers Creek Public School | 756 | 11 |
| P22 | Cadarackque Public School | 679 | 10 |
| P22 | Terry Fox Public School | 426 | 6 |
| P22 | Saint Teresa of Calcutta Catholic School | 477 | 7 |
| | *Ajax DPZ Total:* | *23,526* | *408* |
| | *Ajax CPZ Total:* | *0* | *0* |
| | *Ajax Total:* | *23,526* | *408* |
| **MARKHAM, ONTARIO** | | | |
| CPZ7 | David Suzuki Public School | 802 | 12 |
| CPZ7 | Legacy Public School | 550 | 8 |
| CPZ7 | Cedarwood Public School | 729 | 11 |
| CPZ7 | Boxwood Public School | 401 | 6 |
| CPZ7 | Sir Richard W Scott Catholic Elementary School | 405 | 6 |
| CPZ7 | Ellen Fairclough Public School | 422 | 6 |
| CPZ7 | Parkland Public School | 700 | 10 |
| CPZ7 | William Armstrong Public School | 281 | 4 |
| CPZ7 | Markham Gateway Public School | 472 | 7 |
| CPZ7 | NOIC Academy | 159 | 4 |
| CPZ7 | Markham District High School | 1,473 | 31 |
| CPZ7 | Armadale Public School | 1,000 | 14 |
| CPZ7 | Middlefield Collegiate Institute | 1,478 | 31 |
| CPZ7 | Coppard Glen Public School | 573 | 8 |
| CPZ7 | Cambridge Academy | 23 | 1 |
| CPZ7 | Franklin Street Public School | 438 | 7 |
| CPZ7 | Wilclay Public School | 850 | 12 |
| CPZ7 | Father Michael McGivney Catholic Academy High School | 1,361 | 29 |
| CPZ7 | St. Patrick Catholic Elementary School | 332 | 5 |
| CPZ7 | Roy H Crosby Public School | 270 | 4 |
| CPZ7 | Randall Public School | 729 | 11 |
| CPZ7 | St. Francis Xavier Catholic | 266 | 4 |
| CPZ7 | St. Benedict Catholic Elementary School | 240 | 4 |
| CPZ7 | Aldergrove Public School | 710 | 10 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ7 | Somerset Academy | 80 | 2 |
| CPZ7 | Wesley Christian Academy | 264 | 4 |
| CPZ7 | Ramer Wood Public School | 293 | 5 |
| CPZ7 | St. Edward Catholic School | 447 | 7 |
| CPZ7 | Unionville Meadows Public School | 671 | 10 |
| CPZ7 | Markville Secondary School | 1,424 | 24 |
| CPZ7 | Milliken Mills High School | 1,003 | 21 |
| CPZ7 | Kennedy Montessori School | 30 | 1 |
| CPZ7 | Town Centre Private School | 100 | 3 |
| CPZ7 | Central Park Public School | 575 | 8 |
| CPZ7 | Highgate Public School | 445 | 7 |
| CPZ7 | Trillium School | 330 | 5 |
| CPZ7 | Montessori North School | 30 | 1 |
| CPZ7 | Amberson High School | 228 | 5 |
| CPZ7 | Milliken Mills Public School | 394 | 9 |
| CPZ7 | Bill Crothers Secondary School | 1,453 | 31 |
| CPZ7 | St. Matthew Catholic Elementary School | 175 | 3 |
| CPZ7 | Stonebridge Public School | 770 | 11 |
| CPZ7 | All Saints' Montessori School | 63 | 2 |
| CPZ7 | Castlemore Public School | 752 | 16 |
| CPZ7 | All Saints Catholic Elementary School | 469 | 10 |
| CPZ7 | Pierre Elliott Trudeau High School | 1,984 | 42 |
| CPZ8 | Black Walnut Public School | 702 | 10 |
| CPZ8 | St. Joseph Catholic Elementary School | 443 | 7 |
| CPZ8 | Bill Hogarth Secondary School | 450 | 10 |
| CPZ8 | Cornell Village Public School | 572 | 8 |
| CPZ8 | First Academy Montessori East Campus | 46 | 1 |
| CPZ8 | Reesor Park Public School | 445 | 7 |
| CPZ8 | Little Rouge Public School | 400 | 6 |
| CPZ8 | Kateri Tekakwitha Catholic Elementary School | 349 | 5 |
| CPZ8 | Greensborough Public School | 538 | 8 |
| CPZ8 | Edward T. Crowle Public School | 287 | 4 |
| CPZ8 | St. Brother André Catholic High School | 1,430 | 30 |
| CPZ8 | St. Julia Billiart Catholic School | 608 | 9 |
| CPZ8 | Sam Chapman Public School | 588 | 9 |
| CPZ8 | Marander Montessori School | 15 | 1 |
| CPZ8 | Mount Joy Public School | 672 | 10 |
| CPZ8 | Wismer Public School | 553 | 8 |
| CPZ8 | Bur Oak Secondary School | 1,581 | 33 |
| CPZ8 | Donald Cousens Public School | 703 | 10 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ8 | San Lorenzo Ruiz Catholic Elementary School | 564 | 8 |
| CPZ8 | John McCrae Public School | 638 | 14 |
| | *Markham DPZ Total:* | *0* | *0* |
| | *Markham CPZ Total:* | *38,228* | *670* |
| | *Markham Total:* | *38,228* | *670* |
| **OSHAWA, ONTARIO** | | | |
| CPZ2 | Stephen G. Saywell Public School | 400 | 6 |
| CPZ2 | Waverly Public School | 380 | 6 |
| CPZ2 | College Hill Public School | 243 | 4 |
| CPZ2 | Elementary School Antonine-Maillet | 193 | 3 |
| CPZ2 | Elementary School Catholic Corpus-Christi | 282 | 4 |
| CPZ2 | St. Thomas Aquinas Catholic School | 288 | 4 |
| CPZ2 | Woodcrest Public School | 300 | 5 |
| CPZ2 | Durham Alternative Secondary School | 403 | 9 |
| CPZ2 | R.S. McLaughlin CVI | 1,000 | 21 |
| CPZ2 | Adelaide McLaughlin Public School | 323 | 5 |
| CPZ2 | Monsignor Paul Dwyer Catholic High School | 854 | 18 |
| CPZ2 | St. Christopher Catholic School | 407 | 6 |
| CPZ2 | Monsignor Philip Coffey Catholic School | 247 | 4 |
| CPZ2 | Glen Street Public School | 395 | 6 |
| CPZ2 | Dr C F Cannon Public School | 415 | 6 |
| CPZ2 | G L Roberts Collegiate and Vocational Institute | 481 | 11 |
| CPZ2 | Durham Continuing Education | 184 | 0[29] |
| CPZ2 | Village Union Public School | 337 | 5 |
| CPZ2 | Lakewoods Public School | 333 | 5 |
| CPZ2 | Immanuel Christian School | 126 | 2 |
| CPZ2 | Mary Street Community School | 145 | 3 |
| CPZ2 | O'Neill Collegiate and Vocational Institute | 1,187 | 25 |
| CPZ2 | Bobby Orr Public School | 262 | 4 |
| CPZ2 | Sunset Heights Public School | 315 | 5 |
| CPZ2 | DR S J Phillips Public School | 710 | 10 |
| CPZ2 | Monsignor John Pereyma Catholic Secondary School | 489 | 11 |
| CPZ2 | Blaisdale Montessori Oshawa Campus | 60 | 2 |
| CPZ2 | St. Hedwig Catholic School | 113 | 2 |
| CPZ2 | Queen Elizabeth Public School | 450 | 7 |
| CPZ2 | David Bouchard Public School | 576 | 8 |
| CPZ2 | Beau Valley Public School | 279 | 4 |
| CPZ2 | Coronation Public School | 458 | 7 |
| CPZ2 | Great Beginnings Montessori School | 72 | 1 |
| | *Oshawa DPZ Total:* | *0* | *0* |
| | *Oshawa CPZ Total:* | *12,707* | *219* |
| | *Oshawa Total:* | *12,707* | *219* |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| **PICKERING, ONTARIO** | | | |
| P1 | Frenchman's Bay Public School | 573 | 8 |
| P1 | Fairport Beach Public School | 224 | 4 |
| P1 | Father Fenelon Catholic School | 371 | 7 |
| P2 | Sir John A. Macdonald Public School | 385 | 6 |
| P2 | Bayview Heights Public School | 405 | 6 |
| P2 | Durham Alternative Secondary School - Pickering Campus | 645 | 14 |
| P4 | Dunbarton High School | 1,425 | 30 |
| P4 | Rosebank Road Public School | 193 | 3 |
| P4 | Blaisdale Montessori Pickering Campus | 247 | 5 |
| P4 | Montessori Learning Centre of Pickering | 200 | 3 |
| P4 | Blaisdale Montessori Annex Campus | 50 | 1 |
| P4 | Blaisdale Montessori Rougemount Campus | 89 | 2 |
| P4 | Elizabeth B. Phin Public School | 343 | 5 |
| P4 | St. Monica Catholic School | 373 | 7 |
| P5 | Highbush Public School | 493 | 7 |
| P5 | St. Mary Catholic Secondary School | 1,406 | 30 |
| P5 | St. Elizabeth Seton Catholic School | 800 | 12 |
| P5 | Altona Forest Public School | 361 | 6 |
| P5 | Westcreek Public School | 360 | 5 |
| P6 | Crawford Adventist Academy - East Campus | 71 | 1 |
| P6 | William Dunbar Public School | 674 | 10 |
| P6 | Gandatsetiagon Public School | 459 | 7 |
| P7 | Glengrove Public School | 317 | 5 |
| P7 | Vaughan Willard Public School | 253 | 4 |
| P8 | St. Isaac Jogues Catholic School | 640 | 11 |
| P8 | Maple Ridge Public School | 472 | 7 |
| P8 | Pine Ridge Secondary School | 1,255 | 27 |
| P8 | Valley Farm Public School | 566 | 8 |
| P9 | Brock Elementary School | 70 | 1 |
| P9 | École élémentaire Ronald-Marion | 360 | 8 |
| P9 | St. Wilfrid Catholic School | 457 | 8 |
| CPZ1 | Valley View Public School | 325 | 5 |
| CPZ1 | Claremont Public School | 181 | 3 |
| | *Pickering DPZ Total:* | *14,537* | *258* |
| | *Pickering CPZ Total:* | *506* | *8* |
| | *Pickering Total:* | *15,043* | *266* |
| **TORONTO, ONTARIO** | | | |
| P3 | West Rouge Junior Public School | 239 | 4 |
| P15 | St. Malachy Catholic Elementary School | 284 | 4 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| P15 | Joseph Brant Senior Public School | 537 | 8 |
| P15 | École élémentaire Académie Alexandre-Dumas | 187 | 3 |
| P16 | William G. Davis Junior Public School | 245 | 4 |
| P16 | Joseph Howe Senior Public School | 335 | 5 |
| P16 | Charlottetown Junior Public School | 435 | 7 |
| P16 | Sir Oliver Mowat Collegiate Institute | 1,106 | 24 |
| P16 | Centennial Road Junior Public School | 263 | 4 |
| P17 | St. Brendan Catholic Elementary School | 524 | 8 |
| P17 | Highland Creek Public School | 145 | 3 |
| P17 | West Hill Public School | 232 | 4 |
| P18 | Rouge Valley Public School | 271 | 4 |
| P18 | St. Dominic Savio Catholic Elementary School | 259 | 4 |
| P18 | Chief Dan George Public School | 346 | 5 |
| P18 | Meadowvale Public School | 255 | 4 |
| P18 | John G. Diefenbaker Public School | 260 | 4 |
| P18 | St. Jean de Brebeuf Catholic Elementary School | 226 | 4 |
| P18 | Cardinal Leger Catholic Elementary School | 355 | 5 |
| P18 | Morrish Public School | 300 | 5 |
| P19 | Hillside Outdoor Education School | 65 | 2 |
| P19 | Afzal Islamic Montessori & Academy - Scarborough Campus | 29 | 1 |
| P19 | Fleming Public School | 300 | 5 |
| P19 | St. Bede Catholic Elementary School | 162 | 3 |
| CPZ6 | West Hill Collegiate Institute | 704 | 15 |
| CPZ6 | St. Martin de Porres Catholic School | 331 | 5 |
| CPZ6 | St. Margaret's Public School | 250 | 4 |
| CPZ6 | Poplar Road Junior Public School | 220 | 4 |
| CPZ6 | Eastview Junior Public School | 394 | 6 |
| CPZ6 | Galloway Road Public School | 220 | 4 |
| CPZ6 | Maplewood High School | 163 | 4 |
| CPZ6 | Jack Miner Senior Public School | 172 | 3 |
| CPZ6 | George B Little Public School | 420 | 6 |
| CPZ6 | Heather Heights Junior Public School | 200 | 3 |
| CPZ6 | Guildwood Junior Public School | 117 | 2 |
| CPZ6 | Sir Wilfrid Laurier Collegiate Institute | 1,354 | 29 |
| CPZ6 | St. Ursula Catholic School | 244 | 4 |
| CPZ6 | Willow Park Junior Public School | 374 | 6 |
| CPZ6 | Tecumseh Senior Public School | 247 | 4 |
| CPZ6 | Golf Road Junior Public School | 295 | 5 |
| CPZ6 | Churchill Heights Public School | 375 | 6 |
| CPZ6 | St. Barbara Catholic School | 312 | 5 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ6 | Cornell Junior Public School | 750 | 11 |
| CPZ6 | Elizabeth Simcoe Junior Public School | 265 | 4 |
| CPZ6 | Cedar Drive Junior Public School | 708 | 10 |
| CPZ6 | George P Mackie Junior Public School | 140 | 2 |
| CPZ6 | Bellmere Junior Public School | 390 | 6 |
| CPZ6 | Cedarbrae Collegiate Institute | 1,268 | 27 |
| CPZ6 | Tredway Woodsworth Public School | 759 | 11 |
| CPZ6 | Scarborough Village Alternative Public School | 215 | 3 |
| CPZ6 | St. Boniface School | 350 | 5 |
| CPZ6 | St. Richard Catholic School | 409 | 6 |
| CPZ6 | Cedarbrook Junior Public School | 479 | 7 |
| CPZ6 | Mason Road Junior Public School | 400 | 6 |
| CPZ6 | St. Rose of Lima Catholic School | 469 | 7 |
| CPZ6 | Bendale Junior Public School | 401 | 6 |
| CPZ6 | Bliss Carman Senior Public School | 286 | 4 |
| CPZ6 | UMC High School - Main Campus | 626 | 9 |
| CPZ6 | John McCrae Senior Public School | 596 | 9 |
| CPZ6 | St. Andrews Public School | 342 | 5 |
| CPZ6 | Alternative Scarborough Education 1 | 107 | 3 |
| CPZ6 | H A Halbert Junior Public School | 232 | 4 |
| CPZ6 | St. Agatha Catholic School | 463 | 7 |
| CPZ6 | Knob Hill Junior Public School | 500 | 7 |
| CPZ6 | Fairmount Public School | 423 | 6 |
| CPZ6 | David and Mary Thomson Collegiate Institute | 1,000 | 21 |
| CPZ6 | Donwood Park Junior Public School | 667 | 10 |
| CPZ6 | Anson Park Public School | 250 | 4 |
| CPZ6 | R H King Academy | 1,270 | 27 |
| CPZ6 | Um Al-Qura Islamic School | 154 | 3 |
| CPZ6 | Glen Ravine Junior Public School | 303 | 5 |
| CPZ6 | Walter Perry Junior Public School | 307 | 5 |
| CPZ6 | Hunter's Glen Junior Public School | 404 | 6 |
| CPZ6 | St. Albert Catholic School | 436 | 7 |
| CPZ6 | St. Joan of Arc Catholic Academy | 934 | 20 |
| CPZ6 | Robert Service Senior Public School | 173 | 3 |
| CPZ6 | St. John Henry Newman Catholic High School | 1,091 | 23 |
| CPZ6 | Lord Roberts Junior Public School | 396 | 6 |
| CPZ6 | St. Theresa Shrine Catholic School | 199 | 3 |
| CPZ6 | Scarborough Centre for Alternative Studies | 377 | 8 |
| CPZ6 | Chine Drive Public School | 155 | 3 |
| CPZ6 | John A Leslie Public School | 537 | 8 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ6 | Corvette Junior Public School | 582 | 9 |
| CPZ6 | Winston Churchill Collegiate Institute | 644 | 14 |
| CPZ6 | Dorset Park Public School | 216 | 3 |
| CPZ6 | Norman Cook Junior Public School | 169 | 3 |
| CPZ6 | St. Lawrence Catholic School | 455 | 7 |
| CPZ6 | Ionview Public School | 401 | 6 |
| CPZ6 | General Crerar Public School | 376 | 6 |
| CPZ6 | Cliffside Public School | 150 | 3 |
| CPZ6 | Bond International College | 450 | 8 |
| CPZ6 | Mariyah Islamic School | 20 | 1 |
| CPZ6 | Manhattan Park Junior Public School | 125 | 2 |
| CPZ6 | General Brock Public School | 438 | 7 |
| CPZ6 | Birch Cliff Heights Public School | 262 | 4 |
| CPZ6 | J G Workman Public School | 210 | 3 |
| CPZ6 | Nil Academy | 245 | 5 |
| CPZ6 | Buchanan Public School | 320 | 5 |
| CPZ6 | George Peck Public School | 246 | 4 |
| CPZ6 | Danforth Gardens Public School | 500 | 7 |
| CPZ6 | St. Joachim Catholic School | 307 | 5 |
| CPZ6 | Birchmount Park Collegiate Institute | 873 | 19 |
| CPZ6 | St. Kevin's Catholic School | 212 | 3 |
| CPZ6 | Maryvale Public School | 273 | 6 |
| CPZ6 | W. A. Porter Collegiate Institute | 1,264 | 27 |
| CPZ6 | Wexford Public School | 400 | 6 |
| CPZ6 | Birch Cliff Public School | 355 | 8 |
| CPZ7 | Military Trail Public School | 500 | 7 |
| CPZ7 | St. John Paul II Catholic Secondary School | 1,352 | 29 |
| CPZ7 | Emily Carr Public School | 400 | 6 |
| CPZ7 | St. Florence Catholic School | 189 | 3 |
| CPZ7 | Alexander Stirling Public School | 385 | 6 |
| CPZ7 | Heritage Park Public School | 326 | 5 |
| CPZ7 | Lucy Maud Montgomery Public School | 198 | 3 |
| CPZ7 | St. Columba Catholic School | 220 | 4 |
| CPZ7 | Grey Owl Junior Public School | 247 | 4 |
| CPZ7 | Saint Mother Teresa Academy | 522 | 11 |
| CPZ7 | Highcastle Public School | 400 | 6 |
| CPZ7 | St. Edmund Campion Catholic School | 260 | 4 |
| CPZ7 | Angel Montessori School | 80 | 2 |
| CPZ7 | Mary Shadd Public School | 442 | 7 |
| CPZ7 | Sacred Heart Catholic School | 245 | 4 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ7 | Henry Hudson Senior Public School | 304 | 5 |
| CPZ7 | Berner Trail Junior Public School | 350 | 5 |
| CPZ7 | Lester B Pearson Collegiate Institute | 1,383 | 29 |
| CPZ7 | Dr Marion Hilliard Senior Public School | 287 | 4 |
| CPZ7 | St. Gabriel Lalemant Catholic School | 151 | 3 |
| CPZ7 | Thomas L Wells Public School | 600 | 9 |
| CPZ7 | Whitefield Christian Schools | 350 | 6 |
| CPZ7 | St. Barnabas Catholic Church | 301 | 5 |
| CPZ7 | Islamic Institute of Toronto | 262 | 4 |
| CPZ7 | Burrows Hall Junior Public School | 265 | 4 |
| CPZ7 | Tom Longboat Junior Public School | 320 | 5 |
| CPZ7 | Woburn Junior Public School | 395 | 6 |
| CPZ7 | Woburn Collegiate Institute | 1,086 | 23 |
| CPZ7 | Malvern Junior Public School | 403 | 6 |
| CPZ7 | Blessed Pier Giorgio Frassati Catholic School | 467 | 7 |
| CPZ7 | Al Azhar Islamic School | 55 | 1 |
| CPZ7 | Brookside Public School | 766 | 11 |
| CPZ7 | Woburn Collegiate Institute | 70 | 2 |
| CPZ7 | Kitab Academy | 50 | 2 |
| CPZ7 | Islamic Foundation School | 726 | 11 |
| CPZ7 | St. Elizabeth Seton Catholic School | 152 | 3 |
| CPZ7 | White Haven Junior Public School | 503 | 7 |
| CPZ7 | Excel High School | 22 | 1 |
| CPZ7 | North Bendale Junior Public School | 150 | 3 |
| CPZ7 | Anson S Taylor Junior Public School | 228 | 4 |
| CPZ7 | Éék Saint-Jean-De-Lalande | 108 | 2 |
| CPZ7 | St. Ignatius of Loyola Separate School | 151 | 3 |
| CPZ7 | Percy Williams Junior Public School | 314 | 5 |
| CPZ7 | St. Victor Catholic School | 322 | 5 |
| CPZ7 | C D Farquharson Junior Public School | 383 | 6 |
| CPZ7 | Iroquois Junior Public School | 324 | 5 |
| CPZ7 | Macklin Public School | 483 | 7 |
| CPZ7 | Albert Campbell Collegiate Institute | 1,219 | 26 |
| CPZ7 | St. Bartholomew Catholic School | 95 | 2 |
| CPZ7 | Brimwood Boulevard Junior Public School | 380 | 6 |
| CPZ7 | Francis Libermann Catholic High School | 927 | 20 |
| CPZ7 | Edgewood Public School | 229 | 4 |
| CPZ7 | Our Lady of Grace Catholic School | 267 | 4 |
| CPZ7 | Sir Alexander Mackenzie Senior Public School | 470 | 7 |
| CPZ7 | North Agincourt Junior Public School | 361 | 6 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ7 | Henry Kelsey Senior Public School | 288 | 4 |
| CPZ7 | Laure Riese Elementary School | 208 | 3 |
| CPZ7 | Chartland Junior Public School | 203 | 3 |
| CPZ7 | Agnes Macphail Public School | 306 | 5 |
| CPZ7 | Delphi Secondary Alternative School | 118 | 3 |
| CPZ7 | Agincourt Montessori School | 20 | 1 |
| CPZ7 | Banting & Best Public School | 362 | 6 |
| CPZ7 | Agincourt Collegiate Institute | 1,351 | 29 |
| CPZ7 | Agincourt Junior Public School | 230 | 4 |
| CPZ7 | St. Marguerite Bourgeoys Catholic School | 100 | 2 |
| CPZ7 | Msgr Fraser College - Midland Campus | 160 | 4 |
| CPZ7 | Alexmuir Junior Public School | 361 | 6 |
| CPZ7 | Marilake Academy | 40 | 1 |
| CPZ7 | Sir William Osler High School | 218 | 5 |
| CPZ7 | Milliken Public School | 279 | 4 |
| CPZ7 | Port Royal Public School | 370 | 6 |
| CPZ7 | Lynnwood Heights Junior Public School | 160 | 3 |
| CPZ7 | Smart Start Montessori School | 15 | 1 |
| CPZ7 | Glamorgan Junior Public School | 532 | 8 |
| CPZ7 | Inglewood Heights Junior Public School | 250 | 4 |
| CPZ7 | Ellesmere-Statton Public School | 640 | 9 |
| CPZ7 | Highland Heights Junior Public School | 161 | 3 |
| CPZ7 | Silver Springs Public School | 470 | 7 |
| CPZ7 | St. Sylvester Catholic School | 180 | 3 |
| CPZ7 | Stephen Leacock Collegiate Institute | 983 | 21 |
| CPZ7 | Mary Ward Catholic Secondary School | 1,066 | 23 |
| CPZ7 | Lynngate Junior Public School | 175 | 3 |
| CPZ7 | Holy Spirit Catholic Elementary School | 440 | 7 |
| CPZ7 | Pauline Johnson Junior Public School | 290 | 5 |
| CPZ7 | Kennedy Public School | 607 | 9 |
| CPZ7 | Timberbank Junior Public School | 240 | 4 |
| CPZ7 | St. Aidan Catholic School | 277 | 4 |
| CPZ7 | Brookmill Boulevard Junior Public School | 280 | 4 |
| CPZ7 | New Oriental Technology Education Group | 70 | 2 |
| CPZ7 | Terraview-Willowfield Public School | 109 | 2 |
| CPZ7 | Our Lady of Wisdom Catholic School | 372 | 6 |
| CPZ7 | David Lewis Public School | 488 | 11 |
| CPZ7 | Bridlewood Junior Public School | 229 | 5 |
| CPZ7 | L'Amoreaux Collegiate Institute | 666 | 14 |
| CPZ7 | Terry Fox Public School | 456 | 7 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ7 | Dr. Norman Bethune Collegiate Institute | 1,012 | 22 |
| CPZ7 | North Bridlewood Junior Public School | 244 | 6 |
| CPZ7 | Beverly Glen Junior Public School | 463 | 10 |
| CPZ7 | Mary Ward LINC & ESL Centre | 110 | 3 |
| | *Toronto DPZ Total:* | *7,360* | *124* |
| | *Toronto CPZ Total:* | *72,160* | *1,280* |
| | *Toronto Total:* | *79,520* | *1,404* |
| **WHITBY, ONTARIO** | | | |
| CPZ1 | Meadowcrest Public School | 280 | 4 |
| CPZ1 | Brooklin Mill Montessori School | 91 | 2 |
| CPZ1 | St. Bridget Catholic School | 494 | 7 |
| CPZ1 | Chris Hadfield Public School | 827 | 12 |
| CPZ1 | Brooklin High School | 1,227 | 26 |
| CPZ1 | Brooklin Village Public School | 740 | 11 |
| CPZ2 | Whitby Shores Public School | 565 | 8 |
| CPZ2 | St. Marguerite d'Youville Catholic School | 415 | 6 |
| CPZ2 | West Lynde Public School | 450 | 7 |
| CPZ2 | Colonel J E Farewell Public School | 450 | 7 |
| CPZ2 | St. John the Evangelist Catholic School | 220 | 4 |
| CPZ2 | Henry Street High School | 1,000 | 21 |
| CPZ2 | E A Fairman Public School | 200 | 3 |
| CPZ2 | Donald A. Wilson Secondary School | 1,520 | 32 |
| CPZ2 | All Saints Catholic Secondary School | 817 | 18 |
| CPZ2 | Hatch House Montessori School | 61 | 1 |
| CPZ2 | Sir William Stephenson Public School | 425 | 6 |
| CPZ2 | Captain Michael Vandenbos Public School | 650 | 10 |
| CPZ2 | Blyth Academy - Whitby Campus | 60 | 2 |
| CPZ2 | Williamsburg Public School | 711 | 10 |
| CPZ2 | St. Luke the Evangelist Catholic School | 65 | 1 |
| CPZ2 | Trafalgar Castle School | 205 | 4 |
| CPZ2 | Immanuel Christian School | 58 | 1 |
| CPZ2 | Julie Payette Public School | 700 | 10 |
| CPZ2 | Jean-Paul II Catholic Elementary School | 305 | 5 |
| CPZ2 | Kendalwood Montessori & Elementary School | 107 | 2 |
| CPZ2 | Jack Miner Public School | 530 | 8 |
| CPZ2 | C E Broughton Public School | 320 | 5 |
| CPZ2 | Anderson Collegiate and Vocational Institute | 900 | 19 |
| CPZ2 | St. Matthew the Evangelist Catholic School | 457 | 7 |
| CPZ2 | Pringle Creek Public School | 720 | 10 |
| CPZ2 | St. Theresa Catholic School | 236 | 4 |

| Response Sector | School Name | Enrollment | Buses Required |
|---|---|---|---|
| CPZ2 | Ormiston Public School | 400 | 6 |
| CPZ2 | École Secondaire Catholique Saint-Charles-Garnier | 100 | 3 |
| CPZ2 | Whitby Montessori and Elementary School | 112 | 2 |
| CPZ2 | Glen Dhu Public School | 466 | 7 |
| CPZ2 | Robert Munsch Public School | 635 | 9 |
| CPZ2 | Bellwood Public School | 470 | 7 |
| CPZ2 | St. Bernard's Catholic Elementary School | 335 | 5 |
| CPZ2 | Fallingbrook Public School | 411 | 6 |
| CPZ2 | Father Leo J Austin Catholic Secondary School | 817 | 18 |
| CPZ2 | Sinclair Secondary School | 1,600 | 34 |
| CPZ2 | Dr. Robert Thornton Public School | 350 | 5 |
| CPZ2 | St. Paul Catholic School | 297 | 5 |
| CPZ2 | St. Mark the Evangelist Catholic Elementary School | 304 | 5 |
| CPZ2 | John Dryden Public School | 715 | 10 |
| CPZ2 | Sir Samuel Steele Public School | 500 | 7 |
| CPZ2 | Winchester Public School | 400 | 6 |
| CPZ2 | St. Leo Catholic School | 600 | 9 |
| CPZ2 | Blair Ridge Public School | 740 | 11 |
| CPZ2 | St. John Paul II Catholic School | 130 | 3 |
| | *Whitby DPZ Total:* | *0* | *0* |
| | *Whitby CPZ Total:* | *25,188* | *431* |
| | *Whitby Total:* | *25,188* | *431* |
| | **DPZ TOTAL:** | **45,423** | **790** |
| | **CPZ TOTAL:** | **148,789** | **2,608** |
| | **TOTAL:** | **194,212** | **3,398** |

**Table 3-10. College and University Population Demand Estimates**

| Response Sector | School Name | Enrollment | Buses Required[30] |
|---|---|---|---|
| **OSHAWA, ONTARIO** | | | |
| CPZ2 | Trent University - Durham GTA Campus | 1,960 | 16 |
| CPZ2 | Durham College - Oshawa Campus | 8,539 | 54 |
| CPZ2 | University of Ontario Institute of Technology | 9,732 | 75 |
| | *Oshawa DPZ Total:* | *0* | *0* |
| | *Oshawa CPZ Total:* | *20,231* | *145* |
| | *Oshawa Total:* | *20,231* | *145* |
| **TORONTO, ONTARIO** | | | |
| P17 | University of Toronto - Scarborough | 13,075 | 105 |
| P18 | Centennial College - Morningside Campus | 3,664 | 23 |
| CPZ6 | Redemptoris Mater Seminary | 173 | Evacuate in personal vehicles |
| CPZ6 | CDI College - Scarborough | 288 | Evacuate in personal vehicles |
| CPZ6 | Centennial College - Ashtonbee Campus | 1,933 | 8 |
| CPZ7 | Centennial College - Progress Campus | 10,041 | 76 |
| | *Toronto DPZ Total:* | *16,739* | *128* |
| | *Toronto CPZ Total:* | *12,435* | *84* |
| | *Toronto Total:* | *29,174* | *212* |
| **WHITBY, ONTARIO** | | | |
| CPZ2 | Durham College - Whitby Campus | 1,839 | 12 |
| | *Whitby DPZ Total:* | *0* | *0* |
| | *Whitby CPZ Total:* | *1,839* | *12* |
| | *Whitby Total:* | *1,839* | *12* |
| | **DPZ TOTAL:** | **16,739** | **128** |
| | **CPZ TOTAL:** | **34,505** | **241** |
| | **TOTAL:** | **51,244** | **369** |

[30] Most of the students commute and/or rideshare with friends. Table E-2 shows the number of commuting/ridesharing students. Transportation assistance (buses) would be provided for the remaining students to evacuate. See Section 3.6.1 for details information.

**Table 3-11. Transit-Dependent Population Estimates**

| 2023 PZs Population (Extrapolated) | | Survey Average HH Size with Indicated No. of Vehicles | | | Estimated No. of Households | Survey Percent HH with Indicated No. of Vehicles | | | Survey Percent HH with Commuters | Survey Percent HH with Non-Returning Commuters | Total People Requiring Transport | Estimated Ridesharing Percentage | People Requiring Public Transit | Percent Population Requiring Public Transit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | | 0 | 1 | 2 | | | | | | |
| DPZ | 305,809 | 1.00 | 2.12 | 3.29 | 103,664 | 0.51% | 19.5% | 56.2% | 90.9% | 27.6% | 10,939 | 70.6% | 3,217 | 1.1% |
| CPZ | 974,896 | 1.00 | 2.12 | 3.29 | 330,473 | 0.51% | 19.5% | 56.2% | 90.9% | 27.6% | 34,873 | 70.6% | 10,253 | 1.1% |
| Total | 1,280,705 | | | | 434,137 | | | | | | 45,812 | | 13,470 | |

**Table 3-12. PNGS PZ External Traffic**

| Up Node | Down Node | Road Name | Direction | AADT[31] | K-Factor[32] | D-Factor[32] | Hourly Volume | External Traffic |
|---|---|---|---|---|---|---|---|---|
| 8427 | 3375 | Hwy 401 Express | WB | 223,000 | 0.067 | 0.5 | 7,471 | 29,884 |
| 8902 | 4969 | Hwy 401 Express | EB | 223,000 | 0.067 | 0.25 | 3,735 | 14,940 |
| 8901 | 4970 | Hwy 401 Collector | EB | 223,000 | 0.067 | 0.25 | 3,735 | 14,940 |
| 8982 | 4978 | Hwy 404 | NB | 229,600 | 0.067 | 0.5 | 7,692 | 30,768 |
| 8986 | 5187 | Hwy 404 | SB | 229,600 | 0.067 | 0.5 | 7,692 | 30,768 |
| 8889 | 5889 | Hwy 407 | WB | 13,414 | 0.116 | 0.65 | 1,011 | 4,044 |
| 8071 | 5137 | Hwy 407 | EB | 13,414 | 0.116 | 0.45 | 700 | 2,800 |
| | | | | | | | **TOTAL:** | **128,144** |

[31] 2016 Ontario Ministry of Transportation Provincial Highways Annual Average Daily Traffic (AADT) and 407 ERT Usage Statistics (https://www.407etr.com/en/highway/corporate/usage-statistics.html)

[32] Highway Capacity Manual 2022

**Table 3-13. Summary of Population Demand**

| Response Sector | Residents | Transit-Dependent | Transients | Employees | Special Facilities[33] | Schools/ Summer Day Camps | Commuter Colleges/ Universities | Special Event | Shadow Population[34] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **P1** | 10,398 | 109 | 0 | 731 | 67 | 1,168 | 0 | 0 | 0 | 0 | 12,473 |
| **P2** | 5,250 | 55 | 5,923 | 1,946 | 172 | 1,485 | 0 | 0 | 0 | 0 | 14,831 |
| **P3** | 5,479 | 58 | 312 | 455 | 0 | 239 | 0 | 0 | 0 | 0 | 6,543 |
| **P4** | 8,959 | 94 | 393 | 671 | 54 | 3,070 | 0 | 0 | 0 | 0 | 13,241 |
| **P5** | 18,040 | 190 | 0 | 1,373 | 0 | 3,470 | 0 | 0 | 0 | 0 | 23,073 |
| **P6** | 11,881 | 125 | 0 | 781 | 0 | 1,204 | 0 | 0 | 0 | 0 | 13,991 |
| **P7** | 16,328 | 172 | 0 | 1,108 | 656 | 620 | 0 | 0 | 0 | 0 | 18,884 |
| **P8** | 16,023 | 169 | 0 | 1,072 | 25 | 2,983 | 0 | 0 | 0 | 0 | 20,271 |
| **P9** | 19,508 | 205 | 30 | 994 | 0 | 5,954 | 0 | 0 | 0 | 0 | 26,691 |
| **P10** | 16,694 | 176 | 0 | 666 | 234 | 1,988 | 0 | 0 | 0 | 0 | 19,757 |
| **P11** | 9,448 | 99 | 0 | 408 | 0 | 1,942 | 0 | 0 | 0 | 0 | 11,897 |
| **P12** | 3,983 | 42 | 185 | 301 | 150 | 605 | 0 | 0 | 0 | 0 | 5,266 |
| **P13** | 9,941 | 105 | 0 | 369 | 255 | 815 | 0 | 0 | 0 | 0 | 11,485 |
| **P14** | 10,052 | 106 | 0 | 357 | 128 | 3,167 | 0 | 0 | 0 | 0 | 13,810 |
| **P15** | 12,387 | 130 | 0 | 859 | 0 | 1,008 | 0 | 0 | 0 | 0 | 14,384 |
| **P16** | 11,370 | 120 | 0 | 899 | 159 | 2,384 | 0 | 0 | 0 | 0 | 14,932 |
| **P17** | 14,110 | 148 | 223 | 969 | 132 | 901 | 13,075[35] | 0 | 0 | 0 | 29,558 |
| **P18** | 21,059 | 221 | 494 | 1,155 | 192 | 2,272 | 3,664[36] | 0 | 0 | 0 | 29,057 |
| **P19** | 9,297 | 98 | 10,367 | 563 | 0 | 556 | 0 | 15,300 | 0 | 0 | 36,181 |
| **P20** | 5,476 | 58 | 76 | 360 | 0 | 0 | 0 | 0 | 0 | 0 | 5,970 |
| **P21** | 41,492 | 436 | 521 | 2,179 | 110 | 7,804 | 0 | 0 | 0 | 0 | 52,542 |
| **P22** | 28,634 | 301 | 2,366 | 1,702 | 0 | 2,388 | 0 | 0 | 0 | 0 | 35,391 |

[33] Special Facilities include both medical facilities and correctional facilities.
[34] Shadow population is located between the DPZ outer ring and the CPZ boundary. Since 30% of this population is assumed to voluntarily evacuate, 30% of the total shadow population (shown as "CPZ Total" in Table 3-3) is shown in this table. Refer to Figure 2-1 for additional information.
[35] Includes 3,140 college/university students who would need transportation assistance to evacuate.
[36] Includes 663 college/university students who would need transportation assistance to evacuate.

| Response Sector | Residents | Transit-Dependent | Transients | Employees | Special Facilities[33] | Schools/ Summer Day Camps | Commuter Colleges/ Universities | Special Event | Shadow Population[34] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **P23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **P24** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **P25** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Shadow** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 292,469 | 0 | 292,469 |
| **DPZ Total** | **305,809** | **3,217** | **20,890** | **19,918** | **2,334** | **46,023** | **16,739** | **15,300** | **292,469** | **0** | **722,699** |
| **CPZ1** | 15,530 | 164 | 1,833 | 1,099 | 20 | 4,165 | 0 | 0 | There are no Shadow Vehicles Beyond the CPZ. | 0 | 22,811 |
| **CPZ2** | 219,888 | 2,313 | 19,994 | 15,148 | 3,283 | 34,236 | 22,070[37] | 0 | | 0 | 316,932 |
| **CPZ3** | 419 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 424 |
| **CPZ4** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| **CPZ5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| **CPZ6** | 237,291 | 2,496 | 4,195 | 14,389 | 4,281 | 35,116 | 2,394[38] | 0 | | 0 | 300,162 |
| **CPZ7** | 424,770 | 4,465 | 15,260 | 29,514 | 3,112 | 63,688 | 10,041[39] | 0 | | 0 | 550,850 |
| **CPZ8** | 76,998 | 810 | 1,715 | 8,850 | 806 | 11,584 | 0 | 0 | | 0 | 100,763 |
| **CPZ Total** | **974,896** | **10,253** | **42,997** | **69,000** | **11,502** | **148,789** | **34,505** | **0** | **0** | **0** | **1,291,942** |
| **N/A[40]** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PZ Total** | **1,280,705** | **13,470** | **63,887** | **88,918** | **13,836** | **194,812** | **51,244** | **15,300** | **292,469** | **0** | **2,014,641** |

[37] Includes 4,658 college/university students who would need transportation assistance to evacuate.
[38] Includes 213 college/university students who would need transportation assistance to evacuate.
[39] Includes 2,274 college/university students who would need transportation assistance to evacuate.
[40] External Traffic is considered to begin outside of the DPZ and CPZ.

**Table 3-14. Summary of Vehicle Demand**

| Response Sector | Residents | Transit-Dependent | Transients | Employees | Special Facilities[41] | Schools/ Summer Day Camps[42] | Commuter Colleges/ Universities | Special Event | Shadow Vehicles[43] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **P1** | 4,830 | 8 | 0 | 731 | 18 | 38 | 0 | 0 | 0 | 0 | 5,625 |
| **P2** | 2,441 | 4 | 3,656 | 1,946 | 38 | 54 | 0 | 0 | 0 | 0 | 8,132 |
| **P3** | 2,547 | 4 | 156 | 395 | 0 | 8 | 0 | 0 | 0 | 0 | 3,110 |
| **P4** | 4,161 | 8 | 136 | 671 | 7 | 118 | 0 | 0 | 0 | 0 | 5,101 |
| **P5** | 8,374 | 14 | 0 | 1,373 | 0 | 122 | 0 | 0 | 0 | 0 | 9,883 |
| **P6** | 5,514 | 10 | 0 | 781 | 0 | 36 | 0 | 0 | 0 | 0 | 6,341 |
| **P7** | 7,585 | 12 | 0 | 1,108 | 162 | 20 | 0 | 0 | 0 | 0 | 8,887 |
| **P8** | 7,437 | 12 | 0 | 1,072 | 4 | 108 | 0 | 0 | 0 | 0 | 8,633 |
| **P9** | 9,061 | 14 | 15 | 994 | 0 | 218 | 0 | 0 | 0 | 0 | 10,302 |
| **P10** | 7,752 | 12 | 0 | 666 | 57 | 66 | 0 | 0 | 0 | 0 | 8,553 |
| **P11** | 4,384 | 8 | 0 | 408 | 0 | 70 | 0 | 0 | 0 | 0 | 4,870 |
| **P12** | 1,848 | 4 | 64 | 301 | 33 | 90[44] | 0 | 0 | 0 | 0 | 2,340 |
| **P13** | 4,615 | 8 | 0 | 369 | 71 | 28 | 0 | 0 | 0 | 0 | 5,091 |
| **P14** | 4,666 | 8 | 0 | 357 | 32 | 114 | 0 | 0 | 0 | 0 | 5,177 |
| **P15** | 5,754 | 10 | 0 | 747 | 0 | 30 | 0 | 0 | 0 | 0 | 6,541 |
| **P16** | 5,278 | 8 | 0 | 781 | 26 | 88 | 0 | 0 | 0 | 0 | 6,181 |
| **P17** | 6,548 | 10 | 77 | 844 | 24 | 240[45] | 2,246 | 0 | 0 | 0 | 9,989 |
| **P18** | 9,782 | 16 | 174 | 1,002 | 43 | 116[46] | 1,378 | 0 | 0 | 0 | 12,511 |
| **P19** | 4,318 | 112[47] | 2,536 | 488 | 0 | 22 | 0 | 4,563[48] | 0 | 0 | 12,039 |

[41] Vehicles for special facilities include vans, wheelchair vans, ambulances and buses. Buses are represented as two passenger vehicles.
[42] Buses evacuating children from schools/ summer day camps represented as two passenger vehicles. Refer to Section 3.6 and Section 3.6.2 for additional information.
[43] Shadow vehicles are located between the DPZ outer ring and the CPZ boundary. Since 30% of these vehicles are assumed to voluntarily evacuate, 30% of the total shadow vehicles (shown as "CPZ Total" in Table 3-3) is shown in this table. Refer to Figure 2-1 for additional information.
[44] Includes 70 vehicles for students at Archbishop Anthony Meagher Catholic Continuing Education Centre.
[45] Includes 210 vehicles (105 buses) for students at University of Toronto – Scarborough - to evacuate students who would need transportation assistance.
[46] Includes 46 vehicles (23 buses) for students at Centennial College - Morningside Campus - to evacuate students who would need transportation assistance.
[47] There are 52 buses (104 vehicles) servicing the Toronto Zoo in Response sector P19.
[48] Includes 77 buses for special event attendees (transient visitors)- these who would arrive and/or evacuate by public transportation.

| Response Sector | Residents | Transit-Dependent | Transients | Employees | Special Facilities[41] | Schools/ Summer Day Camps[42] | Commuter Colleges/ Universities | Special Event | Shadow Vehicles[43] | External Traffic | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **P20** | 2,544 | 4 | 39 | 360 | 0 | 0 | 0 | 0 | 0 | 0 | 2,947 |
| **P21** | 19,271 | 30 | 303 | 2,179 | 25 | 274 | 0 | 0 | 0 | 0 | 22,082 |
| **P22** | 13,293 | 22 | 1,024 | 1,702 | 0 | 70 | 0 | 0 | 0 | 0 | 16,111 |
| **P23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **P24** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **P25** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Shadow** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 135,825 | 0 | 135,825 |
| **DPZ Total** | **142,003** | **338** | **8,180** | **19,275** | **540** | **1,930** | **3,624** | **4,563** | **135,825** | **0** | **316,222** |
| **CPZ1** | 7,211 | 12 | 867 | 1,099 | 6 | 140 | 0 | 0 | There are no Shadow Vehicles Beyond the CPZ. | 0 | 9,335 |
| **CPZ2** | 102,114 | 156 | 6,905 | 15,148 | 809 | 1,650[49] | 6,006 | 0 | | 0 | 132,788 |
| **CPZ3** | 195 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 197 |
| **CPZ4** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| **CPZ5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| **CPZ6** | 110,175 | 168 | 1,880 | 12,509 | 955 | 1,242[50] | 1,600 | 0 | | 0 | 128,529 |
| **CPZ7** | 197,282 | 298 | 6,249 | 25,657 | 748 | 2,430[51] | 2,200 | 0 | | 0 | 234,864 |
| **CPZ8** | 35,773 | 54 | 650 | 7,705 | 195 | 396 | 0 | 0 | | 0 | 44,773 |
| **CPZ Total** | **452,750** | **690** | **16,551** | **62,118** | **2,713** | **5,858** | **9,806** | **0** | **0** | **0** | **550,486** |
| **N/A**[40] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 128,144 | 128,144 |
| **PZ Total** | **594,753** | **1,028** | **24,731** | **81,393** | **3,253** | **7,788** | **13,430** | **4,563** | **135,825** | **128,144** | **994,527** |

[49] Includes 314 vehicles (157 buses) needed to evacuate college students within CPZ2 - to evacuate students who would need transportation assistance to evacuate. Also includes 160 vehicles for students at Durham Continuing Education.
[50] Includes 16 vehicles (8 buses) needed to evacuate college students within CPZ6 - to evacuate students who would need transportation assistance to evacuate.
[51] Includes 152 vehicles (76 buses) needed to evacuate college students within CPZ7 - to evacuate students who would need transportation assistance to evacuate.

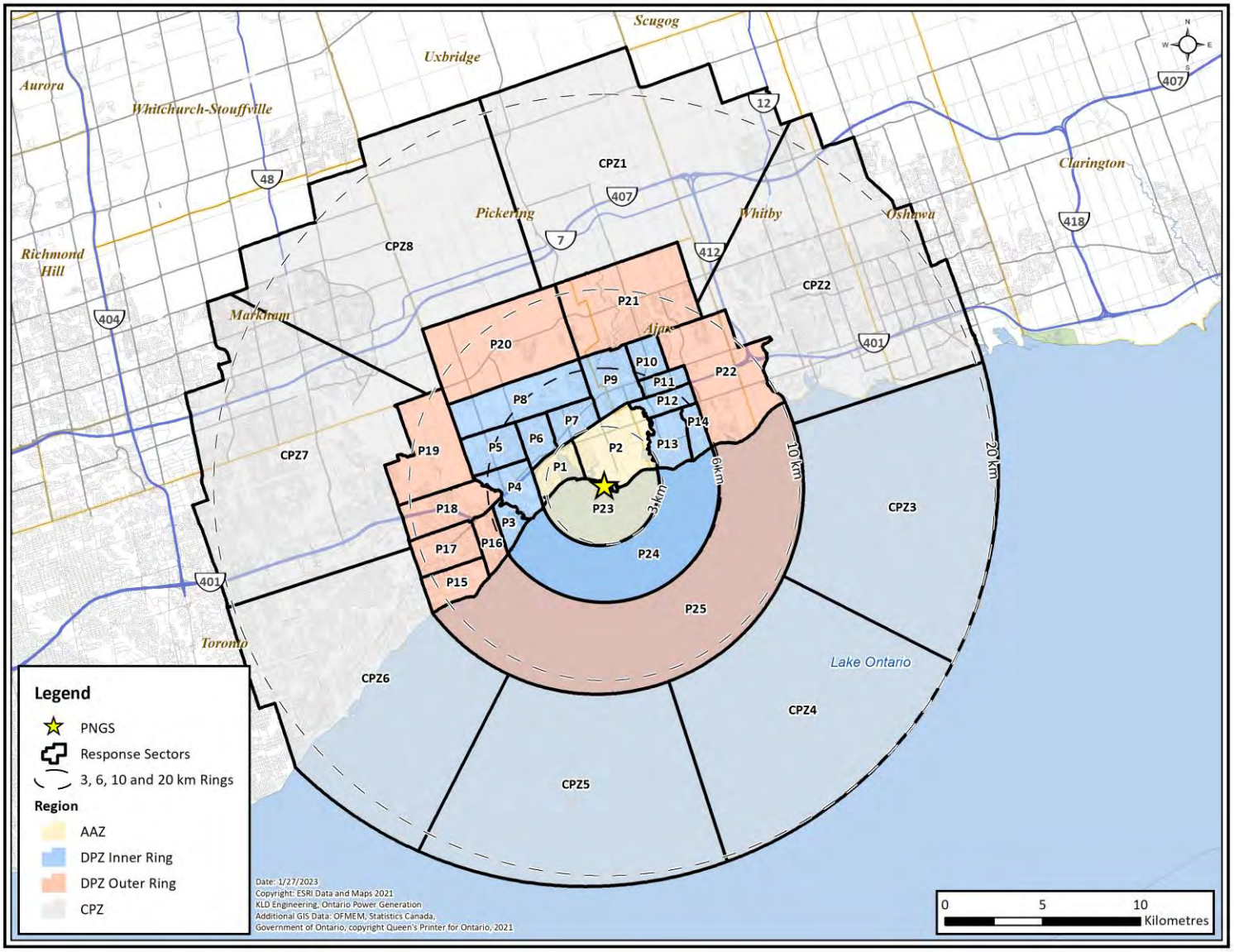



**Figure 3-1. Response Sectors Comprising the PNGS PZs**

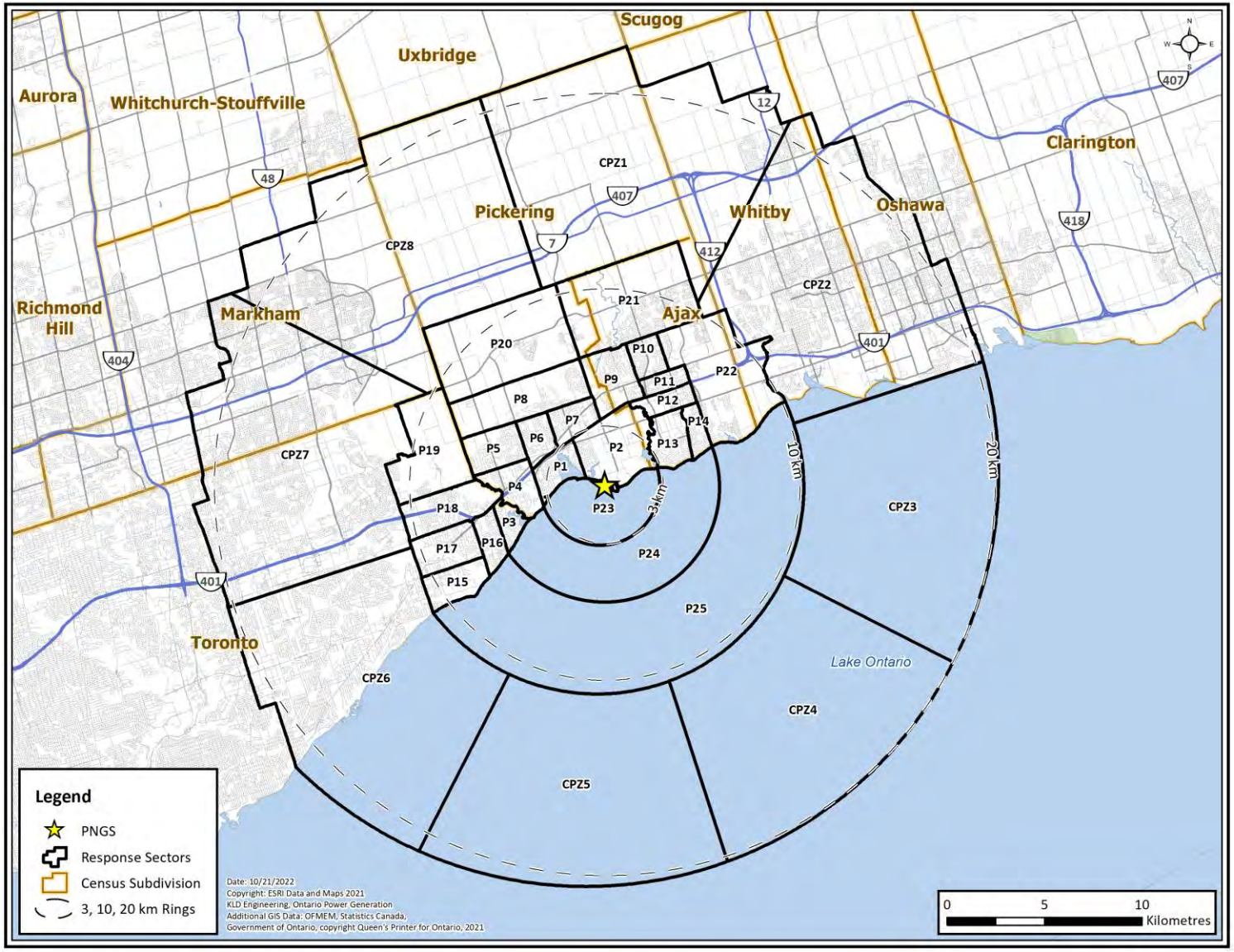
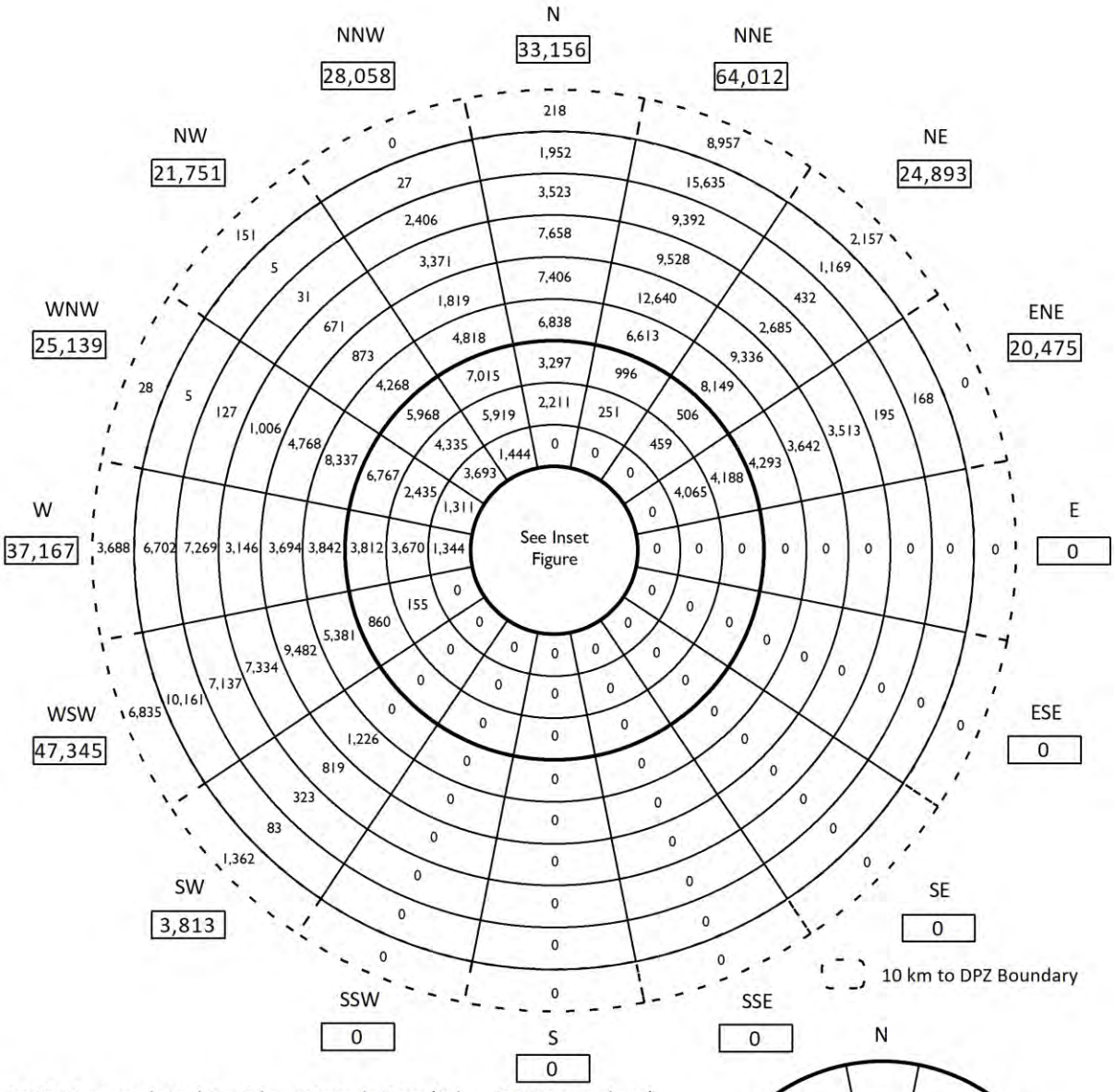



**Figure 3-2. Census Subdivision Boundaries within the PNGS Study Area**




2023 Extrapolated Resident Population (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 3,814 | 3,814 |
| 2 - 3 | 7,792 | 11,606 |
| 3 - 4 | 23,500 | 35,106 |
| 4 - 5 | 33,409 | 68,515 |
| 5 - 6 | 52,539 | 121,054 |
| 6 - 7 | 54,886 | 175,940 |
| 7 - 8 | 39,731 | 215,671 |
| 8 - 9 | 30,835 | 246,506 |
| 9 - 10 | 35,907 | 282,413 |
| 10 - DPZ | 23,396 | 305,809 |
| | Total: | 305,809 |

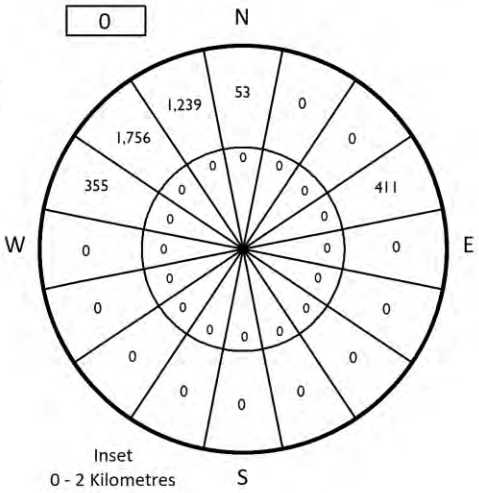
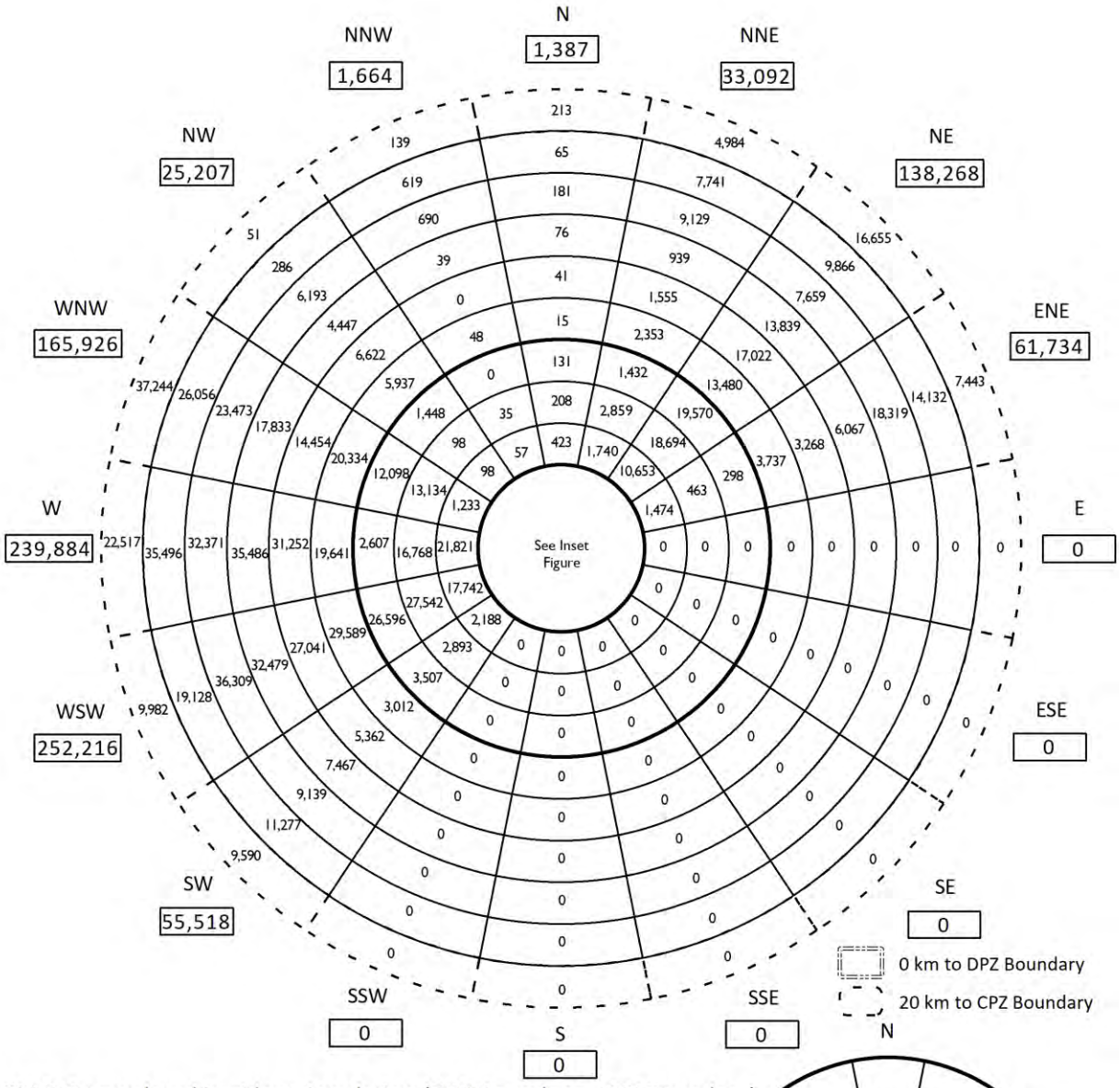



**Figure 3-3. Permanent Resident Population within the DPZ by Sector**




2023 Extrapolated Resident Population (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 17,258 | 17,258 |
| 11 - 12 | 49,446 | 66,704 |
| 12 - 13 | 57,429 | 124,133 |
| 13 - 14 | 82,694 | 206,827 |
| 14 - 15 | 67,687 | 274,514 |
| 15 -16 | 98,146 | 372,660 |
| 16 - 17 | 106,617 | 479,277 |
| 17 - 18 | 118,672 | 597,949 |
| 18 - 19 | 143,463 | 741,412 |
| 19 - 20 | 124,666 | 866,078 |
| 20 - CPZ | 108,818 | 974,896 |
| | Total: | 974,896 |

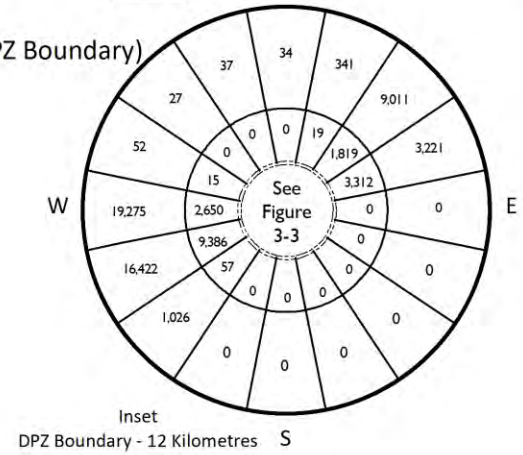
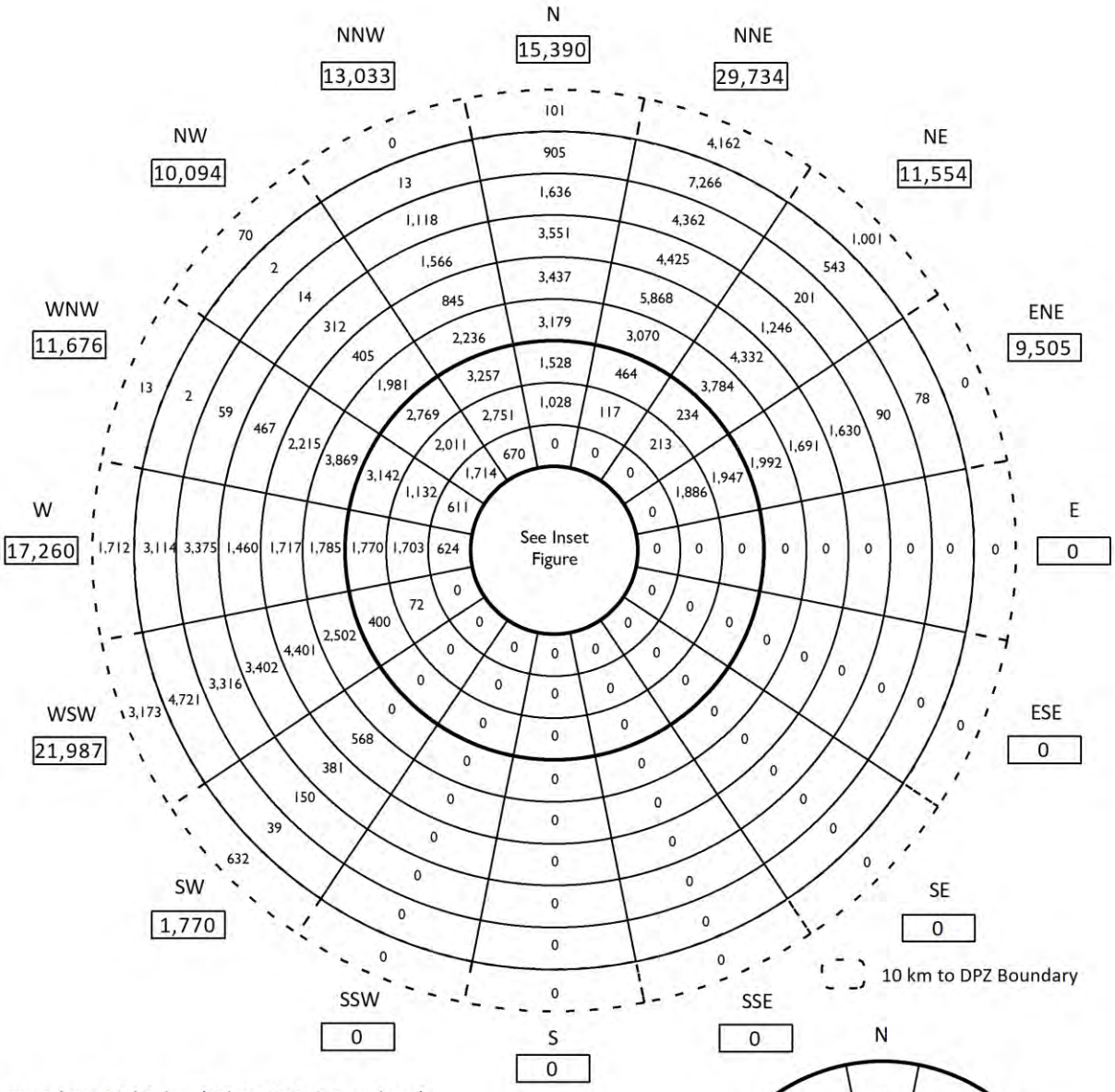



**Figure 3-4. Permanent Resident Population within the CPZ by Sector**




Resident Vehicles (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 0 | 0 |
| 1 - 2 | 1,775 | 1,775 |
| 2 - 3 | 3,619 | 5,394 |
| 3 - 4 | 10,913 | 16,307 |
| 4 - 5 | 15,511 | 31,818 |
| 5 - 6 | 24,398 | 56,216 |
| 6 - 7 | 25,479 | 81,695 |
| 7 - 8 | 18,440 | 100,135 |
| 8 - 9 | 14,321 | 114,456 |
| 9 - 10 | 16,683 | 131,139 |
| 10 - DPZ | 10,864 | 142,003 |
| | Total: | 142,003 |

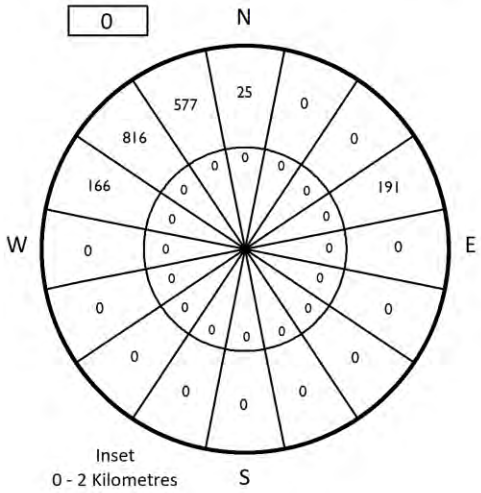
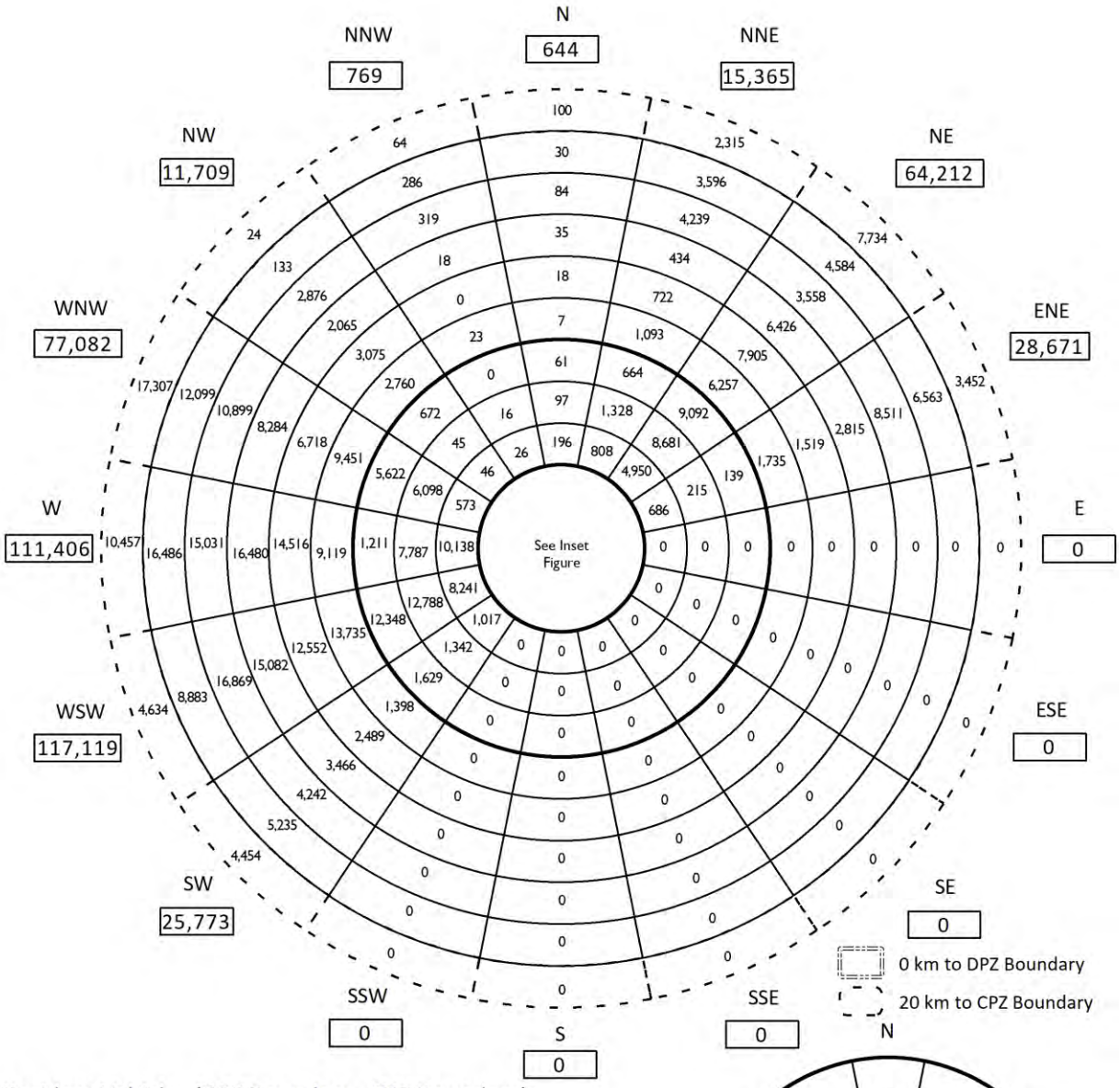
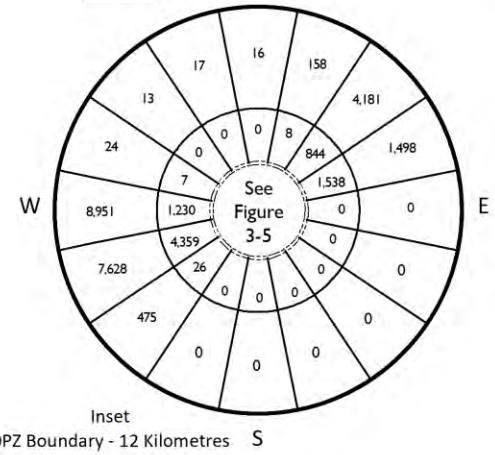



**Figure 3-5. Permanent Resident Vehicles within the DPZ by Sector**



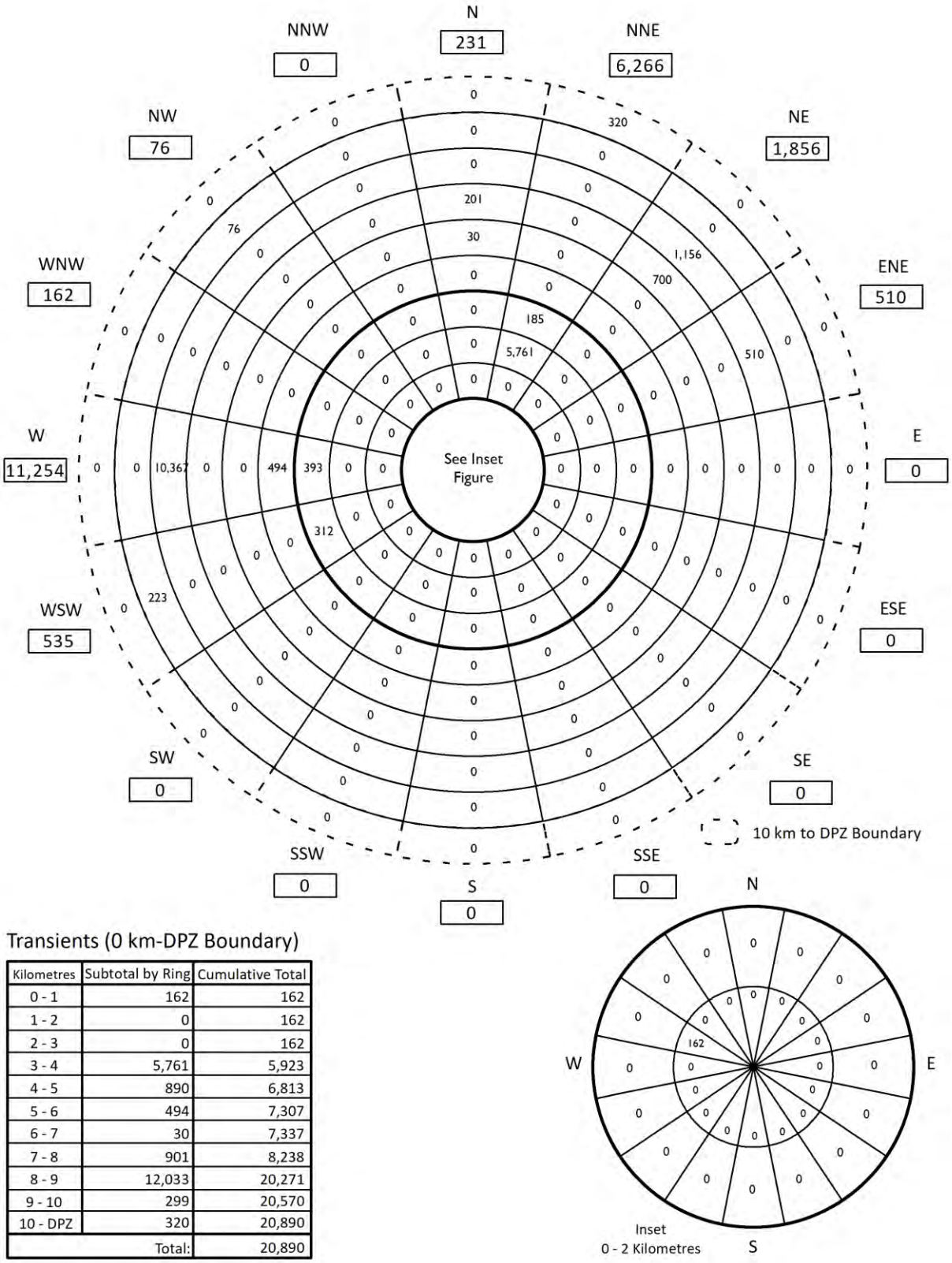

Resident Vehicles (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 8,012 | 8,012 |
| 11 - 12 | 22,961 | 30,973 |
| 12 - 13 | 26,681 | 57,654 |
| 13 - 14 | 38,397 | 96,051 |
| 14 - 15 | 31,438 | 127,489 |
| 15 -16 | 45,578 | 173,067 |
| 16 - 17 | 49,514 | 222,581 |
| 17 - 18 | 55,105 | 277,686 |
| 18 - 19 | 66,628 | 344,314 |
| 19 - 20 | 57,895 | 402,209 |
| 20 - CPZ | 50,541 | 452,750 |
| | Total: | 452,750 |




Inset
DPZ Boundary - 12 Kilometres

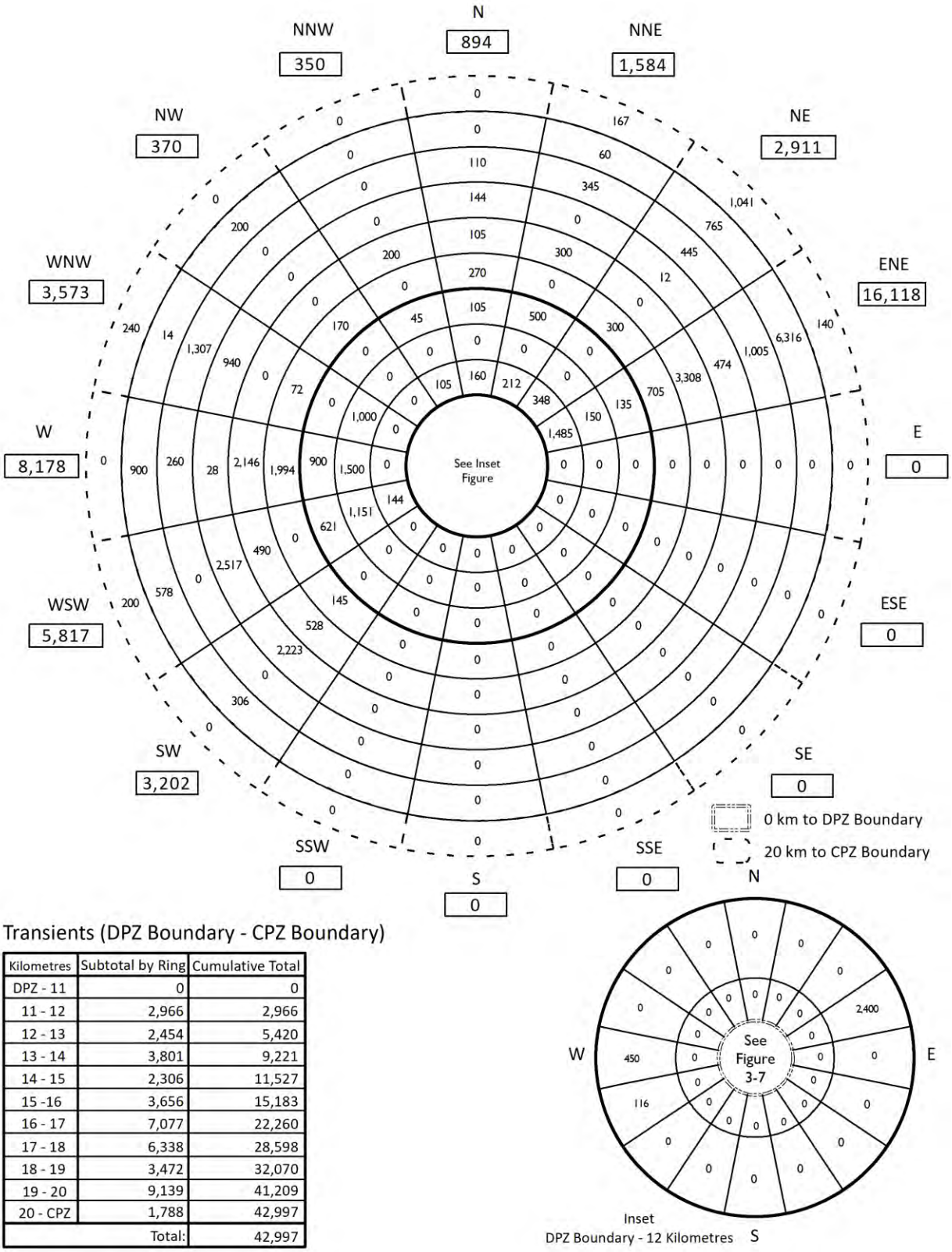
**Figure 3-6. Permanent Resident Vehicles within the CPZ by Sector**




Transients (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 162 | 162 |
| 1 - 2 | 0 | 162 |
| 2 - 3 | 0 | 162 |
| 3 - 4 | 5,761 | 5,923 |
| 4 - 5 | 890 | 6,813 |
| 5 - 6 | 494 | 7,307 |
| 6 - 7 | 30 | 7,337 |
| 7 - 8 | 901 | 8,238 |
| 8 - 9 | 12,033 | 20,271 |
| 9 - 10 | 299 | 20,570 |
| 10 - DPZ | 320 | 20,890 |
| | Total: | 20,890 |

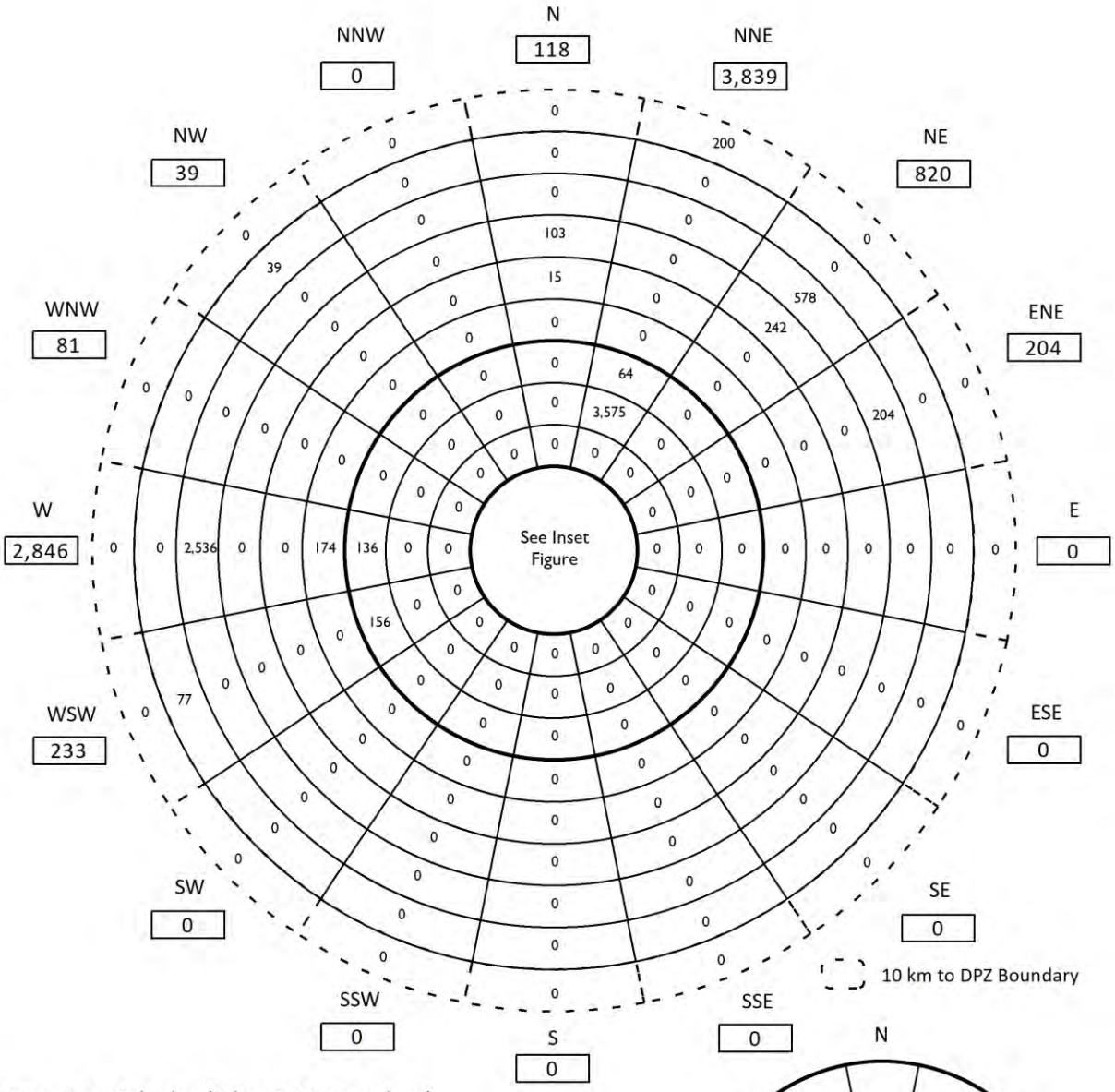
**Figure 3-7. Transient Population within the DPZ by Sector**




Transients (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 0 | 0 |
| 11 - 12 | 2,966 | 2,966 |
| 12 - 13 | 2,454 | 5,420 |
| 13 - 14 | 3,801 | 9,221 |
| 14 - 15 | 2,306 | 11,527 |
| 15 -16 | 3,656 | 15,183 |
| 16 - 17 | 7,077 | 22,260 |
| 17 - 18 | 6,338 | 28,598 |
| 18 - 19 | 3,472 | 32,070 |
| 19 - 20 | 9,139 | 41,209 |
| 20 - CPZ | 1,788 | 42,997 |
| | Total: | 42,997 |

**Figure 3-8. Transit Population within the CPZ by Sector**




Transient Vehicles (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 81 | 81 |
| 1 - 2 | 0 | 81 |
| 2 - 3 | 0 | 81 |
| 3 - 4 | 3,575 | 3,656 |
| 4 - 5 | 356 | 4,012 |
| 5 - 6 | 174 | 4,186 |
| 6 - 7 | 15 | 4,201 |
| 7 - 8 | 345 | 4,546 |
| 8 - 9 | 3,318 | 7,864 |
| 9 - 10 | 116 | 7,980 |
| 10 - DPZ | 200 | 8,180 |
| | Total: | 8,180 |

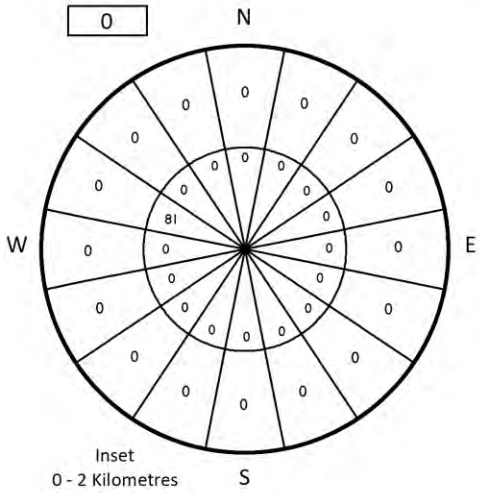
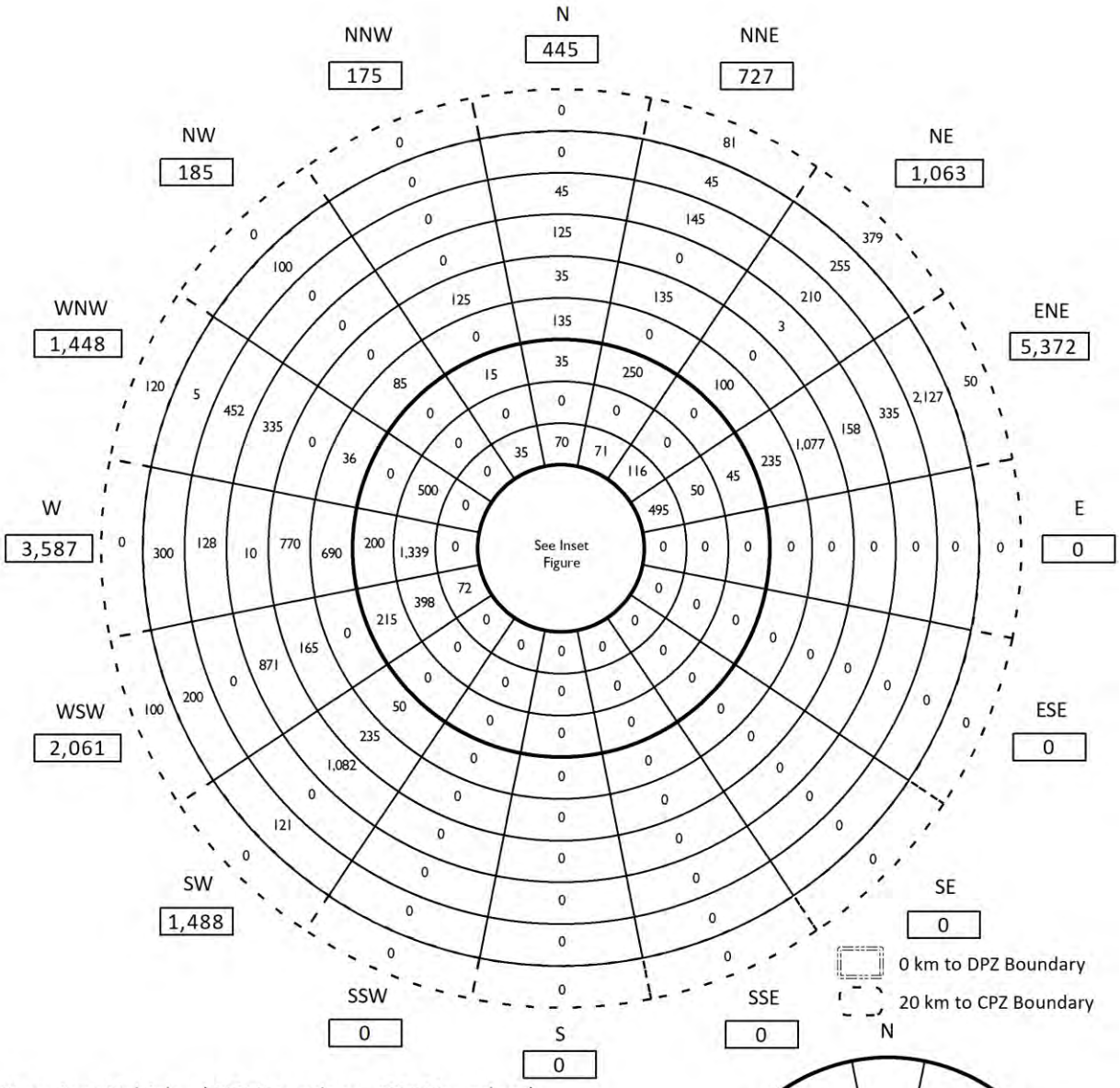
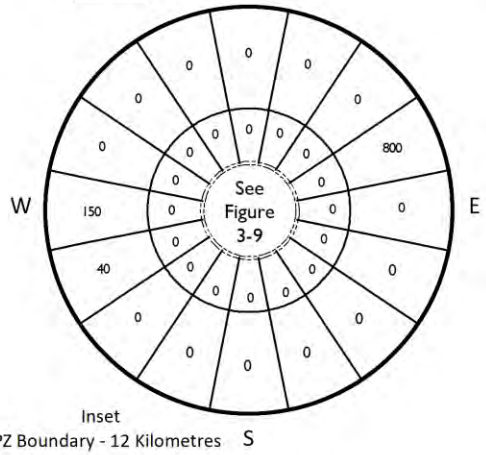



**Figure 3-9. Transient Vehicles within the DPZ by Sector**



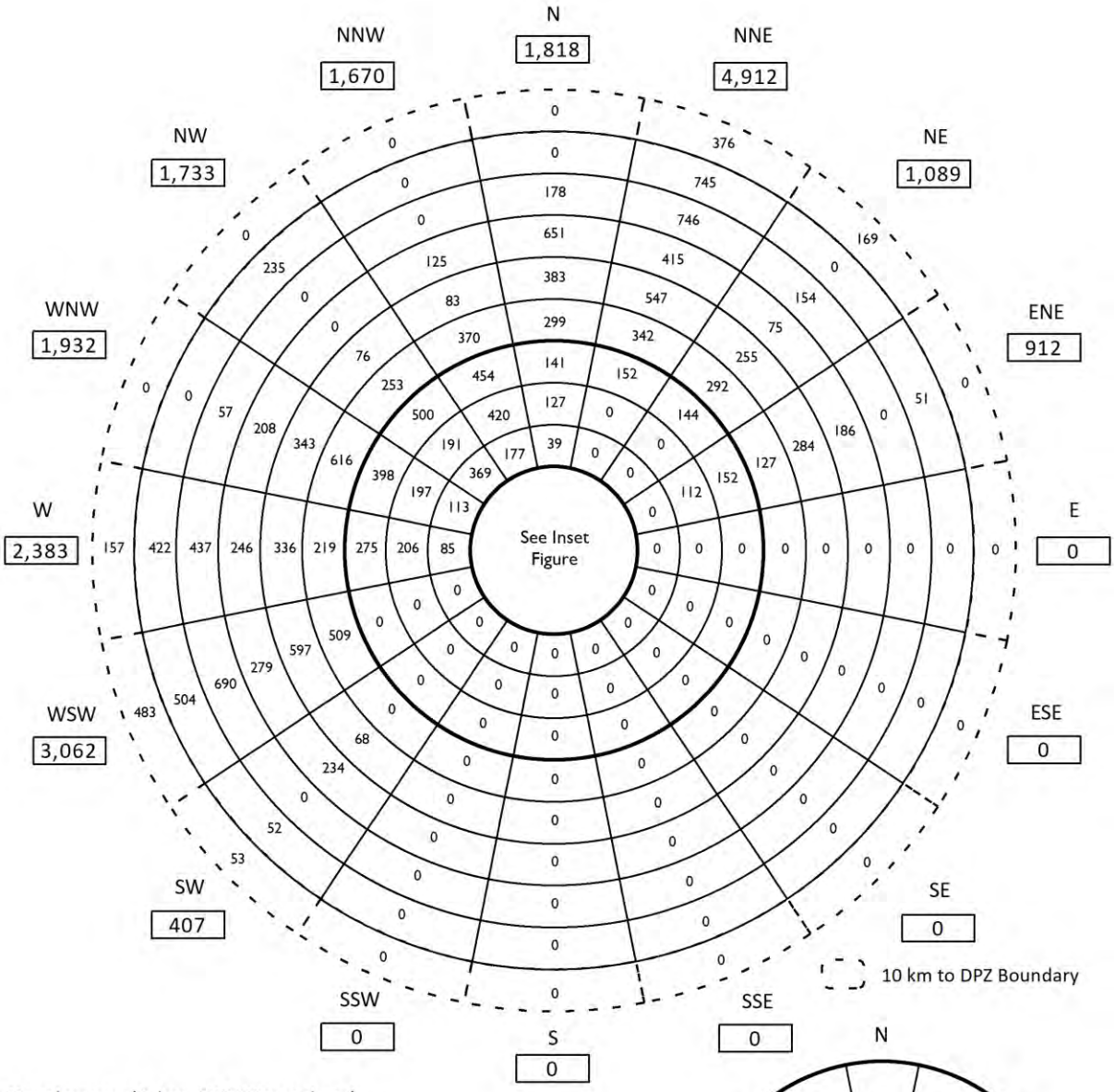

Transient Vehicles (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 0 | 0 |
| 11 - 12 | 990 | 990 |
| 12 - 13 | 859 | 1,849 |
| 13 - 14 | 2,287 | 4,136 |
| 14 - 15 | 760 | 4,896 |
| 15 -16 | 1,331 | 6,227 |
| 16 - 17 | 2,542 | 8,769 |
| 17 - 18 | 2,584 | 11,353 |
| 18 - 19 | 1,315 | 12,668 |
| 19 - 20 | 3,153 | 15,821 |
| 20 - CPZ | 730 | 16,551 |
| | Total: | 16,551 |




Inset
DPZ Boundary - 12 Kilometres

**Figure 3-10. Transient Vehicles within the CPZ by Sector**




Employees (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 1,589 | 1,589 |
| 1 - 2 | 150 | 1,739 |
| 2 - 3 | 783 | 2,522 |
| 3 - 4 | 1,253 | 3,775 |
| 4 - 5 | 2,216 | 5,991 |
| 5 - 6 | 3,027 | 9,018 |
| 6 - 7 | 2,972 | 11,990 |
| 7 - 8 | 2,419 | 14,409 |
| 8 - 9 | 2,262 | 16,671 |
| 9 - 10 | 2,009 | 18,680 |
| 10 - DPZ | 1,238 | 19,918 |
| | Total: | 19,918 |

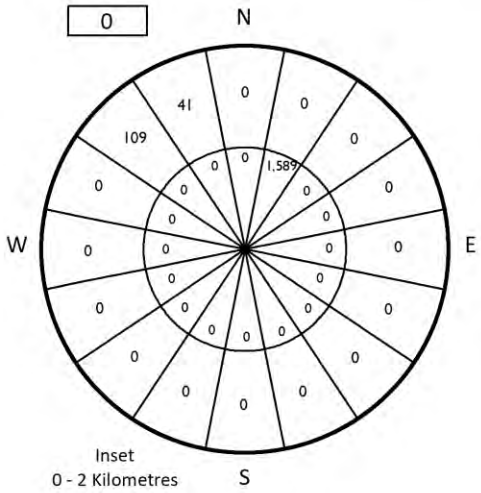
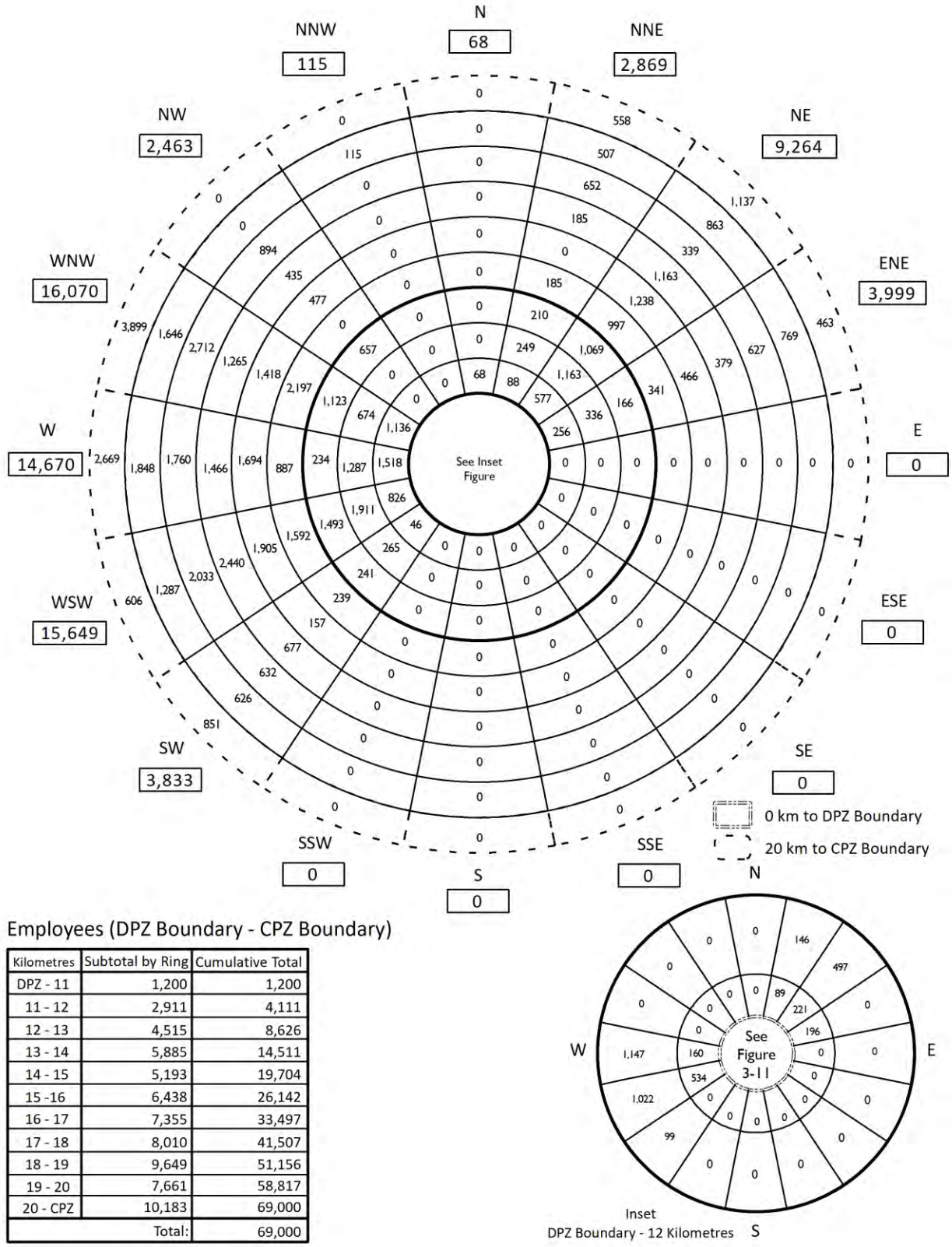


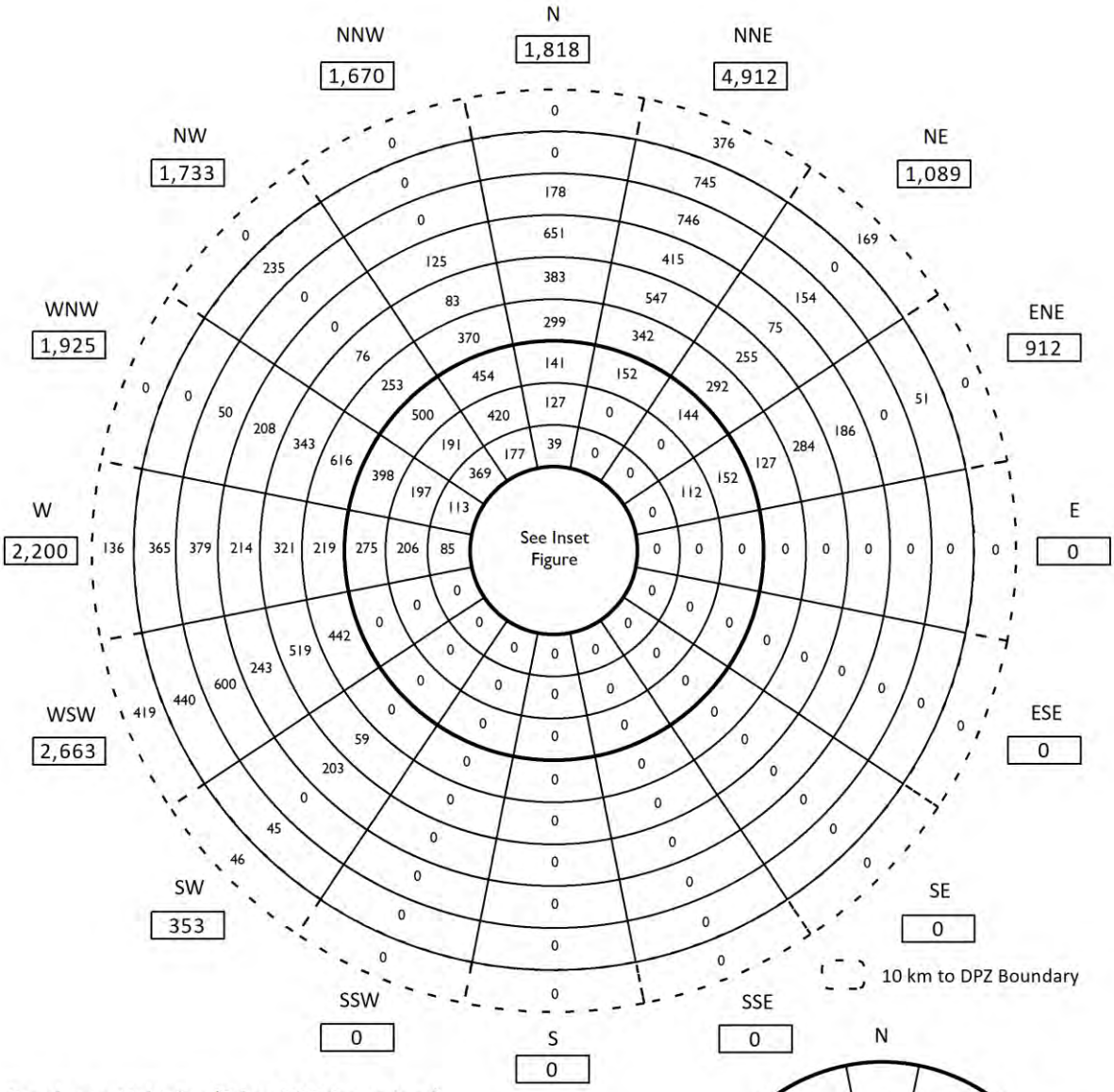

**Figure 3-11. Employee Population within the DPZ by Sector**




Employees (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 1,200 | 1,200 |
| 11 - 12 | 2,911 | 4,111 |
| 12 - 13 | 4,515 | 8,626 |
| 13 - 14 | 5,885 | 14,511 |
| 14 - 15 | 5,193 | 19,704 |
| 15 -16 | 6,438 | 26,142 |
| 16 - 17 | 7,355 | 33,497 |
| 17 - 18 | 8,010 | 41,507 |
| 18 - 19 | 9,649 | 51,156 |
| 19 - 20 | 7,661 | 58,817 |
| 20 - CPZ | 10,183 | 69,000 |
| | Total: | 69,000 |

**Figure 3-12. Employee Population within the CPZ by Sector**




Employee Vehicles (0 km-DPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| 0 - 1 | 1,589 | 1,589 |
| 1 - 2 | 150 | 1,739 |
| 2 - 3 | 783 | 2,522 |
| 3 - 4 | 1,253 | 3,775 |
| 4 - 5 | 2,216 | 5,991 |
| 5 - 6 | 2,960 | 8,951 |
| 6 - 7 | 2,870 | 11,821 |
| 7 - 8 | 2,320 | 14,141 |
| 8 - 9 | 2,107 | 16,248 |
| 9 - 10 | 1,881 | 18,129 |
| 10 - DPZ | 1,146 | 19,275 |
| | Total: | 19,275 |

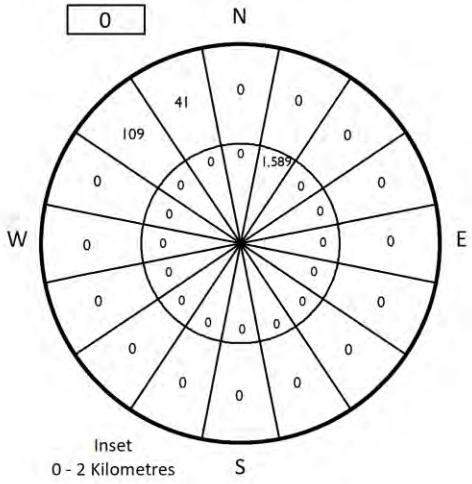
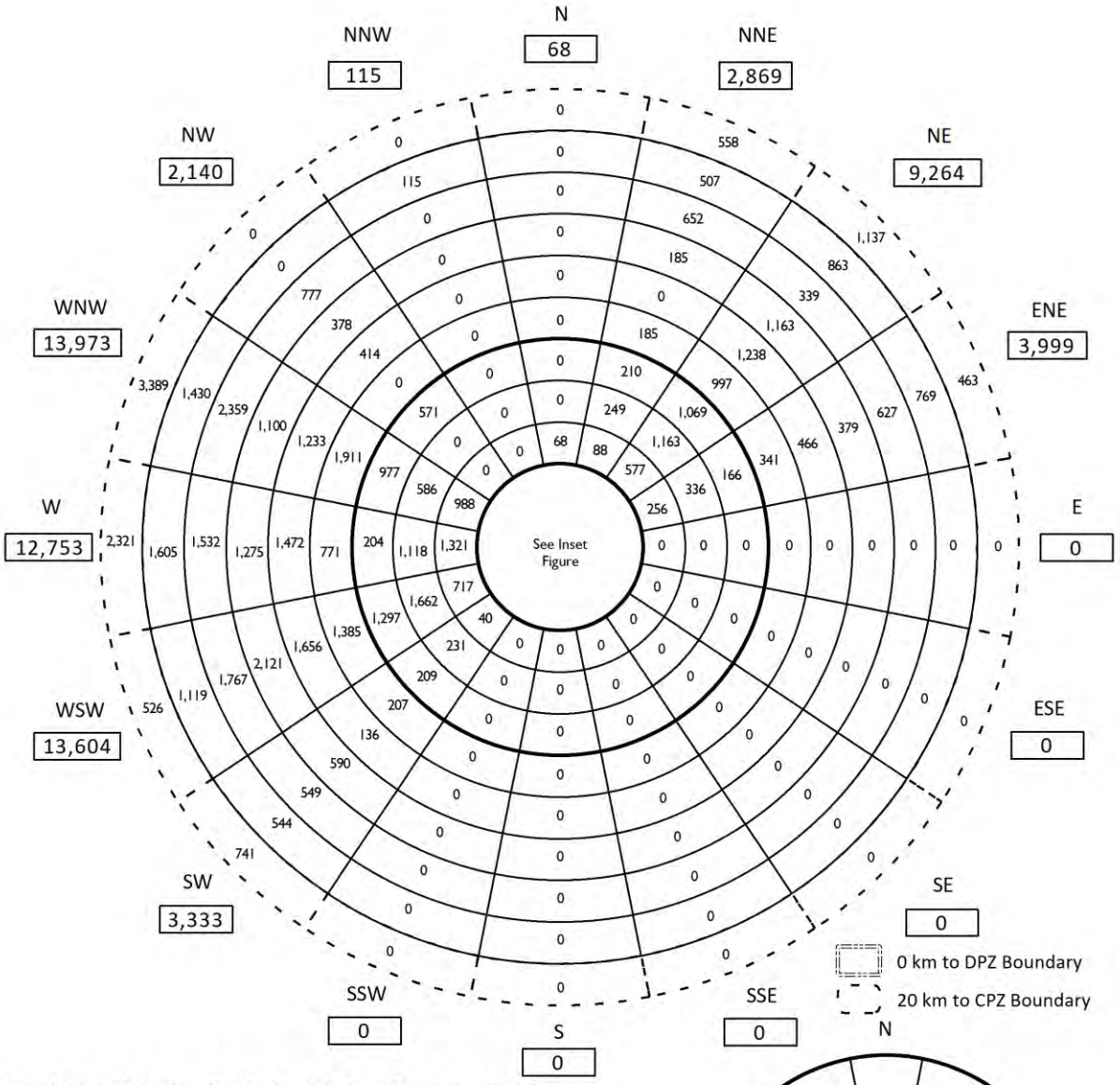



**Figure 3-13. Employee Vehicles within the DPZ by Sector**




Employee Vehicles (DPZ Boundary - CPZ Boundary)

| Kilometres | Subtotal by Ring | Cumulative Total |
|---|---|---|
| DPZ - 11 | 1,109 | 1,109 |
| 11 - 12 | 2,614 | 3,723 |
| 12 - 13 | 4,055 | 7,778 |
| 13 - 14 | 5,345 | 13,123 |
| 14 - 15 | 4,703 | 17,826 |
| 15 -16 | 5,797 | 23,623 |
| 16 - 17 | 6,615 | 30,238 |
| 17 - 18 | 7,191 | 37,429 |
| 18 - 19 | 8,602 | 46,031 |
| 19 - 20 | 6,952 | 52,983 |
| 20 - CPZ | 9,135 | 62,118 |
| | Total: | 62,118 |

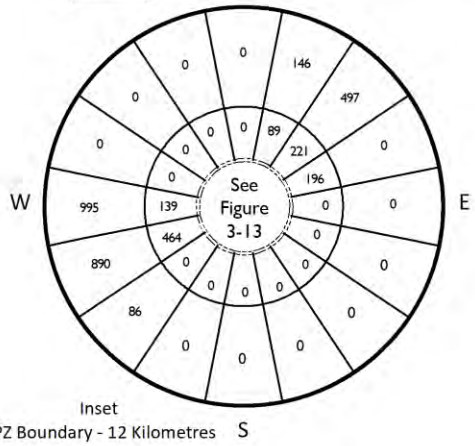



**Figure 3-14. Employee Vehicles within the CPZ by Sector**

# 4 ESTIMATION OF HIGHWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of the road is defined as the maximum sustainable hourly flow rate at which vehicles reasonably can be expected to traverse a point or a uniform segment of a lane or roadway during a given time period under prevailing roadway, environmental, traffic, and control conditions, as stated in in the 2022 Highway Capacity Manual (HCM 2022)[1]. This section discusses how the capacity of the roadway network was estimated[2].

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A connotes free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Another concept, closely associated with capacity, is “Service Volume”. Service volume (SV) is defined as “The maximum hourly rate at which vehicles, bicycles or persons reasonably can be expected to traverse a point or uniform section of a roadway during an hour under specific assumed conditions while maintaining a designated level of service.” This definition is similar to that for capacity. The major distinction is that values of SV vary from one LOS to another, while capacity is the SV at the upper bound of LOS E, only.

Thus, in simple terms, SV is the maximum traffic that can travel on a road and still maintain a certain perceived level of quality to a driver based on the A, B, C, rating system (LOS). Any additional vehicles above the SV would drop the rating to a lower letter grade.

This distinction is illustrated in Exhibit 12-37 of the HCM 2022. As indicated there, the SV varies with Free Flow Speed (FFS), and LOS. The SV is calculated by the DYNEV II simulation model, based on the specified link attributes, FFS, capacity, control device and traffic demand.

Other factors also influence capacity. These include, but are not limited to:

- Lane width
- Shoulder width
- Pavement condition
- Horizontal and vertical alignment (curvature and grade)
- Percent truck traffic
- Control device (and timing, if it is a signal)
- Weather conditions (good, rain, snow, fog, wind speed, ice)

[1] The Highway Capacity Manual for 2022 is authored by the Transportation Research Board (TRB) in the United States. The figures, equations and examples used in the HCM 2022 use English units (miles, miles per hour, etc.) by default. Some of these figures, equations and examples are used in this section and throughout this report with the English units maintained. The inputs and outputs to the DYNEV simulation model used for this study are also in English units. The free flow speeds in kilometres per hour observed during the road survey (See Section 1.3) were converted to miles per hour when input to DYNEV. Likewise, distances measured in kilometres were converted to miles. The model outputs (see Appendix J) were converted to metric units for this study. The critical element of this study, evacuation time, is the same in both the metric and English system of measure.

[2] The 2008 Canadian Capacity Guide was reviewed and considered for the estimation of capacity where applicable. However, the estimates for capacity in this study are based on the HCM 2022 as it is more up to date.

These factors are considered during the road survey and in the capacity estimation process; some factors have greater influence on capacity than others. For example, lane and shoulder width have only a limited influence on free flow speed (FFS) and capacity based on the HCM 2022. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey and these observations were recorded, but no detailed measurements of lane or shoulder width were taken. Horizontal and vertical alignment can influence both FFS and capacity. The estimated FFS were measured using the survey vehicle's speedometer and observing local traffic, under free flow conditions. The FFS ranged from 20 mph to 75 mph (32 kph to 121 kph) in the PZ. Capacity is estimated from the procedures of the HCM 2022. For example, HCM 2022 Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the SV at the upper bound of LOS E).

The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow. As discussed in Section 2.6, it is necessary to adjust capacity figures to represent the prevailing conditions. Adverse conditions like inclement weather, construction, and other incidents tend to slow traffic down and often, also increase vehicle-to-vehicles separation, thus decreasing the amount of traffic flow. Based on limited empirical data, weather conditions such as rain reduce the values of FFS and of highway capacity by approximately 10%. Over the last decade new studies have been made on the effects of rain on traffic capacity. These studies indicate a range of effects between 5% and 25% depending on wind speed and precipitation rates. As indicated in Section 2.6, we employ a reduction in free speed and in highway capacity of 10% for rain/light snow. During heavy snow conditions[3], the free speed and highway capacity reductions are 15% and 25%, respectively.

Since congestion arising from evacuation may be significant, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence highway capacity is presented in this section.

Rural highways generally consist of: (1) one or more uniform sections with limited access (driveways, parking areas) characterized by "uninterrupted" flow; and (2) approaches to at-grade intersections where flow can be "interrupted" by a control device or by turning or crossing traffic at the intersection. Due to these differences, separate estimates of capacity must be made for each section. Often, the approach to the intersection is widened by the addition of one or more lanes (turn pockets or turn bays), to compensate for the lower capacity of the approach due to the factors there that can interrupt the flow of traffic. These additional lanes are recorded during the field survey and later entered as input to the DYNEV II system.

[3] During heavy snow conditions, it is assumed that there is significant snowfall such that minor roadways have snow on them, and major roadways have been plowed but have a coating of snow such that it will reduce free flow speed and capacity. For these scenarios, residents take longer to mobilize (see Section 5) as they might choose to plow their driveway before beginning their evacuation trip. It is assumed that, during this time, roads are made passable by plow trucks and only speeds and capacities are affected. As such, this ETE study assumes all roadways are passible albeit at lower speeds and capacities for certain conditions. In cases wherein roadways are not passible, the ETE results from this study should be added to the time necessary to make the roadways passible and the sum of those times becomes the new ETE. For example, if it takes 24 hours for roadways to be plowed and this report estimates an evacuation time of 3 hours, the ETE under these conditions becomes 27 hours. Essentially, for purposes of this study time zero is from the moment the roadways are passible for heavy snow situations wherein roadways are not immediately traversable. .

## 4.1 Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under local heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices.

The per-lane capacity of an approach to a signalized intersection can be expressed (simplistically) in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m}\right) \times \left(\frac{G-L}{C}\right)_m = \left(\frac{3600}{h_m}\right) \times P_m$$

where:

| | | |
|---|---|---|
| $Q_{cap,m}$ | = | Capacity of a single lane of traffic on an approach, which executes movement, *m*, upon entering the intersection; vehicles per hour (vph) |
| $h_m$ | = | Mean queue discharge headway of vehicles on this lane that are executing movement, *m*; seconds per vehicle |
| *G* | = | Mean duration of GREEN time servicing vehicles that are executing movement, *m*, for each signal cycle; seconds |
| *L* | = | Mean "lost time" for each signal phase servicing movement, *m*; seconds |
| *C* | = | Duration of each signal cycle; seconds |
| $P_m$ | = | Proportion of GREEN time allocated for vehicles executing movement, *m*, from this lane. This value is specified as part of the control treatment. |
| *m* | = | The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, and diagonal. |

The turn-movement-specific mean discharge headway $h_m$, depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", $h_{sat}$, which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behaviours. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \ldots)$$

where:

| | | |
|---|---|---|
| $h_{sat}$ | = | Saturation discharge headway for through vehicles; seconds per vehicle |

| | | |
|---|---|---|
| $F_1, F_2$ | = | The various known factors influencing $h_m$ |
| $f_m( )$ | = | Complex function relating $h_m$ to the known (or estimated) values of $h_{sa}$, $F_1$, $F_2$, … |

The estimation of $h_m$ for specified values of $h_{sat}$, $F_1$, $F_2$, ... is undertaken within the DYNEV II simulation model by a mathematical model[4]. The resulting values for $h_m$ always satisfy the condition:

$$h_m \geq h_{sat}$$

That is, the turn-movement-specific discharge headways are always greater than, or equal to the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observation or using the procedures of the HCM 2022.

The above discussion is necessarily brief given the scope of this evacuation time estimate (ETE) report and the complexity of the subject of intersection capacity. In fact, Chapters 19, 20 and 21 in the HCM 2022 address this topic. The factors, $F_1$, $F_2$, …, influencing saturation flow rate are identified in equation (19-8) of the HCM 2022.

The traffic signals within the Planning Zone (PZ) are modelled using representative phasing plans and phase durations obtained as part of the field data collection. Traffic responsive signal installations allow the proportion of green time allocated ($P_m$) for each approach to each intersection, to be determined by the expected traffic volumes on each approach during evacuation circumstances. The amount of green time (G) allocated is subject to maximum and minimum phase duration constraints; 2 seconds of yellow time are indicated for each signal phase and 1 second of all-red time is assigned between signal phases, typically. If a signal is pre-timed, the yellow and all-red times observed during the road survey are used. A lost time (L) of 2.0 seconds is used for each signal phase in the analysis.

## 4.2 Capacity Estimation along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g., percent heavy trucks and buses in the traffic stream) and, of course, motorist behaviour. There is a fundamental relationship which relates SV (i.e., the number of vehicles serviced within a uniform highway section in a given time period) to traffic density. The top curve in Figure 4-1 illustrates this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side of curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; the SV increases as demand volume and density increase, until the SV attains its maximum value, which is the

[4] Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the Far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980. Lieberman, E., Xin, W., "Macroscopic Traffic Modeling for Large-Scale Evacuation Planning", presented at the TRB 2012 Annual Meeting, January 22-26, 2012.

capacity of the highway section. As traffic demand and the resulting highway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e., the SV) can actually decline below capacity ("capacity drop"). Therefore, in order to realistically represent traffic performance during congested conditions (i.e., when demand exceeds capacity), it is necessary to estimate the service volume, $V_F$, under congested conditions.

The value of $V_F$ can be expressed as:

$$V_F = R \times Capacity$$

where:

*R* = Reduction factor which is less than unity

We have employed a value of R=0.90. The advisability of such a capacity reduction factor is based upon empirical studies that identified a fall-off in the service flow rate when congestion occurs at "bottlenecks" or "choke points" on a freeway system. Zhang and Levinson[5] describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of ETE analyses is to develop a "realistic" estimate of evacuation times, use of the representative value for this capacity reduction factor (R=0.90) is justified. This factor is applied only when flow breaks down, as determined by the simulation model.

Rural roads, like freeways, are classified as "uninterrupted flow" facilities. (This is in contrast with urban street systems which have closely spaced signalized intersections and are classified as "interrupted flow" facilities.) As such, traffic flow along rural roads is subject to the same effects as freeways in the event traffic demand exceeds the nominal capacity, resulting in queuing and lower QDF rates. As a practical matter, rural roads rarely break down at locations away from intersections. Any breakdowns on rural roads are generally experienced at intersections where other model logic applies, or at lane drops which reduce capacity there. Therefore, the application of a factor of 0.90 is appropriate on rural roads, but rarely, if ever, activated.

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. The impact of narrow lanes and shoulders on free-flow speed and on capacity is not material, particularly when flow is predominantly in one direction as is the case during an evacuation.

[5]Lei Zhang and David Levinson, "Some Properties of Flows at Freeway Bottlenecks," Transportation Research Record 1883, 2004.

The procedure used here was to estimate "section" capacity, $V_E$, based on observations made traveling over each section of the evacuation network, based on the posted speed limits and travel behaviour of other motorists and by reference to the HCM 2022. The DYNEV II simulation model determines for each highway section, represented as a network link, whether its capacity would be limited by the "section-specific" service volume, $V_E$, or by the intersection-specific capacity. For each link, the model selects the lower value of capacity.

## 4.3 Application to the PNGS Planning Zone

As part of the development of the link-node analysis network for the PZ, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in[2]:

2022 Highway Capacity Manual (HCM 2022)
Transportation Research Board
National Research Council
Washington, D.C.

The highway system in the PZ consists primarily of three categories of roads and, of course, intersections:

- Two-Lane roads: Local, State
- Multilane Highways (at-grade)
- Freeways

Each of these classifications will be discussed.

### 4.3.1 Two-Lane Roads

Ref: HCM 2022 Chapter 15

Two lane roads comprise the majority of highways within the PZ. The per-lane capacity of a two-lane highway is estimated at 1,700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3,200 pc/h. The HCM 2022 procedures then estimate LOS and Average Travel Speed. The DYNEV II simulation model accepts the specified value of capacity as input and computes average speed based on the time-varying demand: capacity relations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the PZ are classified as “Class I”, with "level terrain"; some are “rolling terrain”.
- “Class II” highways are mostly those within urban and suburban centers.

### 4.3.2 Multilane Highway

Ref: HCM 2022 Chapter 12

Exhibit 12-8 of the HCM 2022 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 70 mph (72 to 97 kph), respectively. Based on observation, the multilane highways outside of urban areas within the PZ, service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand and capacity relationship and the impact of control at intersections. A conservative estimate of per-lane capacity of 1,900 pc/h is adopted for this study for multilane highways outside of urban areas.

### 4.3.3 Freeways

Ref: HCM 2022 Chapters 10, 12, 13, 14

Chapter 10 of the HCM 2022 describes a procedure for integrating the results obtained in Chapters 12, 13 and 14, which compute capacity and LOS for freeway components. Chapter 10 also presents a discussion of simulation models. The DYNEV II simulation model automatically performs this integration process.

Chapter 12 of the HCM 2022 presents procedures for estimating capacity and LOS for "Basic Freeway Segments". Exhibit 12-37 of the HCM 2022 presents capacity vs. free speed estimates, which are provided below.

| Free Speed mph (kph): | 55 (89) | 60 (97) | 65 (105) | 70+ (113+) |
|---|---|---|---|---|
| Per-Lane Capacity (pc/h): | 2,250 | 2,300 | 2,350 | 2,400 |

The inputs to the simulation model are highway geometrics, free-speeds and capacity based on field observations. The simulation logic calculates actual time-varying speeds based on demand: capacity relationships. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways.

Chapter 13 of the HCM 2022 presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity obtained from the computational procedures detailed in Chapter 13 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 14 of the HCM 2022 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM 2022 and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp's FFS. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the

procedures in Chapter 14 of the HCM 2022. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM 2022 does not address LOS F explicitly).

### 4.3.4 Intersections

Ref: HCM 2022 Chapters 19, 20, 21, 22

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 19 (signalized intersections), Chapters 20, 21 (un-signalized intersections) and Chapter 22 (roundabouts). The complexity of these computations is indicated by the aggregate length of these chapters. The DYNEV II simulation logic is likewise complex.

The simulation model explicitly models intersections: Stop/yield controlled intersections (both 2-way and all-way) and traffic signal controlled intersections. Where intersections are controlled by fixed time controllers, traffic signal timings are set to reflect average (non-evacuation) traffic conditions. Actuated traffic signal settings respond to the time-varying demands of evacuation traffic to adjust the relative capacities of the competing intersection approaches.

The model is also capable of modelling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modelled explicitly. A list that includes the total number of intersections modelled that are unsignalized, signalized, or manned by response personnel is noted in Appendix K.

## 4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 2022 is entitled, “HCM and Alternative Analysis Tools.” The chapter discusses the use of alternative tools such as simulation modelling to evaluate the operational performance of highway networks. Among the reasons cited in Chapter 6 to consider using simulation as an alternative analysis tool is:

> *“The system under study involves a group of different facilities or travel modes with mutual interactions involving several HCM chapters. Alternative tools are able to analyze these facilities as a single system.”*

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing a PZ operating under evacuation conditions. The model utilized for this study, DYNEV II is further described in Appendix C. It is essential to recognize that simulation models do not replicate the methodology and procedures of the HCM – they *replace* these procedures by describing the complex interactions of traffic flow and computing Measures of Effectiveness (MOE) detailing the operational performance of traffic over time and by location. The DYNEV II simulation model includes some HCM 2022 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of these are: (1) FFS; and (2) saturation headway, $h_{sat}$. The first of these is estimated by direct observation during the road survey; the second is estimated using the concepts of the HCM 2022, as described earlier.

It is important to note that simulation is a mathematical representation of an assumed set of conditions using the best available knowledge and understanding of traffic flow and available inputs. Simulation should not be assumed to be a prediction of what will happen under any event because a real evacuation can be impacted by an infinite number of things – many of which will differ from these test cases – and many others cannot be taken into account with the tools available.

## 4.5 Boundary Conditions

As illustrated in Figure 1-2 and in Appendix K, the link-node analysis network used for this study is finite. The analysis network extends well beyond the 15-mile radial PZ in some locations in order to model intersections with other major evacuation routes beyond the PZ. However, the network does have an end at the destination (exit) nodes as discussed in Appendix C. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the PZ. Rather than neglect these "boundary conditions", this study assumes a 25% reduction in capacity on two-lane roads (Section 4.3.1 above) and multilane highways (Section 4.3.2 above). There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the PZ and the fact that the evacuating traffic volume ("main street") will be more significant than the competing ("side street") traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

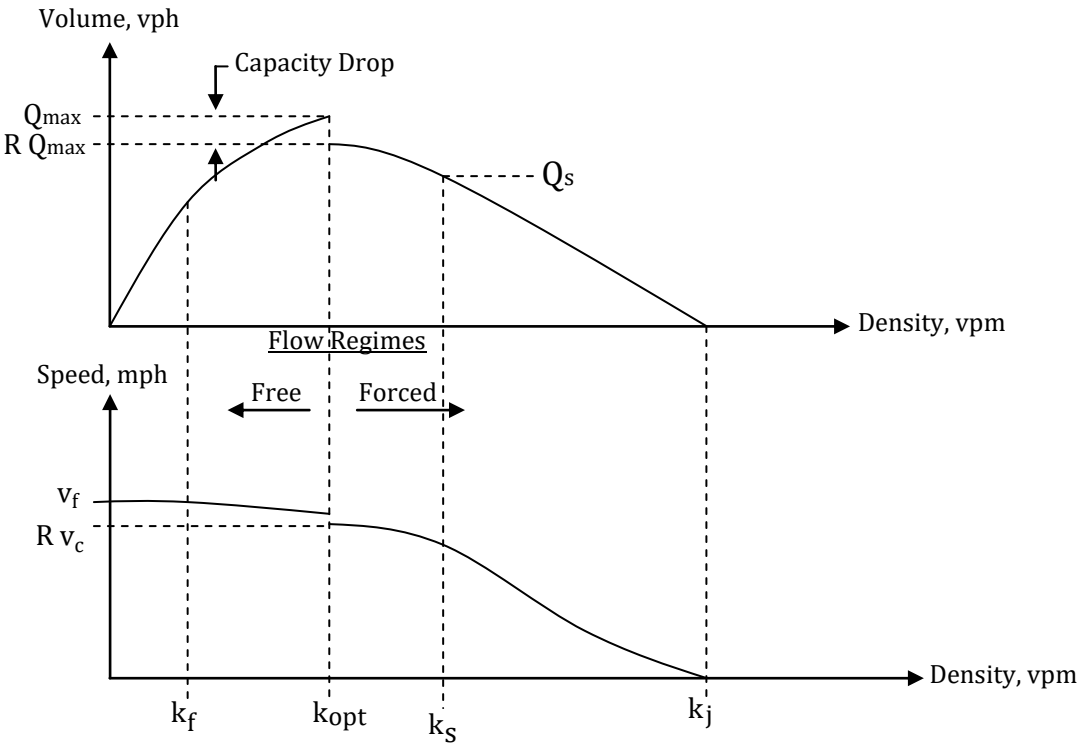



**Figure 4-1. Fundamental Diagrams**

# 5 ESTIMATION OF TRIP GENERATION/MOBILIZATION TIME

Federal guidance (NUREG/CR-7002, Rev. 1) specify that the planner estimate the distributions of elapsed times associated with mobilization activities undertaken by the public to prepare for the evacuation trip. The elapsed time associated with each activity is represented as a statistical distribution reflecting differences between members of the public. The quantification of these activity-based distributions relies largely on the results of the demographic survey. We define the sum of these distributions of elapsed times as the Trip Generation/Mobilization Time Distribution.

## 5.1 Background

In general, an accident at a nuclear power plant is characterized by the following Emergency Categorization Levels (Provincial Nuclear Emergency Response Plan, Implementing Plan for the PNGS, January 2019):

1. Reportable Event
2. Abnormal Incident
3. Onsite Emergency
4. General Emergency

At each level, the Provincial Plan specifies a set of Actions to be undertaken by Provincial and Municipal authorities. In addition, the Provincial Nuclear Emergency Response Plan (PNERP)-Implementing plan for the PNGS specifies default response actions at each level. As a Planning Basis, we will adopt a conservative posture, in accordance with Section 1.2 of NUREG/CR-7002 Rev. 1, that a rapidly progressing severe accident resulting in a Full Activation level of response (General or Onsite Emergency categorization, or emission in 36 hrs or less, or as required due to deteriorating conditions) will be considered in calculating the Trip Generation Time. We will assume:

1. The Emergency Bulletin to evacuate will be announced coincident with the activation of the notification.
2. Mobilization of the general population will commence within 15 minutes after notification.
3. The ETE are measured relative to the Emergency Bulletin to evacuate.

We emphasize that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various Emergency Categorization Levels. For example, suppose one-hour elapses from the siren alert to the Emergency Bulletin to evacuate. In this case, it is reasonable to expect some degree of spontaneous evacuation by the

public during this one-hour period. As a result, the population within the Planning Zones[1] (PZ) will be lower when the Emergency Bulletin to evacuate is announced, than at the time of the siren alert. In addition, many will engage in preparation activities to evacuate, in anticipation that an Emergency Bulletin to evacuate will be broadcasted. Thus, the time needed to complete the mobilization activities and the number of people remaining to evacuate the PZs after the Emergency Bulletin to evacuate, will both be somewhat less than the estimates presented in this report. Consequently, the ETE presented in this report are higher than the actual evacuation time, if this hypothetical situation were to take place.

The notification process consists of two events:

1. Transmitting information using the alert notification systems available within the PZs (e.g., sirens, automated phone calls, National Alert Aggregation & Dissemination System (NAADS), Alert Ready, media).
2. Receiving and correctly interpreting the information that is transmitted.

The population within the DPZ and CPZ is dispersed over a large area and is engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an accident.

The amount of elapsed time will vary from one individual to the next depending on where that person is, what that person is doing, and related factors. Furthermore, some persons who will be directly involved with the evacuation process may be outside the PZs at the time the emergency is declared. These people may be commuters, shoppers and other travellers who reside within the PZs and who will return to join the other household members upon receiving notification of an emergency.

As indicated in Section 2.13 of NUREG/CR-6863, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the PZs. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that accurate ETE may be computed.

For example, people at home or at work within the PZs will be notified by siren, and other means listed above. Those well outside the PZs will be notified by telephone, radio, TV, and word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the population within the PZs will differ with time of day - families will be united in the evenings but dispersed during the day. In this respect, weekends will differ from weekdays.

As indicated in Section 4.3 of NUREG/CR-7002, Rev. 1, the information required to compute trip generation times is typically obtained from a demographic survey of residents within the PZs. Such a survey was conducted in support of this ETE study. Appendix F discusses the survey sampling plan, documents the survey instrument utilized and provides the survey results. The

[1] The Planning Zones include the Automatic Action Zone, Detailed Planning Zone (Inner and Outer Rings) and the Contingency Planning Zone.

remaining discussion will focus on the application of the trip generation data obtained from the demographic survey to the development of the ETE documented in this report.

## 5.2 Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips consists of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e., to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

| Event Number | Event Description |
|---|---|
| 1 | Notification |
| 2 | Awareness of Situation |
| 3 | Depart Work |
| 4 | Arrive Home |
| 5 | Depart on Evacuation Trip |

Associated with each sequence of events are one or more activities, as outlined below:

- An Event is a 'state' that exists at a point in time (e.g., depart work, arrive home)
- An Activity is a 'process' that takes place over some elapsed time (e.g., prepare to leave work, travel home)

These relationships are shown graphically in Table 5-1.

As such, a completed Activity changes the 'state' of an individual (i.e., the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next and are described as statistical distributions on the following pages.

An employee who lives outside the PZs will follow sequence (c) of Figure 5-1. A household within the PZs that has one or more commuters at work and will await their return before beginning the evacuation trip will follow the first sequence of Figure 5-1(a). A household within the PZs that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 5-1(a), regardless of day of week or time of day.

Households with no commuters on weekends or in the evening/night-time, will follow the applicable sequence in Figure 5-1(b). Transients will always follow one of the sequences of Figure 5-1(b). Some transients away from their residence (lodging facility or campground) could elect to evacuate immediately without returning to the residence, as indicated in the second sequence.

It is seen from Figure 5-1, that the Trip Generation time (i.e., the total elapsed time from Event 1

to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities preceding that event. That is, to estimate the time distribution of Event 5, we must obtain estimates of the time distributions of all preceding events. For this study, we adopt the conservative posture that all activities will occur in sequence such that all preceding events must be completed before the current event can occur.

In some cases, assuming certain events occur strictly sequential (for instance, commuter returning home before beginning preparation to leave, or removing snow only after the preparation to leave) can result in rather *conservative* (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.

## 5.3 Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since it is performed on distributions – not scalar numbers).

Time Distribution No. 1, Notification Process: Activity 1 $\rightarrow$ 2

Section 6.2.2 of the *Provincial Nuclear Emergency Response Plan (PNERP) Implementing Plan for the Pickering Nuclear Generating Station (PNGS) January 2019* states that, "The Regional Municipality of Durham and City of Toronto, as the Designated Municipalities in the PNGS Detailed Planning Zone shall make provisions, in their nuclear emergency plans, for a public alerting system which shall ensure that their Automatic Action Zone populations that may be required to undertake the default or immediate protective measures of (e.g., sheltering-in-place, evacuation, and ingestion of KI) can be alerted within 15 minutes of initiation". As discussed in item 1 of Section 2.3, an assumption of the time required to notify essentially 100% the population in the CPZ is necessary to produce ETEs. A value of 45 minutes has been assumed as reasonable and accepted by Provincial emergency managers and OPG to extent possible, given the use of the sirens and land line telephone alerting in the DPZ together with NAAD[2] and wireless public alerting in the DPZ, CPZ, and Ingestion Planning Zone (IPZ) as required. The assumed distribution for notifying the population is provided in in Table 5-2.

Distribution No. 2, Prepare to Leave Work: Activity 2 $\rightarrow$ 3

It is reasonable to expect that the vast majority of business enterprises within the PZs will elect to shut down following notification and most employees would leave work quickly. Commuters, who work outside the PZs could, in all probability, also leave quickly since facilities outside the PZs would remain open and other personnel would remain. Personnel or farmers responsible for equipment/livestock would require additional time to secure their facility. The distribution of Activity 2 $\rightarrow$ 3 shown in Table 5-3 reflects data obtained by the demographic survey. This distribution is also applicable for residents to leave stores, restaurants, parks, and other locations

[2] https://alerts.pelmorex.com/

within the PZs. This distribution is plotted in Figure 5-2.

Distribution No. 3, Travel Home: Activity 3 $\rightarrow$ 4

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-4.

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 $\rightarrow$ 5

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5.

Distribution No. 5, Snow Clearance Time Distribution

Inclement weather scenarios involving snowfall must address the time lags associated with snow clearance. It is assumed that snow equipment is mobilized and deployed during the snowfall to maintain passable roads. The general consensus is that the snow-ploughing efforts are generally successful for all but the most extreme blizzards when the rate of snow accumulation exceeds that of snow clearance over a period of many hours. (Note – evacuation may not be a prudent protective action under such blizzard conditions).

Consequently, it is reasonable to assume that the highway system will remain passable – albeit at a lower capacity – under the vast majority of snow conditions. Nevertheless, for the vehicles to gain access to the highway system, it may be necessary for driveways and employee parking lots to be cleared to the extent needed to permit vehicles to gain access to the roadways. These clearance activities take time; this time must be incorporated into the trip generation time distributions. This distribution is plotted in Figure 5-2 and listed in Table 5-6.

## 5.4 Calculation of Trip Generation Time Distribution

The time distributions for each of the mobilization activities presented herein must be combined to form the appropriate Trip Generation Distributions. As discussed above, this study assumes that the stated events take place in sequence such that all preceding events must be completed before the current event can occur. For example, if a household awaits the return of a commuter, the work-to-home trip (Activity 3 $\rightarrow$ 4) must precede Activity 4 $\rightarrow$ 5.

To calculate the time distribution of an event that is dependent on two sequential activities, it is necessary to "sum" the distributions associated with these prior activities. The distribution summing algorithm is applied repeatedly as shown to form the required distribution. As an outcome of this procedure, new time distributions are formed; we assign "letter" designations to these intermediate distributions to describe the procedure. Table 5-7 presents the summing procedure to arrive at each designated distribution.

Table 5-8 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

### 5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer "Decline to State" to some questions or choose to not respond to a question. The mobilization activity distributions are based upon actual responses. But, it is the nature of surveys that a few numeric responses are inconsistent with the overall pattern of results. An example would be a case in which for 500 responses, almost all of them estimate less than two hours for a given answer, but 3 say "four hours" and 4 say "six or more hours".

These "outliers" must be considered: are they valid responses, or so atypical that they should be dropped from the sample?

In assessing outliers, there are three alternatives to consider:

1. Some responses with very long times may be valid, but reflect the reality that the respondent really needs to be classified in a different population subgroup, based upon access and/or functional needs;
2. Other responses may be unrealistic (6 hours to return home from commuting distance, or 2 days to prepare the home for departure);
3. Some high values are representative and plausible, and one must not cut them as part of the consideration of outliers.

The issue of course is how to make the decision that a given response or set of responses are to be considered "outliers" for the component mobilization activities, using a method that objectively quantifies the process.

There is considerable statistical literature on the identification and treatment of outliers singly or in groups, much of which assumes the data is normally distributed and some of which uses non-parametric methods to avoid that assumption. The literature cites that limited work has been done directly on outliers in sample survey responses.

In establishing the overall mobilization time/trip generation distributions, the following principles are used:

1) It is recognized that the overall trip generation distributions are conservative estimates, because they assume a household will do the mobilization activities sequentially, with no overlap of activities;
2) The individual mobilization activities (prepare to leave work, travel home, prepare home, clear snow) are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-7, and Table 5-8);
3) Outliers can be eliminated either because the response reflects a special population (e.g., access and/or functional needs, transit dependent) or lack of realism, because the purpose is to estimate trip generation patterns for personal vehicles;

4) To eliminate outliers,
    a) the mean and standard deviation of the specific activity are estimated from the responses,
    b) the median of the same data is estimated, with its position relative to the mean noted,
    c) the histogram of the data is inspected, and
    d) all values greater than 3.5 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

    In general, only flagged values more than 4.0 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected.

    When flagged values are classified as outliers and dropped, steps "a" to "d" are repeated.

5) As a practical matter, even with outliers eliminated by the above, the resultant histogram, viewed as a cumulative distribution, is not a normal distribution. A typical situation that results is shown below in Figure 5-3.

6) In particular, the cumulative distribution differs from the normal distribution in two key aspects, both very important in loading a network to estimate evacuation times:
    a) Most of the real data is to the left of the "normal" curve above, indicating that the network loads faster for the first 80-85% of the vehicles, potentially causing more (and earlier) congestion than otherwise modelled;
    b) The last 10-15% of the real data "tails off" slower than the comparable "normal" curve, indicating that there is significant traffic still loading at later times.

    Because these two features are important to preserve, it is the histogram of the data that is used to describe the mobilization activities, not a "normal" curve fit to the data. One could consider other distributions, but using the shape of the *actual* data curve is unambiguous and preserves these important features;

7) With the mobilization activities each modelled according to Steps 1-6, including preserving the features cited in Step 6, the overall (or total) mobilization times are constructed.

This is done by using the data sets and distributions under different scenarios (e.g., commuter returning, no commuter returning, no snow or snow in each). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 5-4 presents the combined trip generation distributions designated for each population group considered. These distributions are presented on the same time scale. (As discussed earlier, the use of strictly additive activities is a conservative approach, because it makes all activities sequential – preparation for departure follows the return of the commuter; snow clearance follows the preparation for departure, and so forth. In practice, it is reasonable that some of these activities are done in parallel, at least to some extent – for instance, preparation to depart begins by a household member at home while the commuter is still on the road.)

The mobilization distributions that result is used in their tabular/graphical form as direct inputs to later computations that lead to the ETE.

The DYNEV II simulation model is designed to accept varying rates of vehicle trip generation for each origin centroid, expressed in the form of histograms. These histograms, which represent Distributions A, C, D, E and F, properly displaced with respect to one another, are tabulated in Table 5-9 (Distribution B, Arrive Home, omitted for clarity).

The final time period (15) is 600 minutes long. This time period is added to allow the analysis network to clear, in the event congestion persists beyond the trip generation period. Note that there are no trips generated during this final time period.

### 5.4.2 Staged Evacuation Trip Generation

NUREG/CR-7002, Rev.1, defines staged evacuation using English units (miles) and the typical planning radii (2, 5 and 10 miles) for U.S. nuclear plants. Adapting the guidance of NUREG/CR-7002, Rev. 1, to Canadian standards and planning radii, staged evacuation consists of the following:

1. Response Sectors comprising the AAZ are advised to evacuate immediately.
2. Response Sectors comprising regions extending beyond the AAZ downwind to the CPZ boundary are advised to shelter in-place while the AAZ region is cleared.
3. As vehicles evacuate the AAZ, sheltered people beyond the AAZ downwind to the CPZ boundary continue to prepare for an evacuation.
4. The population sheltering beyond the AAZ downwind to the CPZ boundary are advised to begin evacuating when approximately 90% of those originally within the AAZ evacuate across the AAZ boundary.
5. Non-compliance with the shelter recommendation is the same as the shadow/voluntary evacuation percentage of 30%.

Assumptions

1. The population in Response Sectors not told to evacuate will shelter-in-place, with the exception of the 30% non-compliance.
2. The transient population will not be expected to stage their evacuation because of the limited sheltering options available to people who may be at parks, at campgrounds, on a beach, or at other venues. Also, notifying the transient population of a staged evacuation would prove difficult.
3. Employees will also be assumed to evacuate without first sheltering.

Procedure

1. Trip generation for population groups in the AAZ will be as computed based upon the results of the demographic survey and analysis.

2. Trip generation for the population subject to staged evacuation will be formulated as follows:
    a. Identify the 90th percentile evacuation time for the Response Sectors comprising the 3 km region. This value, $T_{Scen}^*$, obtained from simulation results, is scenario specific. It will become the time at which the region being sheltered will be told to evacuate for each scenario. To avoid counting vehicles from outside of the AAZ that utilize Highway 401 that could skew the results, this stretch of roadway was considered to be 'outside' of the AAZ for the $T_{Scen}^*$ determination.
    b. The resultant trip generation curves for staging are then formed as follows:
        i. The non-shelter trip generation curve is followed until a maximum of 30% of the total trips are generated (to account for shelter non-compliance).
        ii. No additional trips are generated until time $T_{Scen}^*$
        iii. Following time $T_{Scen}^*$, the balance of trips are generated:
            1. by stepping up and then following the non-shelter trip generation curve (if $T_{Scen}^*$ is $\leq$ max trip generation time) or
            2. by stepping up to 100% (if $T_{Scen}^*$ is > max trip generation time)
    c. Note: This procedure implies that there may be different staged trip generation distributions for different scenarios. NUREG/CR-7002, Rev. 1, uses the statement "approximately 90th percentile" as the time to end staging and begin evacuating. The value of $T_{Scen}^*$ is 4:00 for non-snow scenarios and 4:30 for snow scenarios (see Region R01 in Table 7-1).
3. Staged trip generation distributions are created for the following population groups:
    a. Residents with returning commuters
    b. Residents without returning commuters
    c. Residents with returning commuters and snow conditions
    d. Residents without returning commuters and snow conditions

Figure 5-5 presents the staged trip generation distributions for both residents with and without returning commuters; approximately, the 90th percentile evacuation time of the AAZ is approximately 240 minutes for non-snow scenarios and 270 minutes for snow scenarios (see Region R01 in Table 7-1). At $T_{Scen}^*$, 30% of the permanent resident population (who normally would have completed their mobilization activities for an un-staged evacuation) advised to shelter has nevertheless departed the area. These people do not comply with the shelter advisory. Also included on the plot are the trip generation distributions for these groups as applied to the regions advised to evacuate immediately.

Since the 90th percentile evacuation time occurs before the end of the trip generation time, after the sheltered region is advised to evacuate, the shelter trip generation distribution rises to meet the balance of the non-staged trip generation distribution. Following time $T_{Scen}^*$, the balance of staged evacuation trips that are ready to depart are released within 15 minutes and after this time, the remainder of evacuation trips are generated in accordance with the un-staged trip generation distribution.

Figure 5-5 and Table 5-10 and Table 5-11 provides the trip generation histograms for staged evacuation.

### 5.4.3 Trip Generation for Waterways and Recreational Areas

Section 4.14 of Chapter 4 on page 36 of the Durham Region Nuclear Emergency Response Plan, indicates the Provincial Emergency Operations Centre (PEOC) will issue operational directives to clear boat traffic from Lake Ontario. The Canadian Coast Guard, assisted by the Durham Regional Police Services and Toronto Police marine units, will control entry into the lake during an evacuation.

As discussed in Section 2.2, this study assumes a rapidly progressing severe accident. As indicated in Table 5-2 and and discussed in Section 2.3, this study assumes essentially 100 percent notification in 45 minutes. Table 5-9 indicates that all transients will have mobilized within 1 hour and 15 minutes. It is assumed that this timeframe is sufficient time for boaters, campers, and other transients to return to their vehicles and begin their evacuation trip. It is also assumed this is sufficient time for boaters who entered the Planning Zone by boat to exit the Planning Zone by boat.

**Table 5-1. Event Sequence for Evacuation Activities**

| Event Sequence | Activity | Distribution |
|---|---|---|
| 1 → 2 | Receive Notification | 1 |
| 2 → 3 | Prepare to Leave Work | 2 |
| 2,3 → 4 | Travel Home | 3 |
| 2,4 → 5 | Prepare to Leave to Evacuate | 4 |
| N/A | Snow Clearance | 5 |

**Table 5-2. Time Distribution for Notifying the Public**

| Elapsed Time (Minutes) | Percent of Population Notified |
|---|---|
| 0 | 0% |
| 5 | 7% |
| 10 | 13% |
| 15 | 27% |
| 20 | 47% |
| 25 | 66% |
| 30 | 87% |
| 35 | 92% |
| 40 | 97% |
| 45 | 100% |

**Table 5-3. Time Distribution for Employees to Prepare to Leave Work/College**

| Elapsed Time (Minutes) | Cumulative Percent Employees Leaving Work | Elapsed Time (Minutes) | Cumulative Percent Employees Leaving Work |
|---|---|---|---|
| 0 | 0% | 30 | 96.0% |
| 5 | 34.9% | 35 | 97.3% |
| 10 | 59.1% | 40 | 98.3% |
| 15 | 78.6% | 45 | 99.7% |
| 20 | 85.8% | 50 | 100.0% |
| 25 | 88.8% | | |

**NOTE:** The survey data was normalized to distribute the "Decline to State" response. That is, the sample was reduced in size to include only those households who responded to this question. The underlying assumption is that the distribution of this activity for the "Decline to State" responders, if the event takes place, would be the same as those responders who provided estimates.

**Table 5-4. Time Distribution for Commuters to Travel Home**

| Elapsed Time (Minutes) | Cumulative Percent Returning Home |
|---|---|
| 0 | 0% |
| 5 | 4.1% |
| 10 | 15.3% |
| 15 | 33.4% |
| 20 | 46.2% |
| 25 | 55.3% |
| 30 | 67.4% |
| 35 | 72.8% |
| 40 | 78.9% |
| 45 | 84.6% |
| 50 | 87.2% |
| 55 | 88.7% |
| 60 | 93.5% |
| 75 | 97.2% |
| 90 | 99.1% |
| 105 | 100.0% |

**NOTE:** The survey data was normalized to distribute the " Decline to State" response

**Table 5-5. Time Distribution for Population to Prepare Home to Evacuate**

| Elapsed Time (Minutes) | Cumulative Percent Ready to Evacuate |
|---|---|
| 0 | 0% |
| 15 | 6.9% |
| 30 | 35.4% |
| 45 | 54.6% |
| 60 | 74.7% |
| 75 | 85.0% |
| 90 | 88.7% |
| 105 | 91.0% |
| 120 | 94.7% |
| 135 | 98.7% |
| 150 | 99.2% |
| 165 | 99.5% |
| 180 | 100.0% |

**NOTE:** The survey data was normalized to distribute the " Decline to State " response

**Table 5-6. Time Distribution for Population to Clear 15-20 cm of Snow**

| Elapsed Time (Minutes) | Cumulative Percent Ready to Evacuate |
|---|---|
| 0 | 21.9% |
| 15 | 48.5% |
| 30 | 75.0% |
| 45 | 89.1% |
| 60 | 96.3% |
| 75 | 98.4% |
| 90 | 99.2% |
| 105 | 100.0% |

**NOTE:** The survey data was normalized to distribute the " Decline to State " response

**Table 5-7. Mapping Distributions to Events**

| Apply "Summing" Algorithm To: | Distribution Obtained | Event Defined |
|---|---|---|
| Distributions 1 and 2 | Distribution A | Event 3 |
| Distributions A and 3 | Distribution B | Event 4 |
| Distributions B and 4 | Distribution C | Event 5 |
| Distributions 1 and 4 | Distribution D | Event 5 |
| Distributions C and 5 | Distribution E | Event 5 |
| Distributions D and 5 | Distribution F | Event 5 |

**Table 5-8. Description of the Distributions**

| Distribution | Description |
|---|---|
| **A** | Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the Planning Zones who live outside, and to Transients within the Planning Zones. |
| **B** | Time distribution of commuters arriving home (Event 4). |
| **C** | Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5). |
| **D** | Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5). |
| **E** | Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip, after snow clearance activities (Event 5). |
| **F** | Time distribution of residents with no commuters returning home, leaving to begin the evacuation trip, after snow clearance activities (Event 5). |

**Table 5-9. Trip Generation Histograms for the Population for Un-staged Evacuation[3]**

| Time Period | Duration (Min) | Percent of Total Trips Generated Within Indicated Time Period | | | | | |
|---|---|---|---|---|---|---|---|
| | | Employees (Distribution A) | Transients (Distribution A) | Residents with Commuters (Distribution C) | Residents without Commuters (Distribution D) | Residents with Commuters Snow (Distribution E) | Residents without Commuters Snow (Distribution F) |
| 1 | 15 | 6% | 6% | 0% | 0% | 0% | 0% |
| 2 | 15 | 35% | 35% | 0% | 5% | 0% | 2% |
| 3 | 15 | 40% | 40% | 1% | 16% | 0% | 5% |
| 4 | 15 | 15% | 15% | 4% | 22% | 2% | 13% |
| 5 | 15 | 4% | 4% | 10% | 20% | 4% | 16% |
| 6 | 15 | 0% | 0% | 15% | 15% | 8% | 17% |
| 7 | 30 | 0% | 0% | 33% | 12% | 27% | 25% |
| 8 | 30 | 0% | 0% | 20% | 6% | 26% | 12% |
| 9 | 30 | 0% | 0% | 10% | 3% | 17% | 7% |
| 10 | 15 | 0% | 0% | 3% | 1% | 5% | 1% |
| 11 | 30 | 0% | 0% | 3% | 0% | 7% | 2% |
| 12 | 15 | 0% | 0% | 1% | 0% | 3% | 0% |
| 13 | 15 | 0% | 0% | 0% | 0% | 0% | 0% |
| 14 | 30 | 0% | 0% | 0% | 0% | 1% | 0% |
| 15 | 600 | 0% | 0% | 0% | 0% | 0% | 0% |

[3] Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distributions C and E for good weather and heavy snow, respectively. Special event vehicles are loaded using Distribution A.

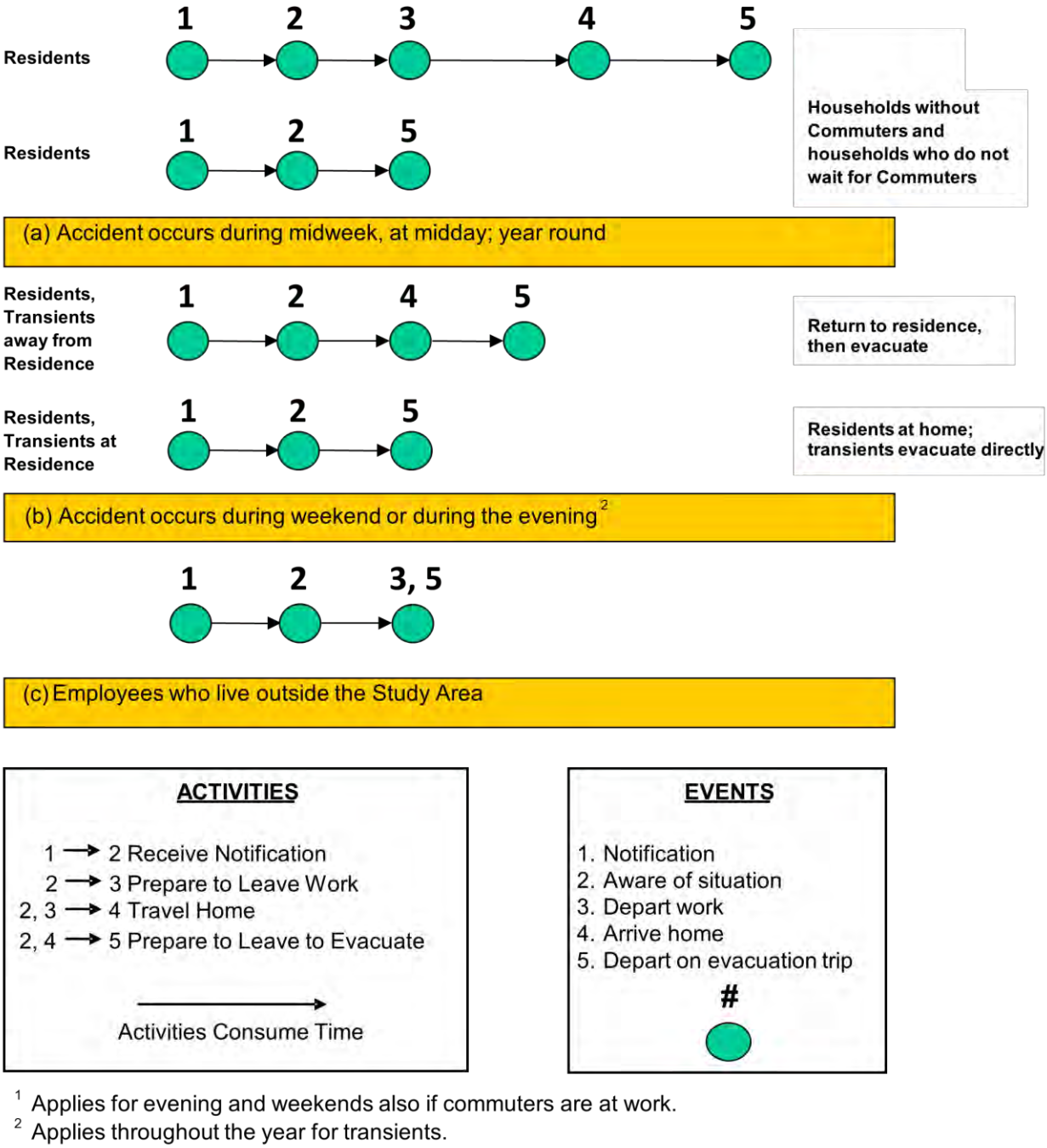
**Table 5-10. Trip Generation Histograms for the Planning Zone Population for Staged Evacuation (Non-Snow)**

| Time Period | Duration (Min) | Percent of Total Trips Generated Within Indicated Time Period[4] | |
|---|---|---|---|
| | | Residents with Commuters (Distribution C) | Residents Without Commuters (Distribution D) |
| 1 | 15 | 0% | 0% |
| 2 | 15 | 0% | 1% |
| 3 | 15 | 0% | 3% |
| 4 | 15 | 1% | 5% |
| 5 | 15 | 2% | 4% |
| 6 | 15 | 3% | 3% |
| 7 | 30 | 7% | 2% |
| 8 | 30 | 4% | 1% |
| 9 | 30 | 2% | 1% |
| 10 | 15 | 0% | 0% |
| 11 | 30 | 1% | 0% |
| 12 | 15 | 0% | 0% |
| 13 | 15 | 80% | 80% |
| 14 | 30 | 0% | 0% |
| 15 | 600 | 0% | 0% |

[4] Trip Generation for Employees and Transients (see Table 5-9) is the same for Un-staged and Staged Evacuation.

**Table 5-11. Trip Generation Histograms for the Planning Zone Population for Staged Evacuation (Snow)**

| Time Period | Duration (Min) | Percent of Total Trips Generated Within Indicated Time Period | |
|---|---|---|---|
| | | Residents With Commuters Snow (Distribution E) | Residents Without Commuters Snow (Distribution F) |
| 1 | 15 | 0% | 0% |
| 2 | 15 | 0% | 0% |
| 3 | 15 | 0% | 1% |
| 4 | 15 | 0% | 3% |
| 5 | 15 | 1% | 3% |
| 6 | 15 | 2% | 4% |
| 7 | 30 | 5% | 5% |
| 8 | 60 | 9% | 3% |
| 9 | 30 | 2% | 1% |
| 10 | 30 | 1% | 0% |
| 11 | 30 | 0% | 0% |
| 12 | 15 | 80% | 80% |
| 13 | 15 | 0% | 0% |
| 14 | 30 | 0% | 0% |
| 15 | 600 | 0% | 0% |




[1] Applies for evening and weekends also if commuters are at work.
[2] Applies throughout the year for transients.

**Figure 5-1. Events and Activities Preceding the Evacuation Trip**

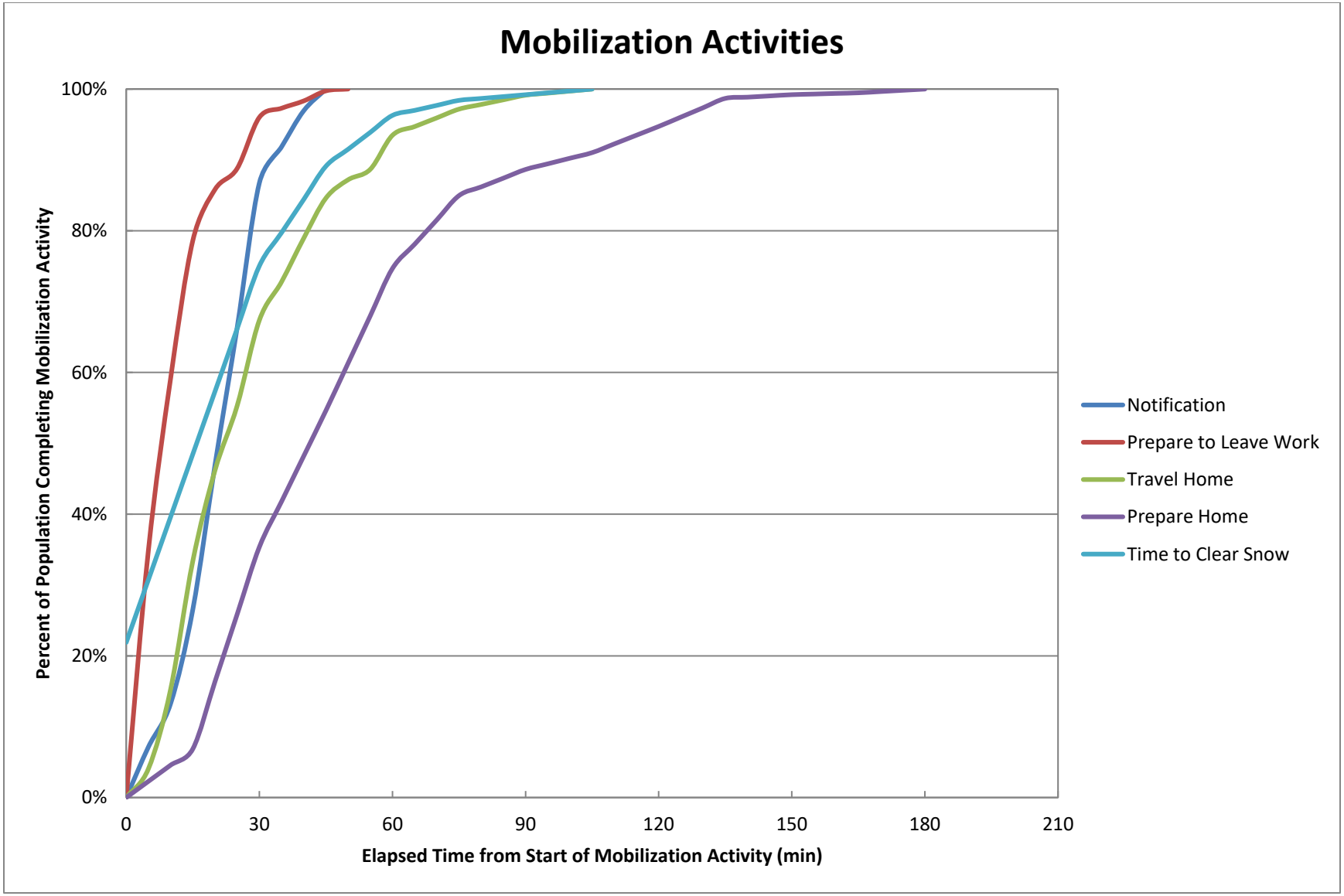



**Figure 5-2. Time Distributions for Evacuation Mobilization Activities**

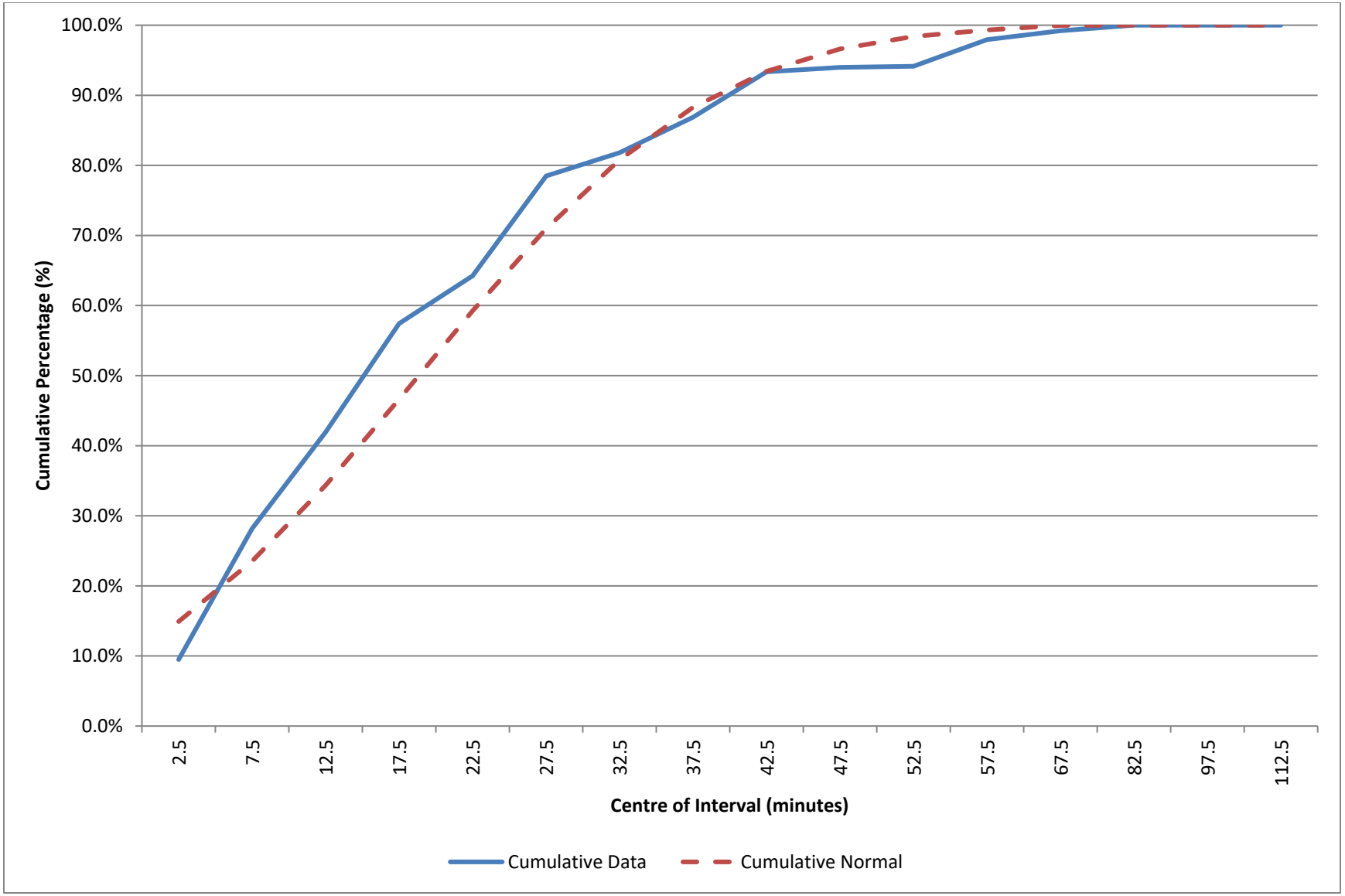



**Figure 5-3. Comparison of Data Distribution and Normal Distribution**

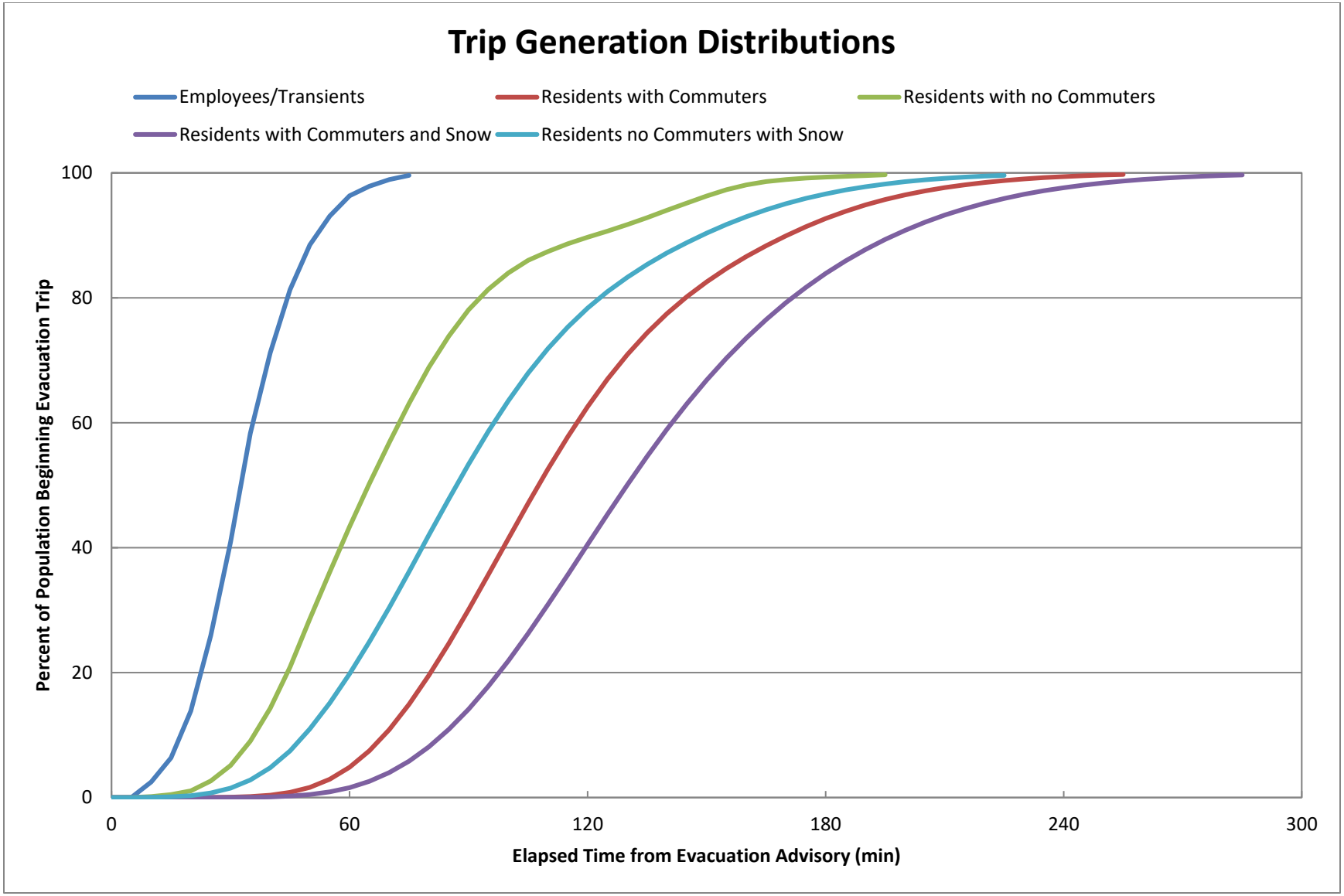
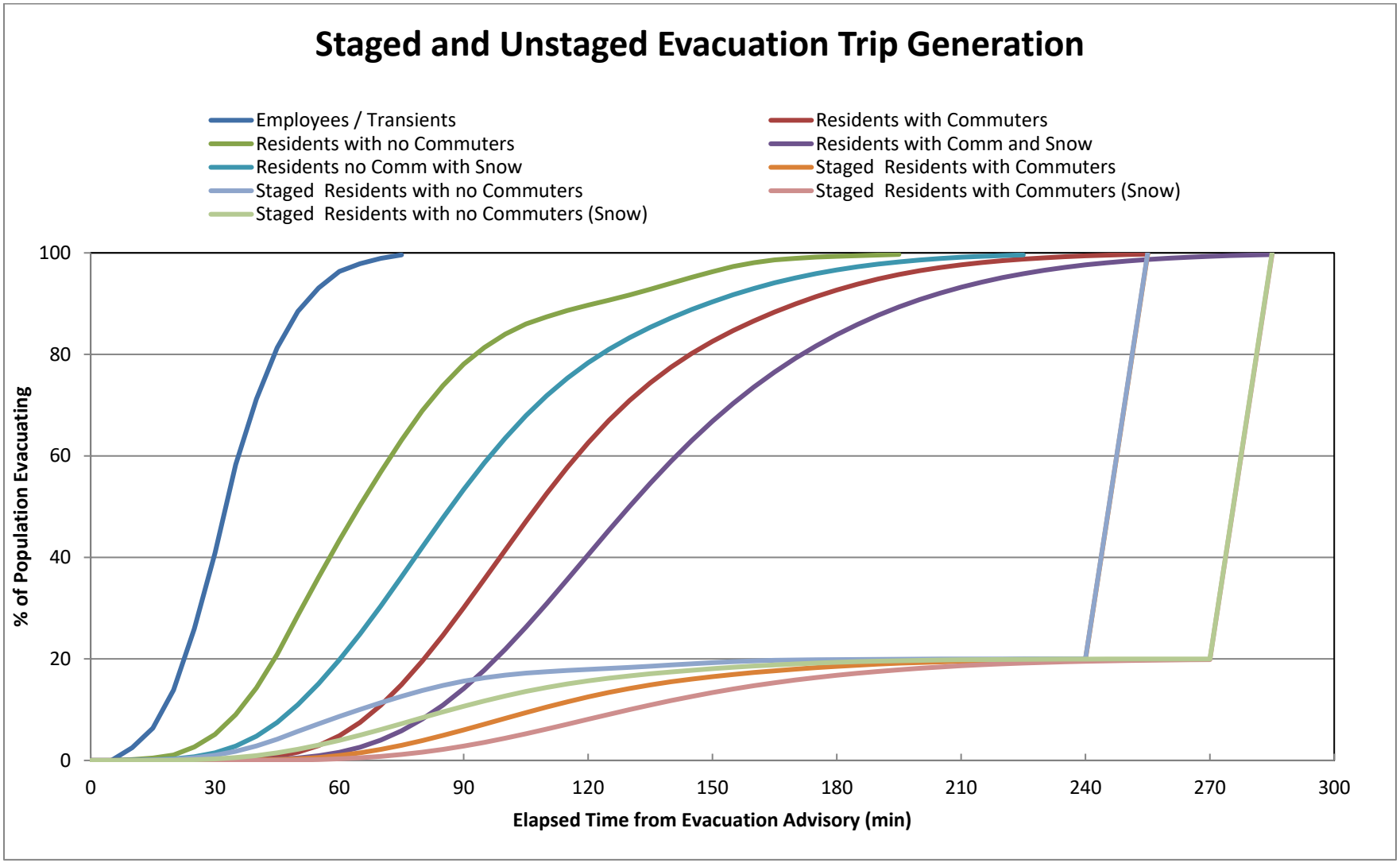



**Figure 5-4. Comparison of Trip Generation Distributions**

**Figure 5-5. Comparison of Staged and Un-staged Trip Generation Distributions in the 3 to 10 km Region**



# 6 EVACUATION CASES

An evacuation "case" defines a combination of Evacuation Region and Evacuation Scenario. The definitions of "Region" and "Scenario" are as follows:

**Region** A grouping of contiguous evacuating Response Sectors that forms either a "keyhole" sector-based area, or a circular area within the PZs, that must be evacuated in response to a radiological emergency.

**Scenario** A combination of circumstances, including time of day, day of week, season, and weather conditions. Scenarios define the number of people in each of the affected population groups and their respective mobilization time distributions.

A total of 53 Regions were defined which encompass all the groupings of Response Sectors considered. These Regions are defined in Table 6-1 and Table 6-2. The Response Sector configurations are identified in Figure 6-1. Regions R01, R02, R03, and R04 represent evacuations of circular areas of the Automatic Action Zone (3km), the Detailed Planning Zone (DPZ) Inner Ring (6km), the DPZ Outer Ring (10km), and the Full Contingency Planning Zone (CPZ) (20km), respectively. Each keyhole sector-based area consists of a central circle centred at the power plant, and three adjoining sectors, each with a central angle of 22.5 degrees, as per NUREG/CR-7002 Rev. 1 guidance. The central sector coincides with the wind direction. These sectors extend to the CPZ boundary from the AAZ boundary (Regions R05 through R20) and from the outer DPZ boundary (Regions R21 through R36). Regions R37 through R53 are identical to Regions R05 through R20 and R04, respectively; however, those Response Sectors between the AAZ and CPZ are staged until 90% of the AAZ (Region R01) has evacuated. Regions R05, R14, R17, and R19 contain Response Sectors that are not within the keyhole but evacuate because they are surrounded by other Response Sectors that are evacuating.

Each Response Sector that intersects the keyhole is included in the Region; however, there are instances when a small portion (a "sliver") of a Response Sector is within the keyhole and the population within that small portion is low (500 people or 10% of the Response Sector population, whichever is less). Under those circumstances, the Response Sector would not be included in the Region so as to not evacuate large numbers of people outside of the keyhole for a small number of people that are actually in the keyhole.

A total of 14 Scenarios were evaluated for all Regions. Thus, there are a total of 53 x 14 = 742 evacuation cases. Table 6-3 is a description of all Scenarios. Each combination of Region and Scenario implies a specific population to be evacuated. Table 6-4 presents the percentage of each population group estimated to evacuate for each Scenario. Table 6-5 and Table 6-6 presents the vehicle counts for each Scenario for an evacuation of Region R03 (DPZ Inner and Outer Ring) and R04 (Full CPZ), respectively.

The vehicle estimates presented in Section 3 are peak values. These peak values are adjusted depending on the scenario and region being considered, using scenario and region-specific

percentages, such that the average population is considered for each evacuation case. The scenario percentages are presented in Table 6-4, while the regional percentages are provided in Table H-1 and Table H-2. Table 6-5 and Table 6-6 provide the vehicle estimates by scenario for the DPZ (Inner plus Outer Ring) and all PZs (including the CPZ), respectively. The percentages in Table 6-4 were determined as follows:

The number of residents with commuters during the week (when workforce is at its peak) is the product of 91% (the number of households with at least one commuter – see Figure F-6) and 72% (the number of households with a commuter that would await the return of the commuter prior to evacuating – see Appendix F, Section F.3.2) which equals 66%. See assumption 2 in Section 2.3. It is estimated for weekend and evening scenarios that 10% of households with returning commuters (66%) will have a commuter at work during those times, or 7% of households overall (10% x 66% = 7% rounded up).

It can be argued that the estimate of permanent residents overstates, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

- Assume 50% of all households vacation for a period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e., 10% of the population is on vacation during each two-week interval.
- Assume half of these vacationers leave the area.

On this basis, the permanent resident population would be reduced by 5% in the summer and by a lesser amount in the off-season. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

Employment is assumed to be at its peak (100%) during the winter, midweek, midday scenarios. Employment is reduced slightly (96%) for summer, midweek, midday scenarios. This is based on the estimation that 50% of the employees commuting into the PZs will be on vacation for a week during the approximate 12 weeks of summer. It is further estimated that those taking vacation will be uniformly dispersed throughout the summer with approximately 4 percent of employees vacationing each week. It is further estimated that only 10% of the employees are working in the evenings and during the weekends.

With the exception of hotels, transient facilities are at their peak during the day on weekends in the summer. As such, transient activity is estimated to be at its peak (80%) during summer weekends and less (60%) during the week. Due to the nature of the transient facilities in the PZs and large number of lodging facilities and a large casino, transient activity is estimated to be at about 65% evening hours in the summer and 55% in the winter. In general, transient activity is less in the winter based on the hours of operation of many of the facilities. The Toronto Zoo is open all year round and has a large transient demand – approximately 10% of the total

transients in the PZs. Since weekends are peak times for the zoo, the winter weekend percent is considerably higher (60%), than the winter weekdays (40%).

As noted in the shadow footnote to Table 6-4, shadow percentages beyond the DPZ Outer Ring are computed using a base of 30% (see assumption 8 in Section 2.2); to include the employees within the shadow region who may choose to evacuate, 30% is multiplied by a scenario-specific proportion of employees to permanent residents in the shadow region. This is only applicable for an evacuation of the AAZ (Region R01), DPZ Inner Ring (Region R02), and the DPZ Outer Ring (Region R03). For example, using the values provided in Table 6-5 for Scenario 1, the percentage is computed as follows:

$$30\% \times \left(1 + \frac{18{,}504}{93{,}416 + 48{,}587}\right) = 34\%$$

One special event – A large event at the Toronto Zoo – was considered as Scenario 13. Thus, the special event traffic is 100% evacuated for Scenario 13, and 0% for all other scenarios.

Schools are in session during the winter season, midweek, midday scenarios. As such, school buses and on and off campus students are all present during winter, midweek, midday scenarios. Since on campus students live in campus housing, it is assumed they are also present on weekends and evenings in the winter. It is estimated that summer school enrollment (including colleges) is approximately 10% of enrollment during the regular school year for summer, midweek, midday scenarios. Similar to winter scenarios, on campus students are assumed to be present at the same rate (10%) during summer weekends and evenings. School and colleges are not in session during weekends and evenings, as such school buses and off campus students are assumed to be 0% for weekend and evening scenarios.

Day Camps are in session (100%) during the summer season, midweek, midday scenarios and are not in session (0%) for any other scenarios.

Transit buses for the transit-dependent population and vehicles for medical and correctional facilities are equal to 100% for all scenarios as it is assumed that the transit-dependent, medical facility, and correctional facility population is present in the PZs for all scenarios.

External traffic is estimated to be reduced by 60% during evening scenarios and is 100% for all other scenarios.

## Table 6-1. Description of Evacuation Regions (Regions R01-R36)

| Region | Description | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R01 | AAZ | X | X | | | | | | | | | | | | | | | | | | | | | X | | | | | | | | | |
| R02 | DPZ Inner Ring | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | X | X | | | | | | | | |
| R03 | DPZ Outer Ring | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | |
| R04 | Full PZ | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R05 | N | X | X | | | | | X | X | X | X | X | X | X | X | | | | | | X | X | X | X | | | X | X | | | | | | X |
| R06 | NNE | X | X | | | | | X | | X | X | X | X | X | X | | | | | | | X | X | X | | | X | X | | | | | | |
| R07 | NE | X | X | | | | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | X | | | | | |
| R08 | ENE | X | X | | | | | | | | | X | X | X | X | | | | | | | | X | X | X | X | | X | X | | | | | |
| R09 | E | X | X | | | | | | | | | | | X | X | | | | | | | | X | X | X | X | | X | X | X | | | | |
| R10 | ESE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | | | | |
| R11 | SE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | X | | | |
| R12 | SSE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | | | |
| R13 | S | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | X | | |
| R14 | SSW | X | X | X | X | | | | | | | | | | | X | X | X | | | | | | X | X | X | | | | | X | X | | |
| R15 | SW | X | X | X | X | | | | | | | | | | | X | X | X | X | | | | | X | X | X | | | | | X | X | X | |
| R16 | WSW | X | X | X | X | X | | | | | | | | | | X | X | X | X | X | | | | X | X | X | | | | | | X | X | |
| R17 | W | X | X | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | | | X | | | | | | | | X | X | X |
| R18 | WNW | X | X | | X | X | X | X | X | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | X |
| R19 | NW | X | X | | | X | X | X | X | X | | | | | | | | | | X | X | X | | X | | | X | | | | | | X | X |
| R20 | NNW | X | X | | | | X | X | X | X | | | | | | | | | | | X | X | | X | | | X | | | | | | | X |
| Evacuate Outer Detailed Planning Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R21 | N | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X |
| R22 | NNE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | |
| R23 | NE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | |
| R24 | ENE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | | | | | |
| R25 | E | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | | | | |
| R26 | ESE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | X | X | | | | |
| R27 | SE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | X | X | X | | | |
| R28 | SSE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | X | X | | | |
| R29 | S | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | X | X | X | | |
| R30 | SSW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | X | X | | |
| R31 | SW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | X | X | X | |
| R32 | WSW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X | |
| R33 | W | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X | X |
| R34 | WNW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | X | X |
| R35 | NW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X |
| R36 | NNW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | X |

Shelter-in-Place | Response Sector(s) Evacuate | Response Sector not within Plume, but Evacuates because it is surrounded by other Response Sectors which are Evacuating

## Table 6-2. Description of Staged Evacuation Regions (Regions R37-R53)

| Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R37 | N | X | X | | | | | X | X | X | X | X | X | X | X | | | | | | X | X | X | X | | | X | X | | | | | | X |
| R38 | NNE | X | X | | | | | X | | X | X | X | X | X | X | | | | | | | X | X | X | | | X | X | | | | | | |
| R39 | NE | X | X | | | | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | X | | | | | |
| R40 | ENE | X | X | | | | | | | | | X | X | X | X | | | | | | | | X | X | X | X | | X | X | | | | | |
| R41 | E | X | X | | | | | | | | | | | X | X | | | | | | | | X | X | X | X | | X | X | X | | | | |
| R42 | ESE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | | | | |
| R43 | SE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | X | | | |
| R44 | SSE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | | | |
| R45 | S | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | X | | |
| R46 | SSW | X | X | X | X | | | | | | | | | | | X | X | X | | | | | | X | X | X | | | | | X | X | | |
| R47 | SW | X | X | X | X | | | | | | | | | | | X | X | X | X | | | | | X | X | X | | | | | X | X | X | |
| R48 | WSW | X | X | X | X | X | | | | | | | | | | X | X | X | X | X | | | | X | X | X | | | | | | X | X | |
| R49 | W | X | X | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | | | X | | | | | | | | X | X | X |
| R50 | WNW | X | X | | X | X | X | X | X | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | X |
| R51 | NW | X | X | | | X | X | X | X | X | | | | | | | | | | X | X | X | | X | | | X | | | | | | X | X |
| R52 | NNW | X | X | | | | X | X | X | X | | | | | | | | | | | X | X | | X | | | X | | | | | | | X |
| R53 | Full PZ | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Shelter-in-Place until 90% ETE for R01, then Evacuate | | | | | | | | | | Shelter-in-Place | | | | | | | | | | | | | Response Sector(s) Evacuate | | | | | | | | | | |

**Table 6-3. Evacuation Scenario Definitions**

| Scenarios | Season[1] | Day of Week | Time of Day | Weather | Special |
|---|---|---|---|---|---|
| 1 | Summer | Midweek | Midday | Good | None |
| 2 | Summer | Midweek | Midday | Rain | None |
| 3 | Summer | Weekend | Midday | Good | None |
| 4 | Summer | Weekend | Midday | Rain | None |
| 5 | Summer | Midweek, Weekend | Evening | Good | None |
| 6 | Winter | Midweek | Midday | Good | None |
| 7 | Winter | Midweek | Midday | Rain/Light Snow | None |
| 8 | Winter | Midweek | Midday | Heavy Snow | None |
| 9 | Winter | Weekend | Midday | Good | None |
| 10 | Winter | Weekend | Midday | Rain/Light Snow | None |
| 11 | Winter | Weekend | Midday | Heavy Snow | None |
| 12 | Winter | Midweek, Weekend | Evening | Good | None |
| 13 | Winter | Weekend | Midday | Good | Large Event at the Toronto Zoo |
| 14 | Summer | Midweek | Midday | Good | Highway 401 Lane Closure |

[1] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

**Table 6-4. Percent of Population Groups Evacuating for Various Scenarios**

| Scenario | Households With Returning Commuters[2] | Households Without Returning Commuters[3] | Employees[4] | Transients[5] | Shadow[6] | Special Event[7] | On-Campus Students[8] | Off-Campus Students[9] | Medical and Correctional Facilities[10] | School Buses[10] | Day Camps[10] | Transit Buses | External Through Traffic[11] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 66% | 34% | 96% | 55% | 34% | 0% | 10% | 10% | 100% | 10% | 100% | 100% | 100% |
| 2 | 66% | 34% | 96% | 55% | 34% | 0% | 10% | 10% | 100% | 10% | 100% | 100% | 100% |
| 3 | 7% | 93% | 10% | 80% | 30% | 0% | 10% | 0% | 100% | 0% | 0% | 100% | 100% |
| 4 | 7% | 93% | 10% | 80% | 30% | 0% | 10% | 0% | 100% | 0% | 0% | 100% | 100% |
| 5 | 7% | 93% | 10% | 65% | 30% | 0% | 10% | 0% | 100% | 0% | 0% | 100% | 40% |
| 6 | 66% | 34% | 100% | 40% | 34% | 0% | 100% | 100% | 100% | 100% | 0% | 100% | 100% |
| 7 | 66% | 34% | 100% | 40% | 34% | 0% | 100% | 100% | 100% | 100% | 0% | 100% | 100% |
| 8 | 66% | 34% | 100% | 40% | 34% | 0% | 100% | 100% | 100% | 100% | 0% | 100% | 100% |
| 9 | 7% | 93% | 10% | 60% | 30% | 0% | 100% | 0% | 100% | 0% | 0% | 100% | 100% |
| 10 | 7% | 93% | 10% | 60% | 30% | 0% | 100% | 0% | 100% | 0% | 0% | 100% | 100% |
| 11 | 7% | 93% | 10% | 60% | 30% | 0% | 100% | 0% | 100% | 0% | 0% | 100% | 100% |
| 12 | 7% | 93% | 10% | 55% | 30% | 0% | 100% | 0% | 100% | 0% | 0% | 100% | 40% |
| 13 | 7% | 93% | 10% | 60% | 30% | 100% | 100% | 0% | 100% | 0% | 0% | 100% | 100% |
| 14 | 66% | 34% | 96% | 65% | 34% | 0% | 10% | 10% | 100% | 10% | 100% | 100% | 100% |

[2] Households of PZs residents who await the return of commuters prior to beginning the evacuation trip.
[3] Households of PZs residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.
[4] PZs employees who live outside the PZs
[5] People who are in the PZs at the time of an accident for recreational or other (non-employment) purposes.
[6] Residents and employees in the shadow region (outside of the DPZ Outer Ring) who will spontaneously decide to relocate during the evacuation. The basis for the values shown is a 30% relocation of shadow residents along with a proportional percentage of shadow employees. Percent of population for the shadow is only applicable for Regions R01, R02, and R03; for all other cases, the shadow population percentage is 0.
[7] Additional vehicles in the PZs due to the identified special event.
[8] College students who live in college housing.
[9] College students who go to college within the PZs but live outside of the PZs and commute using personal vehicles.
[10] Vehicle-equivalents present on the road during evacuation servicing medical and correctional facilities, schools (including day-camps), and transit-dependent people (1 bus is equivalent to 2 passenger vehicles).
[11] Traffic on freeways and major arterial roads at the start of the evacuation. This traffic is stopped by access control 2 hours after the evacuation begins.

**Table 6-5. DPZ Outer Ring Vehicle Estimates by Scenario[12]**

| Scenario | Households With Returning Commuters | Households Without Returning Commuters | Employees | Transients | Shadow | Special Event | On-Campus Students | Off-Campus Students[13] | Medical and Correctional Facilities[14] | Day Camps | School Buses[15] | Transit Buses | External Through Traffic | Total Scenario Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 93,416 | 48,587 | 18,504 | 4,499 | 153,605 | 0 | 14 | 355 | 540 | 24 | 184 | 338 | 128,144 | 448,210 |
| 2 | 93,416 | 48,587 | 18,504 | 4,499 | 153,605 | 0 | 14 | 355 | 540 | 24 | 184 | 338 | 128,144 | 448,210 |
| 3 | 9,342 | 132,661 | 1,928 | 6,544 | 137,677 | 0 | 14 | 0 | 540 | 0 | 0 | 338 | 128,144 | 417,188 |
| 4 | 9,342 | 132,661 | 1,928 | 6,544 | 137,677 | 0 | 14 | 0 | 540 | 0 | 0 | 338 | 128,144 | 417,188 |
| 5 | 9,342 | 132,661 | 1,928 | 5,317 | 137,677 | 0 | 14 | 0 | 540 | 0 | 0 | 338 | 51,258 | 339,075 |
| 6 | 93,416 | 48,587 | 19,275 | 3,272 | 154,347 | 0 | 140 | 3,554 | 540 | 0 | 1,836 | 338 | 128,144 | 453,449 |
| 7 | 93,416 | 48,587 | 19,275 | 3,272 | 154,347 | 0 | 140 | 3,554 | 540 | 0 | 1,836 | 338 | 128,144 | 453,449 |
| 8 | 93,416 | 48,587 | 19,275 | 3,272 | 154,347 | 0 | 140 | 3,554 | 540 | 0 | 1,836 | 338 | 128,144 | 453,449 |
| 9 | 9,342 | 132,661 | 1,928 | 4,908 | 137,677 | 0 | 140 | 0 | 540 | 0 | 0 | 338 | 128,144 | 415,678 |
| 10 | 9,342 | 132,661 | 1,928 | 4,908 | 137,677 | 0 | 140 | 0 | 540 | 0 | 0 | 338 | 128,144 | 415,678 |
| 11 | 9,342 | 132,661 | 1,928 | 4,908 | 137,677 | 0 | 140 | 0 | 540 | 0 | 0 | 338 | 128,144 | 415,678 |
| 12 | 9,342 | 132,661 | 1,928 | 4,499 | 137,677 | 0 | 140 | 0 | 540 | 0 | 0 | 338 | 51,258 | 338,383 |
| 13 | 9,342 | 132,661 | 1,928 | 4,908 | 137,677 | 4,563 | 140 | 0 | 540 | 0 | 0 | 338 | 128,144 | 420,241 |
| 14 | 93,416 | 48,587 | 18,504 | 4,499 | 153,605 | 0 | 14 | 355 | 540 | 24 | 184 | 338 | 128,144 | 448,210 |

[12] Vehicle estimates are for an evacuation of the entire DPZ Outer Ring (Region R03)
[13] Archbishop Anthony Meagher Catholic Continuing Education Centre evacuate in 70 personal vehicles.
[14] There is 1 vehicle for correctional facilities and 539 vehicles for Medical Facilities.
[15] School Buses include buses required for Colleges and Universities.

**Table 6-6. PZ Vehicle Estimates by Scenario[16]**

| Scenario | Households With Returning Commuters | Households Without Returning Commuters | Employees | Transients | Shadow[17] | Special Event | On-Campus Students | Off-Campus Students[18] | Medical and Correctional Facilities[19] | Day Camps | School Buses[15] | Transit Buses | External Through Traffic | Total Scenario Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 391,252 | 203,501 | 78,137 | 13,602 | 0 | 0 | 111 | 1,255 | 3,253 | 24 | 753 | 1,028 | 128,144 | 821,060 |
| 2 | 391,252 | 203,501 | 78,137 | 13,602 | 0 | 0 | 111 | 1,255 | 3,253 | 24 | 753 | 1,028 | 128,144 | 821,060 |
| 3 | 39,125 | 555,628 | 8,139 | 19,785 | 0 | 0 | 111 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 755,213 |
| 4 | 39,125 | 555,628 | 8,139 | 19,785 | 0 | 0 | 111 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 755,213 |
| 5 | 39,125 | 555,628 | 8,139 | 16,075 | 0 | 0 | 111 | 0 | 3,253 | 0 | 0 | 1,028 | 51,258 | 674,617 |
| 6 | 391,252 | 203,501 | 81,393 | 9,892 | 0 | 0 | 1,108 | 12,552 | 3,253 | 0 | 7,534 | 1,028 | 128,144 | 839,657 |
| 7 | 391,252 | 203,501 | 81,393 | 9,892 | 0 | 0 | 1,108 | 12,552 | 3,253 | 0 | 7,534 | 1,028 | 128,144 | 839,657 |
| 8 | 391,252 | 203,501 | 81,393 | 9,892 | 0 | 0 | 1,108 | 12,552 | 3,253 | 0 | 7,534 | 1,028 | 128,144 | 839,657 |
| 9 | 39,125 | 555,628 | 8,139 | 14,839 | 0 | 0 | 1,108 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 751,264 |
| 10 | 39,125 | 555,628 | 8,139 | 14,839 | 0 | 0 | 1,108 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 751,264 |
| 11 | 39,125 | 555,628 | 8,139 | 14,839 | 0 | 0 | 1,108 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 751,264 |
| 12 | 39,125 | 555,628 | 8,139 | 13,602 | 0 | 0 | 1,108 | 0 | 3,253 | 0 | 0 | 1,028 | 51,258 | 673,141 |
| 13 | 39,125 | 555,628 | 8,139 | 14,839 | 0 | 4,563 | 1,108 | 0 | 3,253 | 0 | 0 | 1,028 | 128,144 | 755,827 |
| 14 | 391,252 | 203,501 | 78,137 | 13,602 | 0 | 0 | 111 | 1,255 | 3,253 | 24 | 753 | 1,028 | 128,144 | 821,060 |

[16] Vehicle estimates are for an evacuation of all PZs (includes the CPZ) (Region R04).
[17] It is assumed that there are no shadow vehicles beyond the CPZ; hence there are no shadow vehicles when evacuating Region R04. See Section 2.2, assumption 7.
[18] Archbishop Anthony Meagher Catholic Continuing Education Centre and Durham Continuing Education evacuate in 70 and 160 personal vehicles, respectively.
[19] There are 33 vehicles for correctional facilities and 3,220 vehicles for Medical Facilities.

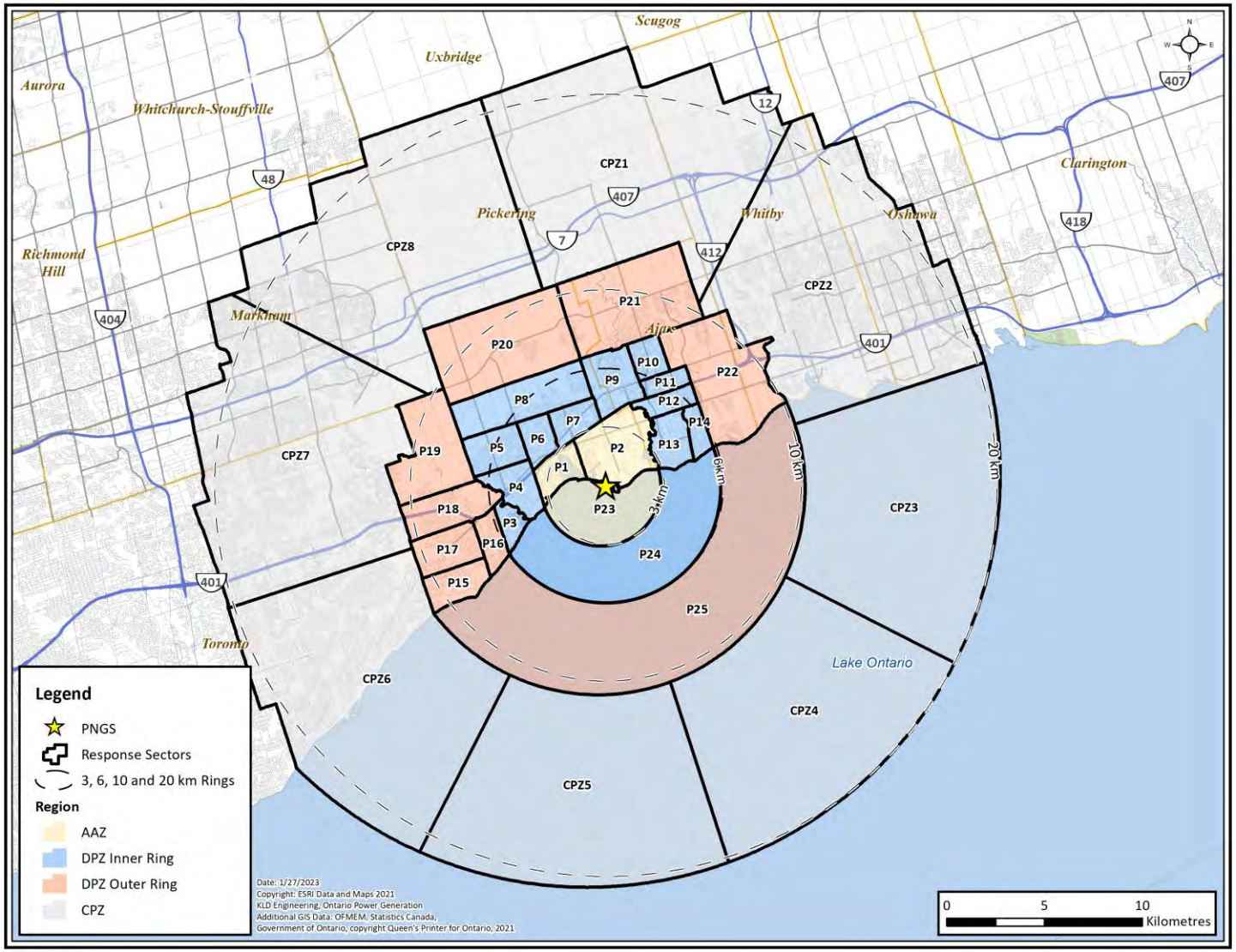



**Figure 6-1. Response Sectors Comprising the PNGS PZs**

# 7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System described in Appendices B, C and D. These results cover 53 regions within the PNGS PZs and the 14 Evacuation Scenarios discussed in Section 6.

The ETE for all Evacuation Cases are presented in Table 7-1 and Table 7-2. These tables present the estimated times to clear the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. The ETE of the automatic action zone in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 and Table 7-6 define the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II System outputs which are generated at 5-minute intervals. Currently, emergency plans are established for the DPZ Outer Ring and contingency plans are established for the CPZ. As such, the results described in this section are divided into the DPZ Outer Ring and all PZs (DPZ Outer Ring plus CPZ).

## 7.1 Voluntary Evacuation and Shadow Evacuation

"Voluntary evacuees" are people within the PZs in Response Sectors for which an advisory to evacuate has not been issued, yet who elect to evacuate. "Shadow evacuation" is the voluntary outward movement of some people from the Shadow Region (outside the DPZ out to 20km) for whom no protective action recommendation has been issued. Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

The ETE for the PNGS PZs addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the PZs, 30% of people located in Response Sectors outside of the evacuation region (who are not advised to evacuate), are assumed to elect to evacuate. Similarly, it is assumed that 30% of those people in the Shadow Region will choose to leave the area. Note that a shadow evacuation was only considered when evacuating Regions R01 (AAZ), R02 (DPZ Inner Ring) and R03 (DPZ Outer Ring). It is assumed no one evacuates beyond the CPZ boundary.

Figure 7-2 presents the area identified as the Shadow Region. This region extends radially from the plant to cover a region between the DPZ Outer Ring boundary and approximately 20 km. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the DPZ (see Section 3.1). As discussed in Section 3.2, it is estimated that a total of 974,896 people reside in the Shadow Region; 30% of them would evacuate. See Table 6-5 for the number of evacuating vehicles from the Shadow Region by scenario for evacuations of the AAZ, DPZ Inner Ring, and DPZ Outer Ring.

Traffic generated within this Shadow Region, traveling away from the PNGS location, has the potential for impeding evacuating vehicles from within the AAZ, DPZ Inner Ring, or DPZ Outer Ring. Regions R01, R02 and R03 ETE calculations include this shadow traffic movement. The

remainder of the regions include voluntary evacuation within Response Sectors not advised to evacuate only.

## 7.2 Staged Evacuation

NUREG/CR-7002, Rev. 1 defines staged evacuation using English units (miles) and the typical planning radii (2, 5 and 10 miles) for U.S. nuclear plants. Adapting the guidance of NUREG/CR-7002, Rev. 1 to Canadian standards and planning radii, staged evacuation consists of the following:

1. Response Sectors comprising the AAZ are advised to evacuate immediately.
2. Response Sectors downwind to the CPZ boundary are advised to shelter in-place while the AAZ is cleared.
3. As vehicles evacuate the AAZ, people downwind within the DPZ and CPZ continue to prepare for evacuation while they shelter.
4. The population sheltering in the DPZ and CPZ is advised to evacuate when approximately 90% of the AAZ evacuating traffic crosses the AAZ boundary.
5. Non-compliance with the shelter recommendation is 30%.

See Section 5.4.2 for additional information on staged evacuation.

## 7.3 Patterns of Traffic Congestion during Evacuation of the DPZ

Figure 7-3 through Figure 7-10 illustrate the patterns of traffic congestion that arise for the case when the entire DPZ Outer Ring (Region R03) is advised to evacuate during the winter, midweek, midday period under good weather conditions (Scenario 6).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2022, page 5-5):

> The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available to describe individually, or in combination, the severity of a LOS F condition:
>
> • *Demand-to-capacity ratios* describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).
>
> • *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h).

• *Spatial extent measures* describe the areas affected by LOS F conditions. They include measures such as the back of queue and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Congestion develops rapidly around concentrations of population and traffic bottlenecks.

Figure 7-3 displays the developing congestion within the study area along Highway 401 and Highway 404 in both directions, as well as along the major arterials that give access to Highway 401 on-ramps (Regional Road 23, Regional Road 41, Rosebank Road and Altona Road) at 30 minutes after the Emergency Bulletin. At this time, only about 7% of the evacuating traffic has mobilized at this point. Traffic on Hwy 401 and Hwy 404 are mostly due to the significant number of external traffic vehicles that traverse these roadways daily (see Section 3.9).

At one hour after the Emergency Bulletin, Figure 7-4 displays worsening congestion throughout the study area with LOS F along almost all major evacuation routes leaving the DPZ. At this time, about one-third of evacuees have mobilized and approximately 14% of vehicles have successfully evacuated the DPZ. Meadowvale Road is congested as transients evacuate from the Toronto Zoo, located in P19. Ajax and the southern portion of Pickering and nearly all major evacuation routes (Brock Road, Church Street, Regional Road 31, Salem Road, Audley Road, Regional Road 23, Regional Road 22, Hwy 30, Taunton Rd, Highway 27, Highway 2 and Highway 401, etc.) are completely congested. As most evacuees from the DPZ Outer Ring have not reached Highway 407 yet, the majority of Hwy 407 is operating below or at capacity (LOS C, D, or E).

At 2 hours and 30 minutes after the Emergency Bulletin, as shown in Figure 7-5, congestion has fully developed throughout the study area. At this time, nearly 90% of vehicles have mobilized and about 40% of evacuating vehicles have successfully crossed the DPZ Outer Ring boundary. Highway 401 throughout the study area is operating at or above capacity (LOS E or F). All major evacuation routes leaving Pickering – Taunton Road westbound and Regional Road 27 and Brock Road Ajax – Church Street, Regional Road 31, and Regional Road 23 northbound, as well as Concession Road 5, Hwy 2, and Regional Road 22 eastbound – experience LOS F conditions. Due to the significant congestion along Highway 401, vehicles utilize local roadways with less capacity – Kingston Road, Ellesmere Road – to the west to evacuate. Evacuees traveling north also experience significant queuing in attempt to access the Highway 407 ramps along Brock Road, and Regional Road 23. Highway 407 eastbound merges onto at Highway 35/115 with a single lane on ramp. Though not pictured, the capacity of Highway 407 travelling eastbound is reduced resulting in congestion and queuing.

At 4 hours and 30 minutes after the Emergency Bulletin, the congestion with the western portion of the Shadow Region (the CPZ) has diminished. Highway 401 and Highway 407 still operate at LOS F conditions, as shown in Figure 7-6. At this time, all evacuees have mobilized and 67% of evacuating vehicles have successfully evacuated the DPZ Outer Ring. Ajax and Pickering are still heavily congested with nearly all north-south and east-west roadways exhibiting LOS F conditions. With the exception of congestion along Highway 401 and a small

section of Regional Rd 22 and Regional Rd 24 in P2, the AAZ is free of congestion. Regional Rd 22 and Regional Rd 24 clear of congestion 45 minutes later at 5 hours and 15 minutes after the Emergency Bulletin. Despite external traffic being stopped by access control 30 minutes earlier, these vehicles are still in the network due to the congestion along Highway 407 and Highway 401. The presence of these vehicles reduces the available roadway capacity for the evacuees within the DPZ Outer Ring. Hence, all roads that access to these highways are operating at LOS F conditions as well.

As shown in Figure 7-7, at 6 hours after the Emergency Bulletin, congestion continues to dissipate in Toronto, Pickering and Ajax (south of Highway 401). Congestion remains along Highway 401, Highway 407 and Highway 404 and along the ramps giving access to these highways. The majority of the evacuation routes leaving Ajax remain heavily congested. Some congestion persists in P4, P5 and P6 as evacuees evacuate southbound to access Highway 401. At this time, approximately 85% of vehicles have successfully evacuated the DPZ Outer Ring. The only road that is still congested inside the AAZ at this time is Highway 401.

One hour later, at 7 hours after the Emergency Bulletin, 96% of vehicles have evacuated the DPZ Outer Ring, as shown in Figure 7-8. Highway 401 in both directions continues to operate at LOS F in Response Sectors P11, P12, P18 and P22. Congestion in the southern portion of Pickering has dissipated. Church Street, Regional Road 5, Harwood Avenue, Regional Road 31 and Pickering Beach Road in Ajax still operate under LOS F conditions at some corridors. Despite more than half of the DPZ population living on the western half of the DPZ, congestion in the western portion clears more quickly than the eastern half since the roadway infrastructure is more advanced near Toronto when compared to Ajax.

Figure 7-9 displays the last bit of congestion in the DPZ along Highway 401 eastbound and Salem Road northbound at 7 hours and 30 minutes after the Emergency Bulletin. At this time, 99% of evacuating vehicles have evacuated the DPZ boundary. All congestion and evacuees within the DPZ clear 15 minutes later at 7 hours and 45 minutes after the Emergency Bulletin. Inside the Shadow Region (CPZ) and beyond, however, Highway 407 eastbound and Highway 418 are still operating at LOS F conditions.

Figure 7-10 displays the patterns of congestion at 8 hours and 30 minutes after the Emergency Bulletin. At this time the DPZ Outer Ring and Shadow Region (CPZ) are completely clear of congestion. Highway 401, Highway 407 and Highway 418 east of the CPZ function at LOS F. As previously mentioned, the capacity along Highway 407 is reduced due to the ramps merging with Highway 35/115 eastbound. Due to this capacity reduction, evacuees are choosing to take Highway 418 southbound to access Highway 401 eastbound instead of utilizing Highway 407. The network is fully clear of congestion 65 minutes later at 9 hours and 35 minutes after the Emergency Bulletin. The last road to clear within the study area is Highway 407 eastbound.

## 7.4 Patterns of Traffic Congestion during Evacuation of all Planning Zones

Figure 7-11 through Figure 7-18 illustrate the patterns of traffic congestion that arise for the case when all PZs (Region R04) are advised to evacuate during the winter, midweek, midday period under good weather conditions (Scenario 6).

As discussed in Section 7.3, all highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Congestion develops rapidly around concentrations of population and traffic bottlenecks.

Figure 7-11 displays the developing congestion within the study area along a number of major evacuation routes including Highway 401, Highway 407 and Highway 404 in both directions at 30 minutes after the Emergency Bulletin. Salem Road northbound is congested leaving Ajax. Thickson Rd, Garrard Rd, Thornton Rd, and Stevenson Rd northbound are congested leaving Whitby and Oshawa. Dundas St/King St is congested eastbound leaving Oshawa. Kingston Rd, Ellesmere Rd, Steeles Ave, Major MacKenzie Dr, and Elgin Mills Rd westbound are all congested as well. At this time, approximately 7% of the population has mobilized and approximately 3% of the vehicles have successfully crossed the CPZ boundary.

Over the next hour and a half congestion continues to build. At 2 hours after the Emergency Bulletin, nearly 76% of evacuees have mobilized and begun their evacuation trip, as shown in Figure 7-12. As a result, the majority of the roads within the study area are operating at LOS F. Congestion conditions can be seen on nearly every north-south and east-west road in the study aera. It is important to note that traffic is moving; it is just moving slowly. Only 19% of vehicles have successfully evacuated the area.

Figure 7-13 displays the patterns of congestion at 4 hours after the Emergency Bulletin. Congestion patterns are similar to those at 2 hours after the Emergency Bulletin. Congestion along Highway 407 and Highway 412 has worsened. At this time, over 99% of vehicles have begun their evacuation trip and about 40% of vehicles have successfully evacuated the CPZ. Nearly 60% of evacuating vehicles are sitting in traffic within the CPZ. At this time, access control is established and external traffic is no longer permitted to flow through the area. The cessation of this flow of vehicles will free up some roadway capacity along Highway 401, Highway 407 and Highway 404 for evacuees.

At 6 hours after the Emergency Bulletin, congestion closest to the plant (the AAZ) has dissipated slightly, as shown in Figure 7-14. At this time, the only remaining congestion within the AAZ is along Highway 401. Congestion in Response Sectors P13 and P14, and along Brock Rd, has also lessened. Heavy congestion remains in all other parts of the study area. At this time, 100% of vehicles have mobilized and 58% of vehicles have successfully evacuated the CPZ.

Congestion slowly dissipates throughout the study area over the next two hours. Figure 7-15 shows the congestion patterns at 8 hours after the Emergency Bulletin. Congestion within the DPZ Outer and Inner rings, as well as the AAZ, has reduced. Congestion in Toronto, Ajax, southern Whitby and southern Oshawa has lessened, but Markham, norther Oshawa, Clarington, and Southern Pickering still remain very congested. Highway 401, Highway 407, Highway 404, Highway 412 and Highway 418 are still operating at LOS F. At this time, 76% of vehicles have successfully crossed the CPZ boundary.

Figure 7-16 displays the last remnants of congestion inside the DPZ Outer Ring within Port Union (Response Sectors P15, P16, and P17) and along Highway 401 and Highway 412 at 9 hours and 30 minutes after the Emergency Bulletin. Congestion within the CPZ remains Along

401 and Highway 407, as well as in Oshawa and Markham. Durham Regional Rd 21, 47/Bloomington Rd and Stouffville Rd remain congested to the north of the study area as well. To the east, Clarington and Highway 418 are also still congested outside of the CPZ. At this time, nearly 90% of vehicles have successfully crossed the CPZ boundary.

Figure 7-17 shows the last remnants of traffic congestion along Highway 401 and Highway 412 within the DPZ Outer Ring at 11 hours after the Emergency Bulletin. The AAZ and DPZ Inner and Outer Rings are completely clear of congestion 10 minutes later at 11 hours and 10 minutes after the Emergency Bulletin. Highway 401 westbound now operates at free-flowing conditions; however, it is still congested in the Eastbound direction. Highway 407 remains severely congested. Parts of Regional Rd 7, Regional Rd 31, and Regional Rd 30 are congested within the CPZ as well. Congestion remains east of the CPZ within parts of Oshawa and Clarington, as well as in northwest Marham to the northwest of the CPZ. At this time, 96% of vehicles have successfully crossed the CPZ boundary.

One hour and 30 minutes later, at 12 hours and 30 minutes after the Emergency Bulletin, the last bit of traffic congestion within the CPZ is along Highway 407, as shown in Figure 7-18. This congestion clears 30 minutes later at 13 hours after the Emergency Bulletin. Durham Regional Rd 21 and 47/Bloomington Rd westbound are operating at LOS F conditions north of the CPZ. East of the CPZ, between Highway 401 and Highway 407 is the last to roadway in the network to clear of congestion. This congestion clears 2 hours and 15 minutes later at 14 hours and 45 minutes after the Emergency Bulletin.

## 7.5 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-19 through Figure 7-32. These figures indicate the rate at which traffic flows out of the indicated areas for the case of an evacuation of the DPZ (Region R03) and all PZs (Region R04 – labelled as CPZ in the figure) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-19, there is typically a long "tail" to these distributions. Vehicles begin to evacuate an area slowly at first, as people respond to the Emergency Bulletin at different rates. Then traffic demand builds rapidly (slopes of curves increase). When the system becomes congested, traffic exits the study area at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the area being evacuated. Towards the end of the process, relatively few evacuation routes service the remaining demand.

Ideally, it would be desirable to fully saturate all evacuation routes equally so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would retain the same slope until the end – thus minimizing evacuation time. In reality, this ideal is generally unattainable reflecting the spatial variation in population density, mobilization rates and in highway capacity over the study area.

## 7.6 Evacuation Time Estimate (ETE) Results

Table 7-1 and Table 7-2 present the ETE values for all 53 Evacuation Regions and all 14 Evacuation Scenarios. Table 7-3 and Table 7-4 present the ETE values for the automatic action zone for both staged and un-staged keyhole regions downwind to the CPZ boundary. The tables are organized as follows:

| Table | Contents |
|---|---|
| 7-1 | ETE represents the elapsed time required for 90% of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios. |
| 7-2 | ETE represents the elapsed time required for 100% of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios. |
| 7-3 | ETE represents the elapsed time required for 90% of the population within the automatic action zone, to evacuate from the automatic action zone with both Concurrent and Staged Evacuations of additional Response Sectors downwind in the keyhole Region. |
| 7-4 | ETE represents the elapsed time required for 100% of the population within the automatic action zone, to evacuate from the automatic action zone with both Concurrent and Staged Evacuations of additional Response Sectors downwind in the keyhole Region. |

The animation snapshots described above reflect the ETE statistics for the concurrent (un-staged) evacuation scenarios and regions, which are displayed in Figure 7-3 through Figure 7-10 for Region R03 (DPZ Outer Ring) and Figure 7-11 through Figure 7-18 for Region R04 (CPZ). Congestion exists throughout the DPZ Outer Ring and CPZ, but migrates away from PNGS during the course of the evacuation; this is reflected in the ETE statistics:

- The 90$^{th}$ percentile ETE for Region R01 (Automatic Action Zone) are on average 5:05 (hr:mm) for all non-snow and daytime scenarios, about 3:45 for evening scenarios, and about 6:30 for snow scenarios.
- The 90$^{th}$ percentile ETE for Region R02 (DPZ Inner Ring) are approximately 30 minutes longer than the 90$^{th}$ percentile ETE for Region R01 and range between 3:45 and 6:05 (higher for snow).
- The 90$^{th}$ percentile ETE for Region R03 (DPZ Outer Ring) are approximately 55 minutes longer than the 90$^{th}$ percentile ETE for Region R02 and generally range between 4:45 and 7:05 (higher for snow).
- The 90$^{th}$ percentile ETE for Region R04 (all PZs) are approximately 3 hours longer than the 90$^{th}$ percentile ETE for Region R03 and range between 8:00 and 10:45 (higher for snow).

The 100th percentile ETE for the AAZ is 4:30 (15 minutes longer than trip generation time) for evening scenarios (Scenarios 5 and 12). The 100th percentile ETE for daytime, non-snow scenarios are 6:05 on average. Even though the local roads inside Response Sectors clear much earlier, Highway 401, which is at the northern boundary of the AAZ, is congested for a long time, see Figure 7-3 through Figure 7-18. External traffic vehicles along Highway 401 are permitted to enter the study area for the first 4 hours of the evacuation until access control can be established. As a result, the evacuation of those within 3km of PNGS is delayed until the congestion along Highway 401 reduces. As a result, the 100th percentile ETE for the AAZ is longer than the time to mobilize. This fact is less of an issue during evening scenarios as the external traffic along Highway 401 is reduced for evening scenarios. As a result, the 100th percentile ETE for the AAZ for evening scenarios more closely mimics trip generation time. For snow scenarios, the 100th percentile ETE for the AAZ is 7:40 to 7:45.

The 100th percentile ETE for the DPZ Inner Ring is on average 60 minutes longer for all daytime, non-snow scenarios, 35 to 40 minutes longer for evening scenarios and about 75 minutes longer, on average, for the snow scenarios compared to the 100th percentile ETE for the AAZ (R01). The 100th percentile ETE for the DPZ Inner Ring range from 5:05 to 7:35 for non-snow cases and are up to 9:05 for snow cases.

Similarly, the 100th percentile ETE for the DPZ Outer Ring is on average 50 minutes longer for all daytime, non-snow scenarios, about 90 minutes longer, on average, for evening scenarios and about 60 minutes longer, on average, for the snow scenarios compared to the 100th percentile ETE for the DPZ Inner Ring (R02). The 100th percentile ETE for the DPZ Outer Ring range from 6:30 to 8:30 for non-snow cases and are up to 10:15 for snow cases.

The 100th percentile ETE for all PZs, Region R04, range from 11:00 to 15:00 (longer for snow). There are an additional 373,354 additional vehicles in Region R04 Scenario 1 compared to Region R03 Scenario 1 (see Section 6, Table 6-5 and Table 6-6). The additional demand exceeds the available capacity generating significant congestion (see Figure 7-11 through Figure 7-18) and significantly prolonging ETE.

Comparison of Scenarios 9 and 13 in Table 7-1 and Table 7-2 indicates that the Special Event – a large event at the Toronto Zoo – has no significant impact on the ETE for the 90th percentile ETE (at most 15 minutes) and at most a 25 minute increase at the 100th percentile ETE. Although the event attracts an additional 4,563 vehicles into the study area, these vehicles comprise less than 2% of the total demand for Region R03 (less than 1% for an evacuation of the full PZ). There is more significant congestion and bottlenecks in other areas that dictate the 90th and 100th percentile ETE. As discussed in Section 5, transients mobilize quickly, and many have already evacuated the area before significant traffic congestion develops. The 20-to-25-minute differences in the 100th percentile ETE occur when all PZs evacuate, R04, and when DPZ Outer Ring Downwind to the CPZ boundary evacuates towards WNW and NW, Regions R34 and R35. These downwind directions include evacuate CPZ7 and CPZ8 without CPZ6. As such, the impacts of the special event can be seen more easily.

Comparison of Scenarios 1 and 14 in Table 7-1 and Table 7-2 indicates that the roadway closure – one lane westbound on Highway 401 Express from the interchange with Brock Road to the

interchange with McCowan Road – does not have a significant impact on the 90th and 100th percentile ETE (at most 25 minutes) for Regions R01 through Region R04. The impact of the road closure is more significant for Region R53 (a staged evacuation of the full PZ), up to 40-minute increase at the 100th percentile. Region R53 is identical to Region R04, however, the response sectors from the AAZ to the CPZ are sheltered in place until 90% of the AAZ has evacuated. This causes a spike in trip generation as nearly 80% of vehicles between the AAZ and CPZ leave within a 15-minute time frame. The loss in capacity of Highway 401 Express compounded with the spike in traffic demand exacerbates an already overwhelmed roadway system causing even worse congestion, longer delays, more queuing and longer ETE. This is discussed in more detail in Section 7.7. As shown in Figure 7-9 and Figure 7-17, the western/westbound portion of the DPZ and CPZ clear before the eastbound portion. This is due to the larger roadway capacity on the west compared to the east. As a result, the congestion to the east dictates ETE, rather than the westbound congestion. A loss in capacity in the westbound direction has some impact, but not enough to significantly impact the ETE.

These results show that events such as adverse weather or traffic accidents which close a lane on a major evacuation route, could impact ETE. Regional and municipal police could consider traffic management tactics such as using the shoulder of the roadway as a travel lane or re-routing of traffic along other evacuation routes to avoid overwhelming major evacuation routes.

## 7.7 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation studies. Note that Regions R37 through R53 are the same geographic areas as Regions R05 through R20 and R04, respectively. The times shown in Table 7-3 and Table 7-4 are when the automatic action zone is 90% clear and 100% clear, respectively.

The objective of a staged evacuation strategy is to minimize the ETE for the AAZ without significantly affecting the exposure of those beyond 3km. When evacuating all PZs (Region R04), the 90th percentile ETE for the AAZ is as much as 3 hours and 50 minutes longer than when evacuating just the AAZ (R01) by itself; compare R01 and R04 in Table 7-3.

In addition, when evacuating the AAZ and downwind to the CPZ boundary, the 90th percentile ETE for the AAZ increases by up to 2 hours and 20 minutes. The 90th percentile ETE increases for nearly all cases except those wherein the AAZ evacuates concurrently with Response Sectors that are over mostly water (Regions R10 through R13). In these cases, the 90th percentile ETE of the concurrent evacuation of the keyhole is the same as the AAZ by itself. For all other cases (except evening scenarios), the evacuation of the densely populated communities in surrounding the AAZ (Toronto, Ajax and Oshawa) causes significant traffic congestion along Highway 401 and Kingston Road. These major evacuation routes are also used by evacuees from the AAZ. Those vehicles evacuating from Toronto, Ajax and Oshawa slow the egress of vehicles from Pickering, resulting in longer ETE for the AAZ. Thus, staging the evacuation to allow the evacuees from the AAZ to clear prior to evacuating Ajax and Oshawa would benefit evacuees that are closest to the plant. (Note these impacts are not seen during evening cases

due to the reduction to external traffic by 60% and the resulting additional available capacity on Highway 401.)

To determine the effect of staged evacuation on residents beyond the AAZ, Regions R04 and R05 through R20 are compared to Regions R53 and R37 through R52, respectively, in Table 7-1. The 90$^{th}$ percentile ETE for most regions increase when staging the evacuation with some regions increasing by up to 2 hours and 20 minutes. As shown in Figure 5-5, staging the evacuation causes a significant "spike" (sharp increase) in mobilization (trip-generation rate) of evacuating vehicles: 80 percent of the evacuating vehicles between the AAZ and the CPZ who have sheltered in place while residents within the AAZ evacuated, begin their evacuation trip over a 15-minute timeframe. This spike oversaturates evacuation routes, increases traffic congestion and prolongs ETE.

In summary, a staged evacuation protective action strategy could benefit those people evacuating from within the AAZ. Although staged evacuation can be disadvantageous to those people living beyond 3km from the plant, it does expedite the evacuation of those evacuees from within the AAZ under certain circumstances.

## 7.8 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (The US NRC guidance calls for the 90$^{th}$ percentile). The applicable value of ETE within the chosen Table may then be identified using the following procedure:

1. Identify the applicable **Scenario**:
   - Season
     - Summer
     - Winter (also Autumn and Spring)
   - Day of Week
     - Midweek
     - Weekend
   - Time of Day
     - Midday
     - Evening
   - Weather Condition
     - Good Weather
     - Rain/Light Snow
     - Heavy Snow
   - Special Event
     - Large Event at the Toronto Zoo
     - Road Closure (One lane on Highway 401 Express WB is closed).
   - Evacuation Staging
     - No, Staged Evacuation is not considered
     - Yes, Staged Evacuation is considered

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The conditions of a summer evening (either midweek or weekend) and rain are not explicitly identified in the Tables. For these conditions, Scenarios (2) and (4) apply.
- The conditions of a winter evening (either midweek or weekend) and rain/light snow are not explicitly identified in the Tables. For these conditions, Scenarios (7) and (10) for rain/light snow apply.
- The conditions of a winter evening (either midweek or weekend) and heavy snow are not explicitly identified in the Tables. For these conditions, Scenarios (8) and (11) for heavy snow apply.
- The seasons are defined as follows:
  - Summer assumes that public schools are not in session.
  - Winter (includes Spring and Autumn) considers that public schools are in session.
- Time of Day: Midday implies the time over which most commuters are at work/college or are travelling to/from work/college.

2. With the desired percentile ETE and Scenario identified, now identify the **Evacuation Region**:
   - Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation: towards N, NNE, NE…
   - Determine the distance that the Evacuation Region will extend from the nuclear power plant. The applicable distances and their associated candidate Regions are given below:
     - Automatic Action Zone (Region R01)
     - Detailed Planning Zone Inner Ring (Region R02)
     - Detailed Planning Zone Outer Ring (Region R03)
     - To Contingency Planning Zone Boundary (R04 through R16)
   - Enter Table 7-5 through Table 7-6 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the PNGS. Select the Evacuation Region identifier in that row, based on the azimuth direction of the plume, from the first column of the Table.
3. Determine the **ETE Table** based on the **percentile** selected. Then, for the **Scenario** identified in Step 1 and the **Region** identified in Step 2, proceed as follows:

The columns of Table 7-1 and Table 7-2 are labelled with the Scenario numbers. Identify the proper column in the selected Table using the Scenario number defined in Step 1.

- Identify the row in the table that provides ETE values for the Region identified in Step 2.
- The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours:Minutes.

<u>Example</u>

It is desired to identify the ETE for the following conditions:

- Sunday, August 10th at 4:00 AM.
- It is raining.
- Wind direction is toward the northeast (NE).
- Wind speed is such that the distance to be evacuated is the full AAZ only.
- The desired ETE is that value needed to evacuate 90 percent of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as summer, weekend, evening and raining. Entering Table 7-1, it is seen that there is no match for these descriptors. However, the clarification given above assigns this combination of circumstances to Scenario 4.
2. Enter Table 7-5 and locate the Region described as "AAZ" read Region R01.
3. Enter Table 7-1 to locate the data cell containing the value of ETE for Scenario 4 and Region R01. This data cell is in column (4) and in the row for Region R01; it contains the ETE value of 5:20.

**Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring, Detailed Planning Zone Outer Ring, and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R02** | 5:25 | 5:55 | 5:15 | 6:05 | 3:45 | 5:35 | 6:05 | 7:15 | 5:10 | 6:00 | 7:00 | 3:45 | 5:20 | 5:50 |
| **R03** | 6:20 | 7:05 | 6:00 | 6:35 | 4:55 | 6:25 | 7:05 | 8:25 | 6:00 | 6:45 | 8:00 | 4:45 | 6:00 | 6:45 |
| **R04** | 9:30 | 10:15 | 8:55 | 9:40 | 8:00 | 9:45 | 10:45 | 12:20 | 8:40 | 9:35 | 11:15 | 8:00 | 8:45 | 9:40 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 9:10 | 10:10 | 8:35 | 9:25 | 7:45 | 9:40 | 10:20 | 12:20 | 8:35 | 9:20 | 11:15 | 8:00 | 8:40 | 9:15 |
| **R06** | 9:00 | 10:05 | 8:40 | 9:20 | 7:50 | 9:30 | 10:30 | 11:55 | 8:25 | 9:05 | 10:50 | 7:35 | 8:35 | 9:20 |
| **R07** | 9:10 | 10:05 | 8:35 | 9:15 | 7:55 | 9:20 | 10:20 | 12:05 | 8:25 | 9:20 | 10:50 | 7:35 | 8:40 | 9:15 |
| **R08** | 7:30 | 8:00 | 6:55 | 7:25 | 6:05 | 7:45 | 8:35 | 9:50 | 6:40 | 7:25 | 8:25 | 6:10 | 6:45 | 7:30 |
| **R09** | 7:20 | 7:55 | 6:45 | 7:30 | 6:00 | 7:35 | 8:20 | 9:20 | 6:35 | 7:25 | 8:25 | 6:05 | 6:40 | 7:20 |
| **R10** | 4:55 | 5:25 | 4:45 | 5:20 | 3:45 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 3:40 | 4:50 | 5:00 |
| **R11** | 4:55 | 5:25 | 4:45 | 5:20 | 3:45 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 3:40 | 4:50 | 5:00 |
| **R12** | 4:55 | 5:25 | 4:50 | 5:20 | 3:40 | 4:55 | 5:20 | 6:25 | 4:50 | 5:20 | 6:25 | 3:45 | 4:50 | 5:00 |
| **R13** | 5:25 | 5:50 | 5:05 | 5:35 | 4:55 | 5:30 | 6:15 | 7:15 | 5:05 | 5:35 | 6:45 | 4:50 | 5:05 | 5:30 |
| **R14** | 5:35 | 6:10 | 5:10 | 5:55 | 5:05 | 5:45 | 6:25 | 7:20 | 5:20 | 5:45 | 6:55 | 5:00 | 5:20 | 5:50 |
| **R15** | 7:40 | 8:15 | 7:10 | 7:40 | 6:50 | 7:50 | 8:35 | 9:45 | 7:05 | 7:40 | 9:05 | 6:45 | 7:10 | 7:45 |
| **R16** | 7:50 | 8:35 | 7:15 | 7:45 | 7:00 | 8:00 | 8:45 | 10:00 | 7:15 | 7:45 | 9:15 | 7:00 | 7:15 | 7:50 |
| **R17** | 8:15 | 8:50 | 7:25 | 8:10 | 7:15 | 8:20 | 9:10 | 10:35 | 7:25 | 8:15 | 9:40 | 7:05 | 7:35 | 8:20 |
| **R18** | 7:00 | 7:35 | 6:25 | 7:05 | 6:00 | 7:05 | 7:45 | 9:10 | 6:25 | 7:00 | 8:10 | 5:50 | 6:30 | 7:10 |
| **R19** | 6:55 | 7:35 | 6:25 | 7:05 | 5:55 | 7:00 | 7:35 | 8:50 | 6:20 | 7:00 | 8:05 | 5:55 | 6:25 | 7:15 |
| **R20** | 4:55 | 5:25 | 4:50 | 5:05 | 3:45 | 5:05 | 5:25 | 6:20 | 4:45 | 5:10 | 5:55 | 3:45 | 4:45 | 5:05 |
| **Evacuate Detailed Planning Zone Outer Ring and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R21** | 9:20 | 10:10 | 8:35 | 9:30 | 7:45 | 9:25 | 10:25 | 11:55 | 8:30 | 9:35 | 11:25 | 7:35 | 8:40 | 9:20 |
| **R22** | 9:20 | 10:00 | 8:40 | 9:30 | 7:40 | 9:30 | 10:25 | 12:10 | 8:30 | 9:10 | 11:20 | 7:55 | 8:30 | 9:25 |
| **R23** | 9:10 | 10:05 | 8:45 | 9:35 | 7:40 | 9:35 | 10:40 | 12:05 | 8:35 | 9:35 | 11:10 | 7:40 | 8:35 | 9:30 |
| **R24** | 7:55 | 8:50 | 7:30 | 8:05 | 6:20 | 8:20 | 9:05 | 10:30 | 7:10 | 7:55 | 9:10 | 6:25 | 7:20 | 8:00 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R25** | 7:55 | 8:50 | 7:30 | 8:05 | 6:20 | 8:15 | 9:05 | 10:25 | 7:10 | 7:50 | 9:10 | 6:25 | 7:20 | 8:00 |
| **R26** | 6:10 | 6:50 | 5:50 | 6:20 | 4:40 | 6:15 | 6:55 | 8:05 | 5:50 | 6:20 | 7:45 | 4:40 | 5:50 | 6:30 |
| **R27** | 6:10 | 6:50 | 5:50 | 6:20 | 4:40 | 6:15 | 6:55 | 8:05 | 5:50 | 6:20 | 7:45 | 4:40 | 5:50 | 6:30 |
| **R28** | 6:15 | 6:50 | 5:50 | 6:30 | 4:45 | 6:15 | 7:00 | 8:15 | 5:45 | 6:30 | 7:35 | 4:40 | 5:55 | 6:35 |
| **R29** | 6:35 | 7:15 | 6:05 | 6:45 | 5:20 | 6:35 | 7:20 | 8:45 | 6:10 | 6:45 | 7:55 | 5:25 | 6:10 | 6:45 |
| **R30** | 6:35 | 7:15 | 6:05 | 6:45 | 5:20 | 6:35 | 7:20 | 8:45 | 6:10 | 6:45 | 7:55 | 5:20 | 6:10 | 6:40 |
| **R31** | 8:00 | 8:50 | 7:25 | 8:05 | 7:00 | 8:20 | 9:00 | 10:30 | 7:25 | 8:15 | 9:40 | 7:10 | 7:30 | 8:10 |
| **R32** | 8:00 | 8:50 | 7:25 | 8:05 | 7:00 | 8:20 | 9:00 | 10:30 | 7:25 | 8:15 | 9:40 | 7:10 | 7:30 | 8:10 |
| **R33** | 8:20 | 9:10 | 7:40 | 8:30 | 7:20 | 8:35 | 9:25 | 10:50 | 7:40 | 8:25 | 9:45 | 7:20 | 7:40 | 8:30 |
| **R34** | 7:25 | 8:05 | 6:50 | 7:35 | 6:15 | 7:35 | 8:20 | 9:35 | 6:45 | 7:35 | 8:45 | 6:15 | 6:55 | 7:35 |
| **R35** | 7:25 | 8:15 | 7:00 | 7:35 | 6:15 | 7:35 | 8:25 | 9:45 | 6:55 | 7:35 | 8:50 | 6:15 | 7:00 | 7:40 |
| **R36** | 6:10 | 6:35 | 5:50 | 6:20 | 4:45 | 6:15 | 6:55 | 8:10 | 5:45 | 6:20 | 7:40 | 4:40 | 5:45 | 6:15 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 9:40 | 10:10 | 9:25 | 10:05 | 8:50 | 9:40 | 10:35 | 12:20 | 9:15 | 10:15 | 11:40 | 8:45 | 9:15 | 9:40 |
| **R38** | 9:40 | 10:15 | 9:35 | 10:10 | 8:50 | 9:45 | 10:50 | 12:20 | 9:10 | 9:40 | 11:50 | 8:45 | 9:10 | 9:40 |
| **R39** | 9:40 | 10:05 | 9:30 | 10:10 | 9:00 | 9:45 | 10:20 | 12:10 | 9:10 | 10:05 | 11:35 | 8:50 | 9:10 | 9:40 |
| **R40** | 8:00 | 8:20 | 7:50 | 8:15 | 7:35 | 8:05 | 8:45 | 10:15 | 7:40 | 8:15 | 9:30 | 7:45 | 7:40 | 8:00 |
| **R41** | 7:55 | 8:25 | 7:50 | 8:10 | 7:30 | 8:00 | 8:40 | 10:00 | 7:40 | 8:10 | 9:30 | 7:35 | 7:40 | 7:55 |
| **R42** | 4:55 | 5:25 | 4:45 | 5:20 | 4:05 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 4:05 | 4:50 | 5:00 |
| **R43** | 4:55 | 5:25 | 4:45 | 5:20 | 4:05 | 4:55 | 5:25 | 6:25 | 4:50 | 5:25 | 6:30 | 4:05 | 4:50 | 5:00 |
| **R44** | 4:55 | 5:25 | 4:50 | 5:20 | 4:00 | 4:55 | 5:20 | 6:25 | 4:50 | 5:20 | 6:25 | 4:05 | 4:50 | 5:00 |
| **R45** | 7:00 | 7:25 | 7:05 | 7:25 | 7:15 | 6:55 | 7:20 | 8:30 | 7:00 | 7:25 | 8:35 | 7:10 | 7:00 | 7:05 |
| **R46** | 7:15 | 7:40 | 7:15 | 7:35 | 7:15 | 7:10 | 7:40 | 8:30 | 7:15 | 7:50 | 8:45 | 7:20 | 7:15 | 7:15 |
| **R47** | 8:30 | 8:55 | 8:30 | 9:00 | 8:30 | 8:25 | 8:55 | 10:20 | 8:30 | 8:55 | 10:20 | 8:25 | 8:30 | 8:30 |
| **R48** | 8:30 | 9:05 | 8:35 | 9:05 | 8:30 | 8:30 | 9:05 | 10:25 | 8:40 | 9:10 | 10:40 | 8:30 | 8:40 | 8:40 |
| **R49** | 8:45 | 9:20 | 8:55 | 9:25 | 8:45 | 8:50 | 9:25 | 10:55 | 8:45 | 9:25 | 10:50 | 8:45 | 8:50 | 8:55 |
| **R50** | 7:55 | 8:20 | 7:55 | 8:25 | 7:50 | 7:50 | 8:20 | 9:35 | 7:55 | 8:30 | 9:45 | 7:45 | 7:55 | 7:55 |
| **R51** | 7:45 | 8:10 | 7:45 | 8:15 | 7:40 | 7:45 | 8:10 | 9:25 | 7:50 | 8:10 | 9:25 | 7:50 | 7:50 | 7:50 |
| **R52** | 6:15 | 6:35 | 6:10 | 6:35 | 6:05 | 6:15 | 6:30 | 7:30 | 6:15 | 6:30 | 7:35 | 6:00 | 6:20 | 6:20 |
| **R53** | 9:40 | 10:25 | 9:40 | 10:10 | 9:15 | 9:50 | 10:45 | 12:25 | 9:30 | 10:15 | 12:00 | 9:15 | 9:30 | 9:50 |

**Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring, Detailed Planning Zone Outer Ring, and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R02** | 7:05 | 7:25 | 6:45 | 7:30 | 5:05 | 6:55 | 7:35 | 9:05 | 6:40 | 7:35 | 8:45 | 5:10 | 6:40 | 7:05 |
| **R03** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R04** | 13:10 | 14:35 | 12:40 | 13:30 | 11:00 | 13:00 | 15:00 | 17:00 | 12:00 | 13:40 | 15:25 | 11:20 | 12:20 | 13:20 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 11:55 | 13:00 | 11:10 | 12:35 | 10:00 | 12:20 | 13:35 | 15:50 | 11:10 | 12:15 | 14:30 | 10:10 | 11:10 | 12:05 |
| **R06** | 11:40 | 13:00 | 10:55 | 12:05 | 10:00 | 12:00 | 13:15 | 14:55 | 10:55 | 11:55 | 14:15 | 9:50 | 10:55 | 11:50 |
| **R07** | 11:40 | 12:50 | 10:55 | 11:40 | 10:00 | 11:45 | 13:10 | 15:10 | 10:50 | 11:55 | 14:05 | 9:45 | 10:50 | 11:40 |
| **R08** | 9:45 | 10:10 | 8:55 | 9:20 | 8:00 | 11:20 | 12:10 | 13:40 | 8:30 | 9:30 | 11:00 | 8:35 | 8:30 | 9:50 |
| **R09** | 9:20 | 10:10 | 8:40 | 9:20 | 7:55 | 11:05 | 11:40 | 12:25 | 8:15 | 9:15 | 10:50 | 8:00 | 8:15 | 9:35 |
| **R10** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R11** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R12** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R13** | 8:25 | 9:05 | 7:35 | 8:15 | 7:45 | 8:30 | 9:25 | 10:50 | 7:35 | 8:25 | 9:30 | 7:40 | 7:35 | 8:25 |
| **R14** | 8:35 | 9:20 | 7:50 | 8:40 | 7:45 | 8:40 | 9:25 | 10:50 | 8:00 | 8:25 | 10:10 | 8:00 | 8:00 | 8:40 |
| **R15** | 10:25 | 10:50 | 9:40 | 10:10 | 9:30 | 10:25 | 11:10 | 12:35 | 9:25 | 10:00 | 11:50 | 9:20 | 9:25 | 10:30 |
| **R16** | 10:35 | 11:05 | 9:40 | 10:15 | 9:40 | 10:45 | 11:25 | 13:25 | 9:35 | 10:10 | 11:50 | 9:40 | 9:35 | 10:35 |
| **R17** | 11:20 | 11:35 | 10:25 | 10:40 | 9:55 | 11:15 | 11:55 | 13:30 | 10:10 | 11:15 | 12:25 | 10:00 | 10:10 | 11:35 |
| **R18** | 10:30 | 10:50 | 9:45 | 10:00 | 9:10 | 10:40 | 11:20 | 13:00 | 9:10 | 9:55 | 11:30 | 9:10 | 9:10 | 10:30 |
| **R19** | 10:35 | 11:20 | 9:40 | 10:10 | 9:35 | 10:30 | 10:55 | 13:10 | 9:25 | 10:00 | 11:40 | 9:20 | 9:25 | 10:55 |
| **R20** | 7:05 | 7:30 | 6:55 | 7:30 | 4:55 | 7:05 | 7:30 | 9:15 | 6:55 | 7:35 | 8:35 | 5:15 | 6:55 | 7:05 |
| **Evacuate Detailed Planning Zone Outer Ring and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R21** | 12:15 | 13:40 | 11:35 | 12:45 | 10:30 | 12:25 | 14:00 | 15:25 | 11:30 | 12:55 | 14:40 | 10:25 | 11:30 | 12:15 |
| **R22** | 12:10 | 13:15 | 11:35 | 12:35 | 10:15 | 12:25 | 13:45 | 15:45 | 11:00 | 12:05 | 14:30 | 10:25 | 11:00 | 12:15 |
| **R23** | 12:10 | 13:15 | 11:35 | 12:35 | 10:15 | 12:25 | 13:45 | 15:55 | 11:00 | 12:05 | 14:30 | 10:25 | 11:00 | 12:15 |
| **R24** | 10:30 | 11:30 | 10:00 | 10:50 | 8:50 | 12:00 | 12:30 | 14:40 | 9:40 | 11:05 | 12:55 | 9:20 | 9:40 | 10:30 |
| **R25** | 10:30 | 11:30 | 10:00 | 10:50 | 8:50 | 12:00 | 12:30 | 14:40 | 9:40 | 11:05 | 12:55 | 9:20 | 9:40 | 10:30 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R26** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R27** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R28** | 7:50 | 8:30 | 7:30 | 8:10 | 6:40 | 7:45 | 8:30 | 10:15 | 7:20 | 8:25 | 9:40 | 6:30 | 7:20 | 8:15 |
| **R29** | 8:50 | 9:30 | 8:20 | 9:05 | 8:15 | 8:40 | 9:55 | 11:15 | 8:10 | 8:55 | 10:10 | 8:15 | 8:10 | 8:50 |
| **R30** | 8:50 | 9:30 | 8:20 | 9:05 | 8:15 | 8:40 | 9:55 | 11:15 | 8:10 | 8:55 | 10:10 | 8:15 | 8:10 | 8:50 |
| **R31** | 10:45 | 11:40 | 9:45 | 10:40 | 9:45 | 10:40 | 11:30 | 13:55 | 9:45 | 10:50 | 12:10 | 9:45 | 9:45 | 11:00 |
| **R32** | 10:45 | 11:40 | 9:45 | 10:40 | 9:45 | 10:40 | 11:30 | 13:55 | 9:45 | 10:50 | 12:10 | 9:45 | 9:45 | 11:00 |
| **R33** | 11:30 | 12:00 | 10:20 | 11:05 | 10:10 | 11:20 | 12:35 | 14:30 | 10:25 | 11:15 | 12:50 | 10:15 | 10:25 | 11:40 |
| **R34** | 10:20 | 11:10 | 9:55 | 10:00 | 9:40 | 11:00 | 11:30 | 13:05 | 9:35 | 9:55 | 11:45 | 9:30 | 10:00 | 10:45 |
| **R35** | 10:20 | 11:30 | 9:55 | 10:20 | 9:40 | 11:10 | 11:45 | 13:05 | 9:35 | 9:55 | 11:45 | 9:30 | 10:00 | 10:45 |
| **R36** | 8:00 | 8:25 | 7:40 | 8:10 | 6:40 | 8:15 | 8:30 | 10:10 | 7:40 | 8:15 | 9:50 | 6:40 | 7:40 | 8:00 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 12:25 | 13:00 | 12:25 | 12:50 | 11:10 | 12:20 | 14:00 | 15:30 | 11:40 | 13:05 | 15:50 | 11:10 | 11:40 | 12:25 |
| **R38** | 12:25 | 13:00 | 12:10 | 12:50 | 11:10 | 12:20 | 13:35 | 15:50 | 11:30 | 12:25 | 14:50 | 10:55 | 11:30 | 12:25 |
| **R39** | 12:25 | 12:50 | 12:10 | 12:50 | 11:10 | 12:20 | 13:35 | 16:30 | 11:25 | 12:25 | 16:00 | 10:55 | 11:25 | 12:25 |
| **R40** | 10:20 | 10:55 | 10:00 | 10:40 | 9:20 | 10:30 | 11:55 | 14:00 | 10:00 | 10:45 | 12:15 | 9:45 | 10:00 | 10:25 |
| **R41** | 10:20 | 10:55 | 10:00 | 10:40 | 9:20 | 10:30 | 11:35 | 13:40 | 10:00 | 10:45 | 12:15 | 9:35 | 10:00 | 10:25 |
| **R42** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R43** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R44** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:45 | 6:05 |
| **R45** | 9:30 | 10:05 | 9:40 | 10:10 | 9:40 | 9:40 | 10:15 | 11:40 | 9:30 | 10:10 | 11:35 | 9:30 | 9:30 | 9:45 |
| **R46** | 9:45 | 10:25 | 9:50 | 10:20 | 9:40 | 10:00 | 10:30 | 11:45 | 9:55 | 10:30 | 12:00 | 10:05 | 9:55 | 9:50 |
| **R47** | 11:20 | 11:25 | 11:00 | 11:30 | 10:55 | 11:00 | 11:30 | 13:05 | 11:00 | 11:15 | 13:15 | 11:10 | 11:00 | 11:20 |
| **R48** | 11:20 | 11:30 | 11:15 | 11:45 | 10:55 | 11:00 | 11:40 | 13:40 | 11:25 | 11:35 | 13:35 | 11:20 | 11:25 | 11:20 |
| **R49** | 11:30 | 11:45 | 11:30 | 11:45 | 11:15 | 11:30 | 11:55 | 14:05 | 11:25 | 12:00 | 13:35 | 11:20 | 11:25 | 11:40 |
| **R50** | 10:55 | 11:15 | 11:15 | 11:25 | 10:45 | 11:05 | 11:25 | 12:35 | 10:45 | 11:25 | 13:20 | 10:40 | 10:45 | 10:55 |
| **R51** | 11:00 | 11:40 | 11:10 | 11:30 | 10:55 | 11:00 | 11:30 | 13:00 | 10:55 | 11:15 | 13:15 | 11:05 | 10:55 | 11:00 |
| **R52** | 8:00 | 8:15 | 7:55 | 8:15 | 7:50 | 8:05 | 8:10 | 9:20 | 8:10 | 8:35 | 9:55 | 7:45 | 8:10 | 8:00 |
| **R53** | 12:55 | 14:10 | 12:55 | 13:30 | 11:35 | 13:15 | 14:35 | 17:10 | 12:25 | 13:25 | 15:35 | 11:35 | 12:25 | 13:35 |

**Table 7-3. Time to Clear *90* Percent of the Automatic Action Zone within the Indicated Region**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R04** | 7:45 | 8:45 | 7:40 | 8:20 | 4:00 | 7:45 | 8:40 | 10:05 | 7:30 | 8:15 | 10:00 | 4:05 | 7:55 | 9:05 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 6:30 | 6:55 | 6:30 | 6:30 | 3:40 | 6:35 | 7:10 | 8:15 | 6:15 | 6:50 | 7:40 | 3:45 | 6:15 | 6:25 |
| **R06** | 6:20 | 6:30 | 6:20 | 6:25 | 3:40 | 6:15 | 6:40 | 7:55 | 5:55 | 6:25 | 7:35 | 3:45 | 6:00 | 6:35 |
| **R07** | 5:55 | 5:55 | 6:05 | 6:05 | 3:40 | 6:00 | 6:40 | 7:15 | 5:45 | 6:10 | 7:25 | 3:45 | 6:15 | 6:00 |
| **R08** | 5:40 | 5:55 | 5:25 | 5:50 | 3:40 | 5:30 | 5:55 | 7:00 | 5:30 | 5:55 | 6:55 | 3:45 | 5:20 | 5:30 |
| **R09** | 5:30 | 5:50 | 5:10 | 6:00 | 3:40 | 5:25 | 5:50 | 7:00 | 5:05 | 5:50 | 6:55 | 3:45 | 5:25 | 5:35 |
| **R10** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R11** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R12** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R13** | 4:55 | 5:20 | 4:45 | 5:20 | 3:40 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 3:45 | 4:45 | 5:15 |
| **R14** | 5:10 | 5:40 | 5:00 | 5:25 | 3:40 | 5:15 | 5:45 | 6:40 | 4:55 | 5:30 | 6:35 | 3:45 | 4:55 | 5:35 |
| **R15** | 5:30 | 6:10 | 5:35 | 6:05 | 3:40 | 5:35 | 6:05 | 7:25 | 5:25 | 6:00 | 7:15 | 3:45 | 5:30 | 6:40 |
| **R16** | 5:40 | 6:15 | 5:35 | 6:05 | 3:40 | 5:35 | 6:15 | 7:25 | 5:40 | 6:10 | 7:25 | 3:45 | 5:35 | 7:00 |
| **R17** | 6:05 | 6:40 | 6:00 | 6:40 | 3:40 | 6:10 | 6:45 | 8:10 | 5:45 | 6:40 | 8:05 | 3:45 | 6:05 | 7:35 |
| **R18** | 5:45 | 6:20 | 5:45 | 6:20 | 3:40 | 5:50 | 6:25 | 7:45 | 5:40 | 6:15 | 7:35 | 3:45 | 5:45 | 6:35 |
| **R19** | 6:05 | 6:40 | 6:00 | 6:25 | 3:40 | 6:00 | 6:45 | 7:55 | 5:50 | 6:25 | 7:30 | 3:45 | 5:50 | 6:45 |
| **R20** | 5:15 | 5:50 | 5:10 | 5:45 | 3:40 | 5:20 | 5:40 | 6:50 | 5:10 | 5:45 | 6:40 | 3:45 | 5:05 | 5:40 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 5:10 | 5:55 | 5:05 | 5:45 | 4:40 | 5:15 | 5:55 | 6:50 | 5:05 | 5:50 | 6:50 | 5:00 | 5:05 | 5:15 |
| **R38** | 4:55 | 5:45 | 4:45 | 5:40 | 4:20 | 5:05 | 5:45 | 6:45 | 5:00 | 5:35 | 6:45 | 4:20 | 5:00 | 5:15 |
| **R39** | 4:55 | 5:20 | 4:45 | 5:20 | 4:10 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:10 | 4:45 | 5:15 |
| **R40** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R41** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:00 | 4:45 | 5:15 |
| **R42** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R43** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R44** | 4:55 | 5:20 | 4:45 | 5:20 | 4:00 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R45** | 4:55 | 5:20 | 4:45 | 5:20 | 4:00 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:00 | 4:45 | 5:15 |
| **R46** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R47** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R48** | 4:55 | 5:20 | 4:45 | 5:20 | 4:05 | 4:45 | 5:25 | 6:30 | 4:45 | 5:20 | 6:25 | 4:05 | 4:45 | 5:15 |
| **R49** | 4:55 | 5:50 | 4:45 | 5:20 | 4:35 | 5:15 | 5:55 | 7:05 | 5:05 | 5:40 | 6:55 | 4:35 | 5:05 | 5:35 |
| **R50** | 5:10 | 5:45 | 4:45 | 5:50 | 4:35 | 5:05 | 5:25 | 7:00 | 4:45 | 5:35 | 6:40 | 4:25 | 5:00 | 5:15 |
| **R51** | 4:55 | 5:45 | 5:00 | 5:40 | 4:45 | 5:00 | 5:45 | 7:10 | 5:00 | 5:40 | 6:50 | 4:45 | 4:45 | 5:15 |
| **R52** | 4:55 | 5:40 | 4:45 | 5:40 | 4:35 | 5:05 | 5:25 | 6:50 | 4:45 | 5:35 | 6:45 | 4:35 | 4:45 | 5:15 |
| **R53** | 5:50 | 6:25 | 5:35 | 6:00 | 5:00 | 6:05 | 6:50 | 8:10 | 5:35 | 6:00 | 7:15 | 5:05 | 5:25 | 6:05 |

**Table 7-4. Time to Clear *100* Percent of the Automatic Action Zone within the Indicated Region**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **Evacuate Automatic Action Zone and Contingency Planning Zone** | | | | | | | | | | | | | | |
| **R01** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R04** | 10:05 | 11:10 | 10:00 | 10:40 | 6:35 | 10:15 | 11:35 | 12:50 | 9:25 | 10:40 | 12:40 | 6:45 | 9:55 | 10:25 |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R05** | 9:15 | 9:50 | 8:45 | 9:40 | 4:30 | 9:45 | 10:10 | 12:00 | 8:40 | 9:45 | 10:50 | 4:30 | 8:45 | 9:15 |
| **R06** | 8:50 | 9:50 | 8:35 | 9:05 | 4:30 | 8:55 | 9:50 | 11:20 | 8:15 | 9:05 | 10:50 | 4:30 | 8:20 | 9:15 |
| **R07** | 8:15 | 9:20 | 8:25 | 8:40 | 4:30 | 8:45 | 9:50 | 11:05 | 8:05 | 8:50 | 10:30 | 4:30 | 8:20 | 8:15 |
| **R08** | 7:35 | 8:25 | 7:10 | 7:50 | 4:30 | 7:30 | 8:25 | 9:40 | 7:05 | 7:55 | 9:25 | 4:30 | 7:25 | 7:35 |
| **R09** | 7:15 | 7:55 | 7:05 | 7:45 | 4:30 | 7:15 | 7:45 | 9:05 | 7:00 | 7:40 | 8:50 | 4:30 | 7:00 | 7:15 |
| **R10** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R11** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R12** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R13** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R14** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R15** | 6:40 | 7:35 | 6:50 | 7:30 | 4:30 | 7:05 | 7:40 | 9:15 | 6:35 | 7:25 | 8:45 | 4:30 | 6:45 | 8:10 |
| **R16** | 7:10 | 8:05 | 7:10 | 7:50 | 4:30 | 7:10 | 8:10 | 9:30 | 7:10 | 7:50 | 9:25 | 4:30 | 7:10 | 8:45 |
| **R17** | 7:55 | 8:50 | 7:45 | 8:35 | 4:55 | 8:15 | 8:55 | 11:00 | 7:40 | 8:40 | 10:25 | 6:45 | 8:00 | 9:30 |
| **R18** | 6:55 | 7:35 | 6:50 | 7:40 | 4:30 | 7:05 | 7:45 | 9:20 | 6:55 | 7:25 | 8:55 | 4:30 | 7:00 | 8:10 |
| **R19** | 7:00 | 7:35 | 6:40 | 7:15 | 4:30 | 7:05 | 7:40 | 9:00 | 6:45 | 7:20 | 8:40 | 4:30 | 6:50 | 8:00 |
| **R20** | 6:30 | 7:15 | 6:20 | 7:00 | 4:30 | 6:30 | 7:15 | 8:35 | 6:20 | 6:55 | 8:20 | 4:30 | 6:20 | 6:30 |
| **Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | |
| **R37** | 6:40 | 7:25 | 6:40 | 7:00 | 6:20 | 6:40 | 7:45 | 9:15 | 7:15 | 7:15 | 9:55 | 7:10 | 7:15 | 6:50 |
| **R38** | 6:40 | 7:15 | 6:35 | 6:55 | 6:15 | 6:40 | 7:10 | 9:00 | 6:25 | 6:50 | 9:35 | 7:10 | 6:25 | 6:50 |
| **R39** | 6:25 | 6:55 | 6:10 | 6:50 | 6:00 | 6:30 | 7:10 | 8:40 | 6:00 | 6:45 | 8:10 | 7:10 | 6:05 | 6:25 |
| **R40** | 6:00 | 6:50 | 5:50 | 6:35 | 5:20 | 6:25 | 6:50 | 8:25 | 5:50 | 6:35 | 7:55 | 5:15 | 5:50 | 6:05 |
| **R41** | 6:00 | 6:45 | 5:50 | 6:35 | 5:00 | 6:15 | 6:50 | 8:05 | 5:45 | 6:20 | 7:55 | 5:00 | 5:50 | 6:05 |
| **R42** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R43** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| **R44** | 6:00 | 6:25 | 5:50 | 6:20 | 4:30 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 4:30 | 5:50 | 6:05 |
| **R45** | 6:00 | 6:25 | 5:50 | 6:20 | 5:05 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 5:05 | 5:50 | 6:05 |
| **R46** | 6:00 | 6:25 | 5:50 | 6:20 | 5:20 | 5:50 | 6:50 | 7:45 | 5:45 | 6:20 | 7:40 | 5:05 | 5:50 | 6:05 |
| **R47** | 6:00 | 6:25 | 5:50 | 6:20 | 5:25 | 5:50 | 6:50 | 7:45 | 5:45 | 6:35 | 7:40 | 5:20 | 5:50 | 6:05 |
| **R48** | 6:20 | 6:25 | 6:20 | 6:20 | 5:40 | 5:50 | 6:50 | 7:45 | 5:45 | 6:35 | 7:40 | 5:55 | 6:25 | 7:00 |
| **R49** | 7:45 | 8:10 | 7:40 | 7:40 | 7:15 | 8:15 | 8:45 | 10:00 | 7:55 | 8:45 | 9:05 | 6:55 | 7:55 | 7:45 |
| **R50** | 6:50 | 6:55 | 6:45 | 7:20 | 6:20 | 6:50 | 6:50 | 9:05 | 6:40 | 7:20 | 8:10 | 6:20 | 7:25 | 7:15 |
| **R51** | 6:35 | 7:15 | 6:50 | 7:40 | 6:25 | 6:35 | 7:05 | 8:45 | 6:55 | 7:20 | 8:20 | 6:45 | 7:20 | 7:35 |
| **R52** | 6:40 | 6:50 | 6:40 | 7:00 | 6:20 | 6:40 | 6:50 | 8:10 | 6:50 | 7:15 | 8:10 | 6:20 | 6:50 | 6:50 |
| **R53** | 7:55 | 8:20 | 8:20 | 8:20 | 7:40 | 8:30 | 8:55 | 11:15 | 7:50 | 7:50 | 9:05 | 7:55 | 8:20 | 8:55 |

## Table 7-5. Description of Evacuation Regions

| Region | Description | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R01 | AAZ | X | X | | | | | | | | | | | | | | | | | | | | | X | | | | | | | | | |
| R02 | DPZ Inner Ring | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | X | X | | | | | | | | |
| R03 | DPZ Outer Ring | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | |
| R04 | Full PZ | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R05 | N | X | X | | | | | X | X | X | X | X | X | X | X | | | | | | X | X | X | X | | | X | X | | | | | | X |
| R06 | NNE | X | X | | | | | X | | X | X | X | X | X | X | | | | | | | X | X | X | | | X | X | | | | | | |
| R07 | NE | X | X | | | | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | X | | | | | |
| R08 | ENE | X | X | | | | | | | | | X | X | X | X | | | | | | | | X | X | X | X | | X | X | | | | | |
| R09 | E | X | X | | | | | | | | | | | X | X | | | | | | | | X | X | X | X | | X | X | X | | | | |
| R10 | ESE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | | | | |
| R11 | SE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | X | | | |
| R12 | SSE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | | | |
| R13 | S | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | X | | |
| R14 | SSW | X | X | X | X | | | | | | | | | | | X | X | X | | | | | | X | X | X | | | | | X | X | | |
| R15 | SW | X | X | X | X | | | | | | | | | | | X | X | X | X | | | | | X | X | X | | | | | X | X | X | |
| R16 | WSW | X | X | X | X | X | | | | | | | | | | X | X | X | X | X | | | | X | X | X | | | | | | X | X | |
| R17 | W | X | X | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | | | X | | | | | | | | X | X | X |
| R18 | WNW | X | X | | X | X | X | X | X | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | X |
| R19 | NW | X | X | | | X | X | X | X | X | | | | | | | | | | X | X | X | | X | | | X | | | | | | X | X |
| R20 | NNW | X | X | | | | X | X | X | X | | | | | | | | | | | X | X | | X | | | X | | | | | | | X |
| Evacuate Outer Detailed Planning Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R21 | N | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X |
| R22 | NNE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | |
| R23 | NE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | |
| R24 | ENE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | | | | | |
| R25 | E | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | | | | |
| R26 | ESE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | X | X | | | | |
| R27 | SE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | X | X | X | | | |
| R28 | SSE | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | X | X | | | |
| R29 | S | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | X | X | X | | |
| R30 | SSW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | X | X | | |
| R31 | SW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | X | X | X | |
| R32 | WSW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X | |
| R33 | W | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X | X |
| R34 | WNW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | X | X |
| R35 | NW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | X | X |
| R36 | NNW | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | X |
| Shelter-in-Place | | Response Sector(s) Evacuate | | | | | | | | | | | | | | | Response Sector not within Plume, but Evacuates because it is surrounded by other Response Sectors which are Evacuating | | | | | | | | | | | | | | | | |

## Table 7-6. Description of Staged Evacuation Regions

| Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R37 | N | X | X | | | | | X | X | X | X | X | X | X | X | | | | | | X | X | X | X | | | X | X | | | | | | X |
| R38 | NNE | X | X | | | | | X | | X | X | X | X | X | X | | | | | | | X | X | X | | | X | X | | | | | | |
| R39 | NE | X | X | | | | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | X | | | | | |
| R40 | ENE | X | X | | | | | | | | | X | X | X | X | | | | | | | | X | X | X | X | | X | X | | | | | |
| R41 | E | X | X | | | | | | | | | | | X | X | | | | | | | | X | X | X | X | | X | X | X | | | | |
| R42 | ESE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | | | | |
| R43 | SE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | X | X | X | | | |
| R44 | SSE | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | | | |
| R45 | S | X | X | | | | | | | | | | | | | | | | | | | | | X | X | X | | | | X | X | X | | |
| R46 | SSW | X | X | X | X | | | | | | | | | | | X | X | X | | | | | | X | X | X | | | | | X | X | | |
| R47 | SW | X | X | X | X | | | | | | | | | | | X | X | X | X | | | | | X | X | X | | | | | X | X | X | |
| R48 | WSW | X | X | X | X | X | | | | | | | | | | X | X | X | X | X | | | | X | X | X | | | | | | X | X | |
| R49 | W | X | X | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | | | X | | | | | | | | X | X | X |
| R50 | WNW | X | X | | X | X | X | X | X | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | X |
| R51 | NW | X | X | | | X | X | X | X | X | | | | | | | | | | X | X | X | | X | | | X | | | | | | X | X |
| R52 | NNW | X | X | | | | X | X | X | X | | | | | | | | | | | X | X | | X | | | X | | | | | | | X |
| R53 | Full PZ | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Shelter-in-Place until 90% ETE for R01, then Evacuate | | | | | | | | | | Shelter-in-Place | | | | | | | | | | | | | Response Sector(s) Evacuate | | | | | | | | | | | |

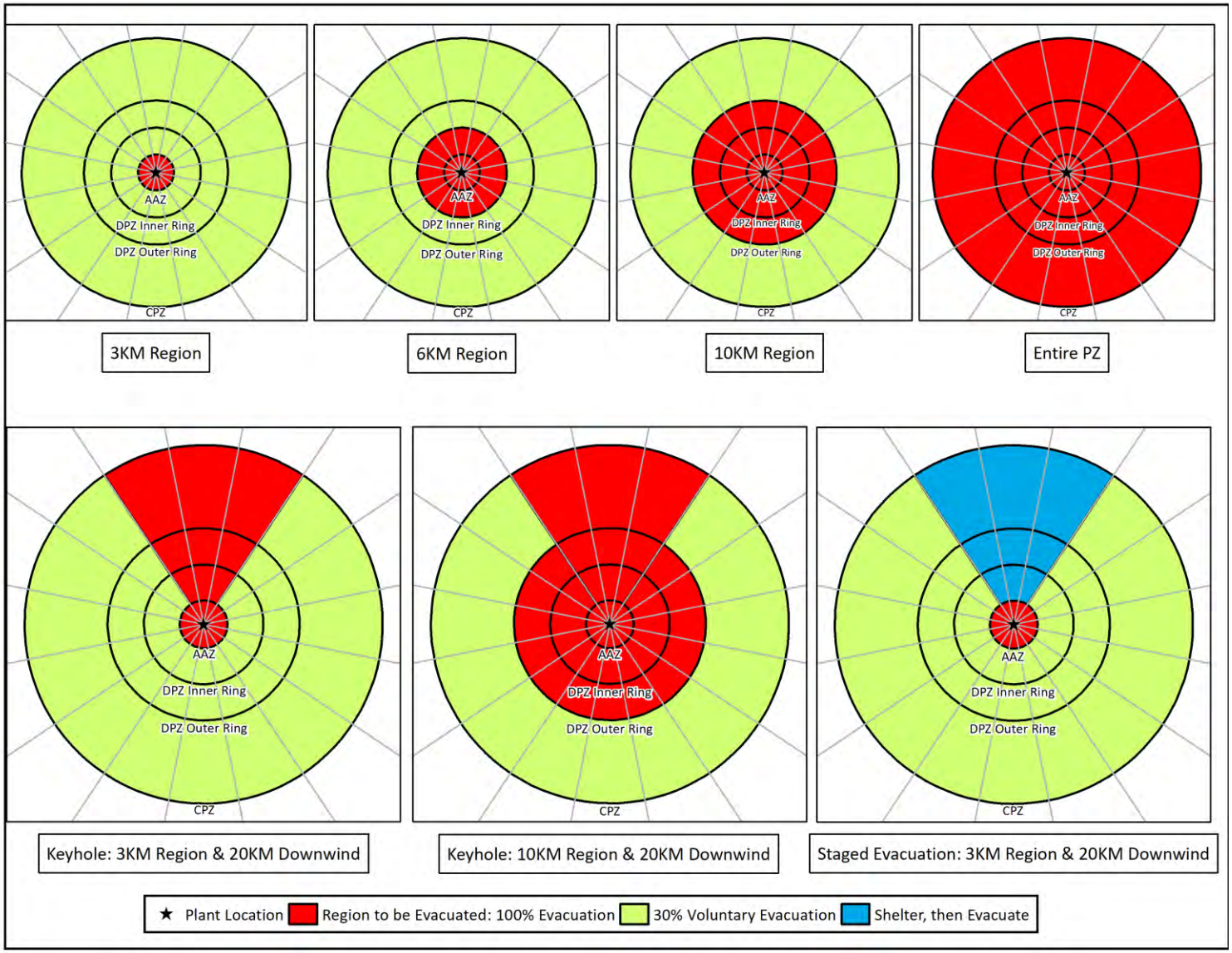



**Figure 7-1. Voluntary Evacuation Methodology**

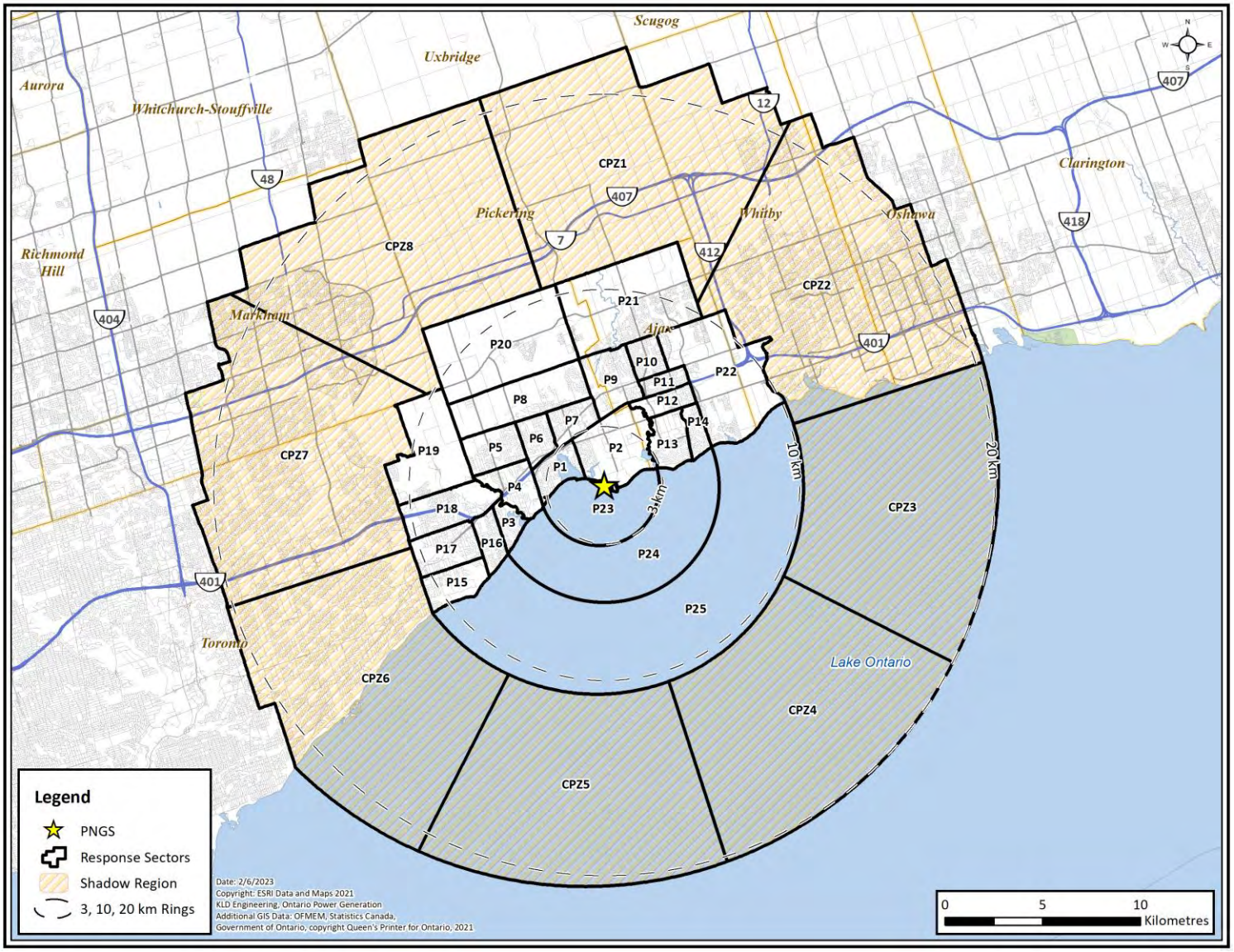



**Figure 7-2. PNGS Shadow Region**

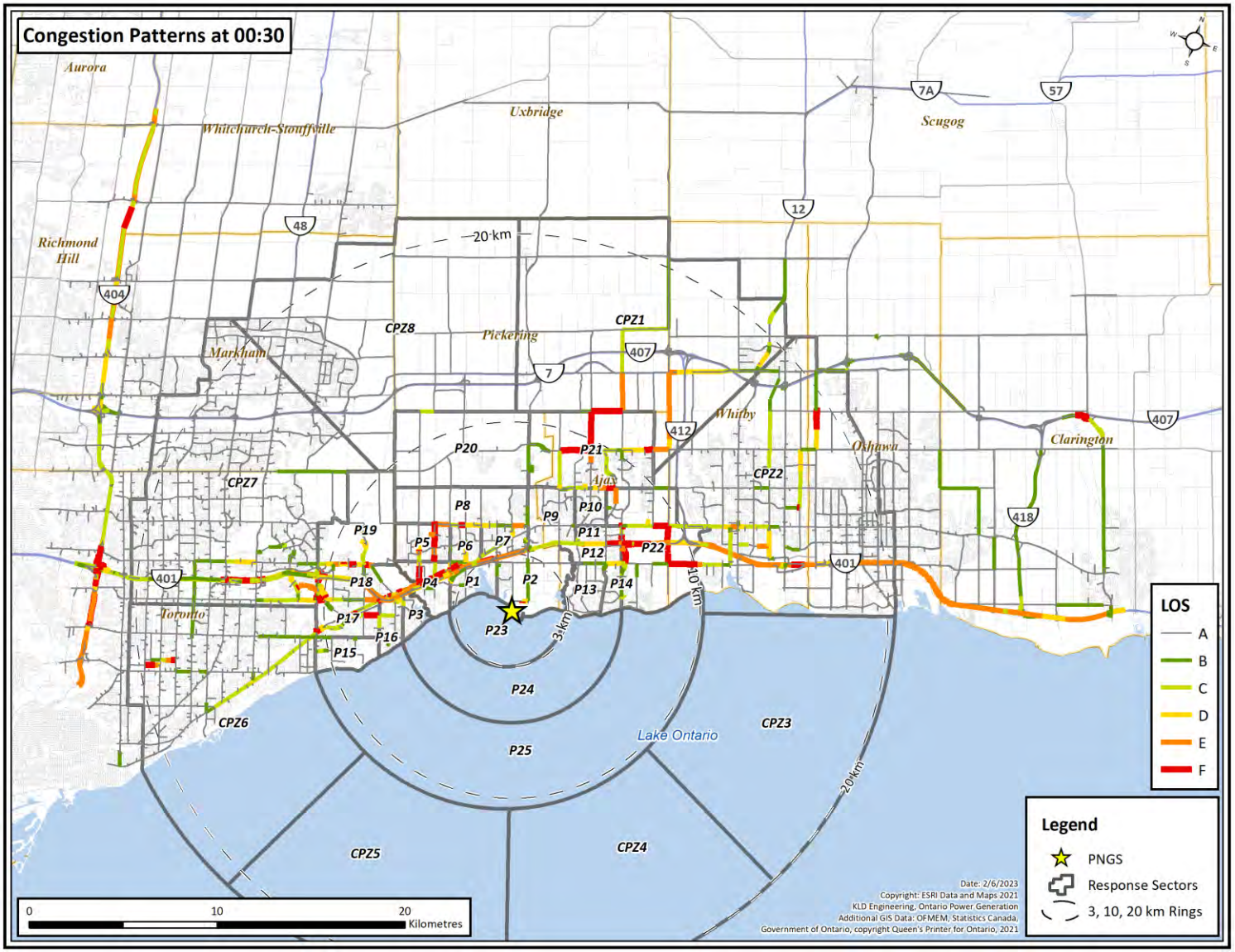



**Figure 7-3. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R03)**

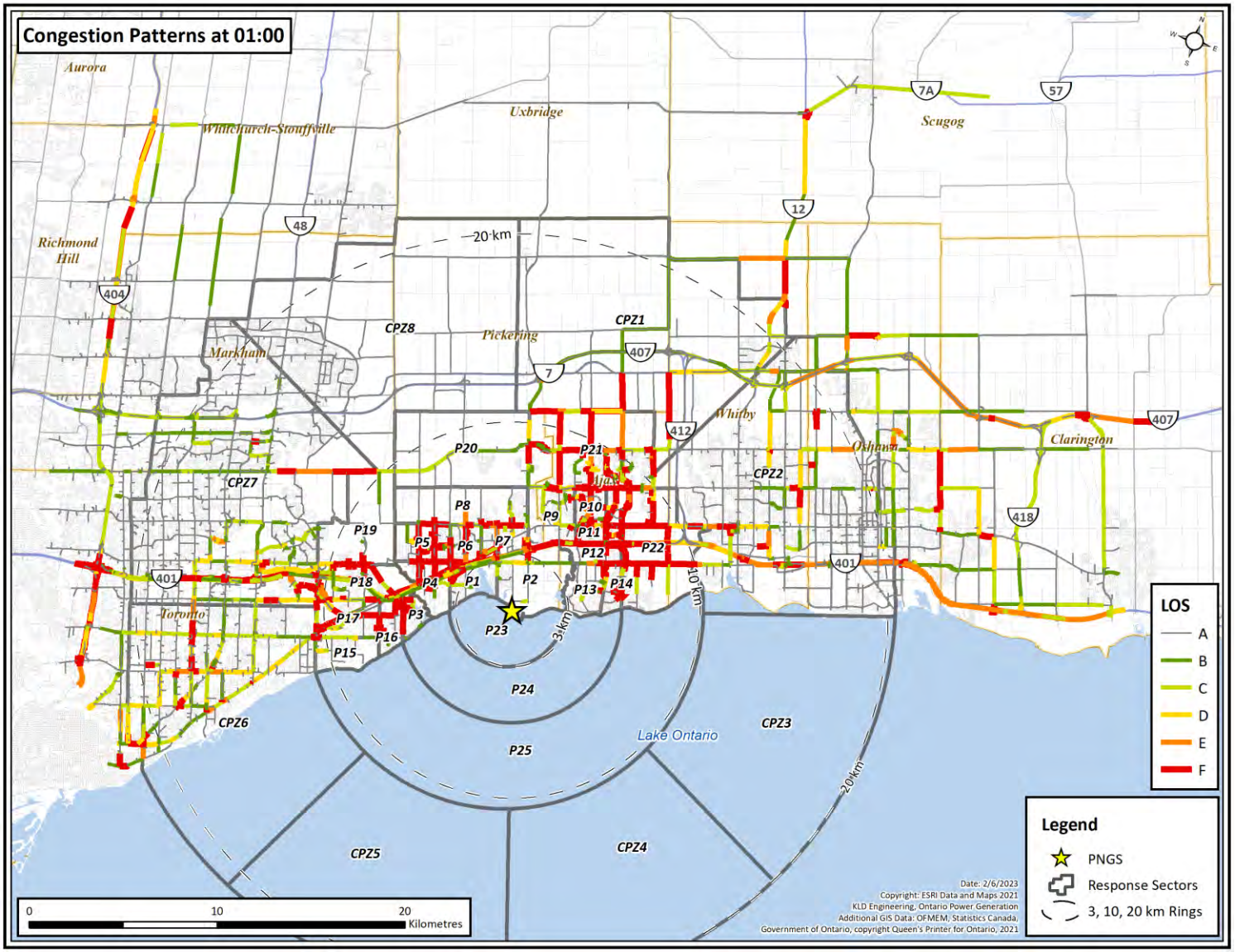



**Figure 7-4. Congestion Patterns at 1 Hour after the Emergency Bulletin (R03)**

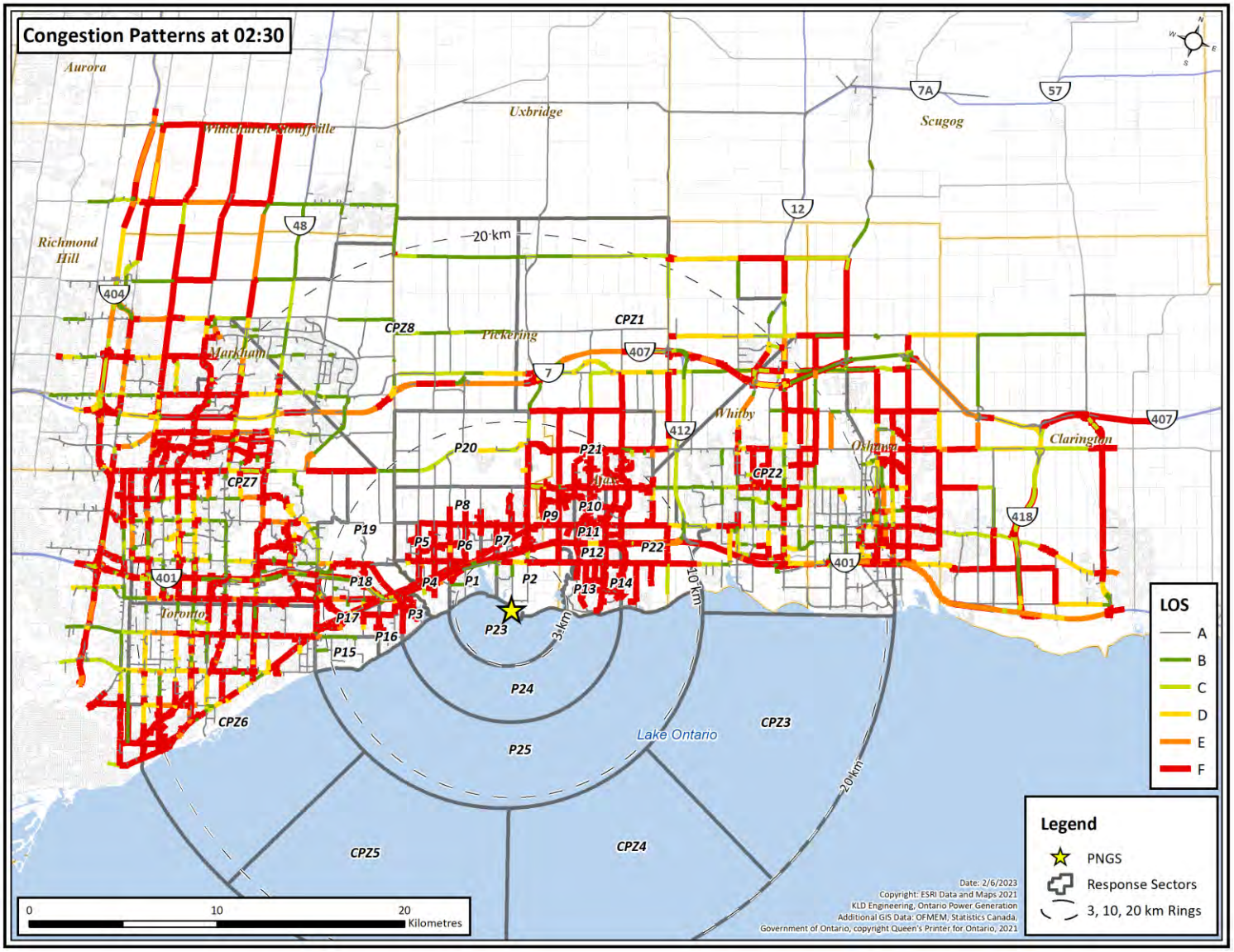



**Figure 7-5. Congestion Patterns at 2 Hours and 30 Minutes after the Emergency Bulletin (R03)**

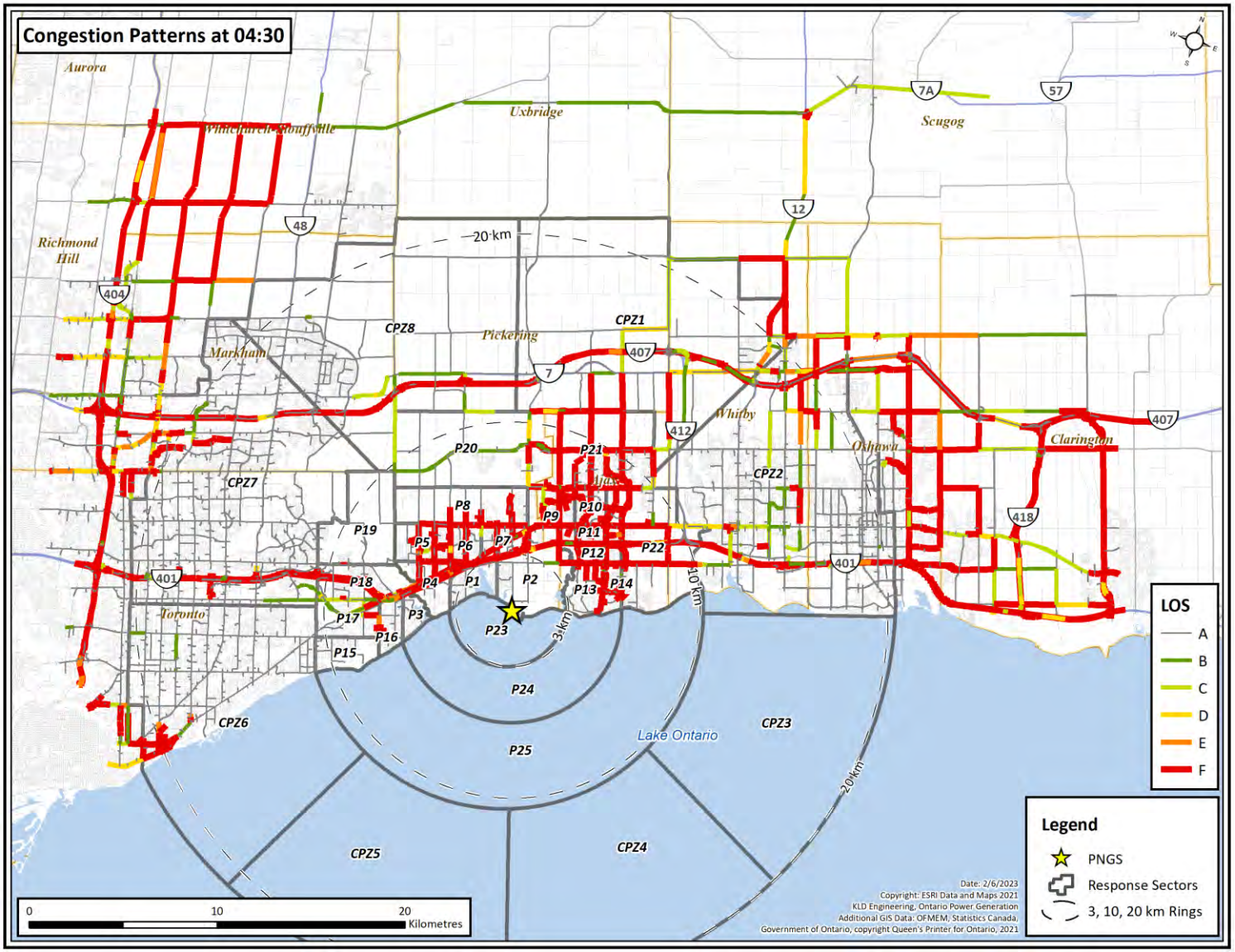



**Figure 7-6. Congestion Patterns at 4 Hours and 30 Minutes after the Emergency Bulletin (R03)**

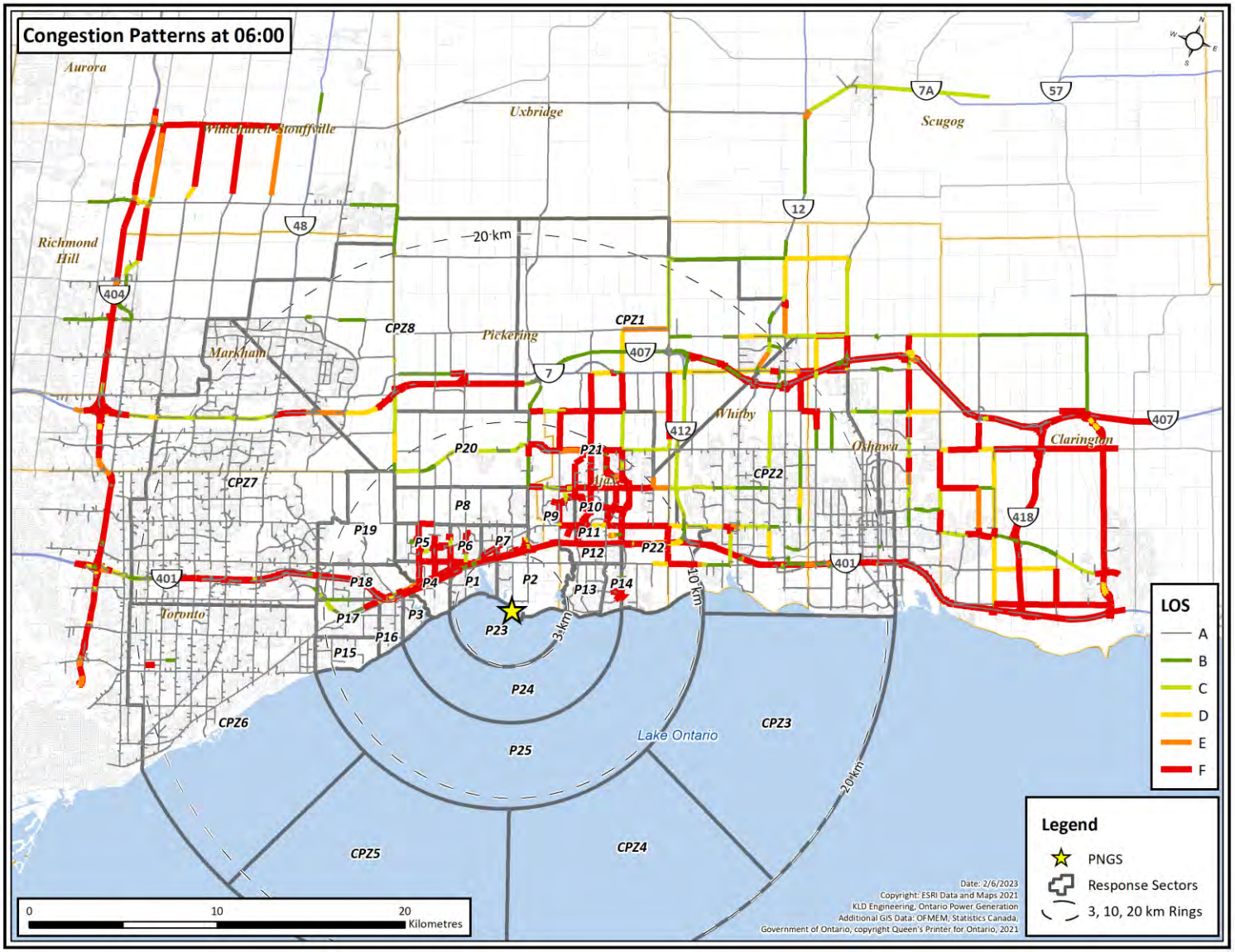



**Figure 7-7. Congestion Patterns at 6 Hours after the Emergency Bulletin (R03)**

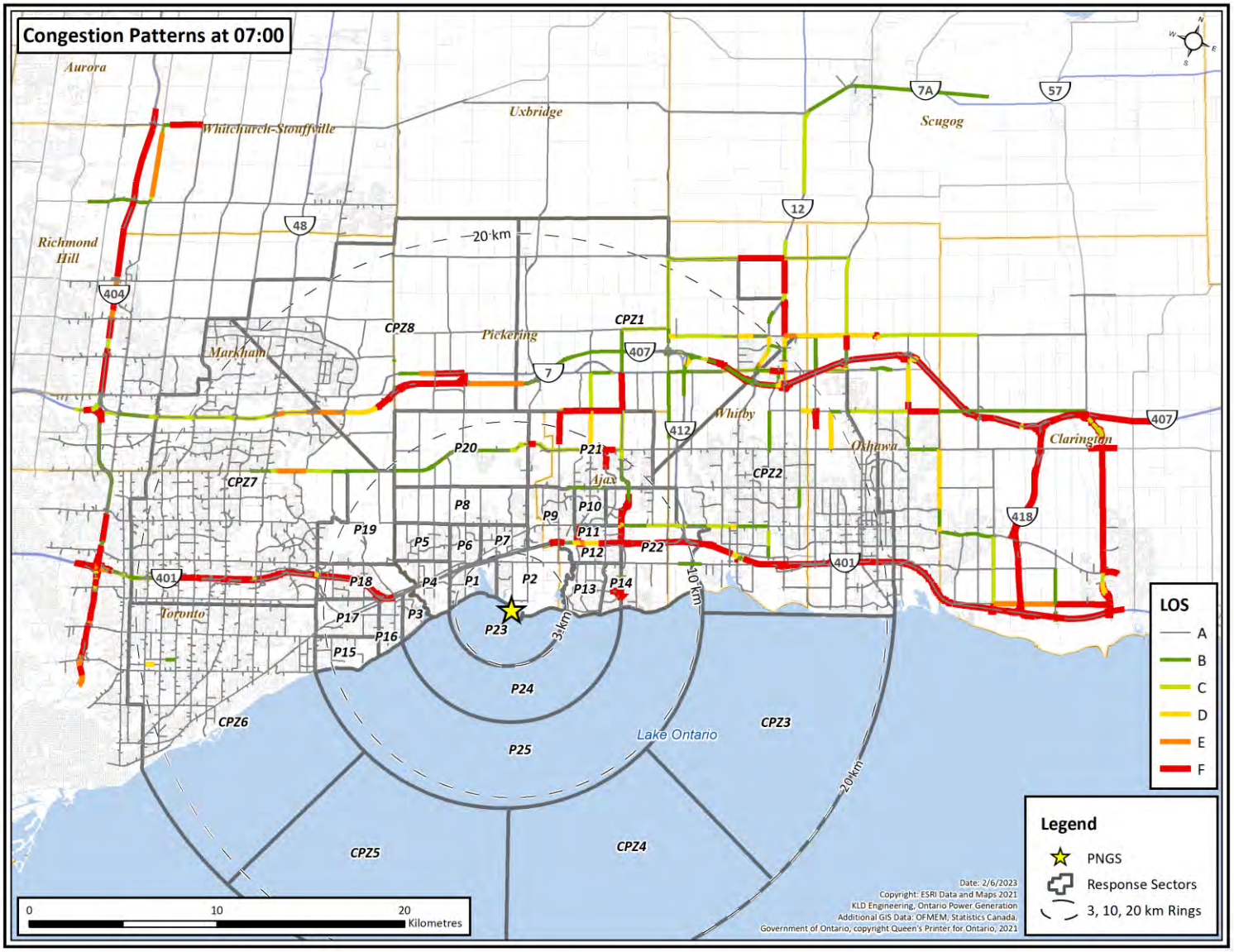



**Figure 7-8. Congestion Patterns at 7 Hours after the Emergency Bulletin (R03)**

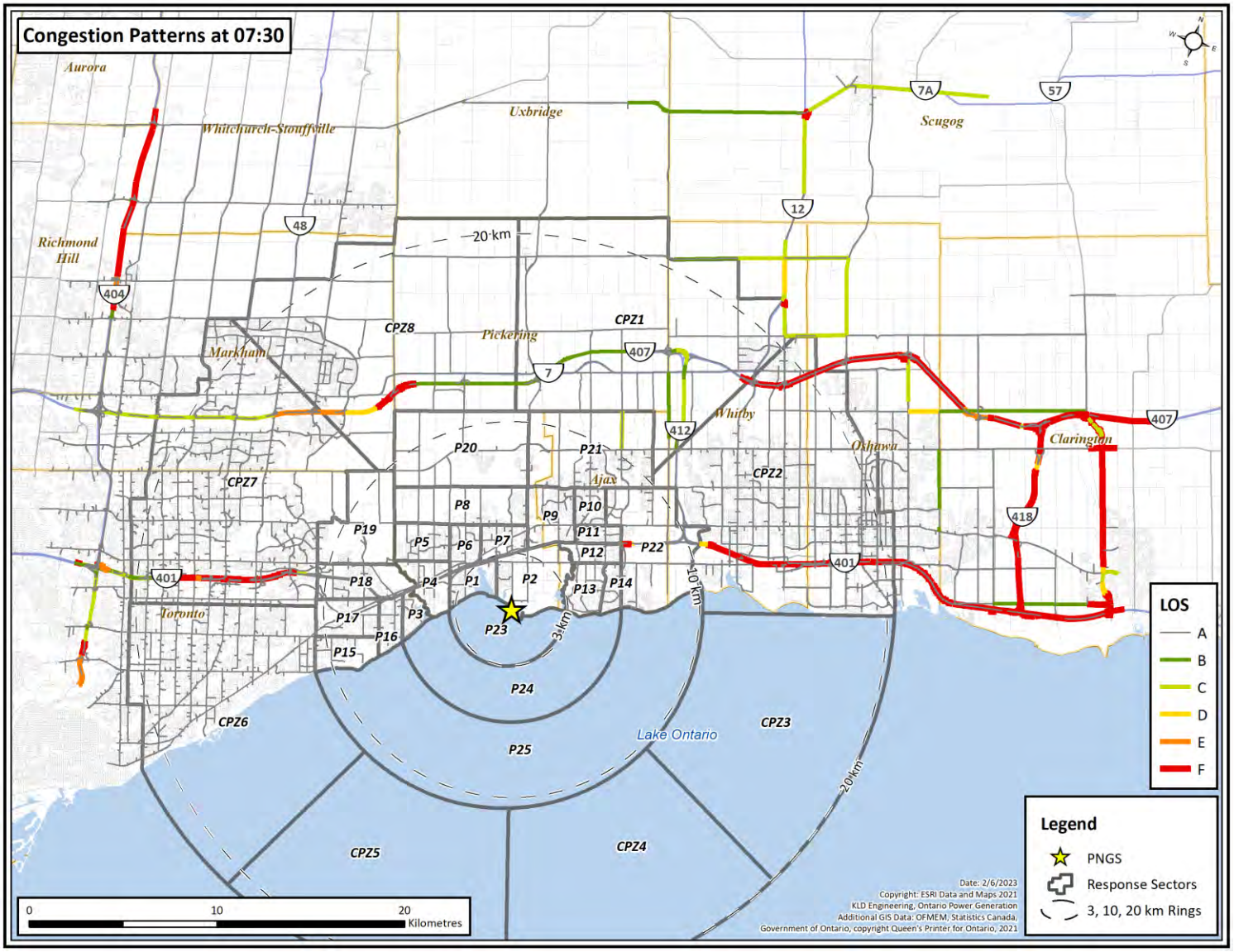



**Figure 7-9. Congestion Patterns at 7 Hours and 30 Minutes after the Emergency Bulletin (R03)**

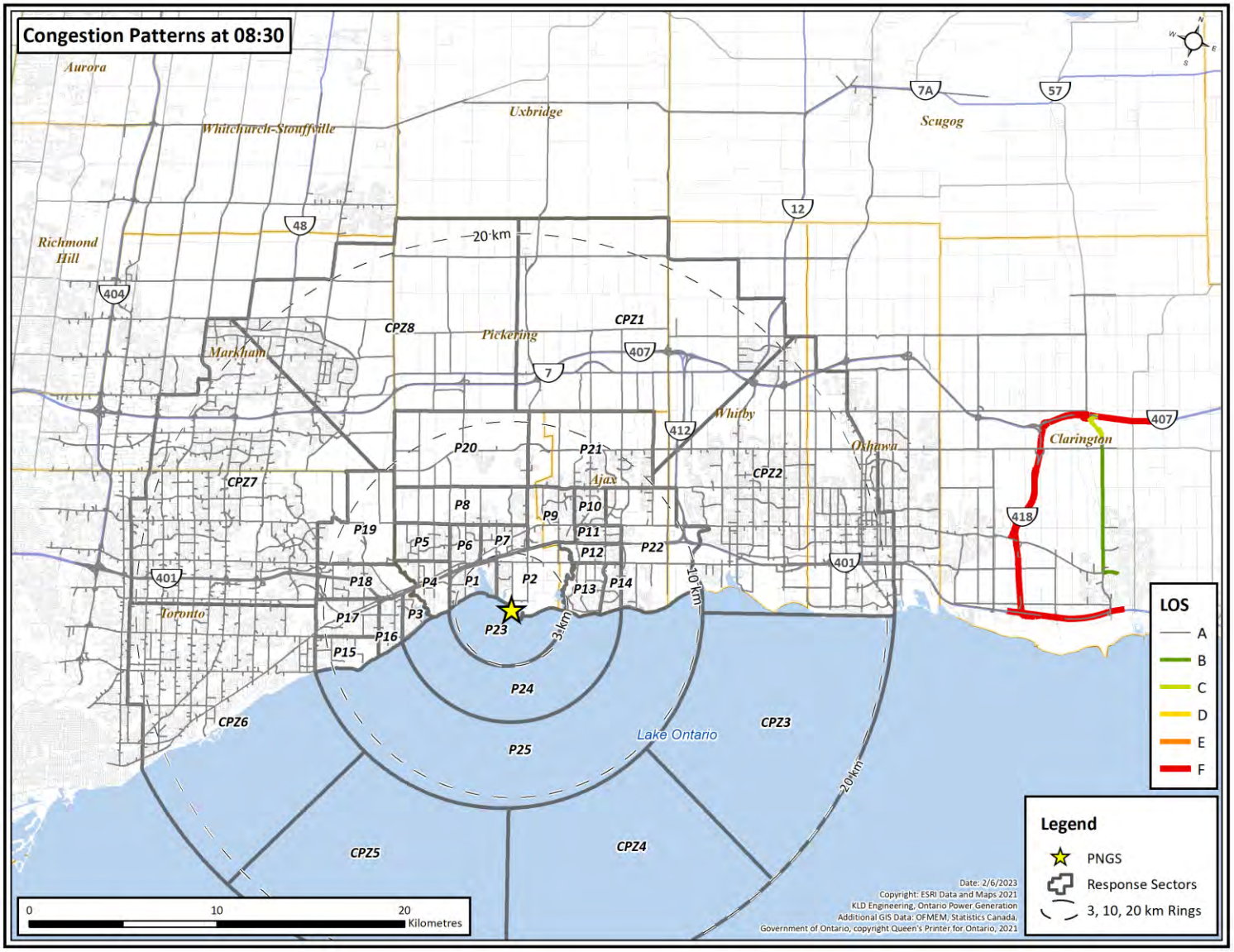



**Figure 7-10. Congestion Patterns at 8 Hours and 30 Minutes after the Emergency Bulletin (R03)**

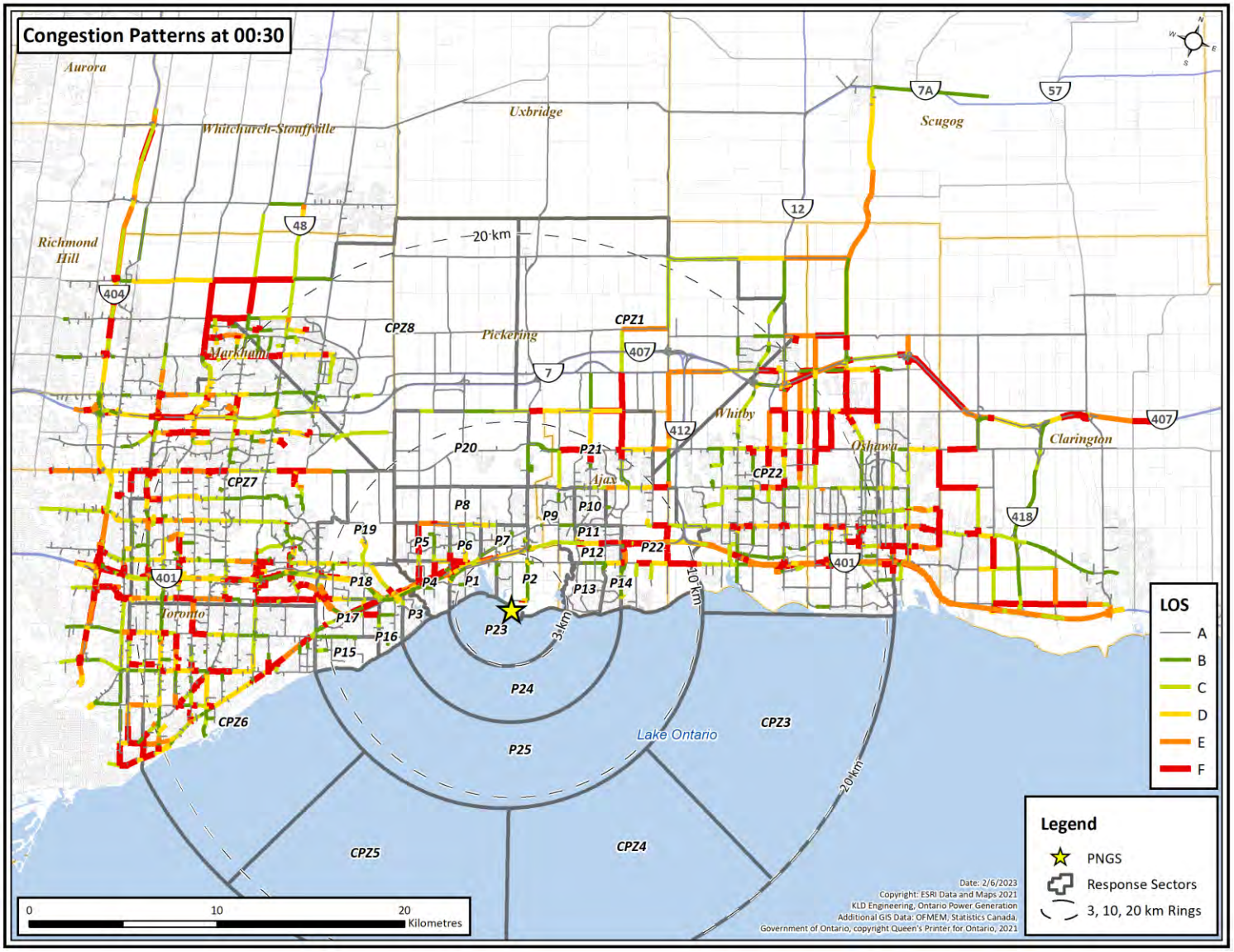



**Figure 7-11. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R04)**

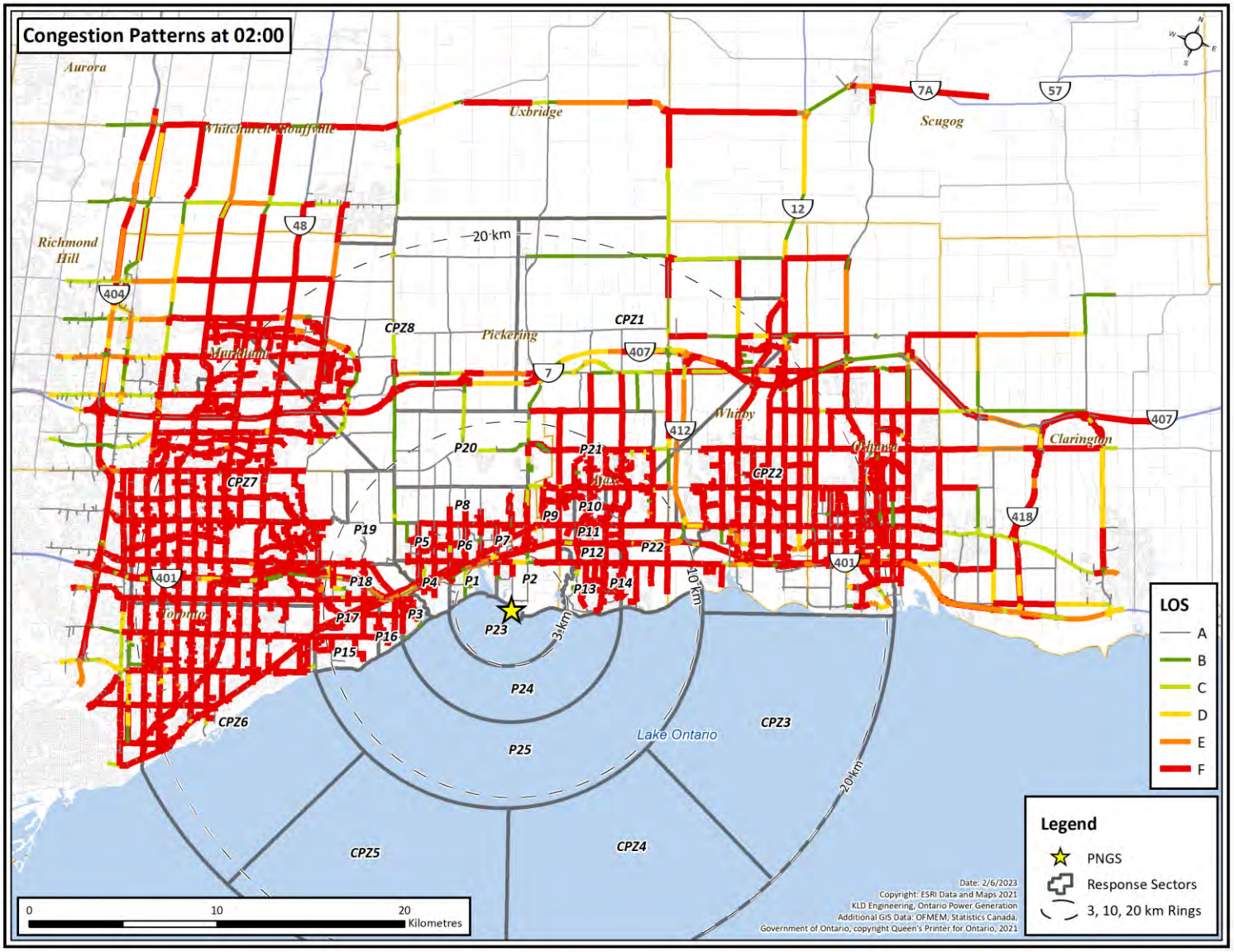



**Figure 7-12. Congestion Patterns at 2 Hours after the Emergency Bulletin (R04)**

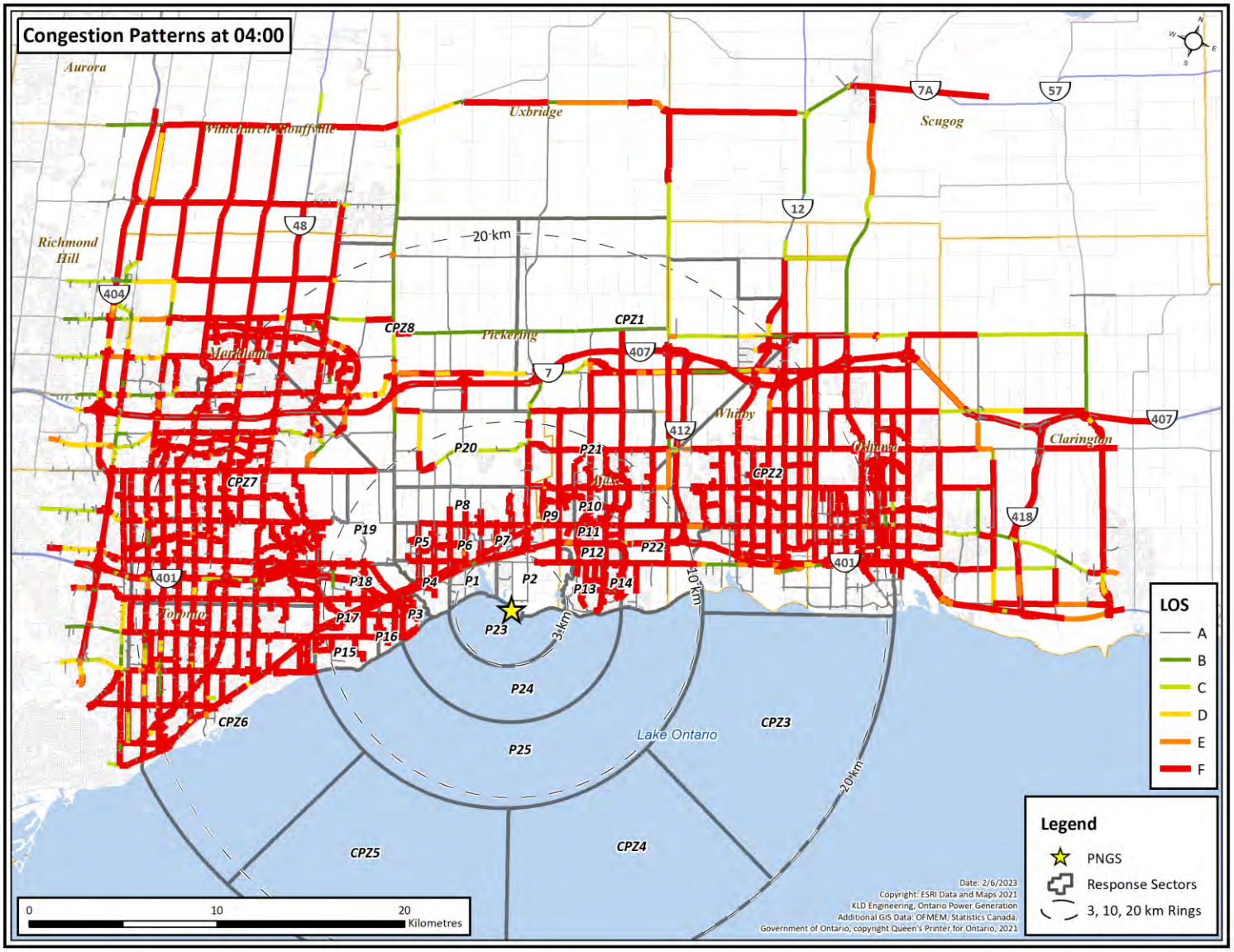



**Figure 7-13. Congestion Patterns at 4 Hours after the Emergency Bulletin (R04)**

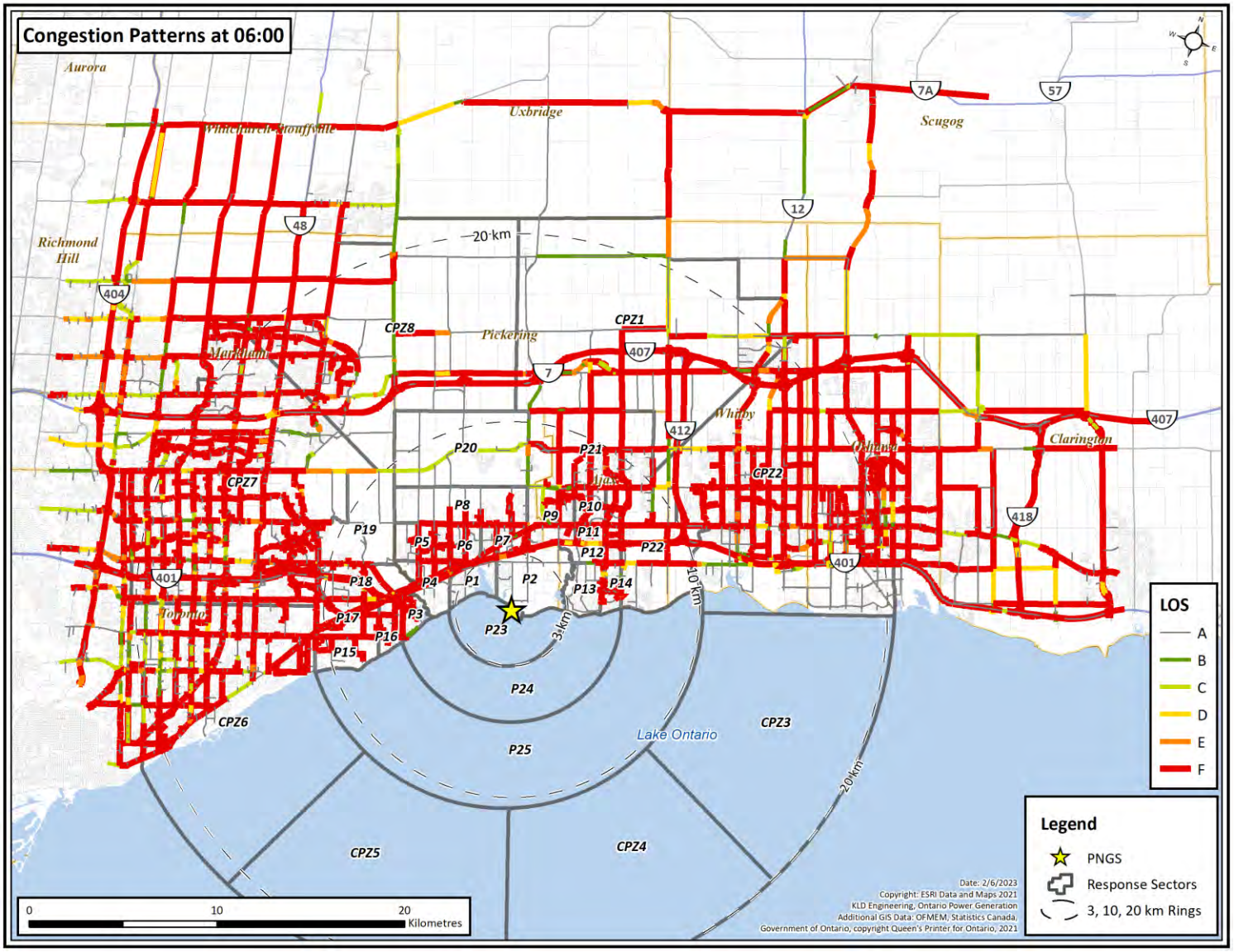



**Figure 7-14. Congestion Patterns at 6 Hours after the Emergency Bulletin (R04)**

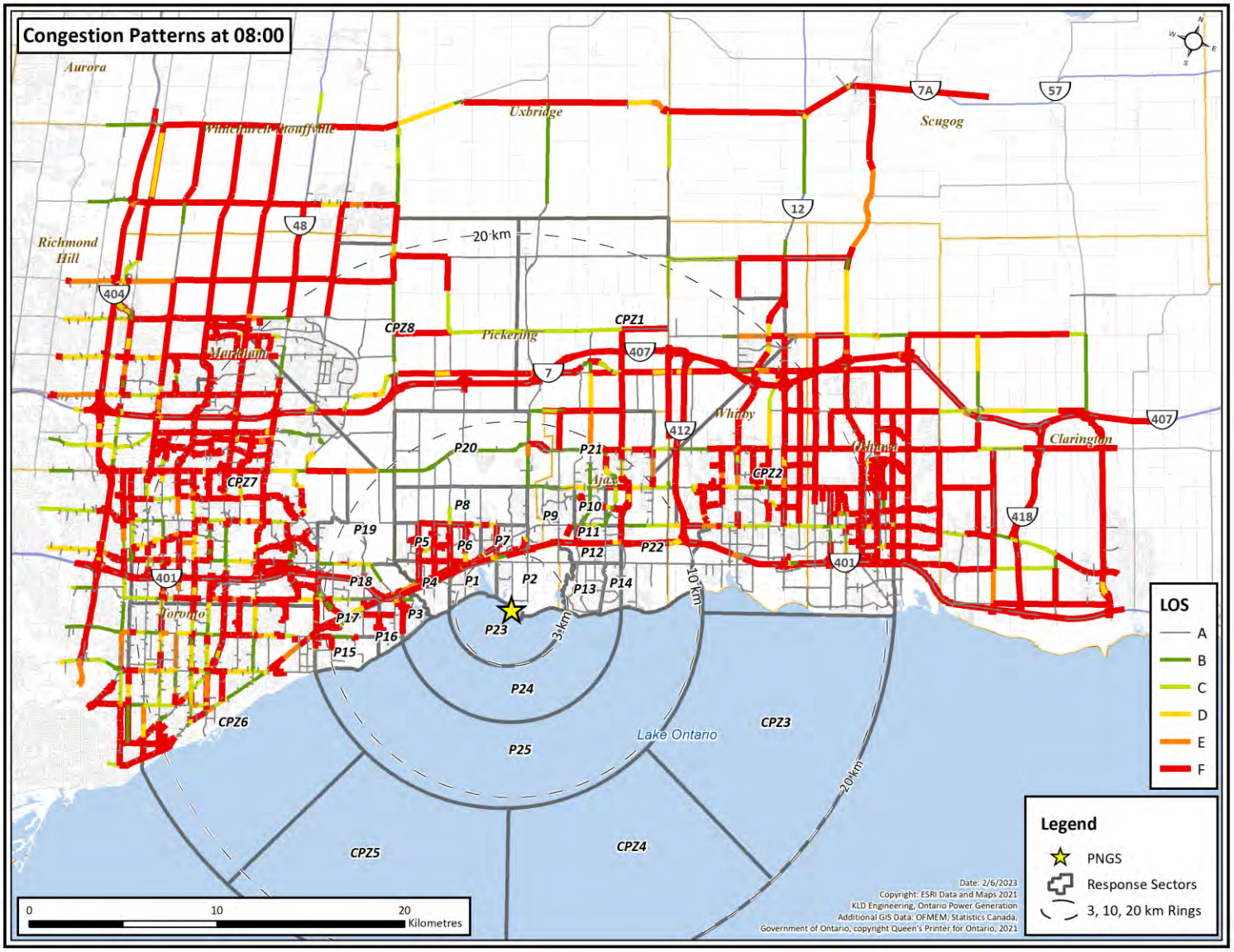



**Figure 7-15. Congestion Patterns at 8 Hours after the Emergency Bulletin (R04)**

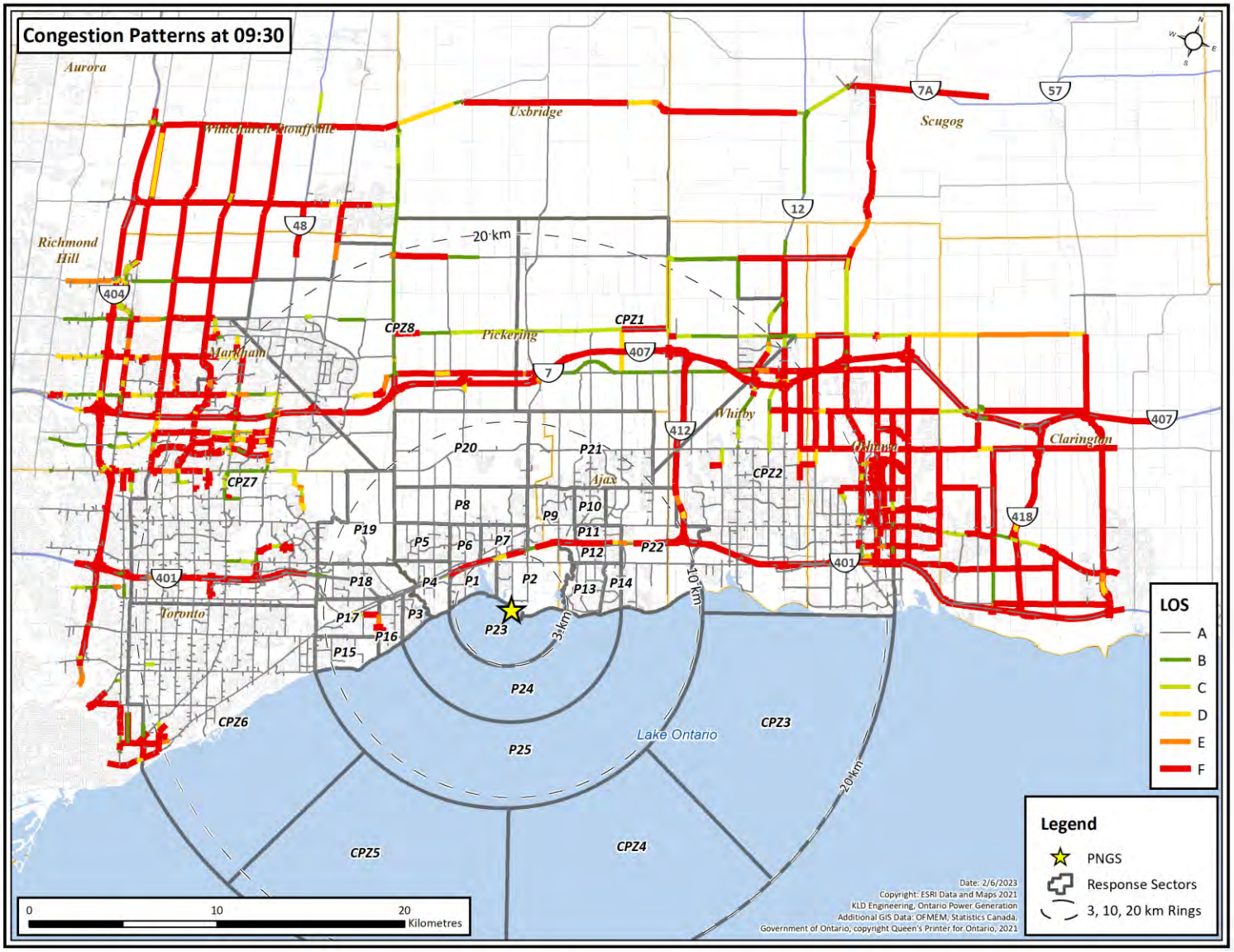



**Figure 7-16. Congestion Patterns at 9 Hours and 30 Minutes after the Emergency Bulletin (R04)**

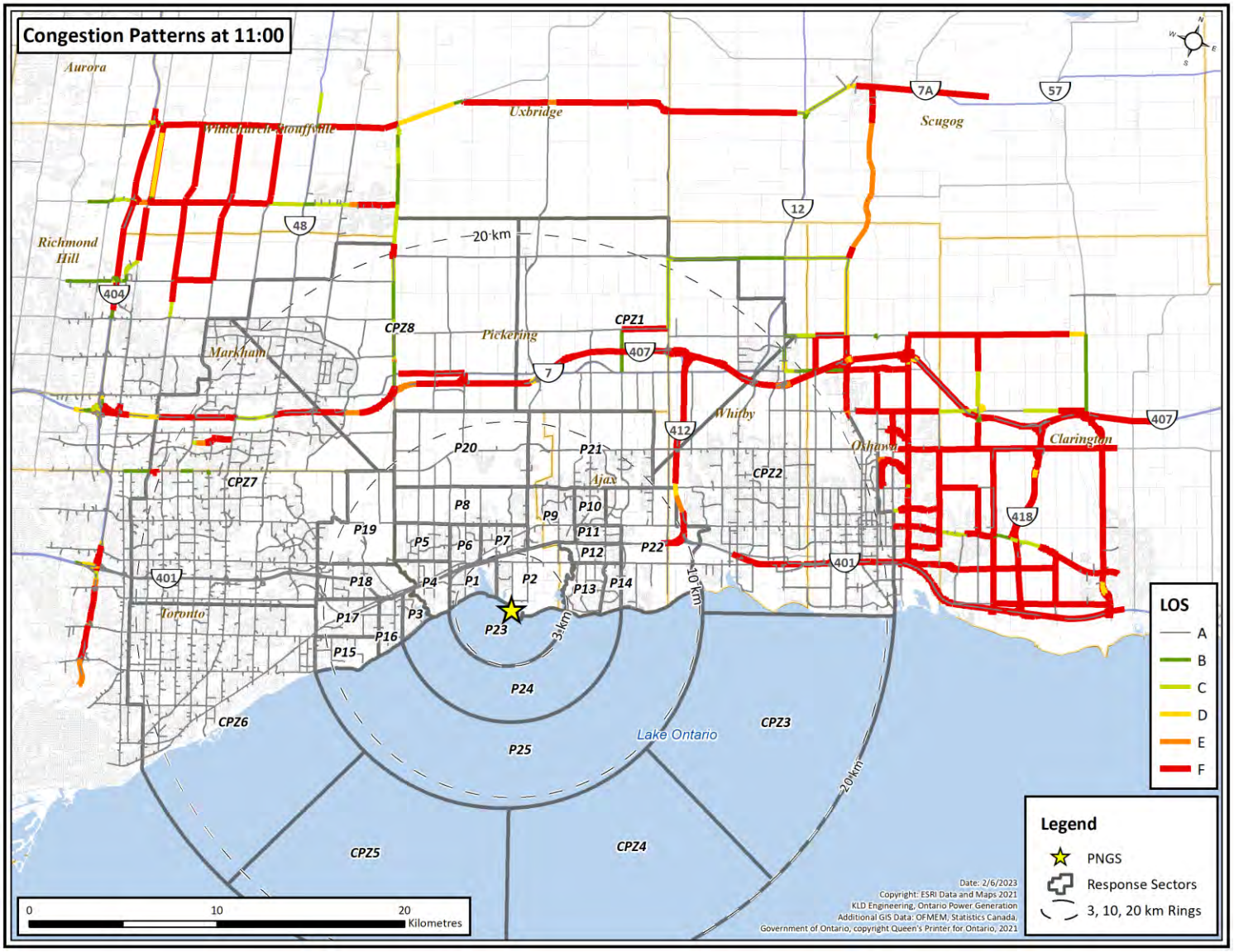



**Figure 7-17. Congestion Patterns at 11 Hours after the Emergency Bulletin (R04)**

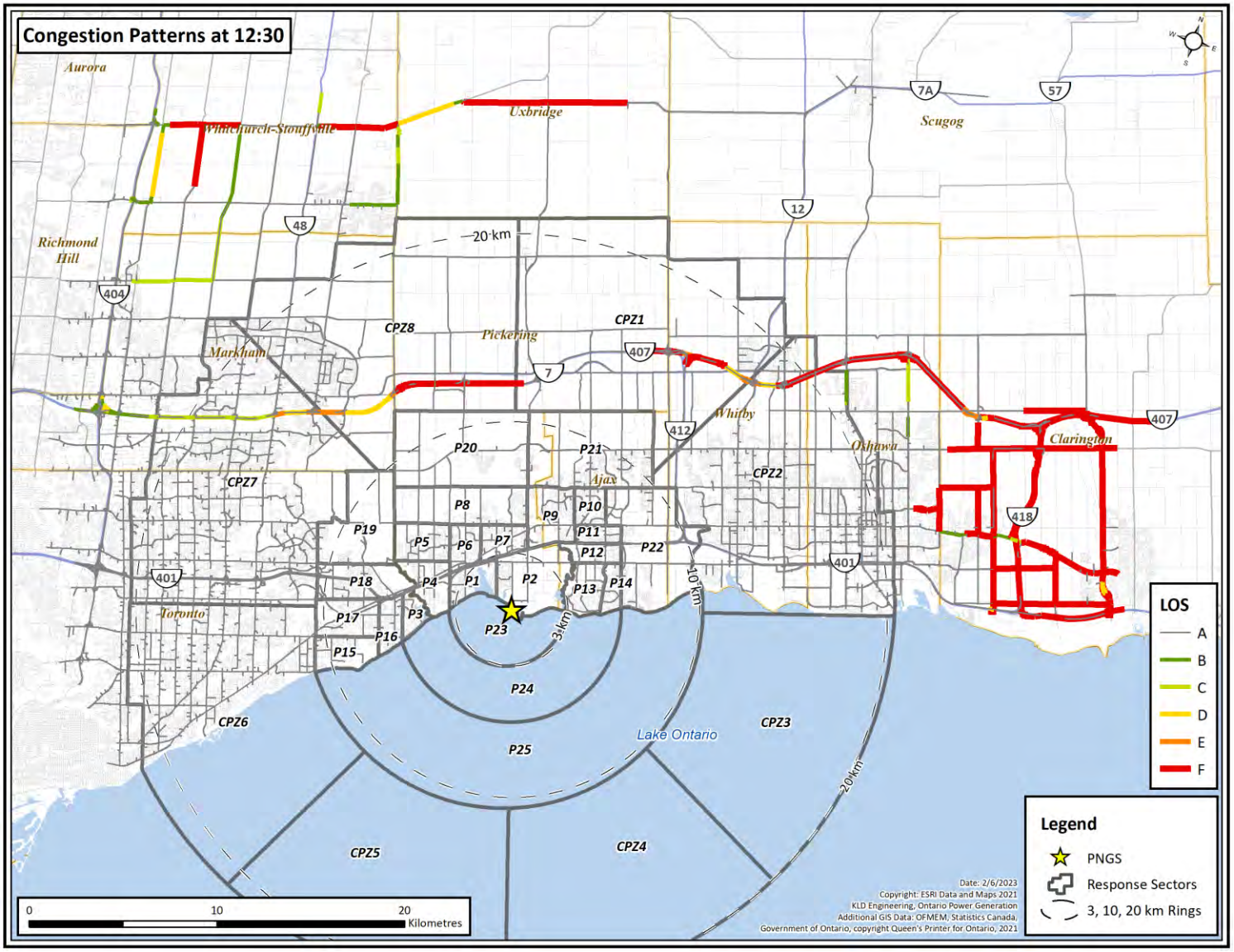



**Figure 7-18. Congestion Patterns at 12 Hours and 30 Minutes after the Emergency Bulletin (R04)**

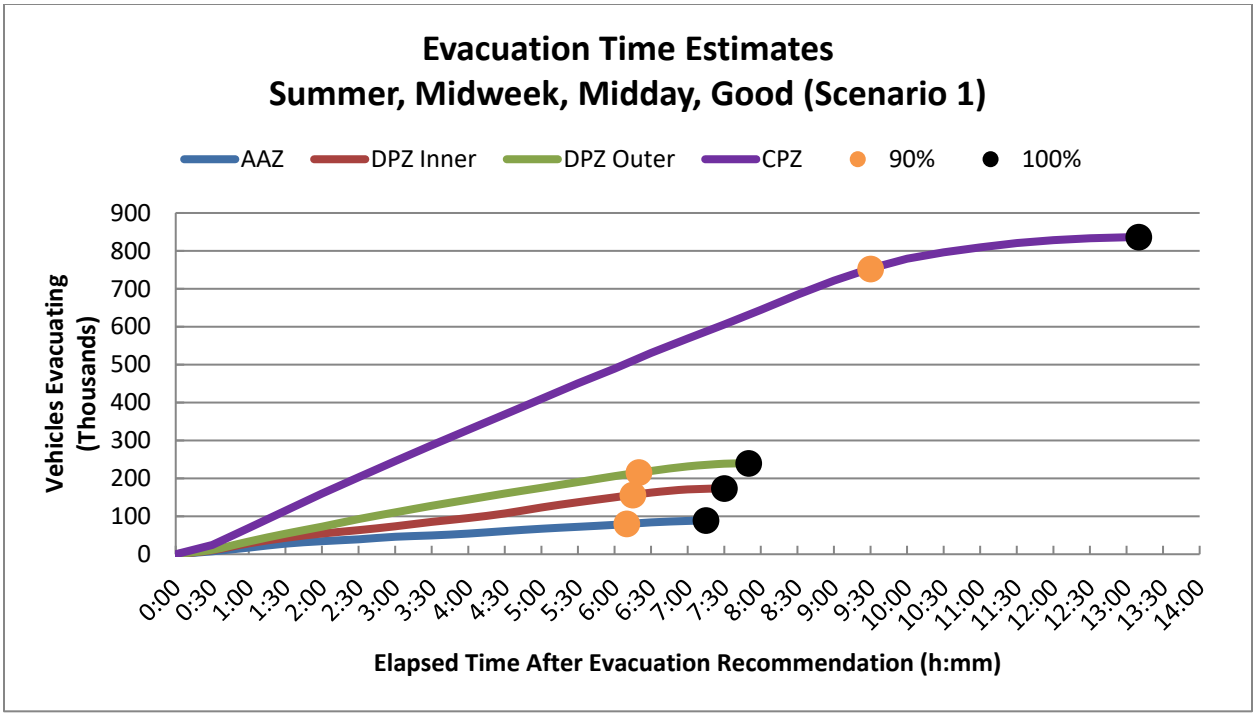



**Figure 7-19. Evacuation Time Estimates - Scenario 1 for Region R03 & R04**

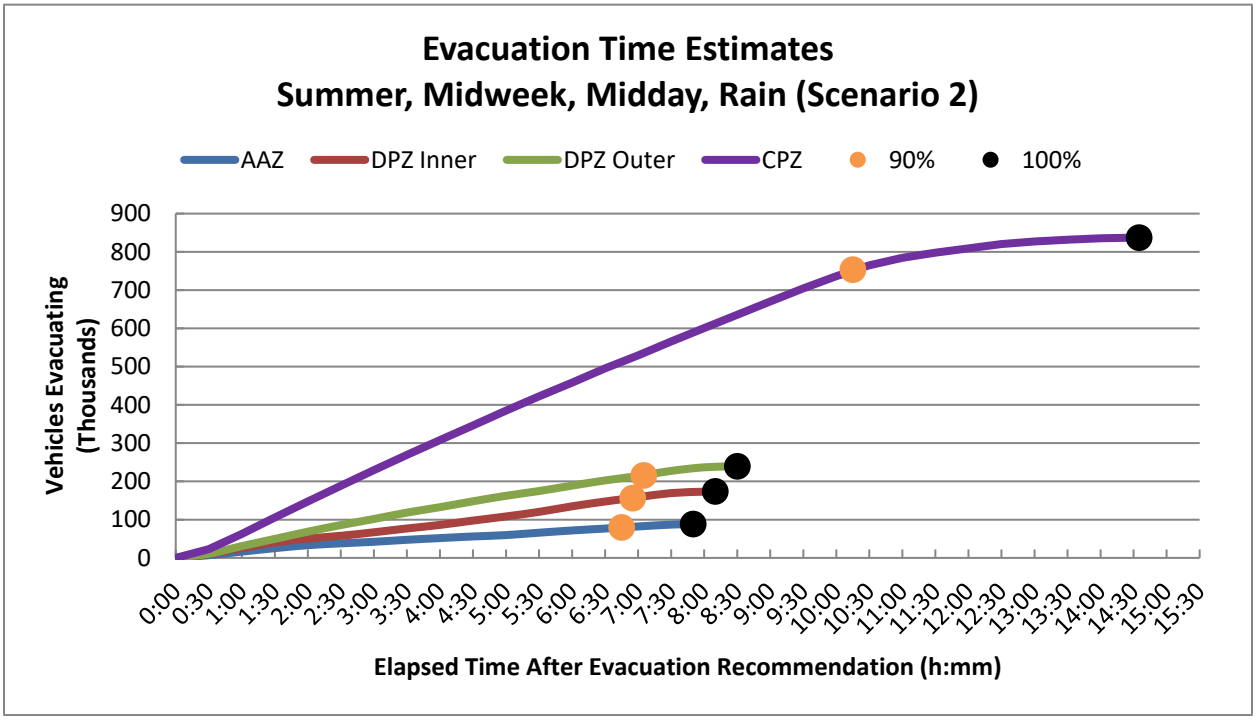



**Figure 7-20. Evacuation Time Estimates - Scenario 2 for Region R03 & R04**

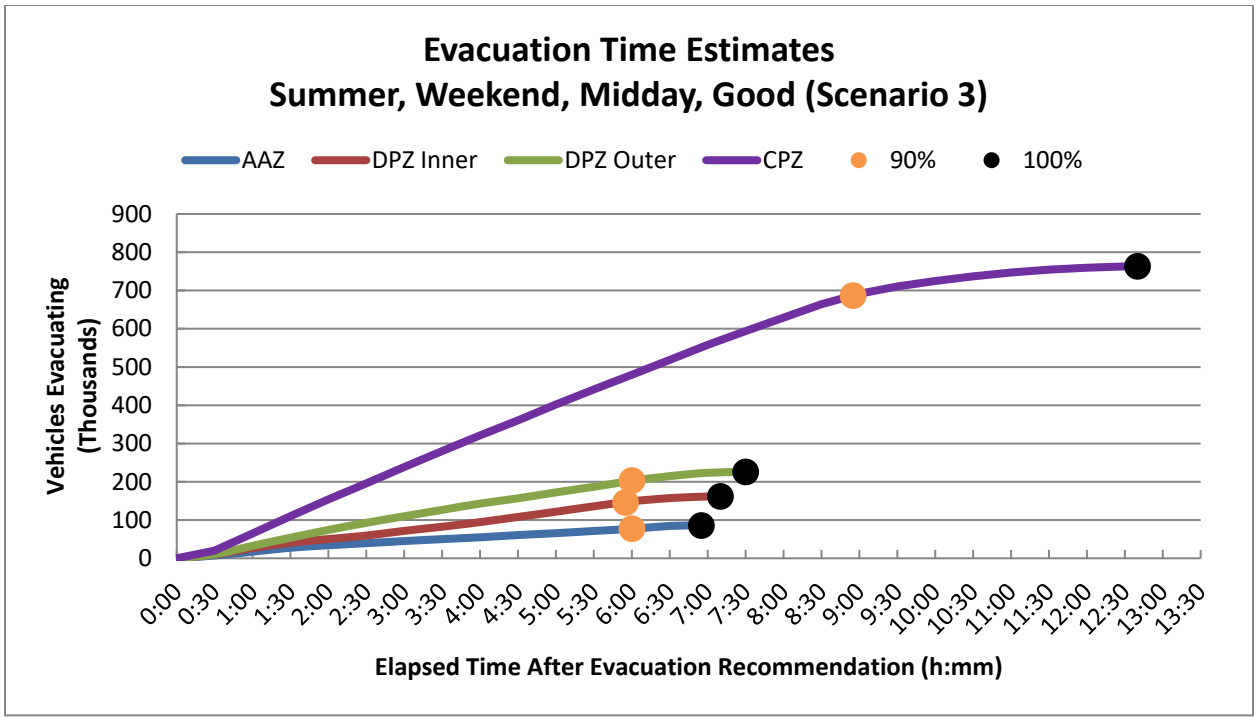



**Figure 7-21. Evacuation Time Estimates - Scenario 3 for Region R03 & R04**

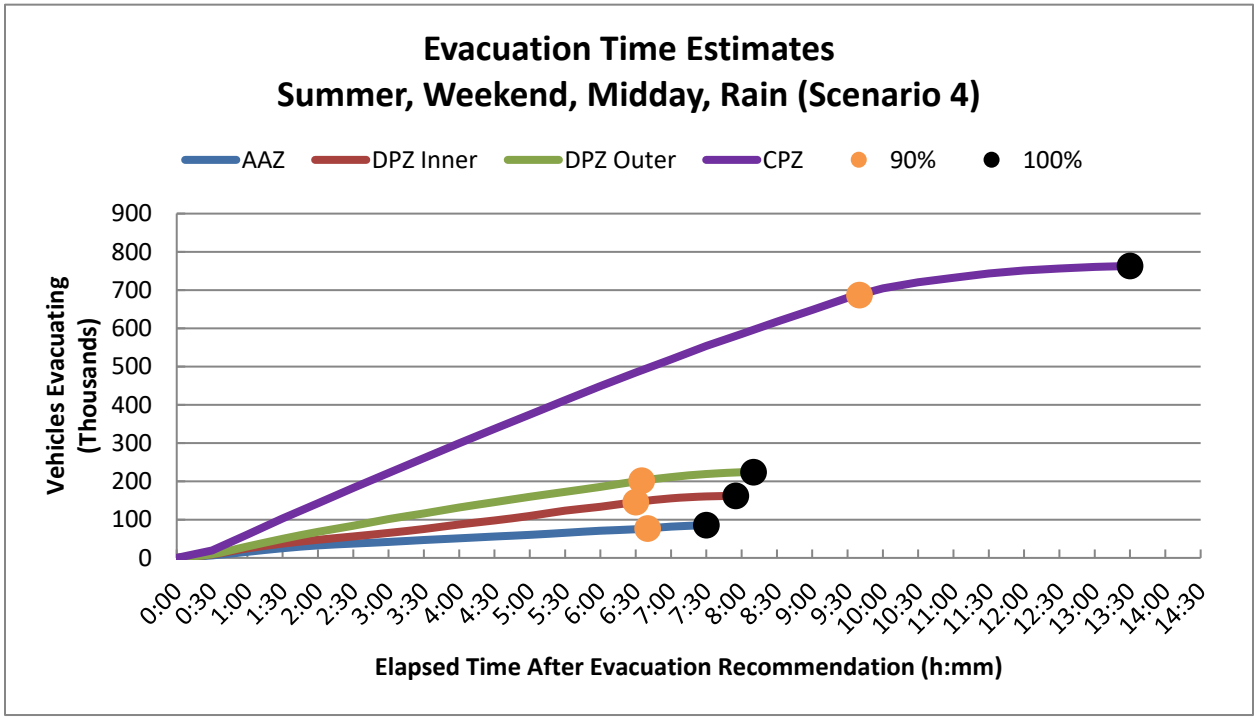



**Figure 7-22. Evacuation Time Estimates - Scenario 4 for Region R03 & R04**

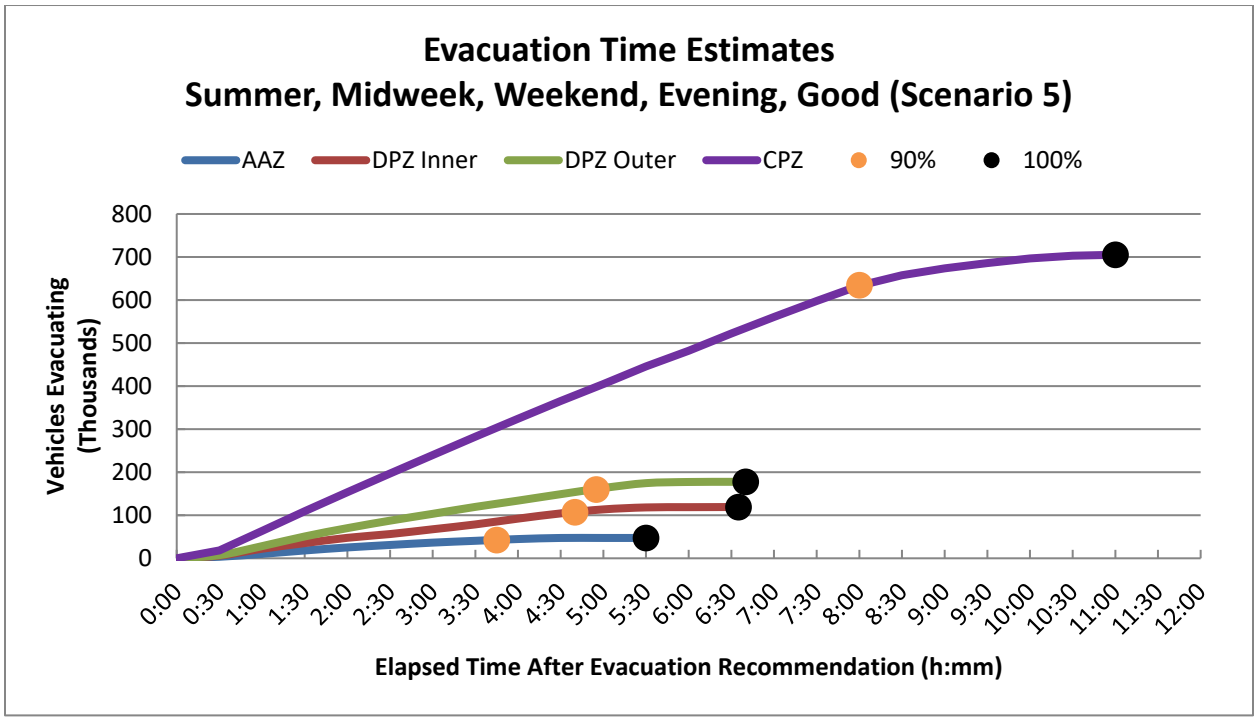



**Figure 7-23. Evacuation Time Estimates - Scenario 5 for Region R03 & R04**

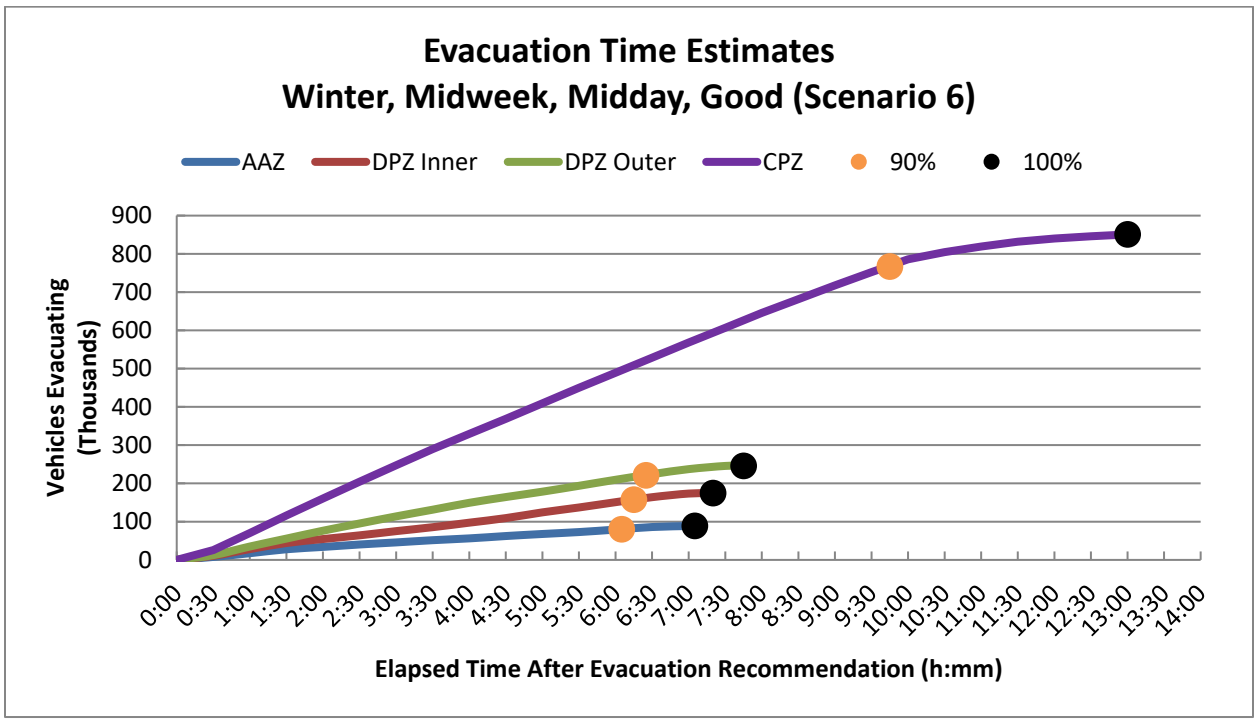



**Figure 7-24. Evacuation Time Estimates - Scenario 6 for Region R03 & R04**

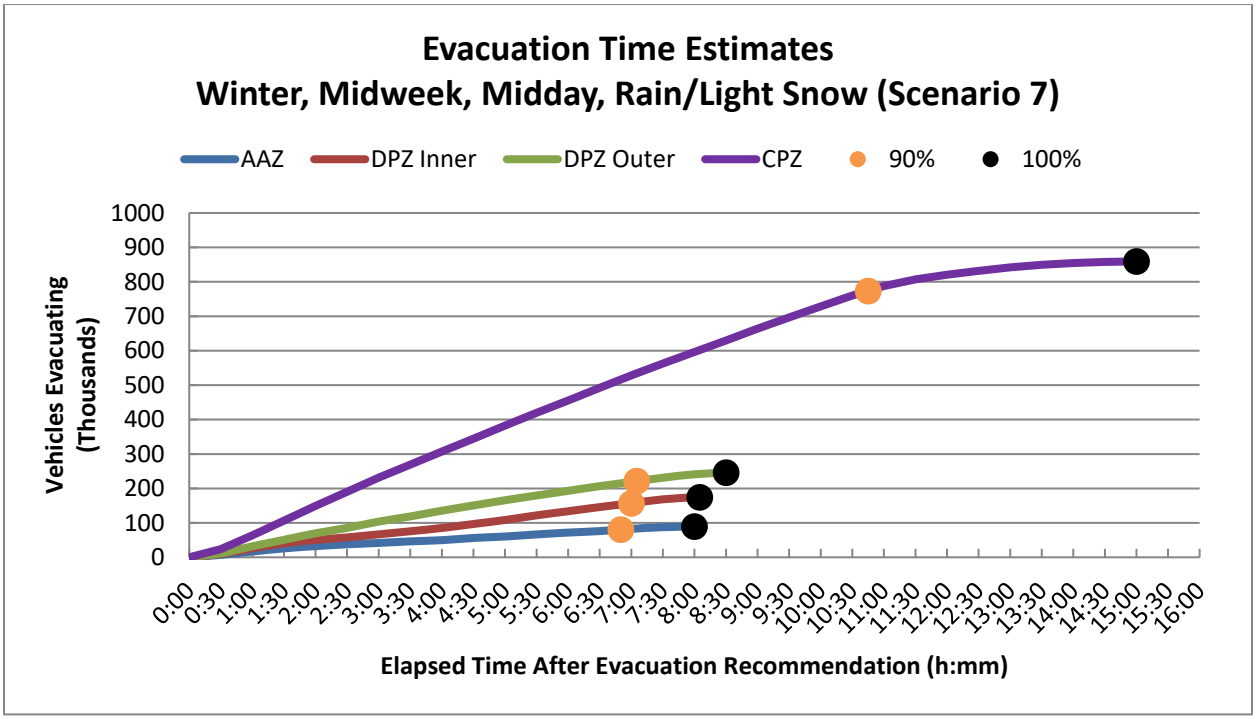



**Figure 7-25. Evacuation Time Estimates - Scenario 7 for Region R03 & R04**

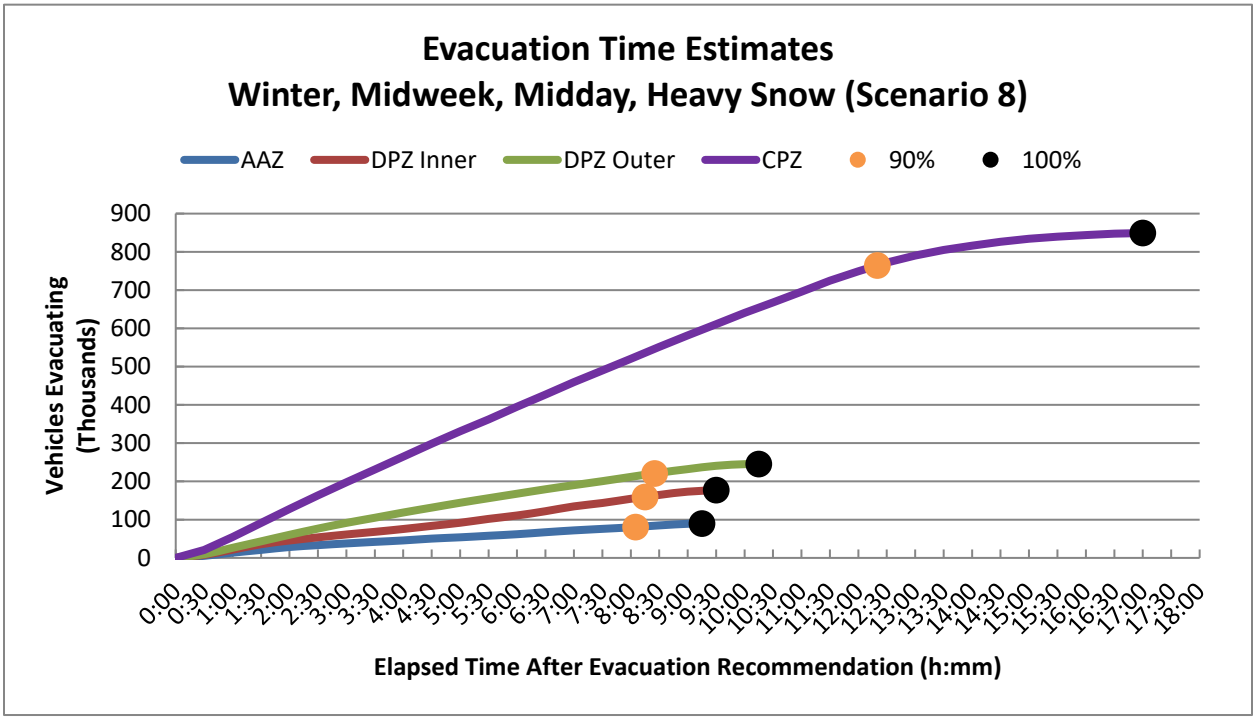



**Figure 7-26. Evacuation Time Estimates - Scenario 8 for Region R03 & R04**

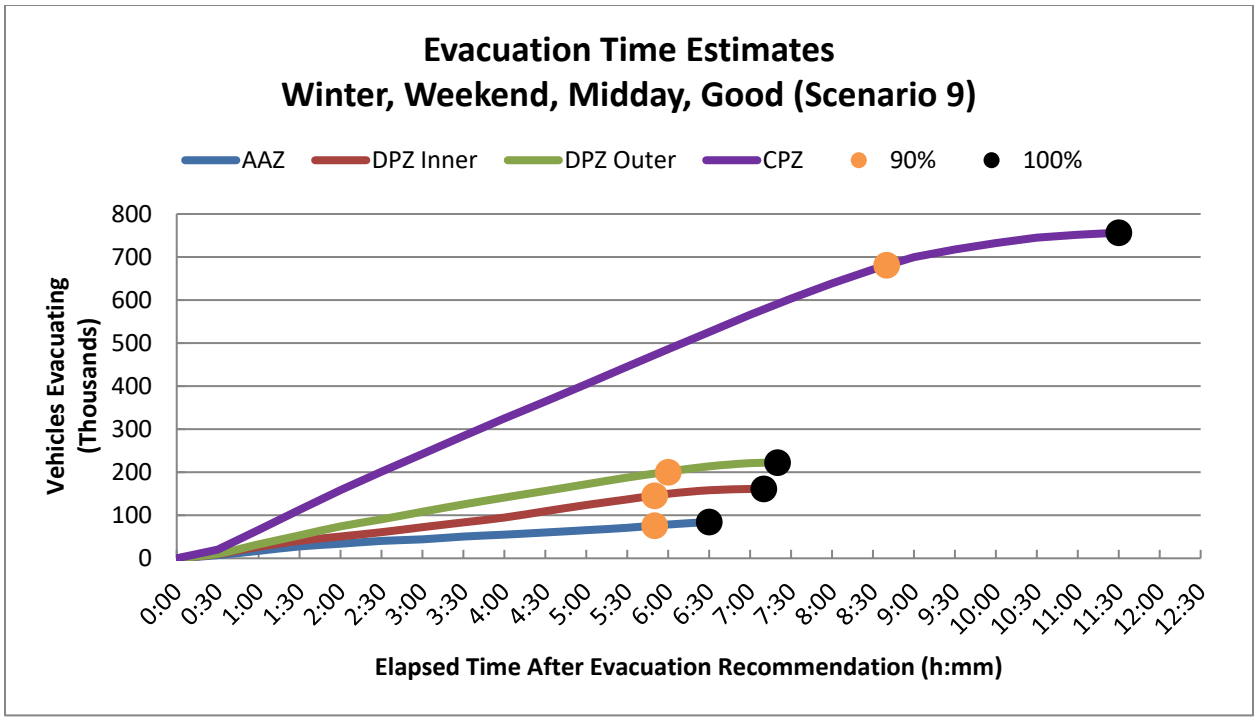



**Figure 7-27. Evacuation Time Estimates - Scenario 9 for Region R03 & R04**

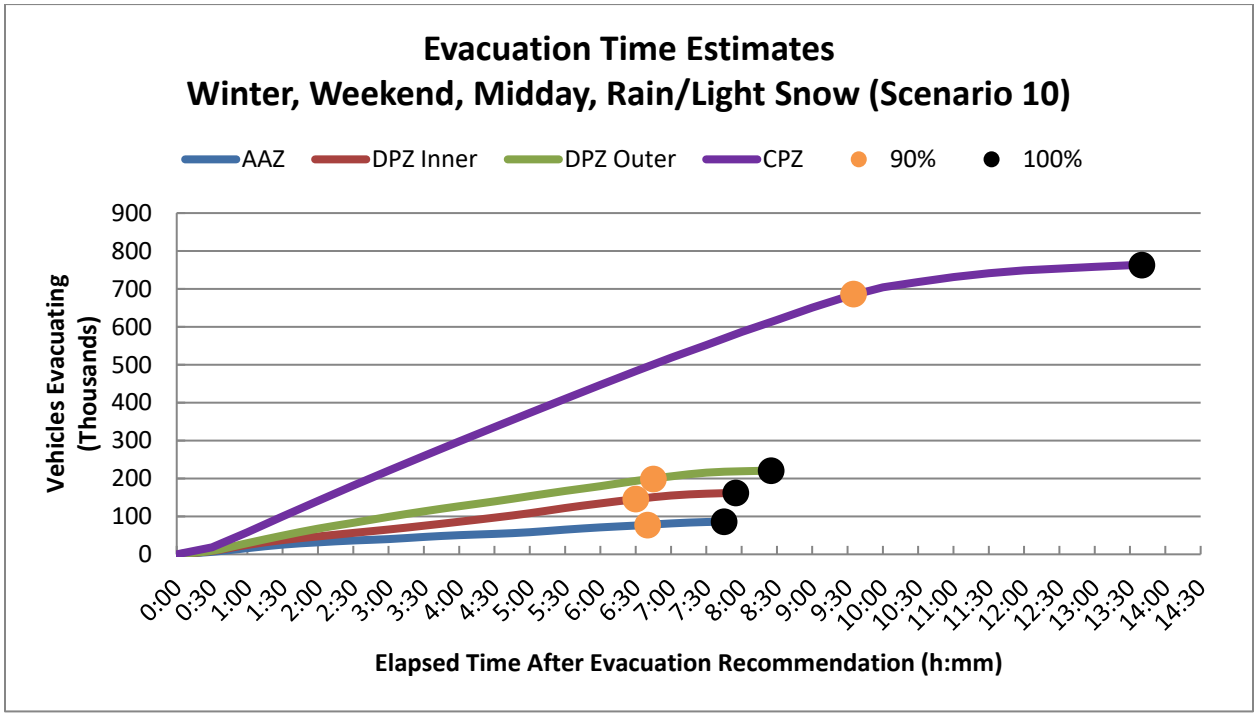



**Figure 7-28. Evacuation Time Estimates - Scenario 10 for Region R03 & R04**

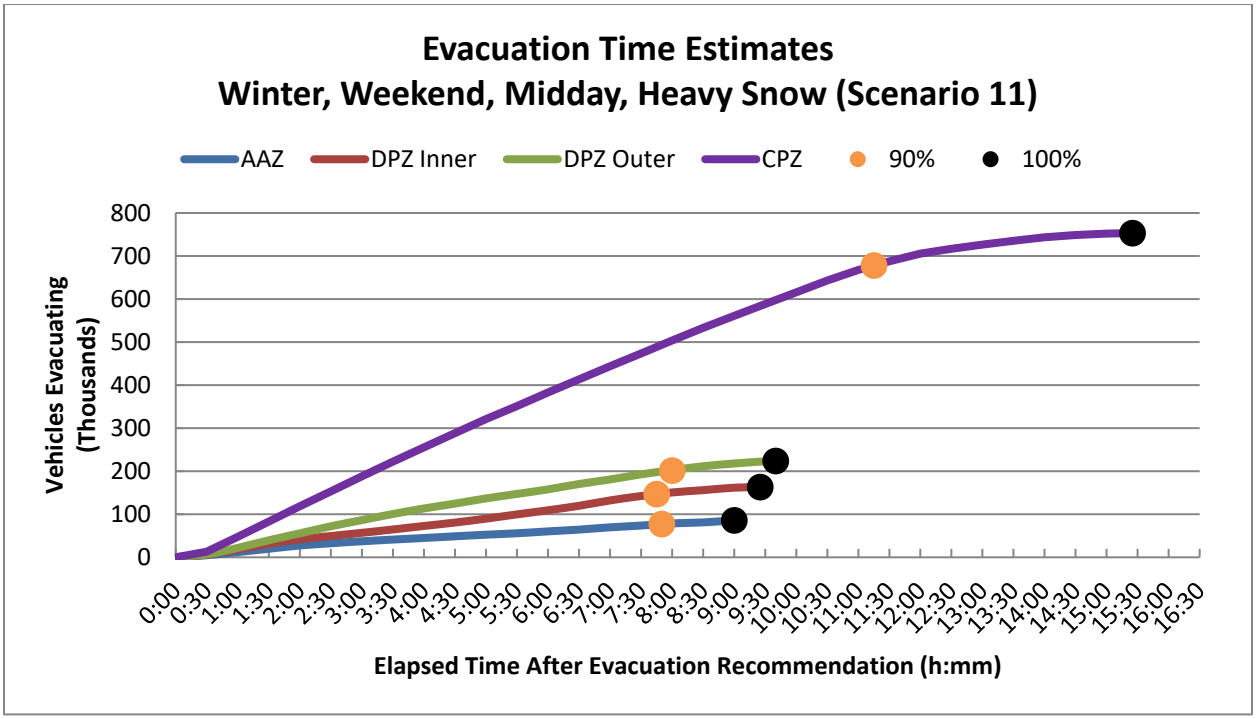



**Figure 7-29. Evacuation Time Estimates - Scenario 11 for Region R03 & R04**

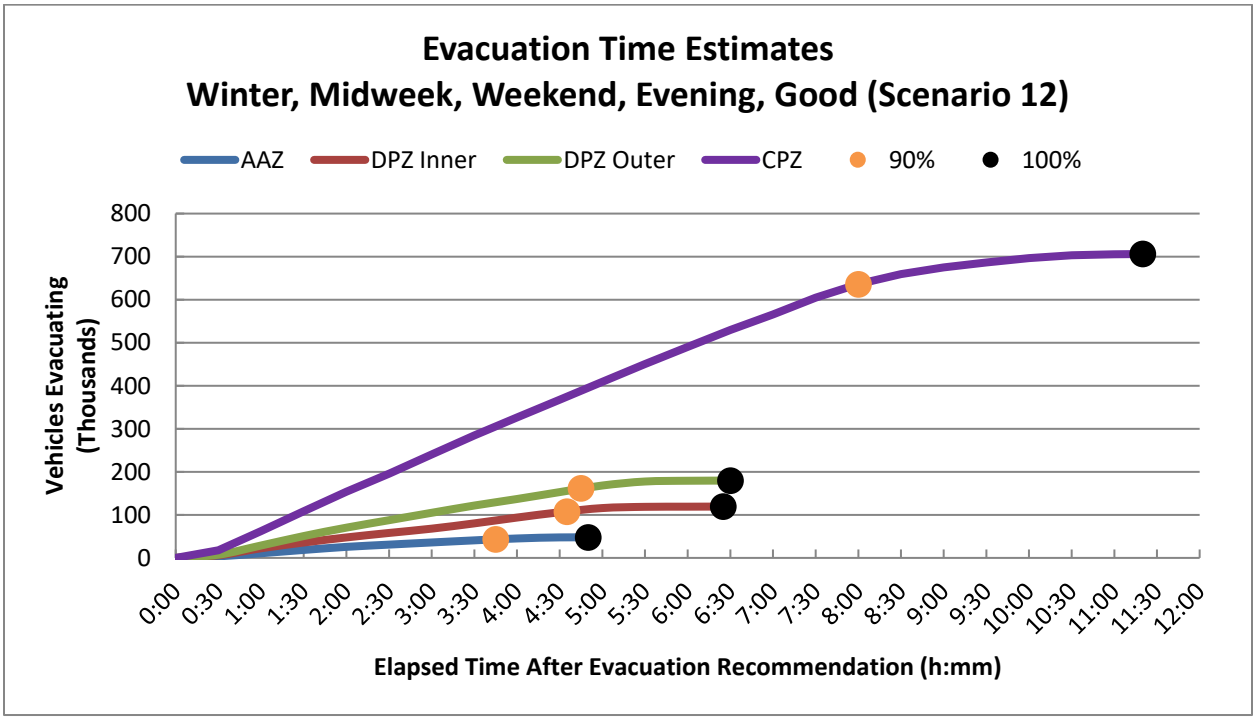



**Figure 7-30. Evacuation Time Estimates - Scenario 12 for Region R03 & R04**

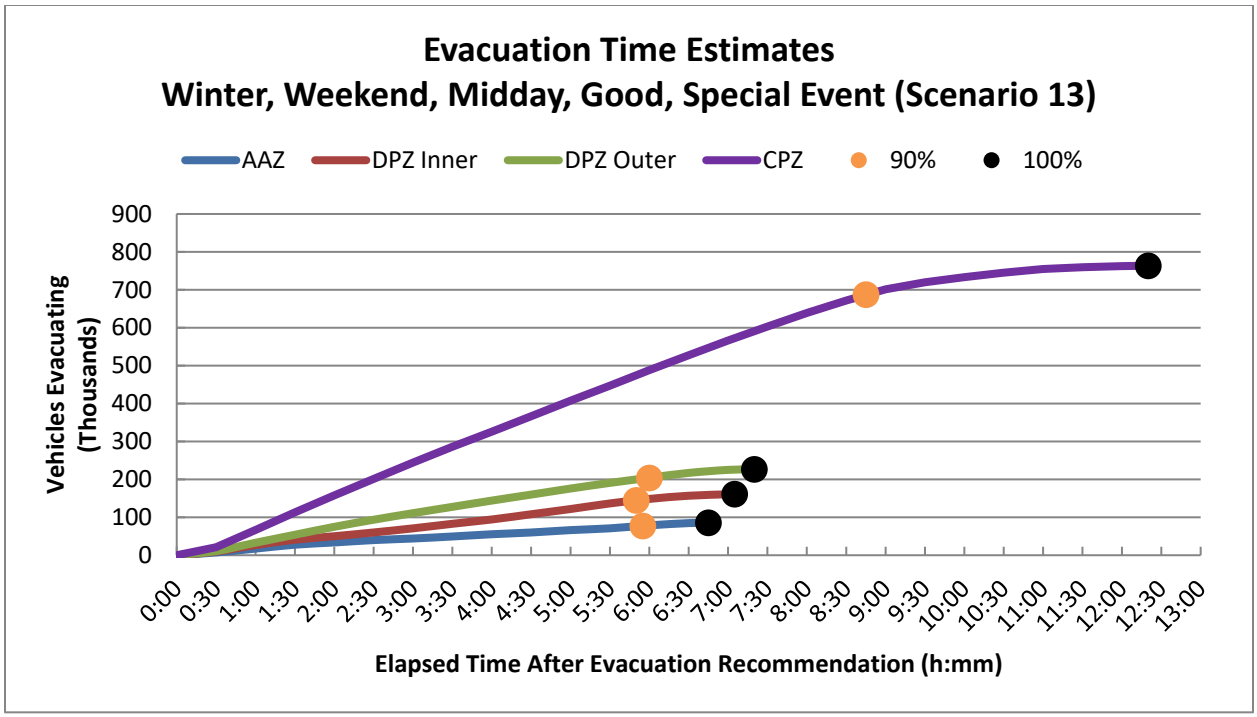



**Figure 7-31. Evacuation Time Estimates - Scenario 13 for Region R03 & R04**

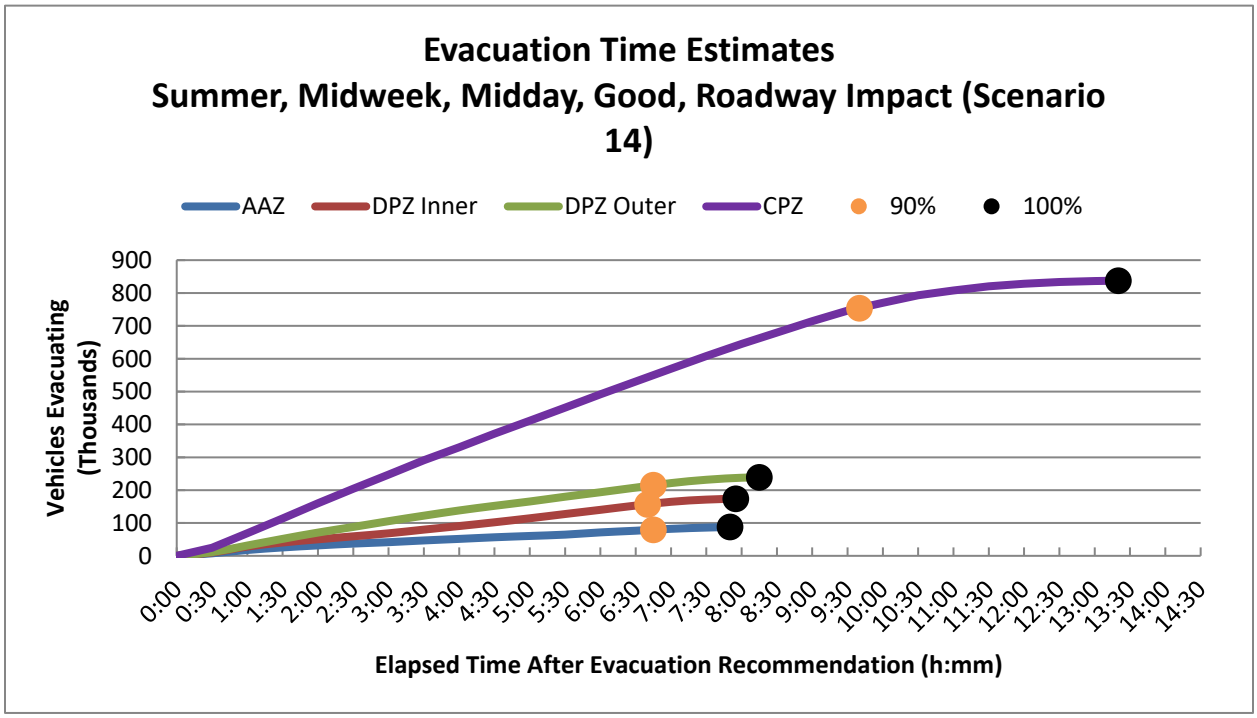



**Figure 7-32. Evacuation Time Estimates - Scenario 14 for Region R03 & R04**

# 8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES

This section details the analyses applied and the results obtained in the form of evacuation time estimates for transit vehicles, buses, ambulances and wheelchair transport vehicles. The demand for transit service reflects the needs of two population groups:

- residents with no vehicles available
- residents of special facilities such as schools, medical facilities, and correctional facilities.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of "passenger cars" (pc's). The presence of each transit vehicle in the evacuating traffic stream is represented within the modelling paradigm described in Appendix D as equivalent to two pc's. This equivalence factor represents the longer size and more sluggish operating characteristics of a transit vehicle, relative to those of a pc.

Transit vehicles must be mobilized in preparation for their respective evacuation missions. Specifically:

- Bus drivers must be alerted
- They must travel to the bus depot
- They must be briefed there and assigned to a route or facility

These activities consume time. Based on discussions with the bus providers within the PZs, it is estimated that bus mobilization time will average approximately 90 minutes for schools, medical facilities, and correctional facilities and 120 minutes for transit-dependent bus mobilization extending from the Emergency Bulletin to the time when buses first arrive at the facility to be evacuated.

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbours, relatives and friends to pick up children from school prior to the arrival of buses, so that they may join their families. Virtually all studies of evacuations have concluded that this "bonding" process of uniting families is universally prevalent during emergencies and should be anticipated in the planning process. The current public information disseminated to residents of the PNGS PZs indicates schools have their own emergency and evacuation plans. The guide indicates local radio and television stations will announce when and where parents can pick up their children.

As discussed in Section 2, this study assumes a fast-breaking general emergency. Therefore, it is assumed children are evacuated directly to Temporary Holding Centres (THCs). Picking up children at school could add to traffic congestion at the schools, delaying the departure of the buses evacuating schoolchildren, which may have to return in a subsequent "wave" to the PZ to evacuate the transit-dependent population. This report provides estimates of buses under the assumption that no children (except for small day care centres) will be picked up by their parents (in accordance with NUREG/CR-7002 Rev.1), to present an upper bound estimate of buses required. This study assumes that public and private schools are evacuated to THCs where they

will be picked up. It is further assumed that parents will pick up their children from small day cares within the PZs before evacuating and the time to do so is included in the time needed to mobilize based on the survey results (see Section 5).

The procedure for computing transit-dependent ETE is to:

- Estimate demand for transit service (discussed in Section 3)
- Estimate time to perform all transit functions
- Estimate route travel times to the PZ boundary and to the THCs or Reception Centres (RCs)

The ETE for transit trips were developed using both good weather and adverse weather conditions. Figure 8-1 presents the chronology of events relevant to transit operations. The elapsed time for each activity will now be discussed with reference to Figure 8-1.

## 8.1 ETEs for Schools, Transit-Dependent People, and Special Facilities

Buses that conduct the daily operations at schools within the PZs are contracted by various bus companies in the area. These resources are assigned to evacuating schoolchildren (if school is in session at the time of the Emergency Bulletin) as the first priority in the event of an emergency. In the event that the allocation of buses dispatched from the depots to the various facilities is somewhat "inefficient", or if there is a shortfall of available drivers, then there may be a need for some buses to return to the PZs from the THCs after completing their first evacuation trip, to complete a "second wave" of providing transport service to evacuees. For this reason, the ETE for the transit-dependent population will be calculated for both a single wave transit evacuation and for a second wave. Of course, if the impacted Evacuation Region is other than R03 (the entire DPZ Outer Ring) or R04 (all PZs), then there will likely be ample transit resources relative to demand in the impacted Region and this discussion of a second wave would likely not apply.

The number of available transportation resources was based on information provided by the offsite agencies. Table 8-1 lists the transportation resources and transportation needs to evacuate the transit dependent and special facility population in the area. As shown in the table, there are no sufficient resources to evacuate all schoolchildren, the transit dependent population, patients at medical facilities and inmates at correctional facilities in a single wave. A representative from Durham Region indicated that Durham Regional School Board manages their own buses and that Durham Region does not have access to that information. Hence, there could be more resources available to the area, but that information was not provided to be part of this study.

When school evacuation needs are satisfied, subsequent assignments of buses to service the remaining transit-dependent population should be sensitive to their mobilization time. Clearly, the buses should be dispatched after people have completed their mobilization activities and are in a position to board the buses when they arrive at the bus stops.

*Evacuation of Schools*

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the Emergency Bulletin until the time the buses arrive at the facility to be evacuated. It is assumed that for a rapidly escalating radiological emergency with no observable indication before the fact, school bus drivers would likely require 90 minutes to be contacted, to travel to the depot, be briefed, and to travel to the transit-dependent facilities. Mobilization time is slightly longer in adverse weather – 100 minutes when raining, 110 minutes when snowing.

Activity: Board Passengers (C→D)

A loading time of 15 minutes (20 minutes for rain/light snow and 25 minutes for heavy snow) for school buses is assumed. See Section 2.4 and Table 2-2.

Activity: Travel to DPZ or CPZ Boundary (D→E)

The buses servicing the schools or day camps are ready to begin their evacuation trips at 105 minutes after the Emergency Bulletin – 90 minutes mobilization time plus 15 minutes loading time – in good weather. The UNITES software discussed in Section 1.3 was used to define bus routes along the most likely path from a school being evacuated to the DPZ or CPZ boundary, traveling toward the appropriate THC or Reception Centre, respectively. This is done in UNITES by interactively selecting the series of nodes from the school or day camp to the PZ boundaries. Each bus route is given an identification number and is written to the DYNEV II input stream. DYNEV computes the route length and outputs the average speed for each 5-minute interval, for each bus route. Due to the large number of schools and day camps within the PZ, a representative route was chosen for each response sector to obtain a representative ETE for all schools or day camps in that Response Sector. The specified bus routes are documented in Table 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations). Data provided by DYNEV during the appropriate timeframe depending on the mobilization and loading times (i.e., 100 to 105 minutes after the Emergency Bulletin for good weather) were used to compute the average speed for each route, as follows:

$$Average\ Speed\ \left(\frac{km}{hr}\right) = \left[\frac{\sum_{i=1}^{n} length\ of\ link\ i\ (km)}{\sum_{i=1}^{n}\left\{Delay\ on\ link\ i\ (min.) + \frac{length\ of\ link\ i\ (km)}{current\ speed\ on\ link\ i\ \left(\frac{km}{hr.}\right)} \times \frac{60\ min.}{1\ hr.}\right\}}\right] \times \frac{60\ min.}{1\ hr.}$$

The average speed computed (using this methodology) for the buses servicing each of the schools in the DPZ and CPZ are shown in Table 8-2 through Table 8-4 for school evacuation. These tables provide ETE for an evacuation of the DPZ (Region R03) and CPZ (Region R04) for emergency

planning and contingency planning, respectively, purposes. The travel time to the DPZ and CPZ boundaries were computed for each bus using the computed average speed and the distance to the DPZ or CPZ boundary along the most likely route out of the area being evacuated. The travel time from the DPZ or CPZ boundary to the THC or Reception Centre was computed assuming an average speed of 100 kph, 90 kph, and 85 kph for good weather, rain/light snow and heavy snow, respectively. Speeds were reduced in Table 8-2 through Table 8-4 to 100 kph (90 kph for rain/light snow and 85 kph for heavy snow) for those calculated bus speeds which exceed 100 kph, as the maximum school bus speed limit for highway routes in the City of Toronto and Durham Region is 100 kph.

Table 8-2 (good weather), Table 8-3 (rain/light snow) and Table 8-4 (heavy snow) present the following evacuation time estimates (rounded up to the nearest 5 minutes) for schools in the study area:

- The elapsed time from the Emergency Bulletin until the bus exits the DPZ or CPZ; and
- The elapsed time until the bus reaches the THC.

The evacuation time out of the DPZ can be computed as the sum of times associated with Activities A→B→C, C→D, and D→E (For example: 90 min. + 15 min. + 175 min. = 4:40 for Schools in P1, in good weather). The average single-wave ETE, for schools, is 3 hours and 20 minutes (6:25 - 3:05 = 3:20) less than the 90$^{th}$ percentile ETE for evacuation of the general population in the DPZ (Region R03) and 4 hours and 5 minutes (9:45 – 5:40 = 4:05) less for Region R04 (CPZ) under winter, midweek, midday, good weather (Scenario 6) conditions.

The evacuation time to the THC is determined by adding the time associated with Activity E→F (discussed below), to this DPZ evacuation time.

Activity: Travel to Temporary Holding Centre (E→F)

The distances from the DPZ boundary to the THC are measured using GIS software along the most likely route from the DPZ exit point to the THC. The locations of the THC are not exactly known but are noted as being outside of the DPZ. A generalized distance to the nearest city centre was used to estimate an Estimated Time of Arrival (ETA) to the THC. For a single wave evacuation, this travel time outside the DPZ does not contribute to the ETE. Assumed bus speeds of 100 kph, 90 kph, and 85 kph for good weather, rain/light snow and heavy snow, respectively, are applied for this activity for the buses servicing the school population.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C →D→E)

As shown in Table 8-1, there is a shortfall of buses for evacuation of children in a single wave, if all of the PZs are evacuated at once (a highly unlikely event). As such, a two-wave evacuation may be needed for some schools. Due to the large number of schools in the PZs, second wave ETE were not computed for each school. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of schools. Page 84 of the PNERP Implementing Plan for the PNGS, dated January 2019, states that public reception centres

should be beyond the DPZ. As such, there is a chance that THCs or RCs are within the CPZ and, therefore, a second wave evacuation of schools were only computed for the DPZ. The travel time from THC back to the DPZ boundary and then back to the school was computed assuming an average speed of 65 kph (good weather) as buses will be traveling counter to the evacuation traffic. Time and distance are based on averages for all schools in the DPZ for good weather:

- School buses arrive at the THC at 3:15.
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to DPZ and completes second route: 7 minutes (equal to average travel time to THC for good weather) + 8 minutes (9.2 km, average distance to DPZ boundary from Table 8-2 @ 65 kph) + 40 minutes (9.2 km, average distance to DPZ boundary from Table 8-2 @ 14 kph, average network speed at this time) = 55 minutes.
- Loading Time: 15 minutes.
- Bus exits DPZ at time 3:15 + 0:15 + 0:55 + 0:15 = 4:40 after the Emergency Bulletin.

Given the average single wave ETE for schools in the DPZ is 3:05, a second wave evacuation would require an additional 1 hour and 35 minutes, on average for good weather.

*Evacuation of Transit Dependent People (Residents without access to a vehicle)*

A detailed computation of transit dependent population was done and is discussed in Section 3.7. The total number of transit dependent people per Response Sector was determined using a weighted distribution based on population. See Table 3-13 for the distribution used. Buses servicing the transit-dependent evacuees will first travel along their routes, then proceed out of the DPZ or CPZ. Figure 10-2 through Figure 10-7 show the existing DRT, TTC, YRT, and GO Transit bus routes that were used in this study. It is assumed that residents will walk to and congregate at bus stops along these routes.

Activity: Mobilize Drivers (A→B→C)

The buses dispatched from the depots to service the transit-dependent evacuees will be scheduled so that they arrive at their respective routes after their passengers have completed their mobilization. As shown in Figure 5-4 (Residents with no Commuters), a large majority (90%) of evacuees will complete their mobilization when the buses begin their routes, approximately 120 minutes after the Emergency Bulletin. Bus mobilization times for the transit-dependent population are therefore assumed to be 120 minutes.

Activity: Board Passengers (C→D)

For multiple stops along a transit route estimation of travel time must allow for the delay associated with stopping and starting at each pick-up point. The time, t, required for a bus to decelerate at a rate, “a”, expressed in m/sec/sec, from a speed, “v”, expressed in m/sec, to a stop, is t = v/a. Assuming the same acceleration rate and final speed following the stop yields a total time, T, to service boarding passengers:

$$T = t + B + t = B + 2t = B + \frac{2v}{a},$$

Where B = Dwell time to service passengers. The total distance, “s” in metres, travelled during

the deceleration and acceleration activities is: $s = v^2/a$. If the bus had not stopped to service passengers, but had continued to travel at speed, v, then its travel time over the distance, s, would be: $s/v = v/a$. Then the total delay (i.e. pickup time, P) to service passengers is:

$$P = T - \frac{v}{a} = B + \frac{v}{a}$$

Assigning reasonable estimates:

- B = 50 seconds: a generous value for a single passenger, carrying personal items, to board per stop
- v = 40 kph = 11 m/sec
- a = 1.22 m/sec/sec, a moderate average rate

Then, P ≈ 1 minute per stop. Allowing 30 minutes pick-up time per bus run implies 30 stops per run, for good weather. It is assumed that bus acceleration and speed will be less in adverse weather; total loading time is 35 minutes per bus in rain/light snow, 40 minutes in heavy snow.

Activity: Travel to PZ Boundary (D→E)

The travel distance along the respective pick-up routes within the PZs are estimated using the UNITES software. Bus travel times within the PZs are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school evacuation.

Table 8-5 through Table 8-7 present the transit-dependent population evacuation time estimates for each bus route calculated using the above procedures for good weather, rain/light snow and heavy snow, respectively. ETE is only presented for the case(s) (DPZ and/or CPZ) in which a given route would be used for evacuating the transit-dependent population. The ETE for the access and/or functional needs population is included in the ETE estimates for the transit dependent population.

For example, the ETE for bus route DRT-101 servicing Response Sectors P1, P2, P4, and P18 (also CPZ6 when evacuating the CPZ) is computed as 120 + 161 + 30 = 5:15 (rounded up to the nearest 5-minute interval) for an evacuation of the DPZ in good weather. Here, 161 minutes is the time to travel 15 kilometres at 5.6 kph, the average speed output by the model for this route starting at 120 minutes.

The average good weather DPZ ETE, shown in Table 8-5, is 3:50. As such, the single wave ETE for the transit-dependent population within the DPZ is nearly 2 hours and 35 minutes shorter than the average 90$^{th}$ percentile ETE for the general population of the entire DPZ (R03) for good weather, as shown in Table 7-1.

The average good weather CPZ ETE, shown in Table 8-5, is 6:15. As such, the single wave ETE for the transit-dependent population within the CPZ is shorter (3 hour 30 minutes) than the average 90$^{th}$ percentile ETE for the general population of an evacuation of all the PZs (R04) for good weather, as shown in Table 7-1.

The ETE for a second wave (discussed below) is presented in the event there is a shortfall of available buses or bus drivers, as previously discussed.

Activity: Travel to Reception Centre (E→F)

The distances from the PZ boundaries to the Reception Centres are measured using GIS software along the most likely route from the boundary of the area being evacuated to the Reception Centre. For a one-wave evacuation, this travel time outside the area being evacuated does not contribute to the ETE. The travel time outside of the area being evacuated is included in the two-wave evacuation. Due to the number of buses that are needed to evacuate the PZ population, a two-wave ETE for buses must be considered, since it could exceed the ETE for the general population. As previously mentioned, a second wave is only computed for the DPZ as some RCs may be located within the CPZ making it impossible to compute a two wave ETE for the CPZ. Assumed bus speeds of 65 kph, 60 kph, and 55 kph for good weather, rain/light snow, and heavy snow, respectively, will be applied for buses to return to the start of their routes since they are travelling against evacuating traffic.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C→D→E)

The buses assigned to return to the DPZ to perform a "second wave" evacuation of transit-dependent evacuees will be those that have already evacuated transit-dependent people who mobilized more quickly. In reality, buses will continue to transport evacuees out of the area before the first wave of buses returns for a second wave. Nonetheless, a second wave computation is provided for informational purposes. The first wave of transit-dependent people departs the bus, and the bus then returns to the DPZ, travels to its route and proceeds to pick up more transit-dependent evacuees along the route. The travel time back to the DPZ is assumed to be equal to the travel time to the Reception Centre.

The second-wave ETE for bus route DRT-101 servicing Response Sectors P1, P2, P4, and P18 is computed as follows for good weather:

- Bus arrives at Reception Centre at 5:33 in good weather (5:15 to exit DPZ + 18 minute travel time to Reception Centre).
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to DPZ and completes second route: 18 minutes (equal to travel time to Reception Centre) + 14 minutes (15 km @ 65 kph – travel back to start of route) + 70 minutes (15 km @ 12.8 kph – complete route again) = 102 minutes
- Bus completes pick-ups along route: 30 minutes.
- Bus exits PZ at time 5:33 + 0:15 + 1:42 + 0:30 = 8:00 (rounded up to nearest 5 minutes) after the Emergency Bulletin.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-5 through Table 8-7. The average two-wave evacuation of transit-dependent people is 30 minutes shorter than the ETE (Region R03) for the general population at the 90$^{th}$ percentile.

*Evacuation of Medical Facilities*

Activity: Mobilize Drivers (A→B→C)

As discussed in Section 2.4, it is assumed that the mobilization time for medical facilities average 90 minutes in good weather, 100 minutes in rain/light snow and 110 minutes for heavy snow. Specially trained medical support staff (working their regular shift) will be on site to assist in the evacuation of patients. Additional staff (if needed) could be mobilized over this same 90-minute timeframe.

Activity: Board Passengers (C→D)

Item 5 of assumption 2.4 discusses transit vehicle loading times for medical facilities. Loading times are assumed to be at least 1 minute per ambulatory passenger, 45 minutes to load wheelchair vans (assumed 12 minutes per wheelchair bound passenger), and 60 minutes to load ambulances. Item 3 of Section 2.4 discusses transit vehicle capacities to cap loading times per vehicle type.

Activity: Travel to PZ Boundary (D→E)

Table 8-8 through Table 8-10 summarize the ETE for medical facilities within the PZs for good weather, rain/light snow, and heavy snow, respectfully. Average speeds output by the model for Scenario 6 (Scenario 7 for rain/light snow and Scenario 8 for heavy snow) Region R03, capped at 100 kph (90 kph for rain/light snow and 85 kph for heavy snow), are used to compute travel time to DPZ or CPZ boundary. The travel time to the DPZ or CPZ boundary is computed by dividing the distance to the DPZ or CPZ boundary by the average travel speed for an evacuation of the DPZ or CPZ, respectively. The ETE is the sum of the mobilization time, total passenger loading time, and travel time out of the area being evacuated. Concurrent loading on multiple buses, wheelchair vans, and ambulances at capacity is assumed such that the maximum loading times for buses, wheelchair vans and ambulances are 30, 48, and 60 minutes, respectively. All ETE are rounded up to the nearest 5 minutes. For example, the calculation of ETE for the Medical Faculties in P1 with 34 ambulatory residents during an evacuation of the DPZ in good weather is:

ETE: 90 + 30 x 1 + 101 = 221 min. or 3:45 (rounded up to the nearest 5 minutes)

It is assumed that medical facility population is directly evacuated to the appropriate medical Reception Centres outside of the area being evacuated. Relocation of this population to permanent facilities and/or passing through the Reception Centre before arriving at the host facility is not considered in this analysis.

The average single wave DPZ and CPZ ETE for medical facilities within the PZs are less than the ETE for the general population for Regions R03 and R04, respectively, at the 90$^{th}$ percentile, shown in Table 7-1.

Due to uncertainty of host medical facilities, or medical facility reception centres, a second wave ETE was not considered or computed.

*Evacuation of Correctional Facilities*

As detailed in Table E-9, there are two correctional facilities within the PZs – Kennedy Detention Centre inside the DPZ and Toronto East Detention Centre inside the CPZ. The total inmate population at these facilities are 485 persons – 12 people in Kennedy Detention Centre and 473 inside Toronto East Detention Centre. Kennedy Detention Centre owns a 12-passenger van that will be used during an evacuation and Toronto Detention Centre will require 16 buses (32 passengers per bus) to evacuate its population. The detailed evacuation plans for these facilities are confidential. For this reason, mobilization time is assumed to be 90 minutes (100 minutes in rain/light snow and 110 minutes in heavy snow) for both facilities. Concurrent loading on multiple buses/vans at 1-minute per inmate is assumed.

For example, for an evacuation of the DPZ (Region R03), the ETE for Kennedy Detention Centre is computed as 90 + 12 + 86 = 3:10 (rounded up to the next 5-minute interval) for good weather. Here, 90 minutes is the mobilization time, 12 minutes is the total loading time (12 people x 1 person per minute 12 x 1 = 12 minutes), and 86 minutes to travel 8.7 km at 6.04 kph.

All ETEs are rounded up to the nearest 5 minutes and are displayed in Table 8-11. Two separate ETEs are calculated for Kennedy Detention Centre. The first ETE displayed is for an evacuation of the DPZ (Region R03) and the second ETE displayed is for an evacuation of the CPZ (Region R04). A single ETE is calculated for Toronto Detention Centre since this facility is located inside the CPZ. It is assumed that Toronto Detention Centre will not evacuate when an evacuation order is given for Regions R01, R02 and R03.

Kennedy Detention Centre has enough resources to evacuate its inmates in one vehicle and a second-wave ETE calculation is not needed. Due to uncertainty of a host facility, or correctional facility reception centre, a second wave ETE was not considered or computed for the Toronto East Detention Centre.

**Table 8-1. Summary of Transportation Resources**

| Transportation Resource | Buses | Vans | Wheelchair Vans | Ambulances |
|---|---|---|---|---|
| **Resources Available** | | | | |
| **Durham Region Transit** | 160 | 0 | 20 | 0 |
| **Ambulances** | 0 | 0 | 0 | 31 |
| **Correctional Facilities** | 16 | 12 | 0 | 0 |
| **TOTAL:** | **176** | **12** | **20** | **31** |
| **DPZ Resources Needed** | | | | |
| **Schools, day camps and colleges (Table 3-9 and Table 3-10):** | 930 | 0 | 0 | 0 |
| **Medical Facilities (Table 3-8):** | 53 | 0 | 218 | 215 |
| **Transit-Dependent Population (Section 3.7):** | 117 | 0 | 0 | 0 |
| **Correctional Facilities (Section 3.5.2):** | 0 | 12 | 0 | 0 |
| **DPZ TRANSPORTATION NEEDS:** | **1,100** | **12** | **218** | **215** |
| **CPZ Resources Needed** | | | | |
| **Schools and colleges (Table 3-9 and Table 3-10):** | 2,849 | 0 | 0 | 0 |
| **Medical Facilities (Table 3-8):** | 217 | 0 | 1,099 | 1,148 |
| **Transit-Dependent Population (Section 3.7):** | 345 | 0 | 0 | 0 |
| **Correctional Facilities (Section 3.5.2):** | 16 | 0 | 0 | 0 |
| **CPZ TRANSPORTATION NEEDS:** | **3,427** | **0** | **1,099** | **1,148** |
| **TOTAL TRANSPORTATION NEEDS:** | **4,527** | **12** | **1,317** | **1,363** |

**Table 8-2. School Evacuation Time Estimates - Good Weather**

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Schools in P1 | 90 | 15 | 15.0 | 25.0 | 5.1 | 5.0 | 175 | 301 | **4:40** | **6:50** | 18.1 | 6.7 | 11 | 4 | **4:55** | **6:55** |
| P2 | Schools in P2 | 90 | 15 | 11.9 | 22.9 | 5.7 | 5.6 | 125 | 247 | **3:50** | **5:55** | 18.1 | 7.4 | 11 | 4 | **4:05** | **6:00** |
| P3 | Schools in P3 | 90 | 15 | 6.1 | 16.1 | 7.3 | 5.6 | 50 | 173 | **2:35** | **4:40** | 15.4 | 6.7 | 9 | 4 | **2:45** | **4:45** |
| P4 | Schools in P4 | 90 | 15 | 15.2 | 25.2 | 12.4 | 4.7 | 74 | 321 | **3:00** | **7:10** | 18.1 | 6.7 | 11 | 4 | **3:15** | **7:15** |
| P5 | Schools in P5 | 90 | 15 | 17.9 | 27.9 | 9.2 | 4.7 | 117 | 356 | **3:45** | **7:45** | 1.9 | 6.7 | 1 | 4 | **3:50** | **7:50** |
| P6 | Schools in P6 | 90 | 15 | 13.6 | 23.6 | 4.9 | 4.6 | 165 | 305 | **4:30** | **6:50** | 4.0 | 6.7 | 2 | 4 | **4:35** | **6:55** |
| P7 | Schools in P7 | 90 | 15 | 12.1 | 23.1 | 5.3 | 4.0 | 137 | 349 | **4:05** | **7:35** | 4.0 | 7.4 | 2 | 4 | **4:10** | **7:40** |
| P8 | Schools in P8 | 90 | 15 | 14.6 | 24.6 | 44.5 | 58.7 | 20 | 25 | **2:05** | **2:10** | 1.9 | 6.7 | 1 | 4 | **2:10** | **2:15** |
| P9 | Schools in P9 | 90 | 15 | 10.5 | 20.5 | 4.8 | 3.5 | 132 | 354 | **4:00** | **7:40** | 18.1 | 4.4 | 11 | 3 | **4:15** | **7:45** |
| P10 | Schools in P10 | 90 | 15 | 9.3 | 19.3 | 9.0 | 5.4 | 62 | 213 | **2:50** | **5:20** | 11.2 | 4.4 | 7 | 3 | **3:00** | **5:25** |
| P11 | Schools in P11 | 90 | 15 | 7.4 | 17.4 | 6.2 | 3.2 | 72 | 322 | **3:00** | **7:10** | 6.5 | 4.4 | 4 | 3 | **3:05** | **7:15** |
| P12 | Schools in P12 | 90 | 15 | 9.4 | 20.4 | 6.9 | 5.3 | 82 | 230 | **3:10** | **5:35** | 2.0 | 7.4 | 1 | 4 | **3:15** | **5:40** |
| P13 | Schools in P13 | 90 | 15 | 10.1 | 21.1 | 4.5 | 4.2 | 135 | 302 | **4:00** | **6:50** | 14.2 | 7.4 | 9 | 4 | **4:10** | **6:55** |
| P14 | Schools in P14 | 90 | 15 | 7.7 | 18.7 | 5.5 | 4.7 | 84 | 240 | **3:10** | **5:45** | 11.3 | 7.4 | 7 | 4 | **3:20** | **5:50** |
| P15 | Schools in P15 | 90 | 15 | 5.9 | 15.9 | 16.5 | 2.9 | 21 | 329 | **2:10** | **7:15** | 15.4 | 6.7 | 9 | 4 | **2:20** | **7:20** |
| P16 | Schools in P16 | 90 | 15 | 6.9 | 16.9 | 8.6 | 5.2 | 48 | 196 | **2:35** | **5:05** | 15.4 | 6.7 | 9 | 4 | **2:45** | **5:10** |
| P17 | Schools in P17 | 90 | 15 | 2.8 | 12.8 | 8.6 | 2.4 | 20 | 319 | **2:05** | **7:05** | 15.4 | 6.7 | 9 | 4 | **2:15** | **7:10** |
| P18 | Schools in P18 | 90 | 15 | 4.4 | 14.4 | 5.1 | 5.1 | 52 | 171 | **2:40** | **4:40** | 15.4 | 6.7 | 9 | 4 | **2:50** | **4:45** |
| P19 | Schools in P19 | 90 | 15 | 2.2 | 12.2 | 17.9 | 3.5 | 7 | 209 | **1:55** | **5:15** | 15.5 | 6.7 | 9 | 4 | **2:05** | **5:20** |
| P21 | Schools in P21 | 90 | 15 | 5.3 | 17.3 | 17.7 | 11.9 | 18 | 87 | **2:05** | **3:15** | 14.3 | 2.2 | 9 | 1 | **2:15** | **3:20** |
| P22 | Schools in P22 | 90 | 15 | 4.2 | 14.2 | 15.3 | 3.0 | 16 | 286 | **2:05** | **6:35** | 8.1 | 8.1 | 5 | 5 | **2:10** | **6:40** |
| | | | | | | | | | **Maximum for DPZ:** | **4:40** | **7:45** | | | | **Maximum:** | **4:55** | **7:50** |
| | | | | | | | | | **Average for DPZ:** | **3:05** | **6:05** | | | | **Average:** | **3:15** | **6:10** |

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Schools in CPZ1 | 90 | 15 | N/A | 13.3 | N/A | 7.5 | N/A | 106 | N/A | **3:35** | N/A | 8.5 | N/A | 5 | N/A | **3:40** |
| CPZ2 | Schools in CPZ2 | 90 | 15 | | 9.7 | | 1.9 | | 304 | | **6:50** | | 8.5 | | 5 | | **6:55** |
| CPZ6 | Schools in CPZ6 | 90 | 15 | | 13.2 | | 2.8 | | 278 | | **6:25** | | 5.5 | | 3 | | **6:30** |
| CPZ7 | Schools in CPZ7 | 90 | 15 | | 12.4 | | 2.8 | | 268 | | **6:15** | | 5.5 | | 3 | | **6:20** |
| CPZ8 | Schools in CPZ8 | 90 | 15 | | 13.5 | | 3.8 | | 212 | | **5:20** | | 9.0 | | 5 | | **5:25** |
| **Maximum for PZ:** | | | | | | | | | | **N/A** | **7:45** | **Maximum:** | | | | **N/A** | **7:50** |
| **Average for PZ:** | | | | | | | | | | | **6:00** | **Average:** | | | | | **6:05** |

**Table 8-3. School Evacuation Time Estimates – Rain/Light Snow**

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Schools in P1 | 100 | 20 | 15.0 | 25.0 | 4.8 | 4.8 | 189 | 315 | **5:10** | **7:15** | 18.1 | 6.7 | 12 | 4 | **5:25** | **7:20** |
| P2 | Schools in P2 | 100 | 20 | 11.9 | 22.9 | 6.4 | 5.3 | 112 | 261 | **3:55** | **6:25** | 18.1 | 7.4 | 12 | 5 | **4:10** | **6:30** |
| P3 | Schools in P3 | 100 | 20 | 6.1 | 16.1 | 5.9 | 5.1 | 62 | 189 | **3:05** | **5:10** | 15.4 | 6.7 | 10 | 4 | **3:15** | **5:15** |
| P4 | Schools in P4 | 100 | 20 | 15.2 | 25.2 | 10.5 | 4.7 | 87 | 324 | **3:30** | **7:25** | 18.1 | 6.7 | 12 | 4 | **3:45** | **7:30** |
| P5 | Schools in P5 | 100 | 20 | 17.9 | 27.9 | 8.2 | 4.2 | 131 | 401 | **4:15** | **8:45** | 1.9 | 6.7 | 1 | 4 | **4:20** | **8:50** |
| P6 | Schools in P6 | 100 | 20 | 13.6 | 23.6 | 4.5 | 4.4 | 182 | 320 | **5:05** | **7:20** | 4.0 | 6.7 | 3 | 4 | **5:10** | **7:25** |
| P7 | Schools in P7 | 100 | 20 | 12.1 | 23.1 | 4.9 | 3.6 | 149 | 385 | **4:30** | **8:25** | 4.0 | 7.4 | 3 | 5 | **4:35** | **8:30** |
| P8 | Schools in P8 | 100 | 20 | 14.6 | 24.6 | 41.4 | 54.1 | 21 | 27 | **2:25** | **2:30** | 1.9 | 6.7 | 1 | 4 | **2:30** | **2:35** |
| P9 | Schools in P9 | 100 | 20 | 10.5 | 20.5 | 4.6 | 3.2 | 138 | 382 | **4:20** | **8:25** | 18.1 | 4.4 | 12 | 3 | **4:35** | **8:30** |
| P10 | Schools in P10 | 100 | 20 | 9.3 | 19.3 | 8.8 | 4.8 | 63 | 243 | **3:05** | **6:05** | 11.2 | 4.4 | 7 | 3 | **3:15** | **6:10** |
| P11 | Schools in P11 | 100 | 20 | 7.4 | 17.4 | 5.9 | 3.0 | 75 | 352 | **3:15** | **7:55** | 6.5 | 4.4 | 4 | 3 | **3:20** | **8:00** |
| P12 | Schools in P12 | 100 | 20 | 9.4 | 20.4 | 7.2 | 5.1 | 79 | 242 | **3:20** | **6:05** | 2.0 | 7.4 | 1 | 5 | **3:25** | **6:10** |
| P13 | Schools in P13 | 100 | 20 | 10.1 | 21.1 | 4.4 | 4.0 | 138 | 313 | **4:20** | **7:15** | 14.2 | 7.4 | 9 | 5 | **4:30** | **7:20** |
| P14 | Schools in P14 | 100 | 20 | 7.7 | 18.7 | 5.5 | 4.6 | 84 | 246 | **3:25** | **6:10** | 11.3 | 7.4 | 8 | 5 | **3:35** | **6:15** |
| P15 | Schools in P15 | 100 | 20 | 5.9 | 15.9 | 10.2 | 2.8 | 35 | 344 | **2:35** | **7:45** | 15.4 | 6.7 | 10 | 4 | **2:45** | **7:50** |
| P16 | Schools in P16 | 100 | 20 | 6.9 | 16.9 | 6.6 | 4.7 | 62 | 214 | **3:05** | **5:35** | 15.4 | 6.7 | 10 | 4 | **3:15** | **5:40** |
| P17 | Schools in P17 | 100 | 20 | 2.8 | 12.8 | 5.4 | 2.3 | 31 | 328 | **2:35** | **7:30** | 15.4 | 6.7 | 10 | 4 | **2:45** | **7:35** |
| P18 | Schools in P18 | 100 | 20 | 4.4 | 14.4 | 4.9 | 4.5 | 54 | 193 | **2:55** | **5:15** | 15.4 | 6.7 | 10 | 4 | **3:05** | **5:20** |
| P19 | Schools in P19 | 100 | 20 | 2.2 | 12.2 | 8.0 | 3.5 | 17 | 207 | **2:20** | **5:30** | 15.5 | 6.7 | 10 | 4 | **2:30** | **5:35** |
| P21 | Schools in P21 | 100 | 20 | 5.3 | 17.3 | 13.7 | 10.5 | 23 | 99 | **2:25** | **3:40** | 14.3 | 2.2 | 10 | 1 | **2:35** | **3:45** |
| P22 | Schools in P22 | 100 | 20 | 4.2 | 14.2 | 11.8 | 2.7 | 21 | 310 | **2:25** | **7:10** | 8.1 | 8.1 | 5 | 5 | **2:30** | **7:15** |
| | | | | | | | | | **Maximum for DPZ:** | **5:10** | **8:45** | | | | **Maximum:** | **5:25** | **8:50** |
| | | | | | | | | | **Average for DPZ:** | **3:25** | **6:35** | | | | **Average:** | **3:35** | **6:40** |

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Schools in CPZ1 | 100 | 20 | | 13.3 | | 23.7 | | 34 | | **2:35** | | 8.5 | | 6 | | **2:45** |
| CPZ2 | Schools in CPZ2 | 100 | 20 | | 9.7 | | 16.8 | | 35 | | **2:35** | | 8.5 | | 6 | | **2:45** |
| CPZ6 | Schools in CPZ6 | 100 | 20 | N/A | 13.2 | N/A | 7.4 | N/A | 107 | N/A | **3:50** | N/A | 5.5 | N/A | 4 | N/A | **3:55** |
| CPZ7 | Schools in CPZ7 | 100 | 20 | | 12.4 | | 8.5 | | 88 | | **3:30** | | 5.5 | | 4 | | **3:35** |
| CPZ8 | Schools in CPZ8 | 100 | 20 | | 13.5 | | 47.0 | | 17 | | **2:20** | | 9.0 | | 6 | | **2:30** |
| | | | | | | | | | **Maximum for PZ:** | **N/A** | **8:45** | | | | **Maximum:** | **N/A** | **8:50** |
| | | | | | | | | | **Average for PZ:** | | **5:55** | | | | **Average:** | | **6:00** |

**Table 8-4. School Evacuation Time Estimates – Heavy Snow**

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Schools in P1 | 110 | 25 | 15.0 | 25.0 | 4.4 | 4.2 | 205 | 354 | **5:40** | **8:10** | 18.1 | 6.7 | 14 | 5 | **5:55** | **8:15** |
| P2 | Schools in P2 | 110 | 25 | 11.9 | 22.9 | 5.4 | 4.6 | 131 | 296 | **4:30** | **7:15** | 18.1 | 7.4 | 14 | 6 | **4:45** | **7:25** |
| P3 | Schools in P3 | 110 | 25 | 6.1 | 16.1 | 6.0 | 4.7 | 61 | 203 | **3:20** | **5:40** | 15.4 | 6.7 | 12 | 5 | **3:35** | **5:45** |
| P4 | Schools in P4 | 110 | 25 | 15.2 | 25.2 | 10.1 | 4.1 | 90 | 367 | **3:45** | **8:25** | 18.1 | 6.7 | 14 | 5 | **4:00** | **8:30** |
| P5 | Schools in P5 | 110 | 25 | 17.9 | 27.9 | 7.1 | 3.8 | 152 | 436 | **4:50** | **9:35** | 1.9 | 6.7 | 1 | 5 | **4:55** | **9:40** |
| P6 | Schools in P6 | 110 | 25 | 13.6 | 23.6 | 4.2 | 4.0 | 193 | 353 | **5:30** | **8:10** | 4.0 | 6.7 | 3 | 5 | **5:35** | **8:15** |
| P7 | Schools in P7 | 110 | 25 | 12.1 | 23.1 | 4.6 | 3.2 | 160 | 434 | **4:55** | **9:30** | 4.0 | 7.4 | 3 | 6 | **5:00** | **9:40** |
| P8 | Schools in P8 | 110 | 25 | 14.6 | 24.6 | 36.0 | 55.3 | 24 | 27 | **2:40** | **2:45** | 1.9 | 6.7 | 1 | 5 | **2:45** | **2:50** |
| P9 | Schools in P9 | 110 | 25 | 10.5 | 20.5 | 4.2 | 2.8 | 151 | 435 | **4:50** | **9:30** | 18.1 | 4.4 | 14 | 3 | **5:05** | **9:35** |
| P10 | Schools in P10 | 110 | 25 | 9.3 | 19.3 | 7.6 | 4.0 | 73 | 291 | **3:30** | **7:10** | 11.2 | 4.4 | 8 | 3 | **3:40** | **7:15** |
| P11 | Schools in P11 | 110 | 25 | 7.4 | 17.4 | 5.3 | 2.6 | 84 | 395 | **3:40** | **8:50** | 6.5 | 4.4 | 5 | 3 | **3:45** | **8:55** |
| P12 | Schools in P12 | 110 | 25 | 9.4 | 20.4 | 5.4 | 4.8 | 105 | 257 | **4:00** | **6:35** | 2.0 | 7.4 | 2 | 6 | **4:05** | **6:45** |
| P13 | Schools in P13 | 110 | 25 | 10.1 | 21.1 | 3.8 | 3.6 | 160 | 351 | **4:55** | **8:10** | 14.2 | 7.4 | 11 | 6 | **5:10** | **8:20** |
| P14 | Schools in P14 | 110 | 25 | 7.7 | 18.7 | 4.3 | 4.2 | 108 | 269 | **4:05** | **6:45** | 11.3 | 7.4 | 8 | 6 | **4:15** | **6:55** |
| P15 | Schools in P15 | 110 | 25 | 5.9 | 15.9 | 15.3 | 2.5 | 23 | 377 | **2:40** | **8:35** | 15.4 | 6.7 | 12 | 5 | **2:55** | **8:40** |
| P16 | Schools in P16 | 110 | 25 | 6.9 | 16.9 | 5.6 | 4.5 | 74 | 226 | **3:30** | **6:05** | 15.4 | 6.7 | 12 | 5 | **3:45** | **6:10** |
| P17 | Schools in P17 | 110 | 25 | 2.8 | 12.8 | 6.8 | 2.2 | 25 | 353 | **2:40** | **8:10** | 15.4 | 6.7 | 12 | 5 | **2:55** | **8:15** |
| P18 | Schools in P18 | 110 | 25 | 4.4 | 14.4 | 4.9 | 4.3 | 54 | 199 | **3:10** | **5:35** | 15.4 | 6.7 | 12 | 5 | **3:25** | **5:40** |
| P19 | Schools in P19 | 110 | 25 | 2.2 | 12.2 | 13.5 | 3.3 | 10 | 225 | **2:25** | **6:00** | 15.5 | 6.7 | 12 | 5 | **2:40** | **6:05** |
| P21 | Schools in P21 | 110 | 25 | 5.3 | 17.3 | 18.1 | 9.3 | 18 | 111 | **2:35** | **4:10** | 14.3 | 2.2 | 11 | 2 | **2:50** | **4:15** |
| P22 | Schools in P22 | 110 | 25 | 4.2 | 14.2 | 9.5 | 2.5 | 27 | 346 | **2:45** | **8:05** | 8.1 | 8.1 | 6 | 6 | **2:55** | **8:15** |
| | | | | | | | | | **Maximum for DPZ:** | **5:40** | **9:35** | | | | **Maximum:** | **5:55** | **9:40** |
| | | | | | | | | | **Average for DPZ:** | **3:50** | **7:20** | | | | **Average:** | **4:00** | **7:25** |

| Response Sector | Representative School by Response Sector | Driver Mobilization Time (min) | Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Average Speed (DPZ Evac) (kph) | Average Speed (CPZ Evac) (kph) | Travel Time to DPZ Bdry (min) | Travel Time to CPZ Bdry (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Dist. DPZ Bdry to THC (km) | Dist. CPZ Bdry to RC (km) | Travel Time from DPZ Bdry to THC (min) | Travel Time from CPZ Bdry to RC (min) | DPZ ETA to THC (hr:min) | CPZ ETA to RC (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Schools in CPZ1 | 110 | 25 | N/A | 13.3 | N/A | 20.0 | N/A | 40 | N/A | **2:55** | N/A | 8.5 | N/A | 6 | N/A | **3:05** |
| CPZ2 | Schools in CPZ2 | 110 | 25 | | 9.7 | | 15.5 | | 38 | | **2:55** | | 8.5 | | 6 | | **3:05** |
| CPZ6 | Schools in CPZ6 | 110 | 25 | | 13.2 | | 6.1 | | 130 | | **4:25** | | 5.5 | | 4 | | **4:30** |
| CPZ7 | Schools in CPZ7 | 110 | 25 | | 12.4 | | 8.4 | | 89 | | **3:45** | | 5.5 | | 4 | | **3:50** |
| CPZ8 | Schools in CPZ8 | 110 | 25 | | 13.5 | | 45.4 | | 18 | | **2:35** | | 9.0 | | 7 | | **2:45** |
| **Maximum for PZ:** | | | | | | | | | | **N/A** | **9:35** | **Maximum:** | | | | **N/A** | **9:40** |
| **Average for PZ:** | | | | | | | | | | | **6:35** | **Average:** | | | | | **6:40** |

**Table 8-5. Transit-Dependent Evacuation Time Estimates - Good Weather**

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **DRT-101** | 4 | 120 | 15.0 | 25.0 | 5.6 | 5.5 | 161 | 273 | 30 | **5:15** | **7:05** | 20.0 | 18 | 5 | 10 | 102 | 30 | **8:00** |
| **DRT-103** | 7 | 120 | 13.0 | 23.0 | 8.0 | 4.9 | 98 | 284 | 30 | **4:10** | **7:15** | 18.0 | 17 | 5 | 10 | 49 | 30 | **6:05** |
| **DRT-110** | 4 | 120 | 11.0 | 21.0 | 6.3 | 4.2 | 105 | 300 | 30 | **4:15** | **7:30** | 18.0 | 17 | 5 | 10 | 43 | 30 | **6:00** |
| **DRT-112** | 8 | 120 | 16.0 | 26.0 | 11.5 | 6.5 | 83 | 242 | 30 | **3:55** | **6:35** | 18.0 | 17 | 5 | 10 | 51 | 30 | **5:50** |
| **DRT-120** | 6 | 120 | 14.0 | 24.0 | 11.2 | 9.8 | 75 | 146 | 30 | **3:45** | **5:00** | 18.0 | 17 | 5 | 10 | 94 | 30 | **6:25** |
| **DRT-216** | 6 | 120 | 10.0 | 23.0 | 10.2 | 4.2 | 59 | 328 | 30 | **3:30** | **8:00** | 23.0 | 21 | 5 | 10 | 50 | 30 | **5:30** |
| **DRT-222** | 8 | 120 | 11.0 | 23.0 | 5.7 | 4.8 | 116 | 286 | 30 | **4:30** | **7:20** | 17.0 | 16 | 5 | 10 | 95 | 30 | **7:10** |
| **DRT-224** | 13 | 120 | 15.0 | 25.0 | 6.7 | 4.4 | 134 | 339 | 30 | **4:45** | **8:10** | 18.0 | 17 | 5 | 10 | 66 | 30 | **6:55** |
| **DRT-291** | 4 | 120 | 22.0 | 32.0 | 6.7 | 5.0 | 196 | 384 | 30 | **5:50** | **8:55** | 18.0 | 17 | 5 | 10 | 73 | 30 | **8:05** |
| **DRT-900** | 11 | 120 | 13.0 | 23.0 | 45.1 | 8.1 | 17 | 170 | 30 | **2:50** | **5:20** | 16.0 | 15 | 5 | 10 | 77 | 30 | **5:10** |
| **DRT-915** | 8 | 120 | 9.0 | 21.0 | 44.1 | 2.7 | 12 | 463 | 30 | **2:45** | **10:15** | 14.0 | 13 | 5 | 10 | 55 | 30 | **4:40** |
| **DRT-916** | 7 | 120 | 11.0 | 23.0 | 30.5 | 3.3 | 22 | 414 | 30 | **2:55** | **9:25** | 20.0 | 18 | 5 | 10 | 70 | 30 | **5:10** |
| **DRT-917** | 2 | 120 | 11.0 | 24.0 | 44.1 | 2.9 | 15 | 491 | 30 | **2:45** | **10:45** | 17.0 | 16 | 5 | 10 | 70 | 30 | **5:00** |
| **DRT-920** | 4 | 120 | 13.0 | 23.0 | 45.1 | 8.1 | 17 | 170 | 30 | **2:50** | **5:20** | 16.0 | 15 | 5 | 10 | 75 | 30 | **5:05** |
| **TTC-38** | 4 | 120 | 7.0 | 17.0 | 43.5 | 7.0 | 10 | 145 | 30 | **2:40** | **4:55** | 17.0 | 16 | 5 | 10 | 39 | 30 | **4:20** |
| **TTC-54** | 2 | 120 | 6.0 | 16.0 | 4.1 | 2.7 | 88 | 350 | 30 | **4:00** | **8:20** | 19.0 | 18 | 5 | 10 | 29 | 30 | **5:35** |
| **TTC-85** | 4 | 120 | 8.0 | 18.0 | 18.5 | 3.5 | 26 | 305 | 30 | **3:00** | **7:35** | 17.0 | 16 | 5 | 10 | 42 | 30 | **4:45** |
| **TTC-86** | 2 | 120 | 7.0 | 18.0 | 5.6 | 3.5 | 76 | 305 | 30 | **3:50** | **7:35** | 17.0 | 16 | 5 | 10 | 29 | 30 | **5:20** |
| **TTC-95** | 3 | 120 | 5.0 | 14.0 | 5.4 | 3.3 | 55 | 255 | 30 | **3:25** | **6:45** | 15.0 | 14 | 5 | 10 | 24 | 30 | **4:50** |
| **GO-41** | 5 | 120 | 12.0 | 22.0 | 6.2 | 4.6 | 116 | 284 | 30 | **4:30** | **7:15** | 17.0 | 16 | 5 | 10 | 38 | 30 | **6:10** |
| **G0-51/92** | 5 | 120 | 15.0 | 25.0 | 5.5 | 3.7 | 163 | 401 | 30 | **5:15** | **9:15** | 17.0 | 16 | 5 | 10 | 45 | 30 | **7:05** |
| **DRT-403** | 9 | 120 | | 11.0 | | 2.5 | | 264 | 30 | | **6:55** | | | | | | | |
| **DRT-405** | 9 | 120 | | 6.0 | | 2.5 | | 145 | 30 | | **4:55** | | | | | | | |
| **DRT-409** | 9 | 120 | | 9.0 | | 2.8 | | 195 | 30 | | **5:45** | | | | | | | |
| **DRT-410** | 9 | 120 | | 5.0 | | 2.0 | | 150 | 30 | | **5:00** | | | | | | | |
| **DRT-411** | 9 | 120 | N/A | 4.0 | N/A | 3.1 | N/A | 77 | 30 | **N/A** | **3:50** | N/A | | | | | | **N/A** |
| **DRT-423** | 8 | 120 | | 4.0 | | 2.5 | | 98 | 30 | | **4:10** | | | | | | | |
| **DRT-902** | 8 | 120 | | 7.0 | | 2.1 | | 198 | 30 | | **5:50** | | | | | | | |
| **TTC-2** | 14 | 120 | | 3.0 | | 2.1 | | 86 | 30 | | **4:00** | | | | | | | |
| **TTC-9** | 14 | 120 | | 12.0 | | 2.4 | | 294 | 30 | | **7:25** | | | | | | | |
| **TTC-16** | 14 | 120 | | 10.0 | | 2.3 | | 261 | 30 | | **6:55** | | | | | | | |
| **TTC-20** | 14 | 120 | | 7.0 | | 3.9 | | 107 | 30 | | **4:20** | | | | | | | |

| Route Number | Number of Buses | One-Way | | | | | | | | | | Two-Way for DPZ Evacuation ONLY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **TTC-39** | 7 | 120 | | 10.0 | | 5.9 | | 102 | 30 | | **4:15** | | | | | | | |
| **TTC-42** | 7 | 120 | | 7.0 | | 2.4 | | 178 | 30 | | **5:30** | | | | | | | |
| **TTC-43** | 14 | 120 | | 13.0 | | 2.6 | | 298 | 30 | | **7:30** | | | | | | | |
| **TTC-53** | 6 | 120 | | 11.0 | | 2.9 | | 228 | 30 | | **6:20** | | | | | | | |
| **TTC-57** | 6 | 120 | | 14.0 | | 3.1 | | 267 | 30 | | **7:00** | | | | | | | |
| **TTC-68** | 6 | 120 | | 6.0 | | 2.2 | | 162 | 30 | | **5:15** | | | | | | | |
| **TTC-102** | 7 | 120 | | 25.0 | | 4.4 | | 341 | 30 | | **8:15** | | | | | | | |
| **TTC-113** | 7 | 120 | | 4.0 | | 3.7 | | 65 | 30 | | **3:35** | | | | | | | |
| **TTC-116** | 7 | 120 | | 17.0 | | 3.9 | | 260 | 30 | | **6:50** | | | | | | | |
| **TTC-131** | 7 | 120 | | 11.0 | | 3.7 | | 177 | 30 | | **5:30** | | | | | | | |
| **TTC-132** | 7 | 120 | | 13.0 | | 3.8 | | 205 | 30 | | **5:55** | | | | | | | |
| **TTC-133** | 7 | 120 | | 14.0 | | 3.3 | | 251 | 30 | | **6:45** | | | | | | | |
| **TTC-134** | 7 | 120 | | 11.0 | | 2.9 | | 227 | 30 | | **6:20** | | | | | | | |
| **TTC-169** | 7 | 120 | | 8.0 | | 2.1 | | 224 | 30 | | **6:15** | | | | | | | |
| **Go-52/56** | 15 | 120 | | 15.0 | | 3.3 | | 272 | 30 | | **7:05** | | | | | | | |
| **Go-54/71** | 6 | 120 | N/A | 6.0 | N/A | 2.6 | N/A | 139 | 30 | **N/A** | **4:50** | | | N/A | | | | **N/A** |
| **GO-81** | 9 | 120 | | 16.0 | | 3.3 | | 287 | 30 | | **7:20** | | | | | | | |
| **YRT-1** | 4 | 120 | | 10.0 | | 3.8 | | 157 | 30 | | **5:10** | | | | | | | |
| **YRT-2** | 9 | 120 | | 15.0 | | 2.2 | | 402 | 30 | | **9:15** | | | | | | | |
| **YRT-8** | 6 | 120 | | 7.0 | | 2.6 | | 159 | 30 | | **5:10** | | | | | | | |
| **YRT-9** | 4 | 120 | | 10.0 | | 3.0 | | 203 | 30 | | **5:55** | | | | | | | |
| **YRT-14** | 9 | 120 | | 9.0 | | 5.1 | | 106 | 30 | | **4:20** | | | | | | | |
| **YRT-16** | 4 | 120 | | 7.0 | | 2.5 | | 165 | 30 | | **5:15** | | | | | | | |
| **YRT-18** | 4 | 120 | | 8.0 | | 2.3 | | 207 | 30 | | **6:00** | | | | | | | |
| **YRT-25** | 4 | 120 | | 9.0 | | 6.6 | | 82 | 30 | | **3:55** | | | | | | | |
| **YRT-301** | 9 | 120 | | 11.0 | | 5.3 | | 125 | 30 | | **4:35** | | | | | | | |
| **YRT-303** | 9 | 120 | | 14.0 | | 11.6 | | 72 | 30 | | **3:45** | | | | | | | |
| **YRT-305** | 9 | 120 | | 10.0 | | 6.1 | | 98 | 30 | | **4:10** | | | | | | | |
| **YRT-402** | 9 | 120 | | 8.0 | | 2.1 | | 228 | 30 | | **6:20** | | | | | | | |
| **YRT-417** | 9 | 120 | | 8.0 | | 4.8 | | 99 | 30 | | **4:10** | | | | | | | |
| **YRT-522** | 4 | 120 | | 9.0 | | 3.0 | | 179 | 30 | | **5:30** | | | | | | | |

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **YRT-Purple/Purple A** | 3 | 120 | N/A | 9.0 | N/A | 3.4 | N/A | 158 | 30 | **N/A** | **5:10** | N/A | | | | | | **N/A** |
| | | | | | | | | | **Maximum ETE:** | **5:50** | **10:45** | | | | | | **Maximum ETE:** | **8:05** |
| | | | | | | | | | **Average ETE:** | **3:50** | **6:15** | | | | | | **Average ETE:** | **5:55** |

**Table 8-6. Transit-Dependent Evacuation Time Estimates – Rain/Light Snow**

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **DRT-101** | 4 | 130 | 15.0 | 25.0 | 5.3 | 5.3 | 169 | 283 | 35 | **5:35** | **7:30** | 20.0 | 20 | 5 | 10 | 124 | 35 | **8:50** |
| **DRT-103** | 7 | 130 | 13.0 | 23.0 | 7.1 | 4.6 | 110 | 298 | 35 | **4:35** | **7:45** | 18.0 | 18 | 5 | 10 | 58 | 35 | **6:45** |
| **DRT-110** | 4 | 130 | 11.0 | 21.0 | 6.1 | 4.2 | 109 | 303 | 35 | **4:35** | **7:50** | 18.0 | 18 | 5 | 10 | 60 | 35 | **6:45** |
| **DRT-112** | 8 | 130 | 16.0 | 26.0 | 9.9 | 6.1 | 97 | 255 | 35 | **4:25** | **7:00** | 18.0 | 18 | 5 | 10 | 51 | 35 | **6:25** |
| **DRT-120** | 6 | 130 | 14.0 | 24.0 | 10.8 | 9.6 | 78 | 150 | 35 | **4:05** | **5:15** | 18.0 | 18 | 5 | 10 | 85 | 35 | **6:40** |
| **DRT-216** | 6 | 130 | 10.0 | 23.0 | 8.0 | 3.7 | 75 | 372 | 35 | **4:00** | **9:00** | 23.0 | 23 | 5 | 10 | 56 | 35 | **6:10** |
| **DRT-222** | 8 | 130 | 11.0 | 23.0 | 5.7 | 4.8 | 115 | 289 | 35 | **4:40** | **7:35** | 17.0 | 17 | 5 | 10 | 93 | 35 | **7:20** |
| **DRT-224** | 13 | 130 | 15.0 | 25.0 | 6.0 | 3.9 | 149 | 385 | 35 | **5:15** | **9:10** | 18.0 | 18 | 5 | 10 | 68 | 35 | **7:35** |
| **DRT-291** | 4 | 130 | 22.0 | 32.0 | 6.4 | 4.5 | 205 | 430 | 35 | **6:10** | **9:55** | 18.0 | 18 | 5 | 10 | 68 | 35 | **8:30** |
| **DRT-900** | 11 | 130 | 13.0 | 23.0 | 41.0 | 7.2 | 19 | 193 | 35 | **3:05** | **6:00** | 16.0 | 16 | 5 | 10 | 69 | 35 | **5:20** |
| **DRT-915** | 8 | 130 | 9.0 | 21.0 | 39.0 | 2.5 | 14 | 497 | 35 | **3:00** | **11:05** | 14.0 | 14 | 5 | 10 | 53 | 35 | **5:00** |
| **DRT-916** | 7 | 130 | 11.0 | 23.0 | 20.0 | 3.2 | 33 | 431 | 35 | **3:20** | **10:00** | 20.0 | 20 | 5 | 10 | 67 | 35 | **5:40** |
| **DRT-917** | 2 | 130 | 11.0 | 24.0 | 40.7 | 2.7 | 16 | 536 | 35 | **3:05** | **11:45** | 17.0 | 17 | 5 | 10 | 64 | 35 | **5:20** |
| **DRT-920** | 4 | 130 | 13.0 | 23.0 | 41.0 | 7.2 | 19 | 193 | 35 | **3:05** | **6:00** | 16.0 | 16 | 5 | 10 | 73 | 35 | **5:25** |
| **TTC-38** | 4 | 130 | 7.0 | 17.0 | 39.1 | 6.0 | 11 | 169 | 35 | **3:00** | **5:35** | 17.0 | 17 | 5 | 10 | 35 | 35 | **4:45** |
| **TTC-54** | 2 | 130 | 6.0 | 16.0 | 3.8 | 2.6 | 94 | 373 | 35 | **4:20** | **9:00** | 19.0 | 19 | 5 | 10 | 29 | 35 | **6:00** |
| **TTC-85** | 4 | 130 | 8.0 | 18.0 | 15.3 | 3.5 | 31 | 313 | 35 | **3:20** | **8:00** | 17.0 | 17 | 5 | 10 | 41 | 35 | **5:10** |
| **TTC-86** | 2 | 130 | 7.0 | 18.0 | 5.0 | 3.2 | 84 | 339 | 35 | **4:10** | **8:25** | 17.0 | 17 | 5 | 10 | 29 | 35 | **5:50** |
| **TTC-95** | 3 | 130 | 5.0 | 14.0 | 4.8 | 3.0 | 62 | 283 | 35 | **3:50** | **7:30** | 15.0 | 15 | 5 | 10 | 24 | 35 | **5:20** |
| **GO-41** | 5 | 130 | 12.0 | 22.0 | 7.0 | 4.5 | 102 | 291 | 35 | **4:30** | **7:40** | 17.0 | 17 | 5 | 10 | 37 | 35 | **6:15** |
| **G0-51/92** | 5 | 130 | 15.0 | 25.0 | 5.2 | 3.4 | 172 | 437 | 35 | **5:40** | **10:05** | 17.0 | 17 | 5 | 10 | 43 | 35 | **7:30** |
| **DRT-403** | 9 | 130 | | 11.0 | | 2.4 | | 279 | 35 | | **7:25** | | | | | | | |
| **DRT-405** | 9 | 130 | | 6.0 | | 2.3 | | 154 | 35 | | **5:20** | | | | | | | |
| **DRT-409** | 9 | 130 | | 9.0 | | 2.6 | | 205 | 35 | | **6:10** | | | | | | | |
| **DRT-410** | 9 | 130 | | 5.0 | | 1.9 | | 155 | 35 | | **5:20** | | | | | | | |
| **DRT-411** | 9 | 130 | | 4.0 | | 3.0 | | 80 | 35 | | **4:05** | | | | | | | |
| **DRT-423** | 8 | 130 | N/A | 4.0 | N/A | 2.6 | N/A | 93 | 35 | **N/A** | **4:20** | | | | N/A | | | **N/A** |
| **DRT-902** | 8 | 130 | | 7.0 | | 2.1 | | 201 | 35 | | **6:10** | | | | | | | |
| **TTC-2** | 14 | 130 | | 3.0 | | 2.3 | | 80 | 35 | | **4:05** | | | | | | | |
| **TTC-9** | 14 | 130 | | 12.0 | | 2.4 | | 300 | 35 | | **7:45** | | | | | | | |
| **TTC-16** | 14 | 130 | | 10.0 | | 2.2 | | 267 | 35 | | **7:15** | | | | | | | |
| **TTC-20** | 14 | 130 | | 7.0 | | 4.3 | | 98 | 35 | | **4:25** | | | | | | | |

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **TTC-39** | 7 | 130 | | 10.0 | | 5.1 | | 118 | 35 | | **4:45** | | | | | | | |
| **TTC-42** | 7 | 130 | | 7.0 | | 2.5 | | 169 | 35 | | **5:35** | | | | | | | |
| **TTC-43** | 14 | 130 | | 13.0 | | 2.4 | | 322 | 35 | | **8:10** | | | | | | | |
| **TTC-53** | 6 | 130 | | 11.0 | | 2.8 | | 232 | 35 | | **6:40** | | | | | | | |
| **TTC-57** | 6 | 130 | | 14.0 | | 2.9 | | 291 | 35 | | **7:40** | | | | | | | |
| **TTC-68** | 6 | 130 | | 6.0 | | 2.1 | | 170 | 35 | | **5:35** | | | | | | | |
| **TTC-102** | 7 | 130 | | 25.0 | | 4.2 | | 359 | 35 | | **8:45** | | | | | | | |
| **TTC-113** | 7 | 130 | | 4.0 | | 3.7 | | 65 | 35 | | **3:50** | | | | | | | |
| **TTC-116** | 7 | 130 | | 17.0 | | 3.8 | | 265 | 35 | | **7:10** | | | | | | | |
| **TTC-131** | 7 | 130 | | 11.0 | | 3.7 | | 180 | 35 | | **5:45** | | | | | | | |
| **TTC-132** | 7 | 130 | | 13.0 | | 3.7 | | 211 | 35 | | **6:20** | | | | | | | |
| **TTC-133** | 7 | 130 | | 14.0 | | 3.5 | | 241 | 35 | | **6:50** | | | | | | | |
| **TTC-134** | 7 | 130 | | 11.0 | | 2.8 | | 235 | 35 | | **6:40** | | | | | | | |
| **TTC-169** | 7 | 130 | | 8.0 | | 2.1 | | 231 | 35 | | **6:40** | | | | | | | |
| **Go-52/56** | 15 | 130 | | 15.0 | | 3.2 | | 285 | 35 | | **7:30** | | | | | | | |
| **Go-54/71** | 6 | 130 | N/A | 6.0 | N/A | 2.4 | N/A | 147 | 35 | **N/A** | **5:15** | | N/A | | | | | **N/A** |
| **GO-81** | 9 | 130 | | 16.0 | | 3.2 | | 298 | 35 | | **7:45** | | | | | | | |
| **YRT-1** | 4 | 130 | | 10.0 | | 3.5 | | 172 | 35 | | **5:40** | | | | | | | |
| **YRT-2** | 9 | 130 | | 15.0 | | 2.1 | | 422 | 35 | | **9:50** | | | | | | | |
| **YRT-8** | 6 | 130 | | 7.0 | | 2.5 | | 167 | 35 | | **5:35** | | | | | | | |
| **YRT-9** | 4 | 130 | | 10.0 | | 2.9 | | 209 | 35 | | **6:15** | | | | | | | |
| **YRT-14** | 9 | 130 | | 9.0 | | 4.3 | | 125 | 35 | | **4:50** | | | | | | | |
| **YRT-16** | 4 | 130 | | 7.0 | | 2.5 | | 169 | 35 | | **5:35** | | | | | | | |
| **YRT-18** | 4 | 130 | | 8.0 | | 2.2 | | 213 | 35 | | **6:20** | | | | | | | |
| **YRT-25** | 4 | 130 | | 9.0 | | 5.2 | | 104 | 35 | | **4:30** | | | | | | | |
| **YRT-301** | 9 | 130 | | 11.0 | | 5.1 | | 129 | 35 | | **4:55** | | | | | | | |
| **YRT-303** | 9 | 130 | | 14.0 | | 10.0 | | 84 | 35 | | **4:10** | | | | | | | |
| **YRT-305** | 9 | 130 | | 10.0 | | 5.4 | | 111 | 35 | | **4:40** | | | | | | | |
| **YRT-402** | 9 | 130 | | 8.0 | | 2.0 | | 236 | 35 | | **6:45** | | | | | | | |
| **YRT-417** | 9 | 130 | | 8.0 | | 4.2 | | 115 | 35 | | **4:40** | | | | | | | |
| **YRT-522** | 4 | 130 | | 9.0 | | 3.0 | | 179 | 35 | | **5:45** | | | | | | | |

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **YRT-Purple/Purple A** | 3 | 130 | N/A | 9.0 | N/A | 3.3 | N/A | 166 | 35 | **N/A** | **5:35** | N/A | | | | | | **N/A** |
| | | | | | | | | | **Maximum ETE:** | **6:10** | **11:45** | | | | | | **Maximum ETE:** | **8:50** |
| | | | | | | | | | **Average ETE:** | **4:10** | **6:45** | | | | | | **Average ETE:** | **6:20** |

**Table 8-7. Transit Dependent Evacuation Time Estimates – Heavy Snow**

| Route Number | Number of Buses | One-Wave | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **DRT-101** | 4 | 140 | 15.0 | 25.0 | 4.9 | 4.8 | 184 | 315 | 40 | **6:05** | **8:15** | 20.0 | 22 | 5 | 10 | 135 | 40 | **9:40** |
| **DRT-103** | 7 | 140 | 13.0 | 23.0 | 6.8 | 4.1 | 114 | 333 | 40 | **4:55** | **8:35** | 18.0 | 20 | 5 | 10 | 76 | 40 | **7:30** |
| **DRT-110** | 4 | 140 | 11.0 | 21.0 | 5.4 | 3.8 | 121 | 336 | 40 | **5:05** | **8:40** | 18.0 | 20 | 5 | 10 | 78 | 40 | **7:40** |
| **DRT-112** | 8 | 140 | 16.0 | 26.0 | 9.6 | 5.5 | 100 | 286 | 40 | **4:40** | **7:50** | 18.0 | 20 | 5 | 10 | 57 | 40 | **6:55** |
| **DRT-120** | 6 | 140 | 14.0 | 24.0 | 10.7 | 10.2 | 78 | 141 | 40 | **4:20** | **5:25** | 18.0 | 20 | 5 | 10 | 108 | 40 | **7:25** |
| **DRT-216** | 6 | 140 | 10.0 | 23.0 | 6.3 | 3.4 | 96 | 409 | 40 | **4:40** | **9:50** | 23.0 | 25 | 5 | 10 | 68 | 40 | **7:10** |
| **DRT-222** | 8 | 140 | 11.0 | 23.0 | 4.5 | 4.4 | 147 | 313 | 40 | **5:30** | **8:15** | 17.0 | 19 | 5 | 10 | 156 | 40 | **9:20** |
| **DRT-224** | 13 | 140 | 15.0 | 25.0 | 5.2 | 3.4 | 173 | 436 | 40 | **5:55** | **10:20** | 18.0 | 20 | 5 | 10 | 95 | 40 | **8:45** |
| **DRT-291** | 4 | 140 | 22.0 | 32.0 | 5.5 | 3.9 | 238 | 493 | 40 | **7:00** | **11:15** | 18.0 | 20 | 5 | 10 | 82 | 40 | **9:40** |
| **DRT-900** | 11 | 140 | 13.0 | 23.0 | 32.1 | 6.1 | 24 | 227 | 40 | **3:25** | **6:50** | 16.0 | 17 | 5 | 10 | 98 | 40 | **6:15** |
| **DRT-915** | 8 | 140 | 9.0 | 21.0 | 38.0 | 2.3 | 14 | 544 | 40 | **3:15** | **12:05** | 14.0 | 15 | 5 | 10 | 71 | 40 | **5:40** |
| **DRT-916** | 7 | 140 | 11.0 | 23.0 | 26.6 | 2.7 | 25 | 513 | 40 | **3:25** | **11:35** | 20.0 | 22 | 5 | 10 | 92 | 40 | **6:15** |
| **DRT-917** | 2 | 140 | 11.0 | 24.0 | 35.8 | 2.4 | 18 | 594 | 40 | **3:20** | **12:55** | 17.0 | 19 | 5 | 10 | 92 | 40 | **6:10** |
| **DRT-920** | 4 | 140 | 13.0 | 23.0 | 32.1 | 6.1 | 24 | 227 | 40 | **3:25** | **6:50** | 16.0 | 17 | 5 | 10 | 93 | 40 | **6:10** |
| **TTC-38** | 4 | 140 | 7.0 | 17.0 | 31.9 | 5.3 | 13 | 193 | 40 | **3:15** | **6:15** | 17.0 | 19 | 5 | 10 | 39 | 40 | **5:10** |
| **TTC-54** | 2 | 140 | 6.0 | 16.0 | 3.7 | 2.3 | 98 | 421 | 40 | **4:40** | **10:05** | 19.0 | 21 | 5 | 10 | 32 | 40 | **6:30** |
| **TTC-85** | 4 | 140 | 8.0 | 18.0 | 13.7 | 3.2 | 35 | 336 | 40 | **3:35** | **8:40** | 17.0 | 19 | 5 | 10 | 68 | 40 | **6:00** |
| **TTC-86** | 2 | 140 | 7.0 | 18.0 | 4.2 | 2.9 | 99 | 369 | 40 | **4:40** | **9:10** | 17.0 | 19 | 5 | 10 | 32 | 40 | **6:30** |
| **TTC-95** | 3 | 140 | 5.0 | 14.0 | 4.2 | 2.7 | 72 | 309 | 40 | **4:15** | **8:10** | 15.0 | 16 | 5 | 10 | 25 | 40 | **5:55** |
| **GO-41** | 5 | 140 | 12.0 | 22.0 | 5.8 | 3.7 | 124 | 356 | 40 | **5:05** | **9:00** | 17.0 | 19 | 5 | 10 | 41 | 40 | **7:00** |
| **G0-51/92** | 5 | 140 | 15.0 | 25.0 | 4.8 | 3.0 | 188 | 497 | 40 | **6:10** | **11:20** | 17.0 | 19 | 5 | 10 | 47 | 40 | **8:15** |
| **DRT-403** | 9 | 140 | | 11.0 | | 2.1 | | 314 | 40 | | **8:15** | | | | | | | |
| **DRT-405** | 9 | 140 | | 6.0 | | 2.3 | | 155 | 40 | | **5:35** | | | | | | | |
| **DRT-409** | 9 | 140 | | 9.0 | | 2.5 | | 213 | 40 | | **6:35** | | | | | | | |
| **DRT-410** | 9 | 140 | | 5.0 | | 1.8 | | 167 | 40 | | **5:50** | | | | | | | |
| **DRT-411** | 9 | 140 | | 4.0 | | 3.0 | | 81 | 40 | | **4:25** | | | | | | | |
| **DRT-423** | 8 | 140 | N/A | 4.0 | N/A | 2.4 | N/A | 101 | 40 | **N/A** | **4:45** | N/A | | | | | | **N/A** |
| **DRT-902** | 8 | 140 | | 7.0 | | 2.0 | | 207 | 40 | | **6:30** | | | | | | | |
| **TTC-2** | 14 | 140 | | 3.0 | | 2.1 | | 85 | 40 | | **4:25** | | | | | | | |
| **TTC-9** | 14 | 140 | | 12.0 | | 2.1 | | 338 | 40 | | **8:40** | | | | | | | |
| **TTC-16** | 14 | 140 | | 10.0 | | 2.2 | | 276 | 40 | | **7:40** | | | | | | | |
| **TTC-20** | 14 | 140 | | 7.0 | | 3.7 | | 115 | 40 | | **4:55** | | | | | | | |

| Route Number | Number of Buses | One-Wave | | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **TTC-39** | 7 | 140 | | 10.0 | | 5.1 | | 118 | 40 | | **5:00** | | | | | | | |
| **TTC-42** | 7 | 140 | | 7.0 | | 2.2 | | 188 | 40 | | **6:10** | | | | | | | |
| **TTC-43** | 14 | 140 | | 13.0 | | 2.2 | | 354 | 40 | | **8:55** | | | | | | | |
| **TTC-53** | 6 | 140 | | 11.0 | | 2.6 | | 257 | 40 | | **7:20** | | | | | | | |
| **TTC-57** | 6 | 140 | | 14.0 | | 2.6 | | 318 | 40 | | **8:20** | | | | | | | |
| **TTC-68** | 6 | 140 | | 6.0 | | 2.0 | | 179 | 40 | | **6:00** | | | | | | | |
| **TTC-102** | 7 | 140 | | 25.0 | | 3.6 | | 415 | 40 | | **9:55** | | | | | | | |
| **TTC-113** | 7 | 140 | | 4.0 | | 3.5 | | 68 | 40 | | **4:10** | | | | | | | |
| **TTC-116** | 7 | 140 | | 17.0 | | 3.5 | | 288 | 40 | | **7:50** | | | | | | | |
| **TTC-131** | 7 | 140 | | 11.0 | | 3.5 | | 189 | 40 | | **6:10** | | | | | | | |
| **TTC-132** | 7 | 140 | | 13.0 | | 3.6 | | 219 | 40 | | **6:40** | | | | | | | |
| **TTC-133** | 7 | 140 | | 14.0 | | 2.9 | | 285 | 40 | | **7:45** | | | | | | | |
| **TTC-134** | 7 | 140 | | 11.0 | | 2.8 | | 240 | 40 | | **7:00** | | | | | | | |
| **TTC-169** | 7 | 140 | | 8.0 | | 1.9 | | 253 | 40 | | **7:15** | | | | | | | |
| **Go-52/56** | 15 | 140 | | 15.0 | | 2.8 | | 319 | 40 | | **8:20** | | | | | | | |
| **Go-54/71** | 6 | 140 | N/A | 6.0 | N/A | 2.2 | N/A | 167 | 40 | **N/A** | **5:50** | | N/A | | | | | **N/A** |
| **GO-81** | 9 | 140 | | 16.0 | | 3.0 | | 317 | 40 | | **8:20** | | | | | | | |
| **YRT-1** | 4 | 140 | | 10.0 | | 3.3 | | 182 | 40 | | **6:05** | | | | | | | |
| **YRT-2** | 9 | 140 | | 15.0 | | 1.9 | | 464 | 40 | | **10:45** | | | | | | | |
| **YRT-8** | 6 | 140 | | 7.0 | | 2.3 | | 181 | 40 | | **6:05** | | | | | | | |
| **YRT-9** | 4 | 140 | | 10.0 | | 2.7 | | 224 | 40 | | **6:45** | | | | | | | |
| **YRT-14** | 9 | 140 | | 9.0 | | 4.1 | | 133 | 40 | | **5:15** | | | | | | | |
| **YRT-16** | 4 | 140 | | 7.0 | | 2.3 | | 185 | 40 | | **6:05** | | | | | | | |
| **YRT-18** | 4 | 140 | | 8.0 | | 2.1 | | 225 | 40 | | **6:45** | | | | | | | |
| **YRT-25** | 4 | 140 | | 9.0 | | 5.3 | | 102 | 40 | | **4:45** | | | | | | | |
| **YRT-301** | 9 | 140 | | 11.0 | | 4.5 | | 146 | 40 | | **5:30** | | | | | | | |
| **YRT-303** | 9 | 140 | | 14.0 | | 9.4 | | 89 | 40 | | **4:30** | | | | | | | |
| **YRT-305** | 9 | 140 | | 10.0 | | 5.1 | | 117 | 40 | | **5:00** | | | | | | | |
| **YRT-402** | 9 | 140 | | 8.0 | | 2.0 | | 245 | 40 | | **7:05** | | | | | | | |
| **YRT-417** | 9 | 140 | | 8.0 | | 3.7 | | 129 | 40 | | **5:10** | | | | | | | |
| **YRT-522** | 4 | 140 | | 9.0 | | 2.7 | | 199 | 40 | | **6:20** | | | | | | | |

| Route Number | Number of Buses | One-Wave | | | | | | | | | | | Two-Wave for DPZ Evacuation ONLY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mobilization (min) | Route Length DPZ (km) | Route Length CPZ (km) | Speed DPZ Evac (kph) | Speed CPZ Evac (kph) | DPZ Route Travel Time (min) | CPZ Route Travel Time (min) | Pickup Time (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) | Distance to R. C. (km) | Travel Time to R. C. (min) | Unload (min) | Driver Rest (min) | Route Travel Time (min) | Pickup Time (min) | ETE (hr:min) |
| **YRT-Purple/Purple A** | 3 | 140 | N/A | 9.0 | N/A | 2.9 | N/A | 184 | 40 | **N/A** | **6:05** | N/A | | | | | | **N/A** |
| | | | | | | | | | **Maximum ETE:** | **7:00** | **12:55** | | | | | | **Maximum ETE:** | **9:40** |
| | | | | | | | | | **Average ETE:** | **4:40** | **7:25** | | | | | | **Average ETE:** | **7:10** |

**Table 8-8. Medical Facility Evacuation Time Estimates - Good Weather**

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Medical Facilities in P1 | Ambulatory | 90 | 1 | 34 | 30 | 8.3 | 18.3 | 101 | 223 | **3:45** | **5:45** |
| | | Wheelchair bound | 90 | 12 | 26 | 48 | 8.3 | 18.3 | 99 | 224 | **4:00** | **6:05** |
| | | Bedridden | 90 | 60 | 7 | 60 | 8.3 | 18.3 | 99 | 224 | **4:10** | **6:15** |
| P2 | Medical Facilities in P2 | Ambulatory | 90 | 1 | 42 | 30 | 11.7 | 22.7 | 134 | 266 | **4:15** | **6:30** |
| | | Wheelchair bound | 90 | 12 | 114 | 48 | 11.7 | 22.7 | 132 | 263 | **4:30** | **6:45** |
| | | Bedridden | 90 | 60 | 4 | 60 | 11.7 | 22.7 | 134 | 263 | **4:45** | **6:55** |
| P4 | Medical Facilities in P4 | Ambulatory | 90 | 1 | 45 | 30 | 8.3 | 18.3 | 76 | 226 | **3:20** | **5:50** |
| | | Wheelchair bound | 90 | 12 | 9 | 48 | 8.3 | 18.3 | 77 | 223 | **3:35** | **6:05** |
| P7 | Medical Facilities in P7 | Ambulatory | 90 | 1 | 399 | 30 | 11.4 | 21.4 | 150 | 297 | **4:30** | **7:00** |
| | | Wheelchair bound | 90 | 12 | 174 | 48 | 11.4 | 21.4 | 148 | 295 | **4:50** | **7:15** |
| | | Bedridden | 90 | 60 | 83 | 60 | 11.4 | 21.4 | 146 | 295 | **5:00** | **7:25** |
| P8 | Medical Facilities in P8 | Ambulatory | 90 | 1 | 22 | 22 | 13.0 | 23.0 | 123 | 334 | **3:55** | **7:30** |
| | | Wheelchair bound | 90 | 12 | 2 | 24 | 13.0 | 23.0 | 123 | 317 | **4:00** | **7:15** |
| | | Bedridden | 90 | 60 | 1 | 60 | 13.0 | 23.0 | 114 | 317 | **4:25** | **7:50** |
| P10 | Medical Facilities in P10 | Ambulatory | 90 | 1 | 119 | 30 | 8.5 | 18.5 | 62 | 210 | **3:05** | **5:30** |
| | | Wheelchair bound | 90 | 12 | 92 | 48 | 8.5 | 18.5 | 67 | 234 | **3:25** | **6:15** |
| | | Bedridden | 90 | 60 | 23 | 60 | 8.5 | 18.5 | 74 | 234 | **3:45** | **6:25** |
| P12 | Medical Facilities in P12 | Ambulatory | 90 | 1 | 50 | 30 | 5.7 | 15.7 | 57 | 178 | **3:00** | **5:00** |
| | | Wheelchair bound | 90 | 12 | 95 | 48 | 5.7 | 15.7 | 48 | 193 | **3:10** | **5:35** |
| | | Bedridden | 90 | 60 | 5 | 60 | 5.7 | 15.7 | 48 | 193 | **3:20** | **5:45** |
| P13 | Medical Facilities in P13 | Ambulatory | 90 | 1 | 157 | 30 | 8.6 | 18.6 | 95 | 244 | **3:35** | **6:05** |
| | | Wheelchair bound | 90 | 12 | 52 | 48 | 8.6 | 18.6 | 95 | 248 | **3:55** | **6:30** |
| | | Bedridden | 90 | 60 | 46 | 60 | 8.6 | 18.6 | 95 | 248 | **4:05** | **6:40** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P14 | Medical Facilities in P14 | Ambulatory | 90 | 1 | 65 | 30 | 7.5 | 17.5 | 81 | 226 | **3:25** | **5:50** |
| | | Wheelchair bound | 90 | 12 | 50 | 48 | 7.5 | 17.5 | 79 | 225 | **3:40** | **6:05** |
| | | Bedridden | 90 | 60 | 13 | 60 | 7.5 | 17.5 | 82 | 225 | **3:55** | **6:15** |
| P16 | Medical Facilities in P16 | Ambulatory | 90 | 1 | 93 | 30 | 6.5 | 16.5 | 49 | 196 | **2:50** | **5:20** |
| | | Wheelchair bound | 90 | 12 | 65 | 48 | 6.5 | 16.5 | 46 | 194 | **3:05** | **5:35** |
| | | Bedridden | 90 | 60 | 1 | 60 | 6.5 | 16.5 | 49 | 194 | **3:20** | **5:45** |
| P17 | Medical Facilities in P17 | Ambulatory | 90 | 1 | 75 | 30 | 3.4 | 13.4 | 41 | 317 | **2:45** | **7:20** |
| | | Wheelchair bound | 90 | 12 | 52 | 48 | 3.4 | 13.4 | 35 | 302 | **2:55** | **7:20** |
| | | Bedridden | 90 | 60 | 5 | 60 | 3.4 | 13.4 | 29 | 302 | **3:00** | **7:35** |
| P18 | Medical Facilities in P18 | Ambulatory | 90 | 1 | 103 | 30 | 3.0 | 13.0 | 35 | 156 | **2:35** | **4:40** |
| | | Wheelchair bound | 90 | 12 | 72 | 48 | 3.0 | 13.0 | 34 | 155 | **2:55** | **4:55** |
| | | Bedridden | 90 | 60 | 17 | 60 | 3.0 | 13.0 | 34 | 155 | **3:05** | **5:05** |
| P21 | Medical Facilities in P21 | Ambulatory | 90 | 1 | 59 | 30 | 5.2 | 15.2 | 54 | 347 | **2:55** | **7:50** |
| | | Wheelchair bound | 90 | 12 | 41 | 48 | 5.2 | 15.2 | 50 | 331 | **3:10** | **7:50** |
| | | Bedridden | 90 | 60 | 10 | 60 | 5.2 | 15.2 | 47 | 331 | **3:20** | **8:05** |
| | | | | | | | | | | **Maximum ETE:** | **5:00** | **8:05** |
| | | | | | | | | | | **Average ETE:** | **3:40** | **6:25** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Medical Facilities in CPZ1 | Ambulatory | 90 | 1 | 10 | 10 | | 9.5 | | 78 | | **3:00** |
| | | Wheelchair bound | 90 | 12 | 8 | 48 | | 9.5 | | 89 | | **3:50** |
| | | Bedridden | 90 | 60 | 2 | 60 | | 9.5 | | 89 | | **4:00** |
| CPZ2 | Medical Facilities in CPZ2 | Ambulatory | 90 | 1 | 1,661 | 30 | | 9.5 | | 298 | | **7:00** |
| | | Wheelchair bound | 90 | 12 | 1,281 | 48 | | 9.5 | | 291 | | **7:10** |
| | | Bedridden | 90 | 60 | 341 | 60 | | 9.5 | | 291 | | **7:25** |
| CPZ6 | Medical Facilities in CPZ6 | Ambulatory | 90 | 1 | 1,924 | 30 | | 9.4 | | 224 | | **5:45** |
| | | Wheelchair bound | 90 | 12 | 1,486 | 48 | N/A | 9.4 | N/A | 207 | N/A | **5:45** |
| | | Bedridden | 90 | 60 | 398 | 60 | | 9.4 | | 207 | | **6:00** |
| CPZ7 | Medical Facilities in CPZ7 | Ambulatory | 90 | 1 | 1,575 | 30 | | 10.2 | | 231 | | **5:55** |
| | | Wheelchair bound | 90 | 12 | 1,213 | 48 | | 10.2 | | 212 | | **5:50** |
| | | Bedridden | 90 | 60 | 324 | 60 | | 10.2 | | 212 | | **6:05** |
| CPZ8 | Medical Facilities in CPZ8 | Ambulatory | 90 | 1 | 409 | 30 | | 8.2 | | 124 | | **4:05** |
| | | Wheelchair bound | 90 | 12 | 314 | 48 | | 8.2 | | 149 | | **4:50** |
| | | Bedridden | 90 | 60 | 83 | 60 | | 8.2 | | 149 | | **5:00** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **7:25** |
| | | | | | | | | | | **Average ETE:** | | **5:30** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **8:05** |
| | | | | | | | | | | **Average ETE:** | | **6:10** |

**Table 8-9. Medical Facility Evacuation Time Estimates – Rain/Light Snow**

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Medical Facilities in P1 | Ambulatory | 100 | 1 | 34 | 30 | 8.3 | 18.3 | 112 | 234 | **4:05** | **6:05** |
| | | Wheelchair bound | 100 | 12 | 26 | 48 | 8.3 | 18.3 | 105 | 232 | **4:15** | **6:20** |
| | | Bedridden | 100 | 60 | 7 | 60 | 8.3 | 18.3 | 102 | 232 | **4:25** | **6:35** |
| P2 | Medical Facilities in P2 | Ambulatory | 100 | 1 | 42 | 30 | 11.7 | 22.7 | 143 | 275 | **4:35** | **6:45** |
| | | Wheelchair bound | 100 | 12 | 114 | 48 | 11.7 | 22.7 | 136 | 273 | **4:45** | **7:05** |
| | | Bedridden | 100 | 60 | 4 | 60 | 11.7 | 22.7 | 134 | 273 | **4:55** | **7:15** |
| P4 | Medical Facilities in P4 | Ambulatory | 100 | 1 | 45 | 30 | 8.3 | 18.3 | 87 | 236 | **3:40** | **6:10** |
| | | Wheelchair bound | 100 | 12 | 9 | 48 | 8.3 | 18.3 | 77 | 231 | **3:45** | **6:20** |
| P7 | Medical Facilities in P7 | Ambulatory | 100 | 1 | 399 | 30 | 11.4 | 21.4 | 160 | 309 | **4:50** | **7:20** |
| | | Wheelchair bound | 100 | 12 | 174 | 48 | 11.4 | 21.4 | 154 | 306 | **5:05** | **7:35** |
| | | Bedridden | 100 | 60 | 83 | 60 | 11.4 | 21.4 | 149 | 306 | **5:10** | **7:50** |
| P8 | Medical Facilities in P8 | Ambulatory | 100 | 1 | 22 | 22 | 13.0 | 23.0 | 131 | 348 | **4:15** | **7:50** |
| | | Wheelchair bound | 100 | 12 | 2 | 24 | 13.0 | 23.0 | 131 | 332 | **4:15** | **7:40** |
| | | Bedridden | 100 | 60 | 1 | 60 | 13.0 | 23.0 | 118 | 332 | **4:40** | **8:15** |
| P10 | Medical Facilities in P10 | Ambulatory | 100 | 1 | 119 | 30 | 8.5 | 18.5 | 59 | 237 | **3:10** | **6:10** |
| | | Wheelchair bound | 100 | 12 | 92 | 48 | 8.5 | 18.5 | 62 | 260 | **3:30** | **6:50** |
| | | Bedridden | 100 | 60 | 23 | 60 | 8.5 | 18.5 | 61 | 260 | **3:45** | **7:00** |
| P12 | Medical Facilities in P12 | Ambulatory | 100 | 1 | 50 | 30 | 5.7 | 15.7 | 52 | 190 | **3:05** | **5:20** |
| | | Wheelchair bound | 100 | 12 | 95 | 48 | 5.7 | 15.7 | 51 | 193 | **3:20** | **5:45** |
| | | Bedridden | 100 | 60 | 5 | 60 | 5.7 | 15.7 | 49 | 193 | **3:30** | **5:55** |
| P13 | Medical Facilities in P13 | Ambulatory | 100 | 1 | 157 | 30 | 8.6 | 18.6 | 94 | 248 | **3:45** | **6:20** |
| | | Wheelchair bound | 100 | 12 | 52 | 48 | 8.6 | 18.6 | 95 | 251 | **4:05** | **6:40** |
| | | Bedridden | 100 | 60 | 46 | 60 | 8.6 | 18.6 | 93 | 251 | **4:15** | **6:55** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P14 | Medical Facilities in P14 | Ambulatory | 100 | 1 | 65 | 30 | 7.5 | 17.5 | 84 | 234 | **3:35** | **6:05** |
| | | Wheelchair bound | 100 | 12 | 50 | 48 | 7.5 | 17.5 | 81 | 229 | **3:50** | **6:20** |
| | | Bedridden | 100 | 60 | 13 | 60 | 7.5 | 17.5 | 78 | 229 | **4:00** | **6:30** |
| P16 | Medical Facilities in P16 | Ambulatory | 100 | 1 | 93 | 30 | 6.5 | 16.5 | 57 | 210 | **3:10** | **5:40** |
| | | Wheelchair bound | 100 | 12 | 65 | 48 | 6.5 | 16.5 | 47 | 207 | **3:15** | **5:55** |
| | | Bedridden | 100 | 60 | 1 | 60 | 6.5 | 16.5 | 42 | 207 | **3:25** | **6:10** |
| P17 | Medical Facilities in P17 | Ambulatory | 100 | 1 | 75 | 30 | 3.4 | 13.4 | 34 | 335 | **2:45** | **7:45** |
| | | Wheelchair bound | 100 | 12 | 52 | 48 | 3.4 | 13.4 | 39 | 319 | **3:10** | **7:50** |
| | | Bedridden | 100 | 60 | 5 | 60 | 3.4 | 13.4 | 37 | 319 | **3:20** | **8:00** |
| P18 | Medical Facilities in P18 | Ambulatory | 100 | 1 | 103 | 30 | 3.0 | 13.0 | 40 | 175 | **2:50** | **5:05** |
| | | Wheelchair bound | 100 | 12 | 72 | 48 | 3.0 | 13.0 | 34 | 172 | **3:05** | **5:20** |
| | | Bedridden | 100 | 60 | 17 | 60 | 3.0 | 13.0 | 32 | 172 | **3:15** | **5:35** |
| P21 | Medical Facilities in P21 | Ambulatory | 100 | 1 | 59 | 30 | 5.2 | 15.2 | 54 | 379 | **3:05** | **8:30** |
| | | Wheelchair bound | 100 | 12 | 41 | 48 | 5.2 | 15.2 | 52 | 360 | **3:20** | **8:30** |
| | | Bedridden | 100 | 60 | 10 | 60 | 5.2 | 15.2 | 50 | 360 | **3:30** | **8:40** |
| | | | | | | | | | | **Maximum ETE:** | **5:10** | **8:40** |
| | | | | | | | | | | **Average ETE:** | **3:50** | **6:50** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Medical Facilities in CPZ1 | Ambulatory | 90 | 1 | 10 | 10 | | 9.5 | | 98 | | **3:20** |
| | | Wheelchair bound | 90 | 12 | 8 | 48 | | 9.5 | | 105 | | **4:05** |
| | | Bedridden | 90 | 60 | 2 | 60 | | 9.5 | | 105 | | **4:15** |
| CPZ2 | Medical Facilities in CPZ2 | Ambulatory | 100 | 1 | 1,661 | 30 | | 9.5 | | 308 | | **7:20** |
| | | Wheelchair bound | 100 | 12 | 1,281 | 48 | | 9.5 | | 303 | | **7:35** |
| | | Bedridden | 100 | 60 | 341 | 60 | | 9.5 | | 303 | | **7:45** |
| CPZ6 | Medical Facilities in CPZ6 | Ambulatory | 100 | 1 | 1,924 | 30 | | 9.4 | | 235 | | **6:05** |
| | | Wheelchair bound | 100 | 12 | 1,486 | 48 | N/A | 9.4 | N/A | 220 | N/A | **6:10** |
| | | Bedridden | 100 | 60 | 398 | 60 | | 9.4 | | 220 | | **6:20** |
| CPZ7 | Medical Facilities in CPZ7 | Ambulatory | 100 | 1 | 1,575 | 30 | | 10.2 | | 222 | | **5:55** |
| | | Wheelchair bound | 100 | 12 | 1,213 | 48 | | 10.2 | | 209 | | **6:00** |
| | | Bedridden | 100 | 60 | 324 | 60 | | 10.2 | | 209 | | **6:10** |
| CPZ8 | Medical Facilities in CPZ8 | Ambulatory | 100 | 1 | 409 | 30 | | 8.2 | | 156 | | **4:50** |
| | | Wheelchair bound | 100 | 12 | 314 | 48 | | 8.2 | | 173 | | **5:25** |
| | | Bedridden | 100 | 60 | 83 | 60 | | 8.2 | | 173 | | **5:35** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **7:45** |
| | | | | | | | | | | **Average ETE:** | | **5:50** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **8:40** |
| | | | | | | | | | | **Average ETE:** | | **6:30** |

**Table 8-10. Medical Facility Evacuation Time Estimates – Heavy Snow**

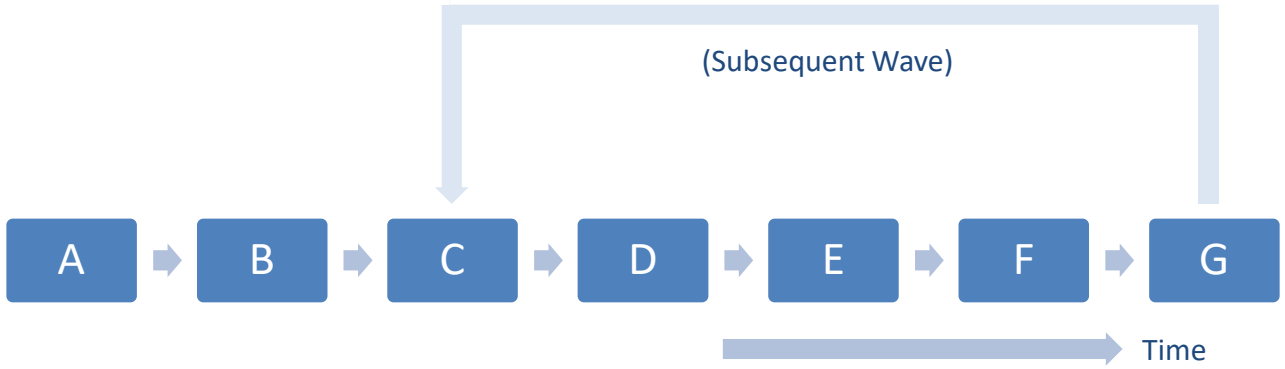
| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Medical Facilities in P1 | Ambulatory | 110 | 1 | 34 | 30 | 8.3 | 18.3 | 114 | 261 | **4:15** | **6:45** |
| | | Wheelchair bound | 110 | 12 | 26 | 48 | 8.3 | 18.3 | 122 | 259 | **4:40** | **7:00** |
| | | Bedridden | 110 | 60 | 7 | 60 | 8.3 | 18.3 | 121 | 259 | **4:55** | **7:10** |
| P2 | Medical Facilities in P2 | Ambulatory | 110 | 1 | 42 | 30 | 11.7 | 22.7 | 157 | 307 | **5:00** | **7:30** |
| | | Wheelchair bound | 110 | 12 | 114 | 48 | 11.7 | 22.7 | 159 | 304 | **5:20** | **7:45** |
| | | Bedridden | 110 | 60 | 4 | 60 | 11.7 | 22.7 | 155 | 304 | **5:25** | **7:55** |
| P4 | Medical Facilities in P4 | Ambulatory | 110 | 1 | 45 | 30 | 8.3 | 18.3 | 93 | 257 | **3:55** | **6:40** |
| | | Wheelchair bound | 110 | 12 | 9 | 48 | 8.3 | 18.3 | 99 | 253 | **4:20** | **6:55** |
| P7 | Medical Facilities in P7 | Ambulatory | 110 | 1 | 399 | 30 | 11.4 | 21.4 | 174 | 339 | **5:15** | **8:00** |
| | | Wheelchair bound | 110 | 12 | 174 | 48 | 11.4 | 21.4 | 169 | 332 | **5:30** | **8:10** |
| | | Bedridden | 110 | 60 | 83 | 60 | 11.4 | 21.4 | 167 | 332 | **5:40** | **8:25** |
| P8 | Medical Facilities in P8 | Ambulatory | 110 | 1 | 22 | 22 | 13.0 | 23.0 | 145 | 388 | **4:40** | **8:40** |
| | | Wheelchair bound | 110 | 12 | 2 | 24 | 13.0 | 23.0 | 145 | 378 | **4:40** | **8:35** |
| | | Bedridden | 110 | 60 | 1 | 60 | 13.0 | 23.0 | 139 | 378 | **5:10** | **9:10** |
| P10 | Medical Facilities in P10 | Ambulatory | 110 | 1 | 119 | 30 | 8.5 | 18.5 | 68 | 279 | **3:30** | **7:00** |
| | | Wheelchair bound | 110 | 12 | 92 | 48 | 8.5 | 18.5 | 72 | 299 | **3:50** | **7:40** |
| | | Bedridden | 110 | 60 | 23 | 60 | 8.5 | 18.5 | 75 | 299 | **4:05** | **7:50** |
| P12 | Medical Facilities in P12 | Ambulatory | 110 | 1 | 50 | 30 | 5.7 | 15.7 | 72 | 202 | **3:35** | **5:45** |
| | | Wheelchair bound | 110 | 12 | 95 | 48 | 5.7 | 15.7 | 68 | 202 | **3:50** | **6:00** |
| | | Bedridden | 110 | 60 | 5 | 60 | 5.7 | 15.7 | 68 | 202 | **4:00** | **6:15** |
| P13 | Medical Facilities in P13 | Ambulatory | 110 | 1 | 157 | 30 | 8.6 | 18.6 | 121 | 271 | **4:25** | **6:55** |
| | | Wheelchair bound | 110 | 12 | 52 | 48 | 8.6 | 18.6 | 119 | 270 | **4:40** | **7:10** |
| | | Bedridden | 110 | 60 | 46 | 60 | 8.6 | 18.6 | 117 | 270 | **4:50** | **7:20** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P14 | Medical Facilities in P14 | Ambulatory | 110 | 1 | 65 | 30 | 7.5 | 17.5 | 106 | 256 | **4:10** | **6:40** |
| | | Wheelchair bound | 110 | 12 | 50 | 48 | 7.5 | 17.5 | 103 | 251 | **4:25** | **6:50** |
| | | Bedridden | 110 | 60 | 13 | 60 | 7.5 | 17.5 | 103 | 251 | **4:35** | **7:05** |
| P16 | Medical Facilities in P16 | Ambulatory | 110 | 1 | 93 | 30 | 6.5 | 16.5 | 69 | 222 | **3:30** | **6:05** |
| | | Wheelchair bound | 110 | 12 | 65 | 48 | 6.5 | 16.5 | 69 | 226 | **3:50** | **6:25** |
| | | Bedridden | 110 | 60 | 1 | 60 | 6.5 | 16.5 | 66 | 226 | **4:00** | **6:40** |
| P17 | Medical Facilities in P17 | Ambulatory | 110 | 1 | 75 | 30 | 3.4 | 13.4 | 35 | 364 | **2:55** | **8:25** |
| | | Wheelchair bound | 110 | 12 | 52 | 48 | 3.4 | 13.4 | 39 | 351 | **3:20** | **8:30** |
| | | Bedridden | 110 | 60 | 5 | 60 | 3.4 | 13.4 | 38 | 351 | **3:30** | **8:45** |
| P18 | Medical Facilities in P18 | Ambulatory | 110 | 1 | 103 | 30 | 3.0 | 13.0 | 37 | 179 | **3:00** | **5:20** |
| | | Wheelchair bound | 110 | 12 | 72 | 48 | 3.0 | 13.0 | 38 | 178 | **3:20** | **5:40** |
| | | Bedridden | 110 | 60 | 17 | 60 | 3.0 | 13.0 | 37 | 178 | **3:30** | **5:50** |
| P21 | Medical Facilities in P21 | Ambulatory | 110 | 1 | 59 | 30 | 5.2 | 15.2 | 62 | 402 | **3:25** | **9:05** |
| | | Wheelchair bound | 110 | 12 | 41 | 48 | 5.2 | 15.2 | 61 | 395 | **3:40** | **9:15** |
| | | Bedridden | 110 | 60 | 10 | 60 | 5.2 | 15.2 | 60 | 395 | **3:50** | **9:25** |
| | | | | | | | | | | **Maximum ETE:** | **5:40** | **9:25** |
| | | | | | | | | | | **Average ETE:** | **4:15** | **7:25** |

| Response Sector | Representative Medical Facility by Response Sector | Patient | Mobilization (min) | Loading Rate (min per person) | People | Total Loading Time (min) | Avg. Dist. To DPZ Bdry (km) | Avg. Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPZ1 | Medical Facilities in CPZ1 | Ambulatory | 110 | 1 | 10 | 10 | N/A | 9.5 | N/A | 132 | N/A | **4:15** |
| | | Wheelchair bound | 110 | 12 | 8 | 48 | | 9.5 | | 153 | | **5:15** |
| | | Bedridden | 110 | 60 | 2 | 60 | | 9.5 | | 153 | | **5:25** |
| CPZ2 | Medical Facilities in CPZ2 | Ambulatory | 110 | 1 | 1,661 | 30 | | 9.5 | | 317 | | **7:40** |
| | | Wheelchair bound | 110 | 12 | 1,281 | 48 | | 9.5 | | 314 | | **7:55** |
| | | Bedridden | 110 | 60 | 341 | 60 | | 9.5 | | 314 | | **8:05** |
| CPZ6 | Medical Facilities in CPZ6 | Ambulatory | 110 | 1 | 1,924 | 30 | | 9.4 | | 264 | | **6:45** |
| | | Wheelchair bound | 110 | 12 | 1,486 | 48 | | 9.4 | | 254 | | **6:55** |
| | | Bedridden | 110 | 60 | 398 | 60 | | 9.4 | | 254 | | **7:05** |
| CPZ7 | Medical Facilities in CPZ7 | Ambulatory | 110 | 1 | 1,575 | 30 | | 10.2 | | 246 | | **6:30** |
| | | Wheelchair bound | 110 | 12 | 1,213 | 48 | | 10.2 | | 231 | | **6:30** |
| | | Bedridden | 110 | 60 | 324 | 60 | | 10.2 | | 231 | | **6:45** |
| CPZ8 | Medical Facilities in CPZ8 | Ambulatory | 110 | 1 | 409 | 30 | | 8.2 | | 152 | | **4:55** |
| | | Wheelchair bound | 110 | 12 | 314 | 48 | | 8.2 | | 175 | | **5:35** |
| | | Bedridden | 110 | 60 | 83 | 60 | | 8.2 | | 175 | | **5:45** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **8:05** |
| | | | | | | | | | | **Average ETE:** | | **6:25** |
| | | | | | | | | | | **Maximum ETE:** | N/A | **9:25** |
| | | | | | | | | | | **Average ETE:** | | **7:05** |

**Table 8-11. Correctional Facility Evacuation Time Estimates**

| Correctional Facility | Weather Conditions | Mobilization (min) | Number of Vehicles | Loading Rate (min per person) | Number of Inmates | Total Loading Time (min) | Dist. To DPZ Bdry (km) | Dist. To CPZ Bdry (km) | Travel Time to DPZ Boundary (min) | Travel Time to CPZ Boundary (min) | DPZ ETE (hr:min) | CPZ ETE (hr:min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kennedy Detention Centre | Good | 90 | 1 | 1 | 12 | 12 | 8.7 | 20.5 | 86 | 228 | **3:10** | **5:30** |
| | Rain/Light Snow | 100 | | | | | | | 74 | 248 | **2:55** | **6:00** |
| | Heavy Snow | 110 | | | | | | | 97 | 266 | **3:30** | **6:30** |
| Toronto East Detention Centre | Good | 90 | 16 | 1 | 473 | 32 | N/A | 2.1 | N/A | 3 | N/A | **2:05** |
| | Rain/Light Snow | 100 | | | | | | | | 3 | | **1:45** |
| | Heavy Snow | 110 | | | | | | | | 4 | | **1:55** |
| | | | | | | | | | | **Maximum ETE:** | **3:30** | **6:30** |
| | | | | | | | | | | **Average ETE:** | **3:15** | **4:00** |




| Event | |
|---|---|
| A | Emergency Bulletin |
| B | Bus Dispatched from Depot |
| C | Bus Arrives at Facility/Transit Route |
| D | Bus Departs for Reception Centre |
| E | Bus Exits PZ |
| F | Bus Arrives at Reception Centre/Temporary Holding Centre |
| G | Bus Available for "Second Wave" Evacuation Service |
| **Activity** | |
| A→B | Driver Mobilization |
| B→C | Travel to Facility or to Transit Route |
| C→D | Passengers Board the Bus |
| D→E | Bus Travels Towards PZ Boundary |
| E→F | Bus Travels Towards Reception Centre/Temporary Holding Centre Outside the PZ |
| F→G | Passengers Leave Bus; Driver Takes a Break |

**Figure 8-1. Chronology of Transit Evacuation Operations**

# 9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested traffic control and management strategy that is designed to expedite the movement of evacuating traffic. The resources required to implement this strategy include:

- Personnel with the capabilities of performing the planned control functions of traffic guides (preferably, not necessarily, law enforcement officers).
- Traffic Control Devices to assist these personnel in the performance of their tasks. These devices should comply with the guidance of the Ontario Traffic Manual and/or the U.S. Manual on Uniform Traffic Control Devices (U.S. MUTCD) published by the U.S. Federal Highway Administration (FHWA) of the U.S.D.O.T. All international transportation agencies have access to the U.S. MUTCD, which is available on-line: http://mutcd.fhwa.dot.gov provides access to the official PDF version.
- A plan that defines all locations provides necessary details and is documented in a format that is readily understood by those assigned to perform traffic control.

The functions to be performed in the field are:

1. Facilitate evacuating traffic movements that safely expedite travel out of the PZs.
2. Discourage traffic movements that move evacuating vehicles in a direction which takes them significantly closer to the power plant, or which interferes with the efficient flow of other evacuees.

We employ the terms "facilitate" and "discourage" rather than "enforce" and "prohibit" to indicate the need for flexibility in performing the traffic control function. There are always legitimate reasons for a driver to prefer a direction other than that indicated. For example:

- A driver may be traveling home from work or from another location, to join other family members prior to evacuating.
- An evacuating driver may be travelling to pick up a relative, or other evacuees.
- The driver may be an emergency worker entering the area being evacuated to perform an important emergency service.

The implementation of a plan must also be flexible enough for the application of sound judgment by the traffic guide.

The existing TCPs and ACPs identified by the offsite agencies in their emergency plans serve as the basis of the traffic management plan, as per NUREG/CR-7002 Rev 1. All TCPs listed at stop and yield signs inside Nuclear Emergency Pickering Guidebook Annex B2 for Durham Region were not modelled as TCPs based on discussions with emergency management personnel from Durham Region. Almost all traffic signals in Durham Region are already wired to the Traffic Management Center (TMC). As a result, manual traffic control may not be necessary as the signals can be changed/controlled from the TMC as needed. No traffic management plans were received from the York Region or the City of Toronto.

## 9.1 Assumptions

The following assumptions made for this study:

- The ETE calculations documented in Sections 7 and 8 assume that the ACPs are implemented during evacuation.
- The ETE calculations reflect the assumption that all "external-external" trips are interdicted and diverted after 4 hours have elapsed from the Emergency Bulletin, as per Ministry of Transportation of Ontario (MTO).
- All transit vehicles and other responders entering the PZs to support the evacuation are assumed to be unhindered by personnel manning ACPs. All ACPs will be manned within 4 hours, after the emergency bulletin.
- Study assumptions 1 and 2 in Section 2.5 discuss ACP staffing schedules and operations.

## 9.2 Additional Considerations

The use of Intelligent Transportation Systems (ITS) technologies can reduce manpower and equipment needs, while still facilitating the evacuation process. Dynamic message signs (DMS) can be placed within the PZs to provide information to travelers regarding traffic conditions, route selection, and reception center information. DMS placed outside of the PZs will warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plant. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees during egress through their vehicle stereo systems. Automated Traveler Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins their trip, while the on-board navigation systems (GPS units) and smartphones can be used to provide information during the evacuation trip.

These are only several examples of how ITS technologies can benefit the evacuation process. Consideration should be given that ITS technologies be used to facilitate the evacuation process, and any additional signage placed should consider evacuation needs.

# 10 EVACUATION ROUTES

Evacuation routes are comprised of two distinct components:

- Routing from a Response Sector being evacuated to the boundary of the Evacuation Region and thence out of the PZ.
- Routing of transit-dependent evacuees from the PZ boundary to appropriate Reception Centres (general public) or THCs (school population).

Evacuees will select routes within the PZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of the plant to the extent practicable. The DTRAD model satisfies this behaviour by routing traffic so as to balance traffic demand relative to the available highway capacity to the extent possible. See Appendices B through D for further discussion. The major evacuation routes for the PZ are presented in Figure 10-1. These routes will be used by the general population evacuating in private vehicles, and by the transit-dependent population evacuating in buses. Transit-dependent evacuees will be routed to Reception Centres or Temporary Holding Centres (THC). General population may evacuate to either a reception centres or some alternate destination (e.g., lodging facility, relative's home, campground) outside the PZs.

According to public transit providers within the PZs, buses will be available during an emergency at PNGS. DRT, TTC, YRT, and GO Transit operators will dispatch buses along pre-established routes within the PZs to collect the transit-dependent population at the predesignated stops along each route. Service along these routes will be increased to accommodate the increase in demand and to facilitate the evacuation.

The existing DRT, GO Transit, TTC, and YRT bus routes that were used in this study are shown in Figure 10-2 through Figure 10-10 and summarized in Table 10-1. The corresponding nodes (see Appendix K) that each route traverses within the model are listed in Table 10-2. It is assumed that residents will walk to and congregate at bus stops along these routes, and that they can arrive at these routes within the 120-minute bus mobilization time (good weather).

Buses servicing the transit-dependent evacuees will first travel along their routes, then proceed out of the PZs. Transit-dependent evacuees that require monitoring and decontamination are transported to the nearest reception centre. The routing of transit-dependent evacuees from the PZ boundary to reception centres utilized existing transit routes. The routing, of the school evacuees from the PZ boundaries to THCs, was designed to minimize the amount of travel outside the PZs from the points where these routes cross the PZ boundaries. THCs and reception centres locations are not specifically listed, but the evacuation routes selected produce representative ETE to be used generally. It is noted that these relocation facilities should be outside of the DPZ Outer Ring. Hence, they could be within the CPZ. It is assumed that all school evacuees will be taken to the appropriate THC and subsequently picked up by parents or guardians.

**Table 10-1. Summary of Transit-Dependent Bus Routes in the DPZ**

| Route | No. of Buses For DPZ | No. of Buses For CPZ | Total No. of Buses | Route Description | Length to DPZ Outer Ring Boundary (km) | Length to CPZ Boundary (km) | Distance from DPZ Outer Ring Boundary to R.C. (km)[1] |
|---|---|---|---|---|---|---|---|
| **DRT-101** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P1, P2, P4, P18, CPZ6 | 15 | 25.0 | 20.0 |
| **DRT-103** | 7 | 0 | 7 | Traverses the major evacuation routes of Response Sector P5, P6, P7, P8, P19, CPZ7 | 13 | 23.0 | 18.0 |
| **DRT-110** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P5, P6, P7, P8, P19, CPZ7 | 11 | 21.0 | 18.0 |
| **DRT-112** | 8 | 0 | 8 | Traverses the major evacuation routes of Response Sector P7, P9, P19, P20, CPZ7 | 16 | 26.0 | 18.0 |
| **DRT-120** | 6 | 0 | 6 | Traverses the major evacuation routes of Response Sector P1, P5, P6, P8, P20, CPZ8 | 14 | 24.0 | 18.0 |
| **DRT-216** | 6 | 0 | 6 | Traverses the major evacuation routes of Response Sector P10, P21, CPZ2 | 10 | 23.0 | 23.0 |
| **DRT-222** | 8 | 0 | 8 | Traverses the major evacuation routes of Response Sector P13, P14, P22, CPZ2 | 11 | 23.0 | 17.0 |
| **DRT-224** | 13 | 0 | 13 | Traverses the major evacuation routes of Response Sector P12, P13, P22, CPZ2 | 15 | 25.0 | 18.0 |
| **DRT-291** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P11, P12, P13, P14, P22, CPZ2 | 22 | 32.0 | 18.0 |
| **DRT-403** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 11.0 | - |
| **DRT-405** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 6.0 | - |
| **DRT-409** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 9.0 | - |
| **DRT-410** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 5.0 | - |
| **DRT-411** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 4.0 | - |
| **DRT-423** | 0 | 8 | 8 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 4.0 | - |
| **DRT-900** | 11 | 0 | 11 | Traverses the major evacuation routes of Response Sector P1, P4, P6, P7, P9, P17, P18, CPZ6 | 13 | 23.0 | 16.0 |
| **DRT-902** | 0 | 8 | 8 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 7.0 | - |
| **DRT-915** | 8 | 0 | 8 | Traverses the major evacuation routes of Response Sector P10, P11, P21, CPZ2 | 9 | 21.0 | 14.0 |
| **DRT-916** | 7 | 0 | 7 | Traverses the major evacuation routes of Response Sector P10, P11, P21, CPZ2 | 11 | 23.0 | 20.0 |

[1] The distance to the R.C. is measured from the DPZ boundary for routes that evacuate during an evacuation of the DPZ Outer Ring (Region R03). Since reception centres can be with in the CPZ, distances are not provided when all PZs (Region R04) evacuate.

| Route | No. of Buses For DPZ | No. of Buses For CPZ | Total No. of Buses | Route Description | Length to DPZ Outer Ring Boundary (km) | Length to CPZ Boundary (km) | Distance from DPZ Outer Ring Boundary to R.C. (km)[1] |
|---|---|---|---|---|---|---|---|
| **DRT-917** | 2 | 0 | 2 | Traverses the major evacuation routes of Response Sector P2, P12, P13, P14, P22, CPZ2 | 11 | 24.0 | 17.0 |
| **DRT-920** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P1, P4, P6, P7, P9, P17, P18, CPZ6 | 13 | 23.0 | 16.0 |
| **TTC-2** | 0 | 14 | 14 | Traverses the major evacuation routes of Response Sector CPZ6 | - | 3.0 | - |
| **TTC-9** | 0 | 14 | 14 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 12.0 | - |
| **TTC-16** | 0 | 14 | 14 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 10.0 | - |
| **TTC-20** | 0 | 14 | 14 | Traverses the major evacuation routes of Response Sector CPZ6 | - | 7.0 | - |
| **TTC-38** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P16, P17, P18, CPZ7 | 7 | 17.0 | 17.0 |
| **TTC-39** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 10.0 | - |
| **TTC-42** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 7.0 | - |
| **TTC-43** | 0 | 14 | 14 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 13.0 | - |
| **TTC-53** | 0 | 6 | 6 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 11.0 | - |
| **TTC-54** | 2 | 0 | 2 | Traverses the major evacuation routes of Response Sector P3, P15, P16, P17, CPZ6 | 6 | 16.0 | 19.0 |
| **TTC-57** | 0 | 6 | 6 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 14.0 | - |
| **TTC-68** | 0 | 6 | 6 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 6.0 | - |
| **TTC-85** | 4 | 0 | 4 | Traverses the major evacuation routes of Response Sector P16, P18, P19, CPZ7 | 8 | 18.0 | 17.0 |
| **TTC-86** | 2 | 0 | 2 | Traverses the major evacuation routes of Response Sector P17, P18, P19, CPZ6 | 7 | 18.0 | 17.0 |
| **TTC-95** | 3 | 0 | 3 | Traverses the major evacuation routes of Response Sector P17, P18, CPZ7 | 5 | 14.0 | 15.0 |
| **TTC-102** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7, CPZ8 | - | 25.0 | - |
| **TTC-113** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ6 | - | 4.0 | - |
| **TTC-116** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 17.0 | - |
| **TTC-131** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 11.0 | - |
| **TTC-132** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 13.0 | - |
| **TTC-133** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ6, CPZ7 | - | 14.0 | - |
| **TTC-134** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 11.0 | - |

| Route | No. of Buses For DPZ | No. of Buses For CPZ | Total No. of Buses | Route Description | Length to DPZ Outer Ring Boundary (km) | Length to CPZ Boundary (km) | Distance from DPZ Outer Ring Boundary to R.C. (km)[1] |
|---|---|---|---|---|---|---|---|
| **TTC-169** | 0 | 7 | 7 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 8.0 | - |
| **GO-41** | 5 | 0 | 5 | Traverses the major evacuation routes of Response Sector P4, P6, P7, P17, P18 | 12 | 22.0 | 17.0 |
| **G0-51/92** | 5 | 0 | 5 | Traverses the major evacuation routes of Response Sector P3, P4, P15, P16, P17, P18, CPZ6 | 15 | 25.0 | 17.0 |
| **Go-52/56** | 0 | 15 | 15 | Traverses the major evacuation routes of Response Sector CPZ1, CPZ2 | - | 15.0 | - |
| **Go-54/71** | 0 | 6 | 6 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 6.0 | - |
| **GO-81** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ2 | - | 16.0 | - |
| **YRT-1** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 10.0 | - |
| **YRT-2** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 15.0 | - |
| **YRT-8** | 0 | 6 | 6 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 7.0 | - |
| **YRT-9** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 10.0 | - |
| **YRT-14** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 9.0 | - |
| **YRT-16** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 7.0 | - |
| **YRT-18** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 8.0 | - |
| **YRT-25** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ8 | - | 9.0 | - |
| **YRT-301** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 11.0 | - |
| **YRT-303** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 14.0 | - |
| **YRT-305** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 10.0 | - |
| **YRT-402** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7 | - | 8.0 | - |
| **YRT-417** | 0 | 9 | 9 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 8.0 | - |
| **YRT-522** | 0 | 4 | 4 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 9.0 | - |
| **YRT-Purple/Purple A** | 0 | 3 | 3 | Traverses the major evacuation routes of Response Sector CPZ7, CPZ8 | - | 9.0 | - |
| **Total** | **117** | **345** | **462** | | | | |

**Table 10-2. Bus Route Descriptions**

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 1 | Schools in P1 & Medical Facilities in P1 | 702, 701, 700, 699, 697, 695, 691, 693, 943, 944, 770, 762, 769, 774, 782, 778, 946, 786, 793, 947, 812, 813, 814, 820, 821, 832, 836, 831, 952, 956, 843, 857, 861, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 2 | Schools in P2 | 716, 717, 591, 3079, 1049, 1048, 1046, 569, 568, 551, 1044, 552, 1041, 1039, 519, 1037, 500, 494, 447, 1035, 446, 1896, 445, 1898, 1897, 1901, 1903, 444, 436, 1025, 437, 438, 439, 435, 434, 433, 432, 426, 418, 419, 423, 424, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 3 | Schools in P3 | 3127, 3113, 3114, 3115, 1197, 34, 801, 799, 797, 798, 948, 949, 803, 804, 950, 813, 814, 820, 821, 832, 836, 831, 952, 956, 843, 857, 861, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 4 | Schools in P4 | 758, 759, 383, 760, 761, 306, 3041, 3229, 3042, 3043, 3045, 3044, 3046, 3047, 3048, 3049, 3050, 3051, 3052, 3053, 3054, 3055, 55, 1345, 56, 1343, 1346, 6070, 1348, 1352, 1350, 57, 1354, 1356, 50, 3169, 3167, 3165, 13, 1126, 58, 1129, 4324, 4325, 4408, 4326, 4409, 4411, 4327, 4413, 4416, 4383, 4417, 4328, 4394, 4329 |
| 5 | Schools in P5 | 1786, 748, 749, 1780, 1779, 1781, 1782, 1783, 5971, 306, 761, 1213, 1209, 384, 385, 386, 387, 388, 53, 1772, 389, 390, 1630, 1631, 1633, 42, 3242, 1629, 3278, 1628, 1627, 43, 44, 1619, 1617, 1615, 9, 1540, 45, 1543, 1422, 1423, 4443, 4456, 4458, 4444, 4482, 4484, 4486, 4506, 4445, 5524, 4508, 4510 |
| 6 | Schools in P6 | 737, 738, 739, 740, 741, 742, 1089, 724, 1090, 723, 379, 380, 686, 687, 942, 765, 770, 762, 769, 774, 782, 778, 946, 786, 793, 947, 812, 813, 814, 820, 821, 832, 836, 831, 952, 956, 843, 857, 861, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 7 | Schools in P7 | 375, 1226, 374, 373, 1094, 1092, 901, 3073, 372, 3226, 371, 370, 1229, 331, 332, 5981, 369, 348, 1294, 1296, 1298, 1300, 368, 3074, 1301, 1303, 5210, 367, 1890, 366, 1307, 364, 363, 361, 1310, 360, 362, 278, 365, 257, 1315, 261, 1317, 267, 1319, 269, 276, 907, 906, 3385, 3390, 3389, 3484, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459, 3464 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 8 | Schools in P8 | 319, 1795, 321, 322, 323, 1797, 324, 325, 326, 327, 298, 297, 1073, 5272, 328, 212, 1078, 1077, 120, 4770, 4771, 4772, 5420, 4773, 4780, 4775, 4776, 4782, 4774, 3065, 202, 203, 204, 3710, 3715, 3744, 3714, 3713, 3712, 3711, 5371, 5372 |
| 9 | Schools in P9 | 329, 1800, 1799, 1801, 1802, 1233, 333, 1836, 332, 5981, 369, 348, 1294, 1296, 1298, 1300, 368, 3074, 1301, 1303, 5210, 367, 1890, 366, 1307, 364, 363, 361, 1310, 360, 362, 278, 365, 257, 1315, 261, 1317, 267, 1319, 269, 276, 907, 906, 3385, 3390, 3389, 3484, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459, 3464 |
| 10 | Schools in P10 & Medical Facilities in P10 | 341, 342, 343, 352, 1814, 5266, 290, 3138, 1816, 350, 160, 159, 139, 135, 136, 143, 996, 137, 144, 138, 147, 997, 148, 149, 5411, 4849, 4847, 4852, 4792, 4793, 4794, 5412, 4795, 4796, 4797, 4798, 4799, 4800, 4801, 4802, 4803 |
| 11 | Schools in P11 | 3266, 573, 348, 1294, 1296, 1298, 1300, 368, 3074, 1301, 1303, 5210, 367, 1890, 366, 1307, 364, 363, 361, 1310, 360, 362, 278, 365, 257, 1315, 261, 1317, 267, 1319, 269, 276, 907, 906, 3385, 3390, 3389, 3484, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459, 3464 |
| 12 | Schools in P12 | 1844, 579, 578, 577, 581, 582, 585, 518, 517, 516, 515, 514, 513, 507, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 13 | Schools in P13 | 1849, 554, 553, 544, 543, 528, 527, 1852, 526, 525, 524, 1854, 1856, 523, 522, 519, 1037, 500, 494, 493, 492, 1884, 510, 512, 508, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 14 | Schools in P14 & Medical Facilities in P14 | 532, 1880, 533, 497, 534, 535, 536, 537, 538, 539, 496, 1883, 495, 494, 493, 492, 1884, 510, 512, 508, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 15 | Schools in P15 | 1504, 1503, 1505, 1507, 39, 21, 1511, 1513, 1509, 1514, 1516, 1518, 1521, 7, 1142, 1144, 1146, 1148, 1150, 40, 1534, 1428, 4454, 1535, 4473, 4466, 4438, 5306, 4489, 4496, 4498, 4439, 4512, 4509, 4440 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 16 | Schools in P16 & Medical Facilities in P16 | 1202, 1200, 35, 1198, 34, 801, 799, 797, 798, 948, 949, 803, 804, 950, 813, 814, 820, 821, 832, 836, 831, 952, 956, 843, 857, 861, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 17 | Schools in P17 & Medical Facilities in P17 | 3108, 3110, 3236, 1770, 395, 394, 393, 3083, 3085, 3084, 29, 1193, 1194, 27, 1189, 26, 1188, 25, 1187, 24, 23, 21, 1511, 1513, 1509, 1514, 1516, 1518, 1521, 7, 1142, 1144, 1146, 1148, 1150, 40, 1534, 1428, 4454, 1535, 4473, 4466, 4438, 5306, 4489, 4496, 4498, 4439, 4512, 4509, 4440 |
| 18 | Schools in P18 & Medical Facilities in P18 | 1774, 1775, 54, 55, 1345, 56, 1641, 790, 3016, 3017, 5406, 838, 842, 853, 3288, 3287, 855, 856, 860, 869, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 19 | Schools in P19 | 1739, 1759, 1959, 1958, 1957, 1956, 1955, 1954, 1953, 1952, 1951, 1950, 1949, 1948, 1947, 1946, 1943, 1758, 233, 1259, 234, 1944, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058, 4251 |
| 20 | Schools in P21 | 3138, 1816, 350, 160, 159, 139, 135, 140, 141, 915, 917, 3716, 3722, 3735, 5566 |
| 21 | Schools in P22 | 1305, 366, 1307, 364, 363, 361, 1310, 360, 362, 278, 365, 257, 1315, 261, 1317, 267, 1319, 269, 276, 907, 906, 3385, 3390, 3389, 3484, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459, 3464 |
| 22 | Schools in CPZ1 & Medical Facilities in CPZ1 | 159, 139, 135, 136, 143, 996, 137, 144, 138, 147, 997, 148, 149, 2, 921, 920, 922, 3683, 3684, 3685, 5452, 3682, 3615, 5237, 3653, 3654, 3655, 3656, 3657 |
| 23 | Schools in CPZ2 & Medical Facilities in CPZ2 | 355, 354, 353, 283, 1032, 282, 1271, 277, 1269, 1268, 255, 1266, 259, 1264, 265, 275, 1325, 1328, 3469, 3473, 3477, 3481, 3491, 3492, 3504, 3506, 3536, 3559, 3470, 3597 |
| 24 | Schools in CPZ6 & Medical Facilities in CPZ6 | 21, 1185, 1183, 1181, 1179, 22, 1177, 1175, 20, 1171, 4, 19, 1173, 1174, 5317, 4432, 4626, 4423, 5315, 5313, 5441, 4424, 4714, 4715, 4716, 4704, 4710, 4712, 4713, 4720, 4721 |
| 25 | Schools in CPZ7 & Medical Facilities in CPZ7 | 3032, 3028, 3027, 3026, 3025, 3024, 1476, 69, 1474, 1472, 68, 67, 1469, 66, 50, 3169, 3167, 3165, 13, 1126, 58, 1129, 4324, 4325, 4408, 4326, 4409, 4411, 4327, 4413, 4416, 4383, 4417, 4328, 4394, 4329 |
| 26 | Schools in CPZ8 & Medical Facilities in CPZ8 | 974, 978, 977, 976, 1102, 975, 1394, 1395, 1396, 1414, 1390, 1392, 1397, 3753, 5201, 3754, 3755, 3756, 3766, 5381, 5445 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 27 | Medical Facilities in P2 | 716, 715, 714, 1055, 1056, 713, 712, 1057, 649, 651, 644, 645, 650, 663, 648, 670, 674, 678, 682, 940, 687, 942, 765, 770, 762, 769, 774, 782, 778, 946, 786, 793, 947, 812, 813, 814, 820, 821, 832, 836, 831, 838, 842, 853, 3288, 3287, 855, 856, 860, 869, 872, 871, 876, 880, 892, 894, 897, 3, 1463, 1460, 1466, 4891, 5198, 4917, 4906, 4927, 4887, 4945, 4886 |
| 28 | Medical Facilities in P4 | 1211, 759, 383, 1208, 384, 385, 386, 387, 388, 53, 1772, 389, 818, 819, 820, 821, 832, 836, 831, 838, 842, 853, 3288, 3287, 855, 856, 860, 869, 872, 871, 876, 880, 892, 894, 897, 3, 1463, 1460, 1466, 4891, 5198, 4917, 4906, 4927, 4887, 4945, 4886 |
| 29 | Medical Facilities in P7 | 375, 1224, 396, 376, 377, 378, 379, 380, 686, 687, 942, 765, 770, 762, 769, 774, 782, 778, 946, 786, 793, 947, 812, 813, 814, 820, 821, 832, 836, 831, 838, 842, 853, 3288, 3287, 855, 856, 860, 869, 872, 871, 876, 880, 892, 894, 897, 3, 1463, 1460, 1466, 4891, 5198, 4917, 4906, 4927, 4887, 4945, 4886 |
| 30 | Medical Facilities in P8 | 318, 317, 309, 5576, 310, 311, 312, 313, 305, 3231, 1087, 5287, 5288, 1086, 231, 252, 1942, 232, 1758, 233, 1259, 234, 1944, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058, 4251 |
| 31 | Medical Facilities in P12 | 1862, 1861, 3212, 3213, 3214, 3215, 1884, 510, 512, 508, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 32 | Medical Facilities in P13 | 526, 525, 524, 1854, 1856, 523, 522, 519, 1037, 500, 494, 493, 492, 1884, 510, 512, 508, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 33 | Medical Facilities in P21 | 348, 345, 349, 343, 352, 1814, 5266, 290, 5267, 1279, 289, 288, 287, 1276, 286, 285, 284, 283, 1032, 282, 1271, 277, 1269, 1268, 255, 1266, 259, 1264, 265, 275, 1325, 1328, 3469, 3473, 3477, 3481, 3491, 3492, 3504, 3506, 3536, 3559, 3470, 3597 |
| 34 | Kennedy Detention Centre | 569, 568, 551, 580, 579, 578, 577, 581, 582, 585, 518, 517, 516, 515, 514, 513, 507, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 35 | Toronto East Detention Centre | 4571, 4616, 4618, 4428, 4620, 4592 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 36 | DRT-110 | 632, 638, 639, 640, 641, 374, 1789, 642, 643, 1791, 318, 317, 309, 5576, 310, 311, 312, 313, 305, 3231, 1087, 5287, 5288, 1086, 231, 252, 1942, 232, 1758, 233, 1259, 234, 1944, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058, 4251 |
| 37 | DRT-112 | 375, 1227, 643, 1791, 318, 3269, 1796, 319, 3227, 320, 1068, 1069, 1071, 1067, 297, 1073, 5272, 328, 212, 1075, 219, 1076, 220, 5444, 1258, 221, 226, 227, 228, 231, 252, 1942, 232, 1758, 233, 1259, 234, 1944, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058 |
| 38 | DRT-120 | 649, 711, 710, 709, 708, 707, 706, 699, 697, 695, 691, 692, 381, 1220, 722, 3012, 728, 3011, 312, 1286, 1285, 314, 315, 301, 307, 308, 226, 227, 228, 229, 249, 86, 85, 100, 84, 3135, 97, 81, 5233, 80, 1084, 197, 1370, 983, 3762, 5295, 3742, 3741, 3743, 5378, 5370 |
| 39 | DRT-216 | 367, 1867, 1868, 1869, 1870, 1871, 1278, 287, 397, 398, 399, 400, 1825, 1827, 158, 1254, 1252, 157, 156, 4844, 4840, 4842, 174, 176, 5261, 180, 222, 1244, 5583, 224, 3082, 1242, 1240, 223, 1236, 1238, 902, 3571, 3577, 3574, 3579, 3582, 3583, 3592, 3595 |
| 40 | DRT-222 | 533, 497, 534, 535, 536, 537, 538, 539, 496, 1883, 495, 494, 493, 492, 1884, 510, 512, 508, 509, 490, 489, 488, 487, 486, 485, 484, 480, 479, 481, 473, 472, 471, 429, 428, 425, 427, 3298, 3294, 3314, 5349, 5350, 3293, 3371 |
| 41 | DRT-224 | 5991, 5992, 533, 497, 534, 535, 536, 537, 538, 539, 496, 1883, 495, 494, 493, 492, 1884, 510, 501, 491, 1887, 1889, 367, 1867, 1868, 1869, 1870, 1871, 1278, 287, 397, 398, 399, 400, 1825, 1827, 158, 1254, 1252, 157, 156, 4844, 4840, 4842, 174, 176, 5261, 180, 222, 1244, 5583, 224, 3082, 1242, 1240, 223, 1236, 1238, 902, 3571, 3577, 3574, 3579, 3582, 3583, 3592, 3595 |
| 42 | DRT-411 | 36, 1206, 1202, 1200, 35, 1770, 395, 394, 393, 3083, 392, 3289, 1652, 3237, 1651, 1659, 1632, 1627, 1644, 1645, 1643, 1646, 1647, 1648, 1649, 1362, 46, 47, 48, 49, 864, 867, 868, 959, 3038, 876, 880, 892, 894, 897, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 43 | DRT-405 | 6014, 6012, 6015, 5568, 1166, 1162, 33, 4434, 5438, 5557, 5558, 4433, 4436, 4432, 4626, 4625, 4627, 4636, 4649, 4635, 4637, 4638, 5556, 4639, 4676 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 44 | DRT-409 | 1428, 1439, 4539, 4540, 5532, 4545, 4541, 4542, 4425, 4622, 4629, 4630, 4631, 5443, 4632, 4651, 4633, 4634, 4635, 4637, 4638, 5556, 4639, 4734, 4733, 4720, 4721 |
| 45 | DRT-423 | 1470, 1478, 64, 1724, 1726, 17, 65, 1933, 1934, 4267, 4269, 4180, 4273, 4181, 4278, 4235, 4285, 4182, 4295, 4300, 4303, 4183, 4308, 4317, 4184 |
| 46 | DRT-900, DRT-920 & TTC-38 | 448, 1919, 1922, 3307, 3306, 3305, 3309, 3310, 3333, 3328, 3332, 3329, 3330, 3331, 3430, 3436, 3291, 3445, 3370 |
| 47 | DRT-915 & DRT-917 | 3479, 3480, 3488, 3503, 3493, 3501, 3507, 3526, 3530, 3542, 3537, 3560, 3553, 3552, 3551, 3563, 3564 |
| 48 | DRT-916 | 411, 3067, 3068, 269, 1323, 268, 1326, 1325, 5211, 3573, 5580, 3571, 3577, 3574, 3579, 3582, 3583, 3592, 3595 |
| 49 | DRT-101 | 721, 718, 1054, 716, 715, 714, 1055, 1056, 713, 712, 1057, 649, 651, 644, 645, 650, 663, 648, 670, 674, 678, 682, 940, 687, 942, 765, 770, 762, 769, 774, 782, 778, 946, 786, 793, 947, 812, 813, 814, 820, 821, 832, 836, 831, 838, 842, 853, 3288, 3287, 855, 856, 860, 869, 872, 871, 876, 880, 892, 894, 897, 3, 1463, 1460, 1466, 4891, 5198, 4917, 4906, 4927, 4887, 4945, 4886 |
| 50 | DRT-103 | 632, 638, 639, 640, 641, 374, 1789, 642, 643, 729, 735, 736, 737, 738, 739, 740, 741, 742, 1089, 724, 725, 726, 727, 728, 3011, 312, 313, 305, 3231, 1087, 5287, 5288, 1086, 231, 252, 1942, 232, 1758, 233, 1259, 234, 1944, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058, 4251 |
| 51 | DRT-902 | 18, 3131, 3132, 4189, 4190, 4191, 6045, 4192, 4275, 4193, 4194, 4195, 4196, 4197, 4198, 4239, 4199, 4200, 4201, 4202, 4203, 4204, 4205, 4310, 4206 |
| 52 | DRT-403 & DRT-410 | 1643, 51, 1365, 43, 5446, 1368, 1961, 1366, 23, 21, 1185, 1183, 1181, 1179, 22, 1177, 1175, 20, 1171, 4, 19, 1173, 1174, 5317, 4432, 4626, 4423, 5315, 5313, 5441, 4424, 4714, 4715, 4716, 4704, 4710, 4711, 4705, 4759, 4706 |
| 53 | DRT-291 | 528, 527, 1852, 526, 525, 524, 1854, 1856, 523, 522, 519, 520, 1859, 1861, 521, 1863, 1865, 3076, 3075, 3074, 1301, 1303, 5210, 367, 1890, 366, 1307, 364, 363, 361, 1310, 360, 362, 278, 365, 257, 1315, 261, 1317, 267, 1319, 269, 276, 907, 906, 3385, 3390, 3389, 3484, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459, 3464 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 54 | TTC-86 & TTC-95 | 578, 577, 581, 570, 573, 348, 345, 349, 343, 352, 1814, 5266, 290, 3138, 1816, 350, 160, 218, 1256, 158, 1254, 1252, 157, 156, 4844, 4840, 4842, 174, 176, 5261, 180, 222, 1244, 5583, 224, 3082, 1242, 1240, 223, 1236, 1238, 902, 3571, 3577, 3574, 3579, 3582, 3583, 3592, 3595, 3606 |
| 55 | TTC-85 | 3322, 3321, 3302, 5690, 3319, 3311, 5961, 3300, 3295, 3401, 3317, 3397, 3411, 3398, 3404, 3403, 3391, 3514, 3392, 3393, 6228, 3527, 3533, 3394, 3455, 3456, 3459 |
| 56 | TTC-54 & G0-51/92 | 372, 3073, 901, 1092, 1094, 373, 374, 1226, 375, 1224, 396, 376, 377, 378, 379, 380, 1222, 1219, 381, 1217, 382, 383, 1208, 384, 385, 386, 387, 388, 53, 1772, 389, 390, 1630, 391, 392, 3289, 1196, 1195, 1194, 27, 1189, 26, 1188, 25, 1187, 24, 23, 21, 1185, 1183, 1181, 1179, 22, 1177, 1175, 20, 1171, 4, 19, 1173, 1174, 5317, 4432, 4626, 4423, 5315, 5313, 5441, 4424, 4714, 4715, 4716, 4704, 4710, 4711, 4705, 4759, 4706, 4763 |
| 57 | TTC-134 | 375, 1224, 396, 376, 377, 378, 379, 380, 1222, 1219, 381, 1217, 382, 383, 1208, 384, 385, 386, 387, 388, 53, 1772, 389, 390, 1630, 391, 392, 3289, 1652, 3237, 1651, 1659, 1632, 1627, 1644, 1645, 1643, 1660, 52, 848, 851, 852, 954, 3288, 3287, 855, 856, 860, 869, 873, 877, 881, 898, 895, 1556, 1451, 1454, 5197, 4904, 4879, 4878, 4928, 4877 |
| 58 | TTC-43 | 391, 392, 3289, 1196, 1195, 1194, 27, 1189, 26, 1188, 25, 1187, 24, 23, 21, 1185, 1183, 1181, 1179, 22, 1177, 1175, 20, 1171, 4, 19, 1173, 1174, 5317, 4432, 4626, 4423, 5315, 5313, 5441, 4424, 4714, 4715, 4716, 4704, 4710, 4712, 4713, 4720 |
| 59 | TTC-68 | 1535, 4532, 5527, 4533, 4534, 4535, 4426, 4622, 4629, 4630, 4631, 5443, 4632, 4651, 4633, 4634, 4635, 4724, 4725, 4726, 4727, 4731, 4732, 4733, 4721 |
| 60 | TTC-16 | 3119, 3117, 3118, 1205, 1497, 36, 1499, 37, 3235, 38, 1502, 1503, 1505, 1507, 39, 21, 1511, 1513, 1509, 1514, 1516, 1518, 1521, 7, 1142, 1144, 1146, 1148, 1150, 40, 1534, 1428, 4454, 1535, 4473, 4466, 4438, 5306, 4489, 4496, 4498, 4439, 4512, 4509, 4440 |
| 61 | TTC-102 | 5951, 1479, 1480, 1481, 1493, 1495, 1482, 1483, 1484, 1496, 1485, 1178, 1177, 1175, 20, 32, 1168, 5, 1160, 1161, 1162, 33, 4434, 4425, 4426, 4610, 4550, 4427, 4613, 4614, 4571, 4616, 4618, 4428, 4620, 4592 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 62 | TTC-53 | 1631, 1633, 42, 3242, 1629, 3278, 1628, 1627, 43, 44, 1619, 1617, 1615, 9, 1540, 45, 1543, 1422, 1423, 4443, 4456, 4458, 4444, 4482, 4484, 4486, 4506, 4445, 5524, 4508, 4510 |
| 63 | TTC-133 | 4339, 4334, 4340, 4351, 4352, 4347, 4354, 4358, 4362, 4370, 4368, 4369, 4372, 4373, 4374, 4379, 4380, 4381, 4382, 4388, 4398, 4392 |
| 64 | TTC-113, TTC-116, TTC-131 & TTC-132 | 3182, 3173, 3181, 3180, 3179, 3178, 3177, 3175, 3174, 3172, 3171, 1131, 1130, 884, 894, 897, 3, 1463, 1460, 1466, 4891, 5198, 4917, 4906, 4927, 4887, 4945, 4886 |
| 65 | TTC-39 | 4439, 4582, 4583, 5541, 4584, 4578, 4581, 4428, 4667, 4668, 4669, 4639, 4734, 4733, 4720, 4721 |
| 66 | TTC-42 | 56, 1343, 1346, 6070, 1348, 1352, 1350, 57, 1354, 1356, 50, 3169, 3167, 3165, 13, 1126, 58, 1129, 4324, 4325, 4408, 4326, 4409, 4411, 4327, 4413, 4416, 4383, 4417, 4328, 4394, 4329 |
| 67 | TTC-20 | 4466, 4551, 4548, 4554, 5535, 4549, 4557, 4550, 4427, 4613, 4614, 4571, 4616, 4618, 4428, 4620, 4592 |
| 68 | TTC-169 | 385, 386, 387, 388, 53, 1772, 389, 390, 1630, 391, 392, 3289, 1196, 1195, 1194, 27, 1189, 26, 1188, 25, 1187, 24, 23, 21, 1185, 1183, 1181, 1179, 22, 1177, 1175, 20, 1171, 4, 19, 1173, 1174, 5317, 4432, 4626, 4423, 5315, 5313, 5441, 4424, 4714, 4715, 4716, 4704, 4710, 4711, 4705, 4759, 4706, 4763 |
| 69 | TTC-9 | 1112, 1111, 1117, 1110, 1931, 1109, 4060, 4062, 4056, 4223, 4220, 4226, 4227, 4229, 5277, 4057, 4250, 4159, 5501, 4058, 4251 |
| 70 | TTC-57 | 9, 1137, 8, 1140, 7, 1153, 1152, 6, 1157, 3130, 1158, 5, 3128, 1172, 4, 19, 1173, 1174, 5317, 4432, 4626, 4625, 4627, 4636, 4649, 4635, 4637, 4638, 5556, 4639, 4676, 4640 |
| 71 | TTC-2 | 4427, 5539, 4562, 5537, 4561, 4560, 4559, 4438, 4477, 4476, 4475, 4907, 4444, 4908, 4909, 4926, 4913, 4910, 4912, 4924, 4911, 4921, 5515, 4327, 4413, 4416, 4383, 4417, 4328, 4394, 4329 |
| 72 | YRT-25 | 979, 1095, 1096, 1393, 1391, 1398, 1390, 1392, 1397, 3753, 5201, 3754, 3755, 3756, 3766, 3765, 3757, 3760, 3758, 3818, 3776, 3777, 3821 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 73 | YRT-9 | 238, 239, 240, 241, 245, 246, 247, 248, 1402, 970, 962, 973, 972, 971, 5479, 967, 1406, 1409, 1410, 1104, 975, 1394, 1395, 1396, 1414, 1390, 3058, 3059, 3060, 3752, 3061, 5379, 5377 |
| 74 | YRT-1 | 1376, 989, 93, 1373, 76, 92, 79, 191, 192, 3145, 969, 968, 967, 966, 965, 5215, 5226, 3772, 3773, 5217, 5219, 5221, 3771, 3954, 3957, 3958, 3787, 3961, 3963, 3965, 3967, 3969, 3980, 3788, 3991 |
| 75 | YRT-303 | 961, 998, 1975, 1972, 1994, 3960, 1974, 3789, 4011, 3790, 4019, 3791, 4038, 3792 |
| 76 | YRT-16 | 1409, 1410, 1104, 975, 1097, 5213, 5297, 3767, 3768, 3869, 3871, 3770, 3769, 3875, 3879, 3881, 3781, 3897 |
| 77 | YRT-2 | 1113, 4080, 4081, 4079, 4068, 4072, 4093, 4088, 4096, 4116, 4117, 4118, 4119, 4120, 4121, 4122, 4102, 4131, 4149, 4148, 4150, 4151, 4152, 4143, 4142 |
| 78 | YRT-8 | 4100, 4132, 4101, 4129, 4102, 4103, 4104, 4007, 4016, 4015, 4014, 4017, 4020, 3949, 3948, 3947, 3946, 3787, 3883, 3884, 3885, 3886, 3887, 3888, 3781, 3897 |
| 79 | YRT-14 | 1377, 1378, 241, 242, 1415, 243, 244, 1416, 1107, 1106, 1105, 1418, 1983, 1982, 1980, 1981, 1979, 1978, 1977, 4064, 4067, 4083, 4085, 4006, 4098, 4007, 4135, 4136, 4138, 4005, 4026 |
| 80 | YRT-18 | 1396, 3799, 3800, 3801, 3802, 3803, 3804, 3798, 3805, 3838, 3837, 3843, 3836, 3835, 3839, 3834, 3840, 3857, 3858, 3855, 3856, 3854, 3862, 3853, 3849, 3777, 3821 |
| 81 | YRT-301 | 3824, 3771, 3952, 3794, 3790, 4019, 3791, 4038 |
| 82 | YRT-305 | 5299, 1415, 243, 244, 1416, 1107, 1106, 1105, 1418, 1983, 1982, 1980, 1981, 5325, 3134, 1993, 1991, 1992, 1994, 3960, 1974, 3789, 4011, 3790, 4019, 3791, 4038 |
| 83 | YRT-402 | 1413, 1396, 3799, 3800, 3801, 3802, 3803, 3804, 3798, 3805, 3838, 3837, 3843, 3836, 3835, 3839, 3834, 3840, 3857, 3858, 3855, 3856, 3854, 3862, 3853, 3849, 3777 |
| 84 | YRT-417 | 6220, 1408, 1409, 1410, 1104, 975, 1394, 1395, 1396, 1414, 1390, 3058, 3059, 3060, 3752, 3061, 5379, 5377 |
| 85 | YRT-522 | 967, 966, 965, 5215, 5226, 3772, 3773, 5217, 5219, 5221, 3771, 3954, 3957, 3958, 3787, 3946, 3947, 3948, 3949, 4020, 4017, 3791, 4038 |

| Bus Route Number | Description | Nodes Traversed from Route Start to PZ Boundary |
|---|---|---|
| 86 | YRT-Purple/Purple A | 3145, 969, 968, 967, 966, 965, 5215, 5226, 3772, 3773, 5217, 5219, 5221, 3771, 3954, 3957, 3958, 3787, 3961, 3963, 3965, 3967, 3969, 3980, 3788 |
| 87 | GO-41 | 591, 3079, 1049, 1048, 1046, 569, 568, 551, 1044, 552, 1041, 1039, 519, 1037, 500, 494, 447, 1035, 446, 1896, 445, 1898, 1897, 1901, 1903, 444, 436, 476, 482, 470, 469, 1909, 459, 1911, 412, 1926, 454, 1927, 455, 456, 457, 458, 3299, 3296, 3297, 3295, 3300, 3304, 3303, 3294, 3314, 5349, 5350, 3293, 3371 |
| 88 | Go-52/56 | 3322, 3321, 3302, 5690, 3301, 3292, 3331, 3430, 3429, 3428, 3427, 3426, 3425, 3424, 3435, 3422, 3421, 3393, 3508, 3511, 3512, 6083, 3507, 3523, 3524, 3522, 3506, 5361, 3585, 3586, 3583, 3592, 3595 |
| 89 | Go-54/71 | 6079, 5493, 5492, 3829, 3831, 3890, 3891, 3892, 3893, 3894, 3885, 3886, 3887, 3888, 3781, 3897 |
| 90 | GO-81 | 476, 482, 470, 467, 1021, 1019, 257, 1013, 1016, 1017, 1014, 256, 255, 254, 1008, 1009, 1002, 3081, 224, 1243, 1001, 1006, 3136, 1004, 253, 1000, 999, 3696, 5421, 3697, 4817, 3698, 5677, 5674, 4815, 3699, 3684, 3685, 5452, 3682, 3615, 3670, 3671, 3616, 3617, 3618, 3705, 3728 |

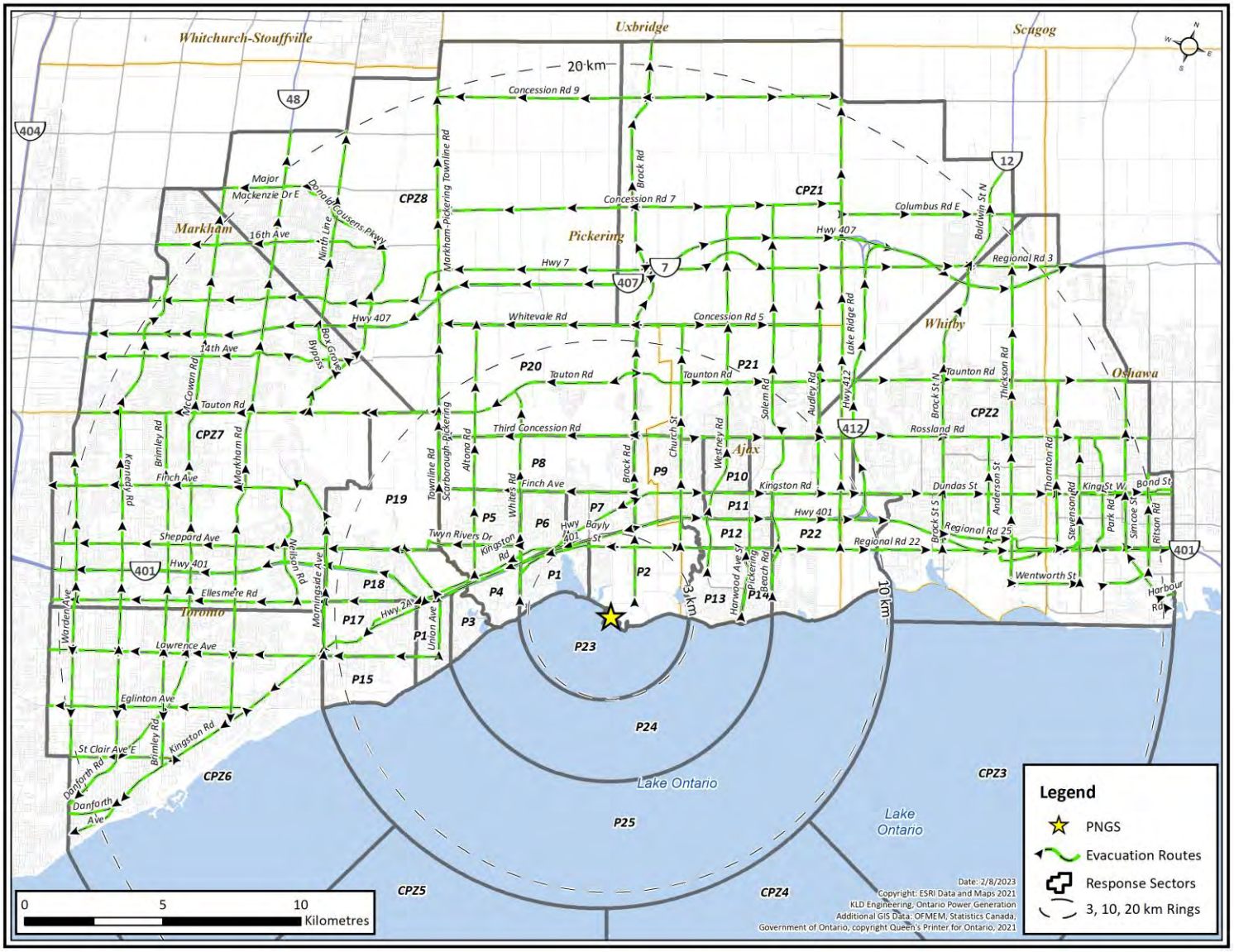



**Figure 10-1. Major Evacuation Routes**

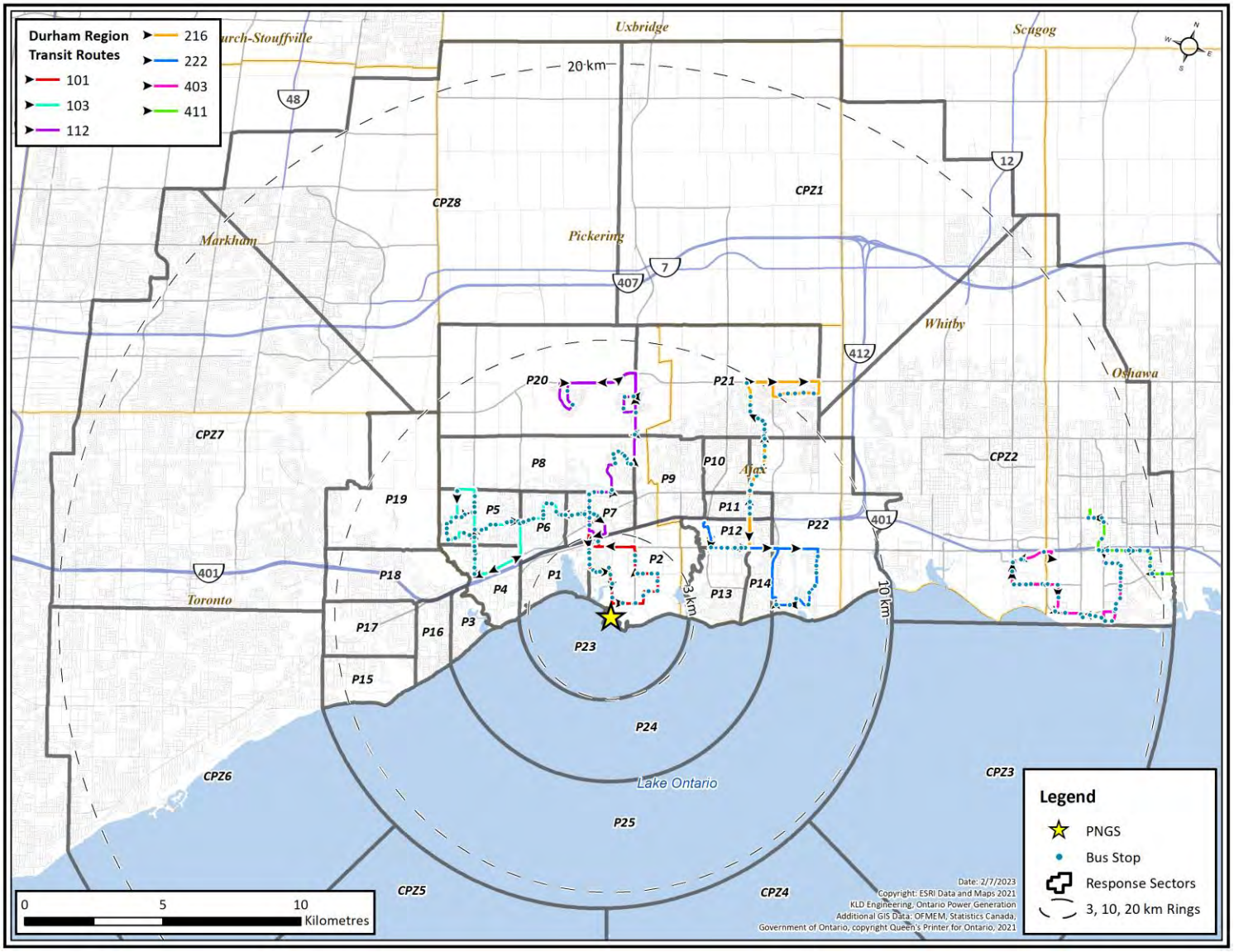



**Figure 10-2. Durham Region Transit Transit-Dependent Routes (1 of 3)**

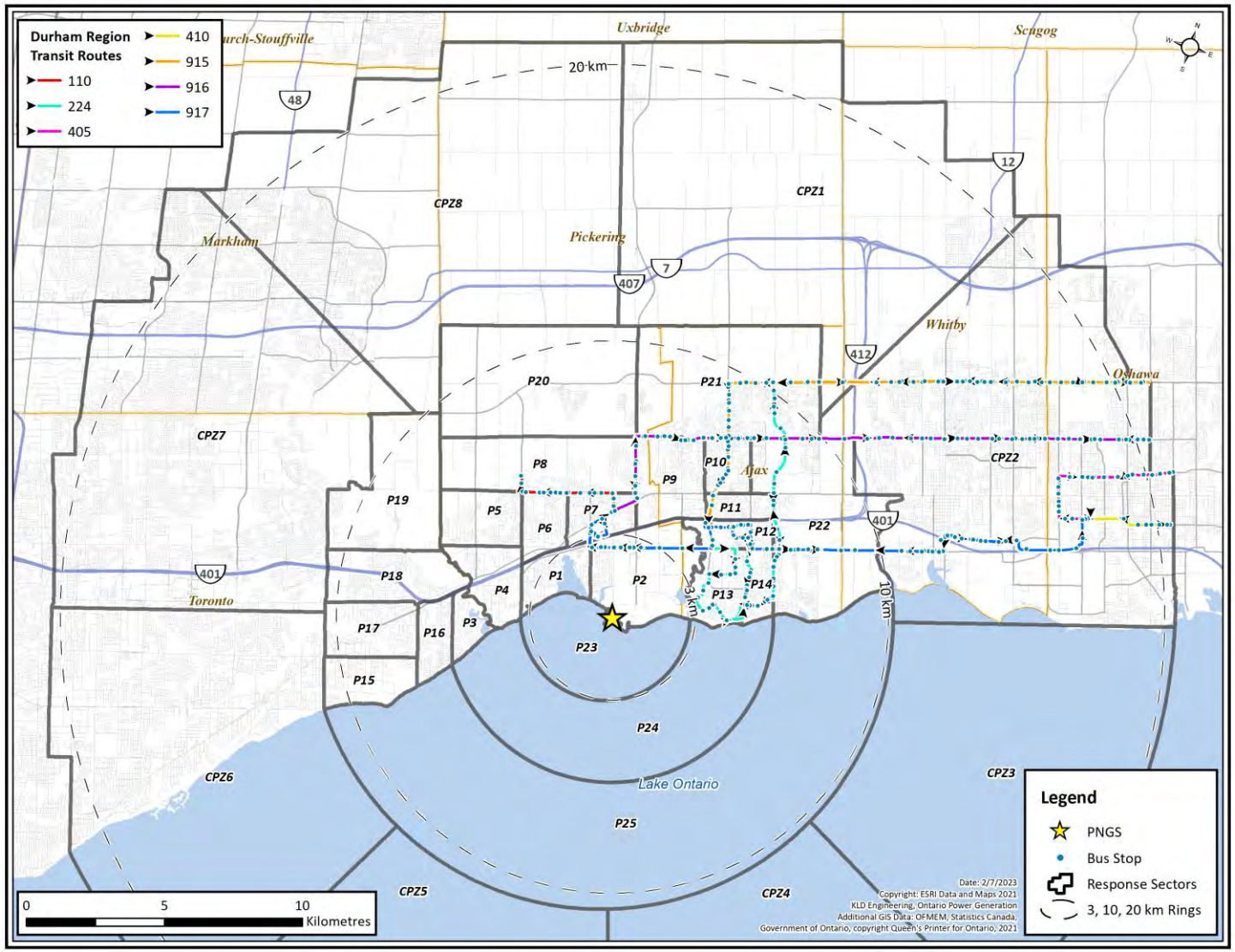



**Figure 10-3. Durham Region Transit Transit-Dependent Routes (2 of 3)**

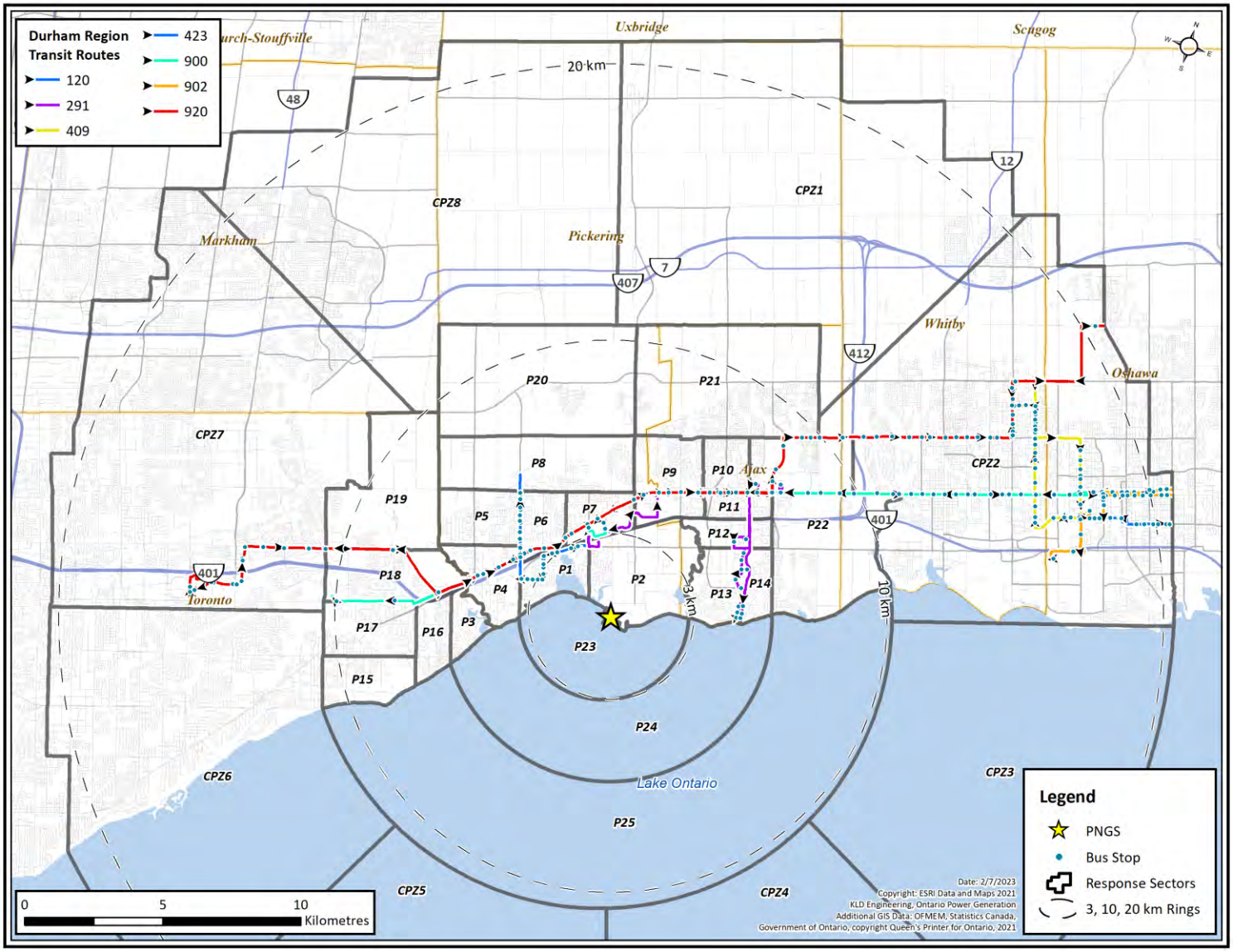



**Figure 10-4. Durham Region Transit Transit-Dependent Routes (3 of 3)**

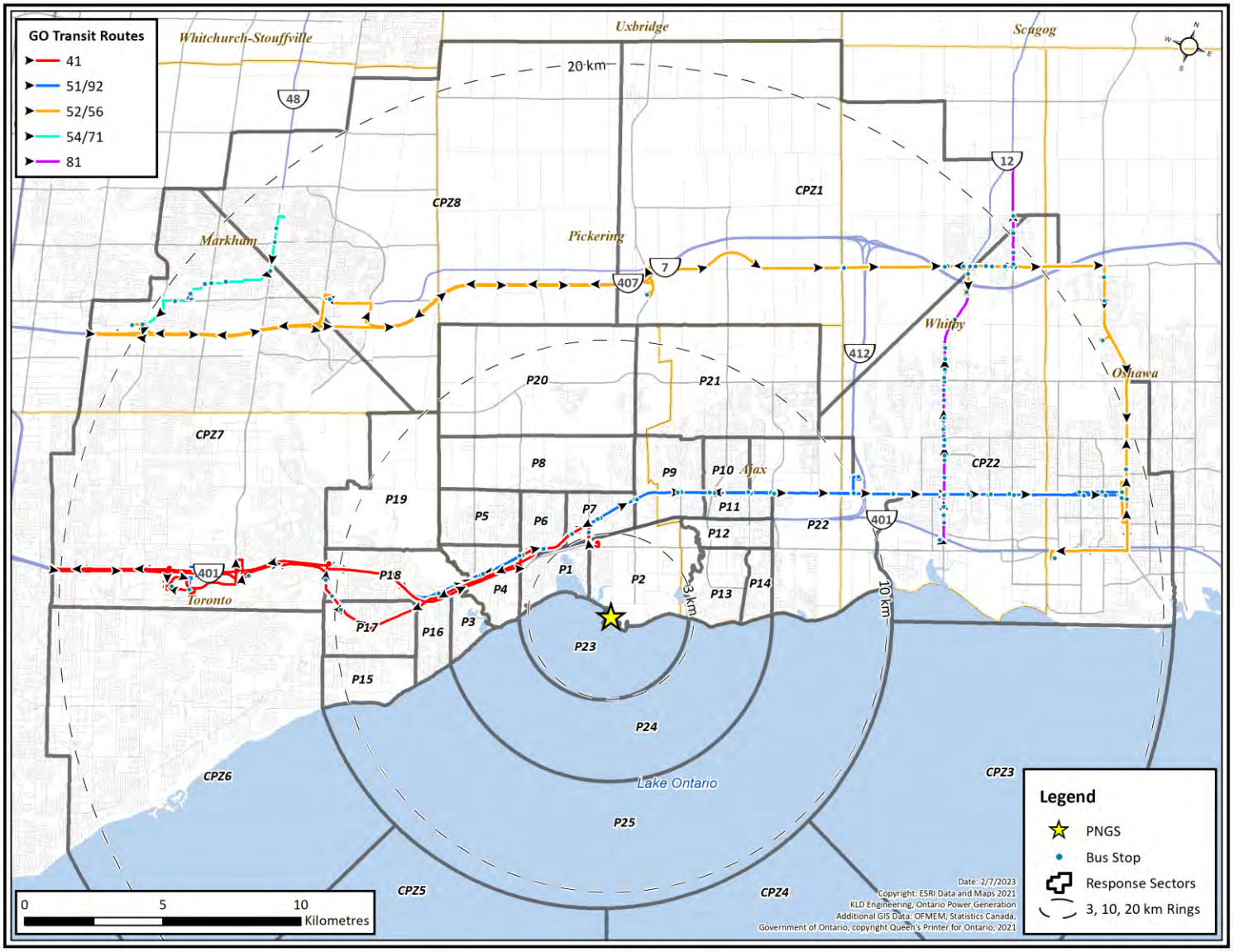



**Figure 10-5. GO Transit Transit-Dependent Routes**

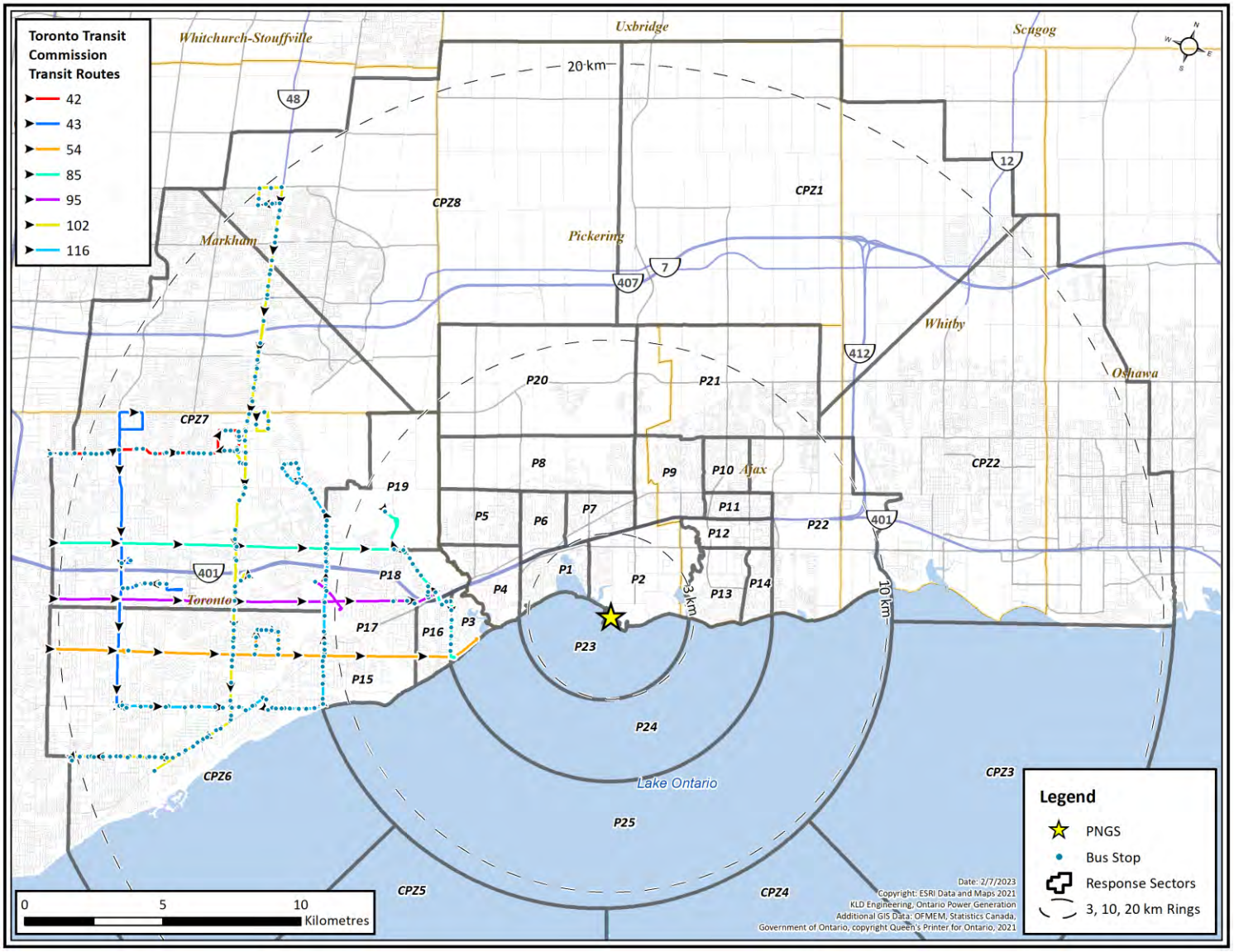



**Figure 10-6. Toronto Transit Commission Transit-Dependent Routes (1 of 3)**

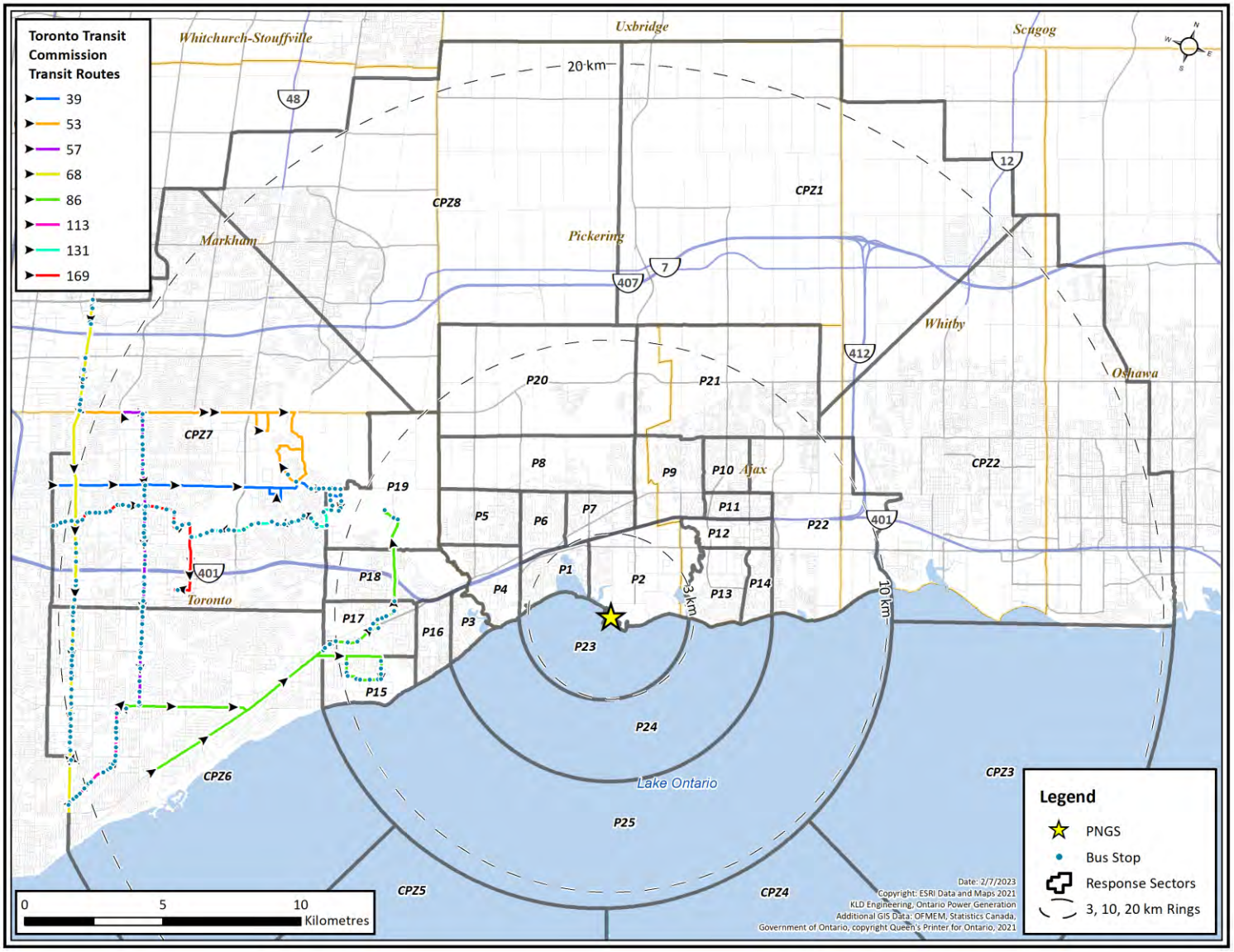



**Figure 10-7. Toronto Transit Commission Transit-Dependent Routes (2 of 3)**

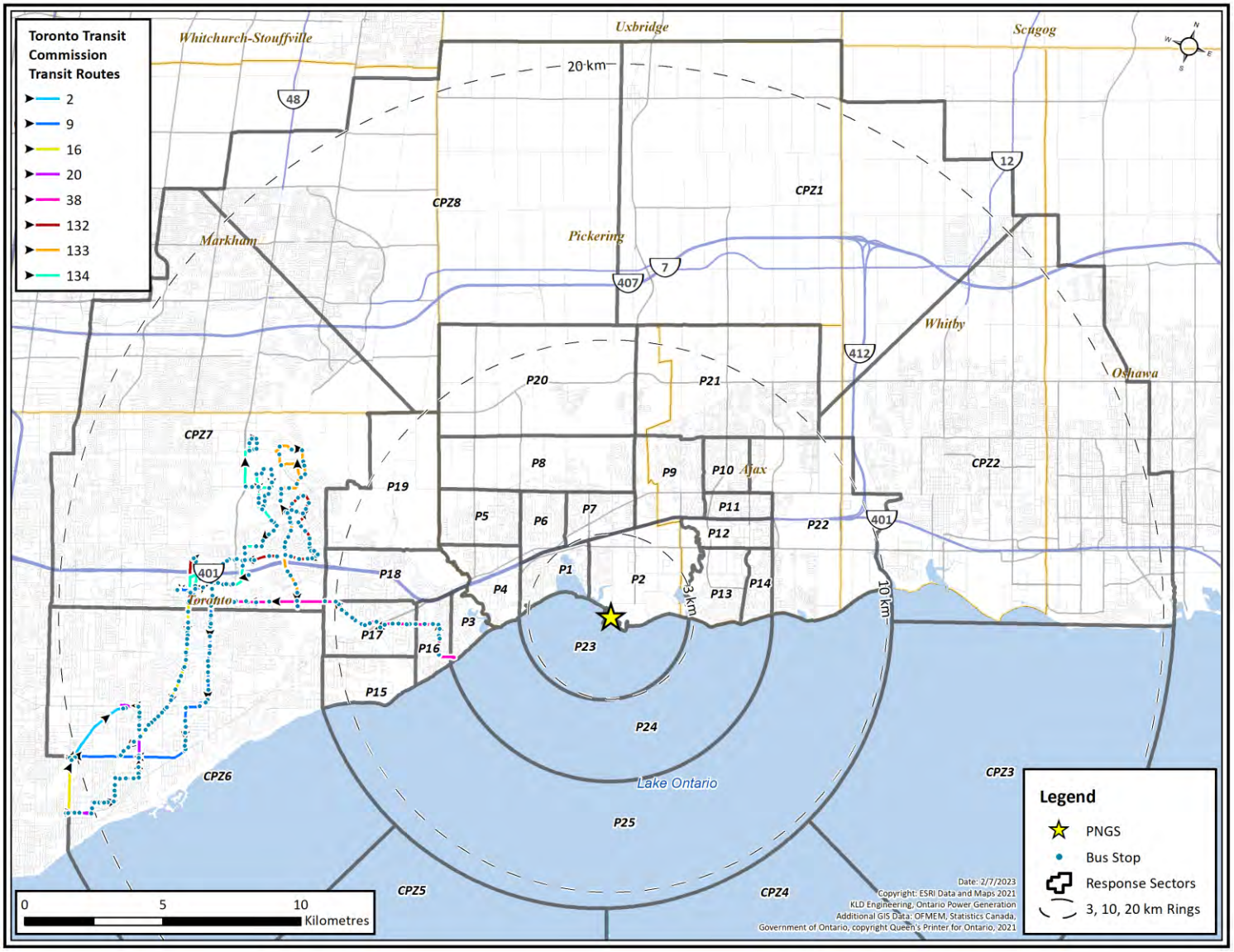



**Figure 10-8. Toronto Transit Commission Transit-Dependent Routes (3 of 3)**

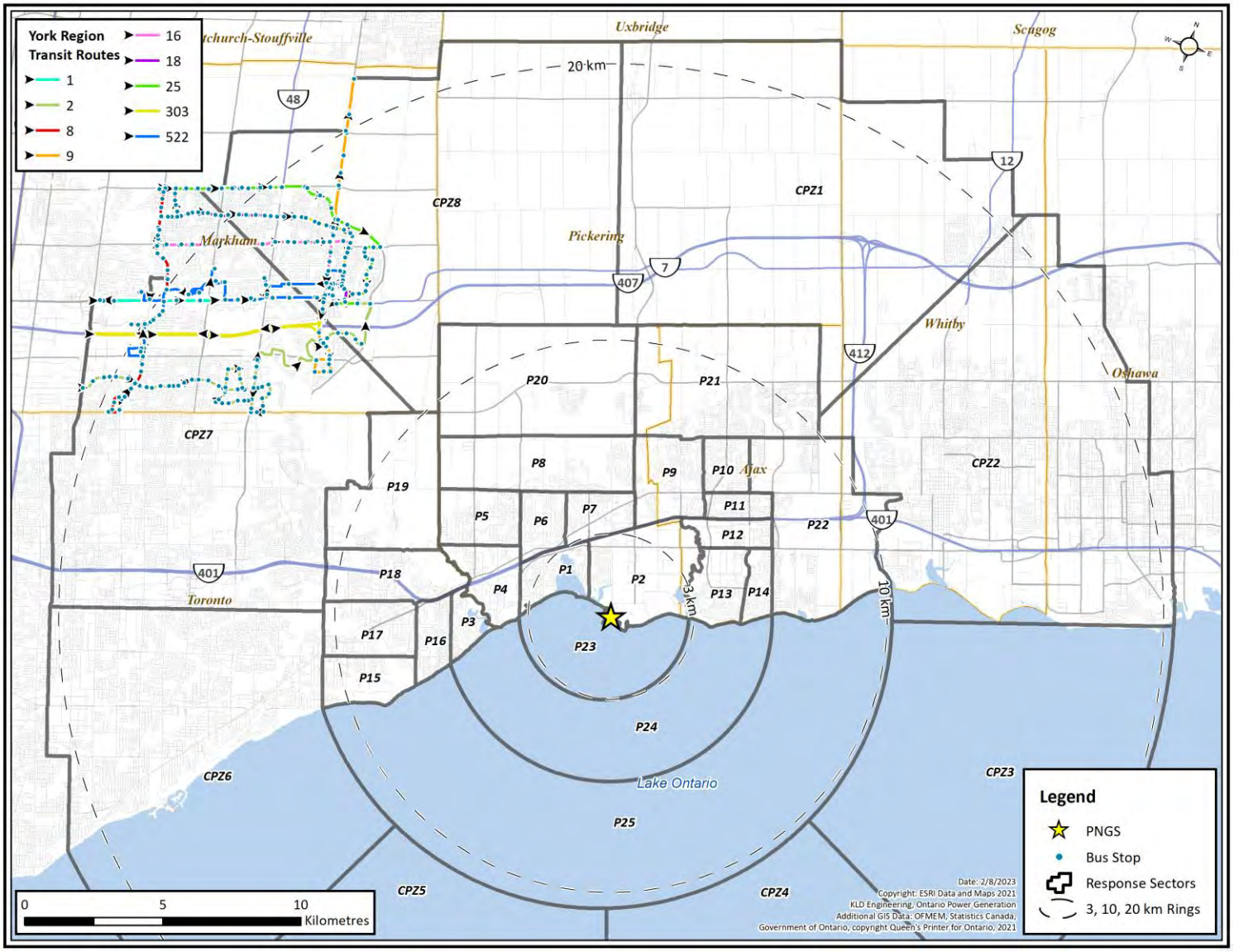



**Figure 10-9. York Region Transit Transit-Dependent Routes (1 of 2)**

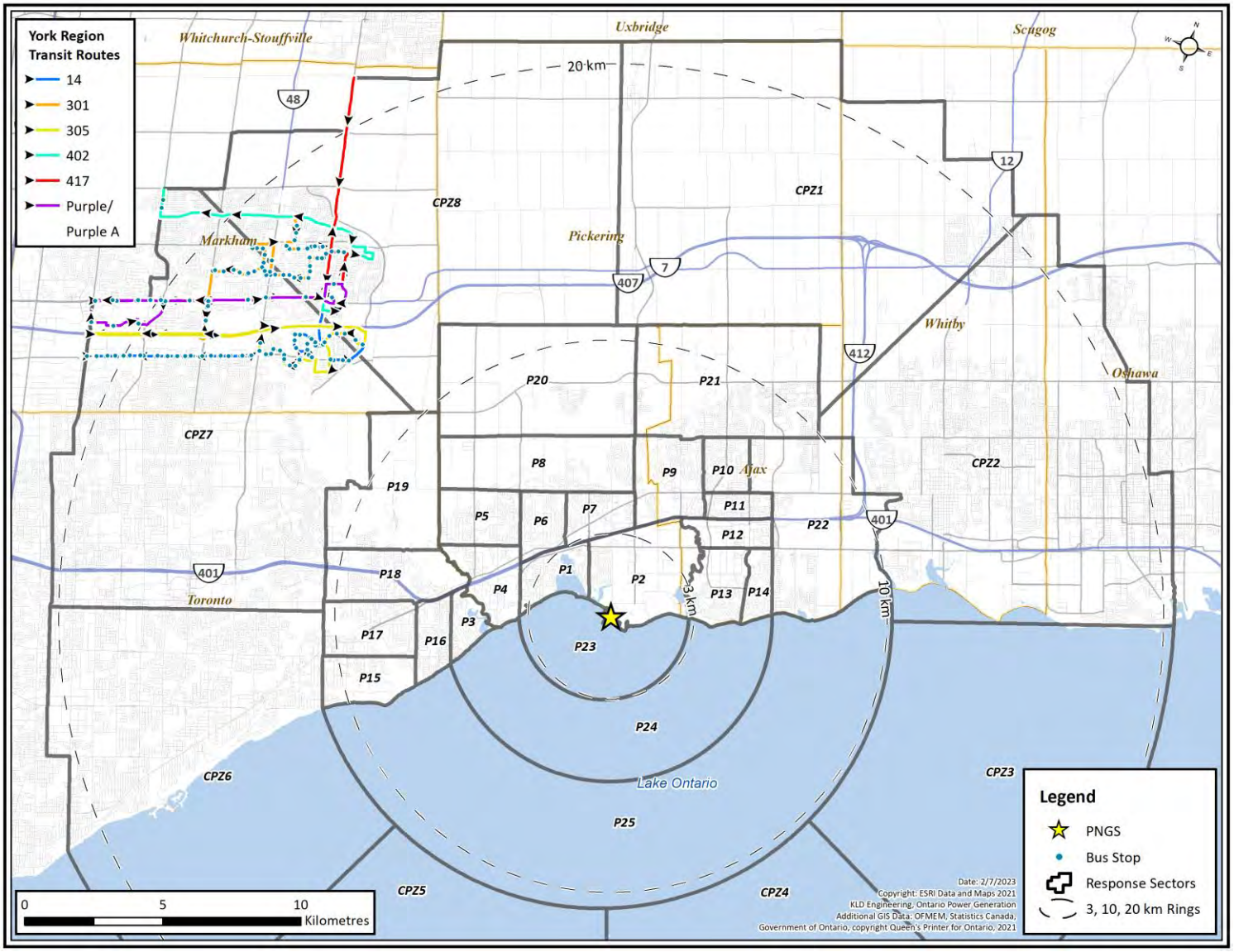



**Figure 10-10. York Region Transit Transit-Dependent Routes (2 of 2)**

## APPENDIX A

Glossary of Traffic Engineering Terms

## A. GLOSSARY OF TRAFFIC ENGINEERING TERMS

**Table A-1. Glossary of Traffic Engineering Terms**

| Term | Definition |
|---|---|
| Analysis Network | A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes. |
| Link | A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics. |
| Measures of Effectiveness | Statistics describing traffic operations on a roadway network. |
| Node | A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link. |
| Origin | A location attached to a network link, within the PZ or Shadow Region, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations. |
| Prevailing Roadway and Traffic Conditions | Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.). |
| Service Rate | Maximum rate at which vehicles, executing a specific turn manoeuvre, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vph. |
| Service Volume | Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service (The Service Volume at the upper bound of Level of Service, E, equals Capacity). Service Volume is usually expressed as vph. |
| Signal Cycle Length | The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds. |
| Signal Interval | A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals, usually green, yellow, red. |

| Term | Definition |
|---|---|
| Signal Phase | A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds. |
| Traffic (Trip) Assignment | A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time. |
| Traffic Density | The number of vehicles that occupy one lane of a roadway section of specified length at a point in time, expressed as vehicles per mile (vpm). |
| Traffic (Trip) Distribution | A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes. |
| Traffic Simulation | A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness. |
| Traffic Volume | The number of vehicles that pass over a section of roadway in one direction, expressed in vph. Where applicable, traffic volume may be stratified by turn movement. |
| Travel Mode | Distinguishes between private auto, bus, rail, pedestrian and air travel modes. |
| Trip Table or Origin-Destination Matrix | A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vph or in vehicles. |
| Turning Capacity | The capacity associated with that component of the traffic stream which executes a specified turn manoeuvre from an approach at an intersection. |

## APPENDIX B

DTRAD: Dynamic Traffic Assignment and Distribution Model

## B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL

This appendix describes the integrated dynamic trip assignment and distribution model named DTRAD (Dynamic TRaffic Assignment and Distribution) that is expressly designed for use in analyzing evacuation scenarios. DTRAD employs logit-based path-choice principles and is one of the models of the DYNEV II System. The DTRAD module implements path-based *Dynamic Traffic Assignment* (DTA) so that time dependent Origin-Destination (OD) trips are "assigned" to routes over the network based on prevailing traffic conditions.

To apply the DYNEV II System, the analyst must specify the highway network, link capacity information, the time-varying volume of traffic generated at all origin centroids and, optionally, a set of accessible candidate destination nodes on the periphery of the Planning Zones (PZ) for selected origins. DTRAD calculates the optimal dynamic trip distribution (i.e., trip destinations) and the optimal dynamic trip assignment (i.e., trip routing) of the traffic generated at each origin node traveling to its set of candidate destination nodes, so as to minimize evacuee travel "cost."

### B.1 Overview of Integrated Distribution and Assignment Model

The underlying premise is that the selection of destinations and routes is intrinsically coupled in an evacuation scenario. That is, people in vehicles seek to travel out of an area of potential risk as rapidly as possible by selecting the "best" routes. The model is designed to identify these "best" routes in a manner that realistically distributes vehicles from origins to destinations and routes them over the highway network, in a consistent and optimal manner, reflecting evacuee behaviour.

For each origin, a set of "candidate destination nodes" is selected by the software logic and by the analyst to reflect the desire by evacuees to travel away from the power plant and to access major highways. The specific destination nodes within this set that are selected by travelers and the selection of the connecting paths of travel, are both determined by DTRAD. This determination is made by a logit-based path choice model in DTRAD, so as to minimize the trip "cost", as discussed later.

The traffic loading on the network and the consequent operational traffic environment of the network (density, speed, throughput on each link) vary over time as the evacuation takes place. The DTRAD model, which is interfaced with the DYNEV simulation model, executes a succession of "sessions" wherein it computes the optimal routing and selection of destination nodes for the conditions that exist at that time.

## B.2 Interfacing the DYNEV Simulation Model with DTRAD

The DYNEV II system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. An algorithm was developed to support the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next. Another algorithm executes a "mapping" from the specified "geometric" network (link-node analysis network) that represents the physical highway system, to a "path" network that represents the vehicle [turn] movements. DTRAD computations are performed on the "path" network: DYNEV simulation model, on the "geometric" network.

### B.2.1 DTRAD Description

DTRAD is the DTA module for the DYNEV II System.

When the road network under study is large, multiple routing options are usually available between trip origins and destinations. The problem of loading traffic demands and propagating them over the network links is called Network Loading and is addressed by DYNEV II using macroscopic traffic simulation modelling. Traffic assignment deals with computing the distribution of the traffic over the road network for given O-D demands and is a model of the route choice of the drivers. Travel demand changes significantly over time, and the road network may have time dependent characteristics, e.g., time-varying signal timing or reduced road capacity because of lane closure, or traffic congestion. To consider these time dependencies, DTA procedures are required.

The DTRAD DTA module represents the dynamic route choice behaviour of drivers, using the specification of dynamic origin-destination matrices as flow input. Drivers choose their routes through the network based on the travel cost they experience (as determined by the simulation model). This allows traffic to be distributed over the network according to the time-dependent conditions. The modelling principles of DTRAD include:

- It is assumed that drivers not only select the best route (i.e., lowest cost path) but some also select less attractive routes. The algorithm implemented by DTRAD archives several "efficient" routes for each O-D pair from which the drivers choose.
- The choice of one route out of a set of possible routes is an outcome of "discrete choice modelling". Given a set of routes and their generalized costs, the percentages of drivers that choose each route is computed. The most prevalent model for discrete choice modelling is the logit model. DTRAD uses a variant of Path-Size-Logit model (PSL). PSL overcomes the drawback of the traditional multinomial logit model by incorporating an additional deterministic path size correction term to address path overlapping in the random utility expression.

- DTRAD executes the traffic assignment (TA) algorithm on an abstract network representation called "the path network" which is built from the actual physical link-node analysis network. This execution continues until a stable situation is reached: the volumes and travel times on the edges of the path network do not change significantly from one iteration to the next. The criteria for this convergence are defined by the user.
- Travel "cost" plays a crucial role in route choice. In DTRAD, path cost is a linear summation of the generalized cost of each link that comprises the path. The generalized cost for a link, a, is expressed as

$$c_a = \alpha t_a + \beta l_a + \gamma s_{a,}$$

  where $c_a$is the generalized cost for link $a$ and $\alpha$, $\beta$, and, $\gamma$ are cost coefficients for link travel time, distance, and supplemental cost, respectively. Distance and supplemental costs are defined as invariant properties of the network model, while travel time is a dynamic property dictated by prevailing traffic conditions. The DYNEV simulation model computes travel times on all edges in the network and DTRAD uses that information to constantly update the costs of paths. The route choice decision model in the next simulation iteration uses these updated values to adjust the route choice behaviour. This way, traffic demands are dynamically re-assigned based on time dependent conditions. The interaction between the DTRAD traffic assignment and DYNEV II simulation models is depicted in Figure B-1. Each round of interaction is called a Traffic Assignment Session (TA session). A TA session is composed of multiple iterations, marked as loop B in the figure.
- The supplemental cost is based on the "survival distribution" (a variation of the exponential distribution).The Inverse Survival Function is a "cost" term in DTRAD to represent the potential risk of travel toward the plant:

  $s_a = - \beta \ln (p), 0 \leq p \leq l ; \beta > 0$

  $p = \frac{d_n}{d_0}$

  $d_n$ = Distance of node, n, from the plant
  $d_0$ =Distance from the plant where there is zero risk
  $\beta$ = Scaling factor

  The value of $d_o$ = 20 kilometres, the outer distance of the Contingency Planning Zone (CPZ). Note that the supplemental cost, $s_{a,}$ of link, a, is (high, low), if its downstream node, n, is (near, far from) the power plant.

### B.2.2 Network Equilibrium

In 1952, John Wardrop wrote:

> *Under equilibrium conditions traffic arranges itself in congested networks in such a way that no individual trip-maker can reduce his path costs by switching routes.*

The above statement describes the "User Equilibrium" definition, also called the "Selfish Driver Equilibrium". It is a hypothesis that represents a [hopeful] condition that evolves over time as drivers search out alternative routes to identify those routes that minimize their respective "costs". It has been found that this "equilibrium" objective to minimize costs is largely realized by most drivers who routinely take the same trip over the same network at the same time (i.e., commuters). Effectively, such drivers "learn" which routes are best for them over time. Thus, the traffic environment "settles down" to a near-equilibrium state.

Clearly, since an emergency evacuation is a sudden, unique event, it does not constitute a long-term learning experience which can achieve an equilibrium state. Consequently, DTRAD was not designed as an equilibrium solution, but to represent drivers in a new and unfamiliar situation, who respond in a flexible manner to real-time information (either broadcast or observed) in such a way as to minimize their respective costs of travel.

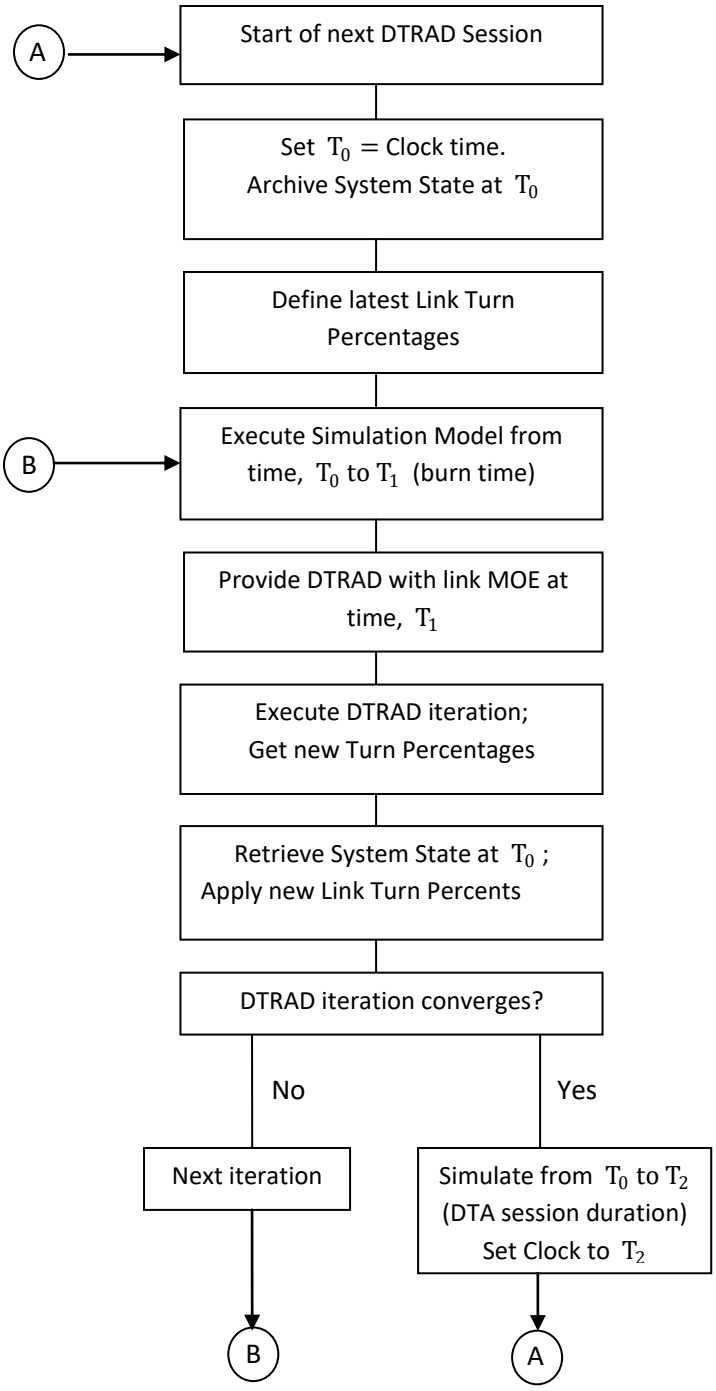



**Figure B-1. Flow Diagram of Simulation-DTRAD Interface**

## APPENDIX C

DYNEV Traffic Simulation Model

## C. DYNEV TRAFFIC SIMULATION MODEL

This appendix describes the DYNEV traffic simulation model. The DYNEV traffic simulation model is a *macroscopic* model that describes the operations of traffic flow in terms of aggregate variables: vehicles, flow rate, mean speed, volume, density, queue length, *on each link*, for each turn movement, during each Time Interval (simulation time step). The model generates trips from "sources" and from Entry Links and introduces them onto the analysis network at rates specified by the analyst based on the mobilization time distributions. The model simulates the movements of all vehicles on all network links over time until the network is empty. At intervals, the model outputs Measures of Effectiveness (MOE) such as those listed in Table C-1.

Model Features Include:

- Explicit consideration is taken of the variation in density over the time step; an iterative procedure is employed to calculate an average density over the simulation time step for the purpose of computing a mean speed for moving vehicles.
- Multiple turn movements can be serviced on one link; a separate algorithm is used to estimate the number of (fractional) lanes assigned to the vehicles performing each turn movement, based, in part, on the turn percentages provided by the Dynamic TRaffic Assignment and Distribution (DTRAD) model.
- At any point in time, traffic flow on a link is subdivided into two classifications: queued and moving vehicles. The number of vehicles in each classification is computed. Vehicle spillback, stratified by turn movement for each network link, is explicitly considered and quantified. The propagation of stopping waves from link to link is computed within each time step of the simulation. There is no "vertical stacking" of queues on a link.
- Any link can accommodate "source flow" from zones via side streets and parking facilities that are not explicitly represented. This flow represents the evacuating trips that are generated at the source.
- The relation between the number of vehicles occupying the link and its storage capacity is monitored every time step for every link and for every turn movement. If the available storage capacity on a link is exceeded by the demand for service, then the simulator applies a "metering" rate to the entering traffic from both the upstream feeders and source node to ensure that the available storage capacity is not exceeded.
- A "path network" that represents the specified traffic movements from each network link is constructed by the model; this path network is utilized by the DTRAD model.
- A two-way interface with DTRAD: (1) provides link travel times; (2) receives data that translates into link turn percentages.
- Provides MOE to animation software, EVacuation Animator (EVAN).
- Calculates Evacuation Time Estimates (ETE) statistics.

All traffic simulation models are data-intensive. Table C-2 outlines the necessary input data elements.

To provide an efficient framework for defining these specifications, the physical highway environment is represented as a network. The unidirectional links of the network represent roadway sections: rural, multi-lane, urban streets or freeways. The nodes of the network generally represent intersections or points along a section where a geometric property changes (e.g., a lane drop, change in grade or free flow speed).

Figure C-1 is an example of a small network representation. The freeway is defined by the sequence of links, (20,21), (21,22), and (22,23). Links (8001, 19) and (3, 8011) are Entry and Exit links, respectively. An arterial extends from node 3 to node 19 and is partially subsumed within a grid network. Note that links (21,22) and (17,19) are grade-separated.

## C.1 Methodology

### C.1.1 The Fundamental Diagram

It is necessary to define the fundamental diagram describing flow-density and speed-density relationships. Rather than "settling for" a triangular representation, a more realistic representation that includes a "capacity drop", (I-R)$Q_{max,}$ at the critical density when flow conditions enter the forced flow regime, is developed and calibrated for each link. This representation, shown in Figure C-2, asserts a constant free speed up to a density, $k_f$, and then a linear reduction in speed in the range, $k_f \le k \le k_c = 45$ vpm, the density at capacity. In the flow-density plane, a quadratic relationship is prescribed in the range, $k_c < k \le k_s = 95$ vpm which roughly represents the "stop-and-go" condition of severe congestion. The value of flow rate, $Q_s$, corresponding to $k_s$, is approximated at $0.7\,RQ_{max}$. A linear relationship between $k_s$ and $k_j$ completes the diagram shown in Figure C-2. Table C-3 is a glossary of terms.

The fundamental diagram is applied to <u>moving</u> traffic on every link. The specified calibration values for each link are: (1) Free speed, $v_f$ ; (2) Capacity, $Q_{max}$ ; (3) Critical density, $k_c = 45$ vpm ; (4) Capacity Drop Factor, R = 0.9 ; (5) Jam density, $k_j$ . Then, $v_c = \frac{Q_{max}}{k_c}$ , $k_f = k_c - \frac{(V_f - V_c)\,k_c^2}{Q_{max}}$. Setting $\bar{k} = k - k_c$ , then $Q = RQ_{max} - \frac{RQ_{max}}{8333}\,\bar{k}^2$ for $0 \le \bar{k} \le \bar{k}_s = 50$ . It can be shown that $Q = \left(0.98 - 0.0056\,\bar{k}\right) RQ_{max}$ for $\bar{k}_s \le \bar{k} \le \bar{k}_j$, where $\bar{k}_s = 50$ and $\bar{k}_j = 175$.

### C.1.2 The Simulation Model

The simulation model solves a sequence of "unit problems". Each unit problem computes the movement of traffic on a link, for each specified turn movement, over a specified time interval (TI) which serves as the simulation time step for all links. Figure C-3 is a representation of the unit problem in the time-distance plane. Table C-3 is a glossary of terms that are referenced in the following description of the unit problem procedure.

The formulation and the associated logic presented below are designed to solve the unit problem for each sweep over the network (discussed below), for each turn movement serviced on each link that comprises the evacuation network, and for each TI over the duration of the evacuation.
Given = $Q_b$ , $M_b$ , L , TI , $E_0$ , LN , $G/C$ , h , $L_v$ , $R_0$ , $L_c$ , E , M

Compute $= O\,, Q_e\,, M_e$
Define $O = O_Q + O_M + O_E$ ; $E = E_1 + E_2$

1. For the first sweep, s = 1, of this TI, get initial estimates of mean density, $k_0$ , the R – factor, $R_0$ and entering traffic, $E_0$ , using the values computed for the final sweep of the prior TI. For each subsequent sweep, $s > 1$ , calculate $E = \sum_i P_i\ O_i + S$ where $P_i\,, O_i$ are the relevant turn percentages from feeder link, i , and its total outflow (possibly metered) over this TI; S is the total source flow (possibly metered) during the current TI.
   Set iteration counter, n = 0, $k = k_0$ , and $E = E_0$ .

2. Calculate $v\,(k)$ such that $k \le 130$ using the analytical representations of the fundamental diagram.
   Calculate $Cap = \frac{Q_{max}(TI)}{3600}\ (G/C)\ LN$ , in vehicles, this value may be reduced due to metering
   Set $R = 1.0$ if $G/C < 1$ or if $k \le k_c$ ; Set $R = 0.9$ only if $G/C = 1$ and $k > k_c$
   Calculate queue length, $L_b = Q_b\ \frac{L_v}{LN}$

3. Calculate $t_1 = TI - \frac{L}{V}$ . If $t_1 < 0$ , set $t_1 = E_1 = O_E = 0$ ; Else, $E_1 = E\ \frac{t_1}{TI}$.

4. Then $E_2 = E - E_1$ ; $t_2 = TI - t_1$

5. If $Q_b \ge Cap$ , then
   $O_Q = Cap\,, O_M = O_E = 0$
   If $t_1 > 0$ , then
   $Q'_e = Q_b + M_b + E_1 - Cap$
   Else
   $Q'_e = Q_b - Cap$
   End if
   Calculate $Q_e$ and $M_e$ using Algorithm A (below)

6. Else $(Q_b < Cap)$
   $O_Q = Q_b\,,$ $RCap = Cap - O_Q$

7. If $M_b \le RCap$ , then

8. If $t_1 > 0$ , $O_M = M_b\,, O_E = \min\left(RCap - M_b, \frac{t_1\ Cap}{TI}\right) \ge 0$
   $Q'_e = E_1 - O_E$
   If $Q'_e > 0$ , then
   Calculate $Q_e\,, M_e$ with Algorithm A
   Else

$Q_e = 0\,,\ M_e = E_2$

End if

Else $(t_1 = 0)$

$O_M = \left(\frac{v(TI) - L_b}{L - L_b}\right) M_b$ and $O_E = 0$

$M_e = M_b - O_M + E\,;\ Q_e = 0$

End if

9. Else $(M_b > RCap)$

$O_E = 0$

If $t_1 > 0$, then

$O_M = \text{RCap}\,,\ Q'_e = M_b - O_M + E_1$

Calculate $Q_e$ and $M_e$ using Algorithm A

10. Else $(t_1 = 0)$

$M_d = \left[\left(\frac{v(TI) - L_b}{L - L_b}\right) M_b\right]$

If $M_d > RCap\,,\ then$

$O_M = \text{RCap}$

$Q'_e = M_d - O_M$

Apply Algorithm A to calculate $Q_e$ and $M_e$

Else

$O_M = M_d$

$M_e = M_b - O_M + E$ and $Q_e = 0$

End if

End if

End if

End if

11. Calculate a new estimate of average density, $\bar{k}_n = \frac{1}{4}[k_b + 2\,k_m + k_e]$,

where $k_b$ = density at the beginning of the TI

$k_e$ = density at the end of the TI

$k_m$ = density at the mid-point of the TI

All values of density apply only to the moving vehicles.

If $|\bar{k}_n - \bar{k}_{n-1}| > \epsilon$ and $n < N$

where $N = \max$ number of iterations, and $\epsilon$ is a convergence criterion, then

12. set $n = n + 1$, and return to step 2 to perform iteration, n, using $k = \bar{k}_n$.

End if

**Computation of unit problem is now complete.** Check for excessive inflow causing spillback.

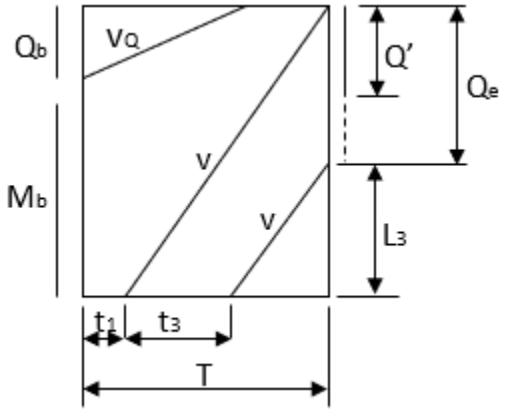
13. If $Q_e + M_e > \frac{(L - W)\,LN}{L_v}$, then

The number of excess vehicles that cause spillback is: $SB = Q_e + M_e - \frac{(L-W)\cdot LN}{L_v}$, where W is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow, S, during this TI by the amount, SB. That is, set

$$M = 1 - \frac{SB}{(E+S)} \geq 0 \text{, where M is the metering factor (over all movements).}$$

This metering factor is assigned appropriately to all feeder links and to the source flow, to be applied during the next network sweep, discussed later.

*Algorithm A*




This analysis addresses the flow environment over a TI during which moving vehicles can join a standing or discharging queue. For the case shown, $Q_b \leq Cap$, with $t_1 > 0$ and a queue of length, $Q'_e$, formed by that portion of $M_b$ and E that reaches the stop-bar within the TI, but could not discharge due to inadequate capacity. That is, $Q_b + M_b + E_1 > Cap$. This queue length, $Q'_e = Q_b + M_b + E_1 - Cap$ can be extended to $Q_e$ by traffic entering the approach during the current TI, traveling at speed, v, and reaching the rear of the queue within the TI. A portion of the entering vehicles, $E_3 = E\ \frac{t_3}{TI}$, will likely join the queue. This analysis calculates $t_3$, $Q_e$ and $M_e$ for the input values of L, TI, v, E, t, $L_v$, LN, $Q'_e$.

When $t_1 > 0$ and $Q_b \leq Cap$:

Define: $L'_e = Q'_e\ \frac{L_v}{LN}$. From the sketch, $L_3 = v(TI - t_1 - t_3) = L - (Q'_e + E_3)\frac{L_v}{LN}$.

Substituting $E_3 = \frac{t_3}{TI}\ E$ yields: $-vt_3 + \frac{t_3}{TI}\ E\ \frac{L_v}{LN} = L - v(TI - t_1) - L'_e$. Recognizing that the first two terms on the right hand side cancel, solve for $t_3$ to obtain:

$$t_3 = \frac{L'_e}{\left[v - \frac{E}{TI}\ \frac{L_v}{LN}\right]} \qquad \text{such that} \quad 0 \leq t_3 \leq TI - t_1$$

If the denominator, $\left[v - \frac{E}{TI}\ \frac{L_v}{LN}\right] \leq 0$, set $t_3 = TI - t_1$.

Then, $Q_e = Q'_e + E\ \frac{t_3}{TI}$, $\quad M_e = E\left(1 - \frac{t_1 + t_3}{TI}\right)$

The complete Algorithm A considers all flow scenarios; space limitation precludes its inclusion, here.

### C.1.3 Lane Assignment

The "unit problem" is solved for each turn movement on each link. Therefore, it is necessary to calculate a value, $LN_x$, of allocated lanes for each movement, x. If in fact all lanes are specified by, say, arrows painted on the pavement, either as full lanes or as lanes within a turn bay, then the problem is fully defined. If however there remain un-channelized lanes on a link, then an analysis is undertaken to subdivide the number of these physical lanes into turn movement specific virtual lanes, $LN_x$.

## C.2 Implementation

### C.2.1 Computational Procedure

The computational procedure for this model is shown in the form of a flow diagram as Figure C-4. As discussed earlier, the simulation model processes traffic flow for each link independently over TI that the analyst specifies; it is usually 60 seconds or longer. The first step is to execute an algorithm to define the sequence in which the network links are processed so that as many links as possible are processed after their feeder links are processed, within the same network sweep. Since a general network will have many closed loops, it is not possible to guarantee that every link processed will have all of its feeder links processed earlier.

The processing then continues as a succession of time steps of duration, TI, until the simulation is completed. Within each time step, the processing performs a series of "sweeps" over all network links; this is necessary to ensure that the traffic flow is synchronous over the entire network. Specifically, the sweep ensures continuity of flow among all the network links; in the context of this model, this means that the values of E, M, and S are all defined for each link such that they represent the synchronous movement of traffic from each link to all of its outbound links. These sweeps also serve to compute the metering rates that control spillback.

Within each sweep, processing solves the "unit problem" for each turn movement on each link. With the turn movement percentages for each link provided by the DTRAD model, an algorithm allocates the number of lanes to each movement serviced on each link. The timing at a signal, if any, applied at the downstream end of the link, is expressed as a G/C ratio, the signal timing needed to define this ratio is an input requirement for the model. The model also has the capability of representing, with macroscopic fidelity, the actions of actuated signals responding to the time-varying competing demands on the approaches to the intersection.

The solution of the unit problem yields the values of the number of vehicles, O, that discharge from the link over the time interval and the number of vehicles that remain on the link at the end of the time interval as stratified by queued and moving vehicles: $Q_e$ and $M_e$. The procedure considers each movement separately (multi-piping). After all network links are processed for a given network sweep, the updated consistent values of entering flows, E; metering rates, M; and source flows, S are defined so as to satisfy the "no spillback" condition. The procedure then performs the unit problem solutions for all network links during the following sweep.

Experience has shown that the system converges (i.e., the values of E, M and S "settle down" for

all network links) in just two sweeps if the network is entirely under-saturated or in four sweeps in the presence of extensive congestion with link spillback. (The initial sweep over each link uses the final values of E and M, of the prior TI). At the completion of the final sweep for a TI, the procedure computes and stores all MOEs for each link and turn movement for output purposes. It then prepares for the following time interval by defining the values of $Q_b$ and $M_b$ for the start of the next TI as being those values of $Q_e$ and $M_e$ at the end of the prior TI. In this manner, the simulation model processes the traffic flow over time until the end of the run. Note that there is no space-discretization other than the specification of network links.

### C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD)

The **DYNEV II** system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. Thus, an algorithm was developed to identify an appropriate set of destination nodes for each origin based on its location and on the expected direction of travel. This algorithm also supports the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next.

Figure B-1 depicts the interaction of the simulation model with the DTRAD model in the **DYNEV II** system. As indicated, **DYNEV II** performs a succession of DTRAD "sessions"; each such session computes the turn link percentages for each link that remain constant for the session duration, $[T_0, T_2]$, specified by the analyst. The end product is the assignment of traffic volumes from each origin to paths connecting it with its destinations in such a way as to minimize the network-wide cost function. The output of the DTRAD model is a set of updated link turn percentages which represent this assignment of traffic.

As indicated in Figure B-1, the simulation model supports the DTRAD session by providing it with operational link MOE that are needed by the path choice model and included in the DTRAD cost function. These MOE represent the operational state of the network at a time, $T_1 \leq T_2$, which lies within the session duration, $[T_0, T_2]$. This "burn time", $T_1 - T_0$, is selected by the analyst. For each DTRAD iteration, the simulation model computes the change in network operations over this burn time using the latest set of link turn percentages computed by the DTRAD model. Upon convergence of the DTRAD iterative procedure, the simulation model accepts the latest turn percentages provided by the Dynamic Traffic Assignment (DTA) model, returns to the origin time, $T_0$, and executes until it arrives at the end of the DTRAD session duration at time, $T_2$. At this time the next DTA session is launched and the whole process repeats until the end of the **DYNEV II** run.

Additional details are presented in Appendix B.

**Table C-1. Selected Measures of Effectiveness Output by DYNEV II**

| Measure | Units | Applies To |
|---|---|---|
| Vehicles Discharged | Vehicles | Link, Network, Exit Link |
| Speed | Miles/Hours (mph) | Link, Network |
| Density | Vehicles/Mile/Lane | Link |
| Level of Service | LOS | Link |
| Content | Vehicles | Network |
| Travel Time | Vehicle-hours | Network |
| Evacuated Vehicles | Vehicles | Network, Exit Link |
| Trip Travel Time | Vehicle-minutes/trip | Network |
| Capacity Utilization | Percent | Exit Link |
| Attraction | Percent of total evacuating vehicles | Exit Link |
| Max Queue | Vehicles | Node, Approach |
| Time of Max Queue | Hours:minutes | Node, Approach |
| Route Statistics | Length (mi); Mean Speed (mph); Travel Time (min) | Route |
| Mean Travel Time | Minutes | Evacuation Trips; Network |

**Table C-2. Input Requirements for the DYNEV II Model**

HIGHWAY NETWORK

- Links defined by upstream and downstream node numbers
- Link lengths
- Number of lanes (up to 9) and channelization
- Turn bays (1 to 3 lanes)
- Destination (exit) nodes
- Network topology defined in terms of downstream nodes for each receiving link
- Node Coordinates (X,Y)
- Nuclear Power Plant Coordinates (X,Y)

GENERATED TRAFFIC VOLUMES

- On all entry links and source nodes (origins), by Time Period

TRAFFIC CONTROL SPECIFICATIONS

- Traffic signals: link-specific, turn movement specific
- Signal control treated as fixed time or actuated
- Location of traffic control points (these are represented as actuated signals)
- Stop and Yield signs
- Right-turn-on-red (RTOR)
- Route diversion specifications
- Turn restrictions
- Lane control (e.g., lane closure, movement-specific)

DRIVER'S AND OPERATIONAL CHARACTERISTICS

- Driver's (vehicle-specific) response mechanisms: free-flow speed, discharge headway
- Bus route designation.

DYNAMIC TRAFFIC ASSIGNMENT

- Candidate destination nodes for each origin (optional)
- Duration of DTA sessions
- Duration of simulation "burn time"
- Desired number of destination nodes per origin

INCIDENTS

- Identify and Schedule of closed lanes
- Identify and Schedule of closed links

**Table C-3. Glossary**

| | |
|---|---|
| Cap | The maximum number of vehicles, of a particular movement, that can discharge from a link within a time interval. |
| E | The number of vehicles, of a particular movement, that enter the link over the time interval. The portion, $E_{TI}$, can reach the stop-bar within the TI. |
| G/C | The green time: cycle time ratio that services the vehicles of a particular turn movement on a link. |
| h | The mean queue discharge headway, seconds. |
| k | Density in vehicles per lane per mile. |
| $\bar{k}$ | The average density of moving vehicles of a particular movement over a TI, on a link. |
| L | The length of the link in feet. |
| $L_b$ , $L_e$ | The queue length in feet of a particular movement, at the [beginning, end] of a time interval. |
| LN | The number of lanes, expressed as a floating point number, allocated to service a particular movement on a link. |
| $L_v$ | The mean effective length of a queued vehicle including the vehicle spacing, feet. |
| M | Metering factor (Multiplier): 1. |
| $M_b$ , $M_e$ | The number of moving vehicles on the link, of a particular movement, that are moving at the [beginning, end] of the time interval. These vehicles are assumed to be of equal spacing, over the length of link upstream of the queue. |
| O | The total number of vehicles of a particular movement that are discharged from a link over a time interval. |
| $O_Q$ , $O_M$ , $O_E$ | The components of the vehicles of a particular movement that are discharged from a link within a time interval: vehicles that were Queued at the beginning of the TI; vehicles that were Moving within the link at the beginning of the TI; vehicles that Entered the link during the TI. |
| $P_x$ | The percentage, expressed as a fraction, of the total flow on the link that executes a particular turn movement, x. |

| | |
|---|---|
| $Q_b$ , $Q_e$ | The number of queued vehicles on the link, of a particular turn movement, at the [beginning, end] of the time interval. |
| $Q_{max}$ | The maximum flow rate that can be serviced by a link for a particular movement in the absence of a control device. It is specified by the analyst as an estimate of link capacity, based upon a field survey, with reference to the Highway Capacity Manual (HCM) 2016. |
| R | The factor that is applied to the capacity of a link to represent the "capacity drop" when the flow condition moves into the forced flow regime. The lower capacity at that point is equal to $RQ_{max}$ . |
| RCap | The remaining capacity available to service vehicles of a particular movement after that queue has been completely serviced, within a time interval, expressed as vehicles. |
| $S_x$ | Service rate for movement x, vehicles per hour (vph). |
| $t_1$ | Vehicles of a particular turn movement that enter a link over the first $t_1$ seconds of a time interval, can reach the stop-bar (in the absence of a queue down-stream) within the same time interval. |
| TI | The time interval, in seconds, which is used as the simulation time step. |
| v | The mean speed of travel, in feet per second (fps) or miles per hour (mph), of moving vehicles on the link. |
| $v_Q$ | The mean speed of the last vehicle in a queue that discharges from the link within the TI. This speed differs from the mean speed of moving vehicles, v. |
| W | The width of the intersection in feet. This is the difference between the link length which extends from stop-bar to stop-bar and the block length. |

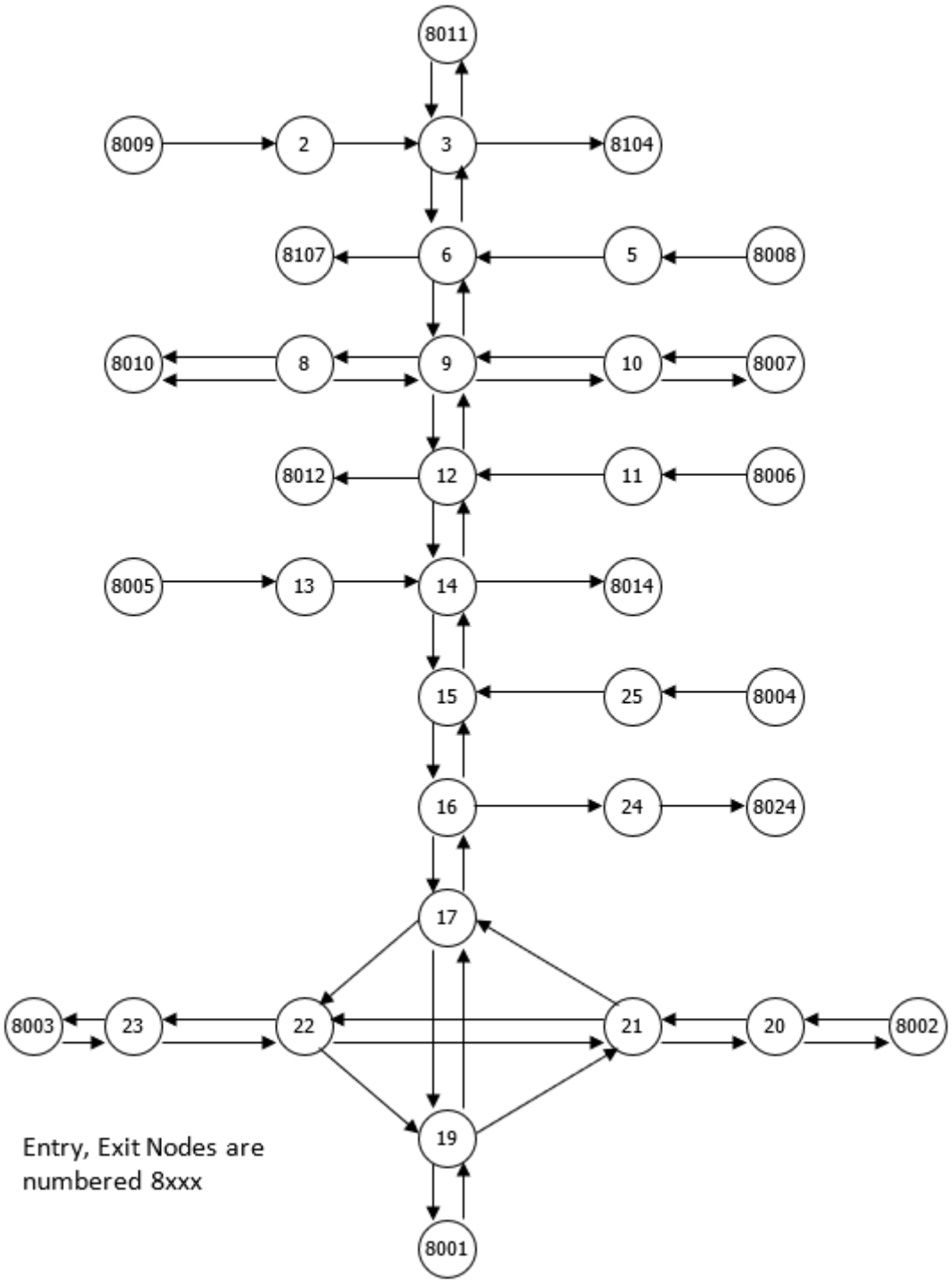



**Figure C-1. Representative Analysis Network**

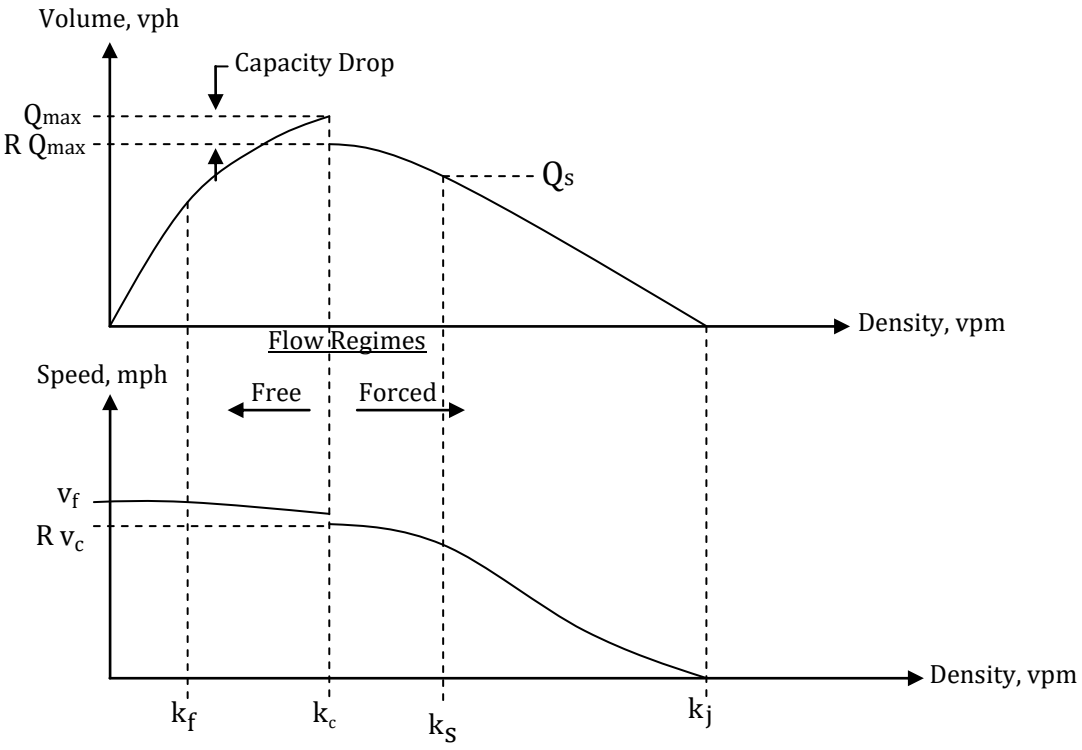



**Figure C-2. Fundamental Diagrams**

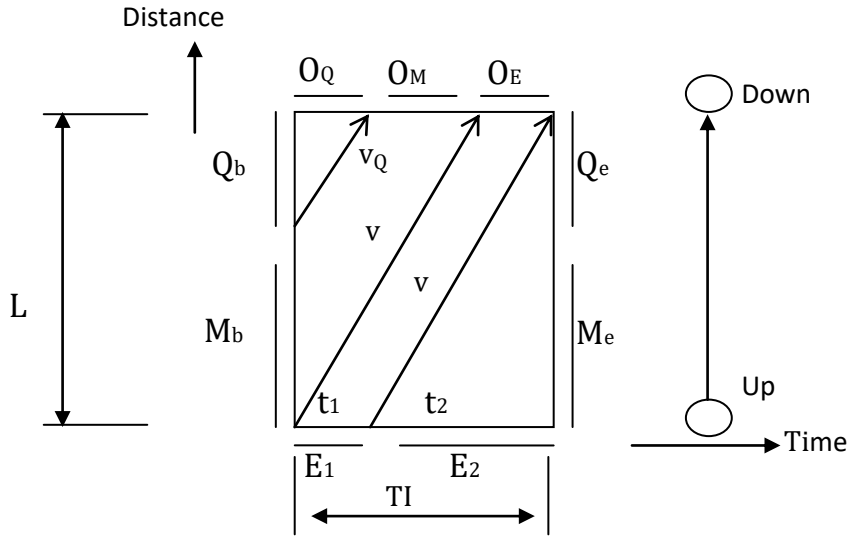



**Figure C-3. A UNIT Problem Configuration with $t_1 > 0$**

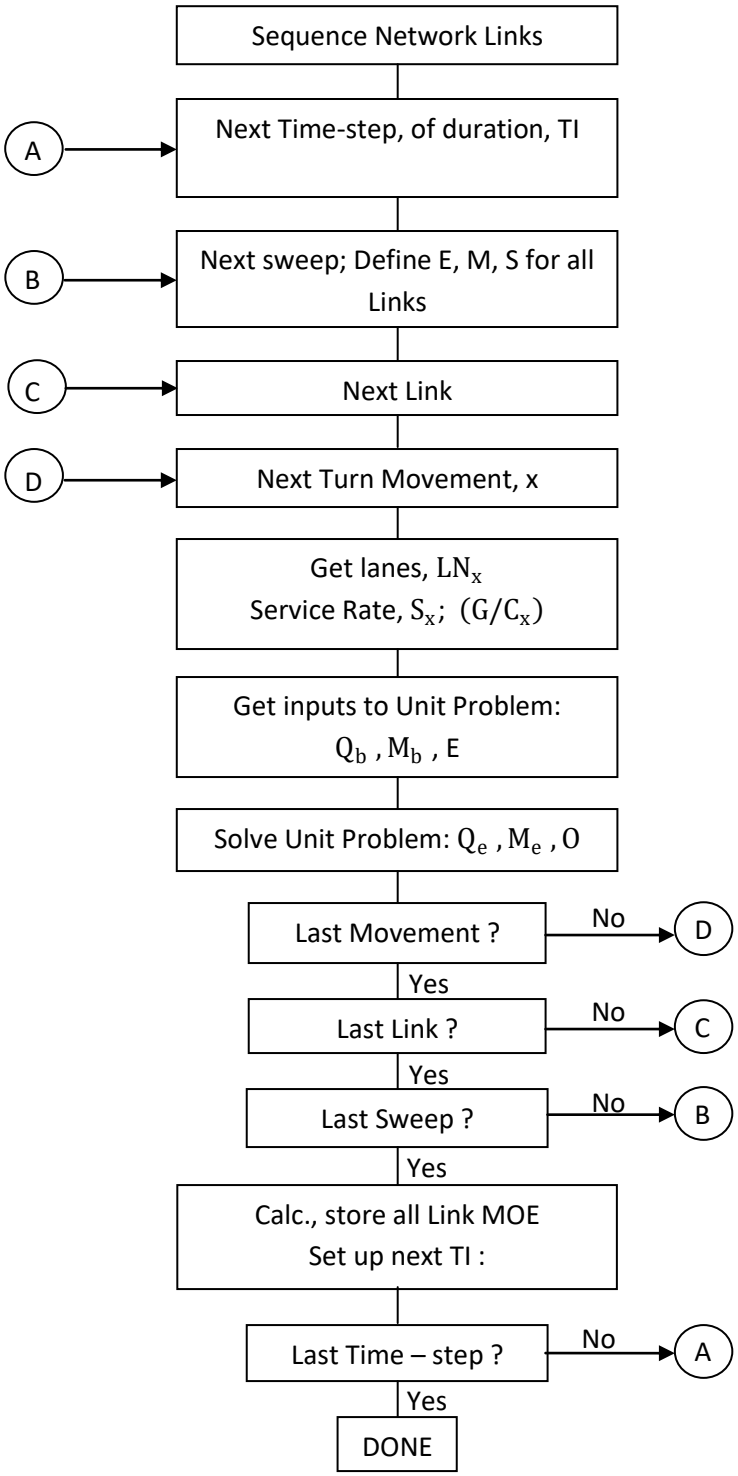



**Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)**

## APPENDIX D

Detailed Description of Study Procedure

## D. DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute Evacuation Time Estimates (ETE). The individual steps of this effort are represented as a flow diagram in Figure D-1. Each numbered step in the description that follows corresponds to the numbered element in the flow diagram.

Step 1

The first activity was to obtain the Planning Zone (PZ)[1] boundary information and create a geographic information system (GIS) base map. The base map extends beyond the Contingency Planning Zone (CPZ) which extends approximately 20 kilometres (radially) from the power plant. The base map incorporates the local roadway topology, a suitable topographic background and the PZ boundaries.

Step 2

The 2021 Statistics Canada population information[2] was obtained in GIS format. This information was used to extrapolate and estimate the permanent resident population within the study area to year 2023 as the base year of analysis and to define the spatial distribution and demographic characteristics of the population within the study area. Data for employees, transients, schools/colleges and universities/summer day camps, and other facilities were obtained from Statistics Canada, Ontario Power Generation (OPG)[3], Durham Region, cities and municipalities within the PZ, the 2019 ETE study, supplemented by internet searches and aerial imagery for parking spaces where data is missing. When aerial imagery is used, it is assumed that parking lots are full during peak times. In addition, transportation resources available during an emergency were provided by the Durham Region.

Step 3

A kickoff meeting was conducted with major stakeholders (municipal, regional, and provincial emergency officials, local police, and OPG personnel). The purpose of the kick-off meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to the city/municipality and provincial emergency agency personnel and OPG utility managers. Unique features of the study area were discussed to identify the local concerns that should be addressed by the ETE study.

[1] The Planning Zone represents entire study area which includes the Automatic Action Zone, Detailed Planning Zone (Inner and Outer) and the Contingency Planning Zone.

[2] https://www.statcan.gc.ca/eng/start

[3] Some OPG employees can work from home (WFH) 2 days a week. However, the current WFH agreement might change during the next Collective Agreement and there could be more or less employees who WFH. In addition, there are a number of contractors that are on site that are present at the site every day. The number of contractors fluctuates daily. As such, the percentage of employees who WFH was disregarded and it is conservatively assumed that during peak time, the maximum shift is present at the site on average. Essentially, it is assumed the WFH employees are offset by the additional contractors that are present on site each day.

Step 4

Next, a physical survey of the roadway system in the study area was conducted to determine the geometric properties of the highway sections, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and functioning of traffic control devices, gathering signal timings for pre-timed traffic signals (if any exist within the study area), and to make the necessary observations needed to estimate realistic values of roadway capacity. Roadway characteristics were also verified using aerial imagery.

Step 5

An online demographic survey of the households within the Planning Zone was conducted to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the study area population for this study. This information was used to determine important study factors including the average number of evacuating vehicles used by each household, and the time required to perform pre-evacuation mobilization activities.

Step 6

A computerized representation of the physical roadway system, called a link-node analysis network, was developed using the most recent UNITES software (see Section 1.3) developed by KLD. Once the geometry of the network was completed, the network was calibrated using the information gathered during the road survey (Step 4) and information obtained from aerial imagery. Estimates of highway capacity for each link and other link-specific characteristics were introduced to the network description. Traffic signal timings were input accordingly. The link-node analysis network was imported into a GIS map. The 2023 extrapolated permanent resident population estimates (Step 2) were overlaid in the map, and origin centroids where trips would be generated during the evacuation process were assigned to appropriate links.

Step 7

The Detailed Planning Zone (DPZ) is subdivided into 25 Response Sectors (P1 through P25). The CPZ is subdivided into 8 Response Sectors (CPZ1 through CPZ8). Based on wind direction and speed, Regions (groupings of Response Sectors) that may be advised to evacuate, were developed.

The need for evacuation can occur over a range of time-of-day, day-of-week, seasonal and weather-related conditions. Scenarios were developed to capture the variation in evacuation demand, highway capacity and mobilization time, for different time of day, day of the week, time of year, and weather conditions.

Step 8

The input stream for the DYNEV II System, which integrates the dynamic traffic assignment and distribution model, DTRAD, with the evacuation simulation model, was created for a prototype evacuation case – the evacuation of the entire DPZ and CPZ for representative scenarios.

Step 9

After creating this input stream, the DYNEV II model was executed on the prototype evacuation case to compute evacuating traffic routing patterns consistent with the appropriate NRC guidelines. DYNEV II contains an extensive suite of data diagnostics which check the completeness and consistency of the input data specified. The analyst reviews all warning and error messages produced by the model and then corrects the database to create an input stream that properly executes to completion.

The model assigns destinations to all origin centroids consistent with a (general) radial evacuation of the study area. The analyst may optionally supplement and/or replace these model-assigned destinations, based on professional judgment, after studying the topology of the analysis highway network. The model produces link and network-wide measures of effectiveness as well as estimates of evacuation time.

Step 10

The results generated by the prototype evacuation case are critically examined. The examination includes observing the animated graphics (using the EVAN software - see Section 1.3) produced by DYNEV II and reviewing the statistics output by the model. This is a labour-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those bottlenecks in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to high rates of trip generation, improper routing, a shortfall of capacity, or as a quantitative flaw in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are satisfactory; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment and experience based upon the results obtained in previous applications of the model and a comparison of the results of the latest prototype evacuation case iteration with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 13. Otherwise, proceed to Step 11.

Step 11

There are many "treatments" available to the user in resolving apparent problems. These treatments range from decisions to reroute the traffic by assigning additional evacuation destinations for one or more sources, imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, adding minor routes (which are paved and traversable) that were not previously modelled but may assist in an evacuation and increase the available roadway network capacity, or in prescribing specific treatments for

channelizing the flow so as to expedite the movement of traffic along major roadway systems. Such "treatments" take the form of modifications to the original prototype evacuation case input stream. All treatments are designed to improve the representation of evacuation behaviour.

Step 12

As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 11. At the completion of this activity, the process returns to Step 9 where the DYNEV II System is again executed.

Step 13

Evacuation of transit-dependent evacuees and special facilities are included in the evacuation analysis. Fixed routing for Durham regional transit (DRT) buses, Toronto Transit Commission (TTC) buses, GO Transit buses, York Region Transit (YRT) buses, and specialized wheelchair buses, and/or school buses, and ambulances are introduced into the final prototype evacuation case data set. DYNEV II generates route-specific speeds over time for use in the estimation of evacuation times for the transit dependent and special facility population groups.

Step 14

The prototype evacuation case was used as the basis for generating all region and scenario-specific evacuation cases to be simulated. This process was automated through the UNITES user interface. For each specific case, the population to be evacuated, the trip generation distributions, the highway capacity and speeds, and other factors are adjusted to produce a customized case-specific data set.

Step 15

All evacuation cases were executed using the DYNEV II System to compute ETE. Once results are available, quality control procedures were used to assure the results were consistent, dynamic routing was reasonable, and traffic congestion/bottlenecks were addressed properly. Traffic management plans are analyzed, and traffic control points are prioritized, if applicable. Additional analysis is conducted to identify the sensitivity of the ETE to change in some base evacuation conditions and model assumptions.

Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes are used to compute ETE for transit-dependent permanent residents, schools, colleges/universities and day camps, medical facilities, and other special facilities.

Step 17

The simulation results are analyzed, tabulated, and graphed. The results are then documented, as required by NUREG/CR-7002, Rev. 1.

Step 18

Following the completion of documentation activities, the ETE criteria checklist (see Appendix N) is completed. An appropriate report reference is provided for each criterion provided in the checklist.

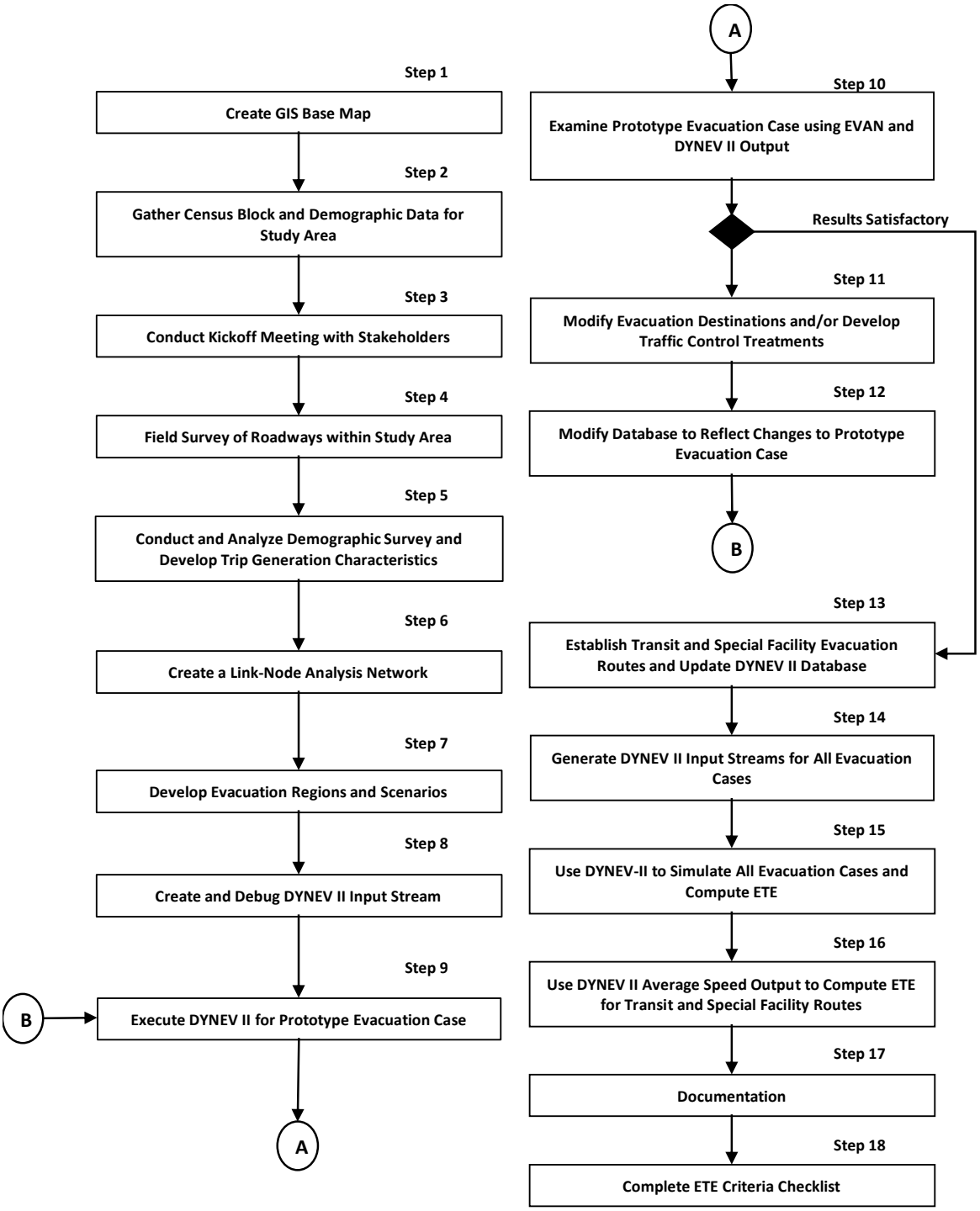



**Figure D-1. Flow Diagram of Activities**

## APPENDIX E

Special Facility Data

## E. SPECIAL FACILITY DATA

The following tables list population information, as of November 2022, for special facilities, recreational areas and major employers that are located within the PNGS PZs. Special facilities are defined as schools, colleges/universities, day camps, medical facilities and correctional facilities. Transient population data is included in the tables for recreational areas and lodging facilities. Employment data is included in the table for major employers. Each table is grouped by municipality. The location of the facility is defined by its straight-line distance (kilometres) and direction (magnetic bearing) from the centre point of the plant. Maps of each school, college/university, day camp, medical facility, major employer, recreational area, lodging facility, and correctional facility are also provided.

**Table E-1. Schools within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| AJAX, ONTARIO | | | | | | |
| P9 | 4.8 | NNE | St. Francis de Sales Catholic School | 72 Church St S | Ajax | 171 |
| P9 | 5.1 | N | Harwood Montessori School Inc. | 23 Church St S | Ajax | 40 |
| P9 | 5.1 | N | Blaisdale Montessori Village Campus | 56 Old Kingston Rd | Ajax | 89 |
| P9 | 5.2 | NNE | Lincoln Avenue Public School | 70 Lincoln St | Ajax | 250 |
| P9 | 5.5 | N | Lincoln Alexander Public School | 95 Church St N | Ajax | 477 |
| P9 | 5.6 | N | Pickering High School | 180 Church St N | Ajax | 1,984 |
| P9 | 6.0 | N | Eagle Ridge Public School | 425 Delaney Dr | Ajax | 519 |
| P9 | 6.5 | N | St. Patrick Catholic School | 280 Delaney Dr | Ajax | 917 |
| P9 | 6.8 | N | Alexander Graham Bell Public School | 25 Harkins Dr | Ajax | 570 |
| P10 | 6.5 | NNE | Westney Heights Public School | 45 Brennan Rd | Ajax | 329 |
| P10 | 6.9 | NNE | St. Jude Catholic School | 68 Coles Ave | Ajax | 255 |
| P10 | 7.0 | NNE | Applecroft Public School | 55 Coles Ave | Ajax | 327 |
| P10 | 7.2 | NNE | Lester B. Pearson Public School | 21 Coughlen St | Ajax | 344 |
| P10 | 7.5 | NNE | Dr. Roberta Bondar Public School | 25 Sullivan Dr | Ajax | 300 |
| P10 | 7.6 | NNE | St. Catherine of Siena Catholic School | 15 Bennett Ave | Ajax | 383 |
| P11 | 5.6 | NNE | Roland Michener Public School | 95 Ritchie Ave | Ajax | 573 |
| P11 | 5.7 | NNE | École Élémentaire Catholique Notre-dame-de-la-jeunesse | 71 Ritchie Ave | Ajax | 289 |
| P11 | 5.8 | NNE | Cambridge International Academy | 1 Cedar St | Ajax | 30 |
| P11 | 6.2 | NNE | Lord Elgin Public School | 24 Ontario St | Ajax | 200 |
| P11 | 6.7 | NE | Archbishop Denis O'Connor Catholic High School | 80 Mandrake St | Ajax | 850 |
| P12 | 4.4 | NNE | Blaisdale Montessori Westney Campus | 20 O'Brien Ct | Ajax | 290 |
| P12 | 4.8 | NNE | Father Donald MacLellan Catholic Secondary School | 458 Fairall St #7 | Ajax | 235 |
| P12 | 4.9 | NNE | Archbishop Anthony Meagher Catholic Continuing Education Centre[1] | 458 Fairall St #7 | Ajax | 80 |
| P13 | 3.7 | ENE | Lakeside Public School | 4 Parkes Dr | Ajax | 315 |
| P13 | 3.7 | NE | Exceptional Learning Centre - Head Office | 520 Westney Rd S Unit 1-2 | Ajax | 8 |
| P13 | 4.2 | ENE | Duffin's Bay Public School | 66 Pittmann Cres | Ajax | 276 |
| P13 | 4.7 | ENE | St. James Catholic School | 10 Clover Ridge Dr W | Ajax | 216 |
| P14 | 5.5 | ENE | Southwood Park Public School | 28 Lambard Cres | Ajax | 699 |

[1] Archbishop Anthony Meagher Catholic Continuing Education Centre and Durham Continuing Education are adult education facilities where students will be evacuated in private vehicles in the event of emergency. Thus, no buses were assigned to these two schools. See Section 3 for additional information.

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| P14 | 5.6 | NE | Bolton C. Falby Public School | 80 Falby Ct | Ajax | 578 |
| P14 | 5.7 | NE | St. Bernadette Catholic School | 41 Bayly St E | Ajax | 729 |
| P14 | 5.9 | NE | Ajax High School | 105 Bayly St E | Ajax | 1,161 |
| P21 | 7.9 | N | Vimy Ridge Public School | 40 Telford St E | Ajax | 593 |
| P21 | 8.3 | NNE | Nottingham Public School | 50 Seggar Ave | Ajax | 604 |
| P21 | 8.4 | NNE | St. André Bessette Catholic School | 60 Seggar Ave | Ajax | 464 |
| P21 | 8.7 | NNE | Pickering Christian School | 162 Rossland Rd E | Ajax | 197 |
| P21 | 8.8 | NNE | J. Clarke Richardson Collegiate | 1355 Harwood Ave N | Ajax | 1,630 |
| P21 | 9.0 | NNE | Notre Dame Catholic Secondary School | 1375 Harwood Ave N | Ajax | 1,226 |
| P21 | 9.0 | NNE | Brackendale Montessori | 1485 Harwood Ave N | Ajax | 150 |
| P21 | 9.5 | NNE | St. Josephine Bakhita Catholic School | 51 Williamson Dr E | Ajax | 638 |
| P21 | 9.8 | NNE | Da Vinci Public School | 61 Williamson Dr E | Ajax | 835 |
| P21 | 10.2 | NNE | Faithway Baptist Church School | 1964 Salem Rd | Ajax | 97 |
| P21 | 10.2 | NNE | Michaëlle Jean Public School | 180 Williamson Dr E | Ajax | 633 |
| P21 | 10.9 | NNE | Romeo Dallaire Public School | 300 Williamson Dr E | Ajax | 517 |
| P21 | 12.8 | NNE | Al Madrasah Al-inamiyyah Private School | 2944 Audley Rd | Ajax | 120 |
| P22 | 6.2 | NE | Carruthers Creek Public School | 1 Greenhalf Dr | Ajax | 756 |
| P22 | 7.5 | NE | Cadarackque Public School | 15 Miles Dr | Ajax | 679 |
| P22 | 7.6 | NNE | Terry Fox Public School | 30 Kerrison Dr W | Ajax | 426 |
| P22 | 8.0 | NNE | Saint Teresa of Calcutta Catholic School | 15 Fishlock St | Ajax | 477 |
| | | | | | *Ajax DPZ Total:* | *23,526* |
| | | | | | *Ajax CPZ Total:* | *0* |
| | | | | | *Ajax Total:* | *23,526* |
| **MARKHAM, ONTARIO** | | | | | | |
| CPZ7 | 13.6 | WNW | David Suzuki Public School | 45 Riverwalk Dr | Markham | 802 |
| CPZ7 | 14.6 | WNW | Legacy Public School | 61 Russell Jarvis Dr | Markham | 550 |
| CPZ7 | 14.7 | WNW | Cedarwood Public School | 399 Elson St | Markham | 729 |
| CPZ7 | 15.1 | WNW | Boxwood Public School | 30 Boxwood Cres | Markham | 401 |
| CPZ7 | 15.4 | WNW | Sir Richard W Scott Catholic Elementary School | 90 Roxbury St | Markham | 405 |
| CPZ7 | 15.7 | WNW | Ellen Fairclough Public School | 33 Brando Ave | Markham | 422 |
| CPZ7 | 15.7 | W | Parkland Public School | 18 Coxworth Ave | Markham | 700 |
| CPZ7 | 15.8 | WNW | William Armstrong Public School | 11 Major Buttons Dr | Markham | 281 |
| CPZ7 | 15.9 | WNW | Markham Gateway Public School | 30 Fonda Rd | Markham | 472 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ7 | 16.5 | W | NOIC Academy | 50 Featherstone Ave | Markham | 159 |
| CPZ7 | 16.6 | WNW | Markham District High School | 89 Church St | Markham | 1,473 |
| CPZ7 | 16.7 | W | Armadale Public School | 11 Coppard Ave | Markham | 1,000 |
| CPZ7 | 16.7 | WNW | Middlefield Collegiate Institute | 525 Highglen Ave | Markham | 1,478 |
| CPZ7 | 17.0 | WNW | Coppard Glen Public School | 131 Coppard Ave | Markham | 573 |
| CPZ7 | 17.1 | WNW | Cambridge Academy | 5873 Hwy 7 | Markham | 23 |
| CPZ7 | 17.1 | WNW | Franklin Street Public School | 21 Franklin St | Markham | 438 |
| CPZ7 | 17.4 | W | Wilclay Public School | 60 Wilclay Ave | Markham | 850 |
| CPZ7 | 17.5 | WNW | Father Michael McGivney Catholic Academy High School | 5300 14th Ave | Markham | 1,361 |
| CPZ7 | 17.7 | WNW | St. Patrick Catholic Elementary School | 5607 7 Hwy E | Markham | 332 |
| CPZ7 | 17.8 | WNW | Roy H Crosby Public School | 115 Drakefield Rd | Markham | 270 |
| CPZ7 | 18.0 | W | Randall Public School | 50 Randall Ave | Markham | 729 |
| CPZ7 | 18.0 | W | St. Francis Xavier Catholic | 223 Highglen Ave | Markham | 266 |
| CPZ7 | 18.1 | W | St. Benedict Catholic Elementary School | 50 Aldergrove Dr | Markham | 240 |
| CPZ7 | 18.4 | W | Aldergrove Public School | 150 Aldergrove Dr | Markham | 710 |
| CPZ7 | 18.6 | W | Somerset Academy | 7700 Brimley Rd | Markham | 80 |
| CPZ7 | 18.6 | WNW | Wesley Christian Academy | 22 Heritage Rd | Markham | 264 |
| CPZ7 | 18.6 | WNW | Ramer Wood Public School | 11 Cairns Dr | Markham | 293 |
| CPZ7 | 18.7 | WNW | St. Edward Catholic School | 33 Cairns Dr | Markham | 447 |
| CPZ7 | 18.9 | WNW | Unionville Meadows Public School | 355 South Ave | Unionville | 671 |
| CPZ7 | 19.3 | WNW | Markville Secondary School | 1000 Carlton Rd | Unionville | 1,424 |
| CPZ7 | 19.3 | W | Milliken Mills High School | 7522 Kennedy Rd | Markham | 1,003 |
| CPZ7 | 19.4 | W | Kennedy Montessori School | 7781 Kennedy Rd | Markham | 30 |
| CPZ7 | 19.6 | W | Town Centre Private School | 155 Clayton Dr | Markham | 100 |
| CPZ7 | 19.6 | WNW | Central Park Public School | 100 Central Park Dr | Unionville | 575 |
| CPZ7 | 19.9 | W | Highgate Public School | 35 Highgate Dr | Markham | 445 |
| CPZ7 | 20.0 | W | Trillium School | 4277 14th Ave | Markham | 330 |
| CPZ7 | 20.1 | WNW | Montessori North School | 4561 7 Hwy E | Markham | 30 |
| CPZ7 | 20.2 | W | Amberson High School | 7100 Birchmount Rd | Markham | 228 |
| CPZ7 | 20.3 | W | Milliken Mills Public School | 289 Risebrough Cir | Markham | 394 |
| CPZ7 | 20.3 | WNW | Bill Crothers Secondary School | 44 Main St | Unionville | 1,453 |
| CPZ7 | 20.4 | WNW | St. Matthew Catholic Elementary School | 75 Waterbridge Ln | Unionville | 175 |
| CPZ7 | 20.5 | WNW | Stonebridge Public School | 168 Stonebridge Dr | Markham | 770 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ7 | 20.7 | W | All Saints' Montessori School | 1100 Denison St | Markham | 63 |
| CPZ7 | 21.3 | WNW | Castlemore Public School | 256 Ridgecrest Rd | Markham | 752 |
| CPZ7 | 21.5 | WNW | All Saints Catholic Elementary School | 130 Castlemore Ave | Markham | 469 |
| CPZ7 | 21.6 | WNW | Pierre Elliott Trudeau High School | 90 Bur Oak Ave | Markham | 1,984 |
| CPZ8 | 15.6 | NW | Black Walnut Public School | 30 John Allan Cameron St | Markham | 702 |
| CPZ8 | 15.8 | NW | St. Joseph Catholic Elementary School | 388 White's Hill Ave | Markham | 443 |
| CPZ8 | 16.0 | NW | Bill Hogarth Secondary School | 100 Donald Sim Ave | Markham | 450 |
| CPZ8 | 16.2 | WNW | Cornell Village Public School | 186 Country Glen Rd | Markham | 572 |
| CPZ8 | 16.2 | WNW | First Academy Montessori East Campus | 8961 Ninth Line | Markham | 46 |
| CPZ8 | 16.5 | WNW | Reesor Park Public School | 69 Wootten Way N | Markham | 445 |
| CPZ8 | 16.9 | NW | Little Rouge Public School | 571 Country Glen Rd | Markham | 400 |
| CPZ8 | 17.0 | WNW | Kateri Tekakwitha Catholic Elementary School | 230 Fincham Ave | Markham | 349 |
| CPZ8 | 17.5 | NW | Greensborough Public School | 80 Alfred Paterson Dr | Markham | 538 |
| CPZ8 | 17.6 | WNW | Edward T. Crowle Public School | 15 Larkin Ave | Markham | 287 |
| CPZ8 | 18.0 | WNW | St. Brother André Catholic High School | 6160 16th Ave E | Markham | 1,430 |
| CPZ8 | 18.2 | NW | St. Julia Billiart Catholic School | 2070 Bur Oak Ave | Markham | 608 |
| CPZ8 | 18.4 | NW | Sam Chapman Public School | 270 Alfred Paterson Dr | Markham | 588 |
| CPZ8 | 18.5 | WNW | Marander Montessori School | 5906 16th Ave | Markham | 15 |
| CPZ8 | 18.5 | WNW | Mount Joy Public School | 281 Williamson Rd | Markham | 672 |
| CPZ8 | 19.3 | WNW | Wismer Public School | 171 Mingay Ave | Markham | 553 |
| CPZ8 | 19.5 | WNW | Bur Oak Secondary School | 933 Bur Oak Ave | Markham | 1,581 |
| CPZ8 | 19.8 | WNW | Donald Cousens Public School | 315 Mingay Ave | Markham | 703 |
| CPZ8 | 19.8 | WNW | San Lorenzo Ruiz Catholic Elementary School | 840 Bur Oak Ave | Markham | 564 |
| CPZ8 | 20.4 | WNW | John McCrae Public School | 565 Fred McLaren Blvd | Markham | 638 |
| | | | | | *Markham DPZ Total:* | *0* |
| | | | | | *Markham CPZ Total:* | *38,228* |
| | | | | | *Markham Total:* | *38,228* |
| **OSHAWA, ONTARIO** | | | | | | |
| CPZ2 | 16.9 | NE | Stephen G. Saywell Public School | 855 Roundelay Dr | Oshawa | 400 |
| CPZ2 | 17.1 | ENE | Waverly Public School | 100 Waverly St S | Oshawa | 380 |
| CPZ2 | 17.5 | ENE | College Hill Public School | 530 Laval St | Oshawa | 243 |
| CPZ2 | 17.6 | NE | Elementary School Antonine-Maillet | 615 Ridgeway Ave | Oshawa | 193 |
| CPZ2 | 17.8 | ENE | Elementary School Catholic Corpus-Christi | 362 Hillside Ave | Oshawa | 282 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ2 | 17.8 | ENE | St. Thomas Aquinas Catholic School | 400 Pacific Ave | Oshawa | 288 |
| CPZ2 | 17.9 | NE | Woodcrest Public School | 506 Woodcrest Ave | Oshawa | 300 |
| CPZ2 | 17.9 | ENE | Durham Alternative Secondary School | 240 Simcoe St S | Oshawa | 403 |
| CPZ2 | 18.0 | NE | R.S. McLaughlin CVI | 570 Stevenson Rd N | Oshawa | 1,000 |
| CPZ2 | 18.1 | NE | Adelaide McLaughlin Public School | 630 Stevenson Rd N | Oshawa | 323 |
| CPZ2 | 18.2 | NE | Monsignor Paul Dwyer Catholic High School | 700 Stevenson Rd N | Oshawa | 854 |
| CPZ2 | 18.2 | NE | St. Christopher Catholic School | 431 Annapolis Ave | Oshawa | 407 |
| CPZ2 | 18.2 | ENE | Monsignor Philip Coffey Catholic School | 1324 Oxford St | Oshawa | 247 |
| CPZ2 | 18.5 | ENE | Glen Street Public School | 929 Glen St | Oshawa | 395 |
| CPZ2 | 18.6 | ENE | Dr C F Cannon Public School | 1196 Cedar St | Oshawa | 415 |
| CPZ2 | 18.8 | ENE | G L Roberts Collegiate and Vocational Institute | 399 Chaleur Ave | Oshawa | 481 |
| CPZ2 | 18.9 | ENE | Durham Continuing Education[1] | 120 Centre St S | Oshawa | 184 |
| CPZ2 | 19.0 | ENE | Village Union Public School | 155 Gibb St | Oshawa | 337 |
| CPZ2 | 19.0 | ENE | Lakewoods Public School | 323 Chaleur Ave | Oshawa | 333 |
| CPZ2 | 19.4 | NE | Immanuel Christian School | 416 Taunton Rd W Unit A | Oshawa | 126 |
| CPZ2 | 19.5 | ENE | Mary Street Community School | 110 Mary St N | Oshawa | 145 |
| CPZ2 | 19.6 | NE | O'Neill Collegiate and Vocational Institute | 301 Simcoe St N | Oshawa | 1,187 |
| CPZ2 | 19.6 | ENE | Bobby Orr Public School | 7 Waterloo St | Oshawa | 262 |
| CPZ2 | 19.6 | NE | Sunset Heights Public School | 1130 Mohawk St | Oshawa | 315 |
| CPZ2 | 19.7 | NE | DR S J Phillips Public School | 625 Simcoe St N | Oshawa | 710 |
| CPZ2 | 19.7 | ENE | Monsignor John Pereyma Catholic Secondary School | 316 Conant St | Oshawa | 489 |
| CPZ2 | 20.2 | NE | Blaisdale Montessori Oshawa Campus | 1037 Simcoe St N | Oshawa | 60 |
| CPZ2 | 20.3 | ENE | St. Hedwig Catholic School | 421 Olive Ave | Oshawa | 113 |
| CPZ2 | 20.4 | NE | Queen Elizabeth Public School | 1205 Simcoe St N | Oshawa | 450 |
| CPZ2 | 20.5 | ENE | David Bouchard Public School | 460 Wilson Rd S | Oshawa | 576 |
| CPZ2 | 20.7 | NE | Beau Valley Public School | 230 Marigold Ct | Oshawa | 279 |
| CPZ2 | 20.7 | ENE | Coronation Public School | 441 Adelaide Ave E | Oshawa | 458 |
| CPZ2 | 20.8 | ENE | Great Beginnings Montessori School | 505 Adelaide St E | Oshawa | 72 |
| | | | | | *Oshawa DPZ Total:* | *0* |
| | | | | | *Oshawa CPZ Total:* | *12,707* |
| | | | | | *Oshawa Total:* | *12,707* |
| **PICKERING, ONTARIO** | | | | | | |
| P1 | 2.7 | W | Frenchman's Bay Public School | 920 Oklahoma Dr | Pickering | 573 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| P1 | 3.3 | W | Fairport Beach Public School | 754 Oklahoma Dr | Pickering | 224 |
| P1 | 3.3 | W | Father Fenelon Catholic School | 795 Eyer Dr | Pickering | 371 |
| P2 | 1.5 | NNW | Sir John A. Macdonald Public School | 777 Balaton Ave | Pickering | 385 |
| P2 | 2.2 | NNW | Bayview Heights Public School | 1400 Garvolin Ave | Pickering | 405 |
| P2 | 2.7 | NNW | Durham Alternative Secondary School - Pickering Campus | 1400 Bayly St Unit 9-10 | Pickering | 645 |
| P4 | 4.2 | WNW | Dunbarton High School | 655 Sheppard Ave | Pickering | 1,425 |
| P4 | 4.2 | W | Rosebank Road Public School | 591 Rosebank Rd | Pickering | 193 |
| P4 | 4.6 | W | Blaisdale Montessori Pickering Campus | 415 Toynevale Rd | Pickering | 247 |
| P4 | 4.8 | W | Montessori Learning Centre of Pickering | 401 Kingston Rd | Pickering | 200 |
| P4 | 4.9 | W | Blaisdale Montessori Annex Campus | 1340 Rougemount Dr | Pickering | 50 |
| P4 | 4.9 | W | Blaisdale Montessori Rougemount Campus | 365 Kingston Rd | Pickering | 89 |
| P4 | 5.4 | W | Elizabeth B. Phin Public School | 1500 Rougemount Dr | Pickering | 343 |
| P4 | 5.7 | W | St. Monica Catholic School | 275 Twyn Rivers Dr | Pickering | 373 |
| P5 | 5.0 | WNW | Highbush Public School | 605 Strouds Ln | Pickering | 493 |
| P5 | 5.2 | WNW | St. Mary Catholic Secondary School | 1918 Whites Rd | Pickering | 1,406 |
| P5 | 5.4 | WNW | St. Elizabeth Seton Catholic School | 490 Strouds Ln | Pickering | 800 |
| P5 | 5.5 | WNW | Altona Forest Public School | 405 Woodsmere Cres | Pickering | 361 |
| P5 | 6.2 | WNW | Westcreek Public School | 1779 Westcreek Dr | Pickering | 360 |
| P6 | 4.3 | WNW | Crawford Adventist Academy - East Campus | 1765 Meadowview Ave | Pickering | 71 |
| P6 | 4.4 | NW | William Dunbar Public School | 1030 Glenanna Rd | Pickering | 674 |
| P6 | 5.1 | NW | Gandatsetiagon Public School | 1868 Parkside Dr | Pickering | 459 |
| P7 | 4.0 | NNW | Glengrove Public School | 1934 Glengrove Rd | Pickering | 317 |
| P7 | 4.1 | NW | Vaughan Willard Public School | 1911 Dixie Rd N | Pickering | 253 |
| P8 | 4.8 | NW | St. Isaac Jogues Catholic School | 1166 Finch Ave | Pickering | 640 |
| P8 | 4.9 | NNW | Maple Ridge Public School | 2010 Bushmill St | Pickering | 472 |
| P8 | 5.3 | NNW | Pine Ridge Secondary School | 2155 Liverpool Rd N | Pickering | 1,255 |
| P8 | 5.7 | NNW | Valley Farm Public School | 1615 Pepperwood Gate | Pickering | 566 |
| P9 | 5.0 | N | Brock Elementary School | 2065 Brock Rd | Pickering | 70 |
| P9 | 5.7 | N | École élémentaire Ronald-Marion | 2235 Brock Rd | Pickering | 360 |
| P9 | 6.3 | N | St. Wilfrid Catholic School | 2360 Southcott Rd | Pickering | 457 |
| CPZ1 | 13.0 | N | Valley View Public School | 3530 Westney Rd N | Greenwood | 325 |
| CPZ1 | 18.7 | NNW | Claremont Public School | 1675 Central St | Pickering | 181 |
| | | | | | *Pickering DPZ Total:* | *14,537* |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| | | | | | *Pickering CPZ Total:* | *506* |
| | | | | | *Pickering Total:* | *15,043* |
| **TORONTO, ONTARIO** | | | | | | |
| P3 | 5.5 | WSW | West Rouge Junior Public School | 401 Friendship Ave | Toronto | 239 |
| P15 | 9.0 | WSW | St. Malachy Catholic Elementary School | 80 Bennett Rd | Toronto | 284 |
| P15 | 9.8 | WSW | Joseph Brant Senior Public School | 270 Manse Rd | Toronto | 537 |
| P15 | 10.4 | WSW | École élémentaire Académie Alexandre-Dumas | 255 Coronation Dr | Toronto | 187 |
| P16 | 6.0 | WSW | William G. Davis Junior Public School | 128 East Ave | Toronto | 245 |
| P16 | 6.1 | WSW | Joseph Howe Senior Public School | 20 Winter Gardens Trl | Toronto | 335 |
| P16 | 6.7 | WSW | Charlottetown Junior Public School | 85 Charlottetown Blvd | Toronto | 435 |
| P16 | 6.8 | WSW | Sir Oliver Mowat Collegiate Institute | 5400 Lawrence Ave E | Toronto | 1,106 |
| P16 | 7.0 | WSW | Centennial Road Junior Public School | 271 Centennial Rd | Toronto | 263 |
| P17 | 7.2 | WSW | St. Brendan Catholic Elementary School | 186 Centennial Rd | Toronto | 524 |
| P17 | 9.3 | WSW | Highland Creek Public School | 1410 Military Trl | Toronto | 145 |
| P17 | 10.4 | WSW | West Hill Public School | 299 Morningside Ave | Toronto | 232 |
| P18 | 6.8 | W | Rouge Valley Public School | 30 Durnford Rd | Toronto | 271 |
| P18 | 7.2 | W | St. Dominic Savio Catholic Elementary School | 50 Tideswell Blvd | Scarborough | 259 |
| P18 | 7.7 | W | Chief Dan George Public School | 185 Generation Blvd | Toronto | 346 |
| P18 | 7.8 | WSW | Meadowvale Public School | 761 Meadowvale Rd | Toronto | 255 |
| P18 | 8.4 | W | John G. Diefenbaker Public School | 70 Dean Park Rd | Toronto | 260 |
| P18 | 8.5 | W | St. Jean de Brebeuf Catholic Elementary School | 101 Dean Park Rd | Toronto | 226 |
| P18 | 8.8 | WSW | Cardinal Leger Catholic Elementary School | 600 Morrish Rd | Toronto | 355 |
| P18 | 9.1 | WSW | Morrish Public School | 61 Canmore Blvd | Toronto | 300 |
| P19 | 9.1 | WNW | Hillside Outdoor Education School | 2259 Meadowvale Rd | Toronto | 65 |
| P19 | 10.6 | W | Afzal Islamic Montessori & Academy - Scarborough Campus | 33 Casebridge Ct | Toronto | 29 |
| P19 | 10.9 | W | Fleming Public School | 20 Littles Rd | Toronto | 300 |
| P19 | 11.2 | W | St. Bede Catholic Elementary School | 521 Sewell's Rd | Toronto | 162 |
| CPZ6 | 10.5 | WSW | West Hill Collegiate Institute | 350 Morningside Ave | Scarborough | 704 |
| CPZ6 | 10.6 | WSW | St. Martin de Porres Catholic School | 230 Morningside Ave | West Hill | 331 |
| CPZ6 | 11.2 | WSW | St. Margaret's Public School | 235 Galloway Rd | Scarborough | 250 |
| CPZ6 | 11.4 | SW | Poplar Road Junior Public School | 66 Dearham Wood | Scarborough | 220 |
| CPZ6 | 11.4 | WSW | Eastview Junior Public School | 20 Waldock St | Scarborough | 394 |
| CPZ6 | 11.4 | WSW | Galloway Road Public School | 192 Galloway Rd | Scarborough | 220 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ6 | 11.5 | WSW | Maplewood High School | 120 Galloway Rd | Scarborough | 163 |
| CPZ6 | 11.6 | SW | Jack Miner Senior Public School | 405 Guildwood Pkwy | Scarborough | 172 |
| CPZ6 | 12.0 | WSW | George B Little Public School | 125 Orton Park Rd | Scarborough | 420 |
| CPZ6 | 12.4 | WSW | Heather Heights Junior Public School | 80 Slan Ave | Scarborough | 200 |
| CPZ6 | 12.4 | WSW | Guildwood Junior Public School | 225 Livingston Rd | Scarborough | 117 |
| CPZ6 | 12.4 | SW | Sir Wilfrid Laurier Collegiate Institute | 145 Guildwood Pkwy | Scarborough | 1,354 |
| CPZ6 | 12.5 | WSW | St. Ursula Catholic School | 215 Livingston Rd | Scarborough | 244 |
| CPZ6 | 12.6 | WSW | Willow Park Junior Public School | 45 Windover Dr | Scarborough | 374 |
| CPZ6 | 12.9 | WSW | Tecumseh Senior Public School | 720 Golf Club Rd | Scarborough | 247 |
| CPZ6 | 13.0 | WSW | Golf Road Junior Public School | 730 Golf Club Rd | Scarborough | 295 |
| CPZ6 | 13.1 | WSW | Churchill Heights Public School | 749 Brimorton Dr | Scarborough | 375 |
| CPZ6 | 13.2 | WSW | St. Barbara Catholic School | 25 Janray Dr | Scarborough | 312 |
| CPZ6 | 13.3 | WSW | Cornell Junior Public School | 61 Holmfirth Terr | Scarborough | 750 |
| CPZ6 | 13.6 | SW | Elizabeth Simcoe Junior Public School | 166 Sylvan Ave | Scarborough | 265 |
| CPZ6 | 13.7 | WSW | Cedar Drive Junior Public School | 21 Gatesview Ave | Scarborough | 708 |
| CPZ6 | 13.9 | SW | George P Mackie Junior Public School | Brinloor Blvd | Scarborough | 140 |
| CPZ6 | 14.0 | WSW | Bellmere Junior Public School | 470 Brimorton Dr | Scarborough | 390 |
| CPZ6 | 14.0 | WSW | Cedarbrae Collegiate Institute | 550 Markham Rd | Scarborough | 1,268 |
| CPZ6 | 14.3 | WSW | Tredway Woodsworth Public School | 112 Sedgemount Dr | Scarborough | 759 |
| CPZ6 | 14.4 | WSW | Scarborough Village Alternative Public School | 15 Luella St | Scarborough | 215 |
| CPZ6 | 14.4 | WSW | St. Boniface School | 20 Markanna Dr | Scarborough | 350 |
| CPZ6 | 14.5 | WSW | St. Richard Catholic School | 960 Bellamy Rd N | Scarborough | 409 |
| CPZ6 | 14.7 | WSW | Cedarbrook Junior Public School | 56 Nelson St | Scarborough | 479 |
| CPZ6 | 14.9 | WSW | Mason Road Junior Public School | 78 Mason Rd | Scarborough | 400 |
| CPZ6 | 15.0 | WSW | St. Rose of Lima Catholic School | 3220 Lawrence Ave E | Scarborough | 469 |
| CPZ6 | 15.1 | WSW | Bendale Junior Public School | 61 Benshire Dr | Scarborough | 401 |
| CPZ6 | 15.3 | SW | Bliss Carman Senior Public School | 10 Bellamy Rd S | Scarborough | 286 |
| CPZ6 | 15.5 | WSW | UMC High School - Main Campus | 425 McCowan Rd | Scarborough | 626 |
| CPZ6 | 15.6 | WSW | John McCrae Senior Public School | 431 McCowan Rd | Scarborough | 596 |
| CPZ6 | 15.7 | WSW | St. Andrews Public School | 60 Brimorton Dr | Scarborough | 342 |
| CPZ6 | 15.8 | WSW | Alternative Scarborough Education 1 | 60 Brimorton Dr | Scarborough | 107 |
| CPZ6 | 16.0 | SW | H A Halbert Junior Public School | 25 Halbert Place | Scarborough | 232 |
| CPZ6 | 16.1 | SW | St. Agatha Catholic School | 49 Cathedral Bluffs Dr | Scarborough | 463 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ6 | 16.2 | WSW | Knob Hill Junior Public School | 25 Seminole Ave | Scarborough | 500 |
| CPZ6 | 16.4 | SW | Fairmount Public School | 31 Sloley Rd | Scarborough | 423 |
| CPZ6 | 16.6 | WSW | David and Mary Thomson Collegiate Institute | 2740 Lawrence Ave E | Scarborough | 1,000 |
| CPZ6 | 16.6 | WSW | Donwood Park Junior Public School | 61 Dorcot Ave | Scarborough | 667 |
| CPZ6 | 16.7 | SW | Anson Park Public School | 30 Macduff Cres | Scarborough | 250 |
| CPZ6 | 16.8 | SW | R H King Academy | 3800 St Clair Ave E | Scarborough | 1,270 |
| CPZ6 | 16.8 | WSW | Um Al-Qura Islamic School | 1510 Birchmount Rd | Scarborough | 154 |
| CPZ6 | 16.9 | WSW | Glen Ravine Junior Public School | 11 Gadsby Dr | Scarborough | 303 |
| CPZ6 | 17.0 | WSW | Walter Perry Junior Public School | 45 Falmouth Ave | Scarborough | 307 |
| CPZ6 | 17.0 | WSW | Hunter's Glen Junior Public School | 16 Haileybury Dr | Scarborough | 404 |
| CPZ6 | 17.2 | WSW | St. Albert Catholic School | 1125 Midland Ave | Scarborough | 436 |
| CPZ6 | 17.2 | WSW | St. Joan of Arc Catholic Academy | 959 Midland Ave | Scarborough | 934 |
| CPZ6 | 17.2 | WSW | Robert Service Senior Public School | 945 Danforth Rd | Scarborough | 173 |
| CPZ6 | 17.4 | SW | St. John Henry Newman Catholic High School | 100 Brimley Rd S | Scarborough | 1,091 |
| CPZ6 | 17.4 | WSW | Lord Roberts Junior Public School | 165 Lord Roberts Dr | Scarborough | 396 |
| CPZ6 | 17.4 | SW | St. Theresa Shrine Catholic School | 2665 Kingston Rd | Scarborough | 199 |
| CPZ6 | 17.6 | WSW | Scarborough Centre for Alternative Studies | 720 Midland Ave | Scarborough | 377 |
| CPZ6 | 17.8 | SW | Chine Drive Public School | 51 Chine Dr | Scarborough | 155 |
| CPZ6 | 18.0 | SW | John A Leslie Public School | 459 Midland Ave | Scarborough | 537 |
| CPZ6 | 18.1 | WSW | Corvette Junior Public School | 30 Corvette Ave | Scarborough | 582 |
| CPZ6 | 18.2 | WSW | Winston Churchill Collegiate Institute | 2239 Lawrence Ave E | Scarborough | 644 |
| CPZ6 | 18.2 | WSW | Dorset Park Public School | 28 Blaisdale Rd | Scarborough | 216 |
| CPZ6 | 18.3 | SW | Norman Cook Junior Public School | 725 Danforth Rd | Scarborough | 169 |
| CPZ6 | 18.3 | WSW | St. Lawrence Catholic School | 2216 Lawrence Ave E | Scarborough | 455 |
| CPZ6 | 18.4 | WSW | Ionview Public School | 90 Ionview Rd | Scarborough | 401 |
| CPZ6 | 18.4 | WSW | General Crerar Public School | 30 McGregor Rd | Scarborough | 376 |
| CPZ6 | 18.7 | SW | Cliffside Public School | 27 E Haven Dr | Scarborough | 150 |
| CPZ6 | 18.7 | WSW | Bond International College | 1500 Birchmount Rd | Scarborough | 450 |
| CPZ6 | 18.8 | WSW | Mariyah Islamic School | 3665 Lawrence Ave E | Scarborough | 20 |
| CPZ6 | 19.3 | WSW | Manhattan Park Junior Public School | 90 Manhattan Dr | Scarborough | 125 |
| CPZ6 | 19.5 | WSW | General Brock Public School | 140 Chestnut Cres | Scarborough | 438 |
| CPZ6 | 19.5 | SW | Birch Cliff Heights Public School | 120 Highview Ave | Scarborough | 262 |
| CPZ6 | 19.6 | SW | J G Workman Public School | 487 Birchmount Rd | Scarborough | 210 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ6 | 19.6 | WSW | Nil Academy | 5 Blue Haven Cres | North York | 245 |
| CPZ6 | 19.7 | WSW | Buchanan Public School | 4 Bucannan Rd | Scarborough | 320 |
| CPZ6 | 19.8 | WSW | George Peck Public School | 1 Wayne Ave | Scarborough | 246 |
| CPZ6 | 19.8 | SW | Danforth Gardens Public School | 20 Santamonica Blvd | Scarborough | 500 |
| CPZ6 | 19.8 | SW | St. Joachim Catholic School | 3395 St Clair Ave E | Scarborough | 307 |
| CPZ6 | 20.1 | SW | Birchmount Park Collegiate Institute | 3663 Danforth Ave | Scarborough | 873 |
| CPZ6 | 20.2 | WSW | St. Kevin's Catholic School | 15 Murray Glen Dr | Scarborough | 212 |
| CPZ6 | 20.2 | WSW | Maryvale Public School | 1325 Pharmacy Ave | Scarborough | 273 |
| CPZ6 | 20.4 | WSW | W. A. Porter Collegiate Institute | 40 Fairfax Cres | Scarborough | 1,264 |
| CPZ6 | 20.4 | WSW | Wexford Public School | 1050 Pharmacy Ave | Scarborough | 400 |
| CPZ6 | 20.5 | SW | Birch Cliff Public School | 1650 Kingston Rd | Scarborough | 355 |
| CPZ7 | 10.6 | WSW | Military Trail Public School | 701 Military Trl | Scarborough | 500 |
| CPZ7 | 10.8 | WSW | St. John Paul II Catholic Secondary School | 685 Military Trl | Scarborough | 1,352 |
| CPZ7 | 11.1 | W | Emily Carr Public School | 90 John Tabor Trl | Scarborough | 400 |
| CPZ7 | 11.2 | W | St. Florence Catholic School | 101 Murison Blvd | Scarborough | 189 |
| CPZ7 | 11.2 | W | Alexander Stirling Public School | 70 Fawcett Trl | Scarborough | 385 |
| CPZ7 | 11.3 | W | Heritage Park Public School | 80 Old Finch Ave | Scarborough | 326 |
| CPZ7 | 11.4 | W | Lucy Maud Montgomery Public School | 95 Murison Blvd | Scarborough | 198 |
| CPZ7 | 11.5 | W | St. Columba Catholic School | 10 John Tabor Trl | Scarborough | 220 |
| CPZ7 | 11.7 | W | Grey Owl Junior Public School | 150 Wickson Tr | Scarborough | 247 |
| CPZ7 | 11.7 | W | Saint Mother Teresa Academy | 40 Sewells Rd | Scarborough | 522 |
| CPZ7 | 11.9 | WSW | Highcastle Public School | 370 Military Trl | Scarborough | 400 |
| CPZ7 | 12.1 | WSW | St. Edmund Campion Catholic School | 30 Highcastle Rd | Scarborough | 260 |
| CPZ7 | 12.1 | W | Angel Montessori School | 1301 Neilson Rd | Scarborough | 80 |
| CPZ7 | 12.1 | W | Mary Shadd Public School | 135 Hupfield Trl | Scarborough | 442 |
| CPZ7 | 12.2 | W | Sacred Heart Catholic School | 75 Hupfield Trl | Scarborough | 245 |
| CPZ7 | 12.3 | WSW | Henry Hudson Senior Public School | 350 Orton Park Rd | Scarborough | 304 |
| CPZ7 | 12.3 | W | Berner Trail Junior Public School | 120 Berner Trl | Scarborough | 350 |
| CPZ7 | 12.6 | W | Lester B Pearson Collegiate Institute | 150 Tapscott Rd | Scarborough | 1,383 |
| CPZ7 | 12.7 | W | Dr Marion Hilliard Senior Public School | 280 Washburn Way | Scarborough | 287 |
| CPZ7 | 12.7 | W | St. Gabriel Lalemant Catholic School | 160 Crow Trl | Scarborough | 151 |
| CPZ7 | 12.8 | W | Thomas L Wells Public School | 69 Nightstar Rd | Scarborough | 600 |
| CPZ7 | 12.9 | W | Whitefield Christian Schools | 5808 Finch Ave E | Scarborough | 350 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ7 | 12.9 | W | St. Barnabas Catholic Church | 10 Washburn Way | Scarborough | 301 |
| CPZ7 | 13.0 | W | Islamic Institute of Toronto | 1630 Neilson Rd | Scarborough | 262 |
| CPZ7 | 13.0 | W | Burrows Hall Junior Public School | 151 Burrows Hall Blvd | Scarborough | 265 |
| CPZ7 | 13.1 | W | Tom Longboat Junior Public School | 37 Crow Trl | Scarborough | 320 |
| CPZ7 | 13.2 | WSW | Woburn Junior Public School | 40 Dormington D r | Scarborough | 395 |
| CPZ7 | 13.3 | WSW | Woburn Collegiate Institute | 2222 Ellesmere Rd | Scarborough | 1,086 |
| CPZ7 | 13.3 | W | Malvern Junior Public School | 70 Mammoth Hall Trl | Scarborough | 403 |
| CPZ7 | 13.4 | W | Blessed Pier Giorgio Frassati Catholic School | 8 Seasons Dr | Scarborough | 467 |
| CPZ7 | 13.5 | W | Al Azhar Islamic School | 100 McLevin Ave | Toronto | 55 |
| CPZ7 | 13.5 | W | Brookside Public School | 75 Oasis Blvd | Scarborough | 766 |
| CPZ7 | 13.7 | WSW | Woburn Collegiate Institute | 2020 Ellesmere Rd #2 | Scarborough | 70 |
| CPZ7 | 13.9 | W | Kitab Academy | 203-100 McLevin Ave | Scarborough | 50 |
| CPZ7 | 14.4 | W | Islamic Foundation School | 441 Nugget Ave | Scarborough | 726 |
| CPZ7 | 14.5 | W | St. Elizabeth Seton Catholic School | 25 Havenview Rd | Scarborough | 152 |
| CPZ7 | 14.6 | W | White Haven Junior Public School | 105 Invergordon Ave | Scarborough | 503 |
| CPZ7 | 14.9 | W | Excel High School | 55 Nugget Ave #208 | Scarborough | 22 |
| CPZ7 | 15.1 | WSW | North Bendale Junior Public School | 29 Aveline Cres | Scarborough | 150 |
| CPZ7 | 15.6 | W | Anson S Taylor Junior Public School | 20 Placentia Blvd | Scarborough | 228 |
| CPZ7 | 15.7 | W | Éék Saint-Jean-De-Lalande | 500 Sandhurst Cir | Toronto | 108 |
| CPZ7 | 15.9 | W | St. Ignatius of Loyola Separate School | 2350 McCowan Rd | Scarborough | 151 |
| CPZ7 | 15.9 | W | Percy Williams Junior Public School | 35 White Heather Blvd | Scarborough | 314 |
| CPZ7 | 16.0 | WSW | St. Victor Catholic School | 20 Bernadine St | Scarborough | 322 |
| CPZ7 | 16.2 | W | C D Farquharson Junior Public School | 1965 Brimley Rd | Scarborough | 383 |
| CPZ7 | 16.2 | W | Iroquois Junior Public School | 265 Chartland Blvd S | Scarborough | 324 |
| CPZ7 | 16.2 | W | Macklin Public School | 136 Ingleton Blvd | Scarborough | 483 |
| CPZ7 | 16.4 | W | Albert Campbell Collegiate Institute | 1550 Sandhurst Cir | Scarborough | 1,219 |
| CPZ7 | 16.5 | W | St. Bartholomew Catholic School | 51 Heather Rd | Scarborough | 95 |
| CPZ7 | 16.5 | W | Brimwood Boulevard Junior Public School | 151 Brimwood Blvd | Scarborough | 380 |
| CPZ7 | 16.6 | W | Francis Libermann Catholic High School | 4640 Finch Ave E | Scarborough | 927 |
| CPZ7 | 16.6 | WSW | Edgewood Public School | 230 Birkdale Rd | Scarborough | 229 |
| CPZ7 | 16.6 | W | Our Lady of Grace Catholic School | 121 Brimwood Blvd | Scarborough | 267 |
| CPZ7 | 16.6 | W | Sir Alexander Mackenzie Senior Public School | 33 Heather Rd | Scarborough | 470 |
| CPZ7 | 16.8 | W | North Agincourt Junior Public School | 60 Moran Rd | Scarborough | 361 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ7 | 16.8 | W | Henry Kelsey Senior Public School | 1200 Huntingwood Dr | Scarborough | 288 |
| CPZ7 | 16.9 | W | Laure Riese Elementary School | 339 Alton Towers Cir | Scarborough | 208 |
| CPZ7 | 16.9 | W | Chartland Junior Public School | 109 Chartland Blvd S | Scarborough | 203 |
| CPZ7 | 16.9 | W | Agnes Macphail Public School | 112 Goldhawk Trl | Scarborough | 306 |
| CPZ7 | 16.9 | W | Delphi Secondary Alternative School | 109A Chartland Blvd S | Scarborough | 118 |
| CPZ7 | 17.1 | W | Agincourt Montessori School | 2575 Midland Ave | Scarborough | 20 |
| CPZ7 | 17.1 | W | Banting & Best Public School | 380 Goldhawk Trl | Scarborough | 362 |
| CPZ7 | 17.1 | W | Agincourt Collegiate Institute | 2621 Midland Ave | Scarborough | 1,351 |
| CPZ7 | 17.3 | W | Agincourt Junior Public School | 29 Lockie Ave | Toronto | 230 |
| CPZ7 | 17.4 | W | St. Marguerite Bourgeoys Catholic School | 75 Alexmuir Blvd | Scarborough | 100 |
| CPZ7 | 17.4 | W | Msgr Fraser College - Midland Campus | 2900 Midland Ave | Scarborough | 160 |
| CPZ7 | 17.5 | W | Alexmuir Junior Public School | 95 Alexmuir Blvd | Scarborough | 361 |
| CPZ7 | 17.5 | W | Marilake Academy | 3030 Midland Ave Unit 5 & 5A | Scarborough | 40 |
| CPZ7 | 17.6 | W | Sir William Osler High School | 1050 Huntingwood Dr | Scarborough | 218 |
| CPZ7 | 17.7 | W | Milliken Public School | 130 Port Royal Trl | Scarborough | 279 |
| CPZ7 | 17.9 | W | Port Royal Public School | 408 Port Royal Trl | Scarborough | 370 |
| CPZ7 | 18.0 | W | Lynnwood Heights Junior Public School | 50 Southlawn Dr | Scarborough | 160 |
| CPZ7 | 18.2 | W | Smart Start Montessori School | 2660 Kennedy Rd | Scarborough | 15 |
| CPZ7 | 18.3 | WSW | Glamorgan Junior Public School | 51 Antrim Cres | Scarborough | 532 |
| CPZ7 | 18.3 | WSW | Inglewood Heights Junior Public School | 45 Dempster St | Scarborough | 250 |
| CPZ7 | 18.3 | WSW | Ellesmere-Statton Public School | 739 Ellesmere Rd | Scarborough | 640 |
| CPZ7 | 18.7 | W | Highland Heights Junior Public School | 35 Glendower Cir | Scarborough | 161 |
| CPZ7 | 18.8 | W | Silver Springs Public School | 222 Silver Springs Blvd | Scarborough | 470 |
| CPZ7 | 18.8 | W | St. Sylvester Catholic School | 260 Silver Springs Blvd | Scarborough | 180 |
| CPZ7 | 18.9 | W | Stephen Leacock Collegiate Institute | 2450 Birchmount Rd | Scarborough | 983 |
| CPZ7 | 19.0 | W | Mary Ward Catholic Secondary School | 3200 Kennedy Rd | Scarborough | 1,066 |
| CPZ7 | 19.0 | WSW | Lynngate Junior Public School | 129 Cass Ave | Scarborough | 175 |
| CPZ7 | 19.1 | W | Holy Spirit Catholic Elementary School | 3530 Sheppard Ave E | Scarborough | 440 |
| CPZ7 | 19.1 | W | Pauline Johnson Junior Public School | 35 Dunmurray Blvd | Scarborough | 290 |
| CPZ7 | 19.3 | W | Kennedy Public School | 20 Elmfield Cres | Scarborough | 607 |
| CPZ7 | 19.4 | W | Timberbank Junior Public School | 170 Timberbank Blvd | Scarborough | 240 |
| CPZ7 | 19.5 | W | St. Aidan Catholic School | 3521 Finch Ave E | Scarborough | 277 |
| CPZ7 | 19.8 | W | Brookmill Boulevard Junior Public School | 25 Brookmill Blvd | Scarborough | 280 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ7 | 19.9 | WSW | New Oriental Technology Education Group | 3195 Sheppard Ave E | Scarborough | 70 |
| CPZ7 | 20.0 | WSW | Terraview-Willowfield Public School | 95 Pachino Blvd | Scarborough | 109 |
| CPZ7 | 20.0 | WSW | Our Lady of Wisdom Catholic School | 10 Japonica Rd | Scarborough | 372 |
| CPZ7 | 20.1 | W | David Lewis Public School | 130 Fundy Bay Blvd | Scarborough | 488 |
| CPZ7 | 20.1 | W | Bridlewood Junior Public School | 60 Bridlewood Blvd | Scarborough | 229 |
| CPZ7 | 20.1 | W | L'Amoreaux Collegiate Institute | 2501 Bridletowne Cir | Scarborough | 666 |
| CPZ7 | 20.1 | W | Terry Fox Public School | 185 Wintermute Blvd | Scarborough | 456 |
| CPZ7 | 20.2 | W | Dr. Norman Bethune Collegiate Institute | 200 Fundy Bay Blvd | Scarborough | 1,012 |
| CPZ7 | 20.3 | W | North Bridlewood Junior Public School | 50 Collingsbrook Blvd | Scarborough | 244 |
| CPZ7 | 20.5 | W | Beverly Glen Junior Public School | 85 Beverly Glen Blvd | Scarborough | 463 |
| CPZ7 | 20.7 | W | Mary Ward LINC & ESL Centre | 44 Kelvinway Dr | Scarborough | 110 |
| | | | | | *Toronto DPZ Total:* | *7,360* |
| | | | | | *Toronto CPZ Total:* | *72,160* |
| | | | | | *Toronto Total:* | *79,520* |
| **WHITBY, ONTARIO** | | | | | | |
| CPZ1 | 18.5 | NNE | Meadowcrest Public School | 20 Vipond Rd | Whitby | 280 |
| CPZ1 | 18.6 | NNE | Brooklin Mill Montessori School | 25 Cassels Rd E | Whitby | 91 |
| CPZ1 | 18.6 | NNE | St. Bridget Catholic School | 200 Carnwith Dr W | Whitby | 494 |
| CPZ1 | 18.8 | NNE | Chris Hadfield Public School | 160 Carnwith Dr W | Whitby | 827 |
| CPZ1 | 19.6 | NNE | Brooklin High School | 20 Carnwith Dr W | Brooklin | 1,227 |
| CPZ1 | 20.2 | NNE | Brooklin Village Public School | 25 Selkirk Dr | Brooklin | 740 |
| CPZ2 | 10.9 | ENE | Whitby Shores Public School | 485 Shores Greenway | Whitby | 565 |
| CPZ2 | 11.6 | NE | St. Marguerite d'Youville Catholic School | 250 Michael Blvd | Whitby | 415 |
| CPZ2 | 11.7 | NE | West Lynde Public School | 270 Michael Blvd | Whitby | 450 |
| CPZ2 | 11.7 | NE | Colonel J E Farewell Public School | 810 McQuay Blvd | Whitby | 450 |
| CPZ2 | 11.9 | NE | St. John the Evangelist Catholic School | 1103 Giffard St | Whitby | 220 |
| CPZ2 | 12.1 | NE | Henry Street High School | 600 Henry St | Whitby | 1,000 |
| CPZ2 | 12.5 | NE | E A Fairman Public School | 620 Walnut St W | Whitby | 200 |
| CPZ2 | 12.6 | NE | Donald A. Wilson Secondary School | 681 Rossland Rd W | Whitby | 1,520 |
| CPZ2 | 12.6 | NE | All Saints Catholic Secondary School | 3001 Country Ln | Whitby | 817 |
| CPZ2 | 12.7 | NE | Hatch House Montessori School | 301 Byron St S | Whitby | 61 |
| CPZ2 | 12.7 | ENE | Sir William Stephenson Public School | 1125 Athol St | Whitby | 425 |
| CPZ2 | 12.8 | NE | Captain Michael Vandenbos Public School | 3121 Country Ln | Whitby | 650 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| CPZ2 | 13.0 | NE | Blyth Academy - Whitby Campus | 209 Dundas St E, Suite 105 | Whitby | 60 |
| CPZ2 | 13.0 | NNE | Williamsburg Public School | 20 Kirkland Pl | Whitby | 711 |
| CPZ2 | 13.2 | NE | St. Luke the Evangelist Catholic School | 55 Twin Streams Rd | Whitby | 65 |
| CPZ2 | 13.3 | NE | Trafalgar Castle School | 401 Reynolds St | Whitby | 205 |
| CPZ2 | 13.6 | NE | Immanuel Christian School | 100-A Rossland Rd W | Whitby | 58 |
| CPZ2 | 13.6 | NE | Julie Payette Public School | 300 Garden St | Whitby | 700 |
| CPZ2 | 13.8 | NE | Jean-Paul II Catholic Elementary School | 1001 Hutchison Ave | Whitby | 305 |
| CPZ2 | 13.8 | ENE | Kendalwood Montessori & Elementary School | 104 Consumers Dr | Whitby | 107 |
| CPZ2 | 14.0 | NE | Jack Miner Public School | 144 Whitburn St | Whitby | 530 |
| CPZ2 | 14.2 | NE | C E Broughton Public School | 80 Crawforth St | Whitby | 320 |
| CPZ2 | 14.5 | NE | Anderson Collegiate and Vocational Institute | 400 Anderson St | Whitby | 900 |
| CPZ2 | 14.5 | NE | St. Matthew the Evangelist Catholic School | 60 Willowbrook Dr | Whitby | 457 |
| CPZ2 | 14.5 | NE | Pringle Creek Public School | 80 Ribblesdale Dr | Whitby | 720 |
| CPZ2 | 14.6 | NE | St. Theresa Catholic School | 173 Crawforth St | Whitby | 236 |
| CPZ2 | 14.8 | NE | Ormiston Public School | 20 Forest Heights St | Whitby | 400 |
| CPZ2 | 14.9 | NE | École Secondaire Catholique Saint-Charles-Garnier | 4101 Baldwin St S | Whitby | 100 |
| CPZ2 | 15.0 | NE | Whitby Montessori and Elementary School | 95 Taunton Rd E | Whitby | 112 |
| CPZ2 | 15.1 | NE | Glen Dhu Public School | 29 Fallingbrook St | Whitby | 466 |
| CPZ2 | 15.2 | NNE | Robert Munsch Public School | 20 Norista St | Whitby | 635 |
| CPZ2 | 15.2 | ENE | Bellwood Public School | 30 Bellwood Dr | Whitby | 470 |
| CPZ2 | 15.3 | NE | St. Bernard's Catholic Elementary School | 1000 Dryden Blvd | Whitby | 335 |
| CPZ2 | 15.4 | NE | Fallingbrook Public School | 155 Fallingbrook St | Whitby | 411 |
| CPZ2 | 15.5 | NE | Father Leo J Austin Catholic Secondary School | 1020 Dryden Blvd | Whitby | 817 |
| CPZ2 | 16.0 | NE | Sinclair Secondary School | 380 Taunton Rd E | Whitby | 1,600 |
| CPZ2 | 16.0 | NE | Dr. Robert Thornton Public School | 101 Hazelwood Dr | Whitby | 350 |
| CPZ2 | 16.4 | NE | St. Paul Catholic School | 200 Garrard Rd | Whitby | 297 |
| CPZ2 | 16.6 | NE | St. Mark the Evangelist Catholic Elementary School | 95 Waller St | Whitby | 304 |
| CPZ2 | 16.7 | NE | John Dryden Public School | 40 Rolling Acres Dr | Whitby | 715 |
| CPZ2 | 17.0 | NE | Sir Samuel Steele Public School | 55 Bakerville St | Whitby | 500 |
| CPZ2 | 19.4 | NNE | Winchester Public School | 70 Watford St | Whitby | 400 |
| CPZ2 | 19.6 | NNE | St. Leo Catholic School | 120 Watford St | Whitby | 600 |
| CPZ2 | 20.0 | NNE | Blair Ridge Public School | 100 Blackfriar Ave | Whitby | 740 |
| CPZ2 | 20.2 | NNE | St. John Paul II Catholic School | 160 Cachet Blvd | Brooklin | 130 |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment |
|---|---|---|---|---|---|---|
| | | | | | *Whitby DPZ Total:* | *0* |
| | | | | | *Whitby CPZ Total:* | *25,188* |
| | | | | | *Whitby Total:* | *25,188* |
| | | | | | **DPZ TOTAL:** | **45,423** |
| | | | | | **CPZ TOTAL:** | **148,789** |
| | | | | | **TOTAL:** | **194,212** |

**Table E-2. Colleges and Universities within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Total Enrolment | Commuting/ Ridesharing Students | Student Vehicles |
|---|---|---|---|---|---|---|---|---|
| **OSHAWA, ONTARIO** | | | | | | | | |
| CPZ2 | 16.8 | ENE | Trent University - Durham GTA Campus | 55 Thornton Rd S | Oshawa | 1,960 | 1,496 | 360 |
| CPZ2 | 20.4 | NE | Durham College - Oshawa Campus | 2000 Simcoe St N | Oshawa | 8,539 | 6,933 | 3,000 |
| CPZ2 | 20.4 | NE | University of Ontario Institute of Technology | 2000 Simcoe St N | Oshawa | 9,732 | 7,490 | 2,000 |
| | | | | | *Oshawa DPZ Total:* | *0* | *0* | *0* |
| | | | | | *Oshawa CPZ Total:* | *20,231* | *15,919* | *5,360* |
| | | | | | *Oshawa Total:* | *20,231* | *15,919* | *5,360* |
| **TORONTO, ONTARIO** | | | | | | | | |
| P17 | 9.9 | WSW | University of Toronto - Scarborough | 1265 Military Trl | Toronto | 13,075 | 9,935 | 2,246 |
| P18 | 10.3 | WSW | Centennial College - Morningside Campus | 755 Morningside Ave | Toronto | 3,664 | 3,001 | 1,378 |
| CPZ6 | 17.6 | SW | Redemptoris Mater Seminary | 2661 Kingston Rd | Scarborough | 173 | 173 | 150 |
| CPZ6 | 19.1 | WSW | CDI College - Scarborough | 2206 Eglinton Ave E | Scarborough | 288 | 288 | 250 |
| CPZ6 | 19.9 | WSW | Centennial College - Ashtonbee Campus | 75 Ashtonbee Rd B2-11 75 | Scarborough | 1,933 | 1,720 | 1,200 |
| CPZ7 | 13.1 | WSW | Centennial College - Progress Campus | 941 Progress Ave | Scarborough | 10,041 | 7,767 | 2,200 |
| | | | | | *Toronto DPZ Total:* | *16,739* | *12,936* | *3,624* |
| | | | | | *Toronto CPZ Total:* | *12,435* | *9,948* | *3,800* |
| | | | | | *Toronto Total:* | *29,174* | *22,884* | *7,424* |
| **WHITBY, ONTARIO** | | | | | | | | |
| CPZ2 | 15.1 | ENE | Durham College - Whitby Campus | 1610 Champlain Ave | Whitby | 1,839 | 1,493 | 646 |
| | | | | | *Whitby DPZ Total:* | *0* | *0* | *0* |
| | | | | | *Whitby CPZ Total:* | *1,839* | *1,493* | *646* |
| | | | | | *Whitby Total:* | *1,839* | *1,493* | *646* |
| | | | | | **DPZ TOTAL:** | **16,739** | **12,936** | **3,624** |
| | | | | | **CPZ TOTAL:** | **34,505** | **27,360** | **9,806** |
| | | | | | **TOTAL:** | **51,244** | **40,296** | **13,430** |

**Table E-3. Day Camps within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment[2] |
|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | |
| P10 | 6.4 | NNE | Westney Heights YMCA Before And After School | 45 Brennan Rd | Ajax | 50 |
| P21 | 8.3 | NNE | Nottingham YMCA Childcare Centre | 50 Seggar Ave | Ajax | 50 |
| P21 | 8.4 | NNE | St. Andre of Bessette YMCA Before and After School Program | 60 Seggar Ave | Ajax | 50 |
| P22 | 6.2 | NE | Carruthers Creek YMCA Before and After School Program | 1 Greenhalf Dr | Ajax | 50 |
| | | | | | *Ajax DPZ Total:* | *200* |
| | | | | | *Ajax CPZ Total:* | *0* |
| | | | | | *Ajax Total:* | *200* |
| **MARKHAM, ONTARIO** | | | | | | |
| CPZ7 | 14.7 | WNW | Markham Legacy YMCA Child Care Centre | 61 Russell Jarvis Dr | Markham | - |
| CPZ7 | 16.6 | WNW | Rouge Valley Sports Camp | 525 Highglen Ave | Markham | - |
| CPZ7 | 19.6 | WNW | Unionville Central Park YMCA Child Care Centre | 100 Central Park Dr | Unionville | - |
| CPZ7 | 20.1 | WNW | Markham YMCA Blvd. Rudy Bratty YMCA Centre | 101 YMCA Blvd | Unionville | - |
| CPZ7 | 20.4 | WNW | Markham Stonebridge YMCA Centre | 168 Stonebridge Dr | Markham | - |
| CPZ7 | 21.3 | WNW | Markham Castlemore YMCA Centre | 256 Ridgecrest Rd | Markham | - |
| CPZ8 | 16.5 | WNW | Markham Reesor Park YMCA Child Care Centre | 69 Wootten Way N | Markham | - |
| CPZ8 | 17.5 | NW | Markham Greensborough YMCA Centre | 80 Alfred Paterson Dr | Markham | - |
| CPZ8 | 17.7 | NW | Camp Robin Hood (Summer Location) | 10243 Reesor Rd | Markham | - |
| CPZ8 | 18.5 | WNW | Markham Mount Joy YMCA Centre | 281 William Grant Rd | Markham | - |
| | | | | | *Markham DPZ Total:* | *-* |
| | | | | | *Markham CPZ Total:* | *-* |
| | | | | | *Markham Total:* | *-* |
| **OSHAWA, ONTARIO** | | | | | | |
| CPZ2 | 17.0 | ENE | Oshawa Waverly YMCA Centre | 100 Waverly St S | Oshawa | - |
| CPZ2 | 18.2 | NE | Oshawa St. Christopher YMCA Centre | 431 Annapolis Ave | Oshawa | - |
| CPZ2 | 19.5 | ENE | Oshawa Mary St. YMCA | 99 Mary St N | Oshawa | - |
| CPZ2 | 19.7 | NE | Oshawa Dr. SJ Phillips YMCA Centre | 625 Simcoe St N | Oshawa | - |
| CPZ2 | 20.7 | ENE | Oshawa Coronation YMCA Centre | 445 Adelaide Ave E | Oshawa | - |
| | | | | | *Oshawa DPZ Total:* | *-* |

[2] The number of students at each day camp, within the DPZ, is estimated to be approximately 50 during the summer months. Students from these day camps will be transported to designated Temporary Holding Centres during an evacuation. Data for day camps within the CPZ was not available. For day camps within the CPZ, it is assumed that parents will pick up their children prior to evacuation. As such, no vehicles are considered for those day camps. See Section 3.9 for additional discussion.

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment[2] |
|---|---|---|---|---|---|---|
| | | | | | *Oshawa CPZ Total:* | - |
| | | | | | *Oshawa Total:* | - |
| **PICKERING, ONTARIO** | | | | | | |
| P2 | 1.6 | NW | Father Fenelon YMCA Before and After School | 795 Eyer Dr | Pickering | 50 |
| P4 | 4.2 | W | Rosebank YMCA Before And After School | 591 Rosebank Rd | Pickering | 50 |
| P4 | 5.3 | W | Elizabeth B. Phin YMCA School Age Program | 1500 Rougemount Dr | Pickering | 50 |
| P4 | 5.7 | W | St. Monica YMCA School Age Program | 275 Twyn Rivers Dr | Pickering | 50 |
| P5 | 5.4 | WNW | St. Elizabeth Seton YMCA Child Care Centre | 490 Strouds Ln | Pickering | 50 |
| P7 | 4.1 | NW | Vaughan Willard YMCA Child Care | 1911 Dixie Rd N | Pickering | 50 |
| P8 | 4.8 | NW | St. Isaac Jogues YMCA Before And After School | 1166 Finch Ave | Pickering | 50 |
| P9 | 6.3 | N | St. Wilfrid YMCA Child Care Centre | 2360 Southcott Rd | Pickering | 50 |
| CPZ1 | 16.4 | N | Claremont Field Centre | 4290 Westney Rd N | Goodwood | - |
| | | | | | *Pickering DPZ Total:* | *400* |
| | | | | | *Pickering CPZ Total:* | - |
| | | | | | *Pickering Total:* | *400* |
| **TORONTO, ONTARIO** | | | | | | |
| CPZ6 | 11.6 | WSW | East Scarborough Boys & Girls Club | 100 Galloway Rd | Scarborough | - |
| CPZ6 | 14.4 | WSW | Scarborough St Boniface YMCA Child Care Centre | 20 Markanna Dr | Scarborough | - |
| CPZ6 | 15.0 | WSW | Scarborough St Rose of Lima YMCA Child Care Centre | 3220 Lawrence Ave E | Scarborough | - |
| CPZ6 | 16.3 | WSW | Scarborough Knob Hill YMCA Centre | 25 Seminole Ave | Scarborough | - |
| CPZ6 | 16.9 | WSW | Hunters Glen YMCA Child Care | 16 Haileybury Dr | Scarborough | - |
| CPZ6 | 20.2 | WSW | Scarborough Maryvale YMCA Child Care Centre | 1325 Pharmacy Ave | Scarborough | - |
| CPZ6 | 20.4 | WSW | Scarborough Precious Blood YMCA Centre | 1035 Pharmacy Ave | Scarborough | - |
| CPZ7 | 11.5 | W | YMCA of Greater Toronto | 95 Murison Blvd | Scarborough | - |
| CPZ7 | 13.6 | W | YMCA of Greater Toronto | 10 Milner Businees Court Unit 600 | Scarborough | - |
| CPZ7 | 15.4 | WSW | Toronto Scarborough Town Centre Ct YMCA Child Care Centre | 230 Town Centre Court | Scarborough | - |
| CPZ7 | 15.9 | W | Scarborough Percy Williams YMCA Centre | 35 White Heather Blvd | Scarborough | - |
| CPZ7 | 16.2 | W | Scarborough CD Farquharson YMCA Child Care Centre | 1965 Brimley Rd | Scarborough | - |
| CPZ7 | 16.6 | W | Scarborough Our Lady of Grace YMCA Child Care Centre | 121 Brimwood Blvd | Scarborough | - |
| CPZ7 | 17.9 | W | Scarborough Port Royal YMCA Child Care Centre | 410 Port Royal Trail | Scarborough | - |
| CPZ7 | 18.1 | WSW | Scarborough Glamorgan YMCA Centre | 51 Antrim Crescent | Scarborough | - |
| CPZ7 | 19.1 | W | Scarborough Pauline Johnson YMCA Centre | 35 Dunmurray Blvd | Scarborough | - |

| Response Sector | Distance (km) | Direc-tion | School Name | Street Address | Municipality | Enrol-ment[2] |
|---|---|---|---|---|---|---|
| CPZ7 | 19.1 | W | Scarborough Holy Spirit YMCA Child Care Centre | 3530 Sheppard Ave E | Scarborough | - |
| CPZ7 | 20.1 | W | Scarborough David Lewis YMCA | 130 Fundy Bay Blvd | Scarborough | - |
| CPZ7 | 20.1 | W | Scarborough Bridlewood YMCA Child Care Centre | 60 Bridlewood Blvd | Scarborough | - |
| | | | | | *Toronto DPZ Total:* | - |
| | | | | | *Toronto CPZ Total:* | - |
| | | | | | *Toronto Total:* | - |
| **WHITBY, ONTARIO** | | | | | | |
| CPZ1 | 18.5 | NNE | Brooklin Meadowcrest YMCA Centre | 20 Vipond Rd | Whitby | - |
| CPZ1 | 18.6 | NNE | Brooklin St. Bridget YMCA Centre | 200 Carnwith Dr W | Whitby | - |
| CPZ1 | 18.8 | NNE | Brooklin Chris Hadfield YMCA Centre | 160 Carnwith Dr W | Whitby | - |
| CPZ2 | 11.6 | NE | Whitby Colonel JE Farewell YMCA Centre | 810 McQuay Blvd | Whitby | - |
| CPZ2 | 14.5 | NE | Whitby St. Matthew YMCA Child Care Centre | 60 Willowbrook Dr | Whitby | - |
| CPZ2 | 16.4 | NE | Whitby St. Paul YMCA Centre | 200 Garrard Rd | Whitby | - |
| CPZ2 | 19.6 | NNE | Brooklin St. Leo YMCA Centre | 120 Watford St | Whitby | - |
| CPZ2 | 20.1 | NNE | Brooklin St. John Paul II YMCA Centre | 160 Cachet Blvd | Whitby | - |
| | | | | | *Whitby DPZ Total:* | - |
| | | | | | *Whitby CPZ Total:* | - |
| | | | | | *Whitby Total:* | - |
| | | | | | **DPZ TOTAL:** | **600** |
| | | | | | **CPZ TOTAL:** | **-** |
| | | | | | **TOTAL:** | **600** |

**Table E-4. Medical Facilities within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Capa-city | Current Census | Ambula-tory Patients | Wheel-chair Patients | Bed-ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | | | | |
| P10 | 7.0 | NNE | Chartwell Harwood Retirement Residence | 240 Old Harwood Ave | Ajax | 130 | 130 | 66 | 51 | 13 |
| P10 | 7.2 | NNE | Ashley Manor | 1 Richards Ln | Ajax | 104 | 104 | 53 | 41 | 10 |
| P12 | 5.8 | NE | Chartwell Ballycliffe Retirement & Long Term Care Residence | 70 Station St | Ajax | 234 | 150 | 50 | 95 | 5 |
| P13 | 4.8 | ENE | Westwood Manor | 960 Westney Rd S | Ajax | 83 | 83 | 42 | 32 | 9 |
| P13 | 5.2 | NE | Lakeridge Health Ajax Pickering Hospital | 580 Harwood Ave S | Ajax | 172 | 172 | 115 | 20 | 37 |
| P14 | 5.3 | NE | Harwood Manor | 655 Harwood Ave S | Ajax | 128 | 128 | 65 | 50 | 13 |
| P21 | 7.8 | NNE | Winbourne Park Long Term Care | 1020 Westney Rd N | Ajax | 110 | 110 | 59 | 41 | 10 |
| | | | | | *Ajax DPZ Total:* | *961* | *877* | *450* | *330* | *97* |
| | | | | | *Ajax DPZ Total:* | *0* | *0* | *0* | *0* | *0* |
| | | | | | *Ajax Total:* | *961* | *877* | *450* | *330* | *97* |
| **MARKHAM, ONTARIO** | | | | | | | | | | |
| CPZ7 | 16.3 | WNW | Markhaven Home for Seniors | 54 Pkwy Ave | Markham | 96 | 96 | 49 | 37 | 10 |
| CPZ7 | 19.5 | WNW | Bethany Courts | 34 Swansea Rd | Unionville | 72 | 72 | 36 | 28 | 8 |
| CPZ7 | 19.5 | WNW | Sunrise of Unionville | 38 Swansea Rd | Unionville | 98 | 98 | 50 | 38 | 10 |
| CPZ7 | 19.6 | WNW | Bethany Manor | 25 Second St | Unionville | 38 | 38 | 19 | 15 | 4 |
| CPZ7 | 19.7 | WNW | Bethany Lodge | 23 Second St | Unionville | 128 | 128 | 65 | 50 | 13 |
| CPZ8 | 15.5 | WNW | Markham Stouffville Hospital | 381 Church St | Markham | 329 | 329 | 167 | 128 | 34 |
| CPZ8 | 15.6 | WNW | Chartwell Woodhaven Long Term Care Residence | 380 Church St | Markham | 192 | 192 | 97 | 75 | 20 |
| CPZ8 | 17.1 | WNW | Markhaven Home for Seniors | 54 Pkwy Ave | Markham | 96 | 96 | 49 | 37 | 10 |
| CPZ8 | 17.6 | WNW | Amica at Swan Lake | 6360 16th Ave | Markham | 100 | 100 | 51 | 39 | 10 |
| CPZ8 | 18.4 | WNW | Chartwell Rouge Valley Retirement Residence | 5958 16th Ave | Markham | 89 | 89 | 45 | 35 | 9 |
| | | | | | *Markham DPZ Total:* | *0* | *0* | *0* | *0* | *0* |
| | | | | | *Markham CPZ Total:* | *1,238* | *1,238* | *628* | *482* | *128* |
| | | | | | *Markham Total:* | *1,238* | *1,238* | *628* | *482* | *128* |
| **OSHAWA, ONTARIO** | | | | | | | | | | |
| CPZ2 | 16.5 | ENE | Revera ThorntonView Long Term Care Home | 186 Thornton Rd S | Oshawa | 154 | 154 | 78 | 60 | 16 |
| CPZ2 | 18.4 | ENE | Extendicare Oshawa | 82 Park Rd N | Oshawa | 175 | 175 | 89 | 68 | 18 |
| CPZ2 | 19.0 | ENE | Park View Place | 25 John St W | Oshawa | 60 | 60 | 30 | 24 | 6 |
| CPZ2 | 19.1 | ENE | Faith Place | 44 William St W | Oshawa | 180 | 180 | 91 | 70 | 19 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Capa-city | Current Census | Ambula-tory Patients | Wheel-chair Patients | Bed-ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| CPZ2 | 19.3 | NE | Lakeridge Health Oshawa | 1 Hospital Ct | Oshawa | 363 | 363 | 184 | 141 | 38 |
| CPZ2 | 19.4 | ENE | The Carriage House | 60 Bond St E | Oshawa | 30 | 30 | 15 | 12 | 3 |
| CPZ2 | 20.2 | NE | Hillsdale Terrace | 600 Oshawa Blvd N | Oshawa | 200 | 200 | 101 | 78 | 21 |
| CPZ2 | 20.2 | NE | Hillsdale Estates | 590 Oshawa Blvd N | Oshawa | 300 | 300 | 152 | 117 | 31 |
| CPZ2 | 20.3 | NE | Livita Centennial Retirement Residence | 259 Hillcroft St | Oshawa | 20 | 20 | 10 | 8 | 2 |
| | | | | | *Oshawa DPZ Total:* | *0* | *0* | *0* | *0* | *0* |
| | | | | | *Oshawa CPZ Total:* | *1,482* | *1,482* | *750* | *578* | *154* |
| | | | | | *Oshawa Total:* | *1,482* | *1,482* | *750* | *578* | *154* |
| **PICKERING, ONTARIO** | | | | | | | | | | |
| P1 | 2.6 | NW | St. Martin's Centre | 1203 St Martins Dr | Pickering | 67 | 67 | 34 | 26 | 7 |
| P2 | 1.7 | NW | Fairport Lodge | 1330 Foxglove Ave | Pickering | 36 | 36 | 18 | 14 | 4 |
| P2 | 2.2 | NNW | Bay Ridges Long Term Care Centre | 900 Sandy Beach Rd | Pickering | 124 | 124 | 24 | 100 | 0 |
| P4 | 3.9 | WSW | Abbeylawn Manor Retirement Home | 534 Rodd Ave | Pickering | 57 | 54 | 45 | 9 | 0 |
| P7 | 3.3 | NNW | Chartwell Pickering City Centre Retirement Residence | 1801 Valley Farm Rd | Pickering | 117 | 117 | 63 | 44 | 10 |
| P7 | 3.5 | N | Livita Parkway Retirement Residence | 1645 Pickering Pkwy | Pickering | 75 | 63 | 63 | 0 | 0 |
| P7 | 3.7 | NNW | Viva Pickering | 1880 Glengrove Rd | Pickering | 166 | 160 | 158 | 2 | 0 |
| P7 | 4.0 | NNW | Villa Valeau | 1910 Faylee Cres | Pickering | 36 | 36 | 18 | 14 | 4 |
| P7 | 4.3 | NNW | Orchard Villa Retirement Residence | 1955 Valley Farm Rd | Pickering | 294 | 280 | 97 | 114 | 69 |
| P8 | 5.5 | NNW | Rene Goupil House | 2315 Liverpool Rd N | Pickering | 25 | 25 | 22 | 2 | 1 |
| CPZ1 | 18.5 | N | Deer Run Retirement | 4740 Sideline 8 | Claremont | 20 | 20 | 10 | 8 | 2 |
| | | | | | *Pickering DPZ Total:* | *997* | *962* | *542* | *325* | *95* |
| | | | | | *Pickering CPZ Total:* | *20* | *20* | *10* | *8* | *2* |
| | | | | | *Pickering Total:* | *1,017* | *982* | *552* | *333* | *97* |
| **TORONTO, ONTARIO** | | | | | | | | | | |
| P16 | 5.9 | WSW | Altamont Care Community | 92 Island Rd | Toronto | 159 | 159 | 93 | 65 | 1 |
| P17 | 8.2 | WSW | Tony Stacey Centre for Veterans Care | 59 Lawson Rd | Toronto | 100 | 100 | 58 | 40 | 2 |
| P17 | 10.0 | WSW | Ehatare Retirement and Nursing Home | 40 Kingston Rd | Toronto | 32 | 32 | 17 | 12 | 3 |
| P18 | 9.7 | W | Extendicare Rouge Valley | 551 Conlins Rd | Toronto | 192 | 192 | 103 | 72 | 17 |
| CPZ6 | 12.5 | WSW | Extendicare Scarborough | 3830 Lawrence Ave E | Scarborough | 150 | 150 | 76 | 58 | 16 |
| CPZ6 | 12.6 | SW | Chartwell Guildwood Retirement Residence | 65 Livingston Rd | Scarborough | 172 | 172 | 87 | 67 | 18 |
| CPZ6 | 12.9 | SW | Extendicare Guildwood | 60 Guildwood Pkwy | Scarborough | 169 | 169 | 85 | 66 | 18 |
| CPZ6 | 14.0 | WSW | Cedarbrook Lodge Retirement Residence | 520 Markham Rd | Scarborough | 200 | 200 | 101 | 78 | 21 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Capa-city | Current Census | Ambula-tory Patients | Wheel-chair Patients | Bed-ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| CPZ6 | 14.2 | SW | Momiji Health Care Society | 3555 Kingston Rd | Scarborough | 400 | 400 | 202 | 156 | 42 |
| CPZ6 | 14.3 | WSW | Scarborough Retirement Residence | 148 Markham Rd | Scarborough | 127 | 127 | 64 | 50 | 13 |
| CPZ6 | 15.7 | WSW | Rockcliffe Care Community | 3015 Lawrence Ave E | Scarborough | 204 | 204 | 103 | 80 | 21 |
| CPZ6 | 15.8 | WSW | Chartwell Trilogy Long Term Care Residence | 340 McCowan Rd | Scarborough | 197 | 197 | 100 | 77 | 20 |
| CPZ6 | 15.9 | WSW | McCowan Retirement Residence | 2881 Eglinton Ave E | Scarborough | 142 | 142 | 72 | 55 | 15 |
| CPZ6 | 15.9 | WSW | Bendale Acres Long-Term Care Home | 2920 Lawrence Ave E | Scarborough | 302 | 302 | 152 | 118 | 32 |
| CPZ6 | 16.2 | WSW | St David's Village | 1290 Danforth Rd | Scarborough | 179 | 179 | 90 | 70 | 19 |
| CPZ6 | 17.8 | WSW | Kennedy Lodge Long Term Care | 1400 Kennedy Rd | Scarborough | 289 | 289 | 146 | 113 | 30 |
| CPZ6 | 17.9 | WSW | Hellenic Home for the Aged | 2411 Lawrence Ave E | Scarborough | 128 | 128 | 65 | 50 | 13 |
| CPZ6 | 18.3 | SW | Midland Gardens Retirement Residence | 130 Midland Ave Unit 1 | Scarborough | 299 | 299 | 151 | 117 | 31 |
| CPZ6 | 18.7 | SW | Craiglee Nursing Home | 102 Craiglee Dr | Scarborough | 169 | 169 | 85 | 66 | 18 |
| CPZ6 | 19.3 | SW | Retirement Suites By The Lake | 2121 Kingston Rd | Scarborough | 92 | 92 | 46 | 36 | 10 |
| CPZ6 | 20.4 | SW | Ina Grafton Gage Home | 40 Bell Estate Rd | Scarborough | 128 | 128 | 65 | 50 | 13 |
| CPZ6 | 20.4 | WSW | Cardinal Ambrozic Houses of Providence | 3276 St Clair Ave E | Scarborough | 173 | 173 | 88 | 67 | 18 |
| CPZ6 | 20.5 | WSW | Providence Healthcare | 3276 St Clair Ave E | Scarborough | 350 | 288 | 146 | 112 | 30 |
| CPZ7 | 11.4 | WSW | Scarborough Health Network - Centenary Hospital | 2867 Ellesmere Rd | Scarborough | 1,200 | 1,200 | 607 | 468 | 125 |
| CPZ7 | 14.0 | W | Sts. Peter and Paul Residence | 221 Milner Ave | Scarborough | 300 | 300 | 152 | 117 | 31 |
| CPZ7 | 17.5 | WSW | Fieldstone Commons Care Community | 1000 Ellesmere Rd | Scarborough | 224 | 224 | 113 | 88 | 23 |
| CPZ7 | 18.4 | W | Retirement Living at Shepherd Terrace | 3760 Sheppard Ave E | Scarborough | 96 | 96 | 49 | 37 | 10 |
| CPZ7 | 18.6 | W | Mon Sheong Scarborough LTC | 2030 McNicoll Ave | Scarborough | 160 | 160 | 81 | 62 | 17 |
| CPZ7 | 19.4 | W | Scarborough Health Network - Birchmount Hospital | 3030 Birchmount Rd | Scarborough | 700 | 700 | 354 | 273 | 73 |
| | | | | | *Toronto DPZ Total:* | *483* | *483* | *271* | *189* | *23* |
| | | | | | *Toronto CPZ Total:* | *6,550* | *6,488* | *3,280* | *2,531* | *677* |
| | | | | | *Toronto Total:* | *7,033* | *6,971* | *3,551* | *2,720* | *700* |
| **WHITBY, ONTARIO** | | | | | | | | | | |
| CPZ2 | 11.3 | ENE | Lakeridge Health | 300 Gordon St | Whitby | 74 | 73 | 38 | 28 | 7 |
| CPZ2 | 12.2 | NE | Fairview Lodge | 632 Dundas St W | Whitby | 198 | 198 | 100 | 77 | 21 |
| CPZ2 | 12.5 | NE | Centre - DRLHC | 409 Centre Street S | Whitby | 16 | 16 | 8 | 6 | 2 |
| CPZ2 | 12.5 | NE | Windsor Place | 315 Colborne St W | Whitby | 104 | 104 | 52 | 41 | 11 |
| CPZ2 | 12.6 | NE | Bowling Green Towers | 850 Green St | Whitby | 80 | 80 | 41 | 31 | 8 |
| CPZ2 | 13.5 | NE | Chartwell Colonial Retirement Residence | 101 Manning Rd | Whitby | 96 | 96 | 49 | 37 | 10 |
| CPZ2 | 14.2 | NE | Aspira Lynde Creek Gardens Retirement Living | 50 Paul Burns Way | Whitby | 94 | 94 | 47 | 37 | 10 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Capa-city | Current Census | Ambula-tory Patients | Wheel-chair Patients | Bed-ridden Patients |
|---|---|---|---|---|---|---|---|---|---|---|
| CPZ2 | 14.5 | NE | Amica at Whitby | 200 Kenneth Hobbs Ave | Whitby | 139 | 139 | 70 | 54 | 15 |
| CPZ2 | 14.5 | NE | Oakwood Retirement Communities | 3800 Brock St N | Whitby | 125 | 125 | 63 | 49 | 13 |
| CPZ2 | 14.6 | NE | Village of Taunton Mills | 3800 Brock St N | Whitby | 184 | 184 | 93 | 72 | 19 |
| CPZ2 | 14.8 | NE | Tekoa Manor | 200 Glen Hill Dr S | Whitby | 125 | 125 | 63 | 49 | 13 |
| CPZ2 | 14.9 | NE | Glen Hill Terrace | 100 Glen Hill Drive S | Whitby | 174 | 174 | 88 | 68 | 18 |
| CPZ2 | 15.0 | NE | Bloomsdale Seniors Home | 737 Anderson St | Whitby | 20 | 20 | 10 | 8 | 2 |
| CPZ2 | 15.4 | NE | Sunnycrest Nursing Homes Ltd | 1635 Dundas St E | Whitby | 136 | 136 | 69 | 53 | 14 |
| CPZ2 | 16.1 | NE | The Court At Pringle Creek | 3975 Anderson St | Whitby | 119 | 119 | 60 | 47 | 12 |
| CPZ2 | 19.0 | NNE | The Court at Brooklin | 5909 Anderson St | Whitby | 118 | 118 | 60 | 46 | 12 |
| | | | | | *Whitby DPZ Total:* | *0* | *0* | *0* | *0* | *0* |
| | | | | | *Whitby CPZ Total* | *1,802* | *1,801* | *911* | *703* | *187* |
| | | | | | *Whitby Total:* | *1,802* | *1,801* | *911* | *703* | *187* |
| | | | | | **DPZ TOTAL:** | **2,441** | **2,322** | **1,263** | **844** | **215** |
| | | | | | **CPZ TOTAL:** | **11,092** | **11,029** | **5,579** | **4,302** | **1,148** |
| | | | | | **TOTAL:** | **13,533** | **13,351** | **6,842** | **5,146** | **1,363** |

**Table E-5. Major Employers[3] within the PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Employees (Max Shift)[4] | % Employees Commuting into the PZ[5] | Employees Commuting into the PZ | Employee Vehicles Commuting into the PZ |
|---|---|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | | | |
| P12 | 4.8 | NNE | GO Station - Ajax | 100 Westney Rd S | Ajax | 3,050 | 5.00% | 152 | 152 |
| Various locations throughout the DPZ | | | | | | 45,976 | 13.0% | 6,033 | 6,033 |
| Various locations throughout the CPZ | | | | | | 681 | 13.0% | 89 | 89 |
| | | | | | *Ajax DPZ Total:* | *49,026* | - | *6,185* | *6,185* |
| | | | | | *Ajax CPZ Total:* | *681* | - | *89* | *89* |
| | | | | | *Ajax Total:* | *49,707* | - | *6,274* | *6,274* |
| **MARKHAM, ONTARIO** | | | | | | | | | |
| CPZ7 | 17.7 | WNW | GO Station - Markham | 214 Main St N | Markham | 410 | 5.00% | 23 | 20 |
| CPZ7 | 18.9 | WNW | GO Station - Centennial | 8600 McCowan Rd | Markham | 451 | 5.00% | 26 | 23 |
| CPZ7 | 20.3 | WNW | GO Station - Unionville | 155 YMCA Blvd | Markham | 1,614 | 5.00% | 93 | 81 |
| CPZ8 | 18.7 | NW | GO Station - Mount Joy | 1801 Bur Oak Ave | Markham | 1,333 | 5.00% | 77 | 67 |
| Various locations throughout the CPZ | | | | | | 78,209 | 27.4% | 21,483 | 18,679 |
| | | | | | *Markham DPZ Total:* | *0* | - | *0* | *0* |
| | | | | | *Markham CPZ Total:* | *82,017* | - | *21,702* | *18,870* |
| | | | | | *Markham Total:* | *82,017* | - | *21,702* | *18,870* |
| **OSHAWA, ONTARIO** | | | | | | | | | |
| CPZ2 | 16.2 | ENE | GO Station - Oshawa | 915 Bloor St W | Oshawa | 2,390 | 5.00% | 120 | 120 |
| Various locations throughout the CPZ | | | | | | 20,672 | 27.0% | 5,617 | 5,617 |
| | | | | | *Oshawa DPZ Total:* | *0* | - | *0* | *0* |
| | | | | | *Oshawa CPZ Total:* | *23,062* | - | *5,737* | *5,737* |
| | | | | | *Oshawa Total:* | *23,062* | - | *5,737* | *5,737* |

[3] The major employer locations shown in Figure E-19 are represented by circles which increase in size proportional to the number of employees commuting into the PZs in each Dissemination Area. It includes employment data obtained from Statistics Canada, OPG, and GO Transit website.
[4] The data for PNGS OPG employees were provided by the OPG. The number of employees who work outside of the PZs but evacuate from GO Transit stations within the PZs, is estimated based on the rail station parking capacity. See Section 3.4 for additional discussion.
[5] The 2021 Commuting Flow survey from Statistics Canada was used to calculate the percent of employees commuting into the PZs for each municipality (see Section 3.4). These values were applied to employment data provided by Statistics Canada and by the OPG. The 2022 demographic survey provides the percent of commuters (5.0%, see Appendix F, Section F.3.1) who work outside of the PZs but evacuate from rail stations within the PZs. This value was applied to the employees evacuating from GO Transit stations within the PZs.

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Employees (Max Shift)[4] | % Employees Commuting into the PZ[5] | Employees Commuting into the PZ | Employee Vehicles Commuting into the PZ |
|---|---|---|---|---|---|---|---|---|---|
| **PICKERING, ONTARIO** | | | | | | | | | |
| P2 | - | NNE | Pickering Nuclear Generating Station | 1675 Montgomery Park Rd | Pickering | 3,055 | 52.00% | 1,589 | 1,589 |
| P2 | 2.7 | NNW | GO Station - Pickering | 1322 Bayly S | Pickering | 3,538 | 5.00% | 177 | 177 |
| Various locations throughout the DPZ | | | | | | 36,200 | 18.8% | 6,847 | 6,847 |
| Various locations throughout the CPZ | | | | | | 972 | 18.8% | 183 | 183 |
| *Pickering DPZ Total:* | | | | | | *42,793* | - | *8,613* | *8,613* |
| *Pickering CPZ Total:* | | | | | | *972* | - | *183* | *183* |
| *Pickering Total:* | | | | | | *43,765* | - | *8,796* | *8,796* |
| **TORONTO, ONTARIO** | | | | | | | | | |
| P3 | 6.0 | WSW | GO Station - Rouge Hill | 6251 Lawrence Ave E | Scarborough | 853 | 5.00% | 49 | 43 |
| CPZ6 | 12.1 | WSW | GO Station - Guildwood | 4105 Kingston Rd | Toronto | 888 | 5.00% | 51 | 44 |
| CPZ6 | 15.0 | WSW | GO Station - Eglinton | 2995 Eglinton Ave E | Scarborough | 839 | 5.00% | 48 | 42 |
| CPZ6 | 17.8 | WSW | GO Station - Kennedy | 2467 Eglinton Ave E | Scarborough | 199 | 5.00% | 12 | 10 |
| CPZ6 | 18.2 | SW | GO Station - Scarborough | 3615 St Clair Ave E | Scarborough | 627 | 5.00% | 36 | 31 |
| CPZ7 | 17.6 | W | GO Station - Agincourt | 4100 Sheppard Ave E | Scarborough | 337 | 5.00% | 20 | 17 |
| CPZ7 | 18.9 | W | GO Station - Milliken | 39 Redlea Ave | Toronto | 661 | 5.00% | 38 | 33 |
| Various locations throughout the DPZ | | | | | | 21,494 | 22.4% | 4,851 | 4,214 |
| Various locations throughout the CPZ | | | | | | 136,426 | 22.4% | 30,778 | 26,756 |
| *Toronto DPZ Total:* | | | | | | *22,347* | - | *4,900* | *4,257* |
| *Toronto CPZ Total:* | | | | | | *139,977* | - | *30,983* | *26,933* |
| *Toronto Total:* | | | | | | *162,324* | - | *35,883* | *31,190* |
| **WHITBY, ONTARIO** | | | | | | | | | |
| CPZ2 | 12.2 | ENE | GO Station - Whitby | 1350 Brock St S | Whitby | 4,230 | 5.00% | 212 | 212 |
| Various locations throughout the DPZ | | | | | | 1,035 | 21.1% | 220 | 220 |
| Various locations throughout the CPZ | | | | | | 47,452 | 21.1% | 10,094 | 10,094 |
| *Whitby DPZ Total:* | | | | | | *1,035* | - | *220* | *220* |
| *Whitby CPZ Total:* | | | | | | *51,682* | - | *10,306* | *10,306* |
| *Whitby Total:* | | | | | | *52,717* | - | *10,526* | *10,526* |
| **DPZ TOTAL:** | | | | | | **115,201** | **-** | **19,918** | **19,275** |
| **CPZ TOTAL:** | | | | | | **298,391** | **-** | **69,000** | **62,118** |
| **TOTAL:** | | | | | | **413,592** | **-** | **88,918** | **81,393** |

**Table E-6. Beaches, Campgrounds and Parks within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| **MARKHAM, ONTARIO** | | | | | | | | |
| CPZ7 | 17.6 | WNW | Milne Dam Conservation Park | 8251 McCowan Rd | Markham | Park | 810 | 270 |
| CPZ7 | 19.8 | W | Milliken Mills Park | 4277 14th Ave | Markham | Park | 900 | 300 |
| CPZ7 | 21.3 | WNW | Berczy Park | 447 The Bridle Walk | Markham | Park | 240 | 120 |
| | | | | | | *Markham DPZ Total:* | *0* | *0* |
| | | | | | | *Markham CPZ Total:* | *1,950* | *690* |
| | | | | | | *Markham Total:* | *1,950* | *690* |
| **OSHAWA, ONTARIO** | | | | | | | | |
| CPZ2 | 16.4 | ENE | Lakefront Park West | 1221 Phillip Murray Ave | Oshawa | Park | 900 | 300 |
| CPZ2 | 16.7 | ENE | Civic Auditorium Complex | 99 Thornton Rd S | Oshawa | Park | 600 | 200 |
| CPZ2 | 20.2 | NE | Cedar Valley Conservation Area | 1510 Simcoe St N | Oshawa | Park | 50 | 25 |
| | | | | | | *Oshawa DPZ Total:* | *0* | *0* |
| | | | | | | *Oshawa CPZ Total:* | *1,550* | *525* |
| | | | | | | *Oshawa Total:* | *1,550* | *525* |
| **PICKERING, ONTARIO** | | | | | | | | |
| P2 | 0.9 | WNW | Beachfront Park / Millennium Square | 501 Liverpool Rd | Pickering | Park | 162 | 81 |
| CPZ1 | 16.4 | N | Claremont Field Centre | 4290 Westney Rd N | Goodwood | Park | 105 | 35 |
| | | | | | | *Pickering DPZ Total:* | *162* | *81* |
| | | | | | | *Pickering CPZ Total:* | *105* | *35* |
| | | | | | | *Pickering Subtotal:* | *267* | *116* |
| **TORONTO, ONTARIO** | | | | | | | | |
| P3 | 4.4 | WSW | Rouge Beach | 195 Rouge Hills Dr | Toronto | Beach | 312 | 156 |
| P18 | 5.6 | W | Glen Rouge Campground | 7450 Kingston Rd | Scarborough | Campground | 494 | 174 |
| P19 | 8.3 | W | Rouge Valley Conservation Centre | 1749 Meadowvale Rd | Scarborough | Park | 72 | 36 |
| CPZ6 | 16.1 | WSW | McCowan District Park | 150 McCowan Rd | Toronto | Park | 360 | 120 |
| CPZ6 | 16.3 | SW | Cathedral Bluffs Park | 24 Lyme Regis Cres | Scarborough | Park | 340 | 170 |
| CPZ6 | 19.0 | SW | Scarborough Heights Park | 27 Fishleigh Dr | Scarborough | Park | 100 | 50 |
| CPZ6 | 19.9 | SW | Harrison Estate Park | Springbank Ave | Scarborough | Park | 30 | 10 |
| CPZ6 | 20.2 | WSW | Ashtonbee Reservoir Park | 21 Ashtonbee Rd | Scarborough | Park | 200 | 100 |
| CPZ7 | 12.0 | W | Malvern Recreation Centre | 30 Sewells Rd | Scarborough | Park | 450 | 150 |
| CPZ7 | 16.5 | W | Milliken Park | 5555 Steeles Ave E | Scarborough | Park | 750 | 250 |
| CPZ7 | 16.8 | W | Agincourt Park | 27 Glen Watford Dr | Scarborough | Park | 240 | 120 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| | | | | | | *Toronto DPZ Total:* | *878* | *366* |
| | | | | | | *Toronto CPZ Total:* | *2,470* | *970* |
| | | | | | | *Toronto Total:* | *3,348* | *1,336* |
| **WHITBY, ONTARIO** | | | | | | | | |
| CPZ1 | 16.1 | NNE | Heber Down Conservation Area | 5000 Cochrane St | Whitby | Park | 90 | 30 |
| CPZ2 | 11.4 | ENE | Iroquois Beach | 731 Gordon St | Whitby | Beach | 210 | 70 |
| CPZ2 | 12.7 | ENE | Kiwanis Heydenshore Park | 589 Water St | Whitby | Beach | 165 | 55 |
| CPZ2 | 14.3 | NNE | Cullen Central Park | 300 Taunton Rd E | Whitby | Park | 500 | 250 |
| CPZ2 | 14.5 | ENE | Thickson's Woods Nature Reserve | Waterfront Trl | Whitby | Park | 75 | 25 |
| CPZ2 | 14.5 | ENE | Crystal Beach | 112 Crystal Beach Blvd | Whitby | Beach | 60 | 20 |
| | | | | | | *Whitby DPZ Total:* | *0* | *0* |
| | | | | | | *Whitby CPZ Total:* | *1,100* | *450* |
| | | | | | | *Whitby Total:* | *1,100* | *450* |
| | | | | | | **DPZ TOTAL:** | **1,040** | **447** |
| | | | | | | **CPZ TOTAL:** | **7,175** | **2,670** |
| | | | | | | **TOTAL:** | **8,215** | **3,117** |

**Table E-7. Golf Courses within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | |
| P9 | 6.4 | N | Riverside Golf Course | 837 Riverside Dr | Ajax | 30 | 15 |
| P21 | 11.8 | NNE | Deer Creek Golf & Banquet Facility | 2700 Audley Rd N | Ajax | 320 | 200 |
| P22 | 8.2 | ENE | Carruthers Creek Golf & Country Club | 650 Lake Ridge Rd S | Ajax | 510 | 204 |
| | | | | | *Ajax DPZ Total:* | *860* | *419* |
| | | | | | *Ajax CPZ Total:* | *0* | *0* |
| | | | | | *Ajax Total:* | *860* | *419* |
| **MARKHAM, ONTARIO** | | | | | | | |
| CPZ7 | 14.0 | WNW | Remington Parkview Golf and Country Club | 6400 Steeles Ave E | Markham | 550 | 275 |
| CPZ7 | 15.0 | WNW | Markham Green Golf Club | 120 Rouge Bank Dr | Markham | 72 | 36 |
| CPZ7 | 17.9 | WNW | Markham Executive Golf Course | 7892 McCowan Rd | Markham | 130 | 65 |
| CPZ8 | 19.3 | NW | Bushwood Golf Club | 10905 Reesor Rd | Markham | 200 | 100 |
| | | | | | *Markham DPZ Total:* | *0* | *0* |
| | | | | | *Markham CPZ Total:* | *952* | *476* |
| | | | | | *Markham Total:* | *952* | *476* |
| **OSHAWA, ONTARIO** | | | | | | | |
| CPZ2 | 18.2 | NE | Oshawa Airport Golf Club | 1145 Thornton Rd N | Oshawa | 170 | 85 |
| CPZ2 | 19.0 | NE | Oshawa Golf and Curling Club | 160 Alexandra St | Oshawa | 200 | 100 |
| | | | | | *Oshawa DPZ Total:* | *0* | *0* |
| | | | | | *Oshawa CPZ Total:* | *370* | *185* |
| | | | | | *Oshawa Total:* | *370* | *185* |
| **PICKERING, ONTARIO** | | | | | | | |
| P20 | 9.9 | NW | Whitevale Golf Club | 2985 Golf Club Rd | Whitevale | 76 | 39 |
| P21 | 8.0 | N | Pickering Golf Club | 2575 William Jackson Dr | Pickering | 201 | 103 |
| CPZ1 | 12.8 | N | Hawthorne Valley Golf Course | 3470 Salem Rd Pickering | Pickering | 100 | 50 |
| CPZ1 | 15.0 | N | Cherry Downs Golf Club | 2110 Concession Rd 7 | Pickering | 270 | 135 |
| CPZ1 | 17.0 | NNW | 4 Seasons Country Club | RR #5 Concession 8 #1900 | Claremont | 200 | 125 |
| CPZ1 | 17.1 | N | Watson's Glen Golf Club | 3430 Concession Rd 7 | Pickering | 144 | 125 |
| CPZ1 | 19.0 | N | Spring Creek Golf Club | 2425 Concession Rd 9 | Claremont | 80 | 35 |
| CPZ8 | 15.7 | NW | Glen Cedars | 230 Seventh Concession | Pickering | 170 | 85 |
| | | | | | *Pickering DPZ Total:* | *277* | *142* |
| | | | | | *Pickering CPZ Total:* | *964* | *555* |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| | | | | | *Pickering Total:* | *1,241* | *697* |
| **TORONTO, ONTARIO** | | | | | | | |
| CPZ6 | 12.9 | WSW | Scarboro Golf and Country Club | 321 Scarborough Golf Club Rd | Scarborough | 144 | 72 |
| CPZ7 | 13.2 | WNW | Cedar Brae Golf Club | 55 Mac Frost Way | Scarborough | 450 | 225 |
| CPZ7 | 18.8 | W | Tam O'Shanter Golf Course | 2481 Birchmount Rd | Scarborough | 246 | 123 |
| | | | | | *Toronto DPZ Total:* | *0* | *0* |
| | | | | | *Toronto CPZ Total:* | *840* | *420* |
| | | | | | *Toronto Total:* | *840* | *420* |
| **WHITBY, ONTARIO** | | | | | | | |
| CPZ1 | 16.2 | NNE | Devil's Den Golf & Beach Volleyball Centre | 745 Winchester Rd W | Whitby | 120 | 60 |
| CPZ1 | 18.6 | NNE | Lakeridge Links Golf Club | 1355 Brawley Rd | Brooklin | 180 | 90 |
| CPZ2 | 16.4 | NNE | Lyndebrook Golf Course | 5055 Baldwin St S | Brooklin | 90 | 45 |
| CPZ2 | 19.6 | NNE | Eldorado Golf Club | 615 Winchester Rd E | Whitby | 60 | 45 |
| CPZ2 | 20.2 | NNE | Winchester Golf Club | 750 Winchester Rd E | Whitby | 150 | 75 |
| | | | | | *Whitby DPZ Total:* | *0* | *0* |
| | | | | | *Whitby CPZ Total:* | *600* | *315* |
| | | | | | *Whitby Total:* | *600* | *315* |
| | | | | | **DPZ TOTAL:** | **1,137** | **561** |
| | | | | | **CPZ TOTAL:** | **3,726** | **1,951** |
| | | | | | **TOTAL:** | **4,863** | **2,512** |

**Table E-8. Historic Sites and Museums within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| **MARKHAM, ONTARIO** | | | | | | | | |
| CPZ8 | 18.4 | WNW | Markham Museum | 9350 Markham Rd | Markham | Museum | 1,301 | 450 |
| | | | | | | *Markham DPZ Total:* | *0* | *0* |
| | | | | | | *Markham CPZ Total:* | *1,301* | *450* |
| | | | | | | *Markham Total:* | *1,301* | *450* |
| **OSHAWA, ONTARIO** | | | | | | | | |
| CPZ2 | 18.3 | NE | Ontario Regiment Museum | 1000 Stevenson Rd N | Oshawa | Museum | 75 | 25 |
| CPZ2 | 18.9 | ENE | The Robert McLaughlin Gallery | 72 Queen St | Oshawa | Museum | 270 | 90 |
| CPZ2 | 19.1 | ENE | Canadian Automotive Museum | 99 Simcoe St S | Oshawa | Museum | 150 | 50 |
| CPZ2 | 19.3 | NE | Parkwood Estate | 270 Simcoe St N | Oshawa | Museum | 200 | 67 |
| CPZ2 | 20.3 | ENE | Oshawa Museum | 1450 Simcoe St S | Oshawa | Museum | 140 | 50 |
| | | | | | | *Oshawa DPZ Total:* | *0* | *0* |
| | | | | | | *Oshawa CPZ Total:* | *835* | *282* |
| | | | | | | *Oshawa Total:* | *835* | *282* |
| **PICKERING, ONTARIO** | | | | | | | | |
| CPZ1 | 12.5 | NNW | Bentley House | - | Pickering | Historic Site | 75 | 25 |
| CPZ1 | 12.8 | N | Pickering Museum Village | 2365 Concession Rd 6 | Greenwood | Museum | 60 | 20 |
| CPZ1 | 14.8 | NNW | Thistle Ha' Farm | Concession Rd 7 | Pickering | Historic Site | 45 | 15 |
| | | | | | | *Pickering DPZ Total:* | *0* | *0* |
| | | | | | | *Pickering CPZ Total:* | *180* | *60* |
| | | | | | | *Pickering Subtotal:* | *180* | *60* |
| **TORONTO, ONTARIO** | | | | | | | | |
| CPZ6 | 14.4 | WSW | Taber Hill | Indian Mound Cres | Toronto | Historic Site | 43 | 15 |
| CPZ6 | 16.1 | WSW | Scarborough Museum | 1007 Brimley Rd | Scarborough | Museum | 130 | 45 |
| CPZ7 | 15.2 | W | Sujey Saree Museum | 5215 Finch Ave E | Scarborough | Museum | 477 | 165 |
| CPZ7 | 15.8 | W | Islamic Museum | 328 Passmore Ave | Scarborough | Museum | 1,517 | 525 |
| | | | | | | *Toronto DPZ Total:* | *0* | *0* |
| | | | | | | *Toronto CPZ Total:* | *2,167* | *750* |
| | | | | | | *Toronto Total:* | *2,167* | *750* |
| **WHITBY, ONTARIO** | | | | | | | | |
| CPZ2 | 12.5 | NE | Lynde House Museum | 900 Brock St S | Whitby | Museum | 75 | 25 |
| CPZ2 | 12.9 | NE | Whitby Cenotaph | 109 Dundas St E | Whitby | Museum | 60 | 20 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| CPZ2 | 13.6 | ENE | Thomas House of Music | 1001 Burns St E | Whitby | Museum | 150 | 50 |
| CPZ2 | 18.1 | NNE | Kent Mills Heritage Site | - | Whitby | Historic Site | 15 | 5 |
| | | | | | | *Whitby DPZ Total:* | *0* | *0* |
| | | | | | | *Whitby CPZ Total:* | *300* | *100* |
| | | | | | | *Whitby Total:* | *300* | *100* |
| | | | | | | **DPZ TOTAL:** | **0** | **0** |
| | | | | | | **CPZ TOTAL:** | **4,783** | **1,642** |
| | | | | | | **TOTAL:** | **4,783** | **1,642** |

**Table E-9. Marinas and Other Recreational Areas within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | | |
| P22 | 8.7 | NE | OLG Slots at Ajax Downs | 50 Alexanders Crossing | Ajax | Other, Not Listed | 1,156 | 578 |
| | | | | | | *Ajax DPZ Total:* | *1,156* | *578* |
| | | | | | | *Ajax CPZ Total:* | *0* | *0* |
| | | | | | | *Ajax Total:* | *1,156* | *578* |
| **OSHAWA, ONTARIO** | | | | | | | | |
| CPZ2 | 16.0 | ENE | Canlan Sports | 1401 Phillip Murray Ave | Oshawa | Other, Not Listed | 750 | 250 |
| CPZ2 | 16.3 | ENE | Tosca Banquet Hall | 800 Champlain Ave | Oshawa | Other, Not Listed | 750 | 250 |
| CPZ2 | 18.7 | ENE | Kinsmen Civic Memorial Stadium | 89 Arena St | Oshawa | Other, Not Listed | 225 | 75 |
| CPZ2 | 19.0 | ENE | LVIV Hall | 38 Lviv Blvd | Oshawa | Other, Not Listed | 375 | 125 |
| CPZ2 | 19.4 | ENE | Tribute Communities Centre | 99 Athol St E | Oshawa | Other, Not Listed | 5,500 | 1,833 |
| CPZ2 | 19.5 | NE | Polish Veteran's - Sikorski Hall | 1551 Stevenson Rd N | Oshawa | Other, Not Listed | 565 | 188 |
| CPZ2 | 20.0 | ENE | Oshawa Curling Club | 226 Bond St E | Oshawa | Other, Not Listed | 250 | 125 |
| | | | | | | *Oshawa DPZ Total:* | *0* | *0* |
| | | | | | | *Oshawa CPZ Total:* | *8,415* | *2,846* |
| | | | | | | *Oshawa Total:* | *8,415* | *2,846* |
| **PICKERING, ONTARIO** | | | | | | | | |
| P2 | 4.0 | NNE | Pickering Casino Resort | 888 Durham Live Ave | Pickering | Other, Not Listed | 5,761 | 3,575 |
| CPZ1 | 12.9 | NNE | Holiday Gardens | - | Pickering | Other, Not Listed | 212 | 71 |
| CPZ1 | 14.1 | N | Pickering Horse Centre Ltd. | 3800 Paddock Rd | Claremont | Other, Not Listed | 105 | 35 |
| CPZ1 | 18.9 | N | Native Plants in Claremont | 4965 Westney Rd N | Claremont | Other, Not Listed | 30 | 10 |
| CPZ8 | 12.7 | NNW | High Perspective Hang Gliding & Paragliding School | 1150 ON-7 | Locust Hill | Other, Not Listed | 30 | 10 |
| | | | | | | *Pickering DPZ Total:* | *5,761* | *3,575* |
| | | | | | | *Pickering CPZ Total:* | *377* | *126* |
| | | | | | | *Pickering Total:* | *6,138* | *3,701* |
| **TORONTO, ONTARIO** | | | | | | | | |
| P19 | 8.9 | W | Toronto Zoo | 361 Old Finch Ave | Scarborough | Other, Not Listed | 10,295 | 2,500 |
| CPZ6 | 17.0 | SW | Scarborough Bluffs Sailing Club | 2975 Kingston Rd | Scarborough | Marina | 300 | 150 |
| CPZ6 | 17.2 | SW | Highland Yacht Club | 5 Bluffers Park | Scarborough | Marina | 132 | 66 |
| CPZ6 | 17.4 | SW | Bluffer's Park Marina | 7 Brimley Rd S | Scarborough | Marina | 1,600 | 800 |
| CPZ7 | 13.2 | W | Scarborough Convention Centre | 20 Torham Pl | Scarborough | Other, Not Listed | 1,500 | 1,339 |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Category | Transients | Vehicles |
|---|---|---|---|---|---|---|---|---|
| CPZ7 | 14.0 | WSW | Centennial Arena | 1967 Ellesmere Rd | Scarborough | Other, Not Listed | 578 | 200 |
| CPZ7 | 14.5 | W | Markham Convention Centre | 2901 Markham Rd | Toronto | Other, Not Listed | 900 | 200 |
| CPZ7 | 16.9 | W | Agincourt Recreation Centre | 31 Glen Watford Dr | Scarborough | Other, Not Listed | 1,156 | 400 |
| | | | | | | *Toronto DPZ Total:* | *10,295* | *2,500* |
| | | | | | | *Toronto CPZ Total:* | *6,166* | *3,155* |
| | | | | | | *Toronto Total:* | *16,461* | *5,655* |
| **WHITBY, ONTARIO** | | | | | | | | |
| CPZ2 | 11.6 | ENE | The Whitby Yacht Club Sailing School | 701 Gordon St | Whitby | Marina | 210 | 70 |
| CPZ2 | 11.7 | ENE | Iroquois Park Sports Centre | 500 Victoria St W | Whitby | Other, Not Listed | 1,500 | 500 |
| CPZ2 | 11.8 | ENE | Port Whitby Marina | 301 Watson St W | Whitby | Marina | 480 | 160 |
| CPZ2 | 12.7 | NE | The Centennial Building | 416 Centre St S | Whitby | Other, Not Listed | 63 | 21 |
| CPZ2 | 15.4 | NE | McKinney Centre | 222 McKinney Dr | Whitby | Other, Not Listed | 300 | 100 |
| CPZ2 | 18.5 | NNE | Luther Vipond Brooklin Memorial Arena | 67 Winchester Rd | Whitby | Other, Not Listed | 150 | 50 |
| | | | | | | *Whitby DPZ Total:* | *0* | *0* |
| | | | | | | *Whitby CPZ Total:* | *2,703* | *901* |
| | | | | | | *Whitby Total:* | *2,703* | *901* |
| | | | | | | **DPZ TOTAL:** | **17,212** | **6,653** |
| | | | | | | **CPZ TOTAL:** | **17,661** | **7,028** |
| | | | | | | **TOTAL:** | **34,873** | **13,681** |

**Table E-10. Lodging Facilities within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | | |
| P12 | 4.5 | NNE | Super 8 - Ajax | 210 Westney Rd S | Ajax | 185 | 64 |
| P22 | 7.1 | NE | Hilton Garden Inn | 500 Beck Cres | Ajax | 376 | 130 |
| P22 | 7.2 | NE | Homewood Suites | 600 Beck Cres | Ajax | 324 | 112 |
| | | | | | *Ajax DPZ Total:* | *885* | *306* |
| | | | | | *Ajax CPZ Total:* | *0* | *0* |
| | | | | | *Ajax Total:* | *885* | *306* |
| **MARKHAM, ONTARIO** | | | | | | | |
| CPZ7 | 18.3 | WNW | Wade's Place Bed & Breakfast | 7 Beck Dr | Markham | 6 | 2 |
| CPZ8 | 19.5 | WNW | Detached house with 5 bedrooms at Markham | 12 Hollyhock St | Markham | 14 | 5 |
| | | | | | *Markham DPZ Total:* | *0* | *0* |
| | | | | | *Markham CPZ Total:* | *20* | *7* |
| | | | | | *Markham Total:* | *20* | *7* |
| **OSHAWA, ONTARIO** | | | | | | | |
| CPZ2 | 16.0 | ENE | Travelodge by Wyndham Oshawa Whitby | 940 Champlain Ave | Oshawa | 300 | 100 |
| CPZ2 | 16.9 | ENE | Comfort Inn | 605 Bloor St W | Oshawa | 308 | 77 |
| CPZ2 | 17.0 | ENE | Best Western Plus Durham Hotel & Conference Centre | 559 Bloor St W | Oshawa | 450 | 150 |
| CPZ2 | 17.0 | ENE | Waverly House Bed & Breakfast | 235 Waverly St S | Oshawa | 24 | 8 |
| CPZ2 | 17.6 | NE | Emerson Manor | 132 Stevenson Rd N | Oshawa | 12 | 3 |
| CPZ2 | 18.2 | ENE | Bloor Bed & Breakfast | 220 Bloor St W | Oshawa | 15 | 5 |
| CPZ2 | 18.9 | ENE | Street Side Inn | 394 Simcoe St S | Oshawa | 120 | 40 |
| CPZ2 | 19.2 | ENE | Holiday Inn Express & Suites Oshawa Downtown - Toronto Area | 67 Simcoe St N | Oshawa | 105 | 35 |
| CPZ2 | 19.4 | ENE | La Quinta Inn & Suites Oshawa | 63 King St E | Oshawa | 236 | 59 |
| CPZ2 | 19.5 | ENE | A Cloverleaf Motel | 214 Toronto Ave | Oshawa | 75 | 25 |
| | | | | | *Oshawa DPZ Total:* | *0* | *0* |
| | | | | | *Oshawa CPZ Total:* | *1,645* | *502* |
| | | | | | *Oshawa Total:* | *1,645* | *502* |
| **PICKERING, ONTARIO** | | | | | | | |
| P4 | 4.4 | W | Comfort Inn | 533 Kingston Rd | Pickering | 393 | 136 |
| | | | | | *Pickering DPZ Total:* | *393* | *136* |
| | | | | | *Pickering CPZ Total:* | *0* | *0* |
| | | | | | *Pickering Total:* | *393* | *136* |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| **TORONTO, ONTARIO** | | | | | | | |
| P17 | 9.3 | WSW | Lido Motel | 4674 Kingston Rd | Toronto | 223 | 77 |
| CPZ6 | 11.7 | WSW | Idlewood Inn | 4212 Kingston Rd | Scarborough | 116 | 40 |
| CPZ6 | 15.1 | SW | Super 8 Toronto East ON | 3280 Kingston Rd | Scarborough | 145 | 50 |
| CPZ6 | 16.9 | SW | Henry's Motel | 2785 Kingston Rd | Scarborough | 188 | 65 |
| CPZ6 | 17.0 | SW | Americana Motel | 2757 Kingston Rd | Scarborough | 29 | 10 |
| CPZ6 | 17.1 | SW | Hav-A-Nap Motel | 2733 Kingston Rd | Scarborough | 46 | 16 |
| CPZ6 | 17.1 | SW | Manor Motel | 2740 Kingston Rd | Scarborough | 116 | 40 |
| CPZ6 | 19.1 | SW | Days Inn by Wyndham Toronto East Lakeview | 2151 Kingston Rd | Scarborough | 176 | 61 |
| CPZ7 | 13.7 | WSW | Travelodge by Wyndham Toronto East | 20 Milner Business Ct | Scarborough | 428 | 148 |
| CPZ7 | 13.8 | WSW | Holiday Inn Express Toronto East | 50 Estate Dr | Scarborough | 405 | 140 |
| CPZ7 | 13.9 | WSW | Best Western Plus Executive Inn | 38 Estate Dr | Toronto | 318 | 110 |
| CPZ7 | 17.1 | W | Lucky Cabin Scarborough | 73 Shellamwood Trl | Scarborough | 14 | 5 |
| CPZ7 | 17.5 | WSW | Solaris 2 | 135 Village Green Square | Scarborough | 1,445 | 500 |
| CPZ7 | 17.5 | W | Midland Homestay | 5 Emmeline Cres | Scarborough | 14 | 5 |
| CPZ7 | 17.6 | WSW | Delta Hotels by Marriott Toronto East | 2035 Kennedy Rd | Scarborough | 1,072 | 371 |
| CPZ7 | 18.0 | W | Pacific Mall Homestay | 2 Lantern Ct | Scarborough | 14 | 5 |
| CPZ7 | 19.2 | WSW | Knights Inn Toronto East | 22 Metropolitan Rd | Toronto | 578 | 200 |
| | | | | | *Toronto DPZ Total:* | *223* | *77* |
| | | | | | *Toronto CPZ Total:* | *5,104* | *1,766* |
| | | | | | *Toronto Total:* | *5,327* | *1,843* |
| **WHITBY, ONTARIO** | | | | | | | |
| CPZ1 | 21.2 | NNE | Bon-Voyage Motel | 7645 Baldwin St N | Whitby | 17 | 6 |
| CPZ2 | 12.7 | ENE | Holiday Inn Express Whitby Oshawa | 180 Consumers Dr | Whitby | 345 | 115 |
| CPZ2 | 12.8 | ENE | Motel 6 Toronto East - Whitby | 165 Consumers Dr | Whitby | 450 | 150 |
| CPZ2 | 12.8 | NE | Lucien Motel | 134 Byron St N | Whitby | 150 | 50 |
| CPZ2 | 12.9 | ENE | Residence Inn by Marriott Whitby | 160 Consumers Dr | Whitby | 525 | 175 |
| CPZ2 | 15.5 | ENE | Quality Suites | 1700 Champlain Ave | Whitby | 405 | 135 |
| CPZ2 | 20.2 | NE | Residence & Conference Centre - Oshawa | 32 Commencement Dr | Oshawa | 991 | 354 |
| | | | | | *Whitby DPZ Total:* | *0* | *0* |
| | | | | | *Whitby CPZ Total:* | *2,883* | *985* |
| | | | | | *Whitby Total:* | *2,883* | *985* |
| | | | | | **DPZ TOTAL:** | **1,501** | **519** |

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Transients | Vehicles |
|---|---|---|---|---|---|---|---|
| | | | | | **CPZ TOTAL:** | **9,652** | **3,260** |
| | | | | | **TOTAL:** | **11,153** | **3,779** |

**Table E-11. Correctional Facilities within the PNGS PZs**

| Response Sector | Distance (km) | Direc-tion | Facility Name | Street Address | Municipality | Capa-city |
|---|---|---|---|---|---|---|
| **AJAX, ONTARIO** | | | | | | |
| P2 | 3.1 | NE | Kennedy Detention Centre | 740 Church St S | Ajax | 12 |
| | | | | | *Ajax DPZ Total:* | *12* |
| | | | | | *Ajax CPZ Total:* | *0* |
| | | | | | *Ajax Total:* | *12* |
| **TORONTO, ONTARIO** | | | | | | |
| CPZ6 | 19.4 | WSW | Toronto East Detention Centre | 55 Civic Rd | Scarborough | 473 |
| | | | | | *Toronto DPZ Total:* | *0* |
| | | | | | *Toronto CPZ Total:* | *473* |
| | | | | | *Toronto Total:* | *473* |
| | | | | | **DPZ TOTAL:** | **12** |
| | | | | | **CPZ TOTAL:** | **473** |
| | | | | | **TOTAL:** | **485** |

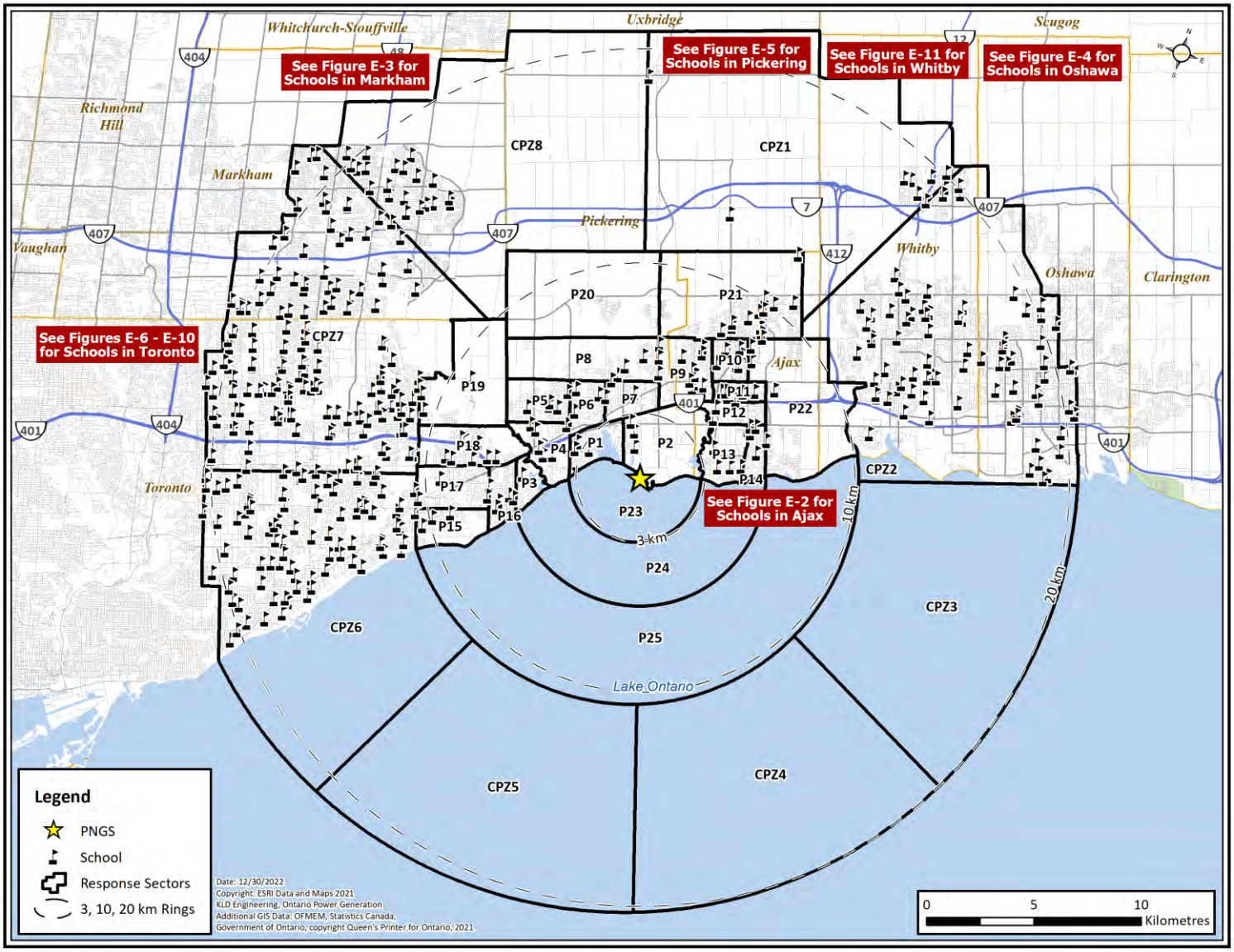
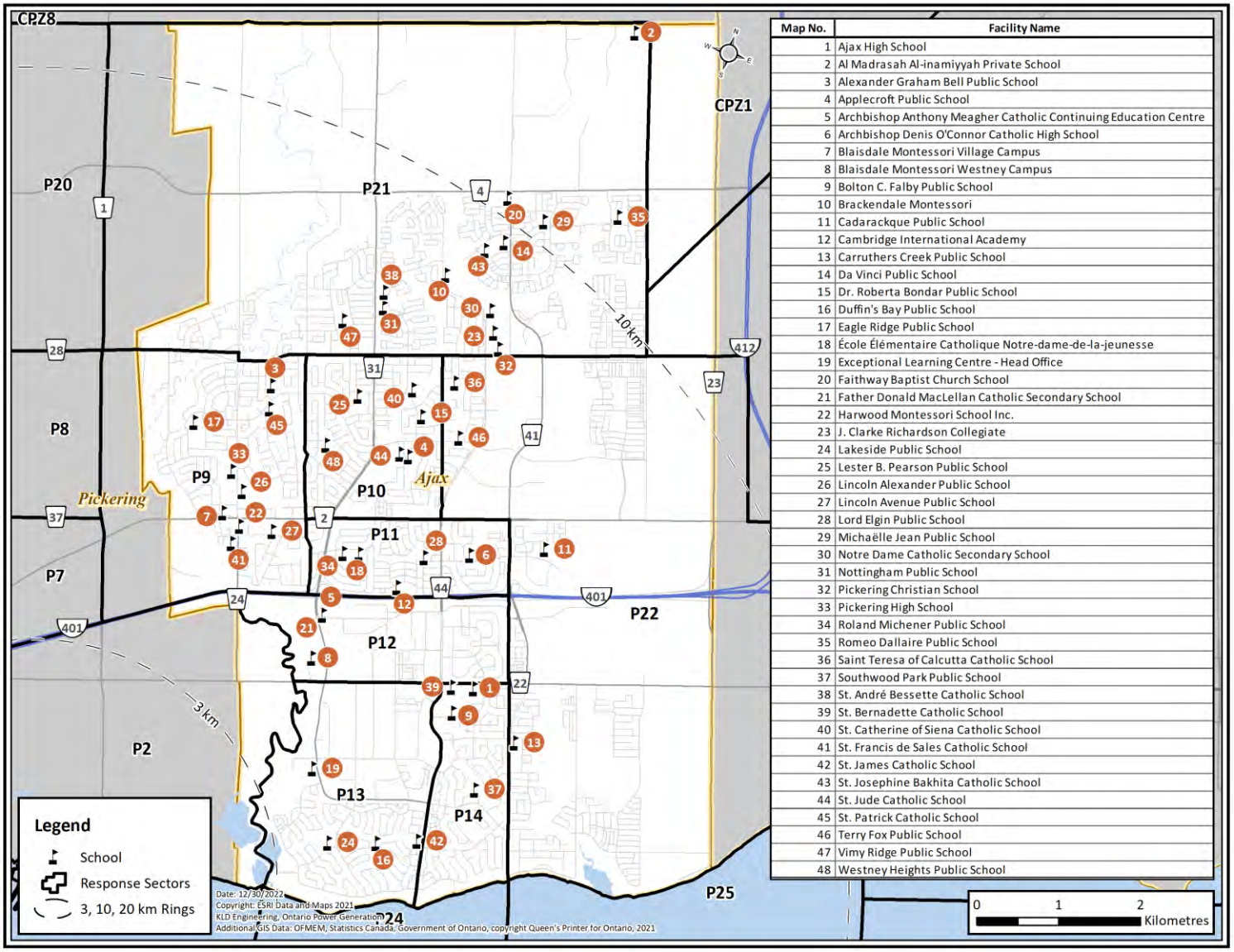
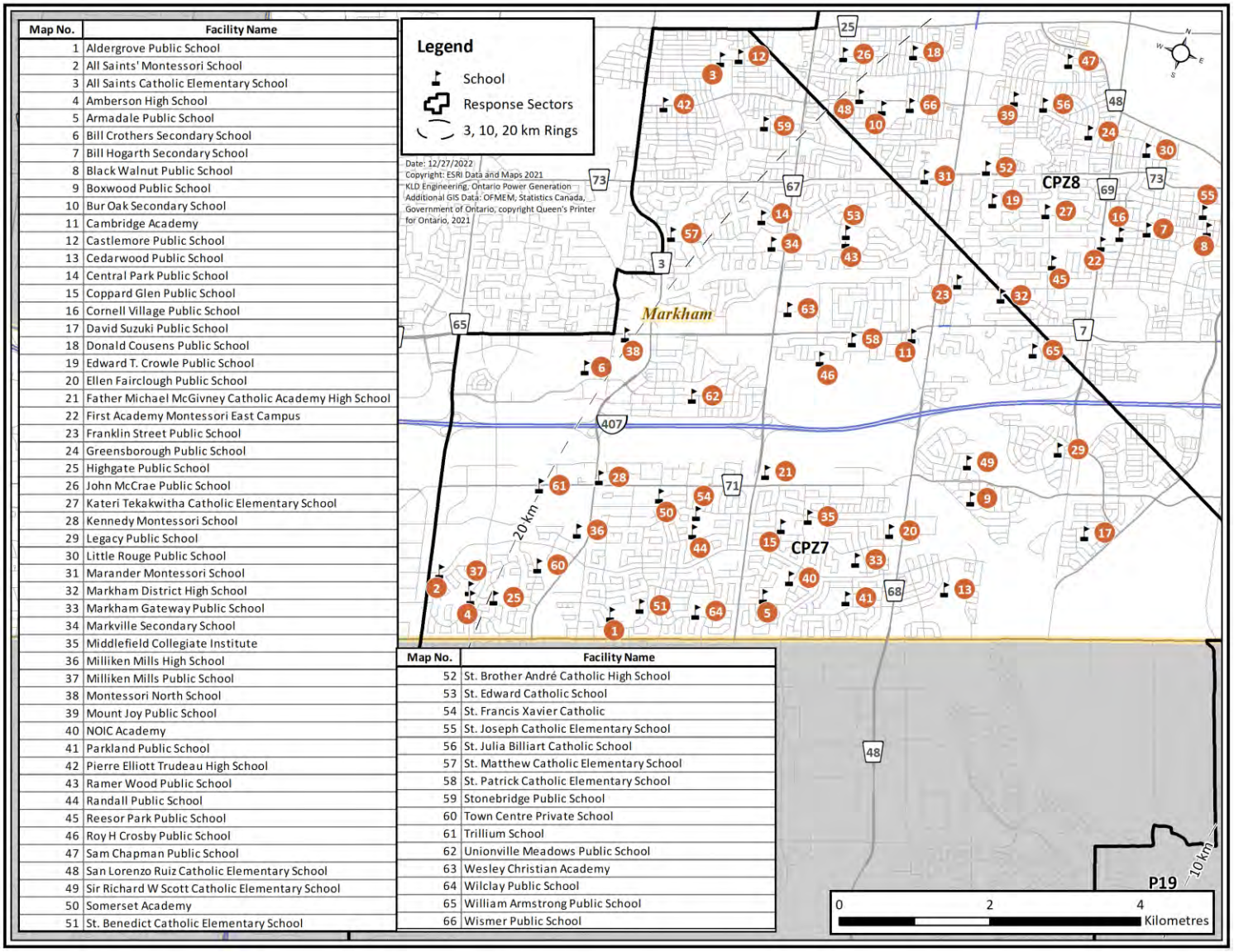



**Figure E-1. Schools within the PNGS PZ – Overview**




| Map No. | Facility Name |
|---|---|
| 1 | Ajax High School |
| 2 | Al Madrasah Al-inamiyyah Private School |
| 3 | Alexander Graham Bell Public School |
| 4 | Applecroft Public School |
| 5 | Archbishop Anthony Meagher Catholic Continuing Education Centre |
| 6 | Archbishop Denis O'Connor Catholic High School |
| 7 | Blaisdale Montessori Village Campus |
| 8 | Blaisdale Montessori Westney Campus |
| 9 | Bolton C. Falby Public School |
| 10 | Brackendale Montessori |
| 11 | Cadarackque Public School |
| 12 | Cambridge International Academy |
| 13 | Carruthers Creek Public School |
| 14 | Da Vinci Public School |
| 15 | Dr. Roberta Bondar Public School |
| 16 | Duffin's Bay Public School |
| 17 | Eagle Ridge Public School |
| 18 | École Élémentaire Catholique Notre-dame-de-la-jeunesse |
| 19 | Exceptional Learning Centre - Head Office |
| 20 | Faithway Baptist Church School |
| 21 | Father Donald MacLellan Catholic Secondary School |
| 22 | Harwood Montessori School Inc. |
| 23 | J. Clarke Richardson Collegiate |
| 24 | Lakeside Public School |
| 25 | Lester B. Pearson Public School |
| 26 | Lincoln Alexander Public School |
| 27 | Lincoln Avenue Public School |
| 28 | Lord Elgin Public School |
| 29 | Michaëlle Jean Public School |
| 30 | Notre Dame Catholic Secondary School |
| 31 | Nottingham Public School |
| 32 | Pickering Christian School |
| 33 | Pickering High School |
| 34 | Roland Michener Public School |
| 35 | Romeo Dallaire Public School |
| 36 | Saint Teresa of Calcutta Catholic School |
| 37 | Southwood Park Public School |
| 38 | St. André Bessette Catholic School |
| 39 | St. Bernadette Catholic School |
| 40 | St. Catherine of Siena Catholic School |
| 41 | St. Francis de Sales Catholic School |
| 42 | St. James Catholic School |
| 43 | St. Josephine Bakhita Catholic School |
| 44 | St. Jude Catholic School |
| 45 | St. Patrick Catholic School |
| 46 | Terry Fox Public School |
| 47 | Vimy Ridge Public School |
| 48 | Westney Heights Public School |

**Figure E-2. Schools within the Ajax Portion of the PNGS PZ**




| Map No. | Facility Name |
|---|---|
| 1 | Aldergrove Public School |
| 2 | All Saints' Montessori School |
| 3 | All Saints Catholic Elementary School |
| 4 | Amberson High School |
| 5 | Armadale Public School |
| 6 | Bill Crothers Secondary School |
| 7 | Bill Hogarth Secondary School |
| 8 | Black Walnut Public School |
| 9 | Boxwood Public School |
| 10 | Bur Oak Secondary School |
| 11 | Cambridge Academy |
| 12 | Castlemore Public School |
| 13 | Cedarwood Public School |
| 14 | Central Park Public School |
| 15 | Coppard Glen Public School |
| 16 | Cornell Village Public School |
| 17 | David Suzuki Public School |
| 18 | Donald Cousens Public School |
| 19 | Edward T. Crowle Public School |
| 20 | Ellen Fairclough Public School |
| 21 | Father Michael McGivney Catholic Academy High School |
| 22 | First Academy Montessori East Campus |
| 23 | Franklin Street Public School |
| 24 | Greensborough Public School |
| 25 | Highgate Public School |
| 26 | John McCrae Public School |
| 27 | Kateri Tekakwitha Catholic Elementary School |
| 28 | Kennedy Montessori School |
| 29 | Legacy Public School |
| 30 | Little Rouge Public School |
| 31 | Marander Montessori School |
| 32 | Markham District High School |
| 33 | Markham Gateway Public School |
| 34 | Markville Secondary School |
| 35 | Middlefield Collegiate Institute |
| 36 | Milliken Mills High School |
| 37 | Milliken Mills Public School |
| 38 | Montessori North School |
| 39 | Mount Joy Public School |
| 40 | NOIC Academy |
| 41 | Parkland Public School |
| 42 | Pierre Elliott Trudeau High School |
| 43 | Ramer Wood Public School |
| 44 | Randall Public School |
| 45 | Reesor Park Public School |
| 46 | Roy H Crosby Public School |
| 47 | Sam Chapman Public School |
| 48 | San Lorenzo Ruiz Catholic Elementary School |
| 49 | Sir Richard W Scott Catholic Elementary School |
| 50 | Somerset Academy |
| 51 | St. Benedict Catholic Elementary School |

| Map No. | Facility Name |
|---|---|
| 52 | St. Brother André Catholic High School |
| 53 | St. Edward Catholic School |
| 54 | St. Francis Xavier Catholic |
| 55 | St. Joseph Catholic Elementary School |
| 56 | St. Julia Billiart Catholic School |
| 57 | St. Matthew Catholic Elementary School |
| 58 | St. Patrick Catholic Elementary School |
| 59 | Stonebridge Public School |
| 60 | Town Centre Private School |
| 61 | Trillium School |
| 62 | Unionville Meadows Public School |
| 63 | Wesley Christian Academy |
| 64 | Wilclay Public School |
| 65 | William Armstrong Public School |
| 66 | Wismer Public School |

**Figure E-3. Schools within the Markham Portion of the PNGS PZ**

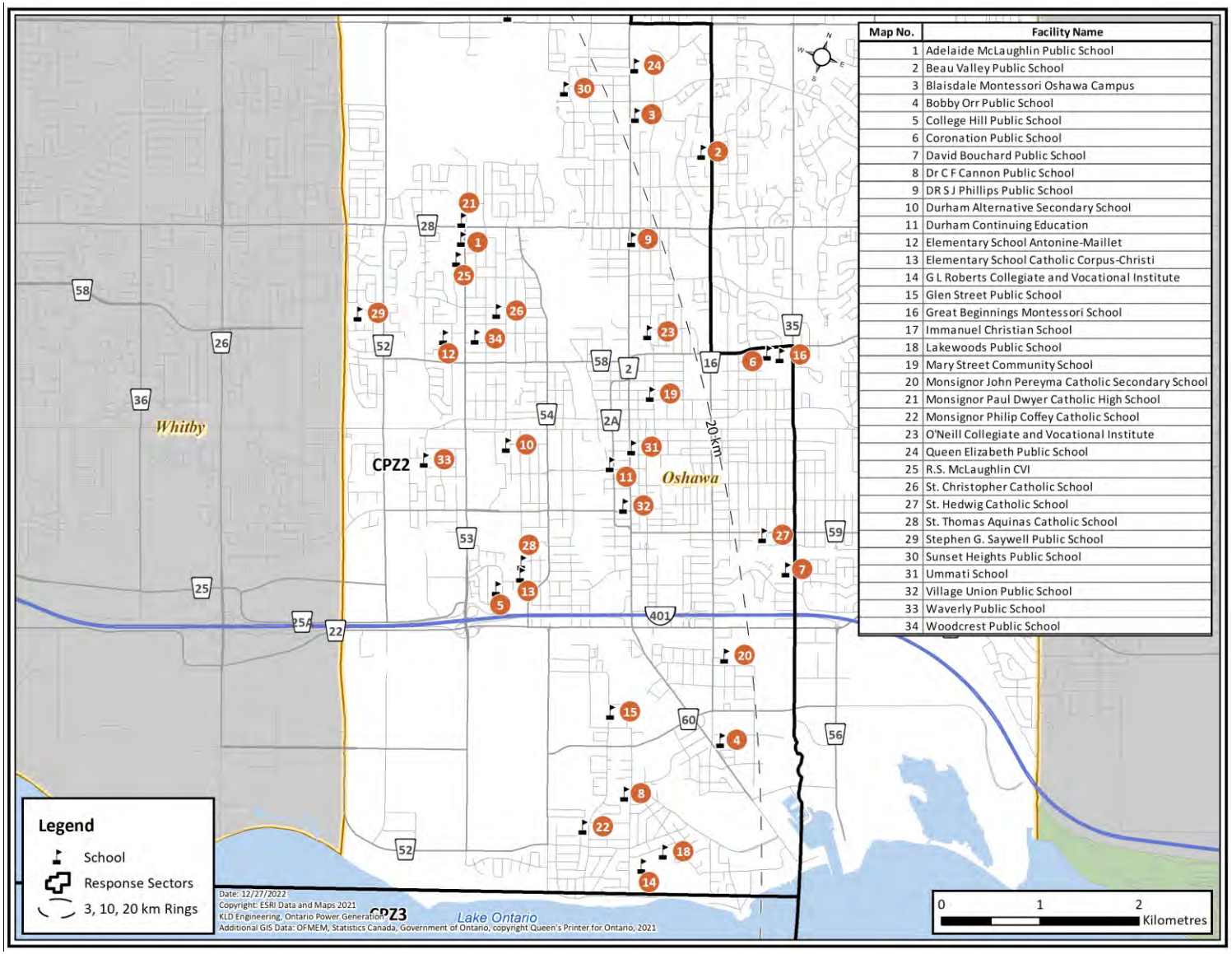



**Figure E-4. Schools within the Oshawa Portion of the PNGS PZ**

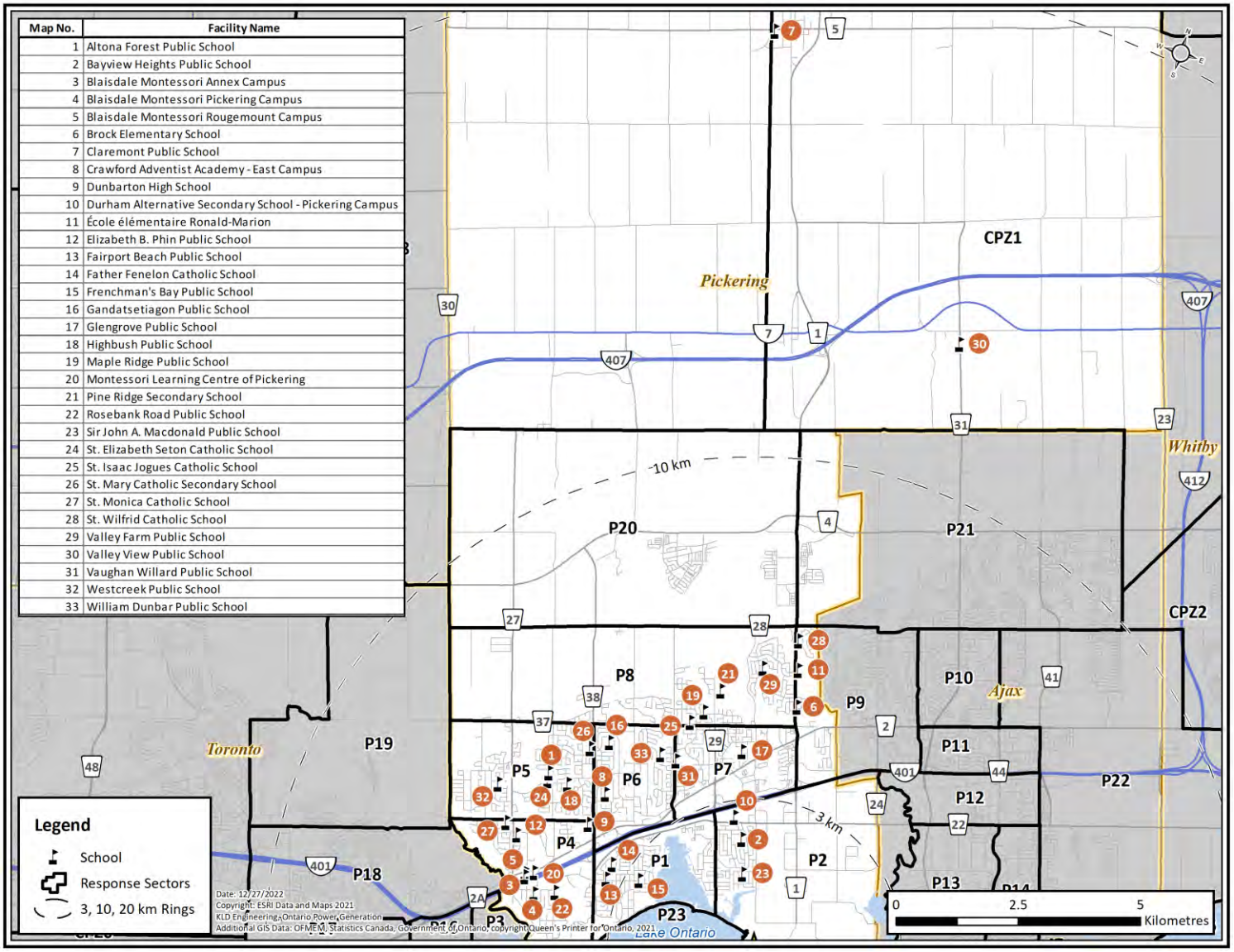



**Figure E-5. Schools within the Pickering Portion of the PNGS PZ**

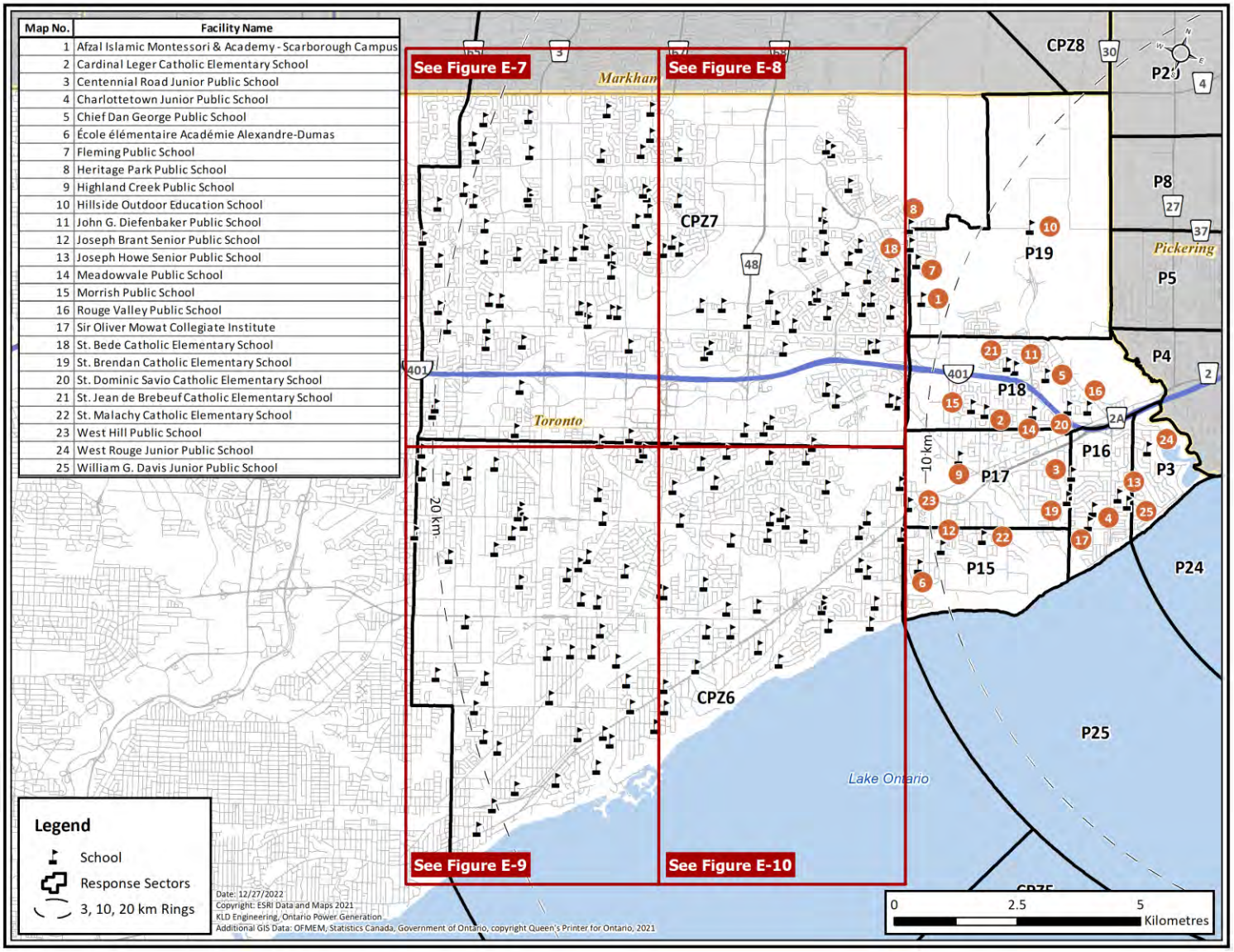



**Figure E-6. Schools within the Toronto Portion of the PNGS PZ (1 of 5)**

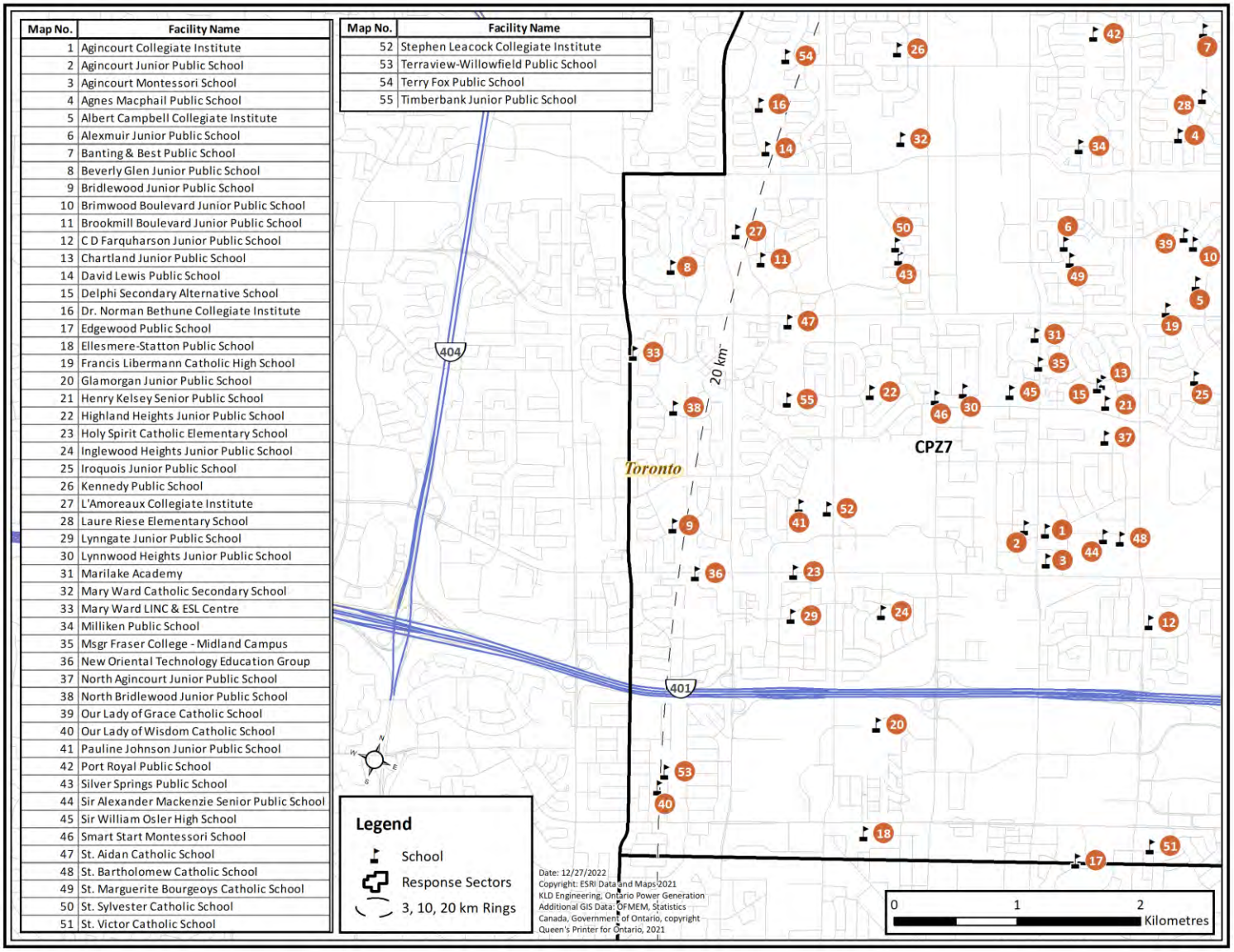



**Figure E-7. Schools within the Toronto Portion of the PNGS PZ (2 of 5)**

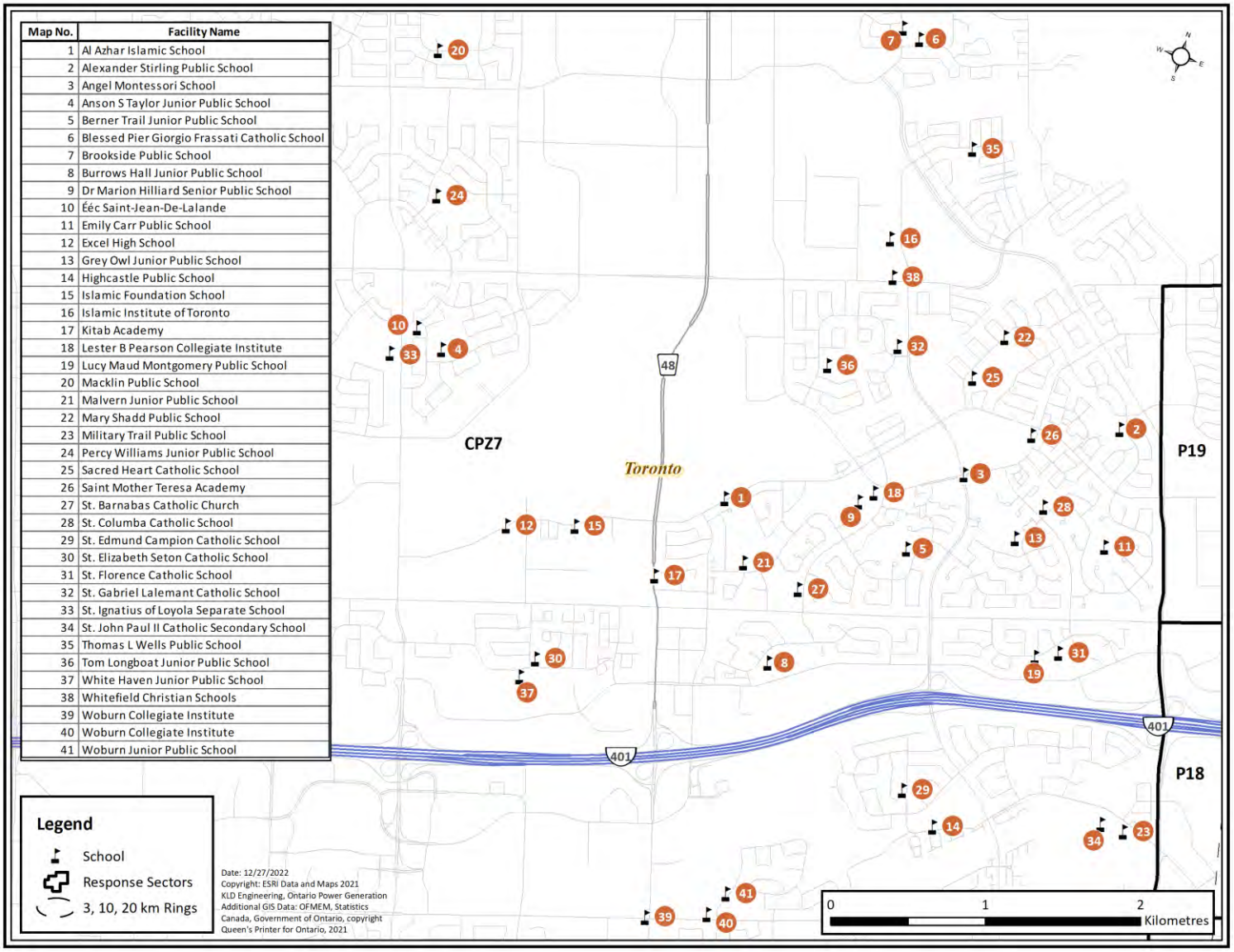
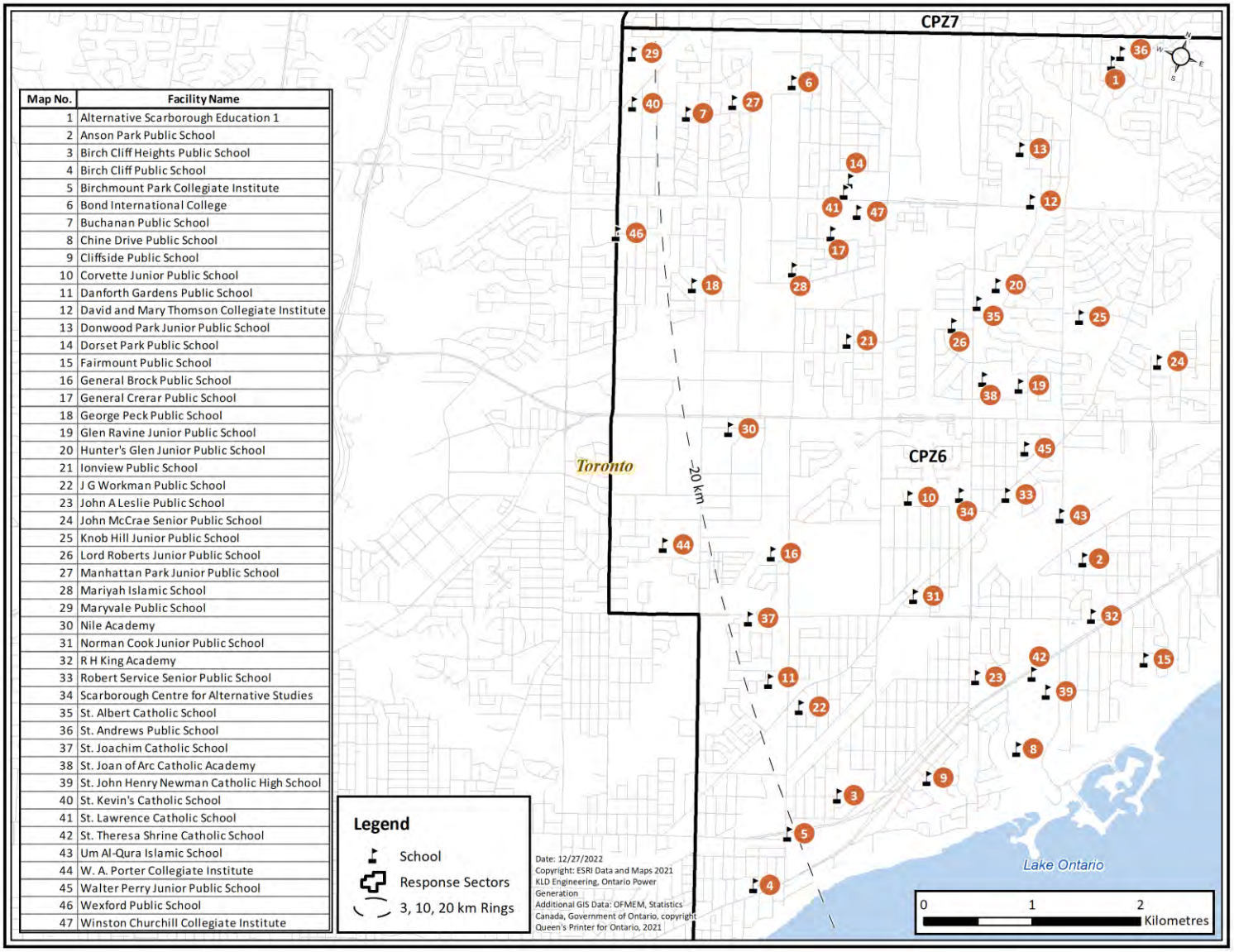
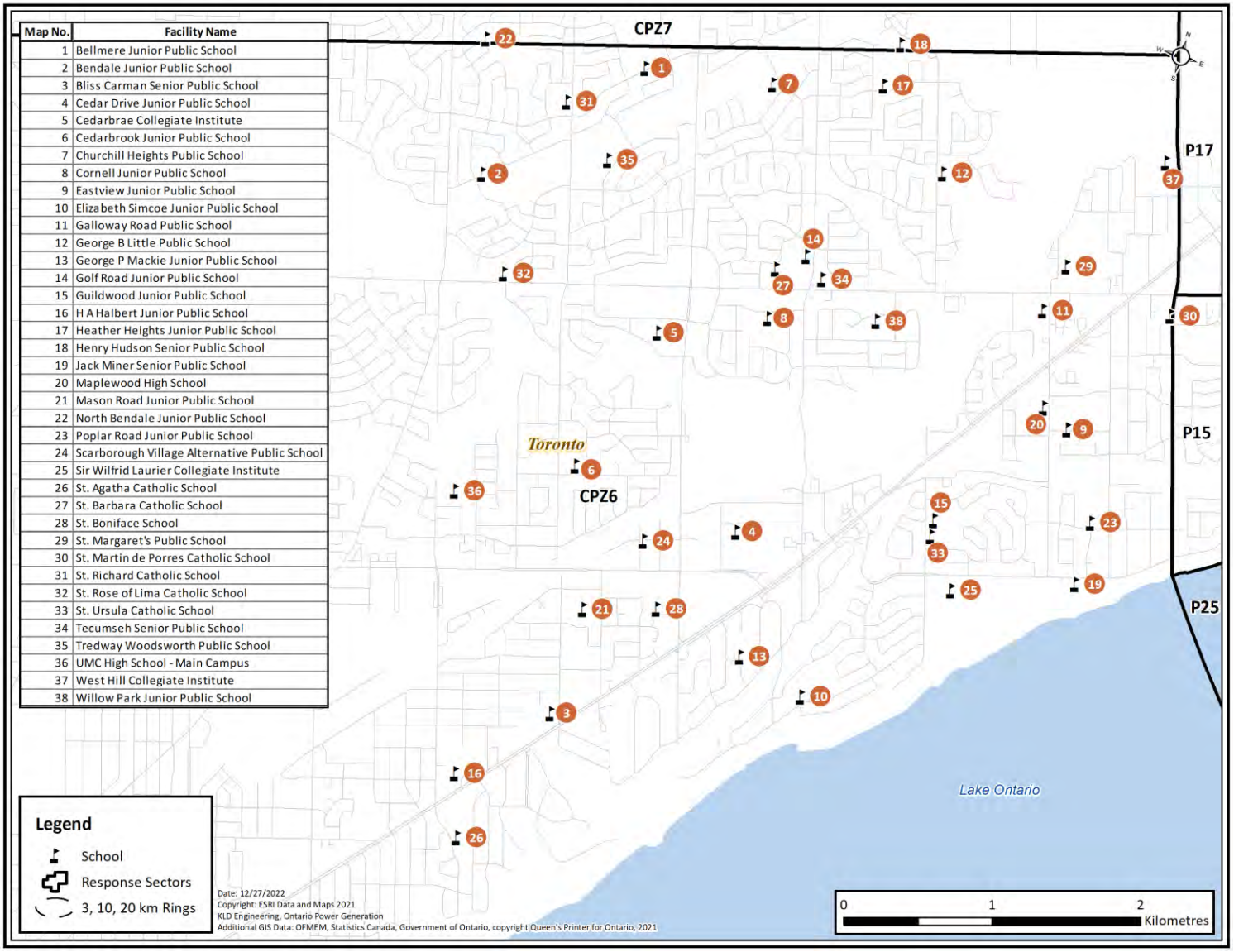



**Figure E-8. Schools within the Toronto Portion of the PNGS PZ (3 of 5)**



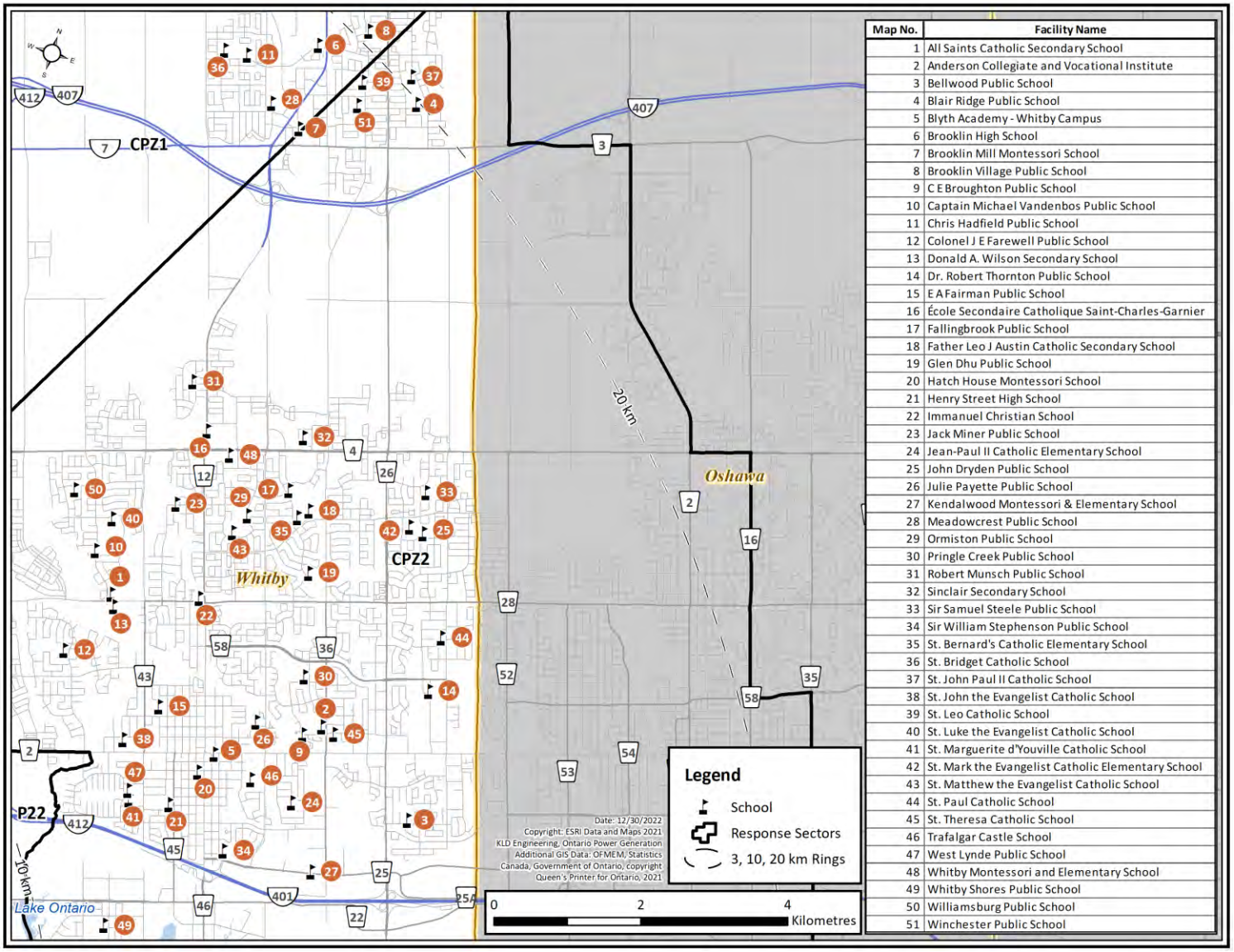

| Map No. | Facility Name |
|---|---|
| 1 | Alternative Scarborough Education 1 |
| 2 | Anson Park Public School |
| 3 | Birch Cliff Heights Public School |
| 4 | Birch Cliff Public School |
| 5 | Birchmount Park Collegiate Institute |
| 6 | Bond International College |
| 7 | Buchanan Public School |
| 8 | Chine Drive Public School |
| 9 | Cliffside Public School |
| 10 | Corvette Junior Public School |
| 11 | Danforth Gardens Public School |
| 12 | David and Mary Thomson Collegiate Institute |
| 13 | Donwood Park Junior Public School |
| 14 | Dorset Park Public School |
| 15 | Fairmount Public School |
| 16 | General Brock Public School |
| 17 | General Crerar Public School |
| 18 | George Peck Public School |
| 19 | Glen Ravine Junior Public School |
| 20 | Hunter's Glen Junior Public School |
| 21 | Ionview Public School |
| 22 | J G Workman Public School |
| 23 | John A Leslie Public School |
| 24 | John McCrae Senior Public School |
| 25 | Knob Hill Junior Public School |
| 26 | Lord Roberts Junior Public School |
| 27 | Manhattan Park Junior Public School |
| 28 | Mariyah Islamic School |
| 29 | Maryvale Public School |
| 30 | Nile Academy |
| 31 | Norman Cook Junior Public School |
| 32 | R H King Academy |
| 33 | Robert Service Senior Public School |
| 34 | Scarborough Centre for Alternative Studies |
| 35 | St. Albert Catholic School |
| 36 | St. Andrews Public School |
| 37 | St. Joachim Catholic School |
| 38 | St. Joan of Arc Catholic Academy |
| 39 | St. John Henry Newman Catholic High School |
| 40 | St. Kevin's Catholic School |
| 41 | St. Lawrence Catholic School |
| 42 | St. Theresa Shrine Catholic School |
| 43 | Um Al-Qura Islamic School |
| 44 | W. A. Porter Collegiate Institute |
| 45 | Walter Perry Junior Public School |
| 46 | Wexford Public School |
| 47 | Winston Churchill Collegiate Institute |

**Figure E-9. Schools within the Toronto Portion of the PNGS PZ (4 of 5)**




| Map No. | Facility Name |
|---|---|
| 1 | Bellmere Junior Public School |
| 2 | Bendale Junior Public School |
| 3 | Bliss Carman Senior Public School |
| 4 | Cedar Drive Junior Public School |
| 5 | Cedarbrae Collegiate Institute |
| 6 | Cedarbrook Junior Public School |
| 7 | Churchill Heights Public School |
| 8 | Cornell Junior Public School |
| 9 | Eastview Junior Public School |
| 10 | Elizabeth Simcoe Junior Public School |
| 11 | Galloway Road Public School |
| 12 | George B Little Public School |
| 13 | George P Mackie Junior Public School |
| 14 | Golf Road Junior Public School |
| 15 | Guildwood Junior Public School |
| 16 | H A Halbert Junior Public School |
| 17 | Heather Heights Junior Public School |
| 18 | Henry Hudson Senior Public School |
| 19 | Jack Miner Senior Public School |
| 20 | Maplewood High School |
| 21 | Mason Road Junior Public School |
| 22 | North Bendale Junior Public School |
| 23 | Poplar Road Junior Public School |
| 24 | Scarborough Village Alternative Public School |
| 25 | Sir Wilfrid Laurier Collegiate Institute |
| 26 | St. Agatha Catholic School |
| 27 | St. Barbara Catholic School |
| 28 | St. Boniface School |
| 29 | St. Margaret's Public School |
| 30 | St. Martin de Porres Catholic School |
| 31 | St. Richard Catholic School |
| 32 | St. Rose of Lima Catholic School |
| 33 | St. Ursula Catholic School |
| 34 | Tecumseh Senior Public School |
| 35 | Tredway Woodsworth Public School |
| 36 | UMC High School - Main Campus |
| 37 | West Hill Collegiate Institute |
| 38 | Willow Park Junior Public School |

**Figure E-10. Schools within the Toronto Portion of the PNGS PZ (5 of 5)**




| Map No. | Facility Name |
|---|---|
| 1 | All Saints Catholic Secondary School |
| 2 | Anderson Collegiate and Vocational Institute |
| 3 | Bellwood Public School |
| 4 | Blair Ridge Public School |
| 5 | Blyth Academy - Whitby Campus |
| 6 | Brooklin High School |
| 7 | Brooklin Mill Montessori School |
| 8 | Brooklin Village Public School |
| 9 | C E Broughton Public School |
| 10 | Captain Michael Vandenbos Public School |
| 11 | Chris Hadfield Public School |
| 12 | Colonel J E Farewell Public School |
| 13 | Donald A. Wilson Secondary School |
| 14 | Dr. Robert Thornton Public School |
| 15 | E A Fairman Public School |
| 16 | École Secondaire Catholique Saint-Charles-Garnier |
| 17 | Fallingbrook Public School |
| 18 | Father Leo J Austin Catholic Secondary School |
| 19 | Glen Dhu Public School |
| 20 | Hatch House Montessori School |
| 21 | Henry Street High School |
| 22 | Immanuel Christian School |
| 23 | Jack Miner Public School |
| 24 | Jean-Paul II Catholic Elementary School |
| 25 | John Dryden Public School |
| 26 | Julie Payette Public School |
| 27 | Kendalwood Montessori & Elementary School |
| 28 | Meadowcrest Public School |
| 29 | Ormiston Public School |
| 30 | Pringle Creek Public School |
| 31 | Robert Munsch Public School |
| 32 | Sinclair Secondary School |
| 33 | Sir Samuel Steele Public School |
| 34 | Sir William Stephenson Public School |
| 35 | St. Bernard's Catholic Elementary School |
| 36 | St. Bridget Catholic School |
| 37 | St. John Paul II Catholic School |
| 38 | St. John the Evangelist Catholic School |
| 39 | St. Leo Catholic School |
| 40 | St. Luke the Evangelist Catholic School |
| 41 | St. Marguerite d'Youville Catholic School |
| 42 | St. Mark the Evangelist Catholic Elementary School |
| 43 | St. Matthew the Evangelist Catholic School |
| 44 | St. Paul Catholic School |
| 45 | St. Theresa Catholic School |
| 46 | Trafalgar Castle School |
| 47 | West Lynde Public School |
| 48 | Whitby Montessori and Elementary School |
| 49 | Whitby Shores Public School |
| 50 | Williamsburg Public School |
| 51 | Winchester Public School |

**Figure E-11. Schools within the Whitby Portion of the PNGS PZ**

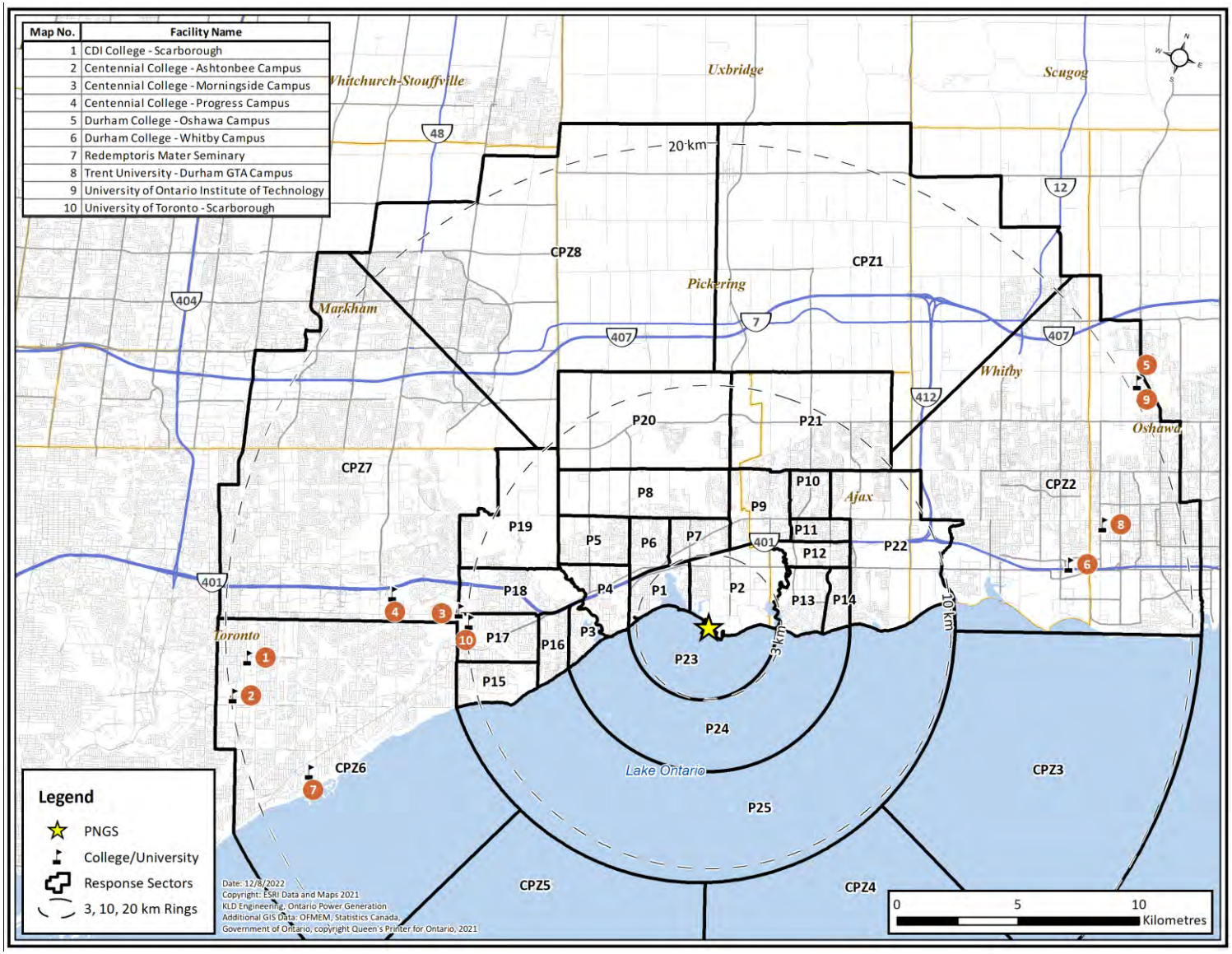



**Figure E-12. Colleges and Universities within the PNGS PZ**

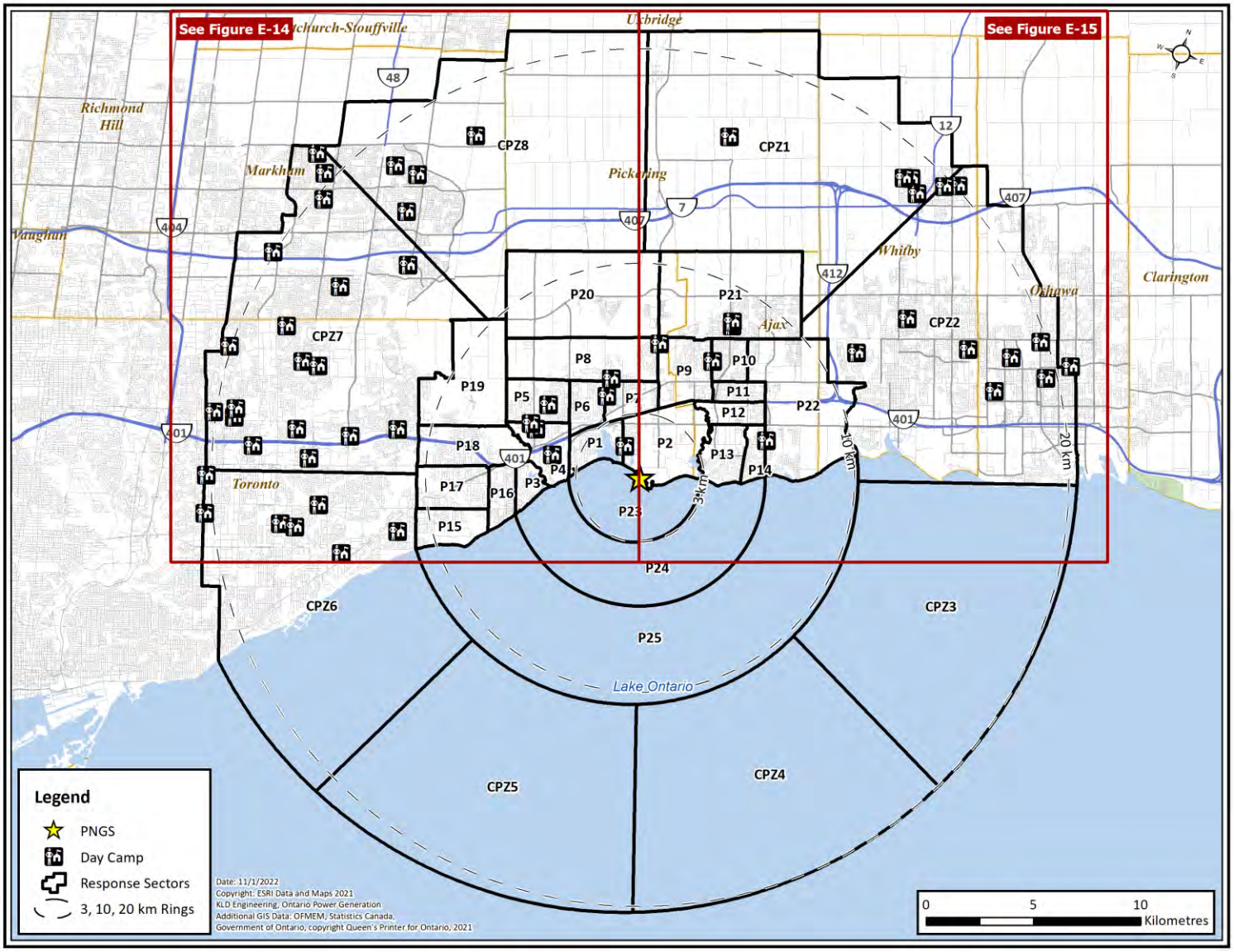



**Figure E-13. Day Camps within the PNGS PZ – Overview**

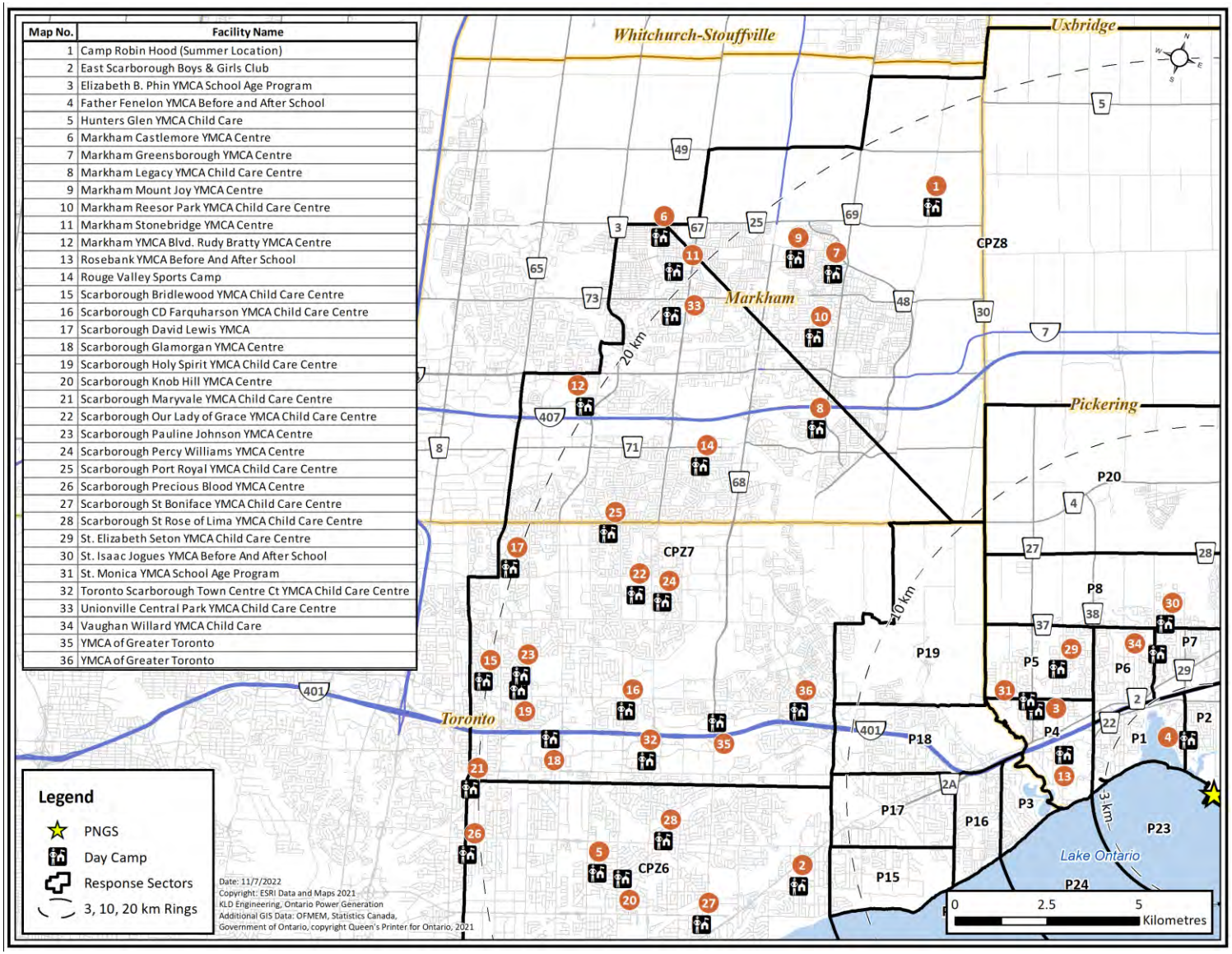
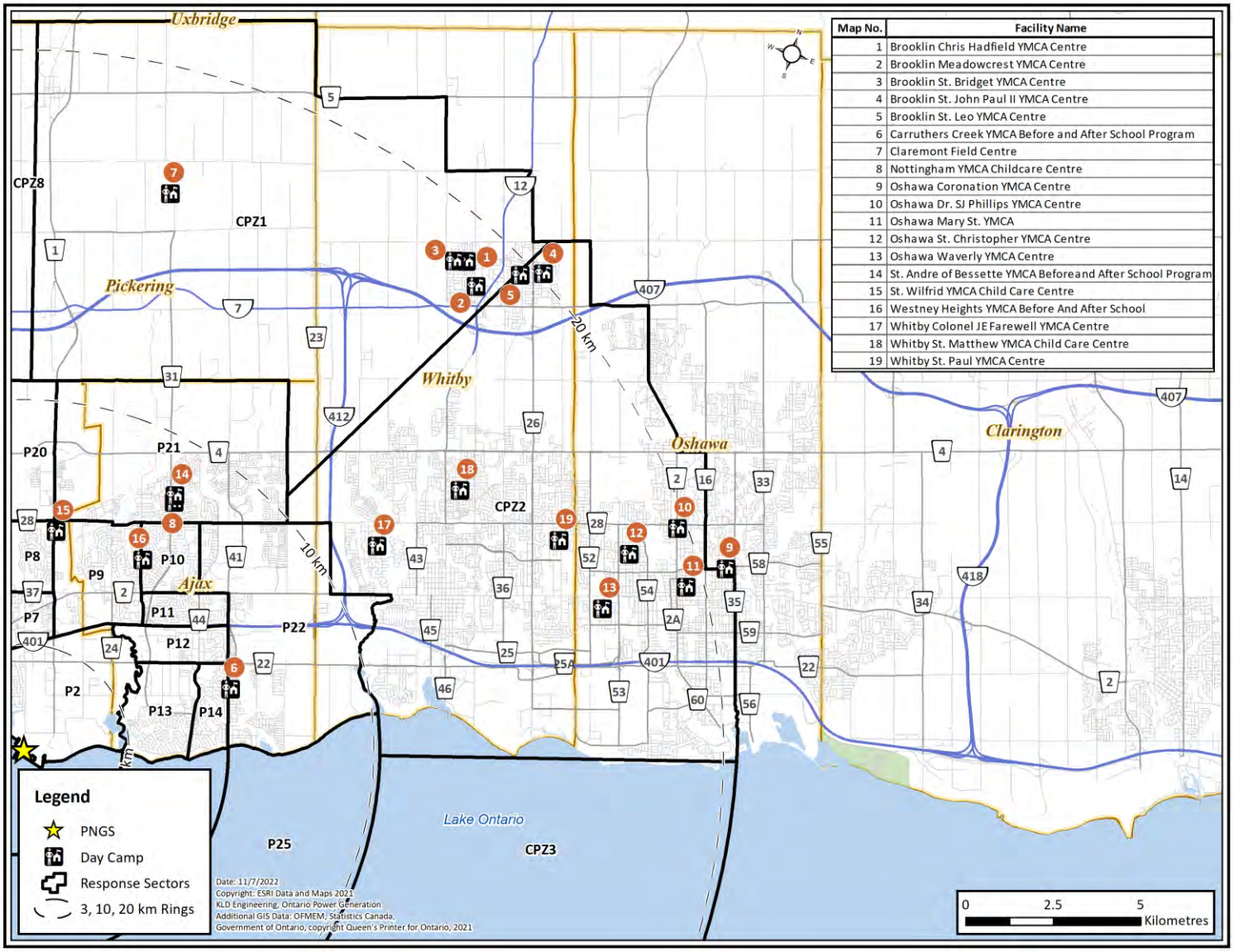



**Figure E-14. Day Camps within the Western Portion of the PNGS PZ**




| Map No. | Facility Name |
|---|---|
| 1 | Brooklin Chris Hadfield YMCA Centre |
| 2 | Brooklin Meadowcrest YMCA Centre |
| 3 | Brooklin St. Bridget YMCA Centre |
| 4 | Brooklin St. John Paul II YMCA Centre |
| 5 | Brooklin St. Leo YMCA Centre |
| 6 | Carruthers Creek YMCA Before and After School Program |
| 7 | Claremont Field Centre |
| 8 | Nottingham YMCA Childcare Centre |
| 9 | Oshawa Coronation YMCA Centre |
| 10 | Oshawa Dr. SJ Phillips YMCA Centre |
| 11 | Oshawa Mary St. YMCA |
| 12 | Oshawa St. Christopher YMCA Centre |
| 13 | Oshawa Waverly YMCA Centre |
| 14 | St. Andre of Bessette YMCA Beforeand After School Program |
| 15 | St. Wilfrid YMCA Child Care Centre |
| 16 | Westney Heights YMCA Before And After School |
| 17 | Whitby Colonel JE Farewell YMCA Centre |
| 18 | Whitby St. Matthew YMCA Child Care Centre |
| 19 | Whitby St. Paul YMCA Centre |

**Figure E-15. Day Camps within the Eastern Portion of the PNGS PZ**

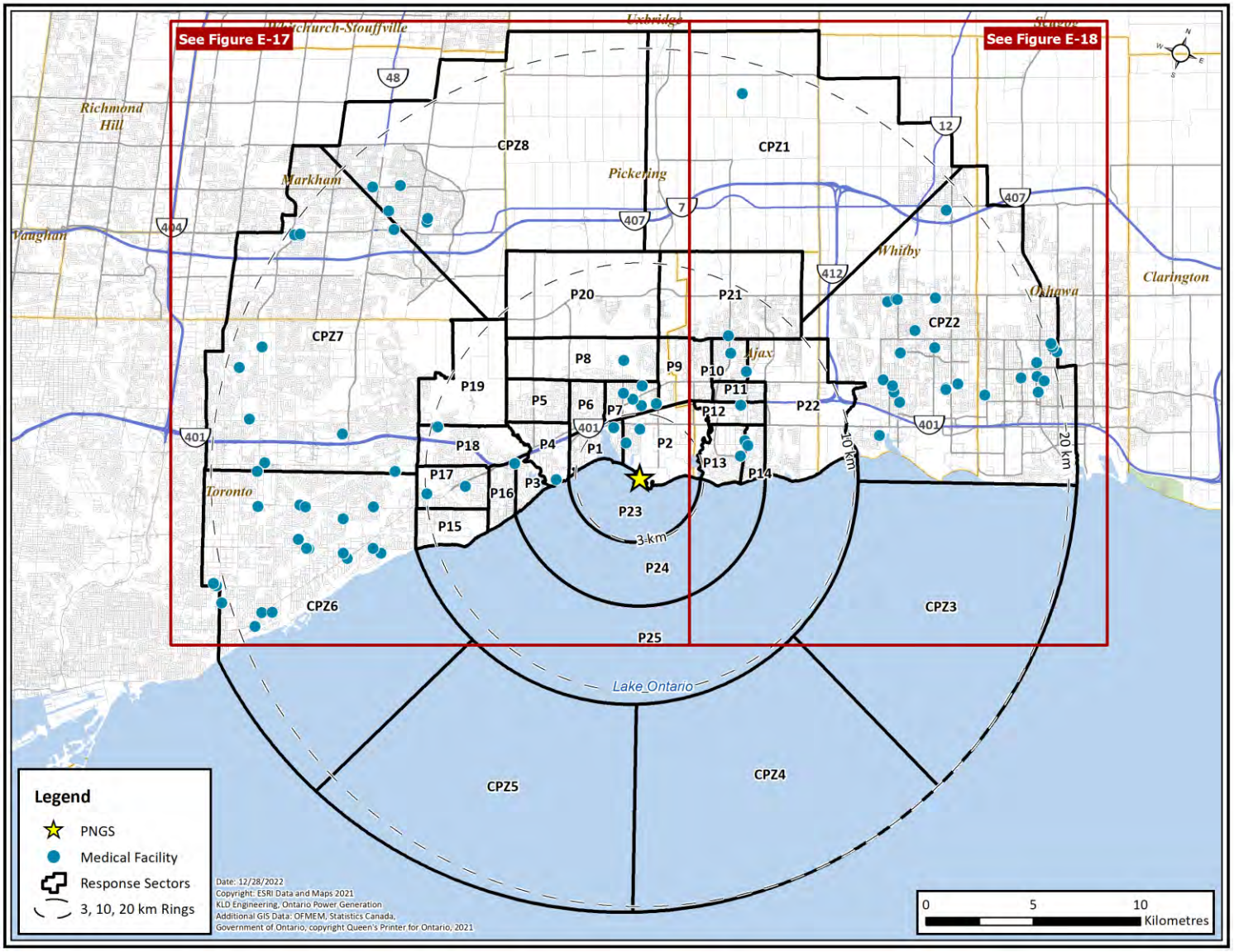
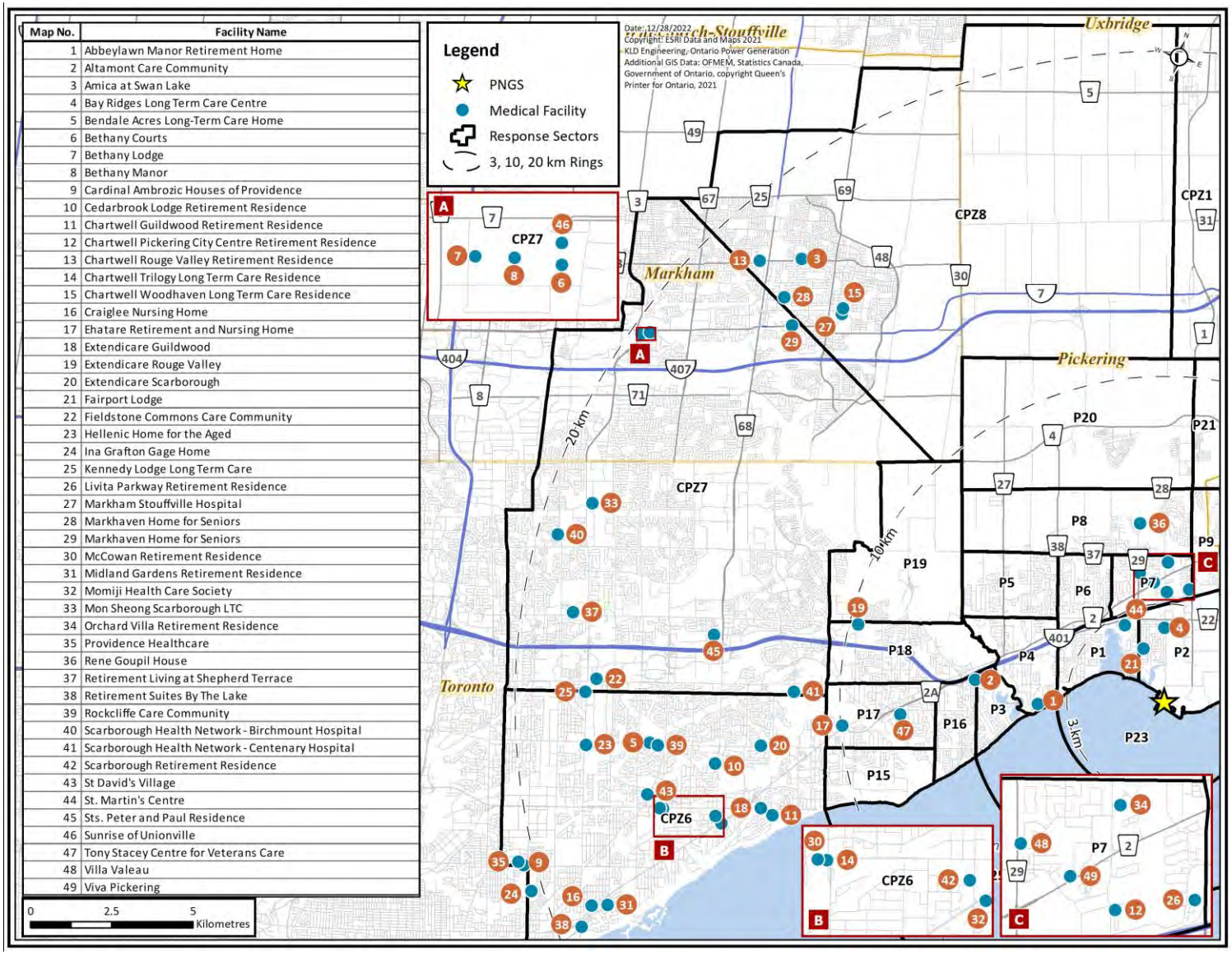
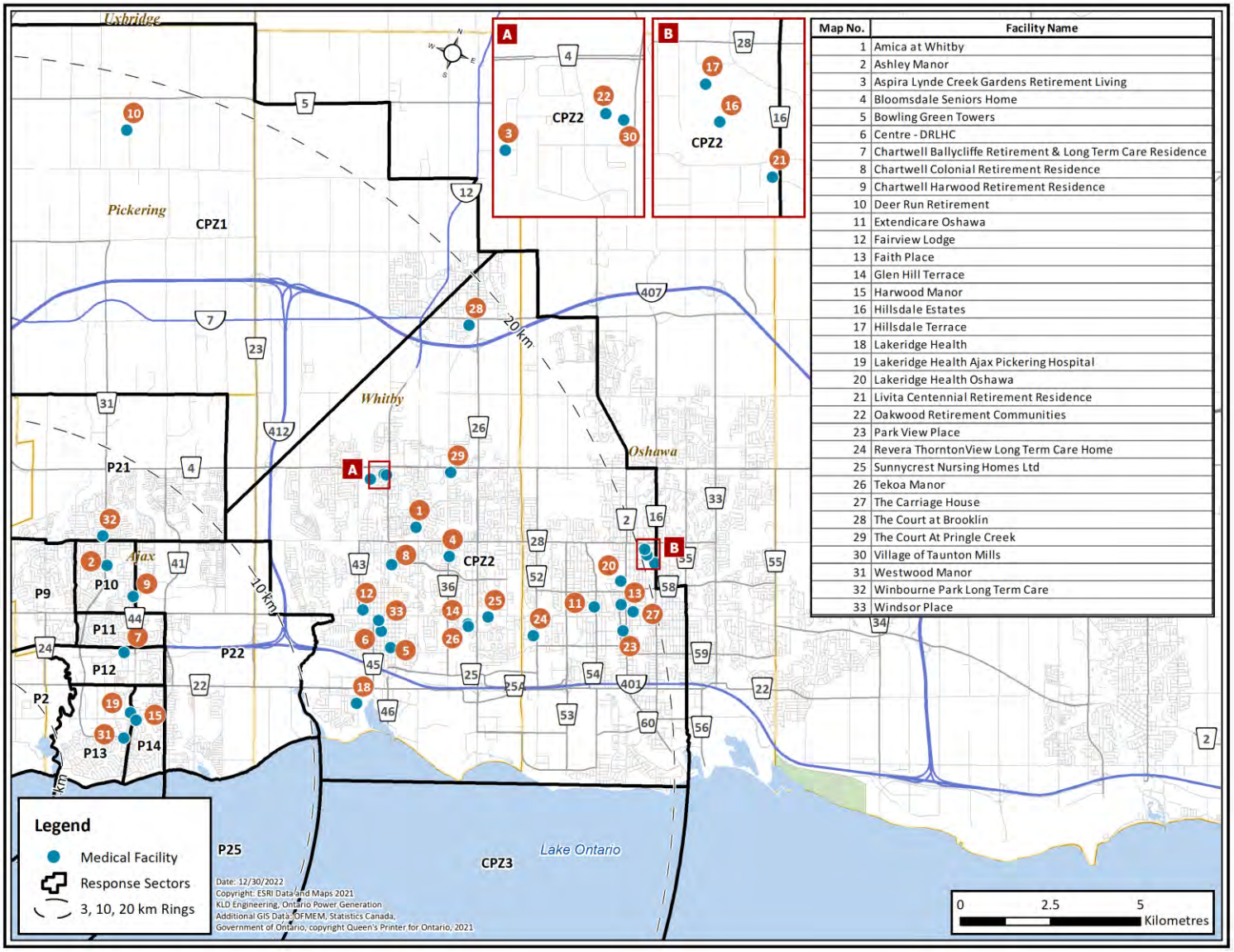



**Figure E-16. Medical Facilities within PNGS PZ – Overview**




| Map No. | Facility Name |
|---|---|
| 1 | Abbeylawn Manor Retirement Home |
| 2 | Altamont Care Community |
| 3 | Amica at Swan Lake |
| 4 | Bay Ridges Long Term Care Centre |
| 5 | Bendale Acres Long-Term Care Home |
| 6 | Bethany Courts |
| 7 | Bethany Lodge |
| 8 | Bethany Manor |
| 9 | Cardinal Ambrozic Houses of Providence |
| 10 | Cedarbrook Lodge Retirement Residence |
| 11 | Chartwell Guildwood Retirement Residence |
| 12 | Chartwell Pickering City Centre Retirement Residence |
| 13 | Chartwell Rouge Valley Retirement Residence |
| 14 | Chartwell Trilogy Long Term Care Residence |
| 15 | Chartwell Woodhaven Long Term Care Residence |
| 16 | Craiglee Nursing Home |
| 17 | Ehatare Retirement and Nursing Home |
| 18 | Extendicare Guildwood |
| 19 | Extendicare Rouge Valley |
| 20 | Extendicare Scarborough |
| 21 | Fairport Lodge |
| 22 | Fieldstone Commons Care Community |
| 23 | Hellenic Home for the Aged |
| 24 | Ina Grafton Gage Home |
| 25 | Kennedy Lodge Long Term Care |
| 26 | Livita Parkway Retirement Residence |
| 27 | Markham Stouffville Hospital |
| 28 | Markhaven Home for Seniors |
| 29 | Markhaven Home for Seniors |
| 30 | McCowan Retirement Residence |
| 31 | Midland Gardens Retirement Residence |
| 32 | Momiji Health Care Society |
| 33 | Mon Sheong Scarborough LTC |
| 34 | Orchard Villa Retirement Residence |
| 35 | Providence Healthcare |
| 36 | Rene Goupil House |
| 37 | Retirement Living at Shepherd Terrace |
| 38 | Retirement Suites By The Lake |
| 39 | Rockcliffe Care Community |
| 40 | Scarborough Health Network - Birchmount Hospital |
| 41 | Scarborough Health Network - Centenary Hospital |
| 42 | Scarborough Retirement Residence |
| 43 | St David's Village |
| 44 | St. Martin's Centre |
| 45 | Sts. Peter and Paul Residence |
| 46 | Sunrise of Unionville |
| 47 | Tony Stacey Centre for Veterans Care |
| 48 | Villa Valeau |
| 49 | Viva Pickering |

**Figure E-17. Medical Facilities within the Western Portion of the PNGS PZ**




| Map No. | Facility Name |
|---|---|
| 1 | Amica at Whitby |
| 2 | Ashley Manor |
| 3 | Aspira Lynde Creek Gardens Retirement Living |
| 4 | Bloomsdale Seniors Home |
| 5 | Bowling Green Towers |
| 6 | Centre - DRLHC |
| 7 | Chartwell Ballycliffe Retirement & Long Term Care Residence |
| 8 | Chartwell Colonial Retirement Residence |
| 9 | Chartwell Harwood Retirement Residence |
| 10 | Deer Run Retirement |
| 11 | Extendicare Oshawa |
| 12 | Fairview Lodge |
| 13 | Faith Place |
| 14 | Glen Hill Terrace |
| 15 | Harwood Manor |
| 16 | Hillsdale Estates |
| 17 | Hillsdale Terrace |
| 18 | Lakeridge Health |
| 19 | Lakeridge Health Ajax Pickering Hospital |
| 20 | Lakeridge Health Oshawa |
| 21 | Livita Centennial Retirement Residence |
| 22 | Oakwood Retirement Communities |
| 23 | Park View Place |
| 24 | Revera ThorntonView Long Term Care Home |
| 25 | Sunnycrest Nursing Homes Ltd |
| 26 | Tekoa Manor |
| 27 | The Carriage House |
| 28 | The Court at Brooklin |
| 29 | The Court At Pringle Creek |
| 30 | Village of Taunton Mills |
| 31 | Westwood Manor |
| 32 | Winbourne Park Long Term Care |
| 33 | Windsor Place |

**Figure E-18. Medical Facilities within the Eastern Portion of the PNGS PZ**

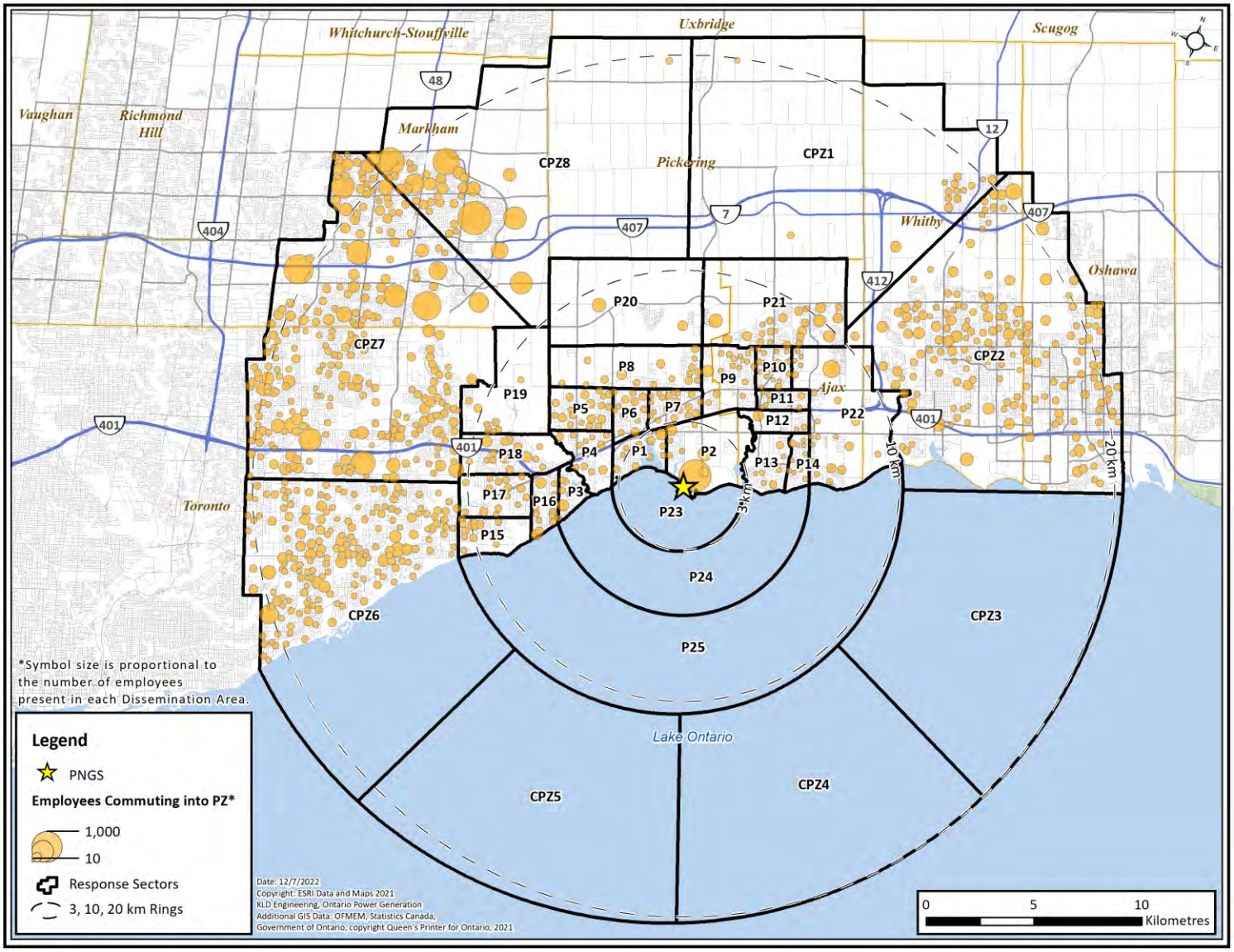



**Figure E-19. Major Employers within the PNGS PZ**

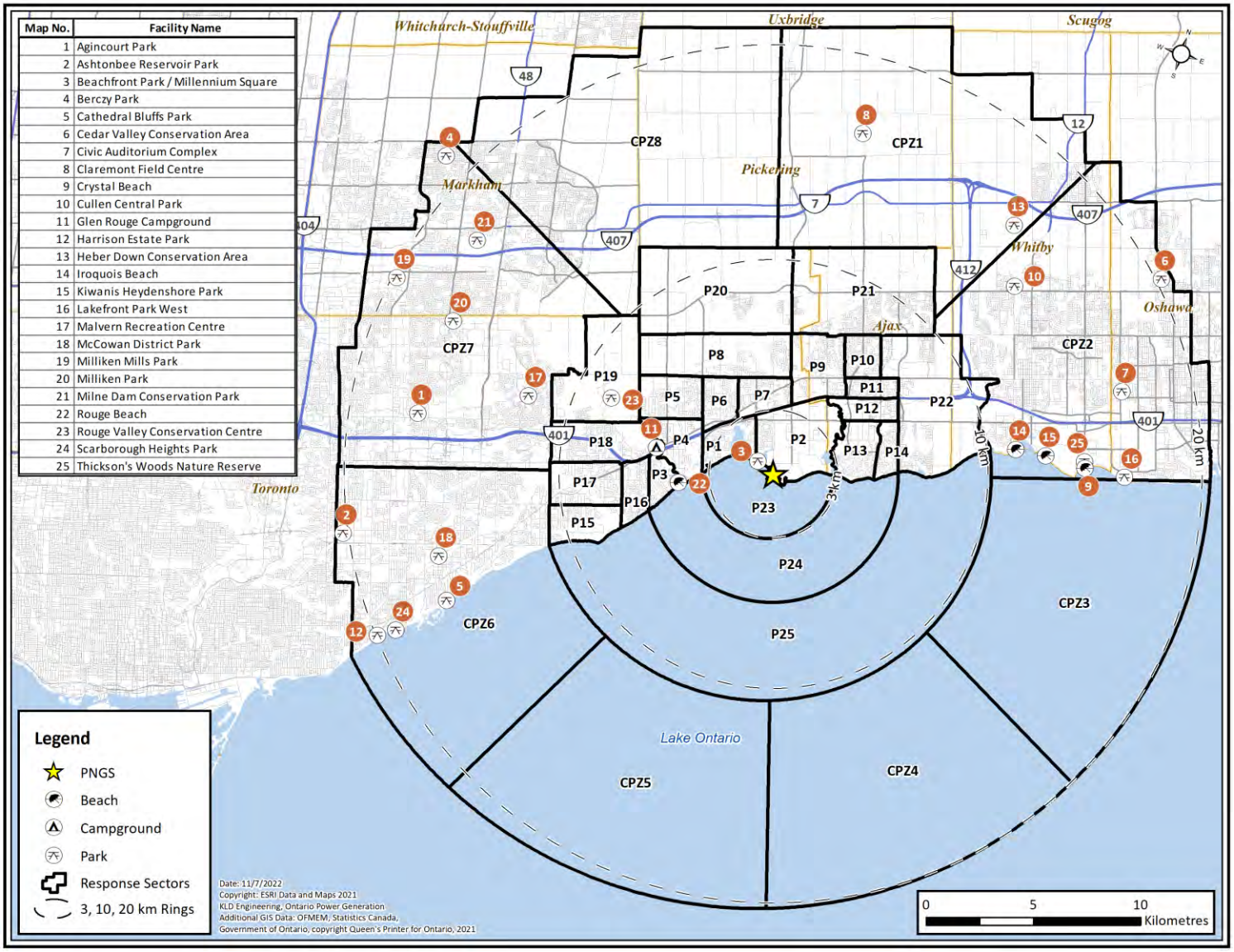



**Figure E-20. Beaches, Campgrounds and Parks within the PNGS PZ**

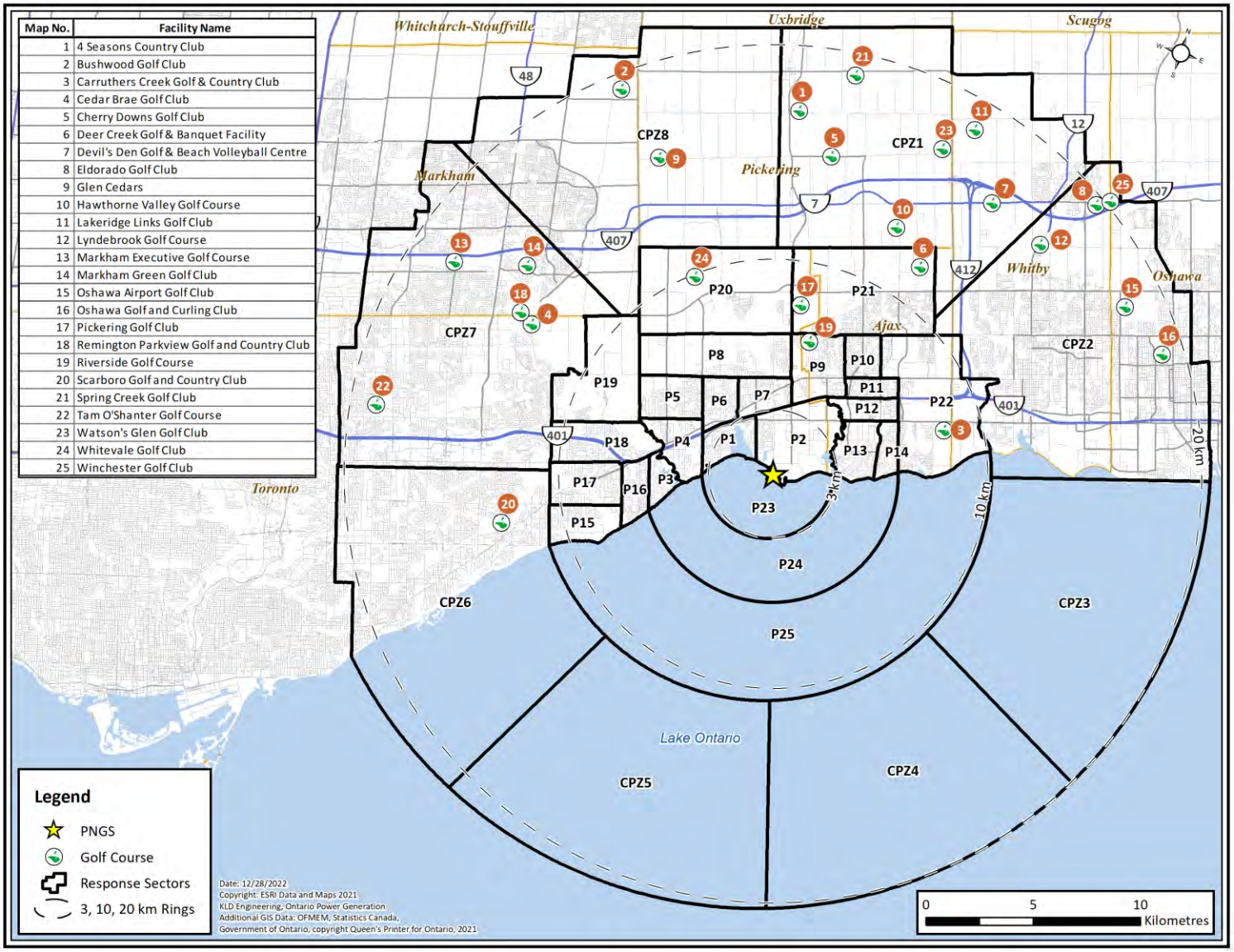



**Figure E-21. Golf Courses within the PNGS PZ**

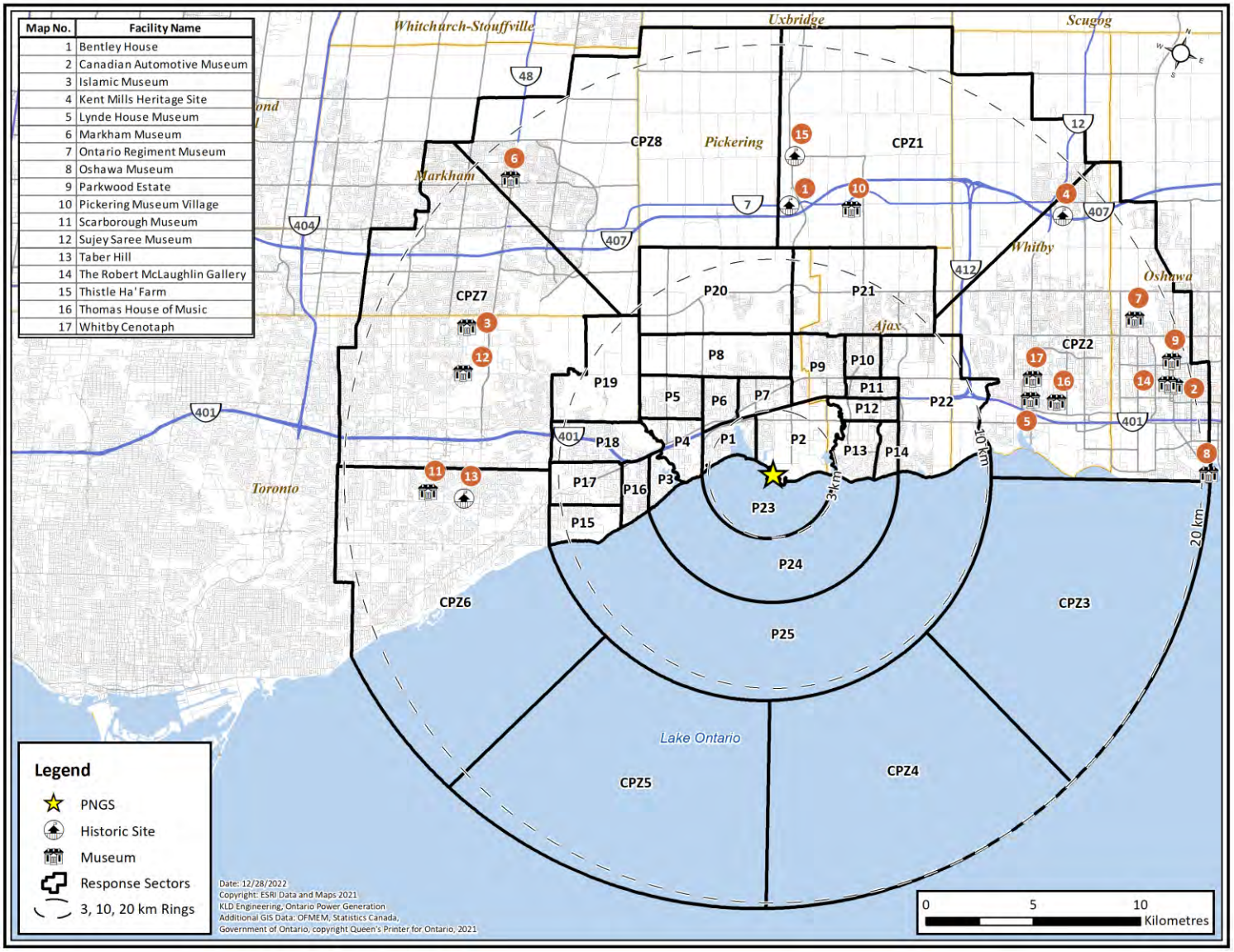



**Figure E-22. Historic Sites and Museums within the PNGS PZ**

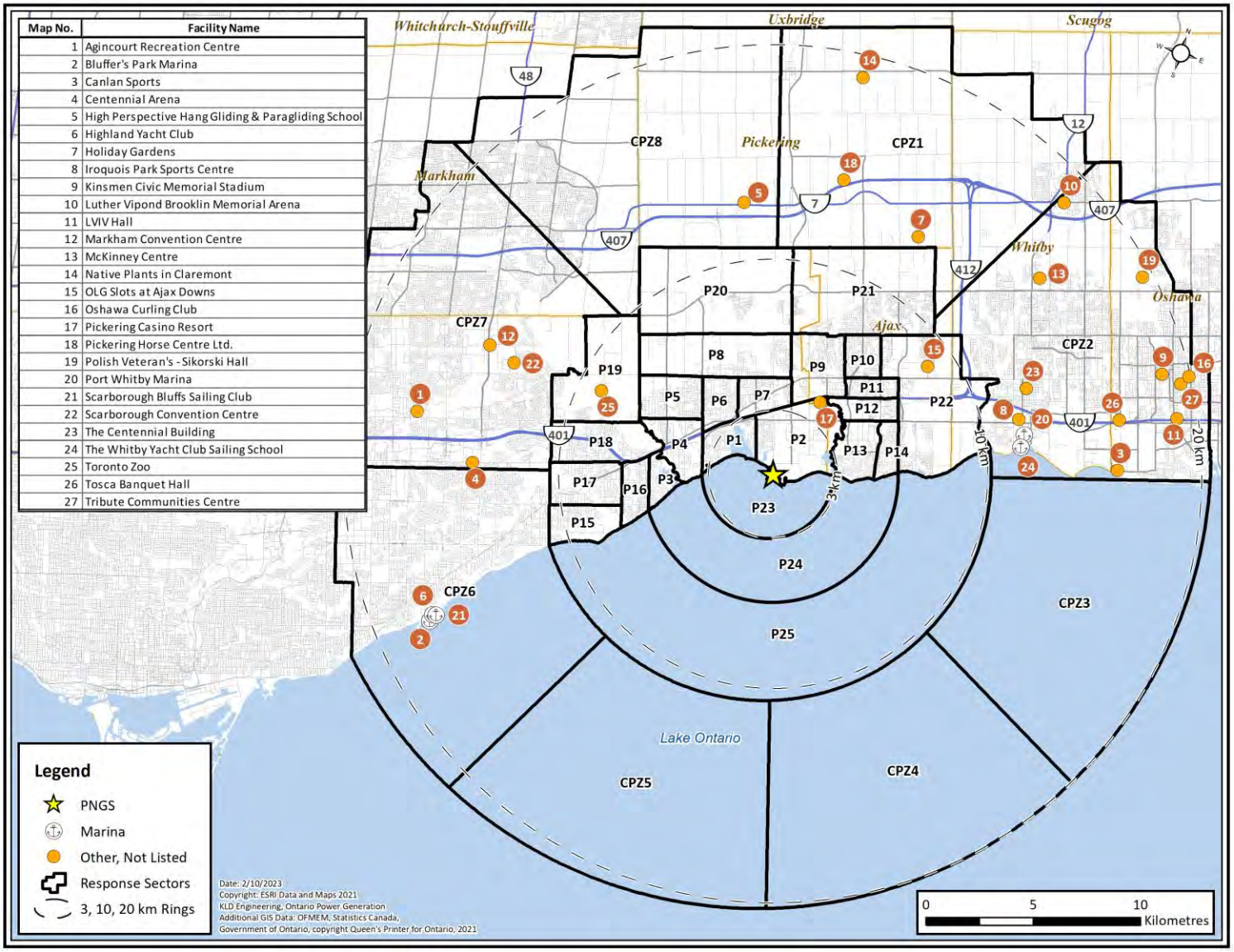



**Figure E-23. Marinas and Other Recreational Areas within the PNGS PZ**

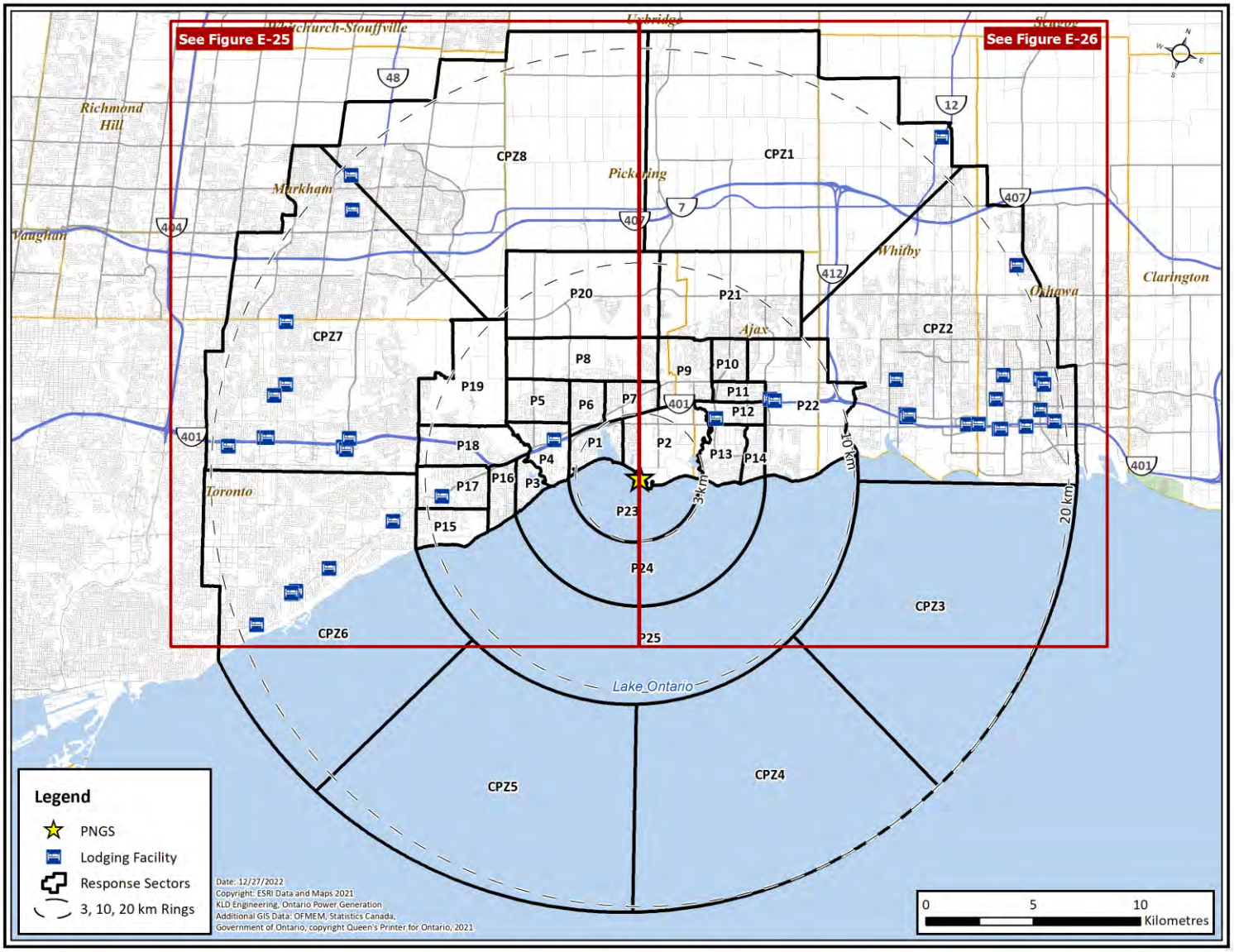



**Figure E-24. Lodging Facilities within the PNGS PZ – Overview**

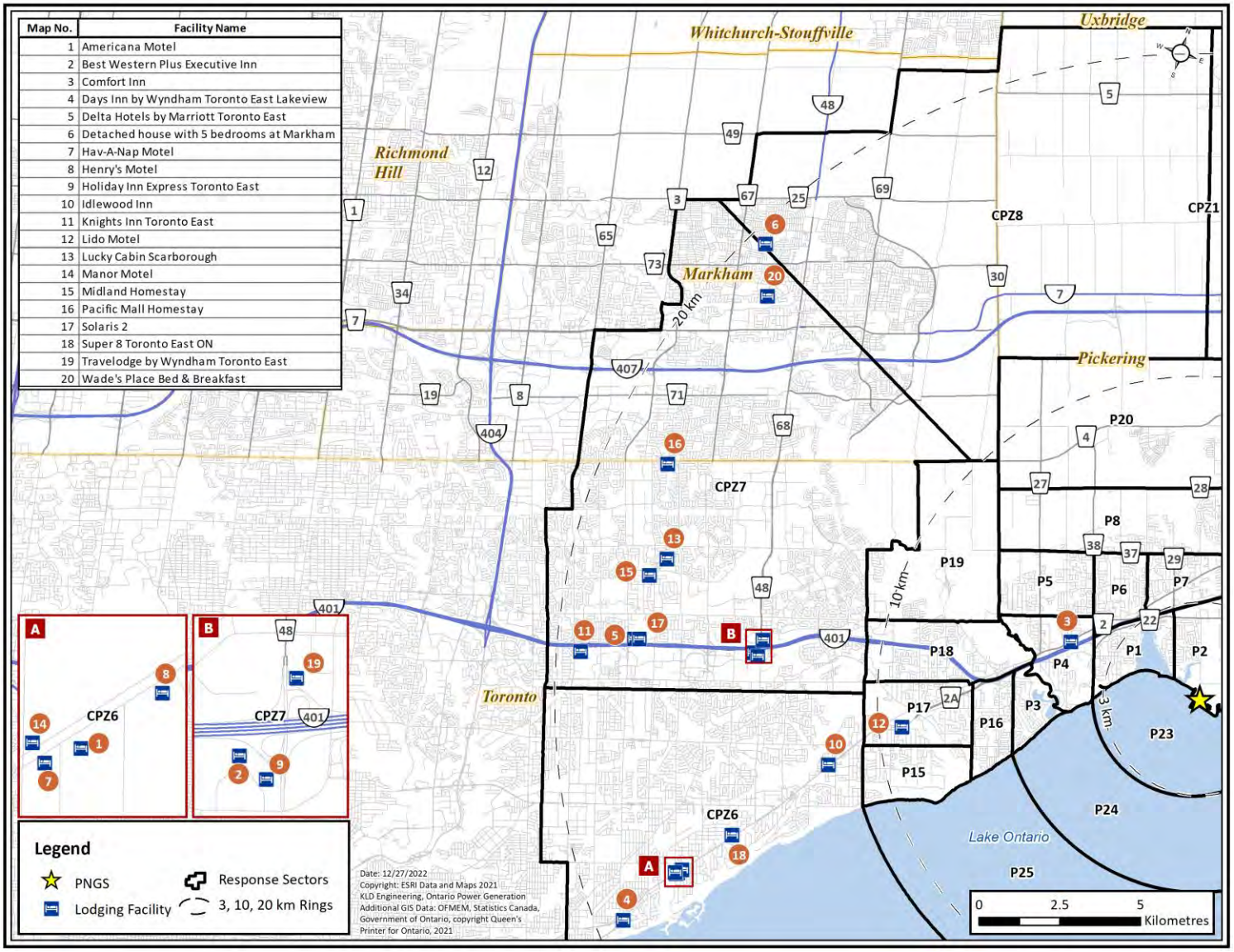



**Figure E-25. Lodging Facilities within the Western Portion of the PNGS PZ**

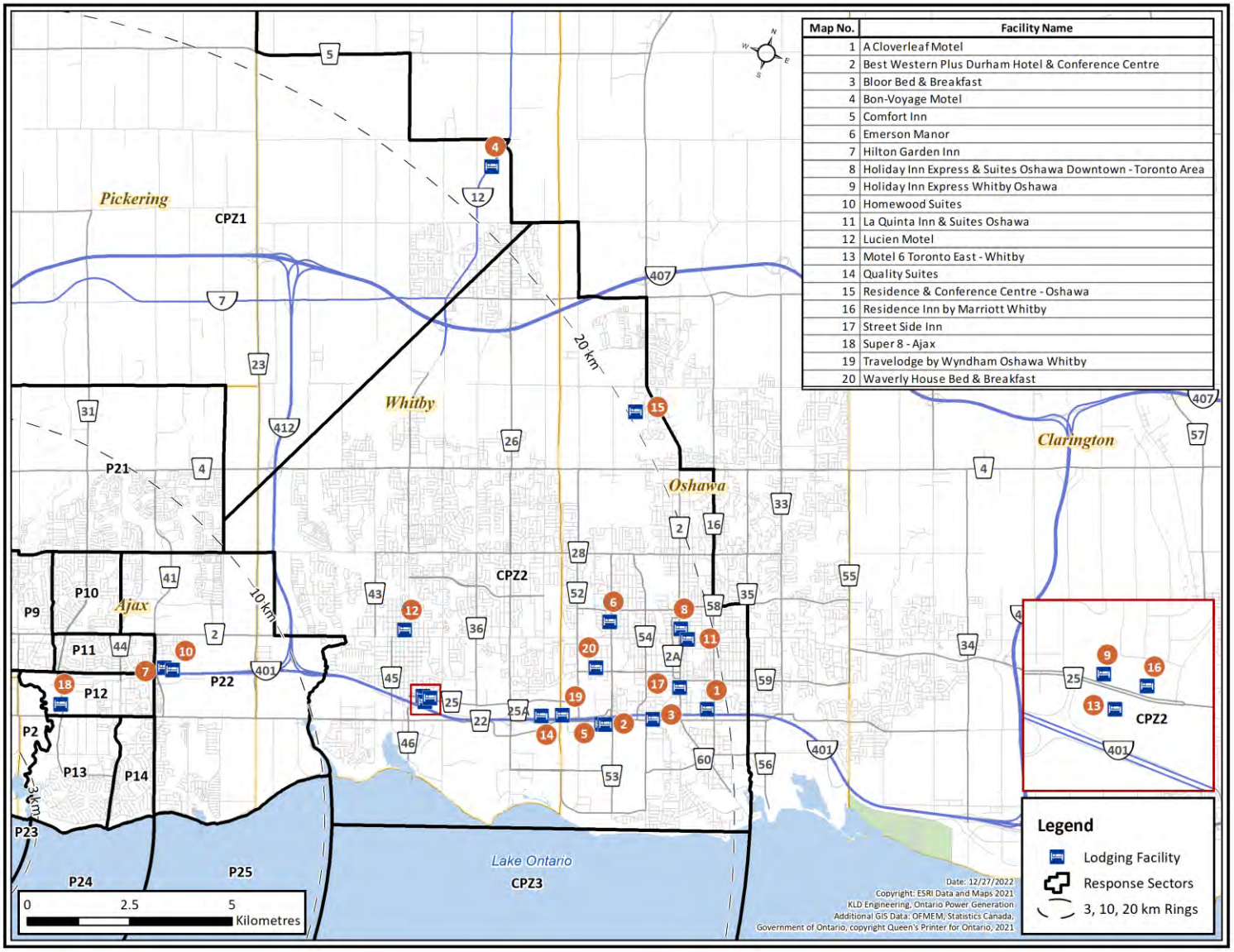



**Figure E-26. Lodging Facilities within the Eastern Portion of the PNGS PZ**

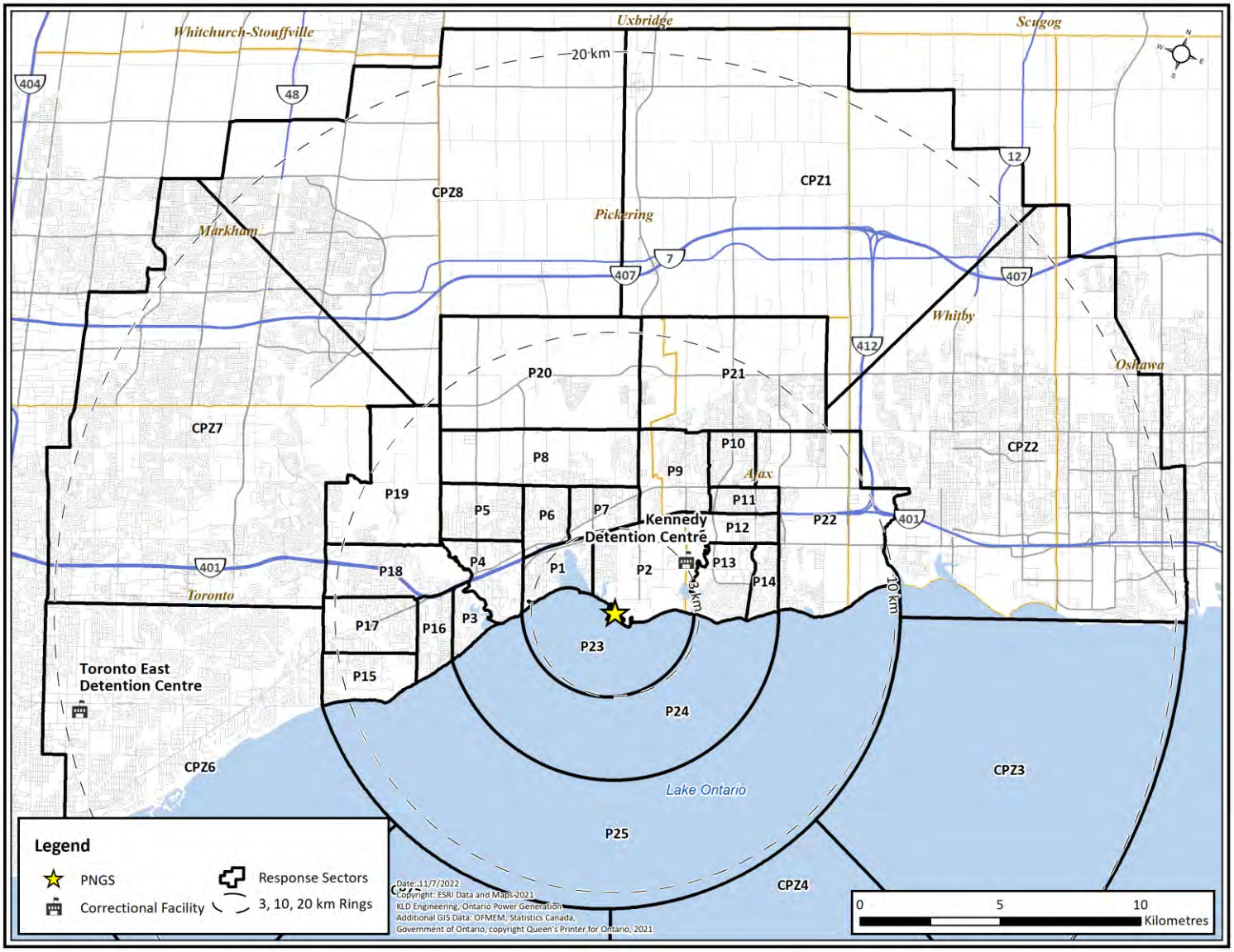



**Figure E-27. Correctional Facilities within the PNGS PZ**

## APPENDIX F

Demographic Survey

# F. DEMOGRAPHIC SURVEY

## F.1 Introduction

The development of evacuation time estimates for the Pickering Nuclear Generating Station (PNGS) study area requires the identification of travel patterns, car ownership and household size of the population within the Planning Zones (PZs)[1]. Demographic information can be obtained from 2021 Statistics Canada Census data. The use of this data has several limitations when applied to emergency planning. First, the Census data does not encompass the range of information needed to identify the time required for preliminary activities (mobilization) that must be undertaken prior to evacuating the area. Secondly, Census data does not contain attitudinal responses needed from the population of the planning zones and consequently may not accurately represent the anticipated behavioural characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the population within the planning zone. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form "What would you do if …?" and other questions regarding activities with which the respondent is familiar ("How long does it take you to …?")

## F.2 Survey Instrument and Sampling Plan

Attachment A presents the final survey instrument used in this study. A draft of the instrument was submitted to stakeholders for comment. Comments were received and the survey instrument was modified accordingly, prior to conducting the survey. Following the completion of the instrument, a sampling plan was developed using the 2021 Statistic Canada data.

A sample size of approximately 380 **completed** survey forms yields results with a sampling error of ±5% at the 95% confidence level. The sample must be drawn from the planning zone population. Consequently, a list of Forward Sortation Areas[2] (FSA) in the planning zone was developed using GIS software. This list is shown in Table F-1. Along with each FSA, an estimate of the population and number of households in each area was determined by overlaying Census data and the planning zone boundary, again using GIS software. The proportional number of desired completed survey interviews for each area was identified, as shown in Table F-1. Note that the average household size computed in Table F-1 was an estimate for sampling purposes and was not used in the ETE study.

[1] The Planning Zone (PZ) represents entire study area which includes the Automatic Action Zone, Detailed Planning Zone (Inner and Outer Rings) and the Contingency Planning Zones.
[2] Given the close proximity and similar demographics between the Pickering Nuclear Generating Station (PNGS) and the Darlington Nuclear Generating Station (DNGS) PZs, one demographic survey conducted which was used for both sites. The FSA used include FSA from both PZs.

The results of the survey exceeded the sampling plan. A total of 398 completed samples were obtained within the Contingency Planning Zones (CPZs)[3] of PNGS and DNGS, which corresponds to a sampling error of ±4.91% at the 95% confidence level. Table F-1 also shows the number of samples obtained within each FSA.

## F.3 Survey Results

The results of the survey fall into two categories. First, the household demographics of the area can be identified. Demographic information includes such factors as household size, automobile ownership, and automobile availability. The distributions of the time to perform certain pre-evacuation activities are the second category of survey results. These data are processed to develop the trip generation distributions used in the evacuation modelling effort, as discussed in Section 5.

A review of the survey instrument reveals that several questions have a "decline to state" entry for a response. It is an accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a decline to state response for a few questions or who refuses to answer a few questions. To address the issue of occasional decline to state responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the "decline to state" responses are ignored, and the distributions are based upon the positive data that is acquired.

### F.3.1 Household Demographic Results

Household Size

Figure F-1 presents the distribution of household size within the planning zone based on the responses to the 2022 demographic survey. According to the responses, the average household contains 3.20 people. The estimated average household size of the planning zone from the 2021 Statistics Canada Census data is 2.95 people. The percent difference between the 2021 Census data and survey data is 8.5%, which exceeds the sampling error of ±4.91%, as discussed in Section F.2. It was decided that the Canadian Census estimate of 2.95 people per household should be used for this study, as it will result in a more conservative number of evacuating vehicles (see Section 3.1 – the number of evacuating vehicles is determined by dividing population by average household size and then multiplying by the number of vehicles per household. Using a smaller average household size will result in a larger number of evacuating vehicles.)

Automobile Ownership

The average number of automobiles available per household in the PZs is 2.13. It should be noted that two households (0.50% of households) stated they do not have access to an automobile. The distribution of automobile ownership is presented in Figure F-2. Figure F-3 and

[3] CPZ represents 0 to 20 km from the plants.

Figure F-4 present the automobile availability by household size. As expected, a majority of households with 2 or more people have access to at least one vehicle.

Ridesharing

Approximately 71% of households responded that they would share a ride with a neighbour, relative, or a friend, if a car was not available to them when advised to evacuate in the event of an emergency, as shown in Figure F-5.

Commuters

Figure F-6 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or college on a daily basis. The data shows an average of 2.10 commuters in each household, and about 91% of households have at least one commuter.

Commuter Travel Modes

Figure F-7 presents the mode of travel that commuters use on a daily basis. The vast majority (68%) of commuters use their private automobiles to travel to work/college, 4% use rail, 8% use a bus, 8% walk or bike and 12% carpool. The data shows an average of 1.15 commuters per vehicle, assuming 2 people per vehicle – on average – for carpools. Based on discussions with Durham Emergency Management, employee occupancy rate of 1 employee per vehicle will be used for major employers in the Durham Region and 1.15 commuters per vehicle (as per demographic survey results) outside of the Durham Region.

For those that responded they commute using rail (4%), 68% stated they would return to their vehicle parked at the rail station and of those who would return to their vehicle, 95% stated they would return home before evacuating.

Impact of Coronavirus Disease 2019 (COVID-19) on Commuters

Figure F-8 presents the distribution of the number of commuters in each household that were temporarily impacted by the COVID-19 pandemic. Approximately 60% of households indicated someone in their household had a work and/or school commute that was temporarily impacted by the COVID-19 pandemic. The data shows an average of 1.21 commuters per household were affected by the COVID-19 pandemic. As the majority of people responded they had someone's commute impacted by COVID-19 pandemic, the commuter patterns were compared to the telephone survey conducted for the previous DNGS ETE study. As discussed below, the commuter travel patterns are very similar between the telephone survey (2018) and the demographic survey (2022).

Functional or Transportation Needs

Figure F-9 presents the distribution of the number of individuals with functional or transportation needs. Approximately 4% of households (17 households out of 398 households total) responded to the survey as having functional or transportation needs. A total of 28 people were identified as having functional and/or transportation needs in those 17 households: 16 require a bus, seven require a medical bus/van, two require a wheelchair

accessible van, and 3 require an ambulance. Of the 17 households that responded having an individual with functional or transportation need, 14 households stated they have not registered with local/provincial agencies for assistance (in the event there is a need for emergency evacuation) and three households declined to respond.

Seasonal Residents

Approximately 6% of the surveyed households (25 households) that they stated they have seasonal residents. As shown in Figure F-10, 68% stated that 1 household member is considered a seasonal resident; 20% have 2 seasonal residents; and remaining 12% have 4 seasonal residents. Approximately 63% of the seasonal residents stay away from home during the Summer and the remaining 37% stay away during the Fall, Winter, and/or Spring seasons.

Evacuation Method

Approximately 99% (392 households) of the surveyed households stated they would use a personal vehicle for an emergency evacuation. Only one household (0.25%) would rideshare with a neighbour or friend, one household (0.25% of households) would use a train and two households (0.5% households) would choose not to evacuate. The one household who responded they would evacuate by train during an emergency evacuation responded that they would evacuate by bus if the train was unavailable.

### F.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

***"How many of the vehicles would your household use during an evacuation?"*** The response is shown in Figure F-11. On average, evacuating households would use 1.37 vehicles.

***"Would your family await the return of other family members prior to evacuating the area?"*** Of the survey participants who responded, about 72% said they would await the return of other family members before evacuating and nearly 28% indicated that they would not await the return of other family members, as shown in Figure F-12.

***"Emergency officials advise you to take shelter at home in an emergency. Would you?"*** This question is designed to elicit information regarding compliance with instructions to shelter in place. The results indicate that about 83% of households who are advised to shelter in place would do so; the remaining 17% would choose to evacuate the area.

Note the baseline ETE study assumes 30% of households will not comply with the shelter advisory, as per discussions with OPG and the OROs. The data obtained above is about 43% less than the baseline assumption of 30%. A sensitivity study was conducted to estimate the impact of shadow evacuation non-compliance of shelter advisory on ETE – see Table M-2 in Appendix M.

***"Emergency officials advise you to take shelter at home now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you?"*** This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to shelter in place now and to evacuate after a specified period of time.

As shown in Figure F-13, results indicate that nearly 66% of households would follow instructions and delay the start of evacuation until so advised, while the remaining 34% would choose to begin evacuating immediately.

***"Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?"*** This question is designed to elicit information regarding the destination of evacuees in case of an evacuation. Approximately 46% of households indicated that they would evacuate to a friend or relative's home, 5% to a reception/evacuation centre, 9% to a hotel, motel or campground, 17% to a second or seasonal home, and the remaining 23% answered other/don't know to this question, as shown in Figure F-14.

***"In the event of an emergency evacuation, would you use a toll road at any point along your route?"*** Based on the responses to the survey, over half (56%) of the households would use a toll road during an emergency evacuation, 19% of households would use the toll road, if tolls are waived, and the remaining 25% would not use any toll road at any point of their evacuation route.

***"If you had a household pet, would you take your pet with you if you were asked to evacuate the area?"*** Based on the responses to the survey, about 98% of households have a family pet. Of the households with pets, nearly 36% indicated that they would take their pets with them to a shelter, about 61% indicated that they would take their pets somewhere else and only 3% would leave their pet at home, as shown Figure F-15. Of the households that would evacuate with their pets, 98% indicated that they have sufficient room in their vehicle to evacuate with their pet(s)/animal(s), 1% said they did not, and 1% would use a trailer.

***"What type of pet(s) and/or animal(s) do you have?"*** Based on the responses to the survey, 93.3% of households with a pet have a household pet (dog, cat, bird, reptile, fish, guinea pig, or hamster) and 2.4% have farm animals (horse, chicken, or cow) and the remaining 4.4% have other large or small pets/animals.

### F.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder's experience.

As discussed in Section F.3.1 and shown in Figure F-8, the COVID-19 pandemic impacted about 60% of the commuters in the planning zone. To minimize uncertainty in the commuting patterns obtained and resulting estimated trip generation times, data from the previous survey [2012 (PNGS) and 2018 (DNGS)] were compared to the results of this survey for the distributions involving commuters (time to prepare to leave work/college and time to travel

home from work/college). For this reason, both the results of this survey, and the results of the previous surveys for these questions are discussed herein. Due to the similar patterns between the two survey results [2022 (both) and 2012 (PNGS)] and the close endpoints to the graphs (within 10 to 15 minutes), the results from this survey [labeled as "2022 (both)" in the graphs] are deemed acceptable for use in this study.

The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 on the component activities of the mobilization.

***"How long does it take the commuter to complete preparation for leaving work or college?"*** Figure F-16 presents the cumulative distribution; in all cases, the activity is completed within 50 minutes. Approximately 96% can leave within 30 minutes. In the previous study [i.e., 2012 (PNGS)], the activity was completed by 105 minutes and 82% could leave within 30 minutes.

***"How long would it take the commuter to travel home?"*** Figure F-17 presents the time to travel home for those who commute to work or college. About 94% (91% in the previous study) of commuters can arrive home within 60 minutes of leaving work/college; all within 105 minutes (120 minutes in the previous study). In comparison, the 2022 distribution curve is shifted to the left resulting in a little less conservative estimate for the time needed to travel home.

***"How long would it take the family to pack clothing, secure the house, and load the car?"*** Figure F-18 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family's preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in Figure F-18 has a long "tail." About 89% of households can be ready to leave home within 90 minutes; the remaining households require up to an additional 1 hour and 30 minutes.

***"How long would it take you to clear 15 to 20 centimetres of snow from your driveway?"*** During adverse, snowy weather conditions, an additional activity must be performed before residents can depart on the evacuation trip. Although snow scenarios assume that the roads and highways have been ploughed and are passable (albeit at lower speeds and capacities), it may be necessary to clear a private driveway prior to leaving the home so that the vehicle can access the street.

Approximately 89% of households can have their car cleared and the driveway passable within 45 minutes; the remaining households would require up to an additional hour to begin their evacuation trip, as shown in Figure F-19. As shown in the graph, only 22% of households would not shovel out and would just begin their evacuation trip (having a zero-shovel time).

### F.3.4 Emergency Communications

***"At your place of residence, how reliable is your cell phone signal?"*** This question is designed to elicit information regarding the ability to be notified in case of an evacuation.

Majority (92.9%) of households indicated that they have very reliable signal to receive texts and phone calls, 3.3% indicated that their signal is reliable for text messages only and remaining 3.8% indicated that they either do not always receive cell communications at their residence or do not have cell service at their residence, as shown in Figure F-20.

***"Emergency management officials in your region/province may send text messages, similar to AMBER Alerts, with emergency directions for the public during an emergency. How likely would you be to take action on these directions, if you received the message?"*** This question is designed to elicit information regarding the likelihood of an individual to take action based on emergency management officials' guidelines.

The majority (64.3%) of households indicated that they are highly likely to take action on these directions, 29.4% indicated likely, 3.8% indicated neither likely nor unlikely (neutral), and the remaining 2.5% (10 households) stated unlikely or strongly unlikely to take action on emergency management officials' directions, as shown in Figure F-21.

***"Which of the following emergency communication methods do you think is most likely to alert you at your residence?"*** This question is designed to elicit information regarding the most efficient way to alert residents within the planning zone.

Majority (73.7%) of households indicated that a emergency alert text message from emergency officials would be most likely to alert them at their residence, 16.9% indicated that a siren sounding near their home, 2.8% indicated an alert broadcast on the radio, 4% indicated an alert broadcast on the television, 2% indicated that a phone call/text message from a family member, friend or neighbour, 0.3% (one household) indicated that information on Facebook/Twitter, and remaining 0.3% (one household) indicated other communication methods would be the most likely way to alert them at their residence, as shown in Figure F-22.

**Table F-1. Demographic Survey Sampling Plan**

| FSA | CPZ Pop in FSA | CPZ HH in FSA | Desired Sample | Sample Obtained |
|---|---|---|---|---|
| L0A | 1,021 | 368 | 0 | 10 |
| L0B | 7,920 | 2,854 | 2 | 18 |
| L0H | 1,055 | 353 | 0 | 0 |
| L1B | 12,996 | 5,059 | 4 | 18 |
| L1C | 50,223 | 17,713 | 14 | 63 |
| L1E | 27,831 | 9,459 | 7 | 36 |
| L1G | 44,502 | 19,104 | 15 | 19 |
| L1H | 31,206 | 13,094 | 10 | 7 |
| L1J | 42,687 | 16,991 | 13 | 8 |
| L1K | 43,397 | 13,475 | 11 | 15 |
| L1L | 12,845 | 3,716 | 3 | 3 |
| L1M | 23,978 | 7,228 | 6 | 8 |
| L1N | 48,825 | 18,771 | 15 | 27 |
| L1P | 21,910 | 6,772 | 5 | 9 |
| L1R | 42,416 | 13,214 | 10 | 19 |
| L1S | 41,434 | 15,449 | 12 | 24 |
| L1T | 52,752 | 15,039 | 12 | 20 |
| L1V | 56,032 | 18,771 | 15 | 25 |
| L1W | 18,428 | 7,088 | 6 | 15 |
| L1X | 21,280 | 6,365 | 5 | 9 |
| L1Y | 1,922 | 687 | 1 | 0 |
| L1Z | 32,482 | 9,000 | 7 | 14 |
| L3P | 37,660 | 12,802 | 10 | 2 |
| L3R | 32,875 | 10,636 | 8 | 2 |
| L3S | 55,585 | 15,021 | 12 | 0 |
| L6B | 34,556 | 10,065 | 8 | 3 |
| L6C | 23,079 | 6,872 | 5 | 1 |
| L6E | 38,557 | 11,703 | 9 | 1 |
| L6G | 8,102 | 4,281 | 3 | 1 |
| M1B | 65,818 | 20,599 | 16 | 3 |
| M1C | 34,874 | 11,144 | 9 | 5 |
| M1E | 48,669 | 17,552 | 14 | 3 |
| M1G | 31,064 | 10,373 | 8 | 1 |
| M1H | 23,538 | 8,470 | 7 | 1 |
| M1J | 37,725 | 12,956 | 10 | 0 |
| M1K | 47,857 | 17,615 | 13 | 1 |
| M1L | 13,458 | 4,275 | 3 | 0 |
| M1M | 22,351 | 8,285 | 6 | 2 |
| M1N | 14,641 | 5,865 | 5 | 1 |
| M1P | 46,008 | 16,735 | 13 | 0 |
| M1R | 16,947 | 5,878 | 5 | 1 |
| M1S | 37,822 | 13,368 | 10 | 2 |
| M1T | 29,471 | 11,062 | 9 | 0 |

| FSA | CPZ Pop in FSA | CPZ HH in FSA | Desired Sample | Sample Obtained |
|---|---|---|---|---|
| M1V | 50,845 | 15,972 | 12 | 0 |
| M1W | 32,295 | 11,405 | 9 | 1 |
| M1X | 14,806 | 3,711 | 3 | 0 |
| **Total** | **1,435,745** | **487,215** | **380** | **398** |
| **Average Household Size** | **2.95** | | | |

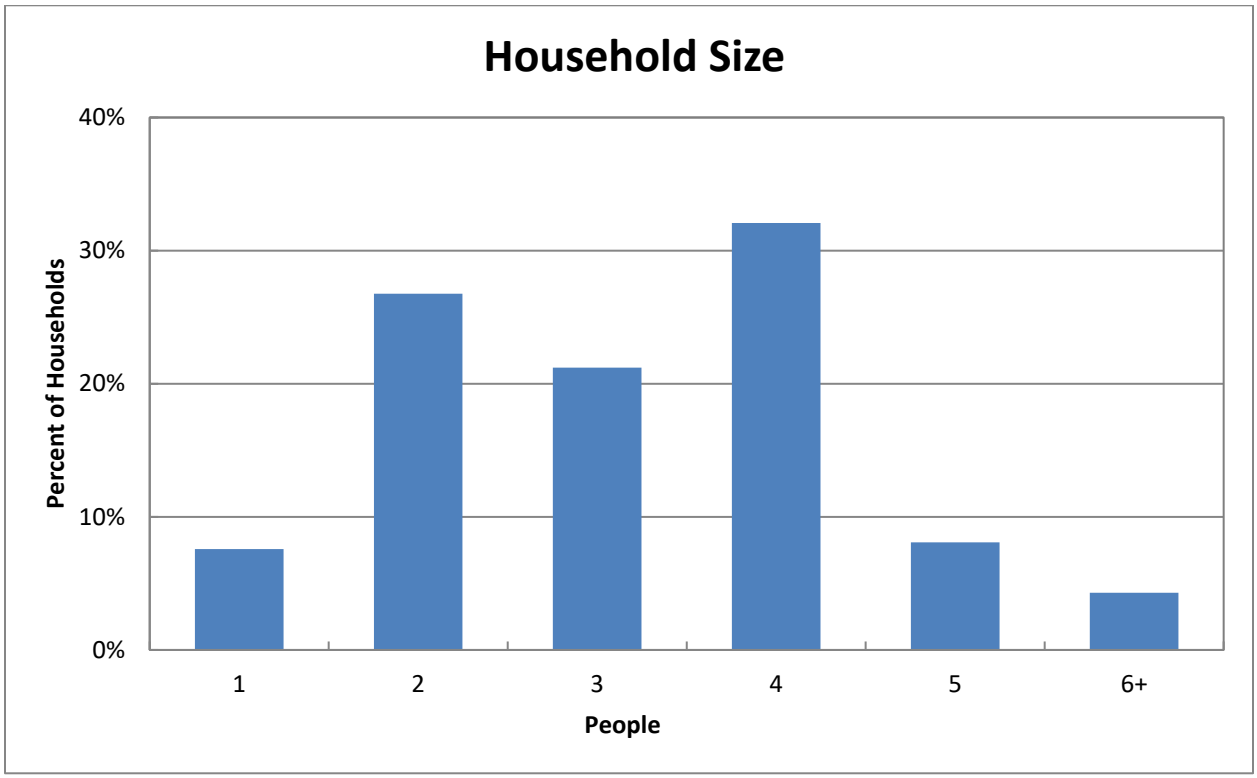



**Figure F-1. Household Size in the Planning Zone**

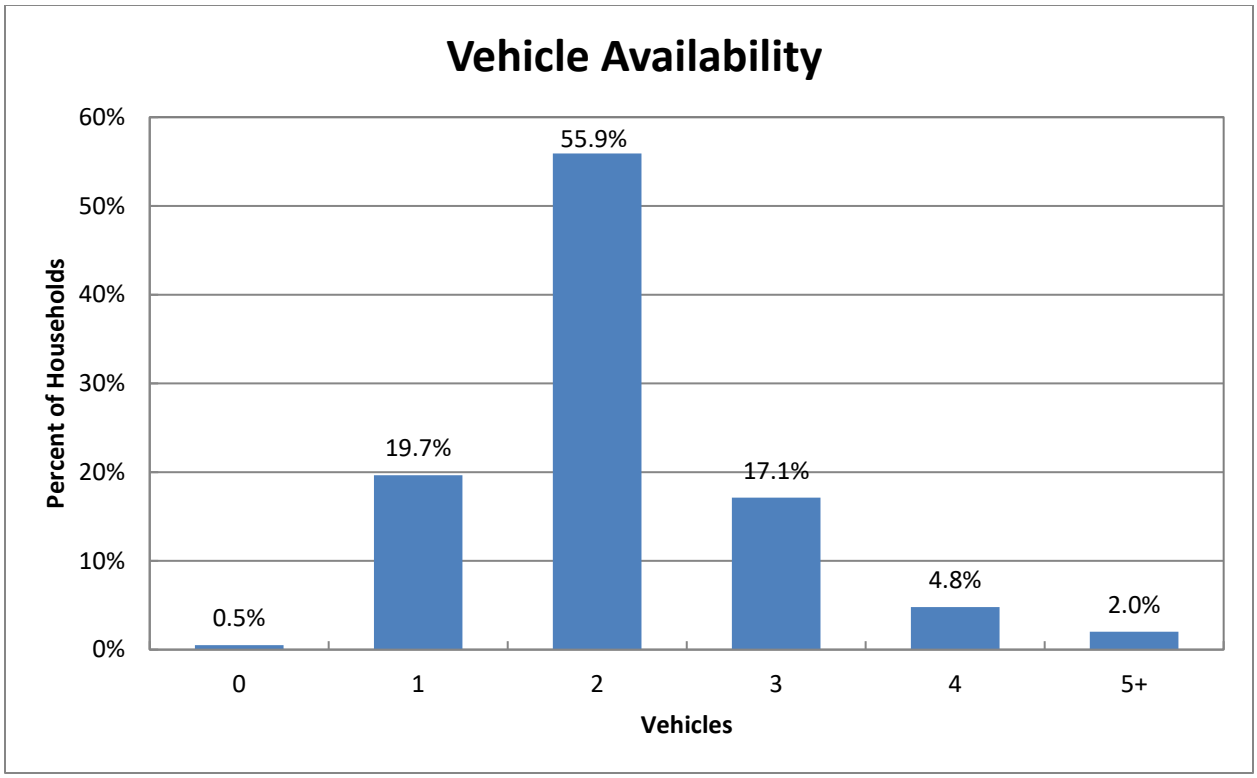



**Figure F-2. Household Vehicle Availability**

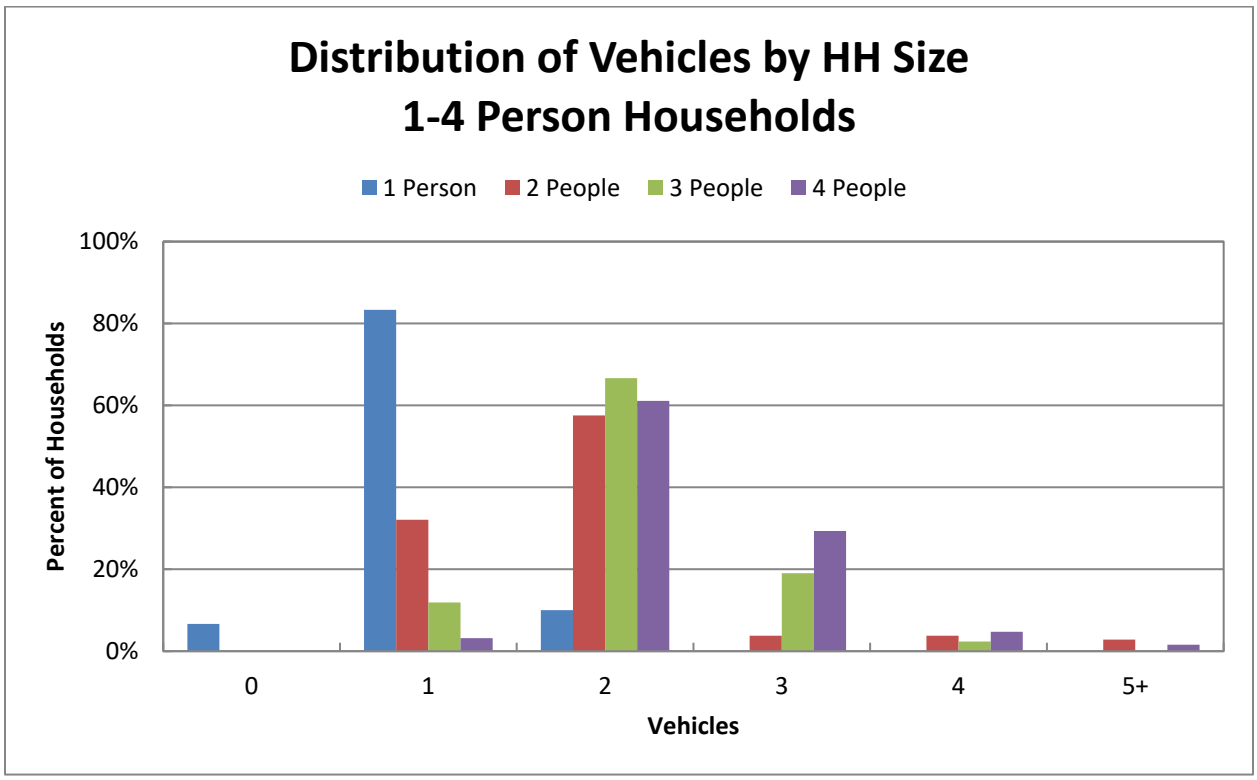



**Figure F-3. Vehicle Availability - 1 to 4 Person Households**

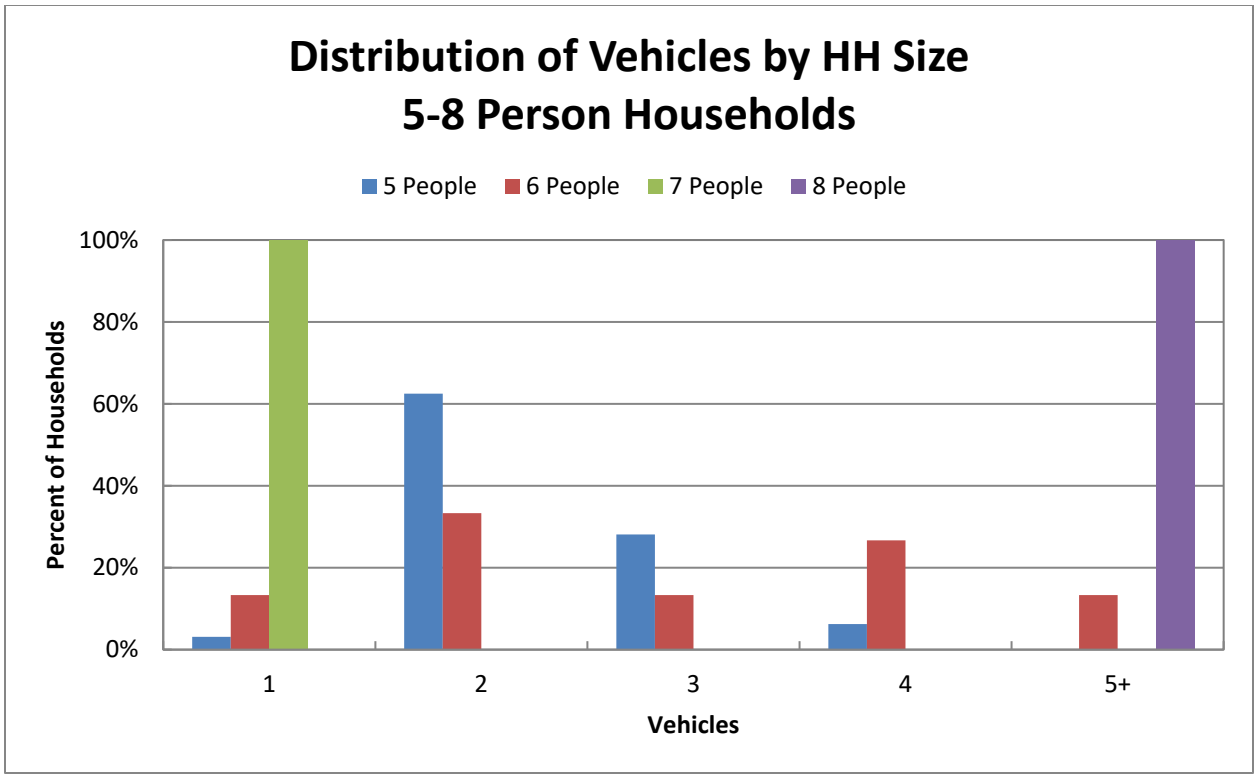



**Figure F-4. Vehicle Availability - 5 to 8 Person Households**

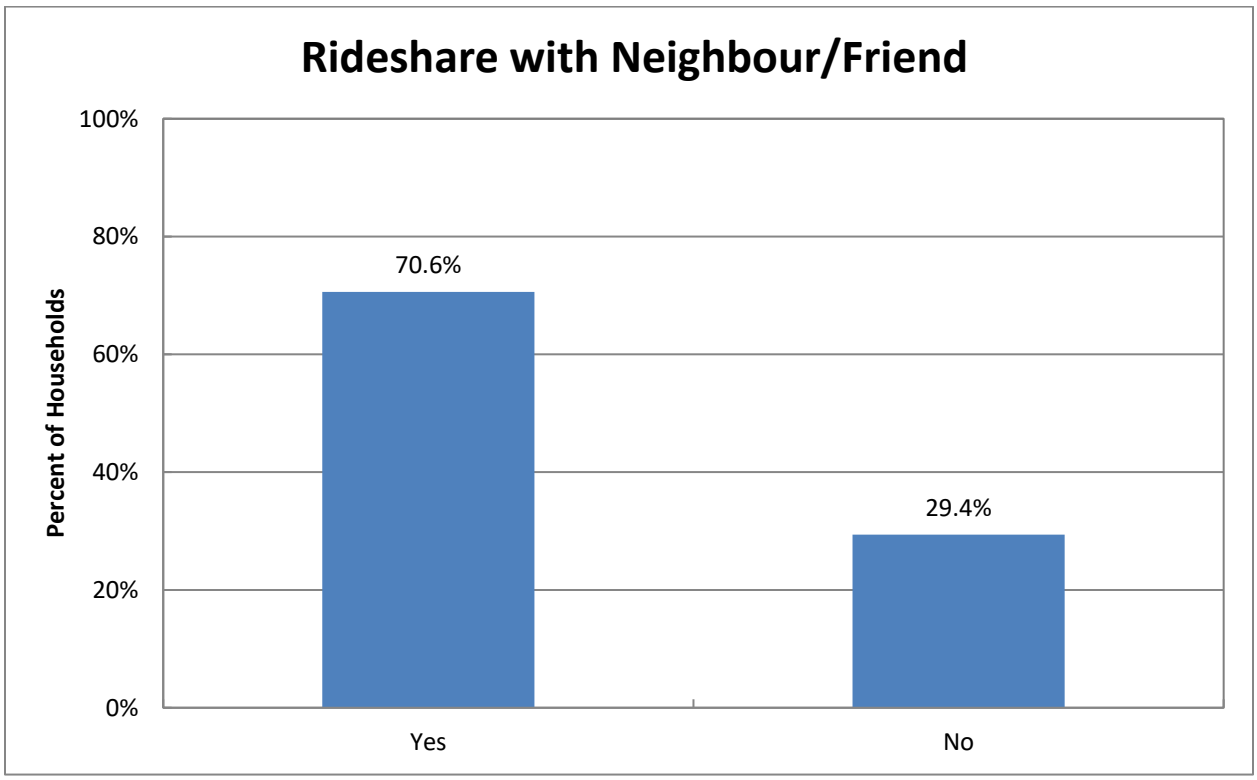



**Figure F-5. Household Ridesharing Preference**

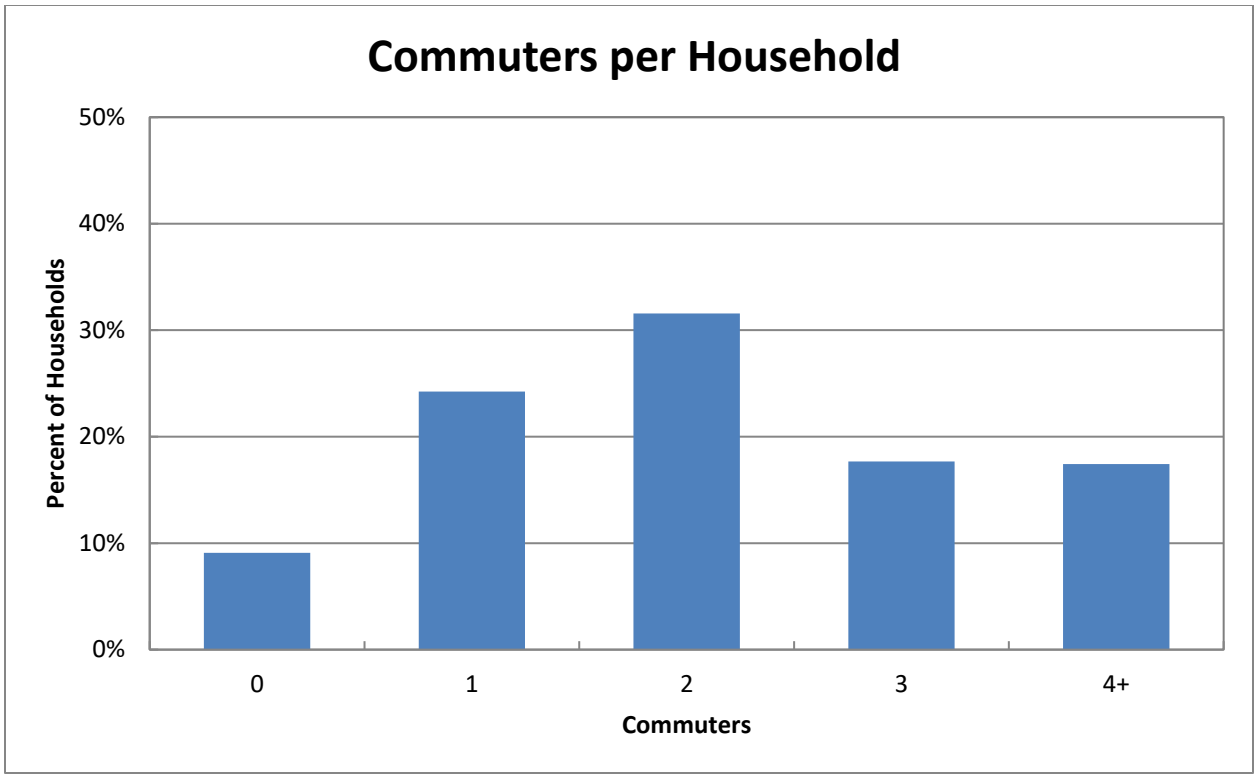



**Figure F-6. Commuters in Households in the Planning Zone**

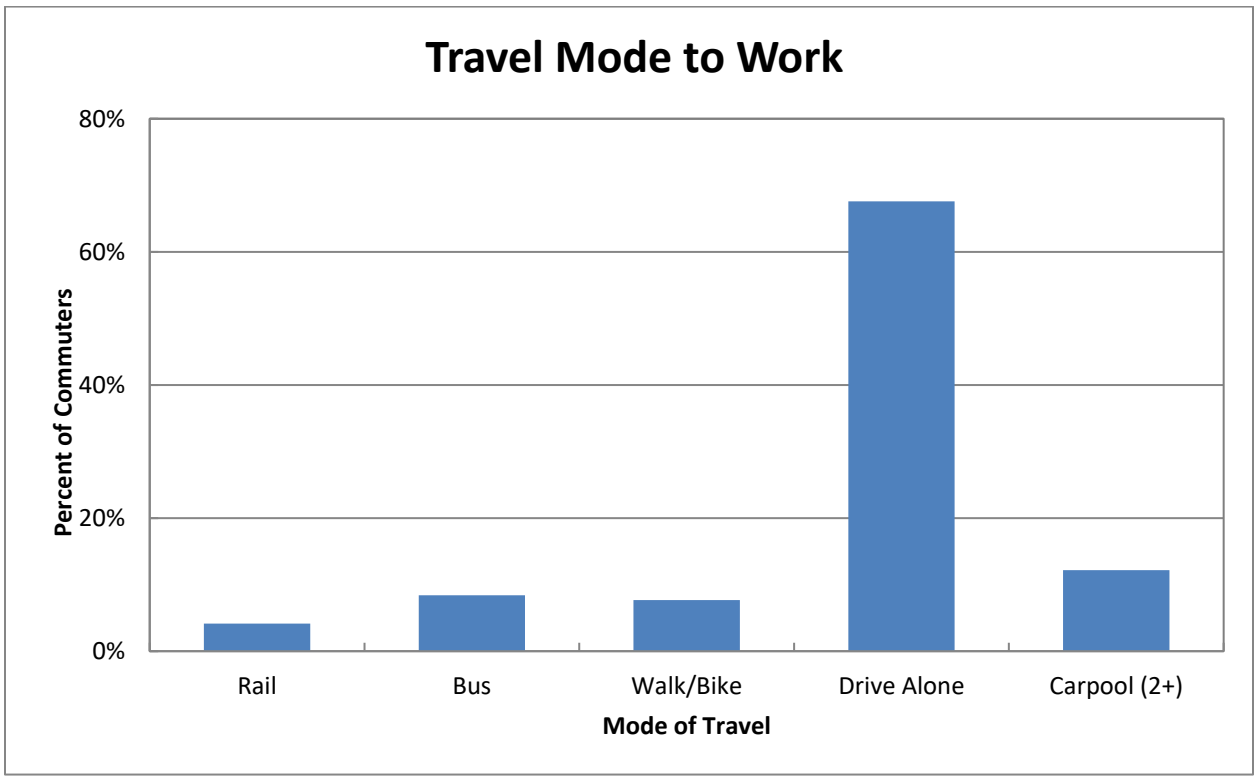



**Figure F-7. Modes of Travel in the Planning Zone**

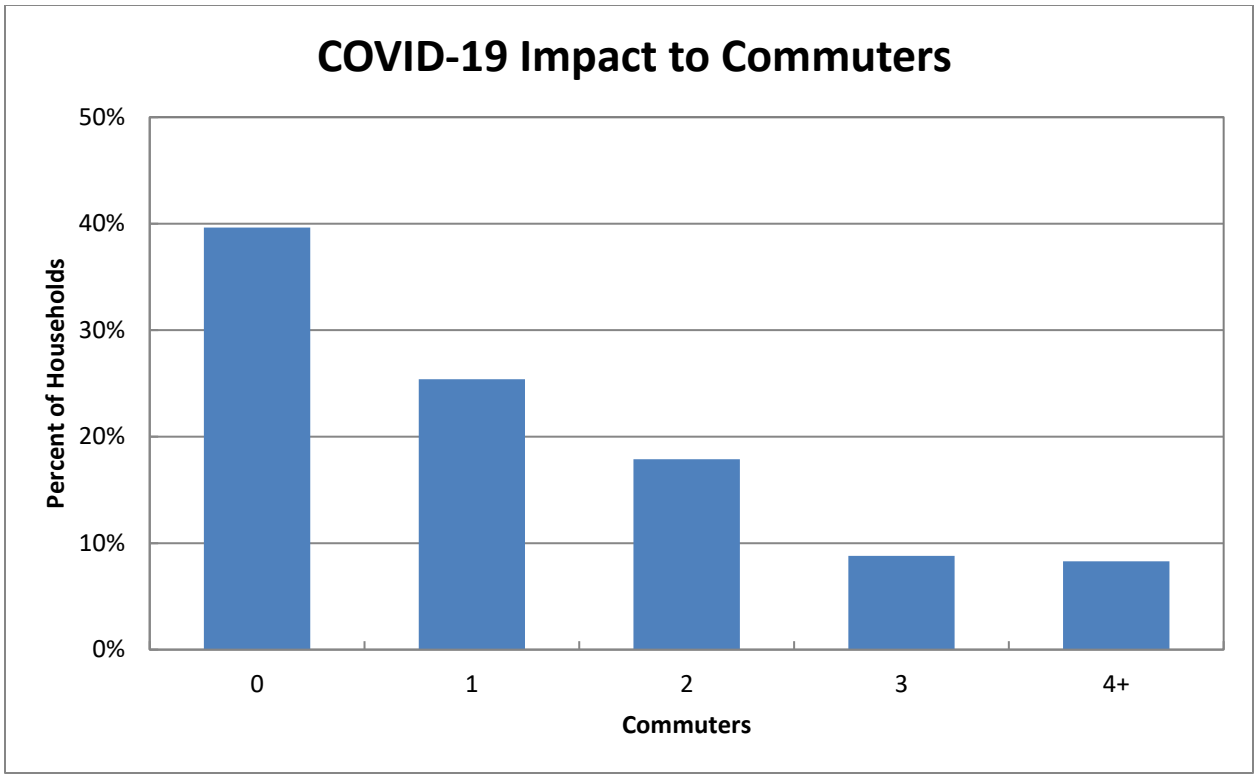



**Figure F-8. Impact to Commuters due to the COVID-19 Pandemic**

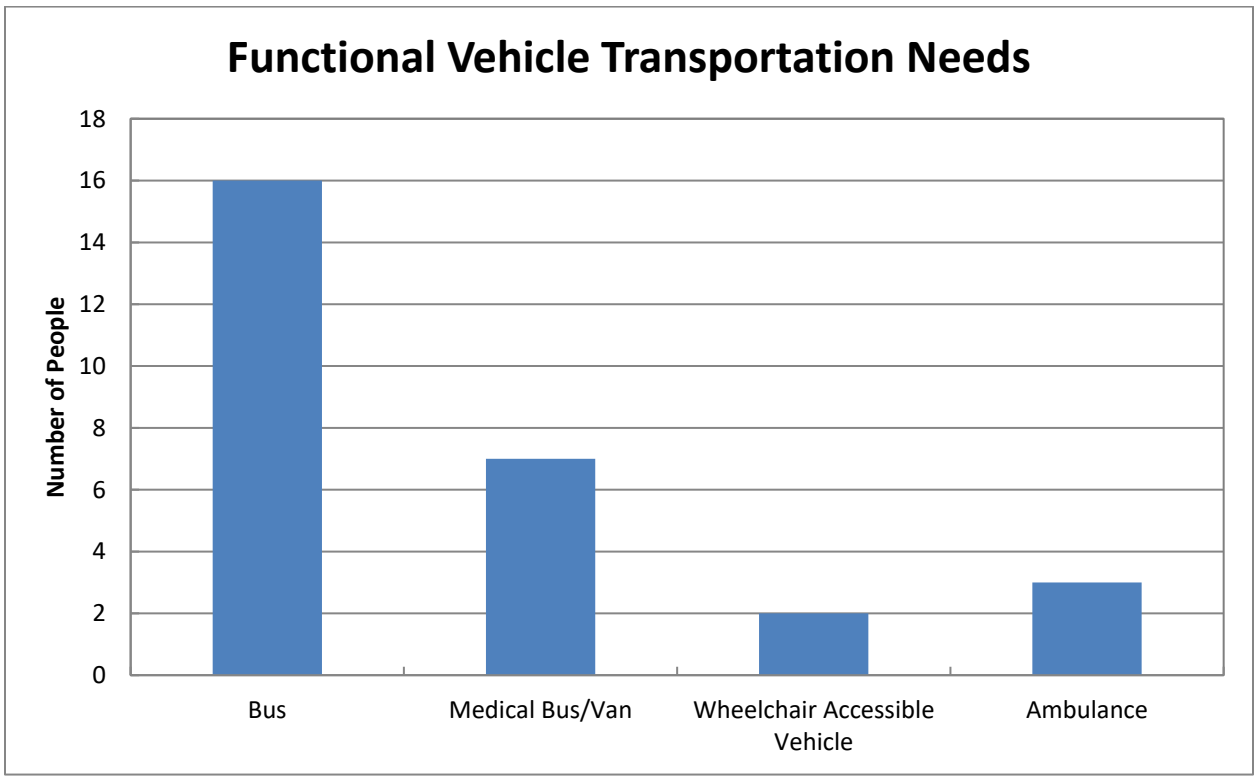



**Figure F-9. People with Functional or Transportation Needs**

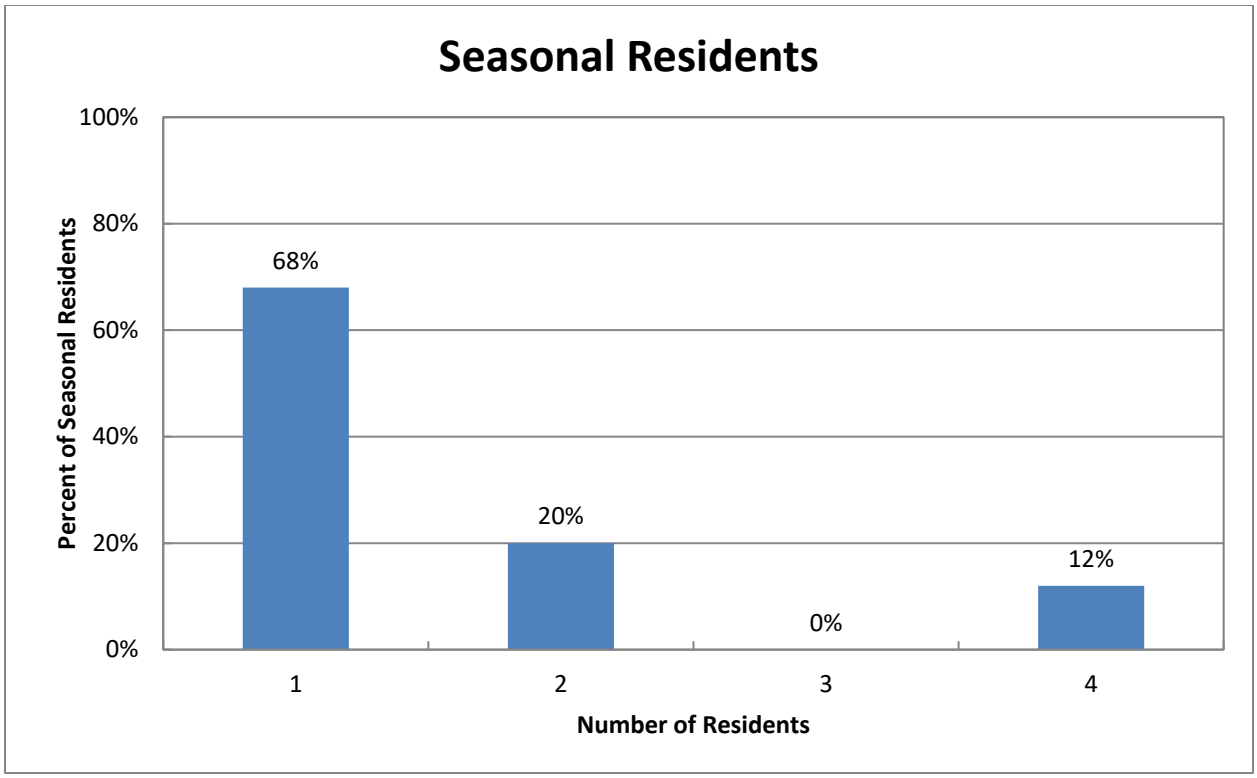



**Figure F-10. Households with Seasonal Residents**

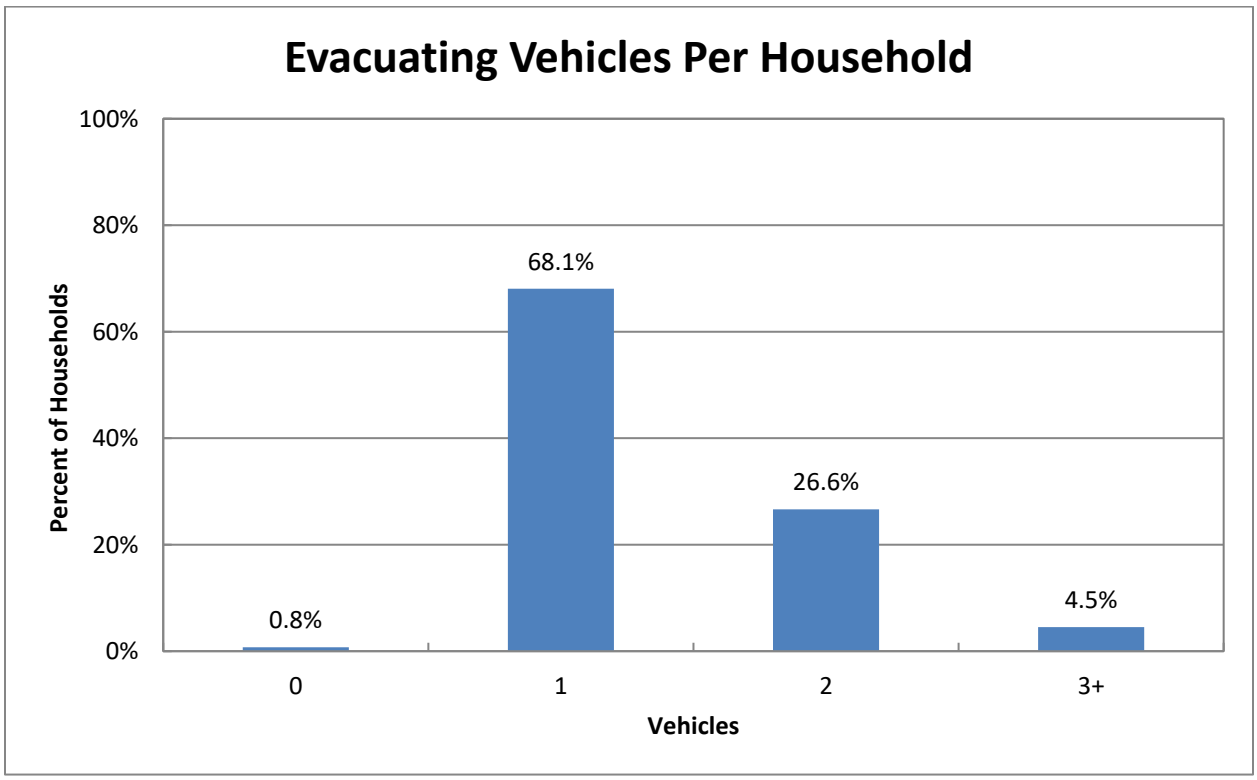



**Figure F-11. Number of Vehicles Used for Evacuation**

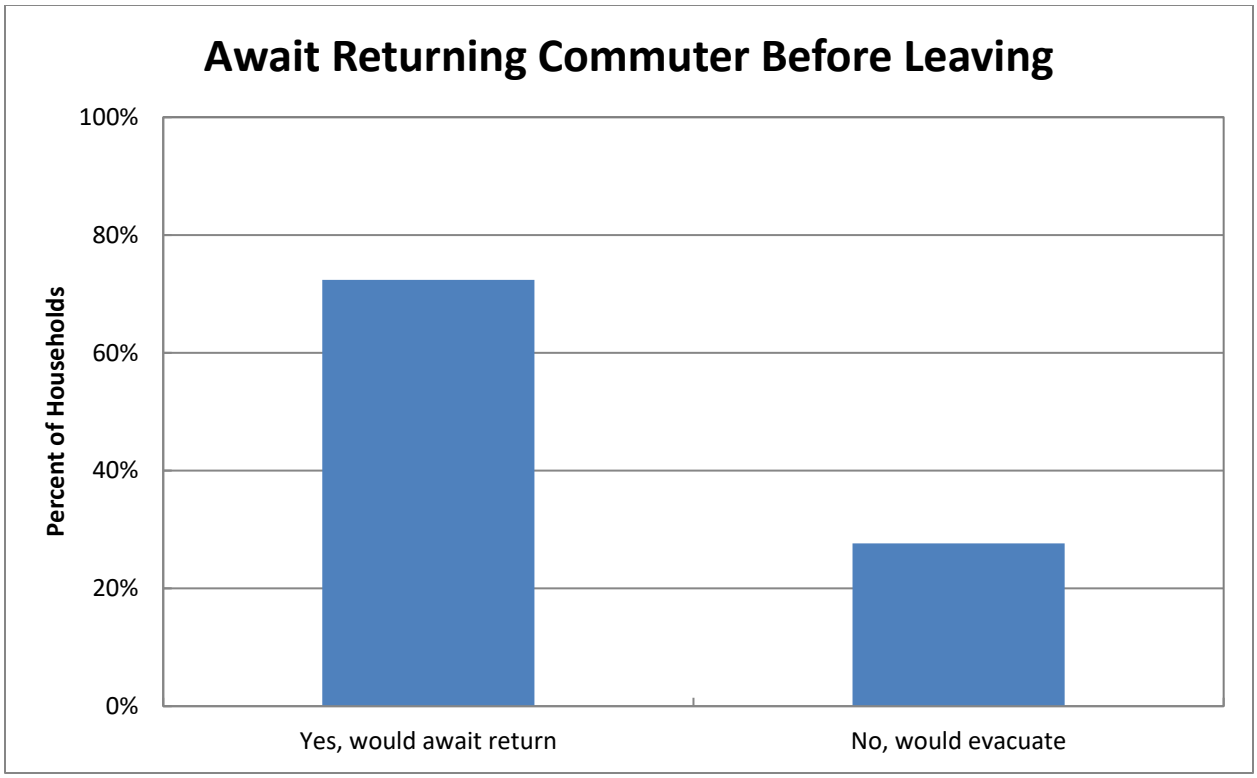



**Figure F-12. Percent of Households that Await Returning Commuter Before Evacuating**

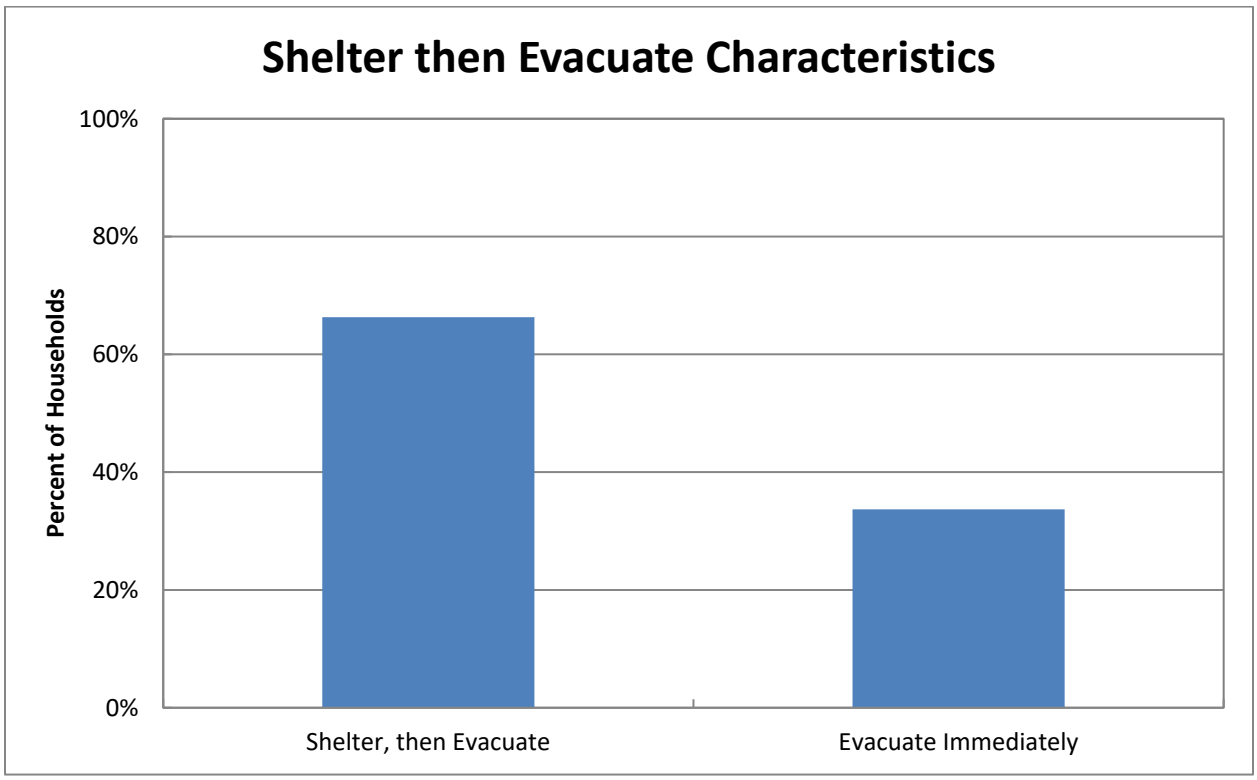



**Figure F-13. Shelter then Evacuate Characteristics**

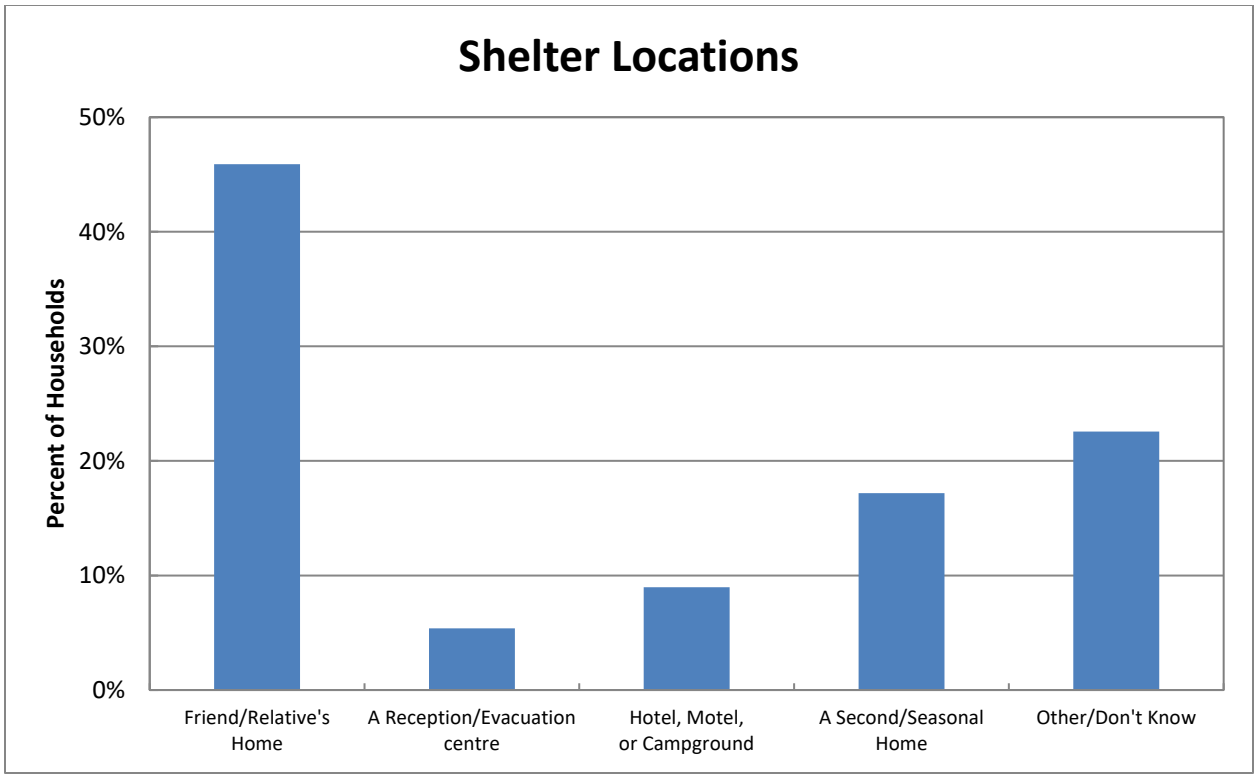



**Figure F-14. Planning Zone Evacuation Destinations**

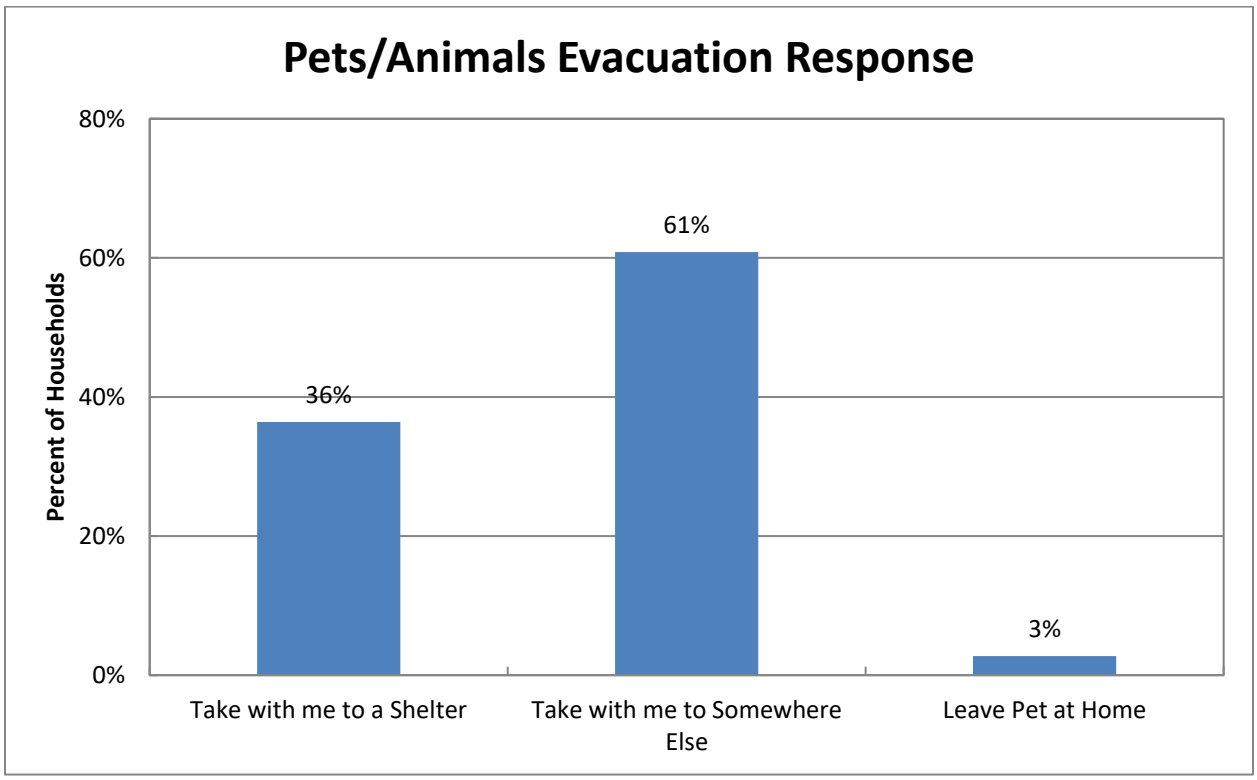



**Figure F-15. Households Evacuating with Pets/Animals**

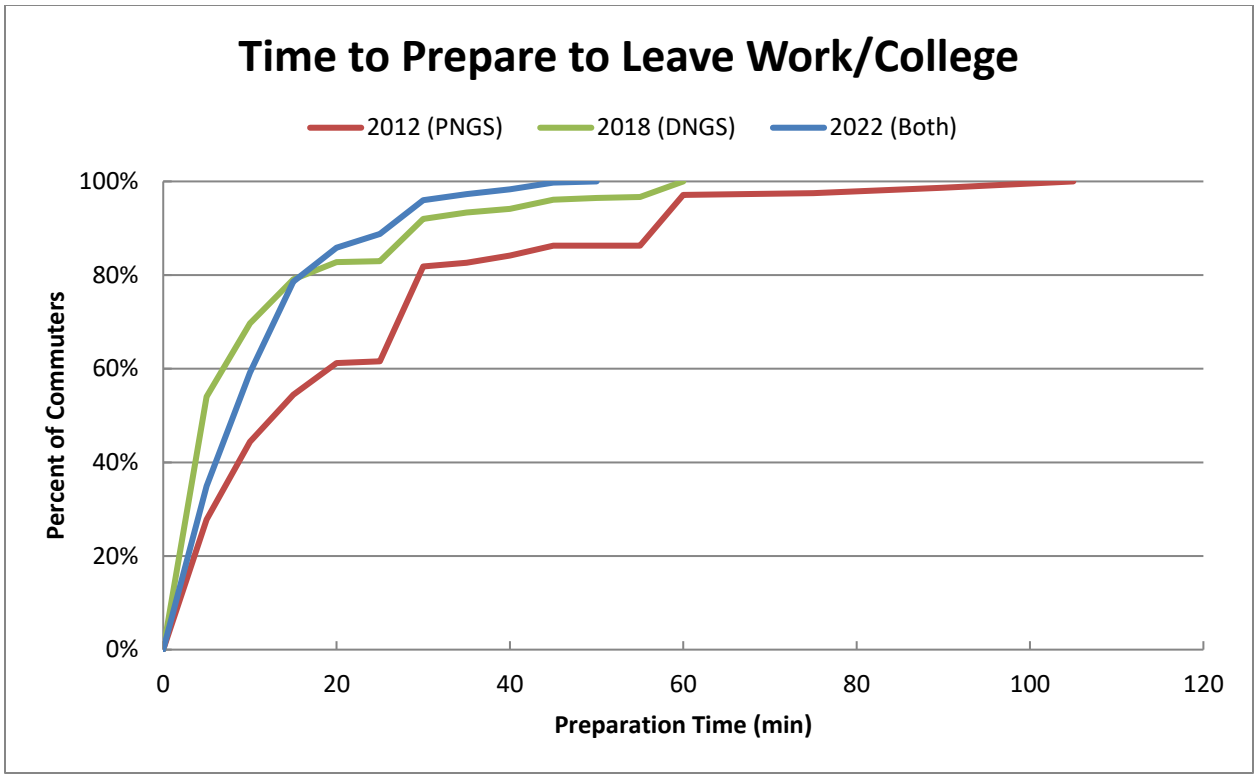



**Figure F-16. Time Required to Prepare to Leave Work/College**

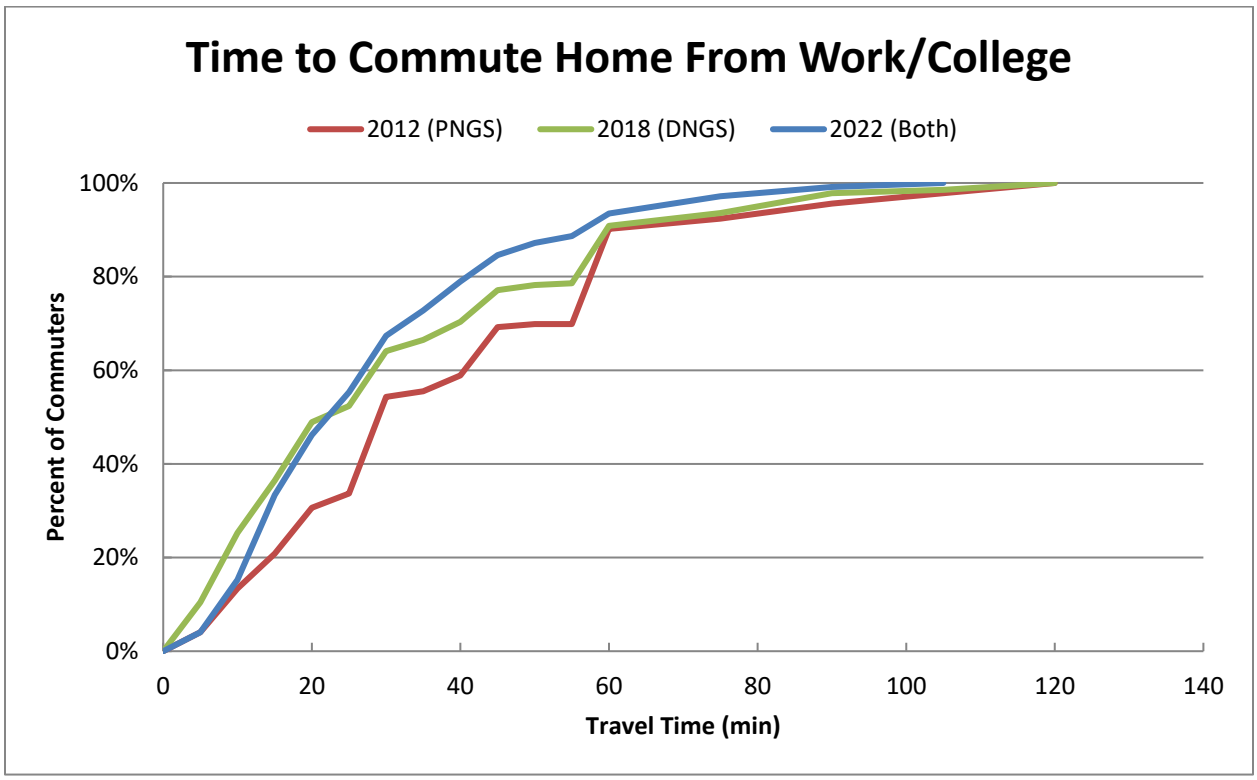



**Figure F-17. Time to Commute Home from Work/College**

**Figure F-18. Time to Prepare Home for Evacuation**

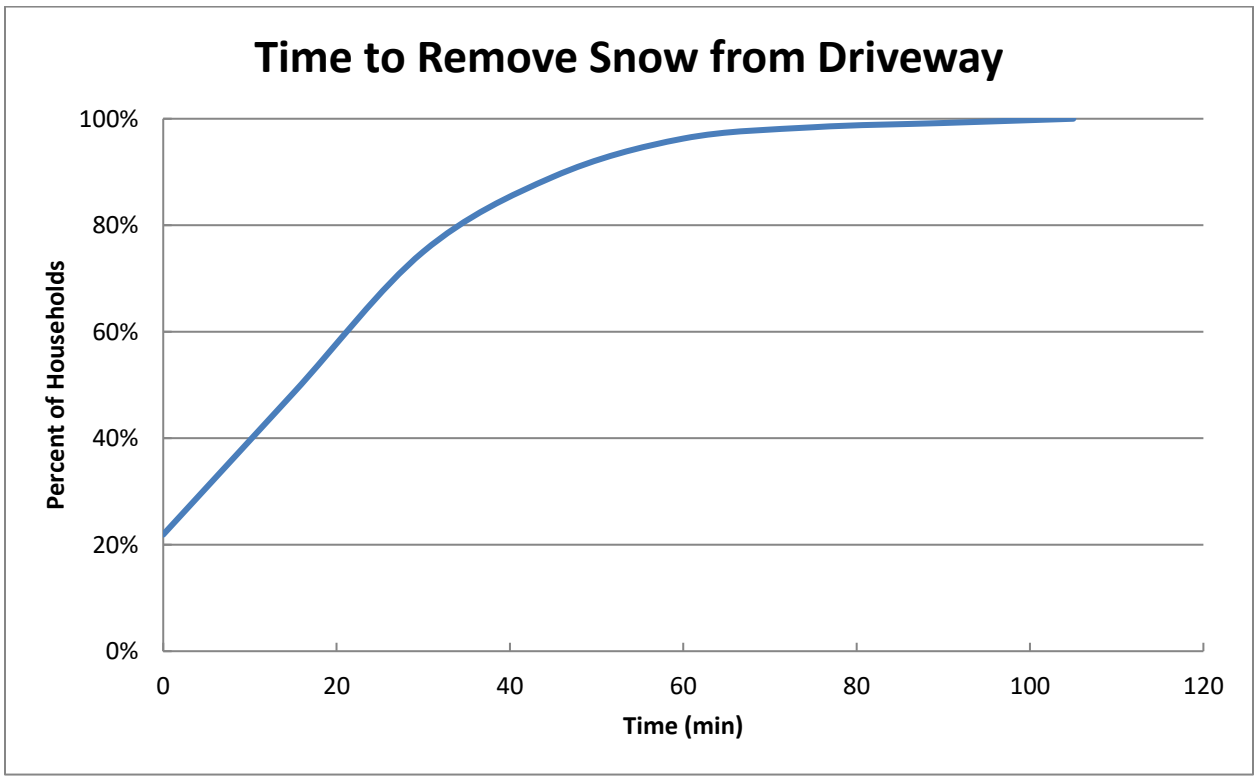



**Figure F-19. Time to Clear Driveway of 15-20 cm of Snow**

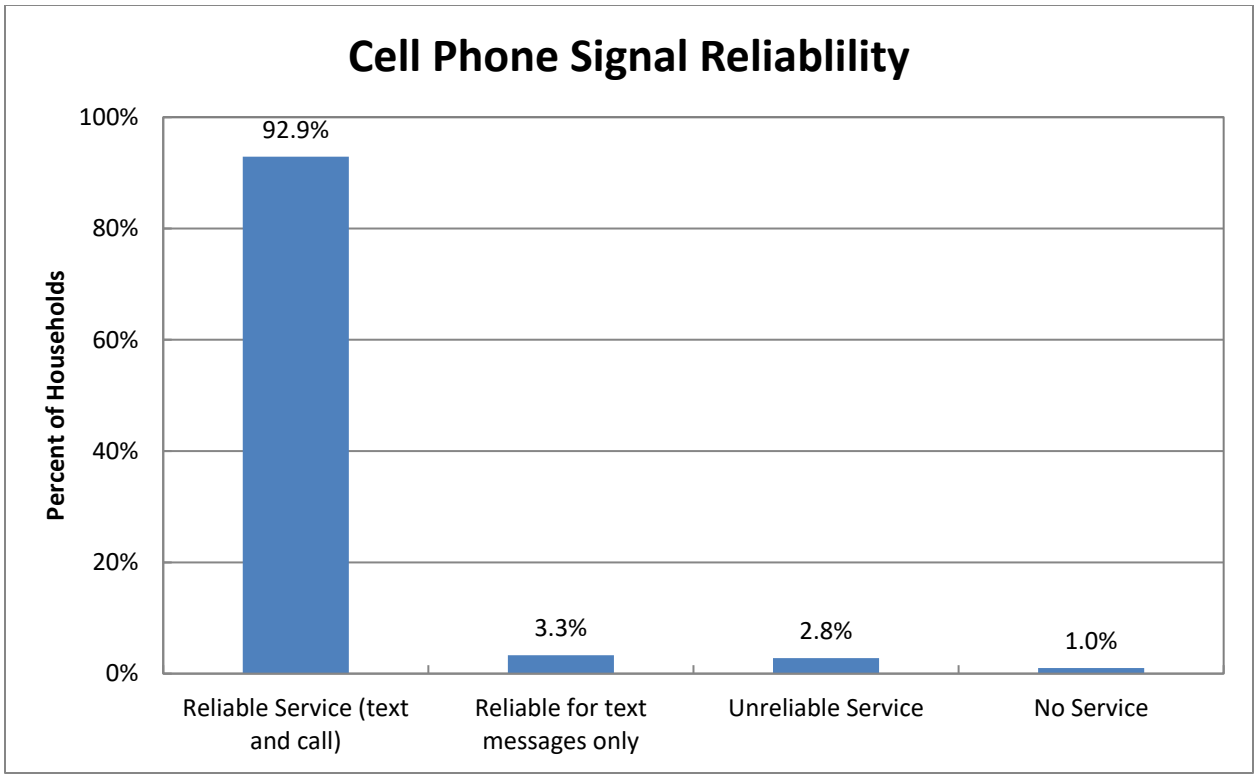



**Figure F-20. Cell Phone Signal Reliability (for Phone Call and/or Text Message)**

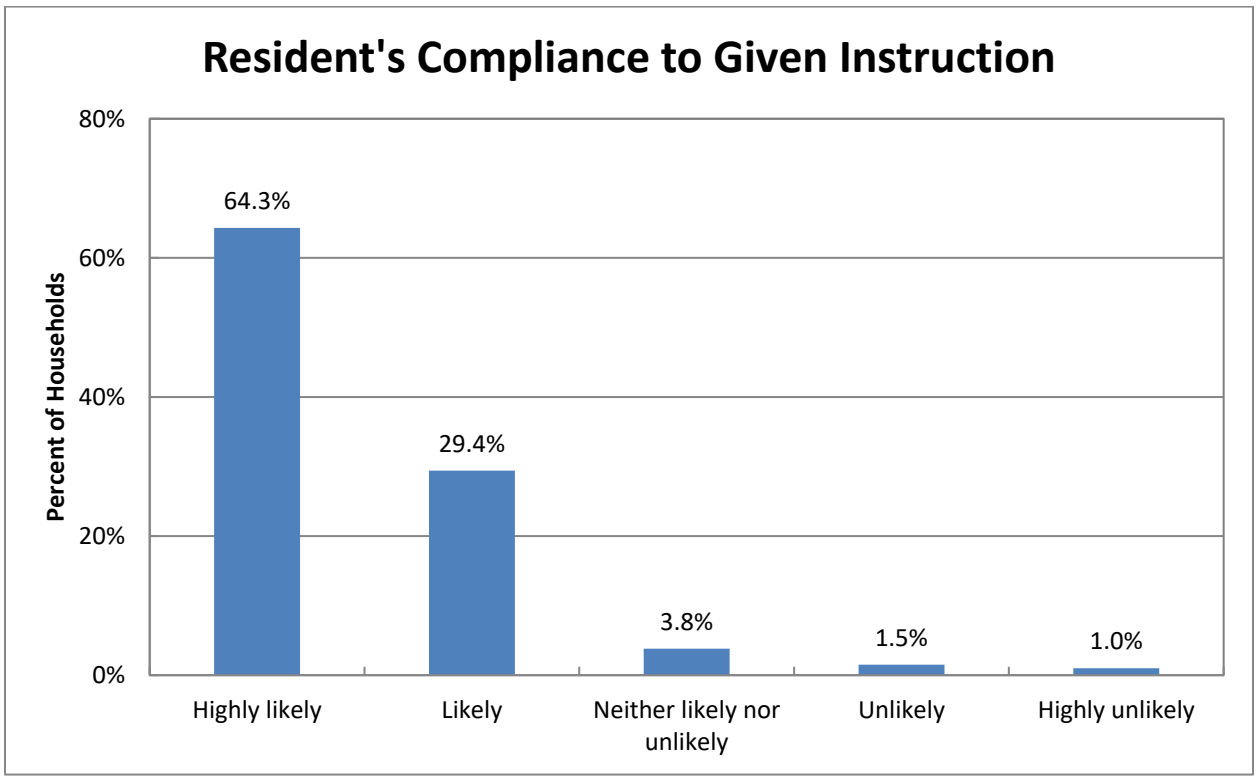



**Figure F-21. Resident's Compliance to Given Instruction (by Emergency Management Officials)**

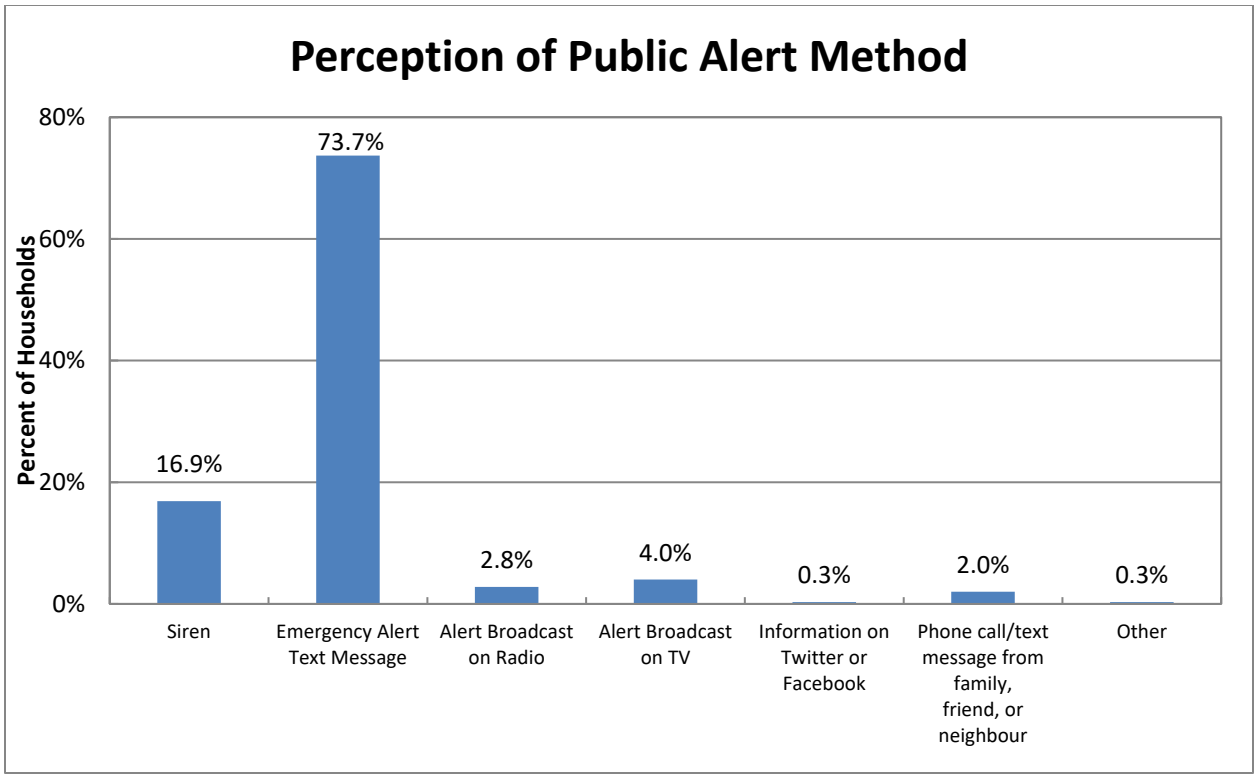



**Figure F-22. Perception of Public Alert Method**

ATTACHMENT A

Demographic Survey Instrument

# Purpose

The purpose of this survey is to identify local behaviour during potential emergency situations. The information gathered in this survey will be shared with local and provincial emergency planners to enhance emergency response plans in your area. Your responses will greatly contribute to local emergency preparedness. **Please only complete one survey per household. Please have the head of the household (18 years or older) complete the survey.** Do not provide your name or any personal information, and the survey will take less than 10 minutes to complete.

* Required

1. 1A. What is your gender?

   *Mark only one oval.*

   - ◯ Male
   - ◯ Female
   - ◯ Decline to State
   - ◯ Other: _____

2. 1B. What is your age?

   *Mark only one oval.*

   - ◯ 18 to 24 years
   - ◯ 25 to 34 years
   - ◯ 35 to 44 years
   - ◯ 45 to 54 years
   - ◯ 55 to 64 years
   - ◯ 65 years and over
   - ◯ Decline to state
   - ◯ Other (please state below)

3. Fill in OTHER answers for question 1B

   _____

4. 2. What is your home postal code? *

   _____

5. 3A. In total, how many running cars, or other vehicles are usually available to the household?

   *Mark only one oval.*

   - ◯ One
   - ◯ Two
   - ◯ Three
   - ◯ Four
   - ◯ Five
   - ◯ Six
   - ◯ Seven
   - ◯ Eight
   - ◯ Nine or more
   - ◯ Zero (None)
   - ◯ Decline to state

6. 3B. In an emergency, could you get a ride out of the area with a neighbour or friend?

   *Mark only one oval.*

   - ◯ Yes
   - ◯ No
   - ◯ Decline to state

7. 4. How would you evacuate in an emergency?

*Mark only one oval.*

- I would evacuate by personal vehicle
- I would rideshare with a neighbour or friend
- I would evacuate by bicycle
- I would evacuate by bus
- I would evacuate by train
- I would evacuate by foot
- I would not evacuate
- Decline to state

8. 4B. What would you do if the train was not available?

*Mark only one oval.*

- I would evacuate by personal vehicle
- I would rideshare with a neighbour or friend
- I would evacuate by bicycle
- I would evacuate by bus
- I would evacuate by foot
- I would require assistance from local/provincial agencies
- I would not evacuate
- Decline to state

9. 4B. What would you do if buses were not available?

*Mark only one oval.*

- I would evacuate by personal vehicle
- I would rideshare with a neighbour or friend
- I would evacuate by bicycle
- I would evacuate by train
- I would evacuate by foot
- I would require assistance from local/provincial agencies
- I would not evacuate
- Decline to state

10. 5. How many vehicles would your household use during an evacuation?

*Mark only one oval.*

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine or more
- Zero (None)
- I would evacuate by bike
- I would evacuate by bus
- Decline to state

11. 6A. How many people usually live in this household?

*Mark only one oval.*

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine
- Ten
- Eleven
- Twelve
- Thirteen
- Fourteen
- Fifteen
- Sixteen
- Seventeen
- Eighteen
- Nineteen or more
- Decline to state

12. 6B. Of these people that live in this household, are any of them seasonal residents?

*Mark only one oval.*

- Yes
- No
- Decline to State

13. 6C. How many of the household residents are seasonal?

*Mark only one oval.*

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine
- Ten
- Eleven
- Twelve
- Thirteen
- Fourteen
- Fifteen
- Sixteen
- Seventeen
- Eighteen
- Nineteen or more
- Decline to state

14. 6D. What season do the seasonal residents live in this home?

*Mark only one oval.*

- Summer
- Fall / Winter / Spring
- Decline to State

COVID-19

15. 7. How many people in your household have a work and/or school commute that has been impacted due to the COVID-19 pandemic?

*Mark only one oval.*

- Zero
- One
- Two
- Three
- Four or more
- Decline to state

Commuters

16. 8. How many people in the household normally (during non-COVID conditions) commute to a place of employment, or to school on a daily basis? *

*Mark only one oval.*

- Zero
- One
- Two
- Three
- Four or more
- Decline to state

Mode of Travel

17. 9. Thinking about each commuter, how does each person usually commute (during non-COVID conditions)?

*Mark only one oval per row.*

| | Rail | Bus | Walk/Bicycle | Drive Alone | Carpool-2 or more people | Don't know |
|---|---|---|---|---|---|---|
| **Commuter 1** | | | | | | |

18. 9A. Thinking about each commuter who travels by rail, if an evacuation was ordered at the station the commuters vehicle is parked, would they return to their vehicle?

*Mark only one oval per row.*

| | Yes | No | Decline to State |
|---|---|---|---|
| **Commuter 1** | | | |

19. 9B. Thinking about each commuter who travels by rail and indicated they will return to their vehicle, would they return home before evacuating?

*Mark only one oval per row.*

| | Yes | No | Not Applicable/Decline to State |
|---|---|---|---|
| **Commuter 1** | | | |

20. 9. Thinking about each commuter, how does each person usually commute (during non-COVID conditions)?

*Mark only one oval per row.*

| | Rail | Bus | Walk/Bicycle | Drive Alone | Carpool-2 or more people | Don't know |
|---|---|---|---|---|---|---|
| **Commuter 1** | | | | | | |
| **Commuter 2** | | | | | | |

21. 9A. Thinking about each commuter who travels by rail, if an evacuation was ordered at the station the commuters vehicle is parked, would they return to their vehicle?

*Mark only one oval per row.*

| | Yes | No | Decline to State |
|---|---|---|---|
| **Commuter 1** | | | |
| **Commuter 2** | | | |

22. 9B. Thinking about each commuter who travels by rail and indicated they will return to their vehicle, would they return home before evacuating?

*Mark only one oval per row.*

| | Yes | No | Not Applicable/Decline to State |
|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ |

23. 9. Thinking about each commuter, how does each person usually commute (during non-COVID conditions)?

*Mark only one oval per row.*

| | Rail | Bus | Walk/Bicycle | Drive Alone | Carpool-2 or more people | Don't know |
|---|---|---|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

24. 9A. Thinking about each commuter who travels by rail, if an evacuation was ordered at the station the commuters vehicle is parked, would they return to their vehicle?

*Mark only one oval per row.*

| | Yes | No | Decline to State |
|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ |

25. 9B. Thinking about each commuter who travels by rail and indicated they will return to their vehicle, would they return home before evacuating?

*Mark only one oval per row.*

| | Yes | No | Not Applicable/Decline to State |
|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ |

26. 9. Thinking about each commuter, how does each person usually commute (during non-COVID conditions)?

*Mark only one oval per row.*

| | Rail | Bus | Walk/Bicycle | Drive Alone | Carpool-2 or more people | Don't know |
|---|---|---|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Commuter 4** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

27. 9A. Thinking about each commuter who travels by rail, if an evacuation was ordered at the station the commuters vehicle is parked, would they return to their vehicle?

*Mark only one oval per row.*

| | Yes | No | Decline to State |
|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ |
| **Commuter 4** | ◯ | ◯ | ◯ |

28. 9B. Thinking about each commuter who travels by rail and indicated they will return to their vehicle, would they return home before evacuating?

*Mark only one oval per row.*

| | Yes | No | Not Applicable/Decline to State |
|---|---|---|---|
| **Commuter 1** | ◯ | ◯ | ◯ |
| **Commuter 2** | ◯ | ◯ | ◯ |
| **Commuter 3** | ◯ | ◯ | ◯ |
| **Commuter 4** | ◯ | ◯ | ◯ |

*Skip to question 29*

Travel Home From Work/College

29. 10-1. How much time on average, would it take Commuter #1 to travel home from a place of employment or school (during non-COVID conditions)?

***Mark only one oval.***

- ◯ 5 minutes or less
- ◯ 6-10 minutes
- ◯ 11-15 minutes
- ◯ 16-20 minutes
- ◯ 21-25 minutes
- ◯ 26-30 minutes
- ◯ 31-35 minutes
- ◯ 36-40 minutes
- ◯ 41-45 minutes
- ◯ 46-50 minutes
- ◯ 51-55 minutes
- ◯ 56 - 1 hour
- ◯ Over 1 hour, but less than 1 hour 15 minutes
- ◯ Between 1 hour 16 minutes and 1 hour 30 minutes
- ◯ Between 1 hour 31 minutes and 1 hour 45 minutes
- ◯ Between 1 hour 46 minutes and 2 hours
- ◯ Over 2 hours
- ◯ Decline to state

30. If Over 2 Hours for Question 10-1, Specify Here

_____

31. 10-2. How much time on average, would it take Commuter #2 to travel home from a place of employment or school (during non-COVID conditions)?

***Mark only one oval.***

- ◯ 5 minutes or less
- ◯ 6-10 minutes
- ◯ 11-15 minutes
- ◯ 16-20 minutes
- ◯ 21-25 minutes
- ◯ 26-30 minutes
- ◯ 31-35 minutes
- ◯ 36-40 minutes
- ◯ 41-45 minutes
- ◯ 46-50 minutes
- ◯ 51-55 minutes
- ◯ 56 - 1 hour
- ◯ Over 1 hour, but less than 1 hour 15 minutes
- ◯ Between 1 hour 16 minutes and 1 hour 30 minutes
- ◯ Between 1 hour 31 minutes and 1 hour 45 minutes
- ◯ Between 1 hour 46 minutes and 2 hours
- ◯ Over 2 hours
- ◯ Decline to state

32. If Over 2 Hours for Question 10-2, Specify Here

_____

33. 10-3. How much time on average, would it take Commuter #3 to travel home from a place of employment or school (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

34. If Over 2 Hours for Question 10-3, Specify Here

35. 10-4. How much time on average, would it take Commuter #4 to travel home from a place of employment or school (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

36. If Over 2 Hours for Question 10-4, Specify Here

*Skip to question 37*

Preparation to leave Work/College

37. 11-1. Approximately how much time would it take Commuter #1 to complete preparation for leaving a place of employment or school prior to starting the trip home (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

38. If Over 2 Hours for Question 11-1, Specify Here

39. 11-2. Approximately how much time would it take Commuter #2 to complete preparation for leaving a place of employment or school prior to starting the trip home (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

40. If Over 2 Hours for Question 11-2, Specify Here

41. 11-3. Approximately how much time would it take Commuter #3 to complete preparation for leaving a place of employment or school prior to starting the trip home (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

42. If Over 2 Hours for Question 11-3, Specify Here

43. 11-4. Approximately how much time would it take Commuter #4 to complete preparation for leaving a place of employment or school prior to starting the trip home (during non-COVID conditions)?

*Mark only one oval.*

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- Decline to state

44. If Over 2 Hours for Question 11-4, Specify Here

*Skip to question 45*

Additional Questions

45. 12. Please choose one of the following:

*Mark only one oval.*

- I would await the return of household members to evacuate together.
- I would evacuate independently and meet other household members later.
- Decline to State

46. 13. If you were advised by local authorities to evacuate, how much time would it take the household to pack clothing, medications, secure the house, load the car, and complete preparations prior to evacuating the area?

*Mark only one oval.*

- Less than 15 minutes
- 15-30 minutes
- 31-45 minutes
- 46 minutes - 1 hour
- 1 hour to 1 hour 15 minutes
- 1 hour 16 minutes to 1 hour 30 minutes
- 1 hour 31 minutes to 1 hour 45 minutes
- 1 hour 46 minutes to 2 hours
- 2 hours to 2 hours 15 minutes
- 2 hours 16 minutes to 2 hours 30 minutes
- 2 hours 31 minutes to 2 hours 45 minutes
- 2 hours 46 minutes to 3 hours
- 3 hours to 3 hours 15 minutes
- 3 hours 16 minutes to 3 hours 30 minutes
- 3 hours 31 minutes to 3 hours 45 minutes
- 3 hours 46 minutes to 4 hours
- 4 hours to 4 hours 15 minutes
- 4 hours 16 minutes to 4 hours 30 minutes
- 4 hours 31 minutes to 4 hours 45 minutes
- 4 hours 46 minutes to 5 hours
- 5 hours to 5 hours 30 minutes
- 5 hours 31 minutes to 6 hours
- Over 6 hours
- Will not evacuate
- Decline to State

47. If Over 6 Hours for Question 13, Specify Here

_____

48. 14. If there are 15-20 centimetres of snow on your driveway or curb, would you need to shovel out to evacuate? If yes, how much time, on average, would it take you to clear the 15-20 centimetres of snow to move the car from the driveway or curb to begin the evacuation trip? Assume the roads are passable.

*Mark only one oval.*

- Less than 15 minutes
- 15-30 minutes
- 31-45 minutes
- 46 minutes - 1 hour
- 1 hour to 1 hour 15 minutes
- 1 hour 16 minutes to 1 hour 30 minutes
- 1 hour 31 minutes to 1 hour 45 minutes
- 1 hour 46 minutes to 2 hours
- 2 hours to 2 hours 15 minutes
- 2 hours 16 minutes to 2 hours 30 minutes
- 2 hours 31 minutes to 2 hours 45 minutes
- 2 hours 46 minutes to 3 hours
- Over 3 hourz
- No, will not shovel out
- Decline to State

49. If Over 3 Hours for Question 14, Specify Here

_____

50. 15. Please specify the number of people in your household who require functional or transportation needs in an evacuation. The intent of this question is to identify those households who will require assistance from a local/provincial agency in an evacuation. If you own your own transportation and do not need assistance from a local/provincial agency, please select "0" below.

*Mark only one oval per row.*

| | 0 | 1 | 2 | 3 | 4 | More than 4 |
|---|---|---|---|---|---|---|
| **Bus** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Medical Bus/Van** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Wheelchair Accessible Vehicle** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Ambulance** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Other** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

51. Specify "Other" Transportation Need Below

_____

52. 15B. You indicated in your response to Question 15 that you would require assistance from a local/provincial agency in an evacuation. Have you already registered with local/provincial agencies for support (for example, Red Cross Transportation)?

*Mark only one oval.*

- ◯ Yes
- ◯ No
- ◯ Decline to state

53. 16A. Emergency officials advise you to shelter-in-place (staying inside your house with the windows closed and ventilation to the outside turned off) in an emergency because you are not in the area of risk. Would you:

*Mark only one oval.*

- ◯ Shelter-in-place
- ◯ Evacuate
- ◯ Decline to state

54. 16B. Emergency officials advise you to shelter-in-place (staying inside your house with the windows closed and ventilation to the outside turned off) now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you:

*Mark only one oval.*

- ◯ Shelter-in-place
- ◯ Evacuate
- ◯ Decline to state

55. 16C. Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?

*Mark only one oval.*

- ◯ A relative's or friend's home
- ◯ A Reception/Evacuation centre
- ◯ A hotel, motel or campground
- ◯ A second/seasonal home
- ◯ Would not evacuate
- ◯ Don't know
- ◯ Other (Specify Below)
- ◯ Decline to state

56. Fill in "Other" answers for question 16C

_____

57. 17. In the event of an emergency evacuation, would you use a toll road at any point along your route?

*Mark only one oval.*

- Yes
- Yes, if tolls were waived
- No
- Decline to state

Pet Questions

58. 18A. Do you have any pet(s) and/or animal(s)?

*Mark only one oval.*

- Yes
- No
- Decline to state

59. 18B. What type of pet(s) and/or animal(s) do you have?

*Check all that apply.*

- Dog
- Cat
- Bird
- Reptile
- Horse
- Fish
- Chicken
- Goat
- Pig
- Other small pets/animals (Specify Below)
- Other large pets/animals (Specify Below)
- Decline to state
- Other: _____

60. 18C. What would you do with your pet(s) and/or animal(s) if you had to evacuate?

*Mark only one oval.*

- Take pet with me to a shelter
- Take pet with me somewhere else
- Leave pet at home
- Decline to state

61. 18D. Do you have sufficient room in your vehicle(s) to evacuate with your pet(s) and/or animal(s)?

*Mark only one oval.*

- Yes
- No
- Will use a trailer
- Decline to state
- Other: _____

*Skip to question 62*

Emergency Communications

62. 19A. At your place of residence, how reliable is your cell phone signal?

*Mark only one oval.*

- Very reliable to receive texts and phone calls
- Reliable for text messages only
- I do not always receive cell communications at my residence
- I do not have cell service at my residence

63. 19B. Emergency management officials in your region/province may send text messages, similar to AMBER Alerts, with emergency directions for the public during an emergency. How likely would you be to take action on these directions, if you received the message?

*Mark only one oval.*

- Highly likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Highly unlikely

64. 19C. Which of the following emergency communication methods do you think is most likely to alert you at your residence?

*Mark only one oval.*

- A siren sounding near your home
- A text message from emergency officials
- Alert Broadcast on radio
- Alert broadcast on TV
- Information on Twitter or Facebook
- Phone call/text message from family, friend, or neighbour
- OTHER

65. Fill in OTHER answers for question 19C

## APPENDIX G

Traffic Management Plan

# G. TRAFFIC MANAGEMENT PLAN

NUREG/CR-7002 Rev. 1 indicates that the existing TCPs and ACPs identified by the offsite agencies should be used in the evacuation simulation modelling. The Region Traffic Control/Sector Book Plan (RTCP) was provided by Durham Region. This plan was reviewed for utilization in this analysis. Durham Emergency Management officers indicated that Durham Region Police Service would not have adequate officers to deploy to all intersections due to staffing resource limits and would only deploy officers based on immediate needs of the impacted intersections. As such, none of the Diversion and Evacuation Traffic Points listed in the RTCP were modelled as Traffic Control Points, except for those located at actuated traffic signalized intersections or those stopping external traffic. Furthermore, no traffic management plans were provided by York Region or the City of Toronto.

## G.1 Traffic Control Points

Usually, TCPs at intersections (that are controlled) are modelled as actuated signals. If an intersection has a pre-timed signal, stop, or yield control, and the intersection is identified as a traffic control point, the control type would be changed to an actuated signal in the model. Due to resource limitations, all stop and yield controlled intersections were left as is. Due to the presence of a traffic management center, and the ability to modify signal timings on demand, TCPs at existing actuated traffic signalized intersections were essentially left alone. Police officers will provide traffic control along major evacuation routes based on the immediate needs during the evacuation according to emergency management representatives from Durham Region. They will also be responsible for coordinating ACPs for areas taking shelter or evacuating.

## G.2 Access Control Points

As discussed in Section 2, it is assumed that ACPs, typically established on the periphery of the PZs to stop the flow of traffic entering the PZs, will be established within 4 hours after the Emergency Bulletin. The ACPs will assist in discouraging through travellers from using major through routes which traverse the PZs. As discussed in Section 3.9 external traffic was considered on the major routes which traverse the study area – Highway 401 (Collector & Express), Highway 407 and Highway 404 – in this analysis. The generation of the external trips ceases at 4 hours after the Emergency Bulletin in the simulation due to the implementation of the ACPs.

## APPENDIX H

Evacuation Regions

## H. EVACUATION REGIONS

This appendix presents the evacuation percentages (Table H-1 and Table H-2) for each Evacuation Region and maps (Figure H-1 through Figure H-53) of all Evacuation Regions. The percentages, presented in Table H-1 and Table H-2, are based on the methodology discussed in assumption 8 of Section 2.2 and shown in Figure 2-1.

Note the baseline ETE study assumes 30 percent of households will not comply with the shelter advisory, as per discussions with OPG and the OROs.

## Table H-1. Percent of Response Sector Population Evacuating for Each Region

| Region | Description | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R01 | AAZ | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| R02 | DPZ Inner Ring | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| R03 | DPZ Outer Ring | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| R04 | Full PZ | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R05 | N | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% |
| R06 | NNE | 30% | 30% | 30% | 30% | 100% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% |
| R07 | NE | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R08 | ENE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R09 | E | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% |
| R10 | ESE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% |
| R11 | SE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% |
| R12 | SSE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% |
| R13 | S | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% |
| R14 | SSW | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% |
| R15 | SW | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% |
| R16 | WSW | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% |
| R17 | W | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% |
| R18 | WNW | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R19 | NW | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R20 | NNW | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% |
| **Evacuate Detailed Planning Zone and Downwind to Contingency Planning Zone Boundary** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R21 | N | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% |
| R22 | NNE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% |
| R23 | NE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R24 | ENE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R25 | E | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% |
| R26 | ESE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% |
| R27 | SE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% |
| R28 | SSE | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% |
| R29 | S | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% |
| R30 | SSW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% |
| R31 | SW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% |
| R32 | WSW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% |
| R33 | W | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% |
| R34 | WNW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R35 | NW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R36 | NNW | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% |

Shelter-in-Place | Response Sector(s) Evacuate | Response Sector not within Plume, but Evacuates because it is surrounded by other Response Sectors which are Evacuating

## Table H-2. Percent of Response Sector Population Evacuating for Each Staged Region

| Staged Evacuation - Evacuate Automatic Action Zone and Downwind to Contingency Planning Zone Boundary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | Wind Direction Towards: | Response Sectors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P24 | P25 | CPZ1 | CPZ2 | CPZ3 | CPZ4 | CPZ5 | CPZ6 | CPZ7 | CPZ8 |
| R37 | N | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% |
| R38 | NNE | 30% | 30% | 30% | 30% | 100% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% |
| R39 | NE | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R40 | ENE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% |
| R41 | E | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% |
| R42 | ESE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% |
| R43 | SE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% |
| R44 | SSE | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% |
| R45 | S | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% |
| R46 | SSW | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% |
| R47 | SW | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% |
| R48 | WSW | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% |
| R49 | W | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% |
| R50 | WNW | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R51 | NW | 30% | 30% | 100% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 100% | 30% | 30% | 30% | 100% | 30% | 30% | 30% | 30% | 30% | 100% | 100% |
| R52 | NNW | 30% | 30% | 30% | 100% | 100% | 100% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 100% | 100% | 30% | 30% | 30% | 100% | 30% | 30% | 30% | 30% | 30% | 30% | 100% |
| R53 | Full PZ | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Shelter-in-Place until 90% ETE for R01, then Evacuate | | | | | | | | | | Shelter-in-Place | | | | | | | | | | | Response Sector(s) Evacuate | | | | | | | | | | |

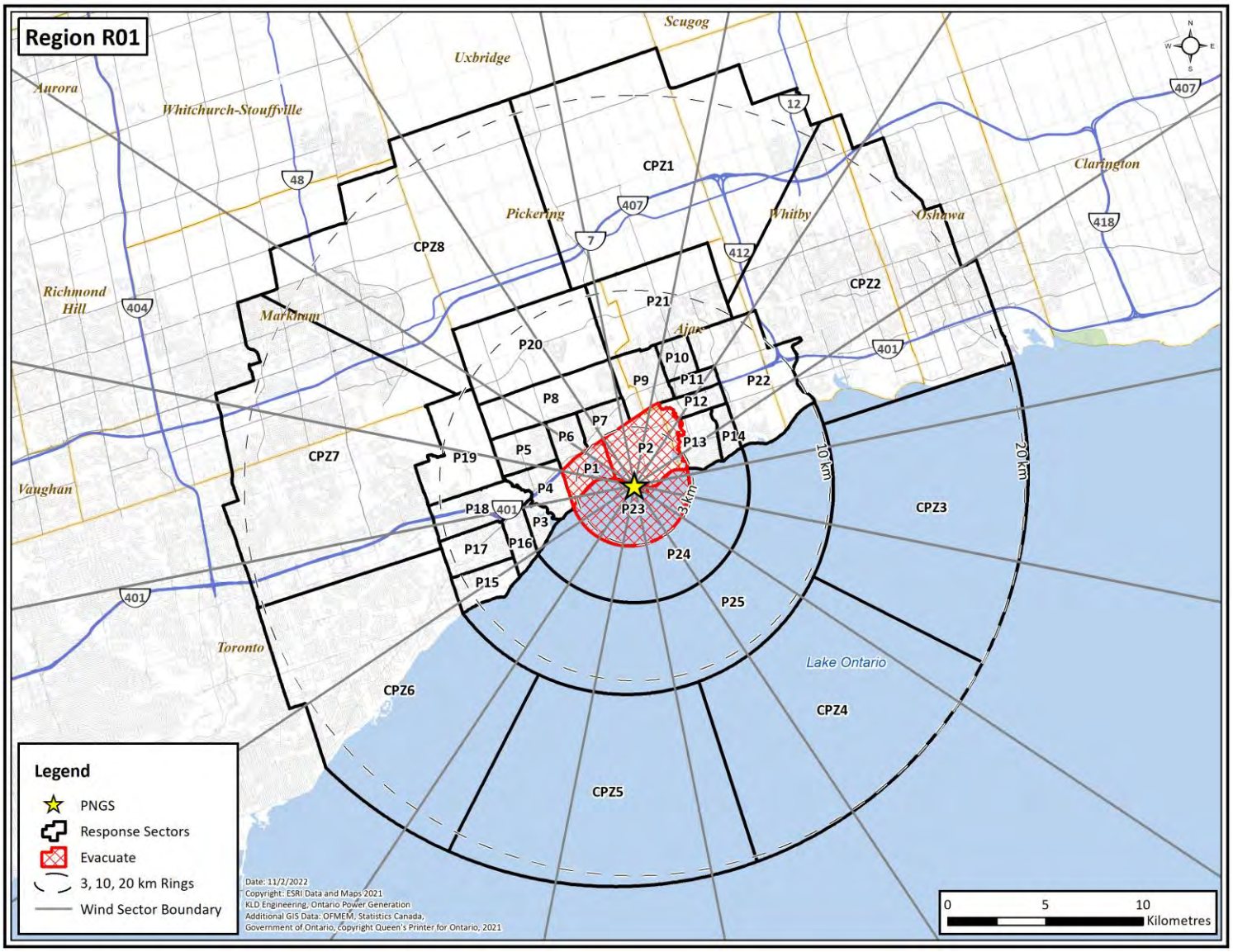



**Figure H-1. Region R01**

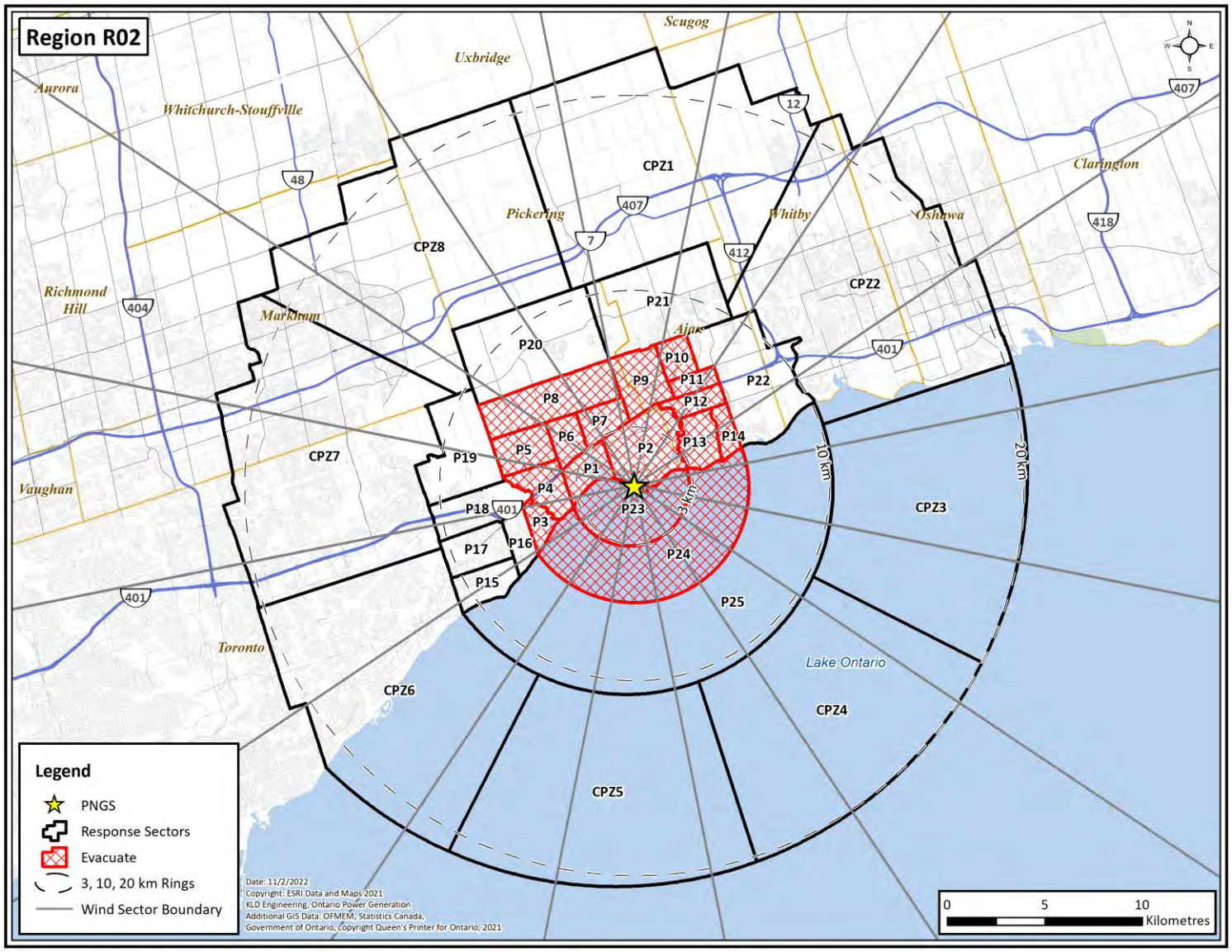



**Figure H-2. Region R02**

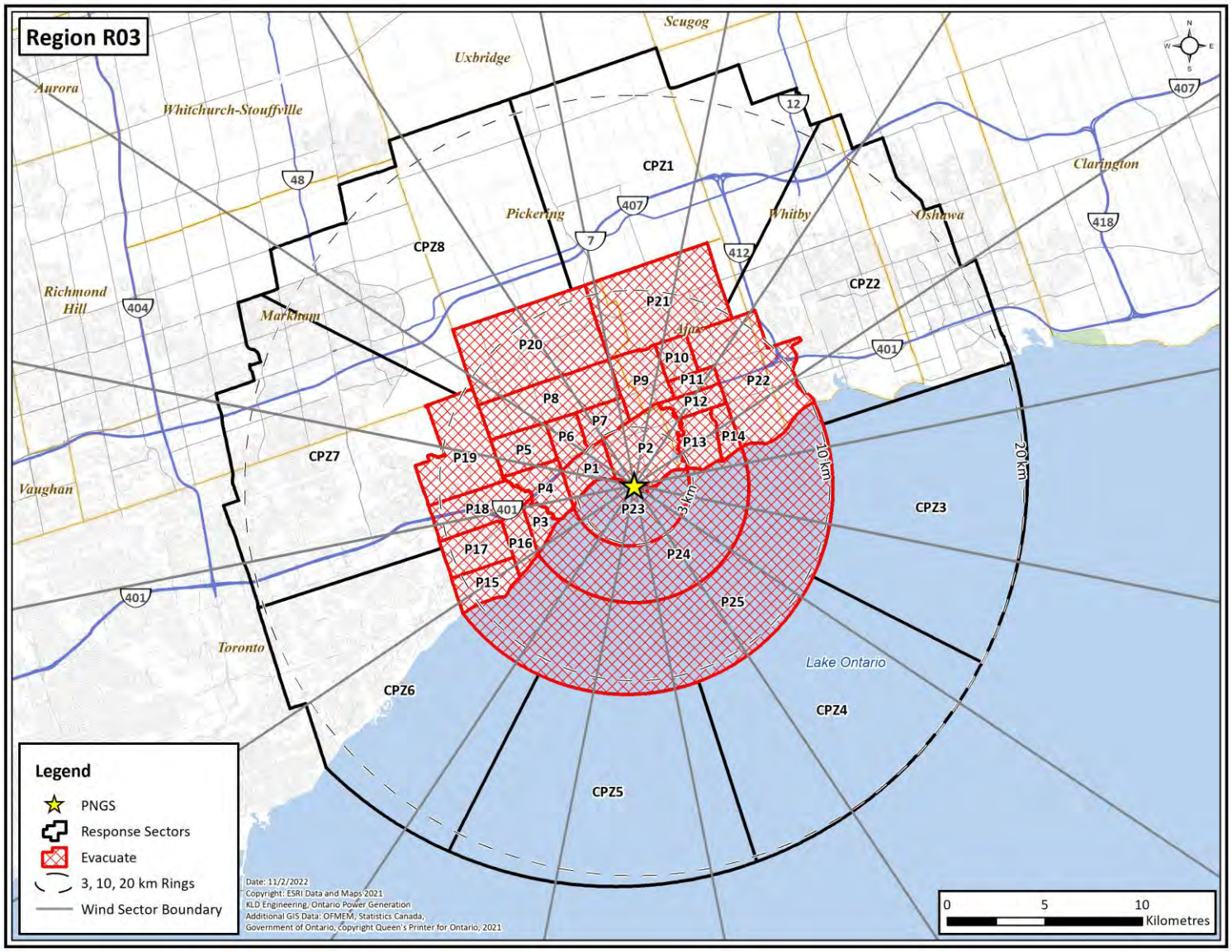



**Figure H-3. Region R03**

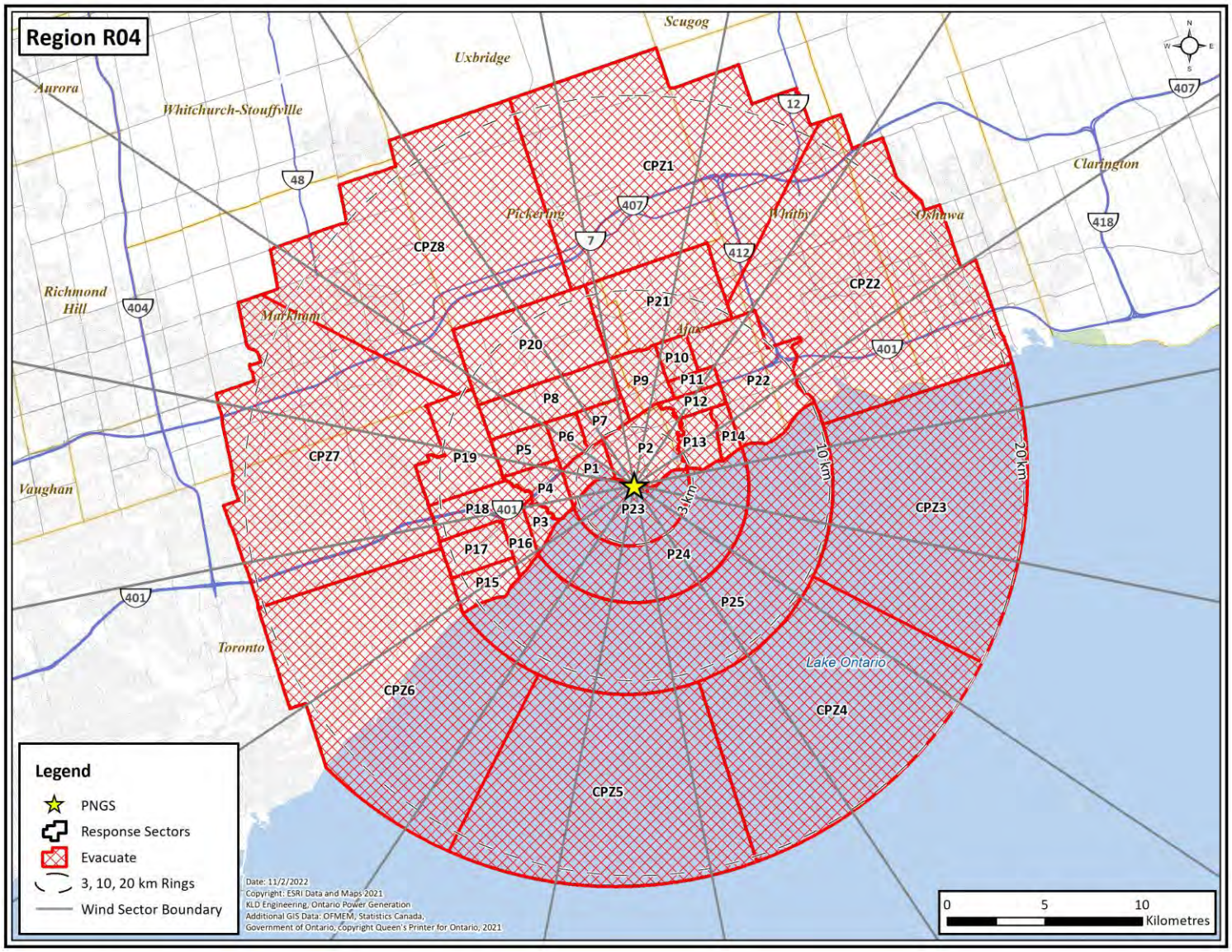
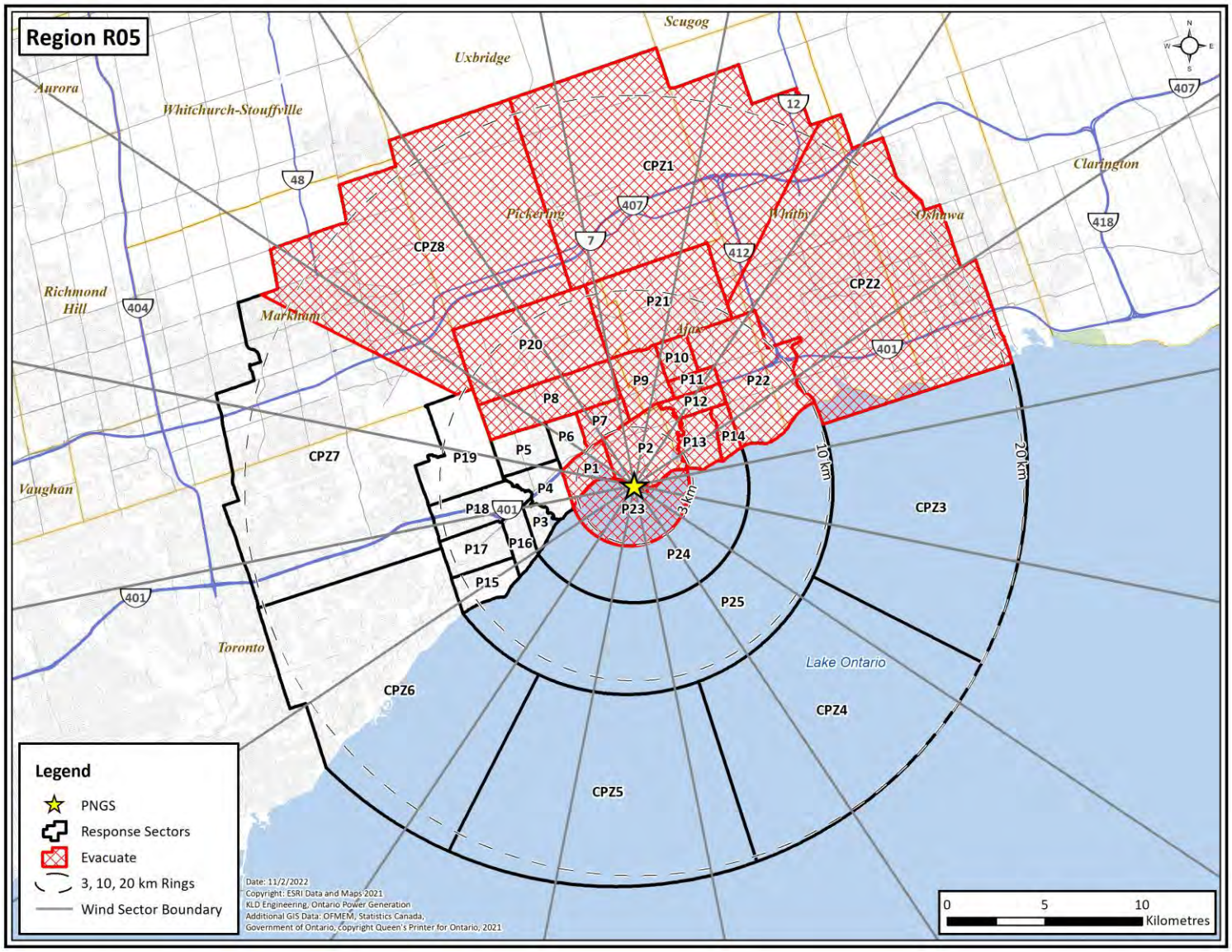



**Figure H-4. Region R04**

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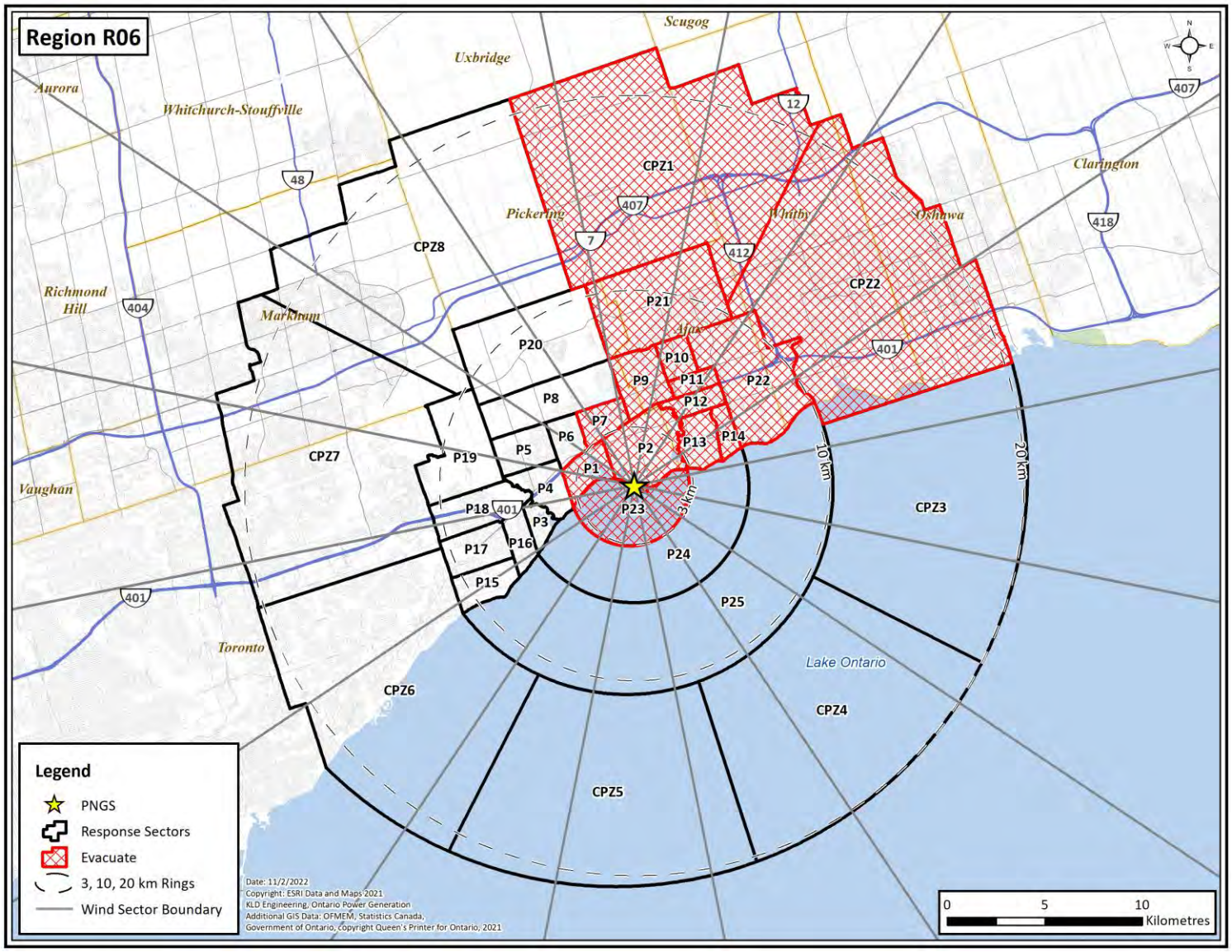


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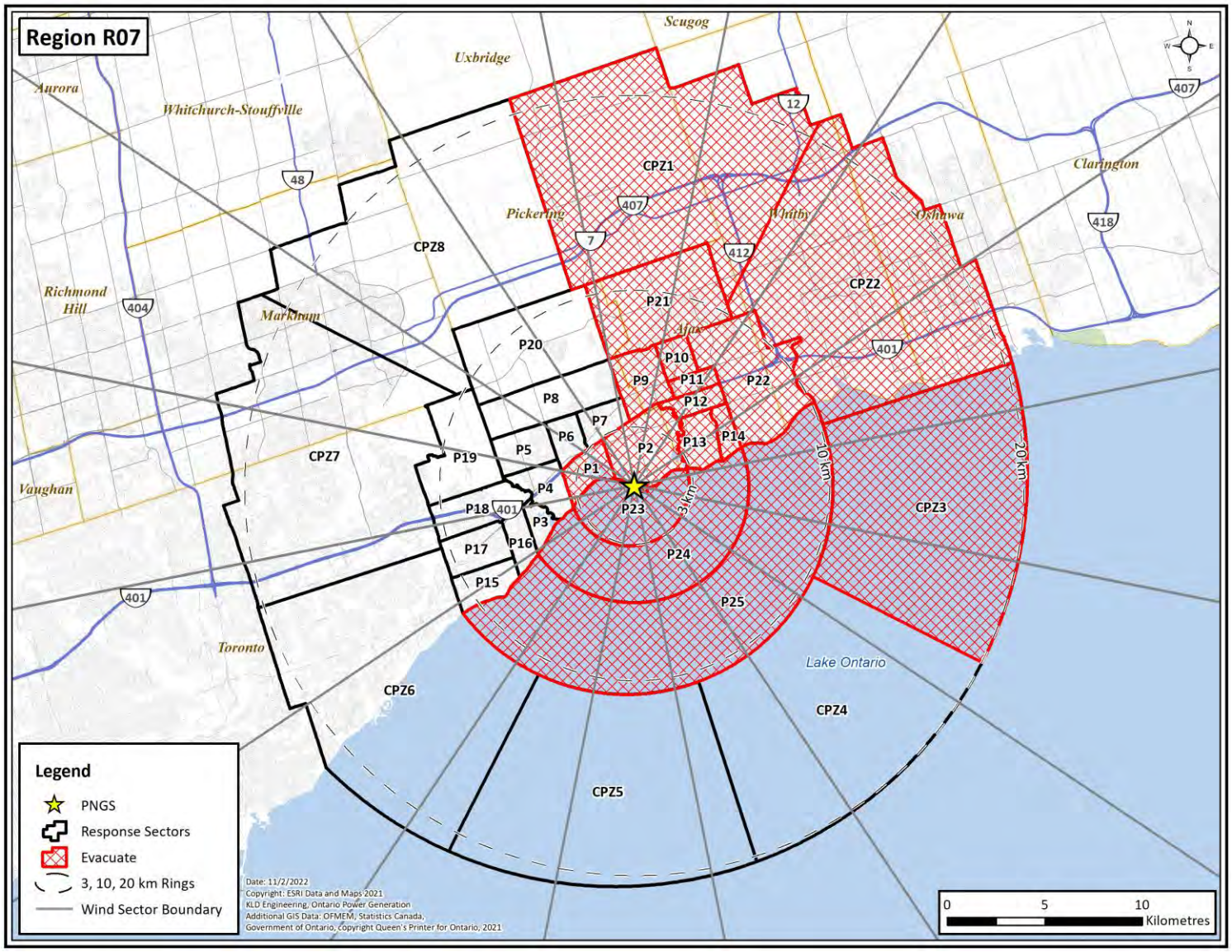
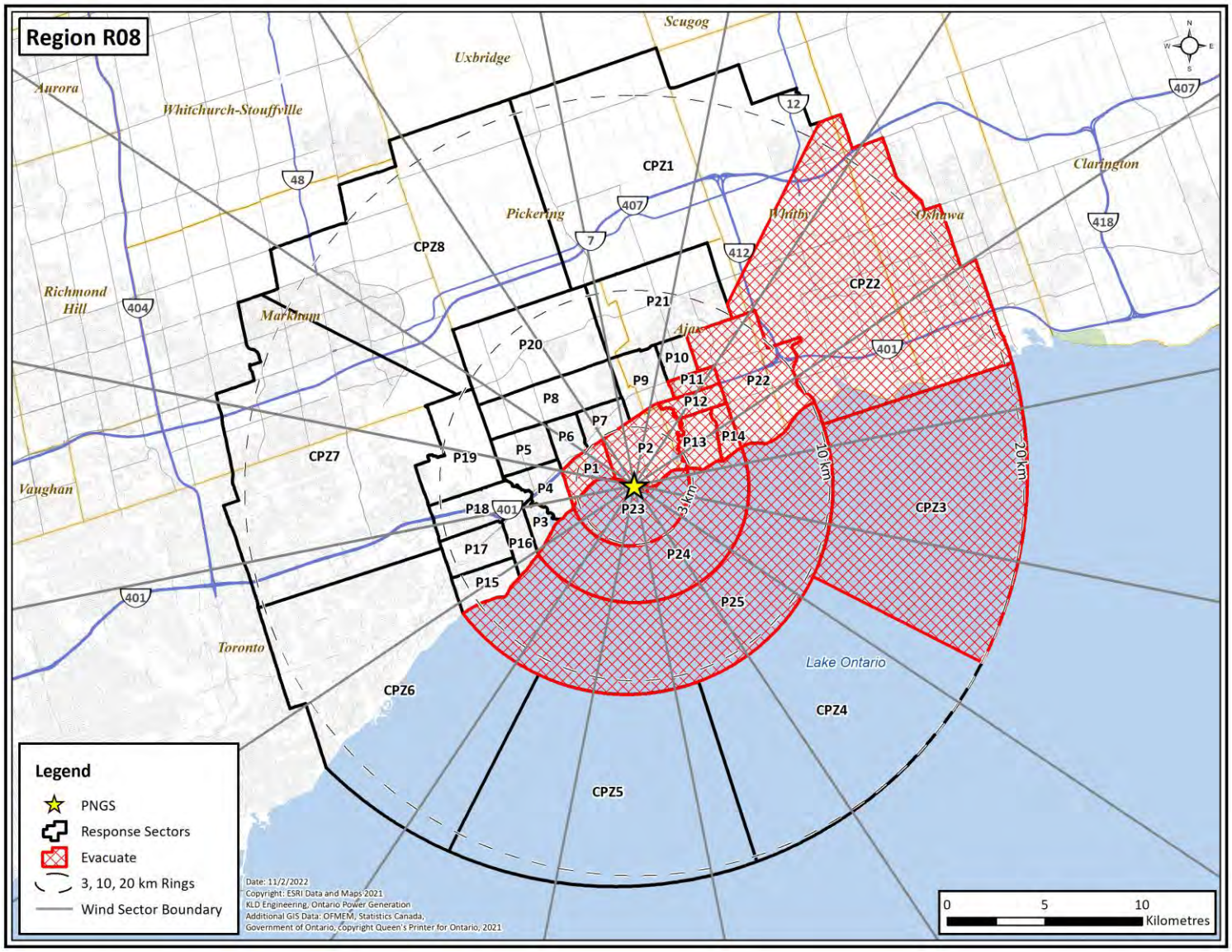



**Figure H-7. Region R07**

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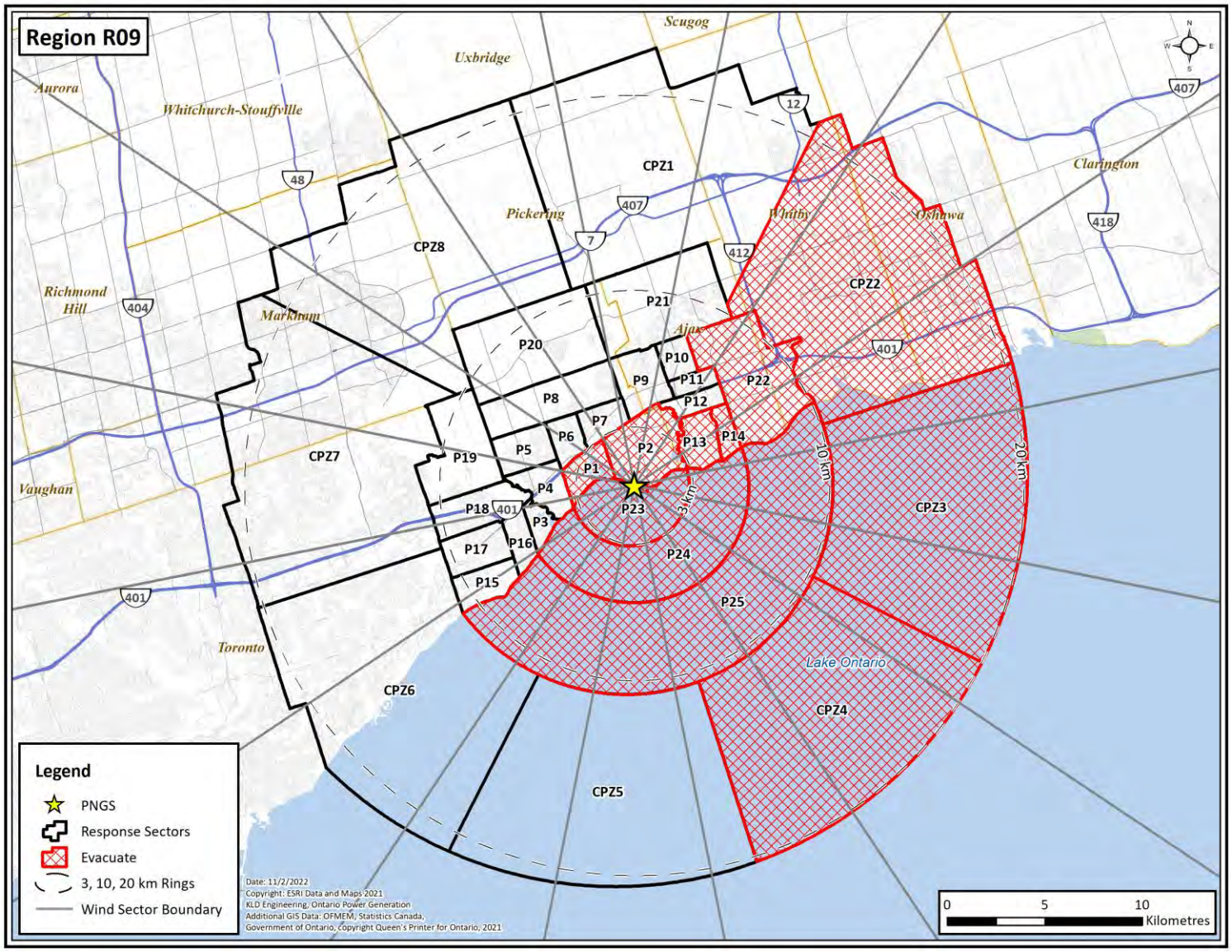


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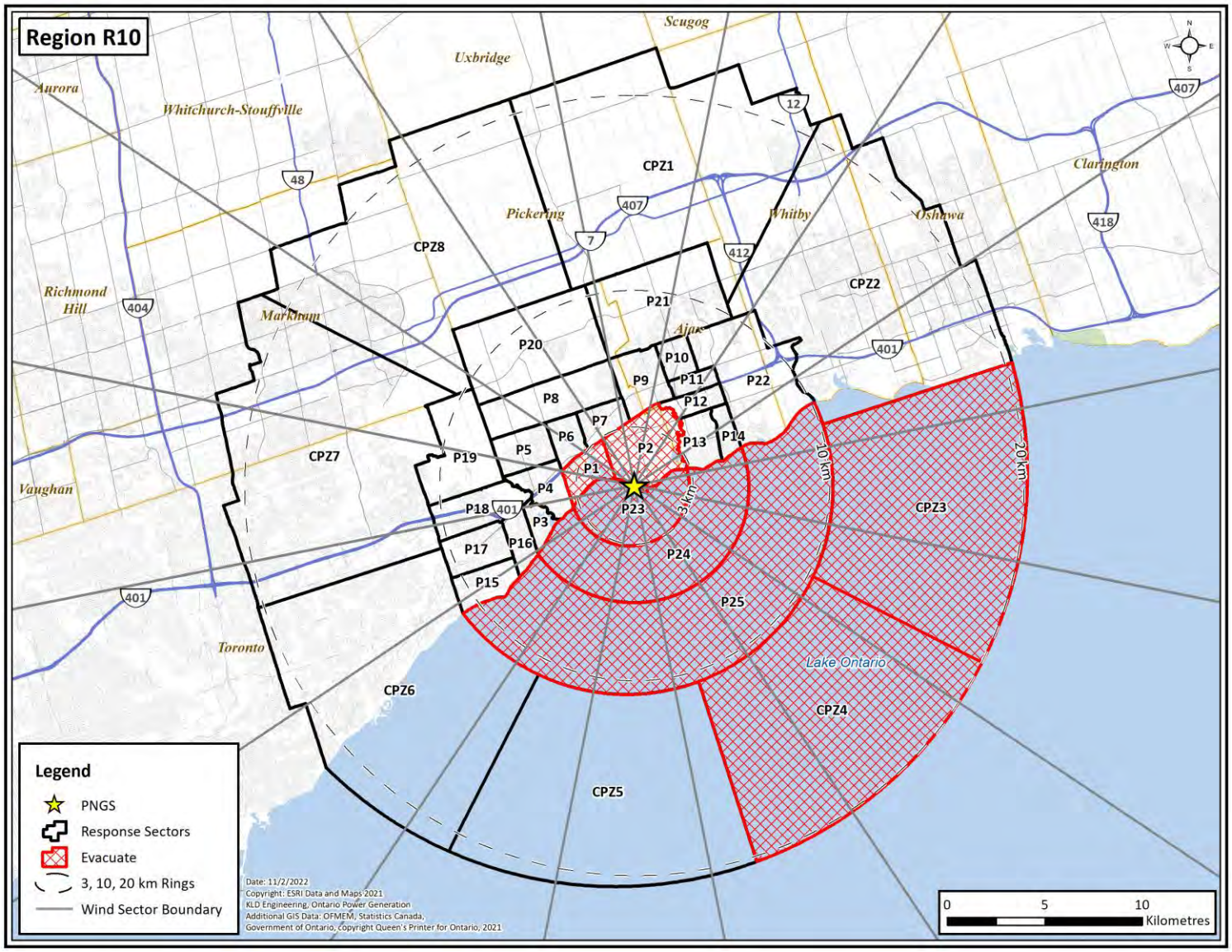


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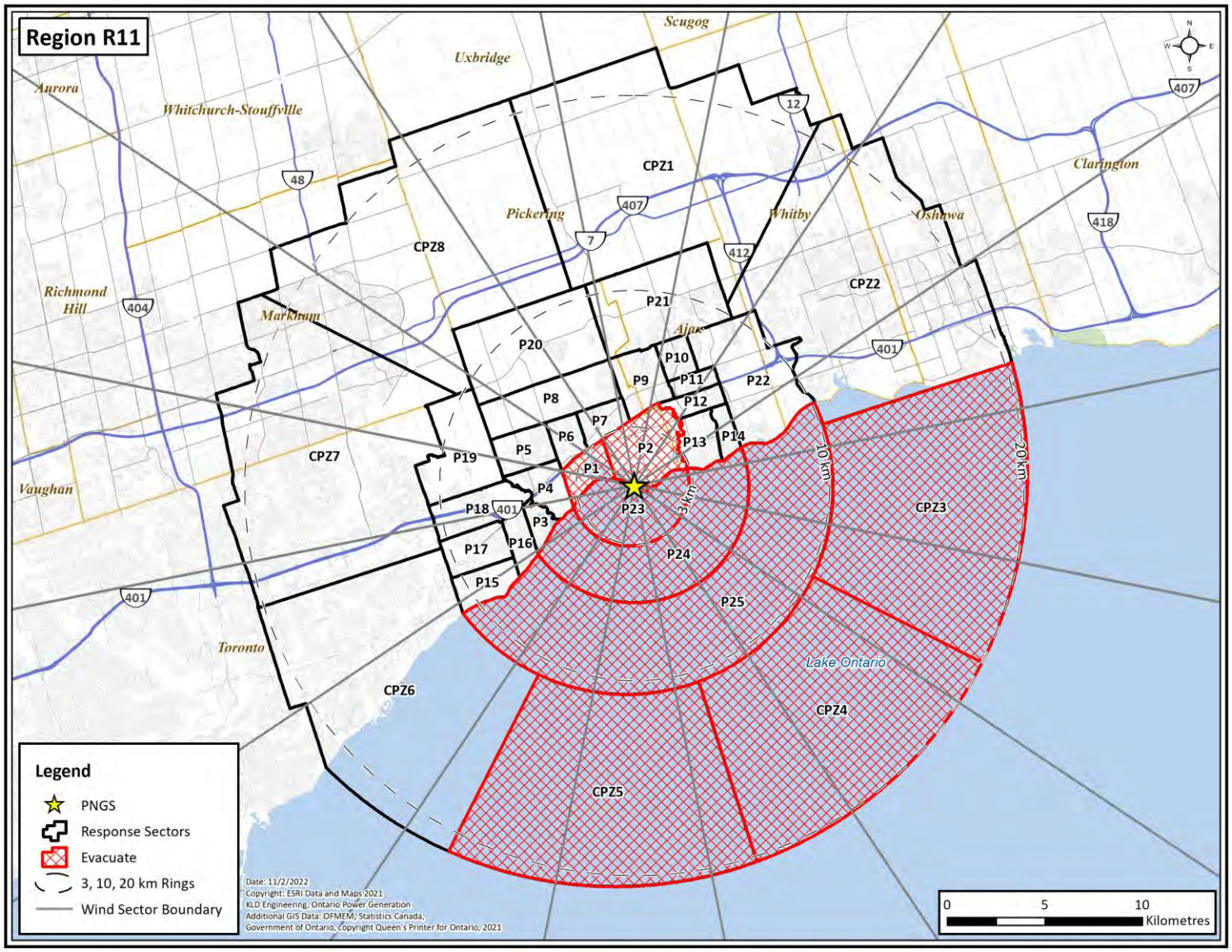


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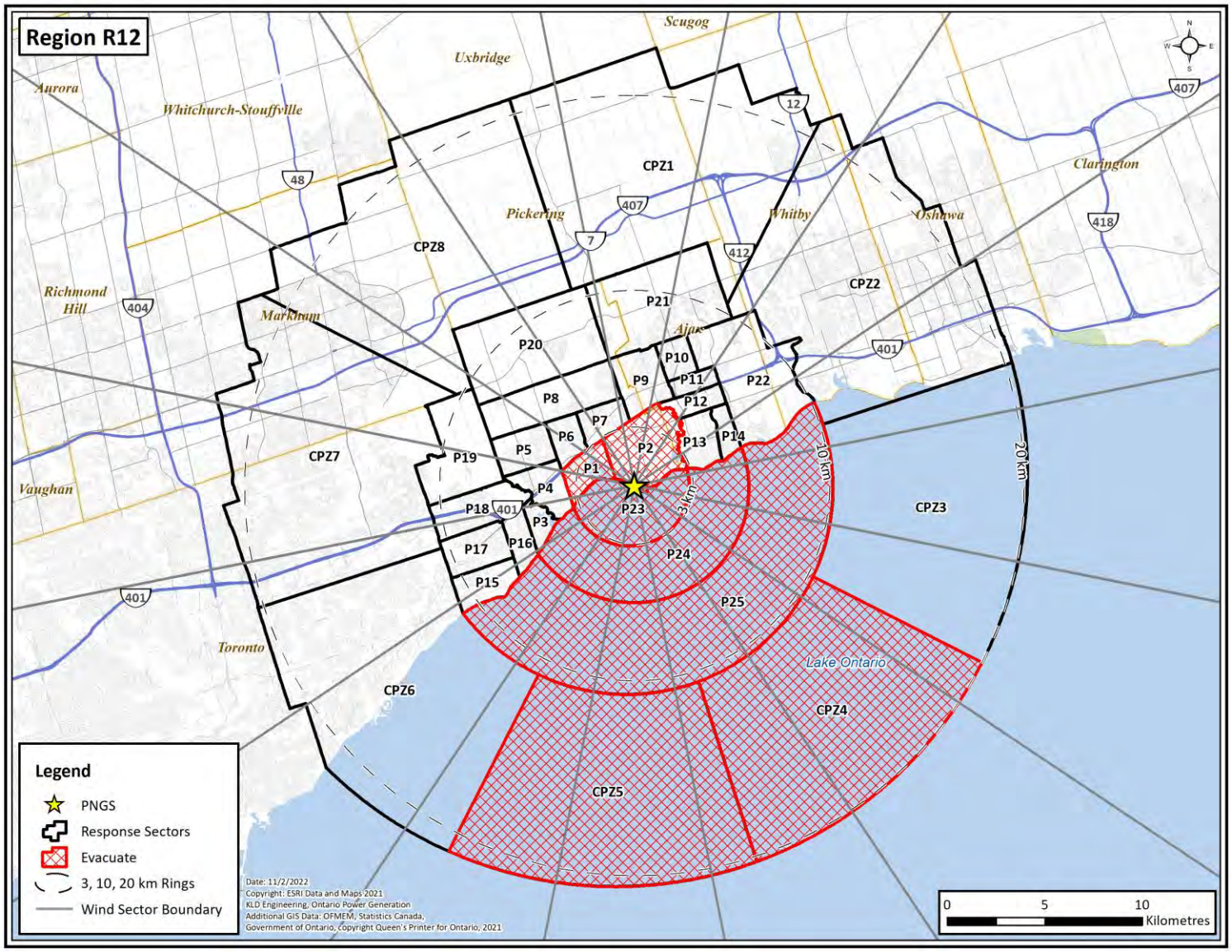


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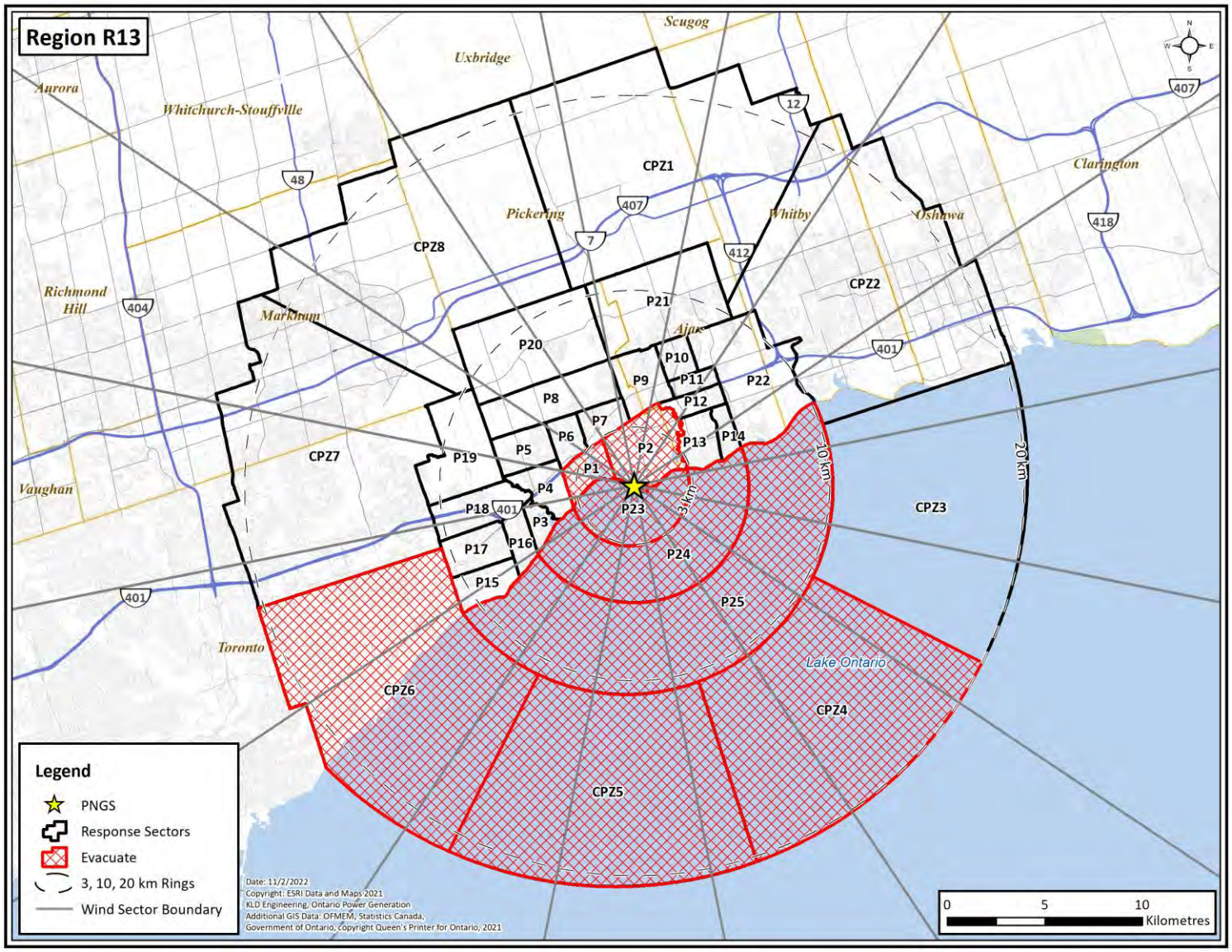


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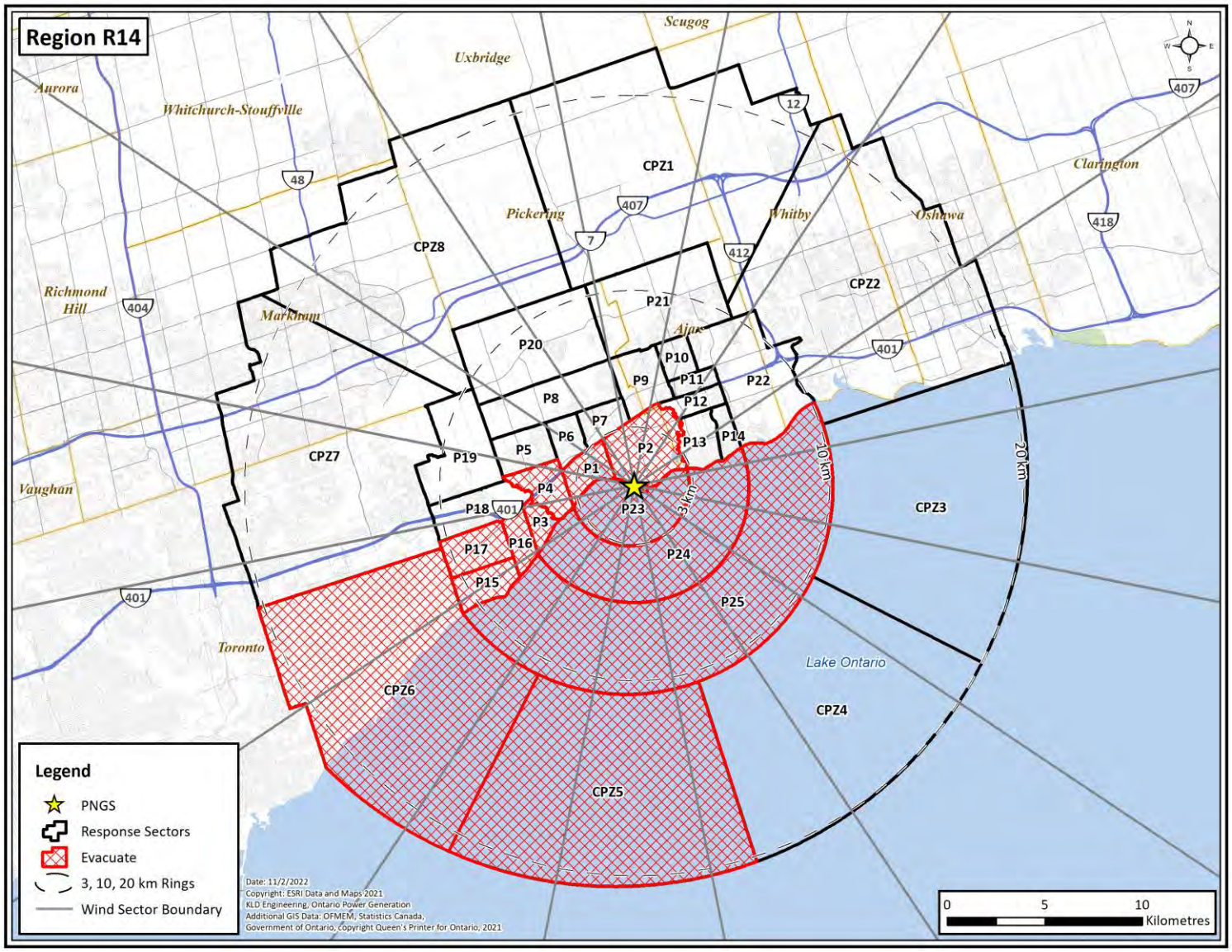


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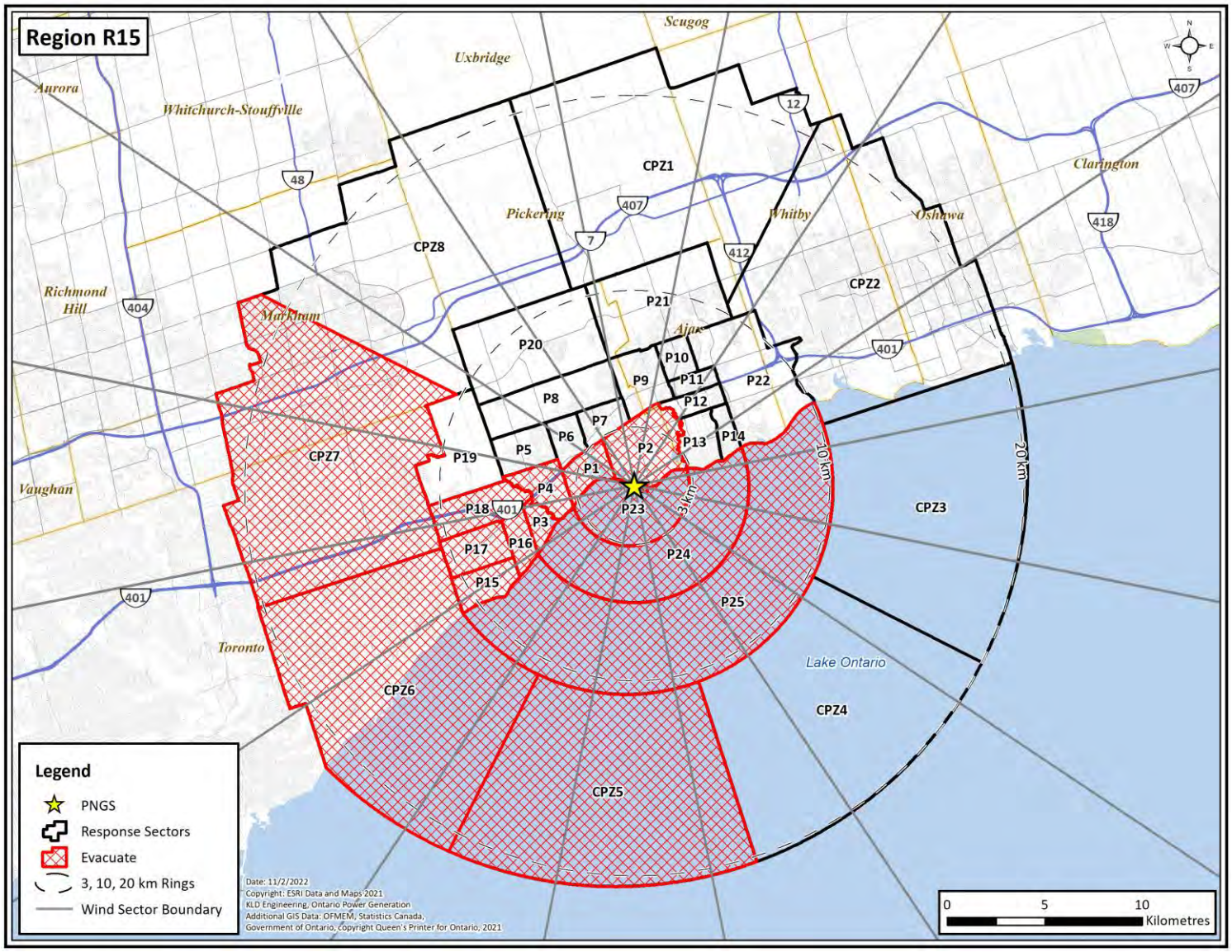


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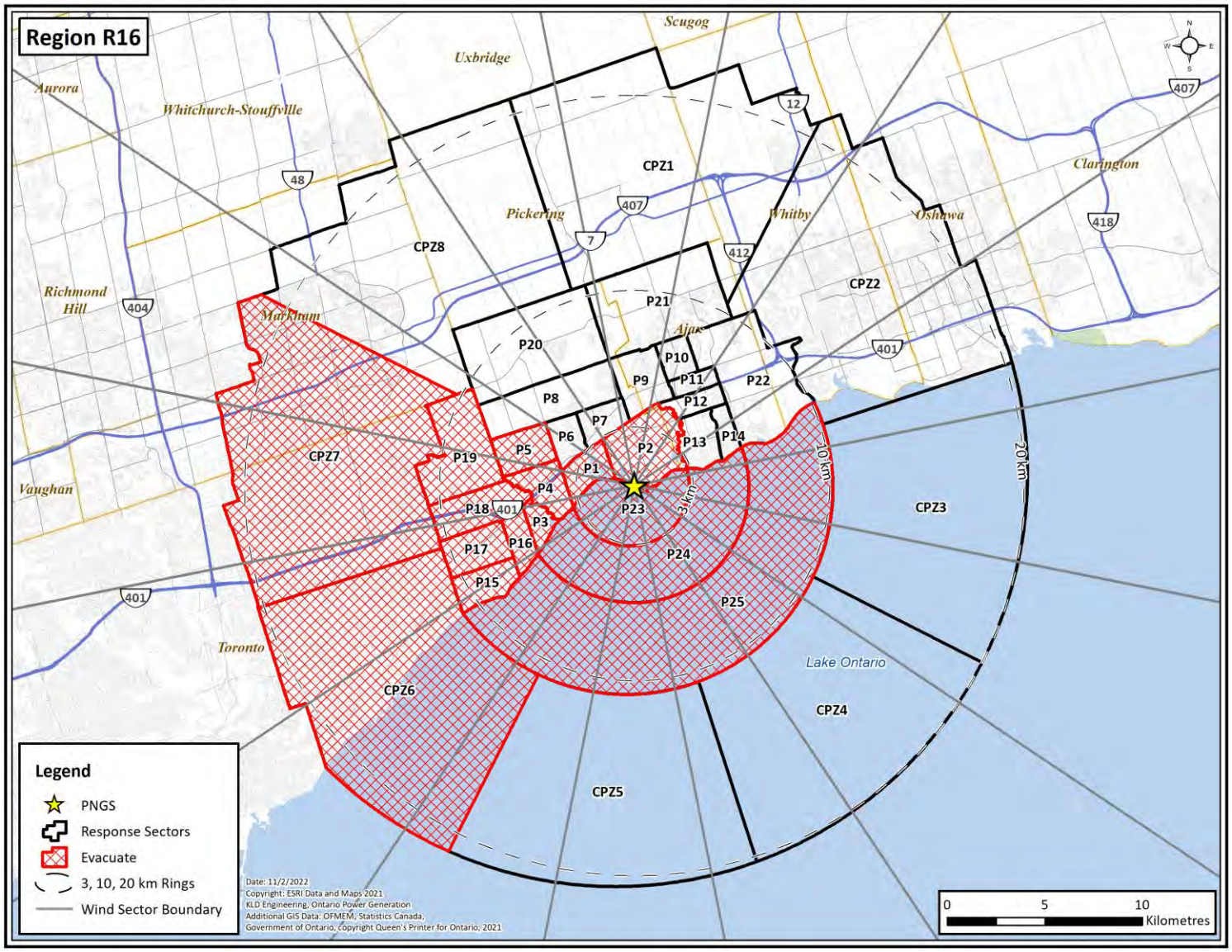


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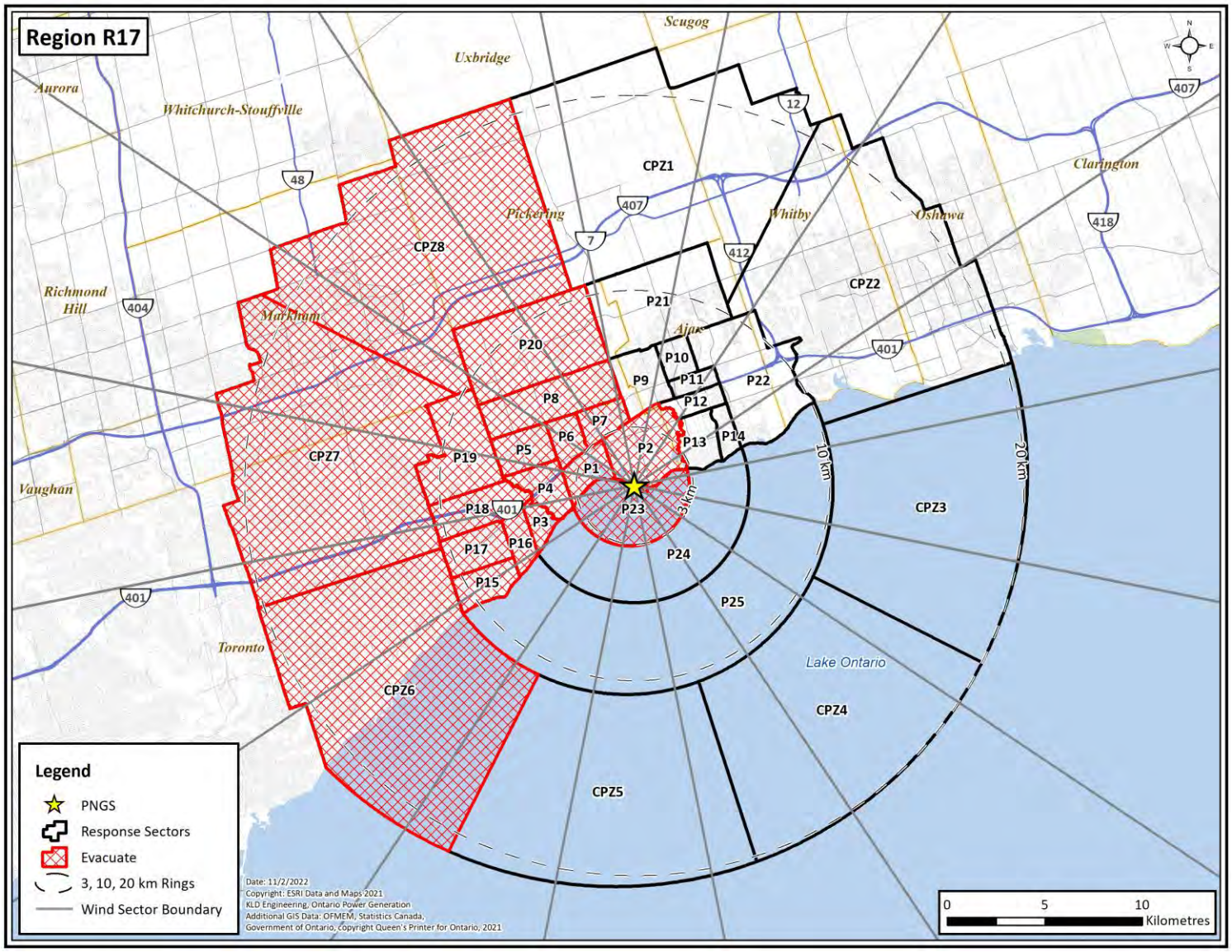


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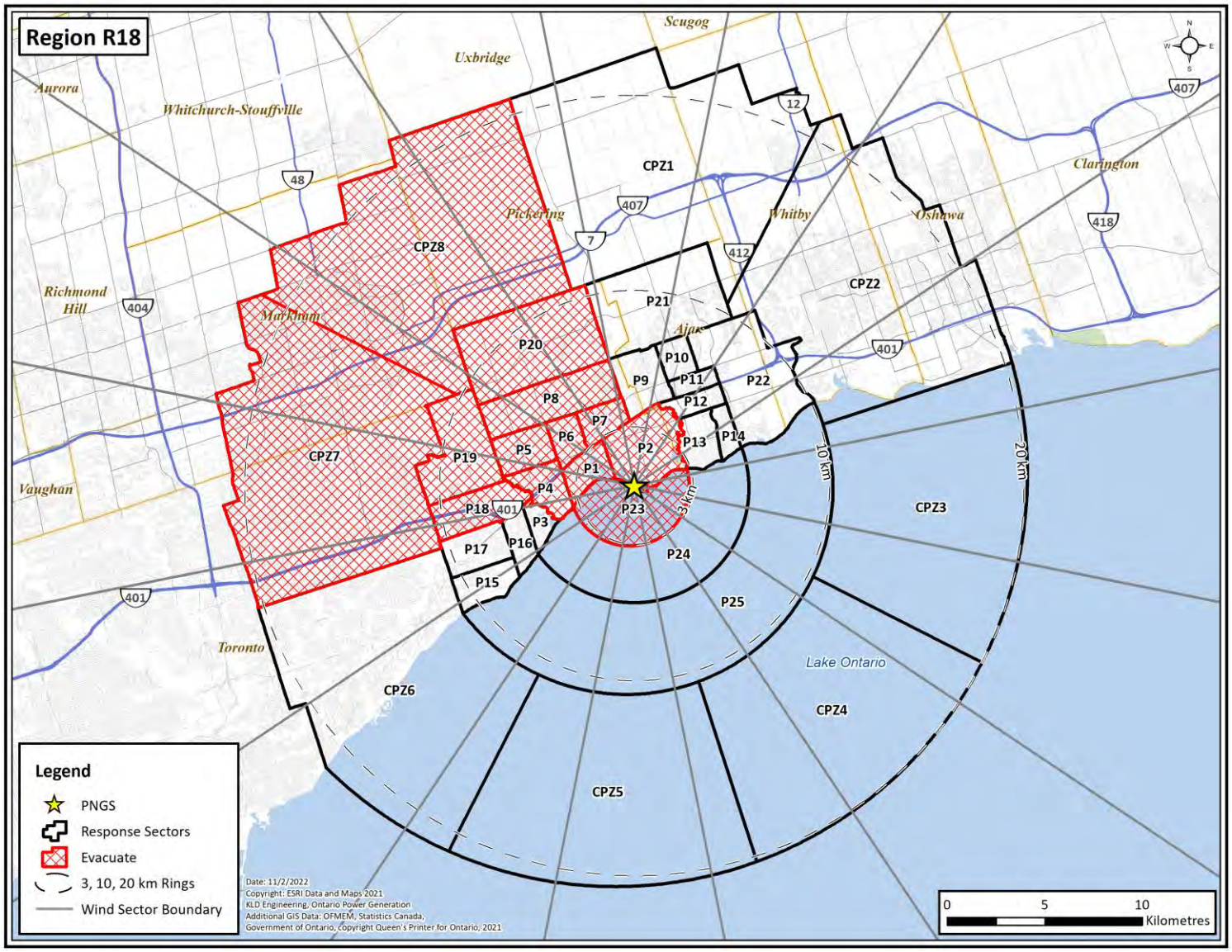


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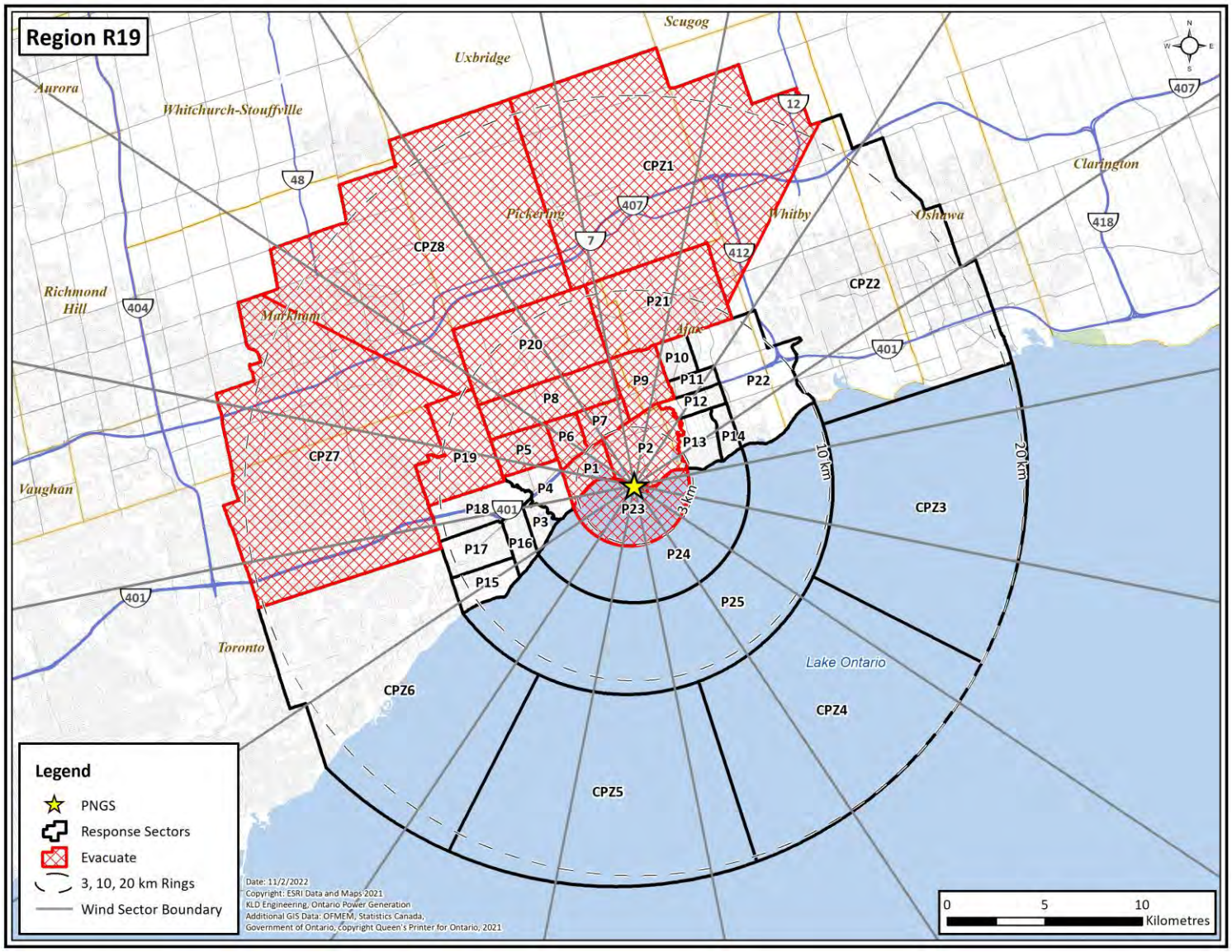


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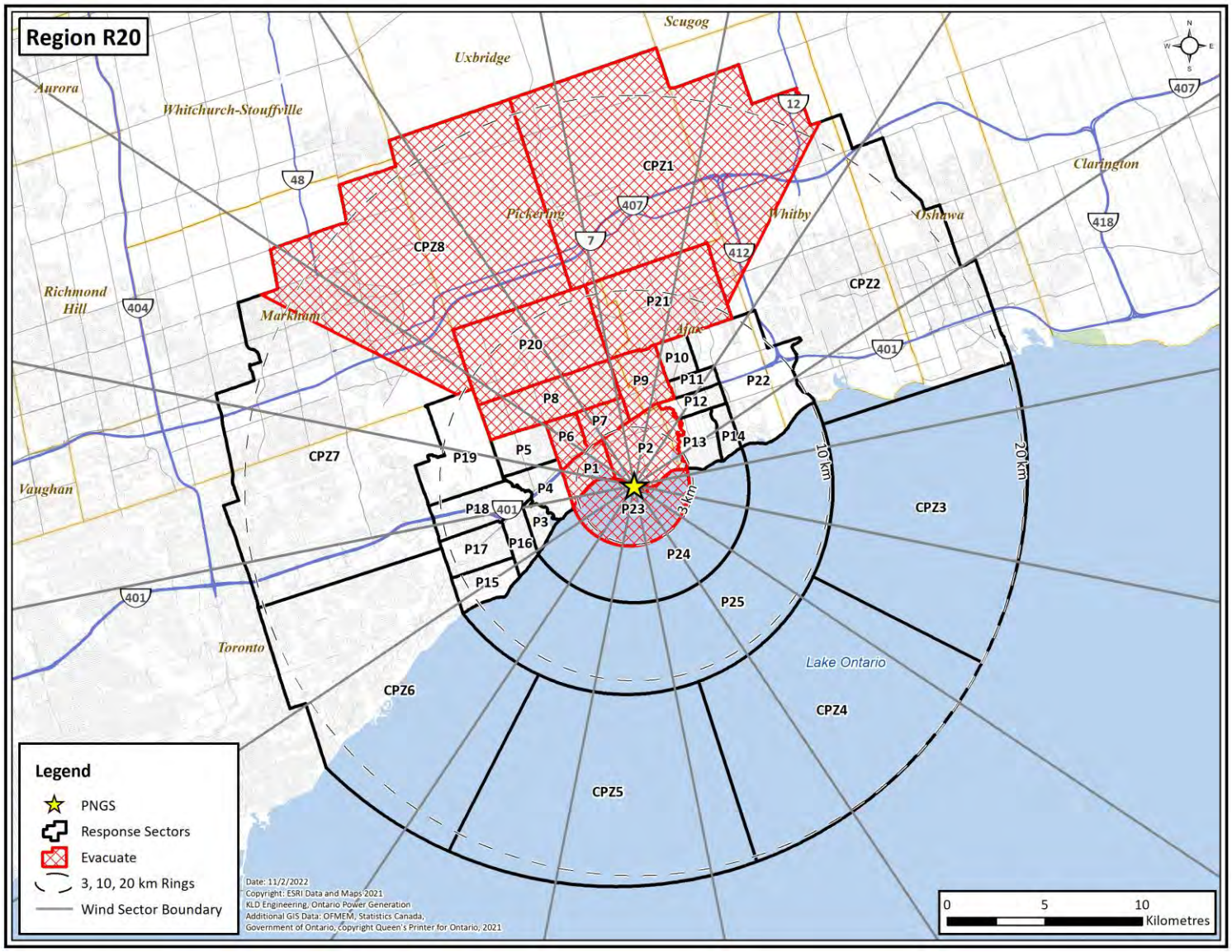


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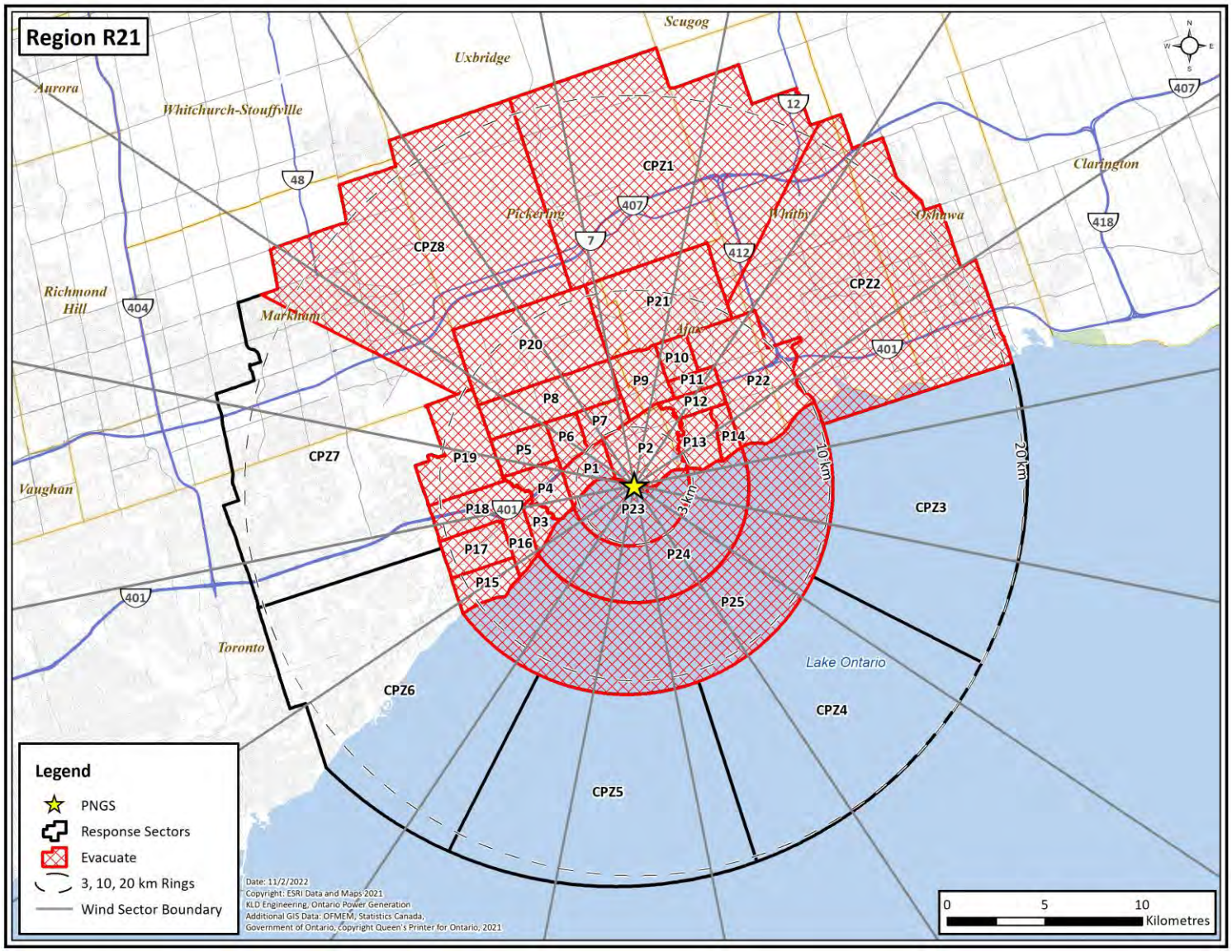


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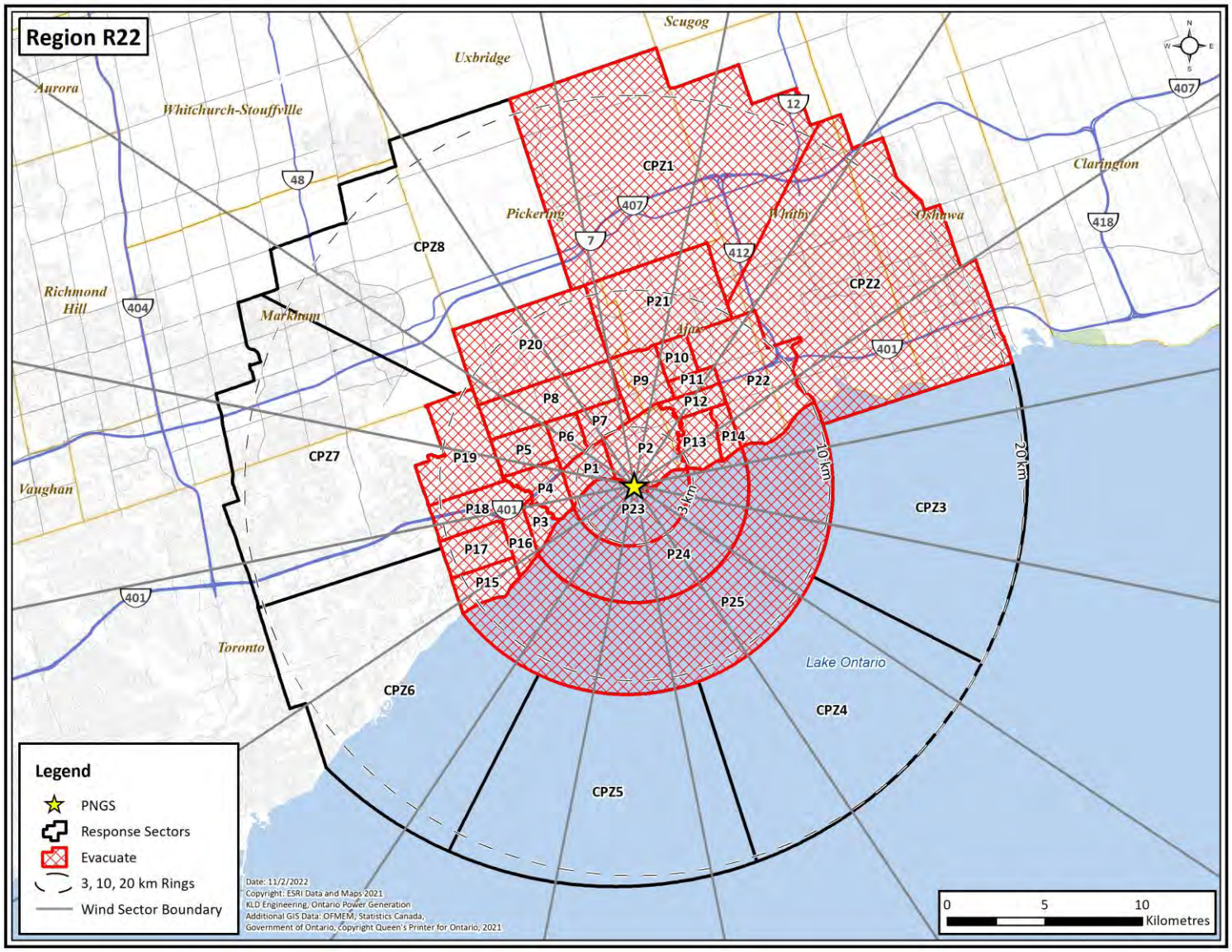


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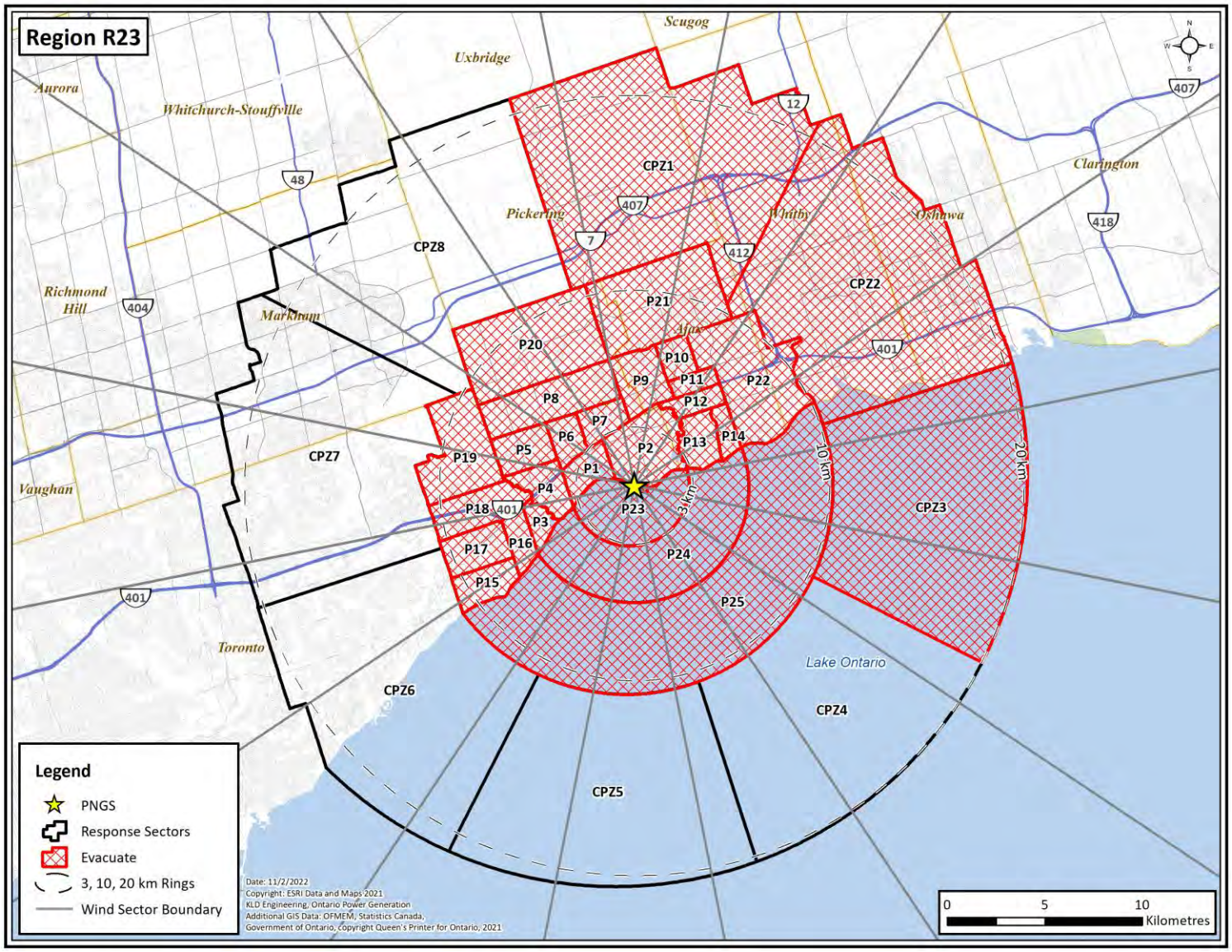


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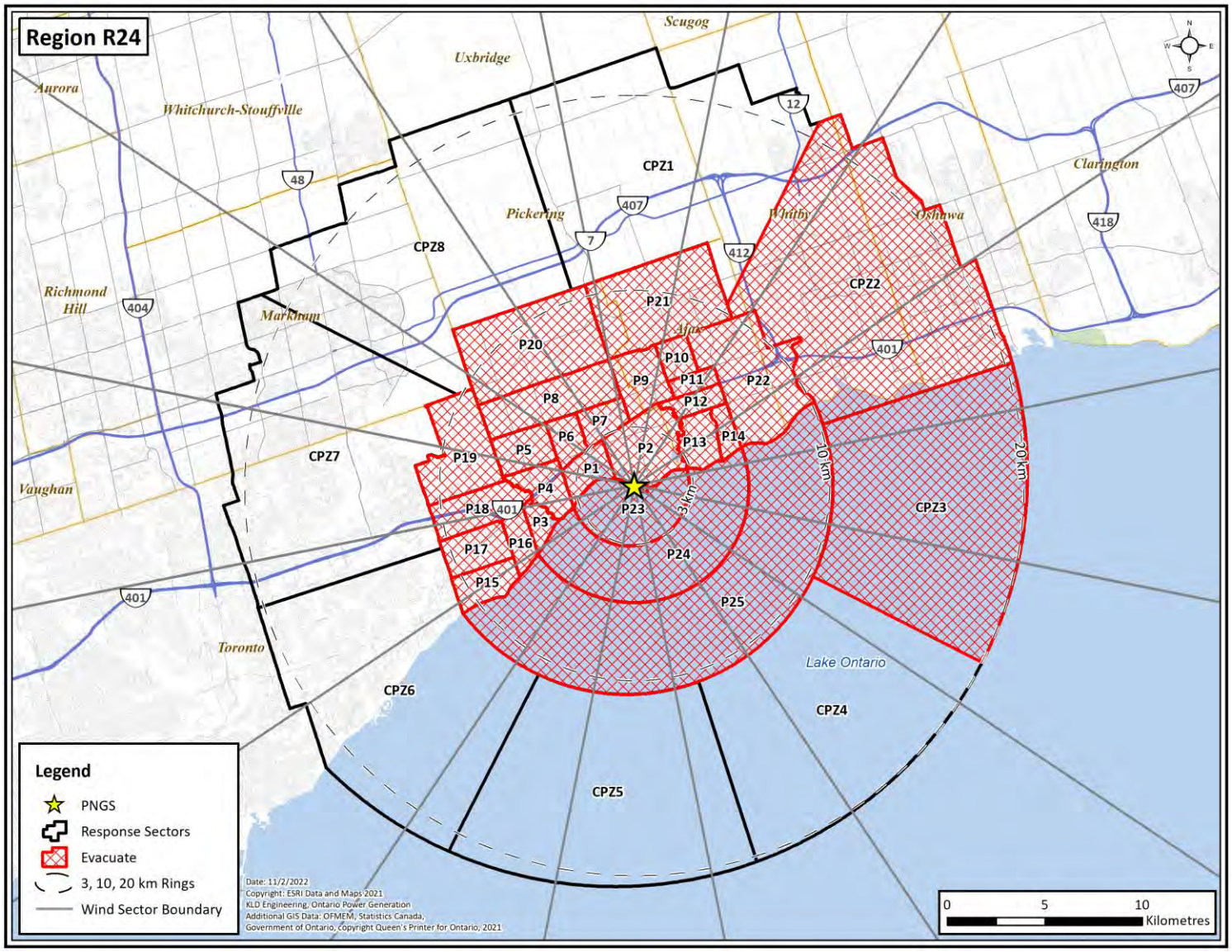


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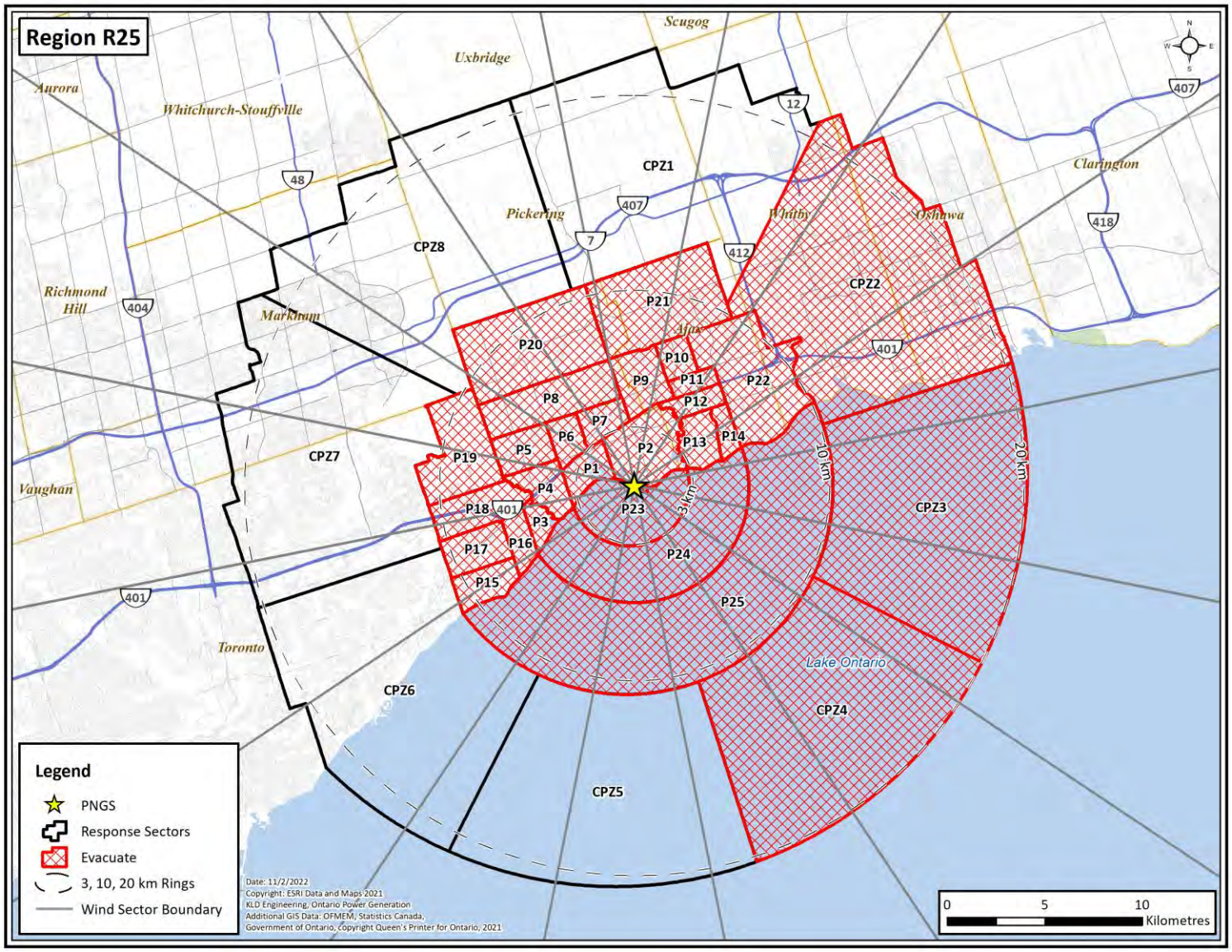


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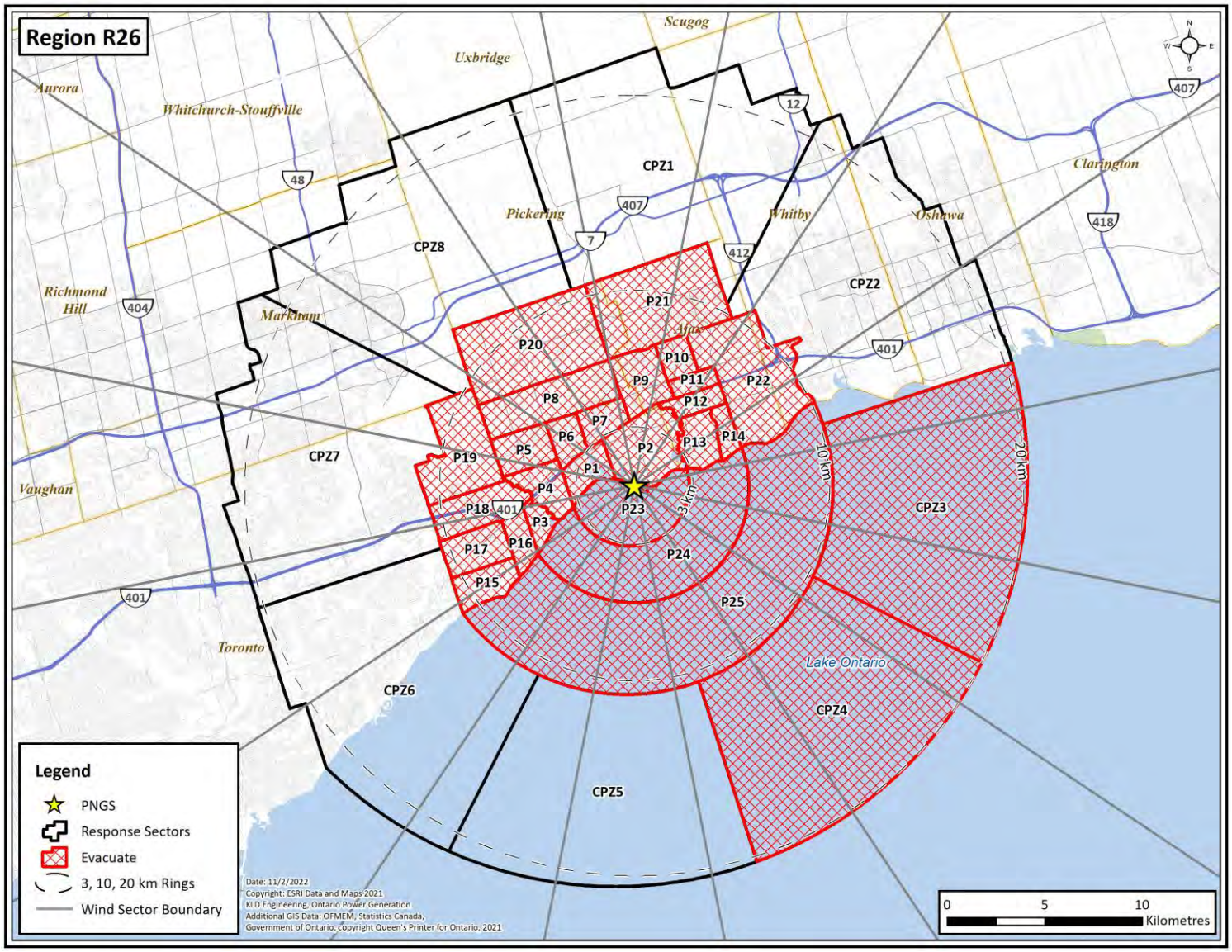


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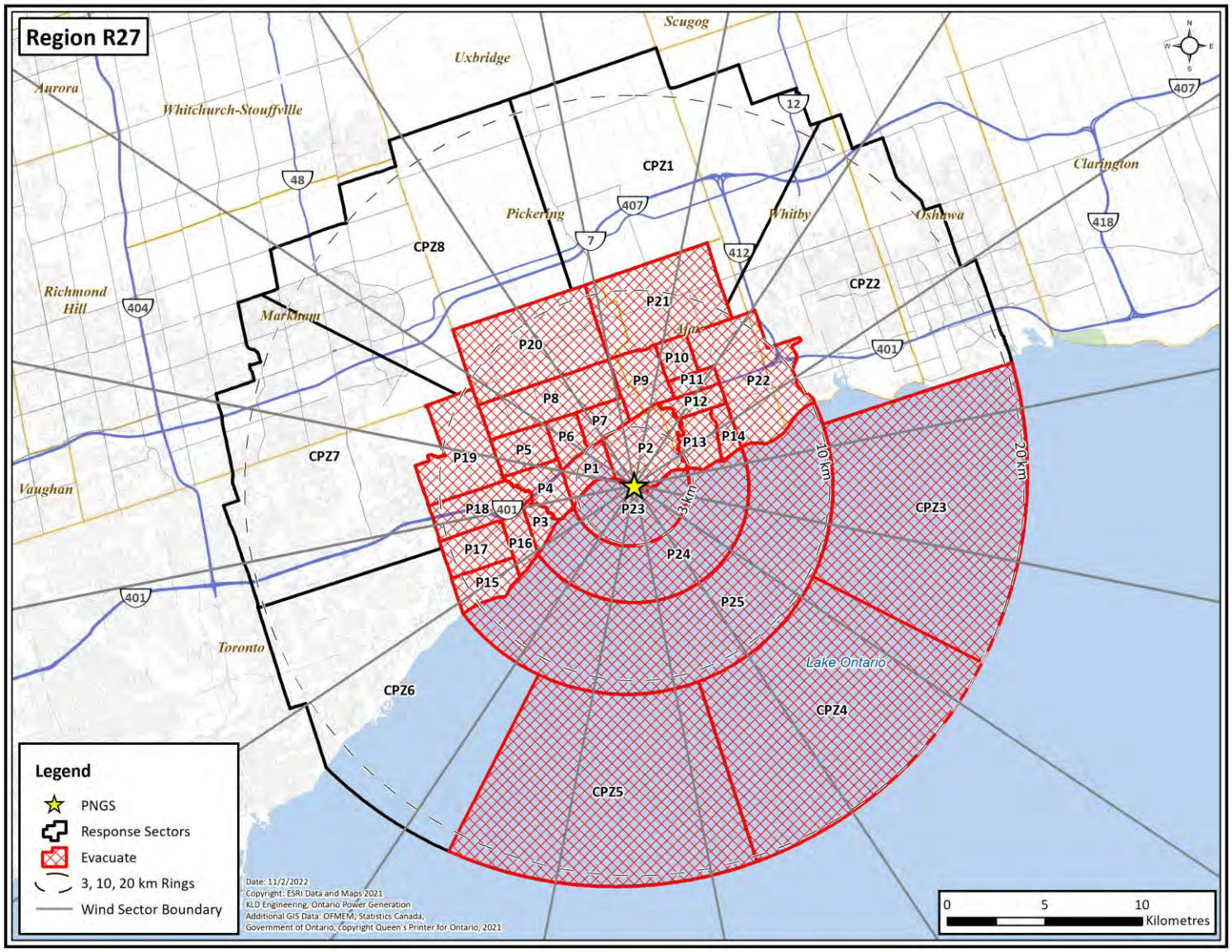


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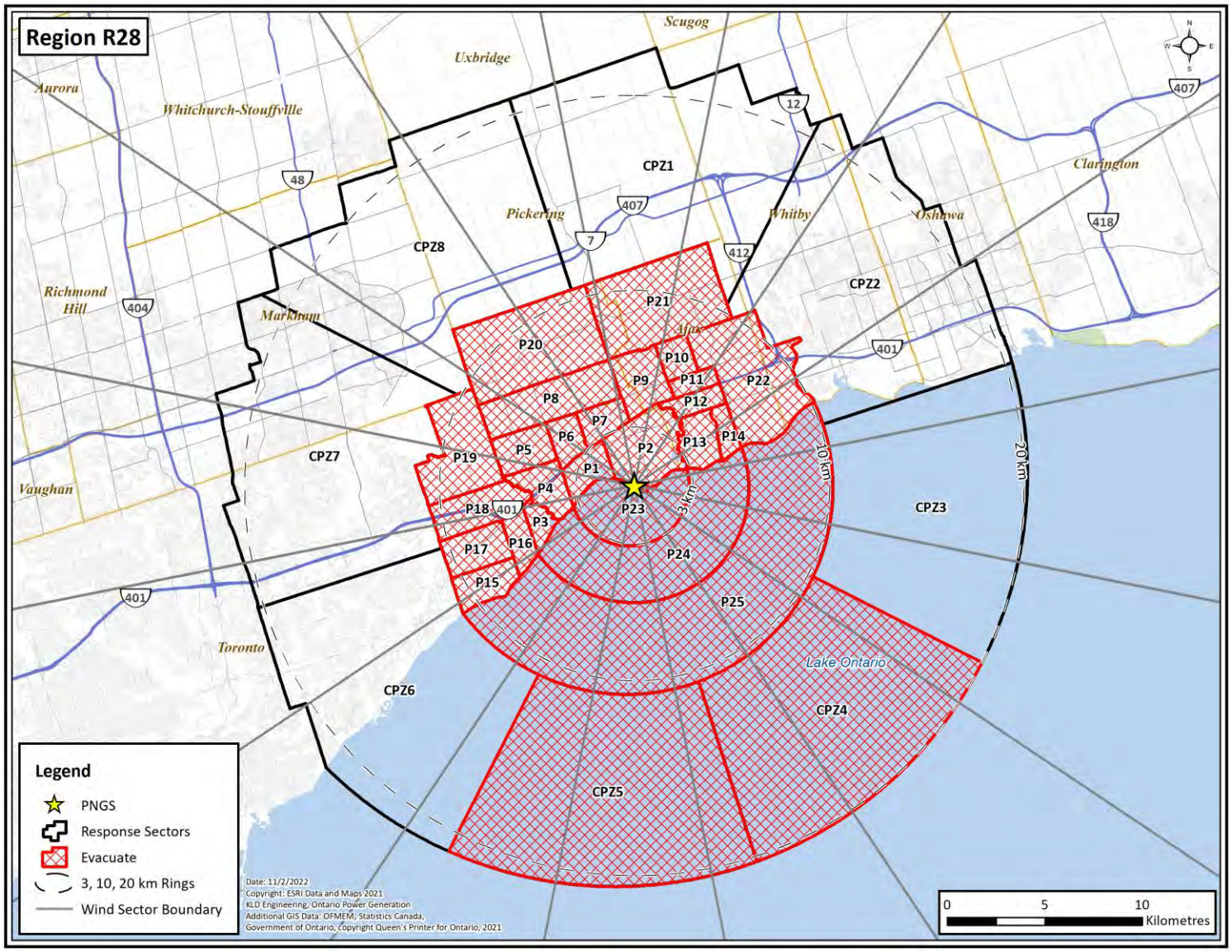
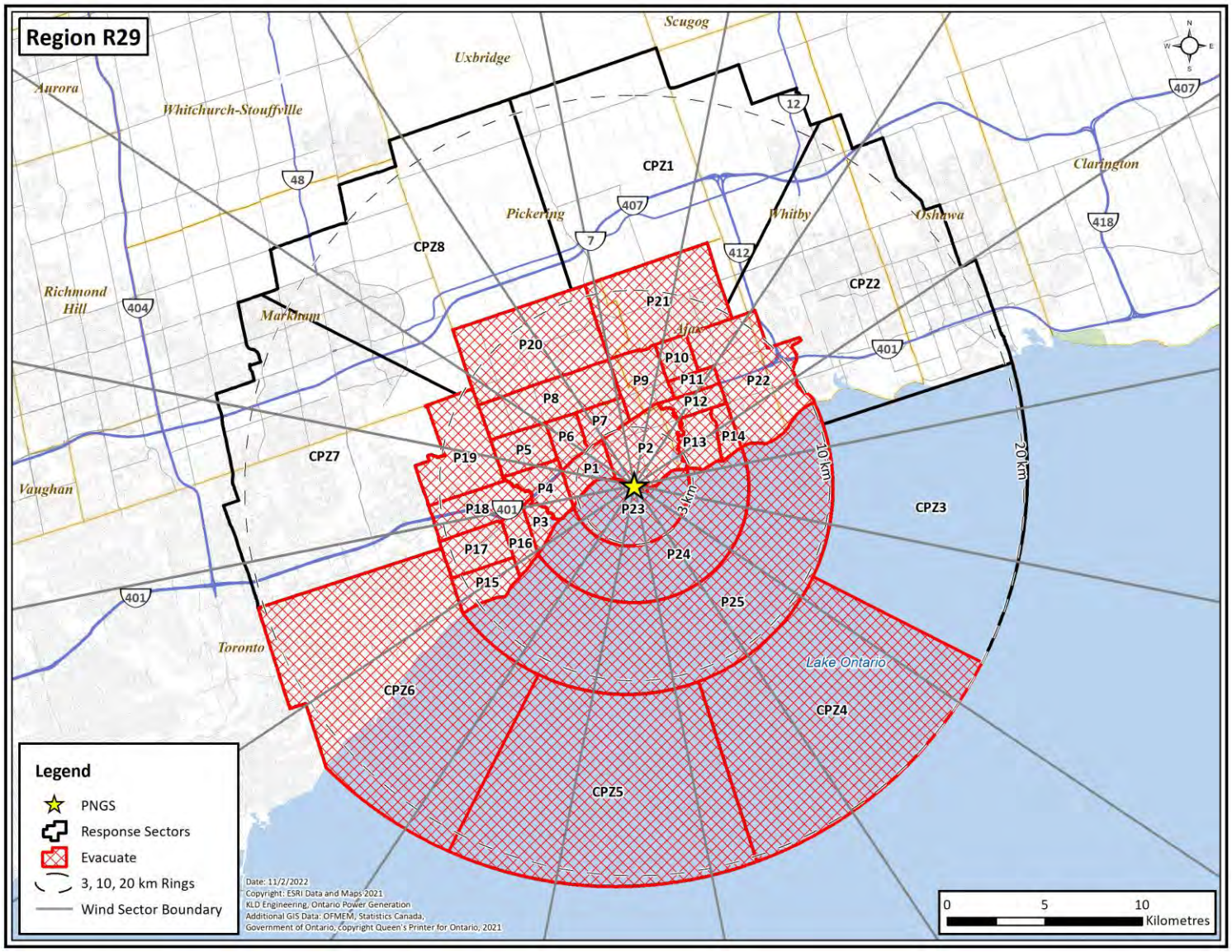



**Figure H-28. Region R28**

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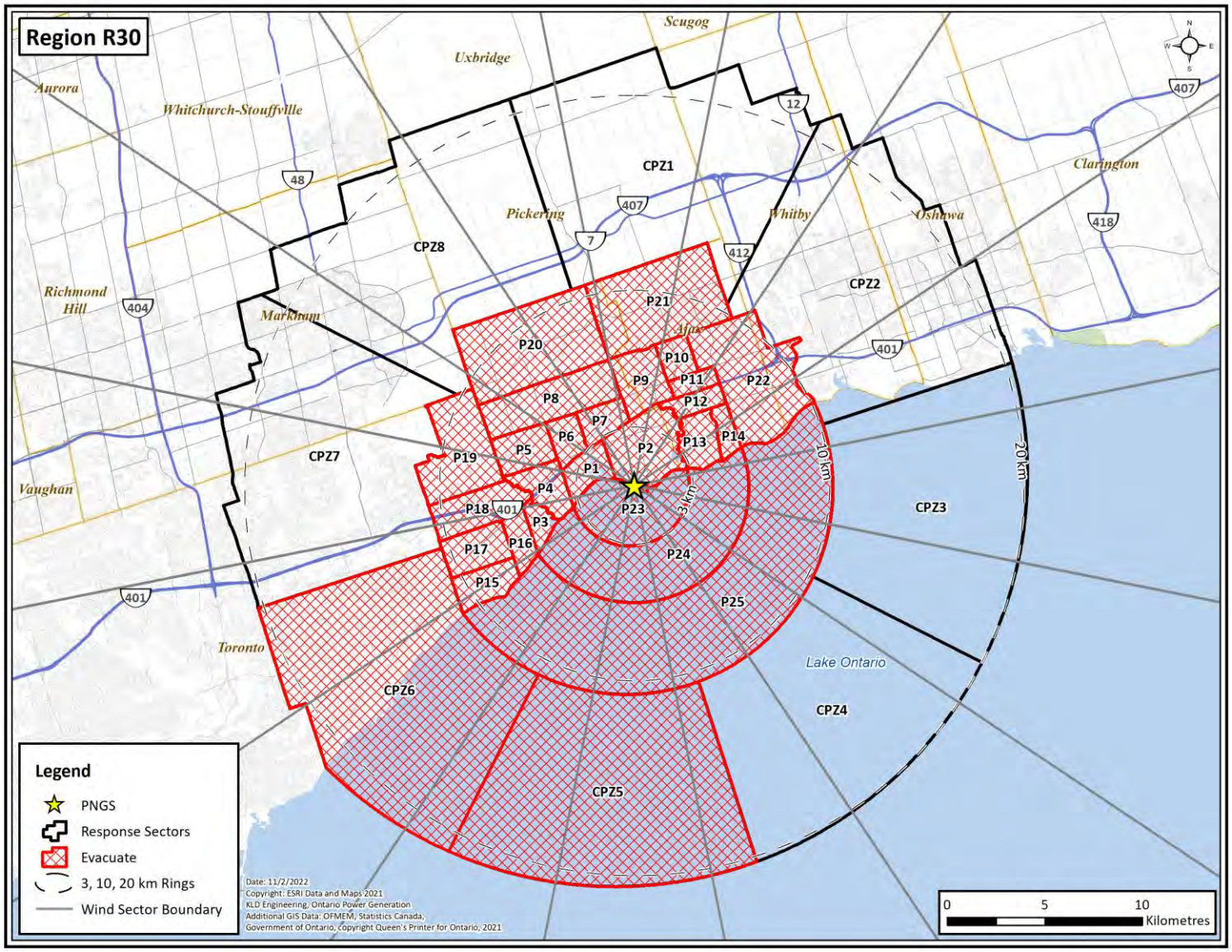



**Figure H-30. Region R30**

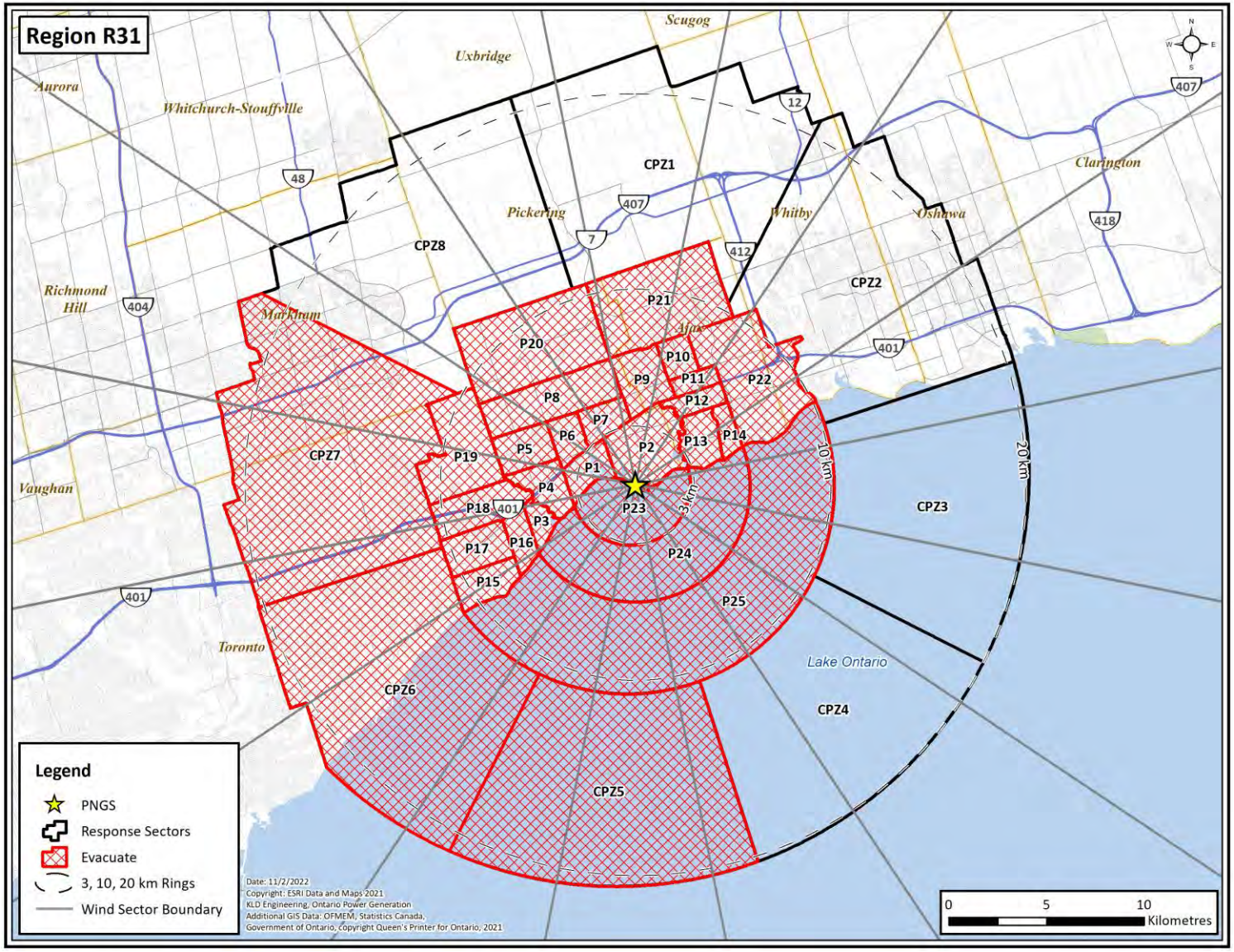



**Figure H-31. Region R31**

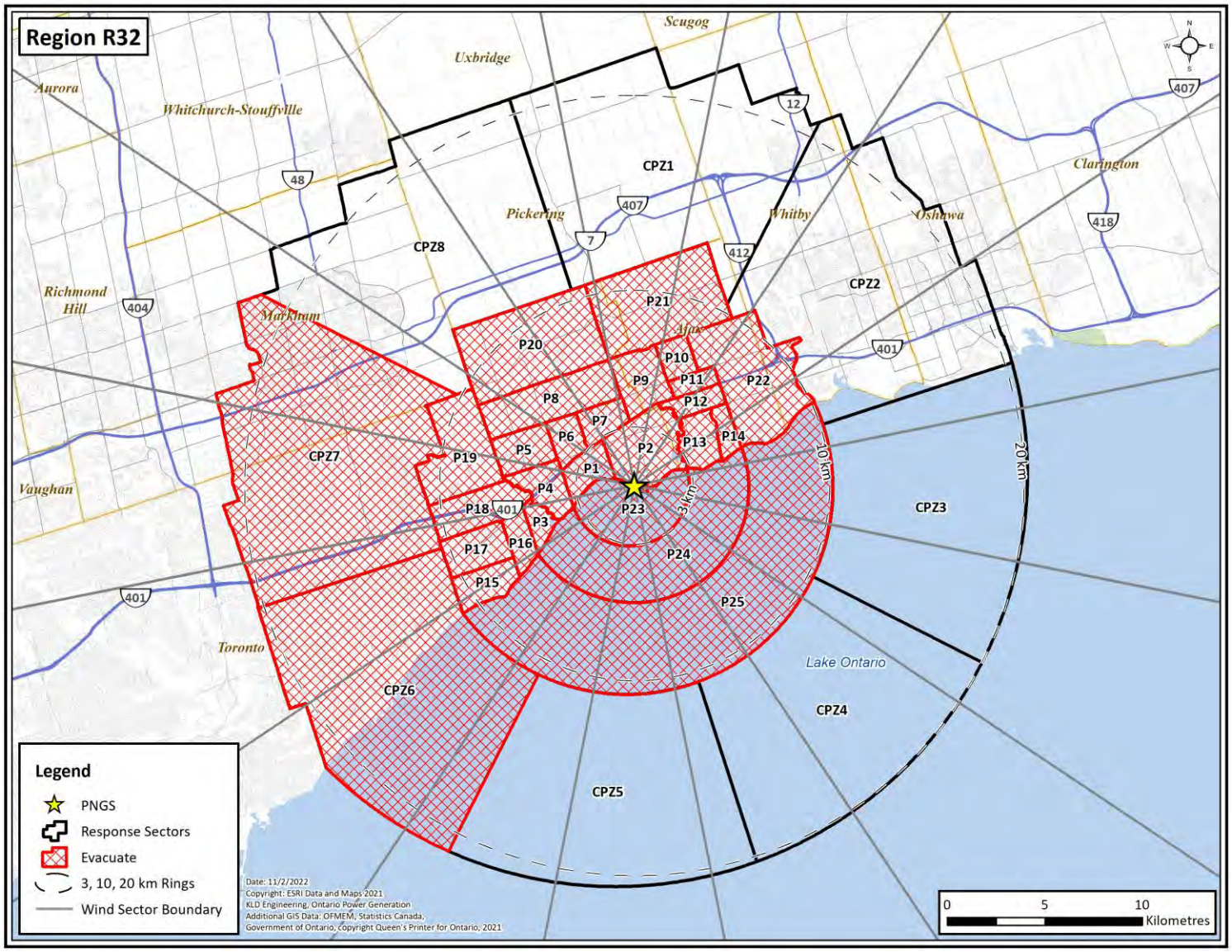
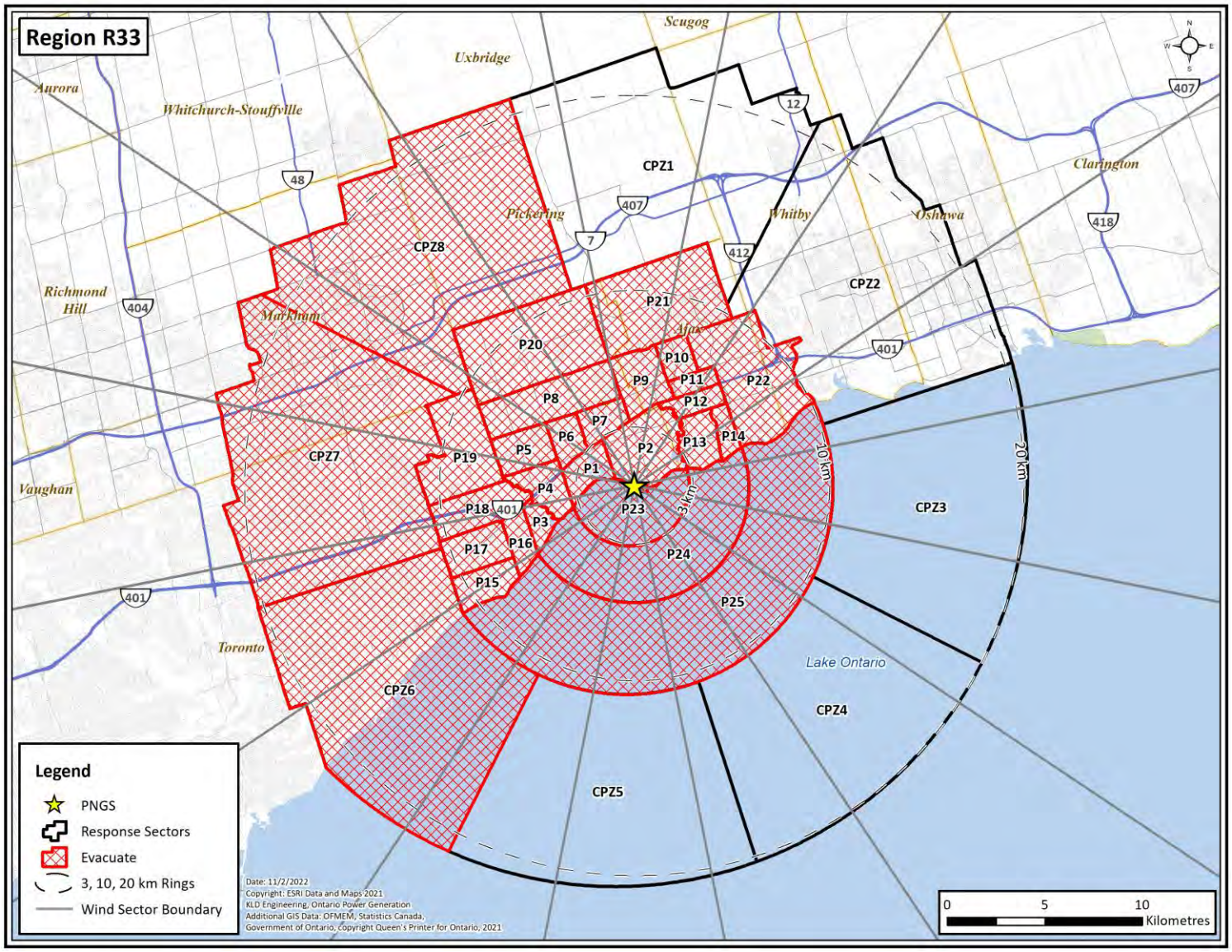



**Figure H-32. Region R32**

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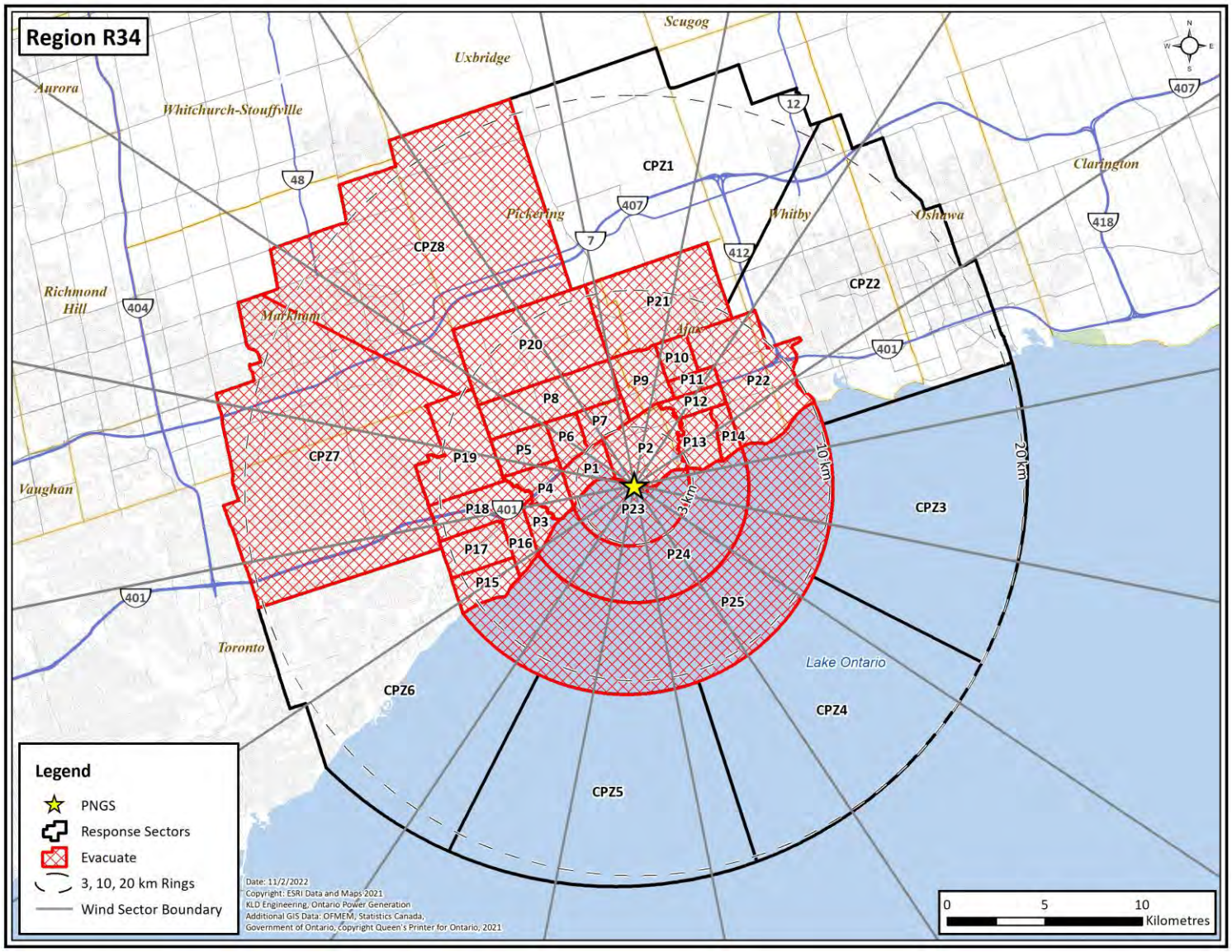
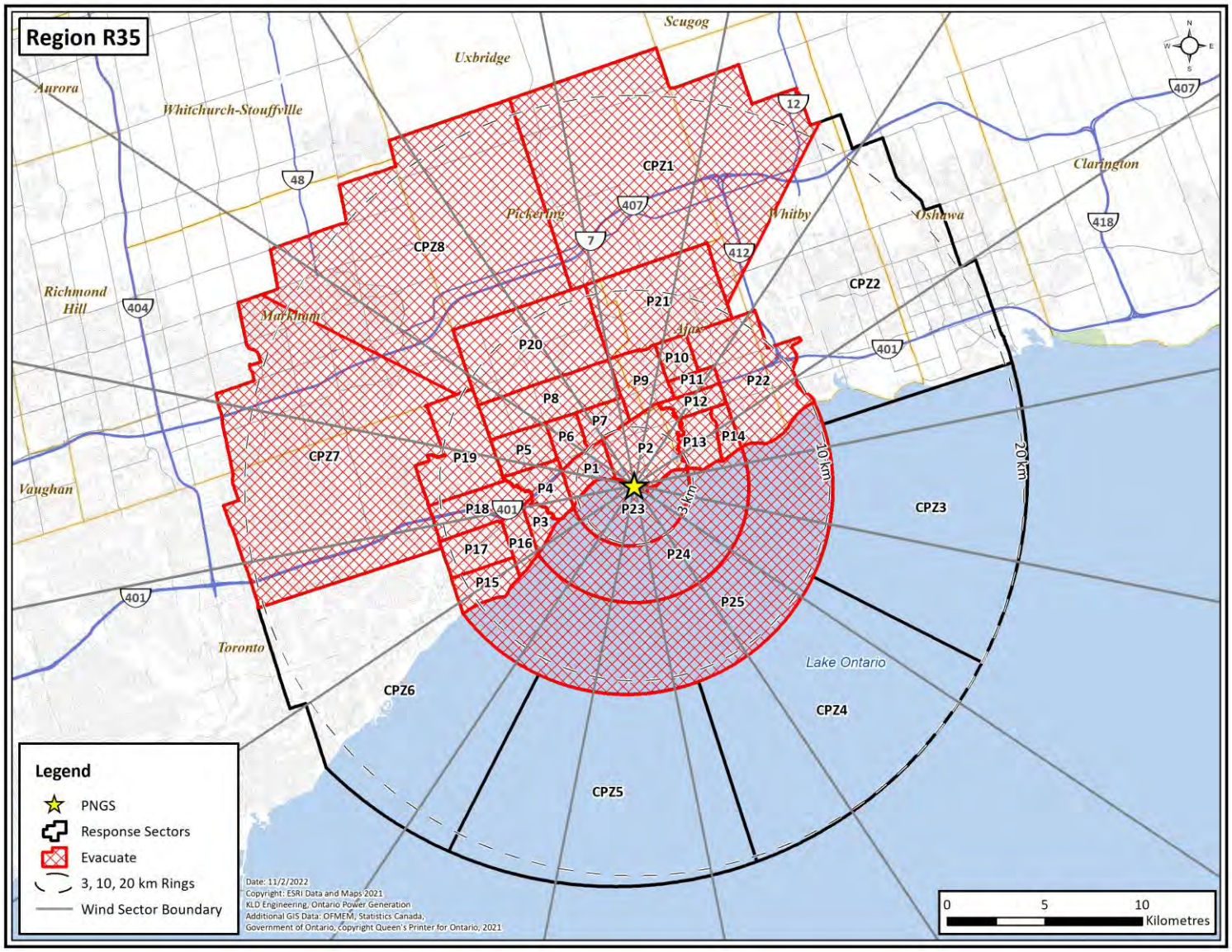



**Figure H-34. Region R34**

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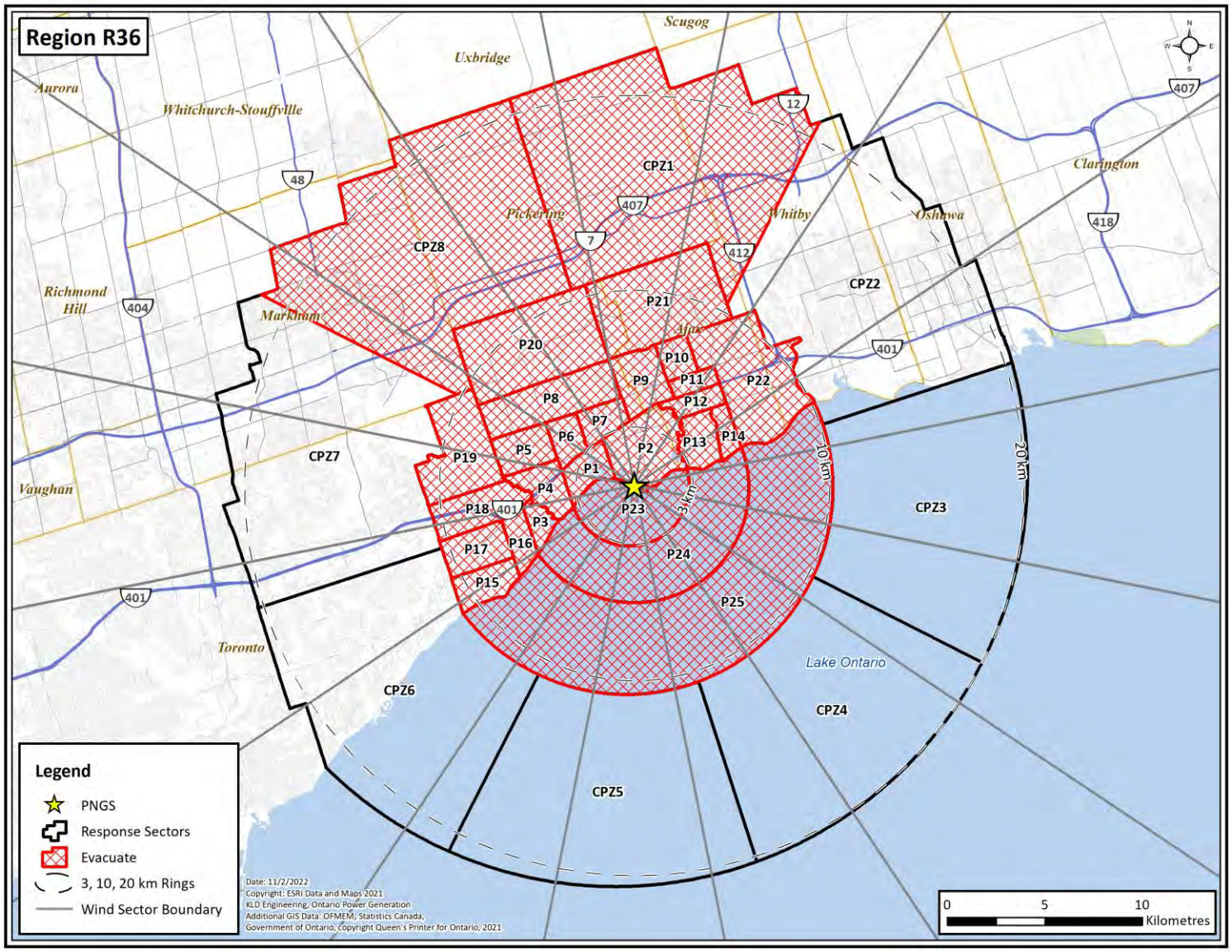


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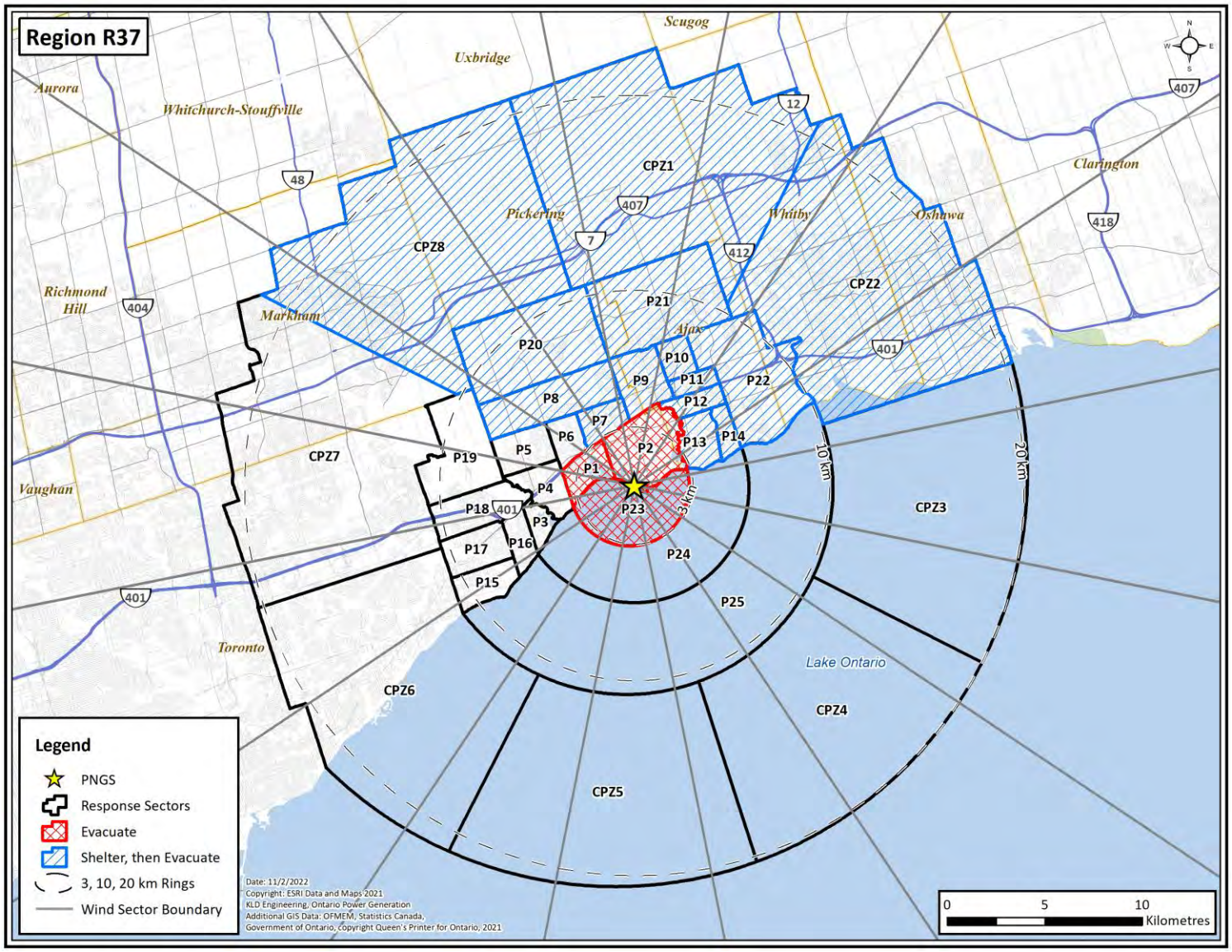


**Figure H-37. Region R37**

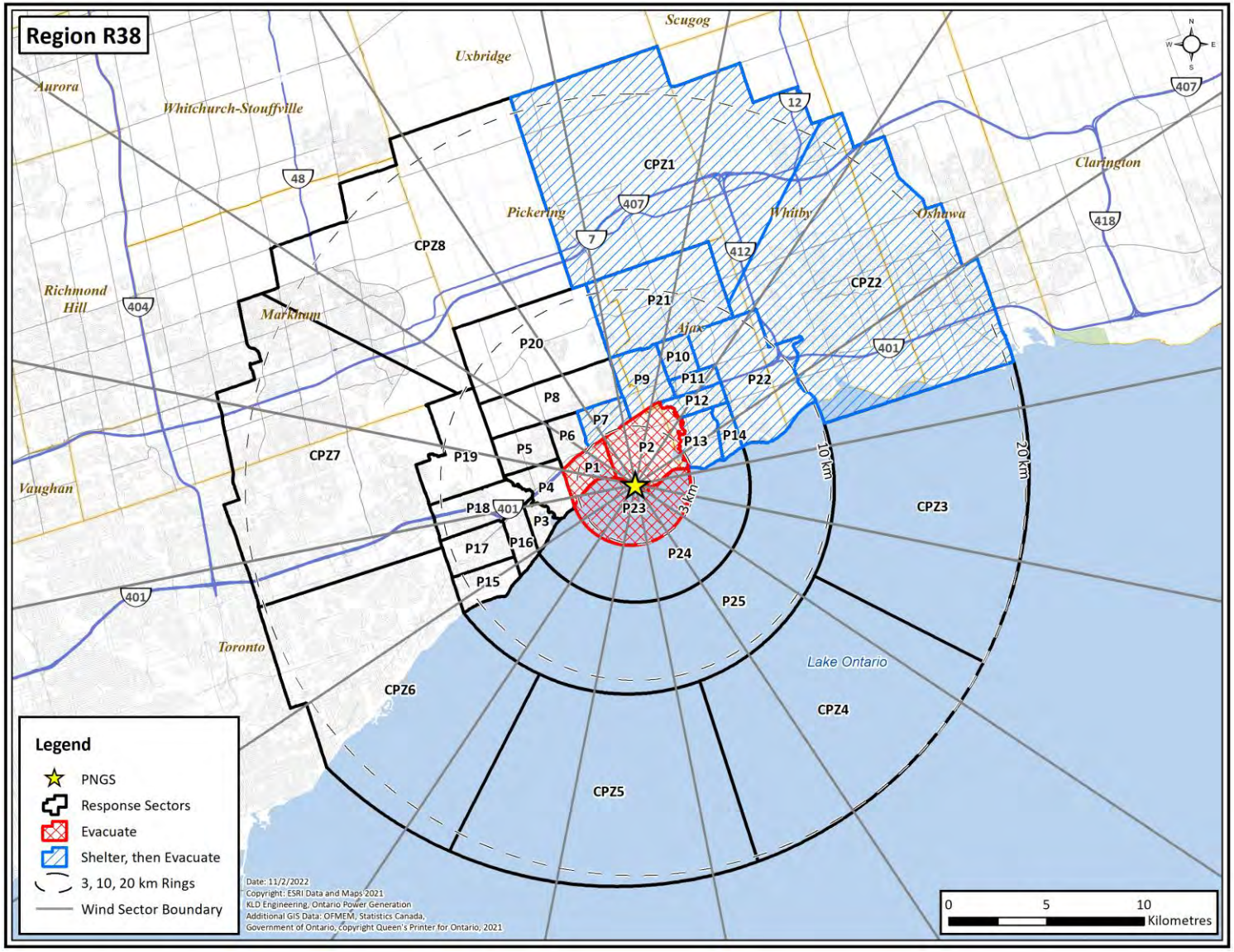


**Figure H-38. Region R38**

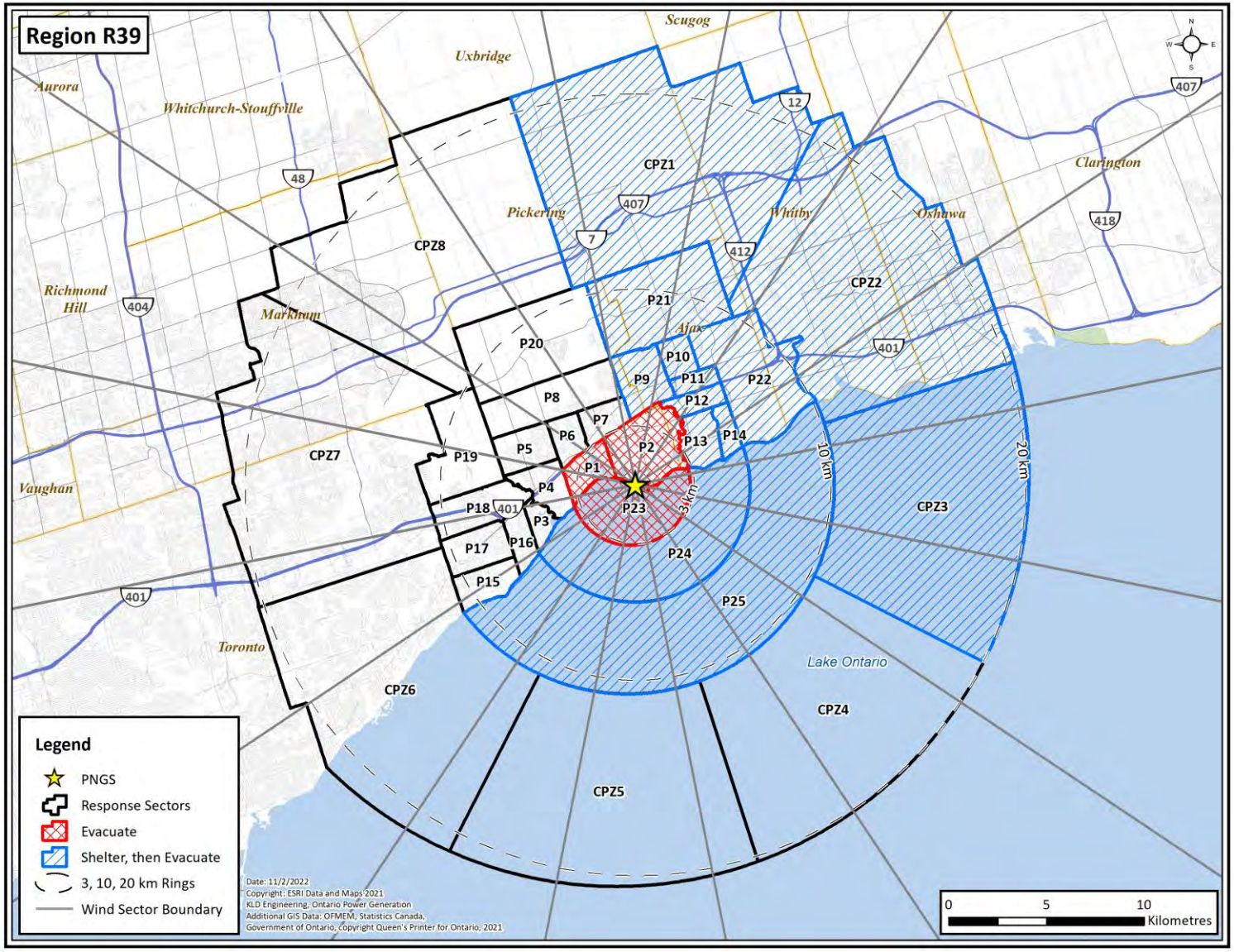


**Figure H-39. Region R39**

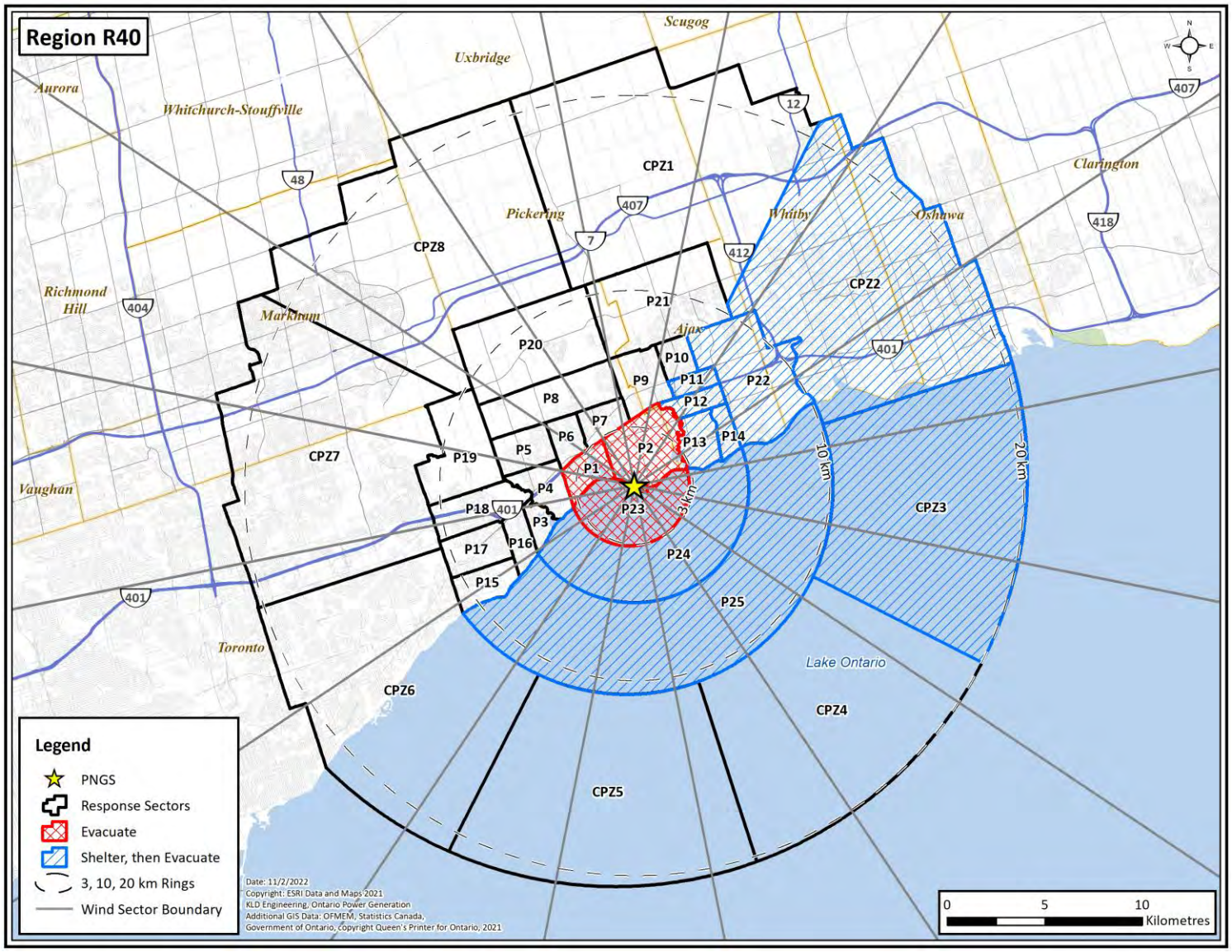


**Figure H-40. Region R40**

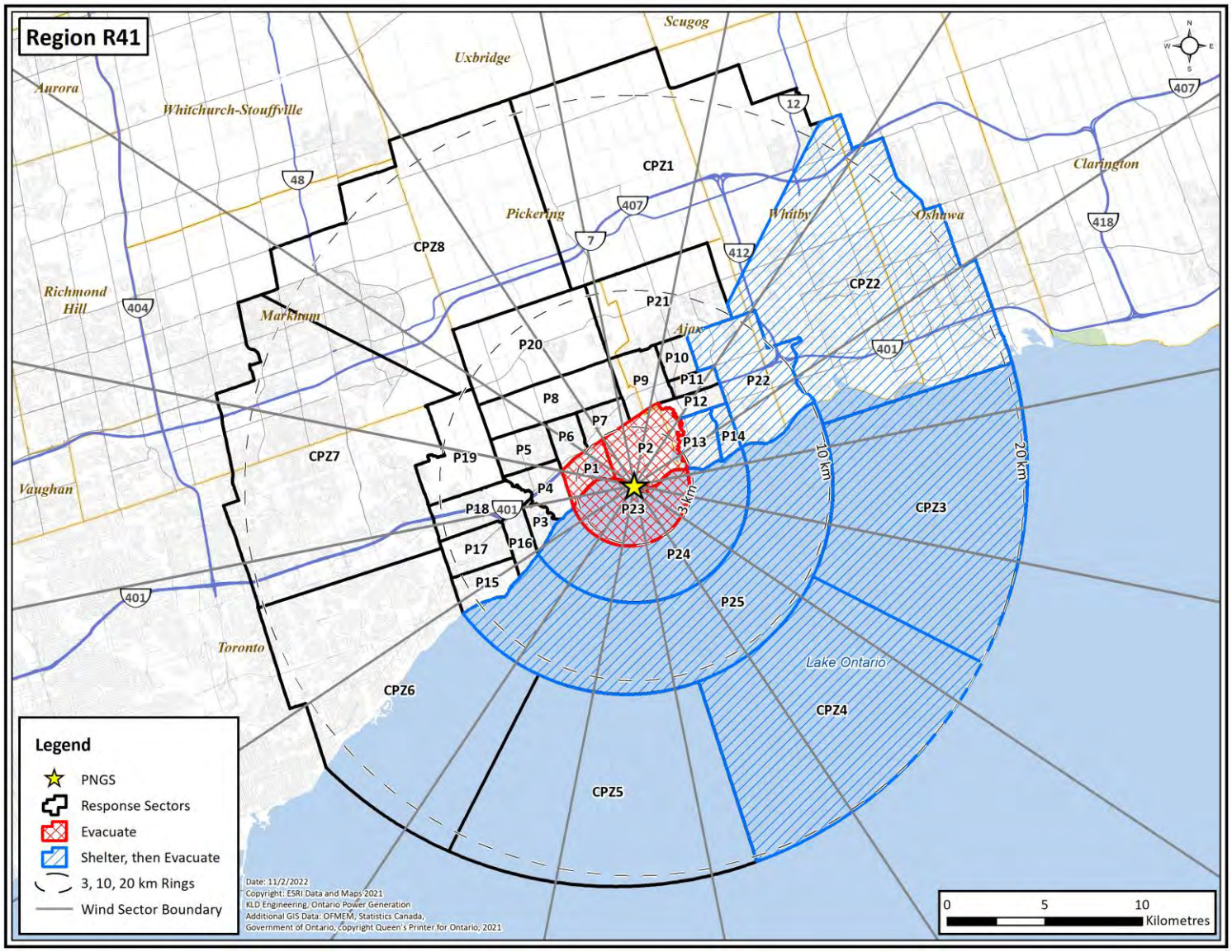


**Figure H-41. Region R41**

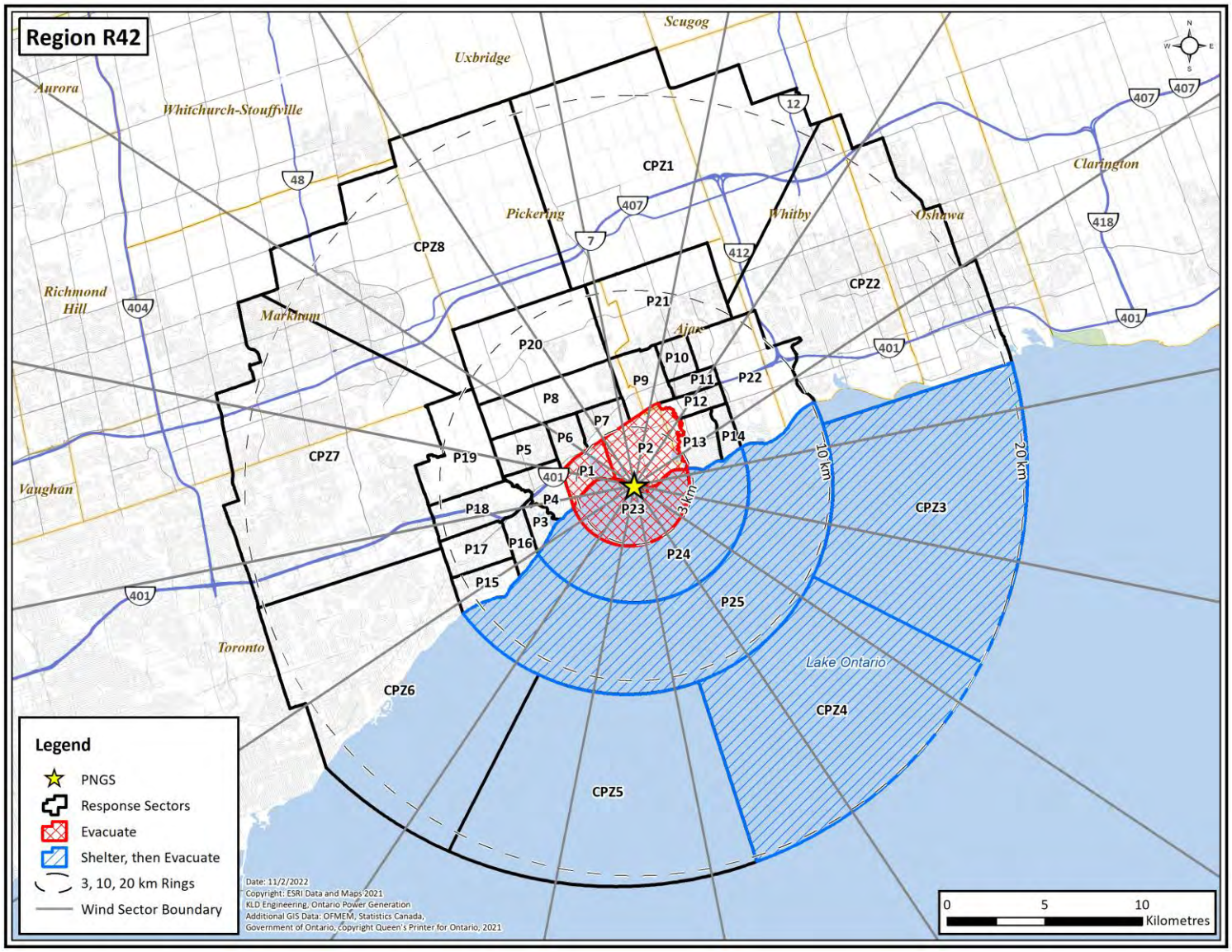


**Figure H-42. Region R42**

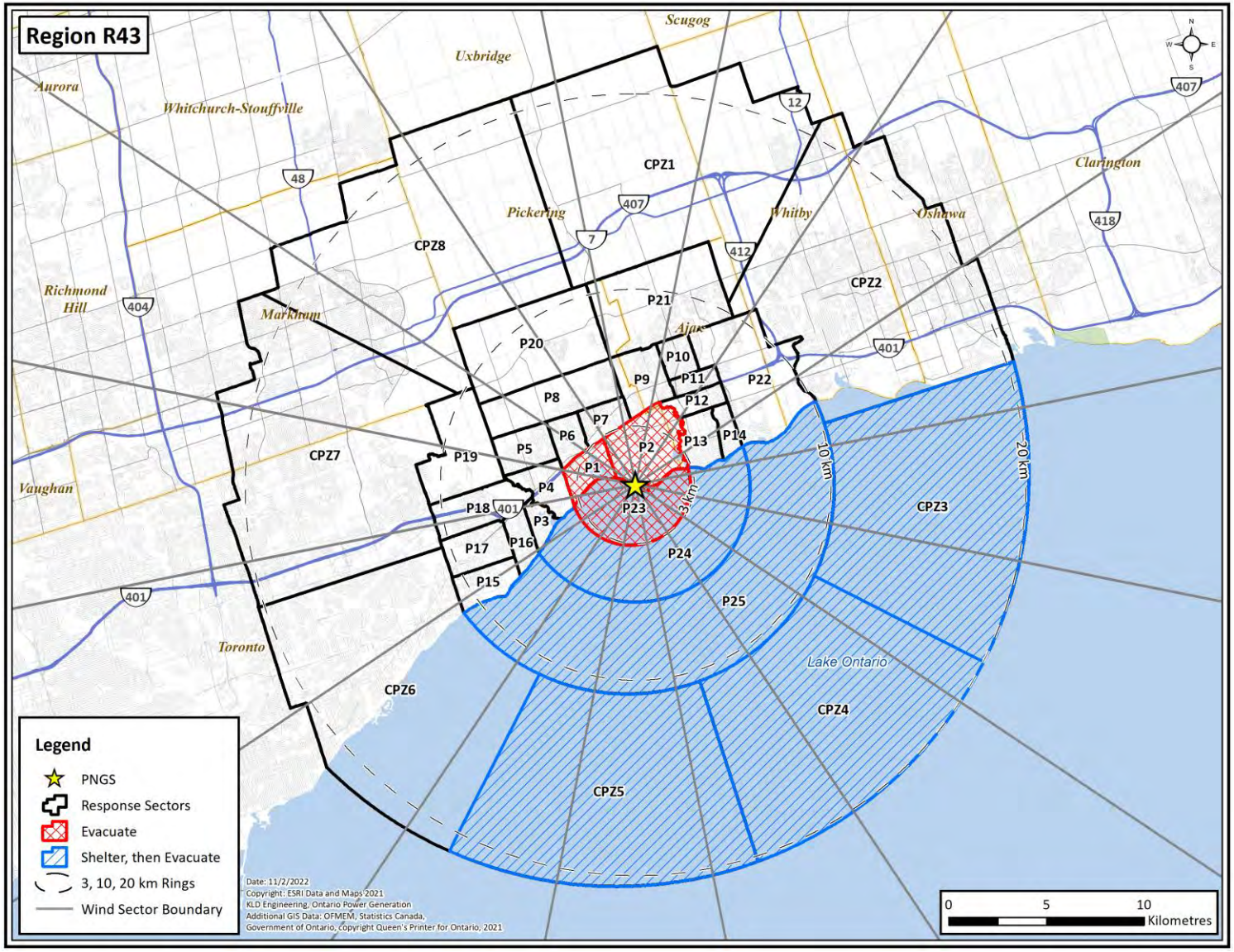


**Figure H-43. Region R43**

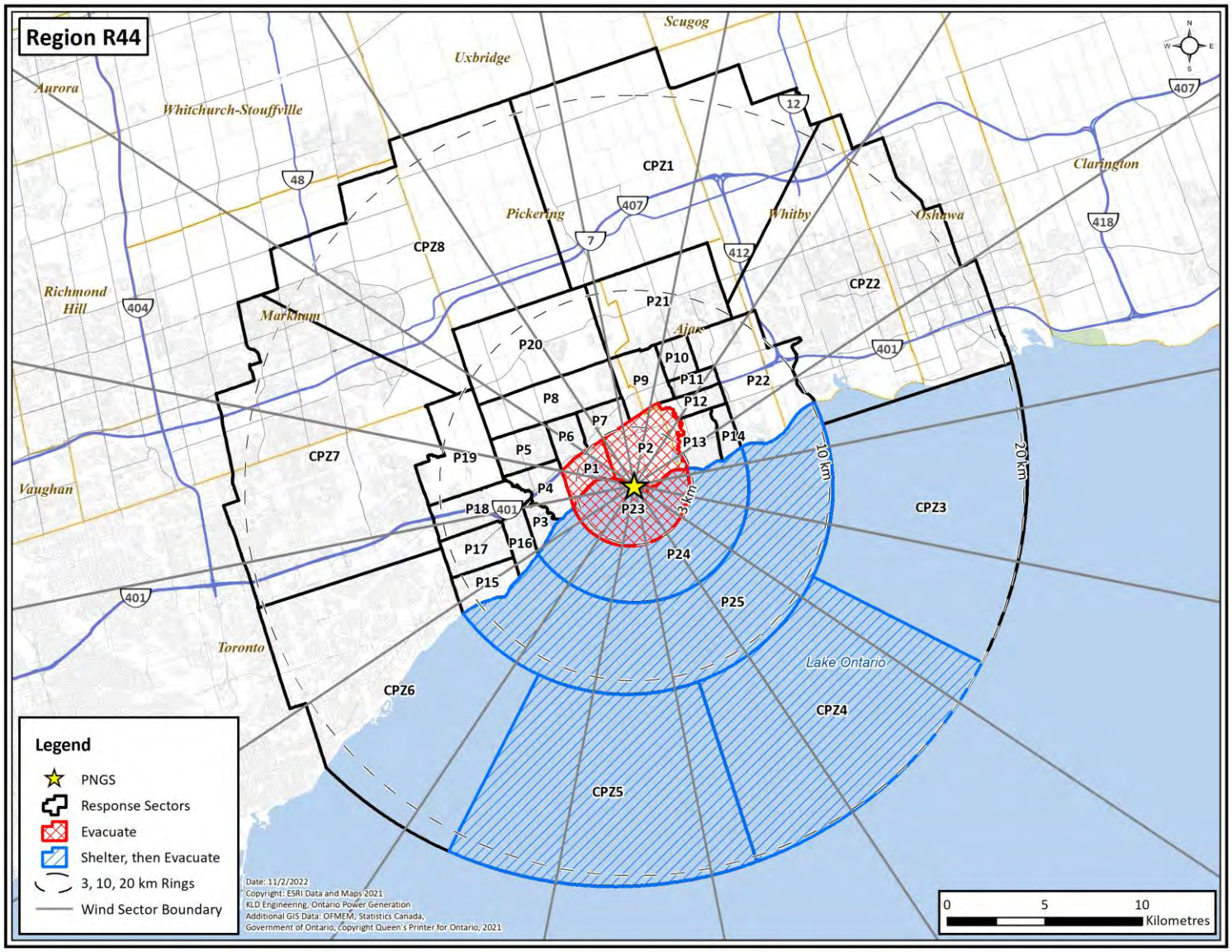


**Figure H-44. Region R44**

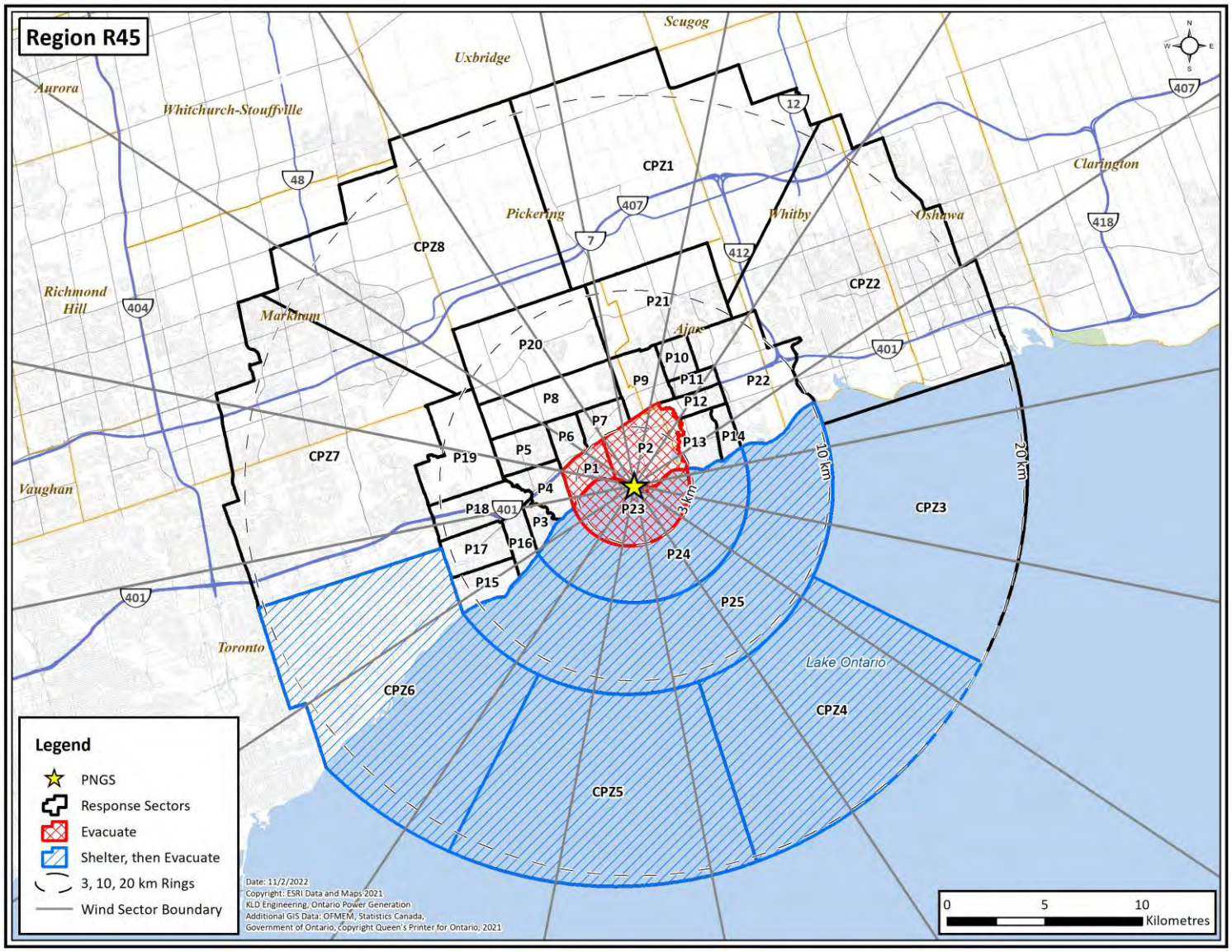


**Figure H-45. Region R45**

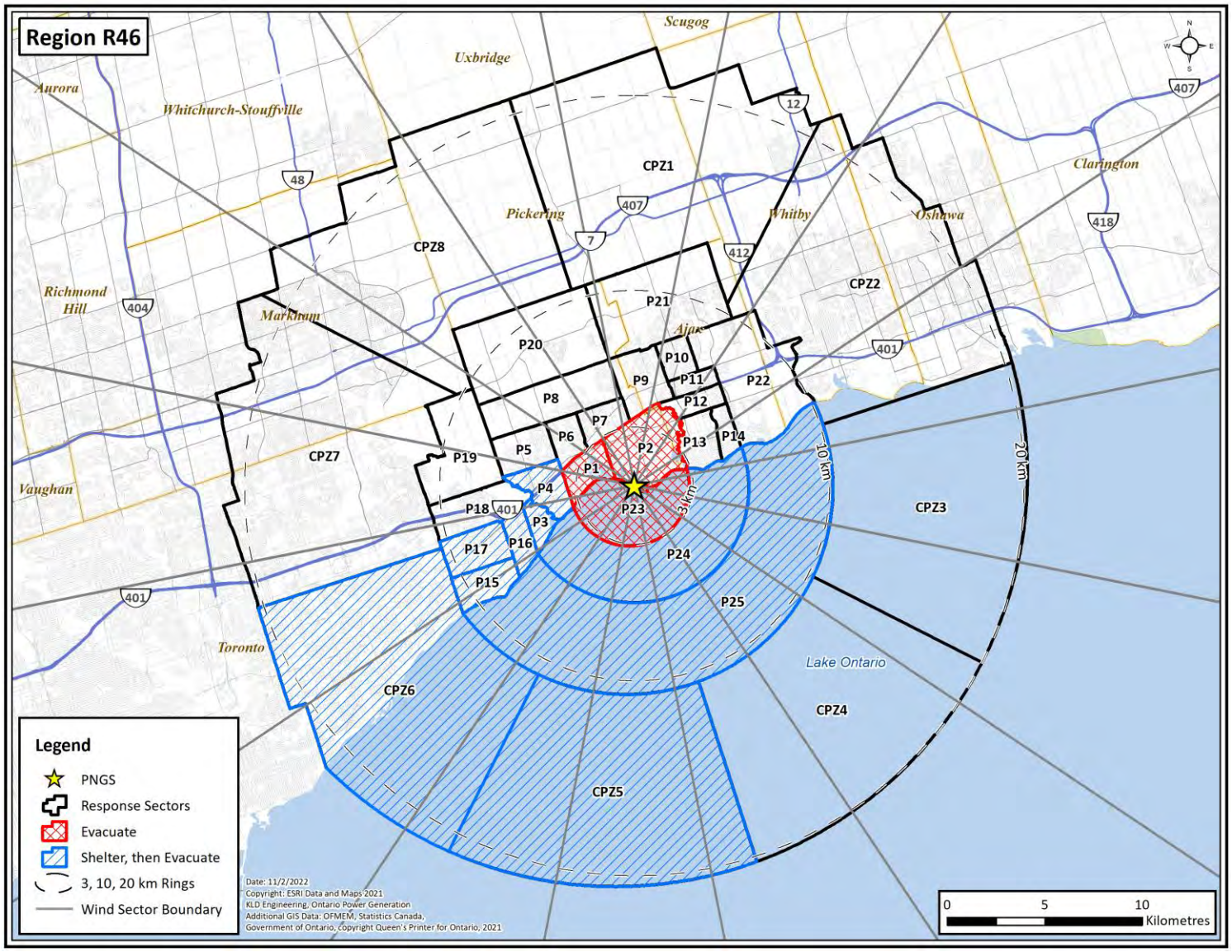


**Figure H-46. Region R46**

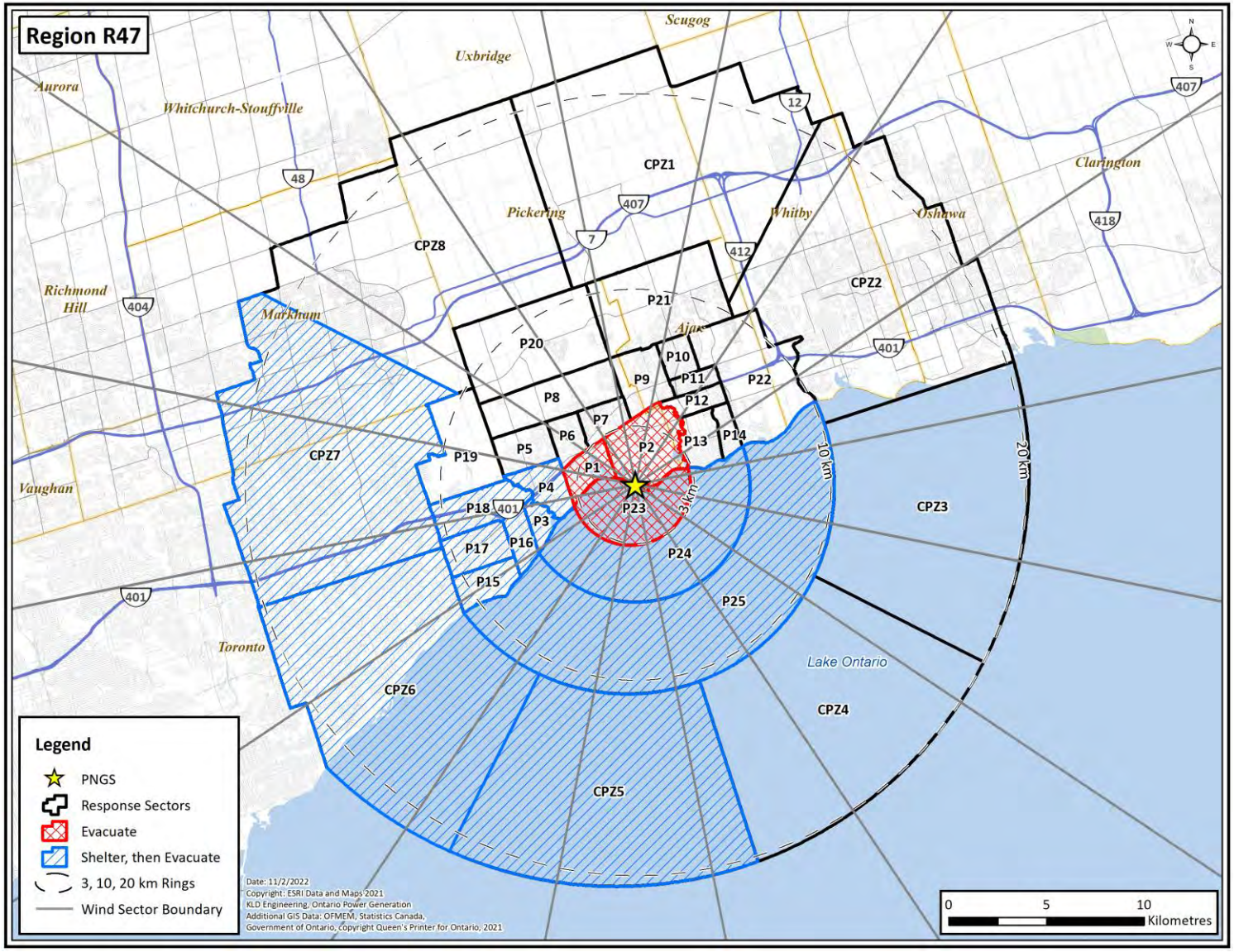


**Figure H-47. Region R47**

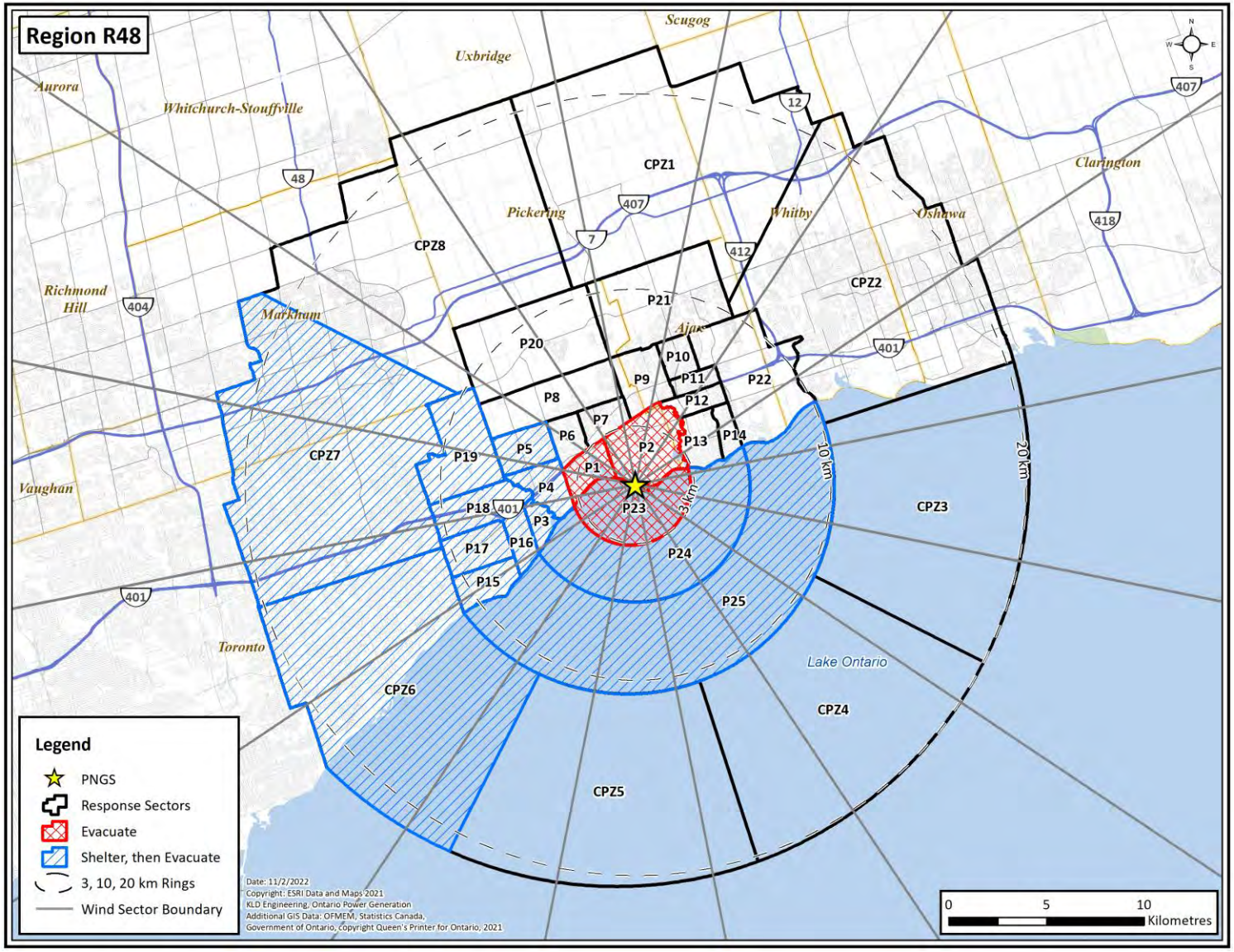


**Figure H-48. Region R48**

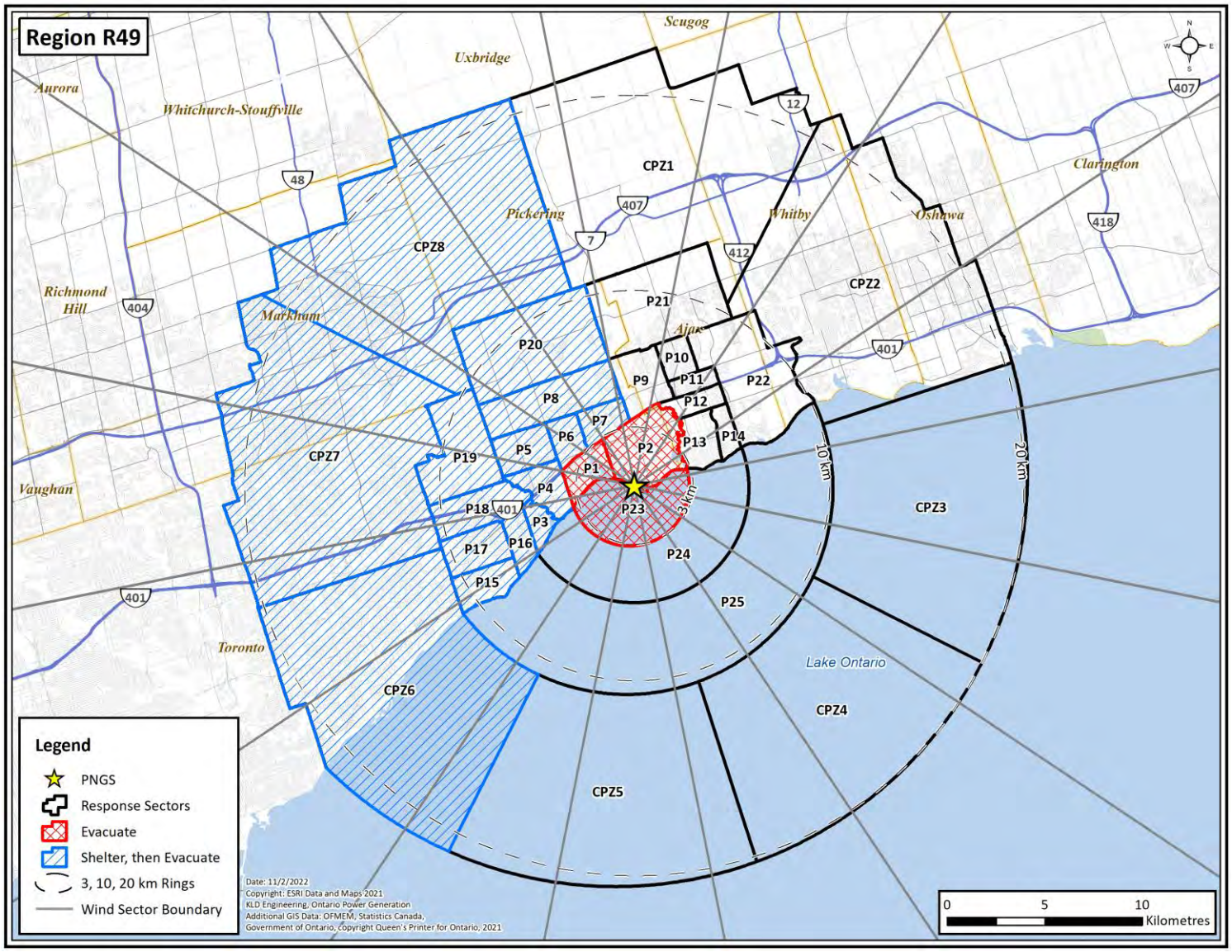


**Figure H-49. Region R49**

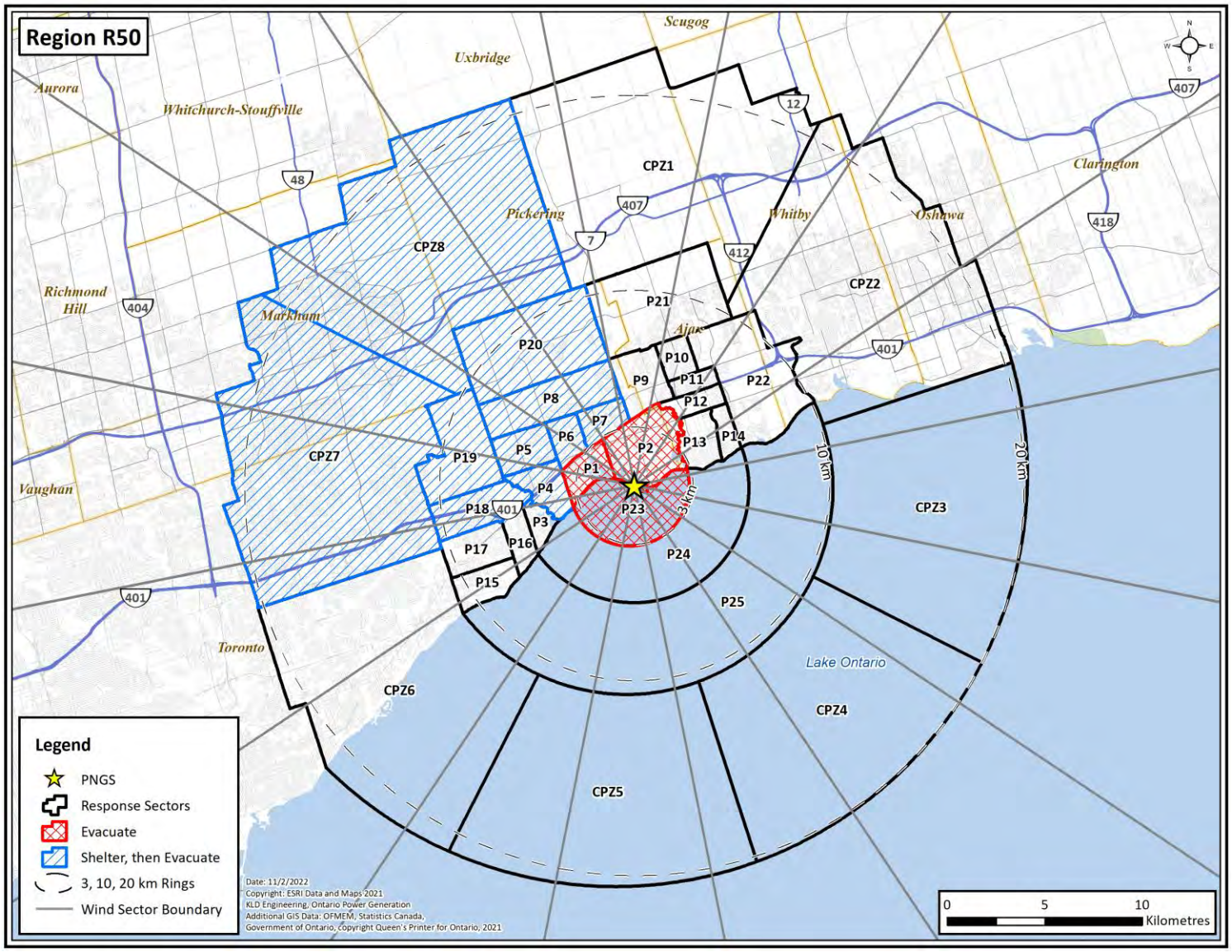


**Figure H-50. Region R50**

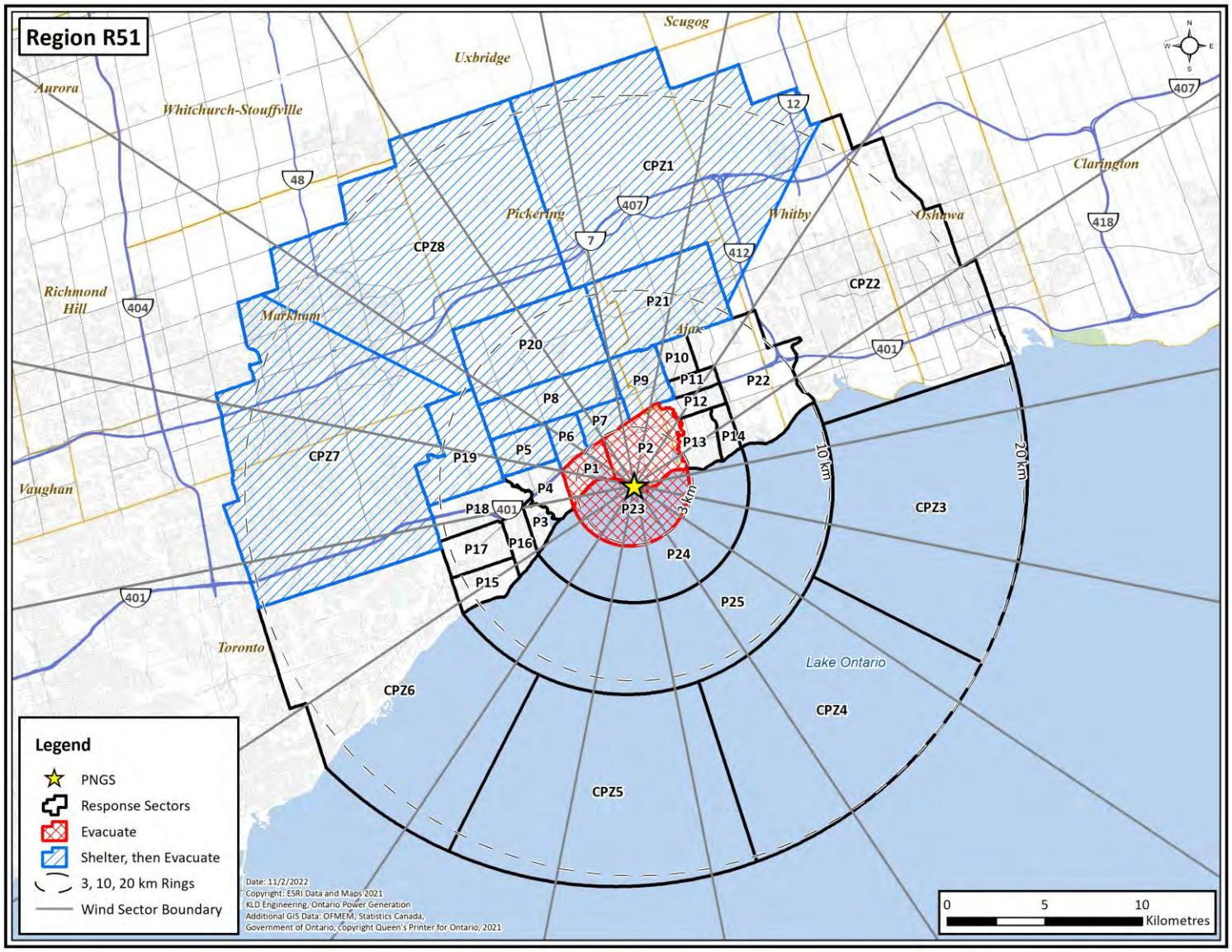


**Figure H-51. Region R51**

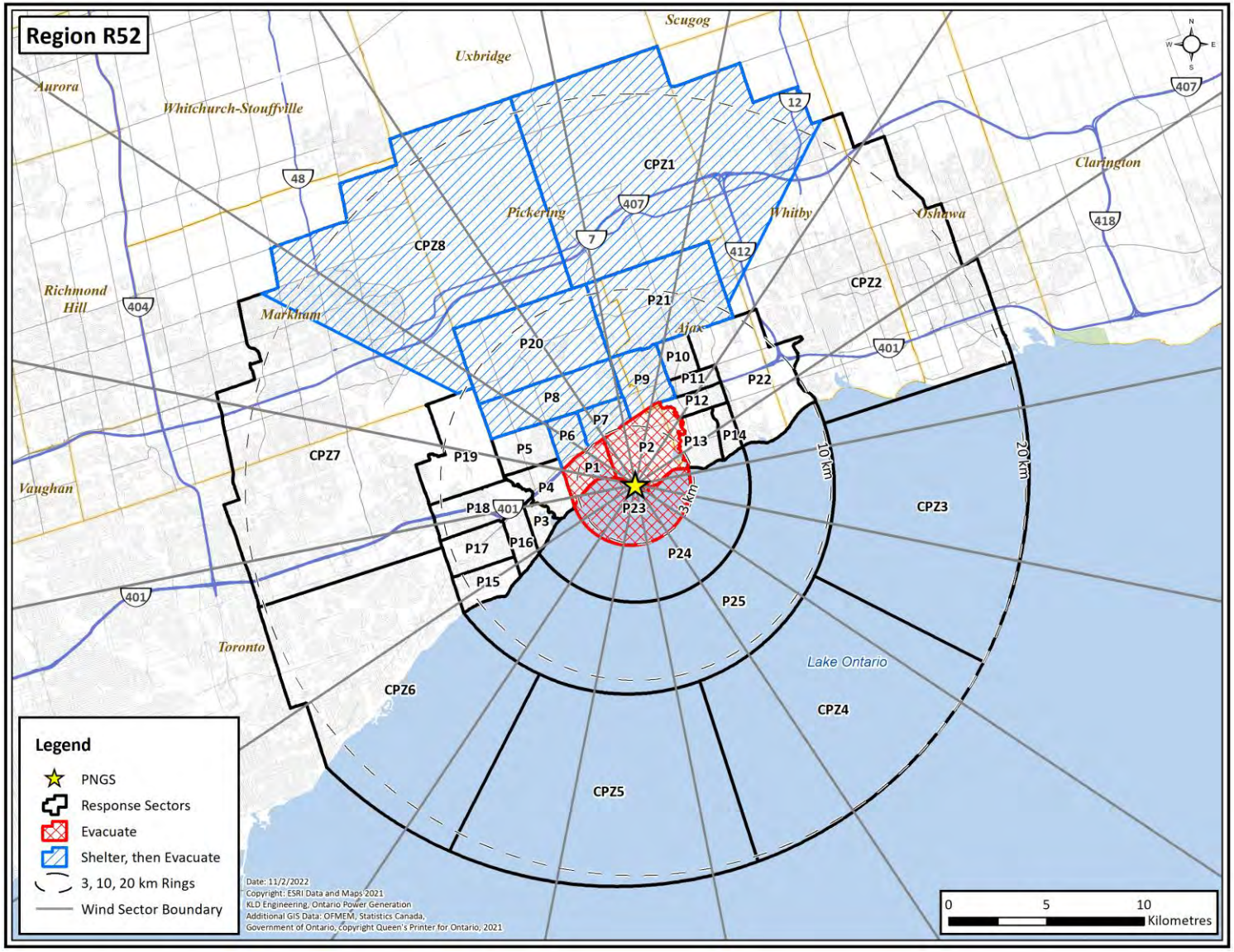


**Figure H-52. Region R52**

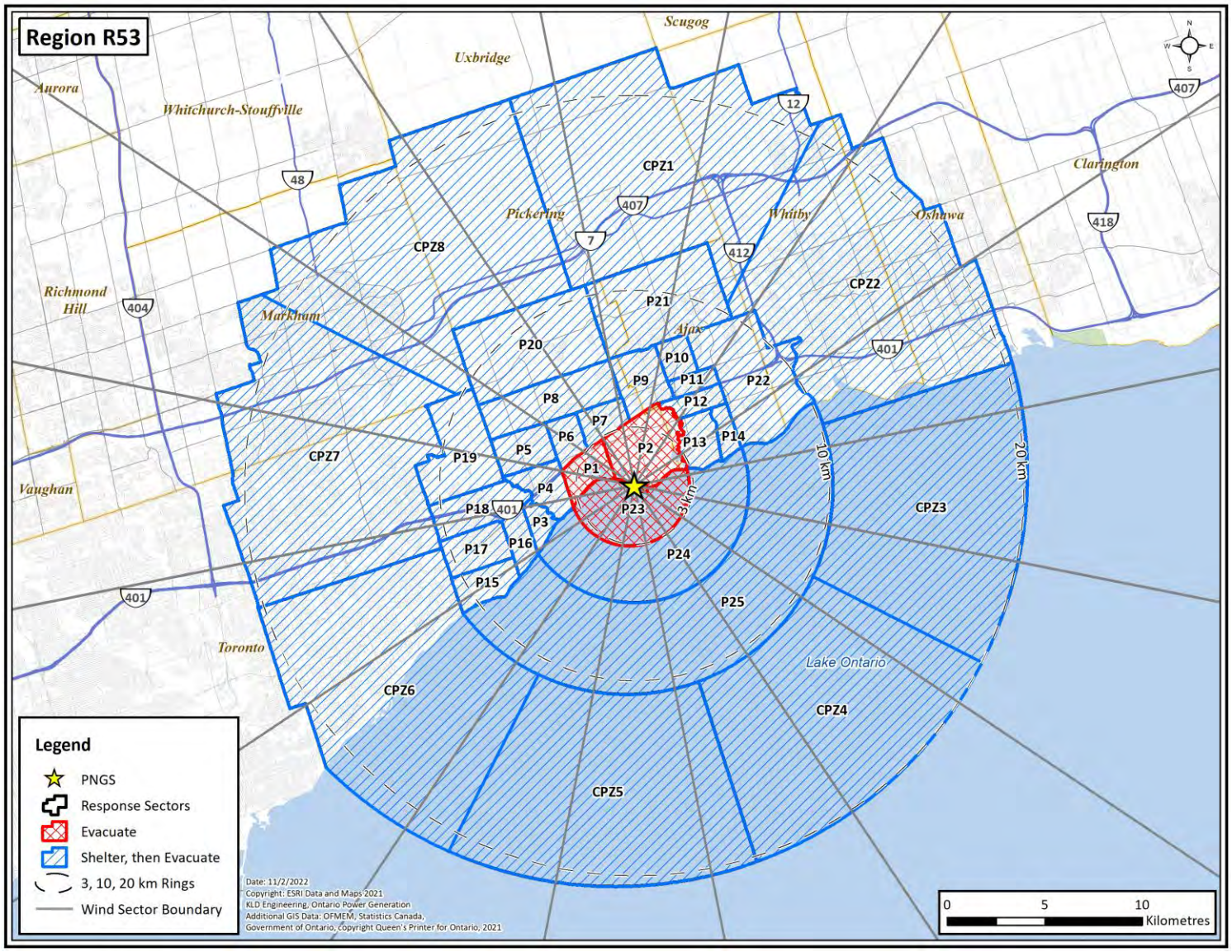


**Figure H-53. Region R53**

## APPENDIX J

Representative Inputs to and Outputs from the DYNEV II System

## J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM

This appendix presents data input to and output from the DYNEV II System.

Table J-1 provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. In total, there are a total of 994 source links (origins) in the model. The source links are shown as centroid points in Figure J-1. On average, evacuees travel a straight-line distance of approximately 3 km to exit the network.

Table J-2 provides network–wide statistics (average travel time, average delay time[1], average speed and number of vehicles) for an evacuation of the Detailed Planning Zone (DPZ) (Region R03) for each scenario. As expected, the heavy snow scenarios (Scenarios 8 and 11) exhibit slower average speeds, longer average delay times and longer average travel times when compared to good weather and rain scenarios.

Table J-3 provides statistics (average speed and travel time) for the major evacuation routes – Hwy 401 and Hwy 407 – for an evacuation of the entire DPZ (Region R03) under Scenario 1 conditions (summer, midweek, midday, with good weather). Average speeds along Hwy 401 are low for about 7 hours due to the volume of external-to-external trips and number of evacuees that utilize it in the evacuation. Hwy 407 slows down during the second through seventh hours of evacuation as vehicles start to mobilize and evacuate along this highway. Hwy 401 and Hwy 407 are essentially free flowing at 8 hours in both directions.

Table J-4 provides the number of vehicles discharged and the cumulative percent of total vehicles discharged for each link exiting the analysis network, for an evacuation of the entire DPZ (Region R03) under Scenario 1 conditions.

Figure J-2 through Figure J-15 plot the trip generation time versus the ETE for each of the 14 Scenarios considered. The distance between the trip generation and ETE curves is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. For low population density sites, the curves are close together, indicating short travel times and minimal traffic congestion. For higher population density sites, the curves are farther apart indicating longer travel times and the presence of traffic congestion.

As seen in Figure J-2 through Figure J-15, the curves are spatially separated as a result of the traffic congestion within in the DPZ, which clears at 7 hours and 45 minutes after the Emergency Bulletin for a summer, midweek, midday, good weather scenario, as discussed in detail in Section 7.3.

[1] Computed as the difference of the average travel time and the average ideal travel time under free flow conditions.

**Table J-1. Sample Simulation Model Input**

| Link Number | Upstream Node | Downstream Node | Vehicles Entering Network on this Link | Directional Preference | Destination Nodes | Destination Capacity |
|---|---|---|---|---|---|---|
| 1461 | 1069 | 1068 | 989 | S | 8981 | 2,850 |
| | | | | | 8980 | 2,850 |
| | | | | | 8019 | 2,850 |
| 2744 | 3239 | 3238 | 301 | SW | 8982 | 6,750 |
| | | | | | 8983 | 2,850 |
| | | | | | 8040 | 4,275 |
| 3460 | 3729 | 3688 | 401 | NE | 8276 | 2,850 |
| | | | | | 8996 | 1,275 |
| | | | | | 8889 | 3,400 |
| 3017 | 3438 | 3439 | 172 | E | 8427 | 6,750 |
| | | | | | 8276 | 2,850 |
| | | | | | 8996 | 1,275 |
| 1588 | 1169 | 1168 | 339 | SW | 8982 | 6,750 |
| | | | | | 8040 | 4,275 |
| | | | | | 8033 | 4,275 |
| 4841 | 4729 | 4727 | 247 | SW | 8982 | 6,750 |
| | | | | | 8902 | 6,750 |
| | | | | | 8983 | 2,850 |
| 2499 | 3025 | 3024 | 366 | SW | 8982 | 6,750 |
| | | | | | 8003 | 6,750 |
| | | | | | 8902 | 6,750 |
| 4184 | 4267 | 4218 | 209 | SW | 8003 | 6,750 |
| | | | | | 8902 | 6,750 |
| | | | | | 8429 | 1,275 |
| 5861 | 5518 | 4875 | 412 | SW | 8982 | 6,750 |
| | | | | | 8902 | 6,750 |
| | | | | | 8003 | 6,750 |

**Table J-2. Selected Model Outputs for the Evacuation of the DPZ (Region R03)**

| Scenario | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Network-Wide Average Travel Time (Min/Veh-Km) | 5.3 | 6.0 | 4.9 | 5.7 | 4.4 | 5.4 | 6.1 |
| Network-Wide Average Delay Time (Min/Veh-Km) | 3.9 | 4.6 | 3.5 | 4.3 | 3.0 | 4.0 | 4.7 |
| Network-Wide Average Speed (kph) | 18.2 | 16.2 | 19.7 | 17.0 | 21.8 | 17.7 | 15.9 |
| Total Vehicles Exiting Network | 479,446 | 480,341 | 446,789 | 447,698 | 356,172 | 487,265 | 488,375 |
| **Scenario** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| Network-Wide Average Travel Time (Min/Veh-Km) | 7.2 | 4.9 | 5.6 | 6.7 | 4.5 | 5.0 | 5.4 |
| Network-Wide Average Delay Time (Min/Veh-Km) | 5.8 | 3.5 | 4.2 | 5.3 | 3.1 | 3.6 | 4.0 |
| Network-Wide Average Speed (kph) | 13.5 | 19.8 | 17.1 | 14.4 | 21.6 | 19.5 | 17.8 |
| Total Vehicles Exiting Network | 484,764 | 446,349 | 447,319 | 448,939 | 356,991 | 451,340 | 479,267 |

**Table J-3. Average Speed (kph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1)**

| Major Evacuation Route | Length (km) | Elapsed Time (hours) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| | | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) | Speed (kph) | Travel Time (min) |
| Hwy 401 EB | 42.1 | 37.5 | 67.6 | 11.4 | 220.2 | 6.3 | 399.1 | 3.7 | 685.3 | 5.1 | 492.1 | 8.5 | 298.2 | 8.5 | 294.2 | 83.5 | 30.3 |
| Hwy 401 WB | 42.1 | 42.5 | 59.5 | 9.8 | 258.1 | 5.8 | 440.6 | 3.9 | 660.8 | 5.5 | 456.3 | 8.0 | 316.5 | 15.6 | 162.7 | 114.6 | 22.1 |
| Hwy 407 EB | 38.1 | 111.4 | 20.5 | 68.9 | 33.2 | 25.4 | 90.1 | 8.9 | 258.4 | 6.1 | 371.0 | 22.2 | 103.2 | 8.5 | 265.9 | 111.5 | 20.5 |
| Hwy 407 WB | 38.1 | 111.2 | 20.5 | 73.9 | 31.0 | 30.3 | 75.6 | 11.4 | 199.8 | 4.5 | 515.1 | 12.6 | 181.5 | 46.8 | 48.8 | 82.7 | 27.6 |

**Table J-4. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1**

| Network Exit Link | Road Name | Upstream Node | Downstream Node | Elapsed Time (hours) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | | Cumulative Vehicles Discharged by the Indicated Time | | | | | | | |
| | | | | Cumulative Percent of Vehicles Discharged by the Indicated Time | | | | | | | |
| 3380 | Scugog St | 3679 | 5802 | 280 | 1,441 | 2,649 | 3,772 | 4,945 | 6,061 | 6,836 | 7,399 |
| | | | | 0.9% | 1.4% | 1.5% | 1.5% | 1.5% | 1.6% | 1.6% | 1.6% |
| 4729 | O'Connor Dr | 4642 | 4698 | 326 | 2,909 | 5,470 | 8,031 | 10,593 | 11,257 | 11,258 | 11,258 |
| | | | | 1.0% | 2.9% | 3.0% | 3.1% | 3.2% | 3.0% | 2.6% | 2.4% |
| 4814 | Kingston Rd | 4707 | 4709 | 675 | 2,586 | 4,319 | 6,028 | 7,745 | 7,876 | 8,014 | 8,073 |
| | | | | 2.0% | 2.6% | 2.4% | 2.3% | 2.4% | 2.1% | 1.9% | 1.7% |
| 4832 | Danforth Ave | 4722 | 4723 | 1,066 | 2,693 | 4,889 | 6,925 | 8,679 | 8,897 | 9,008 | 9,052 |
| | | | | 3.2% | 2.7% | 2.7% | 2.7% | 2.7% | 2.3% | 2.1% | 2.0% |
| 5288 | Hwy 401 | 5047 | 4968 | 4,940 | 10,924 | 17,045 | 23,050 | 29,047 | 35,031 | 41,142 | 45,650 |
| | | | | 15.0% | 10.8% | 9.5% | 8.9% | 8.9% | 9.2% | 9.6% | 9.8% |
| 5289 | Hwy 401 Express | 5048 | 4969 | 4,599 | 10,091 | 16,359 | 22,454 | 28,531 | 34,579 | 40,590 | 43,902 |
| | | | | 13.9% | 10.0% | 9.1% | 8.7% | 8.7% | 9.1% | 9.5% | 9.5% |
| 5651 | Don Valley Pkwy | 5343 | 4978 | 5,721 | 12,316 | 18,548 | 24,880 | 31,085 | 37,275 | 43,352 | 47,854 |
| | | | | 17.3% | 12.2% | 10.3% | 9.6% | 9.5% | 9.8% | 10.1% | 10.3% |
| 5752 | Hwy 407 | 5426 | 5137 | 2,465 | 11,611 | 21,148 | 31,632 | 41,427 | 50,935 | 58,331 | 64,075 |
| | | | | 7.5% | 11.5% | 11.8% | 12.3% | 12.7% | 13.4% | 13.6% | 13.8% |
| 5756 | McNicoll Ave | 5430 | 5429 | 124 | 1,251 | 2,420 | 3,586 | 3,865 | 3,865 | 3,865 | 3,865 |
| | | | | 0.4% | 1.2% | 1.3% | 1.4% | 1.2% | 1.0% | 0.9% | 0.8% |
| 6299 | Hwy 404 | 5835 | 5187 | 4,505 | 10,273 | 16,348 | 22,423 | 28,498 | 34,573 | 40,648 | 45,617 |
| | | | | 13.7% | 10.2% | 9.1% | 8.7% | 8.7% | 9.1% | 9.5% | 9.8% |
| 6453 | Markham Rd | 5942 | 5943 | 2 | 2 | 2 | 685 | 1,489 | 2,026 | 2,026 | 2,026 |
| | | | | 0.0% | 0.0% | 0.0% | 0.3% | 0.5% | 0.5% | 0.5% | 0.4% |
| 6652 | Bloomington Rd | 6108 | 5832 | 1 | 407 | 1,294 | 2,049 | 2,874 | 3,642 | 3,642 | 3,642 |
| | | | | 0.0% | 0.4% | 0.7% | 0.8% | 0.9% | 1.0% | 0.9% | 0.8% |
| 6656 | Stouffville Rd | 6112 | 5867 | 5 | 1,165 | 2,916 | 4,694 | 6,401 | 7,228 | 7,229 | 7,232 |
| | | | | 0.0% | 1.2% | 1.6% | 1.8% | 2.0% | 1.9% | 1.7% | 1.6% |
| 6673 | Elgin Mills Rd | 6129 | 5882 | 7 | 204 | 1,160 | 2,602 | 4,113 | 5,847 | 7,053 | 7,053 |
| | | | | 0.0% | 0.2% | 0.6% | 1.0% | 1.3% | 1.5% | 1.7% | 1.5% |
| 6682 | Mackenzie Dr E | 6138 | 5179 | 79 | 1,634 | 3,672 | 5,953 | 8,068 | 8,069 | 8,069 | 8,069 |
| | | | | 0.2% | 1.6% | 2.0% | 2.3% | 2.5% | 2.1% | 1.9% | 1.7% |
| 6689 | 16th Ave | 6145 | 5168 | 26 | 923 | 3,475 | 6,065 | 7,372 | 7,428 | 7,428 | 7,428 |
| | | | | 0.1% | 0.9% | 1.9% | 2.4% | 2.3% | 2.0% | 1.7% | 1.6% |
| 6693 | Hwy 7 | 6149 | 5151 | 24 | 749 | 2,712 | 4,968 | 6,792 | 6,792 | 6,792 | 6,792 |
| | | | | 0.1% | 0.7% | 1.5% | 1.9% | 2.1% | 1.8% | 1.6% | 1.5% |
| 6708 | John St | 6164 | 5344 | 35 | 385 | 1,182 | 2,637 | 3,400 | 3,401 | 3,401 | 3,401 |
| | | | | 0.1% | 0.4% | 0.7% | 1.0% | 1.0% | 0.9% | 0.8% | 0.7% |
| 6717 | Steeles Ave E | 6173 | 5123 | 220 | 1,520 | 2,890 | 3,668 | 4,705 | 4,840 | 5,058 | 5,133 |
| | | | | 0.7% | 1.5% | 1.6% | 1.4% | 1.4% | 1.3% | 1.2% | 1.1% |
| 6732 | Finch Ave | 6188 | 5109 | 1 | 270 | 713 | 780 | 820 | 820 | 820 | 820 |
| | | | | 0.0% | 0.3% | 0.4% | 0.3% | 0.3% | 0.2% | 0.2% | 0.2% |
| 6744 | Sheppard Ave | 6200 | 5096 | 18 | 2,353 | 4,981 | 7,221 | 7,285 | 7,285 | 7,285 | 7,285 |
| | | | | 0.1% | 2.3% | 2.8% | 2.8% | 2.2% | 1.9% | 1.7% | 1.6% |
| 6748 | York Mills Rd | 6204 | 4531 | 44 | 698 | 2,100 | 2,565 | 2,586 | 2,586 | 2,586 | 2,586 |
| | | | | 0.1% | 0.7% | 1.2% | 1.0% | 0.8% | 0.7% | 0.6% | 0.6% |

| Network Exit Link | Road Name | Upstream Node | Downstream Node | Elapsed Time (hours) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | | Cumulative Vehicles Discharged by the Indicated Time | | | | | | | |
| | | | | Cumulative Percent of Vehicles Discharged by the Indicated Time | | | | | | | |
| 6751 | Lawrence Ave | 6207 | 4994 | 873 | 3,579 | 6,278 | 8,103 | 8,660 | 9,294 | 9,507 | 9,651 |
| | | | | 2.7% | 3.5% | 3.5% | 3.1% | 2.7% | 2.4% | 2.2% | 2.1% |
| 6754 | Eglinton Ave | 6210 | 4977 | 319 | 2,565 | 5,906 | 9,036 | 10,181 | 10,219 | 10,219 | 10,223 |
| | | | | 1.0% | 2.5% | 3.3% | 3.5% | 3.1% | 2.7% | 2.4% | 2.2% |
| 6807 | Regional Rd 20 | 6255 | 5413 | 7 | 74 | 213 | 316 | 402 | 444 | 493 | 517 |
| | | | | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| 6812 | Hwy 407 | 6259 | 5889 | 1,662 | 4,775 | 7,945 | 11,058 | 14,227 | 17,397 | 20,566 | 23,759 |
| | | | | 5.0% | 4.7% | 4.4% | 4.3% | 4.4% | 4.6% | 4.8% | 5.1% |
| 6814 | Taunton Rd | 6260 | 4807 | 61 | 905 | 1,914 | 2,733 | 3,874 | 5,061 | 6,218 | 6,902 |
| | | | | 0.2% | 0.9% | 1.1% | 1.1% | 1.2% | 1.3% | 1.5% | 1.5% |
| 6817 | King St W | 6261 | 5391 | 419 | 2,472 | 5,168 | 7,518 | 9,940 | 12,672 | 15,312 | 17,576 |
| | | | | 1.3% | 2.4% | 2.9% | 2.9% | 3.0% | 3.3% | 3.6% | 3.8% |
| 6820 | Hwy 401 | 6262 | 3375 | 4,495 | 10,436 | 16,314 | 22,828 | 28,936 | 35,045 | 41,154 | 47,386 |
| | | | | 13.6% | 10.3% | 9.1% | 8.8% | 8.9% | 9.2% | 9.6% | 10.2% |

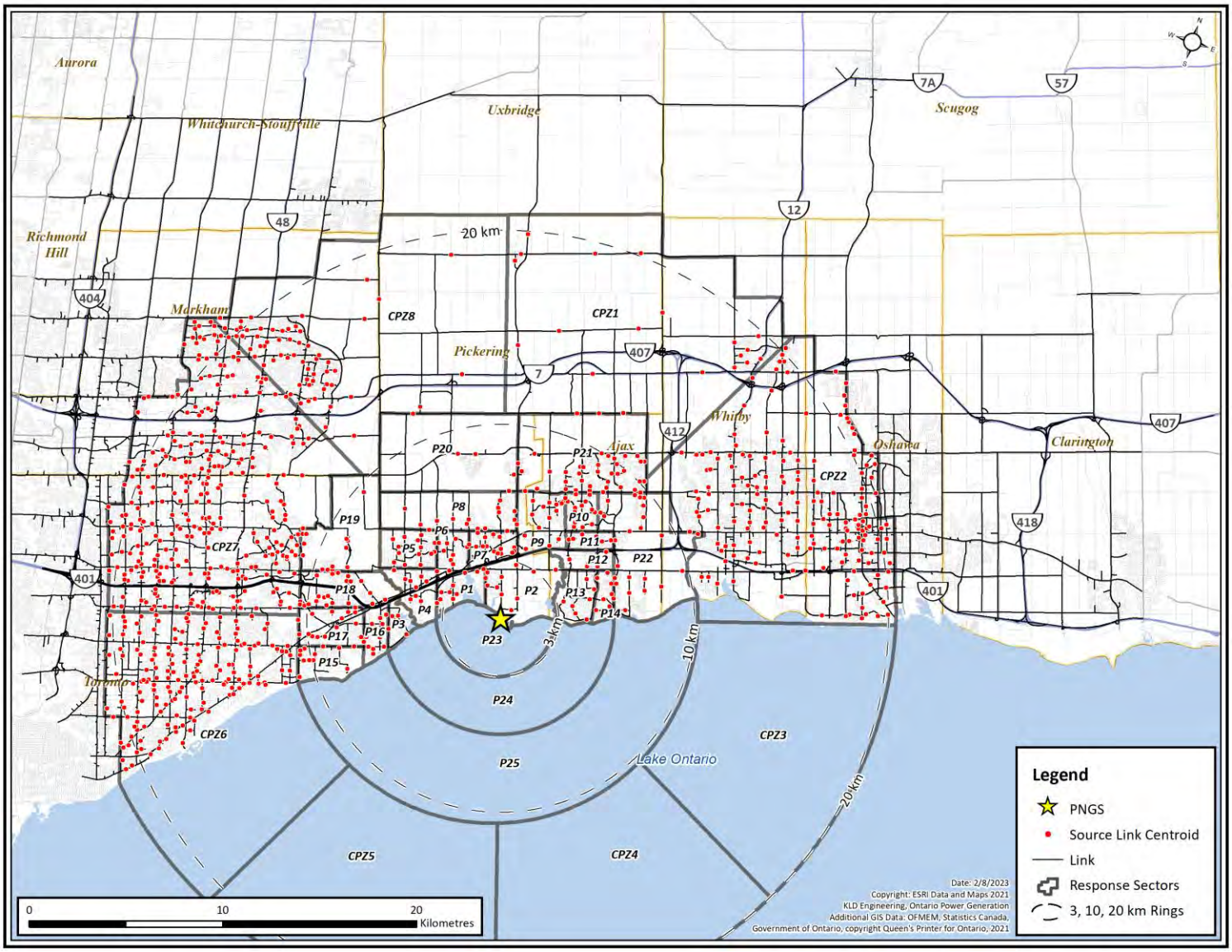


**Figure J-1. Network Sources/Origins**

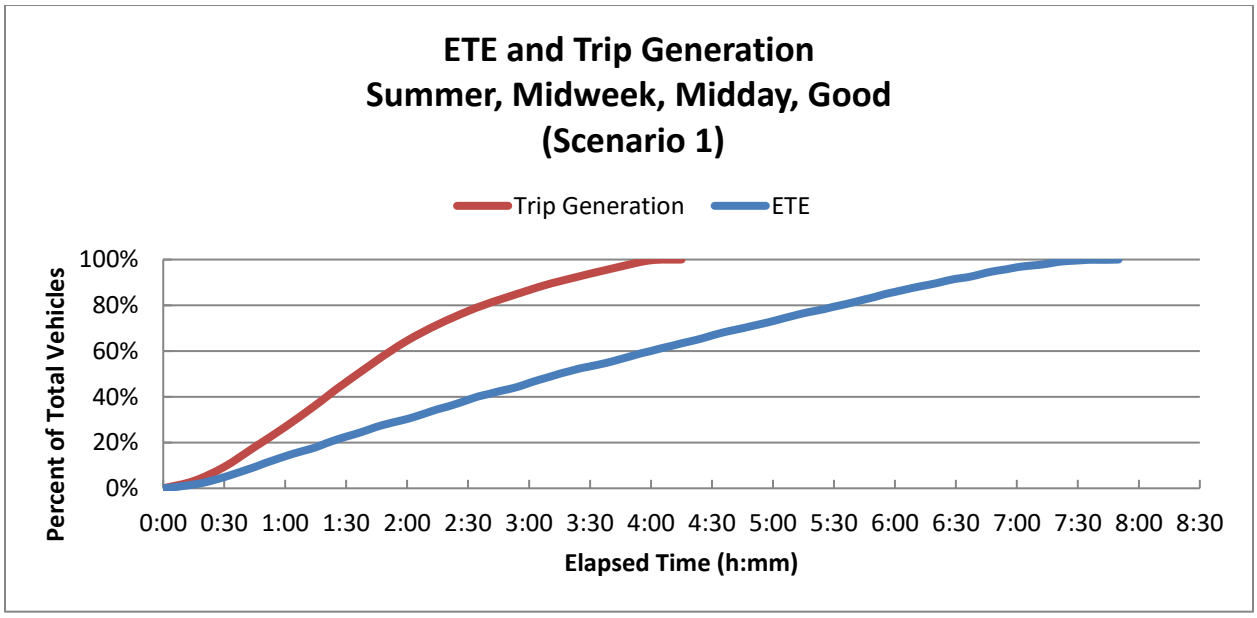


**Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)**

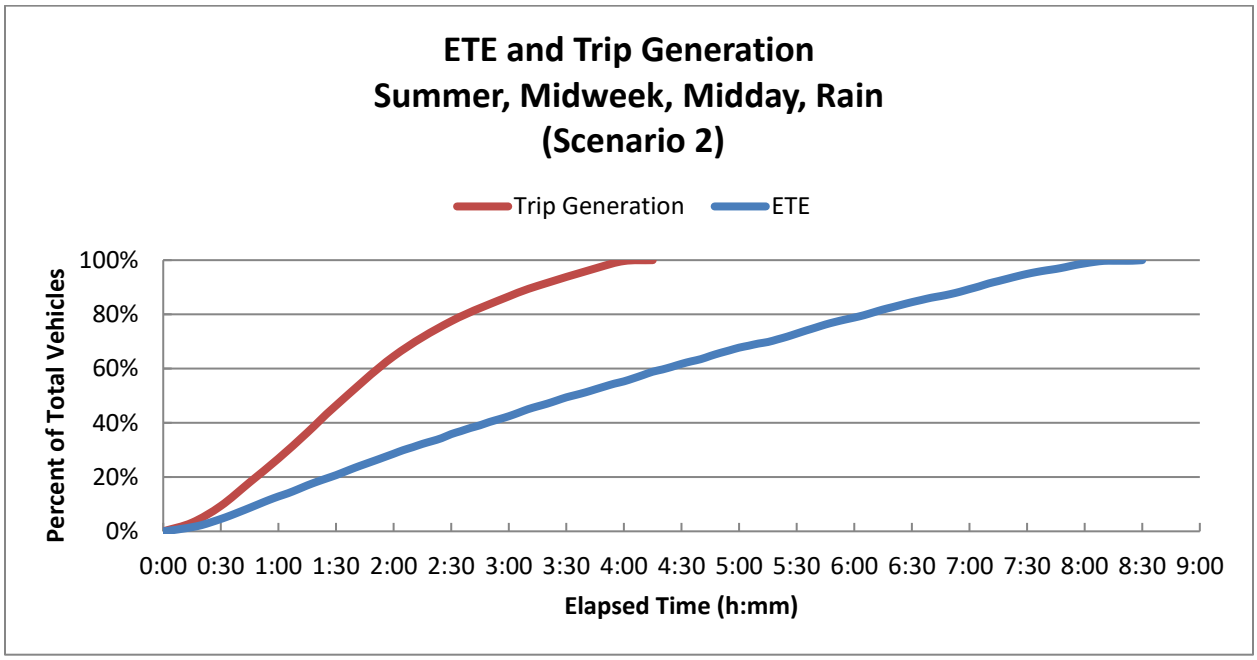


**Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)**

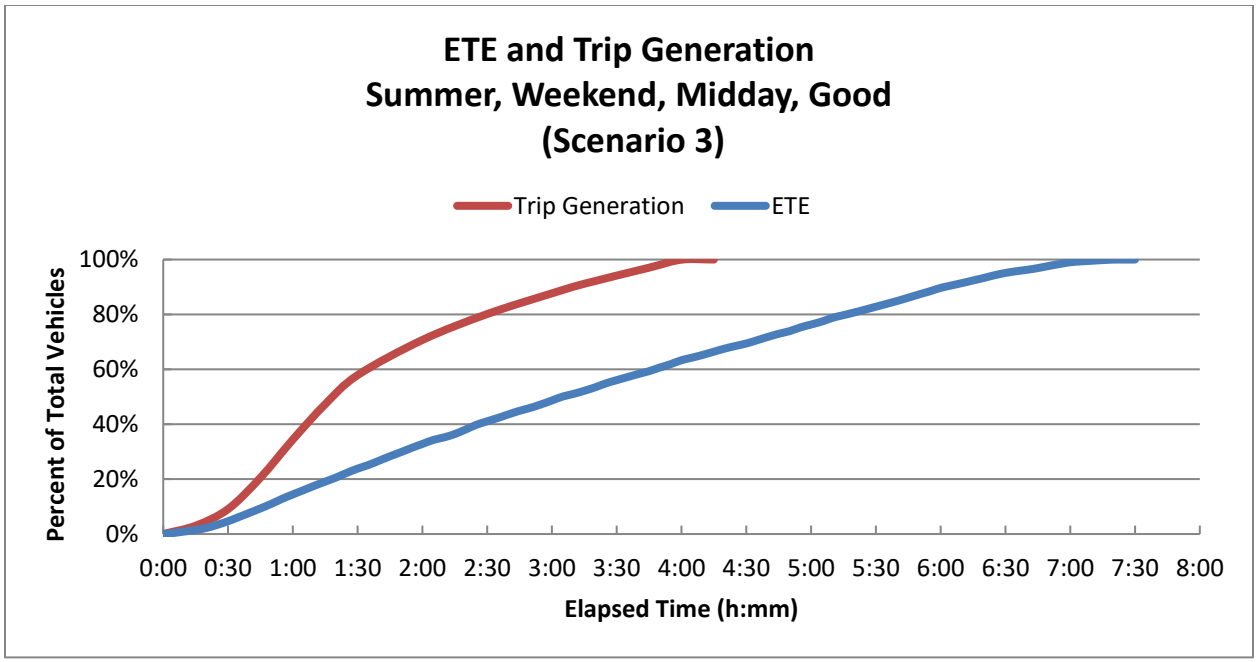


**Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)**

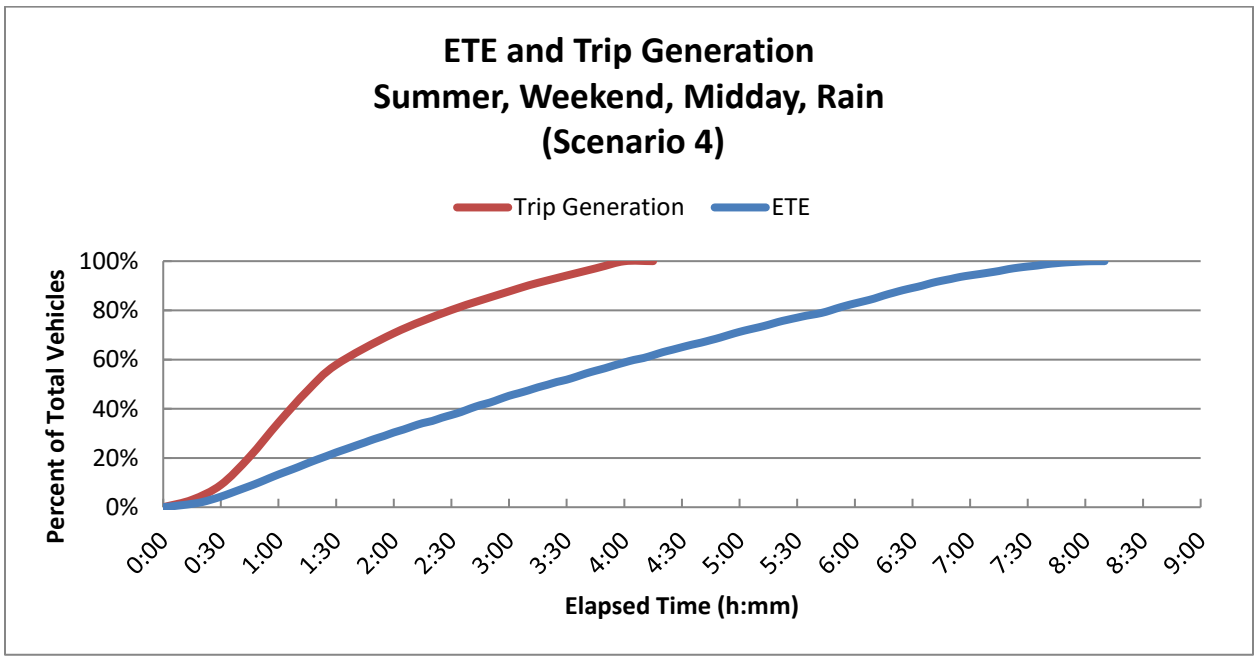


**Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)**

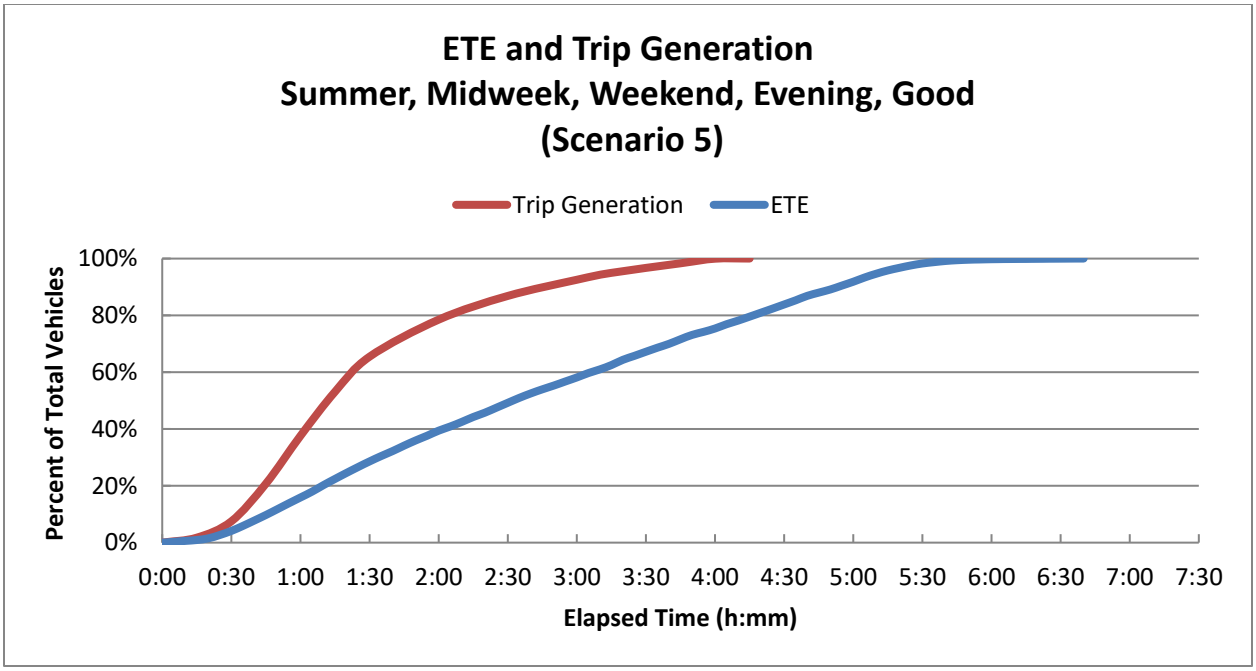


**Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)**

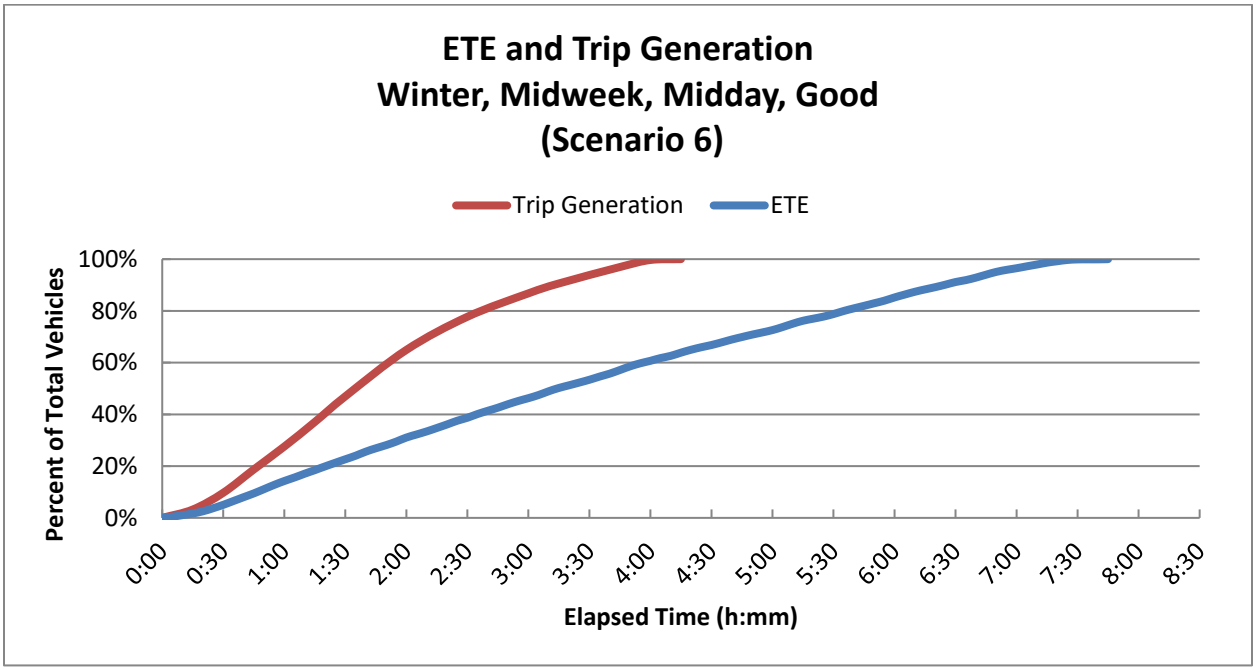


**Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)**

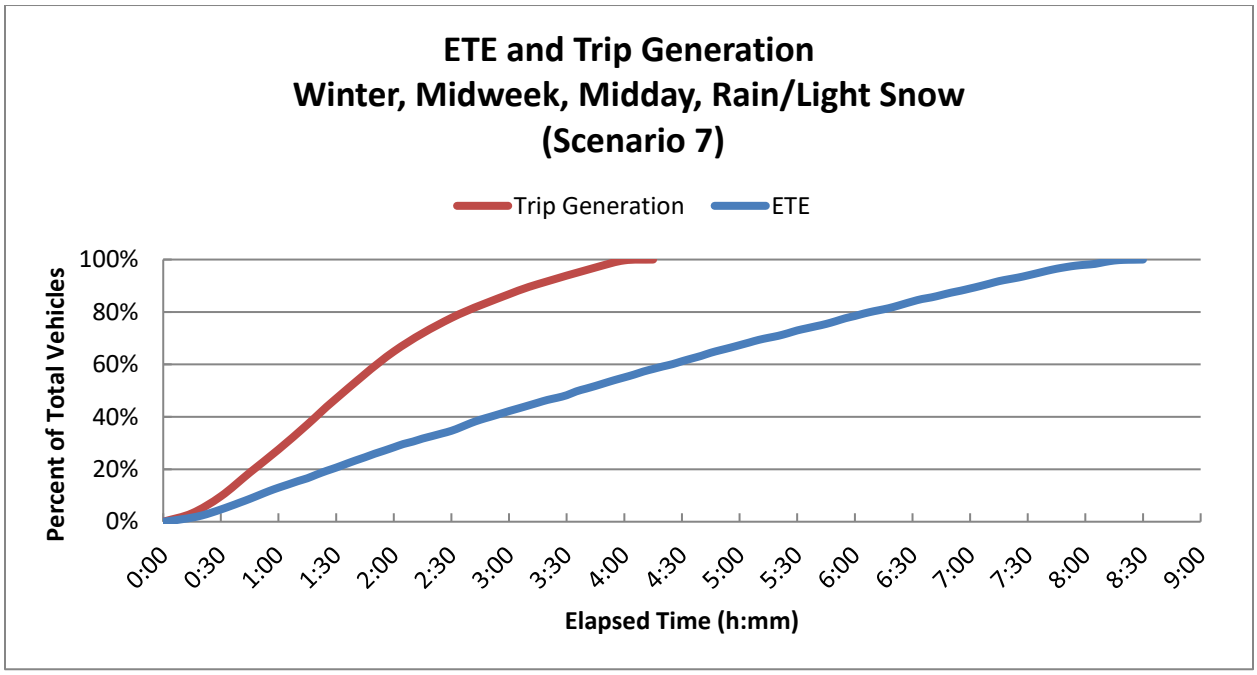


**Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain/Light Snow (Scenario 7)**

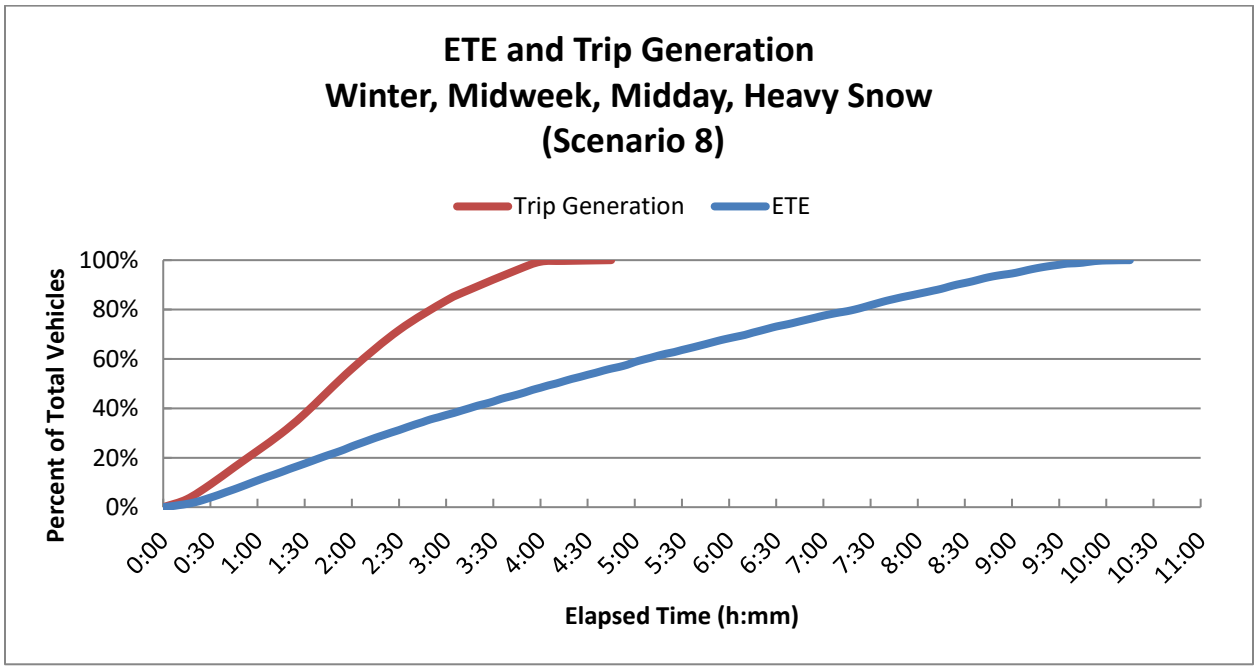


**Figure J-9. ETE and Trip Generation: Winter, Midweek, Midday, Heavy Snow (Scenario 8)**

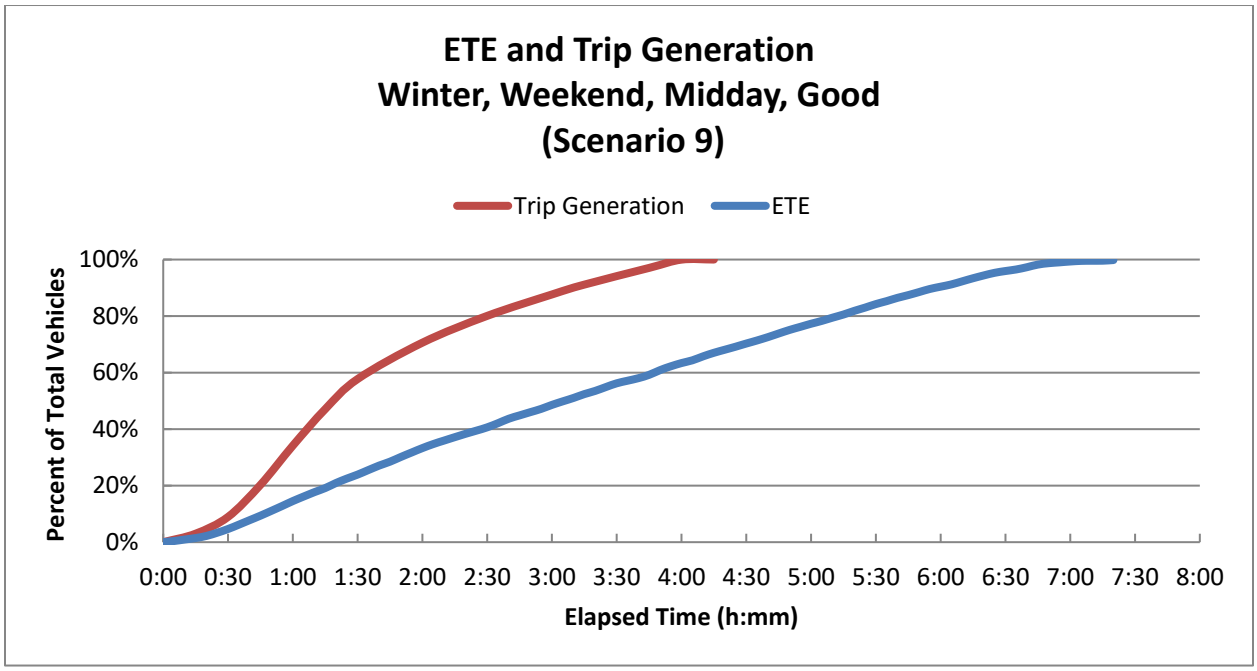


**Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)**

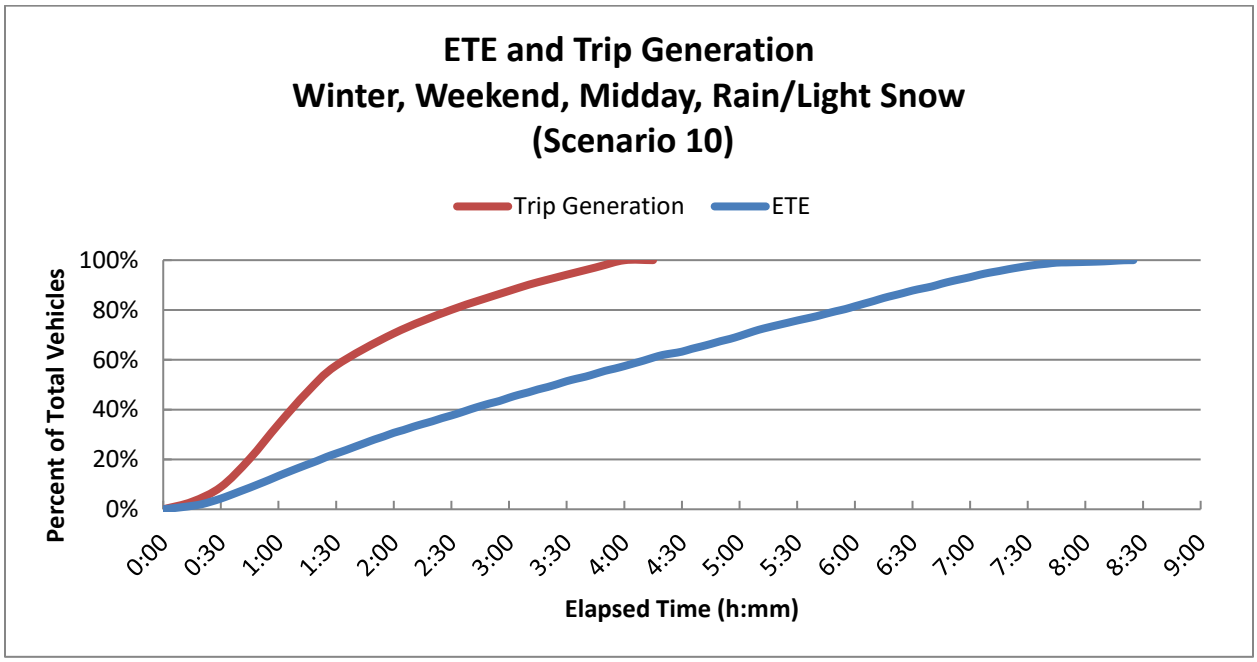


**Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Rain/Light Snow (Scenario 10)**

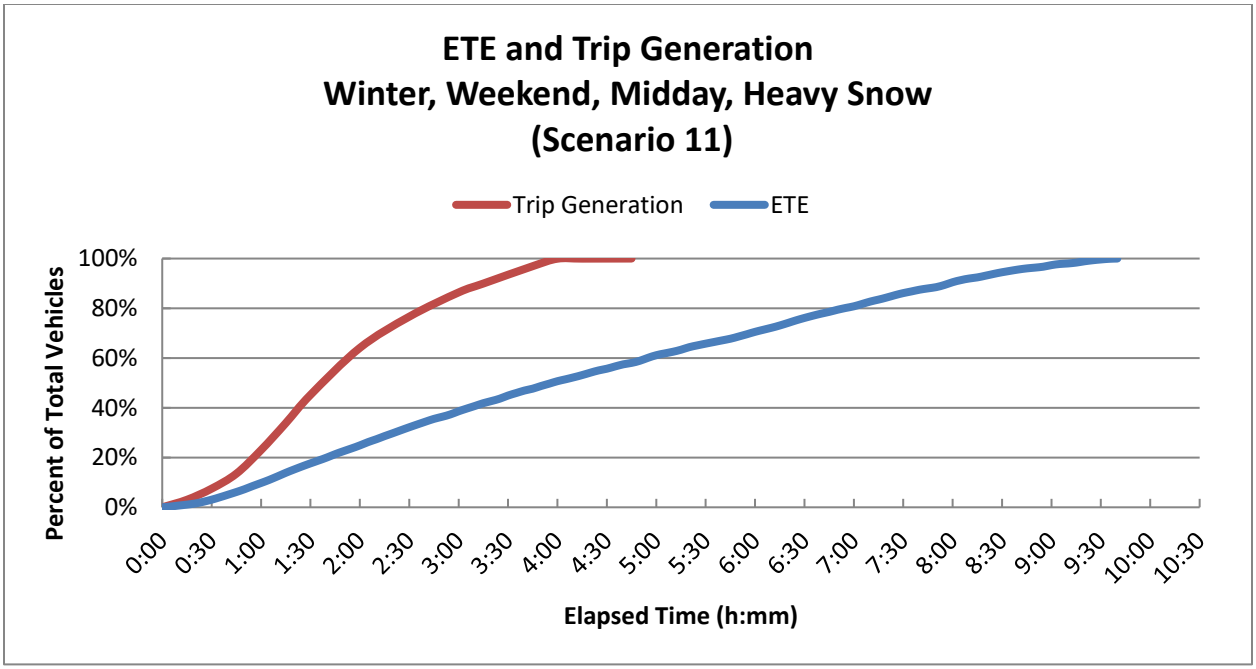


**Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Heavy Snow (Scenario 11)**

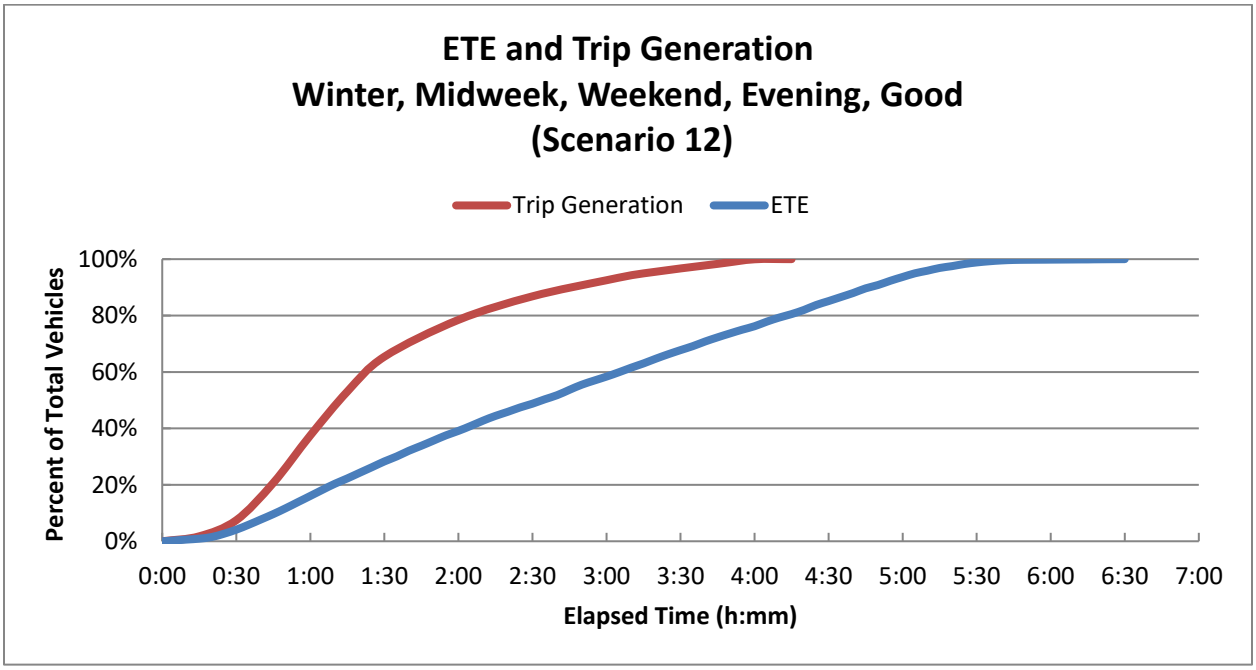


**Figure J-13. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)**

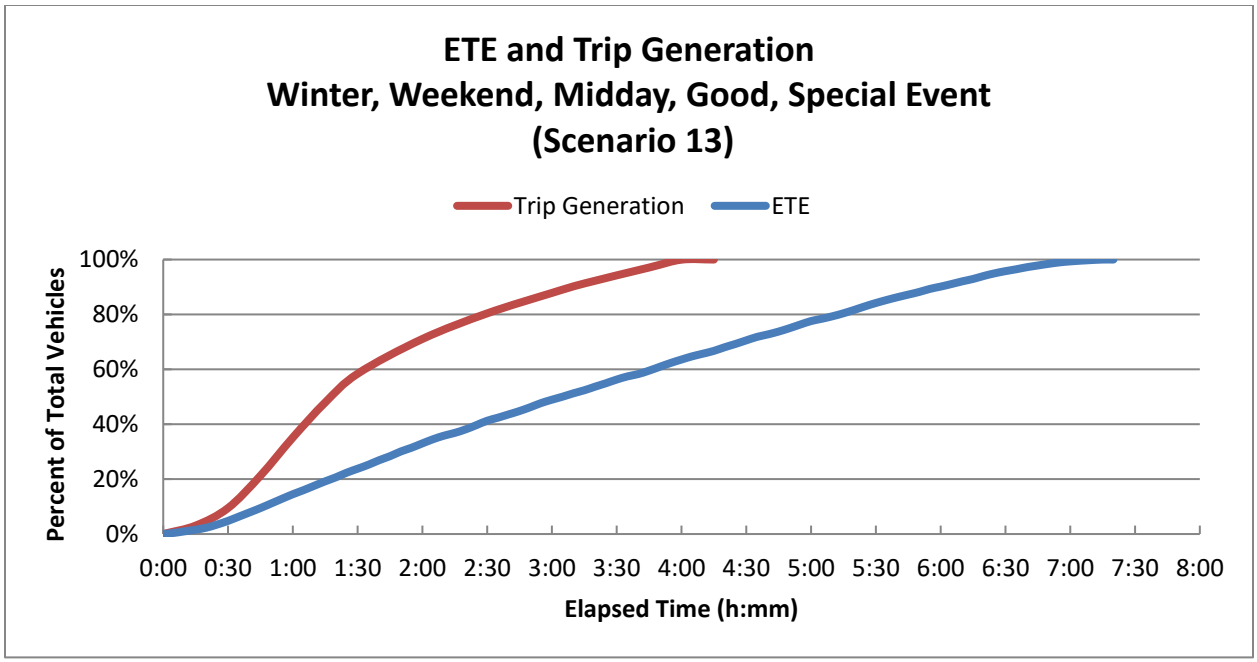


**Figure J-14. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather, Special Event (Scenario 13)**

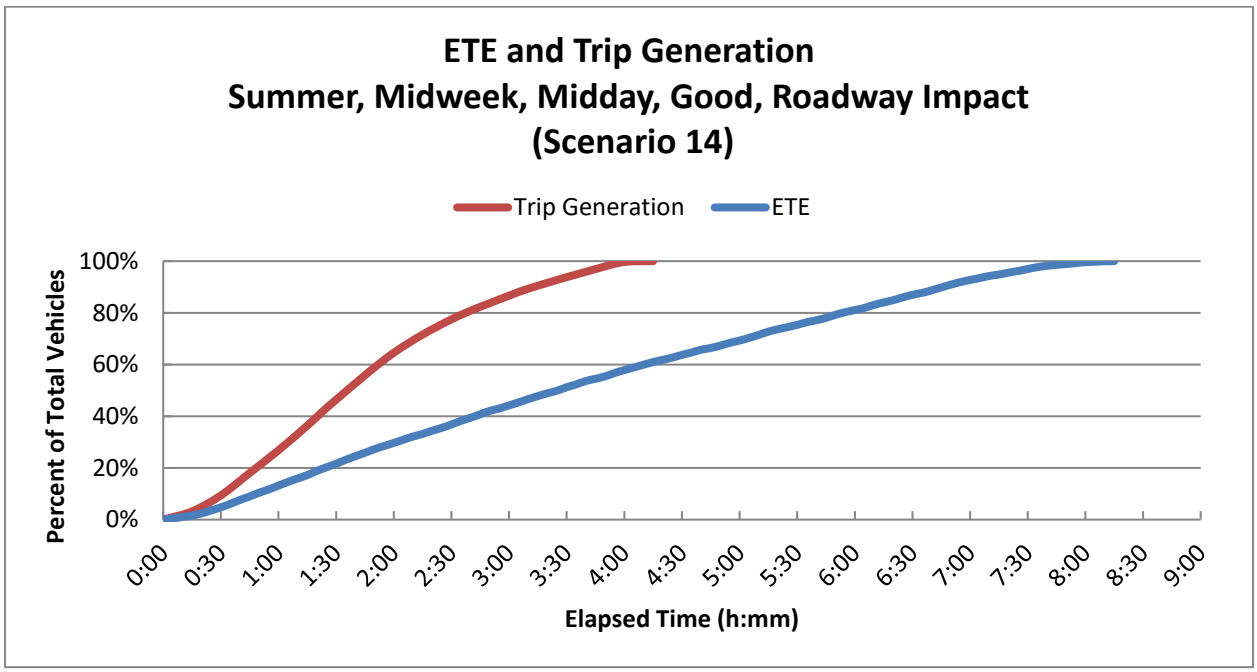


**Figure J-15. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)**

## APPENDIX K

Evacuation Roadway Network

## K. EVACUATION ROADWAY NETWORK

As discussed in Section 1.3, a link-node analysis network was constructed to model the roadway network within the study area. Figure K-1 provides an overview of the link-node analysis network. The figure has been divided up into 128 more detailed figures (Figure K-2 through Figure K-129) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field surveys conducted in April 2022.

Table K-1 summarizes the number of nodes by the type of control (stop sign, yield sign, pre-timed signal, actuated signal , or uncontrolled).

**Table K-1. Summary of Nodes by the Type of Control**

| Control Type | Number of Nodes |
|---|---|
| Uncontrolled | 3,256 |
| Pretimed | 3 |
| Actuated | 1,347 |
| Stop | 379 |
| Yield | 50 |
| **Total:** | **5,035** |

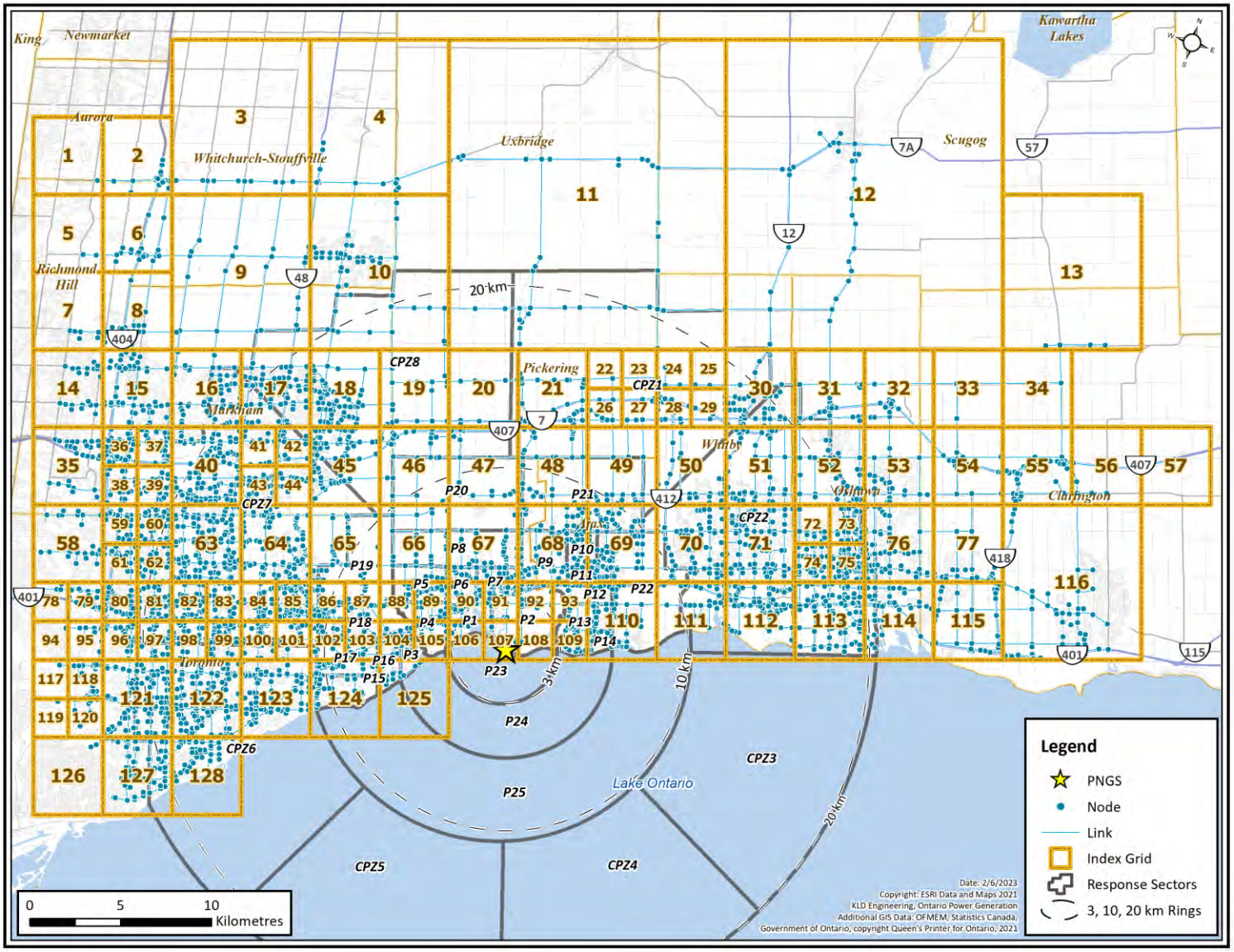


**Figure K-1. PNGS Link-Node Analysis Network**

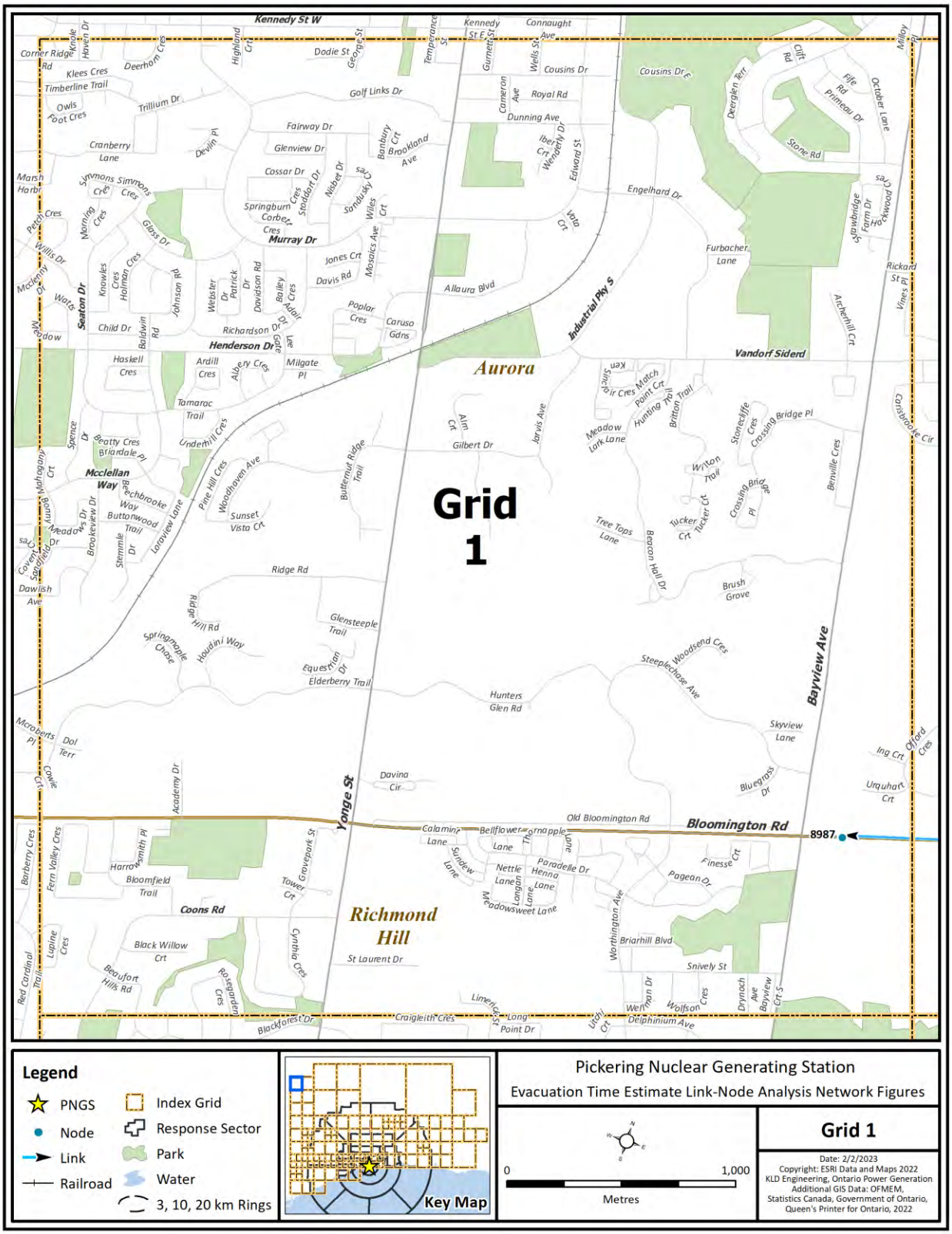


**Figure K-2. Link-Node Analysis Network – Grid 1**

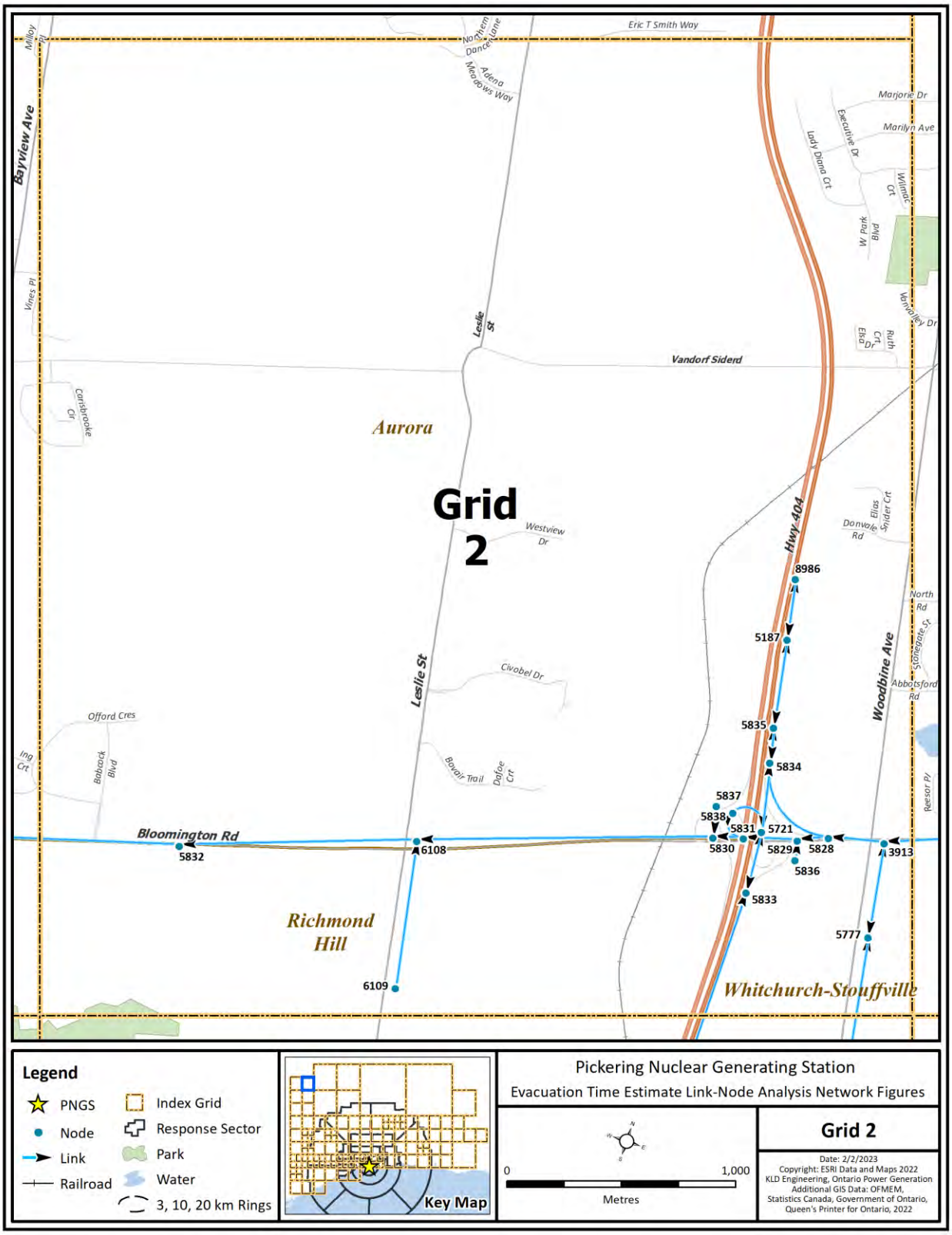


**Figure K-3. Link-Node Analysis Network – Grid 2**

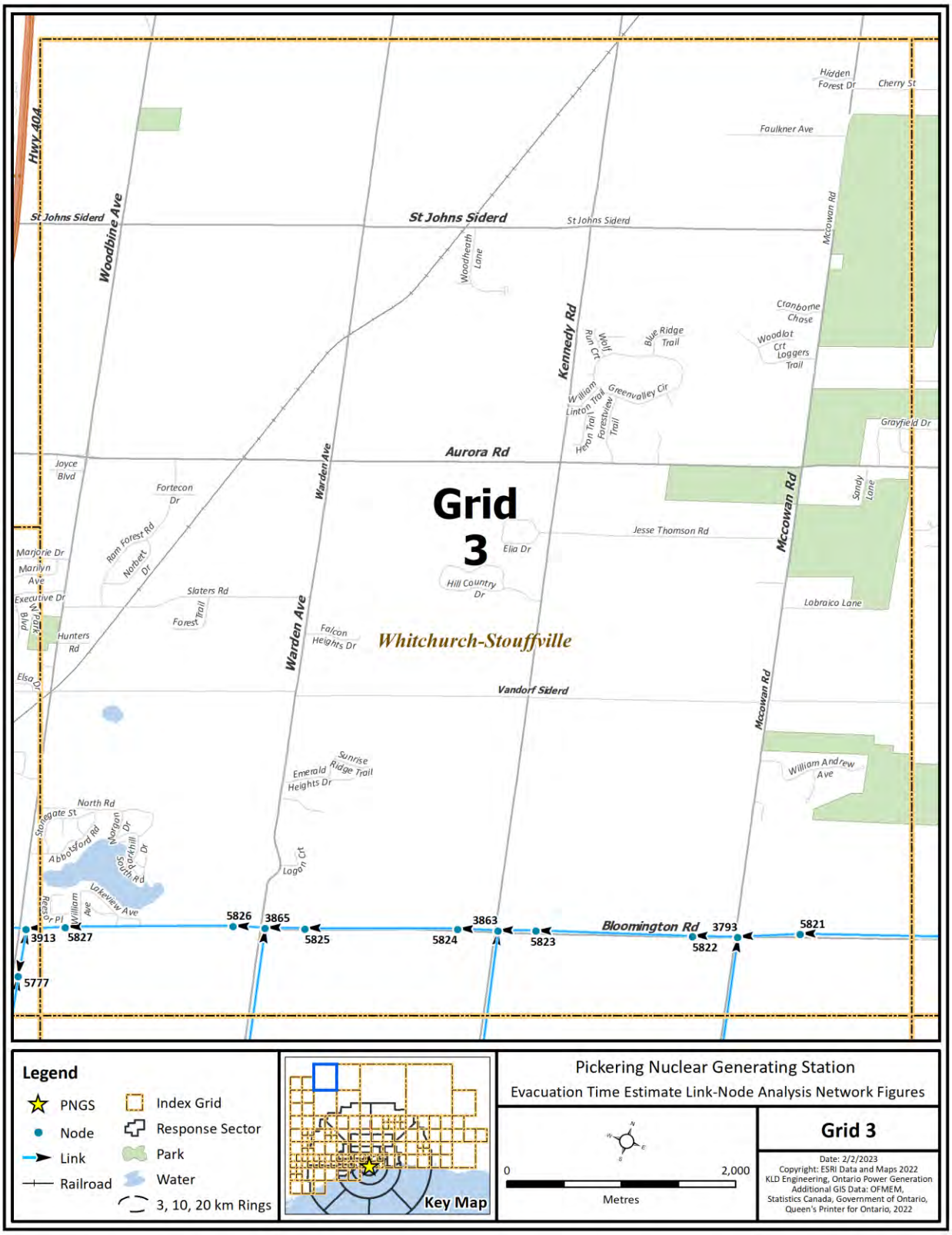


**Figure K-4. Link-Node Analysis Network – Grid 3**

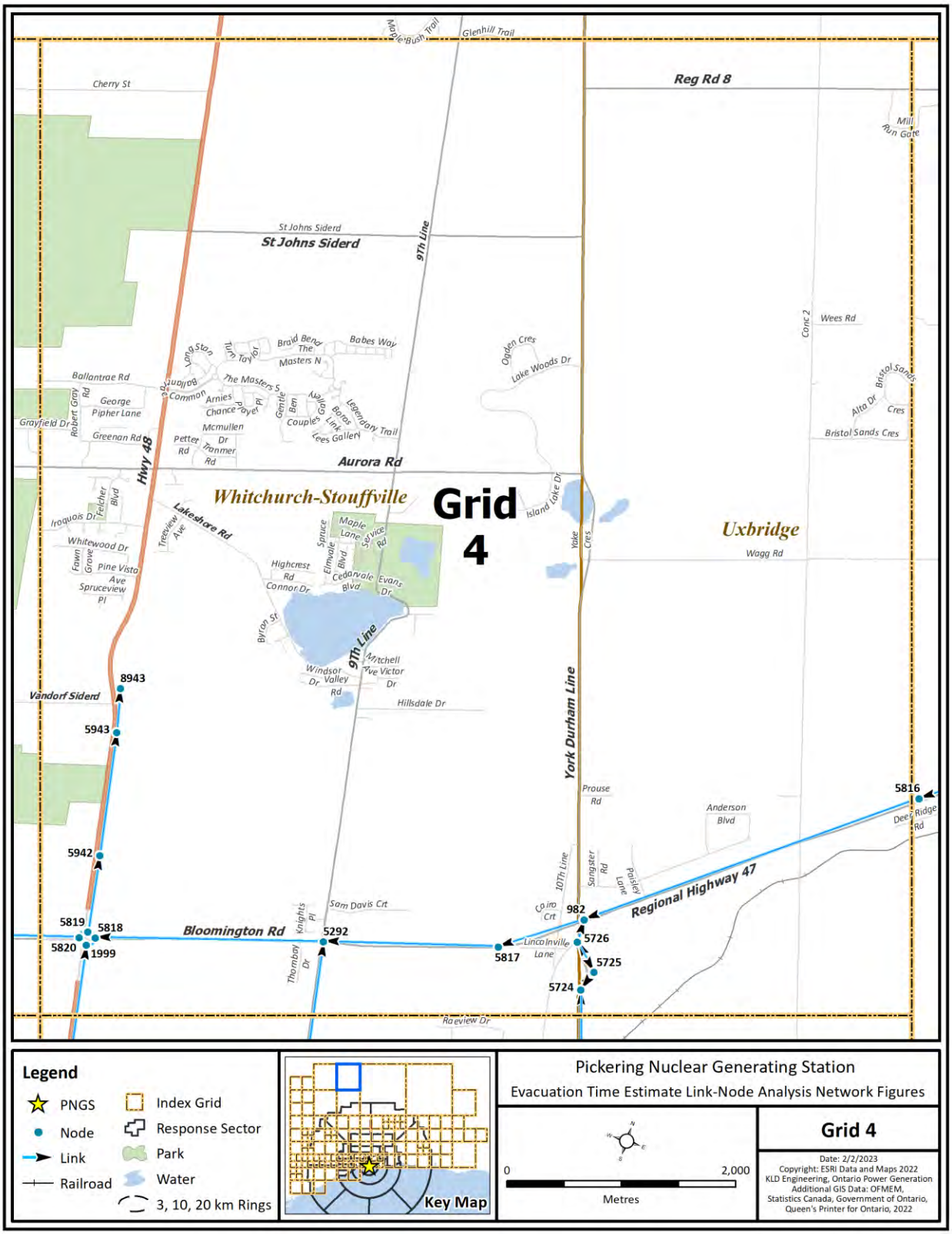


**Figure K-5. Link-Node Analysis Network – Grid 4**

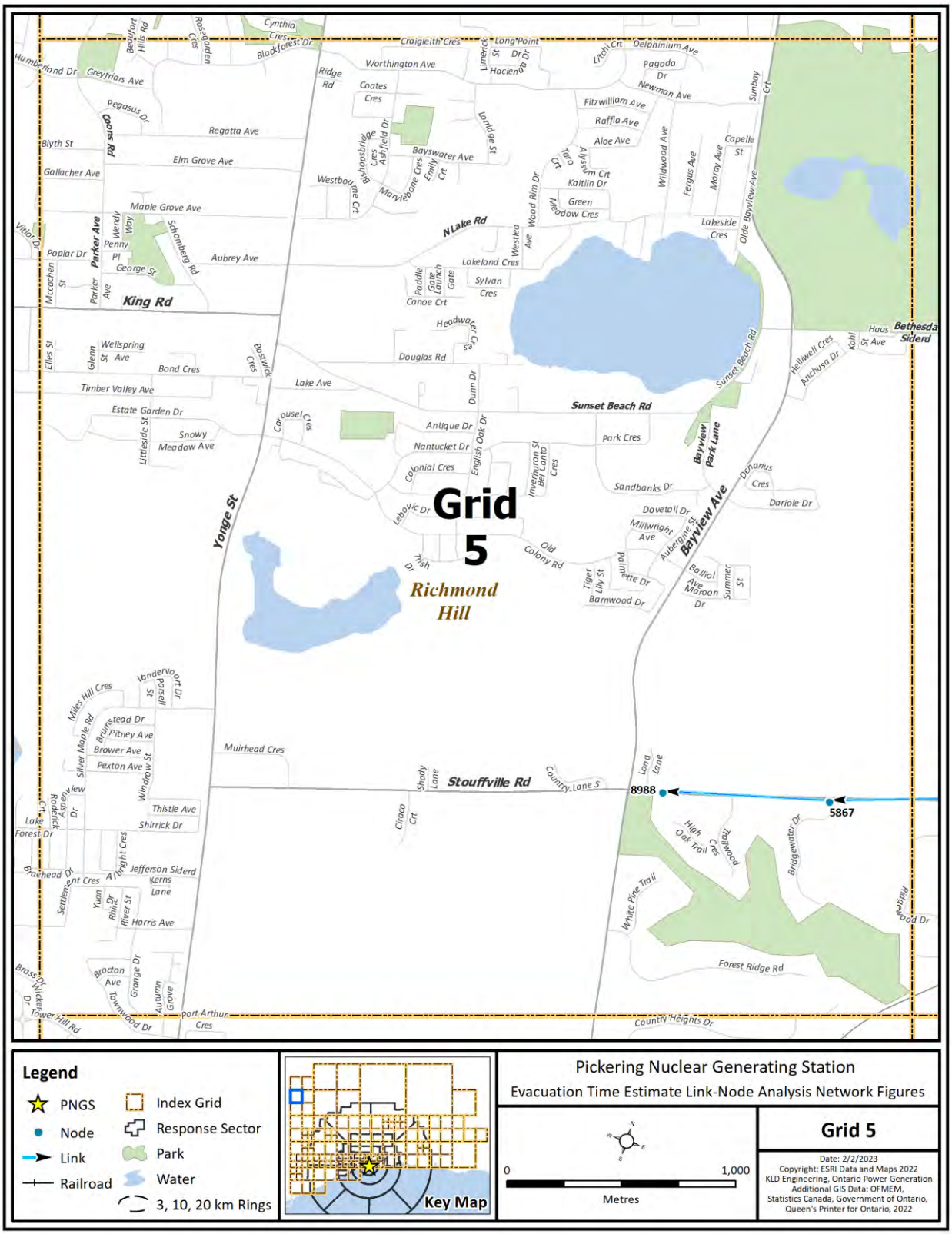


**Figure K-6. Link-Node Analysis Network – Grid 5**

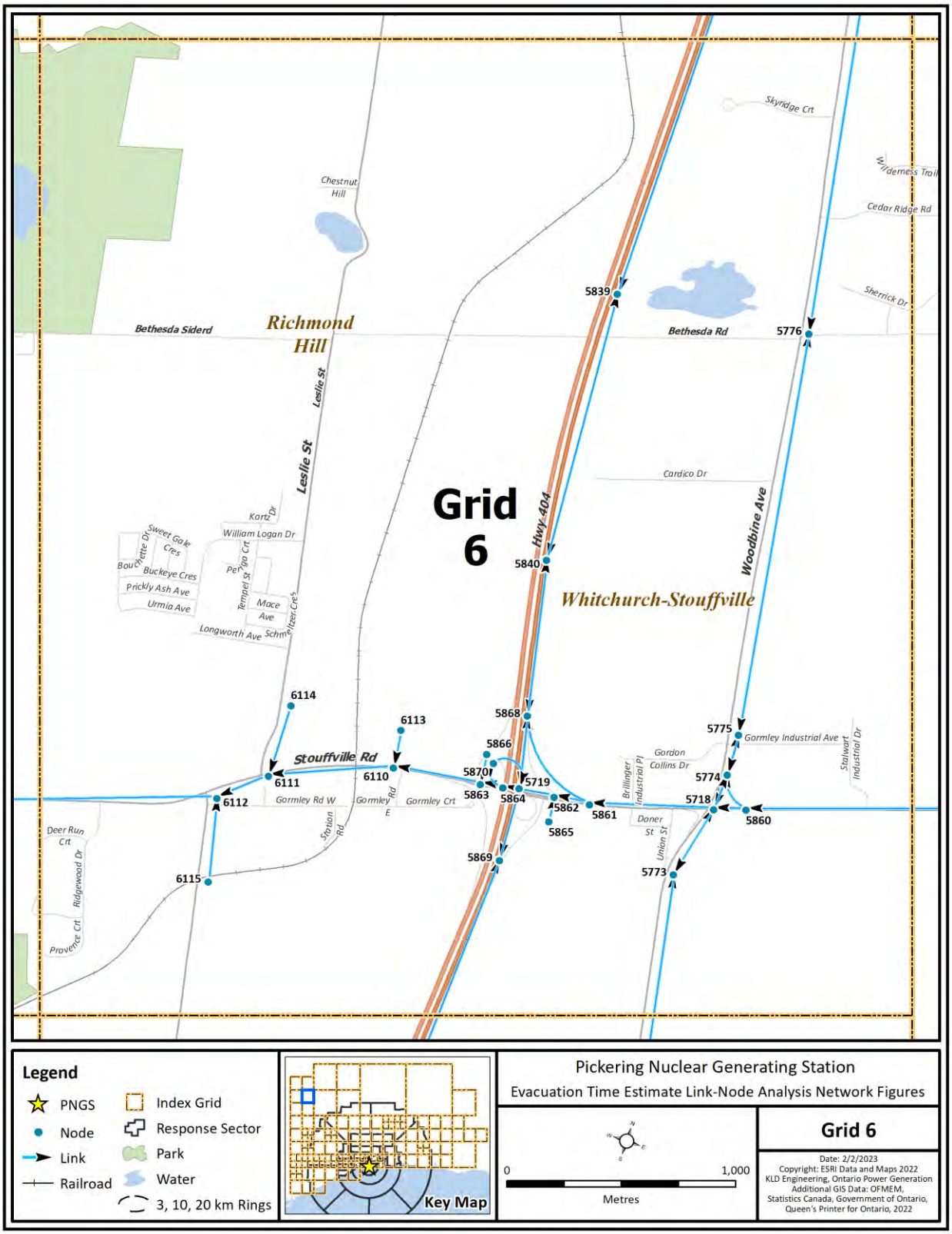


**Figure K-7. Link-Node Analysis Network – Grid 6**

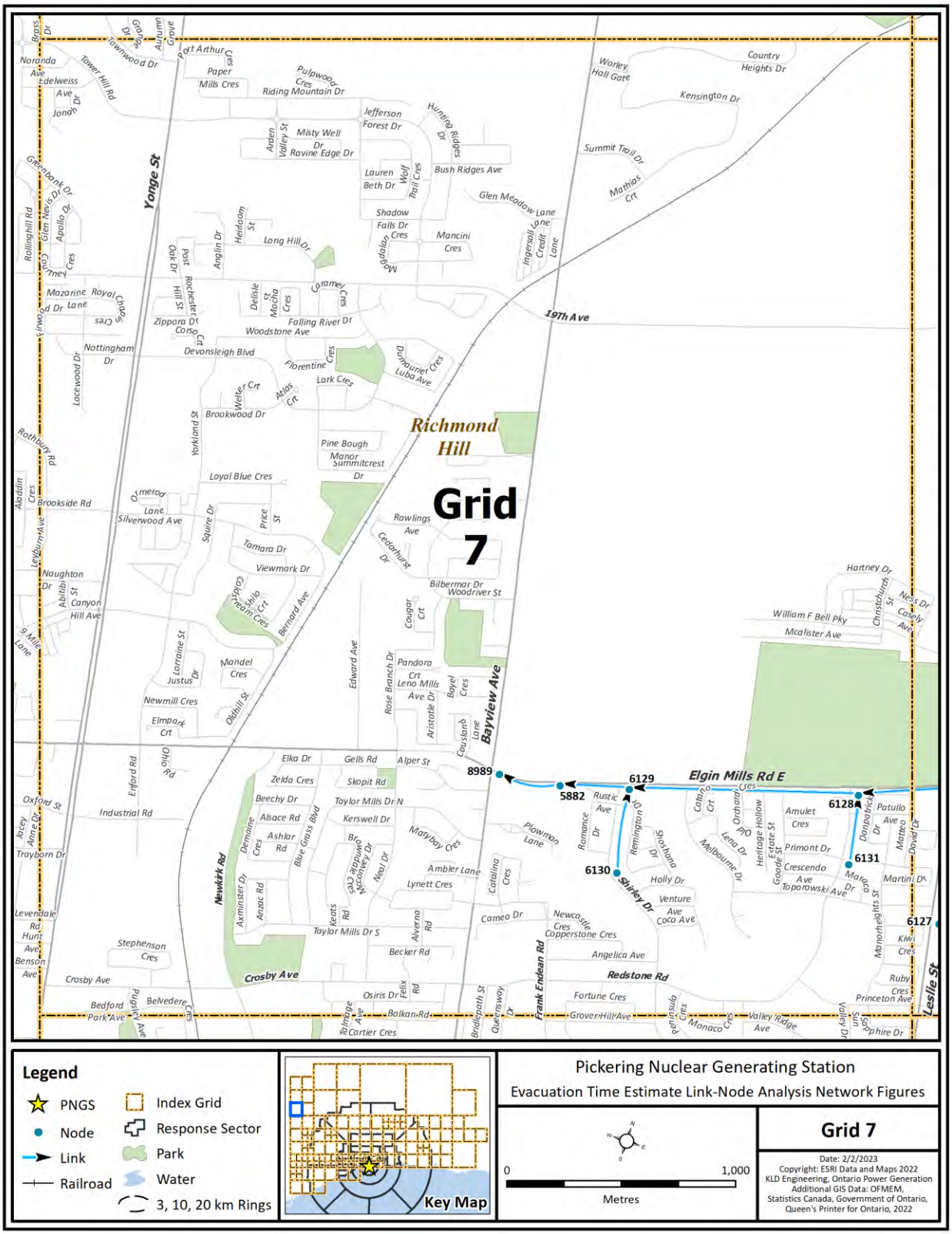


**Figure K-8. Link-Node Analysis Network – Grid 7**

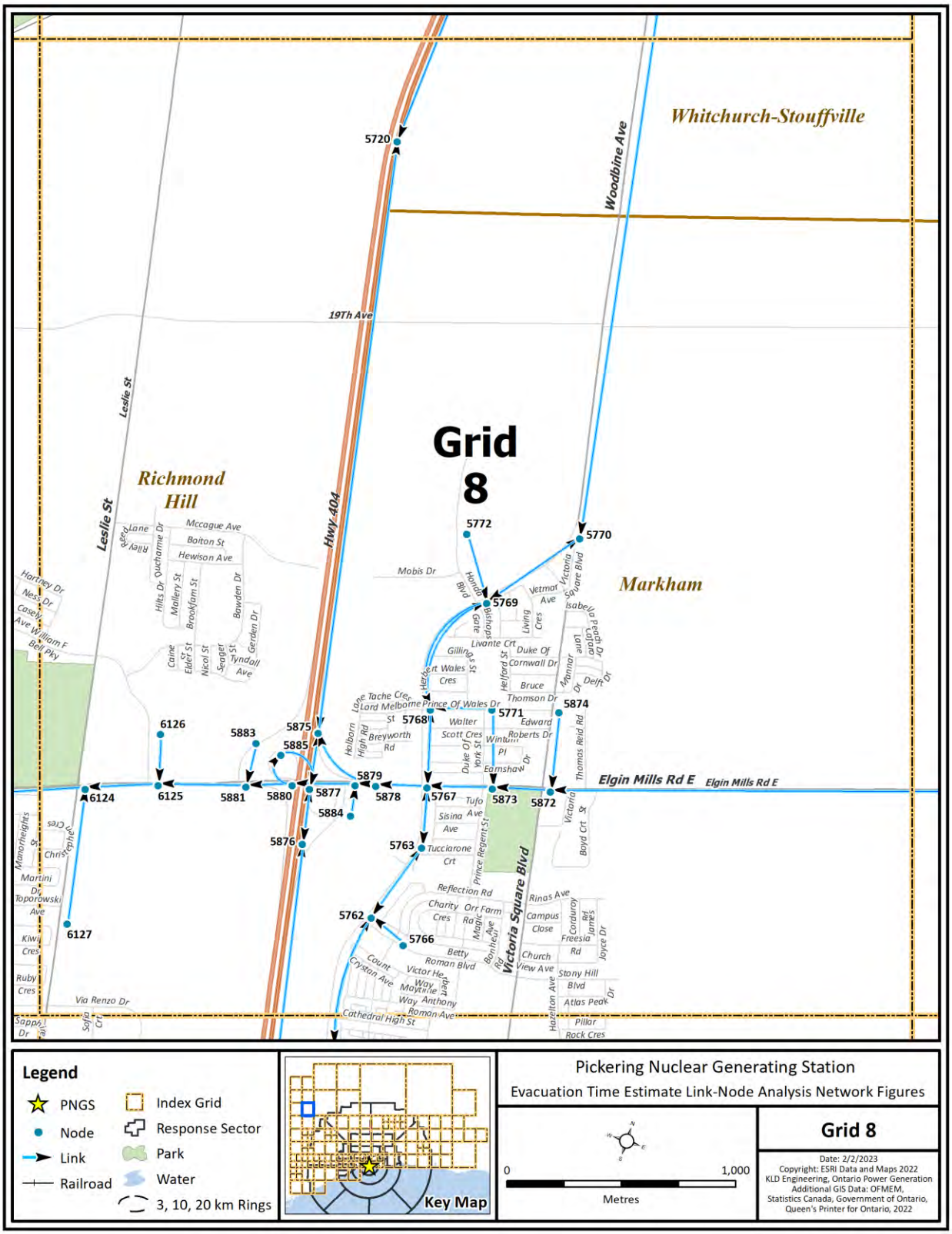


**Figure K-9. Link-Node Analysis Network – Grid 8**

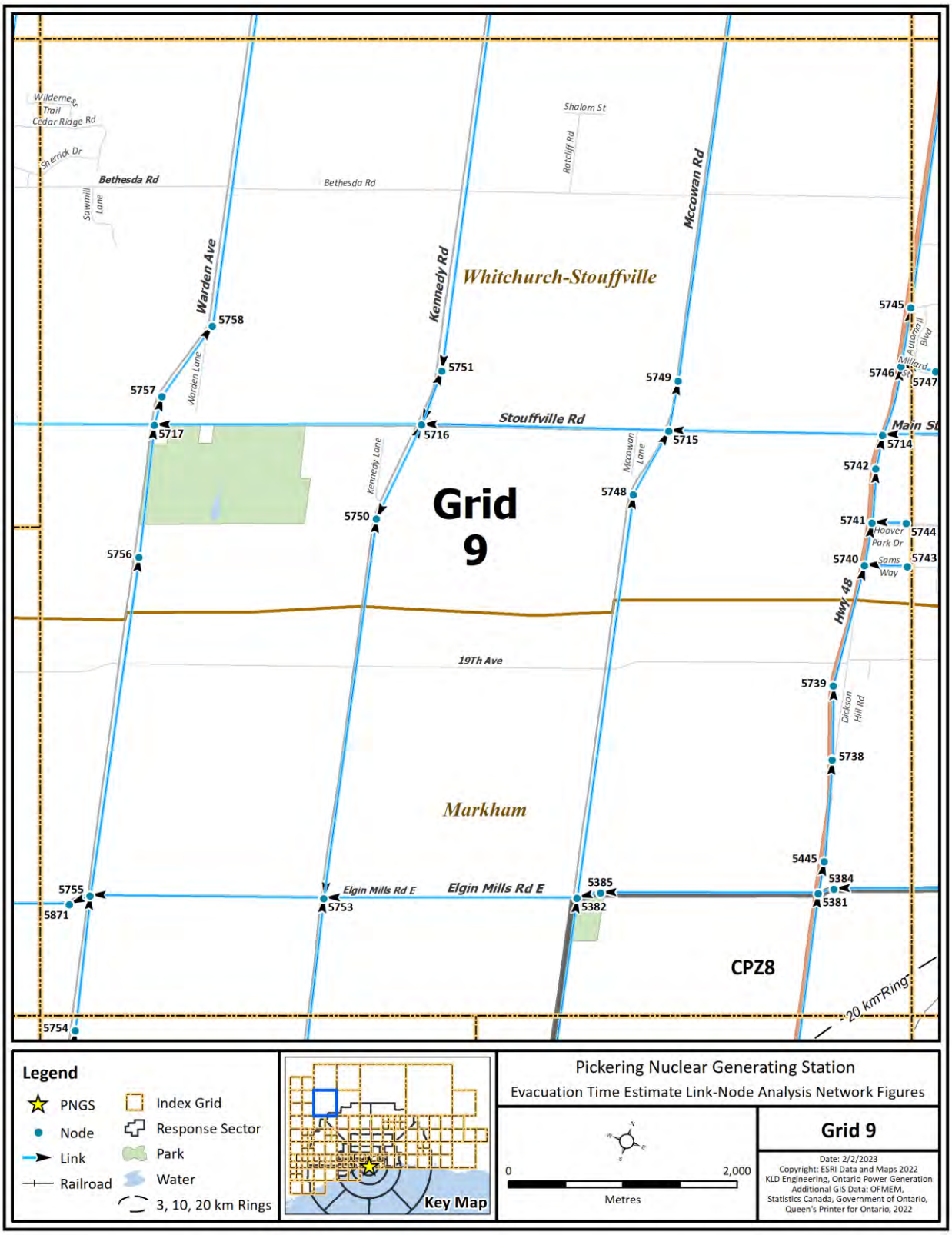


**Figure K-10. Link-Node Analysis Network – Grid 9**

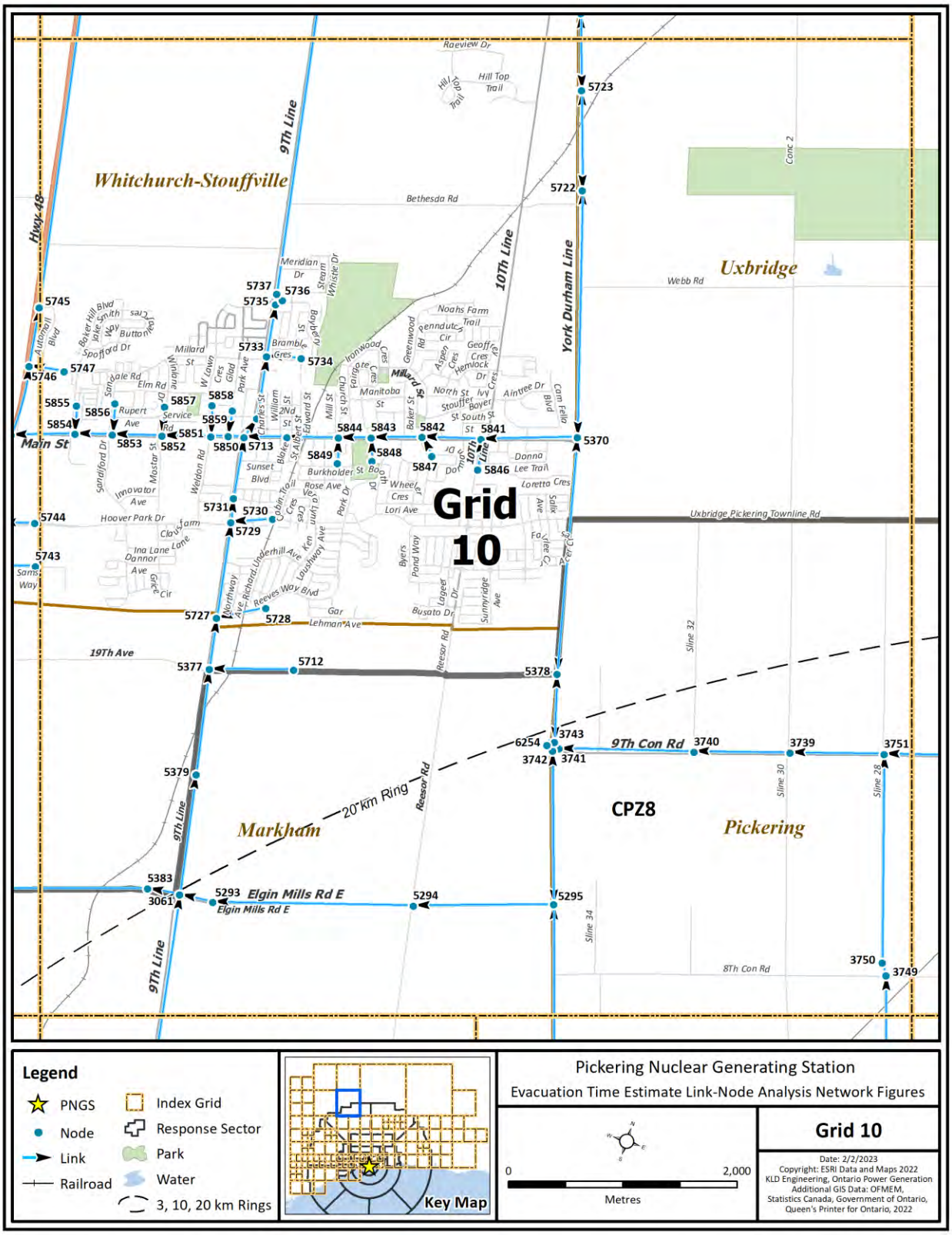


**Figure K-11. Link-Node Analysis Network – Grid 10**

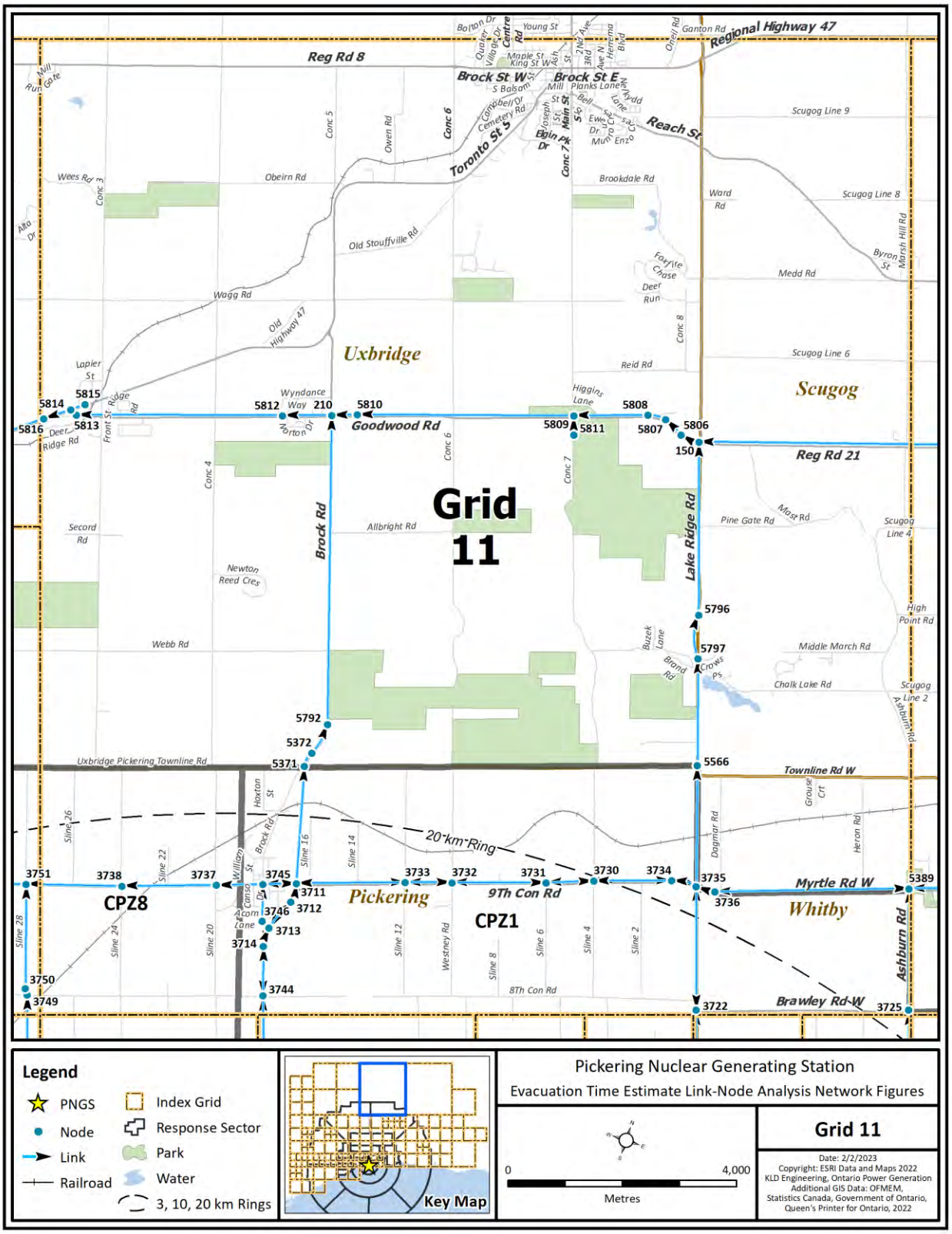


**Figure K-12. Link-Node Analysis Network – Grid 11**

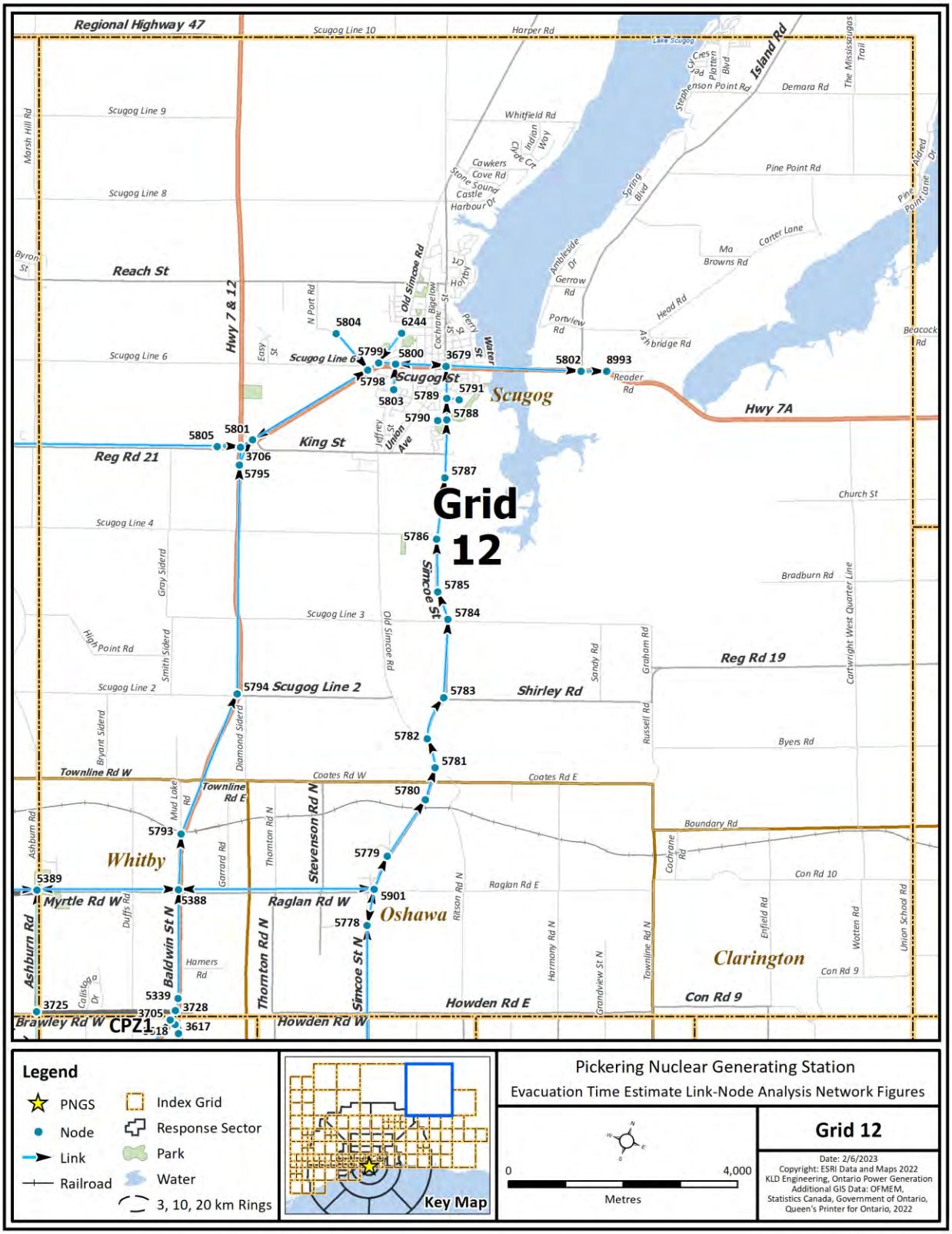


**Figure K-13. Link-Node Analysis Network – Grid 12**

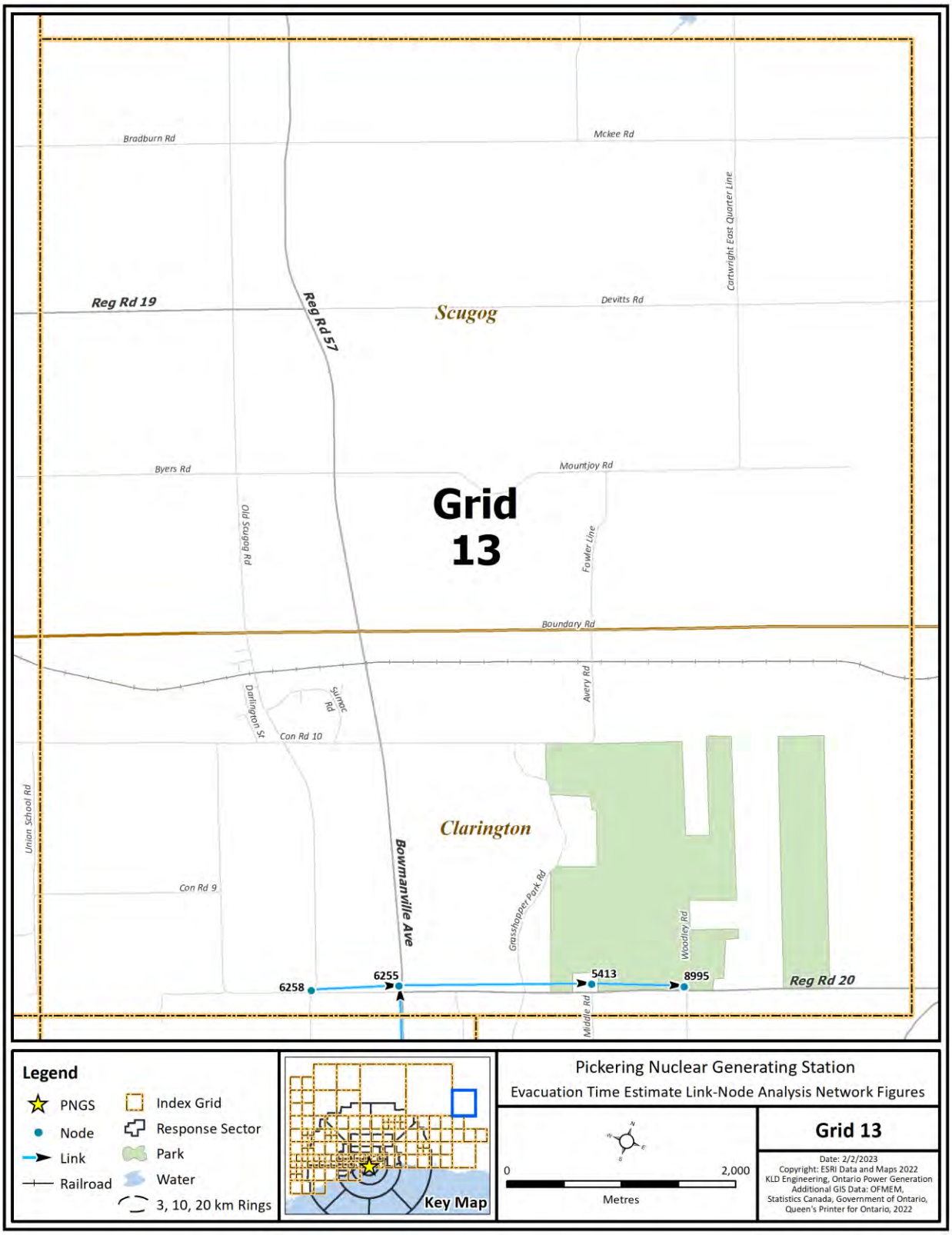


**Figure K-14. Link-Node Analysis Network – Grid 13**

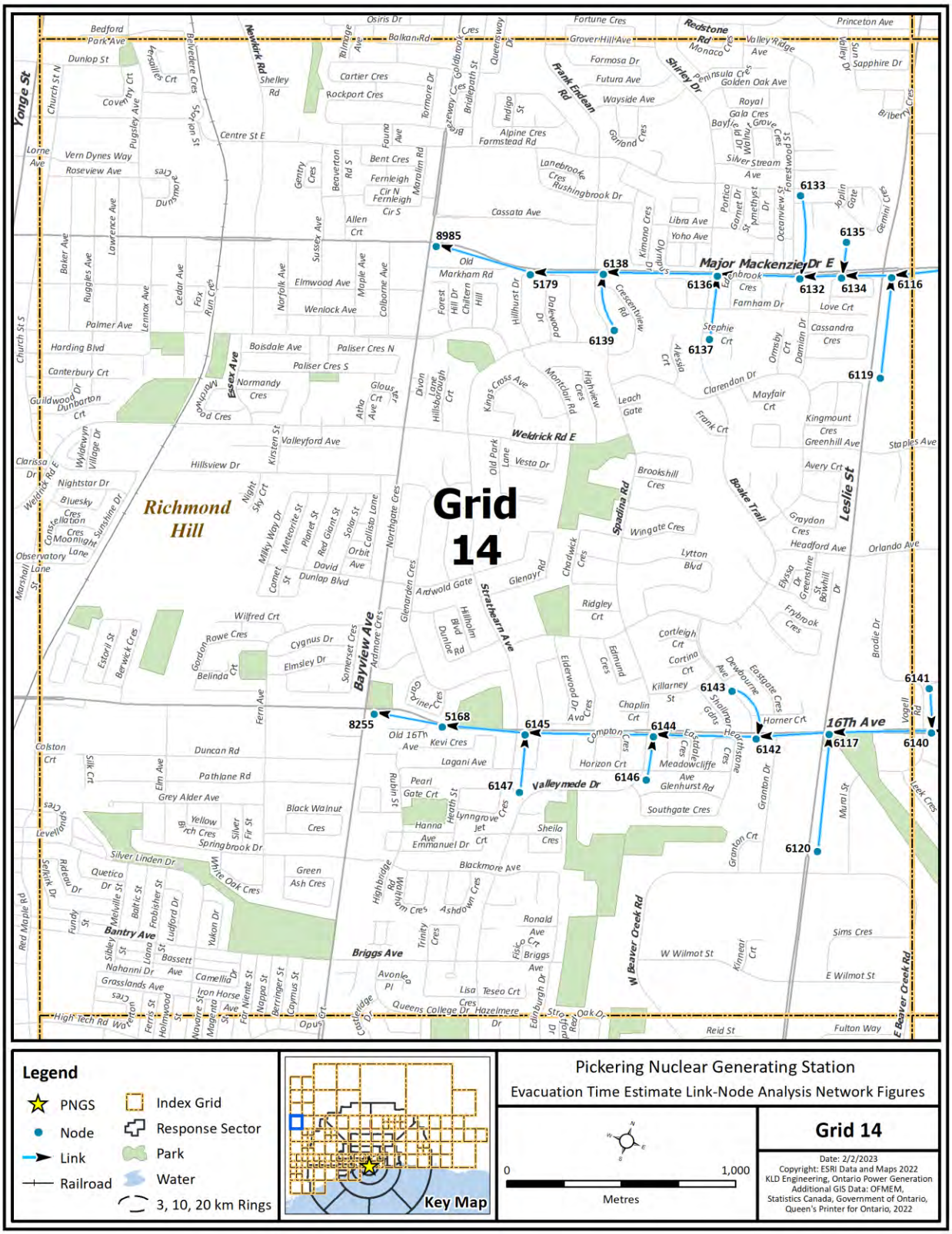


**Figure K-15. Link-Node Analysis Network – Grid 14**

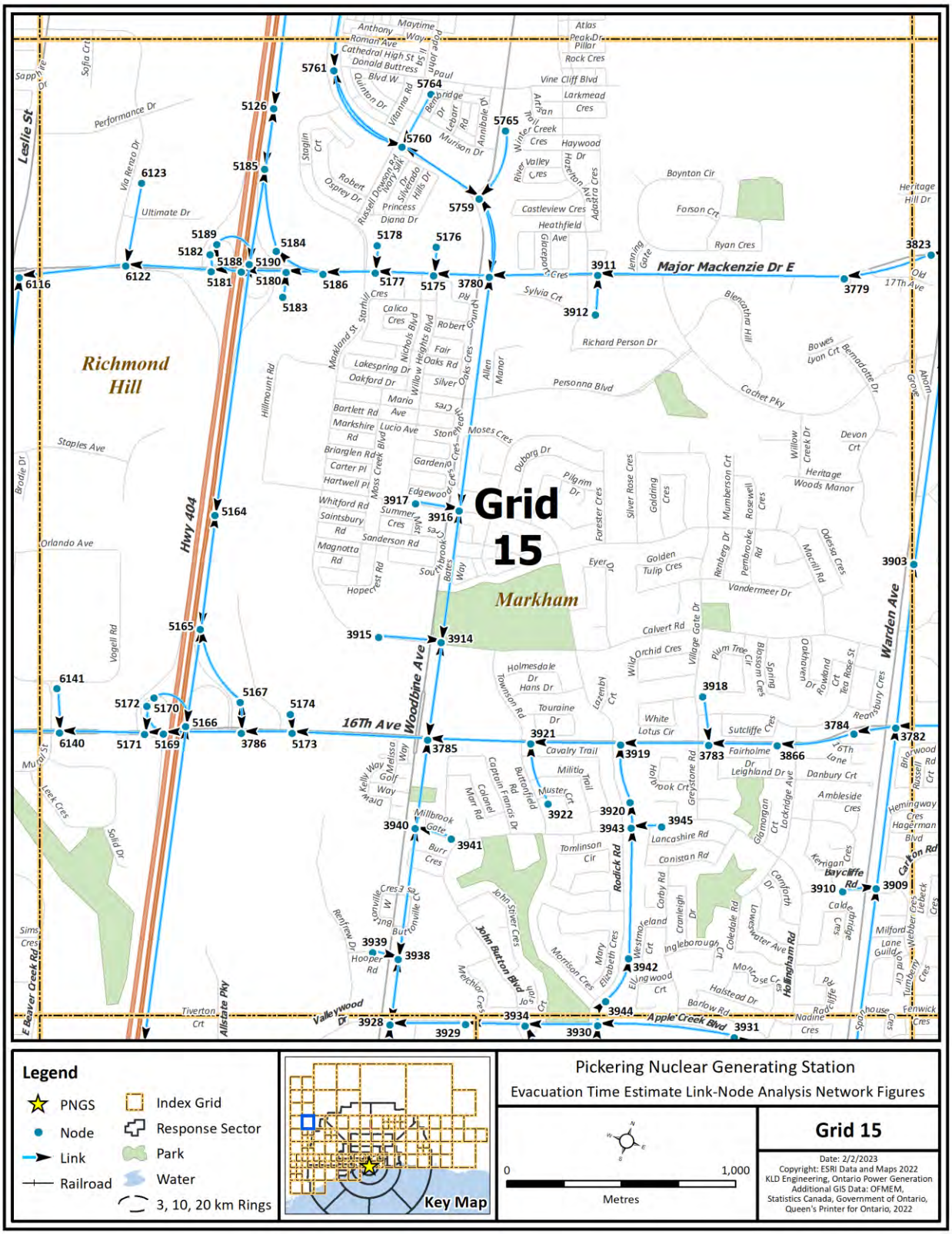


**Figure K-16. Link-Node Analysis Network – Grid 15**

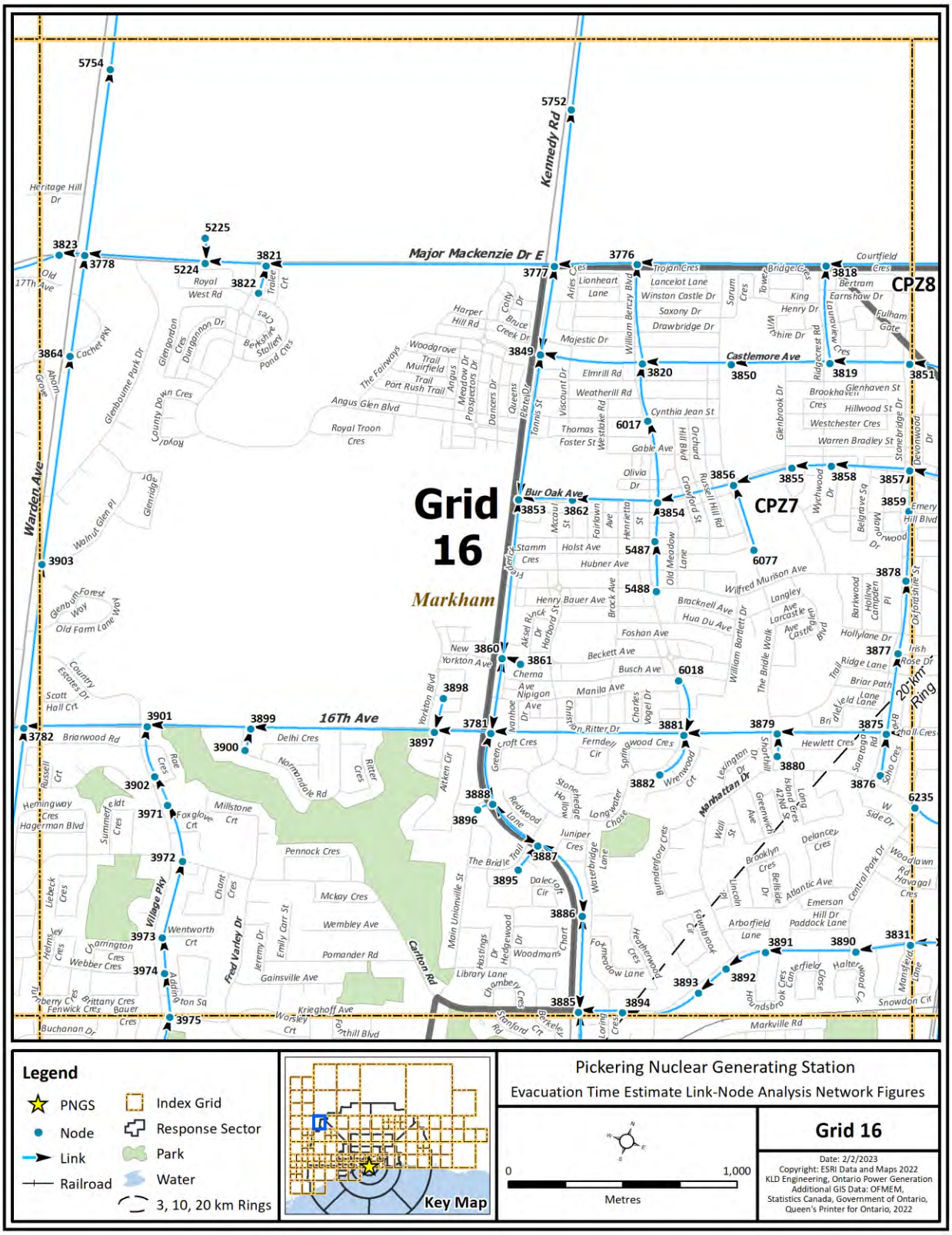


**Figure K-17. Link-Node Analysis Network – Grid 16**

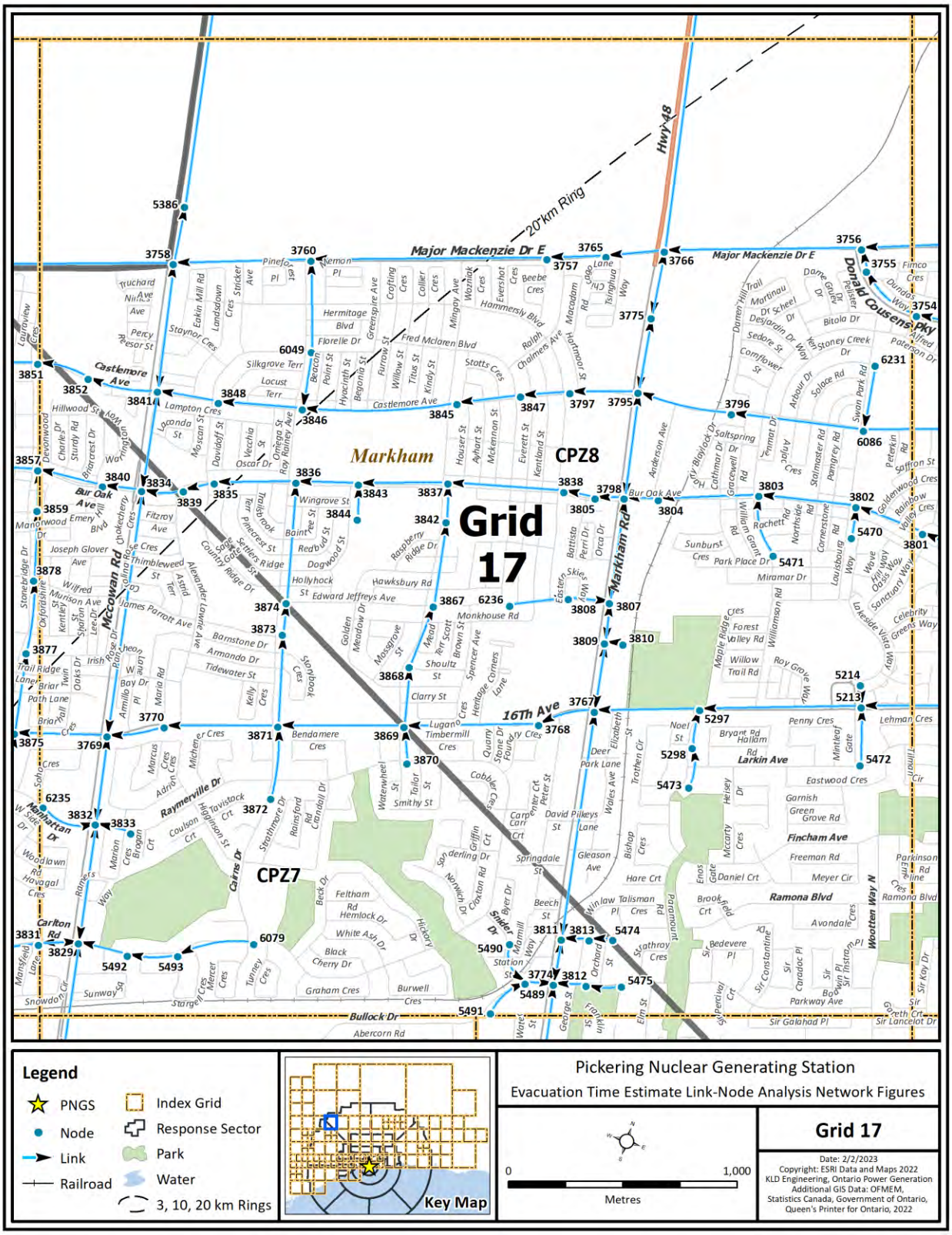


**Figure K-18. Link-Node Analysis Network – Grid 17**

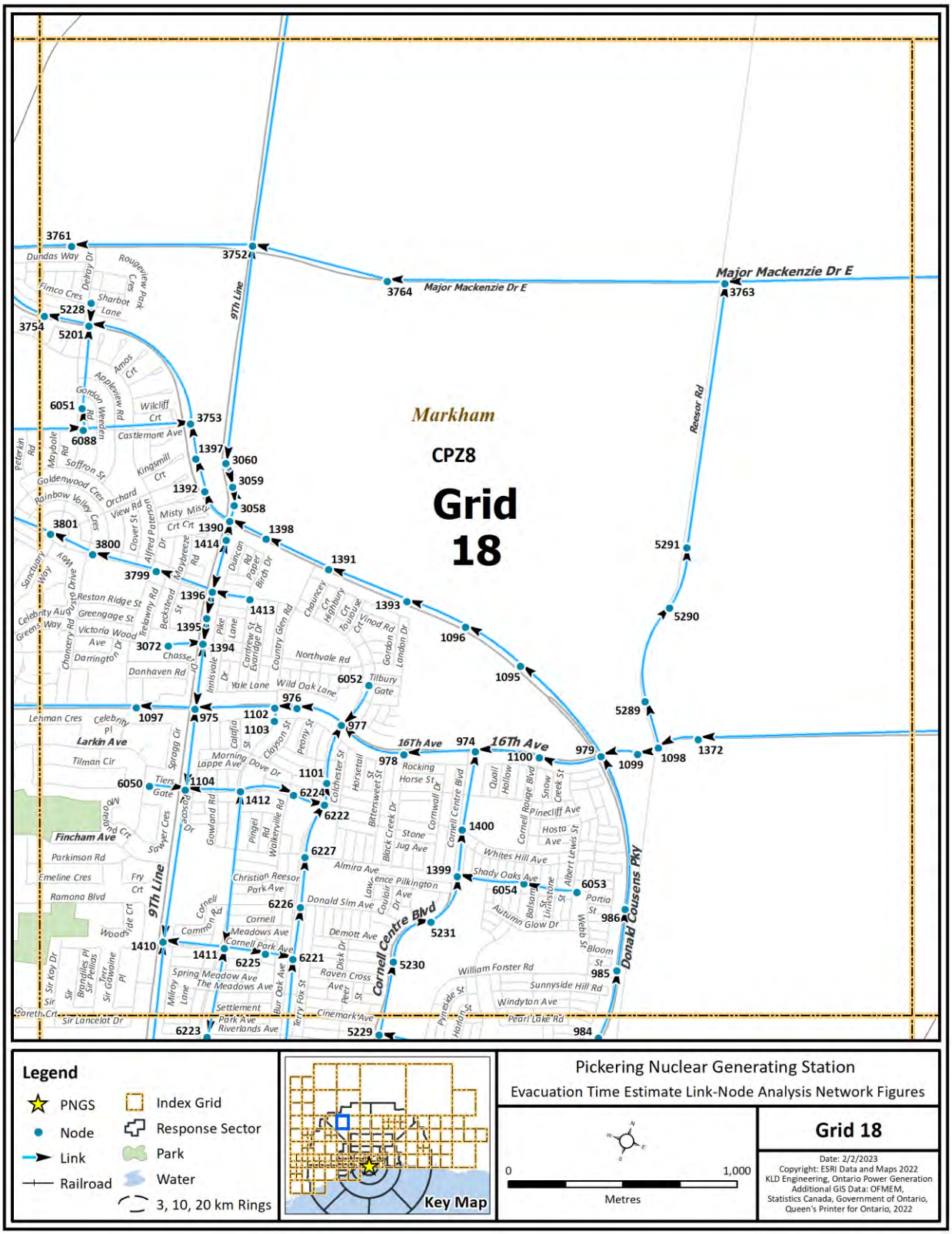


**Figure K-19. Link-Node Analysis Network – Grid 18**

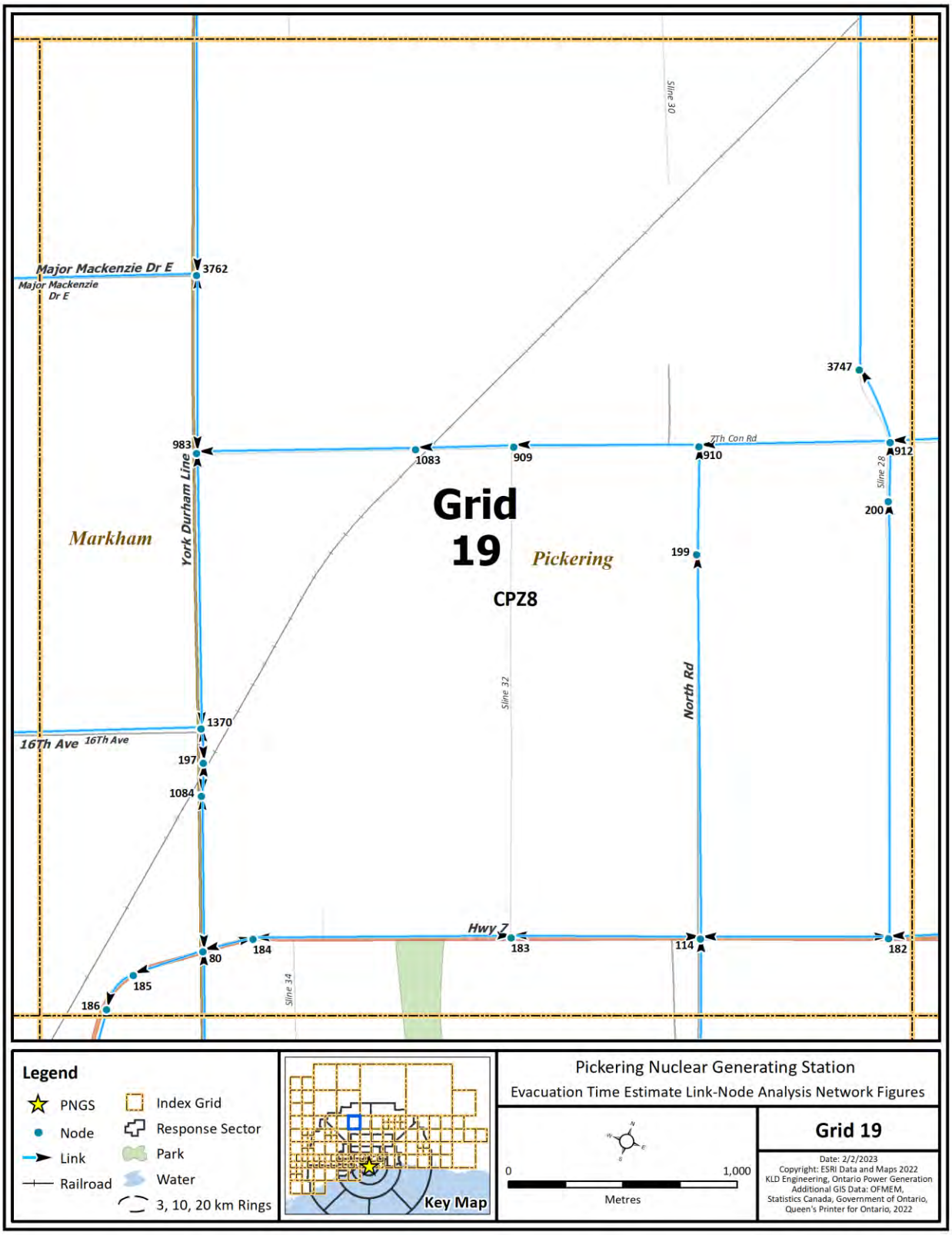


**Figure K-20. Link-Node Analysis Network – Grid 19**

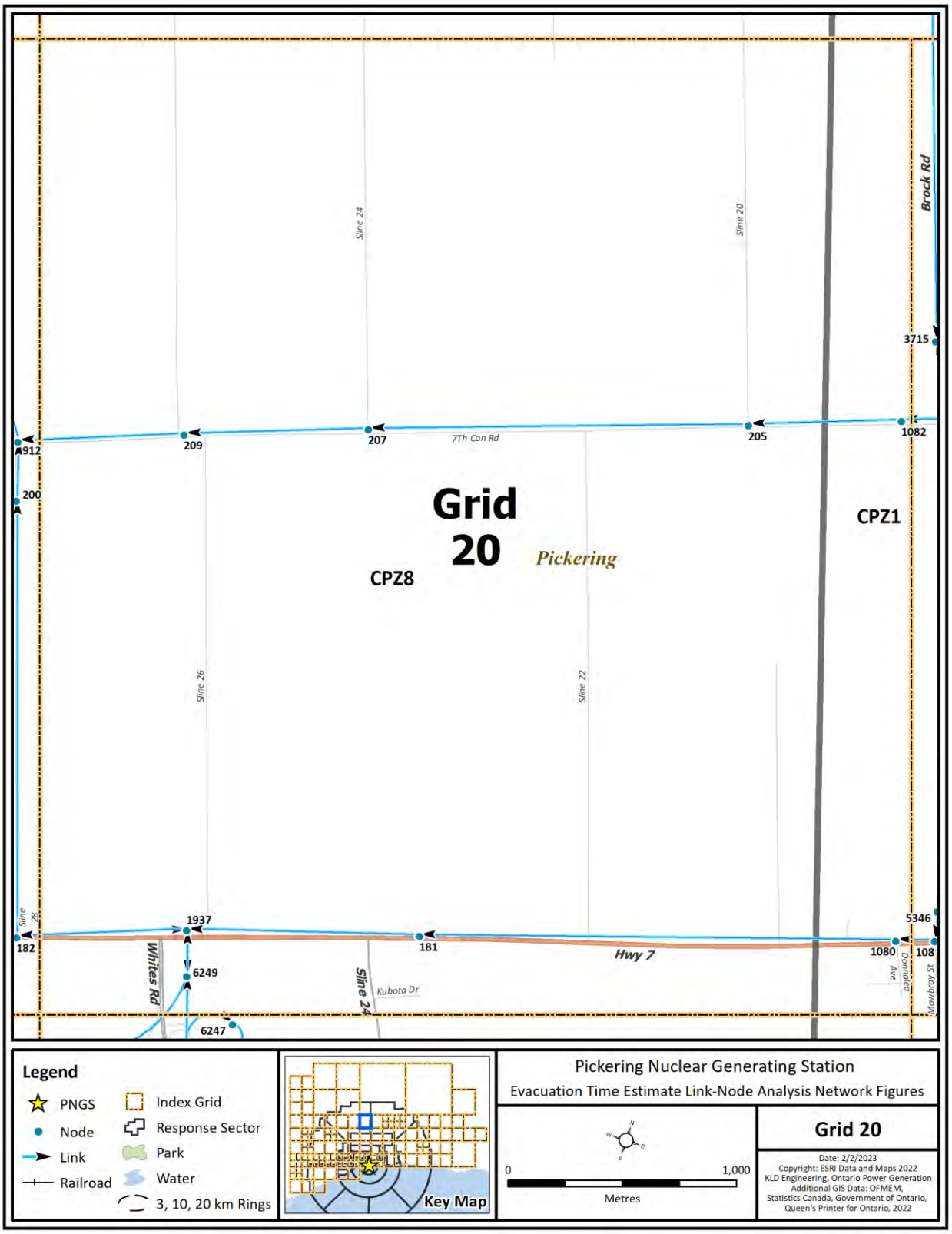


**Figure K-21. Link-Node Analysis Network – Grid 20**

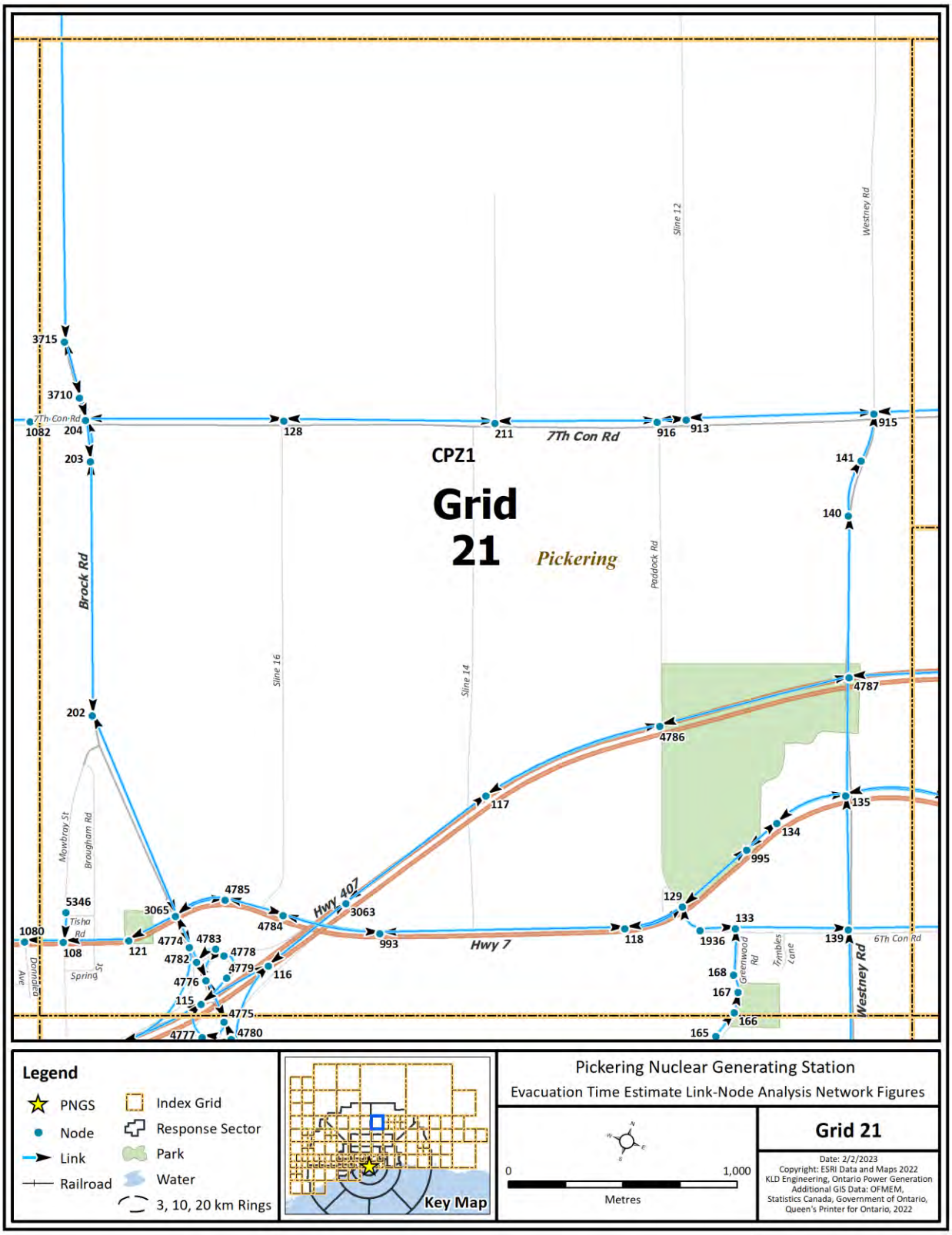


**Figure K-22. Link-Node Analysis Network – Grid 21**

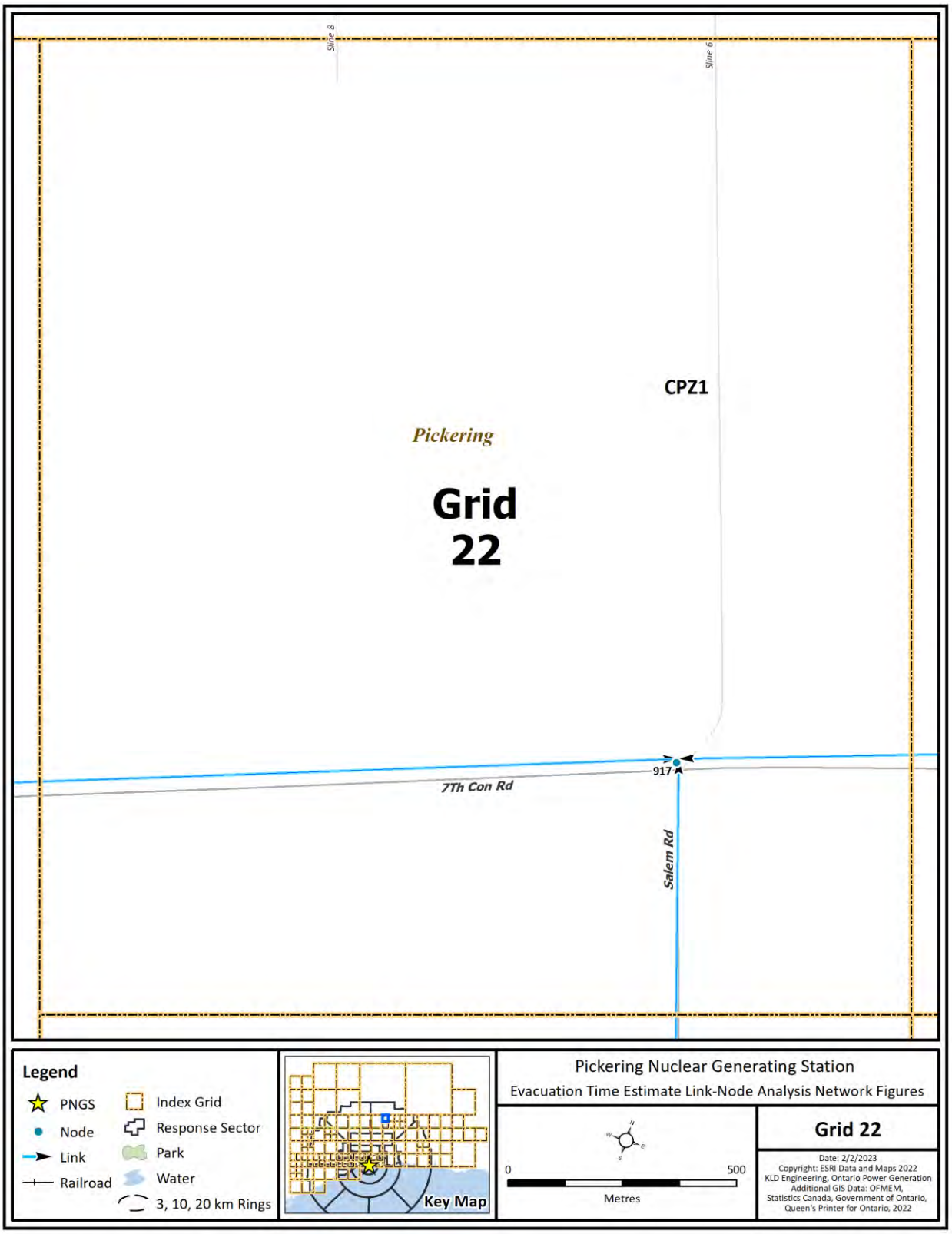


**Figure K-23. Link-Node Analysis Network – Grid 22**

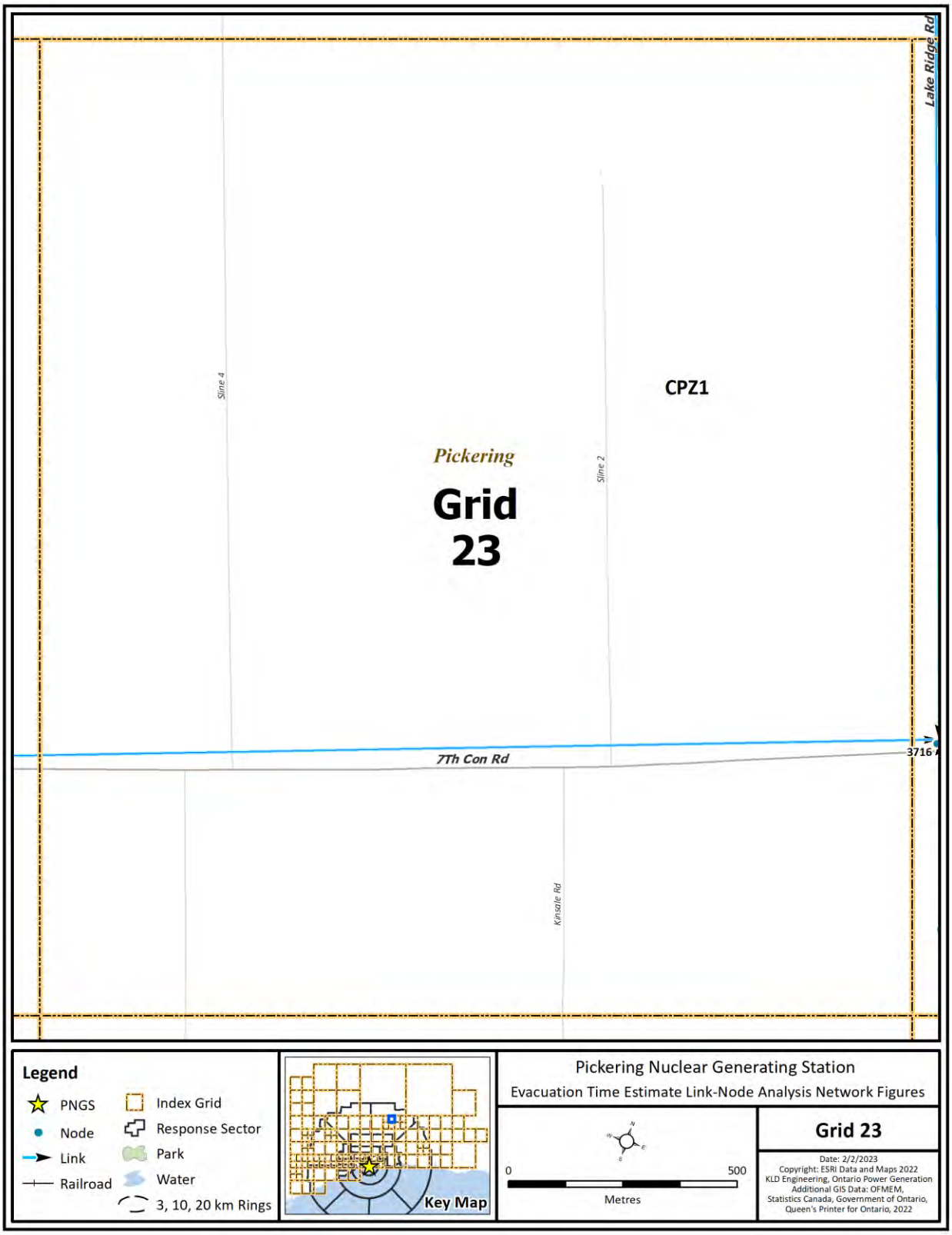


**Figure K-24. Link-Node Analysis Network – Grid 23**

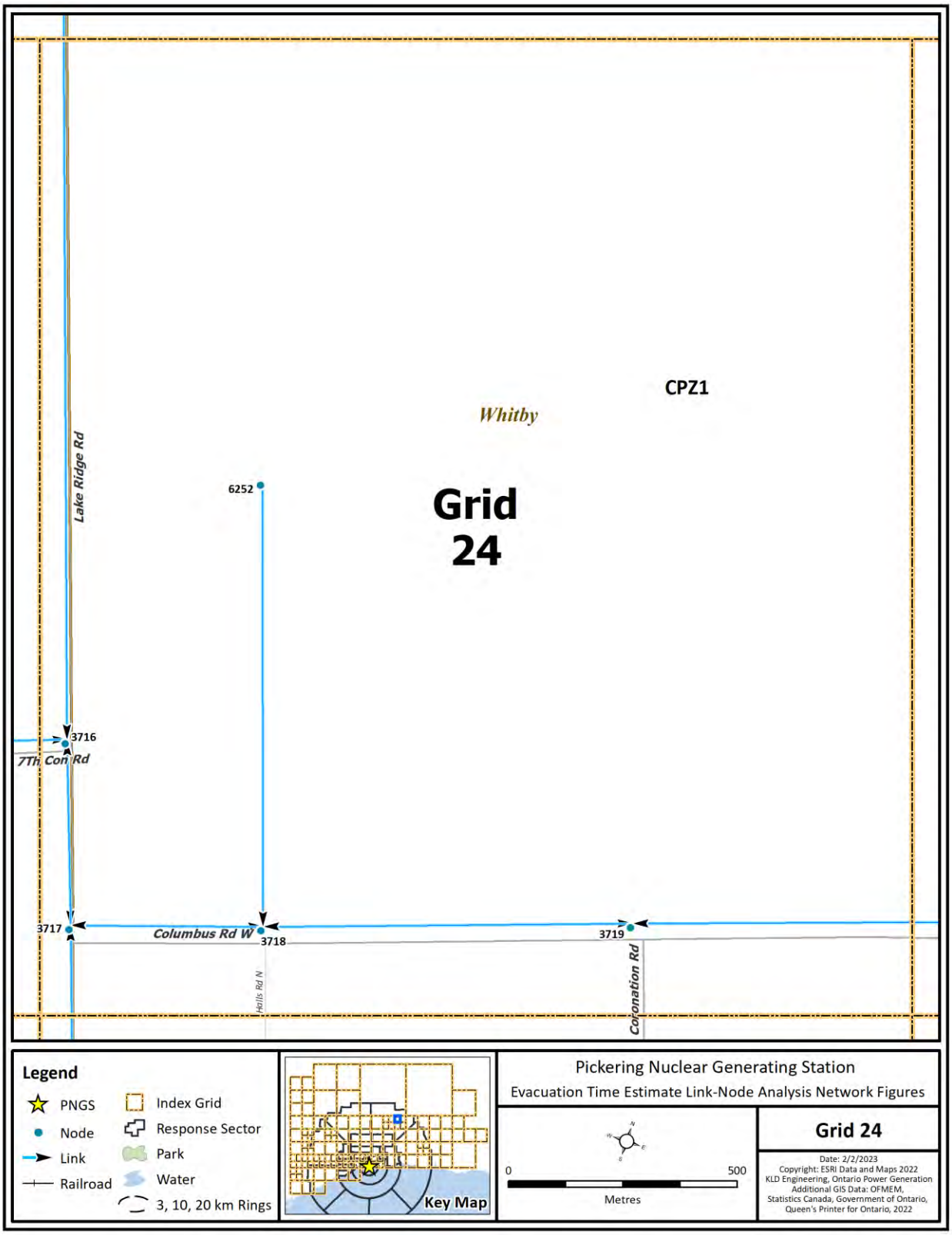


**Figure K-25. Link-Node Analysis Network – Grid 24**

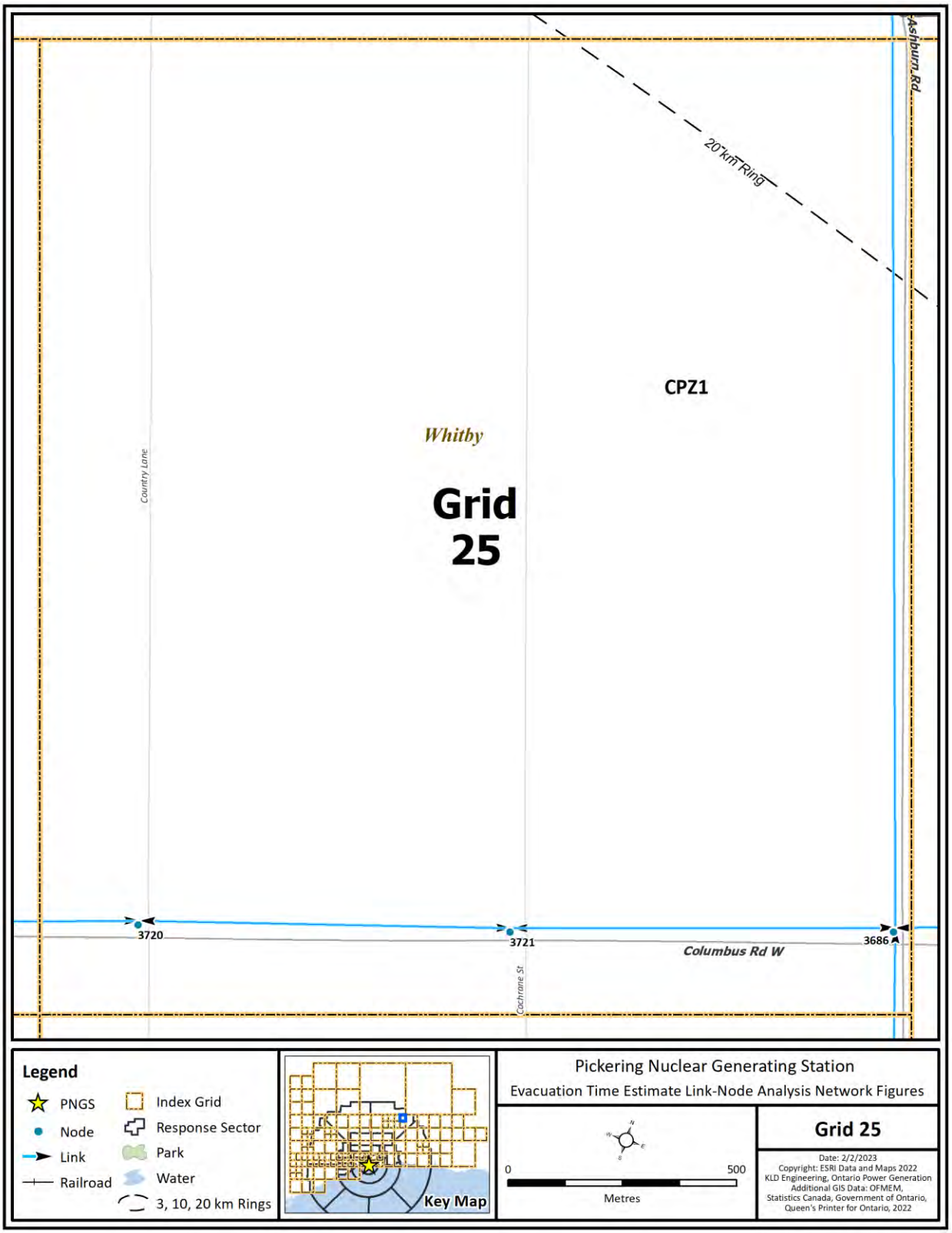


**Figure K-26. Link-Node Analysis Network – Grid 25**

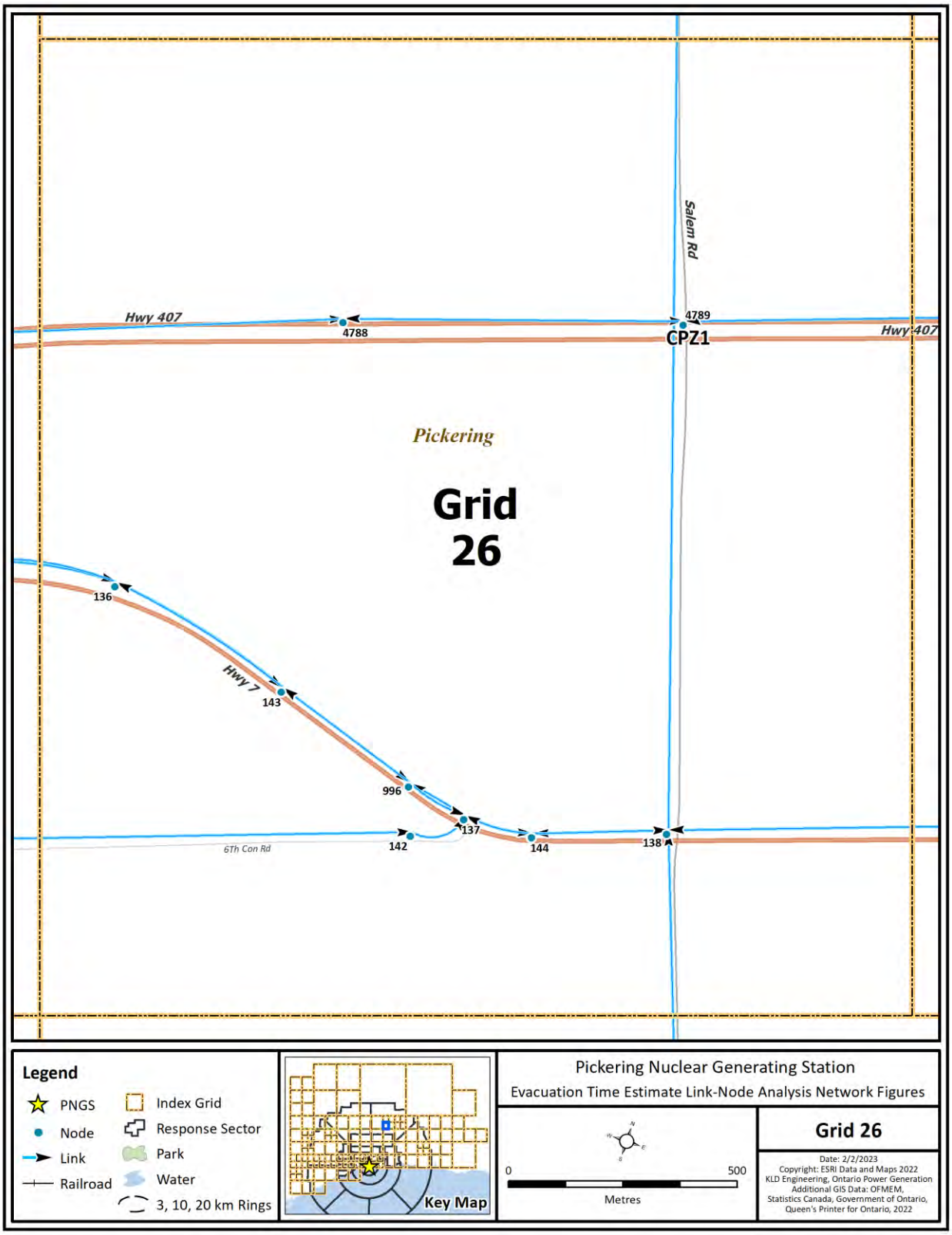


**Figure K-27. Link-Node Analysis Network – Grid 26**

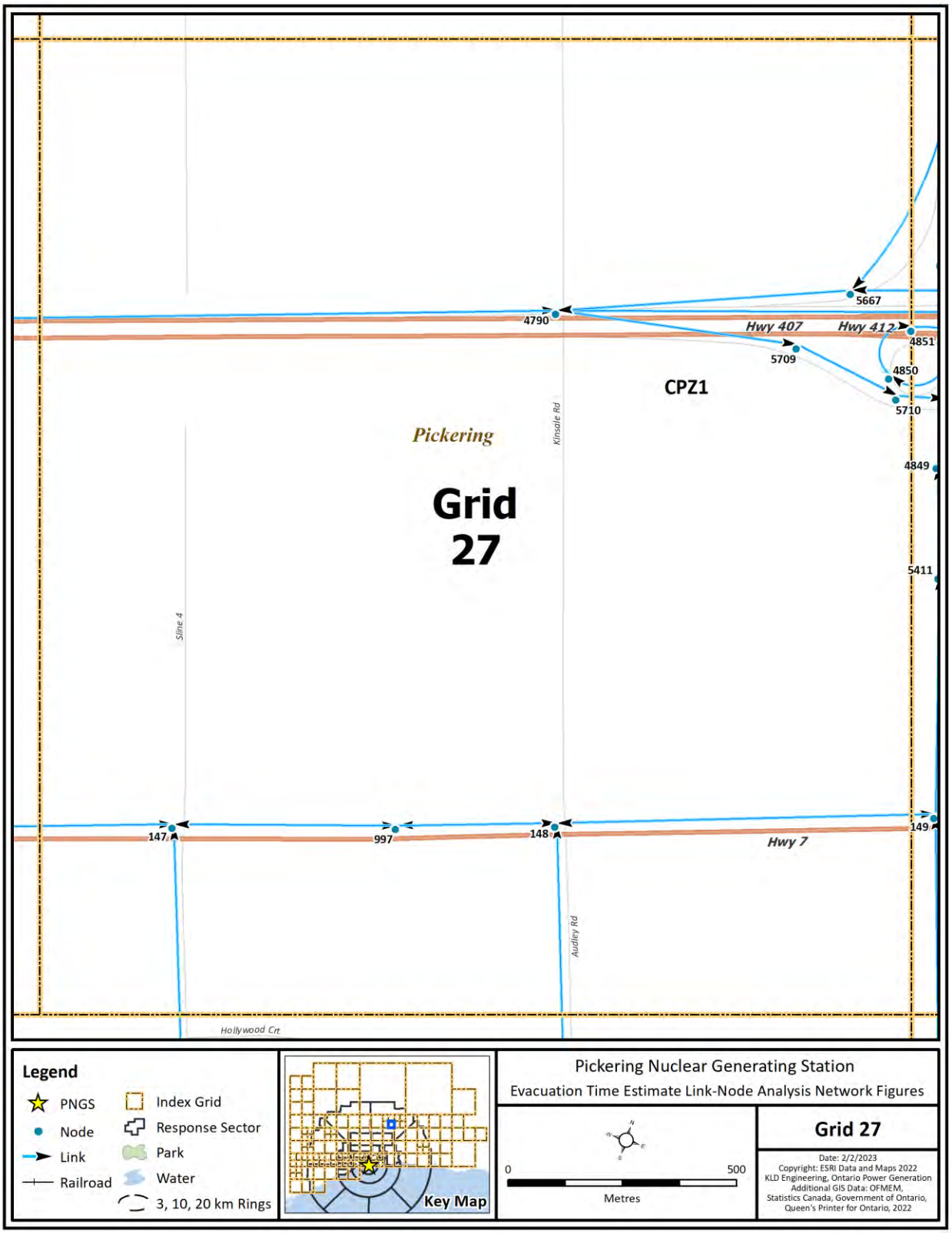


**Figure K-28. Link-Node Analysis Network – Grid 27**

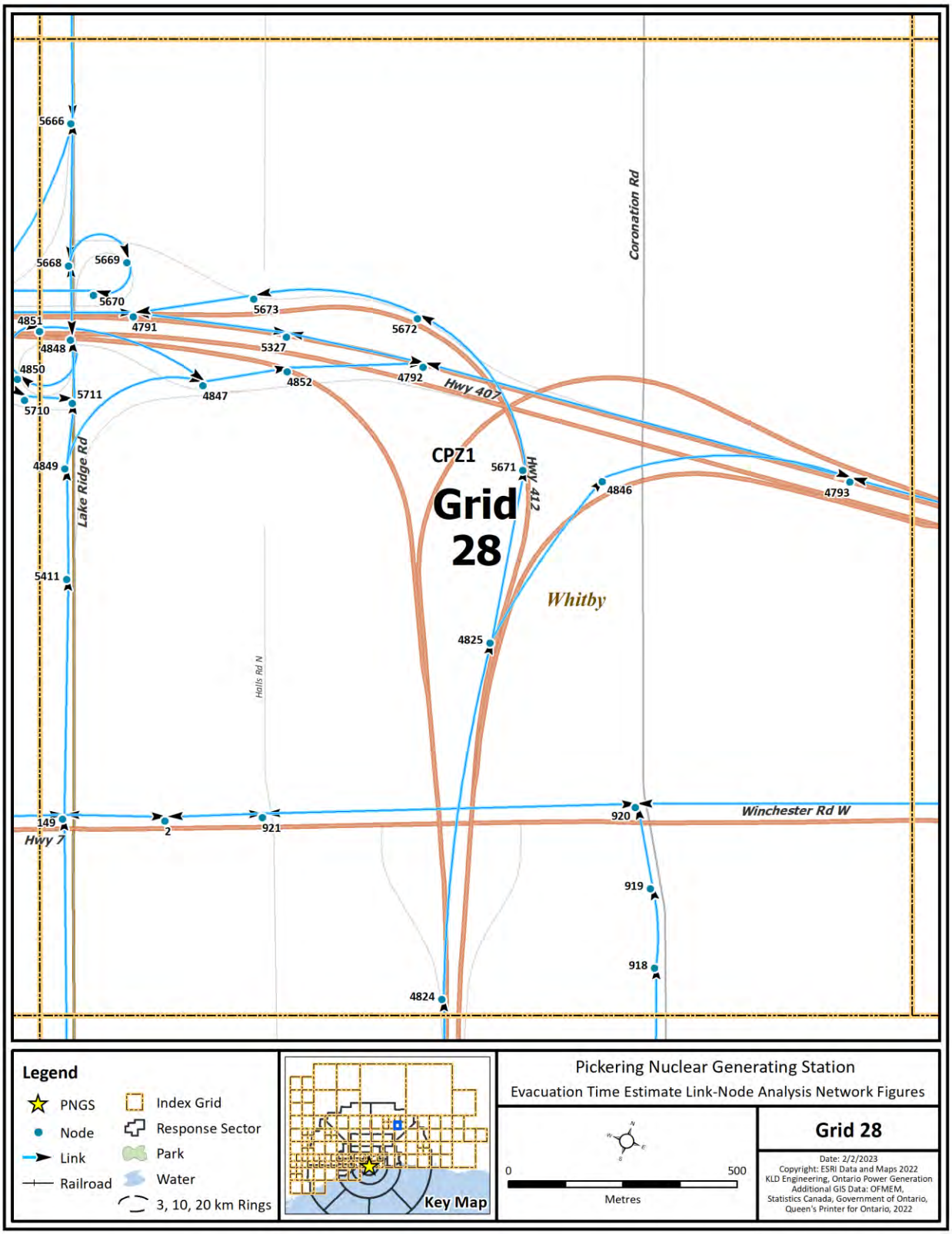


**Figure K-29. Link-Node Analysis Network – Grid 28**

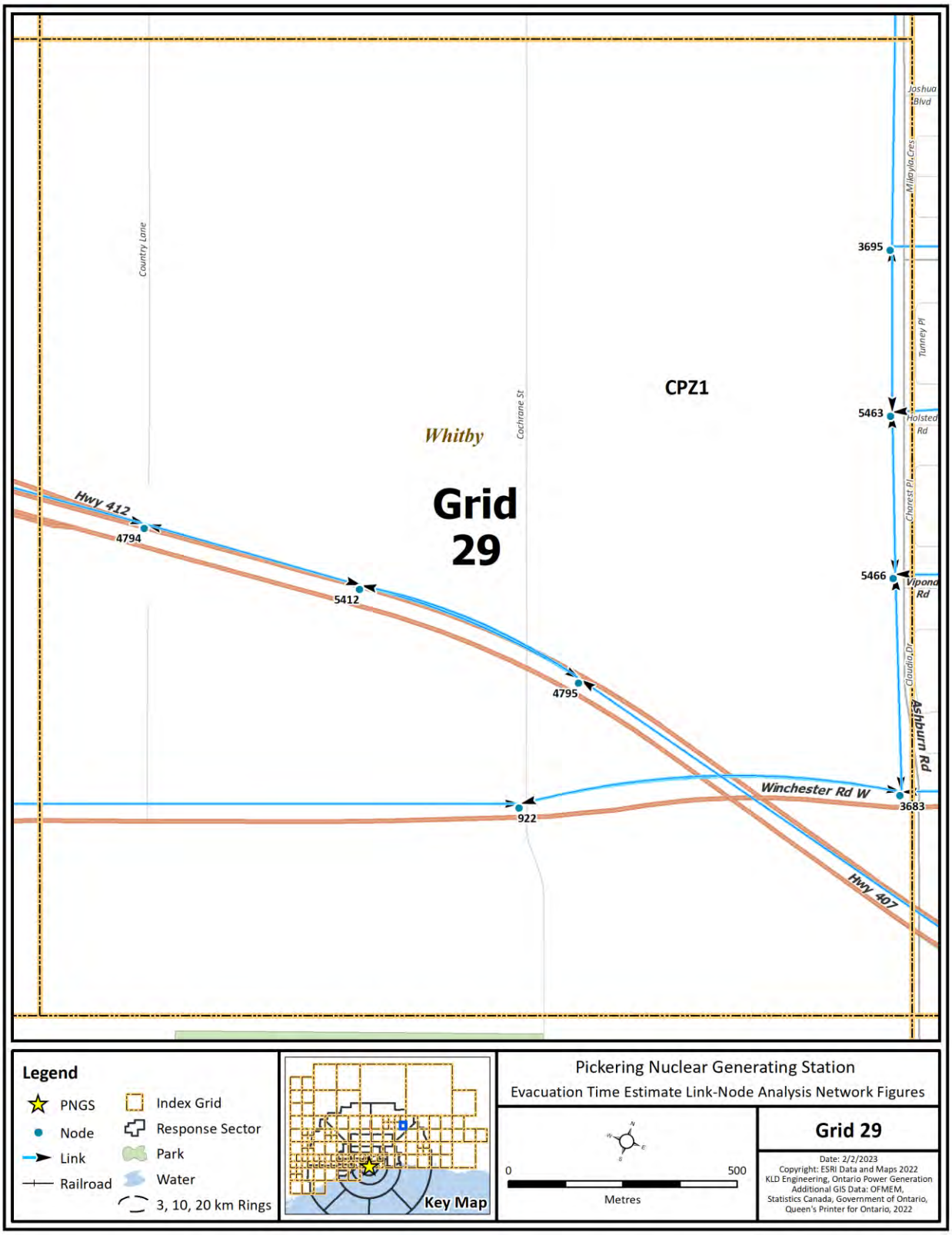


**Figure K-30. Link-Node Analysis Network – Grid 29**

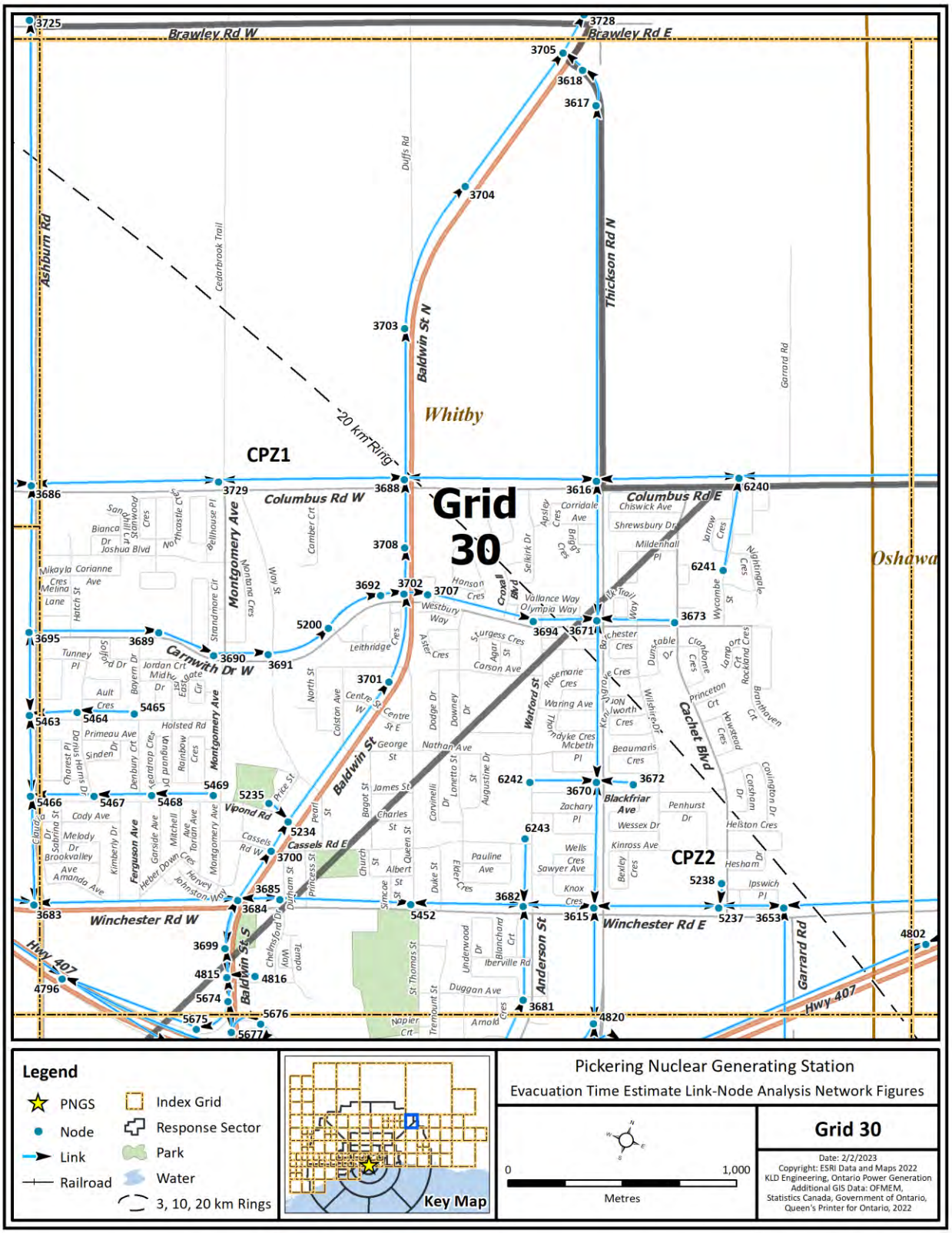


**Figure K-31. Link-Node Analysis Network – Grid 30**

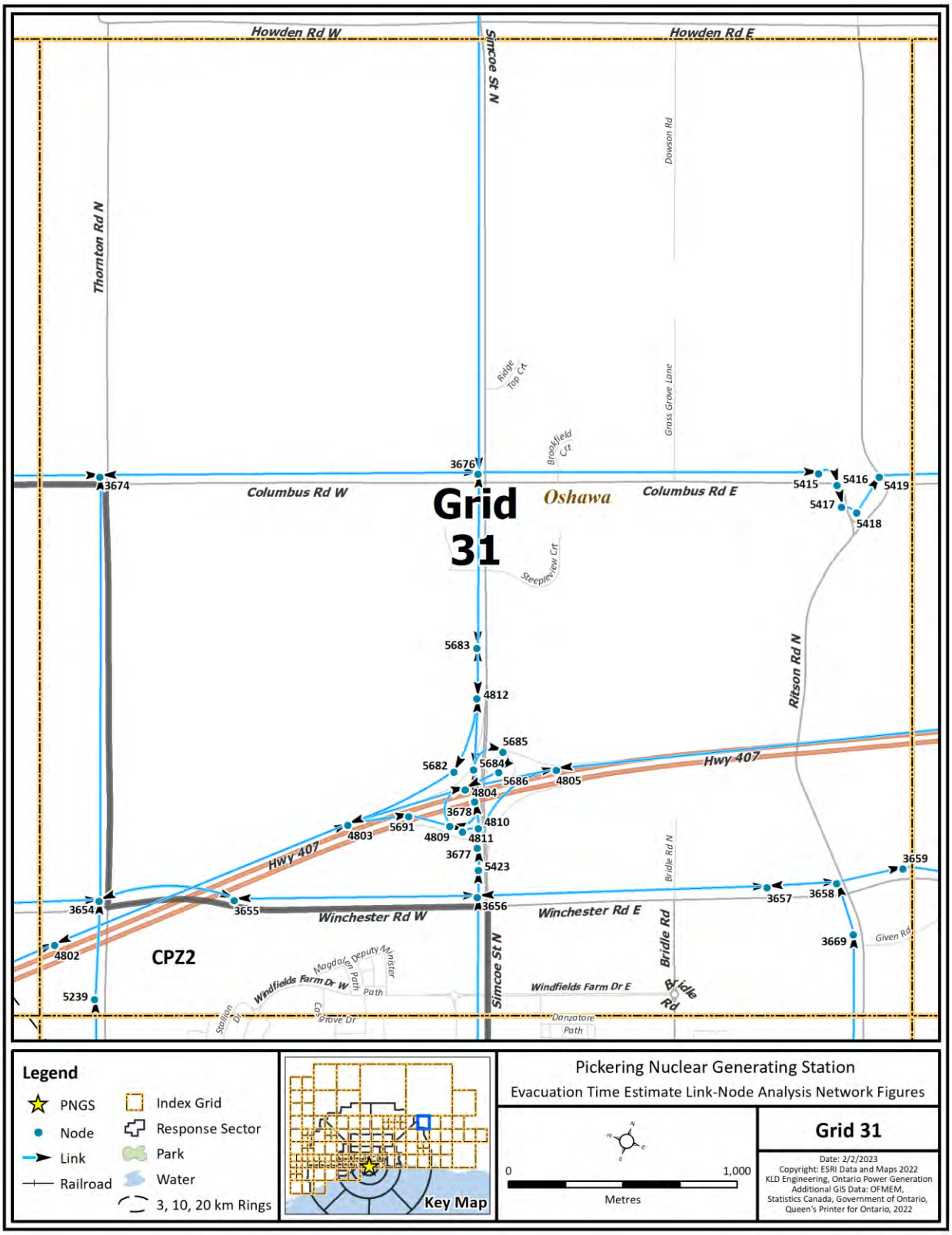


**Figure K-32. Link-Node Analysis Network – Grid 31**

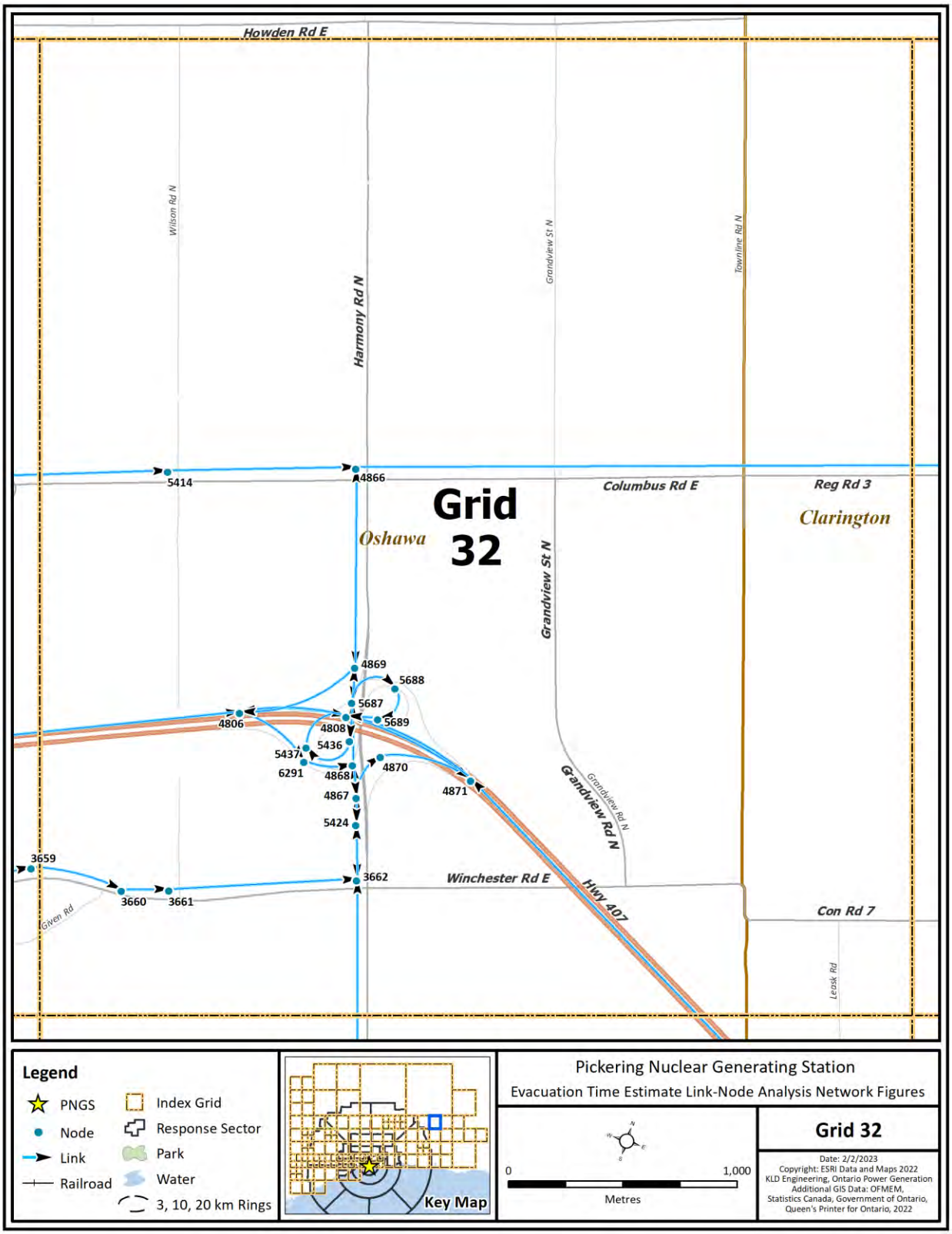


**Figure K-33. Link-Node Analysis Network – Grid 32**

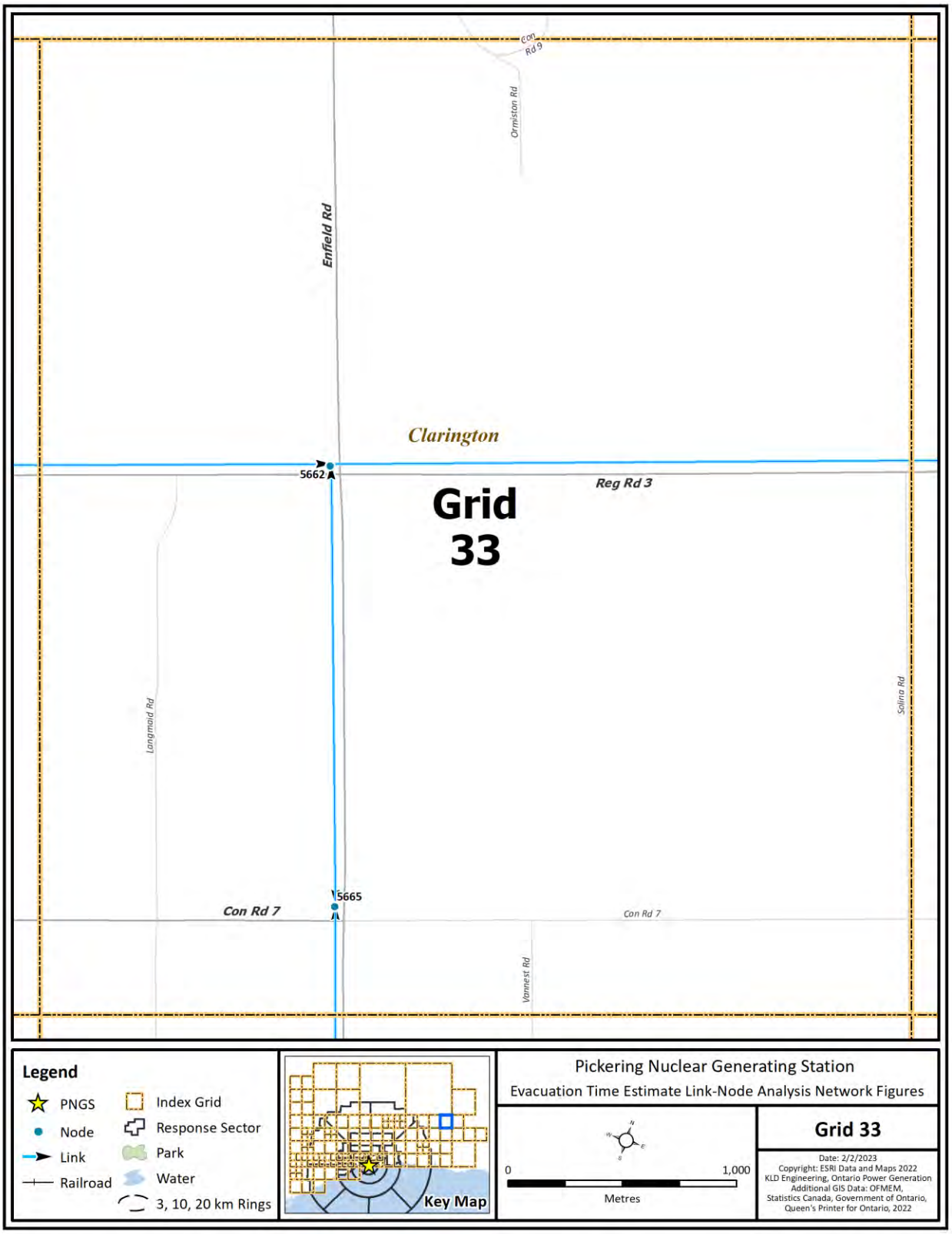


**Figure K-34. Link-Node Analysis Network – Grid 33**

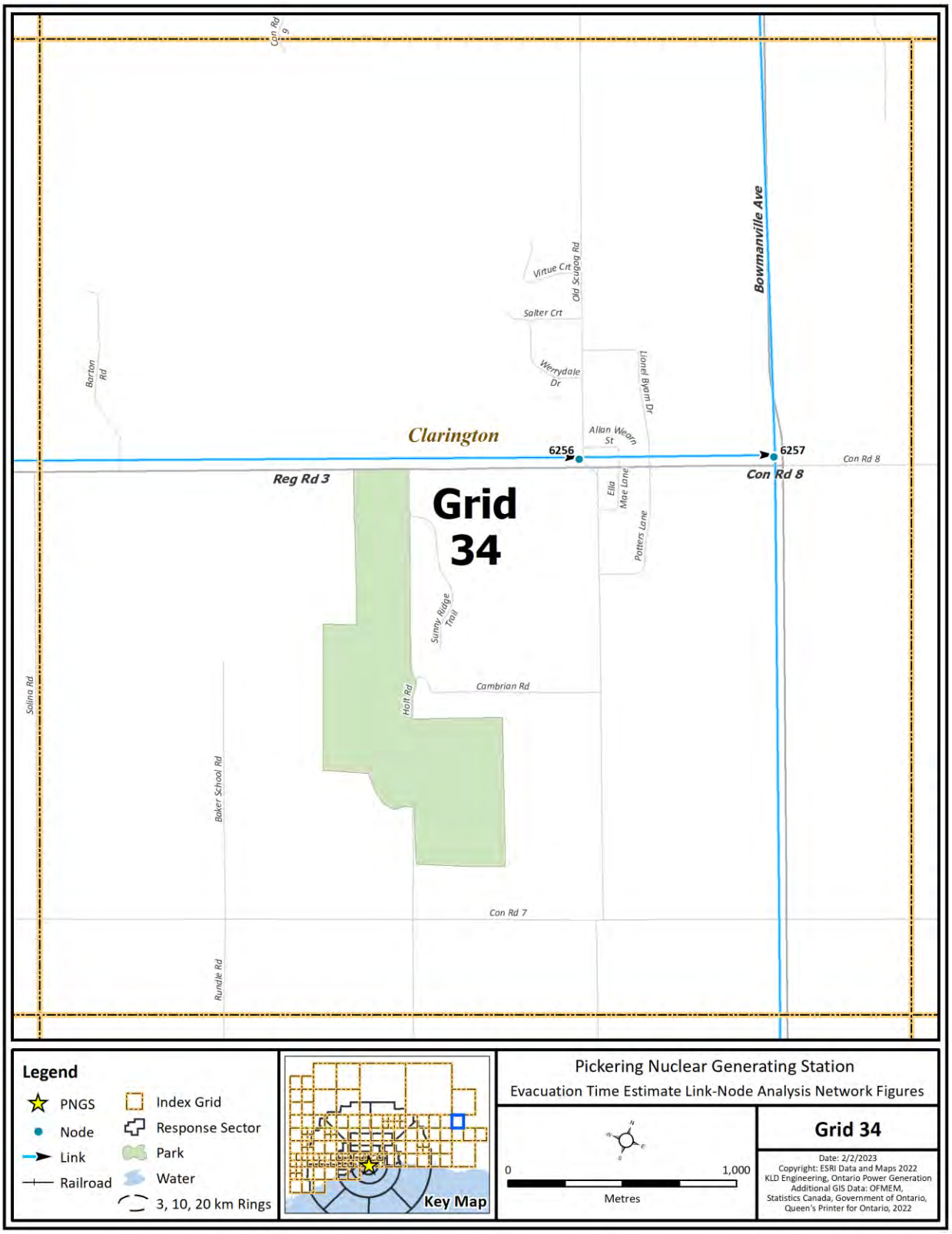


**Figure K-35. Link-Node Analysis Network – Grid 34**

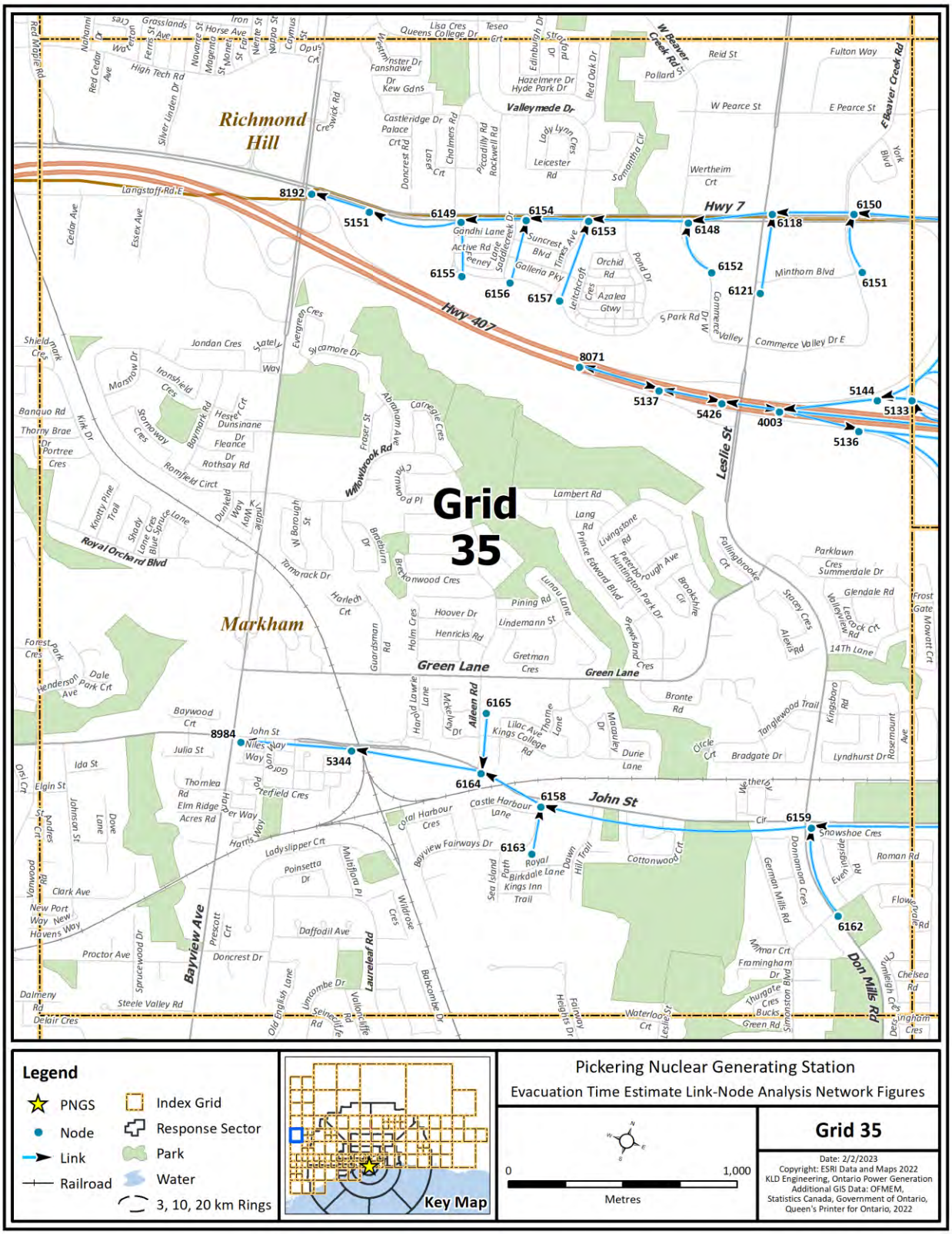


**Figure K-36. Link-Node Analysis Network – Grid 35**

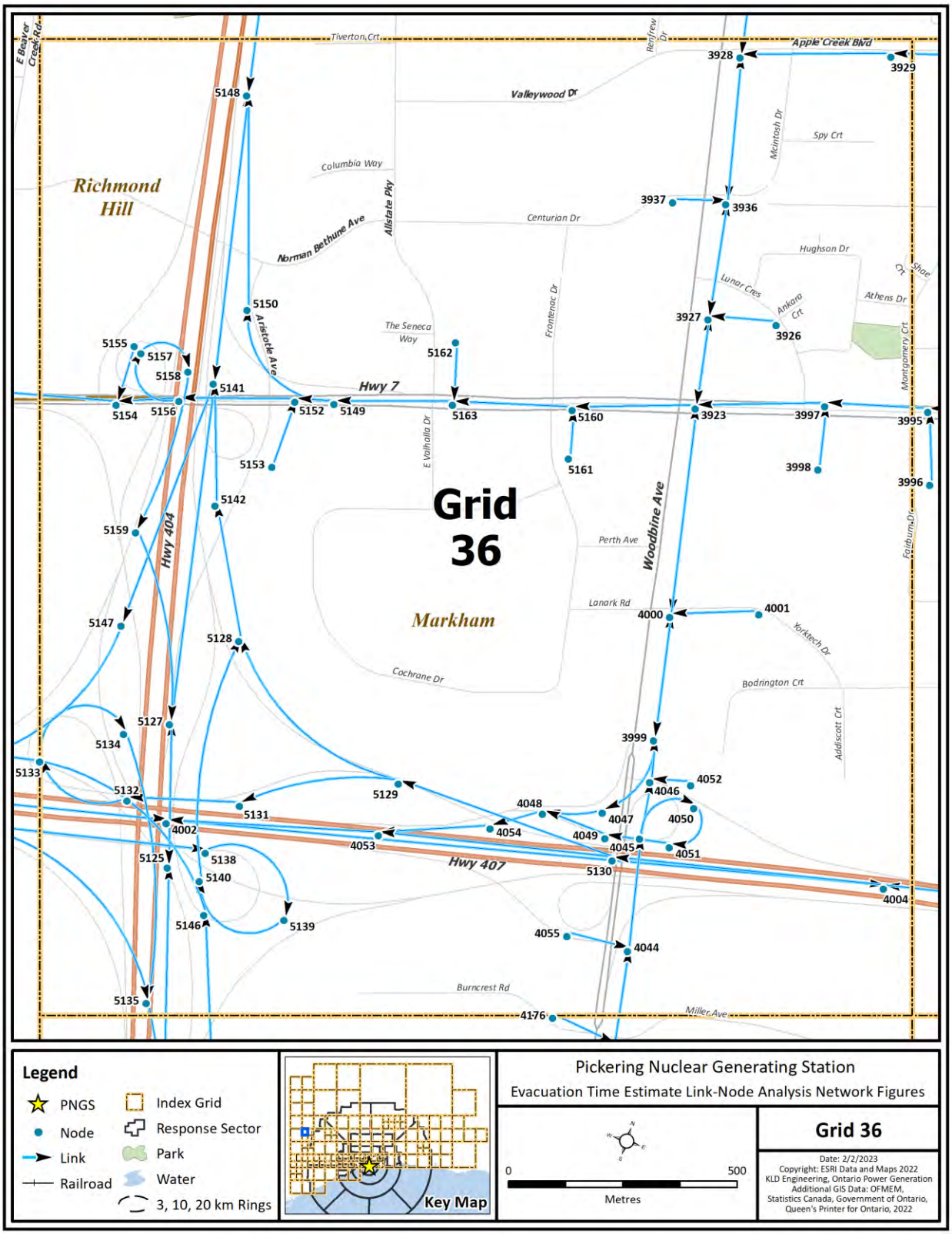


**Figure K-37. Link-Node Analysis Network – Grid 36**

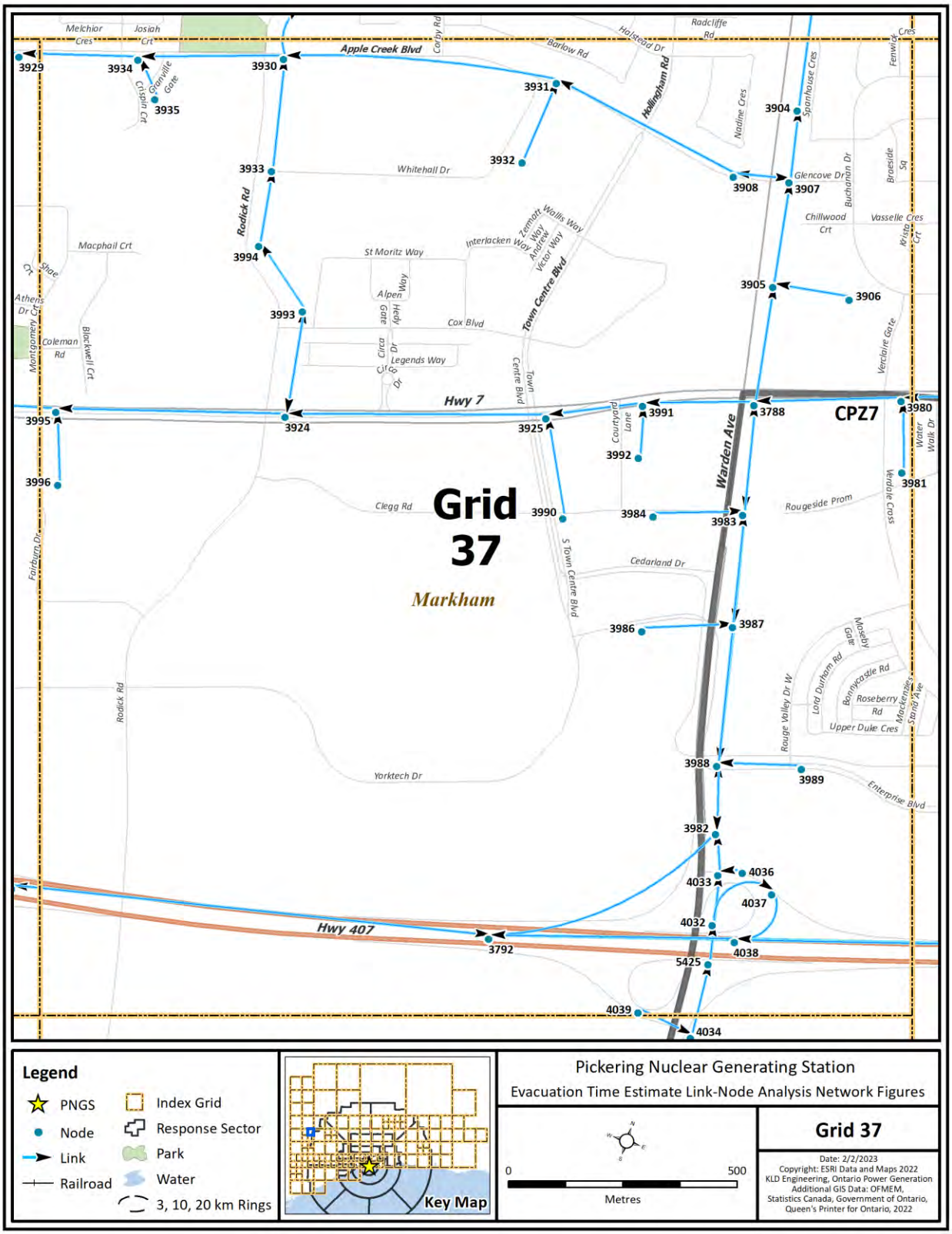


**Figure K-38. Link-Node Analysis Network – Grid 37**

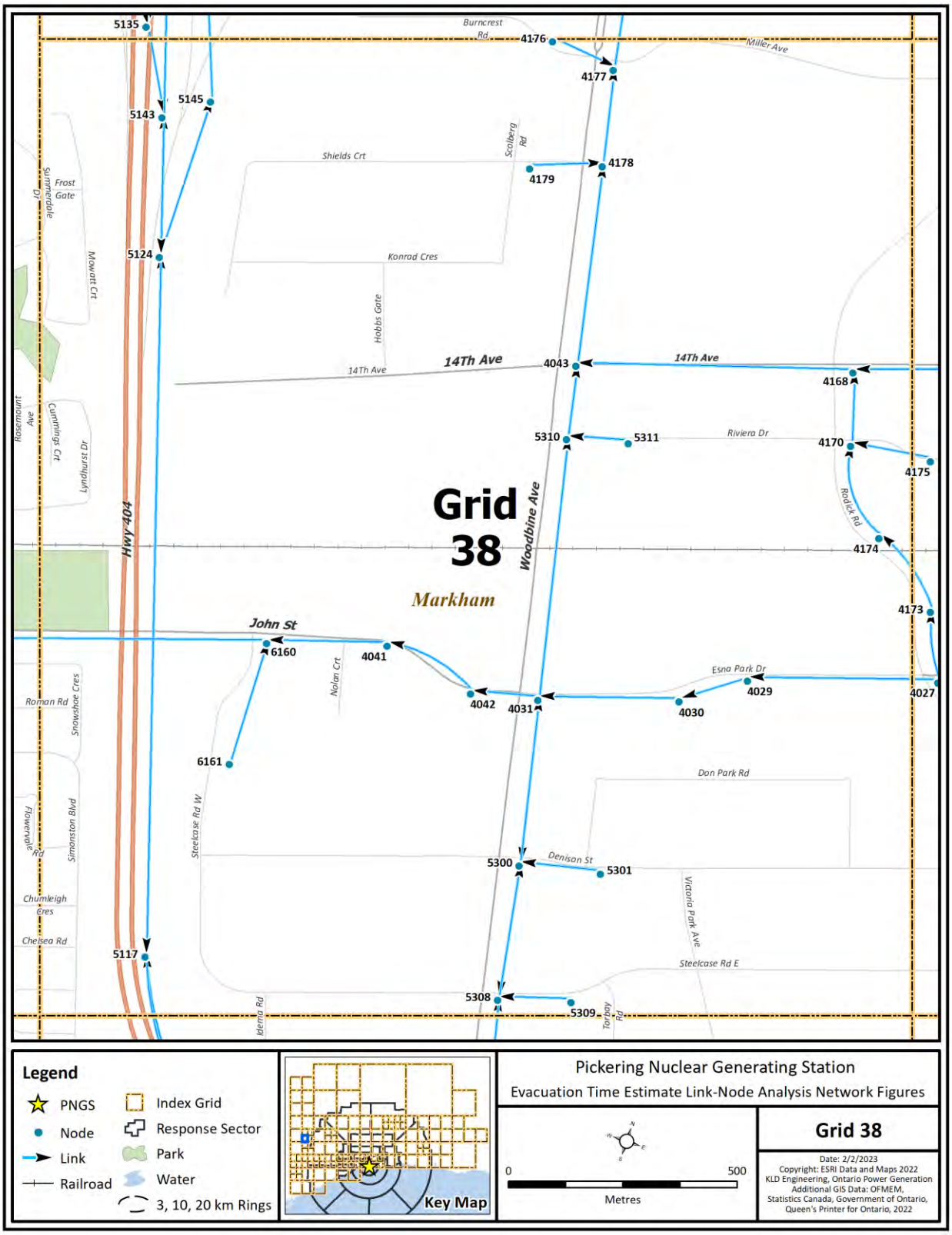


**Figure K-39. Link-Node Analysis Network – Grid 38**

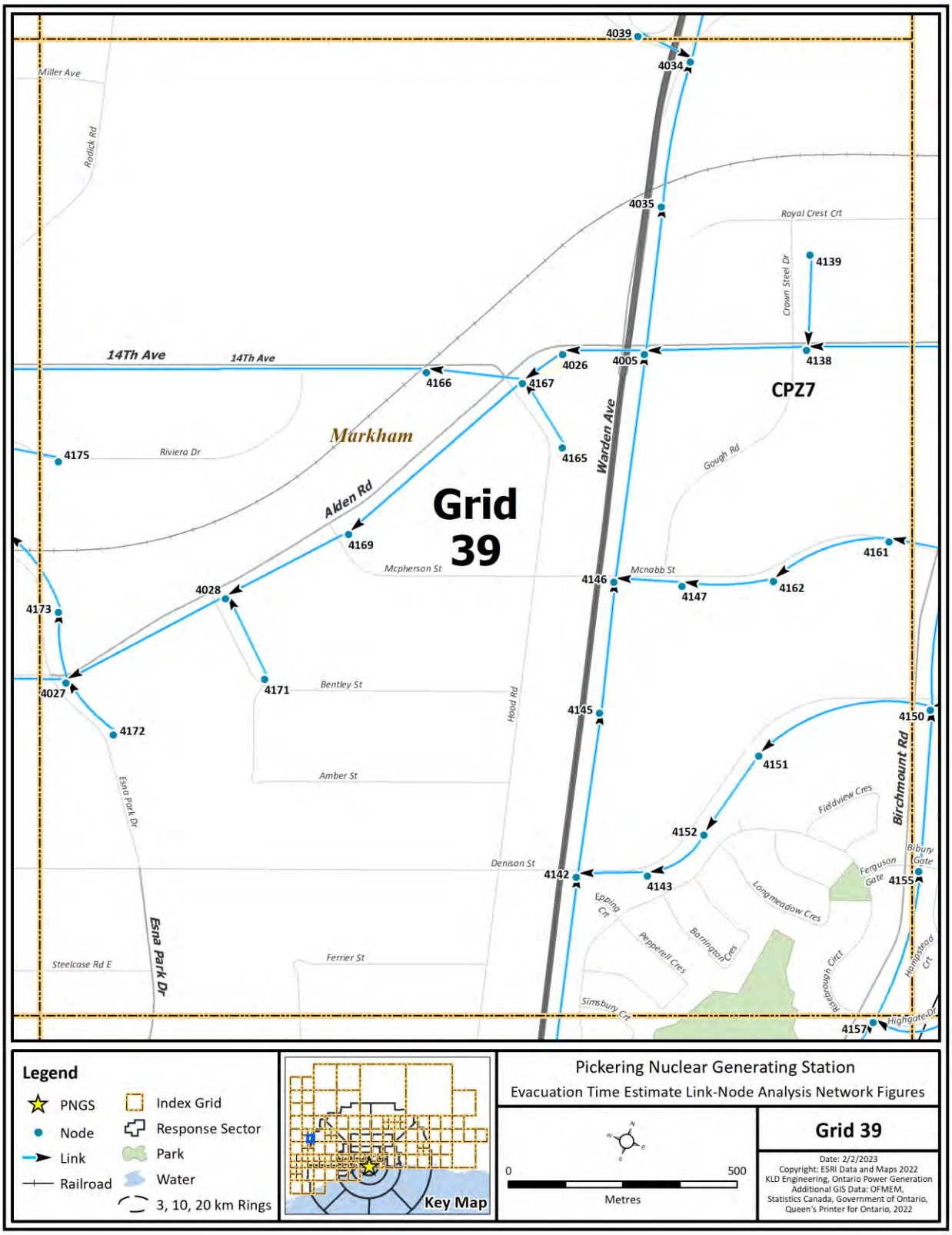


**Figure K-40. Link-Node Analysis Network – Grid 39**

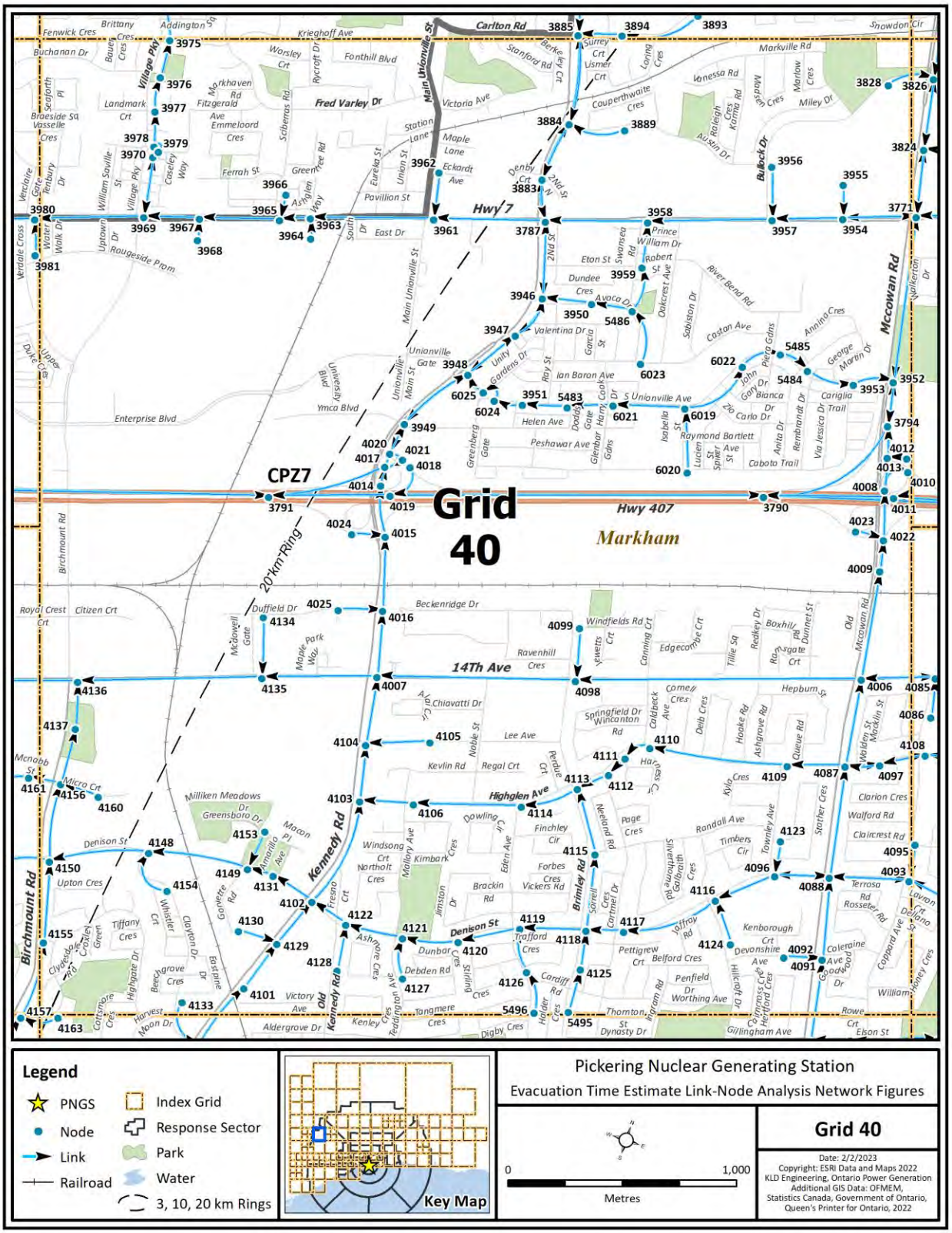


**Figure K-41. Link-Node Analysis Network – Grid 40**

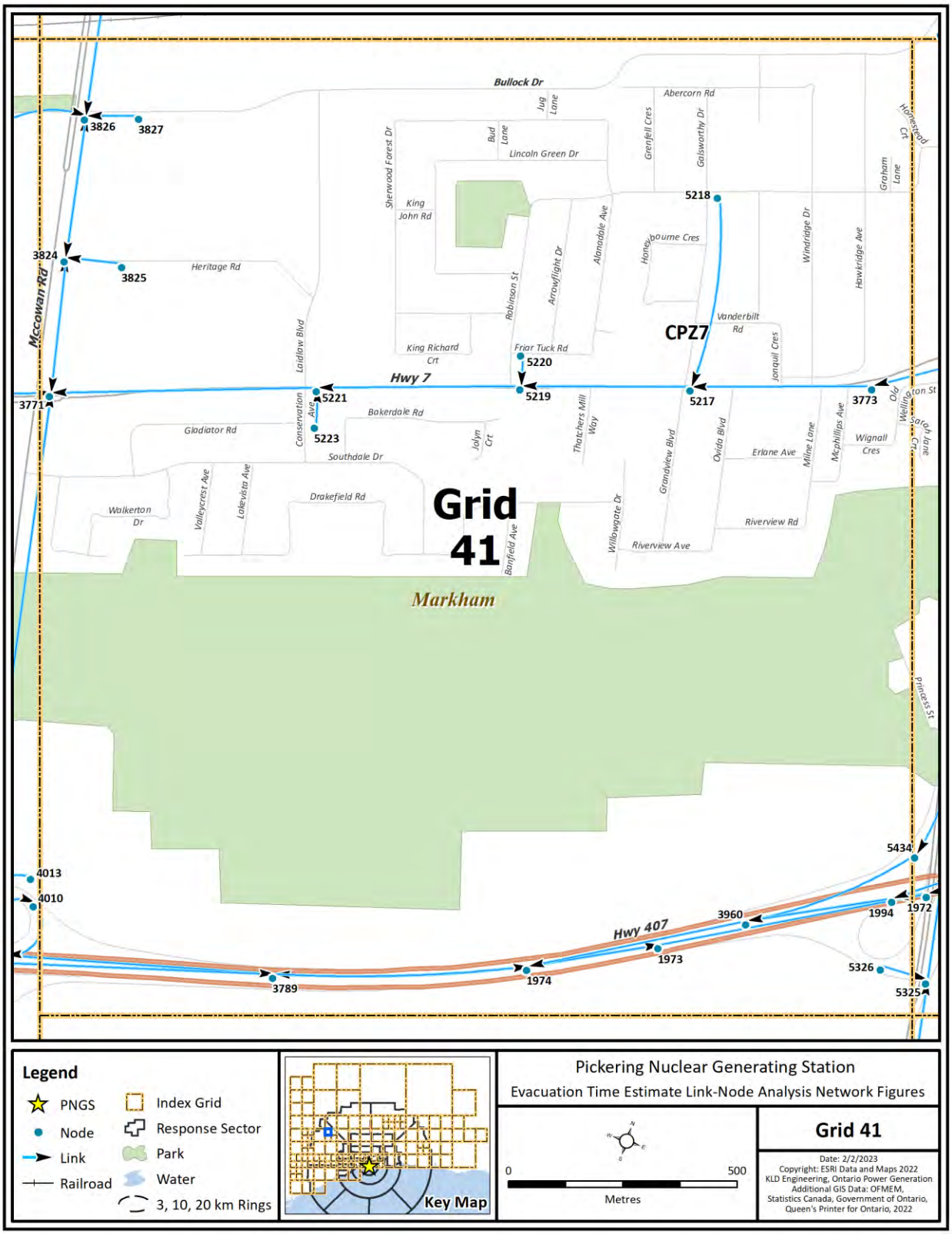


**Figure K-42. Link-Node Analysis Network – Grid 41**

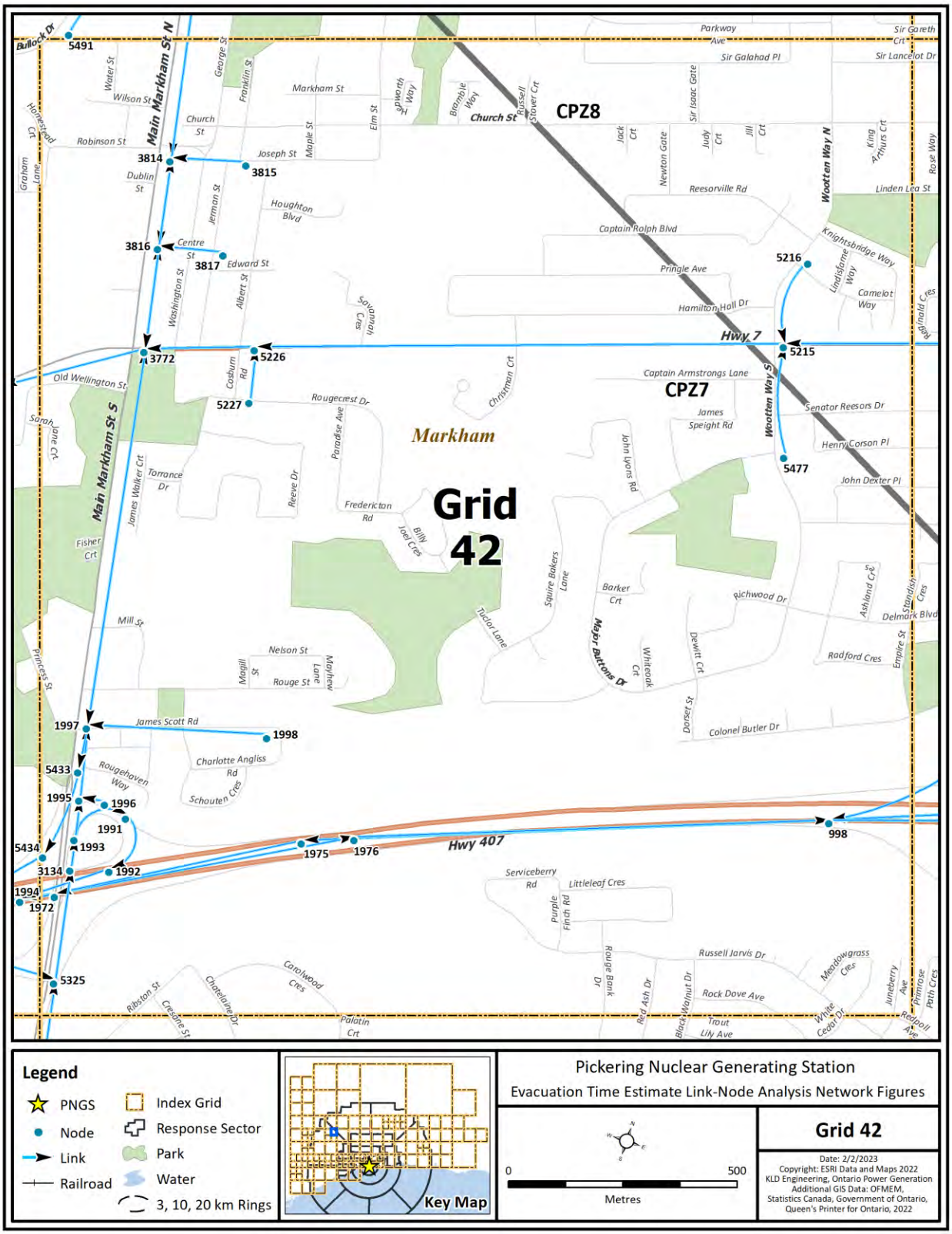


**Figure K-43. Link-Node Analysis Network – Grid 42**

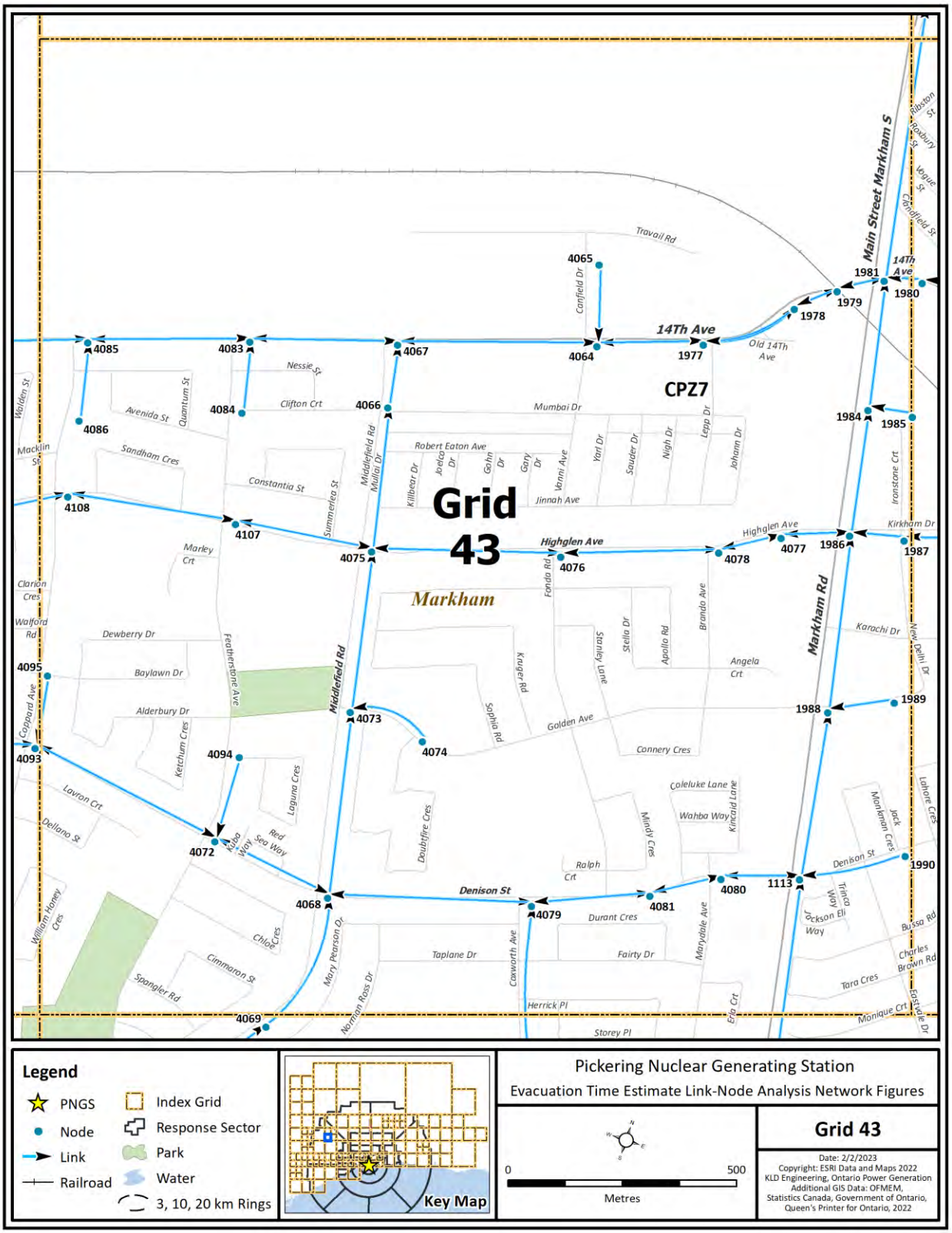


**Figure K-44. Link-Node Analysis Network – Grid 43**

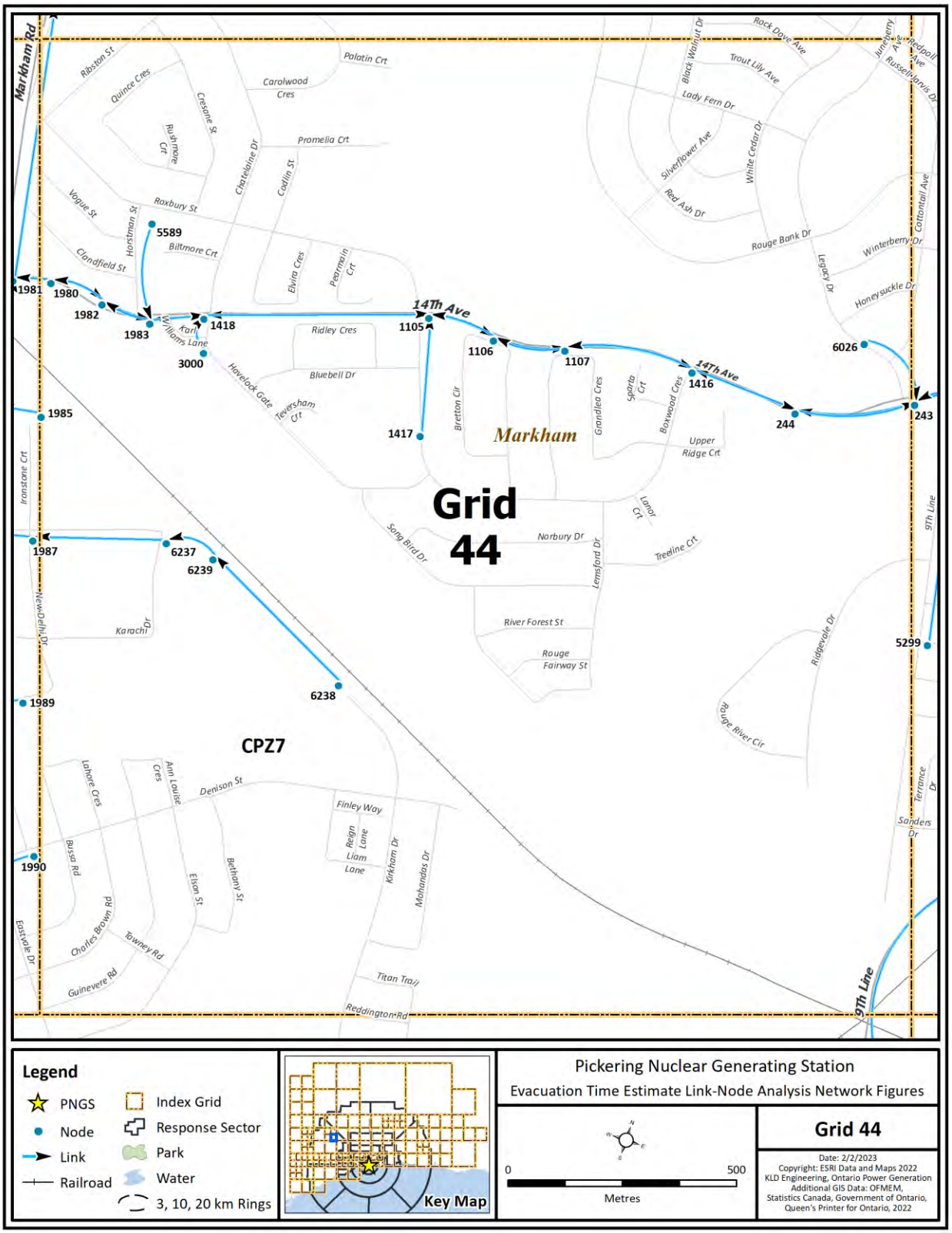


**Figure K-45. Link-Node Analysis Network – Grid 44**

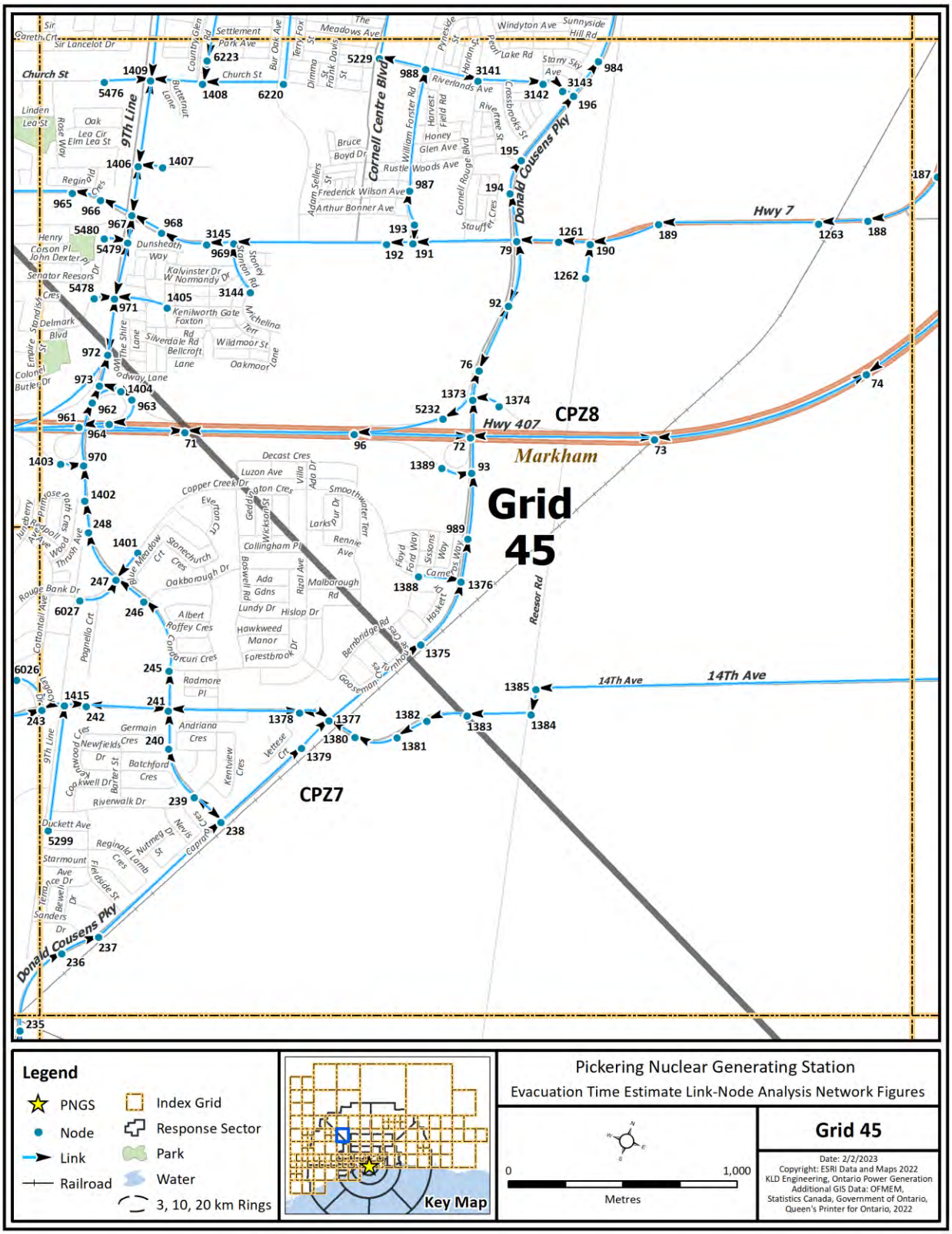


**Figure K-46. Link-Node Analysis Network – Grid 45**

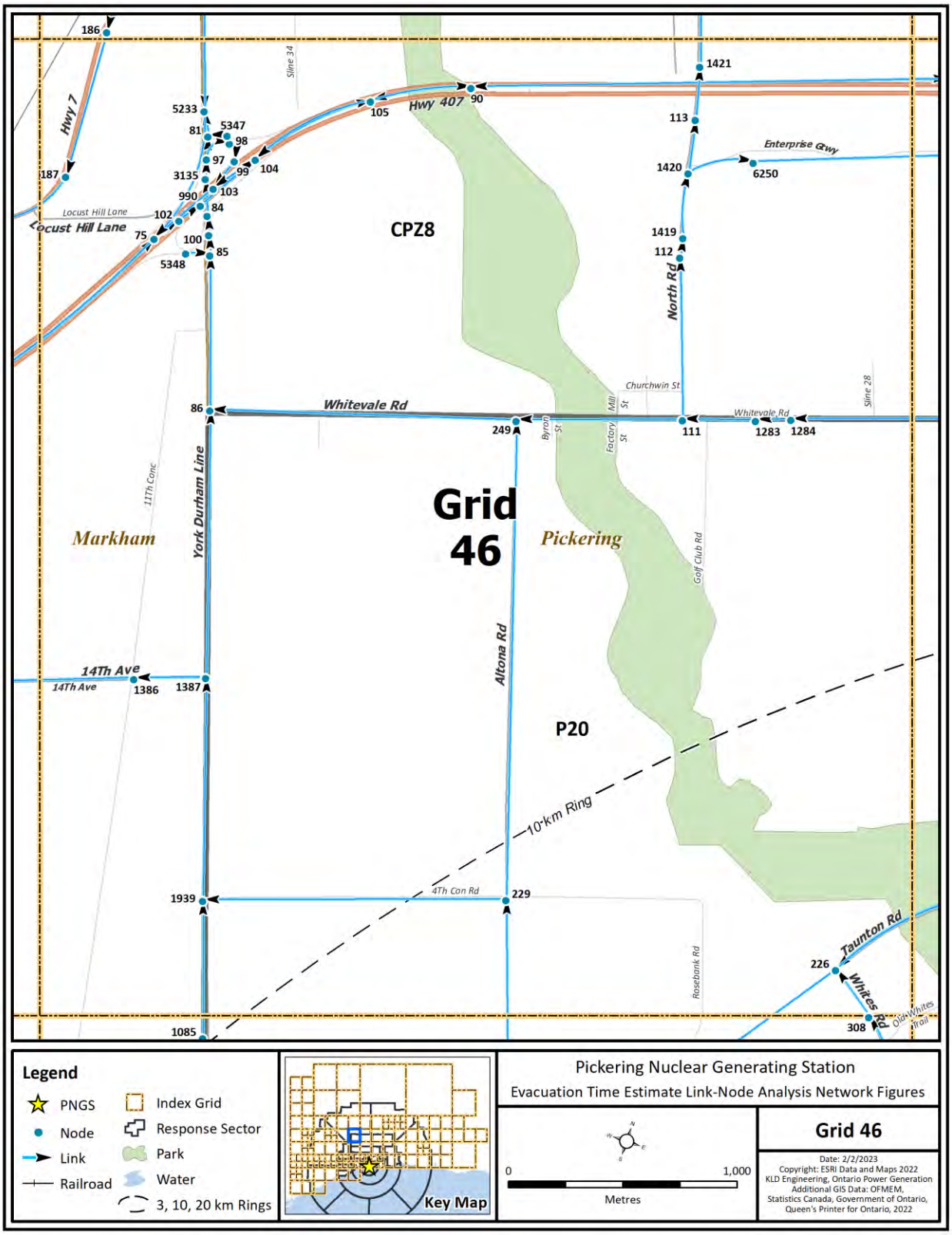


**Figure K-47. Link-Node Analysis Network – Grid 46**

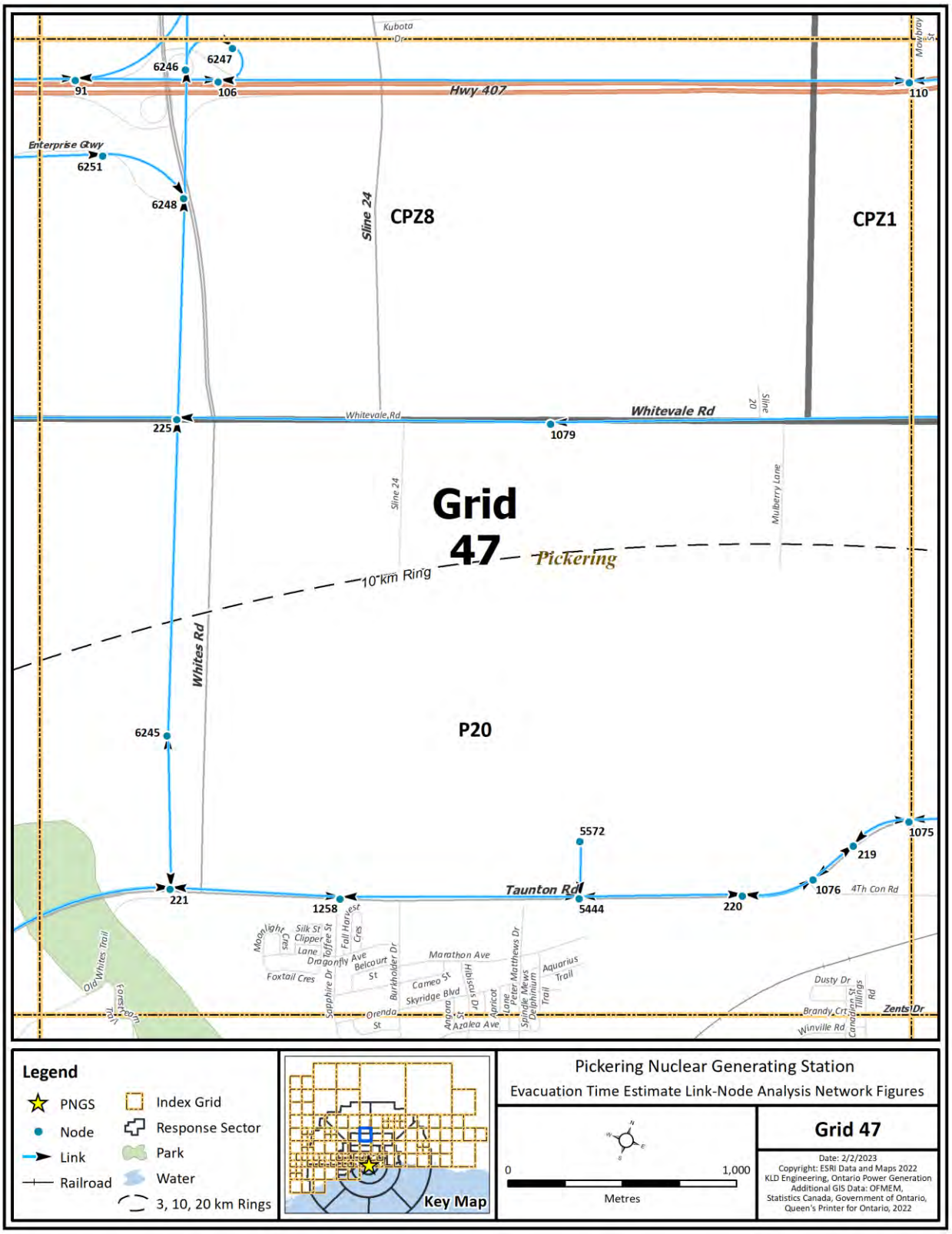


**Figure K-48. Link-Node Analysis Network – Grid 47**

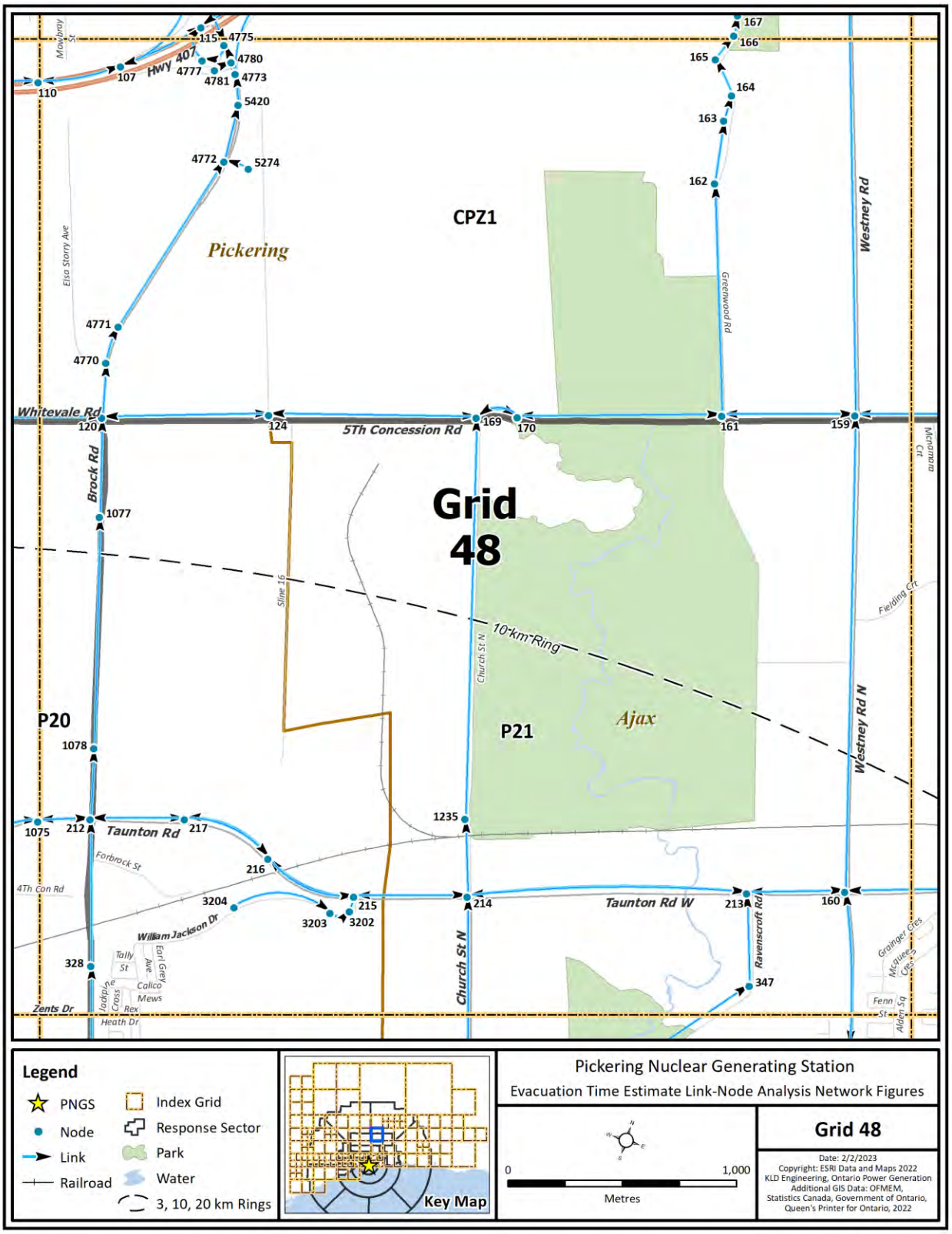


**Figure K-49. Link-Node Analysis Network – Grid 48**

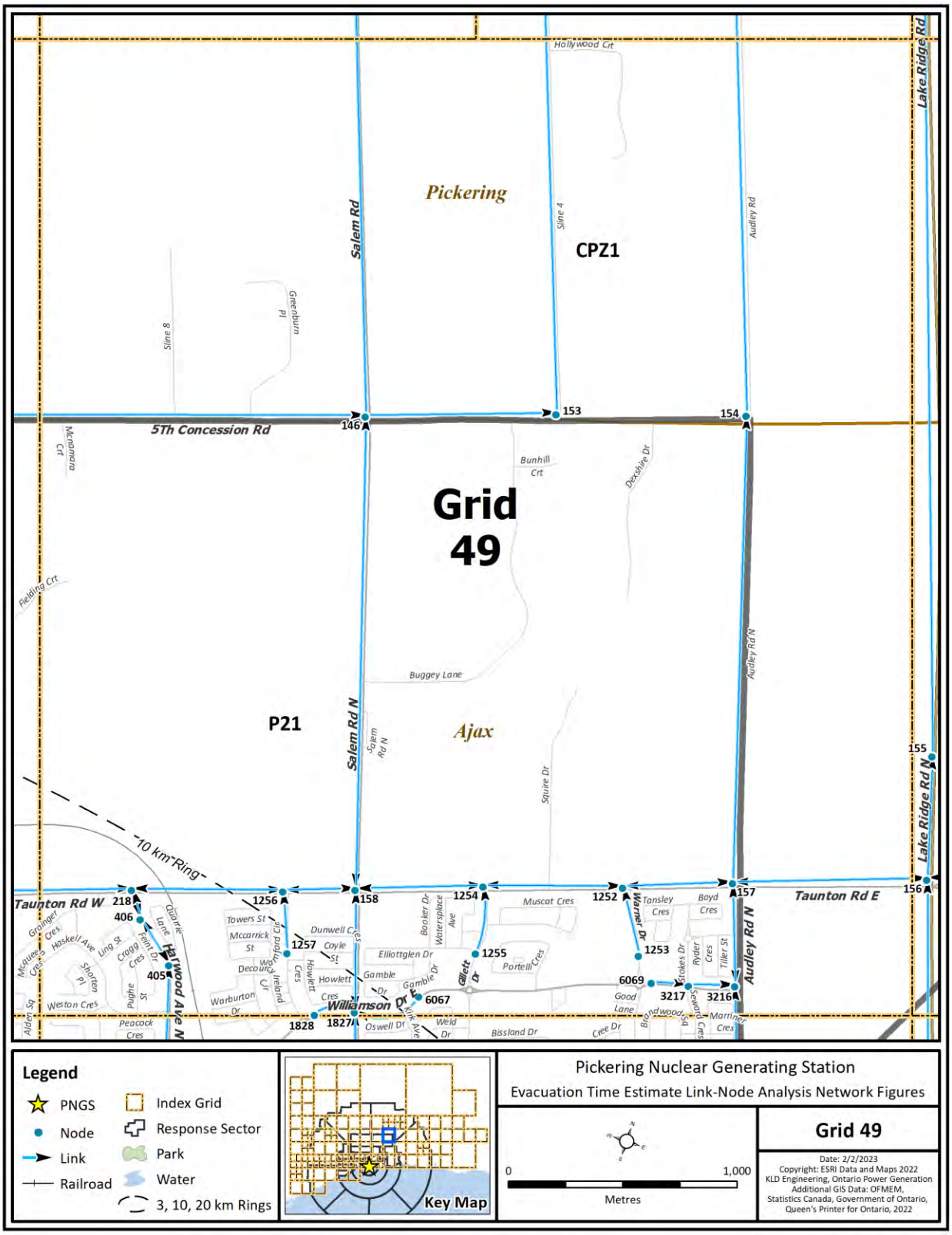


**Figure K-50. Link-Node Analysis Network – Grid 49**

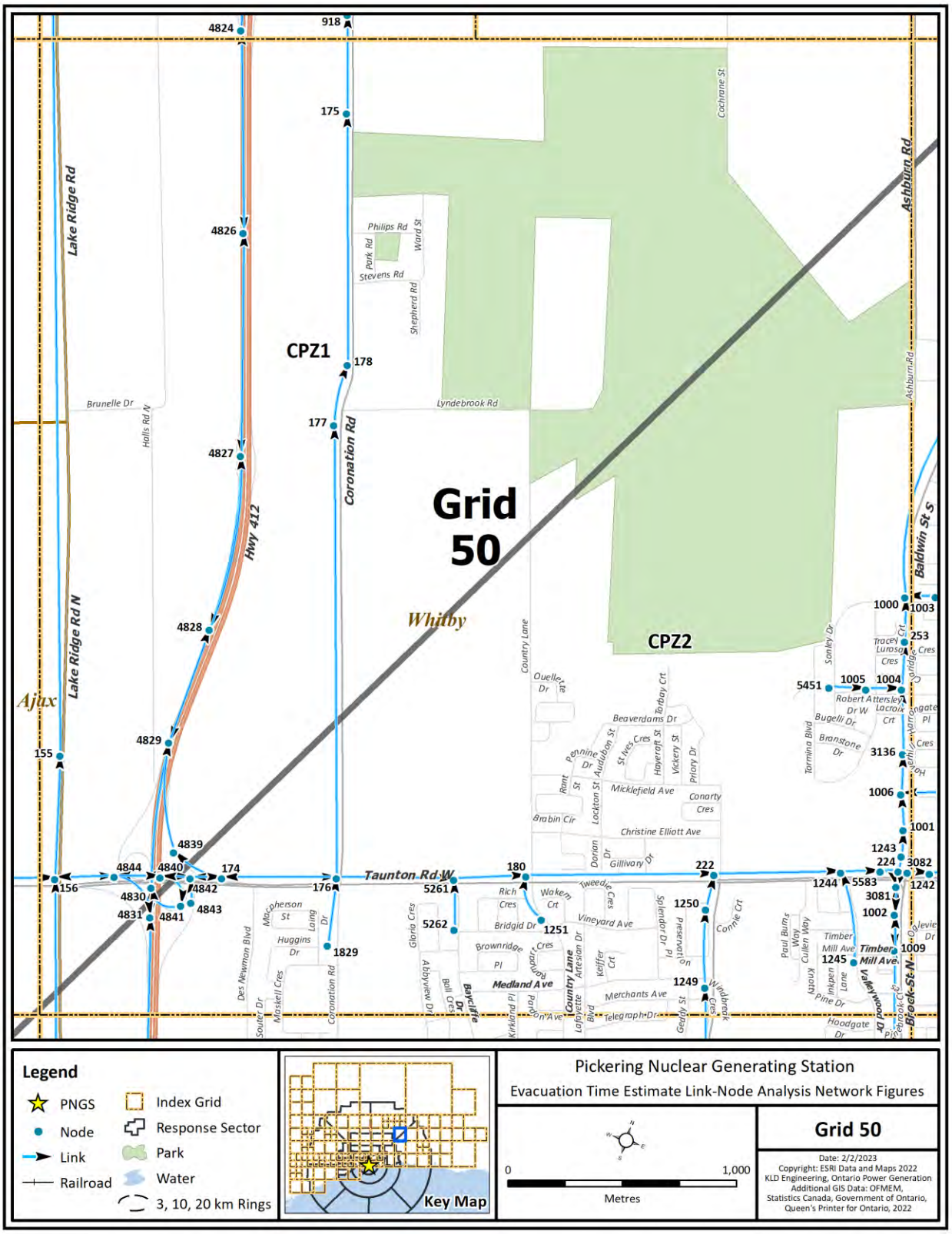


**Figure K-51. Link-Node Analysis Network – Grid 50**

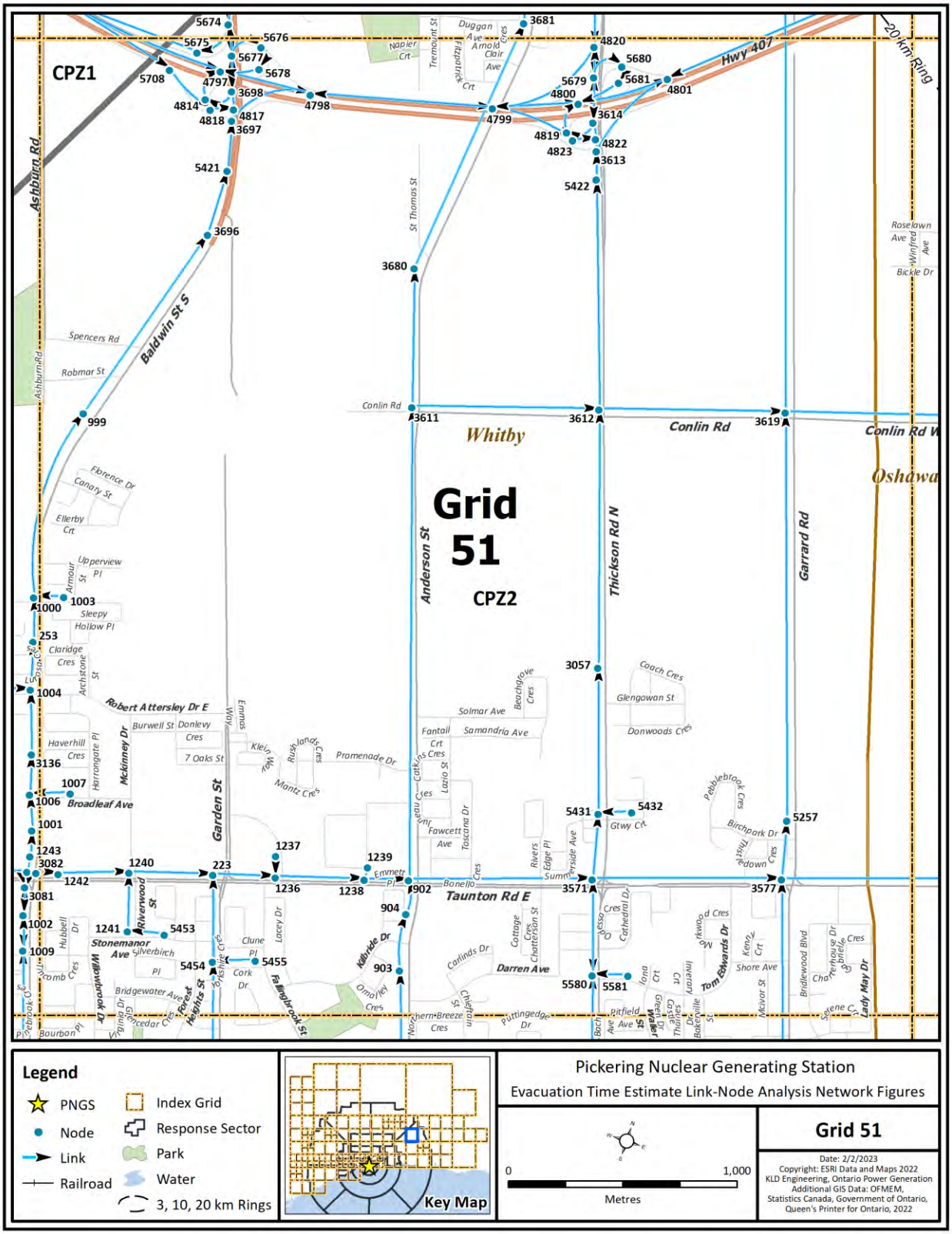


**Figure K-52. Link-Node Analysis Network – Grid 51**

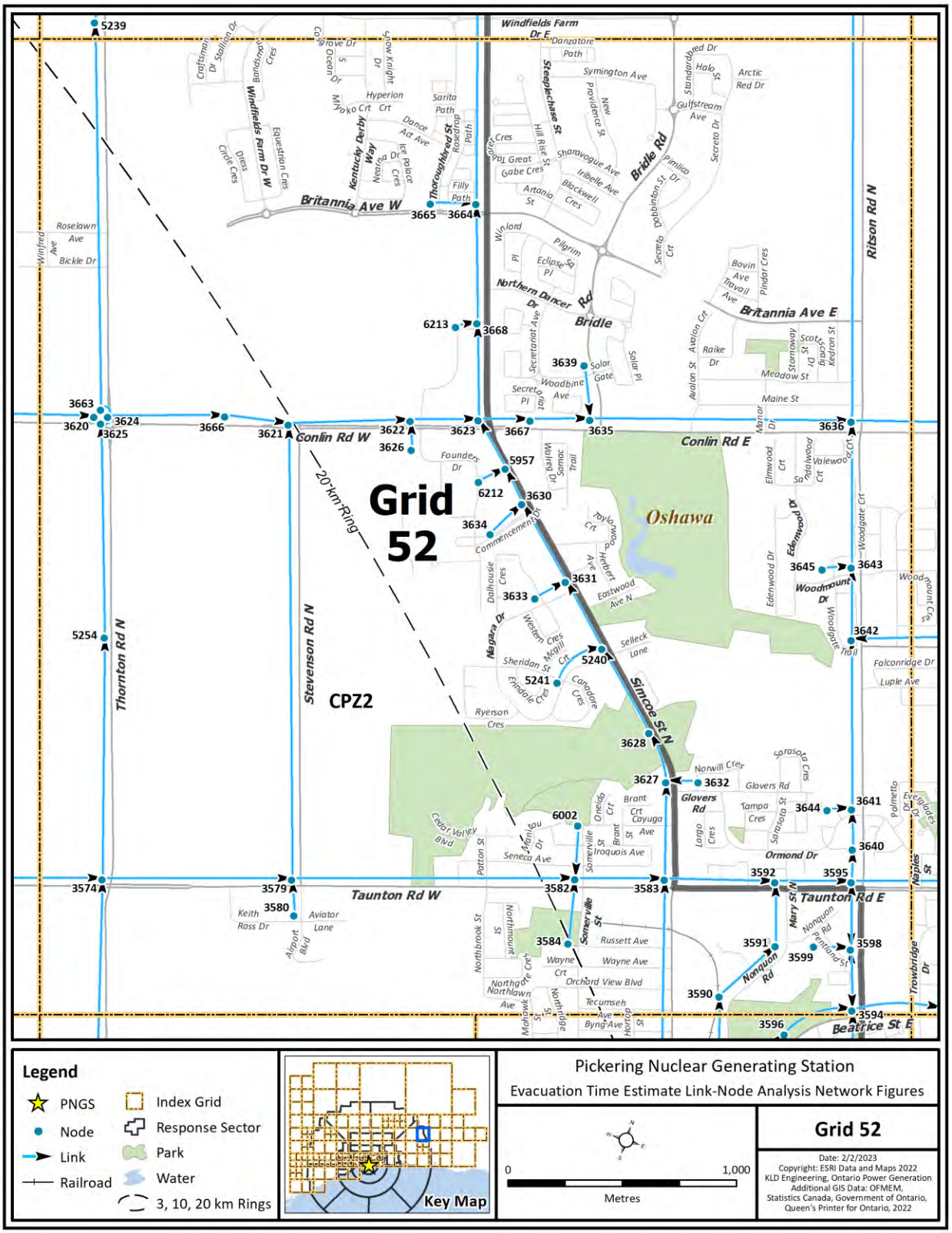


**Figure K-53. Link-Node Analysis Network – Grid 52**

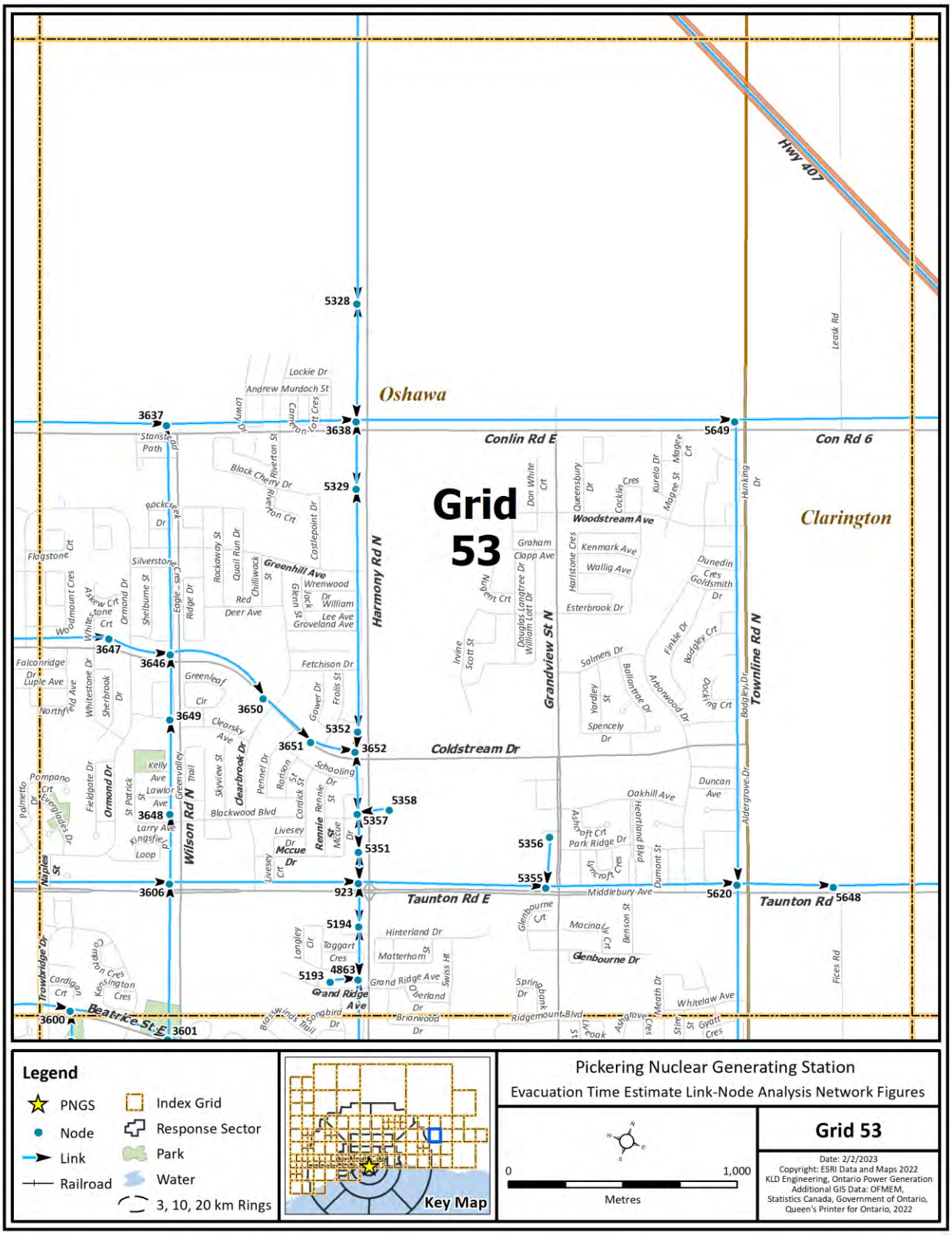


**Figure K-54. Link-Node Analysis Network – Grid 53**

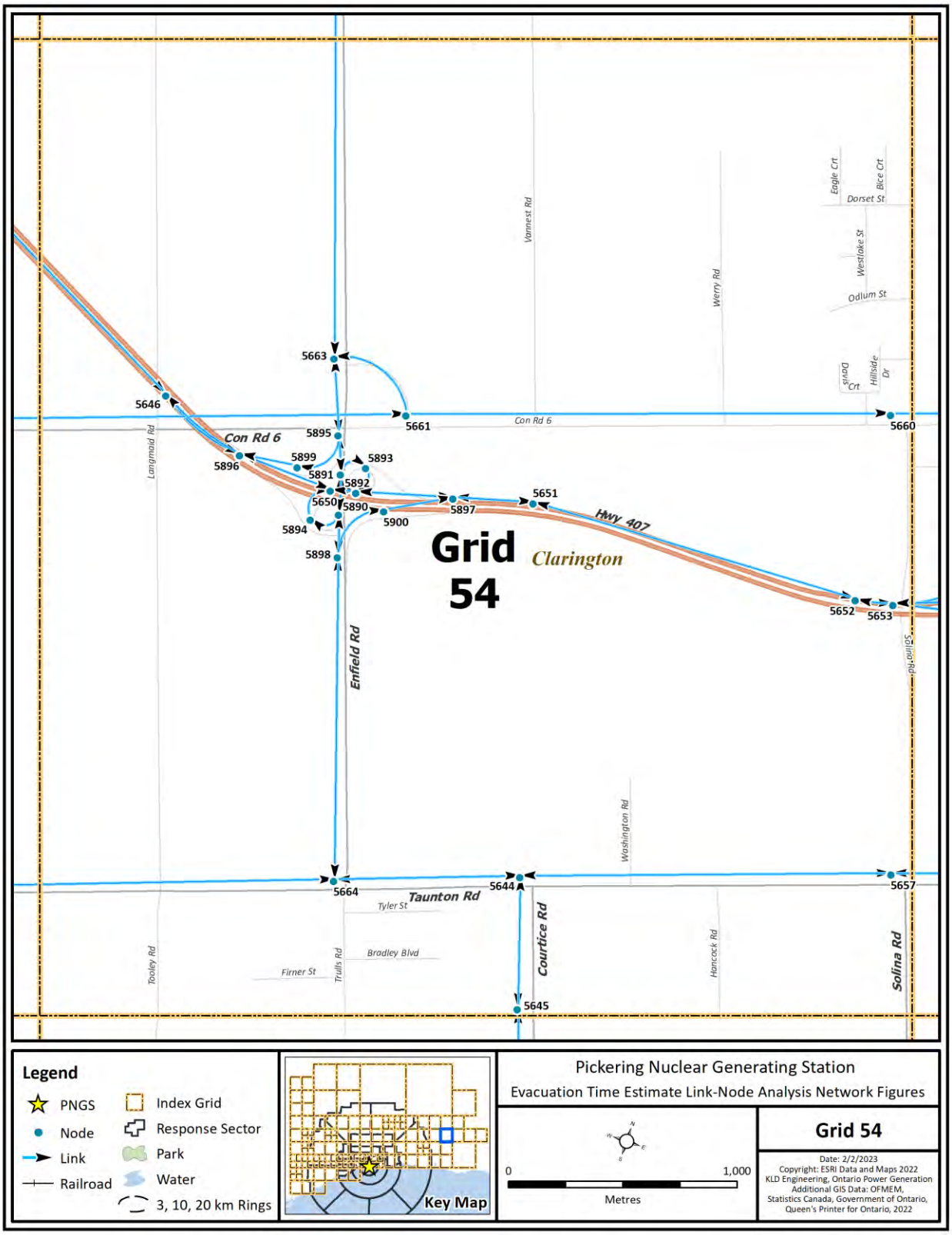


**Figure K-55. Link-Node Analysis Network – Grid 54**

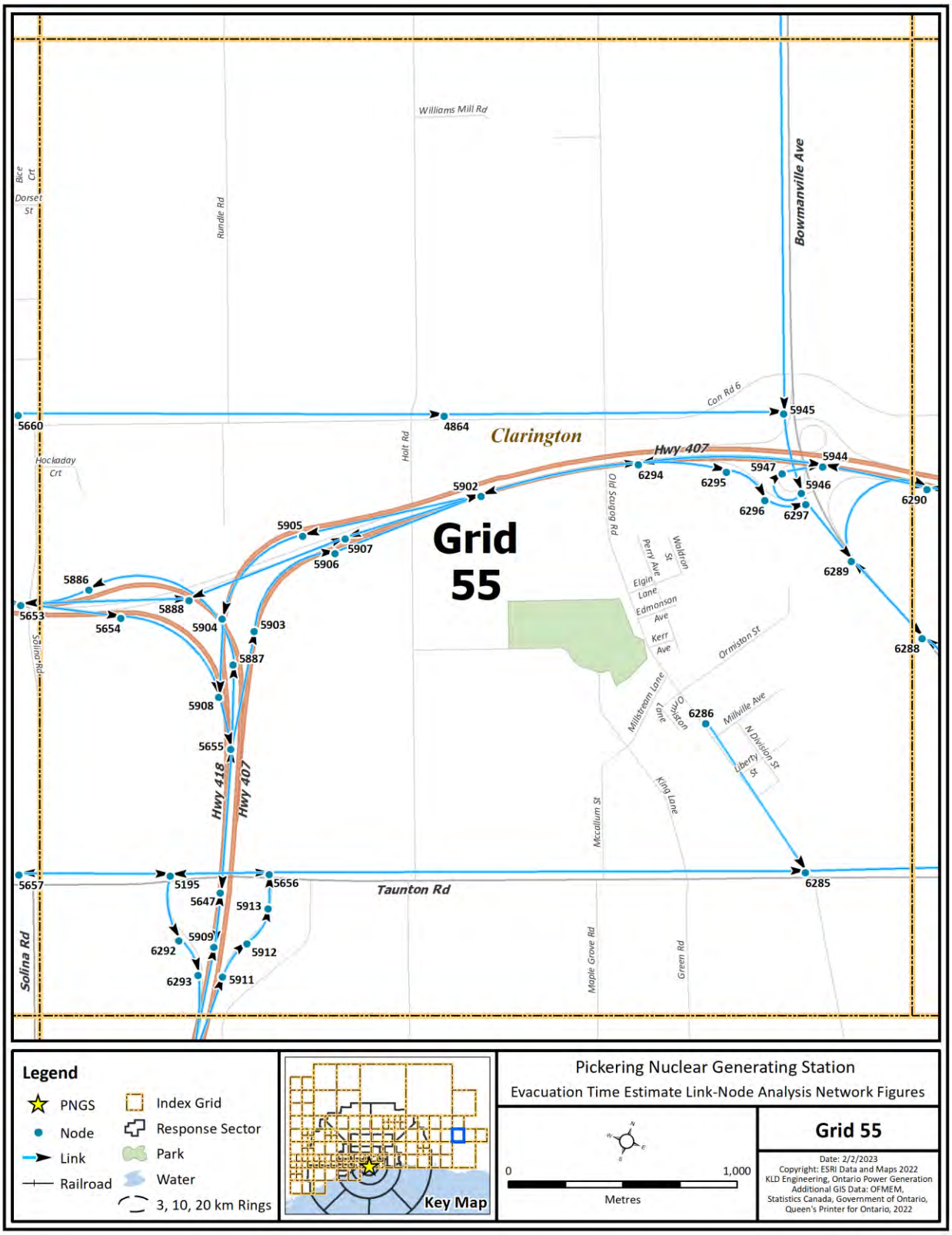


**Figure K-56. Link-Node Analysis Network – Grid 55**

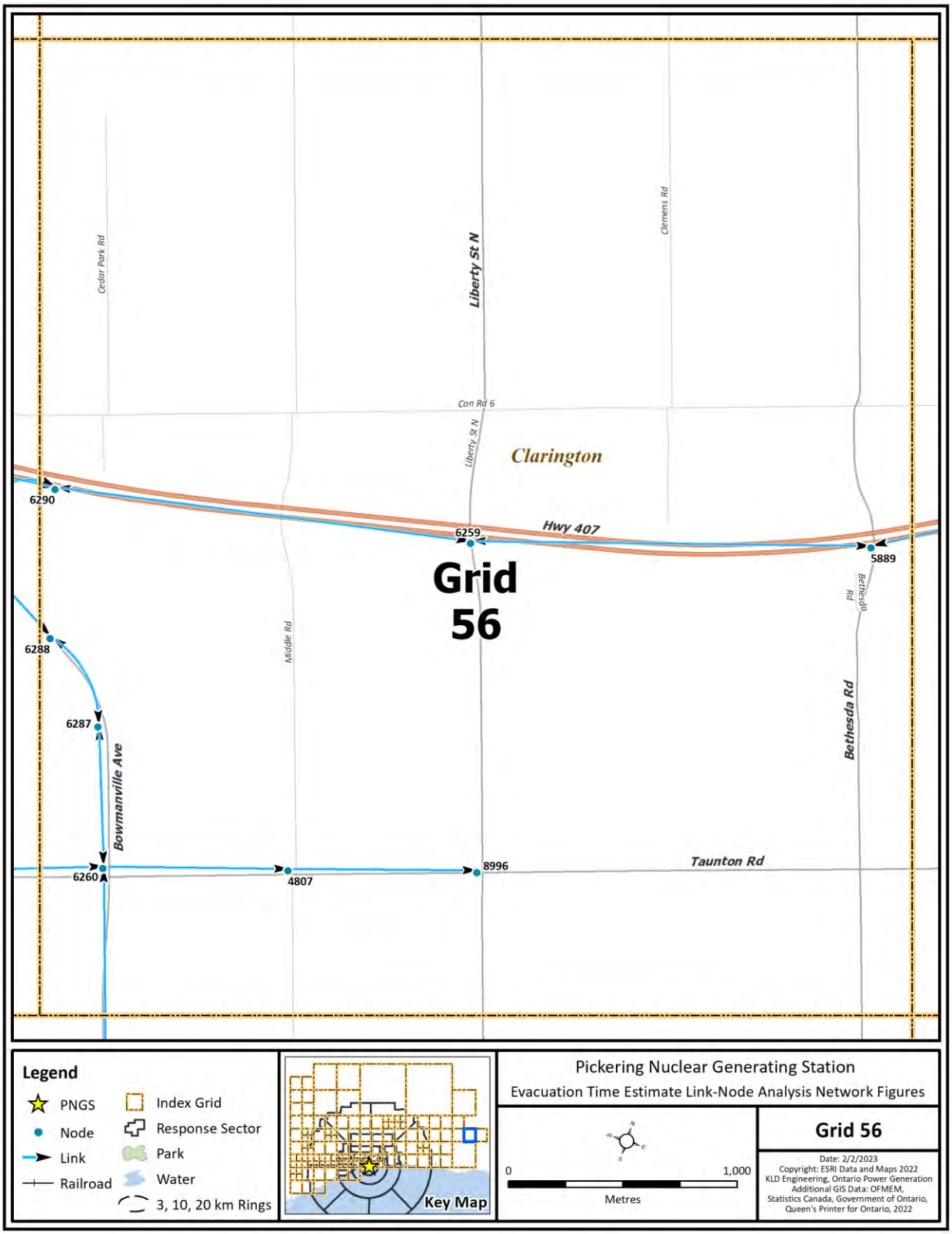


**Figure K-57. Link-Node Analysis Network – Grid 56**

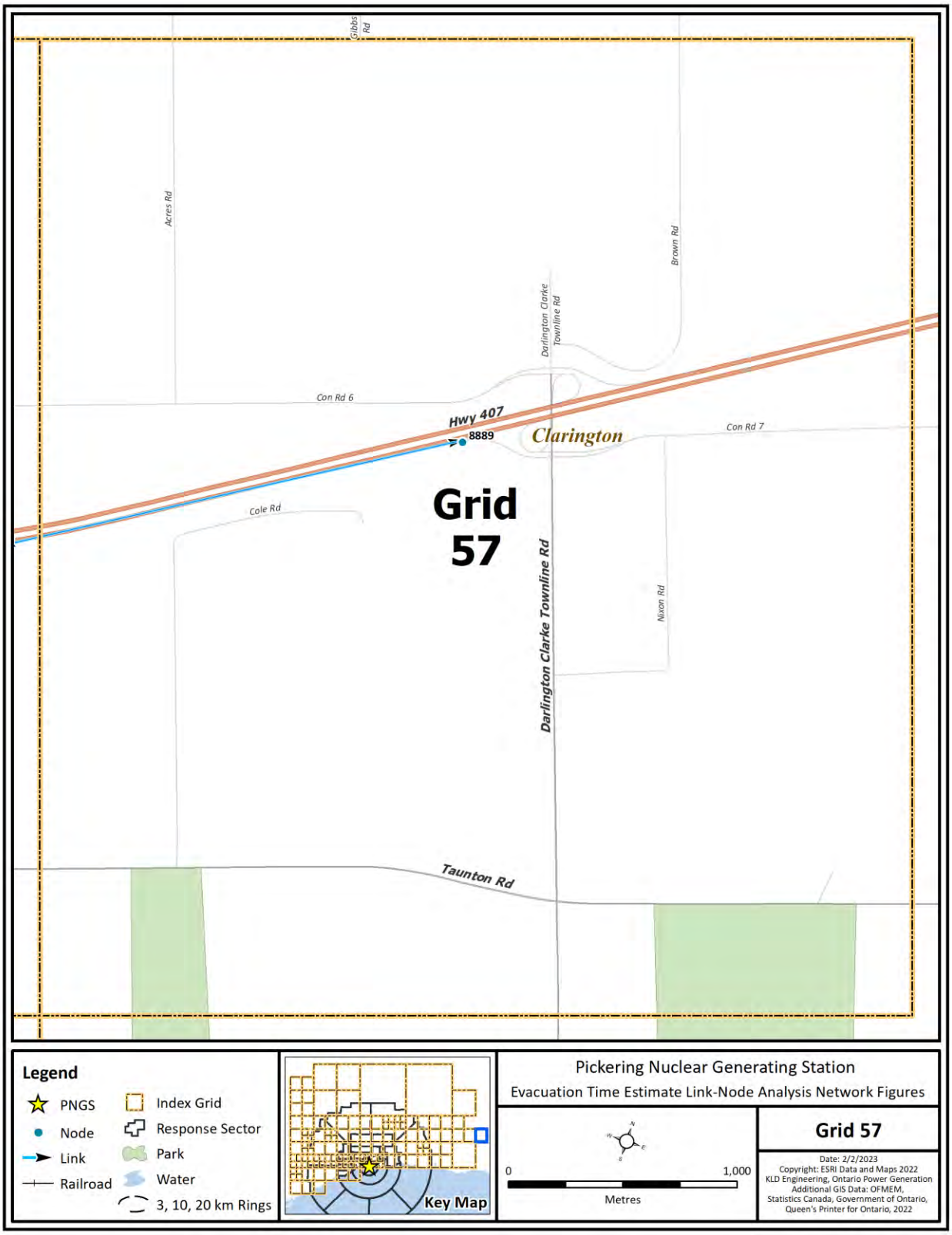


**Figure K-58. Link-Node Analysis Network – Grid 57**

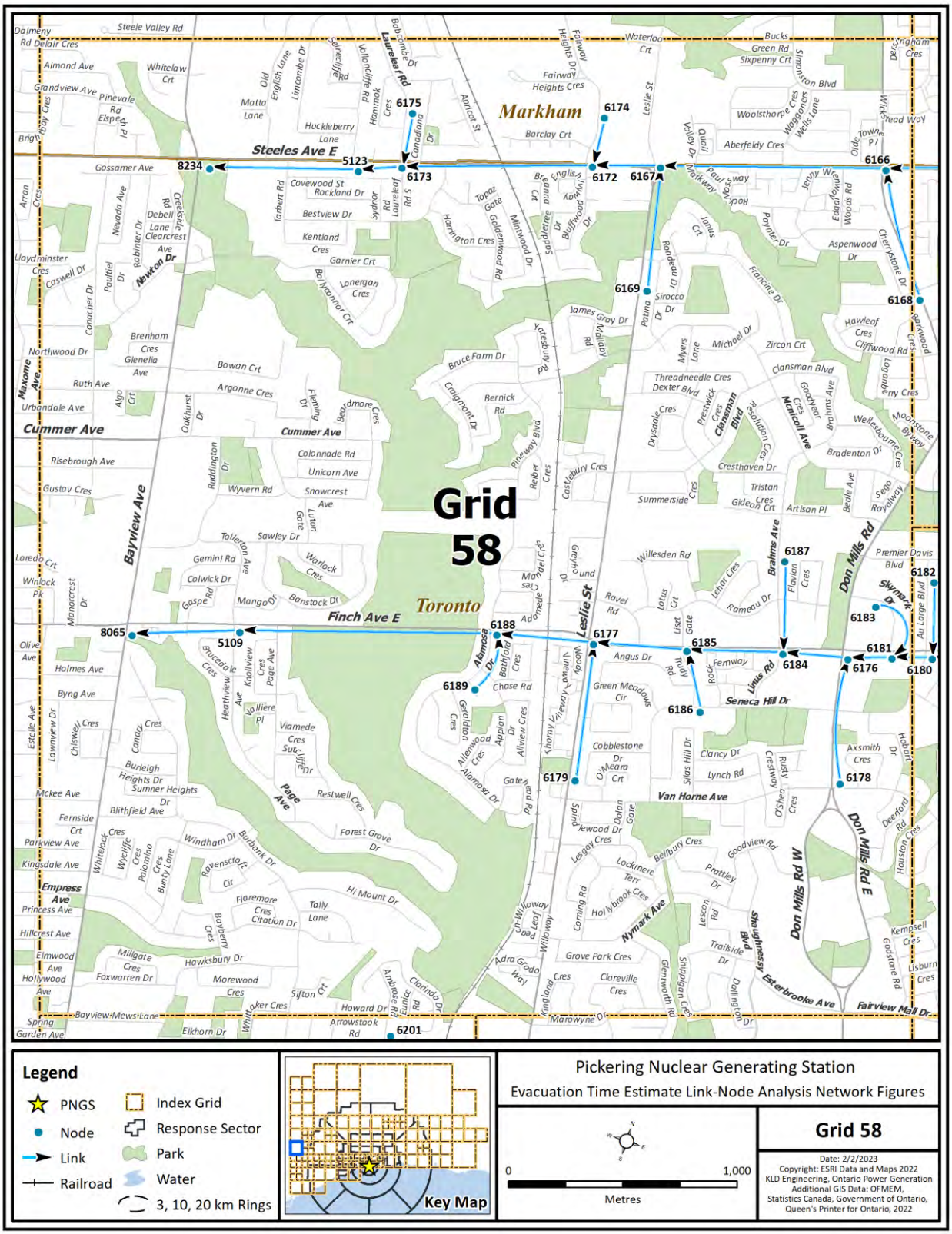


**Figure K-59. Link-Node Analysis Network – Grid 58**

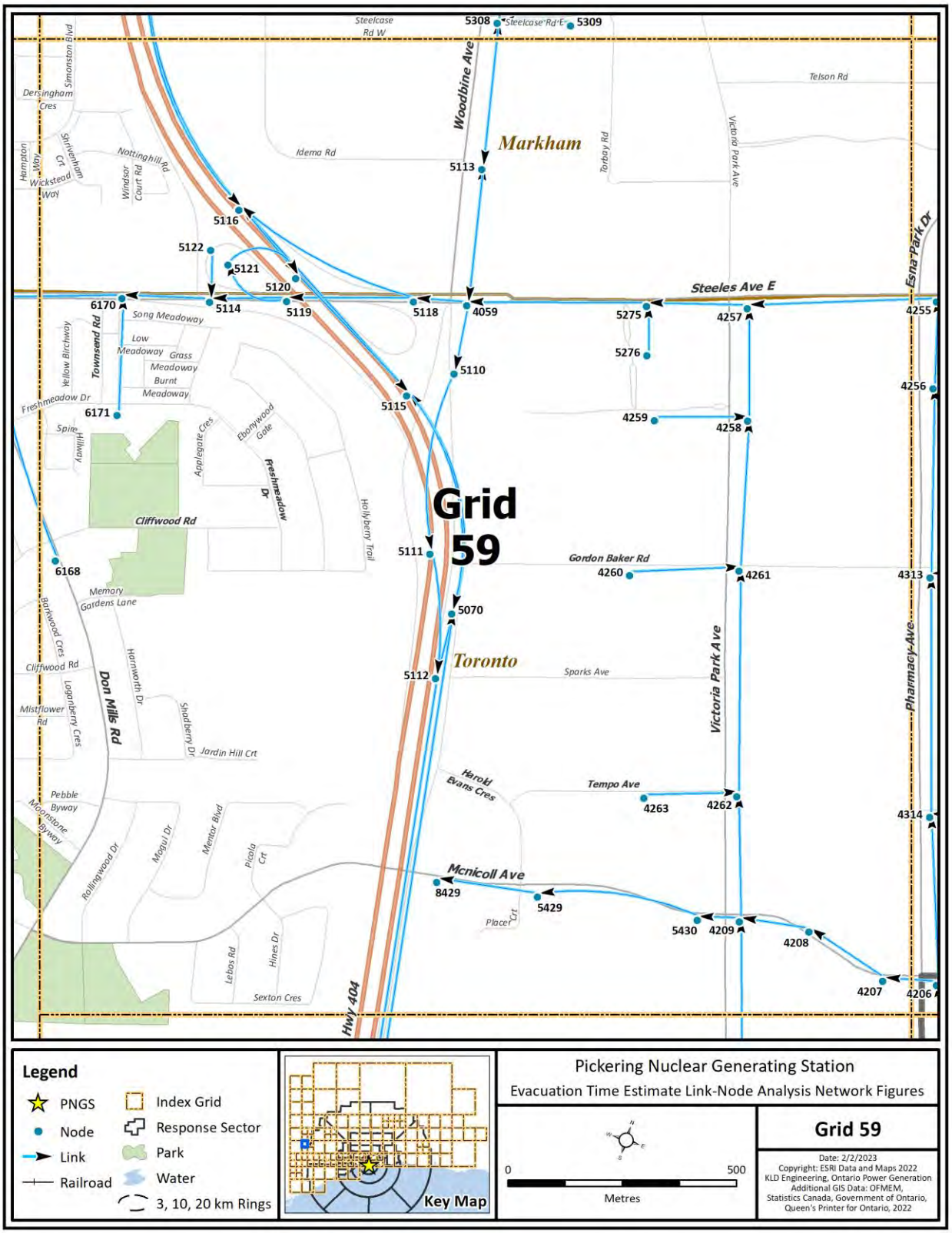


**Figure K-60. Link-Node Analysis Network – Grid 59**

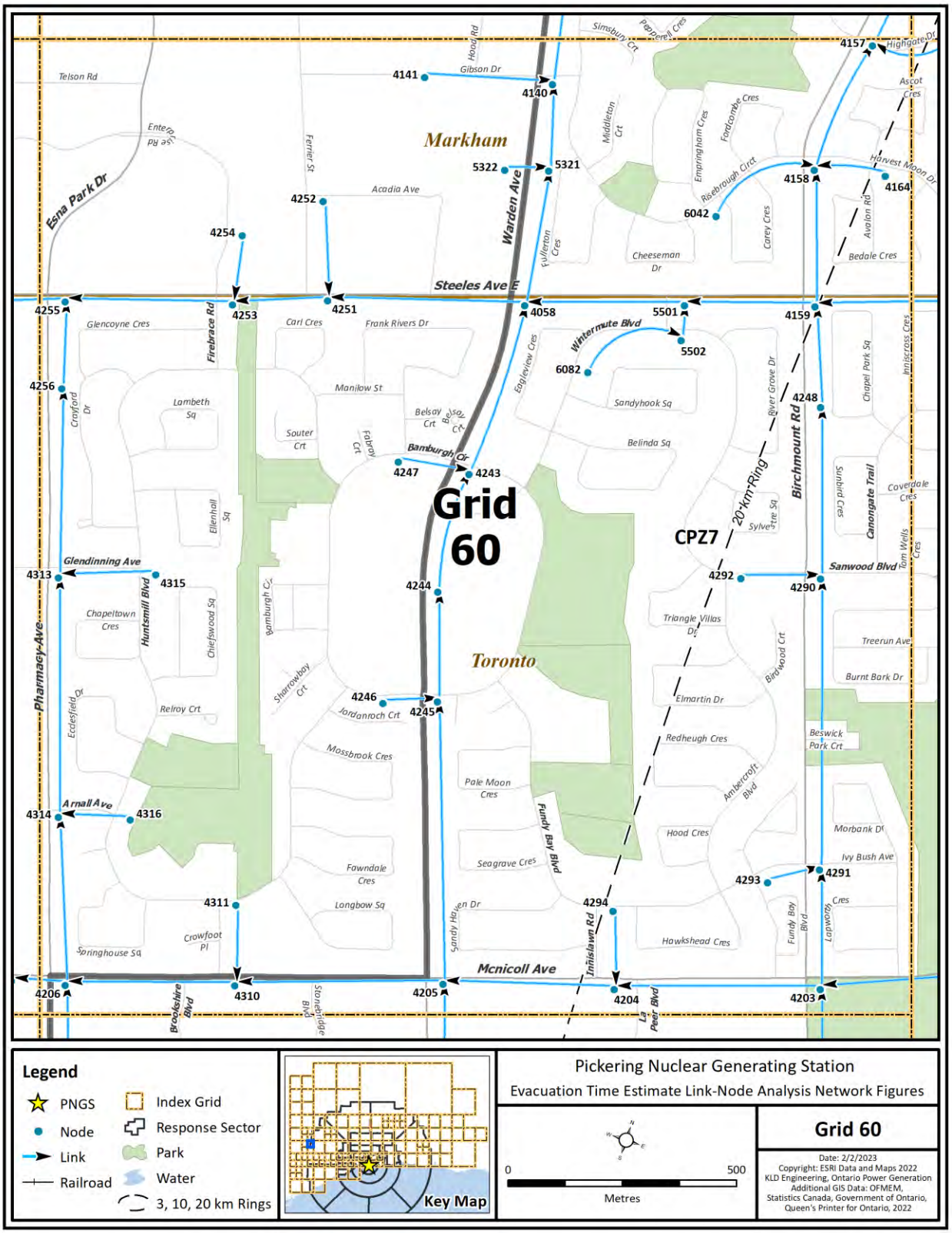


**Figure K-61. Link-Node Analysis Network – Grid 60**

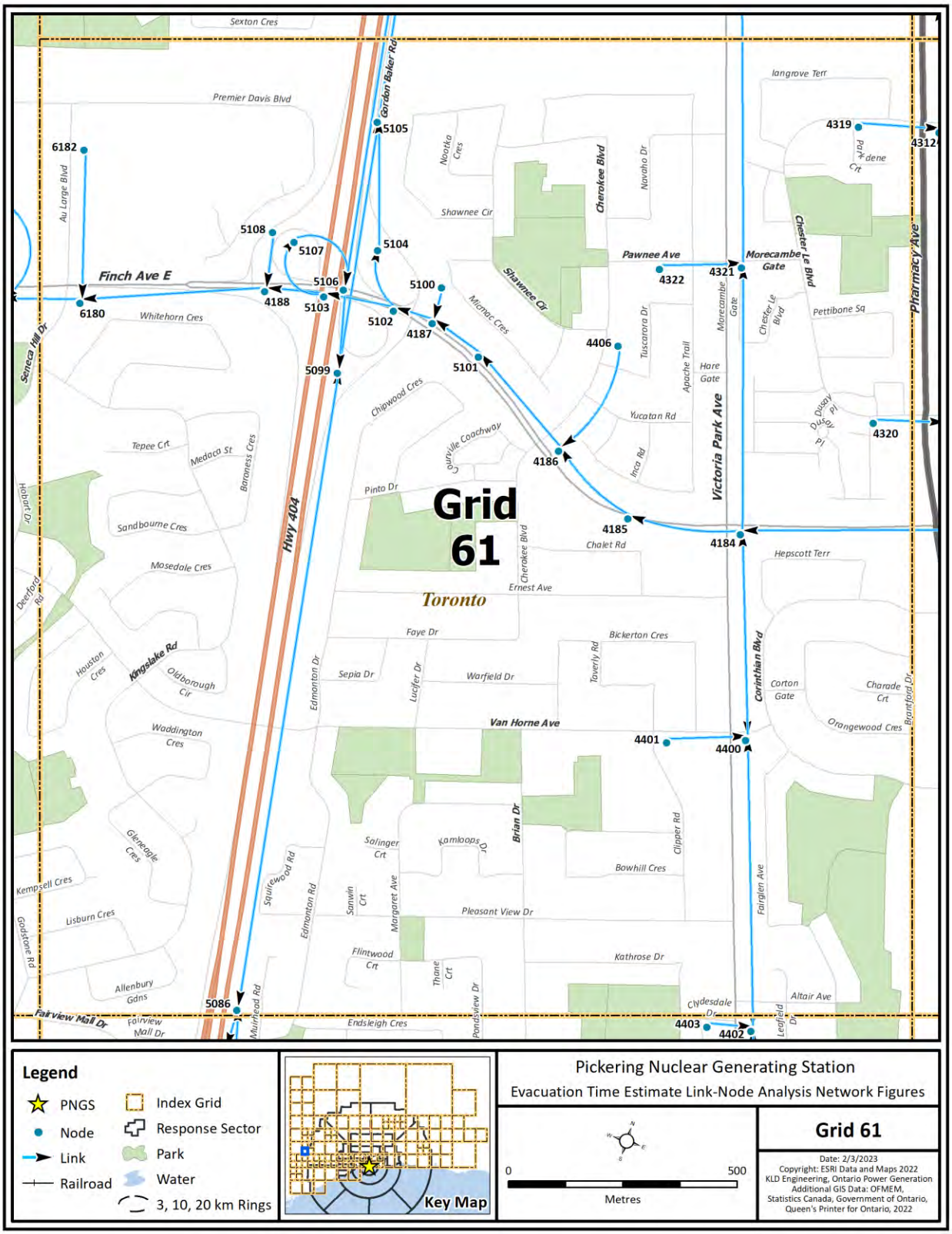


**Figure K-62. Link-Node Analysis Network – Grid 61**

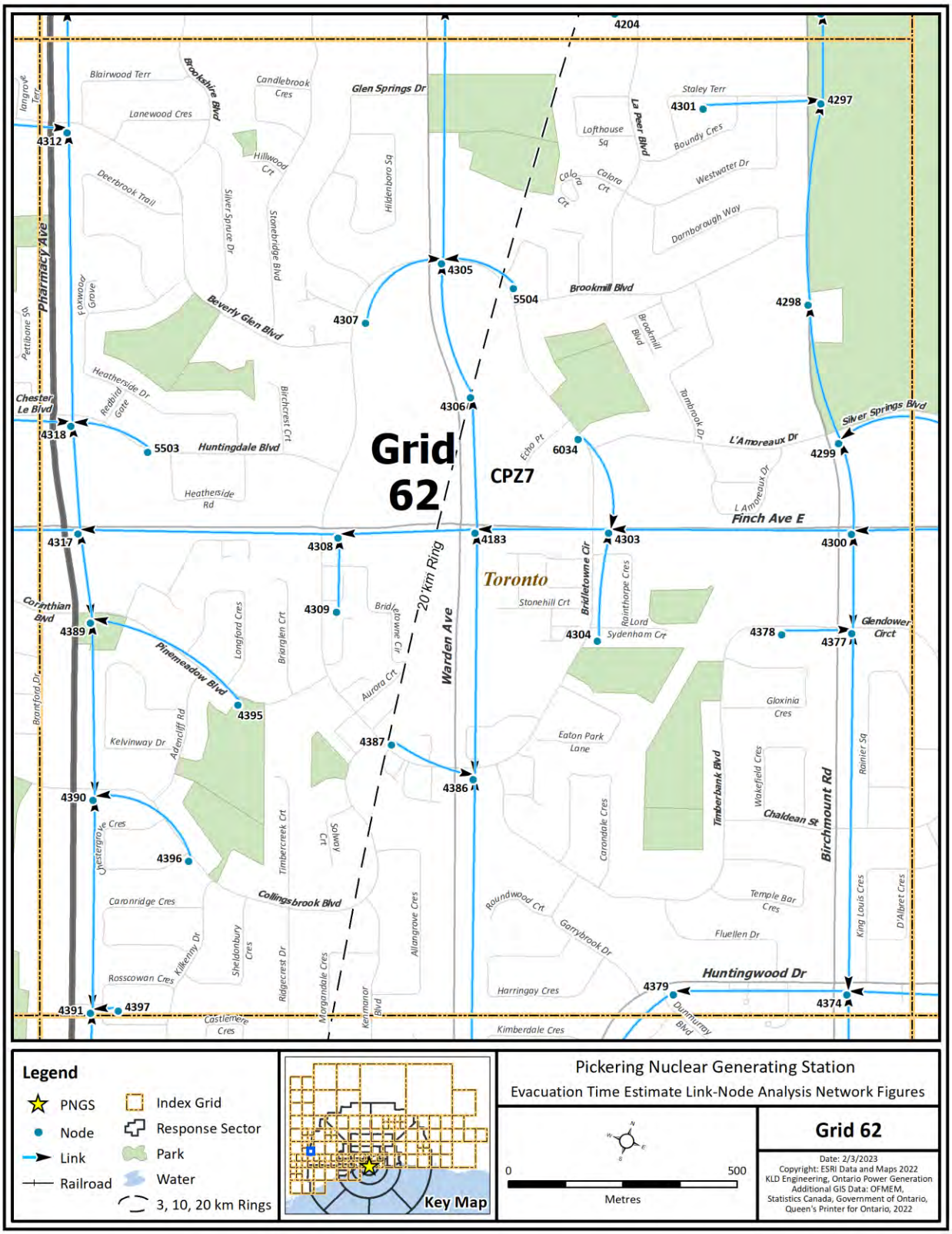


**Figure K-63. Link-Node Analysis Network – Grid 62**

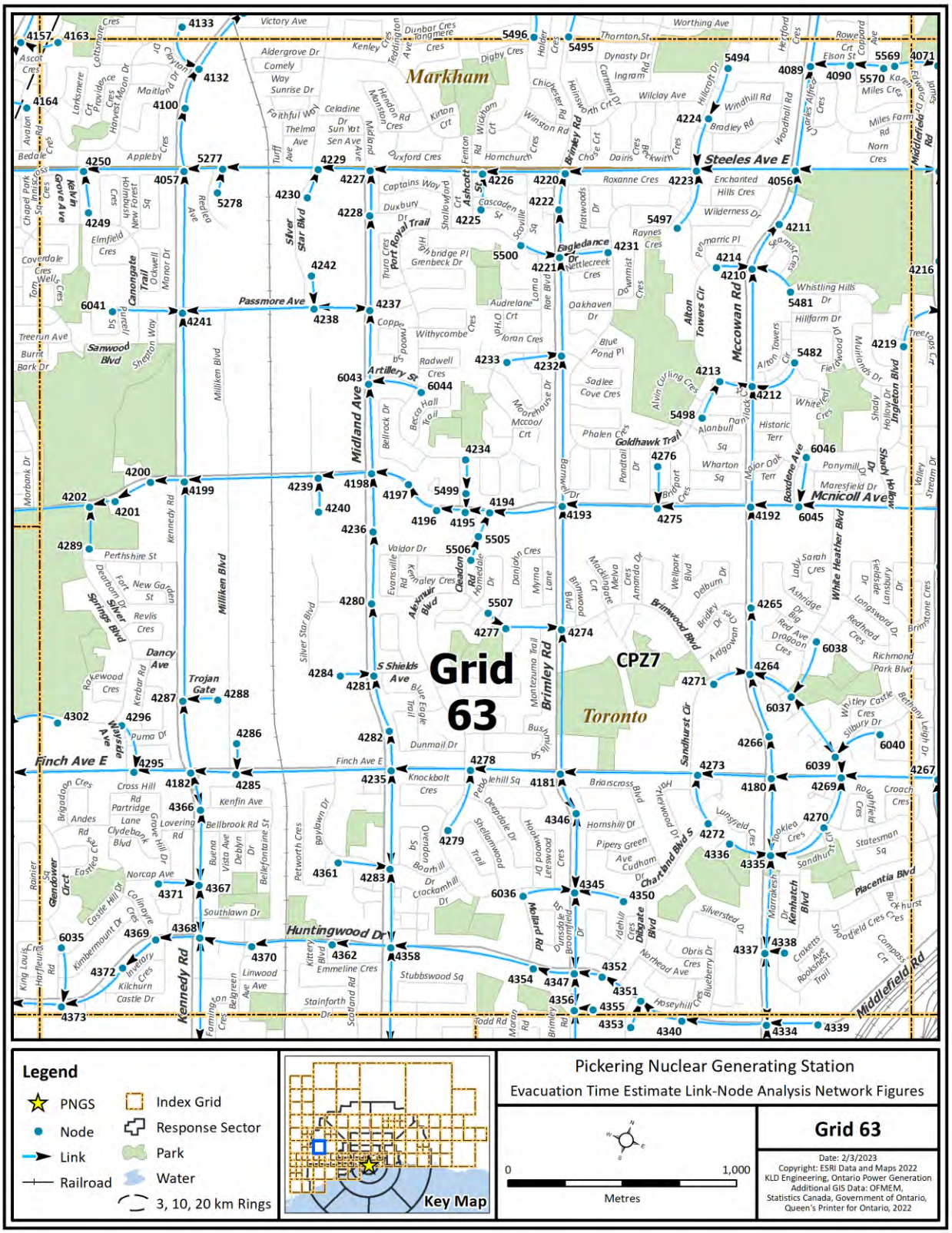


**Figure K-64. Link-Node Analysis Network – Grid 63**

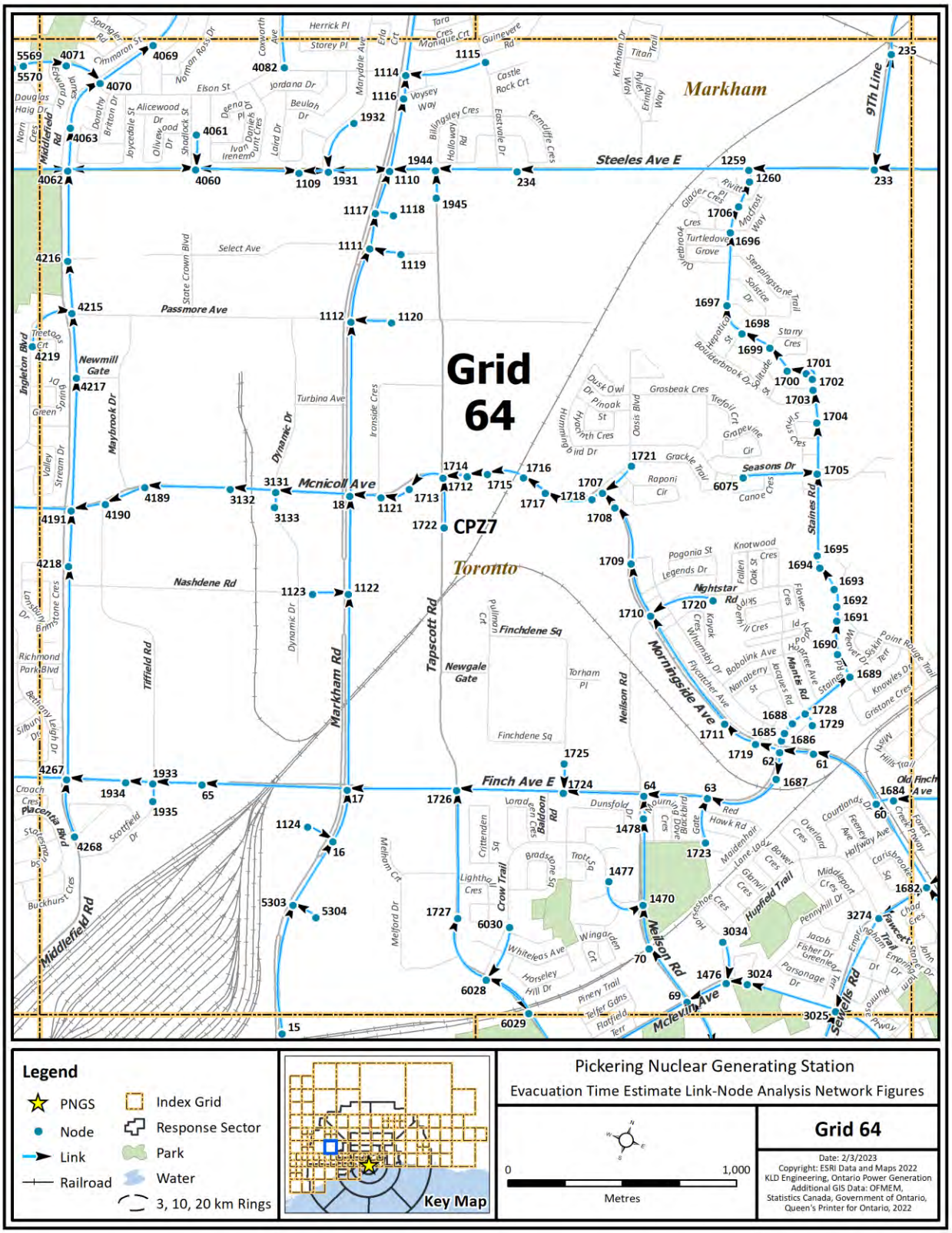


**Figure K-65. Link-Node Analysis Network – Grid 64**

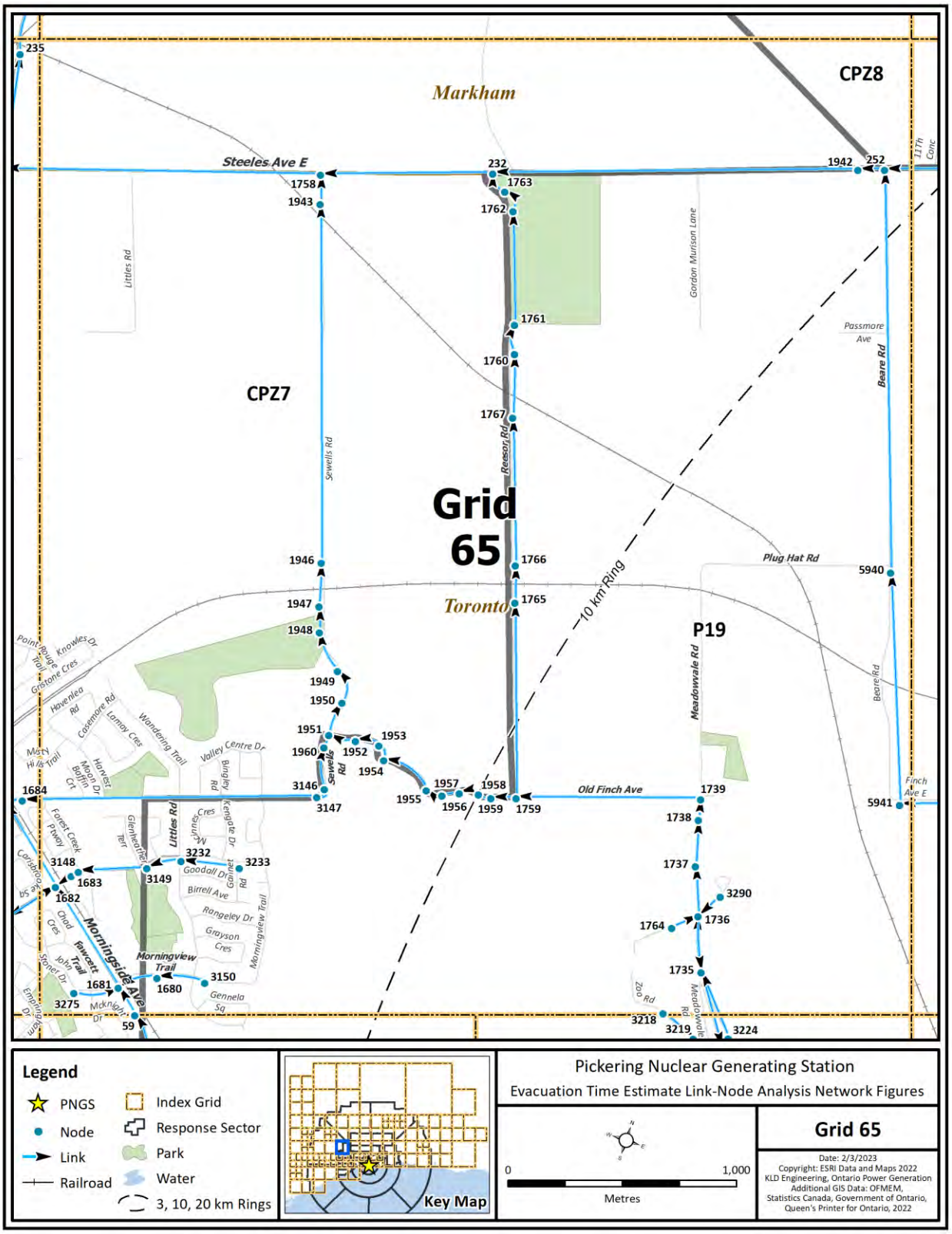


**Figure K-66. Link-Node Analysis Network – Grid 65**

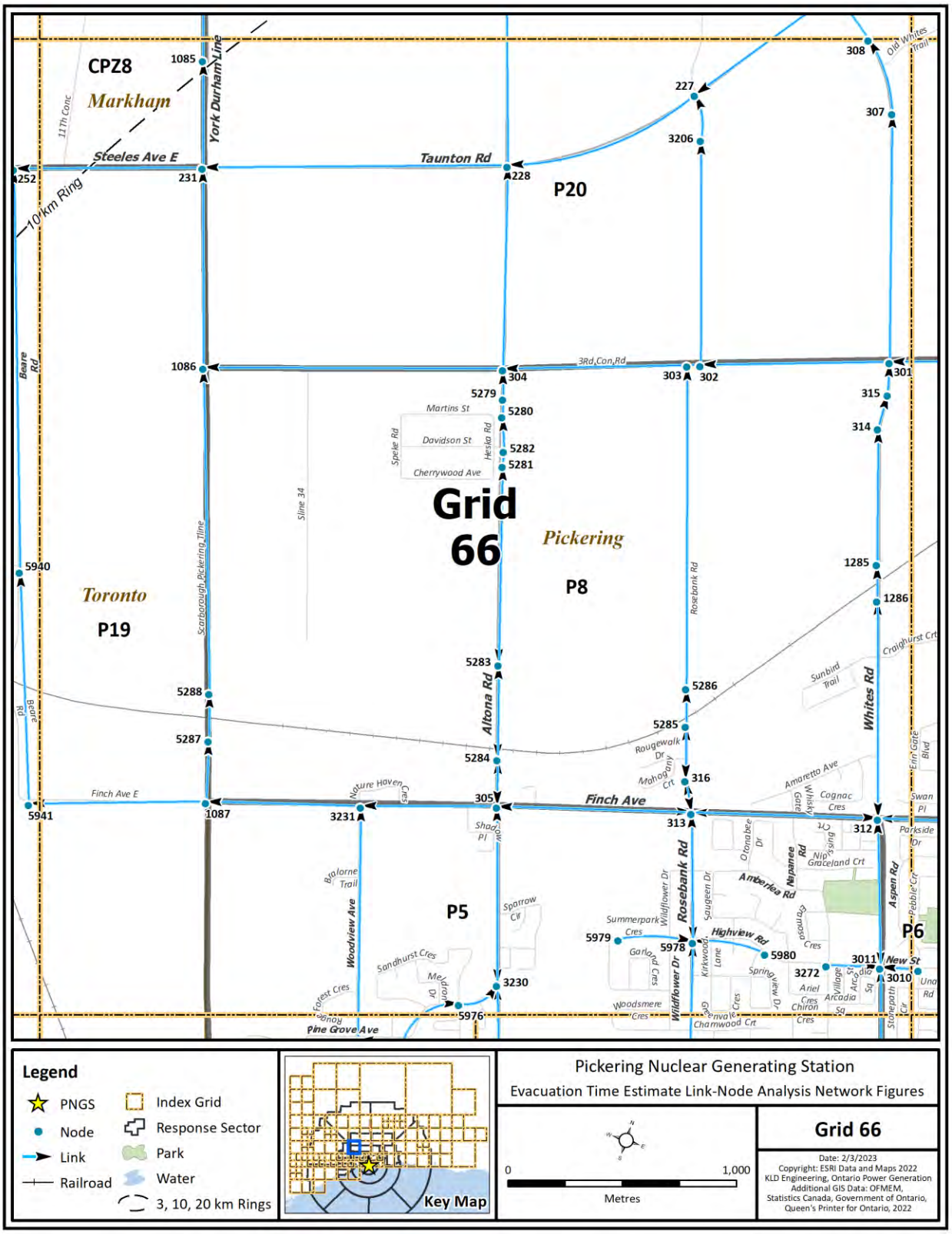


**Figure K-67. Link-Node Analysis Network – Grid 66**

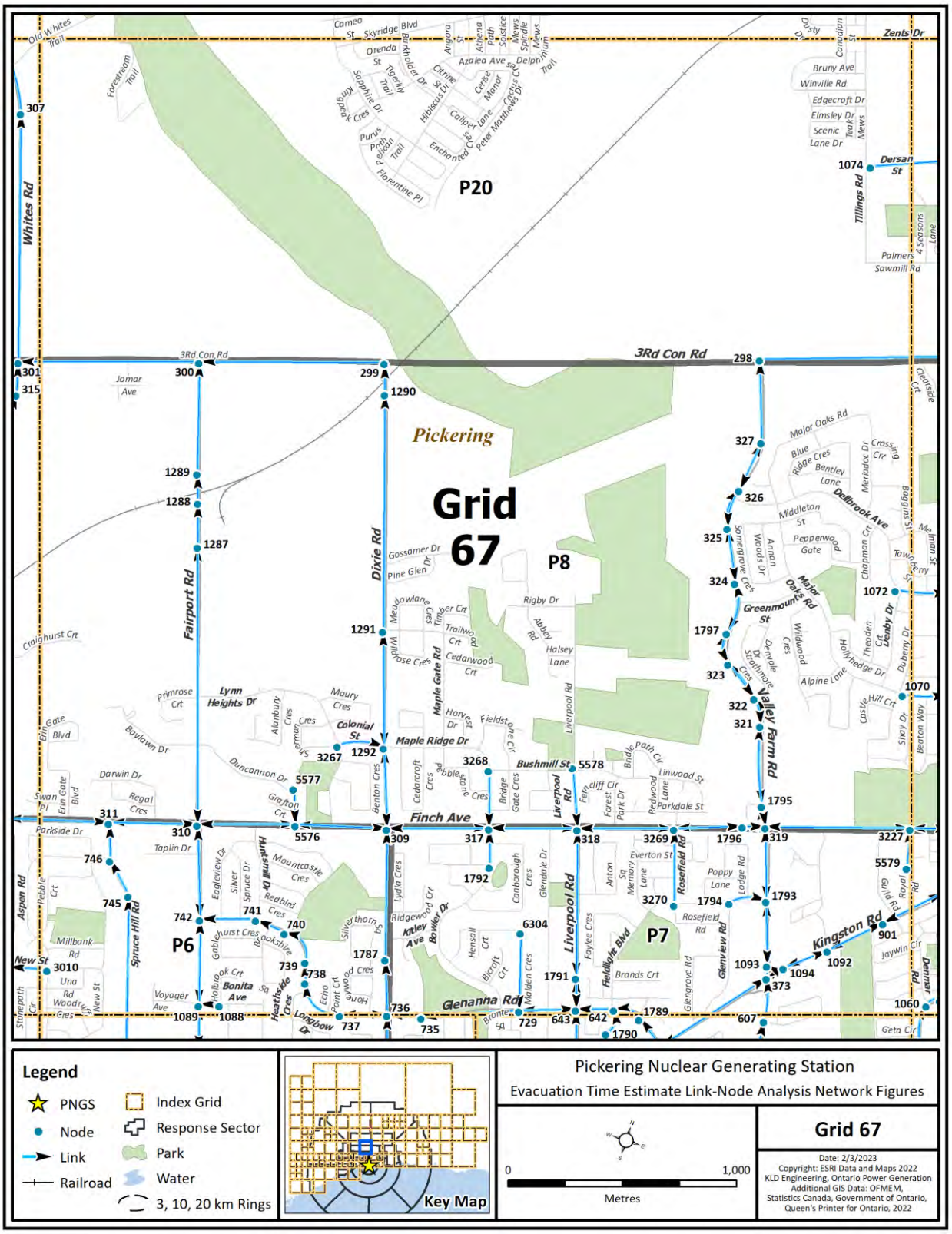


**Figure K-68. Link-Node Analysis Network – Grid 67**

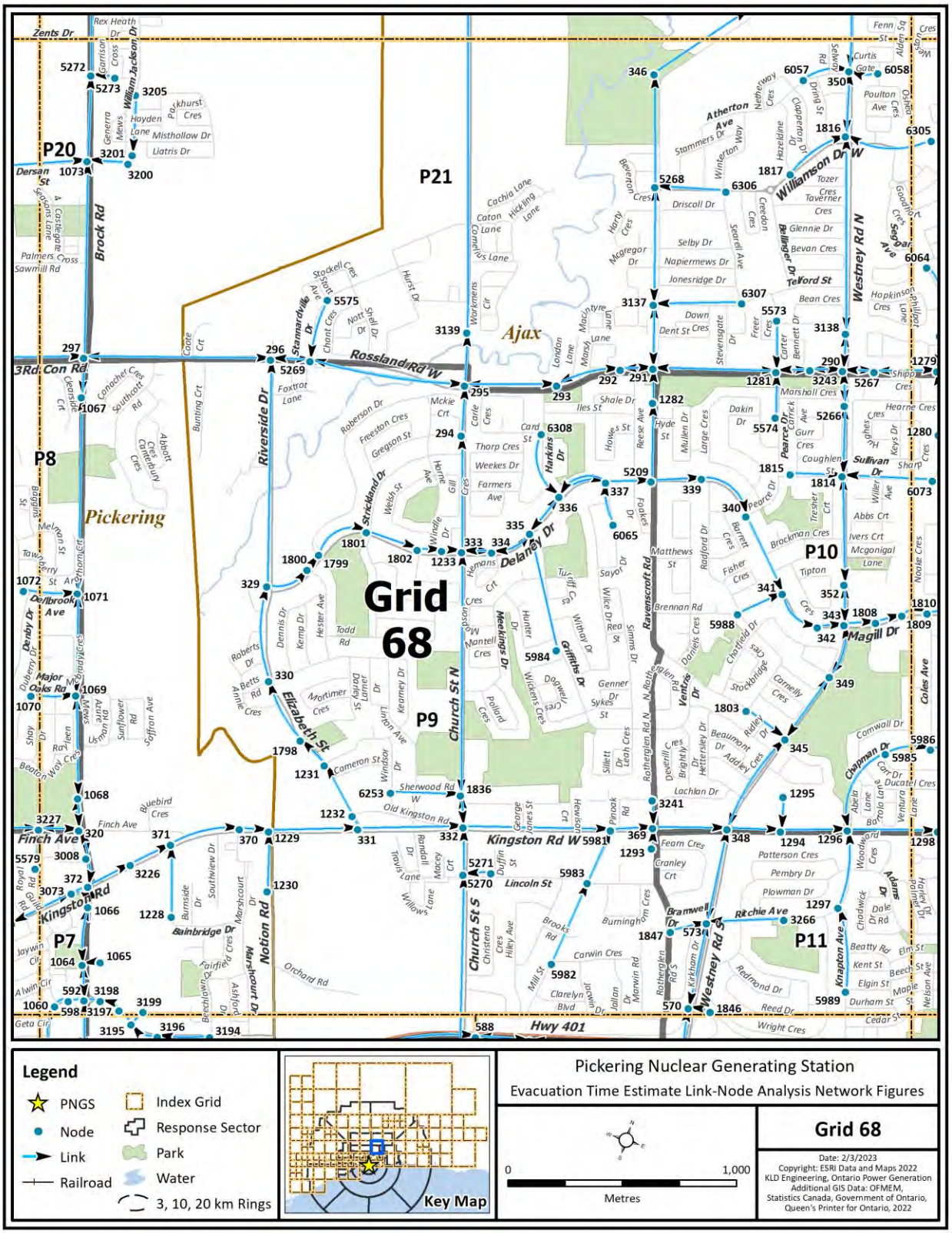


**Figure K-69. Link-Node Analysis Network – Grid 68**

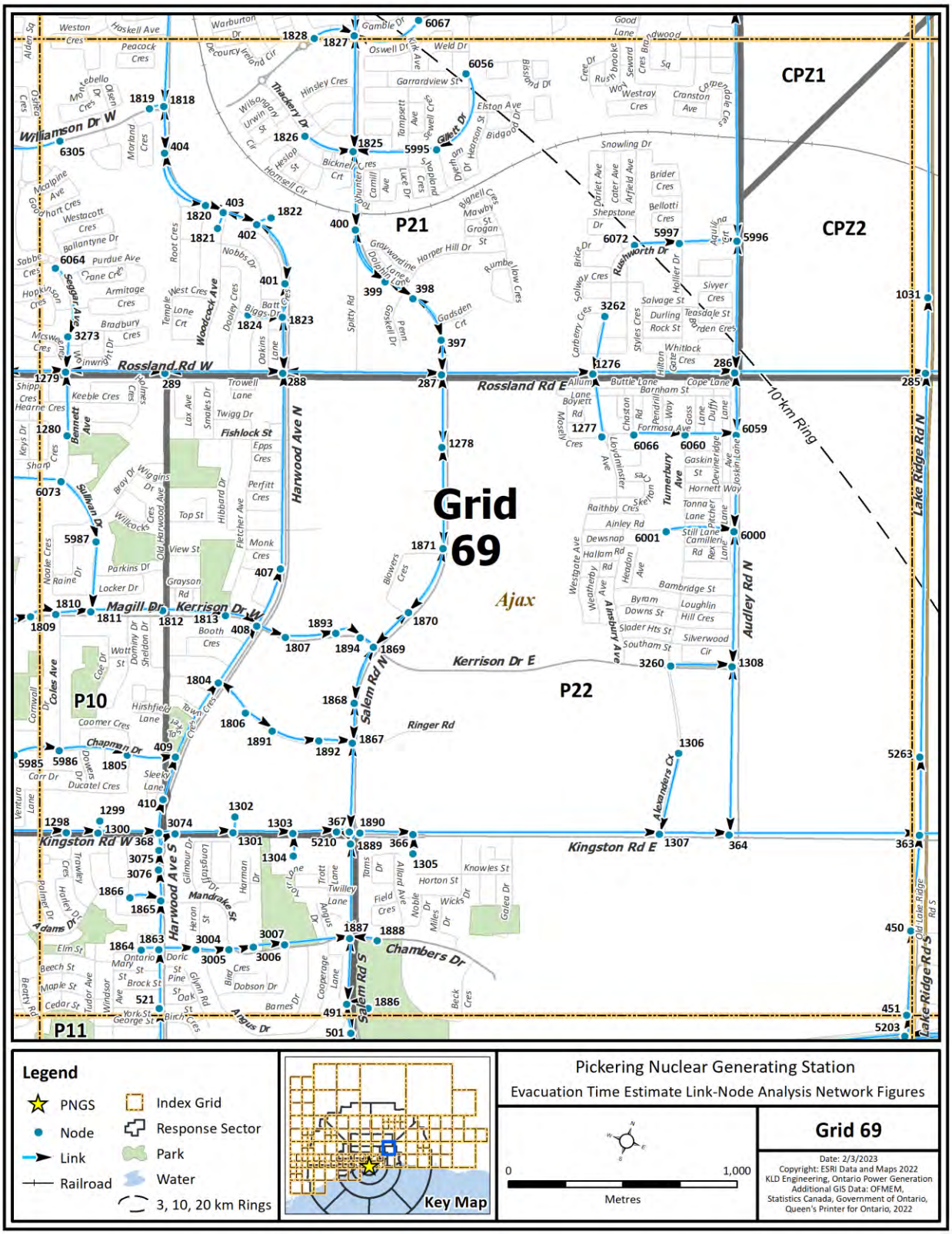


**Figure K-70. Link-Node Analysis Network – Grid 69**

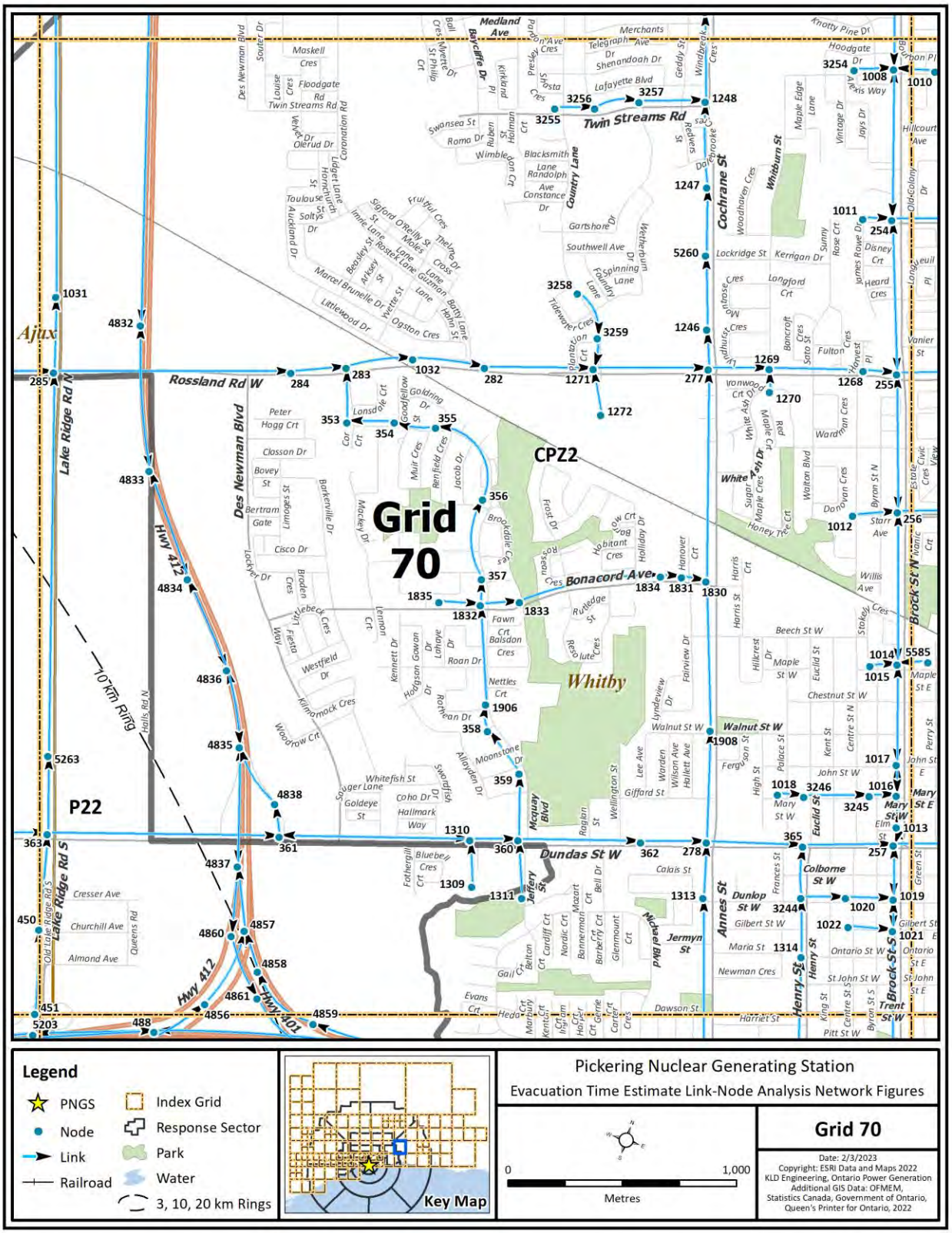


**Figure K-71. Link-Node Analysis Network – Grid 70**

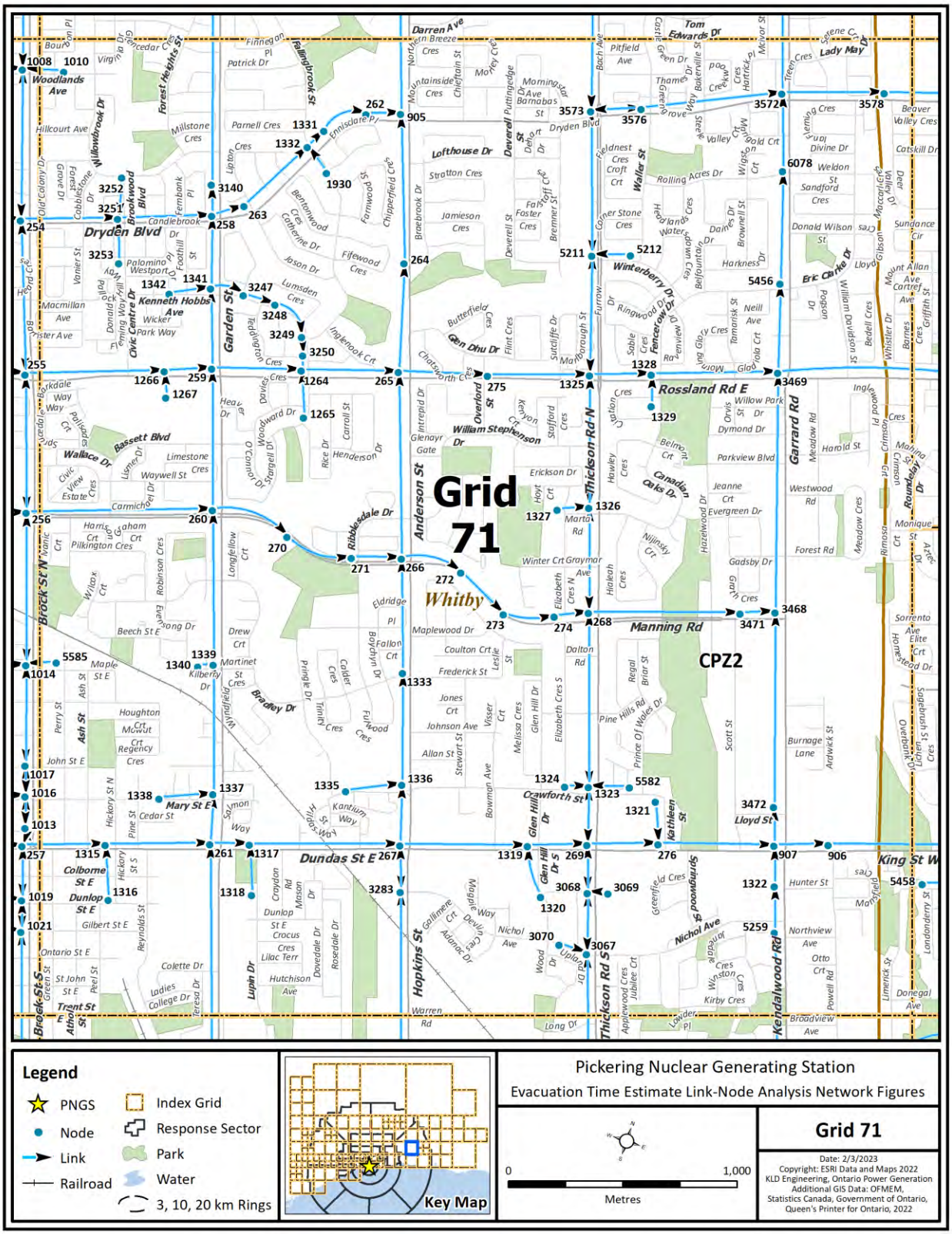


**Figure K-72. Link-Node Analysis Network – Grid 71**

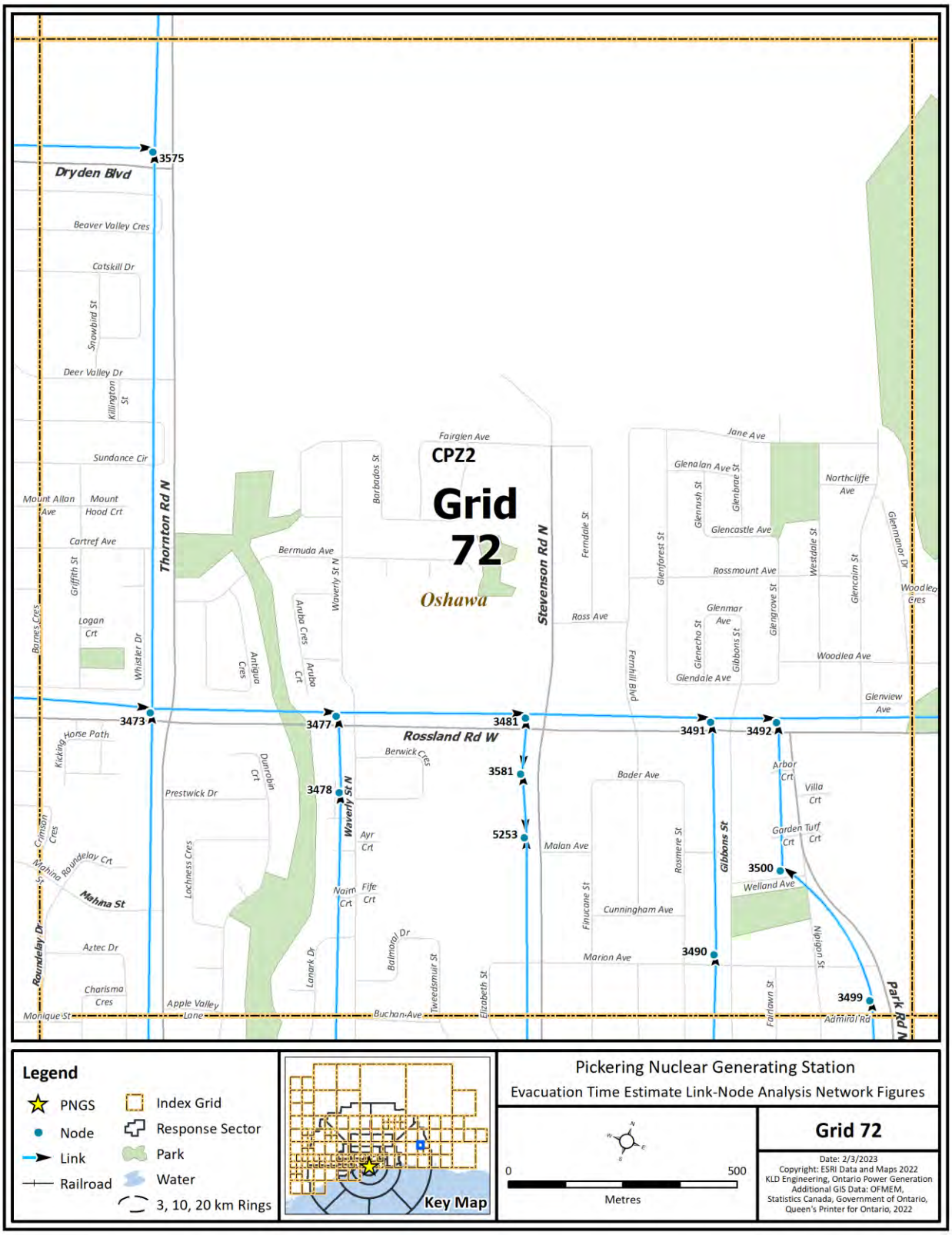


**Figure K-73. Link-Node Analysis Network – Grid 72**

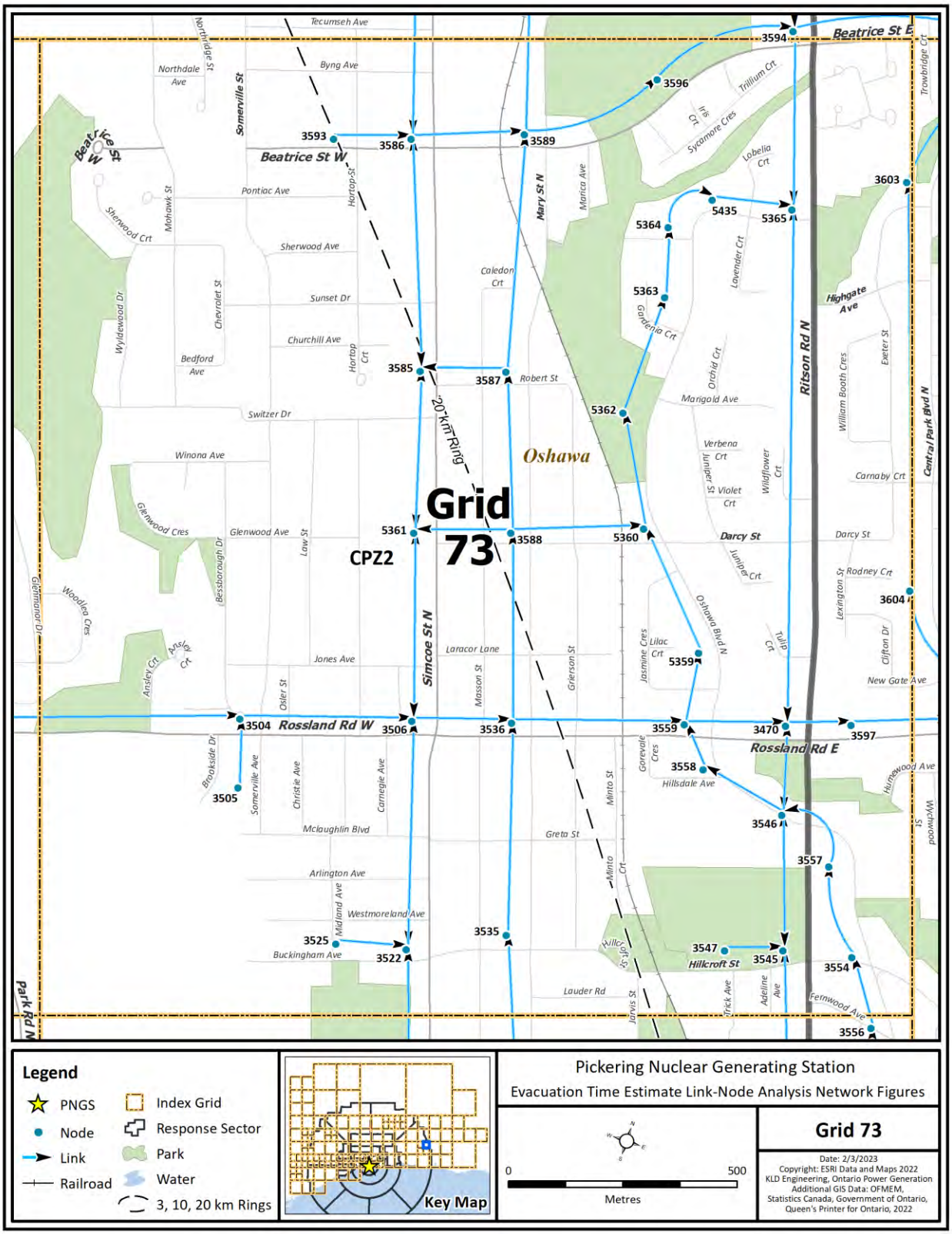


**Figure K-74. Link-Node Analysis Network – Grid 73**

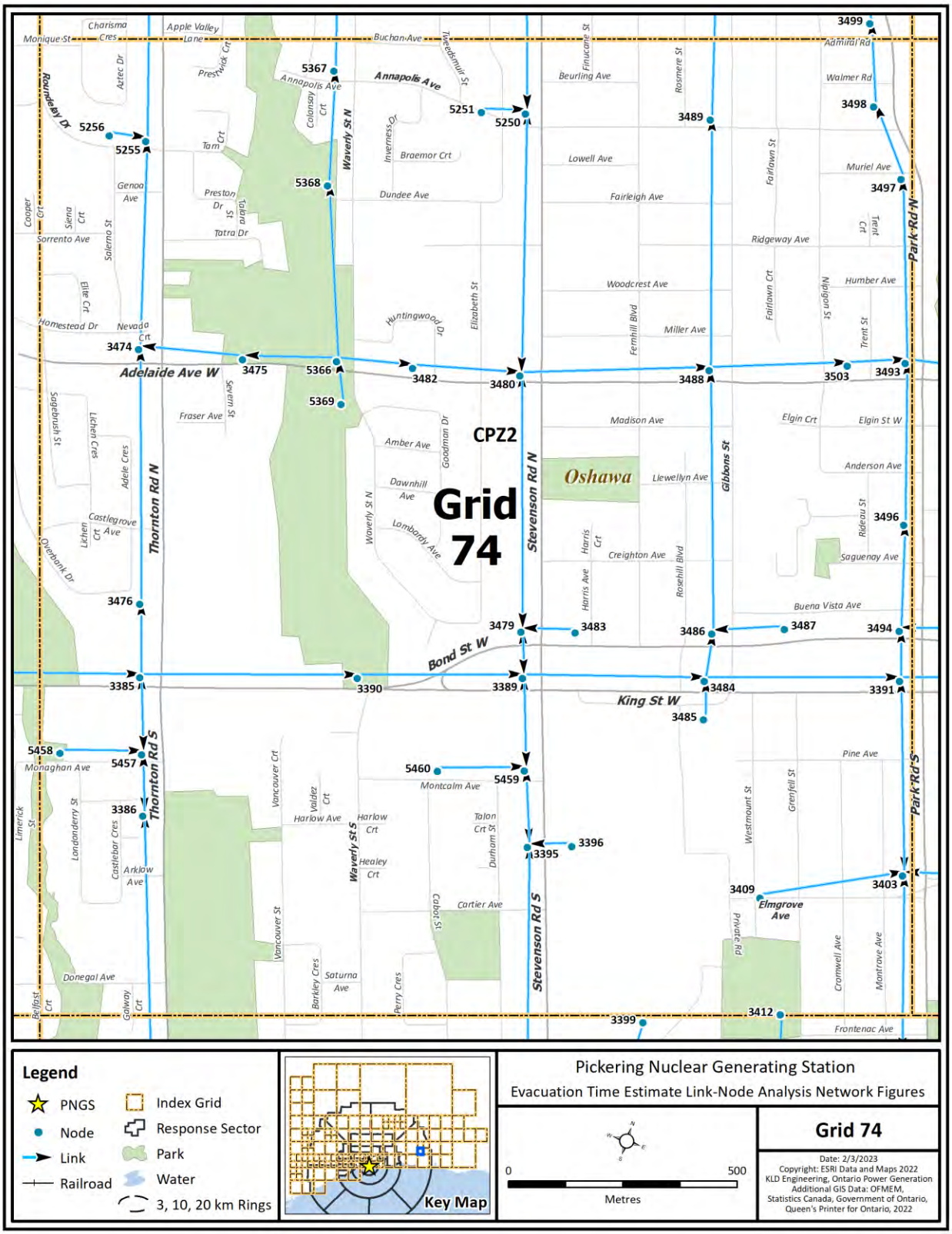


**Figure K-75. Link-Node Analysis Network – Grid 74**

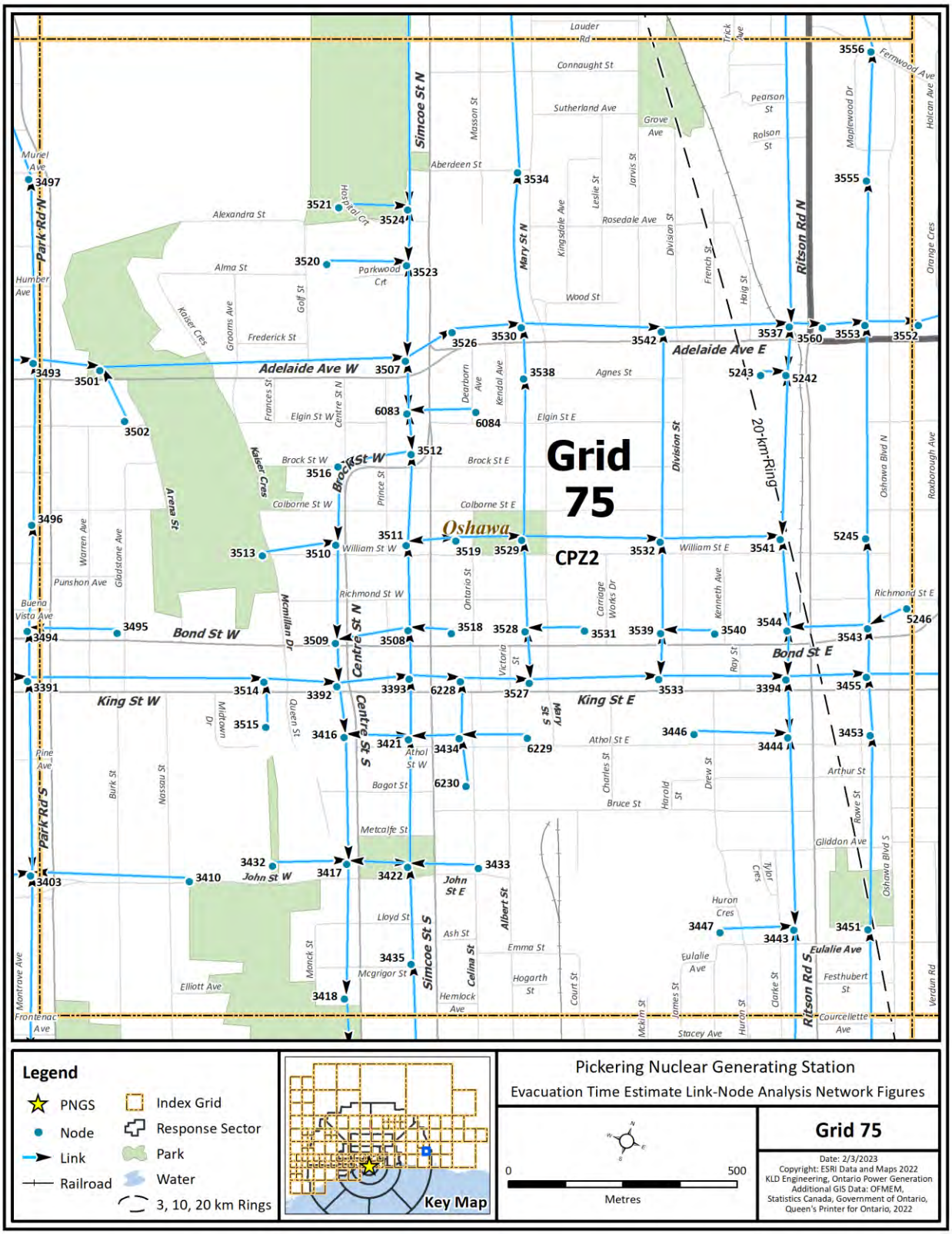


**Figure K-76. Link-Node Analysis Network – Grid 75**

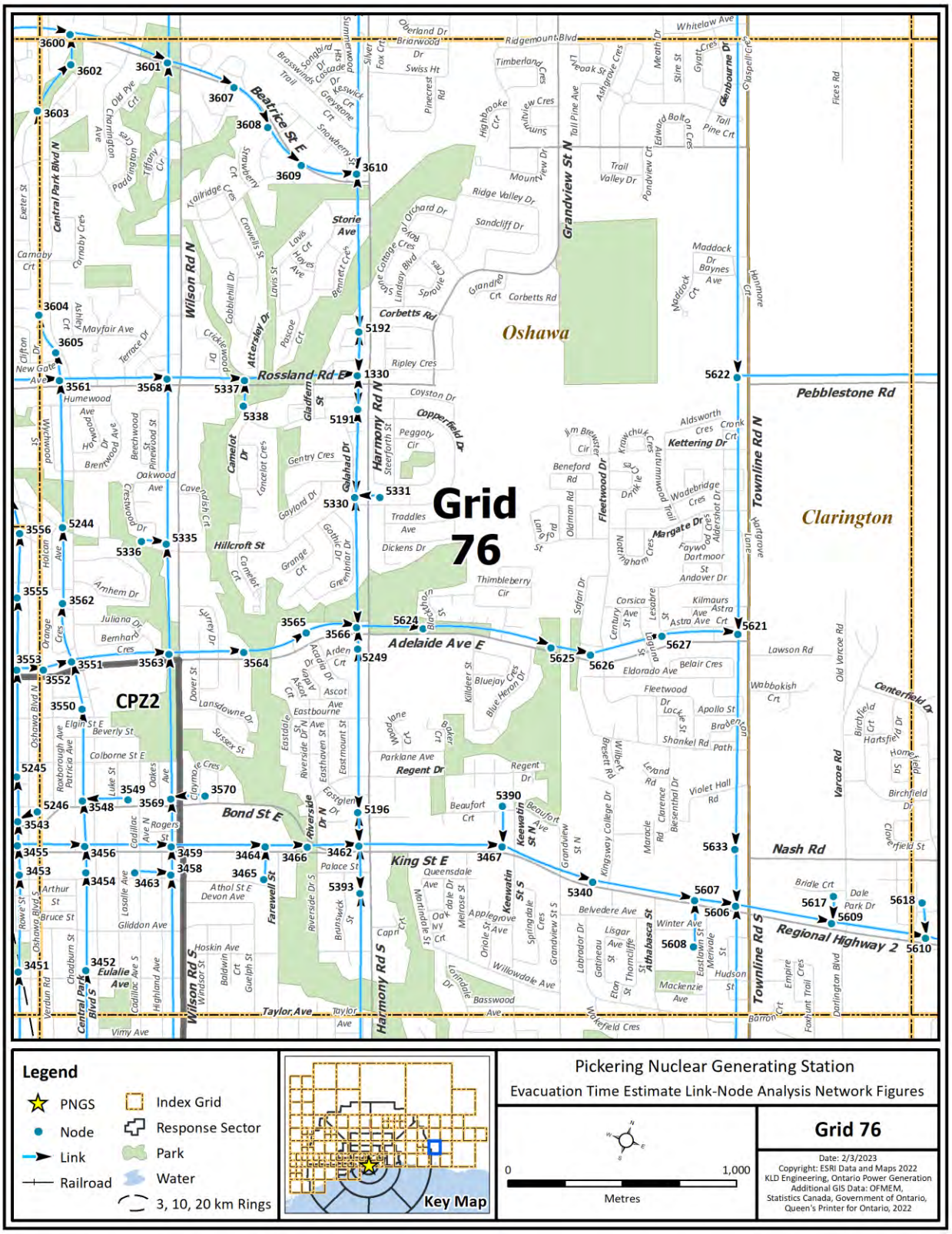


**Figure K-77. Link-Node Analysis Network – Grid 76**

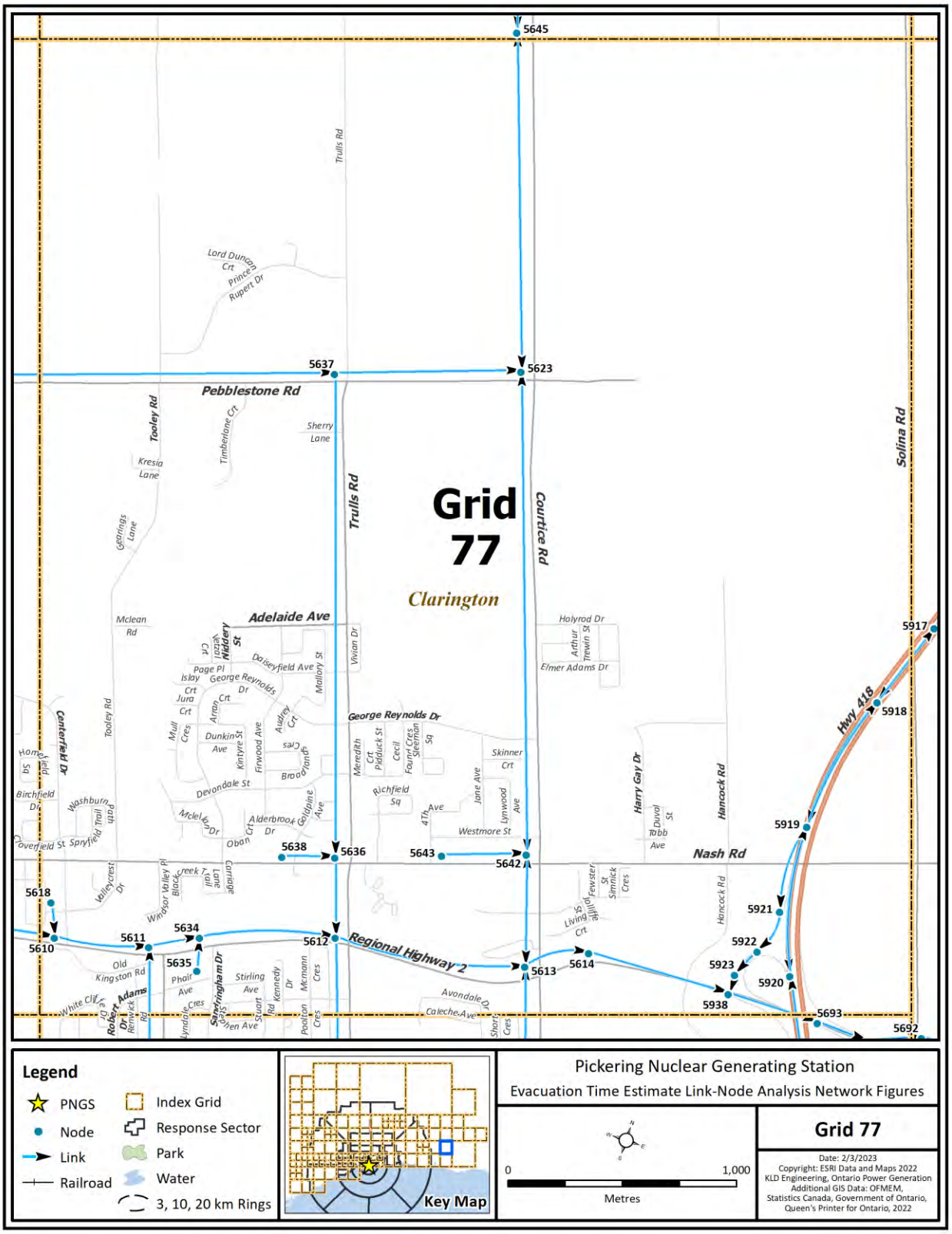


**Figure K-78. Link-Node Analysis Network – Grid 77**

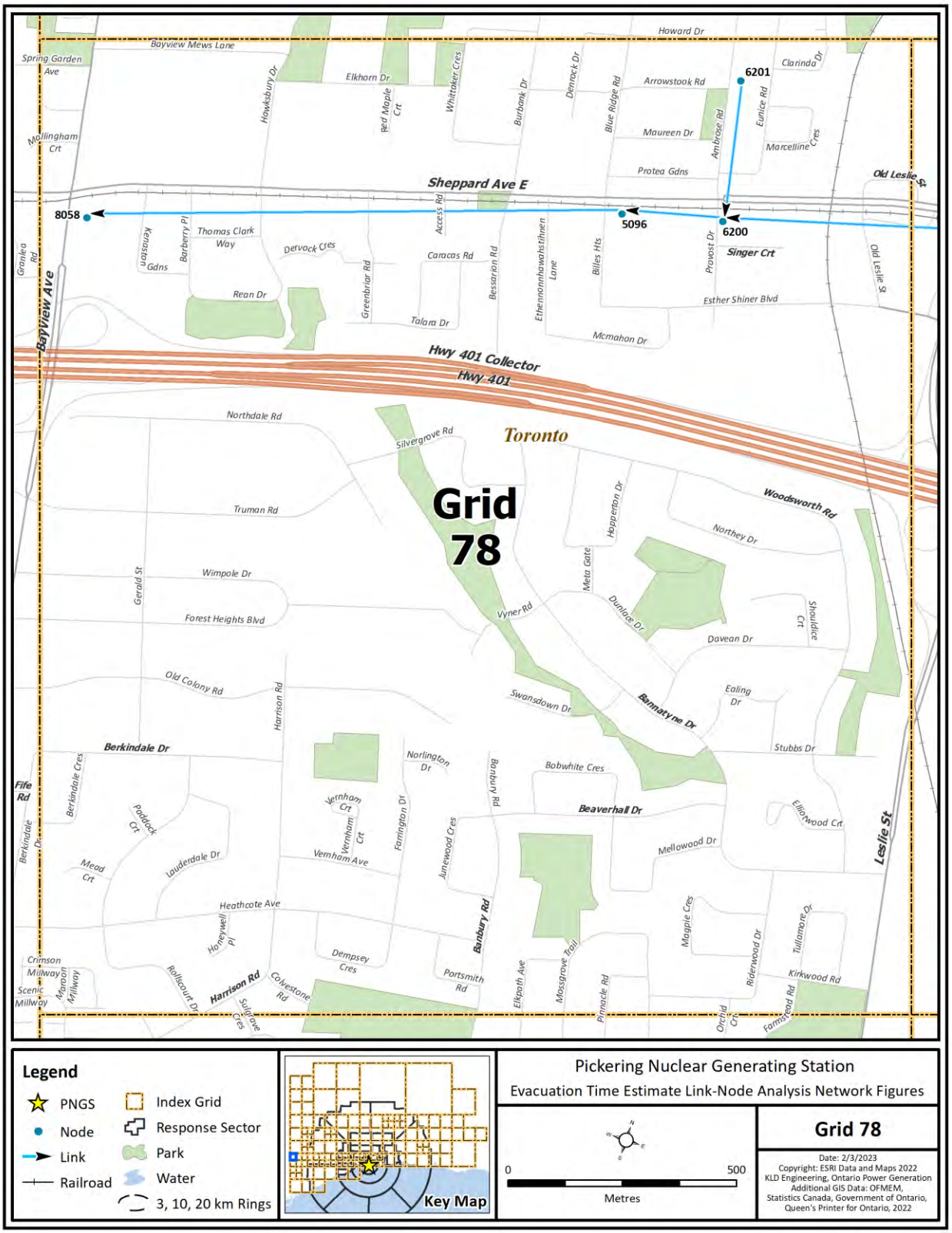


**Figure K-79. Link-Node Analysis Network – Grid 78**

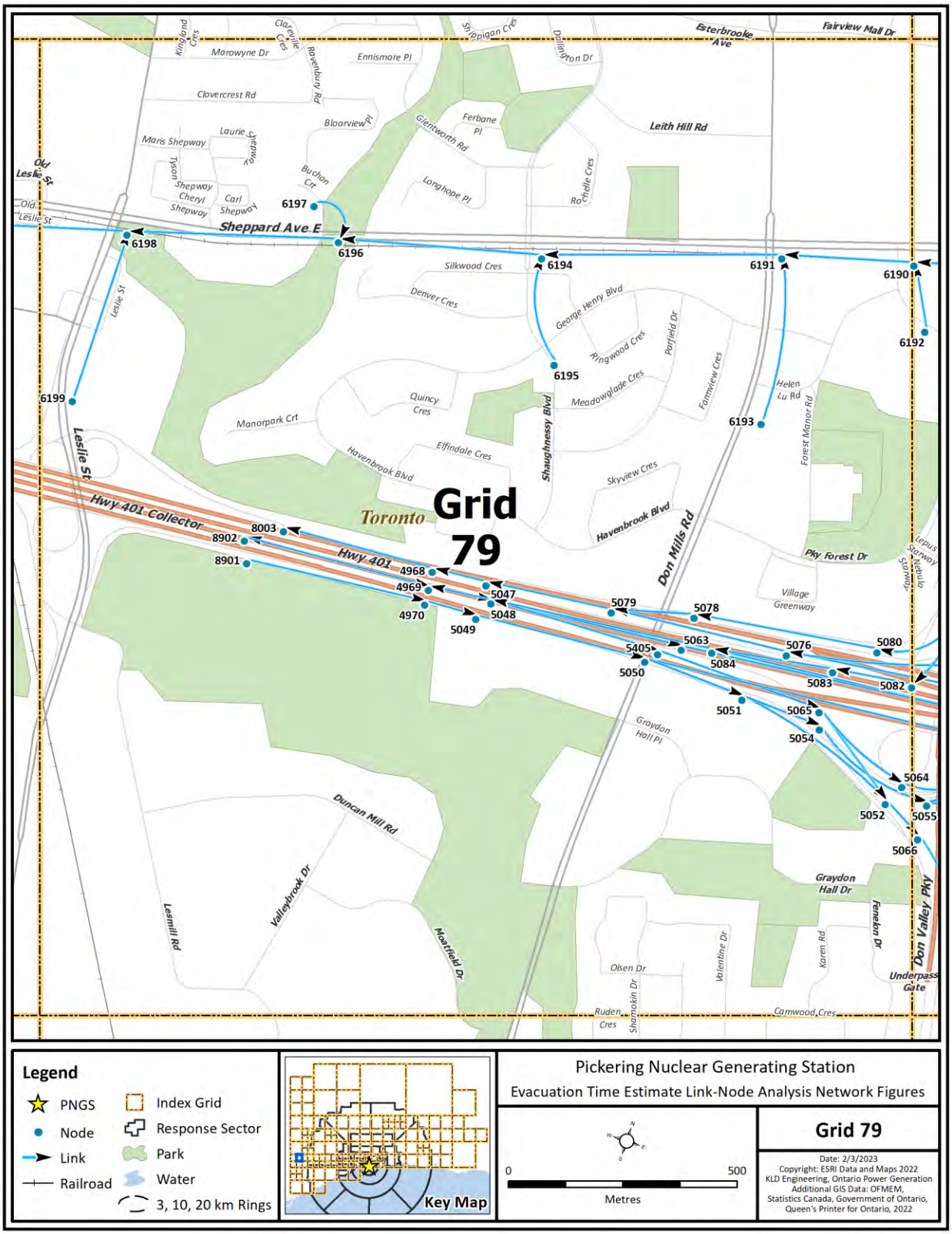


**Figure K-80. Link-Node Analysis Network – Grid 79**

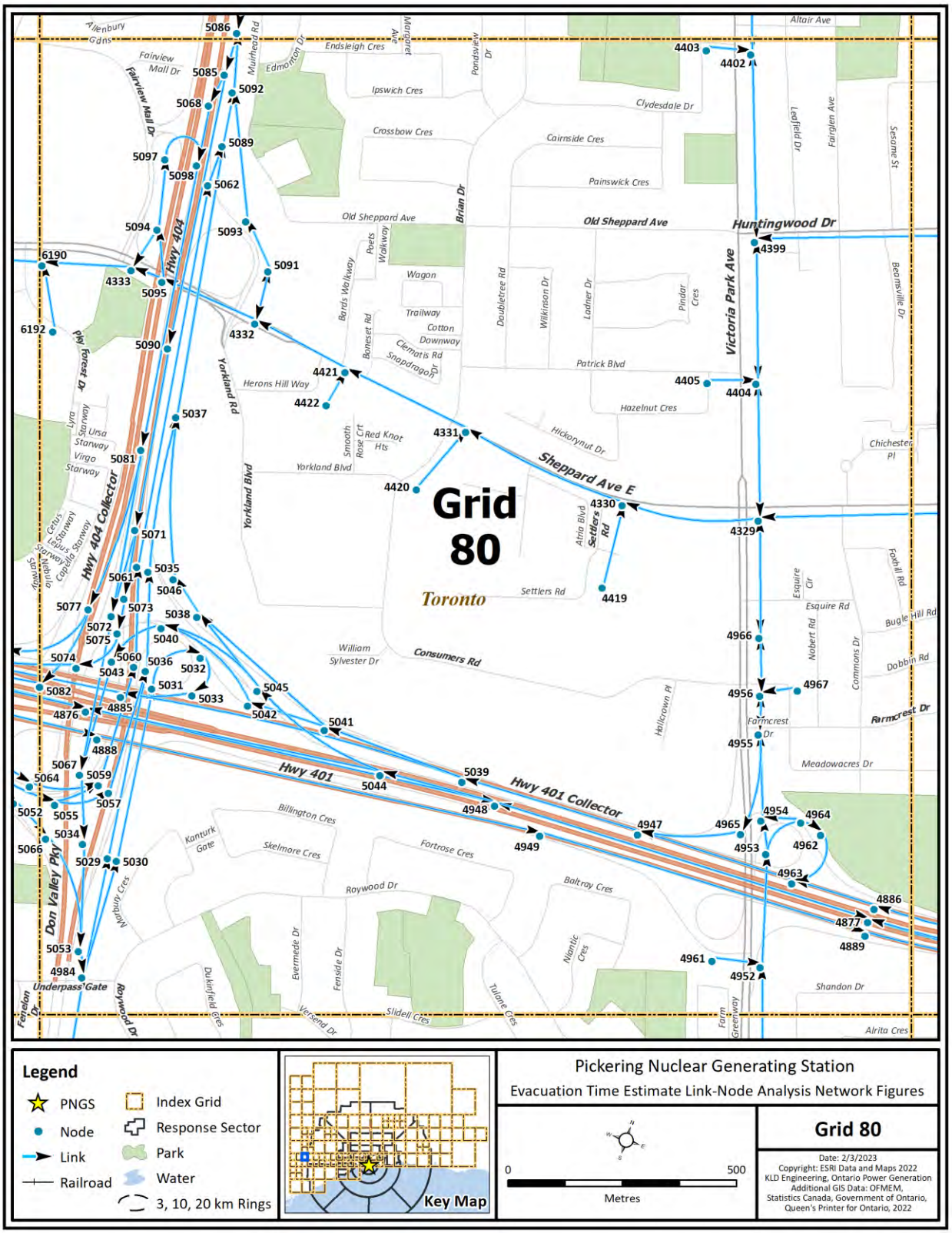


**Figure K-81. Link-Node Analysis Network – Grid 80**

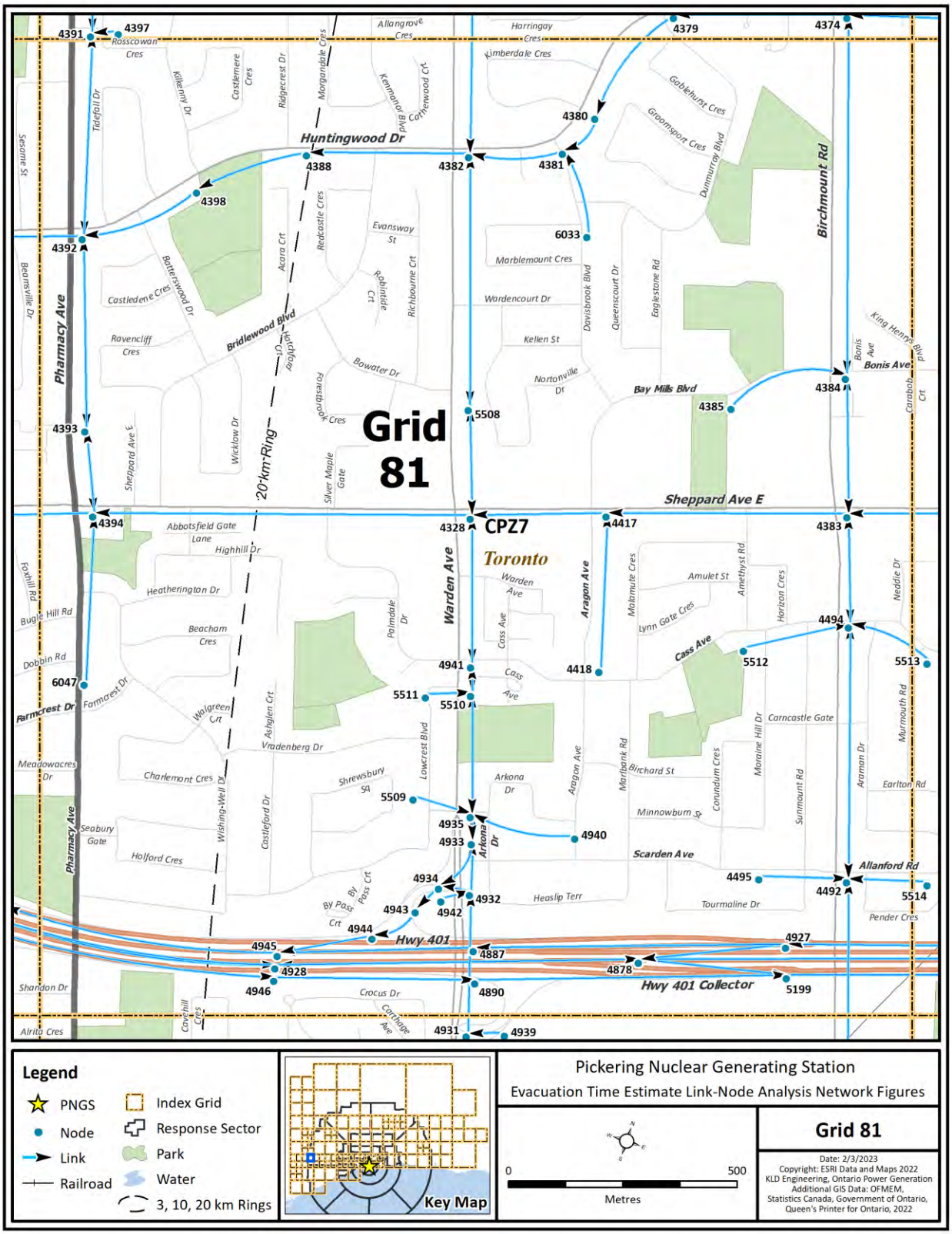


**Figure K-82. Link-Node Analysis Network – Grid 81**

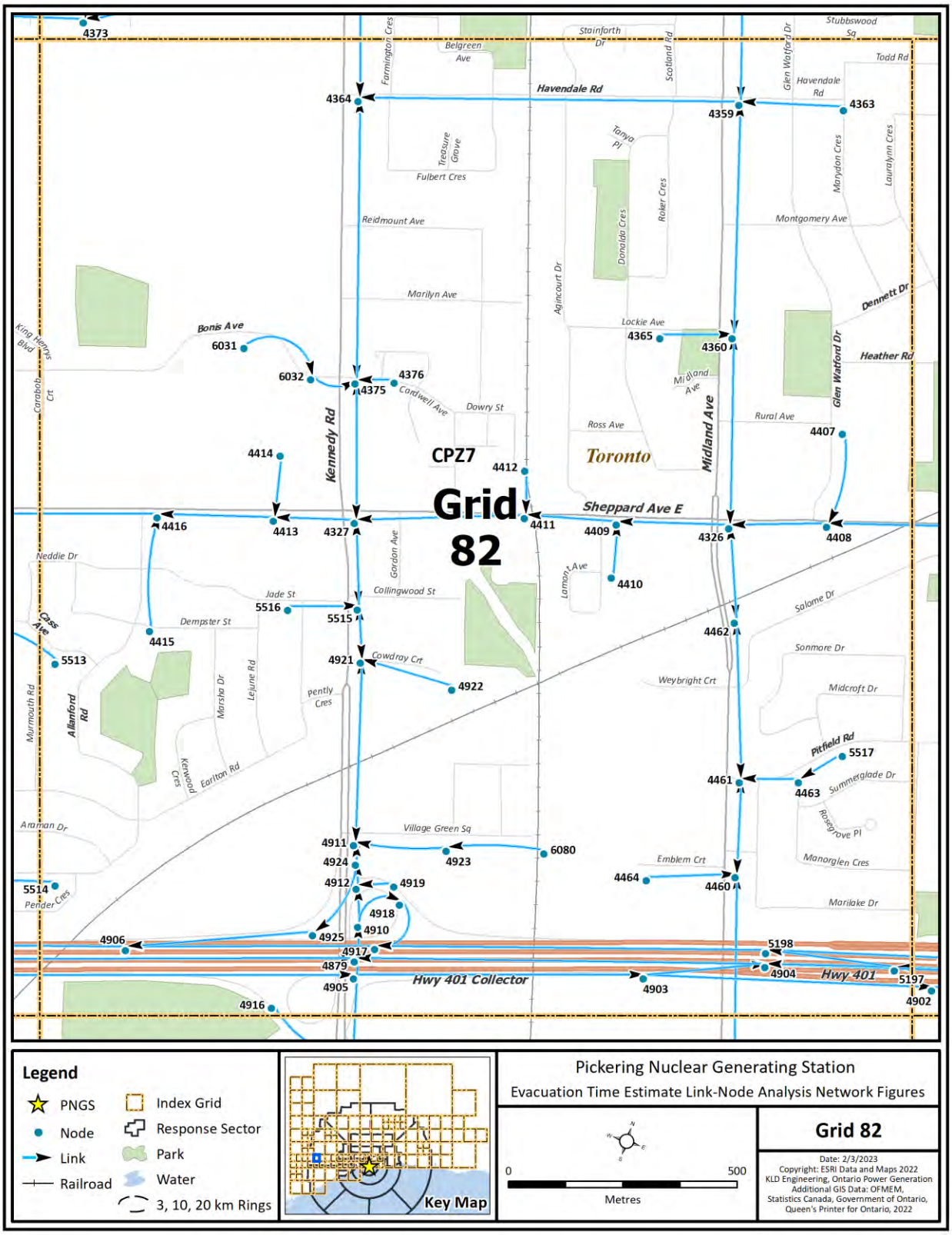


**Figure K-83. Link-Node Analysis Network – Grid 82**

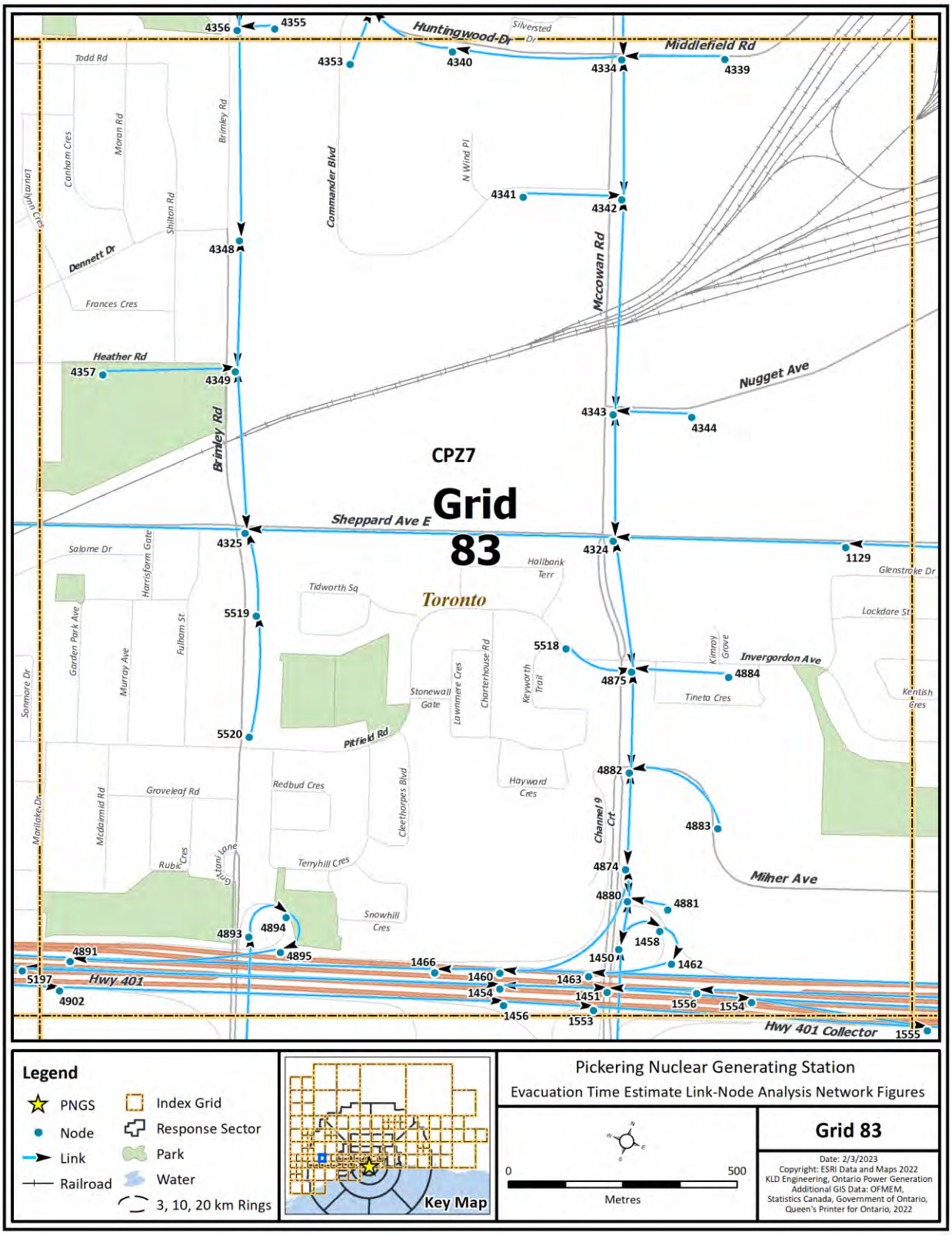


**Figure K-84. Link-Node Analysis Network – Grid 83**

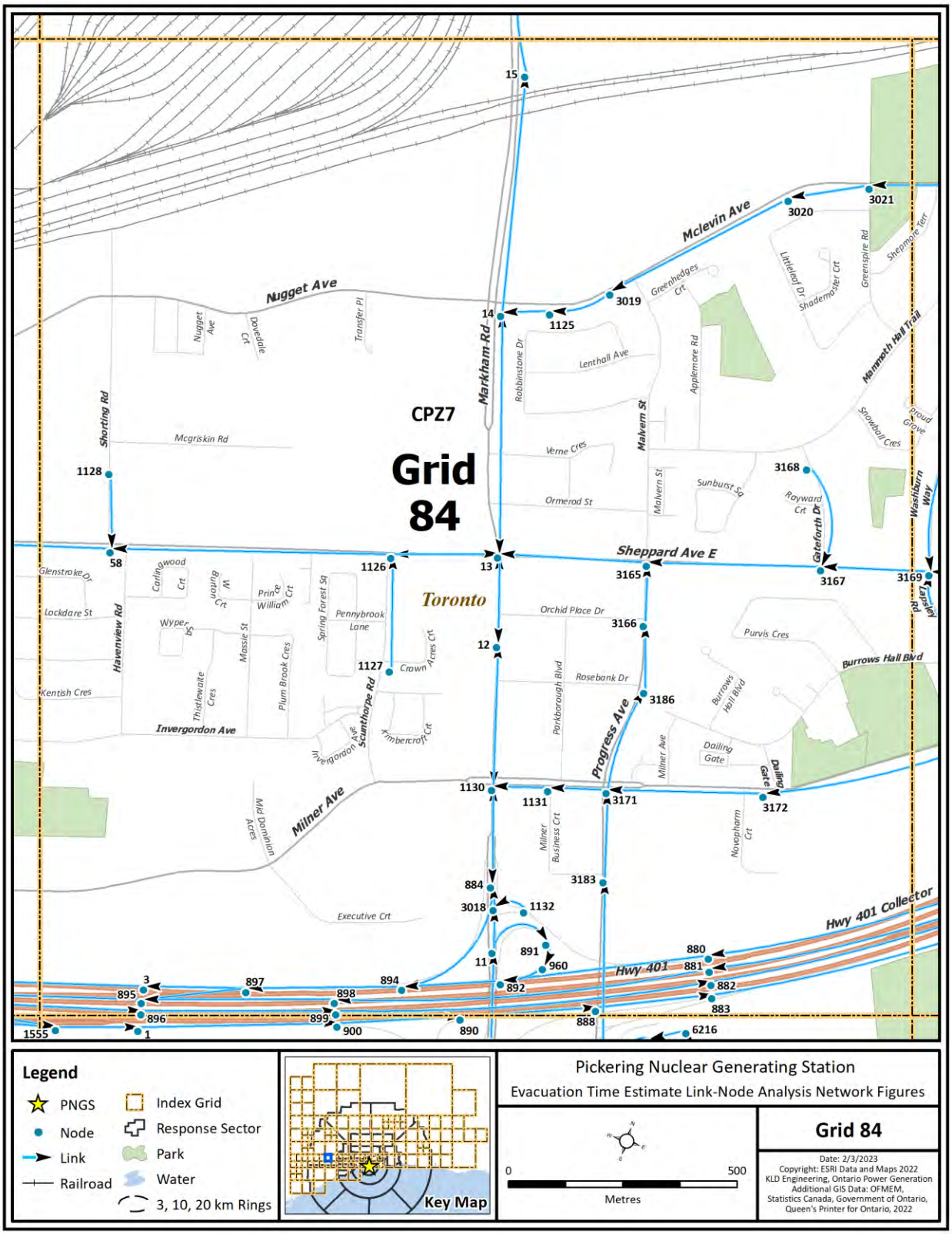


**Figure K-85. Link-Node Analysis Network – Grid 84**

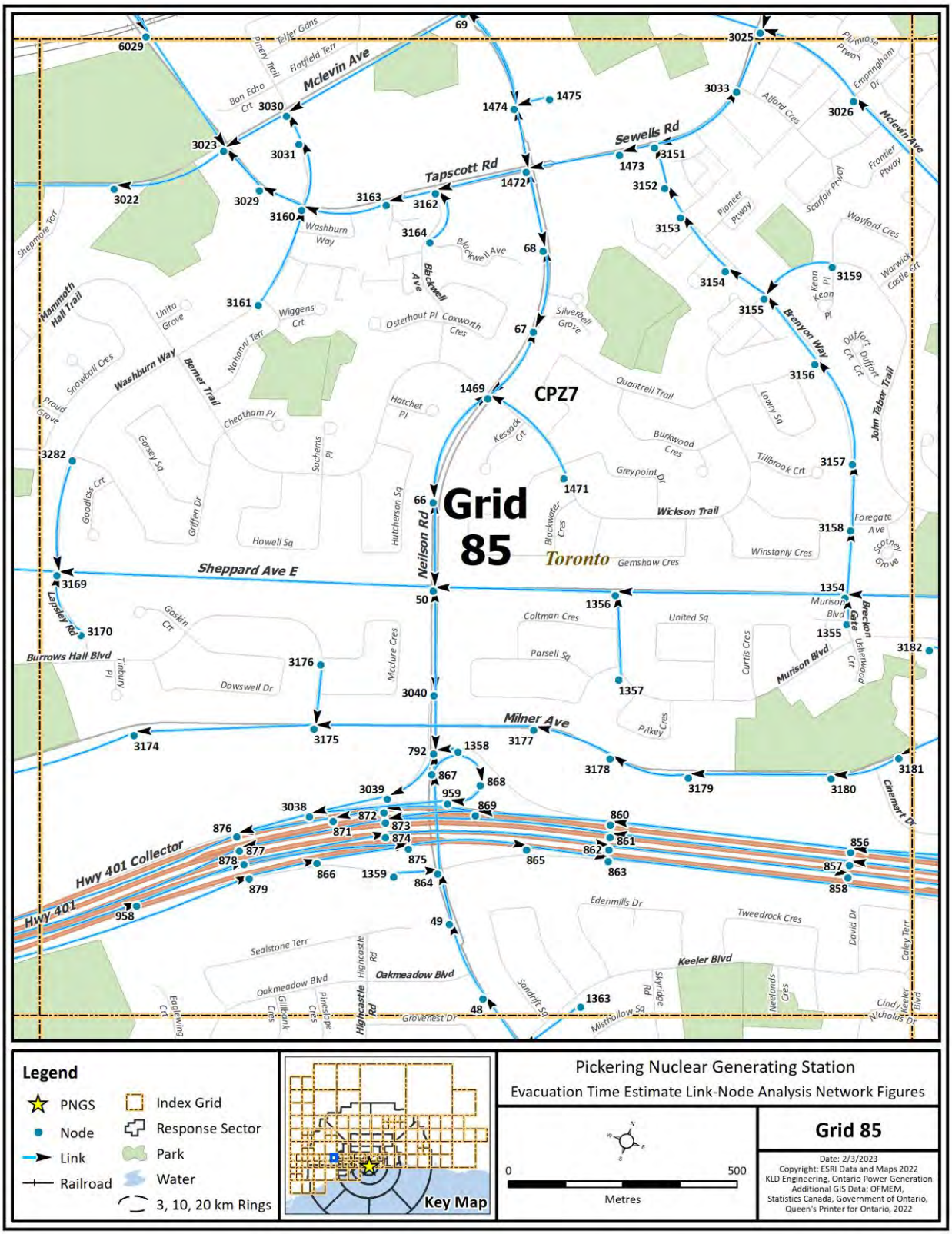


**Figure K-86. Link-Node Analysis Network – Grid 85**

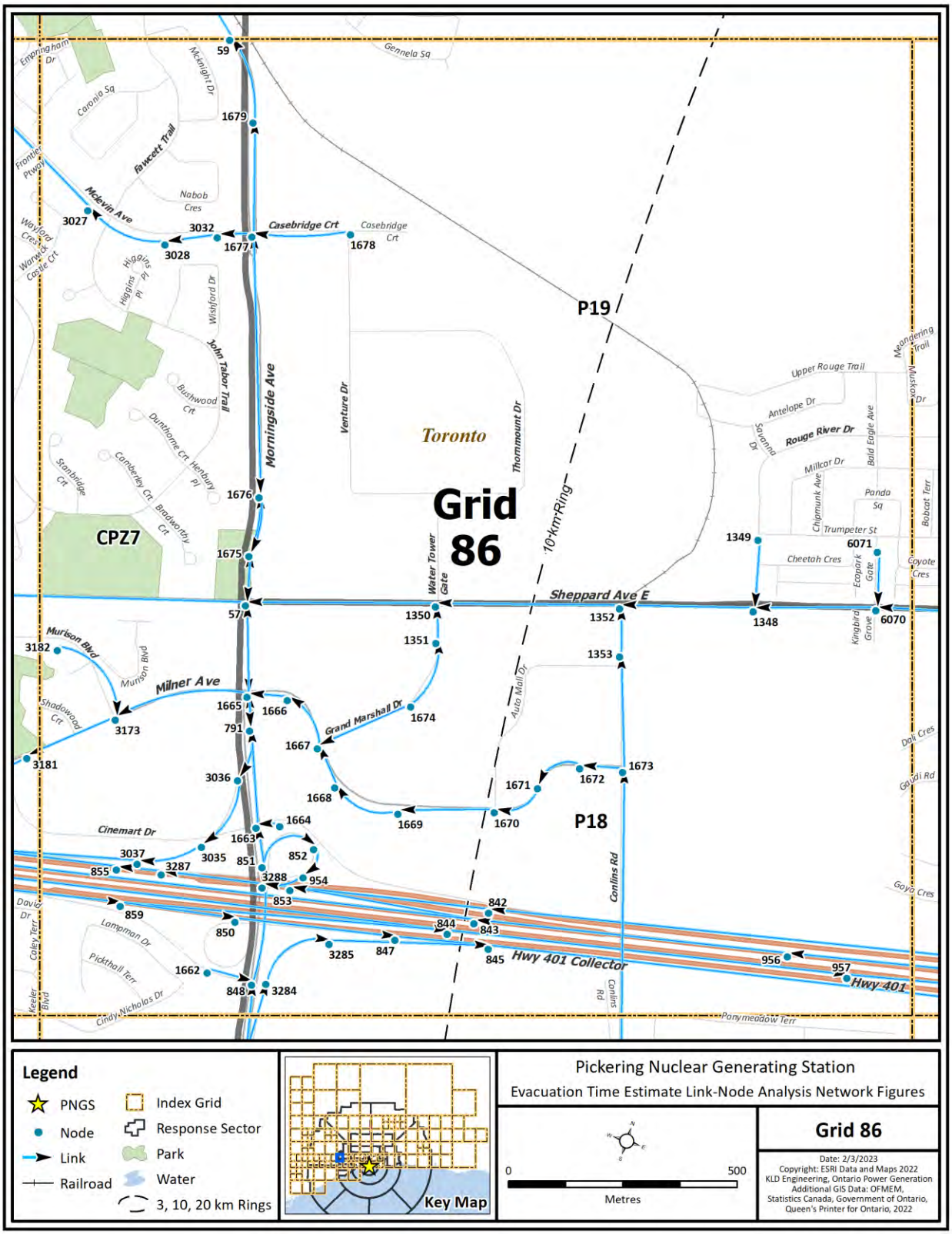


**Figure K-87. Link-Node Analysis Network – Grid 86**

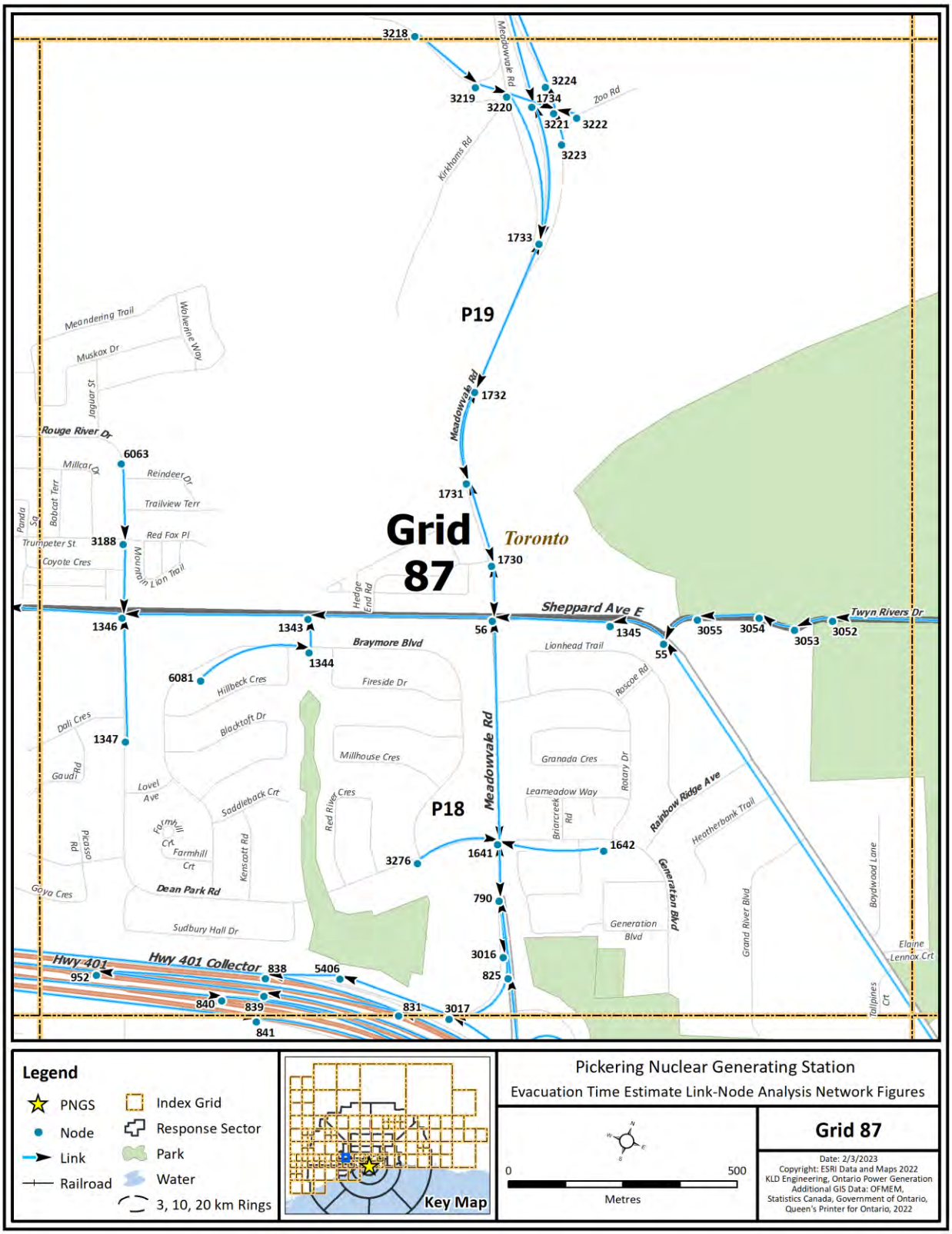


**Figure K-88. Link-Node Analysis Network – Grid 87**

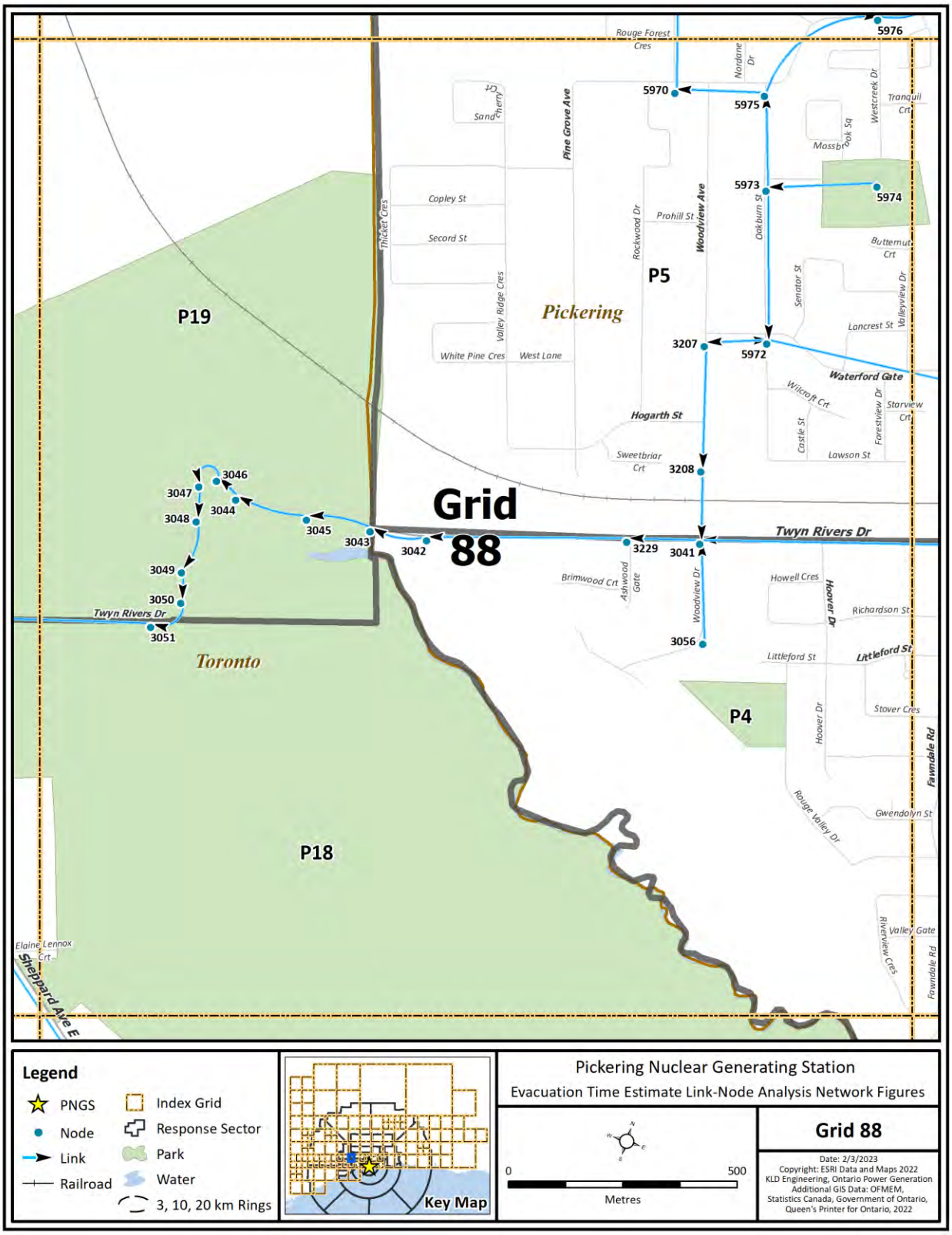


**Figure K-89. Link-Node Analysis Network – Grid 88**

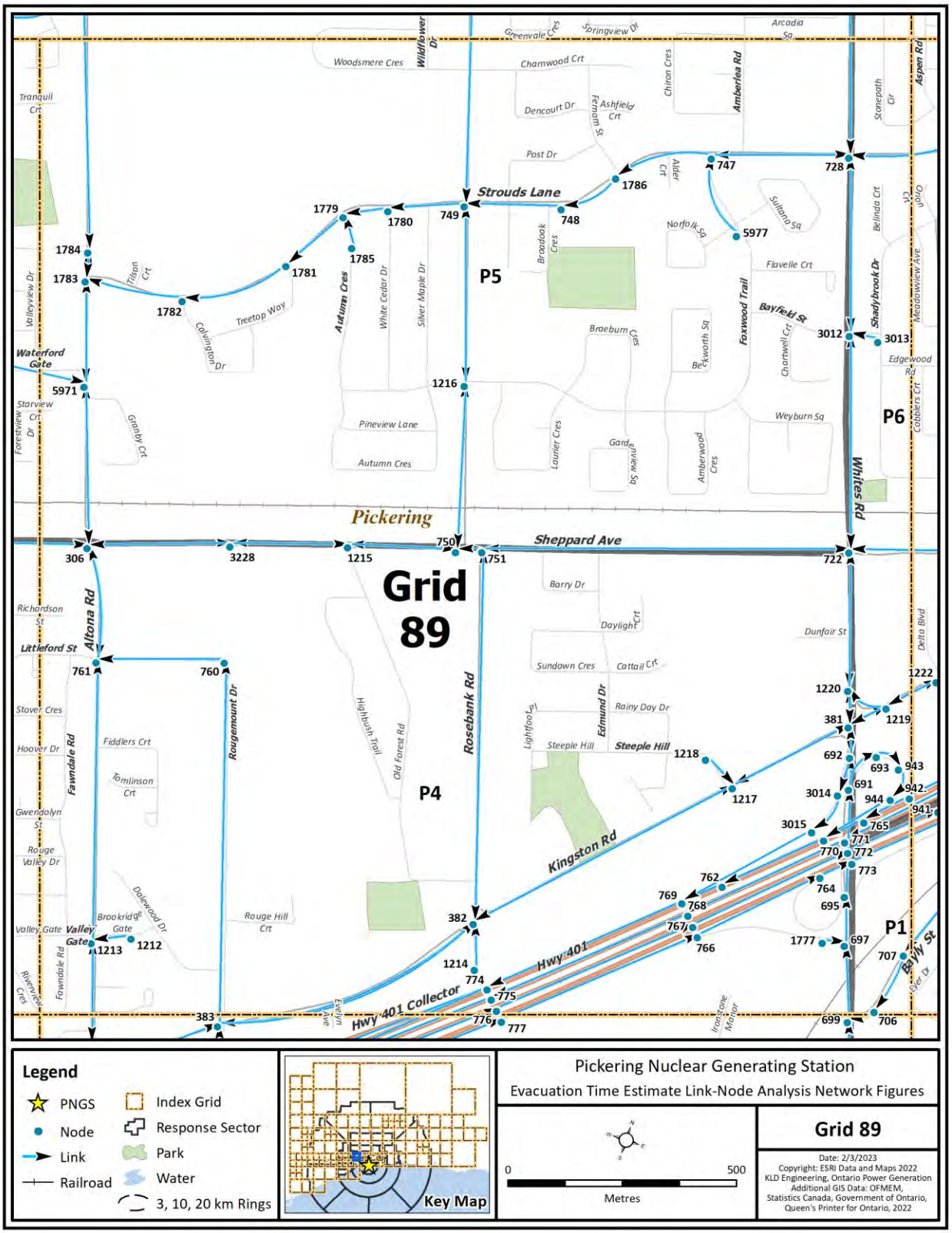


**Figure K-90. Link-Node Analysis Network – Grid 89**

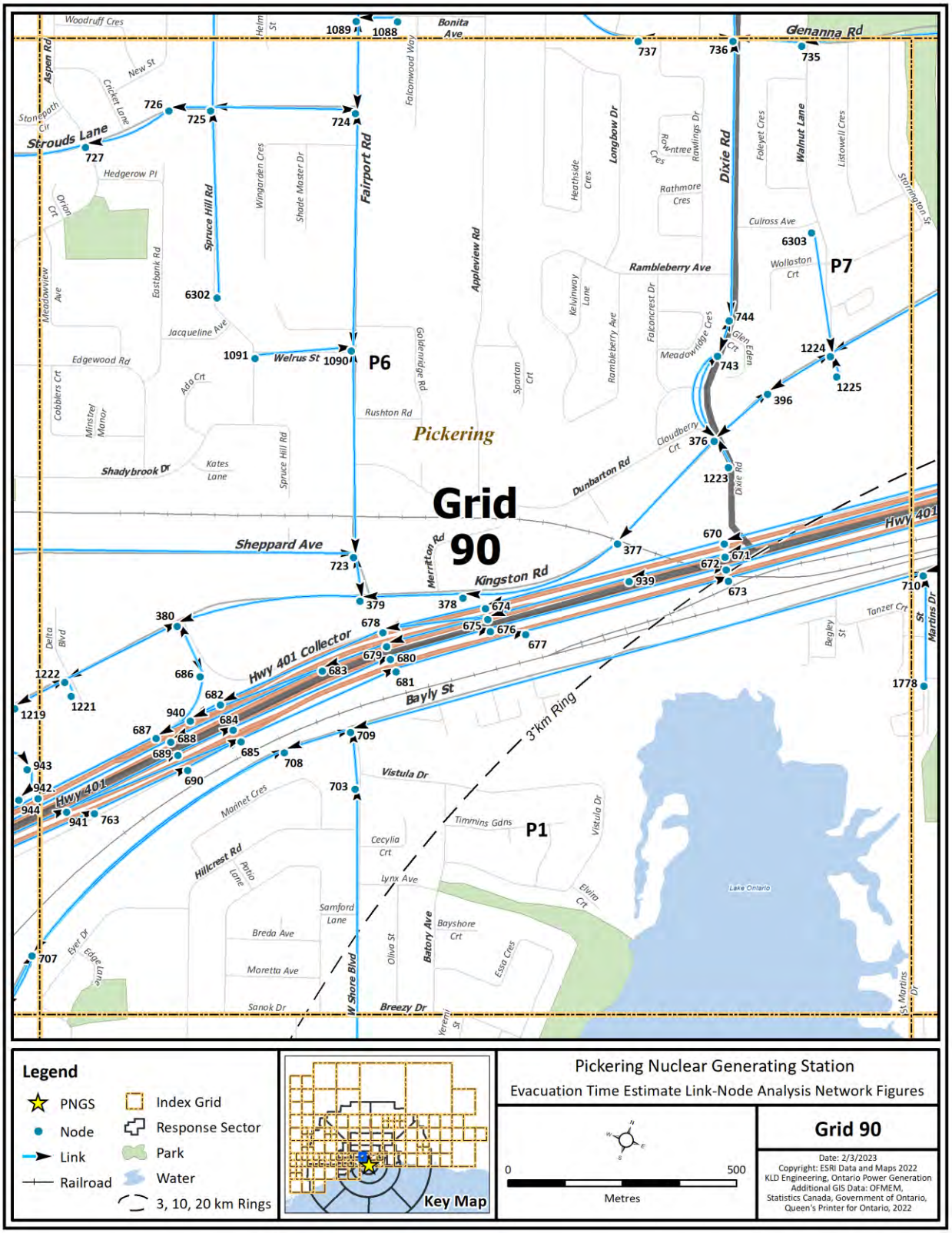


**Figure K-91. Link-Node Analysis Network – Grid 90**

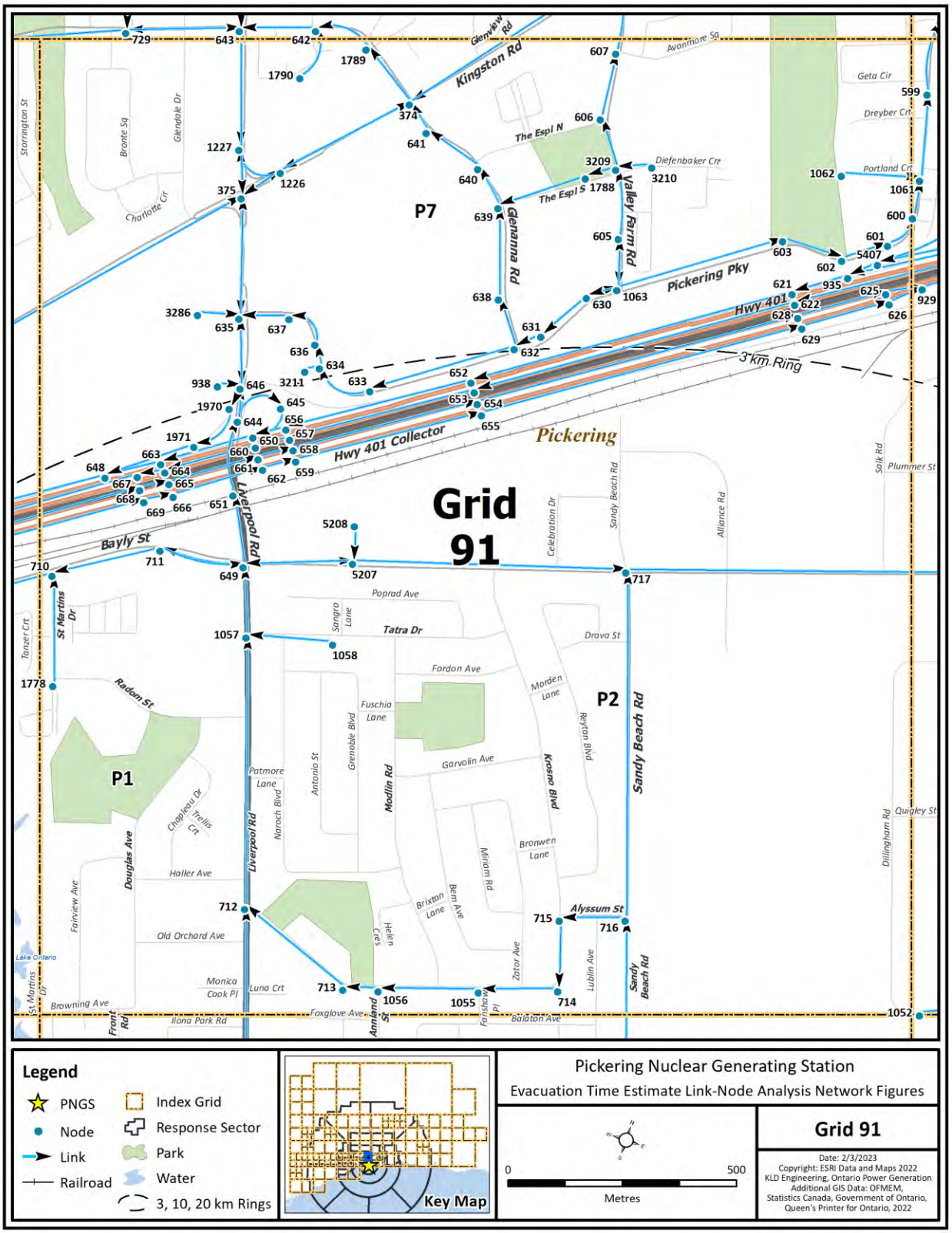


**Figure K-92. Link-Node Analysis Network – Grid 91**

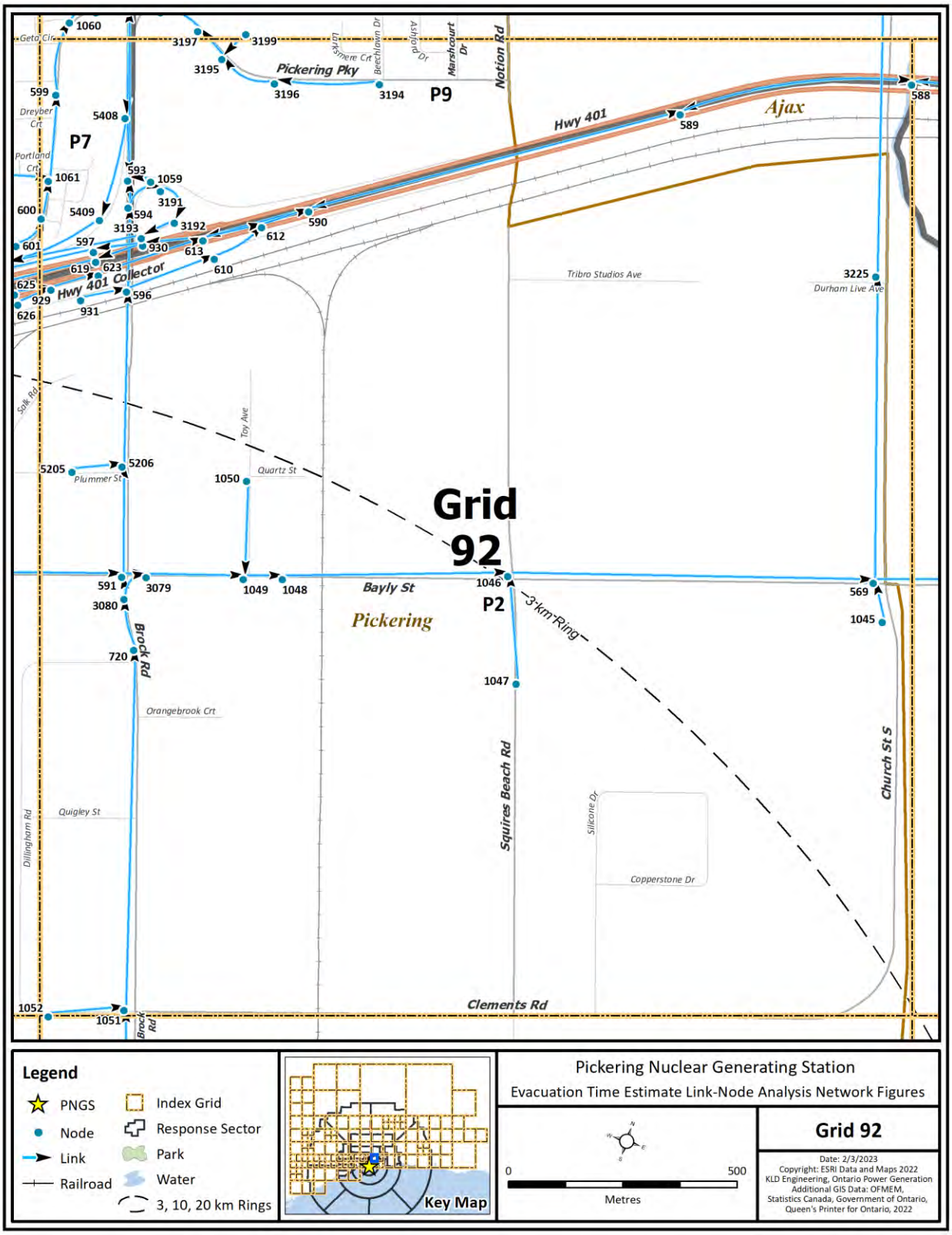


**Figure K-93. Link-Node Analysis Network – Grid 92**

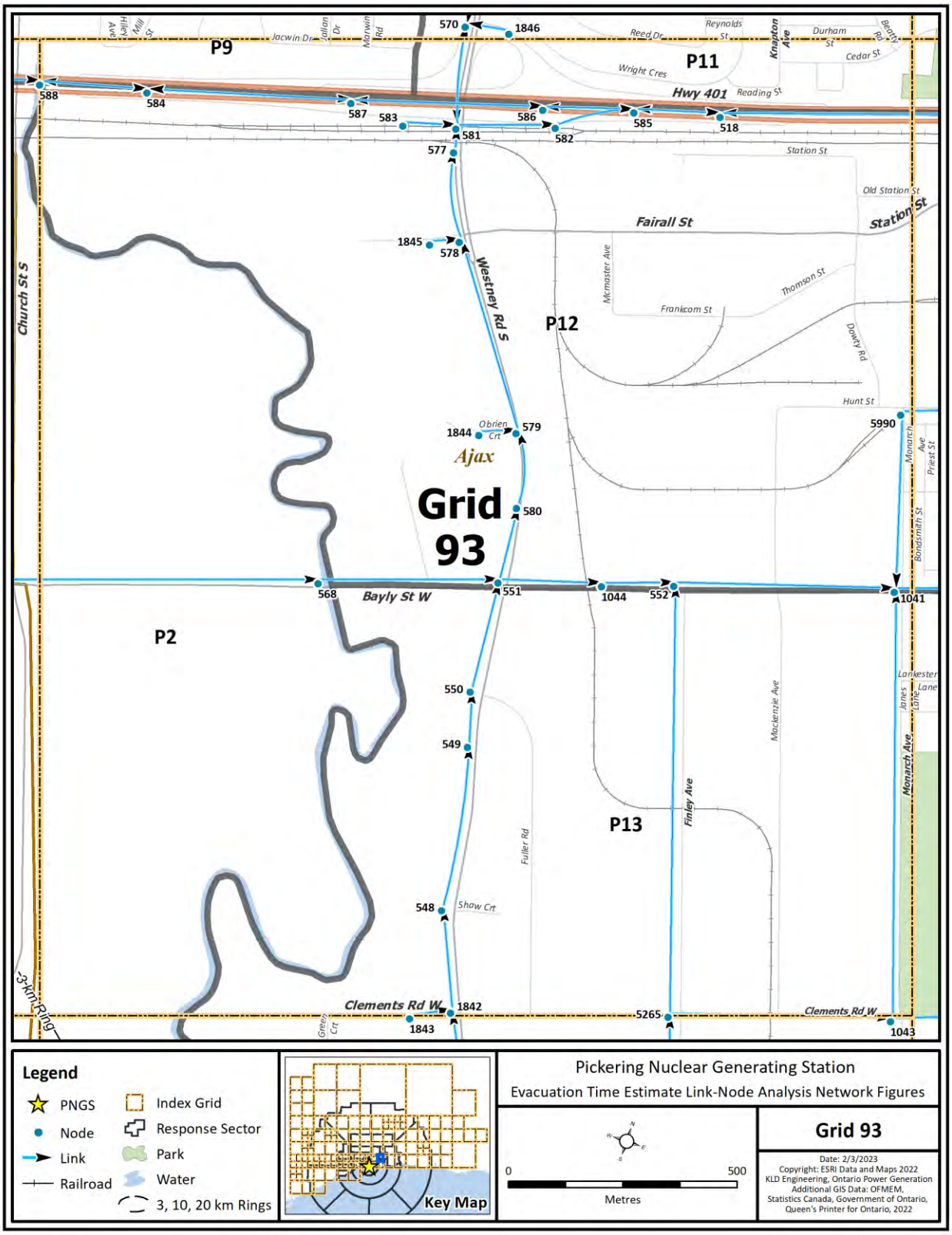


**Figure K-94. Link-Node Analysis Network – Grid 93**

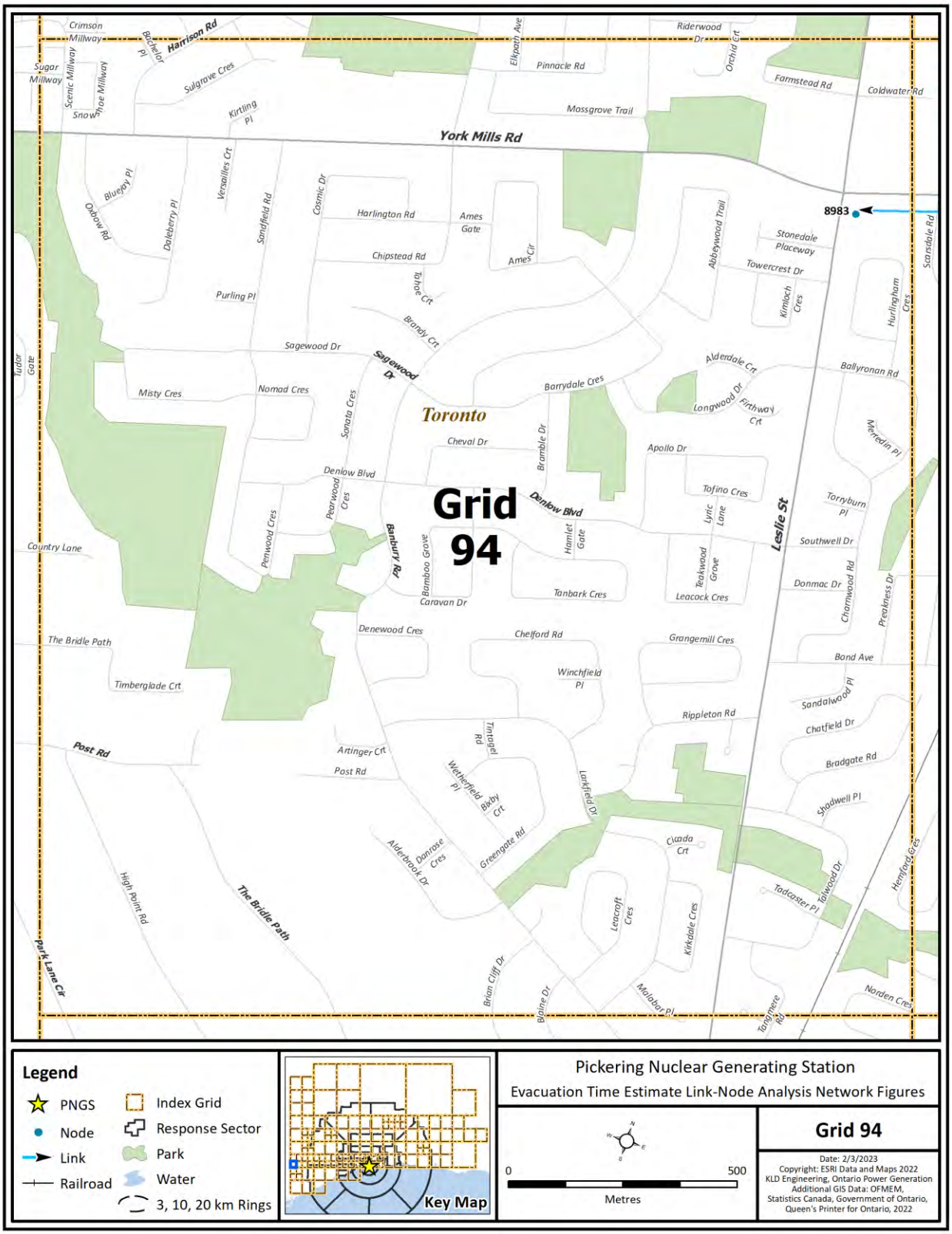


**Figure K-95. Link-Node Analysis Network – Grid 94**

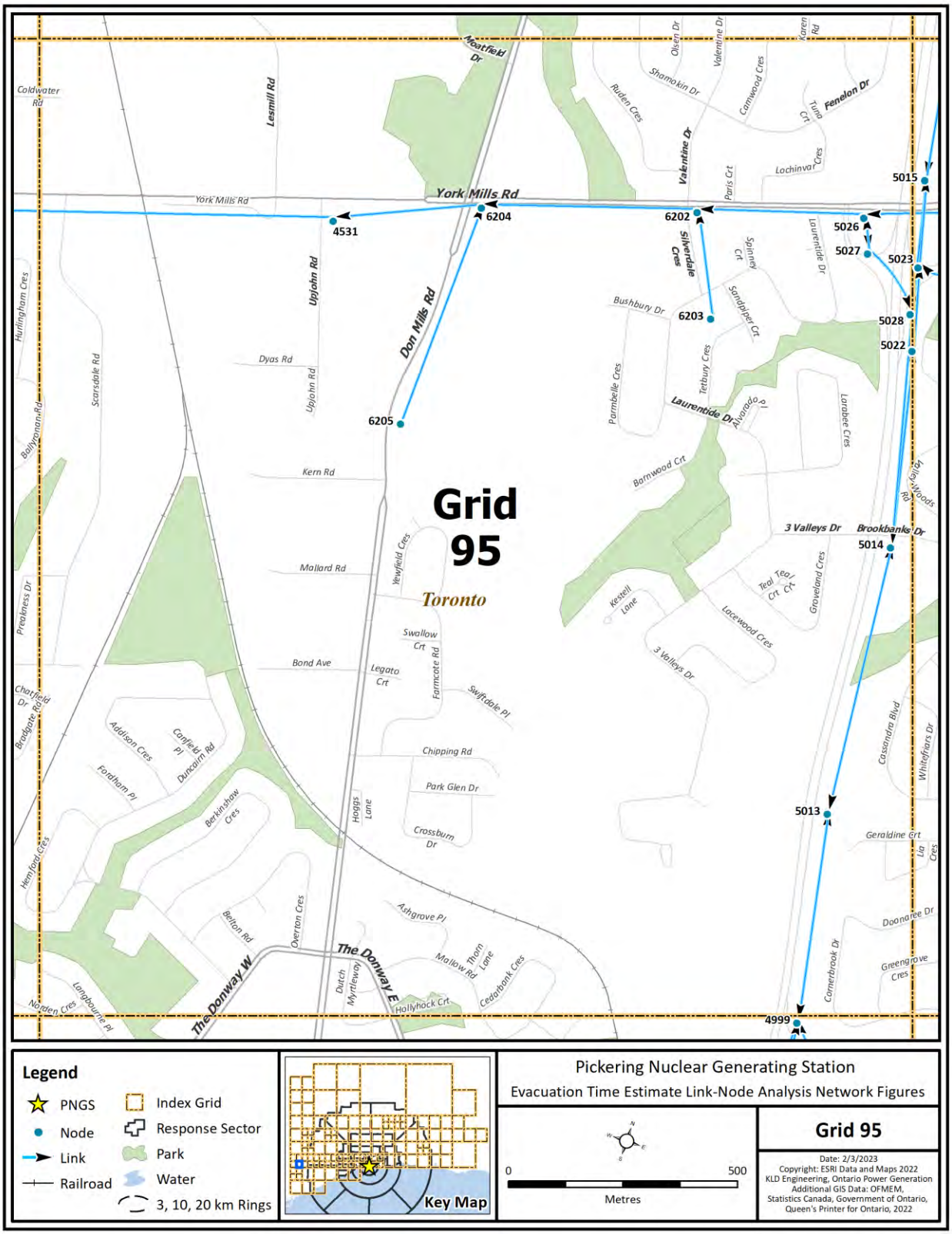


**Figure K-96. Link-Node Analysis Network – Grid 95**

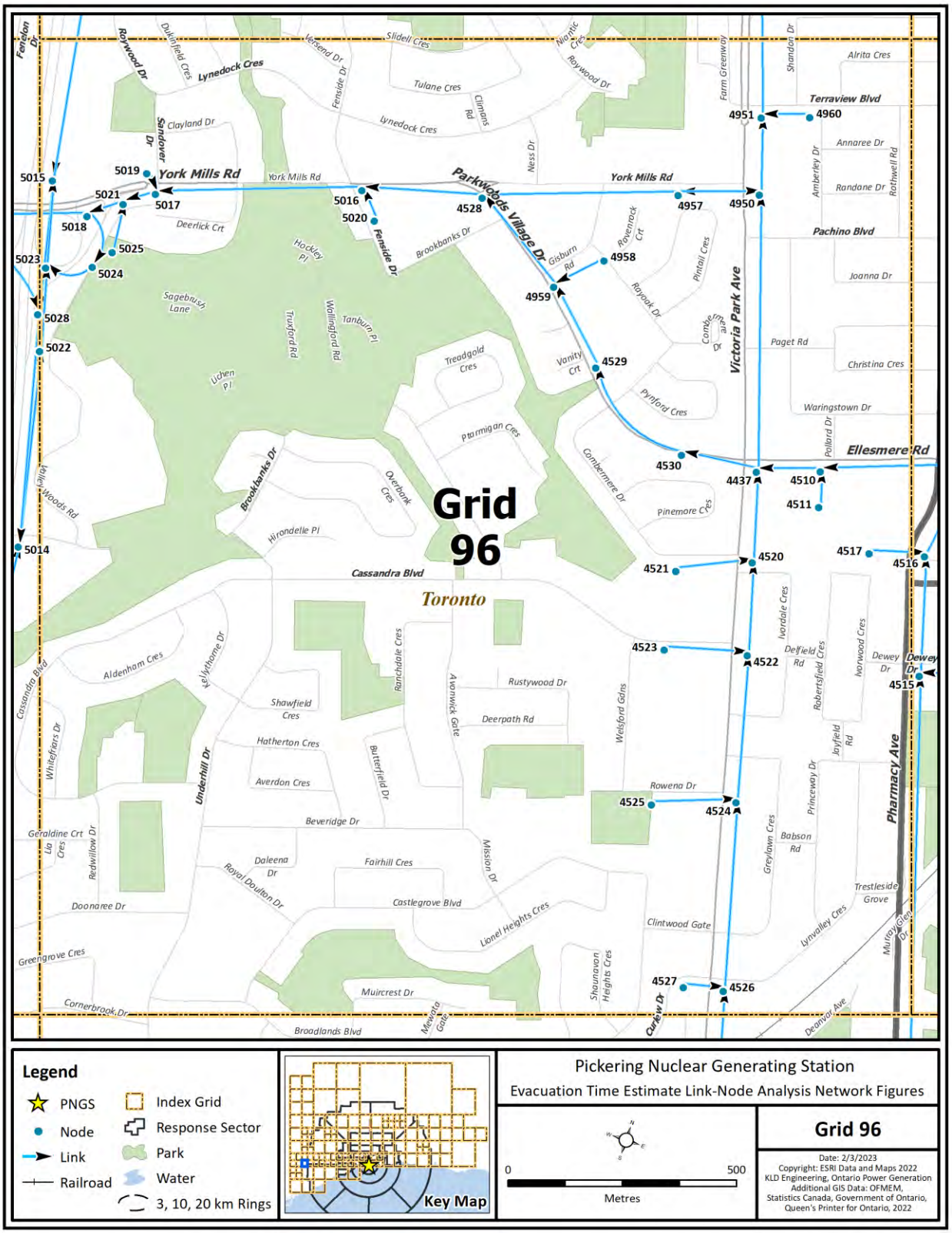


**Figure K-97. Link-Node Analysis Network – Grid 96**

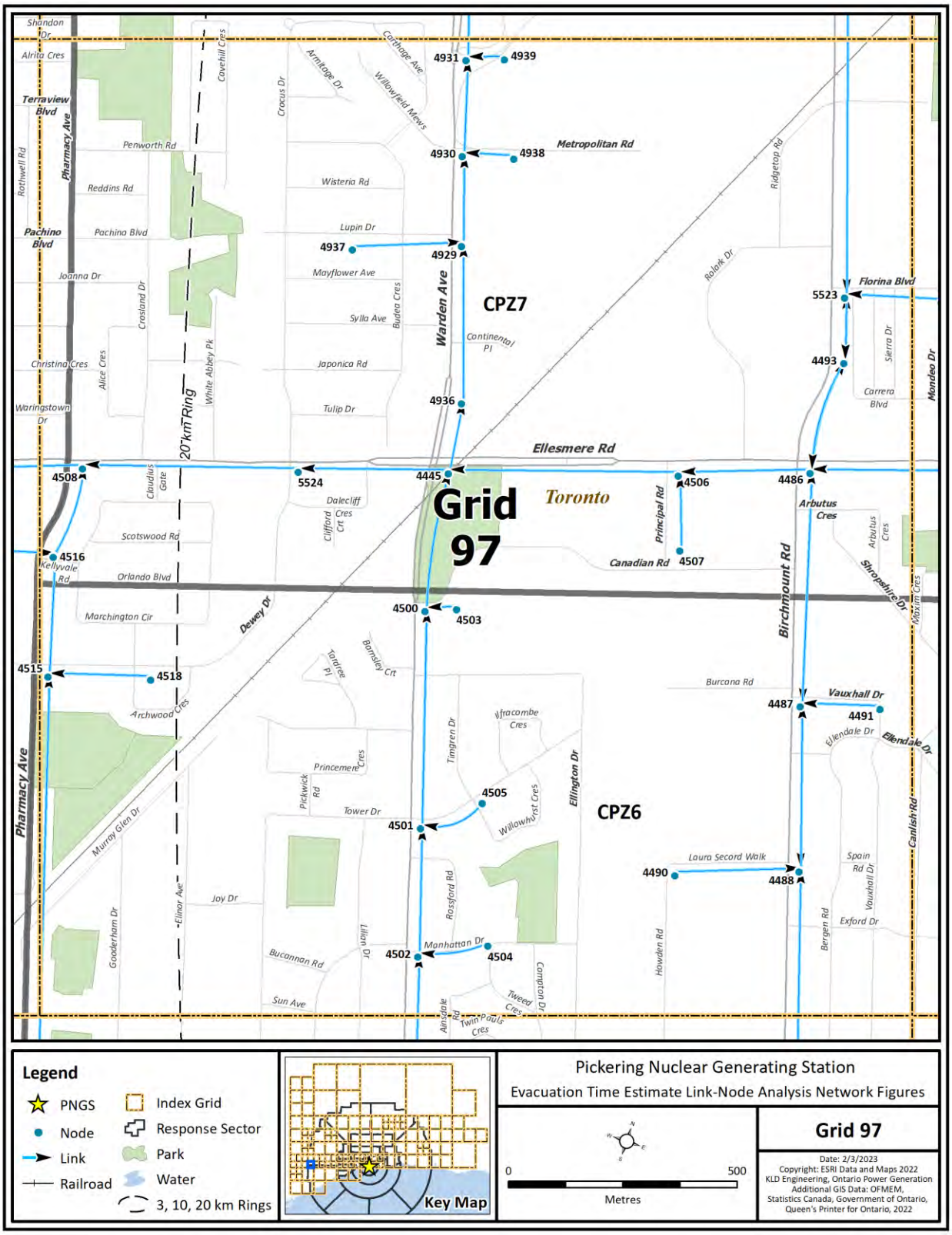


**Figure K-98. Link-Node Analysis Network – Grid 97**

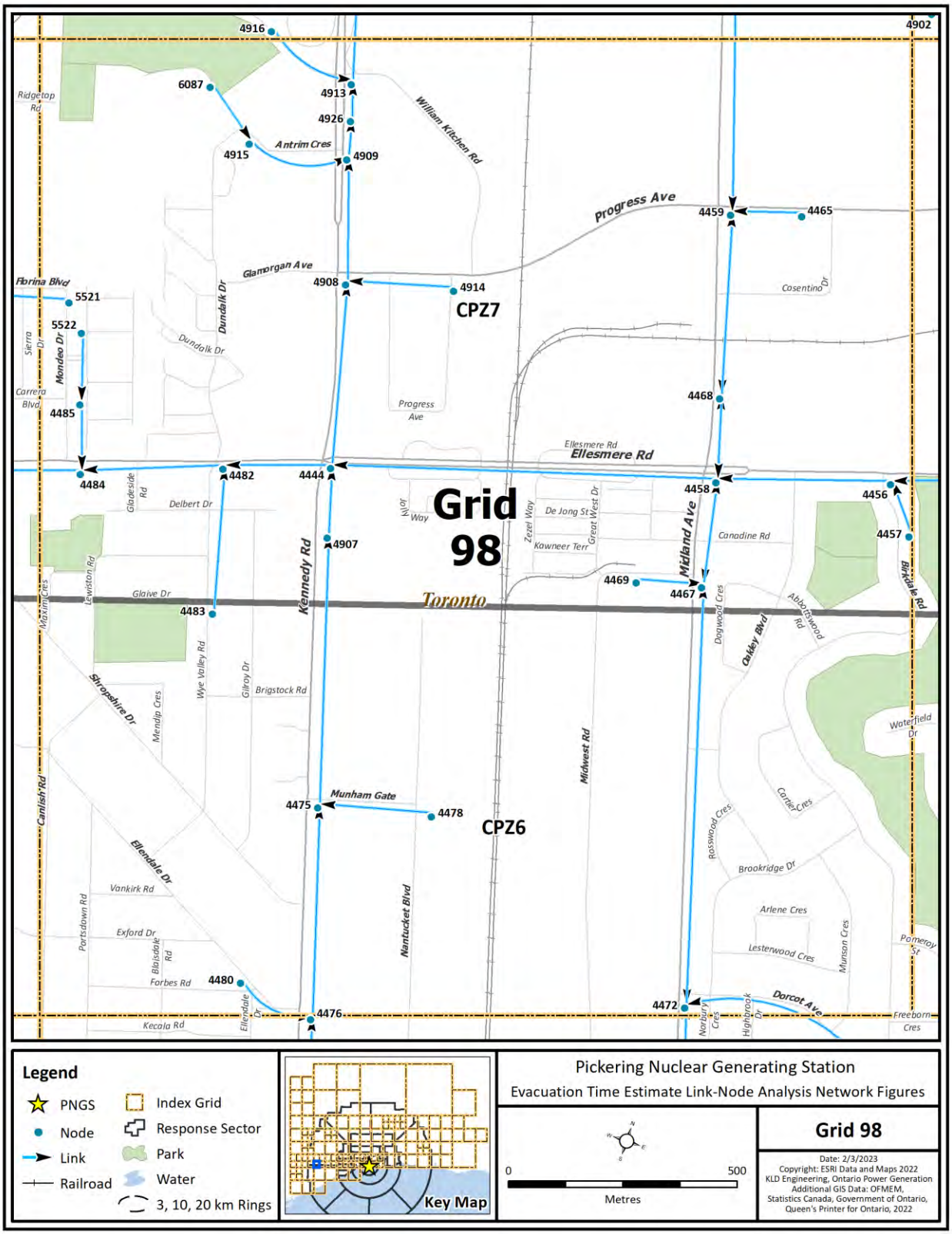


**Figure K-99. Link-Node Analysis Network – Grid 98**

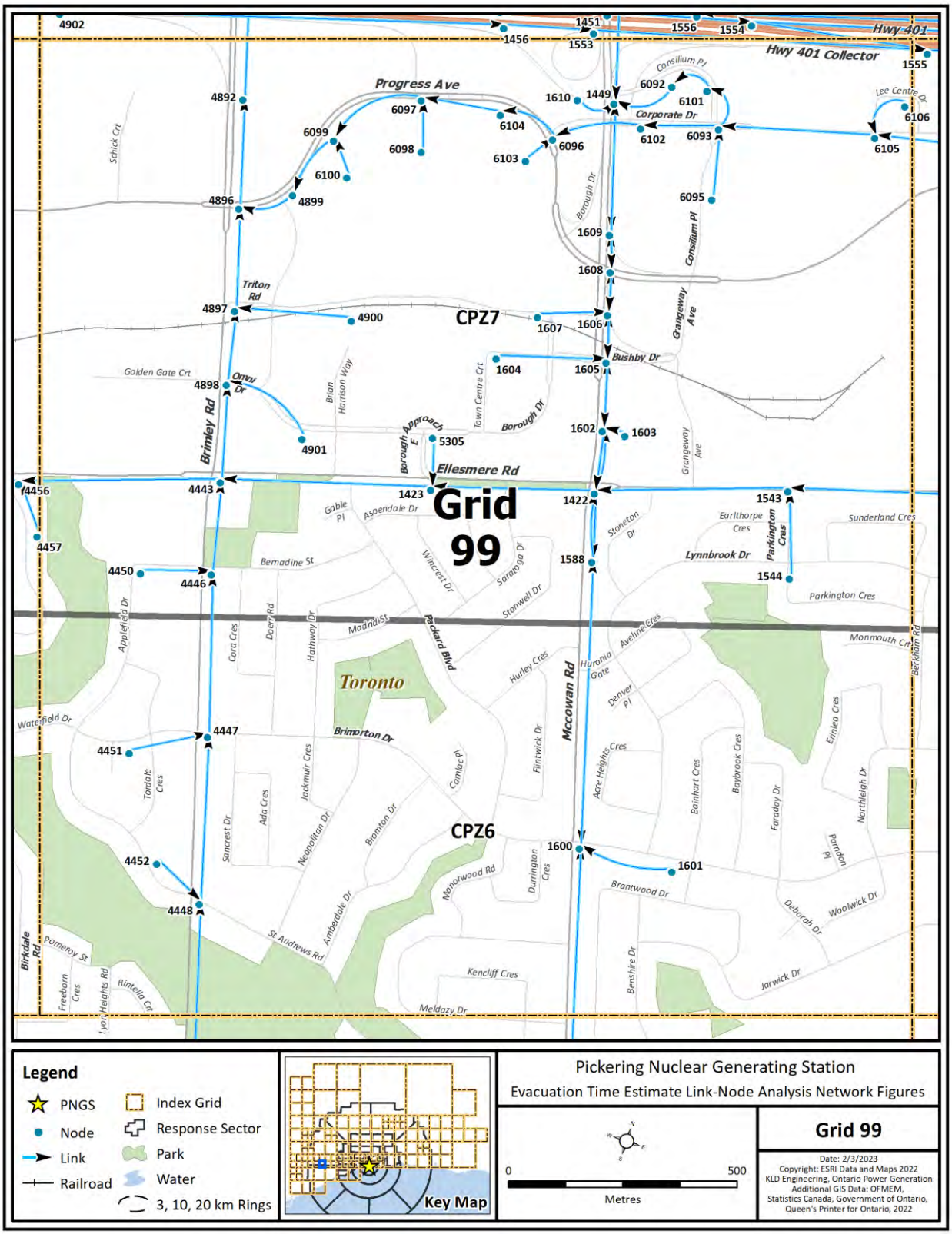


**Figure K-100. Link-Node Analysis Network – Grid 99**

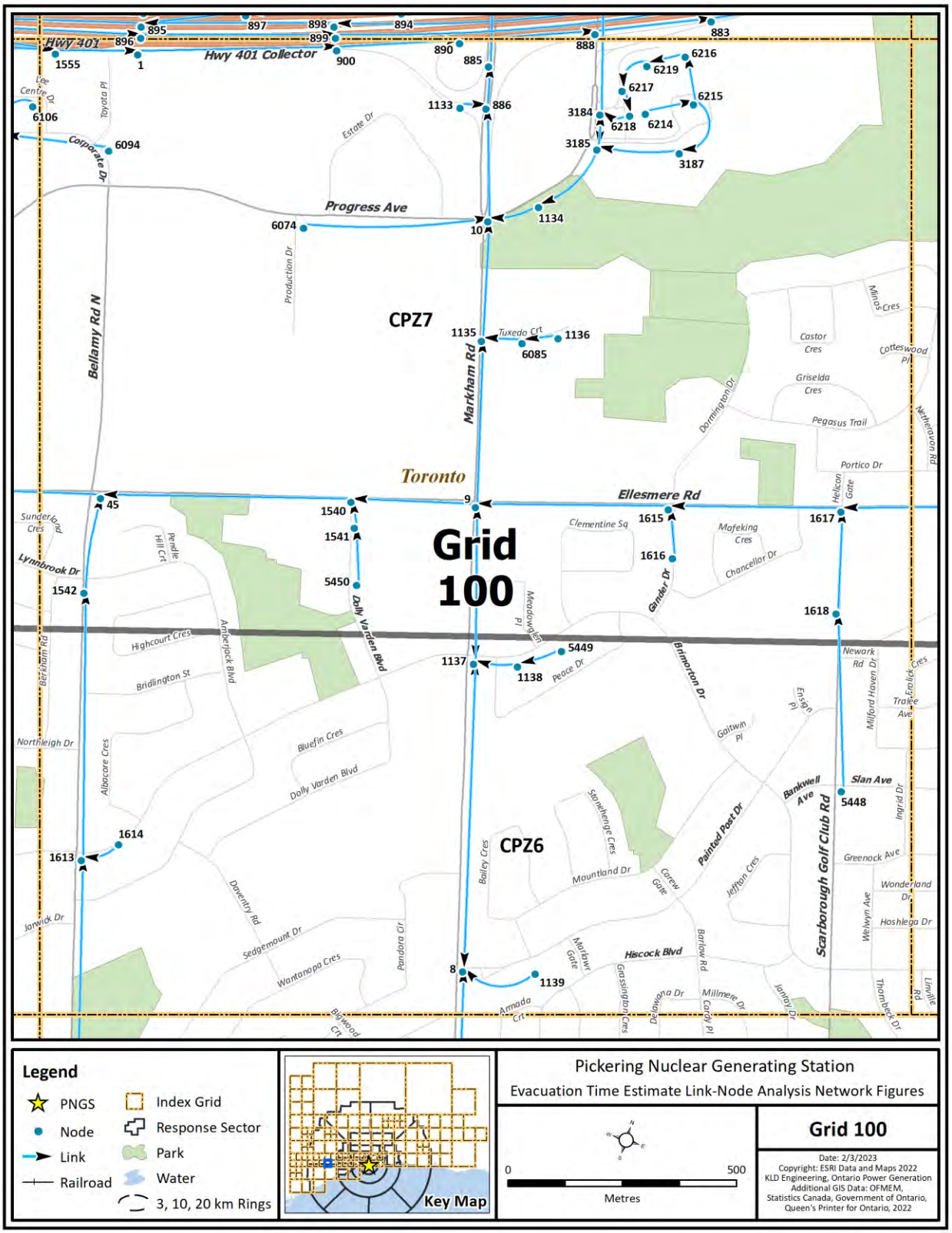


**Figure K-101. Link-Node Analysis Network – Grid 100**

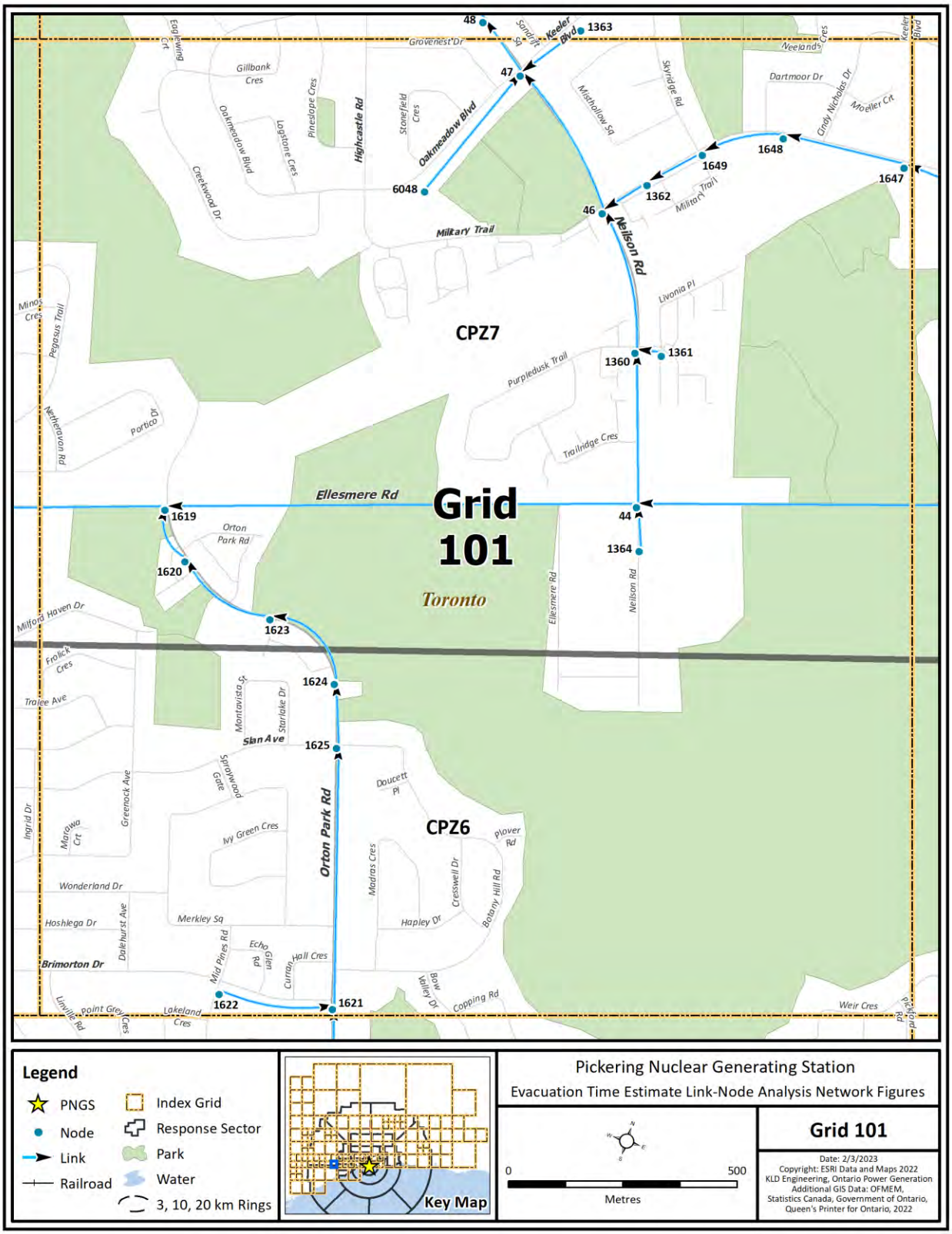


**Figure K-102. Link-Node Analysis Network – Grid 101**

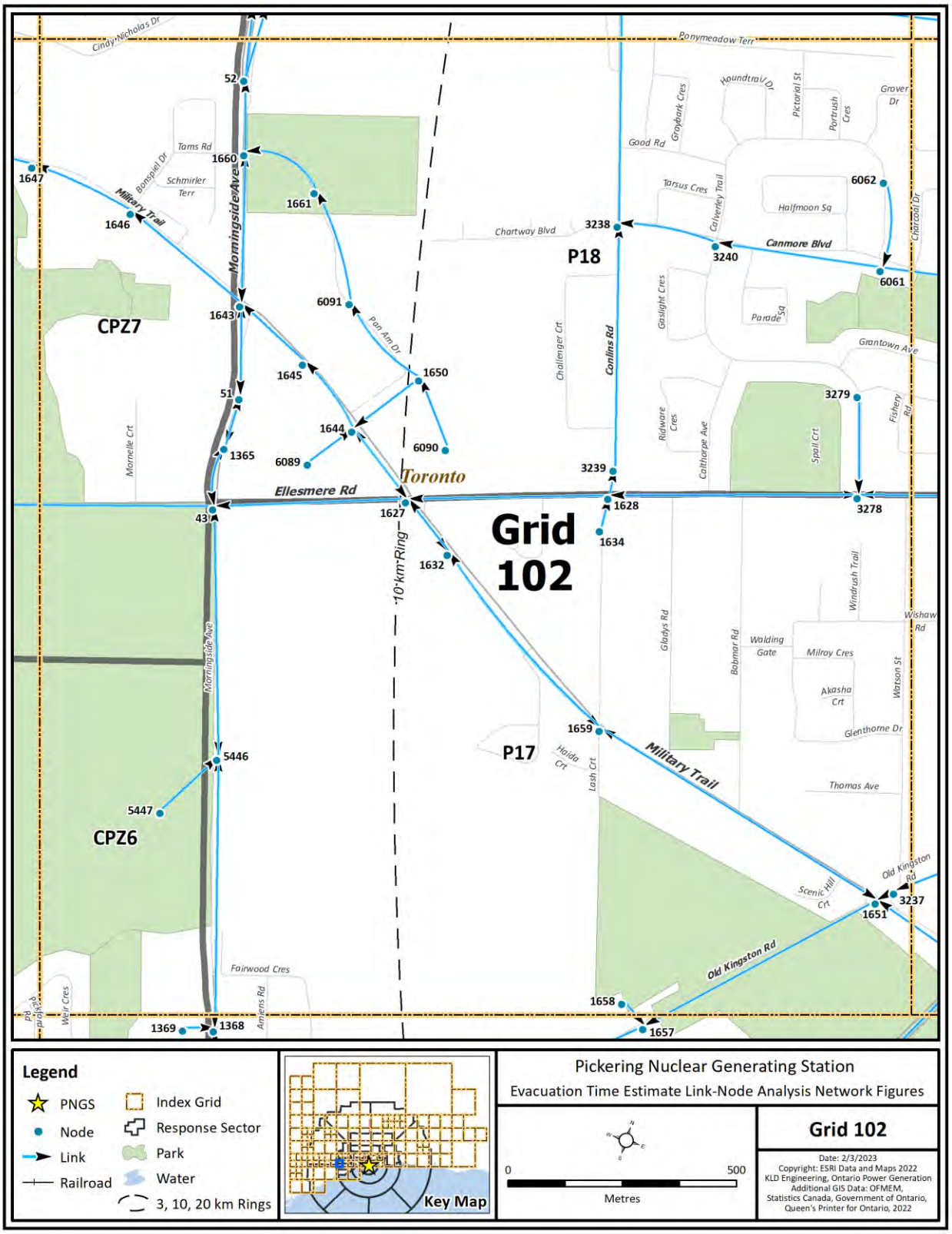


**Figure K-103. Link-Node Analysis Network – Grid 102**

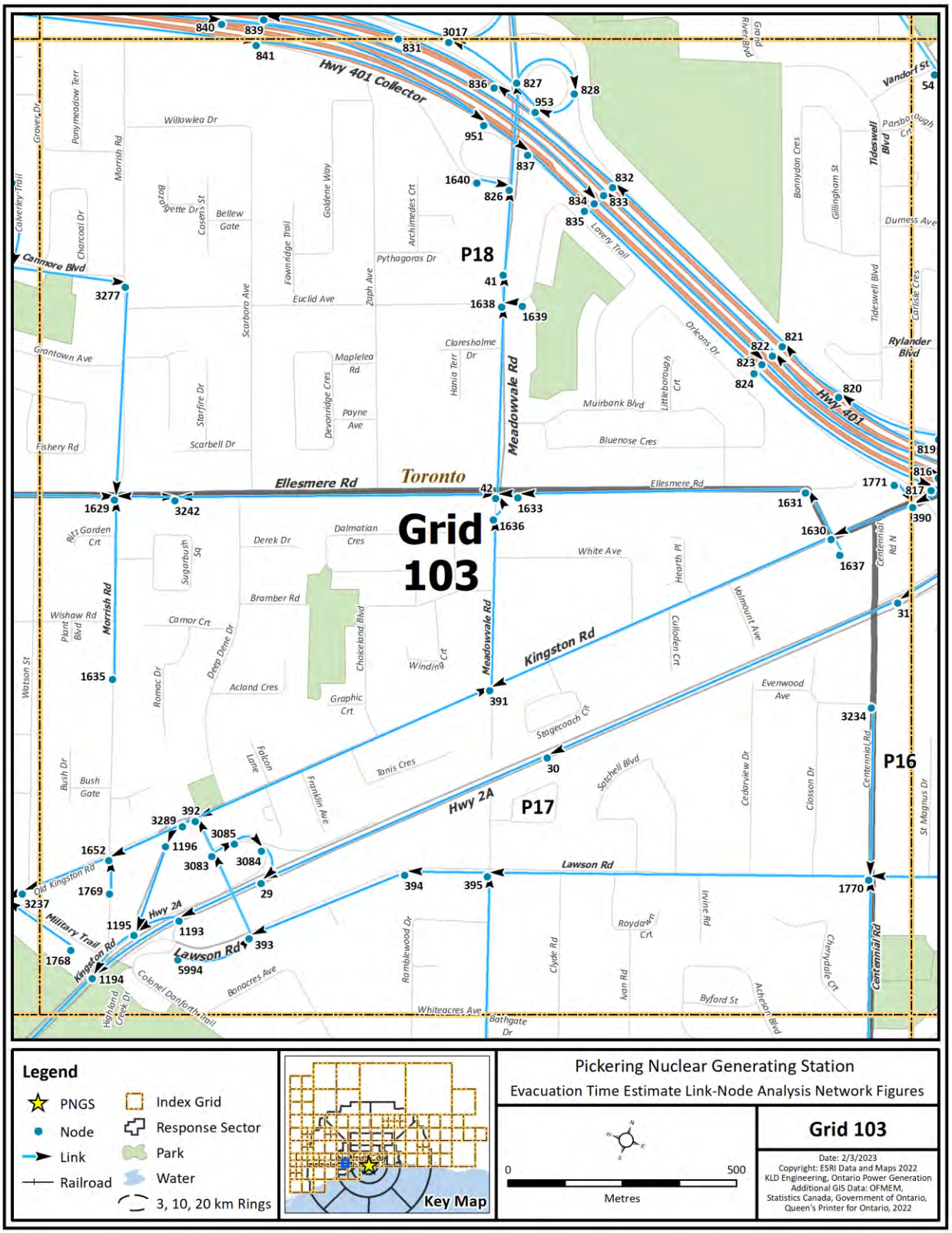


**Figure K-104. Link-Node Analysis Network – Grid 103**

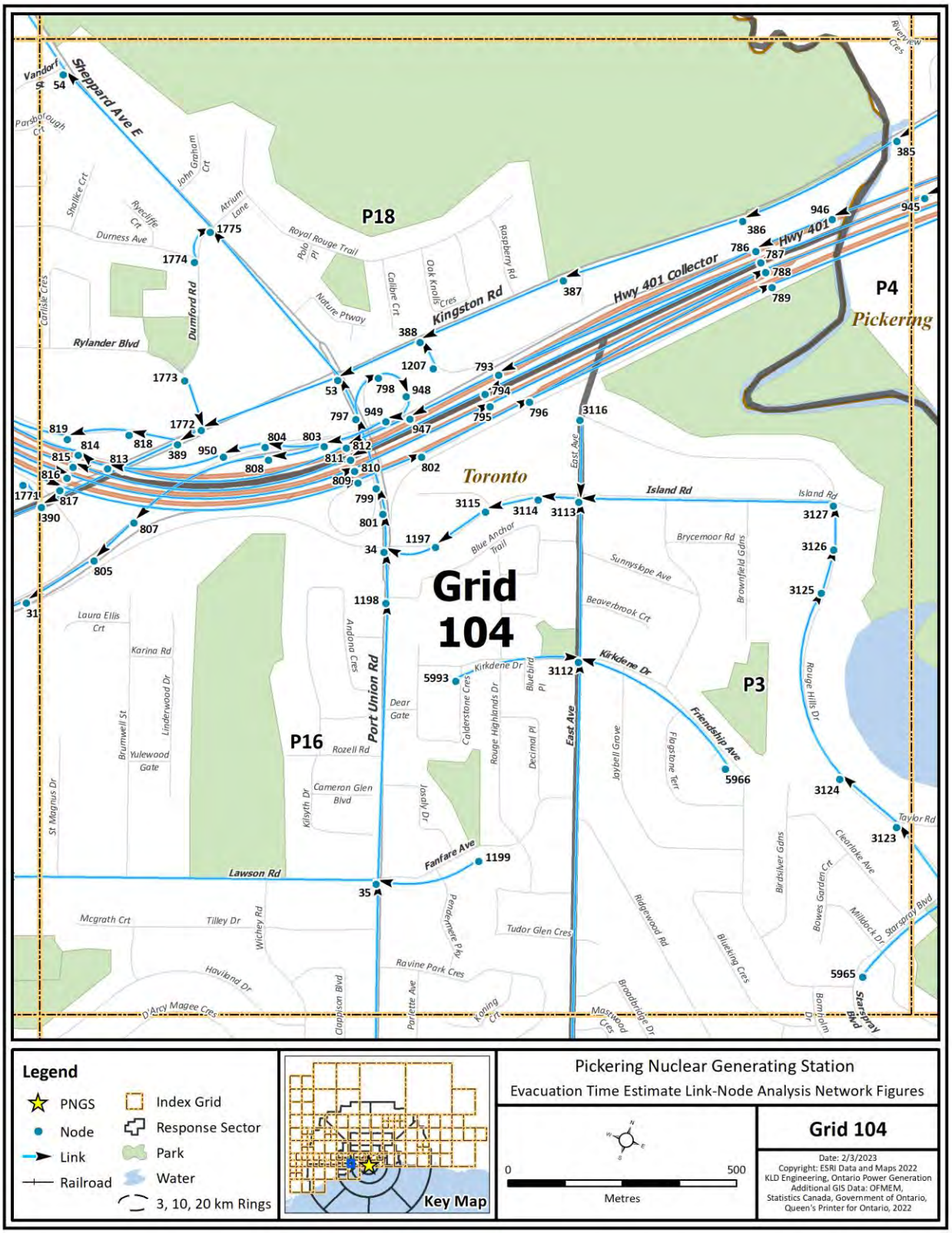


**Figure K-105. Link-Node Analysis Network – Grid 104**

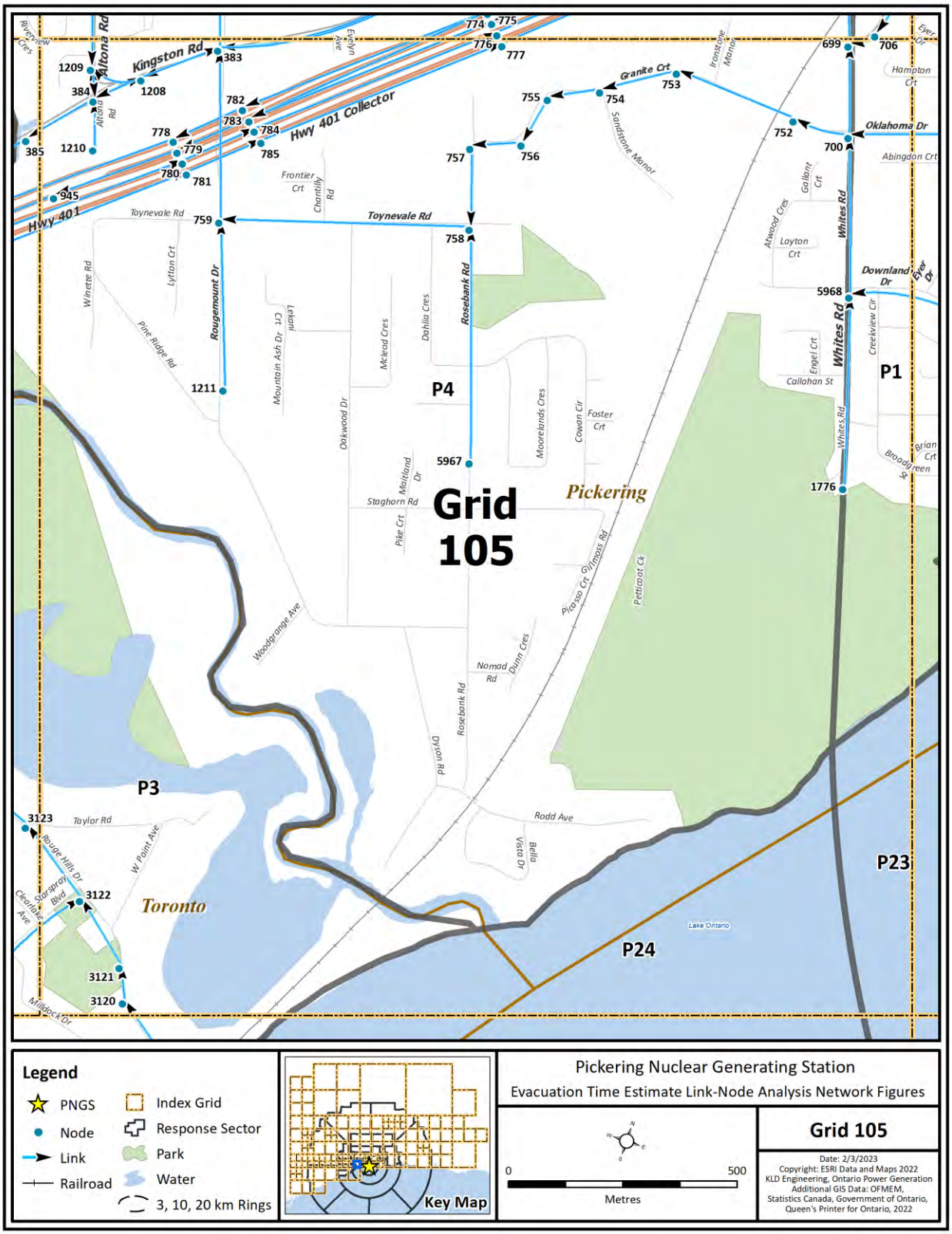


**Figure K-106. Link-Node Analysis Network – Grid 105**

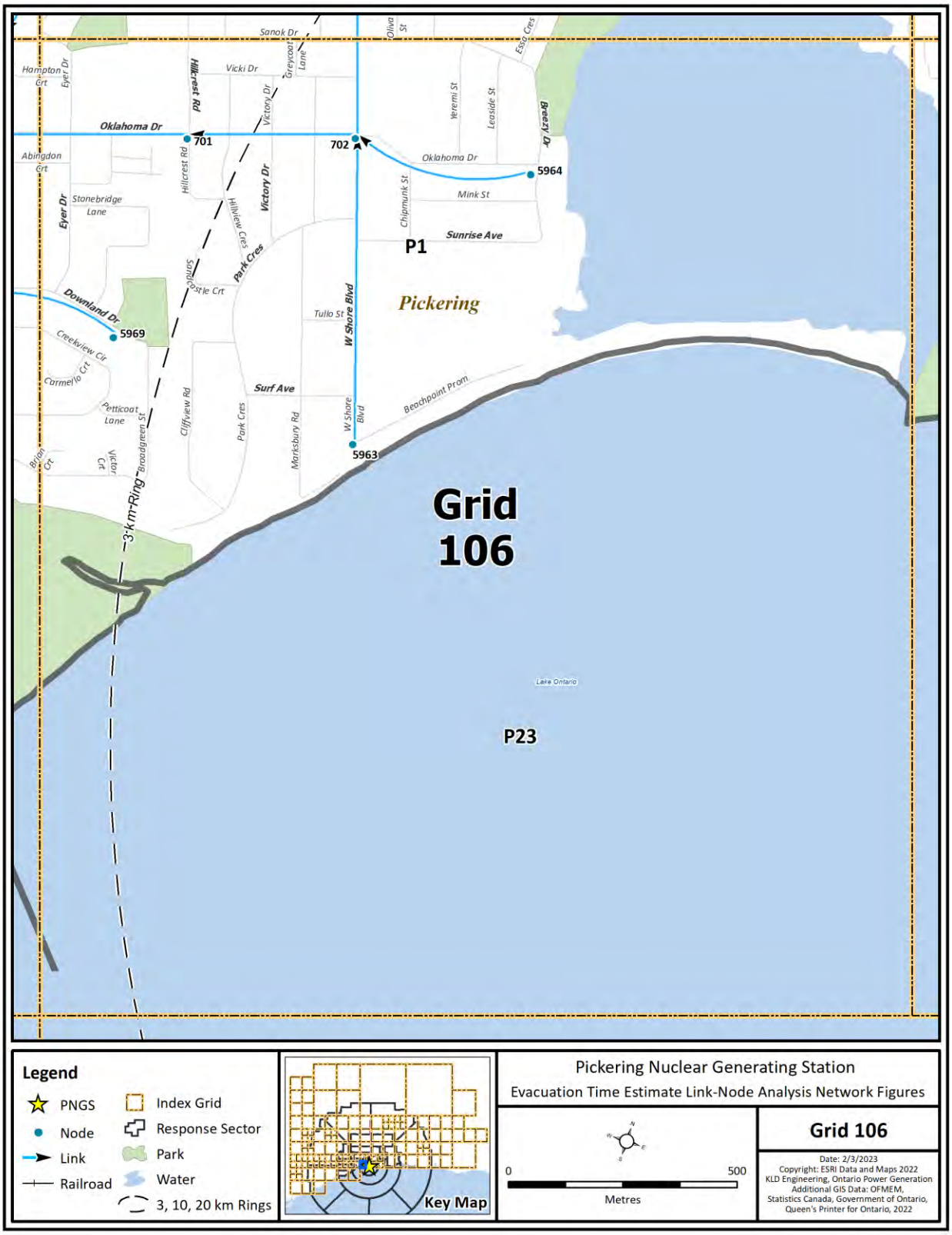


**Figure K-107. Link-Node Analysis Network – Grid 106**

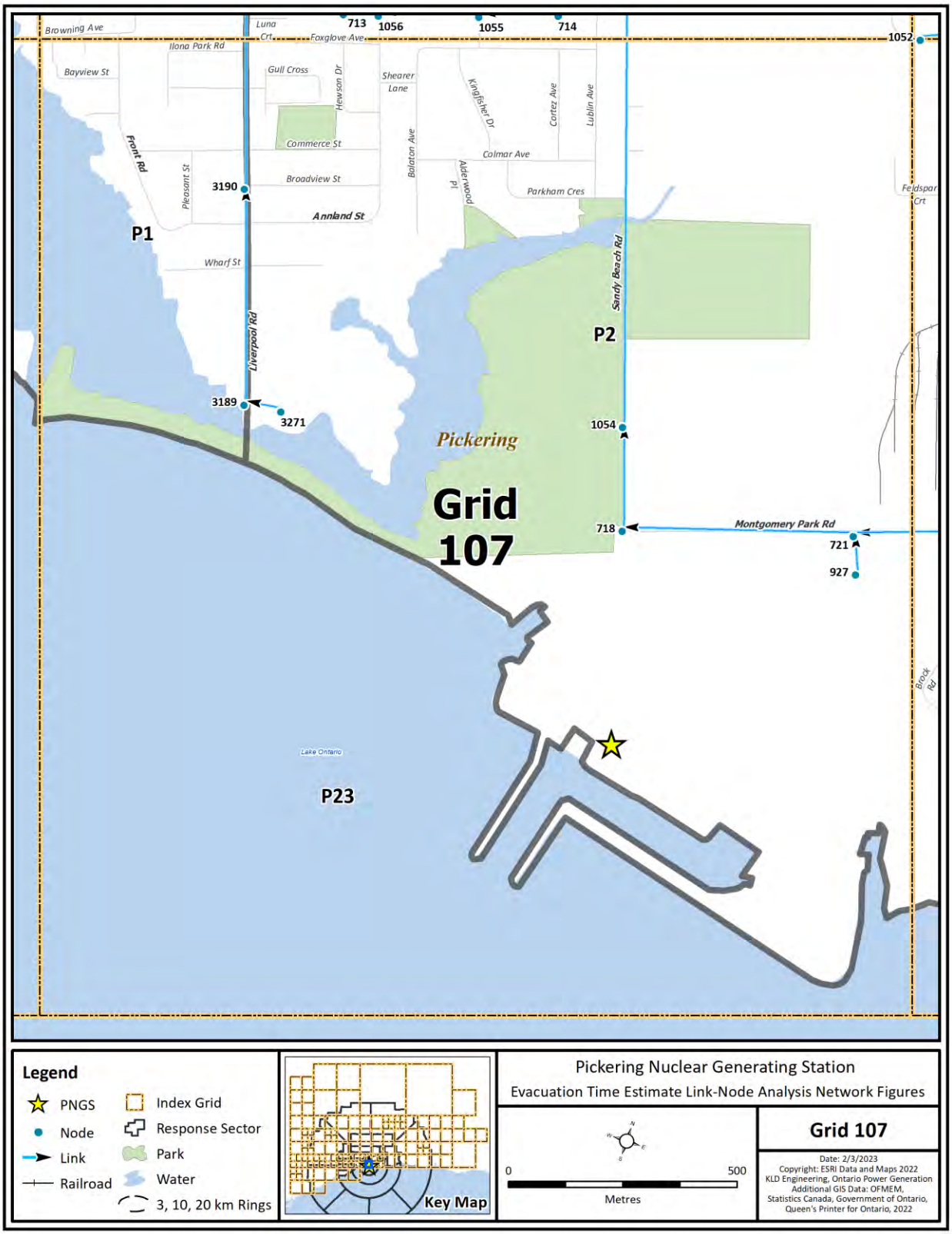


**Figure K-108. Link-Node Analysis Network – Grid 107**

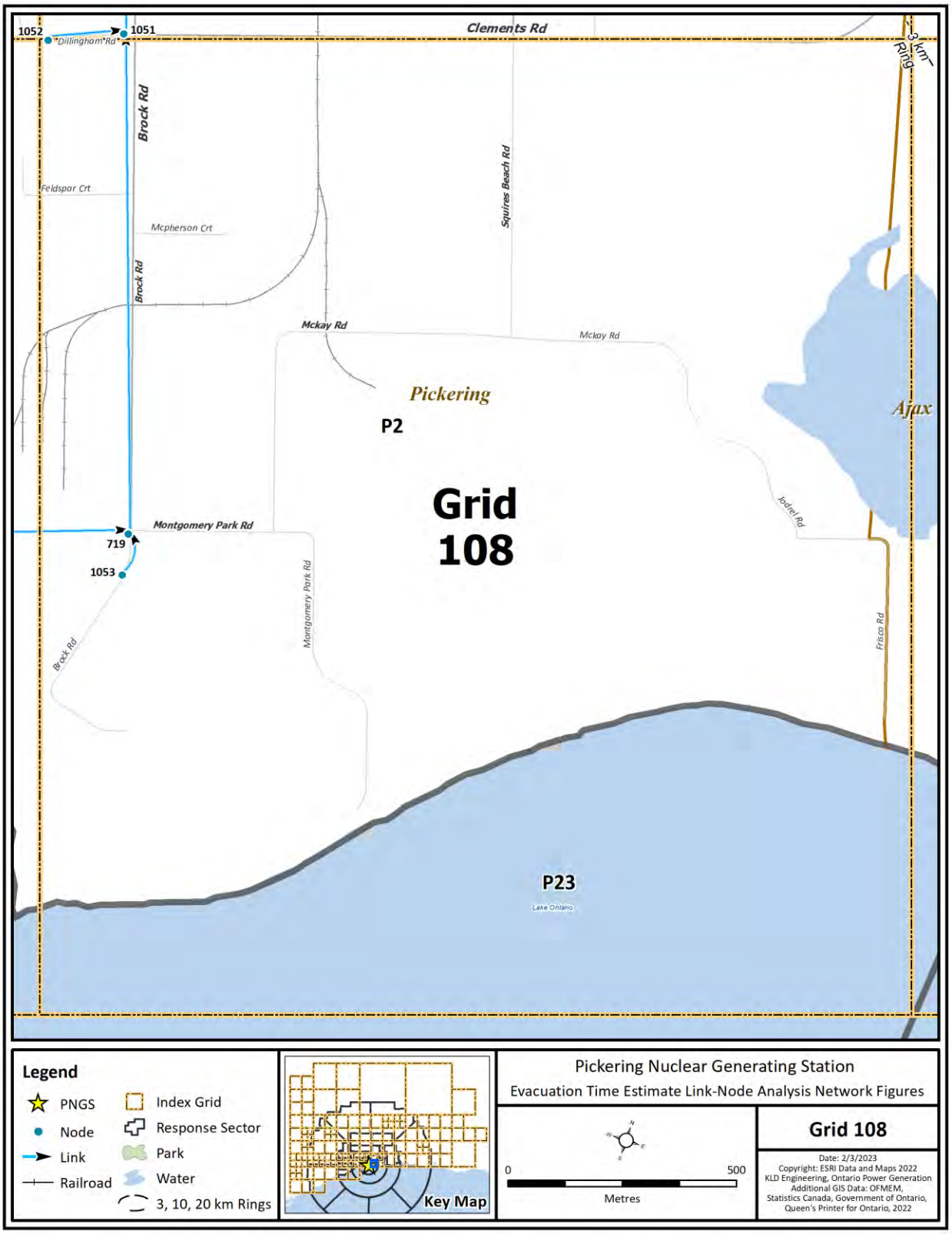


**Figure K-109. Link-Node Analysis Network – Grid 108**

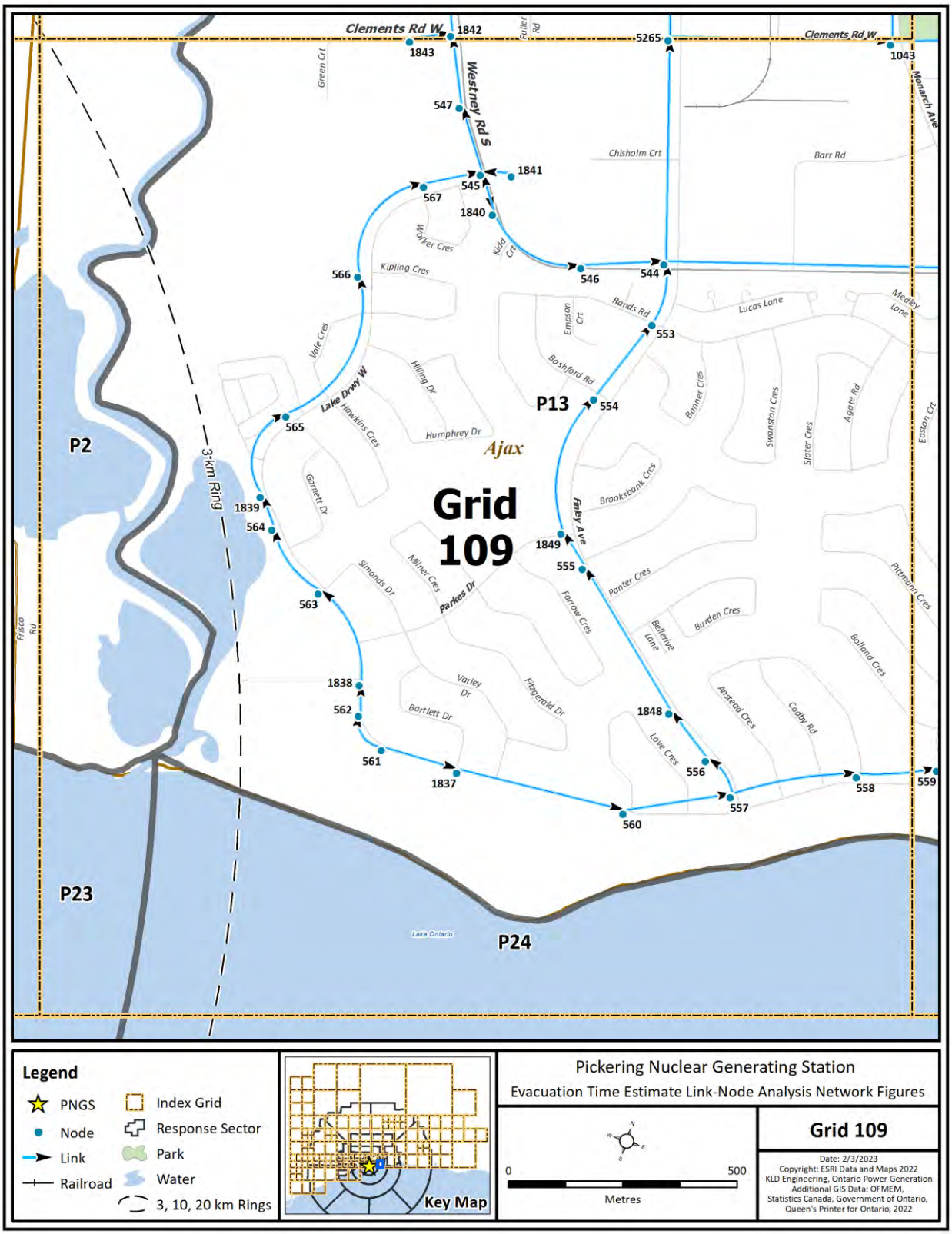


**Figure K-110. Link-Node Analysis Network – Grid 109**

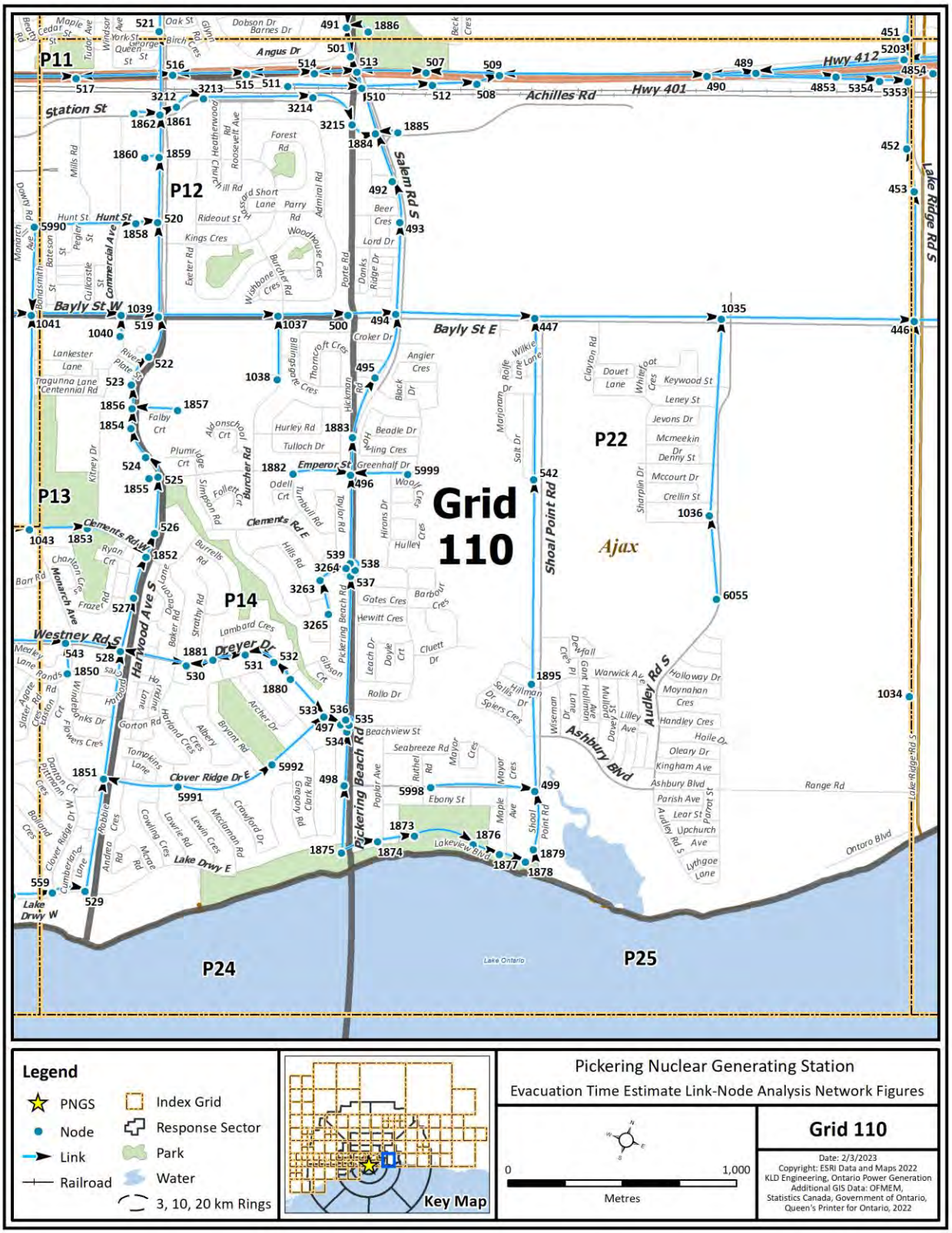


**Figure K-111. Link-Node Analysis Network – Grid 110**

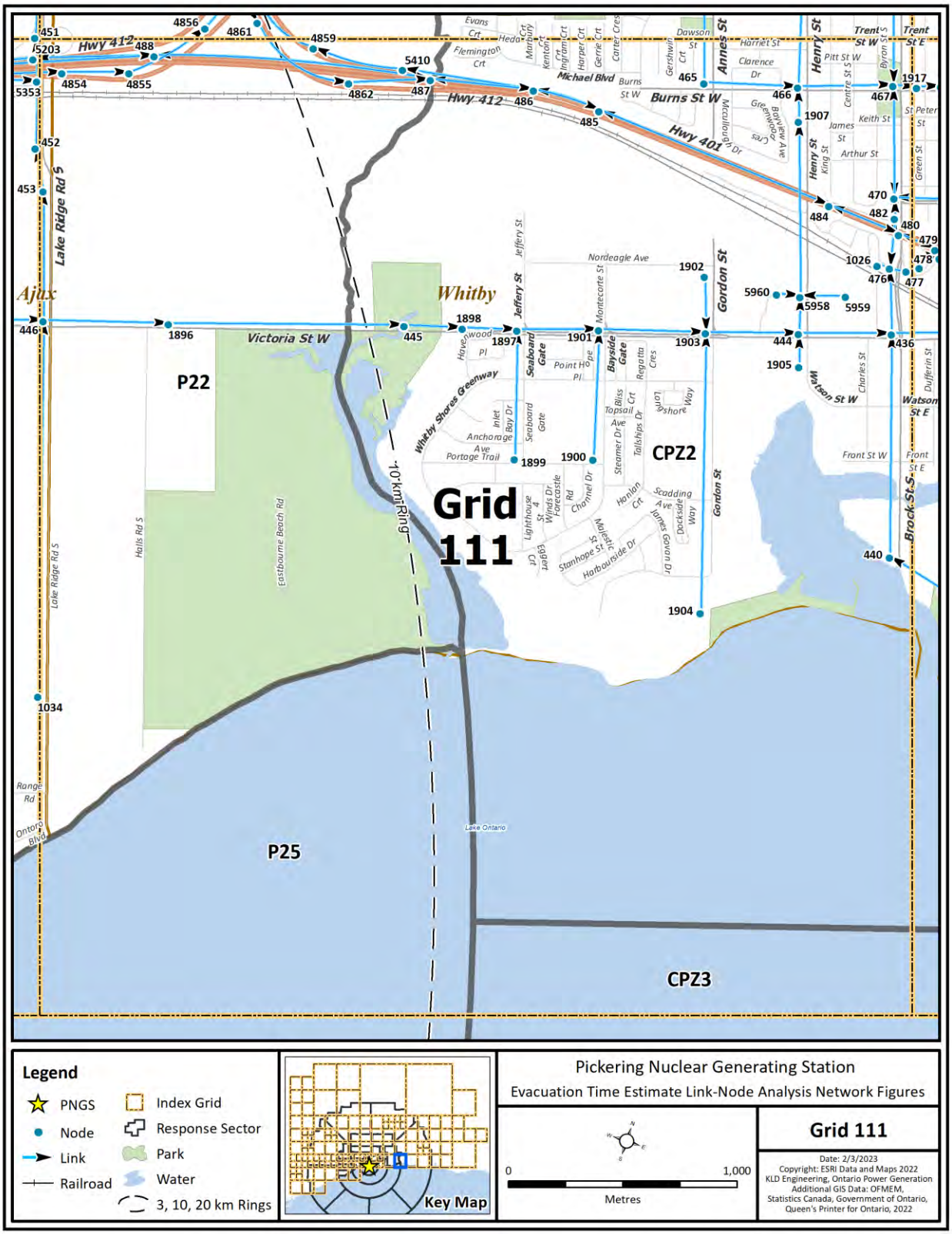


**Figure K-112. Link-Node Analysis Network – Grid 111**

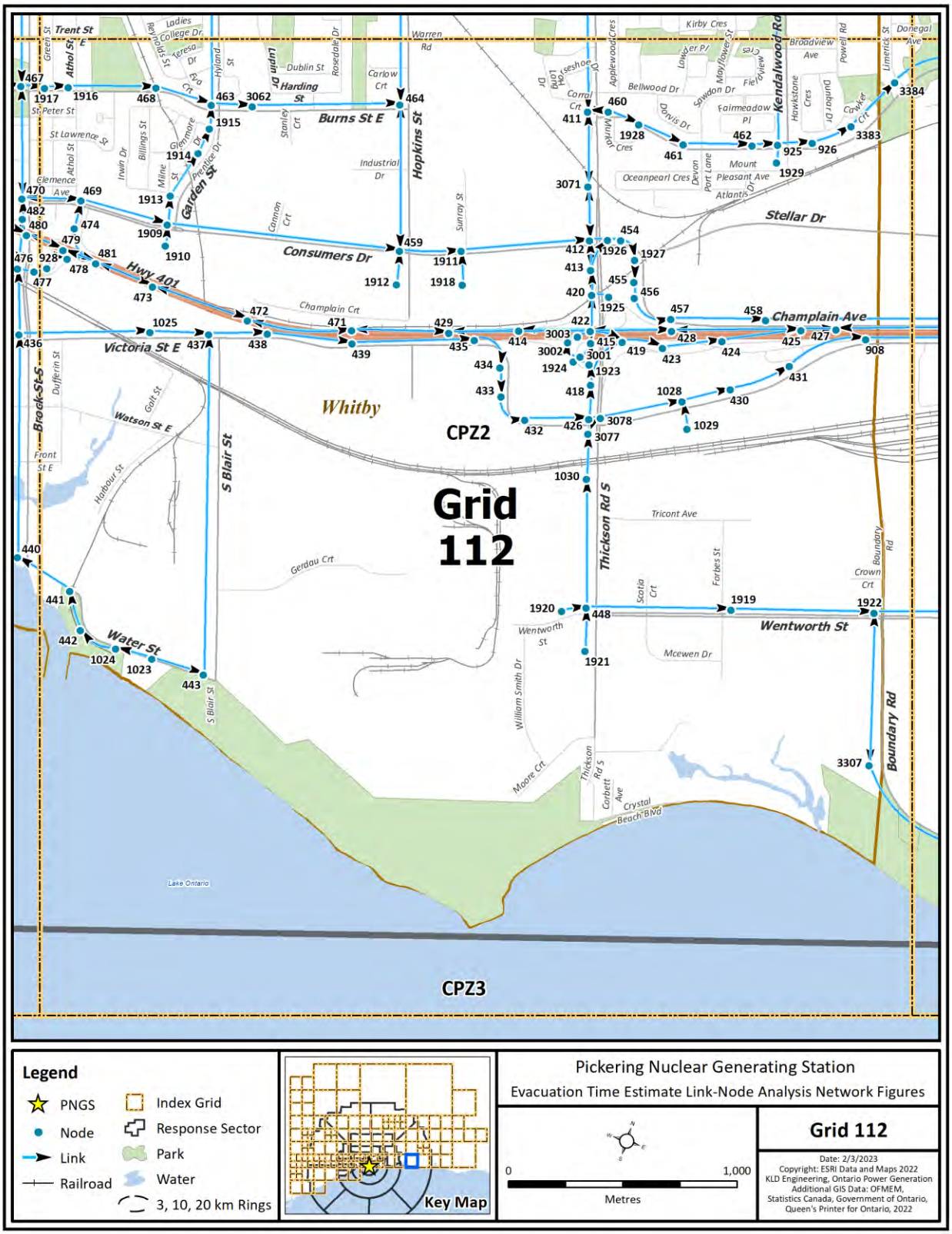


**Figure K-113. Link-Node Analysis Network – Grid 112**

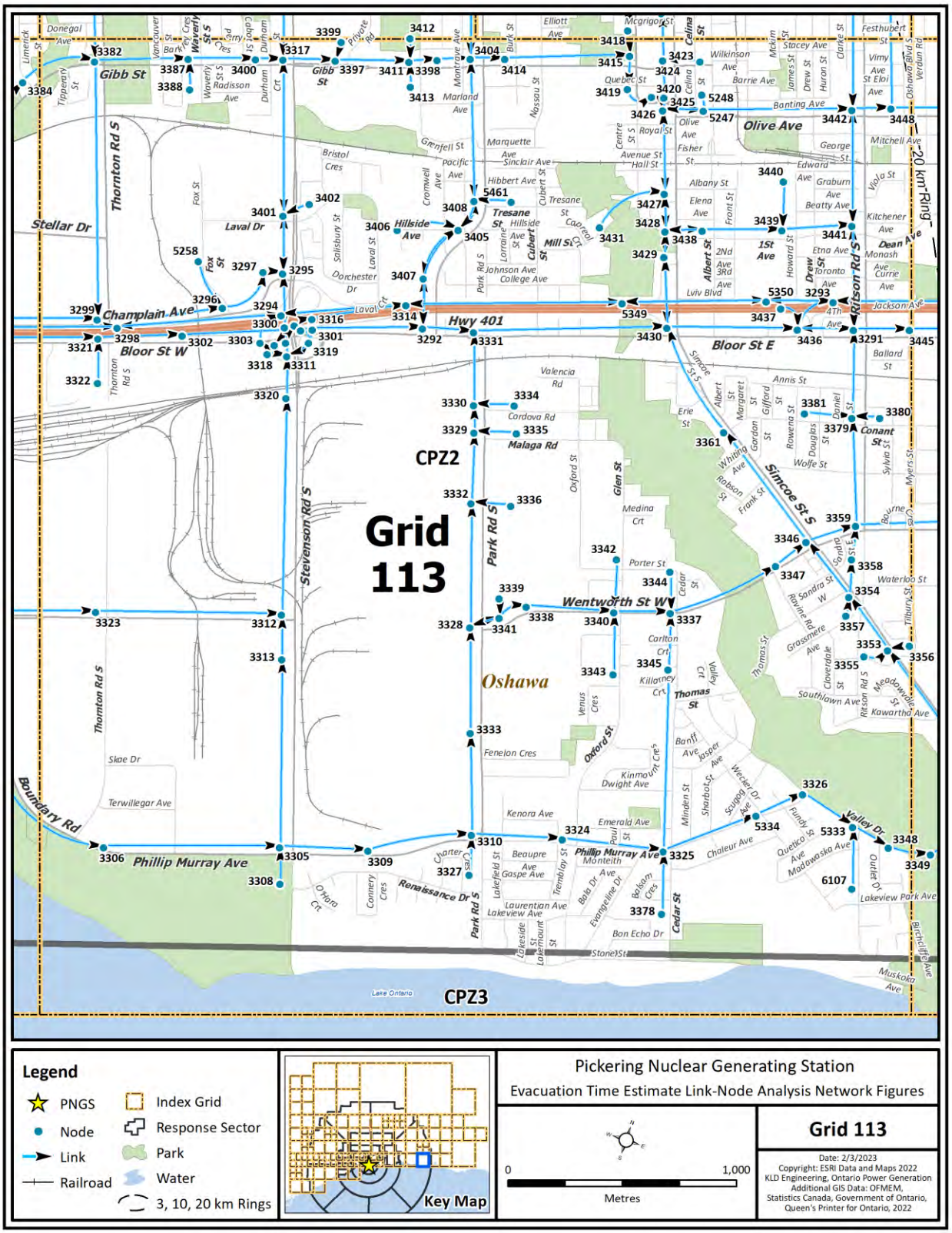


**Figure K-114. Link-Node Analysis Network – Grid 113**

**Figure K-115. Link-Node Analysis Network – Grid 114**

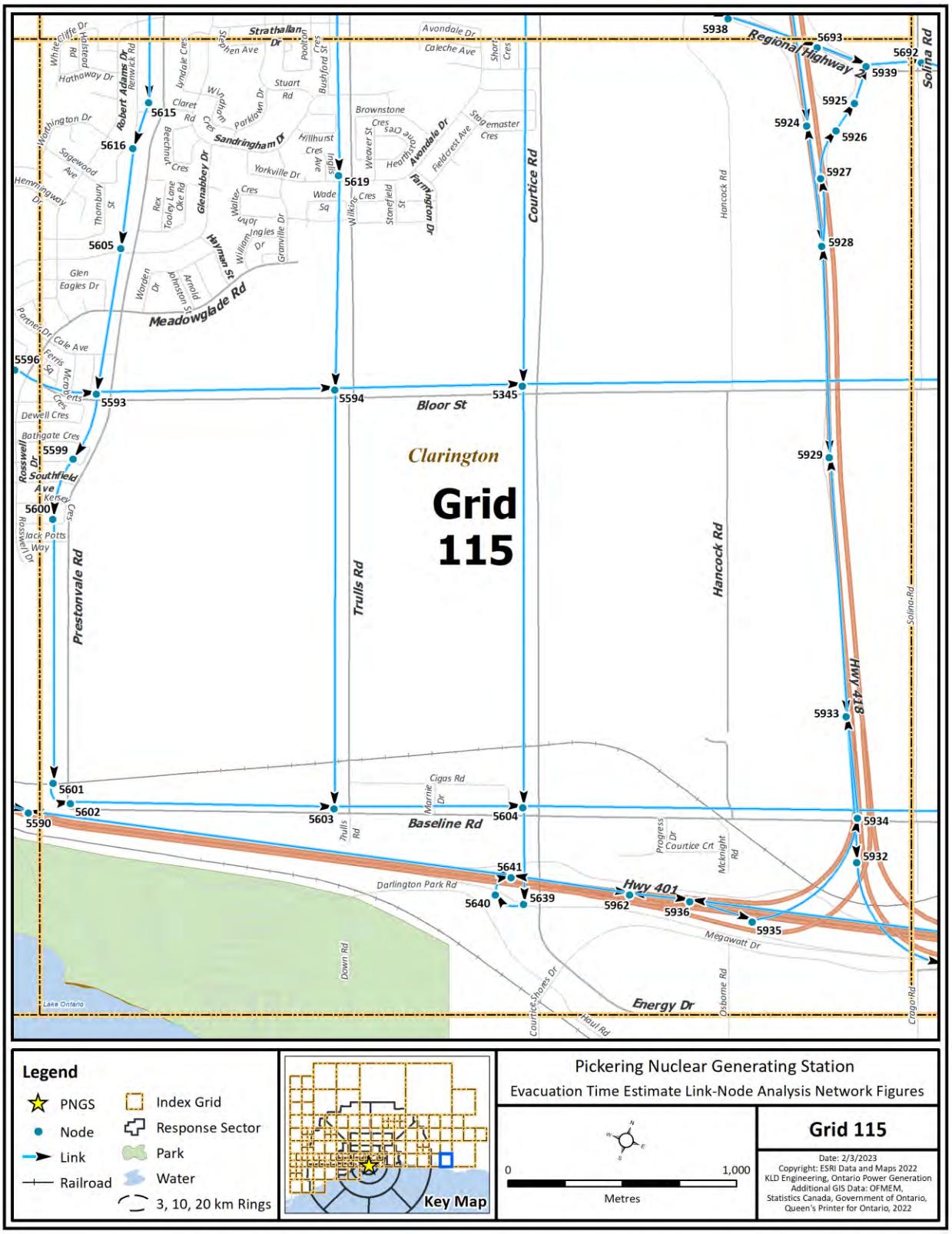


**Figure K-116. Link-Node Analysis Network – Grid 115**

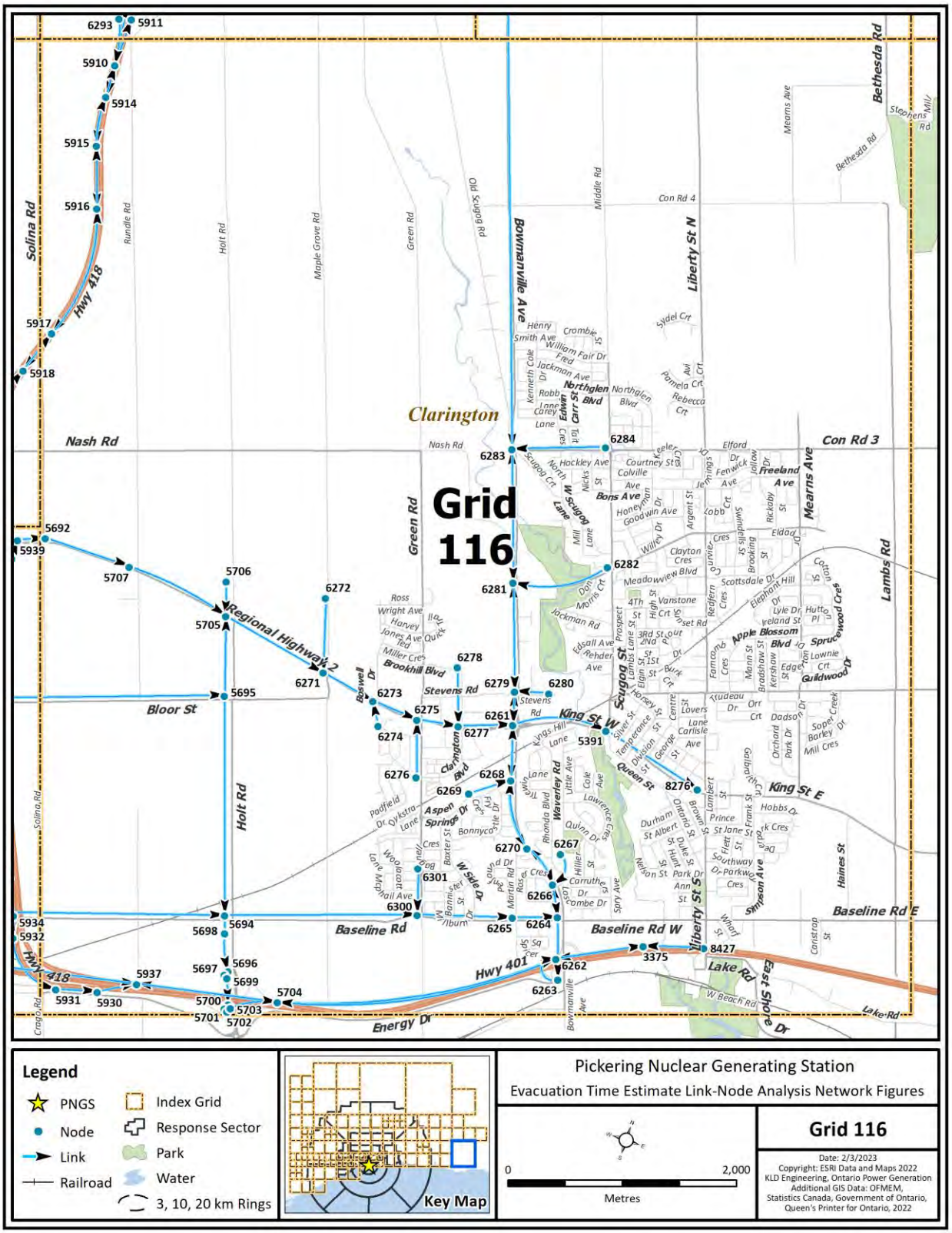


**Figure K-117. Link-Node Analysis Network – Grid 116**

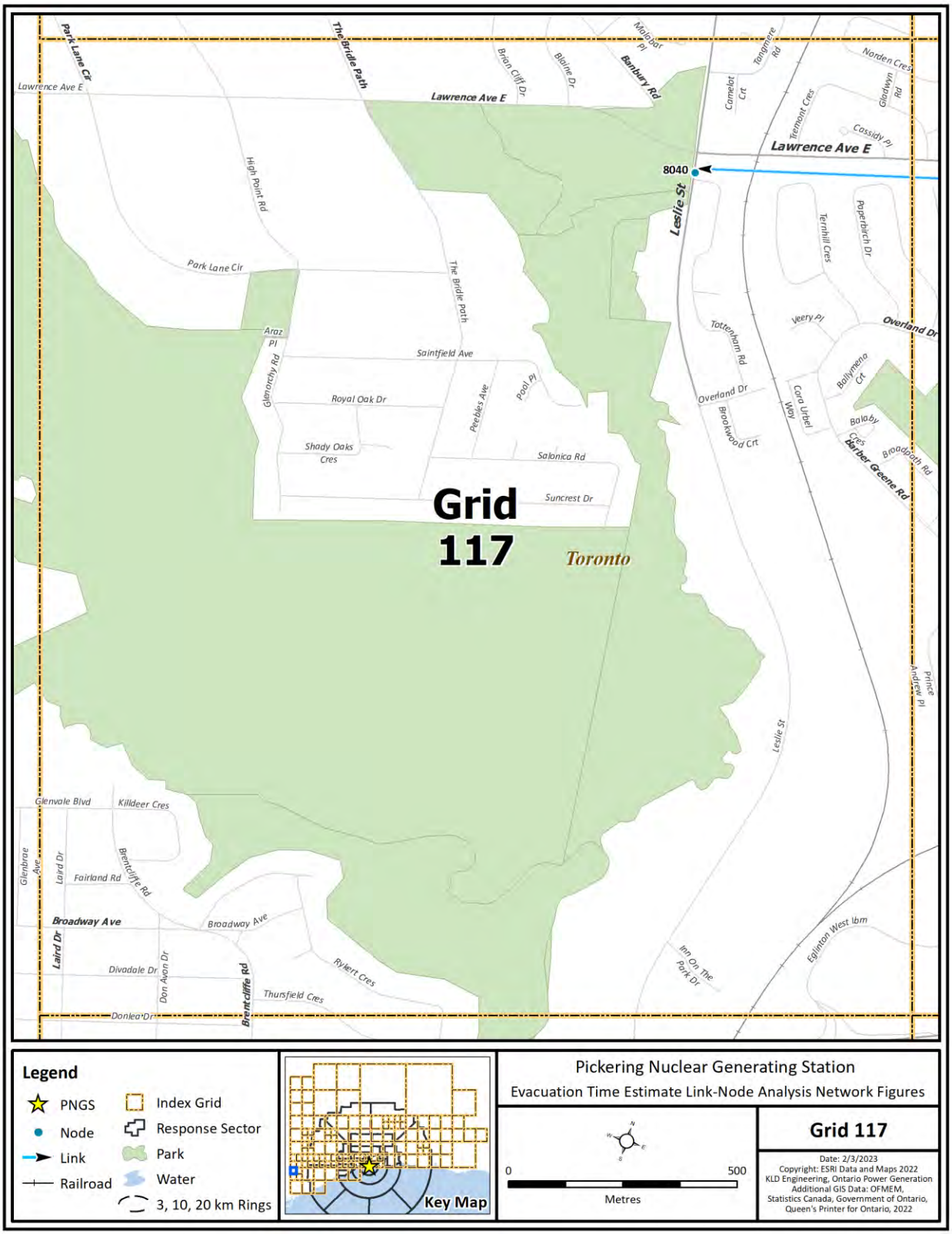


**Figure K-118. Link-Node Analysis Network – Grid 117**

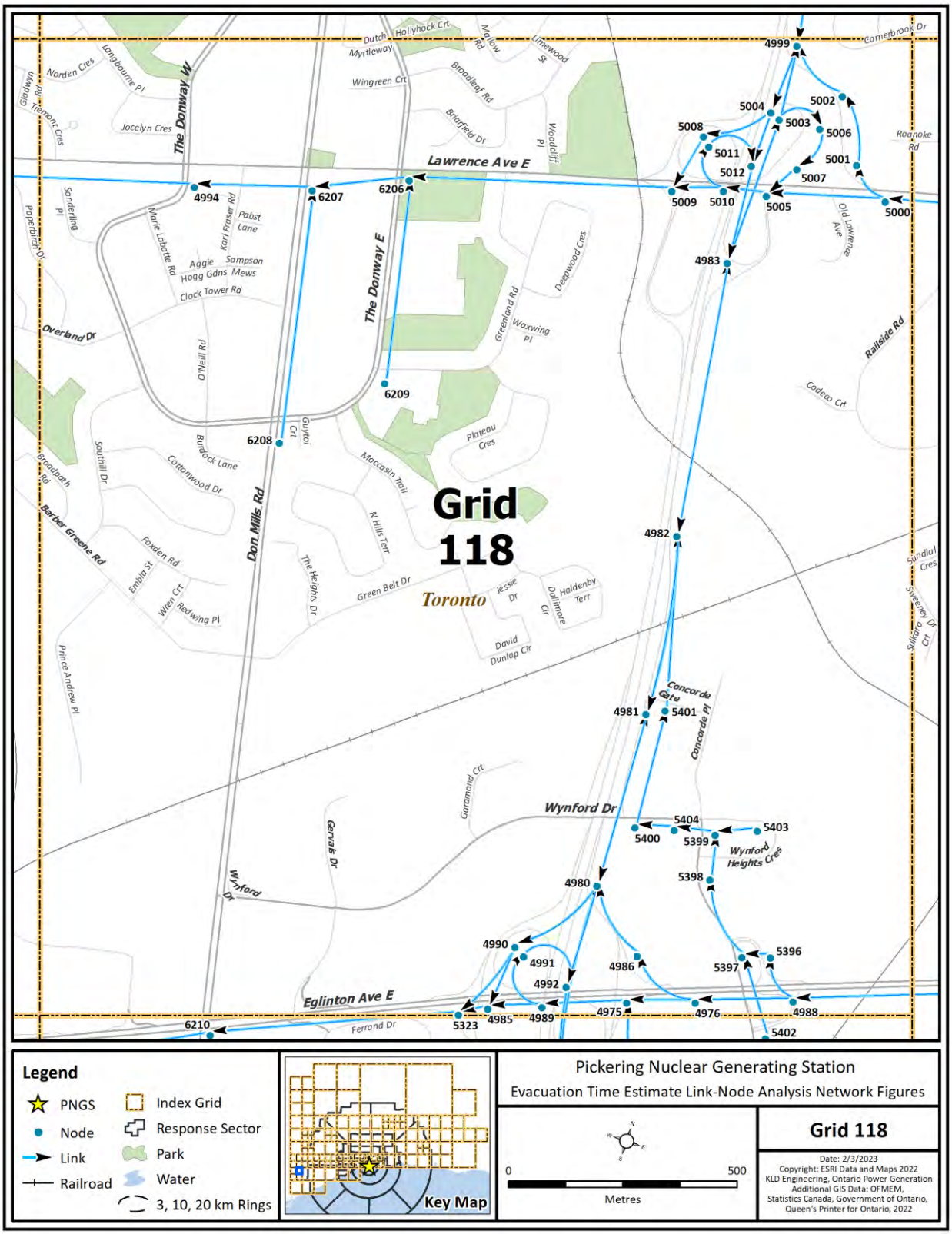


**Figure K-119. Link-Node Analysis Network – Grid 118**

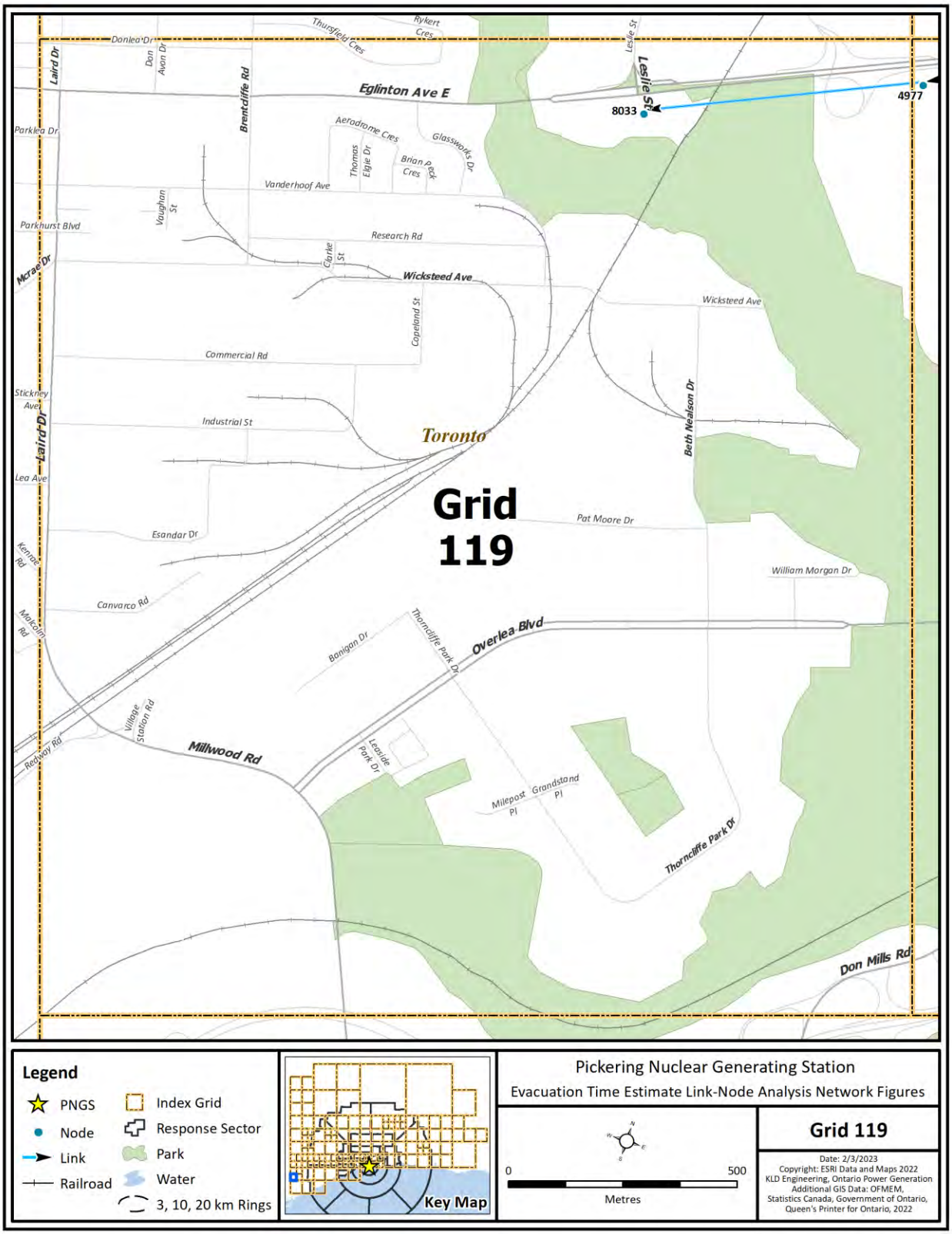


**Figure K-120. Link-Node Analysis Network – Grid 119**

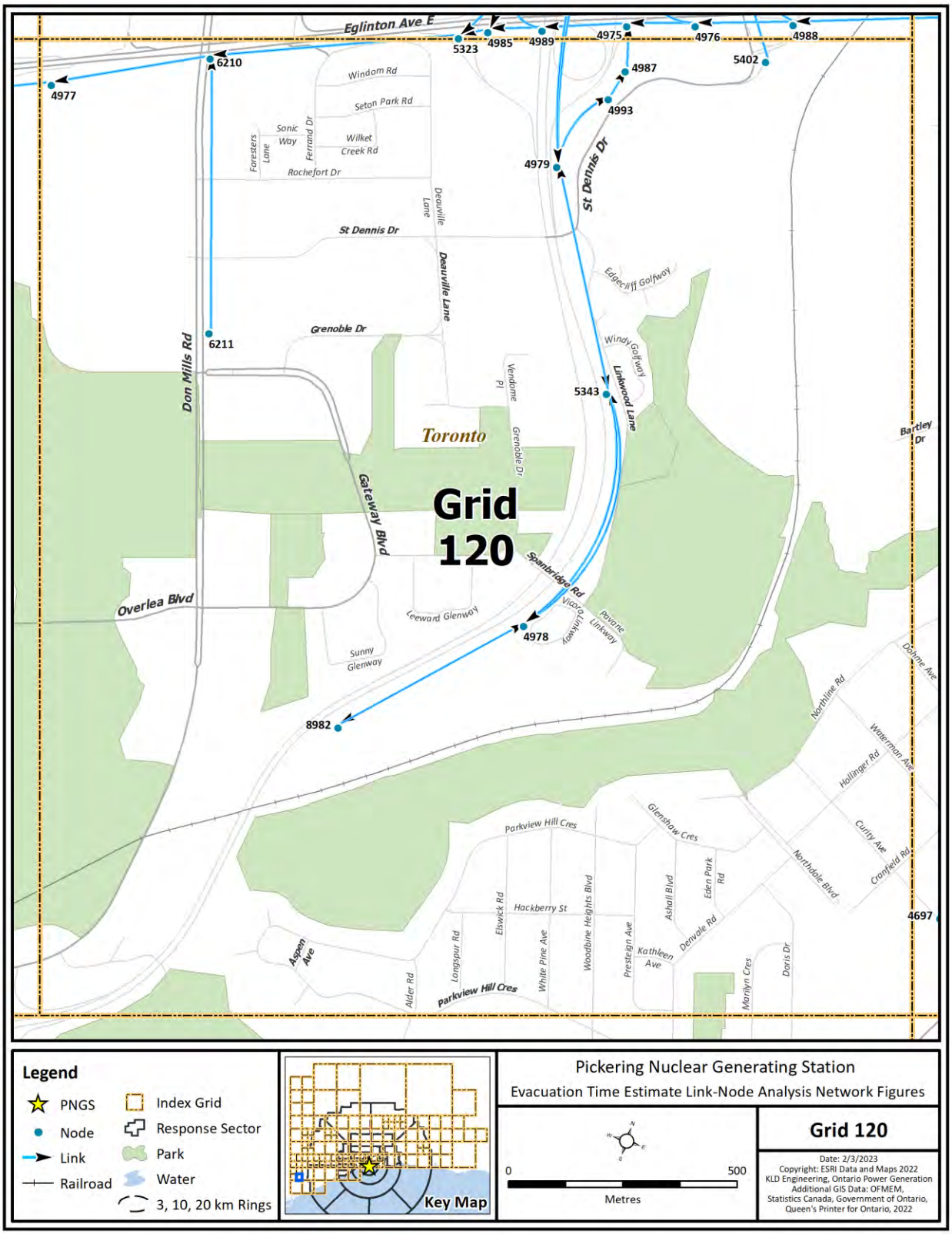


**Figure K-121. Link-Node Analysis Network – Grid 120**

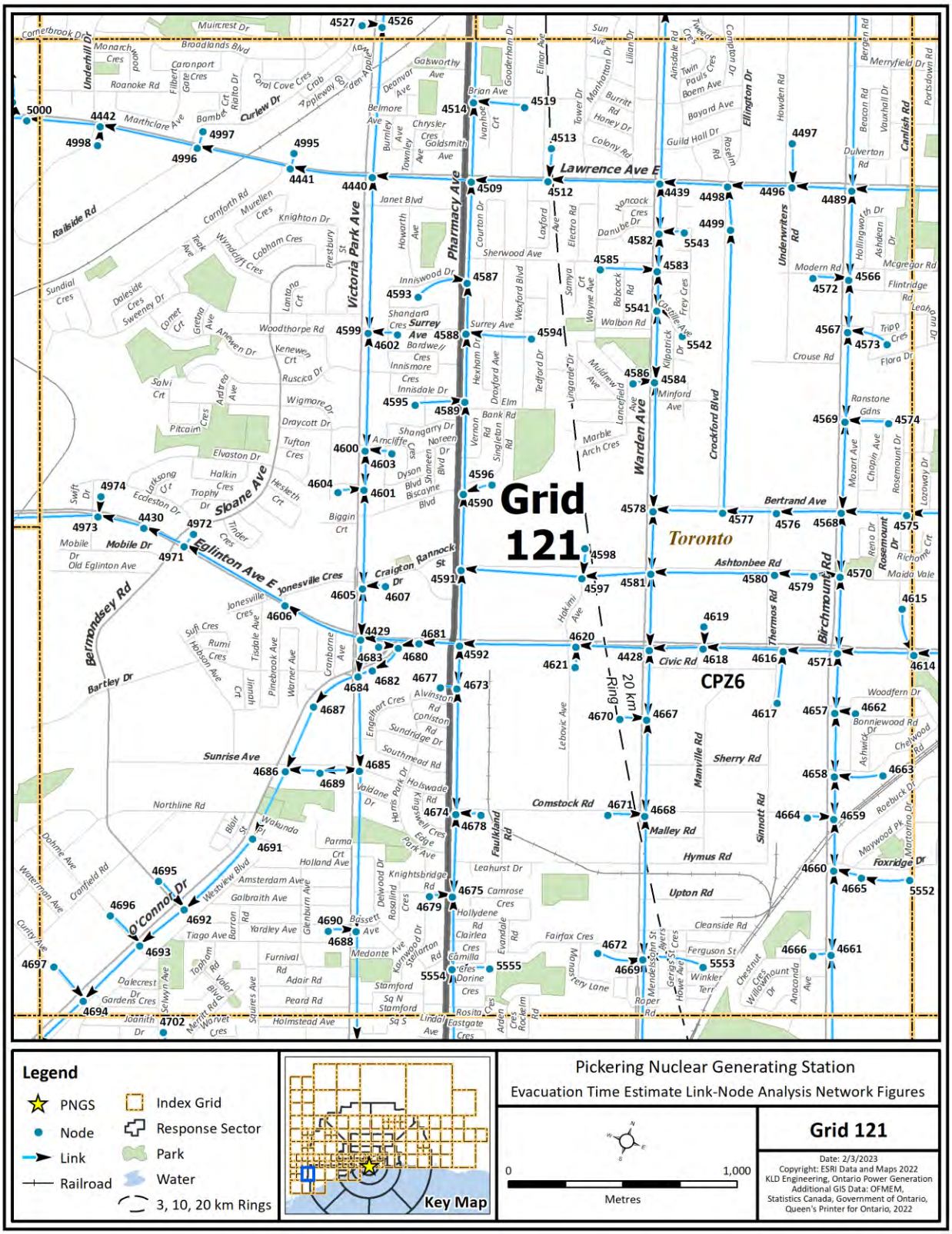


**Figure K-122. Link-Node Analysis Network – Grid 121**

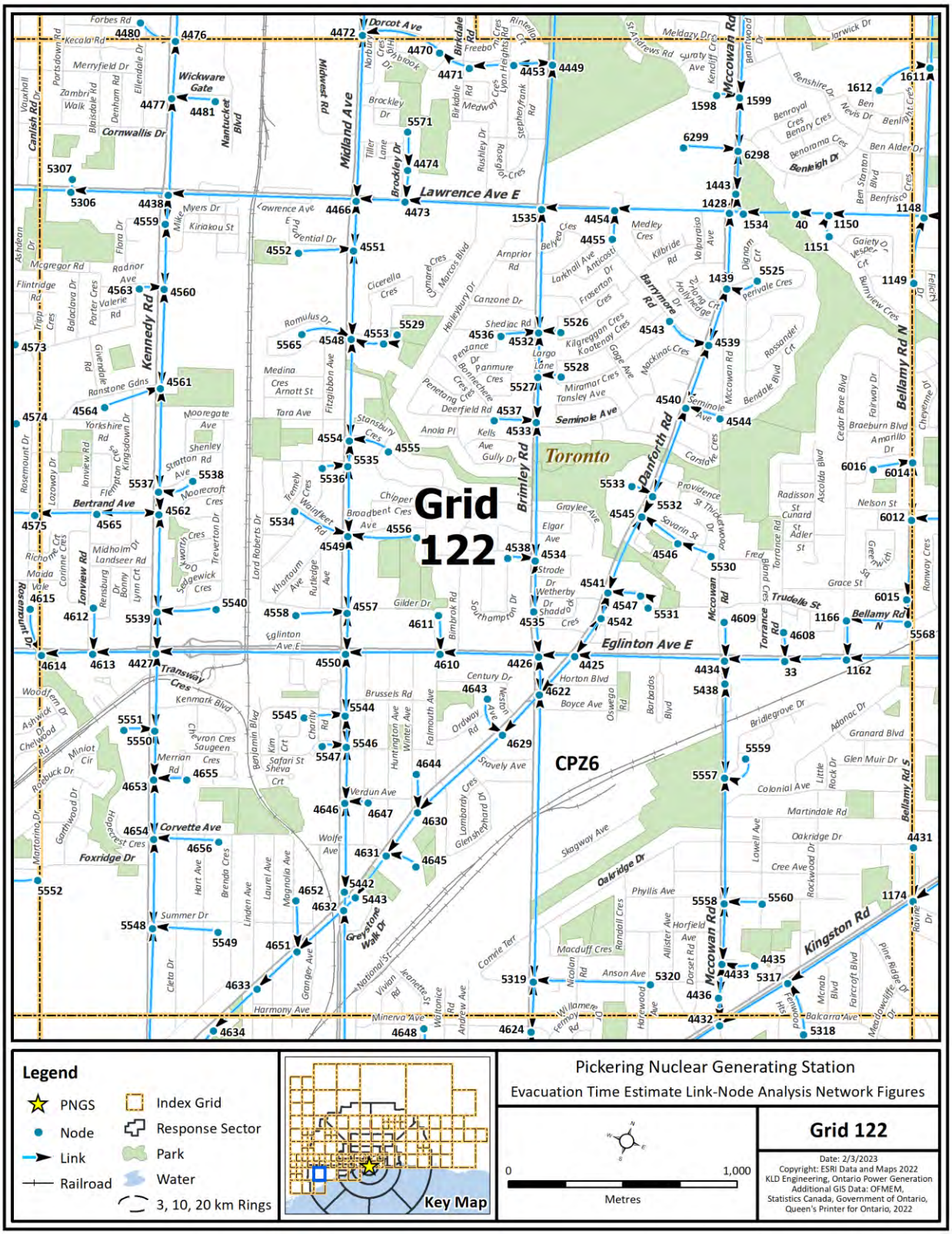


**Figure K-123. Link-Node Analysis Network – Grid 122**

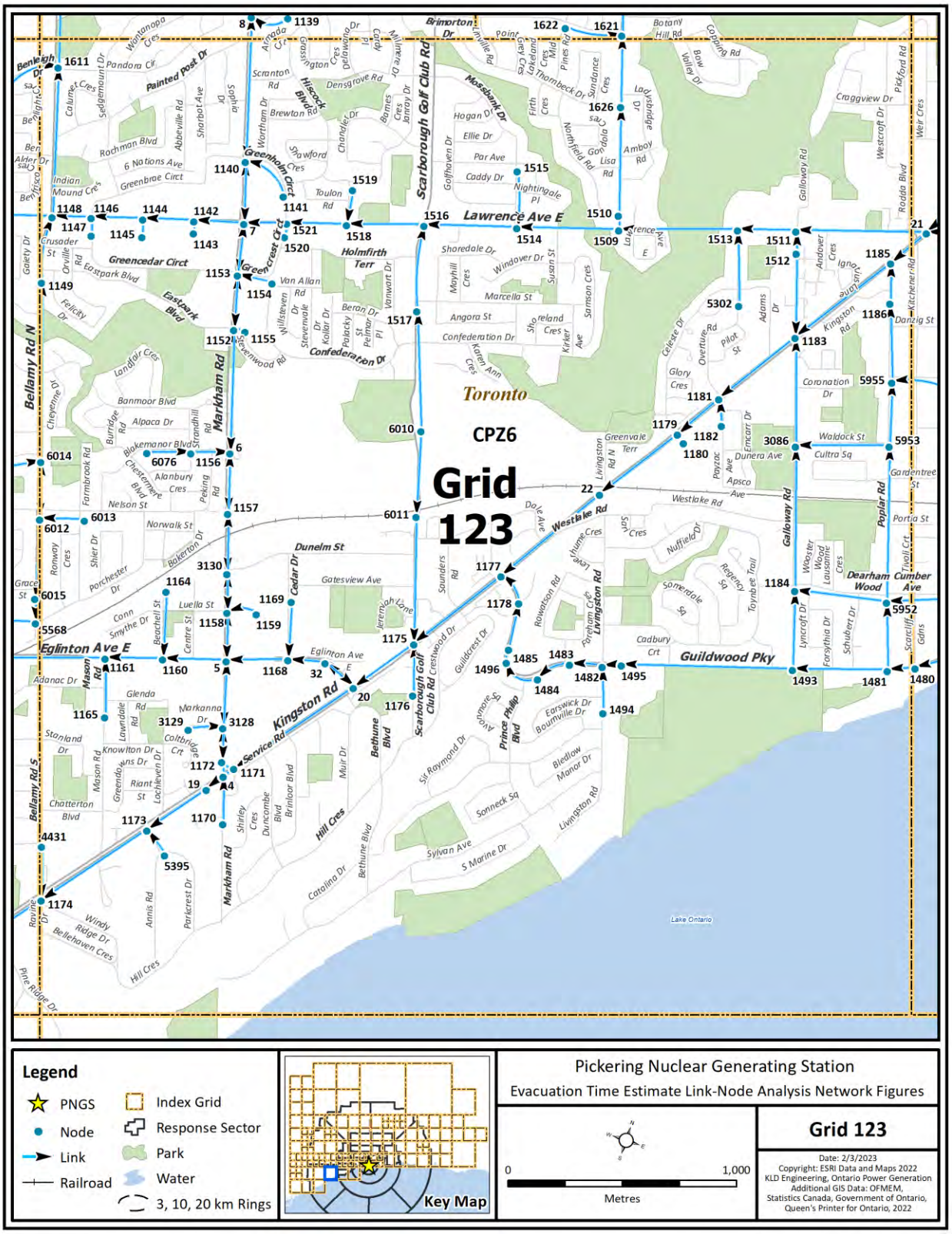


**Figure K-124. Link-Node Analysis Network – Grid 123**

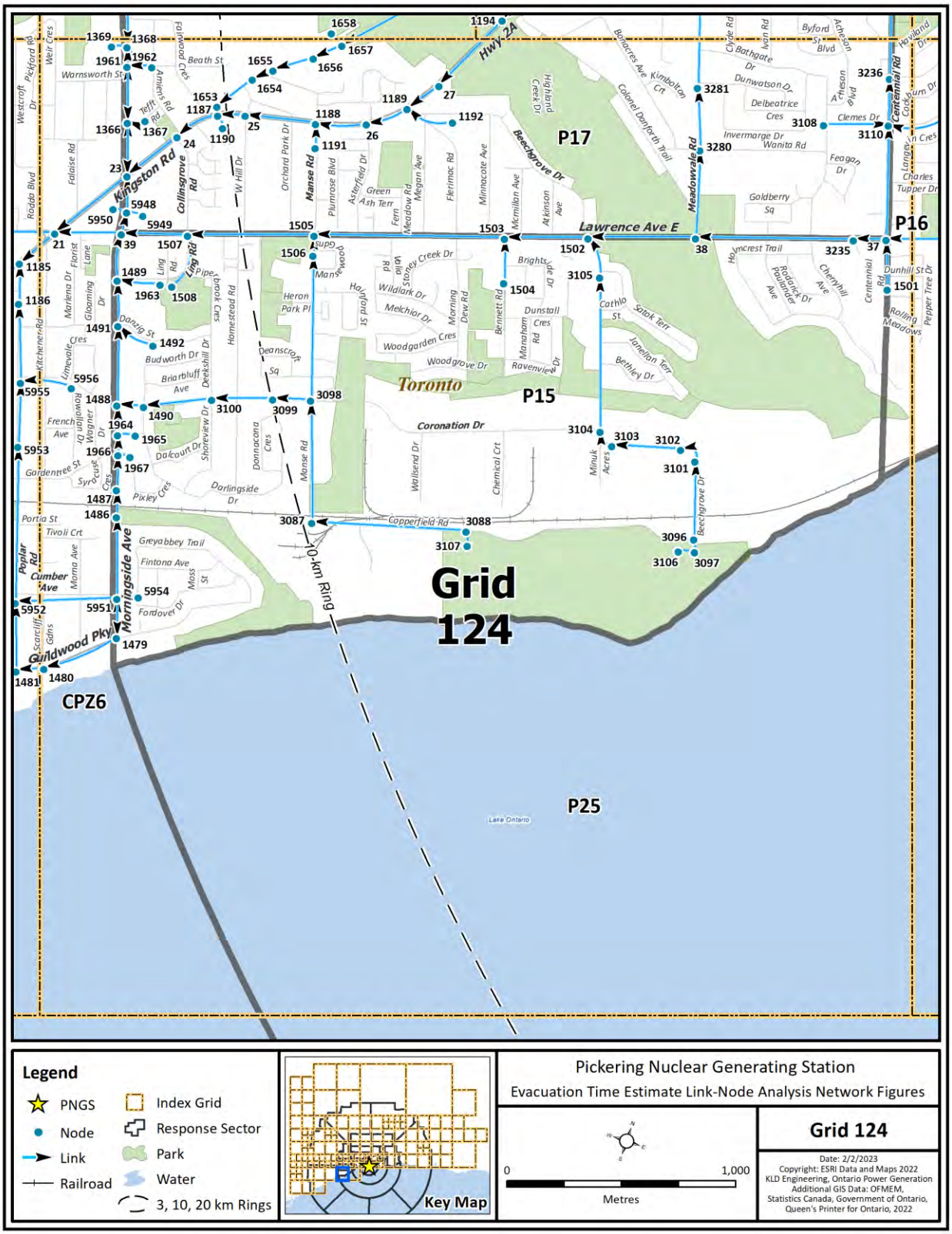


**Figure K-125. Link-Node Analysis Network – Grid 124**

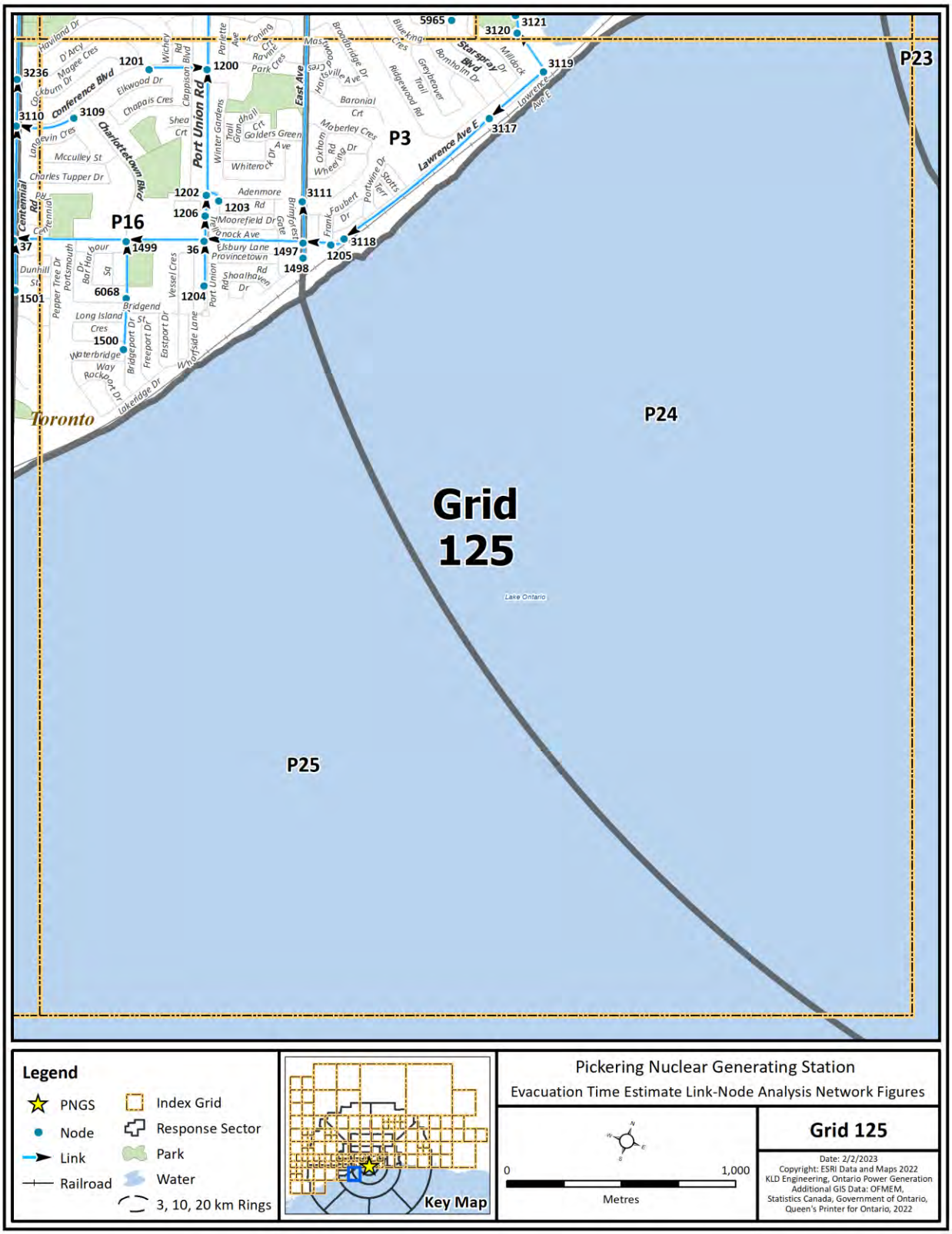


**Figure K-126. Link-Node Analysis Network – Grid 125**

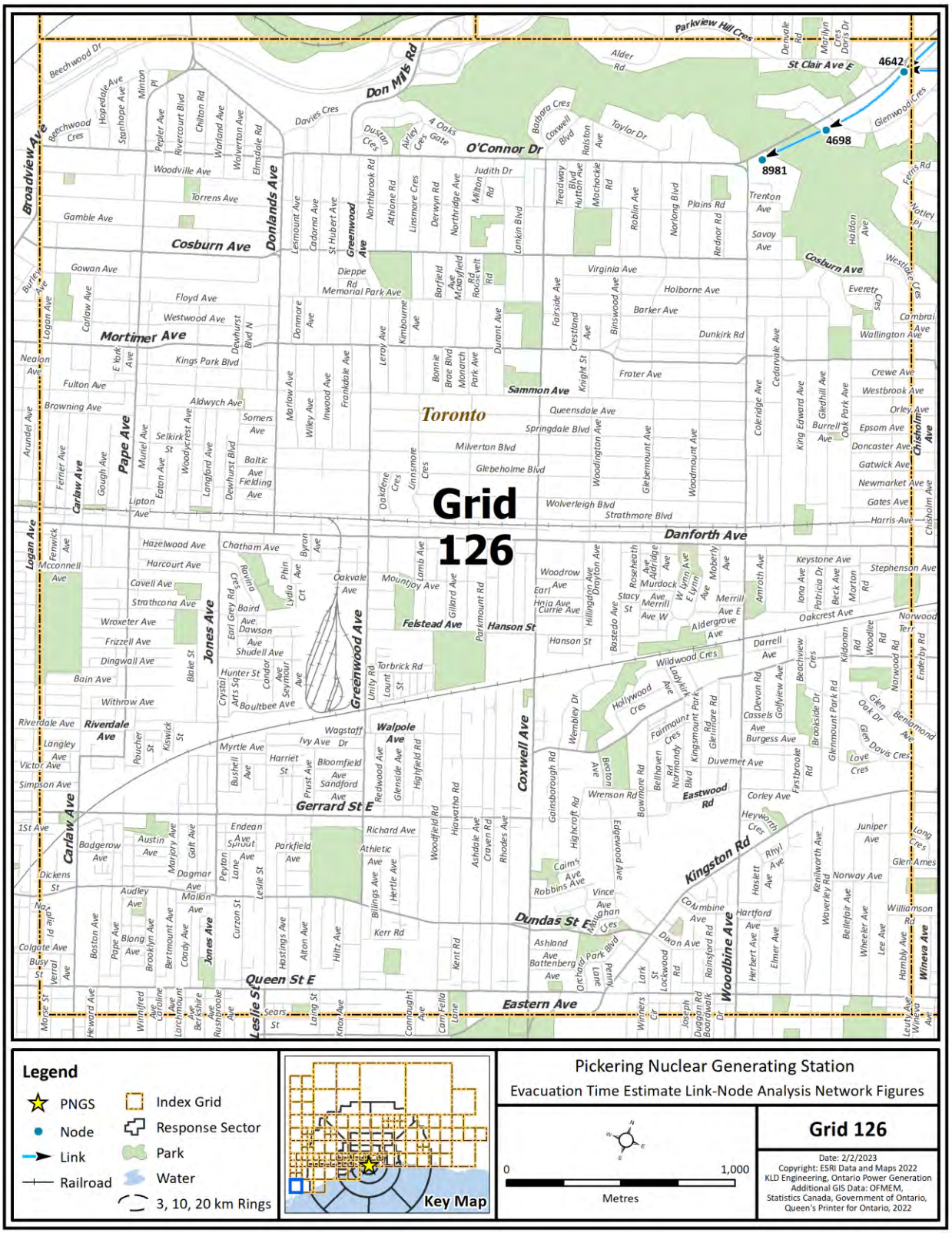


**Figure K-127. Link-Node Analysis Network – Grid 126**

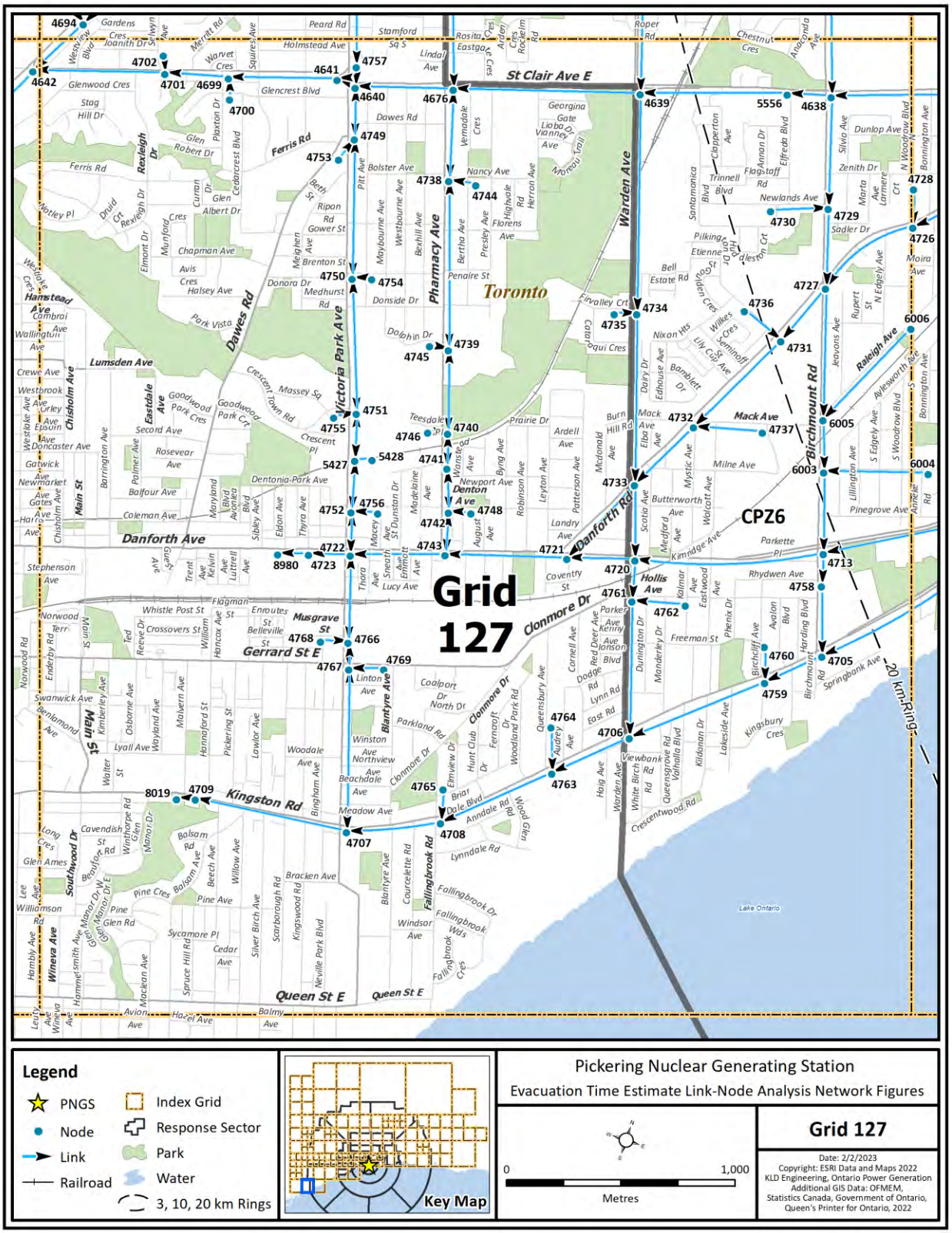


**Figure K-128. Link-Node Analysis Network – Grid 127**

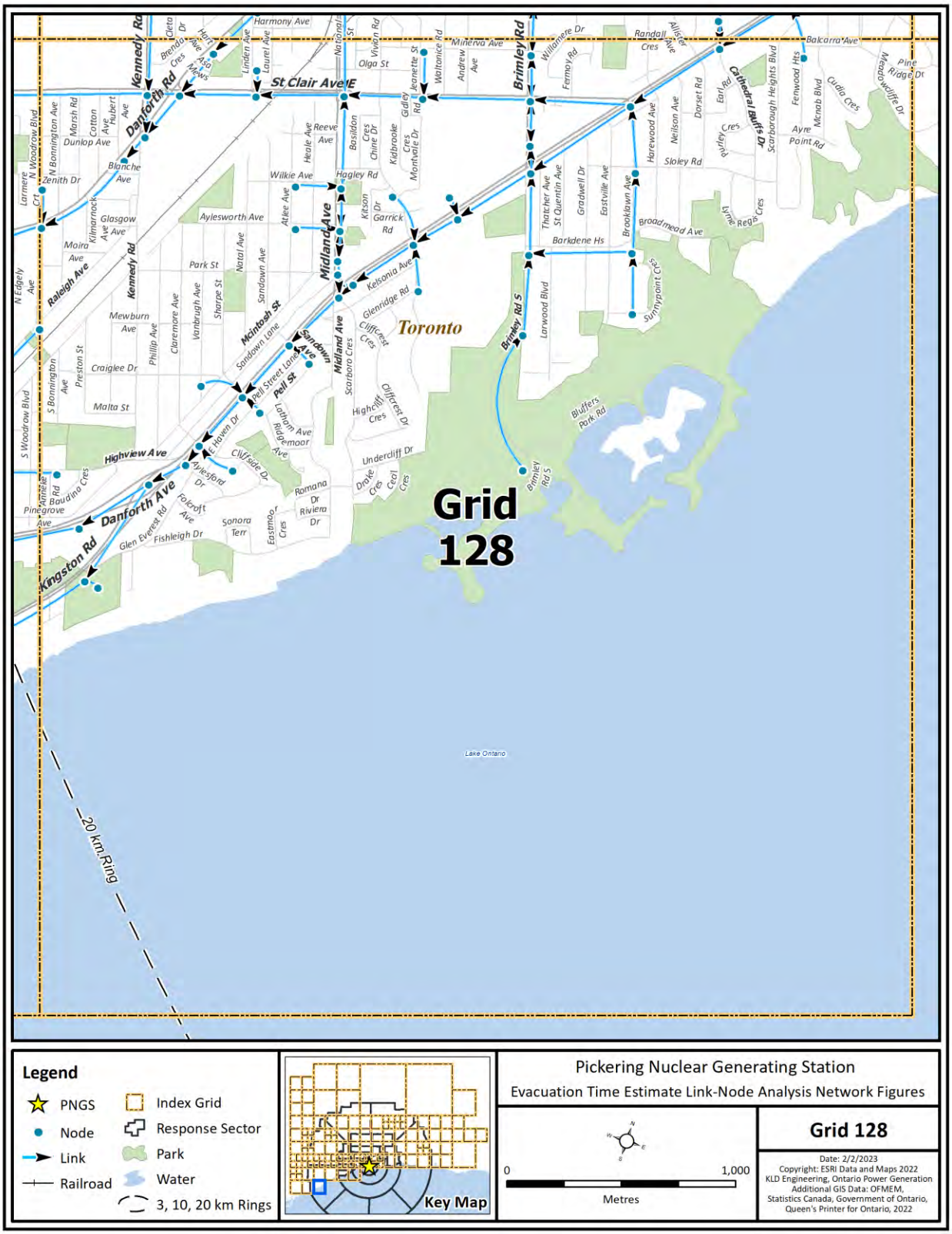


**Figure K-129. Link-Node Analysis Network – Grid 128**

## APPENDIX L

Response Sector Boundaries

## L. RESPONSE SECTOR BOUNDARIES

The Detailed Planning Zone (DPZ) for the Pickering Nuclear Generating Station (PNGS) is divided into 25 Response Sectors (P1 through P25), which fall into the following sector rings around the plant:

- Automatic Action Zone (AAZ): Sectors P1, P2, and Lake Sector P23
- Inner Ring: Sectors P3 through P14 and Lake Sector P24
- Outer Ring: Sectors P15 through P22 and Lake Sector P25

The Contingency Planning Zone (CPZ) is made up of Response Sectors CPZ1 through CPZ8. All Response Sectors make up the full Planning Zone (PZ).

| | |
|---|---|
| Response Sector P1 | Region: Durham<br>Defined as the area within the following boundary: Highway 401; Liverpool Road; Lake Ontario; Whites Road/RR38 |
| Response Sector P2 | Region: Durham<br>Defined as the area within the following boundary: Highway 401; Duffin's Creek; Lake Ontario; Liverpool Road |
| Response Sector P3 | Region: City of Toronto<br>Defined as the area within the following boundary: Highway 401; Rouge River; Lake Ontario; East Avenue |
| Response Sector P4 | Region: Durham<br>Defined as the area within the following boundary: Sheppard Avenue; Whites Road/RR 38; Lake Ontario; Rouge River |
| Response Sector P5 | Region: Durham<br>Defined as the area within the following boundary: Finch Avenue/RR 37; Whites Road/RR 38; Sheppard Avenue; Scarborough-Pickering Townline Road/RR 30 |
| Response Sector P6 | Region: Durham<br>Defined as the area within the following boundary: Finch Avenue/RR 37; Dixie Road; Highway 401; Whites Road/RR 38 |
| Response Sector P7 | Region: Durham<br>Defined as the area within the following boundary: Finch Avenue/RR 37; Brock Road/RR 1; Highway 401; Dixie Road |

| | |
|---|---|
| Response Sector P8 | Region: Durham<br>Defined as the area within the following boundary: 3rd Concession (Rossland); Brock Road/RR 1; Finch Avenue/RR 37; Scarborough-Pickering Townline/RR 30 |
| Response Sector P9 | Region: Durham<br>Defined as the area within the following boundary: 3rd Concession (Rossland); Ravenscroft/Rotherglen Roads; Highway 401; Brock Road/RR 1 |
| Response Sector P10 | Region: Durham<br>Defined as the area within the following boundary: 3rd Concession (Rossland); Old Harwood Avenue; Kingston Road/Highway 2; Rotherglen/Ravenscroft Roads |
| Response Sector P11 | Region: Durham<br>Defined as the area within the following boundary: Kingston Road/Highway 2; Pickering Beach Road; Highway 401; Rotherglen Road |
| Response Sector P12 | Region: Durham<br>Defined as the area within the following boundary: Highway 401; Pickering Beach Road; Bayly Street/RR 22; Duffin's Creek |
| Response Sector P13 | Region: Durham<br>Defined as the area within the following boundary: Bayly Street/RR 22; Harwood Avenue/RR 44; Lake Ontario; Duffin's Creek |
| Response Sector P14 | Region: Durham<br>Defined as the area within the following boundary: Bayly Street/RR 22; Pickering Beach Road; Lake Ontario; Harwood Avenue/RR 44 |
| Response Sector P15 | Region: City of Toronto<br>Defined as the area within the following boundary: Lawrence Avenue; Centennial Road; Lake Ontario; Morningside Avenue |
| Response Sector P16 | Region: City of Toronto<br>Defined as the area within the following boundary: Highway 401; East Avenue; Lake Ontario; Centennial Road |
| Response Sector P17 | Region: City of Toronto<br>Defined as the area within the following boundary: Ellesmere Road; Centennial Road; Lawrence Avenue; Morningside Avenue |
| Response Sector P18 | Region: City of Toronto<br>Defined as the area within the following boundary: Sheppard Avenue; Little Rouge River; Ellesmere Avenue; Morningside Avenue |

| | |
|---|---|
| Response Sector P19 | Region: City of Toronto<br>Defined as the area within the following boundary: Old Finch and Steeles Avenue; Scarborough-Pickering Townline/RR 30; Sheppard Avenue; Morningside Avenue |
| Response Sector P20 | Region: Durham<br>Defined as the area within the following boundary: Whitevale Road; Brock Road/RR 1; 3rd Concession (Rossland); Markham-Pickering Townline/RR 30 |
| Response Sector P21 | Region: Durham<br>Defined as the area within the following boundary: Whitevale Road; Audley Road; 3rd Concession (Rossland); Brock Road/RR 1 |
| Response Sector P22 | Region: Durham<br>Defined as the area within the following boundary: 3rd Concession (Rossland); Hall's Road and Lynde Creek; Lake Ontario; Pickering Beach Road and Harwood Avenue |
| Response Sector P23 | Defined as the area within the following boundary: Lake Ontario out to 3km |
| Response Sector P24 | Defined as the area within the following boundary: Lake Ontario out to the 6km |
| Response Sector P25 | Defined as the area within the following boundary: Lake Ontario out to 10km |
| Response Sector CPZ1 | Region: Durham<br>Defined as the area within the following boundary (north; east; south; west): Uxbridge Picking Townline Road, Lake Ridge Road, Myrtle Road, Ashburn Road, Brawley Road, Baldwin Street and Thickson Road; a straight line following 45° Northeast from PNGS; Whitevale Road and Audley Road; a straight line following 360°/0° North from PNGS |
| Response Sector CPZ2 | Region: Durham<br>Defined as the area within the following boundary (north; east; south; west): a straight line following 45° Northeast from PNGS; Columbus Road, Thornton Road, Winchester Road, Simcoe Street, Taunton Road, Ritson Road, Adelaide Avenue, Wilson Road and Montgomery Creek; a straight line following 90° East from PNGS; Rossland Road, Hall's Road, Dundas Street and Lynde Creek |
| Response Sector CPZ3 | Defined as the area within the following boundary: between 90° East from PNGS to 135° Southeast from PNGS; Lake Ontario from 10km out to 20km |

| | |
|---|---|
| Response Sector CPZ4 | Defined as the area within the following boundary: between 135° Southeast from PNGS to 180° South from PNGS; Lake Ontario from 10km out to 20km |
| Response Sector CPZ5 | Defined as the area within the following boundary: between 180° South from PNGS to 225° Southwest from PNGS; Lake Ontario from 10km out to 20km |
| Response Sector CPZ6 | Region: City of Toronto<br>Defined as the area within the following boundary (north; east; south; west): a straight line 270° West from PNGS; Morningside Avenue; a straight line 225° Southwest from PNGS; Warden Avenue, St Clair Avenue and Pharmacy Avenue |
| Response Sector CPZ7 | Region: City of Toronto and Markham<br>Defined as the area within the following boundary (north; east; south; west): a straight line 315° Northwest from PNGS; Morningside Avenue, Old Finch Avenue, Ressor Road and Steels Avenue; a straight line 270° West from PNGS; Pharmacy Avenue, McNicoll Avenue, Warden Avenue, Highway 7, Main Street Unionville, Carlton Road, Kennedy Road, and Major Mackenzie Drive |
| Response Sector CPZ8 | Region: York and Durham<br>Defined as the area within the following boundary (north; east; south; west): Mackenzie Drive, McCowan Road, Elgin Mills Road, Ninth Line, 19th Avenue, York Durham Line and Uxbridge Pickering Townline; a straight line 360°/0° North to PNGS; Whitevale Road and Markham Picking Townline Road; a straight line 315° Northwest from PNGS |

## APPENDIX M

Evacuation Sensitivity Studies

# M. EVACUATION SENSITIVITY STUDIES

This appendix presents the results of a series of sensitivity analyses. These analyses are designed to identify the sensitivity of the evacuation time estimate (ETE) to changes in some base evacuation conditions.

## M.1 Effect of Changes in Trip Generation Times

A sensitivity study was performed to determine whether changes in the estimated trip generation time have an effect on the ETE for the entire Detailed Protective Zone (DPZ). Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the Emergency Bulletin, could be persuaded to respond much more rapidly) or if the tail were elongated (i.e. spreading out the departure of evacuees to limit the demand during peak times), how would the ETE be affected? The case considered was Scenario 6, Region R03; a winter, midweek, midday, with good weather evacuation of the entire DPZ. Table M-1 presents the results of this study.

If evacuees mobilize 1 hour quicker or take 1 hour longer to mobilize, there is no impact to the 90$^{th}$ and 100$^{th}$ percentile ETE. As discussed in Section 7.3, traffic congestion persists within the DPZ for almost 8 hours. As such, congestion dictates the 90$^{th}$ and 100$^{th}$ percentile ETE until nearly 8 hours after the Emergency Bulletin.

## M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate

A sensitivity study was conducted to determine the effect on ETE due to changes in the percentage of people who decide to relocate from the Shadow Region (CPZ). The case considered was Scenario 6, Region R03; a winter, midweek, midday, with good weather evacuation of the entire DPZ. The movement of people in the Shadow Region has the potential to impede vehicles evacuating from an Evacuation Region within the DPZ. Refer to Sections 3.2 and 7.1 for additional information on population within the Shadow Region.

Table M-2 presents the ETE for each of the cases considered[1]. The results show that eliminating the shadow evacuation (0%) reduces ETE at the 90$^{th}$ and 100$^{th}$ percentile by 15 minutes and 25 minutes respectively. Doubling the shadow (60%) percentage increases the 90$^{th}$ percentile ETE by 30 minutes and the 100$^{th}$ percentile ETE by 55 minutes. Full evacuation (100%) of the Shadow Region increases the 90$^{th}$ percentile ETE by 1 hour and 50 minutes and the 100$^{th}$ percentile ETE by 3 hours and 10 minutes – a significant change. The significant increase in the 100$^{th}$ percentile ETE is due to the proximity of the DPZ boundary to the City of Toronto, which is highly populated. The eastern portion of the City of Toronto within the study area is located within the Shadow Region. Congestion in Toronto increases significantly as Shadow Evacuation increases. The more congestion there is in Toronto, the less roadway capacity is available for DPZ evacuees, thus prolonging ETE.

[1] Seventeen percent (17%) shadow participation was analyzed as it was the results obtained from the demographic survey.

## M.3 Effects of Changes in Access Control Establish Time

A sensitivity study was conducted to determine the effect on ETE due to changes in access control establish time along major evacuation routes. It is assumed that access control along Highway 401, Highway 407 and Highway 404 can be established within 4 hours after the Emergency Bulletin for the base scenario. This allows 128,144 external traffic vehicles to traverse the Study Area. A sensitivity study was performed to measure the effects on ETE when the access control establish time is reduced to 2 hours bringing 64,072 external traffic vehicles onto the Study Area. The case considered was Scenario 6, Region R03; a winter, midweek, midday, with good weather evacuation of the entire DPZ. Table M-3 presents the results of this study.

When access control is established 2-hours earlier, the number of external traffic vehicles that traverse the study area is reduced by 100%, as shown in Table M-3. This reduction in external traffic demand reduces the 90$^{th}$ and 100$^{th}$ percentile ETE by 60 minutes and 30 minutes, respectively – significant changes, for an evacuation of the DPZ. When there are less external traffic vehicles occupying Highway 401, Highway 407 and Highway 404, there is more available capacity for DPZ evacuees, hence, reducing the ETE.

## M.4 Future Year Evacuation Time Estimates

The federal regulations (Section 2.2.4 of CNSC REGDOC-2.10.1) stipulate all licensees of reactor facilities with a thermal capacity greater than 10MW shall collaborate with the municipal or regional authorities to develop and maintain public ETE based on current census data and future population growth projections on a per-decade estimation until the end of the life of the facility.

A sensitivity study was conducted for the DPZ boundary and Shadow Region for future year ETE for the year 2028. Population growth and roadway improvements discussed in the following planning datasets and documents were reviewed as part of this analysis:

- Statistics Canada annual population updates by census subdivision from 2001 through 2021; only the most recent years – 2016 through 2021 – were used to calculate annual growth rates for permanent resident population.
- Statistics Canada labour force data by census subdivision of 2016 and 2021 were used to calculate annual growth rates for employee population.
- York Region Transportation Master Plan - Project Details and Summary Sheets, October 2016
- Durham Transportation Management Plan 2017, December 2017

### M.4.1 Assumptions

The following assumptions were made for future year ETE:

1. Growth rates for permanent resident and employee population were computed from Statistics Canada data.

2. Permanent resident population to be considered for the DPZ study area.
3. The number of transit dependent residents will increase due to the increase in DPZ population.
4. Tt is assumed that PNGS employee numbers will stay consistent for all future years.[2]
5. All planned roadway improvements provided in the aforementioned planning documents will occur on schedule.
6. It is assumed that population at all transient and special facilities will remain the same for all future year ETE.

### M.4.2 Methodology

#### *Population Growth and Estimates*

The base permanent resident population for the 2023 ETE documented in Section 7 of this report was estimated using 2021 Census population data provided on the Statistics Canada website[3] projected to the year 2023 (see Section 3.1 for detailed methodology). The Response Sectors that comprise the approximate 10-kilometre DPZ for the PNGS can be seen in Figure 3-1. The population estimates[4] used for this study are for the time period from July 1, 2016 to July 1, 2021. This data is presented in Table 3-1 by census subdivision (municipality). The Census boundaries for the PNGS study area are shown in Figure 3-2.

Using the methodology discussed in Section 3.1 the permanent resident population was projected to 2028. Table M-4 presents the extrapolated 2023 permanent resident population and estimated permanent resident population for 2028 by Response Sector, for the Automatic Action Zone (AAZ), DPZ Inner Ring, the DPZ as a whole (Outer Ring), the Shadow Region and the entire study area (DPZ & Shadow Region (CPZ)).

#### *Employment Growth*

The 2016 and 2021 Census data products provide labour force statistics for each census subdivision. Using the same methodology discussed in Section 3.1 for the permanent resident population, these employee datasets were used to compute the annual growth rate for employees within the DPZ projected out to 2028. The annual employment growth rates for each municipality used in this sensitivity study are provided in Table M-5.

#### *Transit Dependent Residential Demand*

As discussed in Section 3.7, the demographic survey results were used to estimate the portion of the population requiring transit service based on the percentage of households with no vehicle available. When the growth factor is applied to the permanent resident population of the DPZ, the transit dependent population will also increase. The calculations for the year 2028

[2] The new OPG headquarters (at the old GM building) was not considered for the future year analysis since it was announced after the analysis was completed. Since REGDOC 2.10.1 states that ETE should be computed based on current census data, it is likely that the baseline ETE will be updated prior to 2028. The updated ETE, based on future census data, will include updates to the study area at that time, which will include the new OPG headquarters.
[3] https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E
[4] Detailed methodology of intercensal population estimates can be found at the following Statistics Canada webpage: https://www150.statcan.gc.ca/n1/pub/91-214-x/91-214-x2022001-eng.htm

were performed using the methodology discussed in Section 3.7. Table M-6 presents the total increase in transit buses due to the increase in residential population and subsequent increase in transit dependent population. As discussed in Section 3.7, buses are represented as two passenger cars in this analysis.

#### *External Traffic*

Traffic traveling through the study area was grown as well. An average annual growth rate was computed for external traffic based on AADT data from the years 2014 through 2019 (data taken from the Ontario Ministry of Transportation Traffic Volumes for 1988 – 2019) for Highway 401 and Highway 404 and 407 ETR Usage Statistics website[5] for Highway 407. This annual growth rate was then applied to the external traffic used in the baseline study to project the external traffic to 2028. Table M-7 shows the volume of external traffic that was loaded onto each highway for each study year. Note that Ontario Ministry of Transportation Traffic does not have traffic volumes beyond 2019. Even though this information was available for Highway 407, it was not utilized as the data appeared to be skewed by the COVID-19 pandemic.

Within the 5 years analyzed (from 2014 to 2019), the AADT along Highway 401 increased by 3%, Highway 404 by 0.73% and Highway 407 by 0.83%. It is assumed that these trends will continue over the next 5-year period from 2023 to 2028. Thus, the hourly volume rates along these highways were increased accordingly. These hourly volumes were multiplied by 4 since it takes 4 hours to establish access control along these highways.

#### *Roadway Improvements*

Appendix 4 of the Durham Region Transportation Master Plan (DRTMP) documents all proposed regional road expansion projects planned between 2004 and 2031. The planned roadway improvements provided that fall within the PNGS study area that are scheduled for completion by 2028 are provided in Table M-8. Links and/or nodes were added, changed, or removed to accurately model each of the planned improvements.

### M.4.3 Results

Table M-9 and Table M-10 provide the 90$^{th}$ and 100$^{th}$ percentile projected ETE for 2028, respectively. The 90$^{th}$ percentile ETE for the AAZ ranges from 3 hours and 40 minutes to 6 hours and 40 minutes. The 90$^{th}$ percentile ETE for the DPZ Inner Ring ranges from 3 hours and 55 minutes to 7 hours and 45 minutes. The 90$^{th}$ percentile ETE for the DPZ Outer Ring ranges from 5 hours and 10 minutes to 8 hours and 45 minutes. The 100$^{th}$ percentile ETE ranges between 4 hours 30 minutes to 10 hours 35 minutes. Similar to 2023 results, majority of the 100$^{th}$ percentile ETE results are dictated by congestion within the DPZ for 2028.

Compared to the 2023 ETE results, the 90$^{th}$ percentile ETE increased by as much as 30 minutes and the 100$^{th}$ percentile ETE by 60 minutes – a significant change. The permanent resident population within the DPZ Outer Ring is estimated to increase by approximately 9% and the Shadow Region population by approximately 6%. Even though there are roadway

[5] https://www.407etr.com/en/highway/corporate/usage-statistics.html

improvements that increase the overall capacity of the roadway network within the study area, the increase in permanent resident population outweighs the additional capacity provided by the roadway improvements and the ETE increases.

## M.5 Enhancements in Evacuation Time

This appendix documents sensitivity studies on critical variables that could impact ETE.

- Changes in the trip generation time have little to no impact on ETE (Section M.1) when reducing the trip generation because congestion dictates the ETE for the PNGS DPZ until 7 hours and 45 minutes. If the trip generation time surpasses 7 hours and 45 minutes the 100$^{th}$ percentile ETE would be affected.
- Shadow evacuation can have a significant impact on ETE (Section M.2). Public outreach could be considered to inform those people within the DPZ (and potentially beyond the DPZ) that if they are not advised to evacuate, they should not, as they may delay those who are more at risk.
- The number of external traffic vehicles that traverse the study area can have a significant impact on ETE (See Section M.3). Access control along major highways should be established as quickly as possible. When establishing access control, care should be given to allow first responders and emergency managers into the study area.
- Significant population growth results in more evacuating vehicles which could significantly increase ETE (Section M.4). Public outreach to inform those people within the DPZ to evacuate as a family in a single vehicle would reduce the number of evacuating vehicles and could reduce ETE or offset the impact of increased population.
- Roadway improvements can increase roadway capacity which could decrease ETE. Construction schedules and plans should be monitored to determine if ETE will be impacted.

**Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study**

| Trip Generation Period | Evacuation Time Estimate for Entire DPZ | |
|---|---|---|
| | 90th Percentile | 100th Percentile |
| 3 hours and 15 minutes | 6:25 | 7:45 |
| 4 hours and 15 minutes (Base) | 6:25 | 7:45 |
| 5 hours and 15 minutes | 6:25 | 7:45 |

**Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study**

| Percent Shadow Evacuation | Evacuating Shadow Vehicles[6] | Evacuation Time Estimate for Entire DPZ | |
|---|---|---|---|
| | | 90th Percentile | 100th Percentile |
| 0 | 0 | 6:10 | 7:20 |
| 17 | 87,463 | 6:20 | 7:30 |
| 20 | 102,898 | 6:20 | 7:30 |
| 30 (Base) | 154,347 | 6:25 | 7:45 |
| 40 | 205,795 | 6:35 | 8:00 |
| 60 | 308,693 | 6:55 | 8:40 |
| 80 | 411,591 | 7:35 | 10:00 |
| 100 | 514,488 | 8:15 | 10:55 |

**Table M-3. Evacuation Time Estimates for Access Control Establish Time Sensitivity Study**

| Time to Establish ACPs | Number of External Traffic Vehicles | Evacuation Time Estimate for Entire DPZ | |
|---|---|---|---|
| | | 90th Percentile | 100th Percentile |
| 2 Hours | 64,072 | 5:25 | 7:15 |
| 4 Hours (Base) | 128,144 | 6:25 | 7:45 |

[6] The Evacuating Shadow Vehicles, in Table M-2, represent the residents and employees who will spontaneously decide to relocate during the evacuation. The basis, for the base values shown, is a 30% relocation of shadow residents along with a proportional percentage of shadow employees. See Section 6 for further discussion.

**Table M-4. DPZ Population by Study Year**

| Response Sector | 2023 Extrapolated Population | 2028 Extrapolated Population |
|---|---|---|
| P1 | 10,398 | 11,384 |
| P2 | 5,250 | 5,741 |
| P23 | 0 | 0 |
| **AAZ:** | **15,648** | **17,125** |
| P3 | 5,479 | 5,779 |
| P4 | 8,959 | 9,806 |
| P5 | 18,040 | 19,738 |
| P6 | 11,881 | 12,999 |
| P7 | 16,328 | 17,870 |
| P8 | 16,023 | 17,537 |
| P9 | 19,508 | 21,242 |
| P10 | 16,694 | 18,155 |
| P11 | 9,448 | 10,273 |
| P12 | 3,983 | 4,332 |
| P13 | 9,941 | 10,812 |
| P14 | 10,052 | 10,926 |
| P24 | 0 | 0 |
| **DPZ Inner Ring:** | **146,336** | **159,469** |
| P15 | 12,387 | 13,069 |
| P16 | 11,370 | 11,996 |
| P17 | 14,110 | 14,890 |
| P18 | 21,059 | 22,215 |
| P19 | 9,297 | 9,805 |
| P20 | 5,476 | 5,992 |
| P21 | 41,492 | 45,146 |
| P22 | 28,634 | 31,159 |
| P25 | 0 | 0 |
| **DPZ Outer Ring:** | **143,825** | **154,272** |
| **Shadow Region (CPZ):** | **974,896** | **1,032,545** |
| **DPZ & Shadow Region:** | **1,280,705** | **1,363,411** |

**Table M-5. Employment Growth Rates**

| Municipality | Annual Growth Rate |
|---|---|
| Ajax | -0.82% |
| Markham | -1.63% |
| Oshawa | 0.21% |
| Pickering | -0.38% |
| Toronto | -0.80% |
| Whitby | -0.07% |

**Table M-6. Transit Bus Needs**

| Study Year | DPZ Estimated Transit Dependent Population | Buses Needed |
|---|---|---|
| 2023 | 3,217 | 117 |
| 2028 | 3,480 | 126 |

**Table M-7. External Traffic Demand Growth**

| Road Name | 2023 Hourly Volume | Percent Increase in 5 Years | 2028 Hourly Volume |
|---|---|---|---|
| Hwy 401 | 7,471 | 3.00% | 7,695 |
| Hwy 401 Collector | 3,735 | 3.00% | 3,847 |
| Hwy 401 Express | 3,735 | 3.00% | 3,847 |
| Hwy 404 | 7,692 | 0.73% | 7,748 |
| Hwy 404 | 7,692 | 0.73% | 7,748 |
| Hwy 407 | 1,011 | 0.83% | 1,019 |
| Hwy 407 | 700 | 0.83% | 706 |
| Totals | **32,036** | | **32,611** |

**Table M-8. Roadway Improvements**

| Project Road Description | Endpoints of Construction Project | Project Description |
|---|---|---|
| Brock Road | Taunton Road to Whitevale Road | Widen from 2 to 4 lanes (1 to 2 lanes in one direction) |
| Gibb Street | East of Stevenson Road to Simcoe Street | Widen from 3 to 4/5 lanes (1 to 2 lanes in one direction) |
| Harmony Road | Rossland Road to Taunton Road | Widen from 3 to 5 lanes (1 to 2 lanes in one direction) |
| Harmony Road | Taunton Road to Conlin Road | Widen from 2/3 to 5 lanes (2 to 3 lanes in one direction) |
| Lake Ridge Road | Bayly Street/Victoria Street to Kingston Road/Dundas Street | Widen from 2 to 4/5 lanes (2 to 3 lanes in one direction) |
| Manning Road/Adelaide Ave | Garrard Road to Thornton Road | Construct a new connection to 2 lanes, with new crossing of Corbett Creek |
| Rossland Road | Brock Road to Sideline 24 | Construct a new alignment to lanes with CPR grade separation. |
| Simcoe Street | Conlin Road to Winchester Road | Widen from 2/4 to 5 lanes (1 to 3 lanes in one direction) |
| Thickson Road | Wentworth Street to CNR Kingston | Widen from 2 to 4 lanes (1 to 2 lanes in one direction) |
| Victoria Street | South Blair Street to west of Thickson Road | Construct a new alignment and widen from 2 to 5 lanes (2 to 3 lanes in one direction) |
| Victoria Street | East of Thickson Road to west of Stevenson Road | Widen from 2/3 to 4/5 lanes (2 lanes in one direction) |
| Westney Road | Rossland Road to Taunton Road | Widen from 2 to 5 lanes (2 to 3 lanes in one direction) |
| Winchester Road | Baldwin Street to Anderson Street/Watford Street | Widen from 2 to 3 lanes (1 to 2 lanes in one direction) |
| Winchester Road | Anderson Street/Watford Street to Garrard Road | Widen from 2 to 5 lanes (2 to 3 lanes in one direction) |
| 16th Avenue | Leslie Street to Woodbine Avenue | Widen 4 to 6 lanes (1 lane in one direction) |
| Rossland Road | Sideline 24 to Whitevale Road Realignment | Construct a new alignment to 5 lanes |
| Rossland Road | Ritson Raod to Harmony Road | Widen from 3 to 5 lanes (1 to 2 lanes in one direction) |
| Rossland Road | Whitevale Road Realignment to Highway 7 | Construct new alignment to 5 lanes |
| Liverpool Road | Highway 401 to Kingston Road | Widen from 5 to 6 lanes (1 lane in one direction) |
| Westney Road | Bayly Street to Highway 401 | Widen from 5 to 7 lanes (1 to 2 lanes in one direction) |
| Westney Road | Highway 401 to Kingston Road | Widen from 5 to 7 lanes (1 to 2 lanes in one direction) |
| Hopkins Street | Victoria Street to Consumers Drive | Construct new 4-lane overpass of Highway 401 |
| Finch Avenue | Altona Road to Brock Road | Widen from 2 to 3 lanes (1 lane in one direction) |
| Whites Road | Kingston Road to Finch Avenue | Widen from 5 to 6 lanes including structure widening |
| Whites Road | Finch Avenue to Third Concession Road | Widen from 2 to 6 lanes, with new CPR grade separation |
| Whites Road | Third Concession Road to Taunton Road | Construct new alignment to Sideline 26 (future Whites Road connection) and widen from 2 to 6 lanes across West Duffins Creek |
| Thornton Road | North of Consumers Drive Extension to King Street | Widen from 2 to 4 lanes, with new CPR grade separation |
| Bayly Street | Westney Road to Harwood Avenue | Widen from 5 to 7 lanes (1 to 2 lanes in one direction) |
| Bloor Street | Harmony Road to Grandview Drive | Construct new alignment to 4 lanes, with new CPR grade separation and bridge crossing of Farewell Creek |

| Project Road Description | Endpoints of Construction Project | Project Description |
|---|---|---|
| Bloor Street | Prestonvale Road to Courtice Road | Widen from 2 to 3 lanes and improve profile |
| Lake Ridge Road | Kingston Road/Dundas Street to Rossland Road | Widen 2 to 4/5 lanes (2 to 3 lanes in one direction) |
| Thickson Road | Consumers Drive to Dundas Street | Widen from 5 to 7 lanes (1 to 2 lanes in one direction) |
| Thickson Road | Taunton Road to Highway 407 | Widen from 2 to 4/5 lanes (2 to 3 lanes in one direction |
| Thickson Road | Winchester Road to Baldwin Street | Widen from 2 to 4/5 lanes (2 to 3 lanes in one direction) |
| Ritson Road | Taunton Road to Conlin Road | Widen from 2/3 to 5 lanes (2 to 3 lanes in one direction) |
| Bayly Street | Liverpool Road to Brock Road | Widen from 5 to 6/7 lanes (1 to 2 lanes in one direction) |
| Adelaide Avenue | Townline Road to Trulls Road | Construct new bridge crossing of Farewell Creek and new 3-lane connection |
| Gibb Street/Olive Avenue | Simcoe Street to Ritson Road | Construct new connection and widen from 2/3 lanes to 4/5 lanes (1 to 2 lanes in one direction) |
| Baldwin Street (Regional Highway 12) | Taunton Road to Highway 407 | Widen from 2 to 4/5 lanes (1 to 3 lanes in one direction) |
| 16th Avenue | Woodbine Avenue to McCowan Road | Widen to 6 lanes |
| Kennedy Road | Steeles Avenue to Highway 407 | Widen to 6 lanes |
| Markham Road | Steeles Avenue to north of 14th Avenue | Widen to 6 lanes |

**Table M-9. Time to Clear the Indicated Area of 90 Percent of the Affected Population – 2028**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring and Detailed Planning Zone Outer Ring | | | | | | | | | | | | | | |
| **R01** | 4:55 | 5:30 | 4:55 | 5:30 | 3:40 | 5:05 | 5:35 | 6:40 | 4:55 | 5:30 | 6:35 | 3:45 | 4:55 | 5:25 |
| **R02** | 5:40 | 6:10 | 5:25 | 6:05 | 3:55 | 5:45 | 6:25 | 7:45 | 5:35 | 6:05 | 7:10 | 3:55 | 5:35 | 6:05 |
| **R03** | 6:40 | 7:25 | 6:20 | 7:05 | 5:10 | 6:50 | 7:35 | 8:45 | 6:15 | 7:00 | 8:25 | 5:15 | 6:20 | 7:00 |

**Table M-10. Time to Clear the Indicated Area of *100* Percent of the Affected Population – 2028**

| | Summer | | Summer | | Summer | Winter | | | Winter | | | Winter | Winter | Summer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midweek | | Weekend | | Midweek Weekend | Midweek | | | Weekend | | | Midweek Weekend | Weekend | Midweek |
| **Scenario:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Region** | Midday | | Midday | | Evening | Midday | | | Midday | | | Evening | Midday | Midday |
| | Good Weather | Rain | Good Weather | Rain | Good Weather | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Rain/Light Snow | Heavy Snow | Good Weather | Special Event | Roadway Impact |
| Evacuate Automatic Action Zone, Detailed Planning Zone Inner Ring and Detailed Planning Zone Outer Ring | | | | | | | | | | | | | | |
| **R01** | 6:15 | 6:35 | 5:55 | 6:50 | 4:30 | 6:15 | 6:50 | 8:00 | 5:55 | 6:30 | 7:45 | 4:30 | 5:50 | 6:15 |
| **R02** | 7:10 | 7:50 | 7:00 | 7:50 | 5:35 | 7:10 | 8:00 | 9:15 | 7:00 | 7:55 | 9:00 | 5:35 | 7:00 | 7:35 |
| **R03** | 8:05 | 9:00 | 7:50 | 8:40 | 7:25 | 8:05 | 9:05 | 10:35 | 7:50 | 8:30 | 10:05 | 7:30 | 7:45 | 8:40 |

## APPENDIX N

ETE Criteria Checklist

## N. ETE CRITERIA CHECKLIST

**Table N-1. ETE Review Criteria Checklist**

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **1.0 Introduction** | | |
| a. The study area (AAZ, DPZ Inner Ring, DPZ Outer Ring & CPZ) and surrounding area should be described. | Yes | Section 1.2 |
| b. A map should be included that identifies primary features of the site, including major roadways, significant topographical features, boundaries of municipalities, and population centres within the study area. | Yes | Figures 1-1, Figure 3-1, Figure 6-1 |
| c. A comparison of the current and previous ETE should be provided and includes similar information as identified in Table 1-1, "ETE Comparison," of NUREG/CR-7002, Rev.1. | Yes | Table 1-3 |
| **1.1 Approach** | | |
| a. A general approach is described in the report as outlined in Section 1.1, "Approach," of NUREG/CR-7002, Rev. 1. | Yes | Section 1.1, Section 1.3, Appendix D<br>Table 1-1 |
| **1.2 Assumptions** | | |
| a. Assumptions consistent with Table 1-2, "General Assumptions," of NUREG/CR-7002, Rev. 1 are provided and include the basis to support use. | Yes | Section 2 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **1.3 Scenario Development** | | |
| a. The scenarios in Table 1-3, "Evacuation Scenarios," are developed for the ETE analysis. A reason is provided for use of other scenarios or for not evaluating specific scenarios. | Yes | Table 2-1, Section 6, Table 6-3 |
| **1.4 Evacuation Planning Areas** | | |
| a. A map of the study area with response sectors should be included. | Yes | Figure 3-1, Figure 6-1 |
| **1.4.1 Keyhole Evacuation** | | |
| a. A table similar to Table 1-4 "Evacuation Areas for a Keyhole Evacuation", is provided identifying the Response Sector considered for each ETE calculation by downwind direction. | Yes | Table 6-1, Table 6-2, Table 7-5, Table 7-6, Table H-1 |
| **1.4.2 Staged Evacuation** | | |
| a. The approach used in development of a staged evacuation is discussed | Yes | Section 7.7, Table 6-2, Table 7-6 |
| b. A table similar to Table 1-4, "Evacuation Areas for a Staged Evacuation Keyhole," of NUREG/CR-7002, Rev. 1 should be provided and includes the complete evacuation of the 3, 6, and 10 kilometre areas and for the 3 kilometre area/10 kilometre keyhole evacuations. | Yes | Table 6-2, Table 7-6 |
| **2.0 Demand Estimation** | | |
| a. Demand estimation should be developed for the four population groups, including permanent residents of the study area, transients, special facilities, and schools. | Yes | Section 3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **2.1 Permanent Residents and Transient Population** | | |
| a. The U.S. Census should be the source of the population values, or another credible source should be provided. | Yes | Section 3.1, Used 2021 Statistics Canada |
| b. The availability date of the census data is provided. | Yes | Section 3.1 |
| c. Population values are adjusted as necessary for growth to reflect population estimates to the year of the ETE. | Yes | Section 2.1, Item 2 and Section 3.1 |
| d. A sector diagram, similar to Figure 2-1, "Population by Sector," of NUREG/CR-7002, Rev. 1, showing the population distribution for permanent residents. | Yes | Figure 3-3 and Figure 3-4 |
| **2.1.1 Permanent Residents with Vehicles** | | |
| a. The persons per vehicle value should be between 1 and 3 or justification should be provided for other values. | Yes | Section 3.1, Appendix F |
| **2.1.2 Transient Population** | | |
| a. A list of facilities which attract transient populations should be included, and peak and average attendance for these facilities is listed. The source of information used to develop attendance values is provided. | Yes | Section 3.3, Table E-6 through Table E-10 |
| b. Major employers are listed. | Yes | Section 3.4, Table E-5 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The average population during the season is used, itemized and totalled for each scenario. | Yes | Table 3-5 through Table 3-7 and Appendix E itemize the transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-4 to estimate transient population by scenario. – See Table 6-5 and Table 6-6. |
| d. The percentage of permanent residents assumed to be at facilities should be estimated. | Yes | Section 3.3, |
| e. The number of people per vehicle is provided. Numbers may vary by scenario, and if so, reasons for the variation are discussed. | Yes | Section 3.3, Table 6-4 |
| f. A sector diagram is included, similar to Figure 2-1 of NUREG/CR-7002, Rev 1., showing the population distribution for the transient population. | Yes | Figure 3-7 and Figure 3-8 (transients) and Figure 3-11 and Figure 3-12 (employees) |
| **2.2 Transit Dependent Permanent Residents** | | |
| a. The methodology (e.g., surveys, registration programs) used to determine the number of transit dependent residents is discussed. | Yes | Section 3.7 |
| b. The regional/local evacuation plans for transit dependent residents should be used in the analysis. | Yes | Section 8.1 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities should be provided. Data from local/regional registration programs are used in the estimate. | Yes | Section 3.7 |
| d. Capacities are provided for all types of transportation resources. Bus seating capacity of 50 percent is used or justification is provided for higher values. | Yes | Section 2.4 – Item 3, Section 3.7 |
| e. An estimate of the transit dependent population is provided. | Yes | Section 3.7, Table 3-11 |
| f. A summary table showing the total number of buses, ambulances, or other transport assumed available to support evacuation is provided. The quantification of resources is detailed enough to ensure that double counting has not occurred. | Yes | Table 3-14, Section 8.1, Table 8-1 |
| **2.3 Special Facility Residents** | | |
| a. Special facilities, including the type of facility, location, and average population, are listed. Special facility staff is included in the total special facility population. | Yes | Table E-4 lists all medical facilities by facility name, location, and average population. Staff estimates were not provided. |
| b. The method of obtaining special facility data is discussed. | Yes | Section 3.5 |
| c. An estimate of the number and capacity of vehicles assumed available to support the evacuation of the facility is provided. | Yes | Section 2.4 - Item 3, Table 3-7 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| d. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) are discussed when appropriate. | Yes | Section 8.1 – under Evacuation of Medical Facilities |
| **2.4 Schools** | | |
| a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, is provided. The source of this information should be identified. | Yes | Section 3.6, Table 3-10, Table E-1 through Table E-3 |
| b. Transportation resources for elementary and middle schools are based on 100 percent of the school capacity. | Yes | Section 3.6 |
| c. The estimate of high school students who will use personal vehicle to evacuate is provided and a basis for the values used is given. | Yes | Section 3.6 |
| d. The need for return trips is identified. | Yes | Section 8.1 - under Evacuation of Schools |
| **2.5 Other Demand Estimate Considerations** | | |
| **2.5.1 Special Events** | | |
| a. A complete list of special events is provided including information on the population, estimated duration, and season of the event. | Yes | Section 3.8 |
| b. The special event that encompasses the peak transient population is analyzed in the ETE. | Yes | Section 3.8 |
| c. The percentage of permanent residents attending the event is estimated. | Yes | Section 3.8 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **2.5.2 Shadow Evacuation** | | |
| a. A shadow evacuation of 20 percent is included consistent with the approach outlined in Section 2.5.2 of NUREG/CR-7002, Rev 1., "Shadow Evacuation". | Yes | Item 7 of Section 2.2, Figure 2-1, Section 3.2 and Figure 7-1. A shadow evacuation of 30 percent was used as the base. |
| b. Population estimates for the shadow evacuation beyond the DPZ are provided by sector. | Yes | Section 3.2, Table 3-4, Figure 3-4 and Figure 3-6 |
| c. The loading of the shadow evacuation onto the roadway network is consistent with the trip generation time generated for the permanent resident population. | Yes | Section 5 - Table 5-9 (first footnote) |
| **2.5.3 Background and Pass-Through Traffic** | | |
| a. The volume of background traffic and pass-through traffic is based on the average daytime traffic. Values may be reduced for nighttime scenarios. | Yes | Section 3.9 and Section 3.10 |
| b. The method of reducing background and pass-through traffic is described. | Yes | Section 2.2 – Assumptions 11 and 12<br>Section 2.5<br>Section 3.9 and Section 3.10<br>Table 6-4 – External Through Traffic footnote |
| c. Pass-through traffic is assumed to have stopped entering the study area about two (2) hours after the initial notification. | Yes | Section 2.5. Section 9 and Appendix G. Four Hours was used for this study. |
| **2.6 Summary of Demand Estimation** | | |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| a. A summary table is provided that identifies the total populations and total vehicles used in the analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand in each scenario. | Yes | Table 3-13, Table 3-14, Table 6-5, and Table 6-6 |
| **3.0 Roadway Capacity** | | |
| a. The method(s) used to assess roadway capacity is discussed. | Yes | Section 4 |
| **3.1 Roadway Characteristics** | | |
| a. The process for gathering roadway characteristic data is described including the types of information gathered and how it is used in the analysis. | Yes | Section 1.3, Appendix D |
| b. Legible maps are provided that identify nodes and links of the modeled roadway network similar to Figure A-1, "Roadway Network Identifying Nodes and Links," and Figure A-2, "Grid Map Showing Detailed Nodes and Links." of NUREG/CR-7002, Rev. 1. | Yes | Appendix K |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **3.2 Model Approach** | | |
| a. The approach used to calculate the roadway capacity for the transportation network is described in detail, and the description identifies factors that are expressly used in the modeling. | Yes | Section 4 |
| b. Route assignment follows expected evacuation routes and traffic volumes | Yes | Appendix B and Appendix C |
| c. A basis is provided for static route choices if used to assign evacuation routes | N/A | Static route choices are not used to assign evacuation routes. Dynamic traffic assignment is used. |
| d. Dynamic traffic assignment models are described including calibration of the route assignment. | Yes | Appendix B and Appendix C |
| **3.3 Intersection Control** | | |
| a. A list that includes the total numbers of intersections modeled that are unsignalized, signalized, or manned by response personnel is provided. | Yes | Table K-1 |
| b. The use of signal cycle timing, including adjustments for manned traffic control, is discussed. | Yes | Section 4 and Appendix G |
| **3.4 Adverse Weather** | | |
| a. The adverse weather conditions are identified. | Yes | Section 2.6 – Item 2, Item 3 and Item 4 |
| b. The speed and capacity reduction factors identified in Table 3-1, "Weather Capacity Factors," of NUREG/CR-7002, Rev. 1, are used or a basis is provided for other values, as applicable to the model. | Yes | Table 2-2 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The calibration and adjustment of driver behavior models for adverse weather conditions are described, if applicable. | N/A | This review criteria is for Microscopic simulation models only. This analysis uses a Macroscopic model and is therefore not applicable |
| d. The effect of adverse weather on mobilization is considered and assumptions for snow removal on streets and driveways are identified, when applicable. | Yes | Section 2.6 – Item 5, Table 2-2, Section 5.3 |
| **4.0 Development of Evacuation Times** | | |
| **4.1 Traffic Simulation Models** | | |
| a. General information about the traffic simulation model used in the analysis is provided. | Yes | Section 1.3, Table 1-3, Appendix B, Appendix C |
| b. If a traffic simulation model is not used to perform the ETE calculation, sufficient detail is provided to validate the analytical approach used. | N/A | Not applicable since a traffic simulation model was used. |
| **4.2 Traffic Simulation Model Input** | | |
| a. Traffic simulation model assumptions and a representative set of model inputs are provided. | Yes | Section 2, Appendix J |
| b. The number of origin nodes and method for distributing vehicles among the origin nodes are described. | Yes | Appendix J, Appendix C |
| c. A glossary of terms is provided for the key performance measures and parameters used in the analysis. | Yes | Appendix A, Table C-1 and Table C-3 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **4.3 Trip Generation Time** | | |
| a. The process used to develop trip generation times is identified. | Yes | Section 5 |
| b. When surveys are used, the scope of the survey, area of the survey, number of participants, and statistical relevance are provided. | Yes | Appendix F |
| c. Data used to develop trip generation times are summarized. | Yes | Appendix F and Section 5 |
| d. The trip generation time for each population group is developed from site-specific information. | Yes | Section 5 |
| e. The methods used to reduce uncertainty when developing trip generation times are discussed, if applicable. | Yes | Appendix F – Results of the demographic survey were compared to the 2018 DNGS telephone survey (the most recent previous survey) to minimize uncertainty. |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **4.3.1 Permanent Residents and Transient Population** | | |
| a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip generation time includes the assumption that a percentage of residents will need to return home before evacuating. | Yes | Section 5 discusses trip generation for households with and without returning commuters.<br>Table 6-3 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters.<br>Appendix F presents the percent households who will await the return of commuters.<br>Section 2.3, Item 3 |
| b. The trip generation time accounts for the time and method to notify transients at various locations. | Yes | Section 5 |
| c. The trip generation time accounts for transients potentially returning to hotels before evacuating. | Yes | Section 5, Figure 5-1 |
| d. The effect of public transportation resources used during special events where a large number of transients are expected is considered. | Yes | Section 3.8 |
| **4.3.2 Transit Dependent Residents** | | |
| a. If available, existing and approved plans and bus routes are used in the ETE analysis. | Yes | Section 10<br>Section 8.1 under Evacuation of Transit-Dependent Population |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| b. The means of evacuating ambulatory and non-ambulatory residents are discussed. | Yes | Section 8.1 under Evacuation of Transit-Dependent Population |
| c. Logistical details, such as the time to obtain buses, brief drivers and initiate the bus route are used in the analysis. | Yes | Section 8.1, Figure 8-1 |
| d. The estimated time for transit dependent residents to prepare and then travel to a bus pickup point, including the expected means of travel to the pickup point, is described. | Yes | Section 8.1 under Evacuation of Transit-Dependent Population |
| e. The number of bus stops and time needed to load passengers are discussed. | Yes | Section 8.1, Table 8-5 though Table 8-7 |
| f. A map of bus routes is included. | Yes | Figure 10-2 through Figure 10-10 |
| g. The trip generation time for non-ambulatory persons including the time to mobilize ambulances or special vehicles, time to drive to the home of residents, time to load, and time to drive out of the study area is provided. | Yes | Section 8.1 |
| h. Information is provided to support analysis of return trips, if necessary. | Yes | Section 8.1 |
| **4.3.3 Special Facilities** | | |
| a. Information on evacuation logistics and mobilization times is provided. | Yes | Section 2.4, Section 8.1, Table 8-8 through Table 8-10 |
| b. The logistics of evacuating wheelchair and bed bound residents are discussed. | Yes | Section 8.1, Section 8.1, Table 8-8 through Table 8-10 |
| c. Time for loading of residents is provided. | Yes | Section 2.4 – Item 5, Section 8.1, Table 8-8 through Table 8-10 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| d. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed. | Yes | Section 8.1 |
| e. Discussion is provided on whether special facility residents are expected to pass through the reception centre before being evacuated to their final destination. | Yes | Section 8.1 |
| f. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed. | N/A | Section 8.1 – Due to uncertainty of host facility reception centres, a second wave ETE could not be considered or computed |
| **4.3.4 Schools** | | |
| a. Information on evacuation logistics and mobilization times is provided. | Yes | Section 2.4, Section 8.1, Table 8-2 through Table 8-4 |
| b. Time for loading of students is provided. | Yes | Section 2.4, Section 8.1, Table 8-2 through Table 8-4 |
| c. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed. | Yes | Section 8.1 |
| d. Information reception centres should be identified. A discussion is provided on whether students are expected to pass through the reception centres before being evacuated to their final destination. | Yes | Based on discussions with OPG, reception centre locations are not to be listed in the ETE study as they may change after the report is final. |
| e. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed. | Yes | Section 8.1, Table 8-2 through Table 8-4 |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **4.4 ETE Stochastic Model Runs** | | |
| a. The number of simulation runs needed to produce average results is discussed. | N/A | DYNEV does not rely on simulation averages or random seeds for statistical confidence. For DYNEV/DTRAD, it is a meso-scopic simulation and uses dynamic traffic assignment model to obtain the "average" (stable) network work flow distribution. This is different from microscopic simulation, which is monte-carlo random sampling by nature relying on different seeds to establish statistical confidence. Refer to Appendix B for more details |
| b. If one run of a single random seed is used to produce each ETE result, the report includes a sensitivity study on the 90 percent and 100 percent ETE using 10 different random seeds for evacuation of the full study area under Summer, Midweek, Daytime, Normal Weather conditions. | N/A | |
| **4.5 Model Boundaries** | | |
| a. The method used to establish the simulation model boundaries is discussed. | Yes | Section 4.5 |
| b. Significant capacity reductions or population centres that may influence the ETE and that are located beyond the evacuation area or shadow region are identified and included in the model, if needed. | Yes | Section 4.5 |
| **4.6 Traffic Simulation Model Output** | | |
| a. A discussion of whether the traffic simulation model used must be in equilibration prior to calculating the ETE is provided. | Yes | Appendix B |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| b. The minimum following model outputs for evacuation of the entire study area are provided to support review:<br>1. Evacuee average travel distance and time.<br>2. Evacuee average delay time.<br>3. Number of vehicles arriving at each destination node.<br>4. Total number and percentage of evacuee vehicles not exiting the study area.<br>5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the study area.<br>6. Average speed for each major evacuation route that exits the study area. | Yes | 1. Appendix J, Table J-2<br>2. Table J-2<br>3. Table J-4<br>4. None and 0%. 100 percent ETE is based on the time the last vehicle exits the evacuation area<br>5. Figures J-2 through J-15 (one plot for each scenario considered)<br>6. Table J-3 |
| c. Colour coded roadway maps are provided for various times (e.g., at 2, 4, 6 hrs.) for DPZ and CPZ evacuation scenarios, identifying areas where congestion exists. | Yes | Figure 7-3 through Figure 7-10 for the DPZ and Figure 7-11 through Figure 7-18 for the CPZ |
| **4.7 Evacuation Time Estimates for the General Public** | | |
| a. The ETE includes the time to evacuate 90 percent and 100 percent of the total permanent resident and transient population. | Yes | Table 7-1 and Table 7-2 |
| b. Termination criteria for the 100 percent ETE are discussed, if not based on the time the last vehicle exits the evacuation zone. | N/A | The 100 percent ETE is based on the time the last vehicle exits the evacuation zone. |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| c. The ETE for 100 percent of the general public includes all members of the general public. Any reductions or truncated data is explained | Yes | Section 5.4.1 – truncating survey data to eliminate statistical outliers<br>Table 7-2 – 100$^{th}$ percentile ETE for general population |
| d. Tables are provided for the 90 and 100 percent ETEs similar to Table 4-3, "ETEs for a Staged Evacuation," and Table 4-4, "ETEs for a Keyhole Evacuation." of NUREG/CR-7002, Rev. 1. | Yes | Table 7-3 and Table 7-4 |
| e. ETEs are provided for the 100 percent evacuation of special facilities, transit dependent, and school populations. | Yes | Section 8 |
| **5.0 Other Considerations** | | |
| **5.1 Development of Traffic Control Plans** | | |
| a. Information that responsible authorities have approved the traffic control plan used in the analysis are discussed. | Yes | Discussed with local authorities during the final meeting. |
| b. Adjustments or additions to the traffic control plan that affect the ETE is provided. | Yes | Section 9, Appendix G |
| **5.2 Enhancements in Evacuation Time** | | |
| a. The results of assessments for enhancing evacuations are provided. | Yes | Appendix M |

| NRC Review Criteria | Addressed in ETE Analysis (Yes/No/NA) | Comments |
|---|---|---|
| **5.3 Provincial and Regional Review** | | |
| a. A list of agencies contacted is provided and the extent of interaction with these agencies is discussed. | Yes | Table 1-1 |
| b. Information is provided on any unresolved issues that may affect the ETE. | Yes | Results of the ETE study were formally presented to municipalities and provincial agencies at the final project meeting. Comments on the draft report were provided and were addressed in the final report. There are no unresolved issues. |
| **5.4 Reviews and Updates** | | |
| a. The criteria for when an updated ETE analysis is required to be performed and submitted to the NRC is discussed. | No | Not Applicable in Canada |
| **5. 4.1 Extreme Conditions** | | |
| a. The updated ETE analysis reflects the impact of the study area conditions not adequately reflected in the scenario variations | N/A | This ETE is being updated for regulatory requirements. |
| **5.5 Reception Centres and Congregate Care Centre** | | |
| a. A map of congregate care centres and reception centres is provided. | Yes | Based on discussions with OPG, reception centre locations are not to be listed in the ETE study as they may change after the report is final. |

Canadian Environmental Law Association
EQUITY. JUSTICE. HEALTH.

CELEBRATING 50 Years 1970 - 2020 OF ENVIRONMENTAL PROTECTION

# DURHAM NUCLEAR AWARENESS, SLOVENIAN HOME ASSOCIATION & THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION

***Comments on Ontario Power Generation's Application for the Authorization to Operate Pickering Nuclear Generating Station Units 5 to 8 until 2026***

**Prepared by:**
Sara Libman, Legal Counsel

**Expert Review by:**
M.V. Ramana, Professor and Simons Chair in Disarmament, Global and Human Security

April 26, 2024

Canadian Environmental Law Association
T 416 960-2284 • F 416 960-9392 • 55 University Avenue, Suite 1500 Toronto, Ontario, M5J 2H7 • cela.ca

April 26, 2024

Senior Tribunal Officer, Secretariat
Canadian Nuclear Safety Commission
280 Slater Street, P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9

Dear Sir or Madam:

*Sent by email* interventions@cnsc-ccsn.gc.ca

**Re: Joint Submission of Durham Nuclear Awareness, Slovenian Home Association, and the Canadian Environmental Law Association, Regarding Ontario Power Generation's application for the authorization to operate Pickering Nuclear Generating Station Units 5 to 8 until 2026 (Ref. 2024-H-05)**

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The Canadian Environmental Law Association ("CELA") has enclosed its comments, on behalf of Durham Nuclear Awareness, Slovenian Home Association, and CELA on the OPG's application to extend the operations of Pickering Nuclear Generating Station Units 5 to 8 until 2026.

Please find below our submission for your review.

By this letter, and pursuant to the CNSC's *Rules of Procedure*, CELA request status to participate as an intervenor in the public hearing and an opportunity to make a 30-minute oral presentation at the June 2024 hearing.

Sincerely,

**CANADIAN ENVIRONMENTAL LAW ASSOCIATION**

Sara Libman
Legal Counsel, CELA

# I. INTRODUCTION

Durham Nuclear Awareness (DNA) and Slovenian Home Association (SHA) together with the Canadian Environmental Law Association (CELA) and the expert review by Dr. M.V. Ramana,[1] submit this written report in response to the Canadian Nuclear Safety Commission's (CNSC) Participant Funding Notice to review Ontario Power Generation's (OPG) application and associated documents seeking to extend the operations of Pickering Nuclear Generating Station Units 5 to 8 until December 2026.[2]

DNA, SHA, and CELA's (herein, "the intervenors") submission is the result of a review of OPG's documents which have been made available to the public, as well as the CNSC staff Commission Member Document (CMD) prepared in response to OPG's application. In addition to reviewing the documents submitted by OPG, this submission considers the CNSC's jurisdiction pursuant to the *Nuclear Safety and Control Act* (NSCA), which requires that in making a licensing decision, the CNSC ensure the adequate protection of the environmental and human health. In meeting this objective, per section 24(4) of the NSCA, the intervenors' findings and concerns are itemized below. Our recommendations are summarized in **Appendix A.**

# II. INTEREST AND EXPERTISE OF THE INTERVENORS

## *i. Durham Nuclear Awareness*

Durham Nuclear Awareness (DNA) is a citizens' group with a longstanding interest in the Darlington Nuclear Generating Station and the Pickering Nuclear Generating Station. DNA was first organized in 1986 in the wake of the Chernobyl disaster and born out of a need for people in Durham Region to come together, learn & empower themselves.

As a volunteer group of concerned citizens, DNA dedicates themselves to raising public awareness about nuclear issues facing Durham Region, and fostering greater public involvement in the nuclear decision-making process. DNA has appeared on numerous occasions before the CNSC and has a lengthy history lobbying for critical public health and safety measures, including improved emergency planning and baseline health studies, and setting standards for tritium in drinking water. DNA continues to advocate for upgrades to nuclear emergency plans to ensure the protection of communities in the event of a nuclear accident.

[1] M.V. Ramana is the Simons Chair in Disarmament, Global and Human Security and Professor at the School of Public Policy and Global Affairs, University of British Columbia, Vancouver, Canada.
[2] Canadian Nuclear Safety Commission, *Participant Funding Notice*, online: https://www.nuclearsafety.gc.ca/eng/the-commission/participant-funding-program/opportunities/2023-pic-ext/

### *ii. Slovenian Home Association*

Slovenian Home Association ("SHA") is a non-profit cultural organization dedicated to the preservation of Slovenian culture language, heritage and identity in Canada. Many Slovenians reside in the vicinity of the Pickering and Darlington nuclear plants and are concerned about the proposed plans to expand nuclear power generation within the region, particularly with OPG proposing novel reactor technology at the Darlington site. Much of these concerns stem from emergency planning for nuclear accidents.

SHA members are not aware of what to do in case of a nuclear alert from the Province of Ontario. Some questions posed to SHA by its members include: *Should they be prepared to evacuate or stay at home? Where is their closest evacuation center? How to protect themselves by staying at home?* Despite emergency planning being a heavy concern for its members, SHA not been made aware of any public information meetings where the details of the actions taken by the citizens, in case of a nuclear alert, were discussed. SHA would welcome an opportunity to distribute emergency preparedness instructions to its members and to organize and host a preparedness workshop on the topic of emergency preparedness.

### *iii. Canadian Environmental Law Association*

CELA is a non-profit, public interest law organization. CELA is funded by Legal Aid Ontario as a speciality legal clinic to provide equitable access to justice to those otherwise unable to afford representation for environmental injustices. For nearly 50 years, CELA has used legal tools to advance the public interest, through advocacy and law reform, in order to increase environmental protection and safeguard communities across Canada.

CELA has been involved in number of nuclear facility licensing and regulatory matters before the CNSC including federal environmental assessments. CELA also maintains an extensive library of public legal education materials related to Canada's nuclear sector on its website.[3]

### *iv. Dr. M.V. Ramana*

Expert review of this submission was provided by M. V. Ramana, Professor and Simons Chair in Disarmament, Global and Human Security at the School of Public Policy and Global Affairs (SPPGA), University of British Columbia. M. V. Ramana has extensive knowledge and expertise in the nuclear non-proliferation safety risks of reactor designs and accompanying adverse environmental effects. His research interests are in the broad areas of international security and

[3] Canadian Environmental Law Association, online: www.cela.ca

energy supply, with a particular focus on topics related to nuclear energy and fissile materials that can be used to make nuclear weapons. He combines technical skills and interdisciplinary methods to address policy relevant questions related to security and energy issues.

## III. BACKGROUND

The Pickering Nuclear Generating Station (hereinafter, "Pickering" or "NGS") is located on the north shore of Lake Ontario, in the City of Pickering in the regional municipality of Durham, Ontario. The facility lies 32 km northeast of downtown Toronto and 21 km southwest of Oshawa. The facility is owned and operated by OPG. Pickering consists of eight nuclear reactors, Units 1-4 (Pickering A) and Units 5-8 (Pickering B). Currently, Units 1 and 4, and Units 5-8 are operational, while Units 2 and 3 have been placed in a safe storage state.[4]

In August 2018, the CNSC renewed the licence for Pickering for a period of 10 years. During the relicensing hearing, the Commission noted that should OPG intend to operate any NGS Unit beyond December 31, 2024, a decision from the Commission via a public hearing process would be required to change OPG's licencing basis.[5]

In June 2023, OPG submitted a licence amendment application requesting to operate NGS units 5-8 to December 31, 2026 (units 1 and 4 would adhere to the current licence condition of being shut down by December 31, 2024). Additionally, OPG's application is requesting the Commission's authorization for an increased operating limit for units 5-8 pressure tubes from up to 295,000 effective full power hours (EFPH) to up to 305,000 EFPH.[6]

This licence amendment application marks the third request by OPG to extend Pickering's operating licence beyond its design life. Prior to the 2018 licence renewal hearing, in 2012 OPG applied to renew Pickering's licence for a 5-year period ending in December 2020. Because 2020 was beyond the assumed design life of certain operational parts in the NGS, especially the pressure tubes, OPG was required to demonstrate that Pickering could be operated safely until the end of 2020. The CNSC renewed the licence for Pickering on August 9, 2013, valid to August 31, 2018, but imposed hold points to review additional safety information from OPG about the ability of the pressure tubes and other components to withstand longer operations. The hold- points were removed in 2014.

[4] Canadian Nuclear Safety Commission, "CMD 24-H5: A Licence Amendment – Ontario Power Generation Inc. Pickering Nuclear Generating Station," (27 February 2024), p 4 **[Staff CMD]**
[5] *Ibid*, p 5
[6] *Ibid*, p 6

The Intervenors have previously expressed concerns about the renewal and extension of operations at Pickering.[7] The Pickering NGS reactors are the oldest operating nuclear power reactors in Canada. The original Pickering Generating Station licence application to operate Unit 1 was submitted to the CNSC's predecessor, the Atomic Energy Control Board on August 14, 1970; the construction permit was issued February 24, 1966. The original application to operate Unit 5 was submitted to the then Atomic Energy Control Board on May 6, 1980; the original construction permit had been issued July 19, 1974.[8]

As Canada's oldest operating nuclear power reactor, the Pickering NGS has had a history of poor performance and created a risk to the public. It has also been plagued by substantial operating costs while producing energy that is not needed in the face of much more feasible alternative sources of power. Just as CELA submitted at the 2018 licence renewal hearing, CELA again reiterates that there are significant concerns as to whether OPG will be able make adequate provision for the protection of the environment and the health and safety of persons if it were to be granted an extension of operations at Pickering units 5-8 beyond the current end date. For this and the reasons outlined below, the Intervenors request the CNSC deny OPG's application to extend the operations of Pickering units 5-8 beyond the current expiration of December 31, 2024.

## IV. PRELIMINARY MATTERS & PROCEDURAL CONCERNS

### Transparency, accessibility and disclosure of documents of critical value should be a priority in licencing stages

During the research and revision processes to prepare this submission, the Intervenors encountered several barriers to ensuring that the hearing process is transparent and accessible for members of the public to adequately engage with the licencing amendment materials.

Firstly, the Intervenors raise the issue of ease of access for reviewing documents. When reading through OPG's written submission, there are numerous references made, and various reports and studies mentioned.[9] However, these references are not hyperlinked within the 135-page document. The references within the document are not hyperlinked to the References section at the end of the

[7] Canadian Environmental Law Association, "Evaluating Environmental Protection and Emergency Preparedness at the Pickering Nuclear Generating Station (Ref. 2018-H-03)" (7 May 2018), online: https://cela.ca/wp-content/uploads/2019/07/1189-CELA-Submission-to-the-CNSC-Pickering-Licence-Renewal-2018-H-03.pdf , p 10 **[CELA submission 2018]**

[8] Canadian Environmental Law Association, "Emergency Planning at Pickering NGS - Submission to the CNSC," (May 3, 2013), online: http://www.cela.ca/sites/cela.ca/files/899PickeringEmergencyPlanning.pdf

[9] Ontario Power Generation, "Written submission from Ontario Power Generation Inc." CMD 24-H5.1 (16 June 2023). *For example*, see p 25, where there are references to Pickering's Periodic Safety Review 2 (PSR2-B), as well as CNSC regulatory documents and International Atomic Energy Agency information, but no easy way to access these references. **[OPG CMD]**

document. This requires the reader to scroll to the bottom of the document to track down the referenced document. To further complicate a reader's search for references, the Refence section does not provide hyperlinks to each reference. This means that the reader must conduct a web search to locate important documents, assuming that the document is publicly available for review. Members of the public do not necessarily have the luxury of time scour a document to find a reference made within the proponent's application, and then look up the referenced document separately. When reading through the CNSC Staff's CMD by comparison, there are hyperlinked references throughout the document, which greatly assists a reader's research process. The Intervenors submit that when preparing licencing applications, proponents should be required to hyperlink references made within the document.

Secondly, the Intervenors note that there is a lack of procedural fairness associated with the volume of complex technical documents for the licence amendment versus the time and participant funding available to review the information. While the Intervenors have numerous concerns surrounding the extension of operations at units 5-8, there is simply a lack of resources for members of the public and intervenors to heavily engage with materials to flesh out concerns surrounding safety given the level of funding made available to the funded Intervenors. Comparing these resources to other major federal energy tribunals such as the National Energy Board, the CNSC funding and resulting participation process is inadequate.

Thirdly, there are documents that are not readily available for review prior to the hearing. For instance, in the Periodic Safety Review 2-B (PSR2-B), "Appendix B: Integrated Implementation Plan Resolution Action Overview" shows a list of Resolution Action targets with their completion dates. There are targets as late as 30 November 2024, and the "overall safety evaluation" target date being 31 December 2024, for "correspondence confirming that Pickering NGS safety analysis results in supporting of commercial operations of Pickering Units 5 to 8 to the end of 2026 are submitted by OPG to the CNSC"[10] The Intervenors submit the public should have a chance to see these reports and the CNSC's evaluation of these reports and comment on it before the Commission approves continued operations at Pickering. In other words, the decision timeline set out in PSR2-B undercuts any possibility of meaningful public input during this hearing. For meaningful public engagement to occur, the CNSC needs to ensure there is adequate access and resources available for the members of the public to access and digest complex materials associated with the proponent's requested amendments to Pickering's licence.

Finally, another issue in terms of transparency and fair access to crucial documents stems from the process of document retrieval. During a workshop hosted by OPG in March 2024, a number of intervenors sought clarity from OPG about the process of requesting documents that are not in the possession of the CNSC. It turned out that OPG had not thought about how members of the public

[10] Ontario Power Generation, "Pickering NGS Periodic Safety Review 2-B (PSR2-B) Integrated Implementation Plan" Appendix B, p 45 of 56

and intervenors would access certain documents within the licence application. Initially, intervenors were instructed by OPG to file a freedom of information (FOI) request to access documents from OPG. Submitting an FOI request would take too long for an individual to gain access to specific documents. This process would prohibit an individual from receiving, reading, and responding to the contents of a requested document before the hearing would occur. The Intervenors submit that an FOI request is an unacceptable process for obtaining materials for a public hearing, and should not be the process suggested to member of the public seeking additional documents.

After intervenors expressed concerns to OPG about the unfair recommendation to submit an FOI request, OPG assured that there would be a designated email address established for requesting documents from OPG. However, subsequent advice to the intervenors indicated that some documents might still require a FOI request. The Intervenors submit that proponents should be required to, at a minimum, ensure there is a contact point to quickly and easily request documents for a public hearing. The Intervenors further submit that to best achieve procedural fairness, a proponent should be required to host a public accessible database of all referenced documents (with the exception of those with security-sensitive content) to ensure members of the public have quick and easy access to documents without awaiting a response from a proponent employee. Even in case of security concerns these should be thoroughly scrutinized by the Commission to ensure that no more information is protected than absolutely necessary.

**Recommendation No. 1:** To increase transparency, the Intervenors submit that OPG should be required to make references easily accessible via hyperlinks within documents.

**Recommendation No. 2:** To ensure there is meaningful public engagement and input during public hearings such as this to extend the operations at an ageing nuclear power plant, it is essential that there is ample time provided for the public to have access to and read through essential documents and reports before a decision can be made to approve licencing amendments and renewals.

**Recommendation No. 3:** An FOI request is an unacceptable process for obtaining materials for a public hearing, and should not be the process suggested to member of the public seeking additional documents.

**Recommendation No. 4:** Proponents should be required to, at a minimum, ensure there is a contact point to quickly and easily request documents for a public hearing. Furthermore, to best achieve procedural fairness, a proponent should be required to host a public accessible database of all referenced documents (with the exception of those with security-sensitive content) to ensure members of the public have quick and easy access to documents without awaiting a response from a proponent employee.

## V. ACTION REQUESTED OF THE COMMISSION

After reviewing submissions by CNSC staff and OPG, the Intervenors submit that the CNSC should deny OPG's request to extend the operations of Pickering Units 5-8 to December 2026. Under the NSCA, the Commission has an obligation to "…prevent unreasonable risk, to the environment and to the health and safety of persons, associated with that development, production, possession or use [of nuclear substances].."[11] Upon reviewing the relevant documents associated with OPG's application, the Intervenors identified several areas of concern that would contravene the objective of the CNSC, namely: inadequate emergency planning and evacuation planning measures; risks associated with Pickering's ageing parts and facilities; a history of poor performance at Pickering; and inadequate consideration of climate change impacts.

These concerns are discussed below, along with a number of recommendations and requests for the CNSC to adopt in response to OPG's request to extend the operations at this ageing nuclear power facility.

Based on the findings within this submission, in the interest of protecting the environment and ensuring public health and safety, the Intervenors submit that the Commission cannot, in good conscience, approve an extension of the operation of Pickering Units 5-8 to 2026.

Because the operation timeframe for units 5-8 should not be extended, the Intervenors further submit that the CNSC should not grant OPG's request for an increased operating limit for units 5-8 pressure tubes from up to 295,000 EFPH to up to 305,000 EFPH.

### A. Emergency Planning and Evacuation Planning are inadequate

One of the primary concerns of the Intervenors collectively is ensuring there is adequate emergency planning measures in place to protect the public. This is an issue that the intervenors have vocalized in various public engagement opportunities with the CNSC. During the 2018 licence renewal application for Pickering, CELA expressed concerns surrounding emergency response planning and preparedness, urging the CNSC to exercise its stringent oversight role as to whether emergency planning and preparedness has been proven prior to exercising its discretion with regards to the Pickering NGS licence renewal.[12]

These concerns remain relevant for OPG's request to extend operations at the NGS units 5-8, and the Intervenors urge the Commission to exercise its stringent oversight role and review OPG's emergency plans for Pickering to make a determination whether the risk to the public is acceptably low per section 24(4) of the NSCA. The Intervenors submit the risk is not acceptably low. On a

[11] *Nuclear Safety and Control Act*, SC 1997, c 9 at s 9(a)(i)
[12] CELA submission 2018, p 43

full review of emergency preparedness and especially evacuation planning, the state of emergency preparedness in the Durham Region and beyond is not sufficient.

The concern described above about the risk of severe accidents is exacerbated by weaknesses in plans for how to deal with the large population in the event of a severe accident that requires evacuation of people. As of 2021, the population of the Toronto census metropolitan area (CMA) was 6.2 million, which constitutes nearly 17 percent of the entire population of Canada.[13] Between 2016 and 2021, the population of the Durham Region Census Division grew by 7.3 percent. This rapid population growth rate means that plans for emergency management can quickly become obsolete.

In the event of a severe accident with offsite releases, a significant fraction of these people could have to evacuated.

In the case of the Fukushima Daiichi accidents, areas as far away as 50 km from the site had to be evacuated due to high radiation levels.[14] The U.S. Nuclear Regulatory Commission recommended that U.S. citizens living with 80 kilometers of the Fukushima plants evacuate the area. Finally, in response to Prime Minister Naoto Kan's instructions, the Japan Atomic Energy Commission drew up a worst-case scenario for the nuclear accident, which explained that "all residents living within 170 kilometers or more of the Fukushima plant might need to be relocated, and relocation might need to be advised for those living within 250 kilometers…evacuation of the 30 million residents in the Tokyo metropolitan area could become necessary, depending upon wind direction".[15]

In 2017, CELA recommended that the province expand "the current 50 km secondary zone to 100 km from every Ontario and non-Ontario reactor, and provide for education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident".[16] Given the growing population of the area, CELA reiterates that recommendation.

According to OPG's application, the 2023 Pickering Evacuation Time Estimate (ETE) study determined "the time to evacuate 90% of the population from Pickering Detailed Planning Zone (DPZ) (i.e., out to 10 km) ranges from 4 hours and 45 minutes to 8 hours and 25 minutes (e.g.,

[13] https://www.durham.ca/en/regional-government/resources/Documents/Council/CIP-Reports/CIP-Reports-2022/2022-INFO-31.pdf

[14] Greenpeace, "Lessons from Fukushima", February 2012 at p. 18

[15] Funabashi, Y., and K. Kitazawa. "Fukushima in Review: A Complex Disaster, a Disastrous Response." *Bulletin of the Atomic Scientists* 68, no. 2 (2012): 9–21 at p. 10.

[16] Canadian Environmental Law Association, "Discussion Paper on Planning Basis Review and Recommendations and List of Proposed Changes to the PNERP 2009" (28 July 2017), online: https://cela.ca/provincial-nuclear-emergency-response-plan-pnerp-2009-discussion-paper/ at p 23

wintertime, with heavy snow at mid-day on a weekday)."[17] OPG's application does not discuss the even longer estimates to evacuate 100% of the DPZ: "the ETE for the 100th percentile are significantly longer than those for the 90th percentile, ranging from 4:30 to 10:15 for Regions R01 through R03 and 11:00 to 17:00 for Region R04. This is the result of significant congestion within the study area."[18] In the event of a severe accident, taking up to 17 hours to evacuate 100% of just the DPZ is deeply concerning, as this timing does not capture the impact of a larger zone radius (i.e., our proposed 100 km radius).

The Pickering ETE study notes:

> Current Provincial Nuclear Emergency Response Plans indicate pre-planned protective actions are to be developed for the Detailed Planning Zone Outer Ring (DPZ Outer Ring) and contingency planning and arrangements are to be made for the Contingency Planning Zone (CPZ). As such, this report focuses on the DPZ Outer Ring, but provides information, including data, analyses and results, for the CPZ for contingency planning purposes.[19]

With the current radius limitations, the evacuation times are likely downplaying the potential public confusion and even chaos, and increased evacuation times needed for a larger area in the event of a severe offsite accident. Given the lengthy evacuation times needed to mitigate the health impacts on all the surrounding population of a severe accident at this ageing nuclear plant, the CNSC should insist on the expansion of the planning zones around Pickering.

Another area of concern arising from OPG's application is the failure to carefully sufficiently consider potential accidents with large offsite releases. Hazards such as malfeasance or air accidents, for instance, are not considered by OPG, nor are unexpected chains of events and unexpected consequences of human error. When assessing internal and external hazards that may result in large offsite releases, certain hazards are have been screened out because OPG has deemed the likelihood of occurrence as low, even though risks such as those mentioned above are not outside the realm of possibility of occurring. When discussing the probabilistic safety assessment (PSA), OPG states:

> PSAs are conducted separately for internal and external types of hazards, in particular, they are for internal events, internal fires, internal floods, seismic hazards, and high wind hazards. Many other hazards are also examined and addressed as part of the PSA hazard

[17] OPG CMD at p 36.
[18] Ontario Power Generation, "Pickering Nuclear Generating Station Evacuation Time Estimate" (24 March 2023), online: https://www.opg.com/documents/pickering-ngs-development-of-evacuation-time-estimates/ p ES-2.
[19] *Ibid*, p xiii

> screening process (some hazards – meteorites, for example – are deemed to be of such low likelihood that they were screened out, and not developed into PSA models).[20]

CELA has previously expressed concerns to the CNSC about OPG's lack of consideration for severe accidents, and planning for worst-case scenarios due to low likelihood of occurrence.[21] While meteorite strikes might not be a significant risk, screening out hazards from a PSA on the basis of the OPG's evaluation of the likelihood of the hazard raises concerns that OPG is not prepared for worst case scenario accidents. Many scholars have explained why risk assessments are often unreliable because they cannot account for "unknown unknowns" and estimates of very low probabilities of accidents are not credible.[22] No nuclear plant is immune to the possibility of a major accident, even in case of reactors featuring multiple safety systems. The case of the multiple reactor meltdowns at the Fukushima-Daiichi nuclear power plant involved the failure of many safety systems due to a single root cause – the earthquake, which was also the cause of the tsunami.

The failure was also institutional. The Tokyo Electric Power Company that owned and operated the Fukushima reactors and the nuclear safety agency in Japan both convinced themselves that the reactors were safe. CELA is concerned that safety assessments of the ageing Pickering nuclear plant might be suffering from similar blind spots. As CELA has emphasised in previous submissions before the CNSC, simply because the likelihood of an event occurring is very low, it does not guarantee that a severe nuclear reactor accident will never happen.

The Intervenors submit that the safety assessment for Pickering is inadequate because it does not plan for severe accident scenarios and the CNSC cannot come to the determination that the risk associated with extending units 5-8 would not pose a risk to human health and the environment.

**Recommendation No. 5:** The province should expand the current 50 km secondary zone to 100 km from every Ontario and non-Ontario reactor, and provide for education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be

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[20] OPG CMD at p 29, *emphasis added*.

[21] *See for instance*, CELA, "Comments on the applicability of the Darlington New Nuclear Project's environmental assessment and plant parameter envelope to Ontario Power Generation's selected BWRX-300 reactor technology" (17 November 2023), online: https://api.cnsc-ccsn.gc.ca/dms/digital-medias/CMD24-H2-8.pdf/object?subscription-key=3ff0910c6c54489abc34bc5b7d773be0 p15

[22] Raju, Suvrat. "Estimating the Frequency of Nuclear Accidents." *Science & Global Security* 24, no. 1 (2016): 37–62; Ramana, M. V. "Beyond Our Imagination: Fukushima and the Problem of Assessing Risk." *Bulletin of the Atomic Scientists*, April 19, 2011. https://thebulletin.org/2011/04/beyond-our-imagination-fukushima-and-the-problem-of-assessing-risk/; Downer, John. "Disowning Fukushima: Managing the Credibility of Nuclear Reliability Assessment in the Wake of Disaster." *Regulation & Governance* 8, no. 3 (2014): 287–309. https://doi.org/10.1111/rego.12029; Downer, John, and M. V. Ramana. "Empires Built on Sand: On the Fundamental Implausibility of Reactor Safety Assessments and the Implications for Nuclear Regulation." *Regulation & Governance* 15, no. 4 (2021): 1304–25. https://doi.org/10.1111/rego.12300.

prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident.

**Recommendation No. 6:** CNSC should declare that the accident analysis prepared for Pickering is inadequate and it cannot come to a determination that the risk associated with extending units 5-8 would not pose a risk to human health and the environment.

### B. Ageing Parts and Facilities at the Pickering Nuclear Generating Station pose a cause for concern

CELA emphasizes that the extension request is for a nuclear reactor with old and ageing parts and equipment, while the size of the surrounding population has continued to increase, with more population planned for the area. The request is also being made when OPG has not completed all of the necessary outstanding safety studies relevant to this extension request. We note that Pickering NGS Periodic Safety Review 2-B (April 2023) includes no less than thirteen (13) unresolved issues, many of which have great safety significance. Since they have not been resolved, there is an insufficient basis to authorize continued operations past December 2024. Among the critical components that are at risk of aging related problems are fuel channels and steam generators.

Fuel Channels and their degradation pose major challenges. Each of these fuel channels is in a different location and operating at a different individual power level. Therefore, their degradation will not occur at the same rate; modelling these different components and how they might behave in the event of an accident is very complex.[23]

These concerns should be considered in view of the insights from the Fukushima accident and dangers of climate change related events.

When they melted down, the first three reactor units at Fukushima Daiichi had been operating for 41 years, 38 years and 37 years respectively.[24] Pickering units 5 through 8 have been operating for 42 years, 41 years, 40 years, and 39 years.[25] Old nuclear plants are particularly susceptible to accidents, the likelihood of which can be described by something called the bathtub curve.[26] The failure rate is initially high due to manufacturing problems and operator errors associated with new technology. Then curving like a tub, the failure rate declines with experience and rises again as

[23] Nijhawan, Sunil. "Severe Accident Related Vulnerabilities, Potential Design Enhancements and Opportunities for International Cooperation in Risk Reduction in Pressurized Heavy Water Reactors." American Society of Mechanical Engineers Digital Collection, 2015. https://doi.org/10.1115/NUCLRF2015-49574.
[24] https://pris.iaea.org/pris/CountryStatistics/CountryDetails.aspx?current=JP
[25] https://pris.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=CA
[26] Lochbaum, David. "The Bathtub Curve, Nuclear Safety, and Run-to-Failure." *The Equation* (blog), November 17, 2015. https://blog.ucsusa.org/dlochbaum/the-bathtub-curve-nuclear-safety-and-run-to-failure/.

aging related wear and tear starts increasing. In other words, the dangers of continuing operations are high and increasing.

The problem of ageing is likely to be even more severe in the case of the Pickering units because they were intended to be shut down. The scale of the challenge might be appreciated from looking at the case of the Diablo Canyon nuclear plant in California in the USA. The two reactor units were to be shut down in 2024 and 2025 but due to political reasons, there are now plans to extend operations at this reactor.[27] This has led to an evaluation of its safety.

In July 2022, the Chair of the Diablo Canyon Independent Safety Committee explained why this case was very difficult: "so many different programs and projects and so on have been put in place over the last half a dozen years predicated on that closure in 2024-25 and each one of those would have to be evaluated and some of them are okay and some of them won't be and some are going to be a real stretch and some are going to cost money and some of them aren't going to be able to be done maybe".[28] This is the kind of challenge that we are confronting at Pickering too.

One should note that in February 2011, just a month before the devastating accident at the Fukushima Daiichi nuclear plant, Japan's Nuclear and Industrial Safety Agency, approved a 10-year extension for the oldest of the six reactors at the power station. This was done despite warnings about its safety.[29] This decision, in part, resulted in the disastrous nuclear accident in 2011, posing immense consequences to people's health, the environment, and the economy.

The Intervenors submit that with so many uncertainties surrounding the ageing equipment of Pickering, allowing the NGS to continue operating beyond 2024 would irresponsibly place the environment and the public at enhanced and unsupportable risk. Due to the ageing parts and equipment at Pickering, along with the numerous unresolved issues within the Periodic Safety Review 2-B, the risk for severe incidents is too great to grant OPG's application.

**Recommendation No. 7:** The Commission should deny the application for a further extension of the aging units since allowing the NGS to continue operating beyond 2024 would irresponsibly place the environment and the public at risk.

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[27] Sara Nelson and M. V. Ramana. "Managing Decline: Devaluation and Just Transition at Diablo Canyon Nuclear Power Plant." *Environment and Planning A: Economy and Space* 55, no. 8 (2023): 1951–69. https://doi.org/DOI: 10.1177/0308518X231167865.

[28] *June 22, 2022: Diablo Canyon Independent Safety Committee--Diablo Relicensing Concerns Discussed*, 2022. https://www.youtube.com/watch?v=WjTq-ybnaSY.

[29] Tabuchi, Hiroko, Norimitsu Onishi, and Ken Belson. "Japan Extended Reactor's Life, despite Warning." *New York Times*, March 22, 2011.

### C. Poor Performance at the Pickering Nuclear Generating Station

Pickering's performance data as reported by the International Atomic Energy Agency's ("IAEA") Power Reactor Information System Database does not suggest that these reactors are performing well.[30] The load factors for the last two years reported on the PRIS database for Pickering-5 are below its average lifetime load factor, with the 2022 load factor being a paltry 52.8 percent. Likewise, Pickering-7 and Pickering-8 fell below their lifetime averages in 2021 (with load factors of only 62.8 percent and 54.4 percent respectively).

According to the IAEA's Operating Experience with Nuclear Power Stations in Member Stations document for 2023, Pickering-5 was not functioning for 3826 hours (44 percent of the time), which includes 57 hours because of environmental conditions such as lack of cooling water due to dry weather, cooling water temperature limits, flood, storm, lightning; Pickering-6 for 915 hours, including 94 hours because of environmental conditions; Pickering-7 for 790 hours; and Pickering-8 for 971 hours.[31] In other words, two of the units were not contributing energy for extended periods of time, and two were shut down for 2-4 days due to causes that might well have to do with climate change.

In addition to the findings by the IAEA, the CNSC Staff CMD itself highlights several concerns indicating poor performance at Pickering.

Firstly, in the application of the "as reasonably low as achievable" (ALARA) principle—which is a requirement under the *Radiation Protection Regulations,*[32] through a desktop inspection in December 2022, CNSC staff identified non-compliant findings of low and negligible safety significance:

> During the inspection, CNSC staff reviewed OPG's 5-year ALARA plan and found that OPG did not have the governance support documents in place to drive the creation and content of this plan. As a result, CNSC staff requested that OPG develop governance support documents to formalize the requirements for creating and maintaining a 5-year ALARA plan and create an implementation plan for corrective actions. CNSC staff will continue to monitor and assess OPG's implementation of these corrective actions and its 5-year ALARA plan at the Pickering NGS.[33]

[30] IAEA, "Power Reactor Information System (PRIS)", Canadian plant details, online: https://pris.iaea.org/pris/CountryStatistics/CountryDetails.aspx?current=CA
[31] IAEA, "Operating Experience with Nuclear Power Stations in Member States 2023 Edition" (2023), online: https://www-pub.iaea.org/MTCD/Publications/PDF/OPEX_2023_web.pdf.
[32] Radiation Protection Regulations, under the *Nuclear Safety and Control Act* (SOR/2000-203)
[33] CNSC Staff CMD, p 49.

While the non-compliance with the ALARA principle's application was deemed to be of "low" and "negligible" safety significance by CNSC staff, the failure to have a properly developed ALARA plan in place is concerning, as these plans are intended to ensure that contamination levels and radiation doses received by individuals are monitored, controlled and maintained as low as reasonably achievable. By failing to implement such important safety plans, the Intervenors are concerned that allowing Pickering to continue operations beyond 2024, poses a risk that important health and safety measures and plans will fall to the wayside. As Pickering continues to age and reach the end of its operational lifespan, there are concerns surrounding worker complacency resulting in further non-compliances. The Intervenors submit that the CNSC should not discount the non-compliance with important safety measures.

Yet another non-compliance highlighted within the CNSC staff CMD concerned the maintenance of fire emergency response equipment and the utilization of firefighting equipment and tools.[34] While OPG has implemented corrective action plans to address these non-compliances, it is concerning that fire emergency equipment within a nuclear power plant was not being properly maintained.

CNSC staff have noted that in previous years (2021 and 2022), Pickering failed to meet CNSC staff standards for the Security SCA. Due to an increase in regulatory scrutiny, the CNSC staff note that they are satisfied that OPG is "adequately addressing the identified issues," and "overall, CNSC staff conclude that OPG's programs within the security SCA are adequate for continued commercial operations until the end of 2026."[35] This "enhanced regulatory scrutiny" involved the issuance of an Administrative Monetary Penalty (AMP) to OPG in 2023 as a result of a failure to comply with a licence condition in relation to its security program at the Pickering and Darlington Nuclear Generating Stations. The AMP was issued to promote compliance and deter recurrence."[36] The issuance of an AMP by the CNSC is uncommon, so the requirement to issue a monetary penalty to encourage OPG to maintain compliance at not one but two nuclear power plants does not exude confidence in the ability to maintain proper safety measures at Pickering for two more years beyond the current licence.

While most instances of non-compliance at Pickering have been deemed by CNSC staff to be low risk, the frequency of these occurrences in Pickering's later stages of its operation suggest that safety measures are not being treated as a top priority in day-to-day operations at Pickering. The Intervenors submit that the Commission needs to consider these instances of non-compliance, and balance their frequency of occurrence with the risk of accidents impacting the environment and the public.

[34] *Ibid* at p 64.
[35] *Ibid* at p 69.
[36] *Ibid* at p 69-70.

**Recommendation No. 8:** Given the poor performance of Pickering's reactors, the CNSC should deem units 5-8 as having reached the end of their operational phase, and deny a further extension of their operations.

**Recommendation No. 9:** The Commission should consider these instances of non-compliance, their frequency of occurrence, the age of the plant, and the consequences of a severe accident with large offsite releases that would impact the environment and the public.

### D. The Pickering Nuclear Generating Station is not prepared to adapt to and mitigate the impacts of Climate Change

The impacts of climate change on nuclear reactors includes various climate-related hazards such as heat waves, floods, droughts, storms, lightning events and wildfires which can pose challenges to nuclear safety, necessitating enhanced safety assessments and adaptive management strategies.[37] Rising temperatures can threaten nuclear reactors, as they rely on large external sources of water for cooling. In the case of Canadian reactors, this water is usually from the Great Lakes, or the Bay of Fundy in the case of Point Lepreau. Heightened water stress, either from reduced availability or competing uses, is a concern since nuclear reactors require significant amounts of water for cooling purposes.[38]

Higher water temperatures can reduce the thermal efficiency of nuclear reactors. Studies of climate-driven alterations in energy sectors in Ontario, Canada, show anticipated temperature increases and consequent loss of thermal efficiency in the output from reactors will result in reduced generation of electricity of somewhere between 1.5 and 2.5 percent by the 2050s, and between 2.5 and 4.0 percent by the 2080s.[39] While the current proposed extension is for a much shorter time, the trend is clear.

A second source of reduced output is having to shut down nuclear reactors for shorter or longer periods of time because of extreme weather conditions, including high water temperatures.[40]

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[37] Linnerud, K., Mideksa, T. K., & Eskeland, G. S. (2011). The impact of climate change on nuclear power supply. *The Energy Journal*, 32(1); Kromp-Kolb, Helga, Nikolaus Muellner, Duck Kim, Jaroslav Holy, Sanna Syri, Jean-Yves Caneill, Gernot Thuma, et al. "Climate Change: Assessment of the Vulnerability of Nuclear Power Plants and Approaches for Their Adaptation." Paris: Nuclear Energy Agency, OECD, 2021.

[38] Linnerud, K. et al.

[39] Wang, S., Zhu, J., Huang, G., Baetz, B., Cheng, G., Zeng, X., & Wang, X. (2020). Assessment of climate change impacts on energy capacity planning in Ontario, Canada using high-resolution regional climate model. *Journal of Cleaner Production*, 274, 123026.

[40] *See*: Ahmad, Ali. "Increase in Frequency of Nuclear Power Outages Due to Changing Climate." *Nature Energy* 6, no. 7 (July 2021): 755–62. https://doi.org/10.1038/s41560-021-00849-y; *see also* Ahmad, Ali, Andrei Covatariu, and M. V. Ramana. "A Stormy Future? Financial Impact of Climate Change-Related Disruptions on Nuclear Power Plant Owners." *Utilities Policy* 81 (April 1, 2023): 101484. https://doi.org/10.1016/j.jup.2022.101484.

Reactors have to cease generating power because the required cooling cannot be ensured or because of other operational challenges.

We may already be witnessing such a climate driven impact as increasing temperatures lead to accelerating growth of algae and jellyfish, which can block input of water.[41] Climate impacts have already happened repeatedly at Pickering, most recently in 2018 when heavy rain and warmer temperatures when units 5, 6, 7, and 8 had to be shut down after algae clogged the cooling water intakes.[42] This has happened in earlier years too including in 2003, when OPG had to shut down Unit 7, and in 2005, when Units 5, 6, and 8 were shut down because of a large incursion.[43] Those shut downs prompted OPG to install a diversion net by the water intake and improving its operating procedures, at considerable cost.[44] But as the subsequent forced shut down of four units in 2018 showed, these changes have not eliminated the problem. As climate change intensifies, such shut downs will become more common and result in revenue being lost.

Within OPG's application, the only climate change mitigation discussion surrounds algae accumulation.[45] There is no discussion of how OPG plans to address and prevent other impacts of climate change from shutting down the Pickering reactors. For example, extreme weather events such as floods, heatwaves, wildfires, lightning events or extreme heat events are not discussed within the "Equipment Reliability and Climate Change" section of OPG's application. The Intervenors are concerned that Pickering is not currently equipped to address the impacts of climate change, and granting an additional 2 years of operation time for units 5-8 will not improve OPG's (lack of) mitigation measures. The Intervenors submit that without robust climate change mitigation strategies in place, it would be irresponsible for the Commission to extend the operation period for units 5-8 beyond 2024.

In April 2024, the U.S. Government Accountability Office (GAO) released a report titled "Nuclear Power Plants: NRC Should Take Actions to Fully Consider the Potential Effects of Climate Change." The GAO notes that "climate change is likely to exacerbate natural hazards—such as floods and drought. The risks to nuclear power plants from such hazards include damage to systems

[41] Lin, H., Zhang, S., Cao, R., Yu, S., Bai, W., Zhang, R., ... & Zhang, X. (2023). A review on the risk, prevention and control of cooling water intake blockage in coastal nuclear power plants. *Nuclear Engineering and Technology*.
[42] Dalton, David. "Four Pickering Units Safely Shut Down After Algae Clogs Cooling Water Intakes." *NucNet*, February 22, 2018. https://www.nucnet.org/news/four-pickering-units-safely-shut-down-after-algae-clogs-cooling-water-intakes.
[43] Hamilton, Tyler. "Algae Prompt Reactor Shutdown." *Toronto Star*, August 10, 2007. https://www.thestar.com/business/algae-prompt-reactor-shutdown/article_efafc9ca-d686-5e22-ab91-5300e2f5e1b0.html.
[44] Kopytko, Natalie. "Spineless Attacks on Nuclear Power Plants Could Increase." *Bulletin of the Atomic Scientists*, February 19, 2015. https://thebulletin.org/2015/02/spineless-attacks-on-nuclear-power-plants-could-increase/.
[45] OPG CMD at p 94-95.

and equipment that ensure safe operation."[46] The GAO noted that the Nuclear Regulatory Commission (NRC) does not fully consider potential increases in risk from climate change, and therefore recommended the NRC assess whether its existing processes adequately address climate risks and develop and implement a plan to address any gaps identified.[47] The Intervenors recommend that the CNSC conduct an assessment and mapping of vulnerability of Canadian nuclear power plans to climate change hazards, similar to the one recommended in the GAO report.

**Recommendation No. 10:** Without robust climate change mitigation strategies in place, it would be irresponsible for the Commission to extend the operation period for units 5-8 beyond 2024.

**Recommendation No. 11:** The CNSC should conduct an assessment and mapping of vulnerability of Canadian nuclear power plans to climate change hazards, similar to those shown in the GAO report.

## VI. CONCLUSION

For the foregoing reasons provided in this submission, DNA, SHA, and CELA submit it would be contrary to the responsibility of the Commission to protect the environment and ensuring the health and safety of persons if it were to allow Pickering Units 5-8 to operate beyond 2024, and recommend the CNSC issue an order:

(1) Granting Durham Nuclear Awareness, Slovenian Home Association, and the Canadian Environmental Law Association the status of intervenor;

(2) Granting Durham Nuclear Awareness, Slovenian Home Association, and the Canadian Environmental Law Association the opportunity to make an oral presentation at the January 2024 public hearing;

(3) Denying OPG's request to amend the PROL of Pickering Nuclear Generating Station to operate units 5-8 to December 31, 2026; and

(4) Denying OPG's request to amend the PROL to increase the pressure tube operating limit to 305,000 EFPH.

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[46] U.S. Government Accountability Office, "Nuclear Power Plants: NRC Should Take Actions to Fully Consider the Potential Effects of Climate Change." GA-24-106326 (2 April 2024), online: https://www.gao.gov/products/gao-24-106326?utm_campaign=usgao_email&utm_content=topic_naturalresources&utm_medium=email&utm_source=govdelivery

[47] *Ibid.*

Sincerely,

*On behalf of*

CANADIAN ENVIRONMENTAL LAW ASSOCIATION
DURHAM NUCLEAR AWARENESS
SLOVENIAN HOMEOWNERS ASSOCIATION

Sara Libman

Sara Libman
Legal Counsel

## APPENDIX A - SUMMARY OF RECOMMENDATIONS

**Recommendation No. 1:** To increase transparency, the Intervenors submit that OPG should be required to make references easily accessible via hyperlinks within documents.

**Recommendation No. 2:** To ensure there is meaningful public engagement and input during public hearings such as this to extend the operations at an ageing nuclear power plant, it is essential that there is ample time provided for the public to have access to and read through essential documents and reports before a decision can be made to approve licencing amendments and renewals.

**Recommendation No. 3:** An FOI request is an unacceptable process for obtaining materials for a public hearing, and should not be the process suggested to member of the public seeking additional documents.

**Recommendation No. 4:** Proponents should be required to, at a minimum, ensure there is a contact point to quickly and easily request documents for a public hearing. Furthermore, to best achieve procedural fairness, a proponent should be required to host a public accessible database of all referenced documents (with the exception of those with security-sensitive content) to ensure members of the public have quick and easy access to documents without awaiting a response from a proponent employee.

**Recommendation No. 5:** The province should expand the current 50 km secondary zone to 100 km from every Ontario and non-Ontario reactor, and provide for education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident.

**Recommendation No. 6:** CNSC should declare that the accident analysis prepared for Pickering is inadequate and it cannot come to a determination that the risk associated with extending units 5-8 would not pose a risk to human health and the environment.

**Recommendation No. 7:** The Commission should deny the application for a further extension of the aging units since allowing the NGS to continue operating beyond 2024 would irresponsibly place the environment and the public at risk.

**Recommendation No. 8:** Given the poor performance of Pickering's reactors, the CNSC should deem units 5-8 as having reached the end of their operational phase, and deny a further extension of their operations.

**Recommendation No. 9:** The Commission should consider these instances of non-compliance, their frequency of occurrence, the age of the plant, and the consequences of a severe accident with large offsite releases that would impact the environment and the public.

**Recommendation No. 10:** Without robust climate change mitigation strategies in place, it would be irresponsible for the Commission to extend the operation period for units 5-8 beyond 2024.

**Recommendation No. 11:** The CNSC should conduct an assessment and mapping of vulnerability of Canadian nuclear power plans to climate change hazards, similar to those shown in the GAO report.