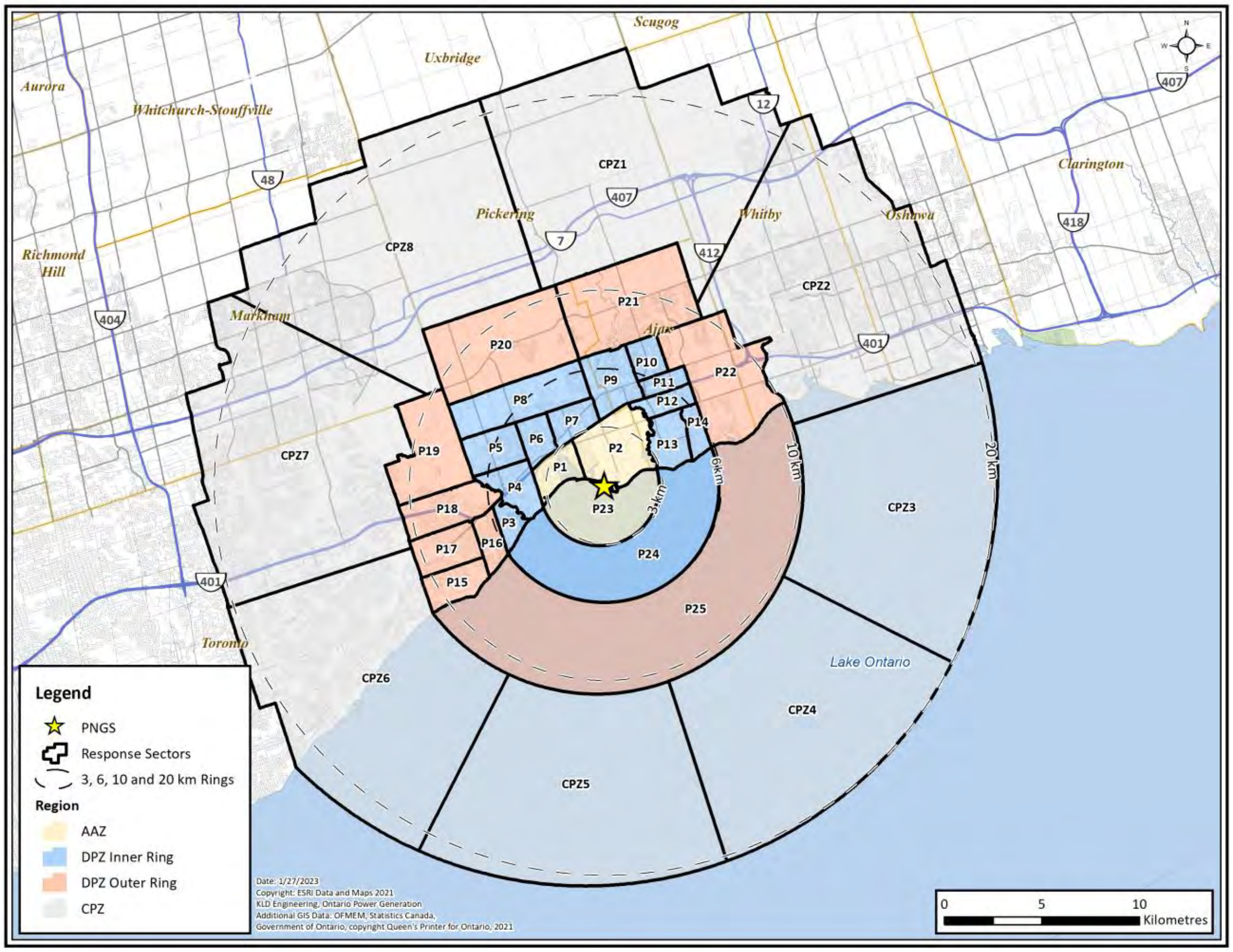
PICKERING NUCLEAR GENERATING STATION

Development of Evacuation Time Estimates



Work performed for Ontario Power Generation, by:

KLD Engineering, P.C.
1601 Veterans Memorial Highway, Suite 340
Islandia, NY 11749
e-mail: kweinisch@kldcompanies.com

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

Table of Contents

List of Appendices

Note: Appendix I intentionally skipped

List of Figures

List of Tables

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

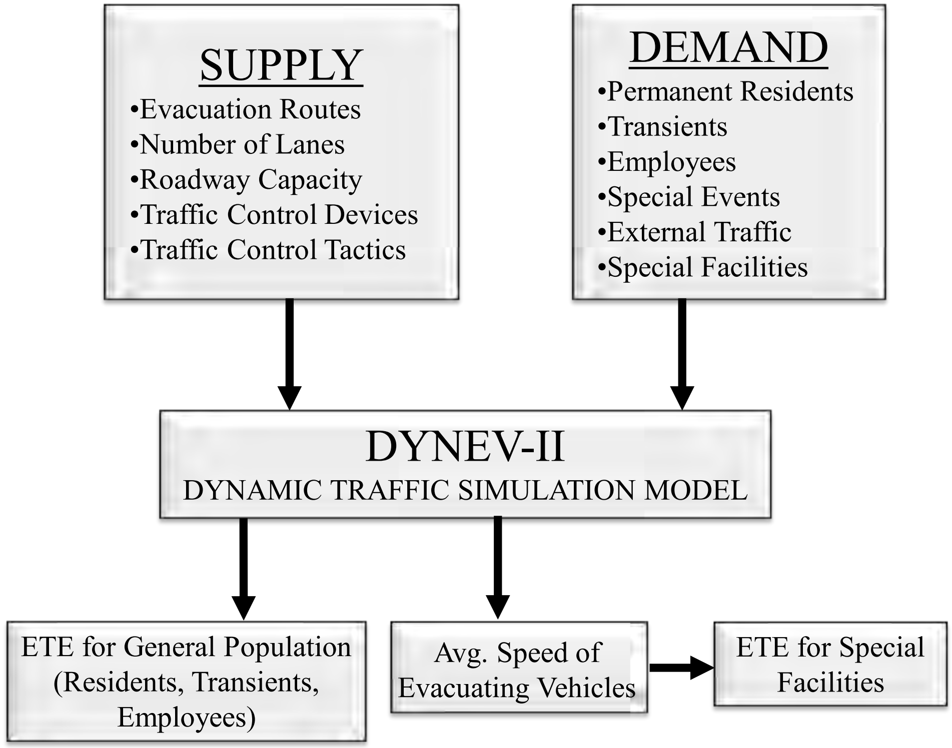


Figure ES-1. ETE Methodology

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 90th 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

<table>
<tr><th>Stakeholder</th><th>Nature of Stakeholder Interaction</th></tr>
<tr><td>Ontario Power Generation (OPG)</td><td>Attended kick-off meeting to define project methodology and data requirements. Set up contacts with provincial, regional, and municipal government agencies.
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.
Attended final meeting where the ETE study results were presented.</td></tr>
<tr><td>Durham Region</td><td rowspan="6">Attended Kick-off meeting to discuss the project methodology, key project assumptions and to define data needs.
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.
Attended final meeting where the ETE study results were presented[4].</td></tr>
<tr><td>City of Toronto Office of Emergency Management (OEM)</td></tr>
<tr><td>Durham Emergency Management Office (DEMO)</td></tr>
<tr><td>Ministry of Transportation of Ontario (MTO)</td></tr>
<tr><td>Ontario Provincial Police</td></tr>
<tr><td>Darlington Regional Police</td></tr>
</table>

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: DPZ Population = 292,024 CPZ Population = 964,688 PZ Total Population = 1,256,712	2021 Statistics Canada data projected to 2023; area ratio method used: DPZ Population = 305,809 DPZ Resident Vehicles= 142,003 CPZ Population = 974,896 CPZ Resident Vehicles= 452,750 PZ Total Population = 1,280,705 PZ Total Resident Vehicles= 594,753
Resident Population Vehicle Occupancy	Based on 2016 Census Data and 2015 telephone survey; Within PNGS only: 2.89 persons/household, 1.23 evacuating vehicles/household yielding: 2.35 persons/vehicle. 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. DPZ Employees = 22,925 CPZ Employees = 92,739 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. DPZ Employees = 19,918 DPZ Employee Vehicles= 19,275 CPZ Employees = 69,000 CPZ Employee Vehicles= 62,118 PZ Total Employees = 88,918 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. The total of people who do not have access to a vehicle: DPZ = 2,607 people in 87 buses to evacuate. CPZ = 8,612 in 288 buses to evacuate. 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. The total number of people who do not have access to a vehicle: DPZ = 3,217 people in 108 buses to evacuate. CPZ = 10,253 in 342 buses to evacuate. PZ Total = 13,470 in 450 buses to evacuate.
Transient Population	Data collected from 2015 ETE study, aerial imagery and internet searches: Transients in DPZ = 17,181 Transients in CPZ = 33,822 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: Transients in DPZ = 20,890 Transient Vehicles in DPZ= 8,180 Transients in CPZ = 42,997 Transient Vehicles in CPZ= 16,551 Total Transients in PZ = 63,887 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. Current DPZ census = 2,334 (Buses Required = 53, Wheelchair Bus Required = 81, Ambulances Required = 215, Vans Required = 1) Current CPZ census = 11,540 (Buses Required = 233, Wheelchair Bus Required = 387, Ambulances Required = 1,153) 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). Current DPZ census = 2,334 (Buses Required = 53, Wheelchair Vans Required = 218, Ambulances Required = 215, Vans Required = 1) Current CPZ census = 11,502 (Buses Required = 233, Wheelchair Vans Required = 1,099, Ambulances Required = 1,148) 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. School/Day Camps Enrolment in DPZ = 45,178; College Enrolment in DPZ = 22,587; School/Day Camps Enrolment in CPZ = 150,556; College Enrolment in CPZ = 32,228; 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. School/Summer Day Camps Enrolment in DPZ = 45,423; College/university Enrolment in DPZ = 16,739; School/Summer Day Camps Enrolment in CPZ = 148,789; College/university Enrolment in CPZ = 34,505; 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 (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. 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. Total External Traffic = 128,144 vehicles
Roadway Geometric Data	Field surveys conducted in June 2018. Roads and intersections were video archived. Road capacities based on 2010 HCM.	Field surveys conducted in April 2022. Roads and intersections were video archived. 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: Residents with commuters returning leave between 30 and 345 minutes. Residents without commuters returning leave between 15 and 285 minutes. Employees and transients leave between 15 and 150 minutes. All times measured from the Emergency Bulletin.	Based on the residential household survey of specific pre-trip mobilization activities: Residents with commuters returning leave between 45 and 255 minutes. Residents without commuters returning leave between 30 and 195 minutes. Employees and transients leave between 15 and 75 minutes. 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 90th and 100th percentile population for the base year of 2018 and projected to 2024 and 2028. Results presented by Region and Scenario.	ETE reported for 90th and 100th 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, Good Weather: 4:30 Summer Weekend, Midday, Good Weather: 4:10	Winter Midweek Midday, Good Weather: 6:25 Summer Weekend, Midday, Good Weather: 6:00
Evacuation Time Estimates for the entire DPZ, 100th percentile	Winter Midweek Midday, Good Weather: 5:55 Summer Weekend, Midday, Good Weather: 5:55	Winter Midweek Midday, Good Weather: 7:45 Summer Weekend, Midday, Good Weather: 7:30
Evacuation Time Estimates for the entire CPZ, 90th percentile	Winter Midweek Midday, Good Weather: 9:20 Summer Weekend, Midday, Good Weather: 8:00	Winter Midweek Midday, Good Weather: 9:45 Summer Weekend, Midday, Good Weather: 8:55
Evacuation Time Estimates for the entire CPZ, 100th percentile	Winter Midweek Midday, Good Weather: 12:40 Summer Weekend, Midday, Good Weather: 10:50	Winter Midweek Midday, Good Weather: 13:00 Summer Weekend, Midday, Good Weather: 12:40

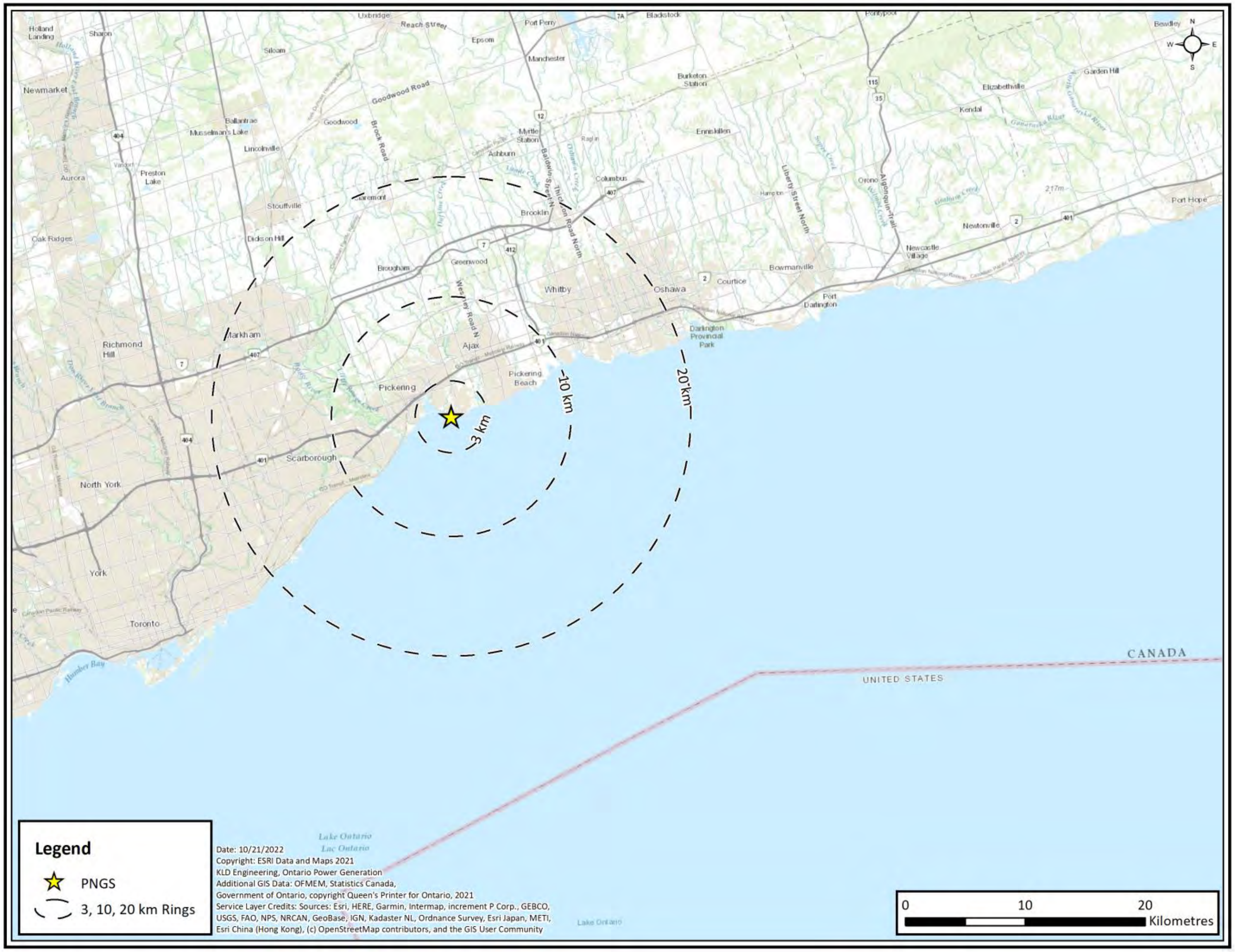


Figure 1-1. PNGS Location

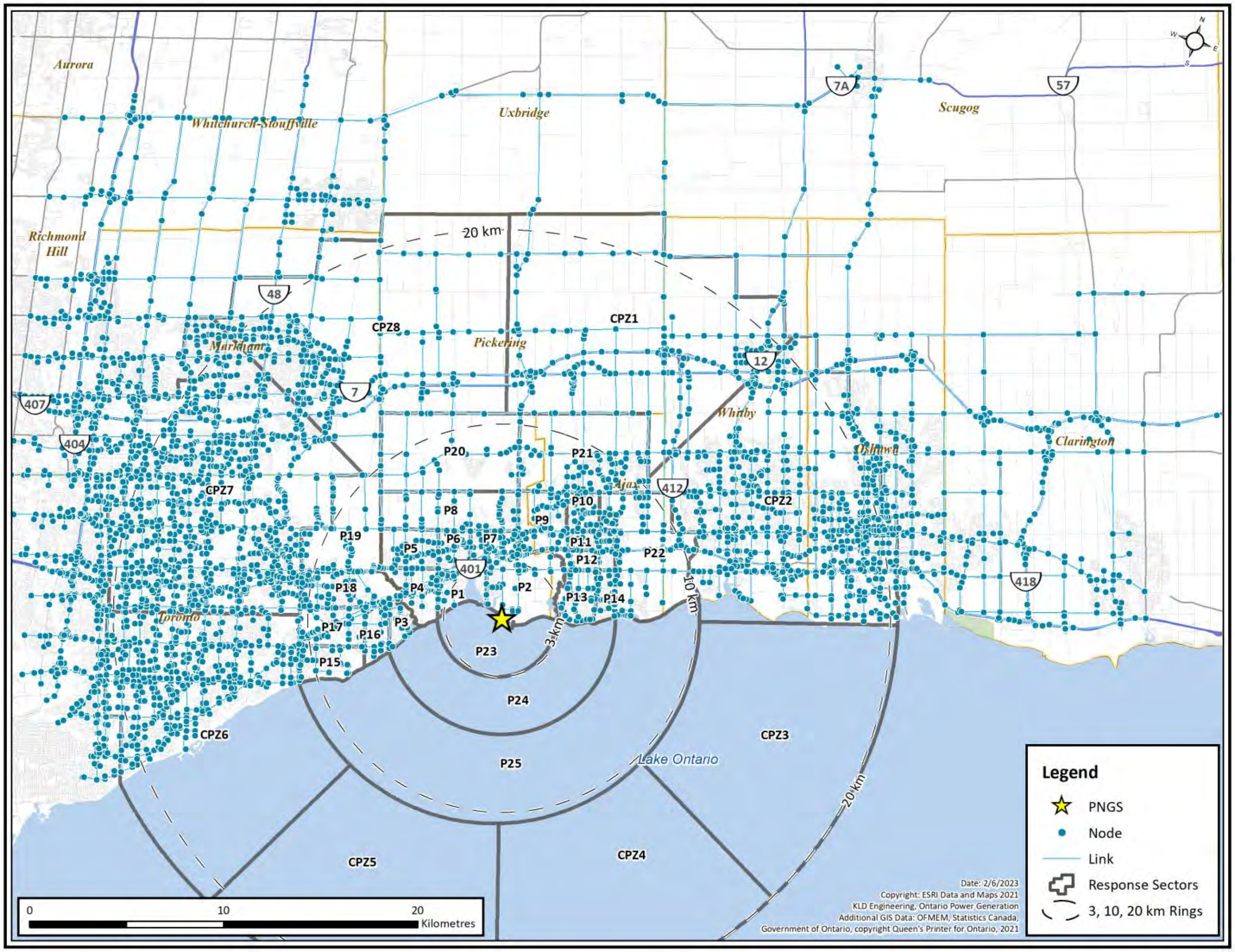


Figure 1-2. PNGS Link-Node Analysis Network

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 <u>not</u> 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.

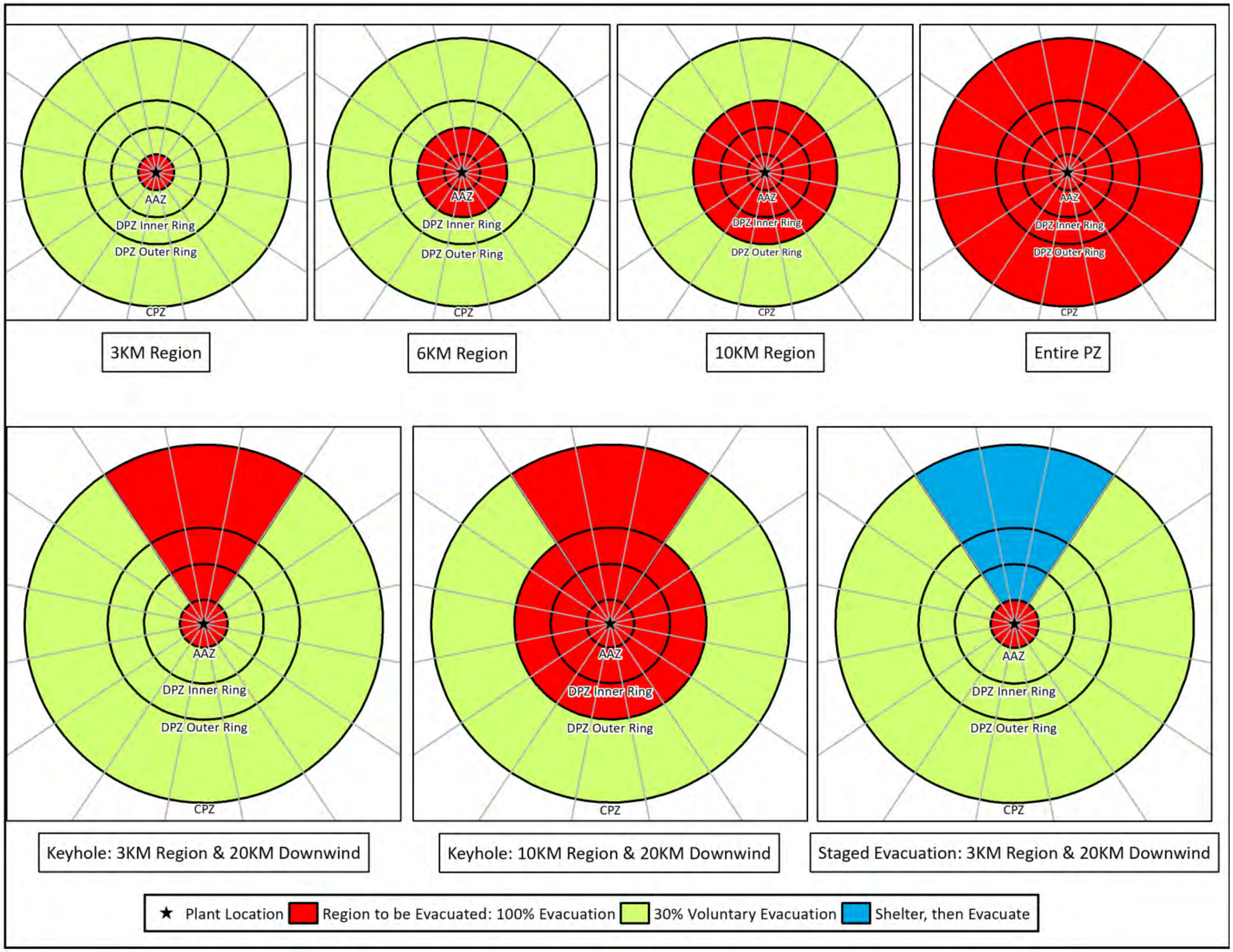


Figure 2-1. Voluntary Evacuation Methodology

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 30th 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 15th 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	Ééc 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 Ministiry 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.

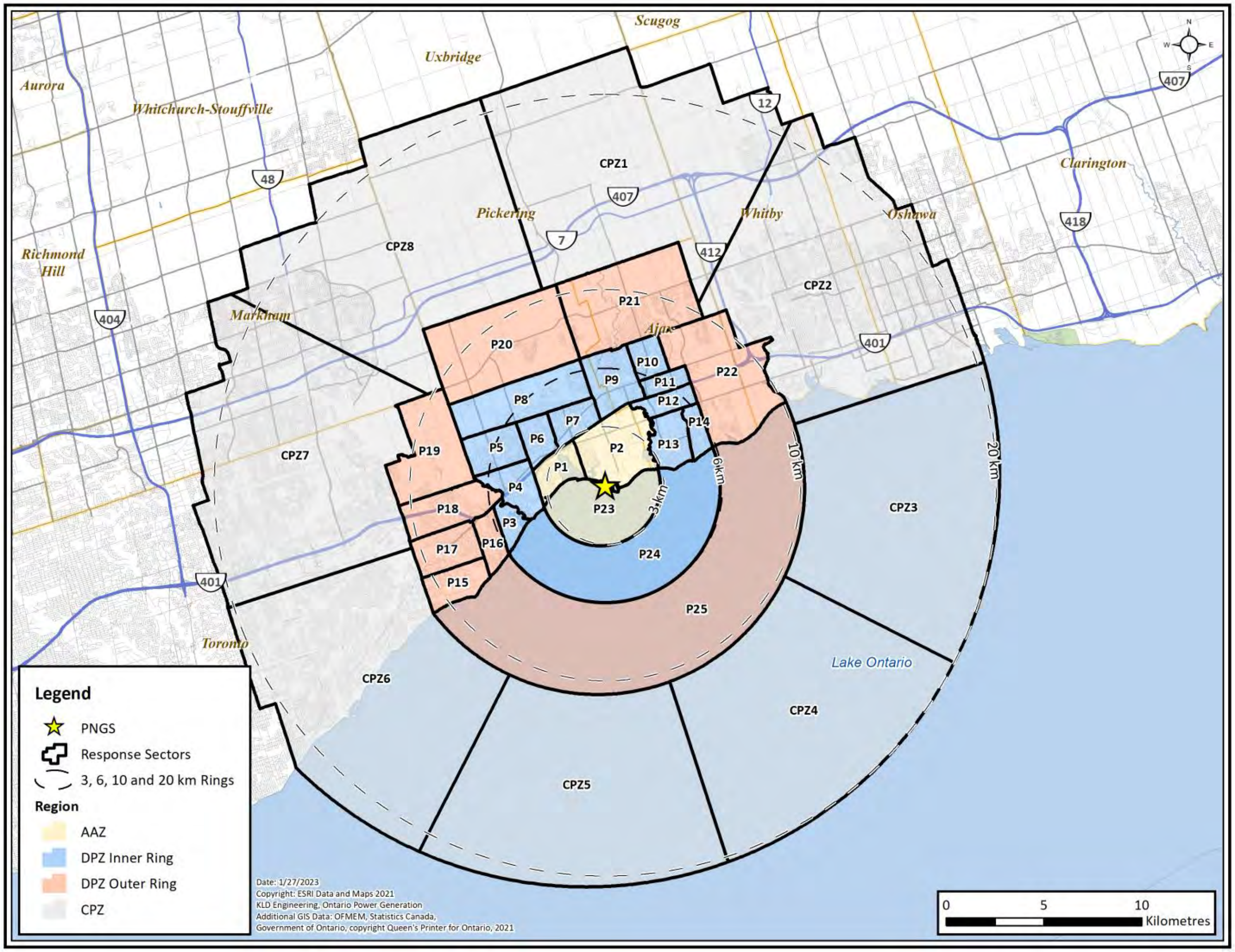


Figure 3-1. Response Sectors Comprising the PNGS PZs

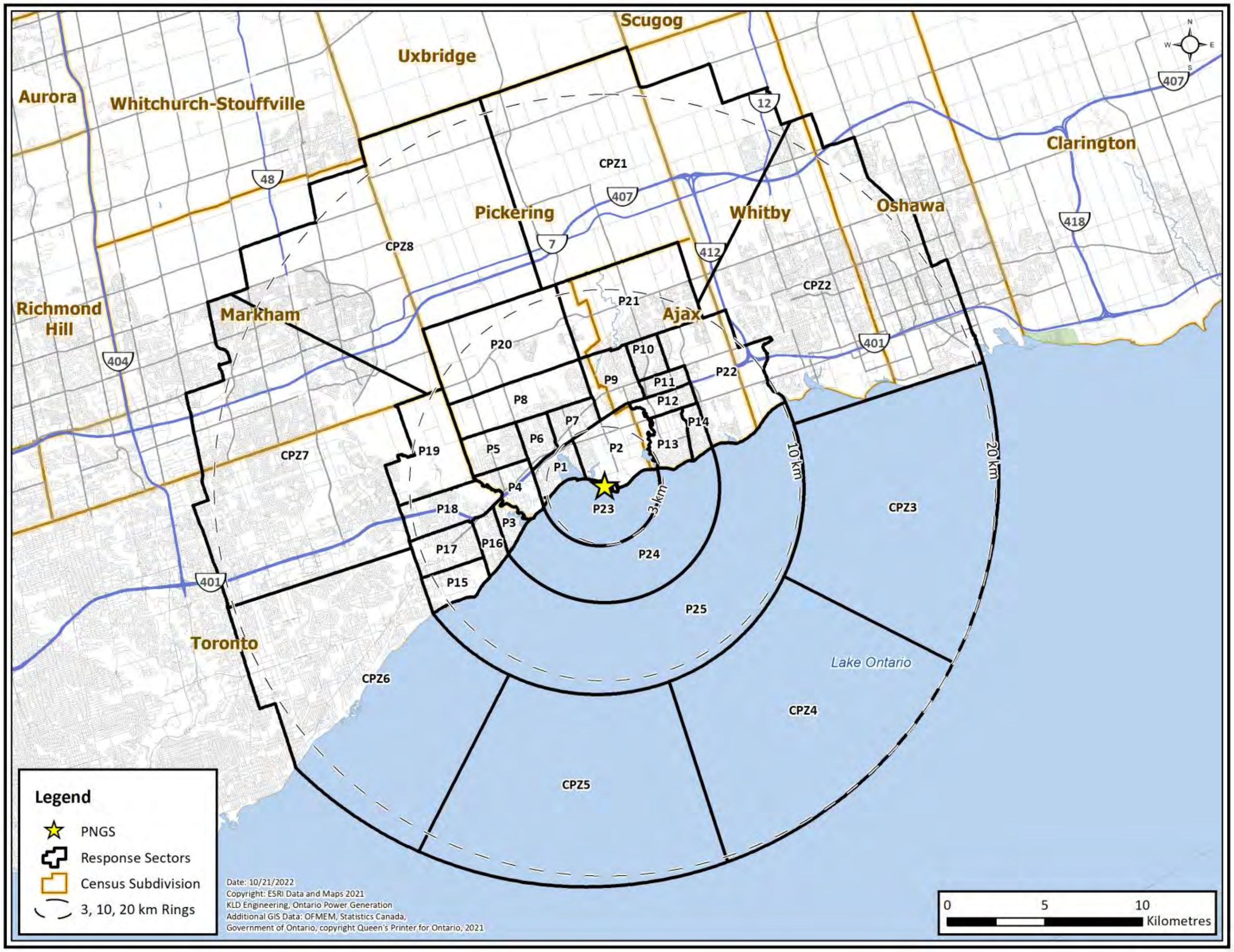
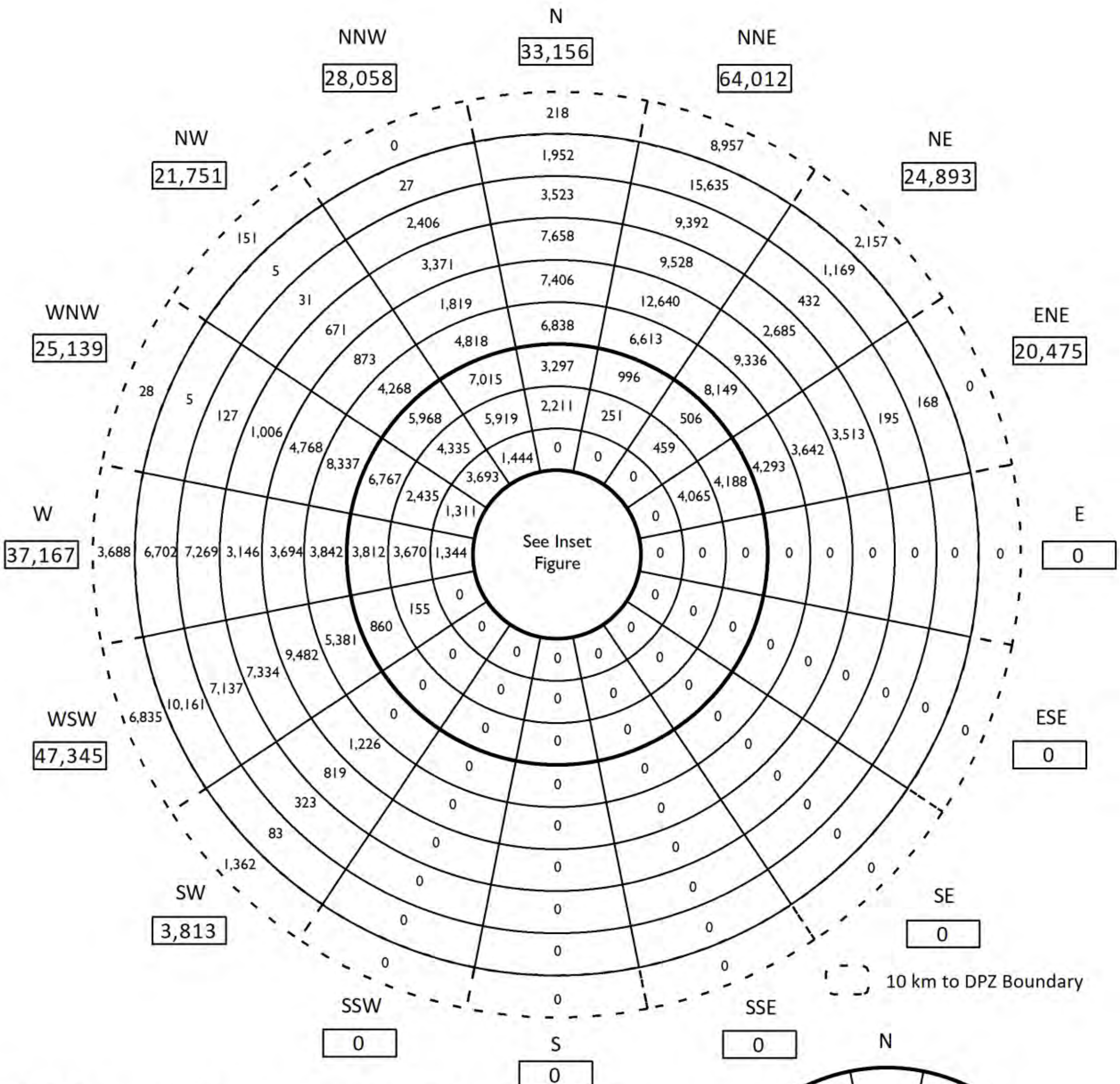


Figure 3-2. Census Subdivision Boundaries within the PNGS Study Area



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

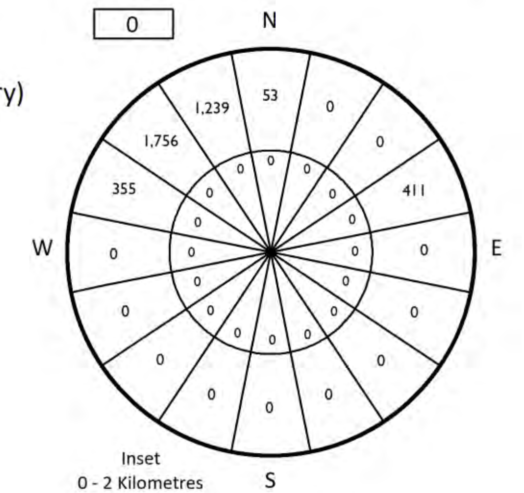
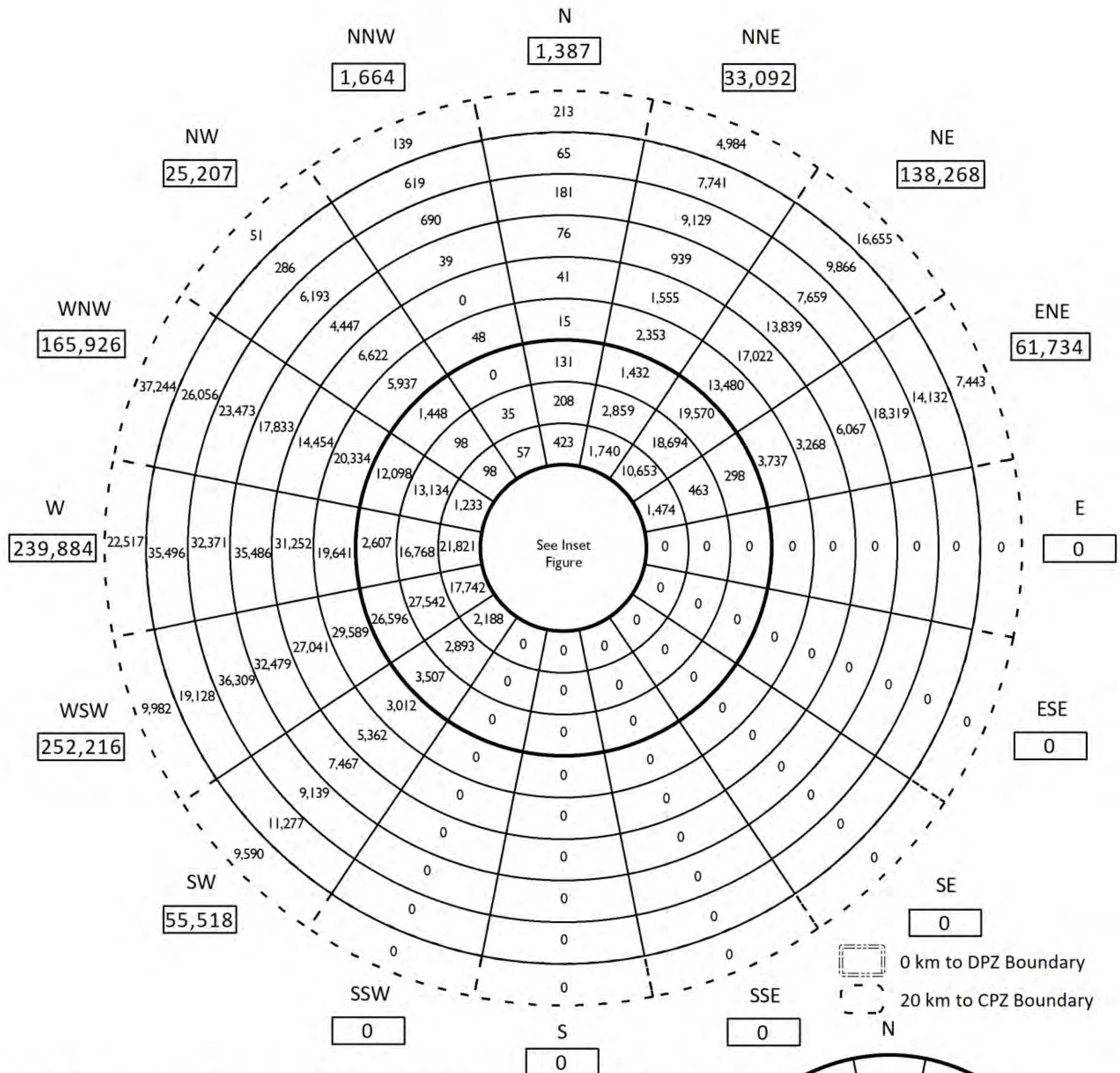
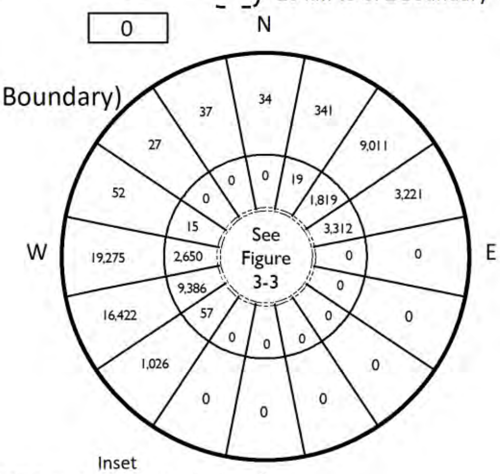


Figure 3-3. Permanent Resident Population within the DPZ by Sector



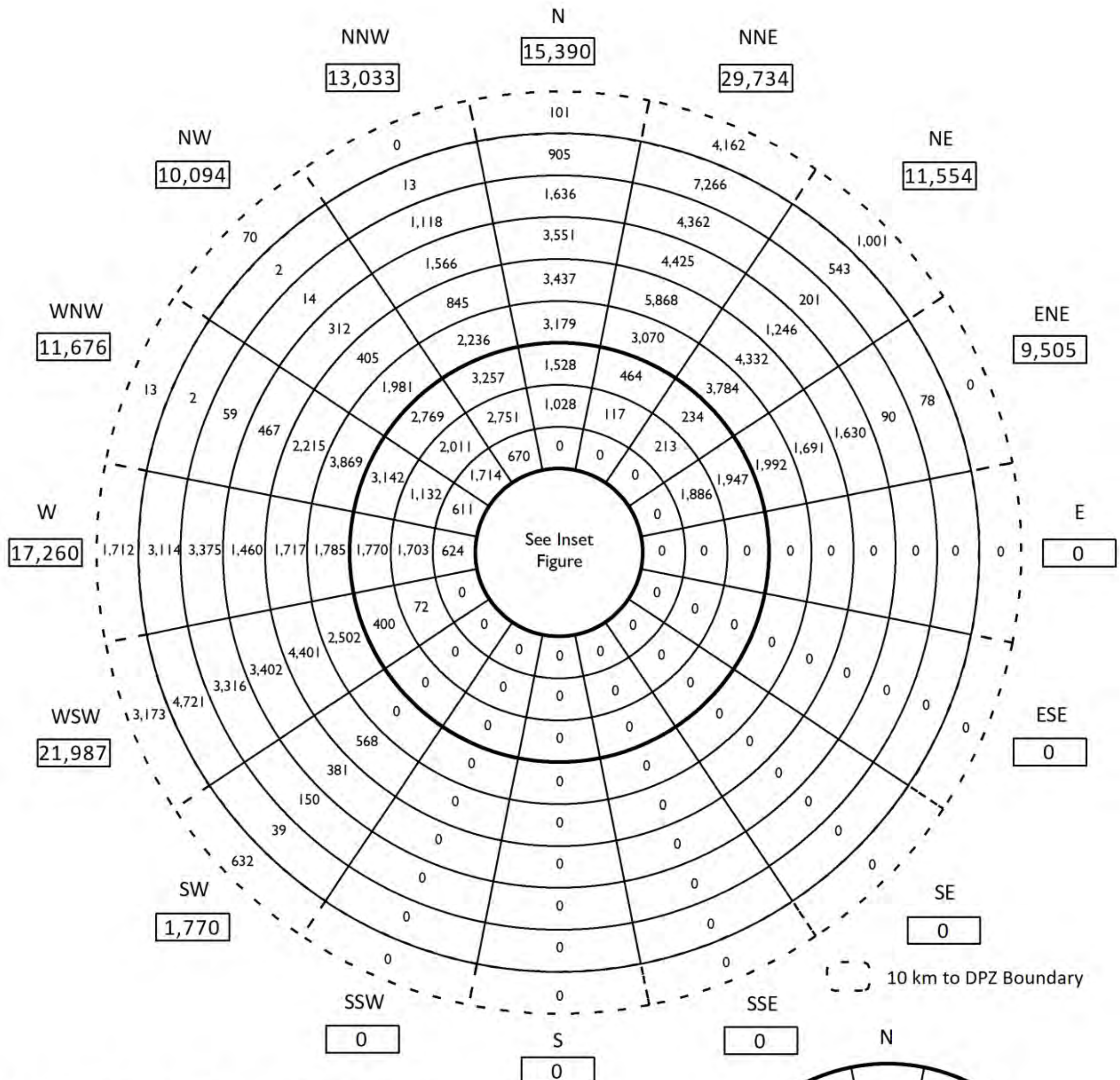
2023 Extrapolated Resident Population (DPZ Boundary - CPZ Boundary)

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



Inset
DPZ Boundary - 12 Kilometres

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

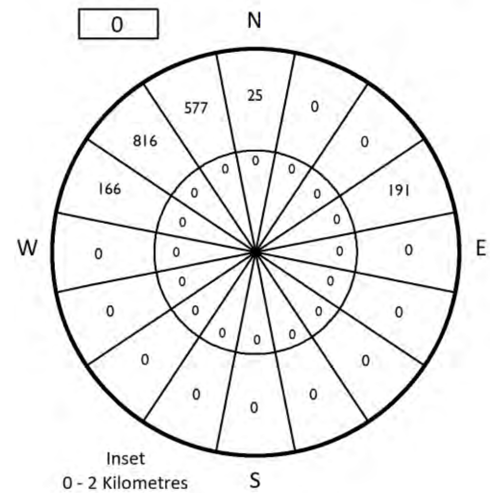
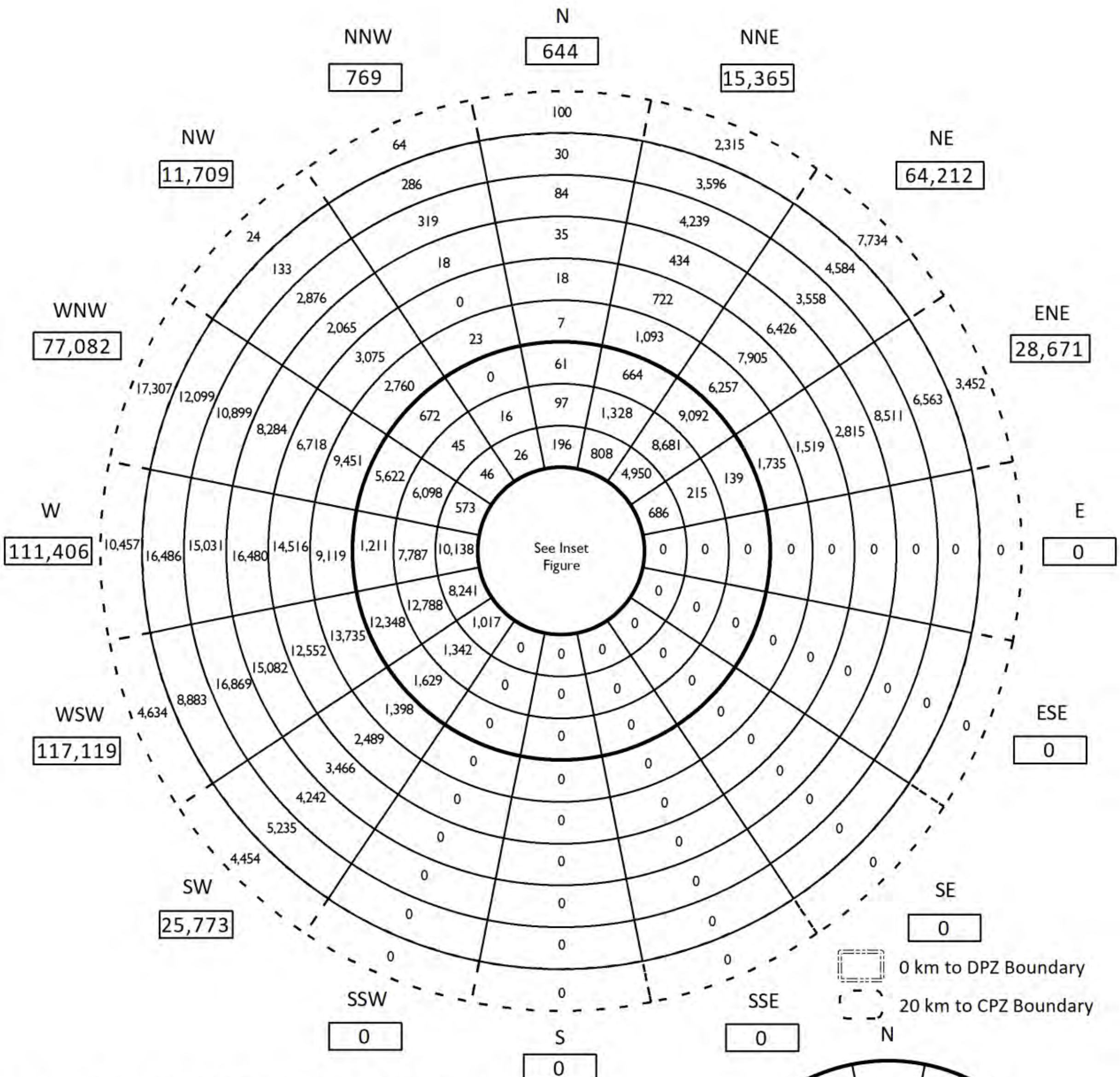


Figure 3-5. Permanent Resident Vehicles within the DPZ by Sector



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

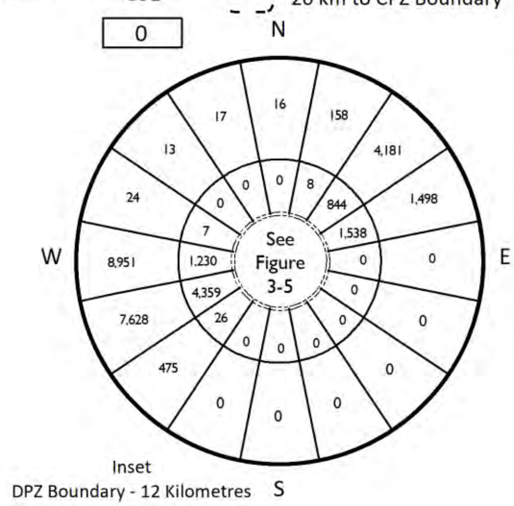
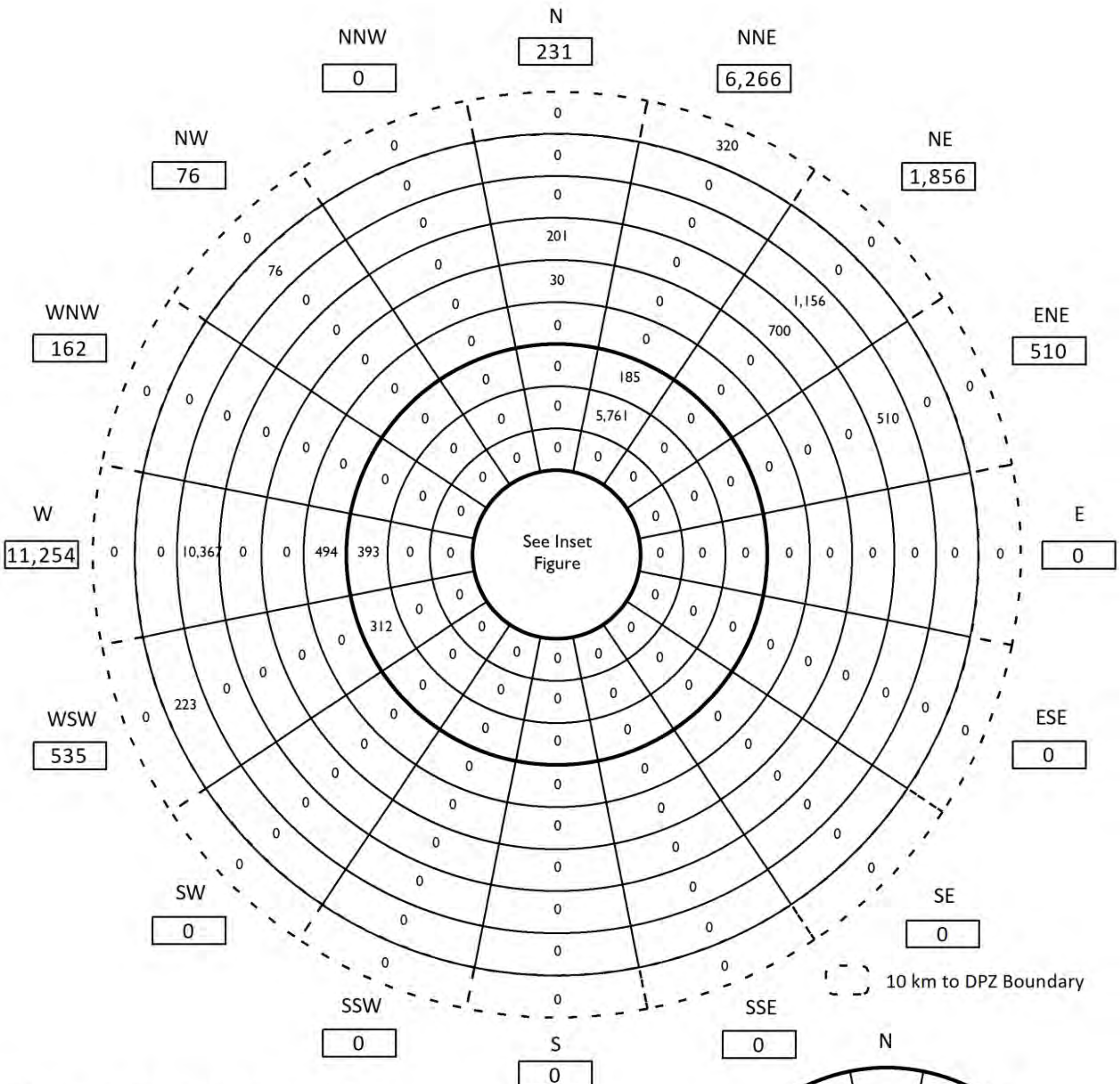


Figure 3-6. Permanent Resident Vehicles within the CPZ by Sector



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

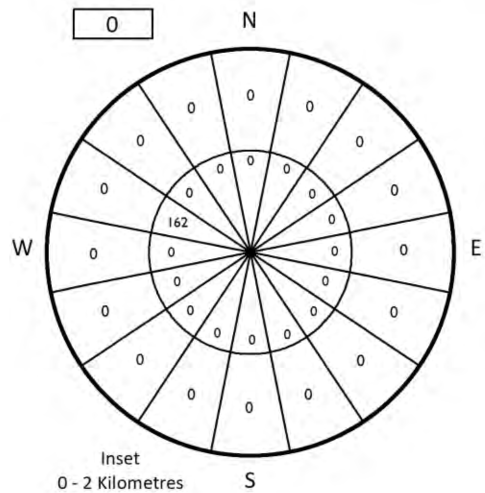
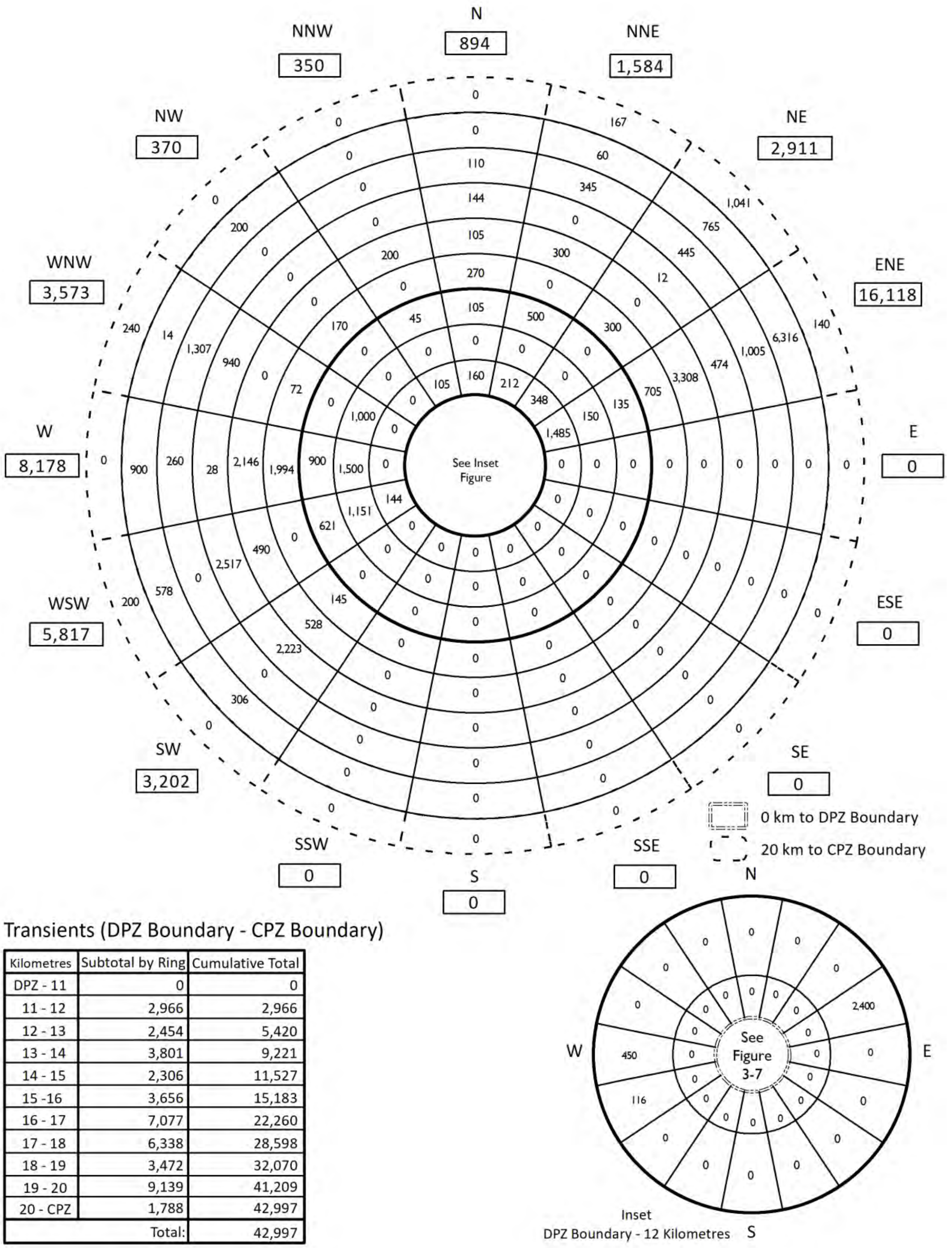


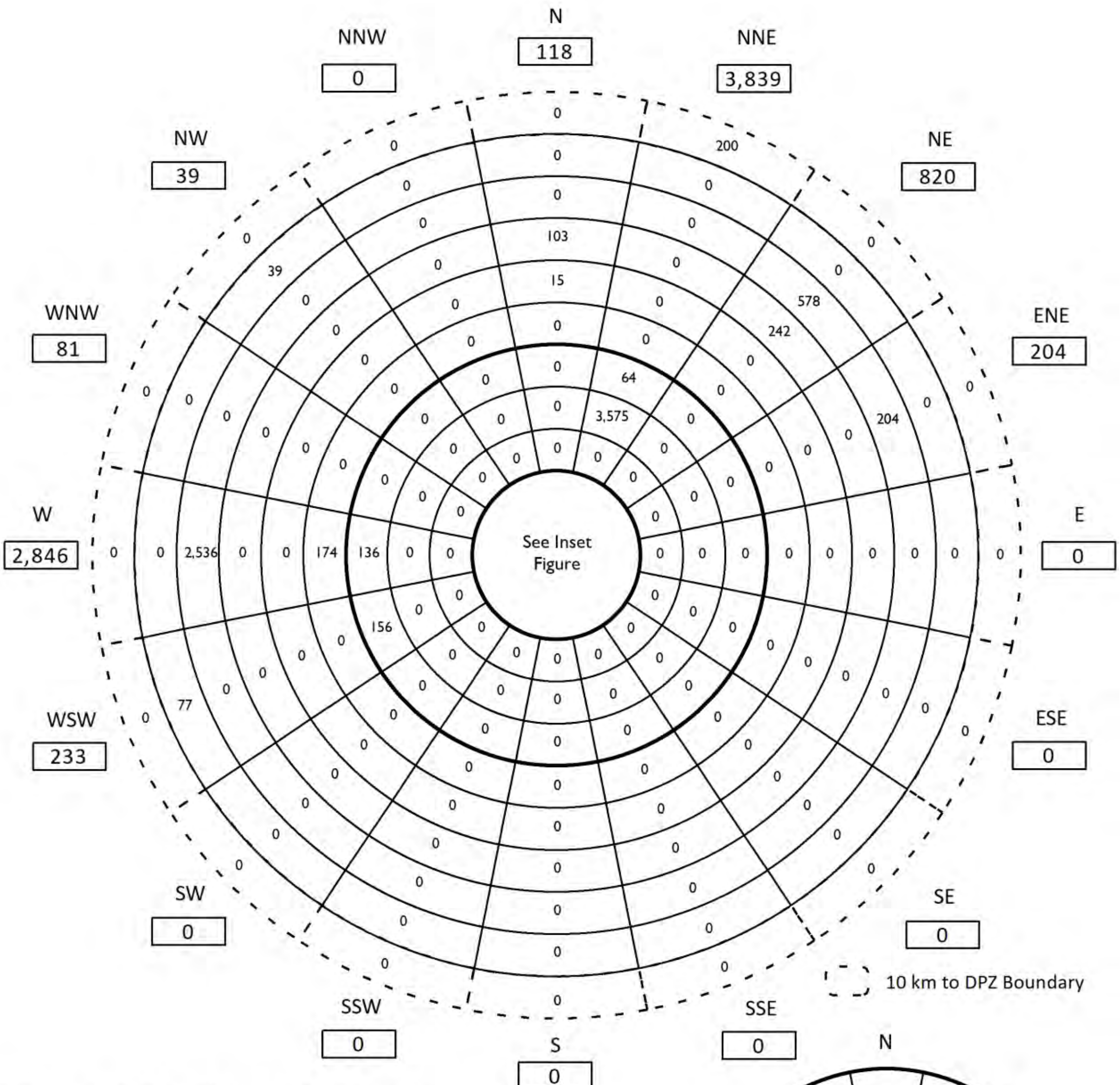
Figure 3-7. Transient Population within the DPZ by Sector



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

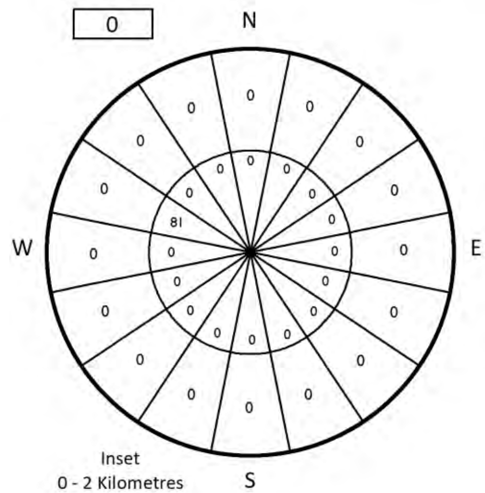
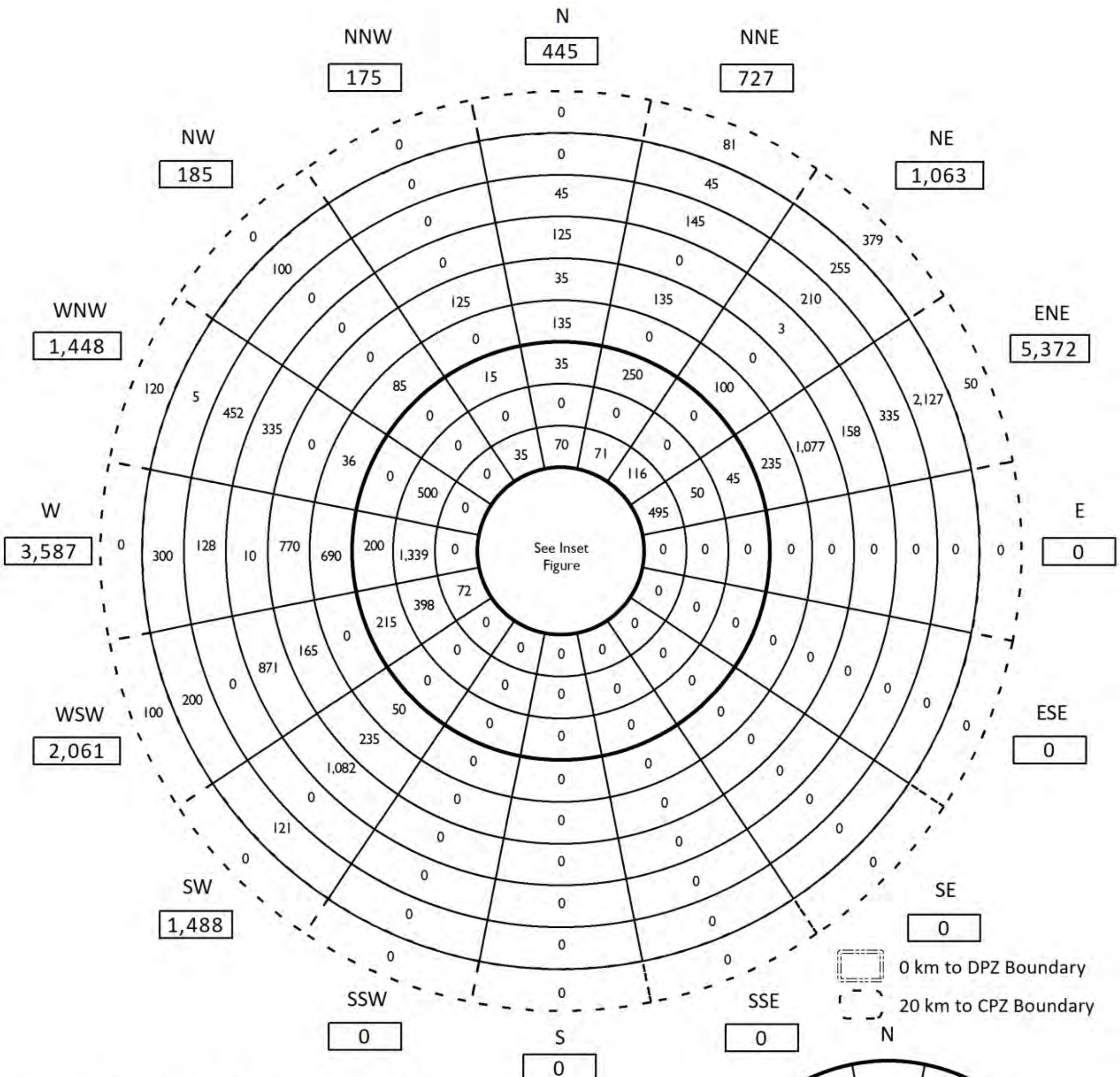


Figure 3-9. Transient Vehicles within the DPZ by Sector



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

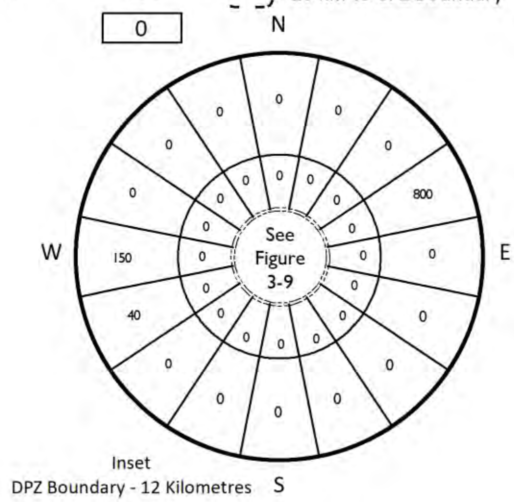
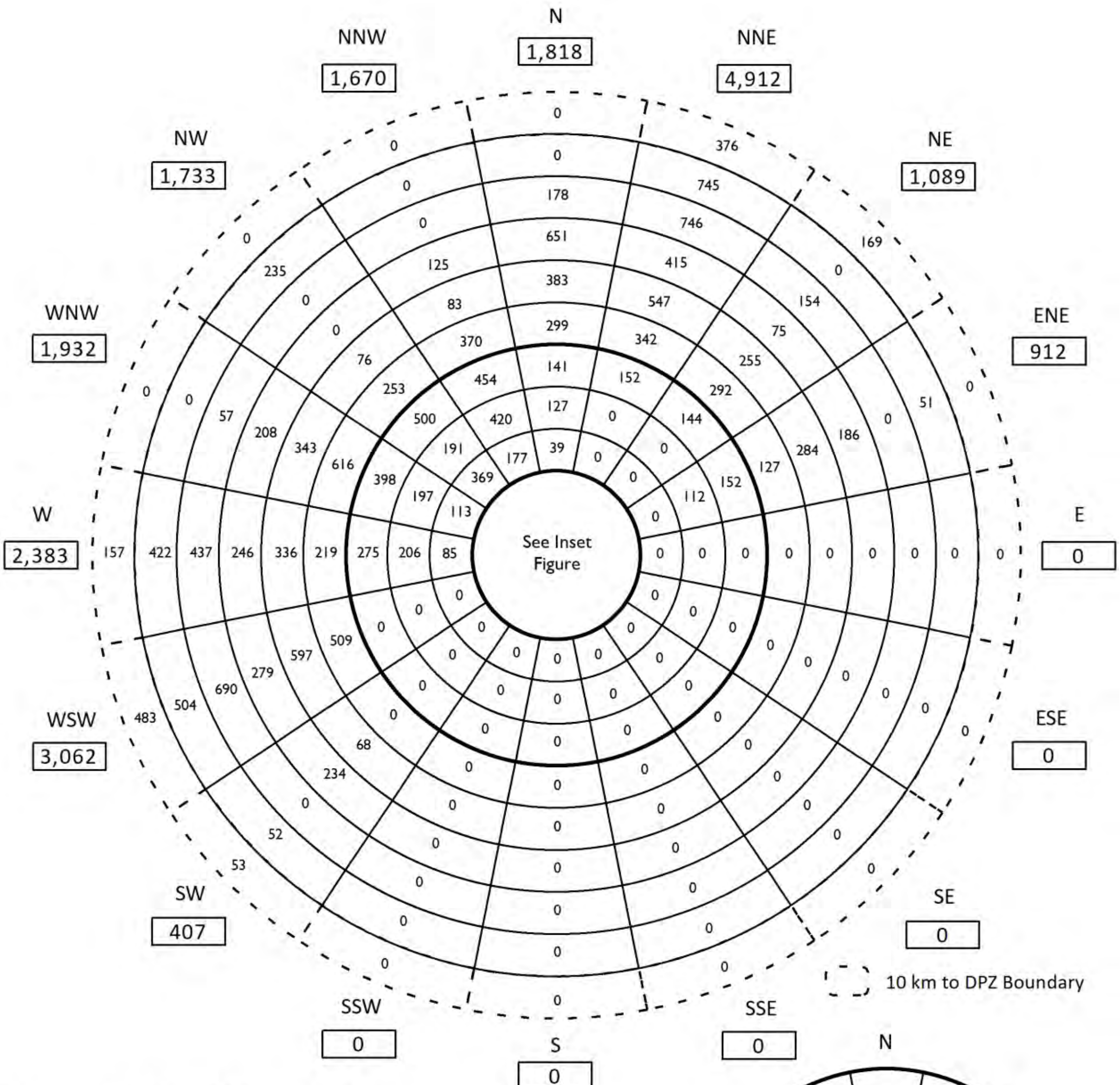


Figure 3-10. Transient Vehicles within the CPZ by Sector



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

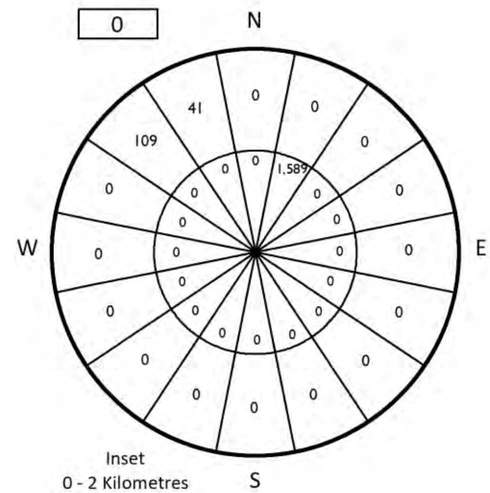
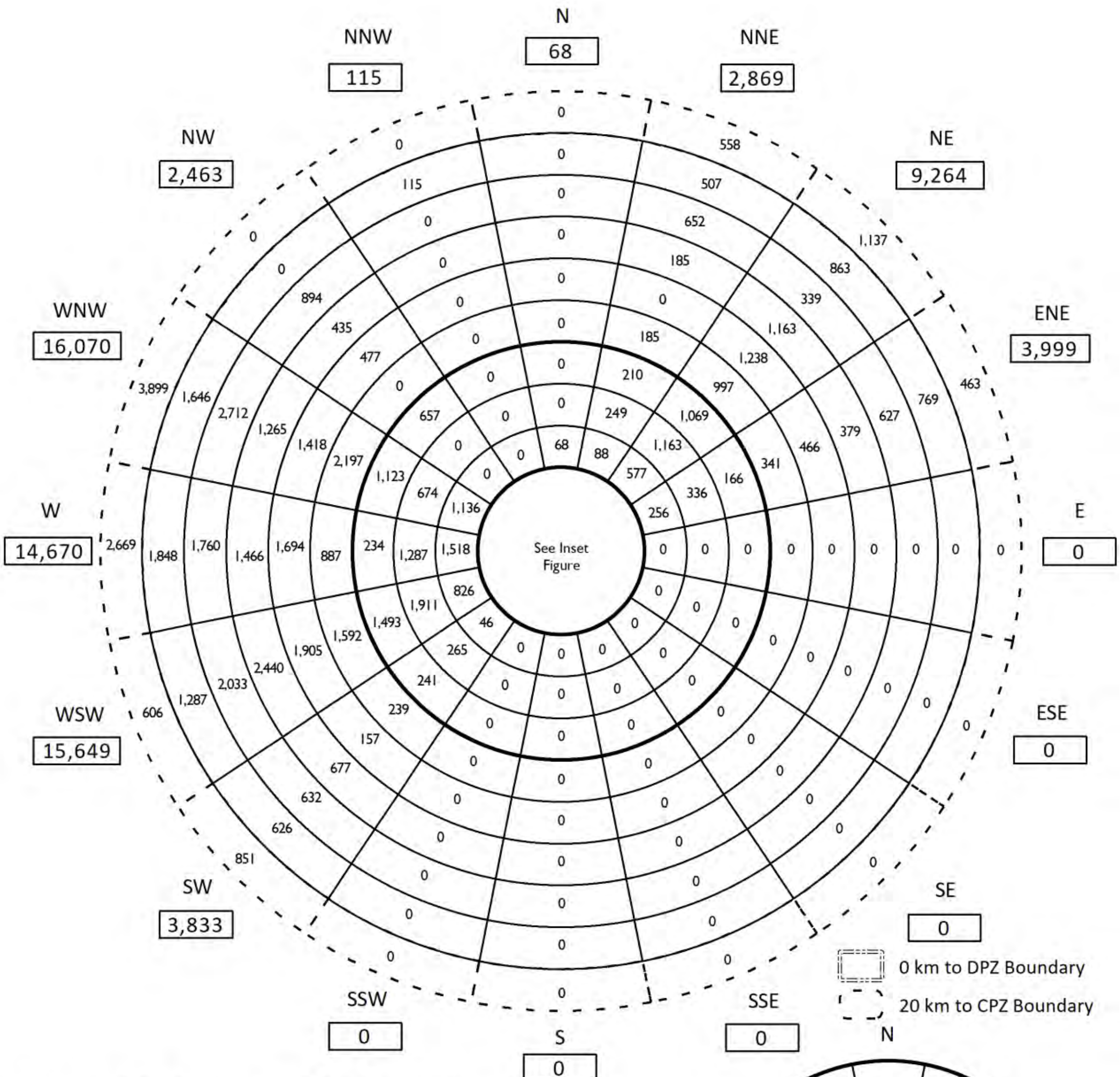


Figure 3-11. Employee Population within the DPZ by Sector



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

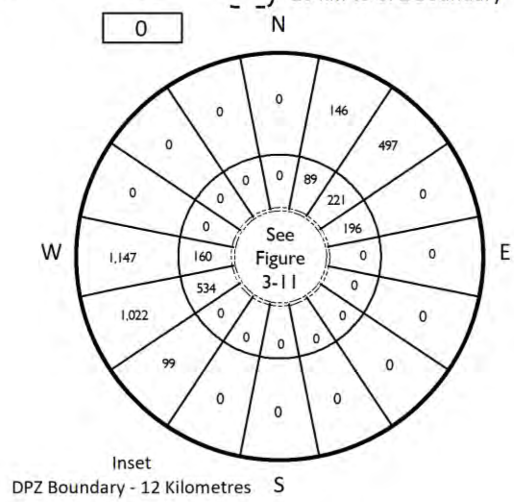
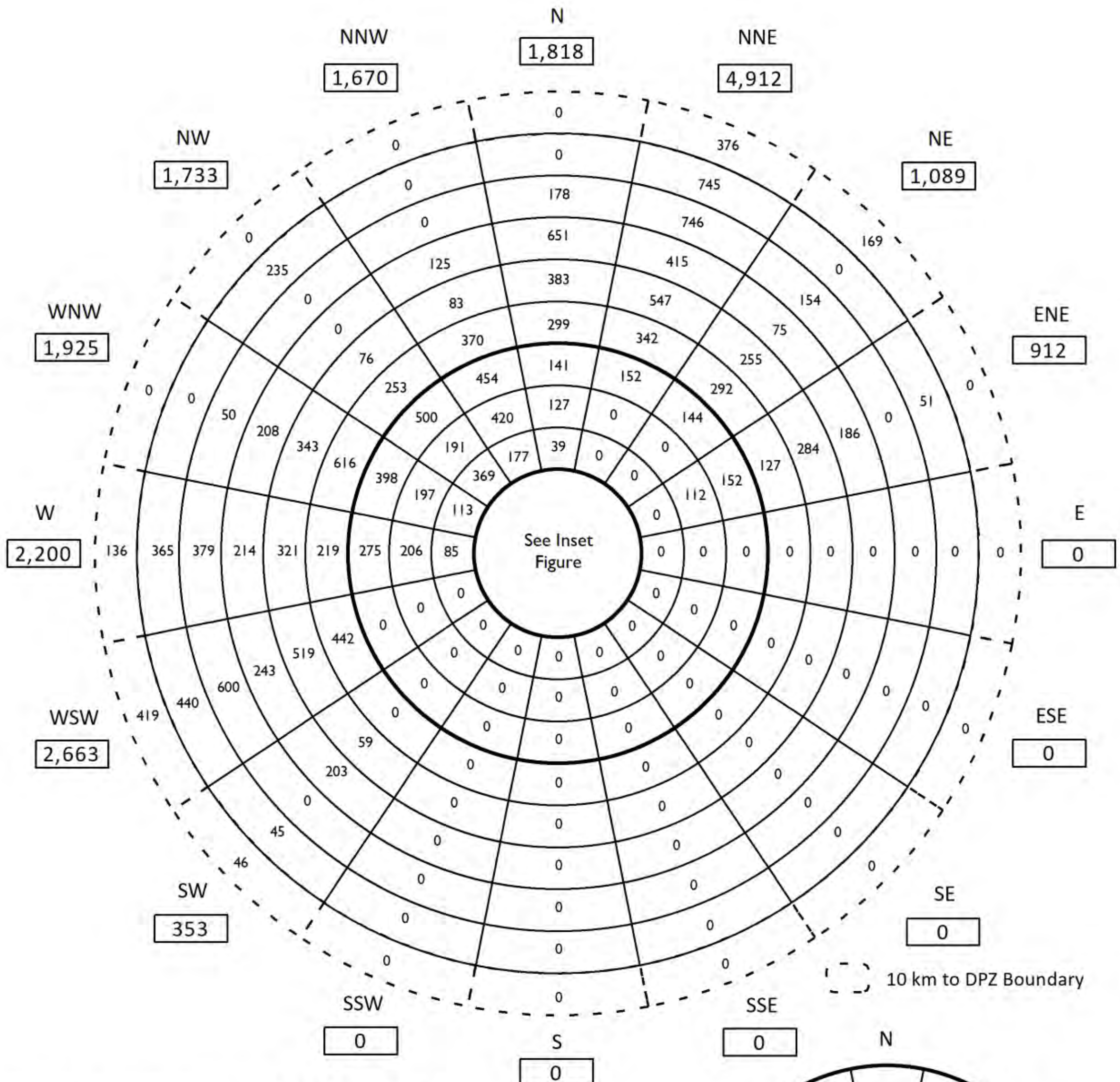


Figure 3-12. Employee Population within the CPZ by Sector



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

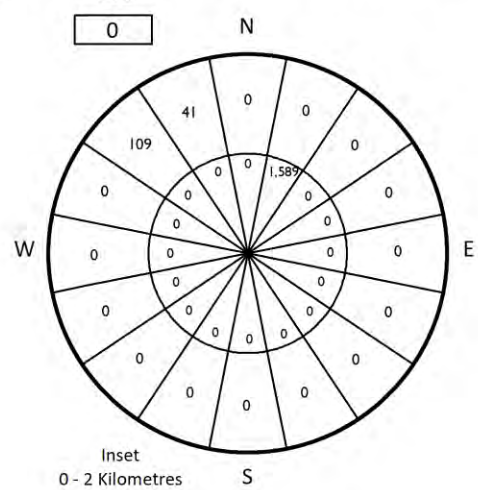
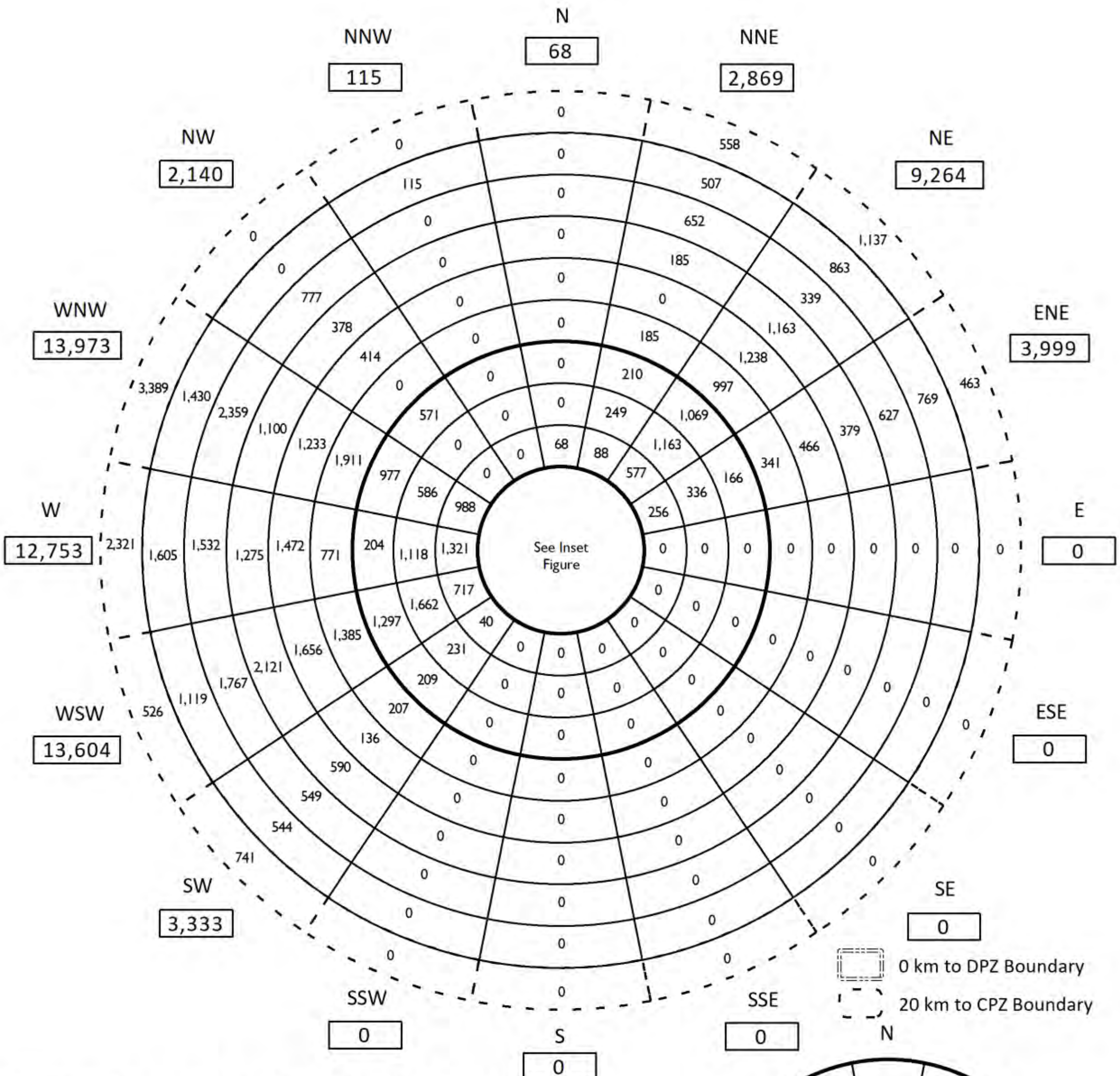


Figure 3-13. Employee Vehicles within the DPZ by Sector



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

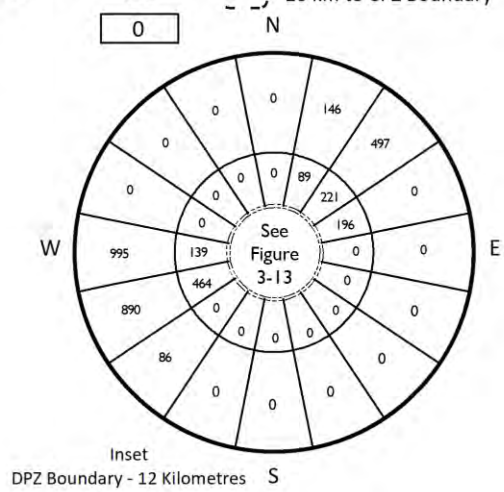


Figure 3-14. Employee Vehicles within the CPZ by Sector

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.

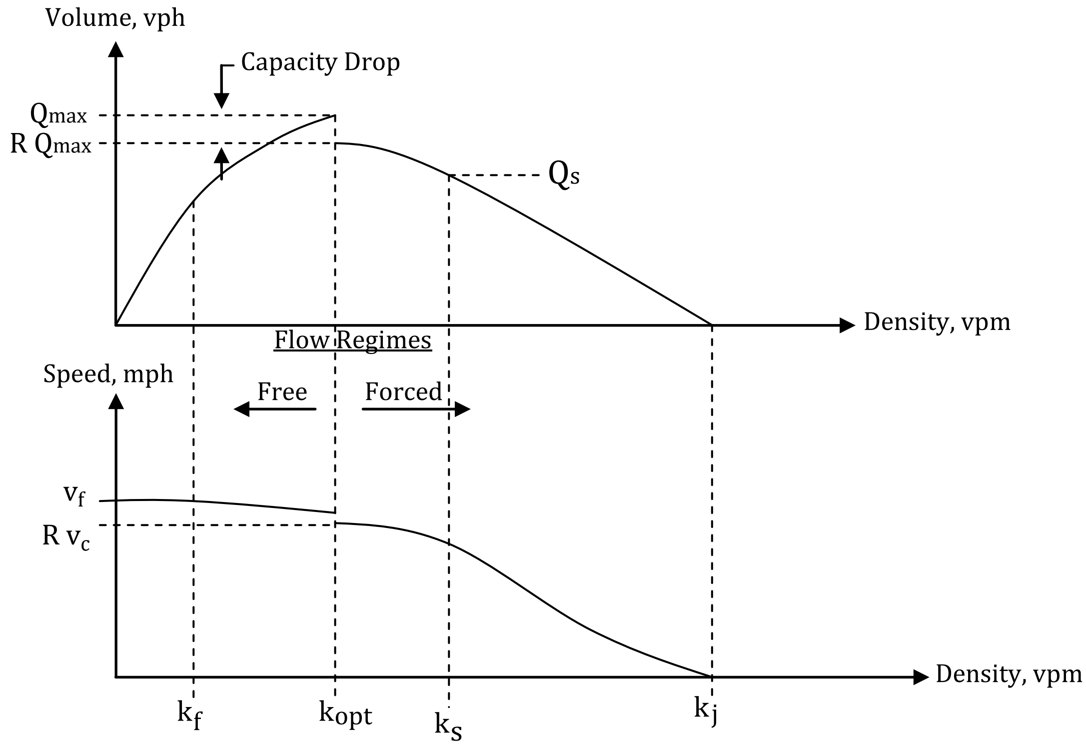


Figure 4-1. Fundamental Diagrams

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 → 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 → 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 → 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 <u>overall</u> 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, <u>not</u> 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 <u>sequential</u> – 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%.

<u>Assumptions</u>

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.

<u>Procedure</u>

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.

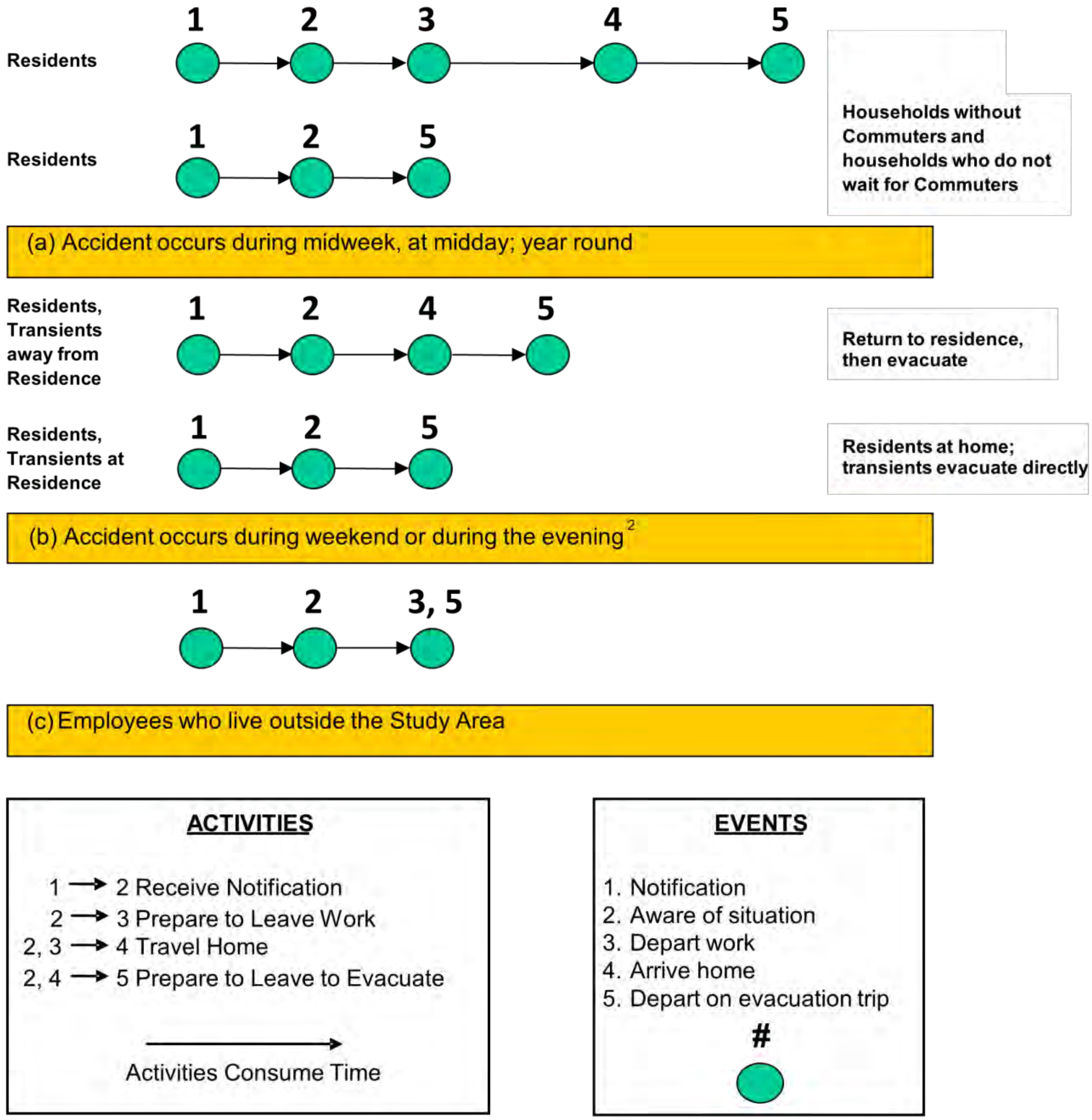
Table 5-10. Trip Generation Histograms for the Planning Zone Population for Staged Evacuation (Non-Snow)

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

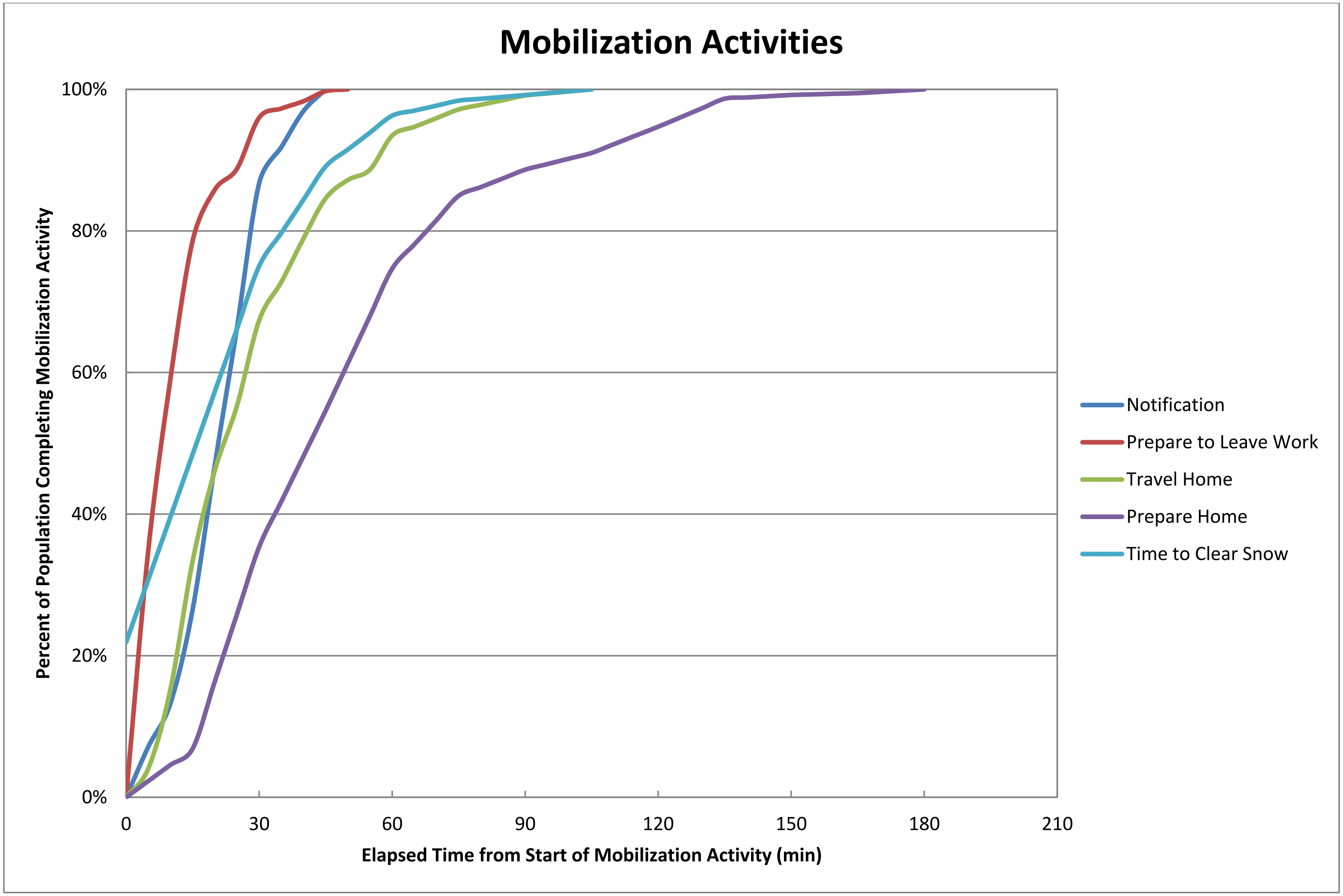


Figure 5-2. Time Distributions for Evacuation Mobilization Activities

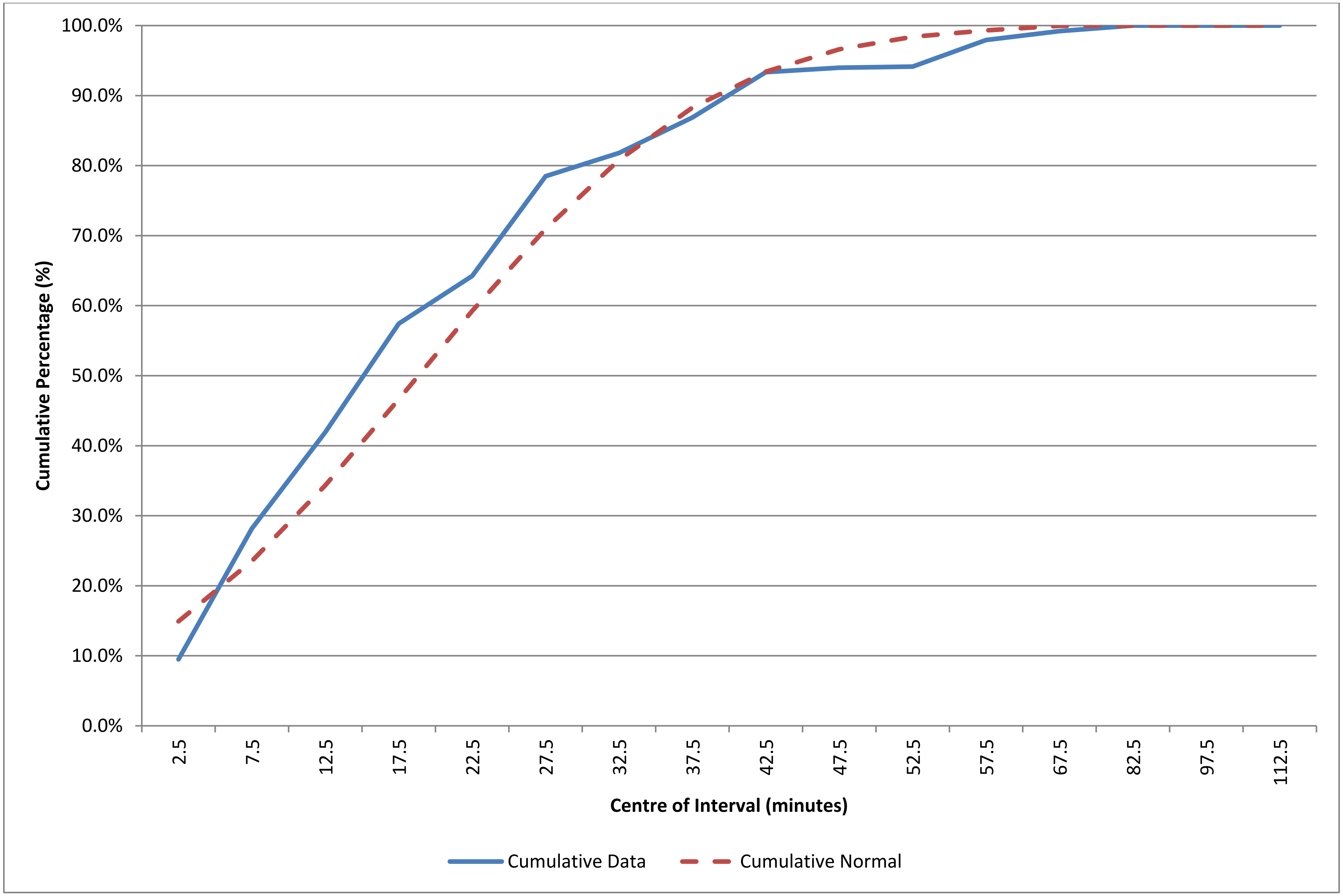


Figure 5-3. Comparison of Data Distribution and Normal Distribution

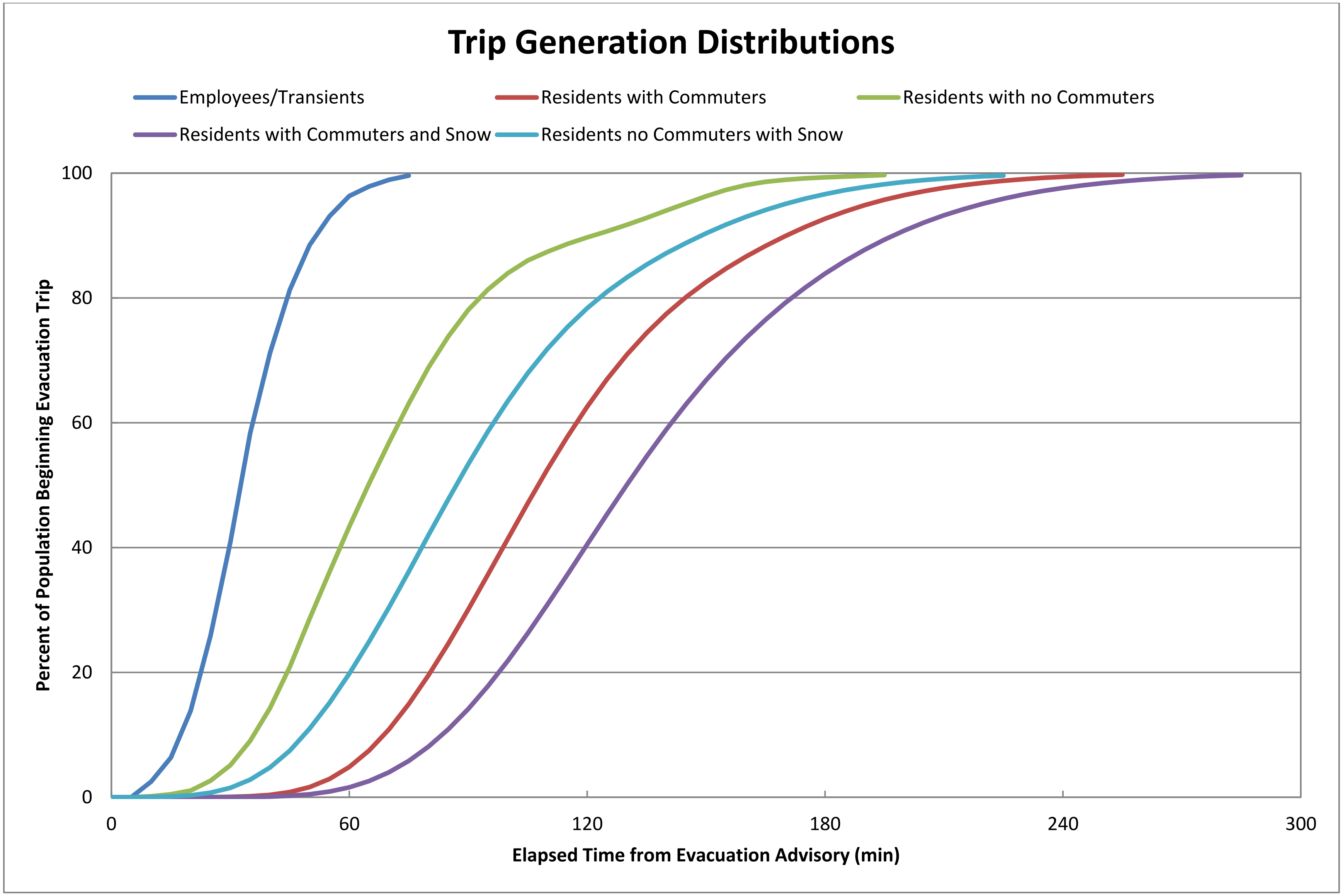
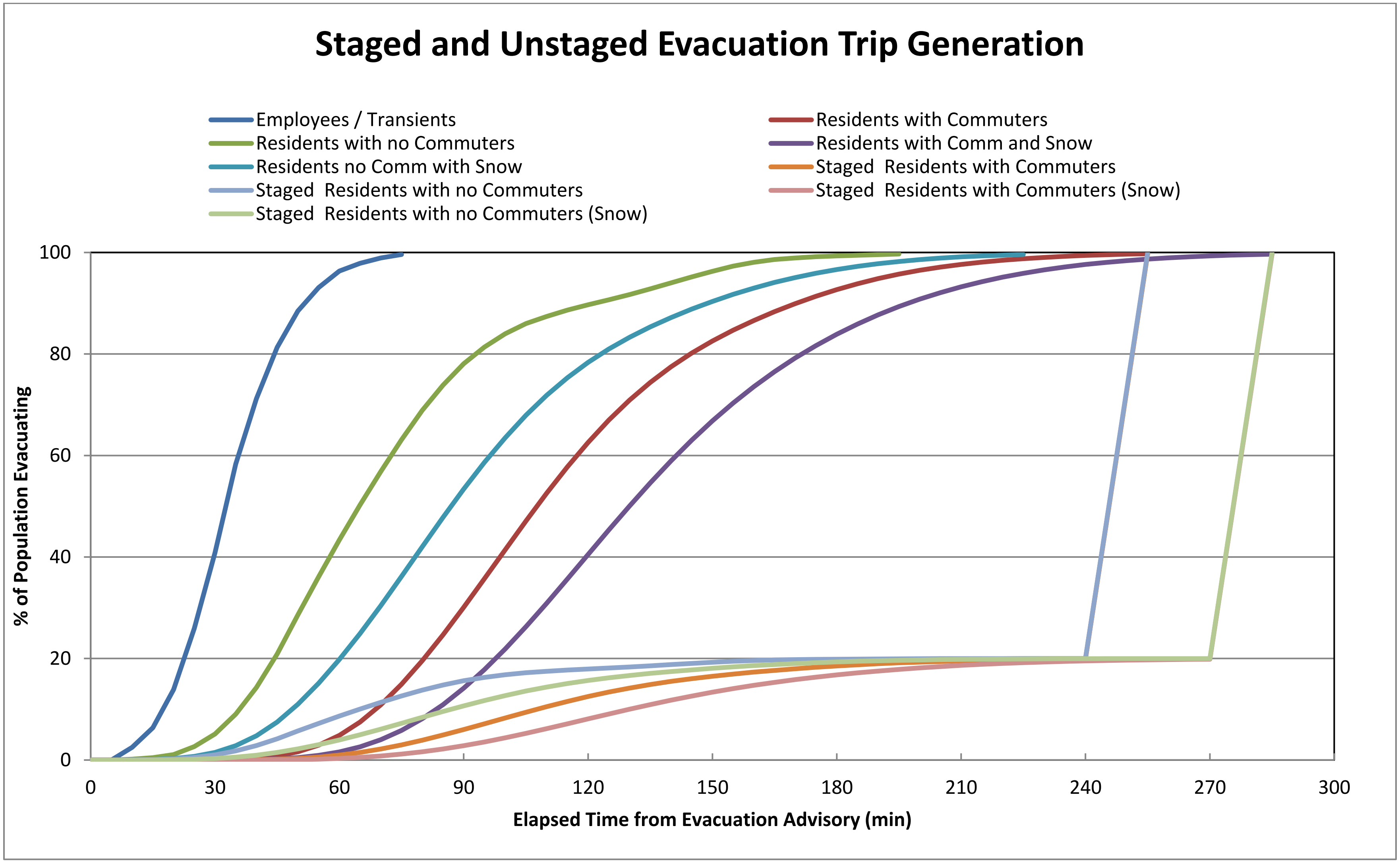


Figure 5-4. Comparison of Trip Generation Distributions

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	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.

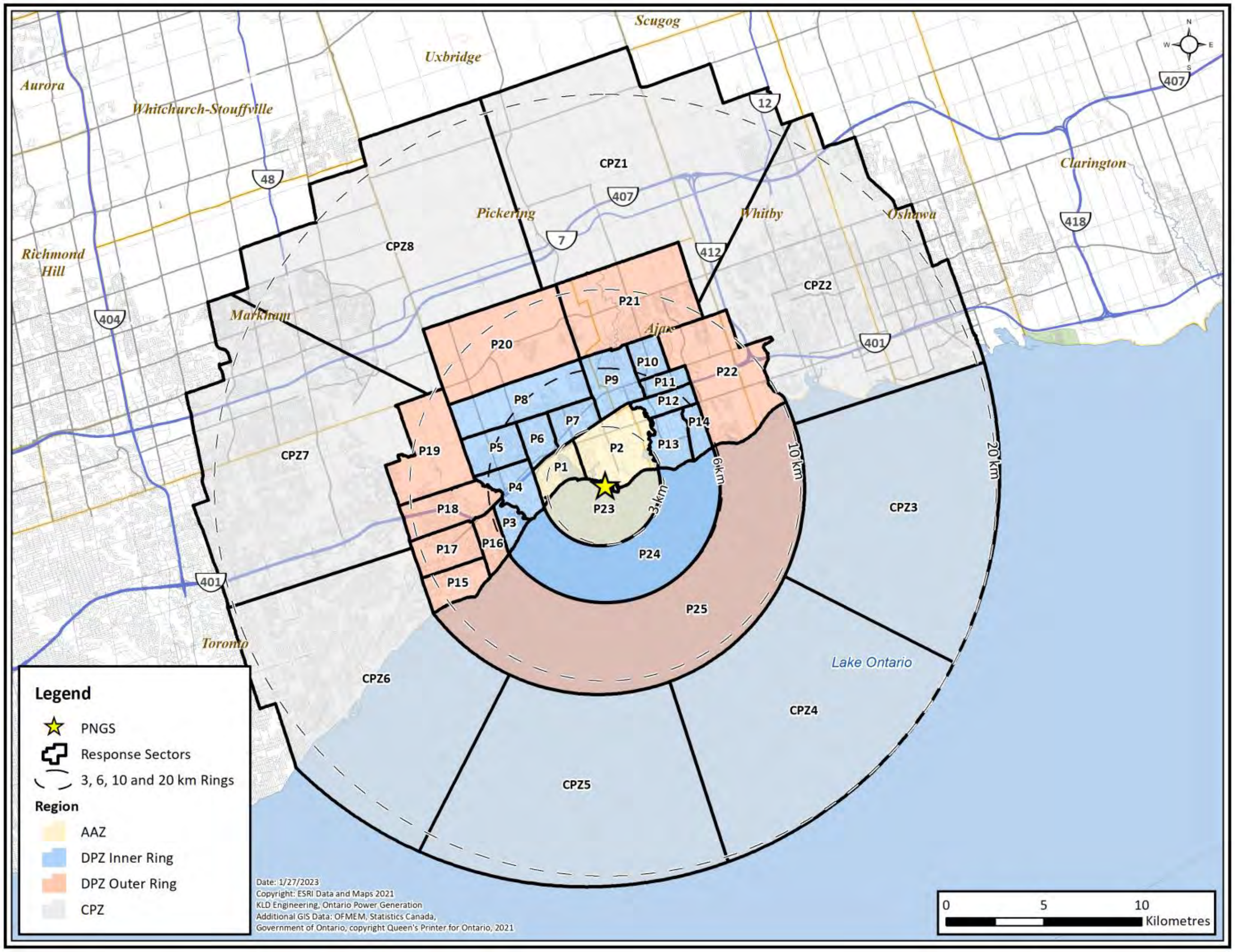


Figure 6-1. Response Sectors Comprising the PNGS PZs

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 90th 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 90th percentile ETE for Region R02 (DPZ Inner Ring) are approximately 30 minutes longer than the 90th percentile ETE for Region R01 and range between 3:45 and 6:05 (higher for snow).
- The 90th percentile ETE for Region R03 (DPZ Outer Ring) are approximately 55 minutes longer than the 90th percentile ETE for Region R02 and generally range between 4:45 and 7:05 (higher for snow).
- The 90th percentile ETE for Region R04 (all PZs) are approximately 3 hours longer than the 90th 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 <u>automatic action zone</u> 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 90th 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 90th 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)
	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
Region	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)
	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
Region	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	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
Shelter-in-Place until 90% ETE for R01, then Evacuate										Shelter-in-Place													Response Sector(s) Evacuate											

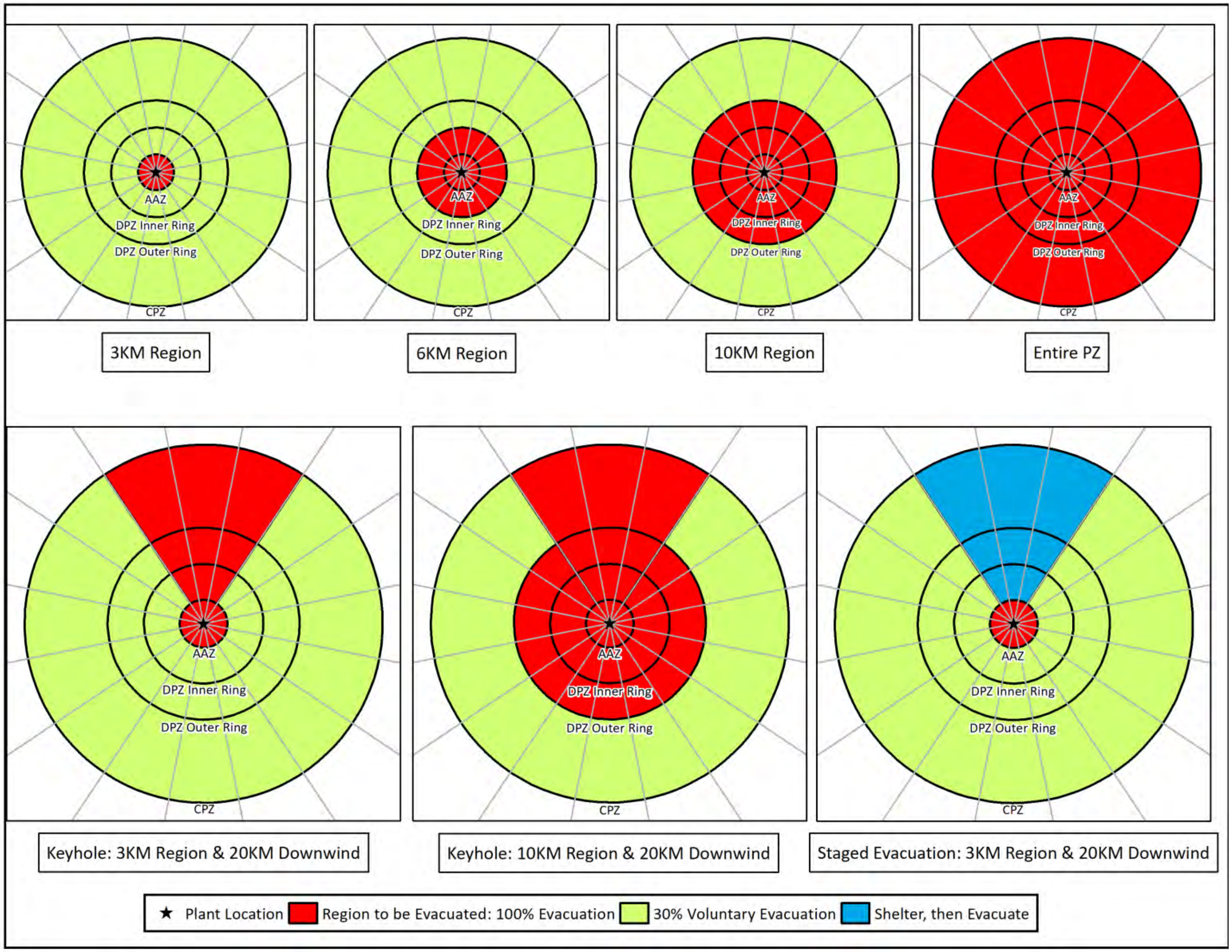


Figure 7-1. Voluntary Evacuation Methodology

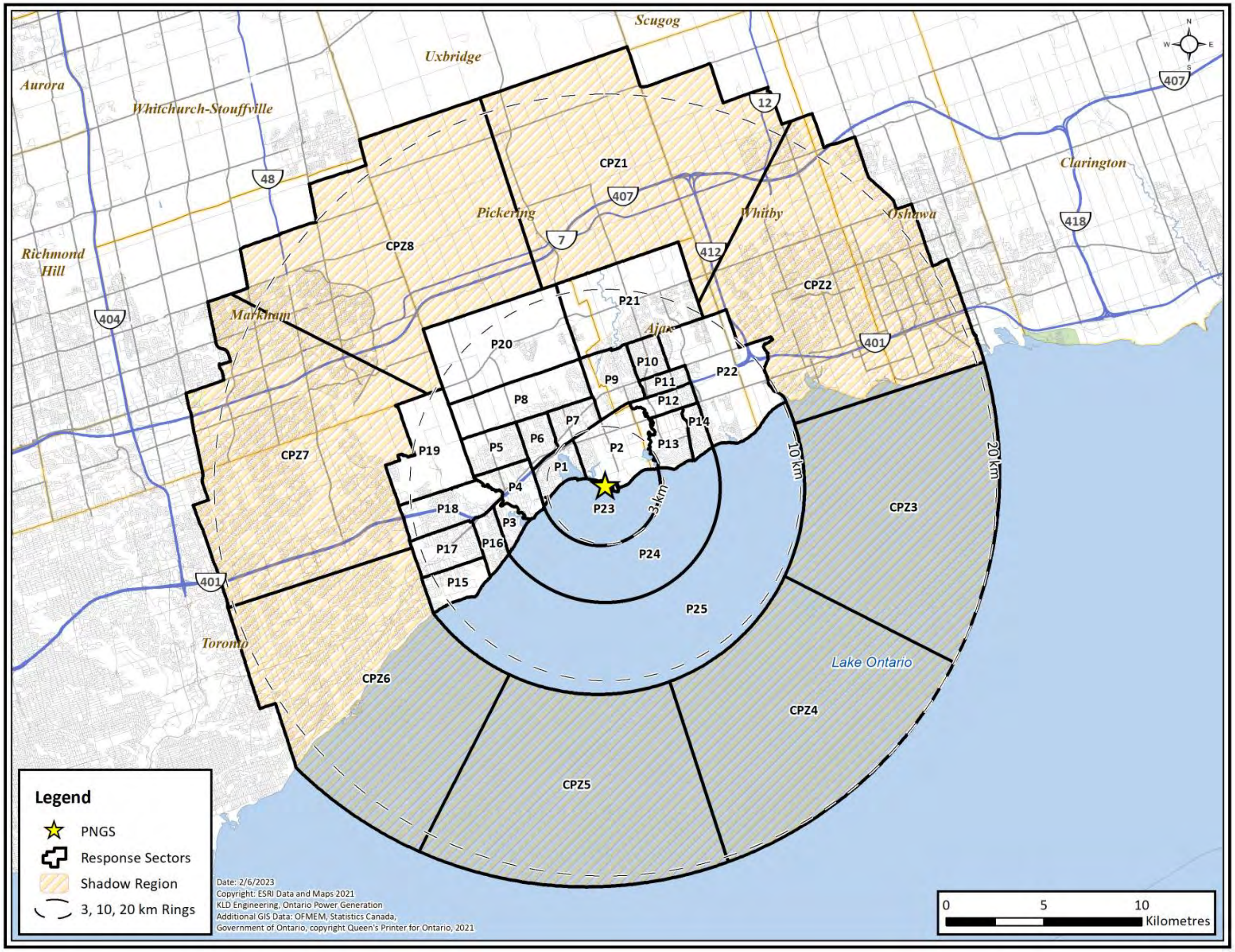


Figure 7-2. PNGS Shadow Region

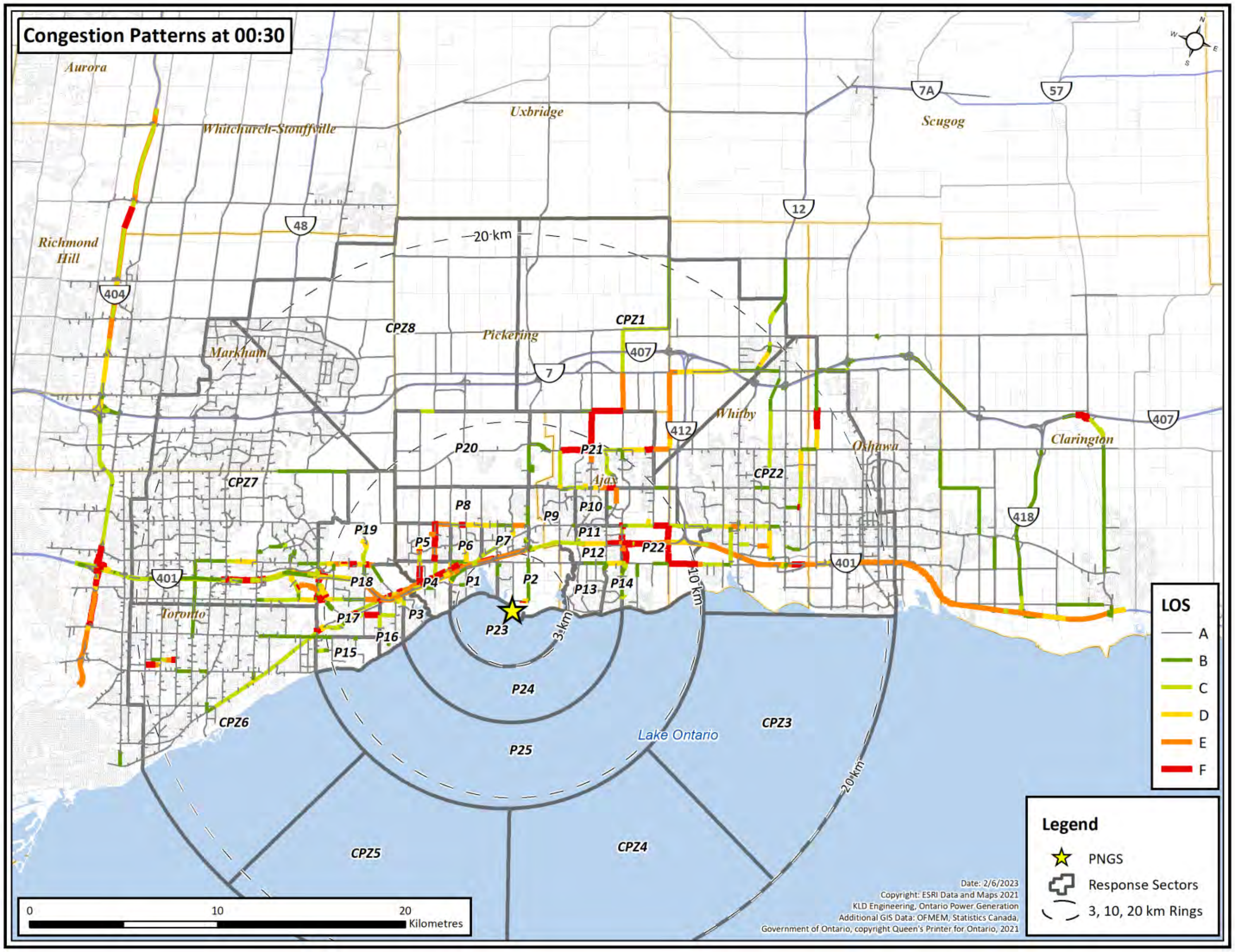


Figure 7-3. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R03)

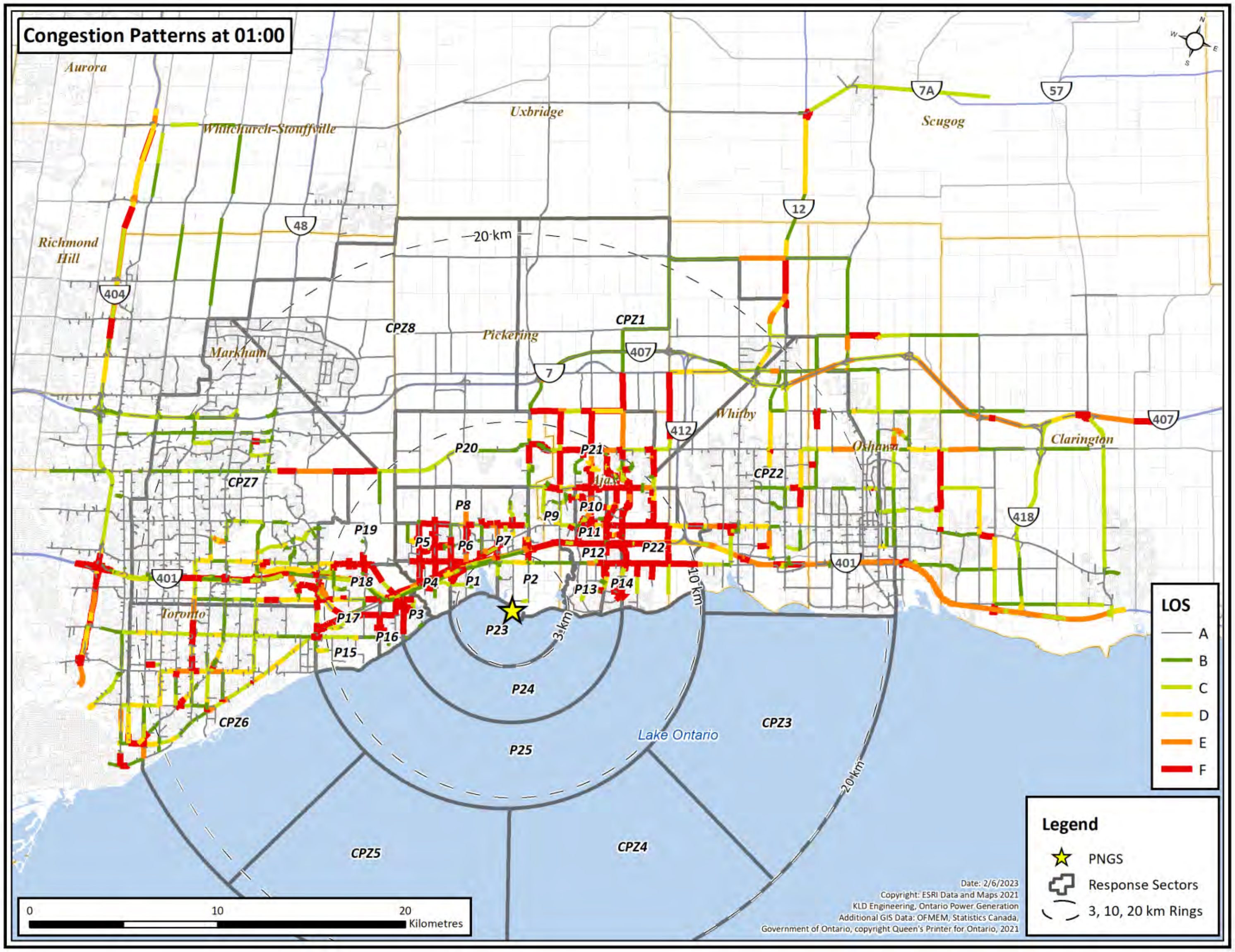


Figure 7-4. Congestion Patterns at 1 Hour after the Emergency Bulletin (R03)

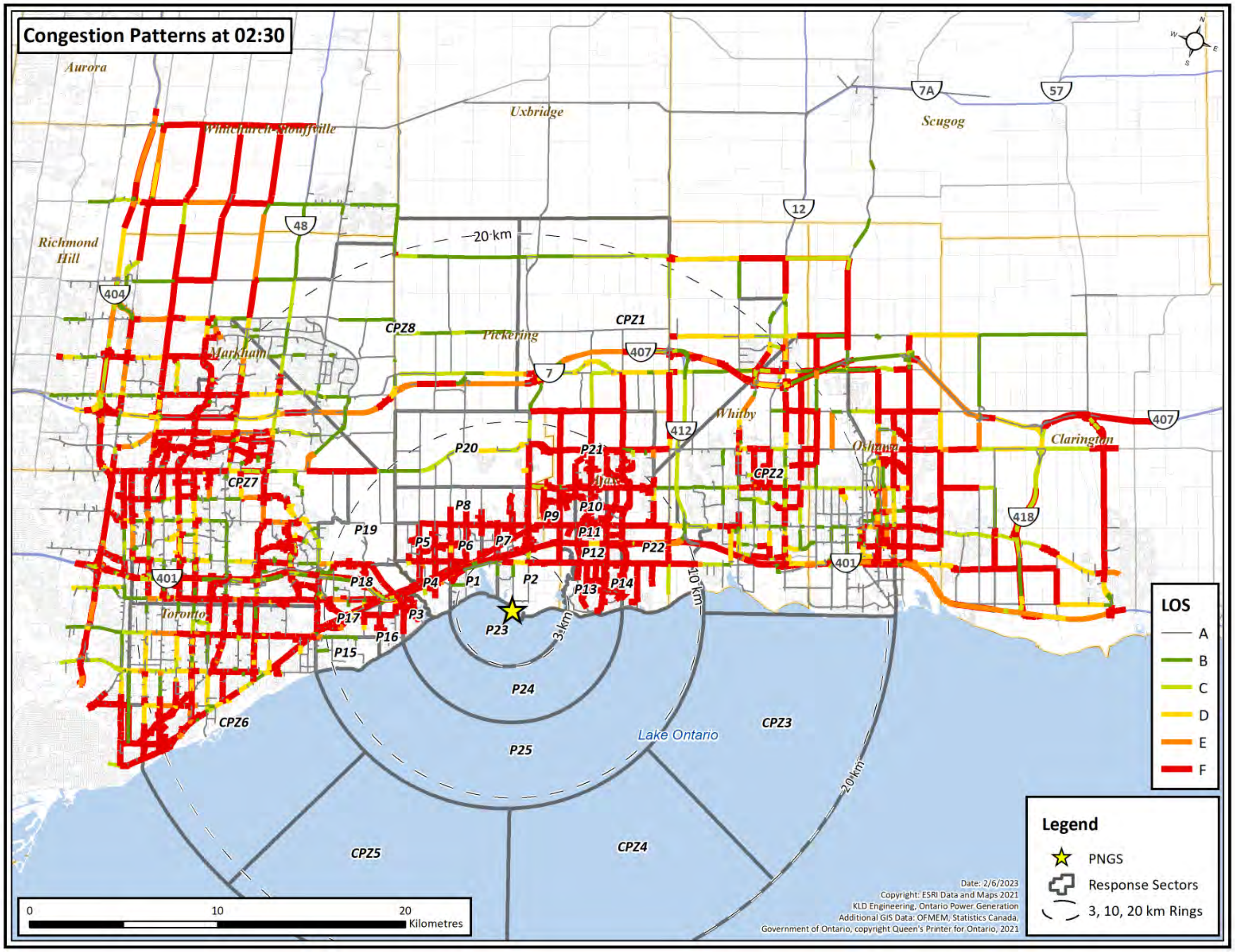


Figure 7-5. Congestion Patterns at 2 Hours and 30 Minutes after the Emergency Bulletin (R03)

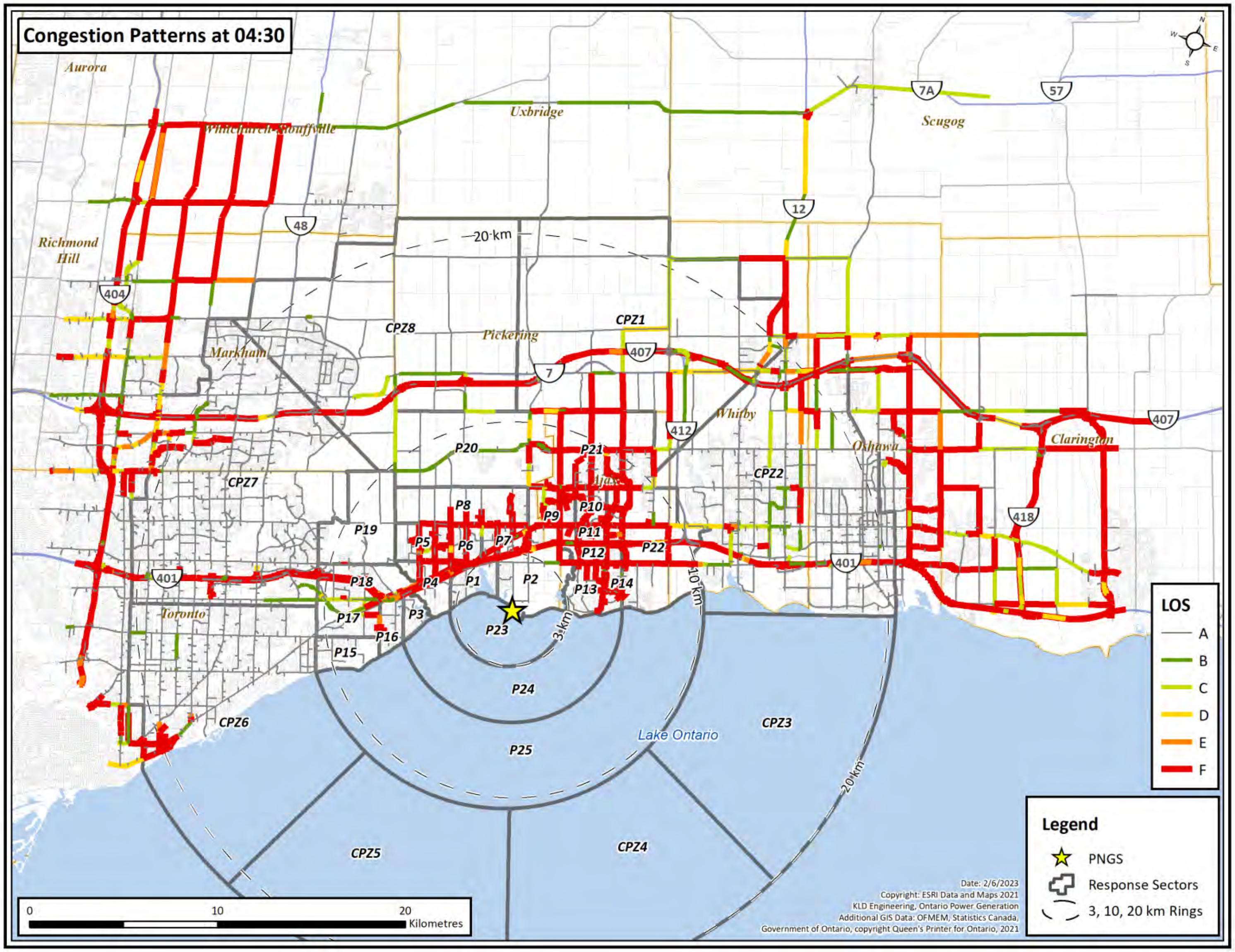


Figure 7-6. Congestion Patterns at 4 Hours and 30 Minutes after the Emergency Bulletin (R03)

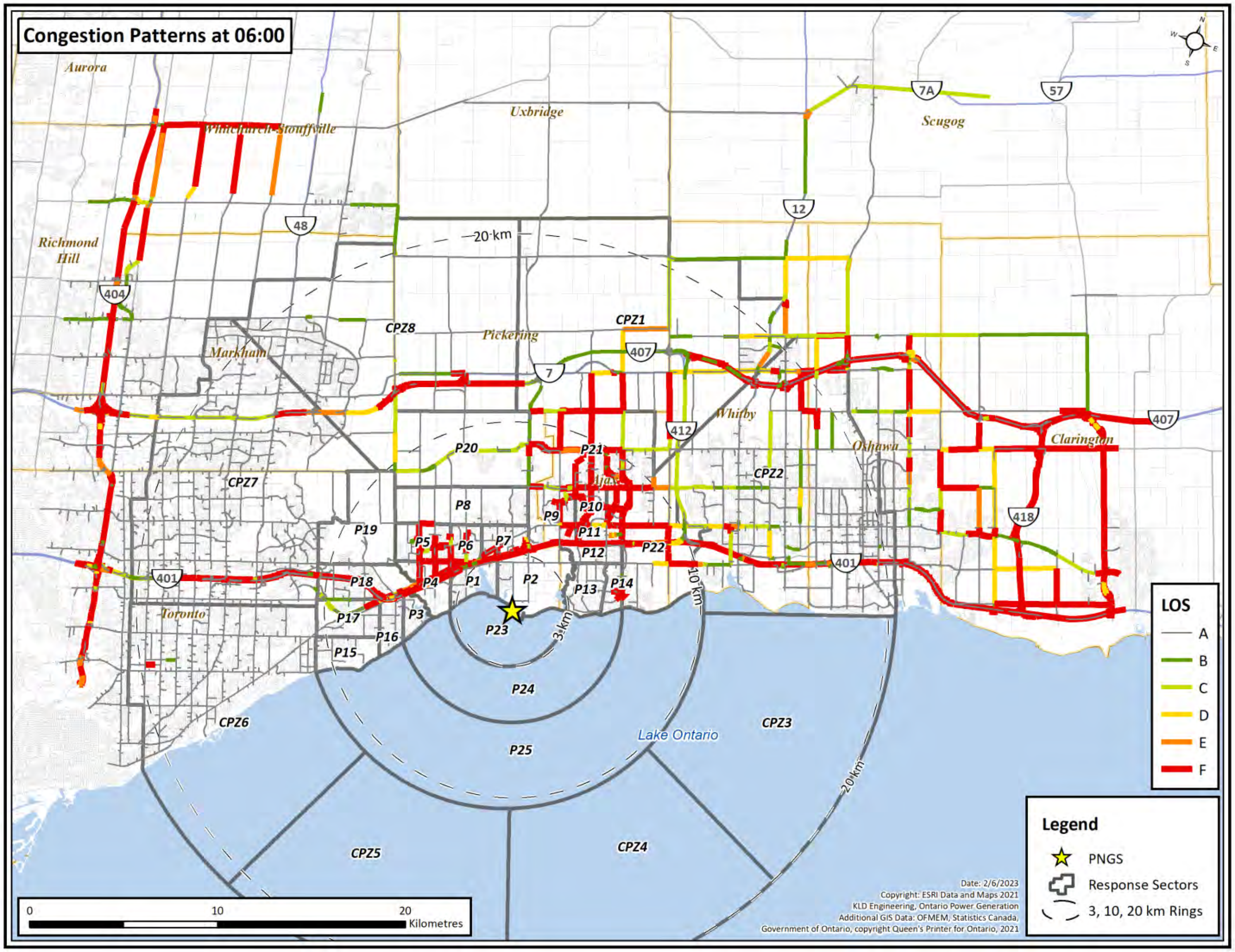


Figure 7-7. Congestion Patterns at 6 Hours after the Emergency Bulletin (R03)

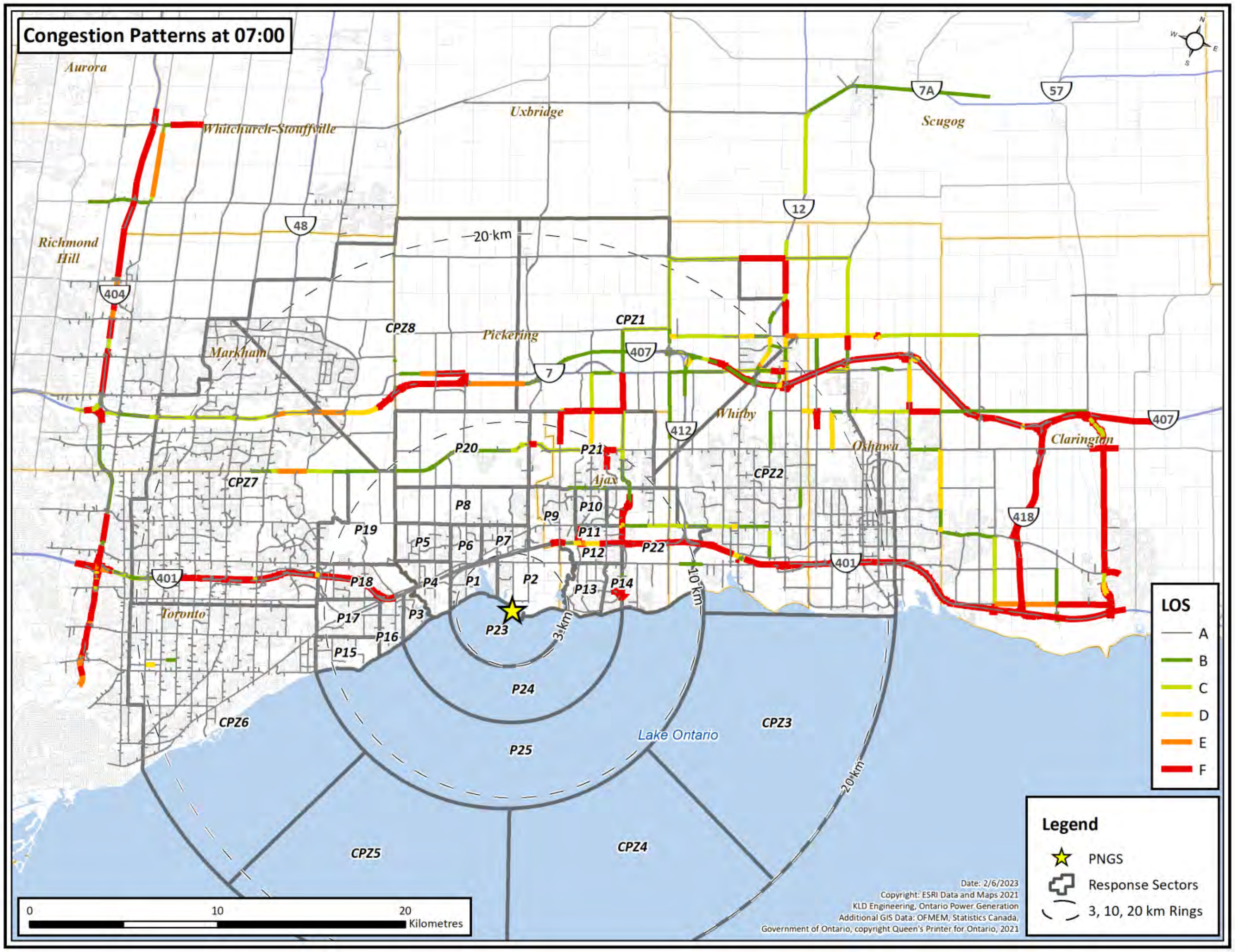


Figure 7-8. Congestion Patterns at 7 Hours after the Emergency Bulletin (R03)

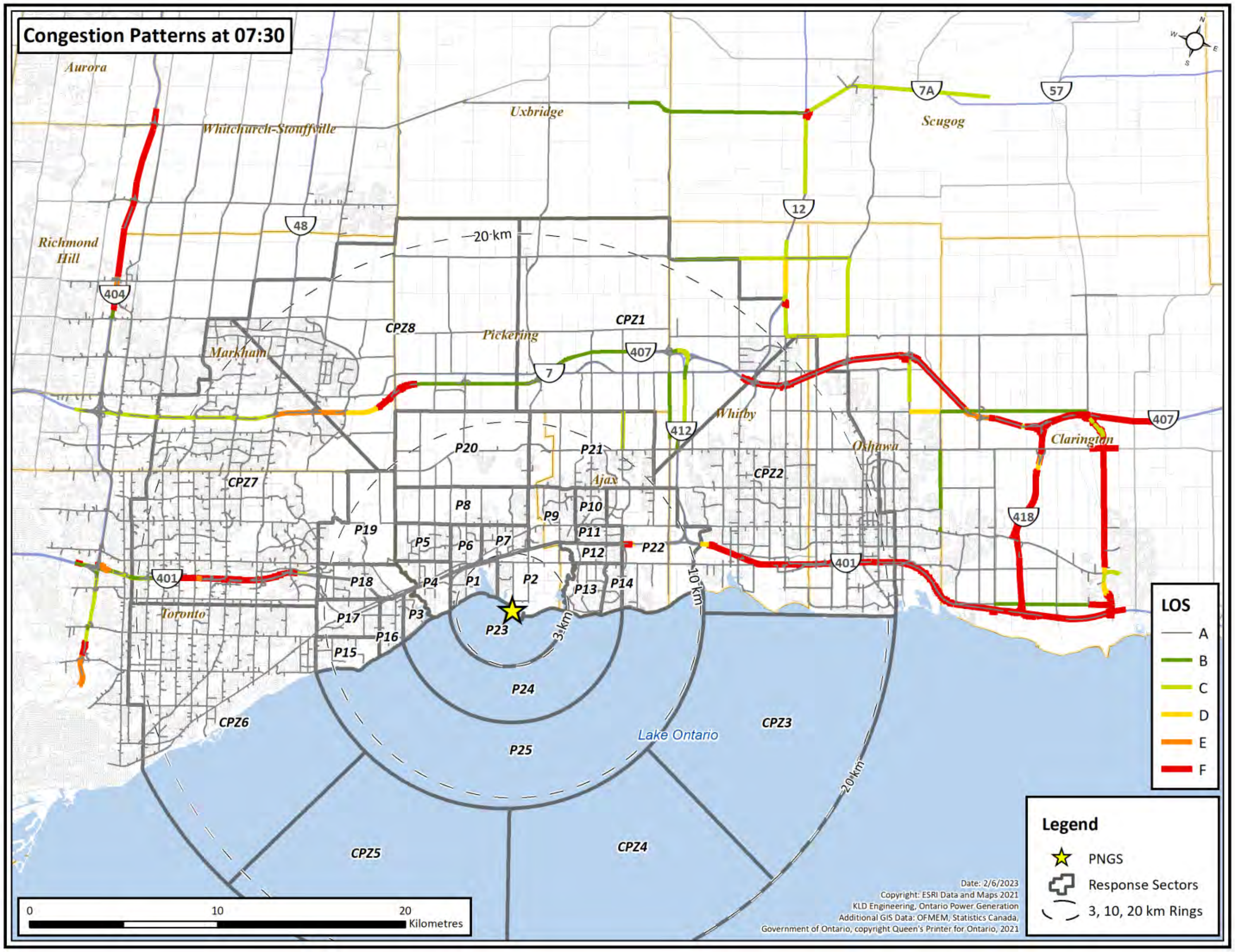


Figure 7-9. Congestion Patterns at 7 Hours and 30 Minutes after the Emergency Bulletin (R03)

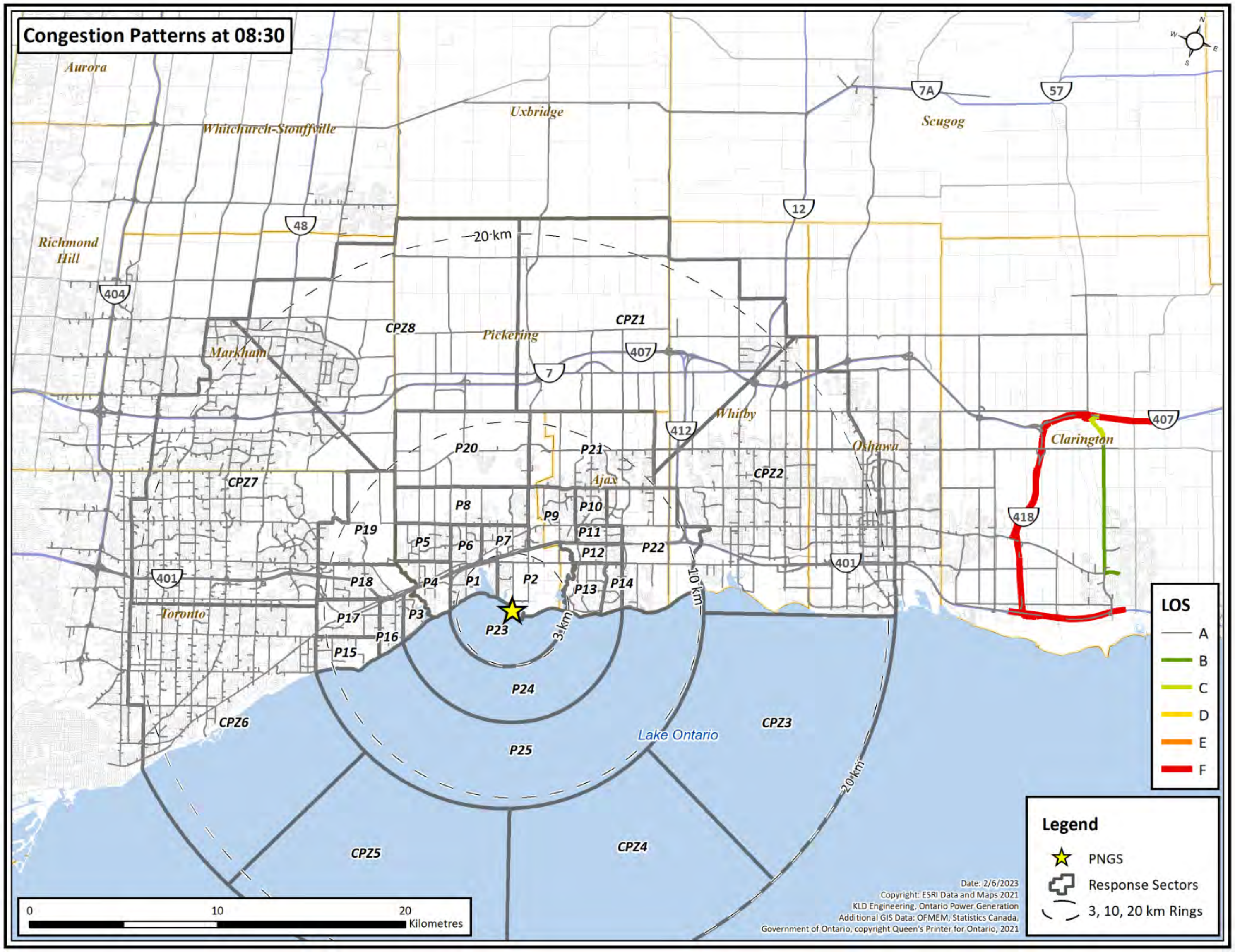


Figure 7-10. Congestion Patterns at 8 Hours and 30 Minutes after the Emergency Bulletin (R03)

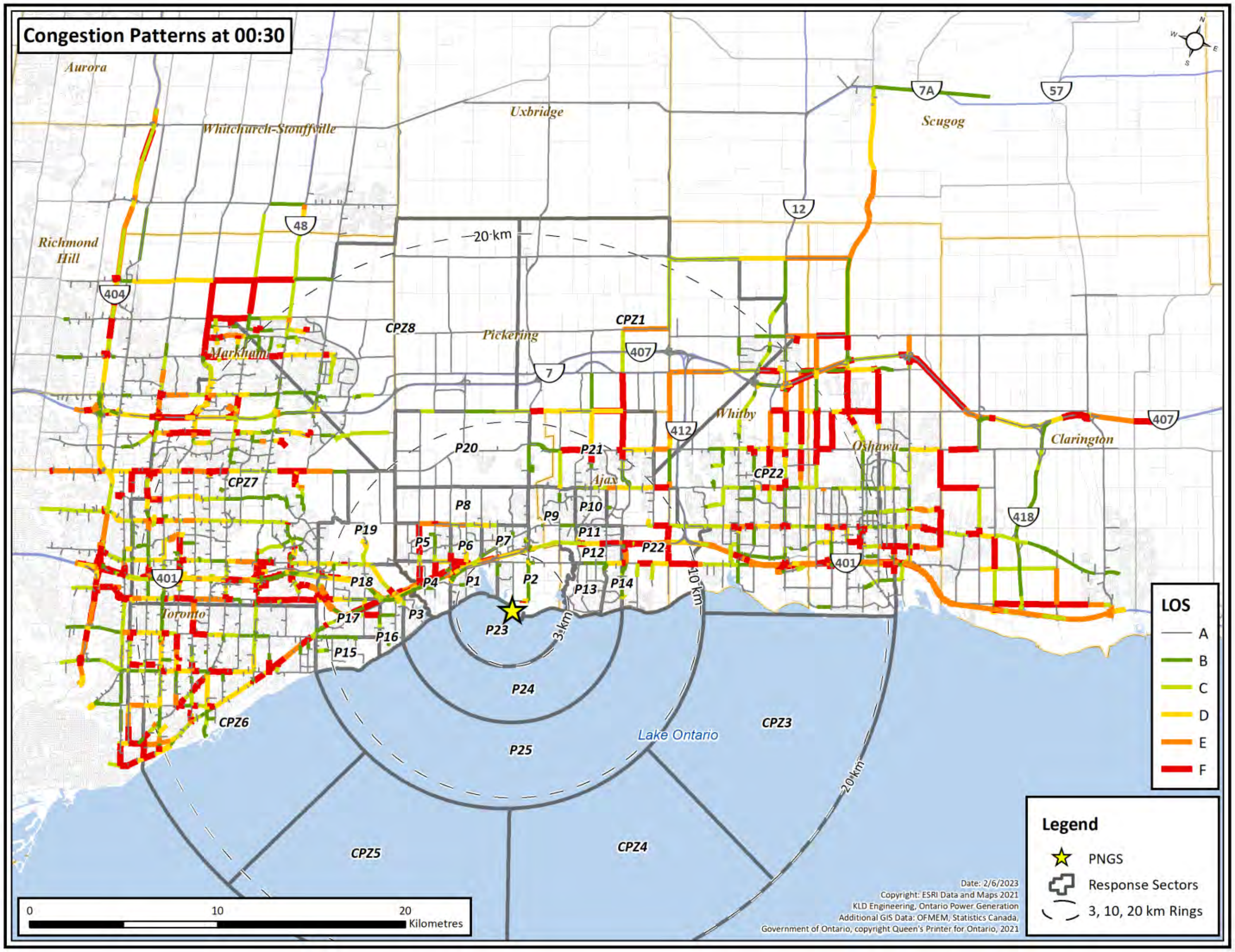


Figure 7-11. Congestion Patterns at 30 Minutes after the Emergency Bulletin (R04)

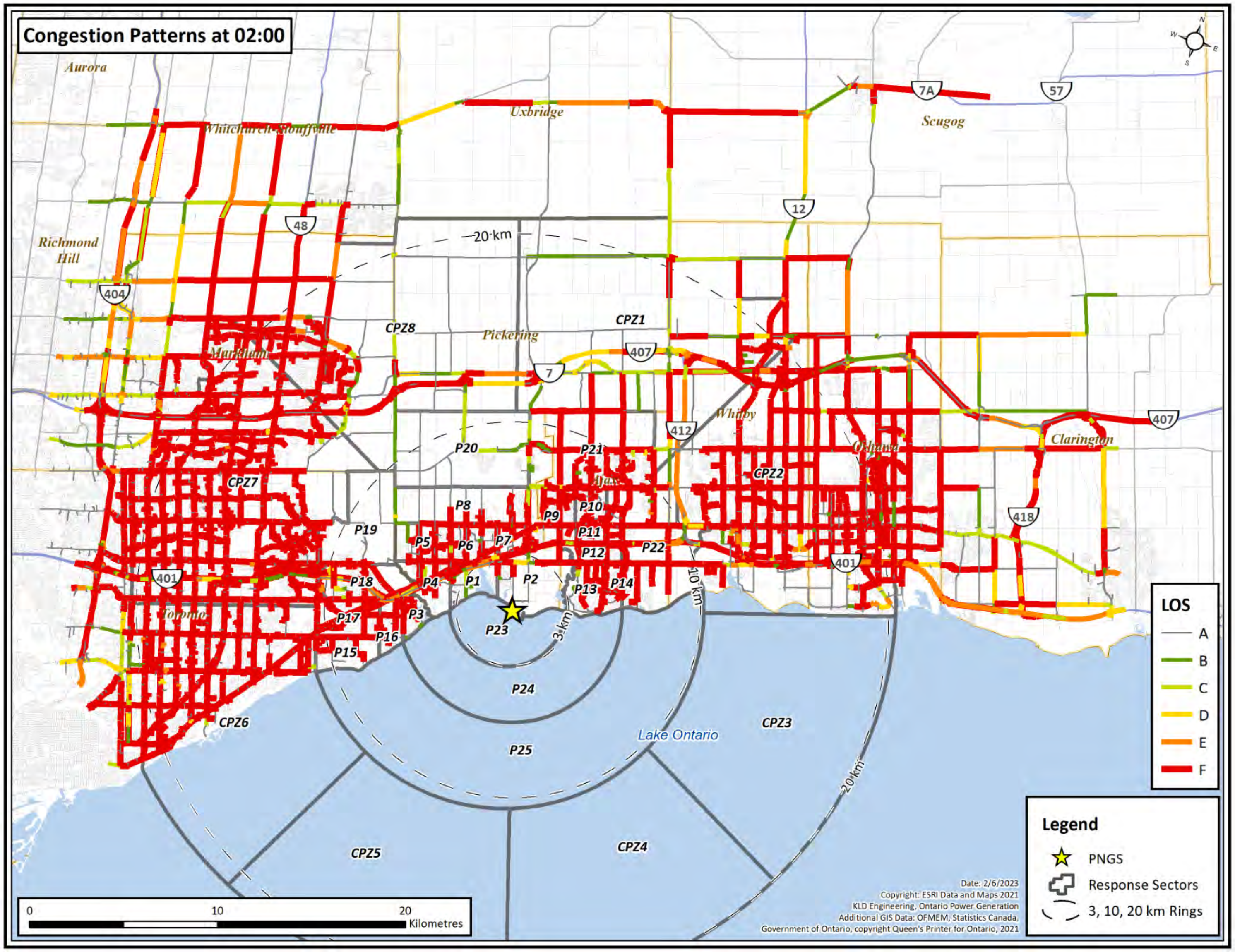


Figure 7-12. Congestion Patterns at 2 Hours after the Emergency Bulletin (R04)

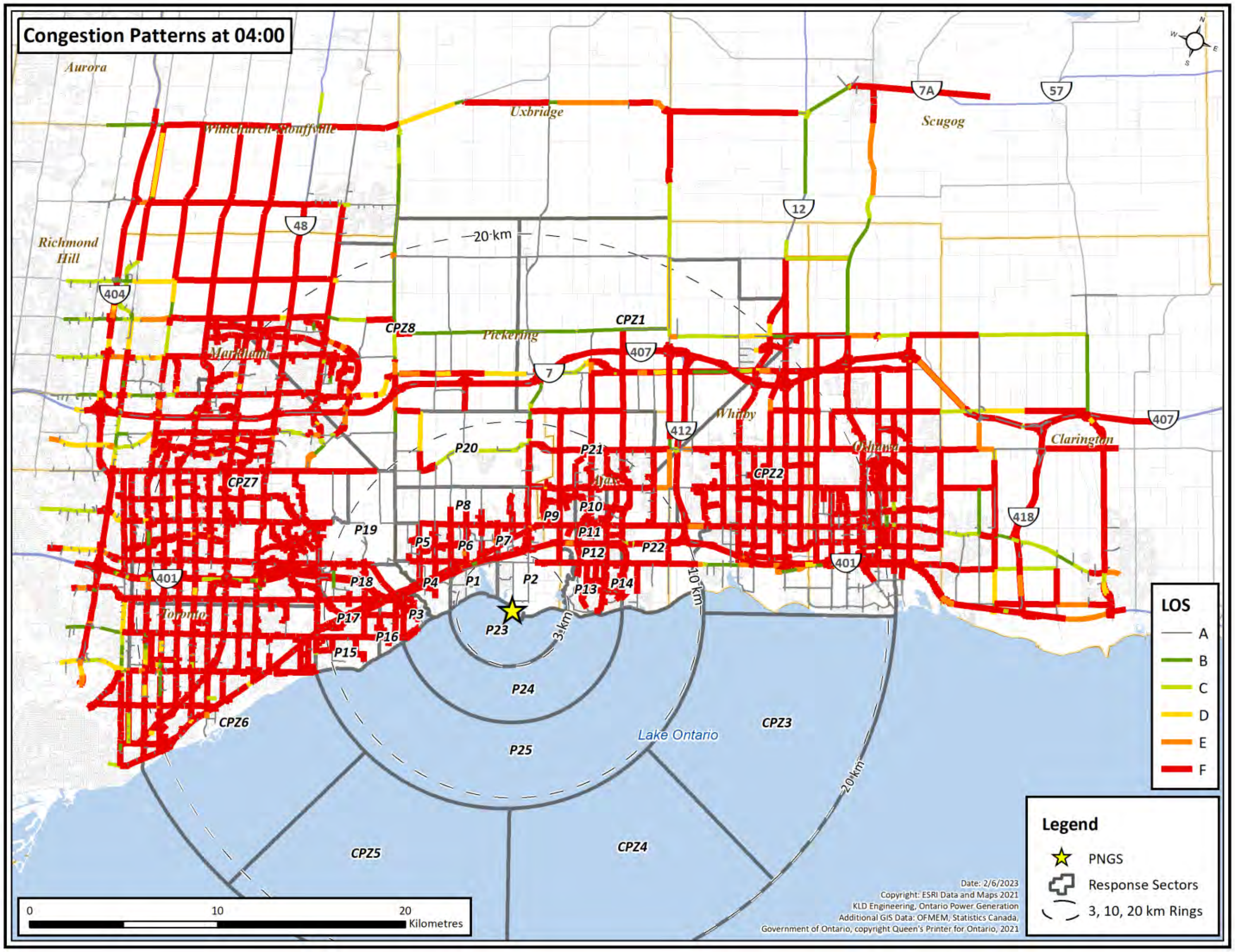


Figure 7-13. Congestion Patterns at 4 Hours after the Emergency Bulletin (R04)

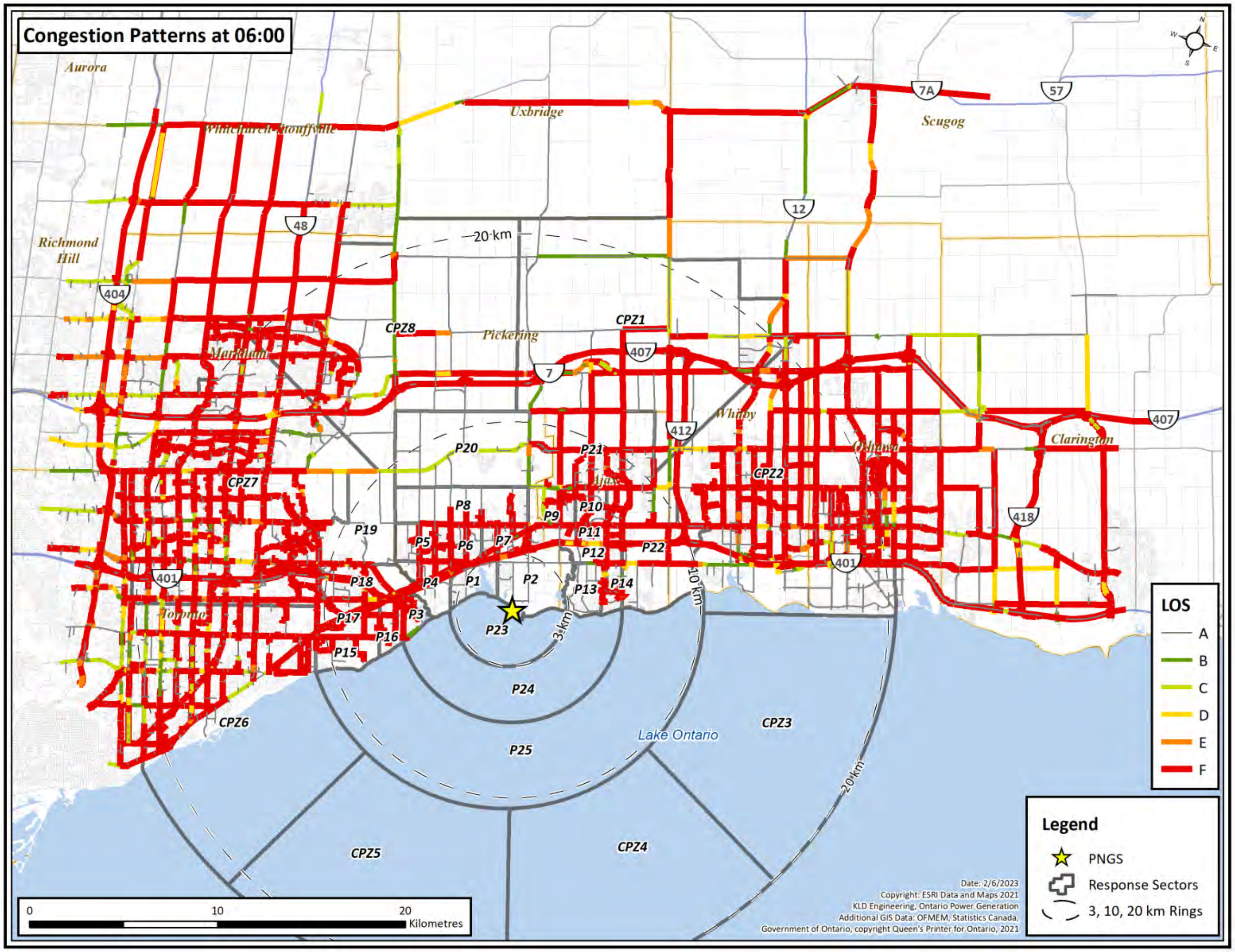


Figure 7-14. Congestion Patterns at 6 Hours after the Emergency Bulletin (R04)

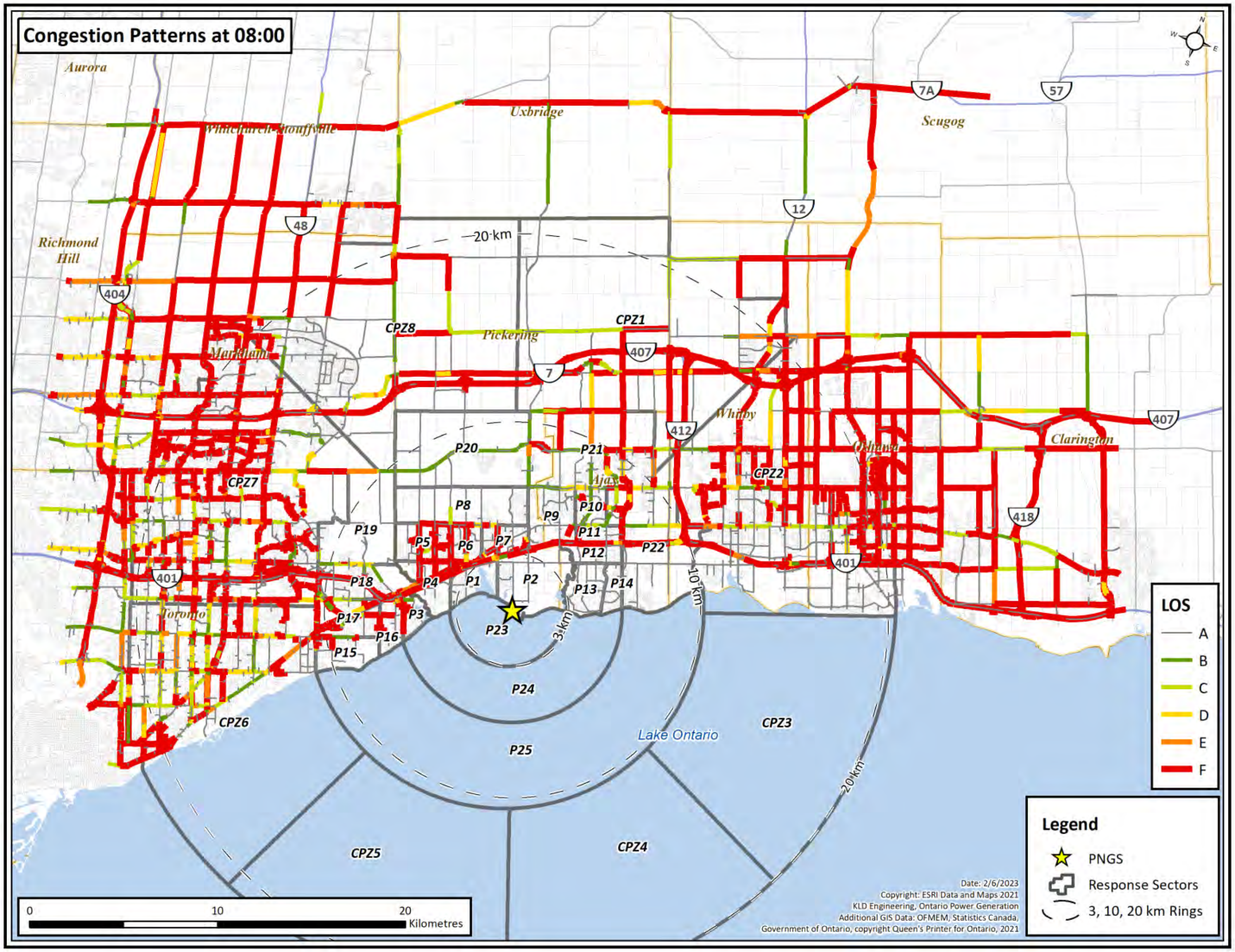


Figure 7-15. Congestion Patterns at 8 Hours after the Emergency Bulletin (R04)

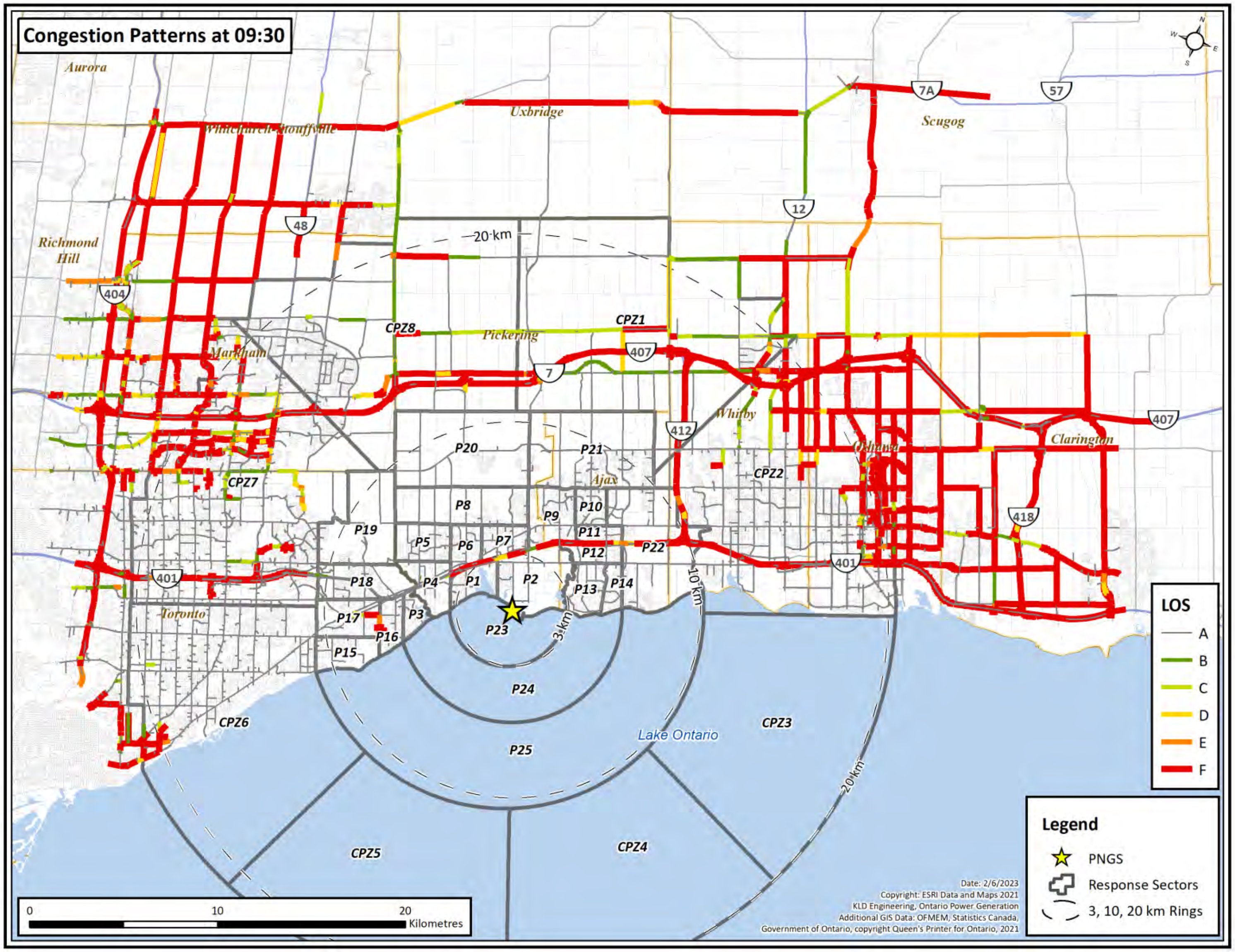


Figure 7-16. Congestion Patterns at 9 Hours and 30 Minutes after the Emergency Bulletin (R04)

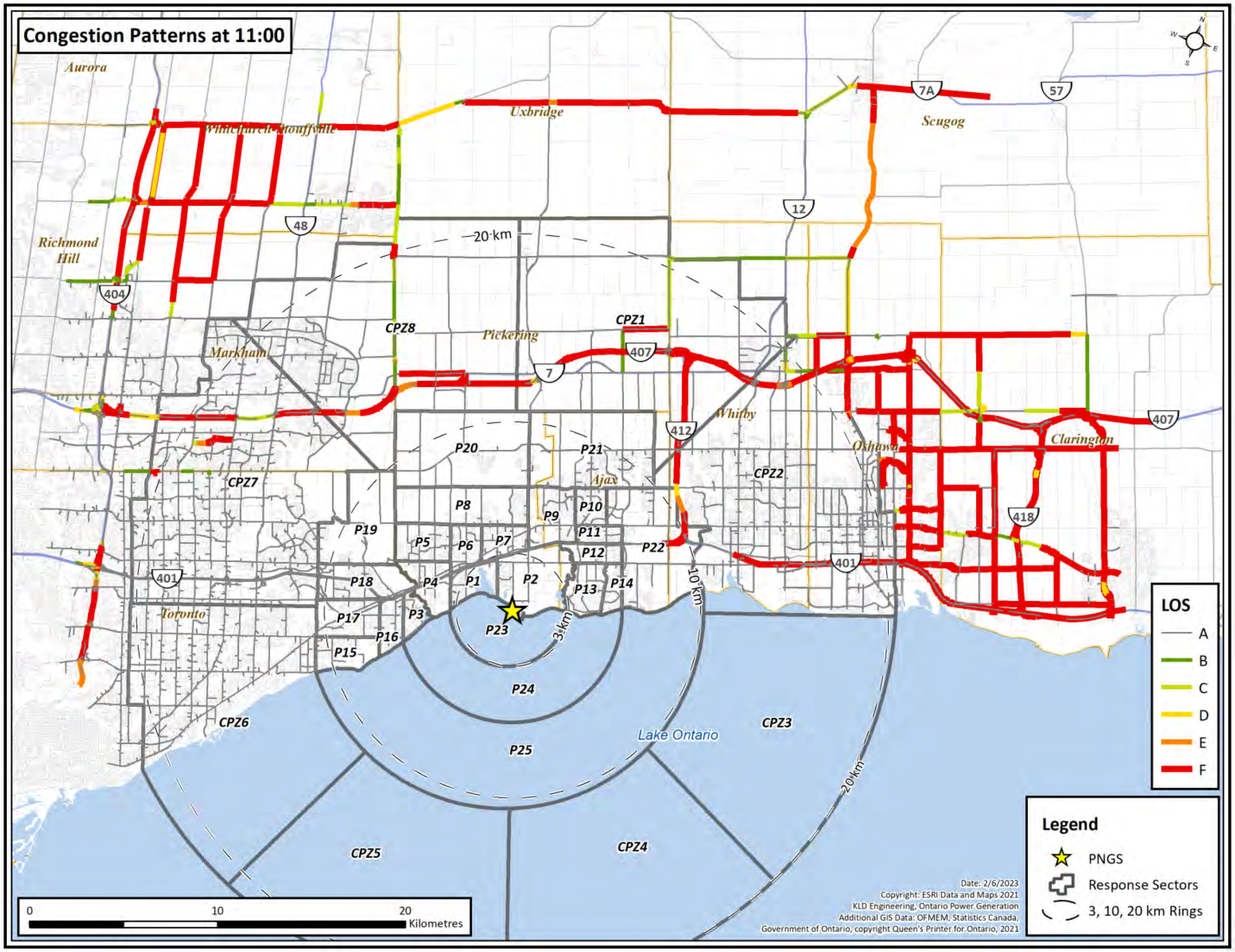


Figure 7-17. Congestion Patterns at 11 Hours after the Emergency Bulletin (R04)

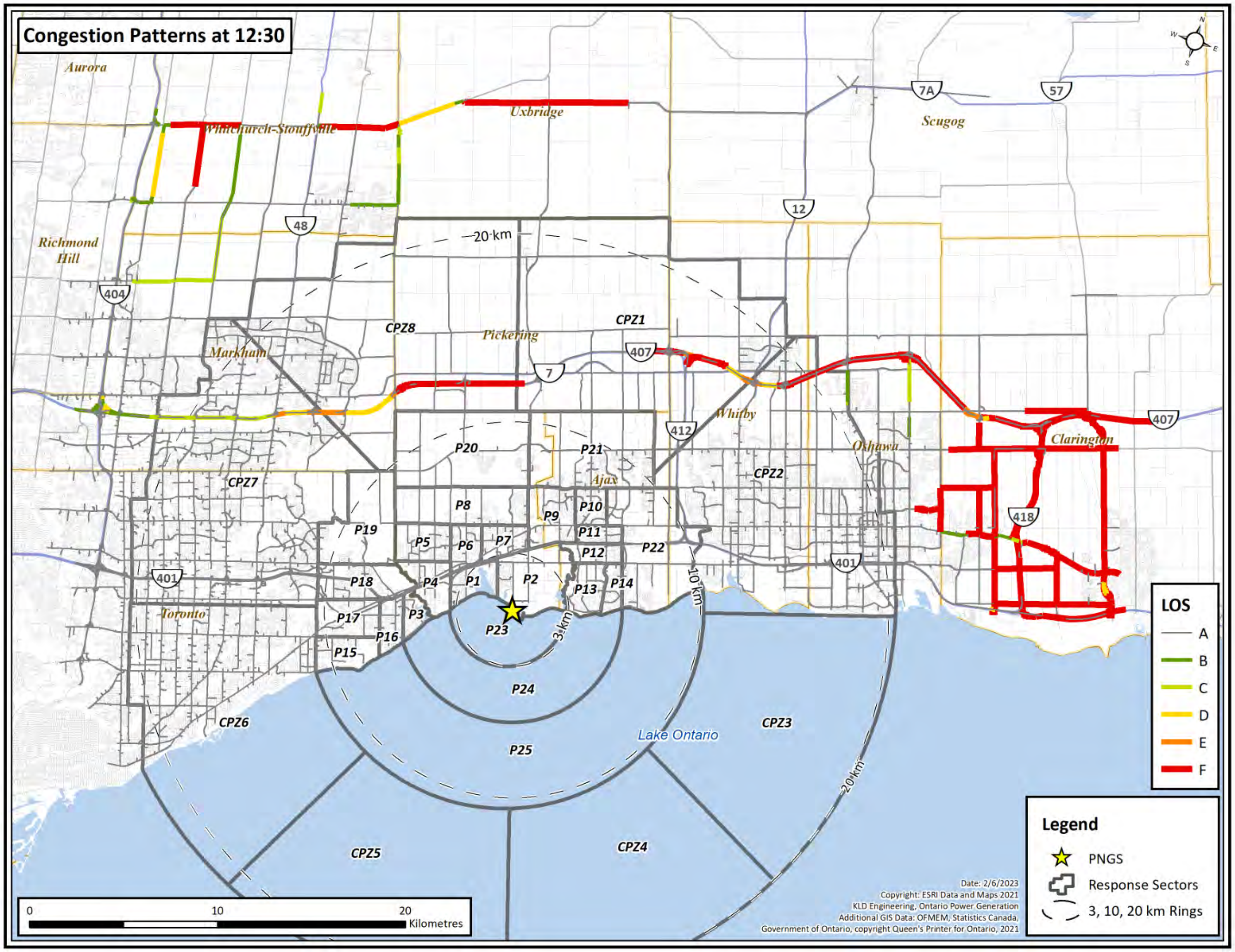


Figure 7-18. Congestion Patterns at 12 Hours and 30 Minutes after the Emergency Bulletin (R04)

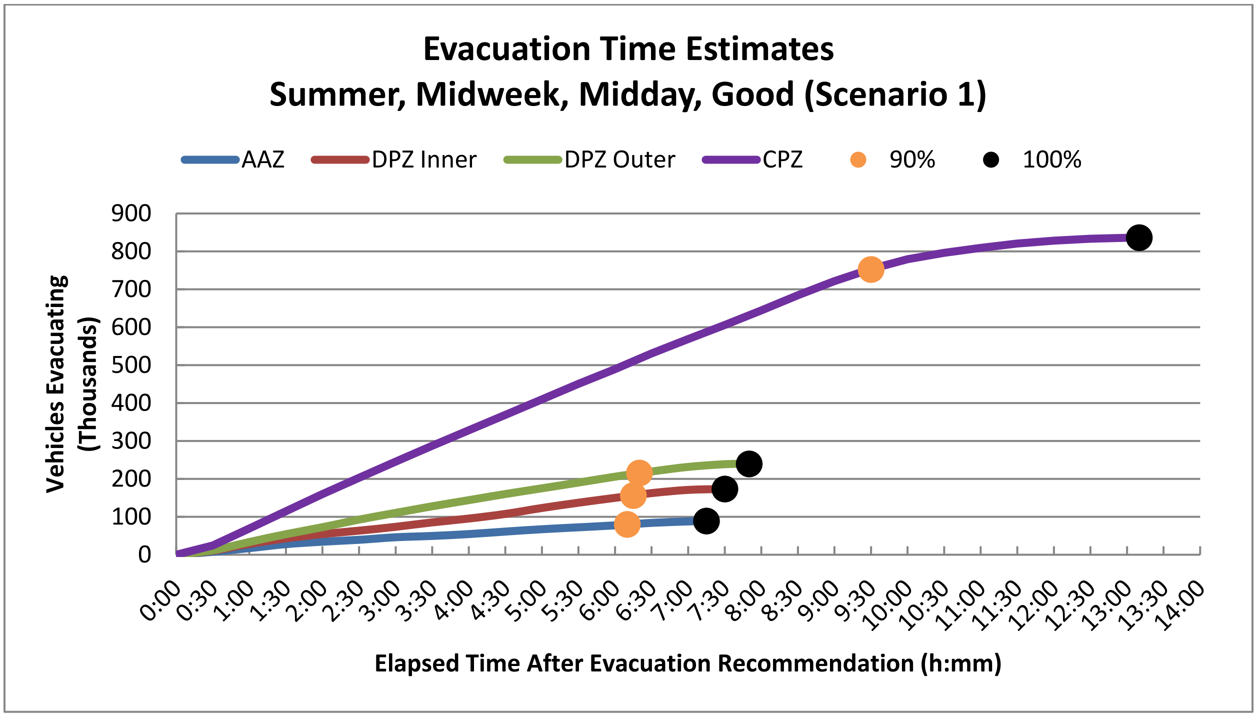


Figure 7-19. Evacuation Time Estimates - Scenario 1 for Region R03 & R04

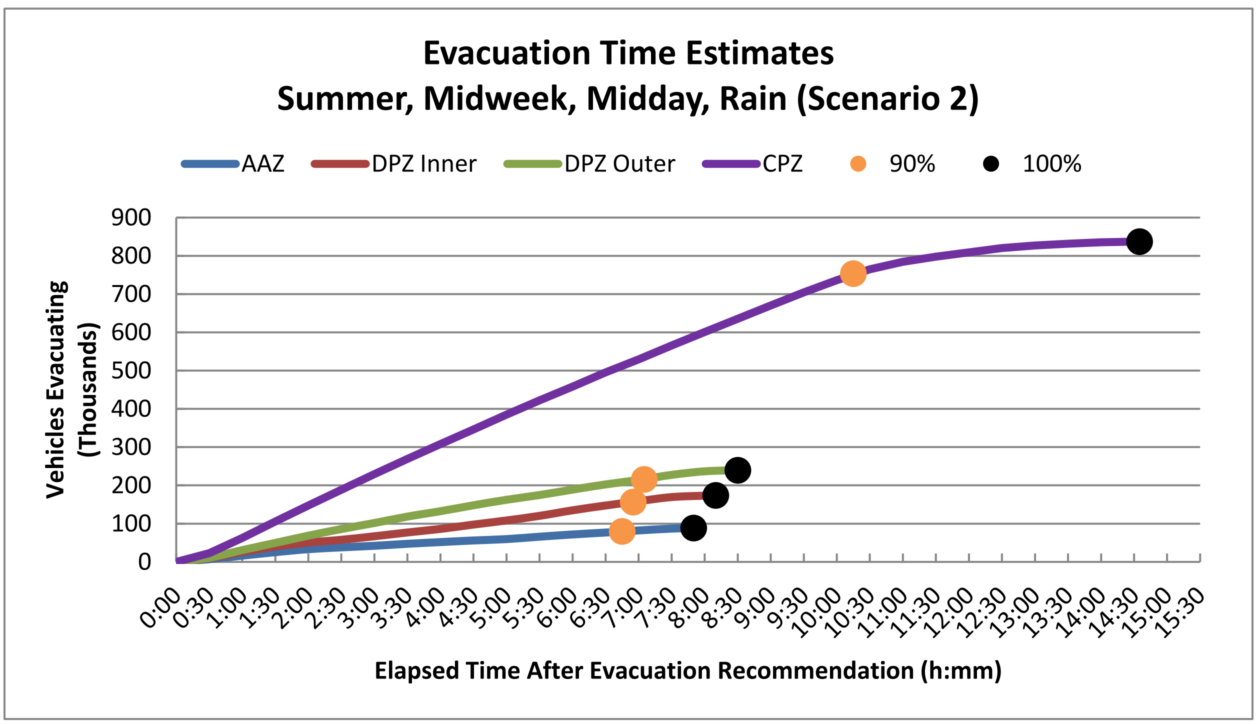


Figure 7-20. Evacuation Time Estimates - Scenario 2 for Region R03 & R04

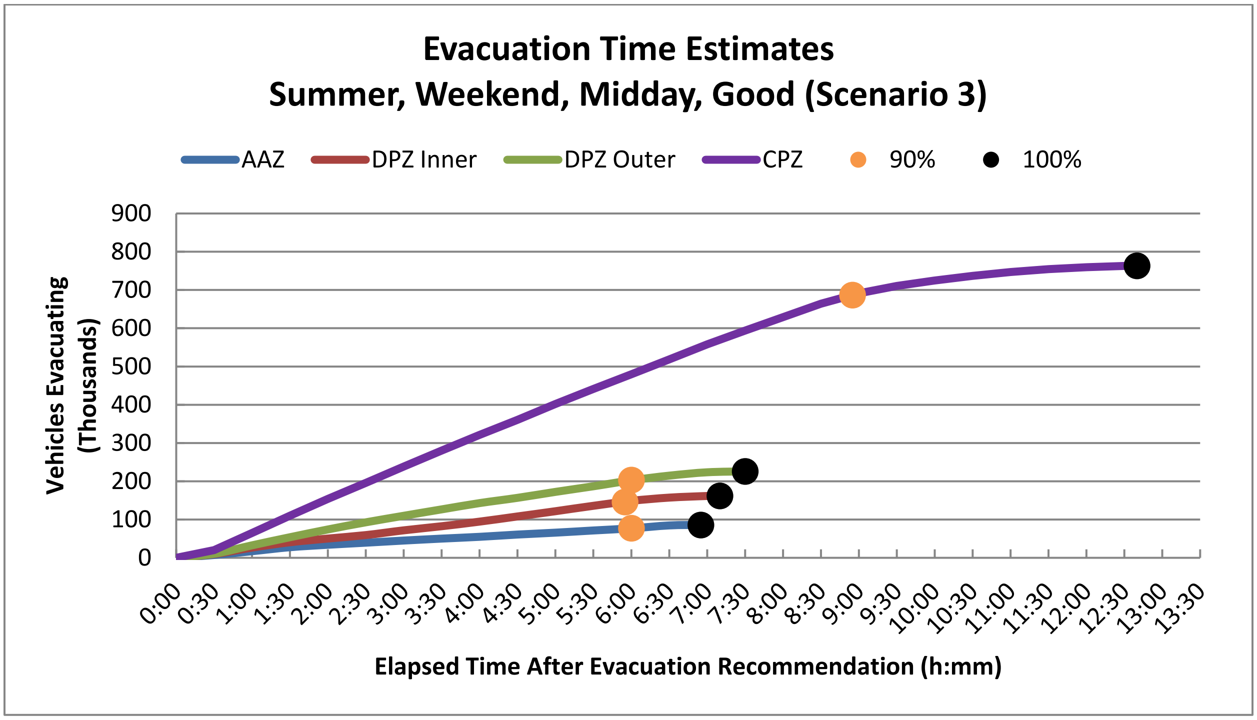


Figure 7-21. Evacuation Time Estimates - Scenario 3 for Region R03 & R04

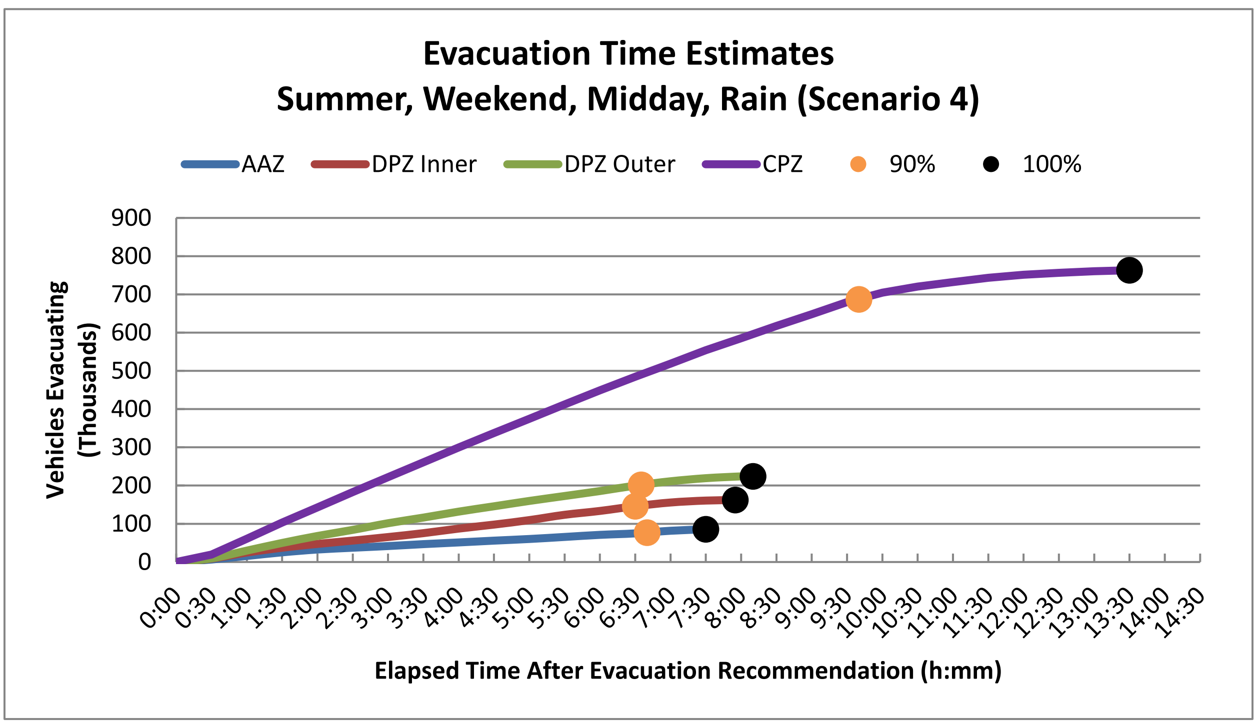


Figure 7-22. Evacuation Time Estimates - Scenario 4 for Region R03 & R04

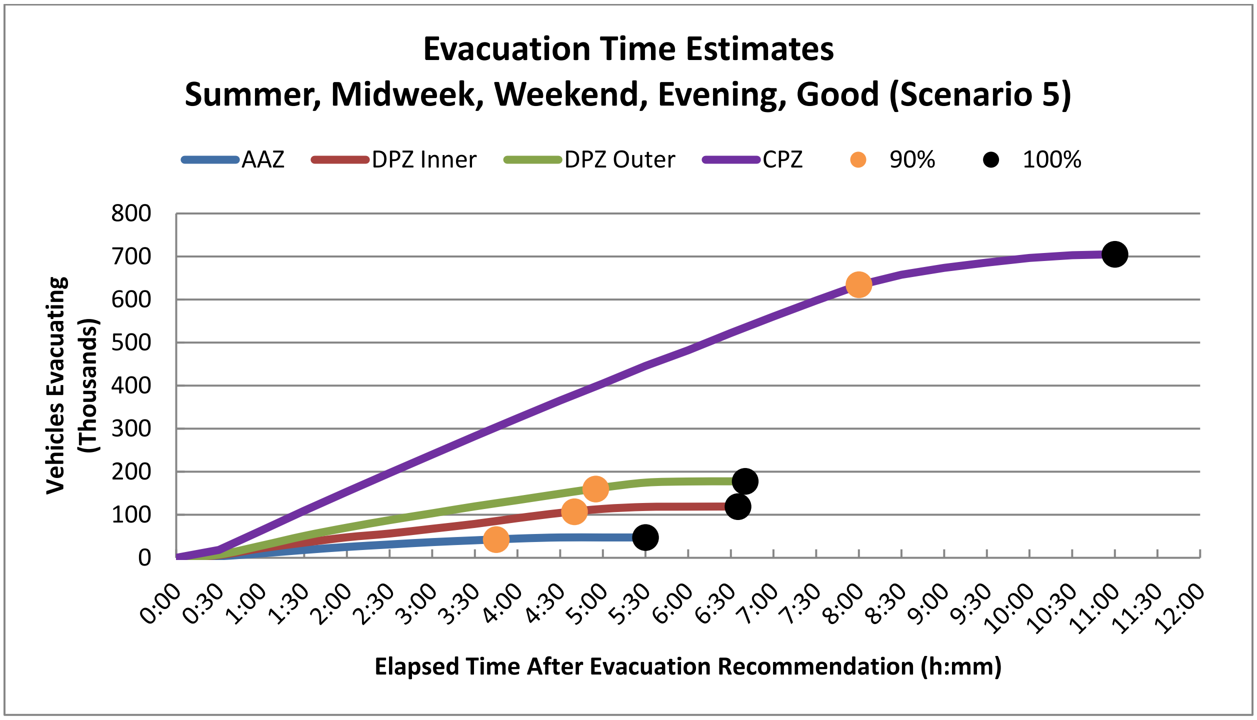


Figure 7-23. Evacuation Time Estimates - Scenario 5 for Region R03 & R04

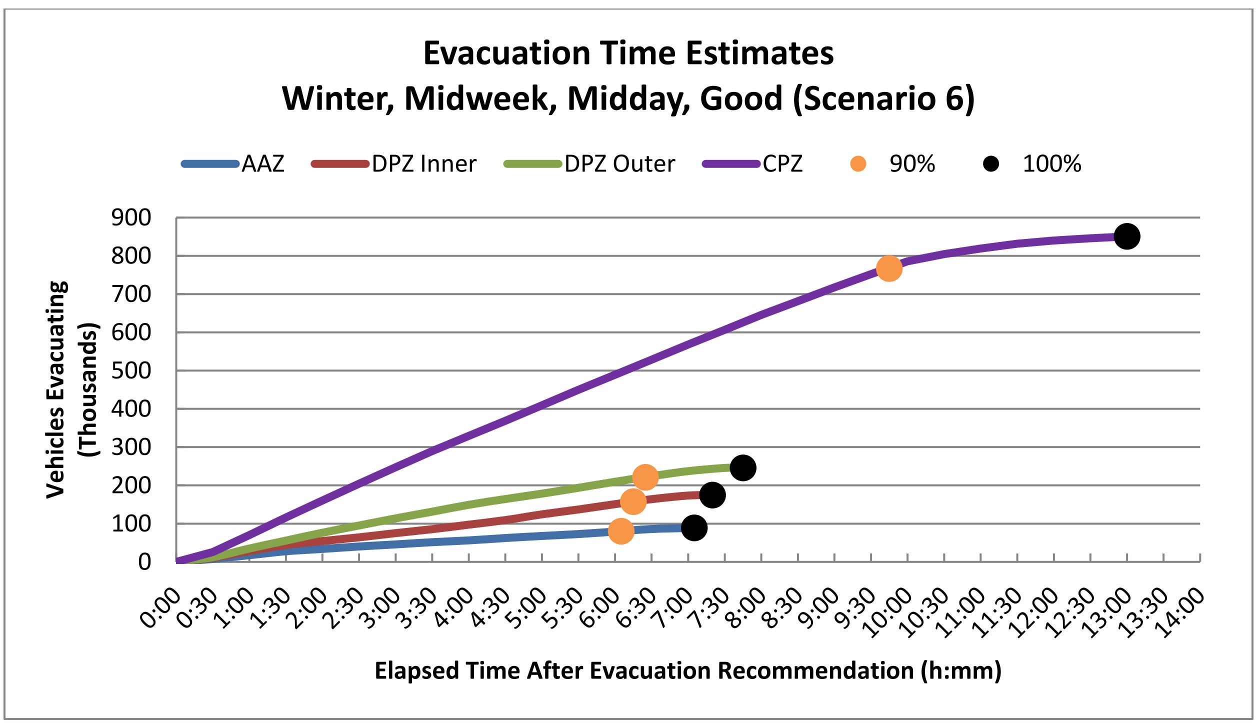


Figure 7-24. Evacuation Time Estimates - Scenario 6 for Region R03 & R04

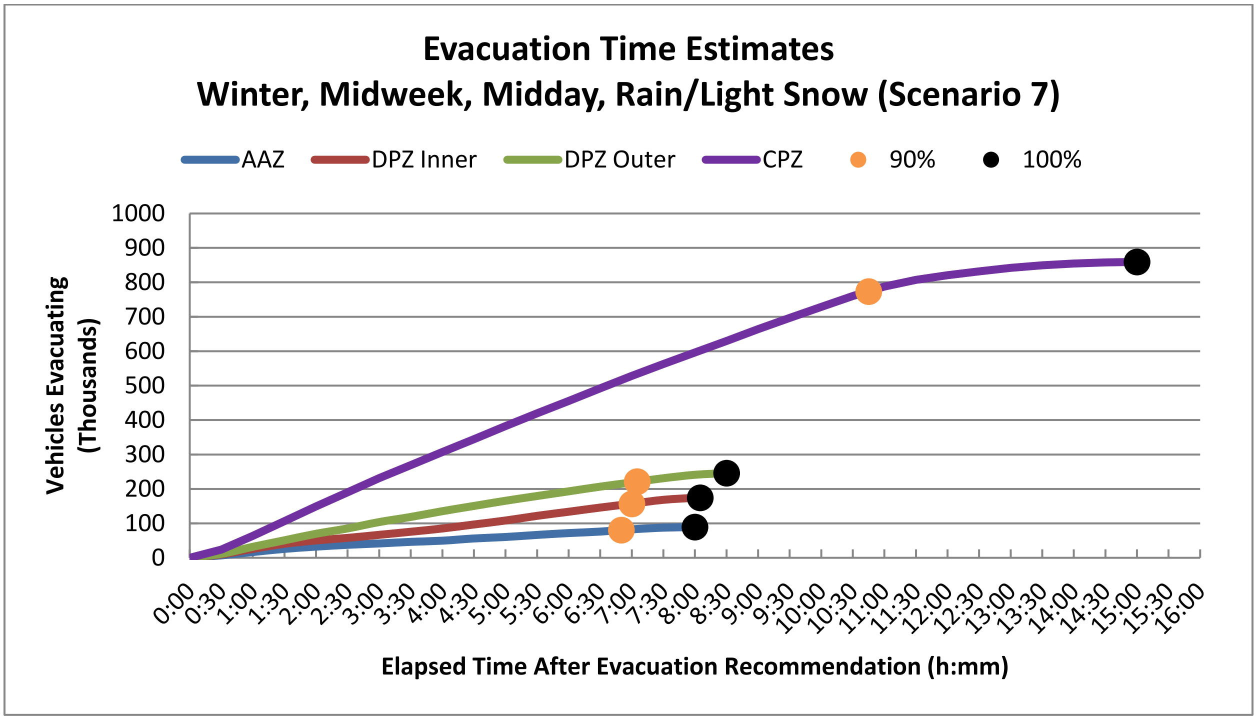


Figure 7-25. Evacuation Time Estimates - Scenario 7 for Region R03 & R04

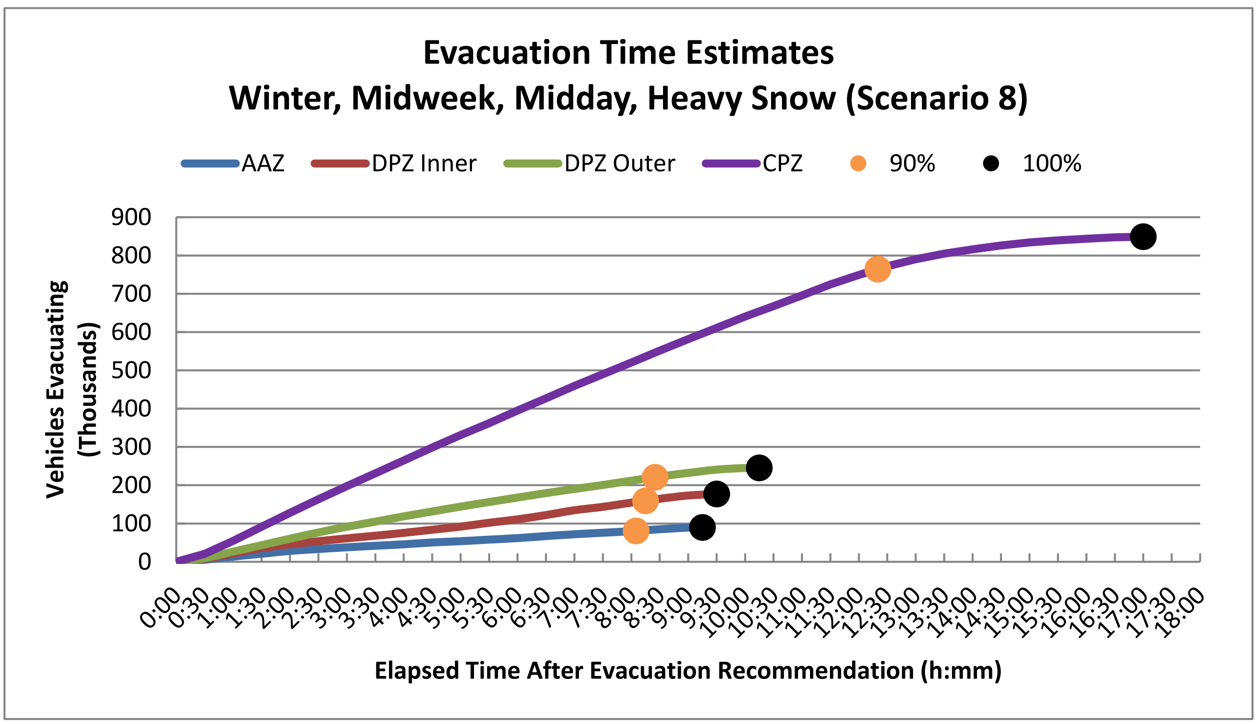


Figure 7-26. Evacuation Time Estimates - Scenario 8 for Region R03 & R04

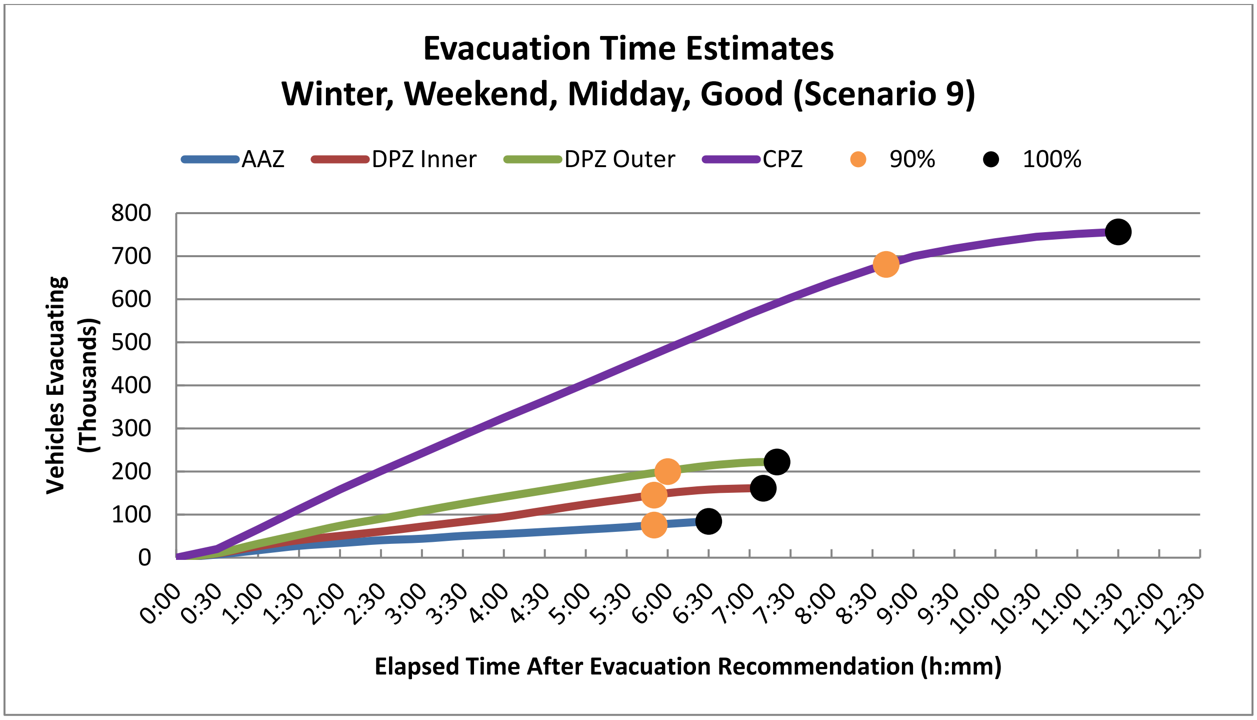


Figure 7-27. Evacuation Time Estimates - Scenario 9 for Region R03 & R04

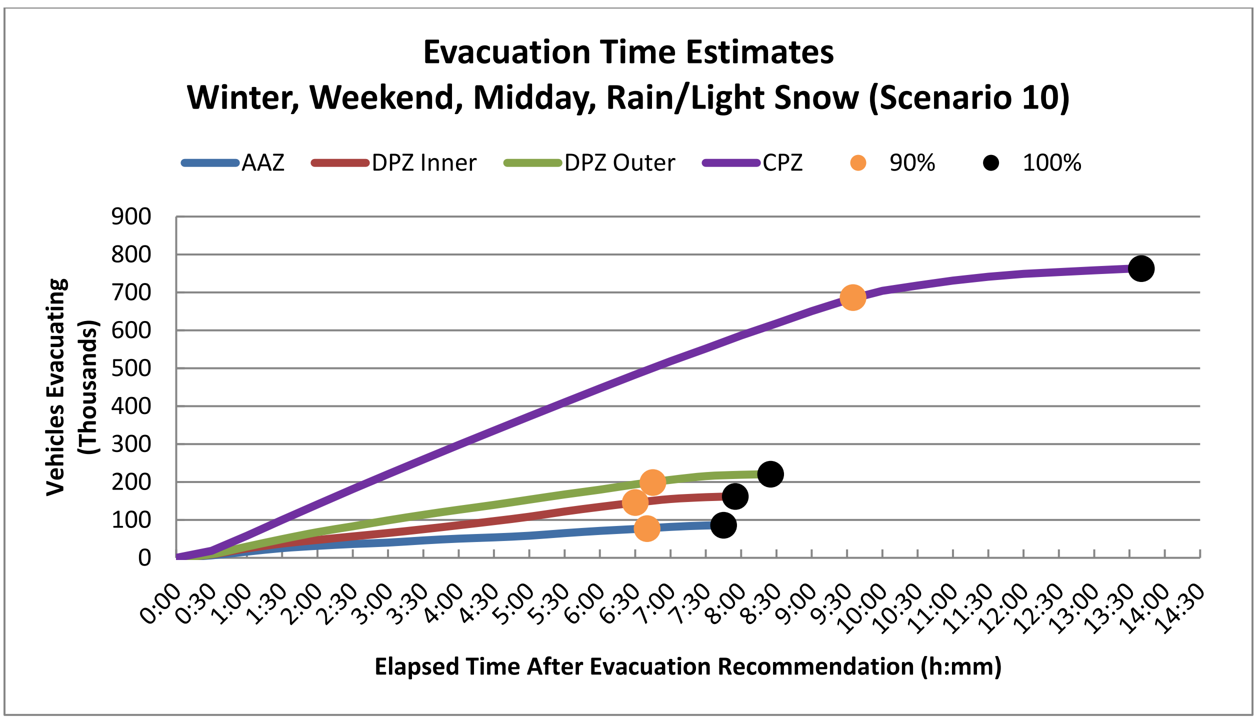


Figure 7-28. Evacuation Time Estimates - Scenario 10 for Region R03 & R04

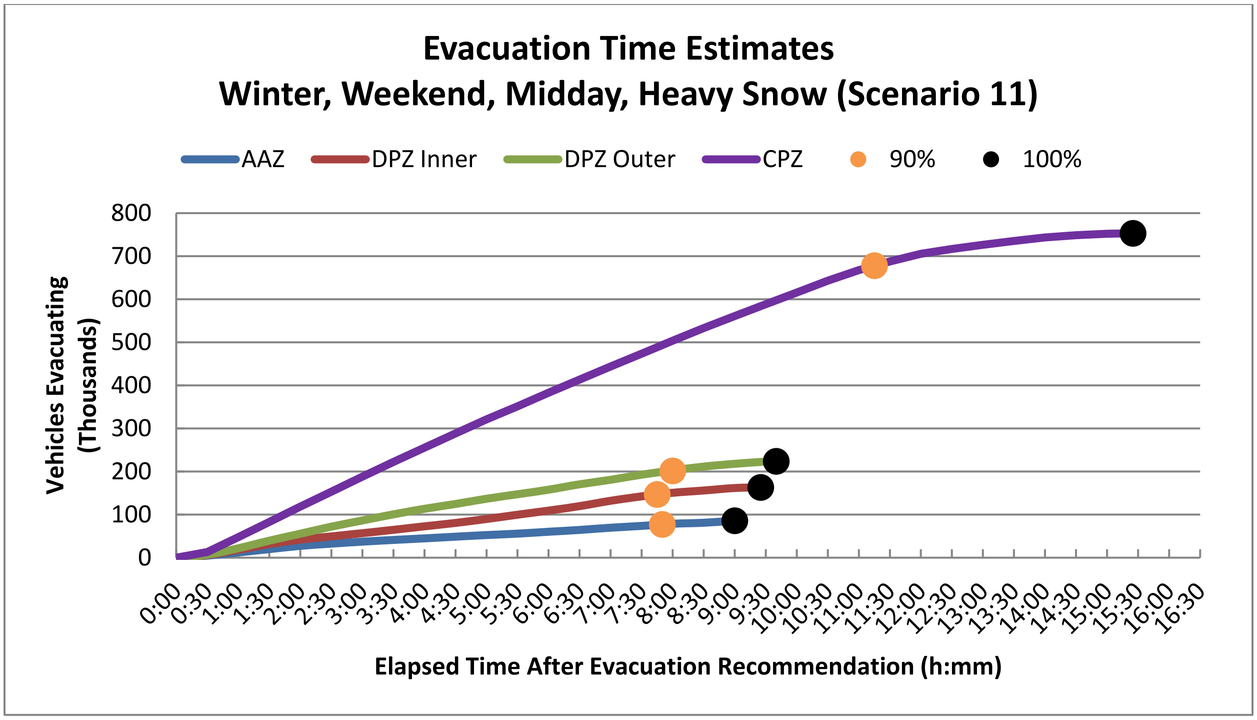


Figure 7-29. Evacuation Time Estimates - Scenario 11 for Region R03 & R04

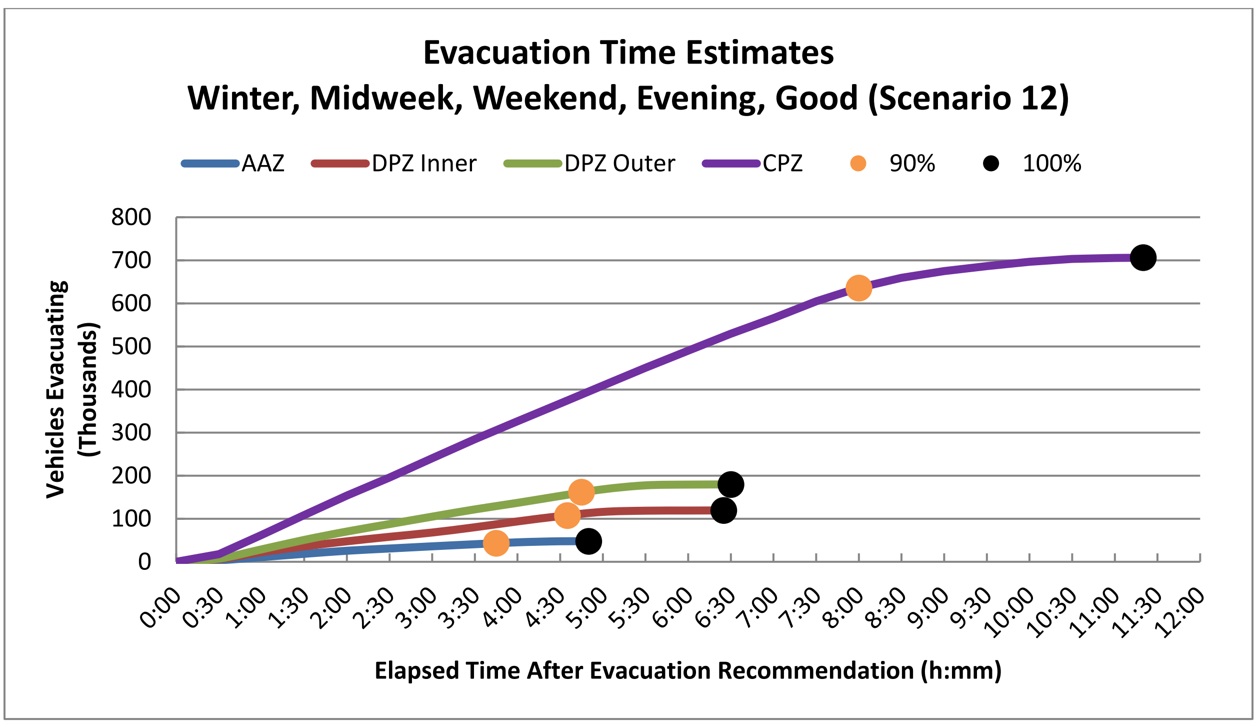


Figure 7-30. Evacuation Time Estimates - Scenario 12 for Region R03 & R04

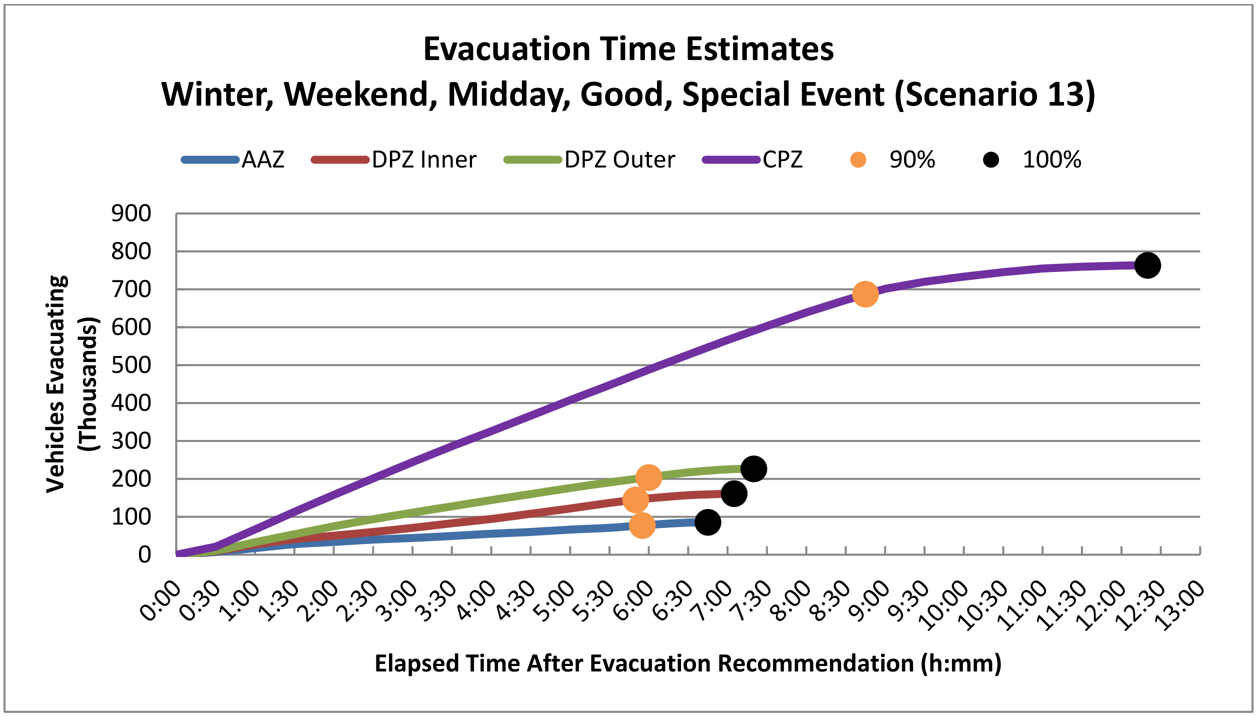


Figure 7-31. Evacuation Time Estimates - Scenario 13 for Region R03 & R04

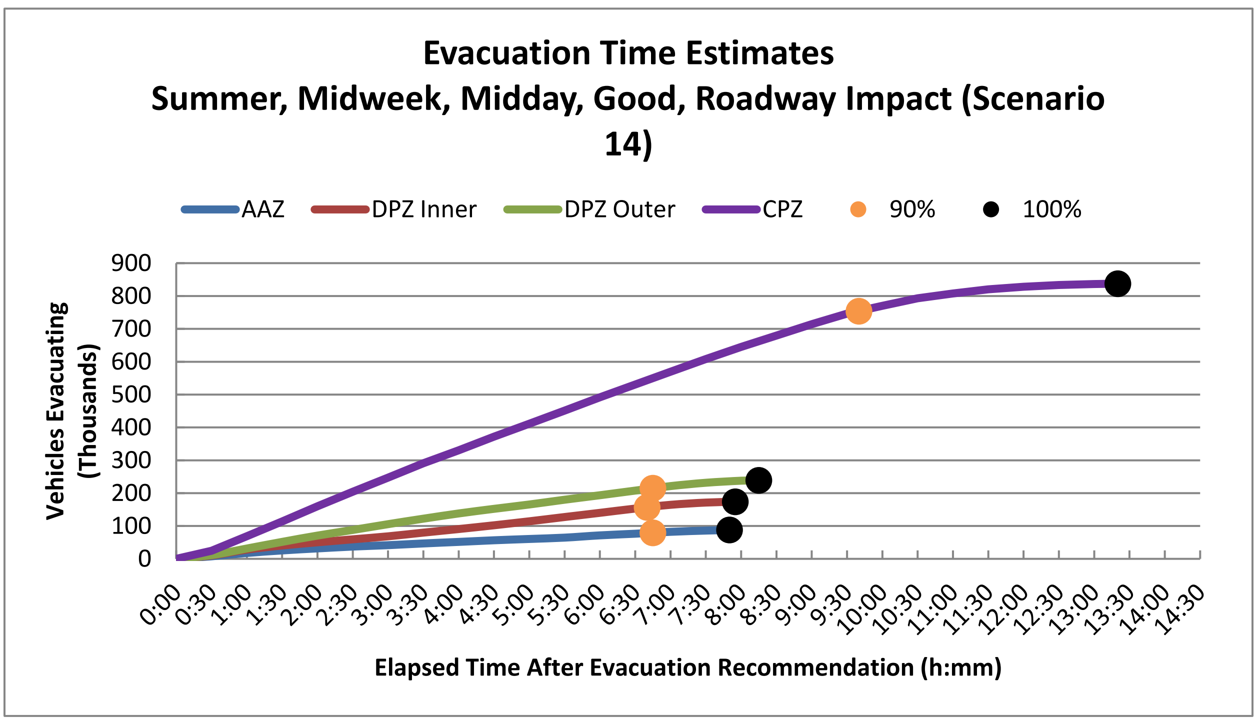


Figure 7-32. Evacuation Time Estimates - Scenario 14 for Region R03 & R04

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:

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

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 90th 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.

<u>Activity: Travel to Temporary Holding Centre (E→F)</u>

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.

<u>Activity: Passengers Leave Bus (F→G)</u>

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

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

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 90th 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 90th 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 90th 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 90th 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		13.3		7.5		106		**3:35**		8.5		5		**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	N/A	13.2	N/A	2.8	N/A	278	N/A	**6:25**	N/A	5.5	N/A	3	N/A	**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	N/A	13.3	N/A	23.7	N/A	34	N/A	**2:35**	N/A	8.5	N/A	6	N/A	**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		13.2		7.4		107		**3:50**		5.5		4		**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	N/A	9.7	N/A	15.5	N/A	38	N/A	**2:55**	N/A	8.5	N/A	6	N/A	**3:05**
CPZ6	Schools in CPZ6	110	25	N/A	13.2	N/A	6.1	N/A	130	N/A	**4:25**	N/A	5.5	N/A	4	N/A	**4:30**
CPZ7	Schools in CPZ7	110	25	N/A	12.4	N/A	8.4	N/A	89	N/A	**3:45**	N/A	5.5	N/A	4	N/A	**3:50**
CPZ8	Schools in CPZ8	110	25	N/A	13.5	N/A	45.4	N/A	18	N/A	**2:35**	N/A	9.0	N/A	7	N/A	**2:45**
									Maximum for PZ:	**N/A**	**9:35**				**Maximum:**	**N/A**	**9:40**
									Average for PZ:	**N/A**	**6:35**				**Average:**	**N/A**	**6:40**

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

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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**							

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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 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)	Two-Wave for DPZ Evacuation ONLY 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**							

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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**							

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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**							

		One-Wave											Two-Wave for DPZ Evacuation ONLY					
Route Number	Number of Buses	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	N/A	9.5	N/A	78	N/A	**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		9.4		207		**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

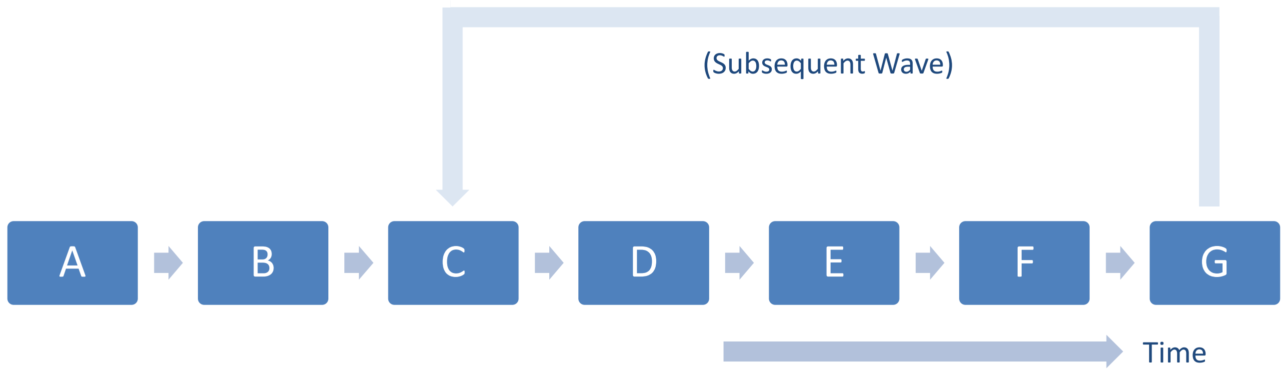
Response Sector	Representative Medical Facility by Response Sector	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Avg. Dist. To DPZ Bdry (km)	Avg. Dist. To CPZ Bdry (km)	Travel Time to DPZ Boundary (min)	Travel Time to CPZ Boundary (min)	DPZ ETE (hr:min)	CPZ 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		9.5		132		**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	N/A	9.4	N/A	254	N/A	**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

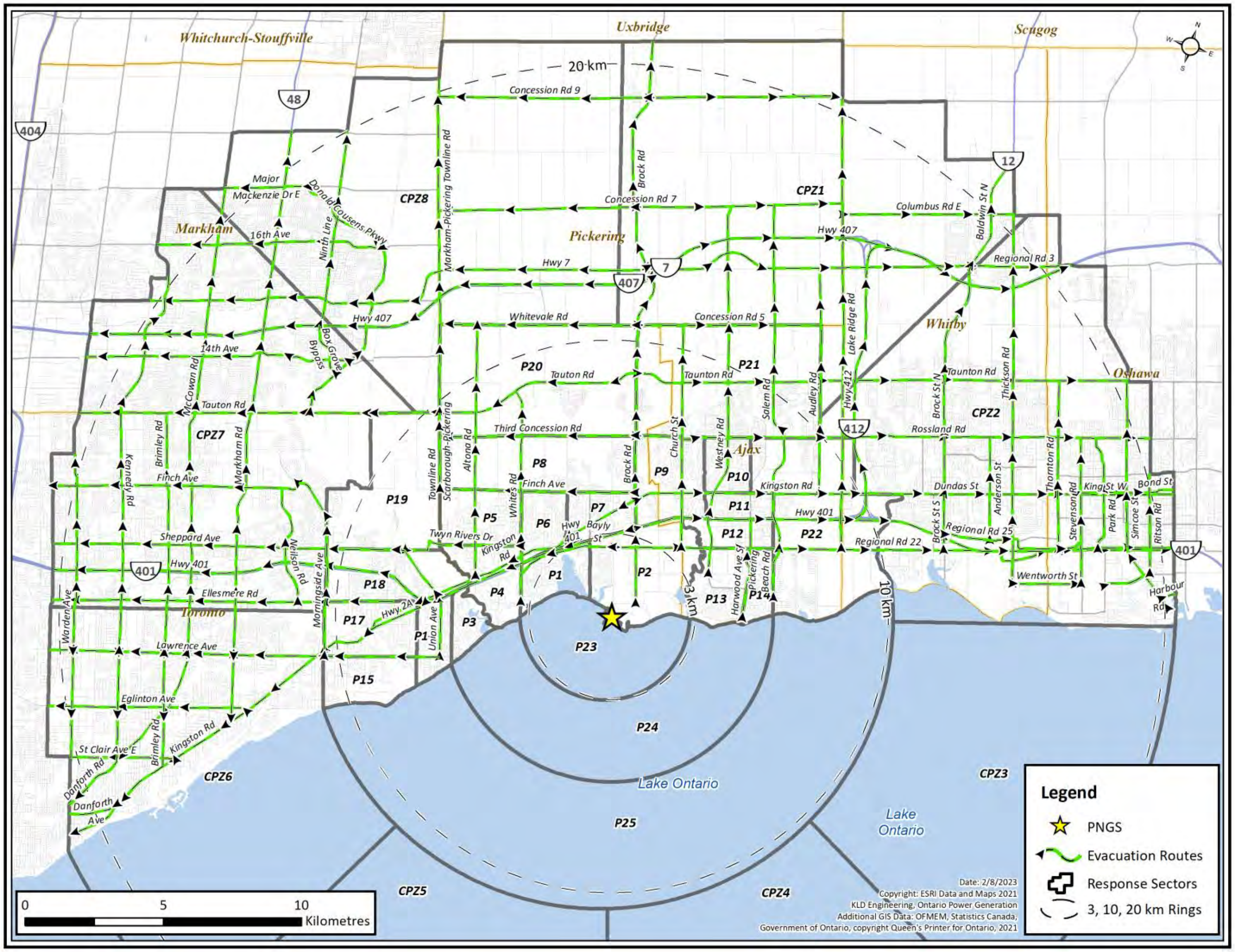


Figure 10-1. Major Evacuation Routes

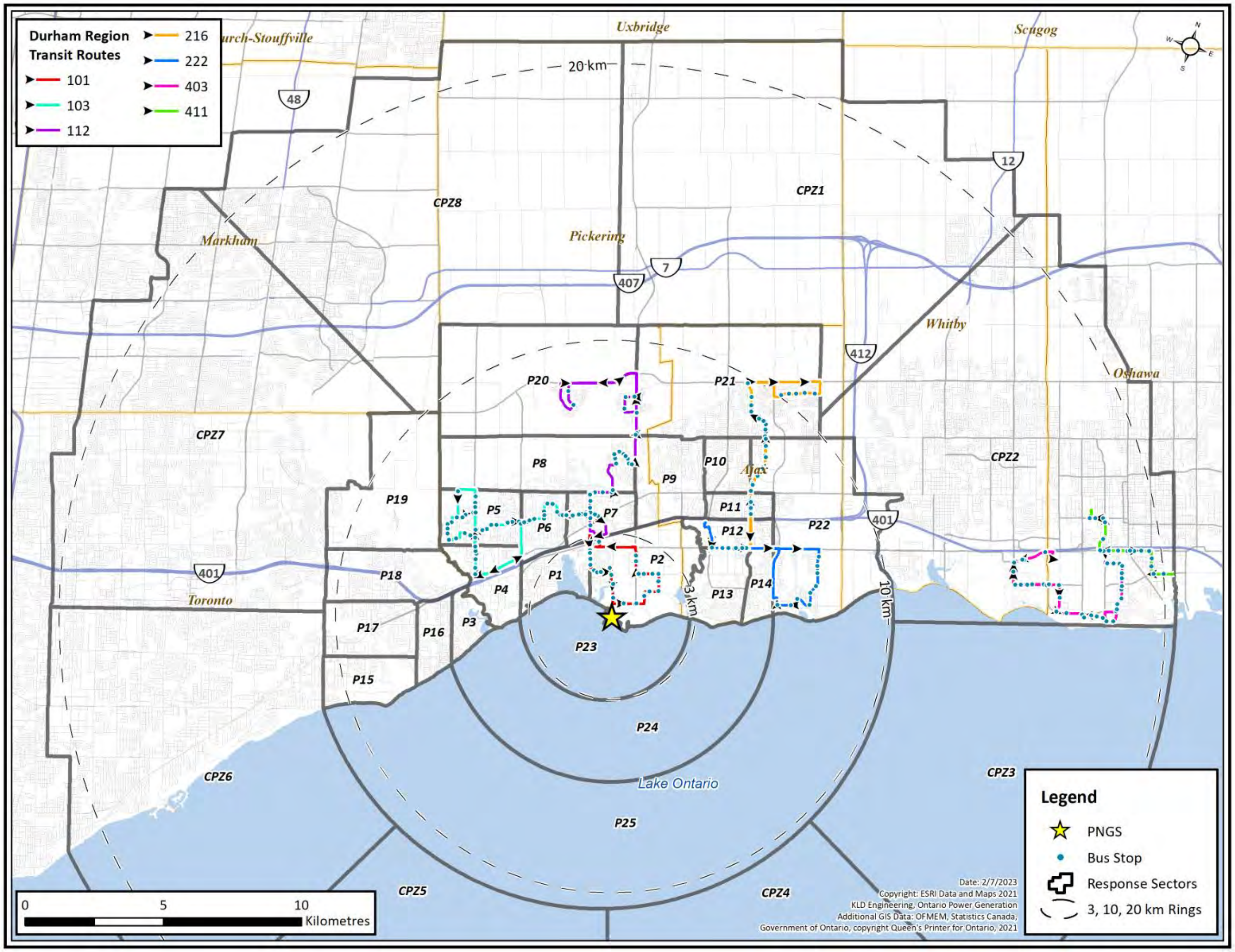


Figure 10-2. Durham Region Transit Transit-Dependent Routes (1 of 3)

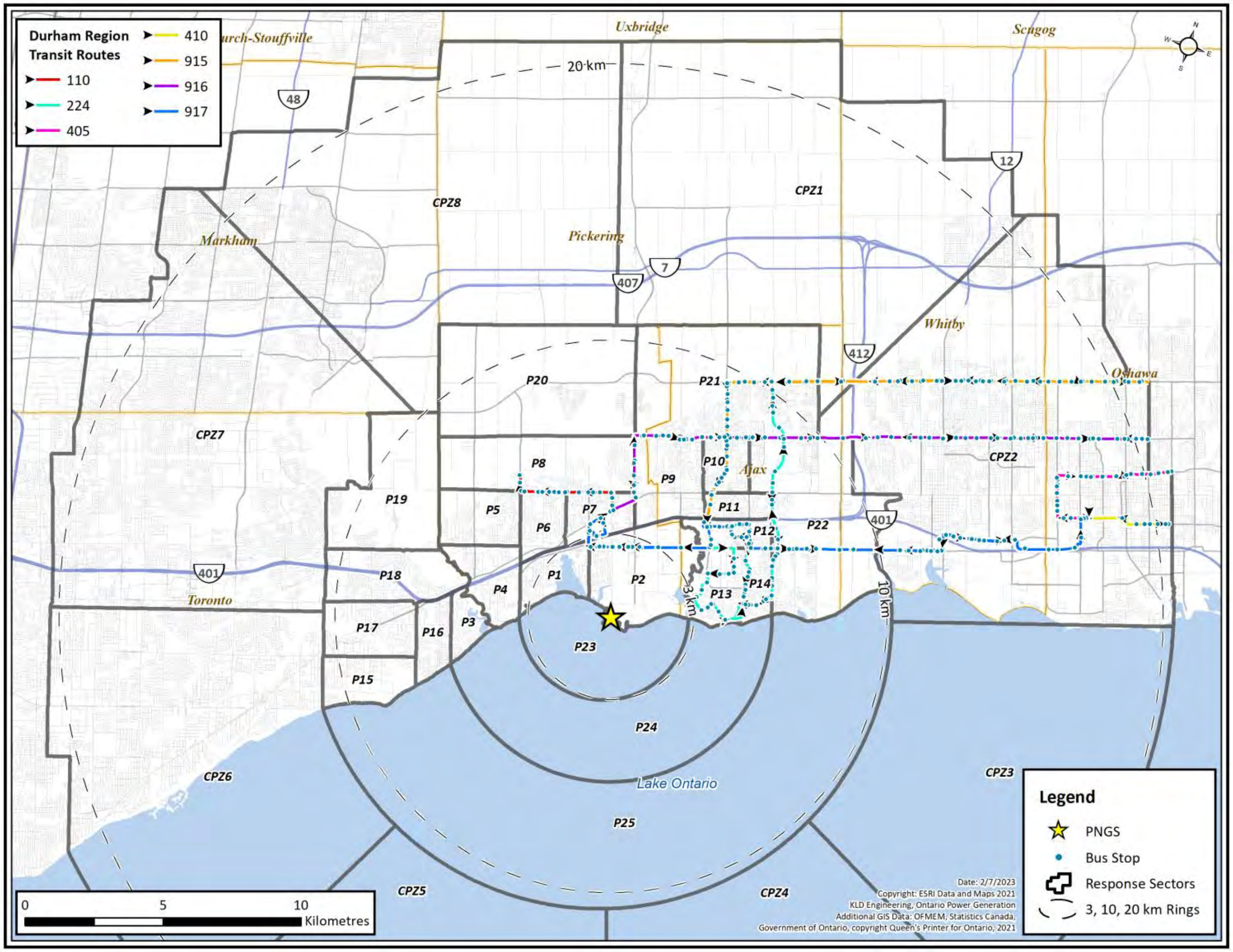


Figure 10-3. Durham Region Transit Transit-Dependent Routes (2 of 3)

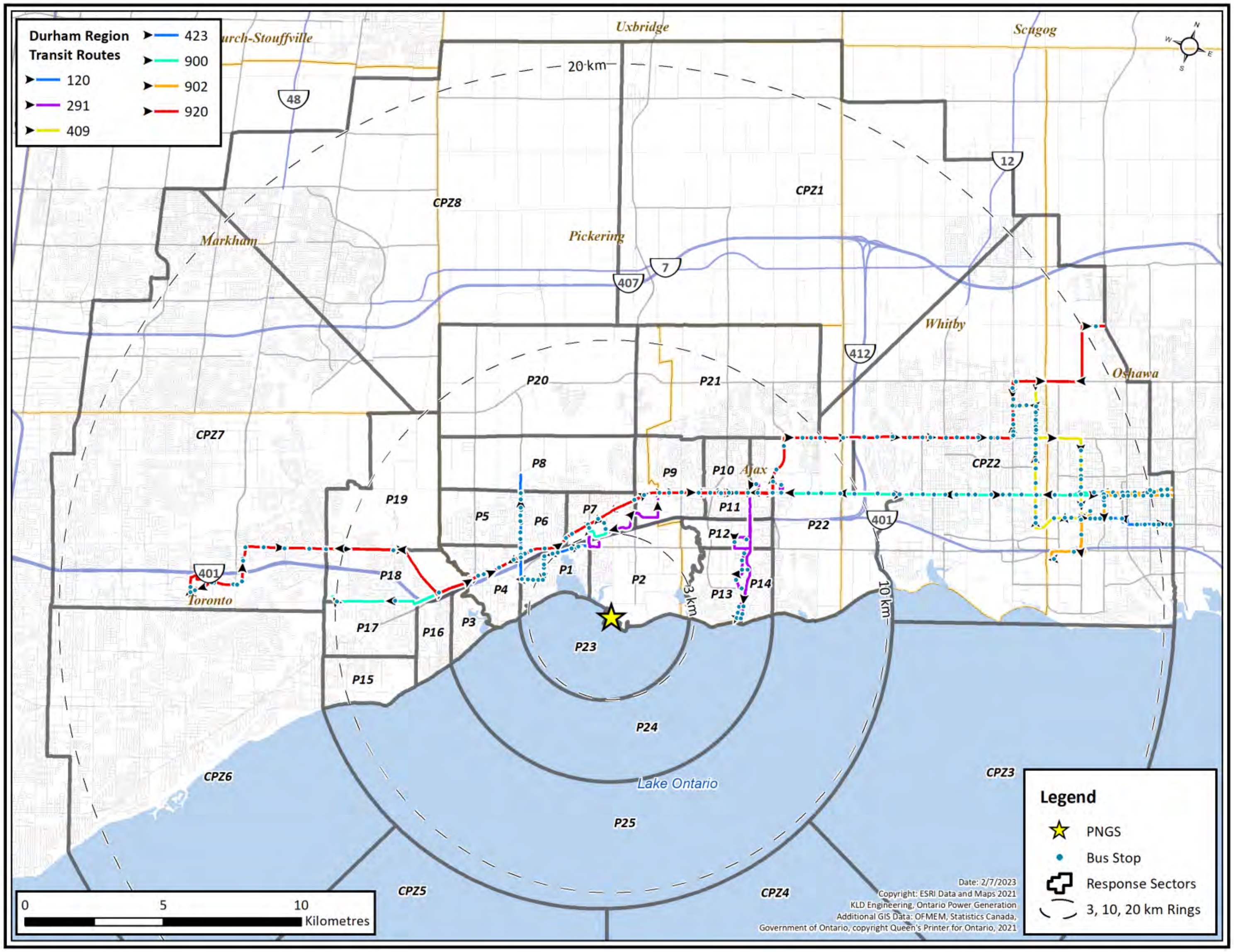


Figure 10-4. Durham Region Transit Transit-Dependent Routes (3 of 3)

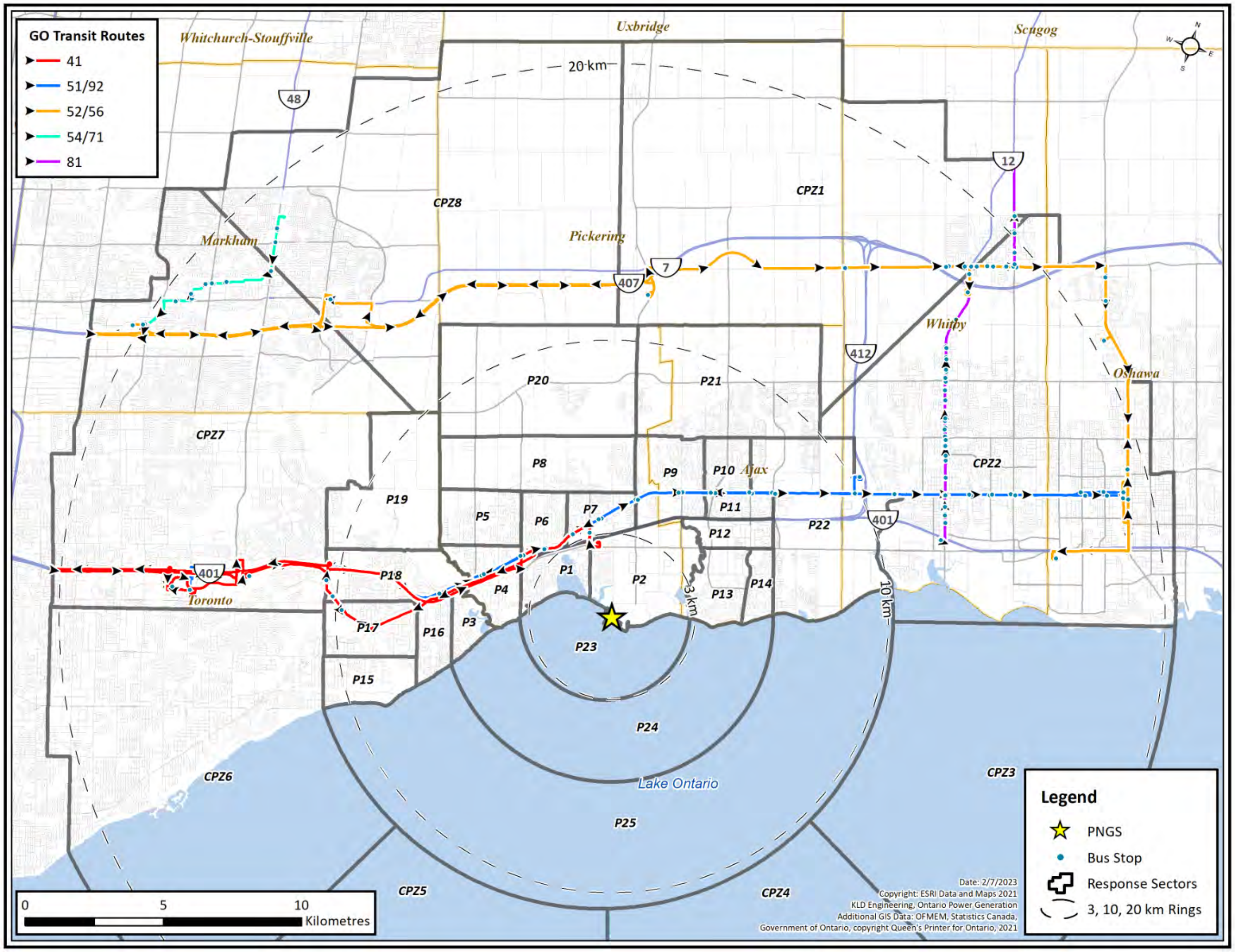


Figure 10-5. GO Transit Transit-Dependent Routes

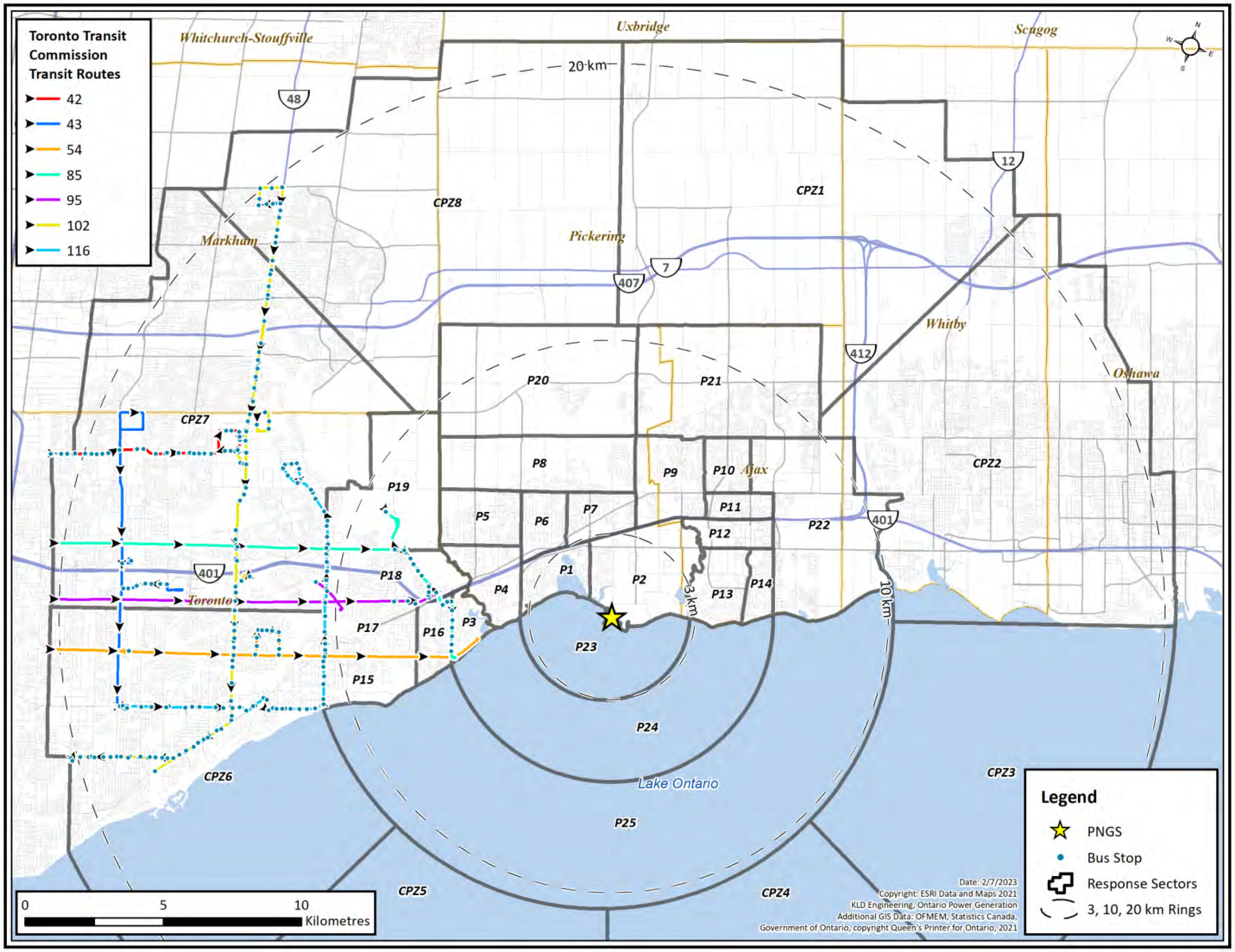


Figure 10-6. Toronto Transit Commission Transit-Dependent Routes (1 of 3)

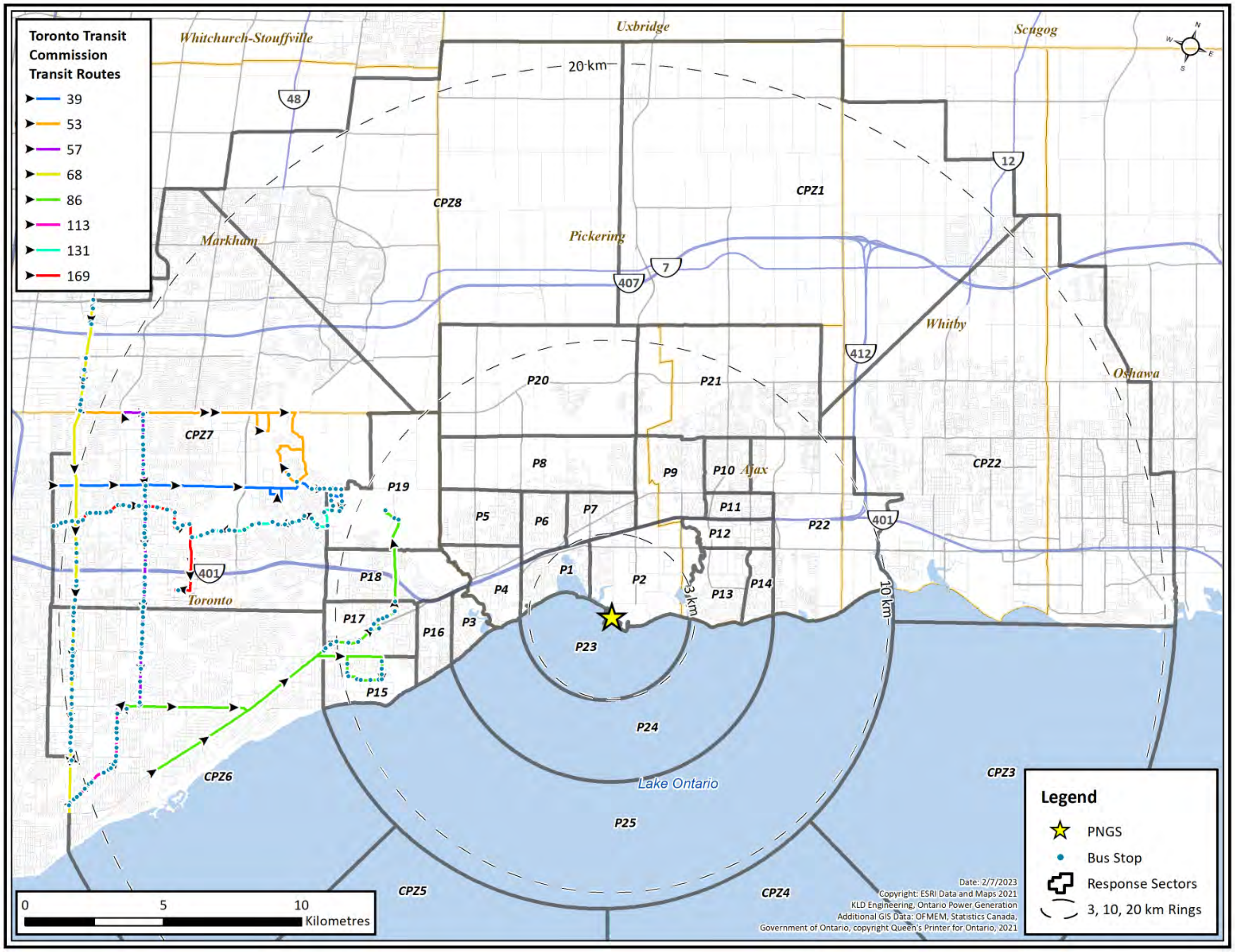


Figure 10-7. Toronto Transit Commission Transit-Dependent Routes (2 of 3)

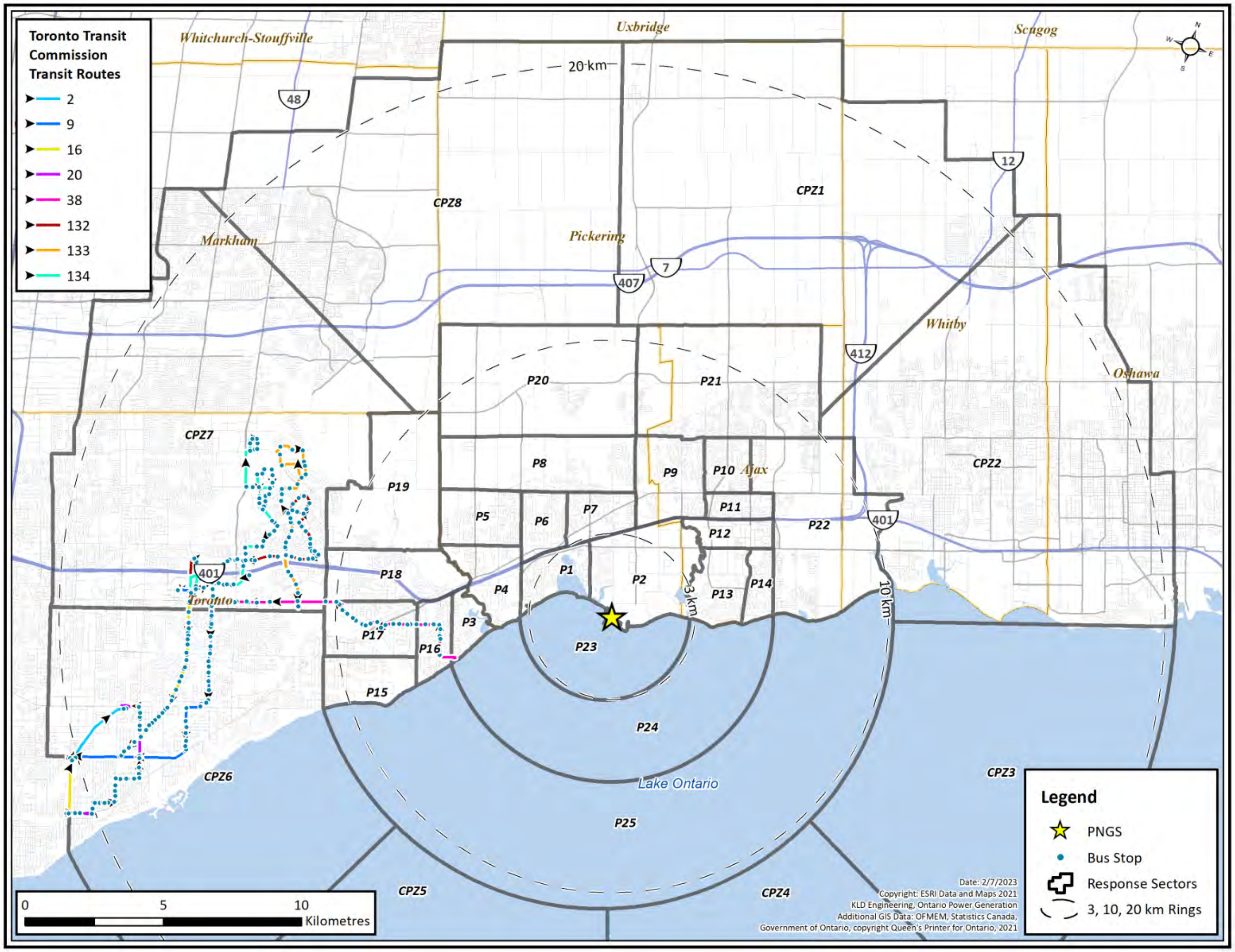


Figure 10-8. Toronto Transit Commission Transit-Dependent Routes (3 of 3)

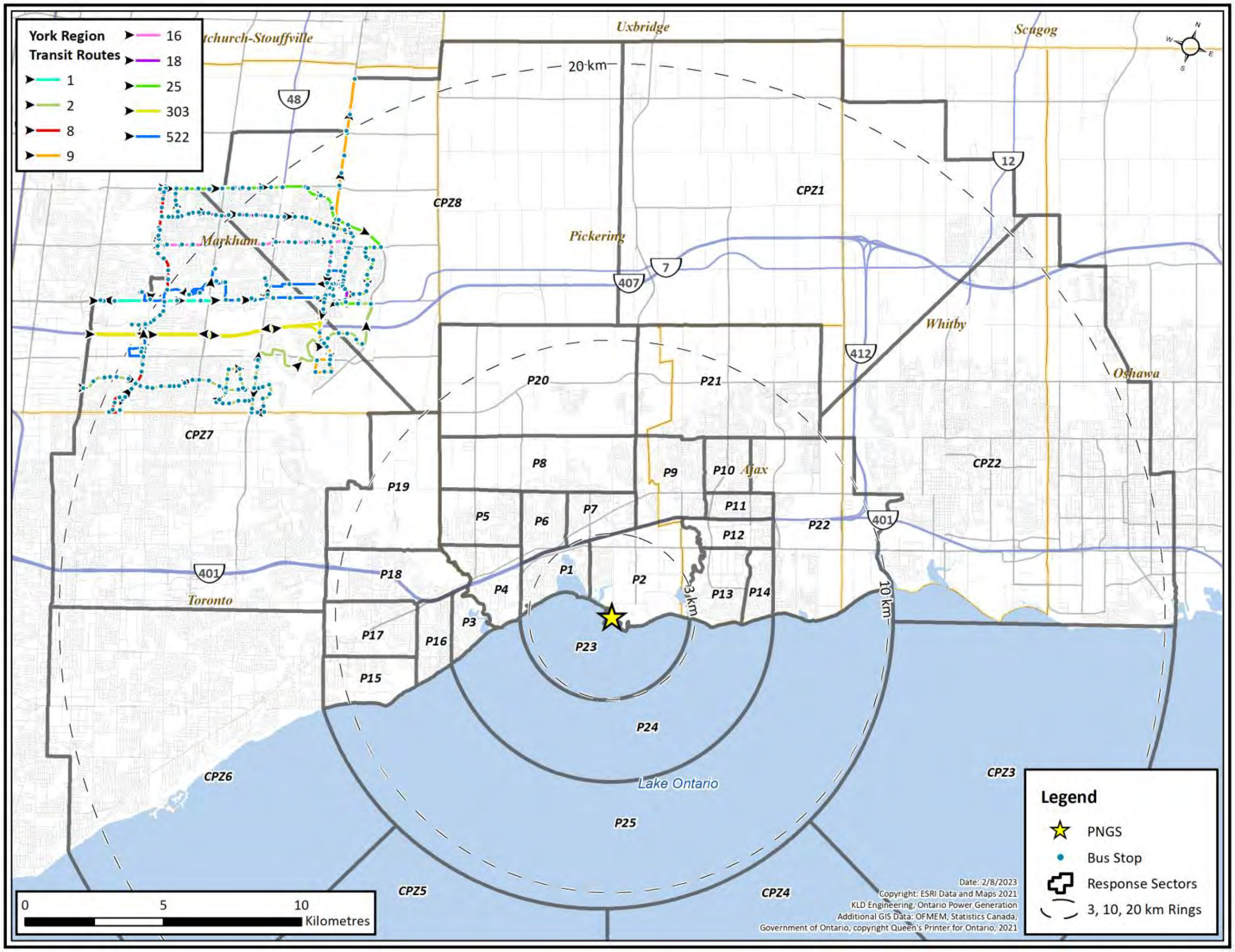


Figure 10-9. York Region Transit Transit-Dependent Routes (1 of 2)

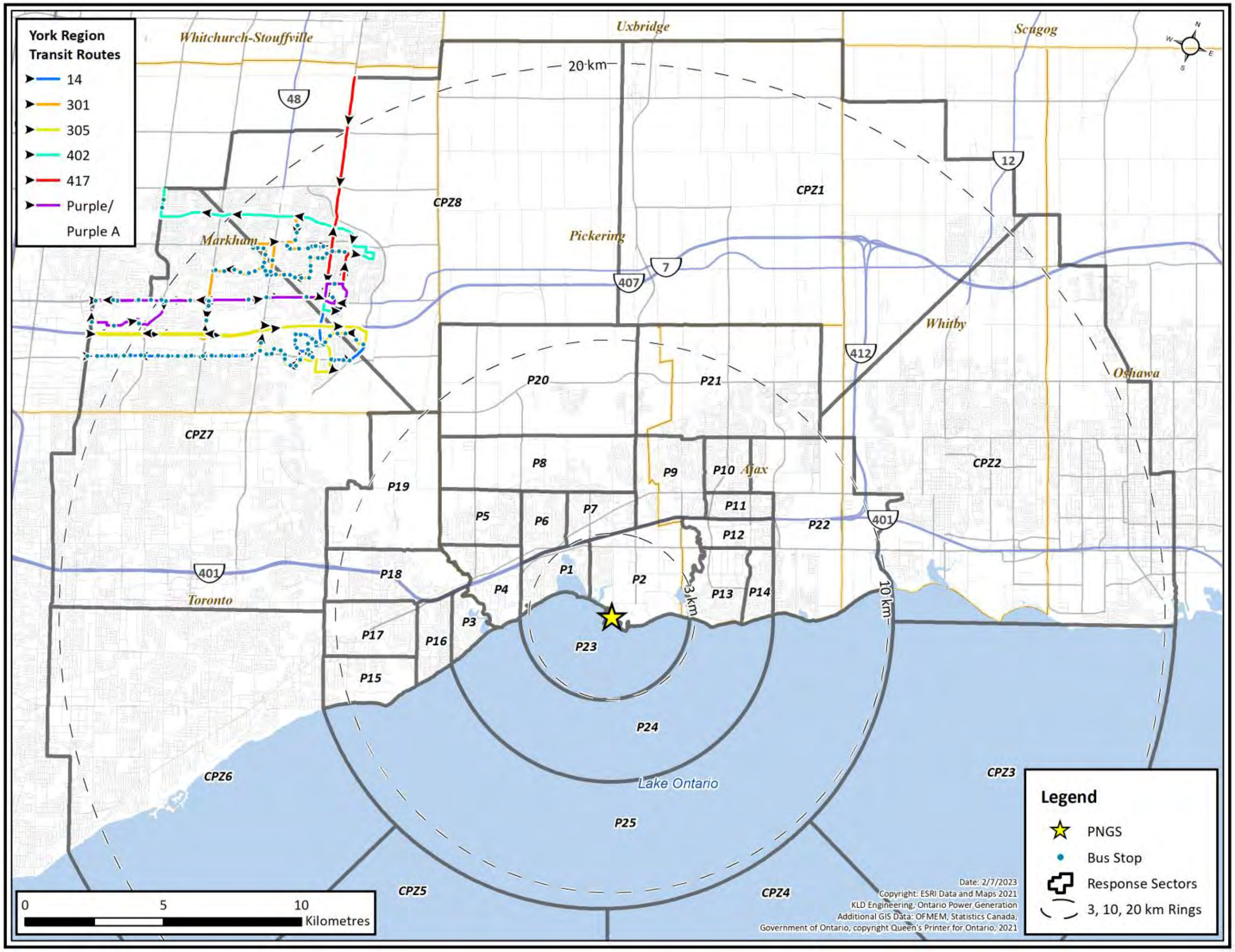


Figure 10-10. York Region Transit Transit-Dependent Routes (2 of 2)

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 α, β, and, γ 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
  β = 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.

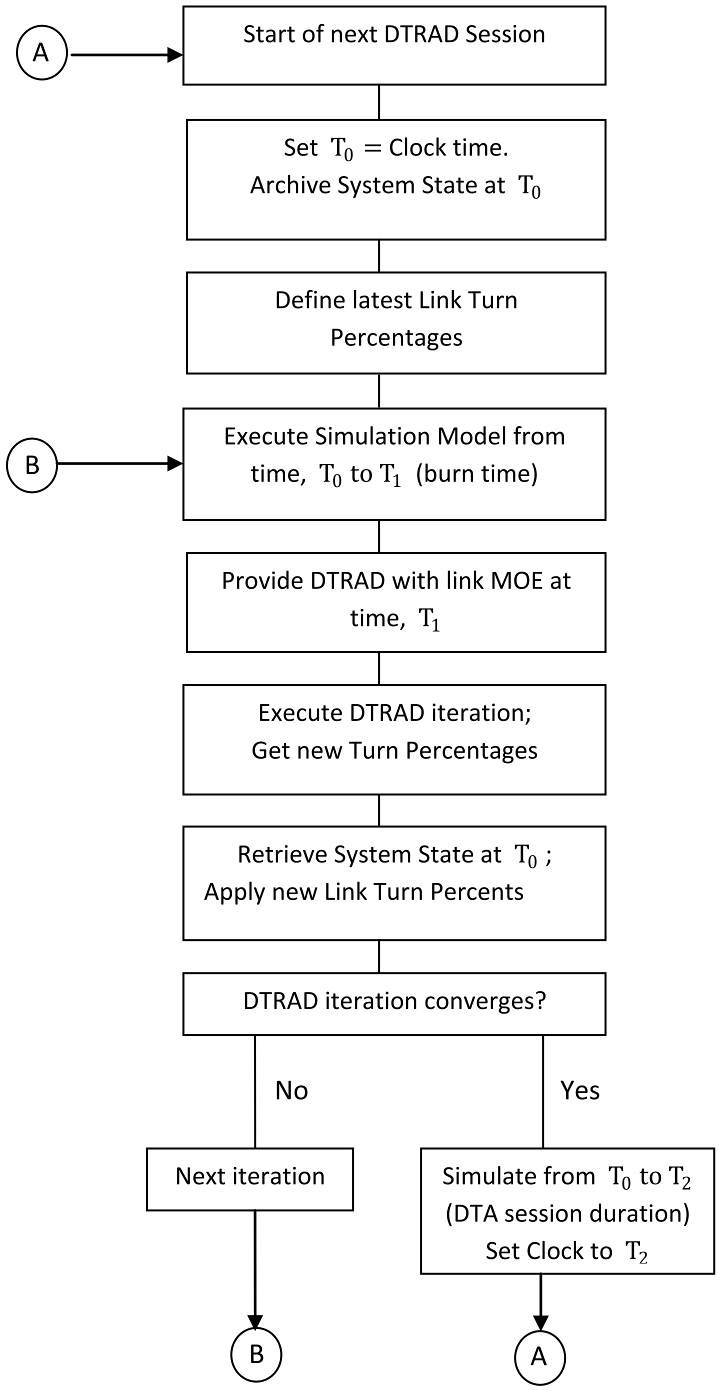


Figure B-1. Flow Diagram of Simulation-DTRAD Interface

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, $k_f \leq k \leq k_c = 45$ vpm, the density at capacity. In the flow-density plane, a quadratic relationship is prescribed in the range, $k_c < k \leq k_s = 95$ 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 $0 \leq \bar{k} \leq \bar{k}_s = 50$. It can be shown that $Q = \left(0.98 - 0.0056\,\bar{k}\right) RQ_{max}$ for $\bar{k}_s \leq \bar{k} \leq \bar{k}_j$, 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 $k \leq 130$ using the analytical representations of the fundamental diagram.
   Calculate $\text{Cap} = \frac{Q_{max}(TI)}{3600}\left({}^{G}/_{C}\right) LN$, in vehicles, this value may be reduced due to metering
   Set $R = 1.0$ if ${}^{G}/_{C} < 1$ or if $k \leq k_c$; 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 $t_1 \prec 0$, 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 $Q_b \geq \text{Cap}$, then
   $O_Q = \text{Cap}, O_M = O_E = 0$
   If $t_1 > 0$, then
   $Q'_e = Q_b + M_b + E_1 - \text{Cap}$
   Else
   $Q'_e = Q_b - \text{Cap}$
   End if
   Calculate Q_e and M_e using Algorithm A (below)

6. Else $(Q_b \prec \text{Cap})$
   $O_Q = Q_b$, $\text{RCap} = \text{Cap} - O_Q$

7. If $M_b \leq \text{RCap}$, then

8. If $t_1 > 0$, $O_M = M_b, O_E = \min\left(\text{RCap} - M_b, \frac{t_1 \text{Cap}}{TI}\right) \geq 0$
   $Q'_e = E_1 - O_E$
   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

$O_M = RCap\ ,\ Q'_e = M_b - O_M + E_1$

Calculate Q_e and M_e using Algorithm A

10. Else $(t_1 = 0)$

$M_d = \left\lfloor \left(\frac{v(TI)-L_b}{L-L_b}\right) M_b \right\rfloor$

If $M_d > RCap$, *then*

$O_M = RCap$

$Q'_e = M_d - O_M$

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 <u>moving</u> vehicles.

If $\left|\bar{k}_n - \bar{k}_{n-1}\right| > \epsilon$ and $n < N$

where $N =$ max number of iterations, and ϵ 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.

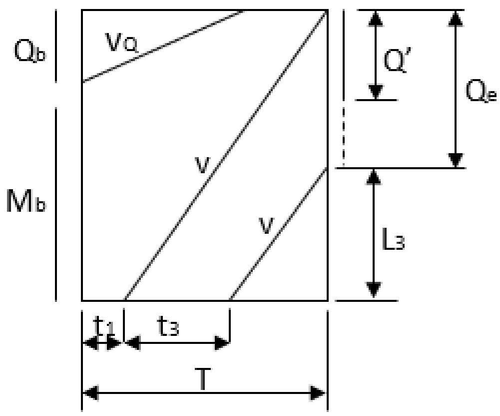
13. If $Q_e + M_e > \frac{(L-W)\ LN}{L_v}$, then

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, $Q_b \leq \text{Cap}$, 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, $Q'_e = Q_b + M_b + E_1 - \text{Cap}$ 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 $Q_b \leq \text{Cap}$:

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, $\mathrm{LN_x}$, 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: $\mathrm{Q_e}$ and $\mathrm{M_e}$. 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 <u>moving</u> 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.

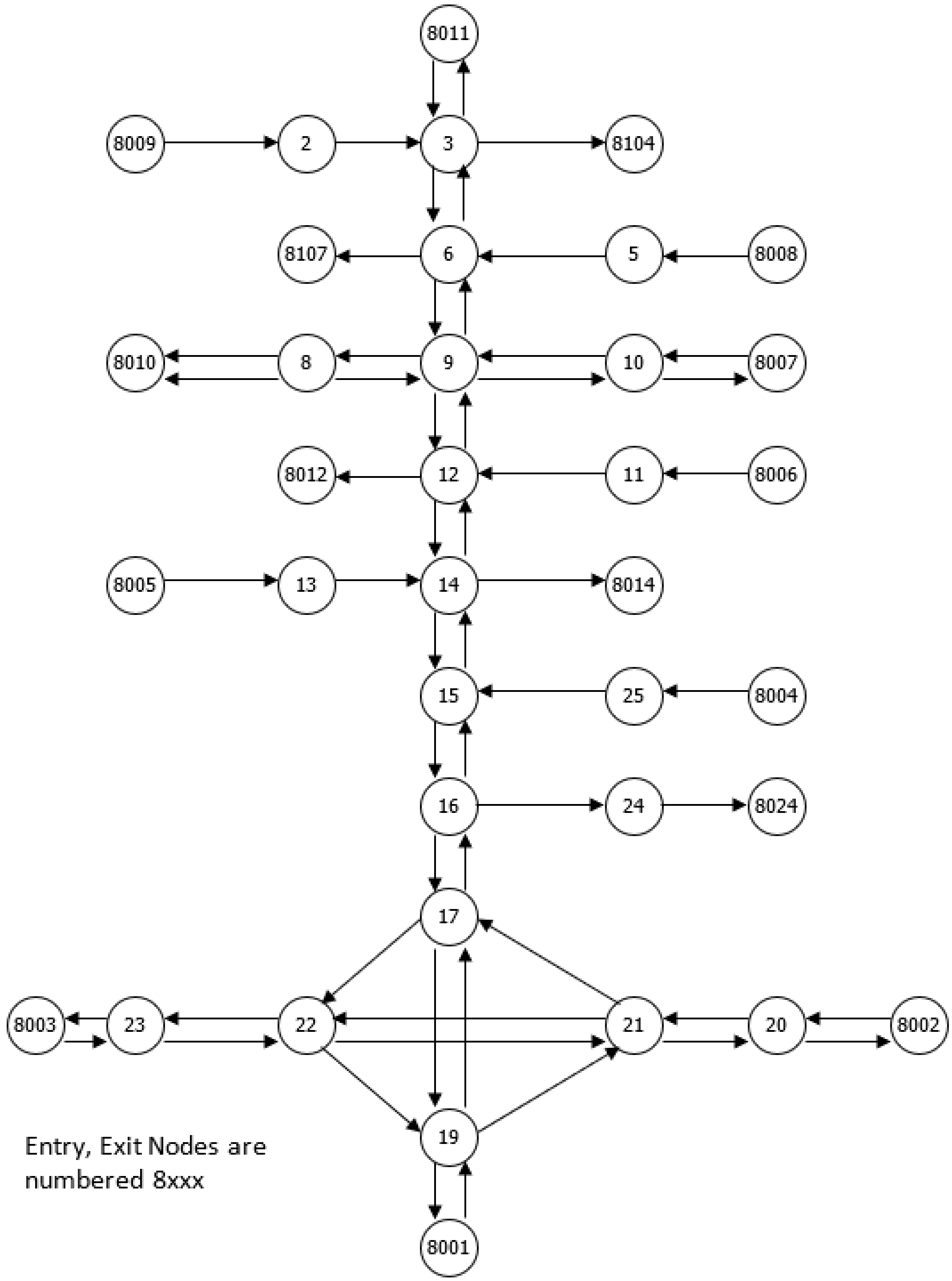


Figure C-1. Representative Analysis Network

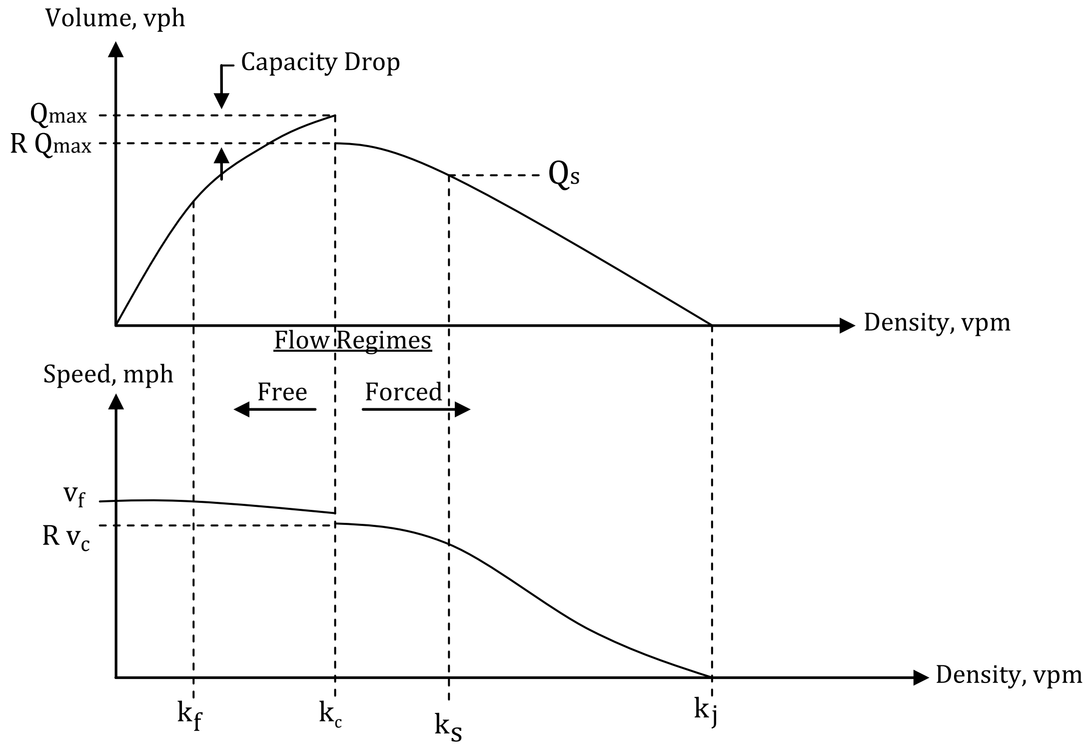


Figure C-2. Fundamental Diagrams

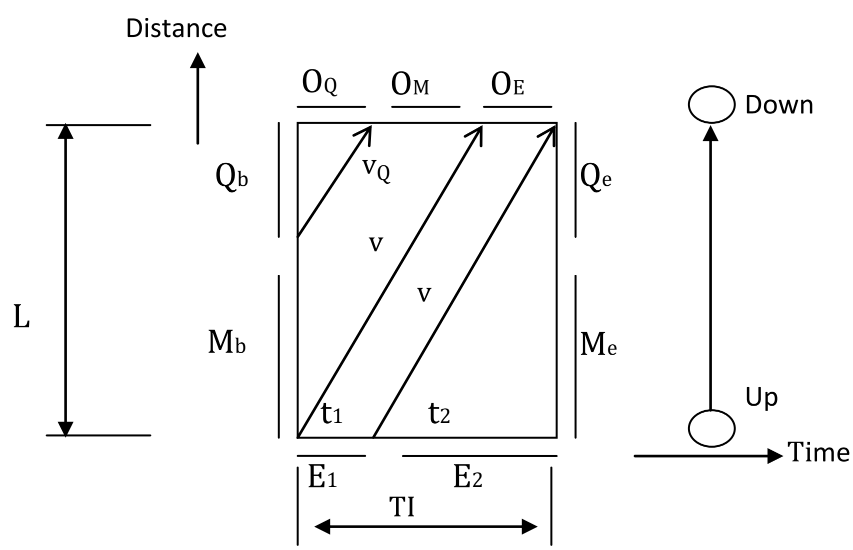


Figure C-3. A UNIT Problem Configuration with $t_1 > 0$

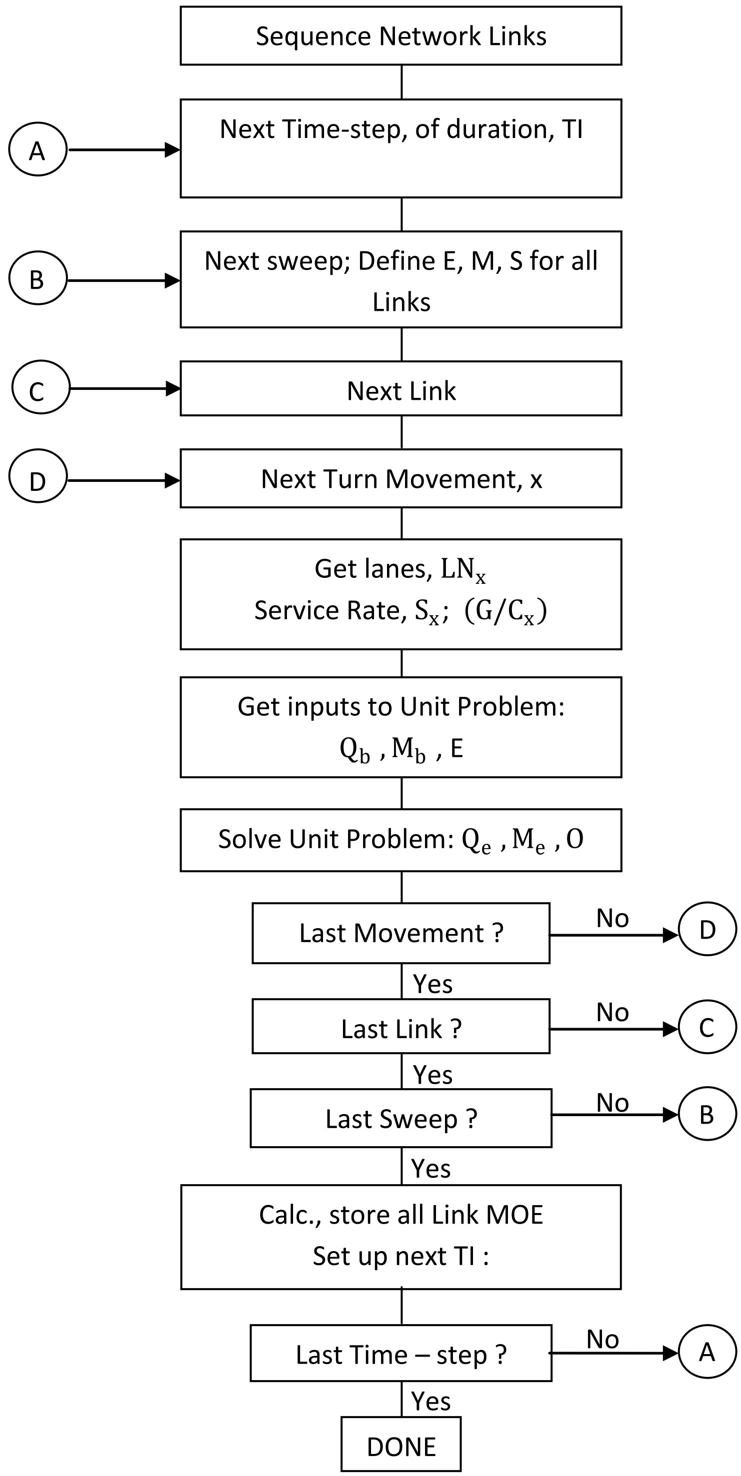


Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)

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.

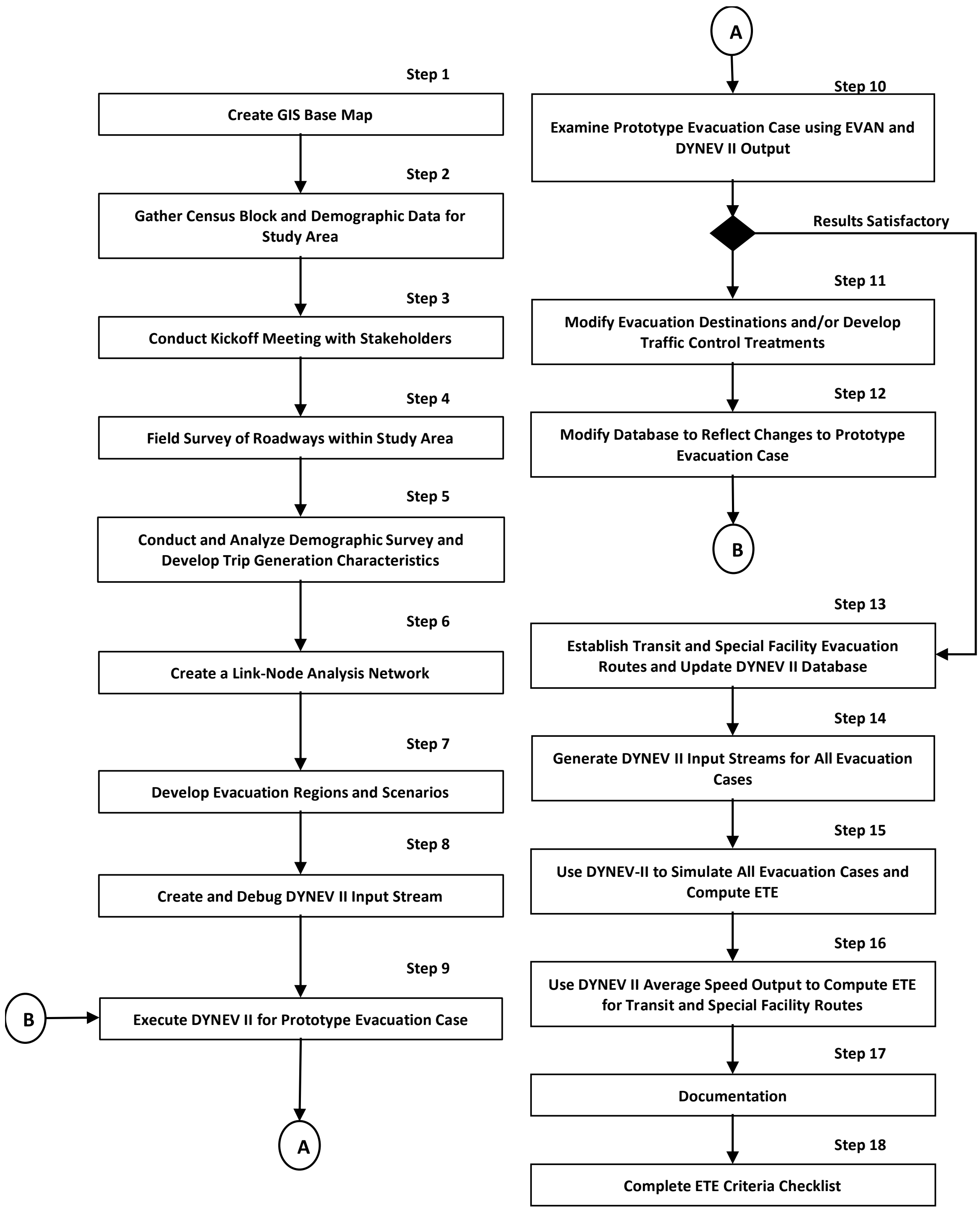


Figure D-1. Flow Diagram of Activities

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	Éèc 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**

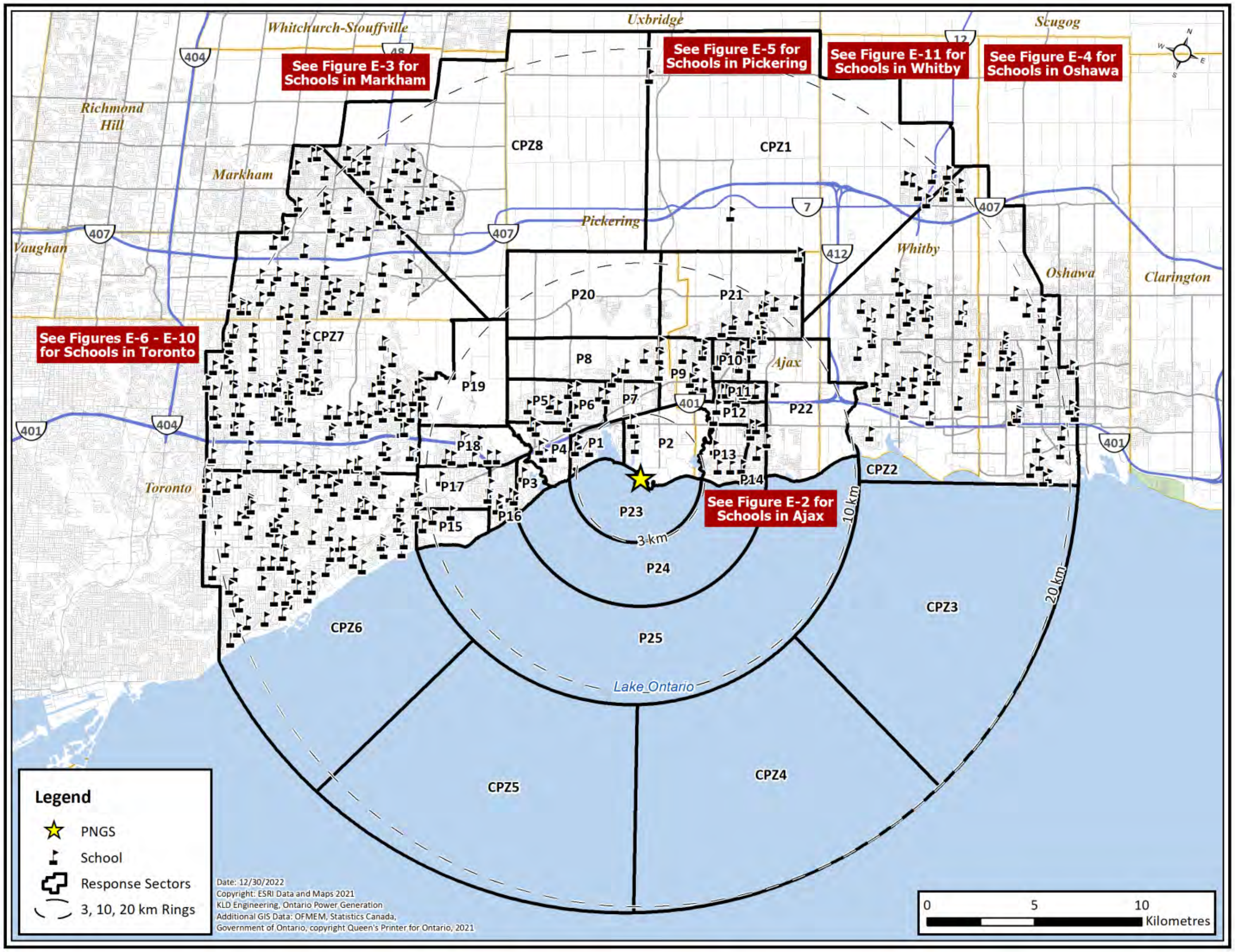
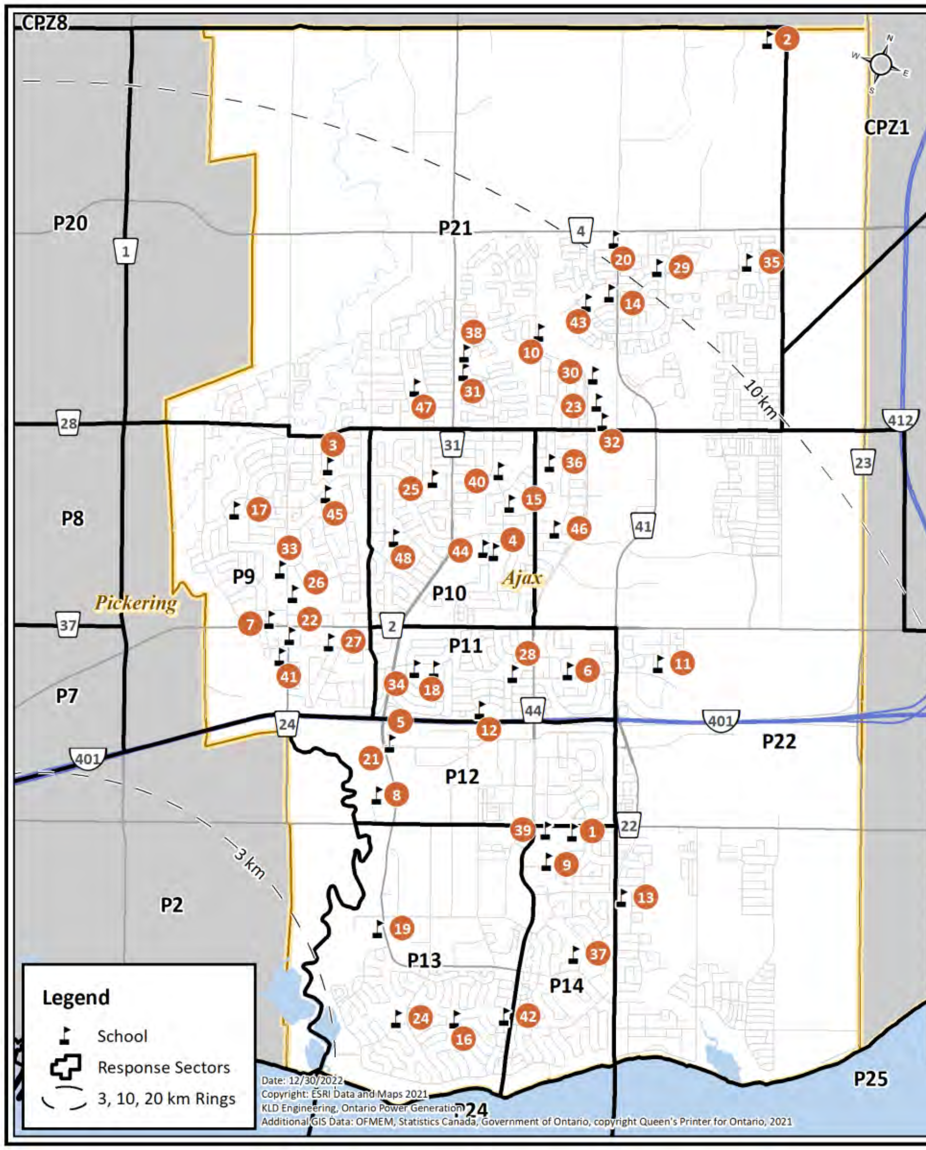


Figure E-1. Schools within the PNGS PZ – Overview



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
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

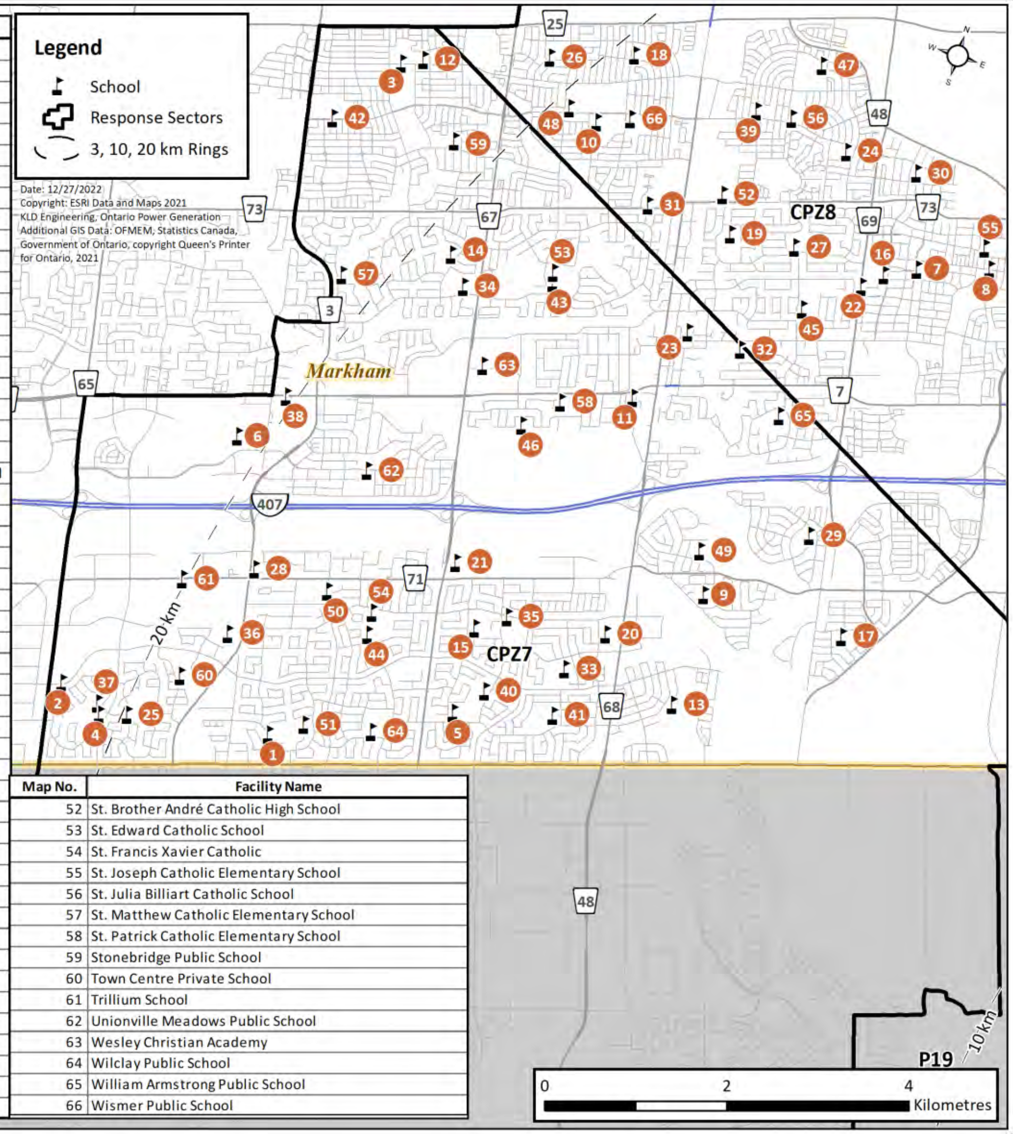


Figure E-3. Schools within the Markham Portion of the PNGS PZ

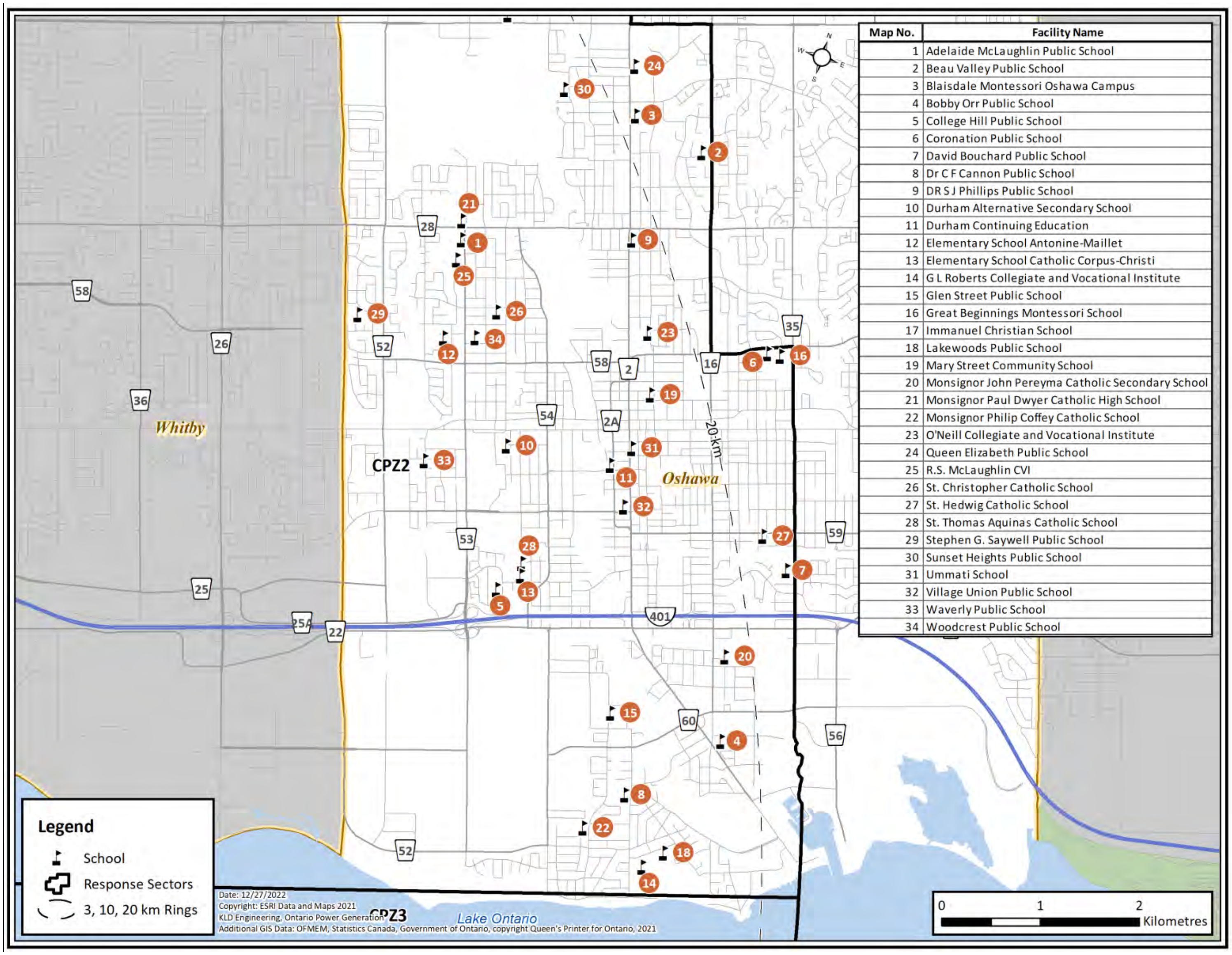


Figure E-4. Schools within the Oshawa Portion of the PNGS PZ

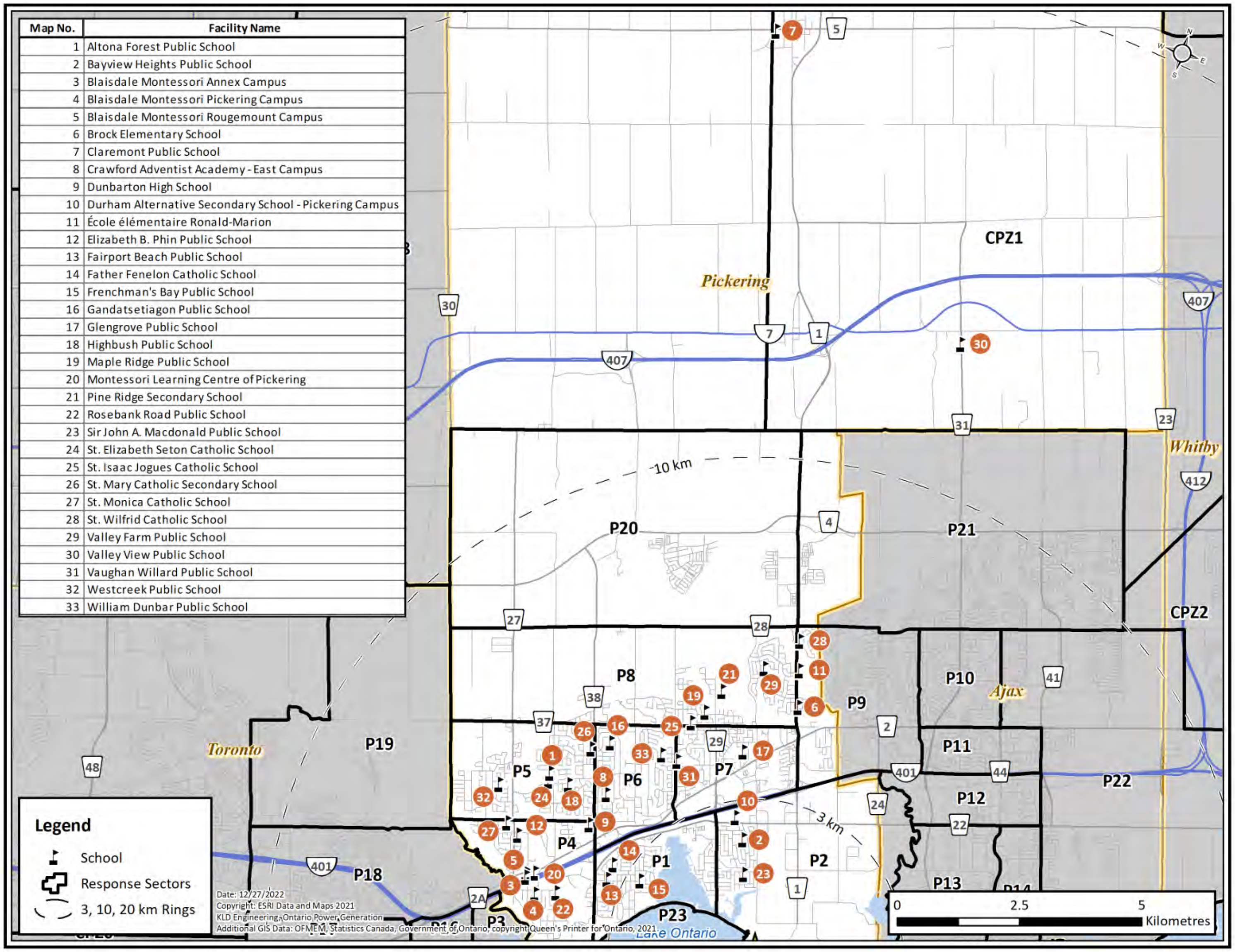
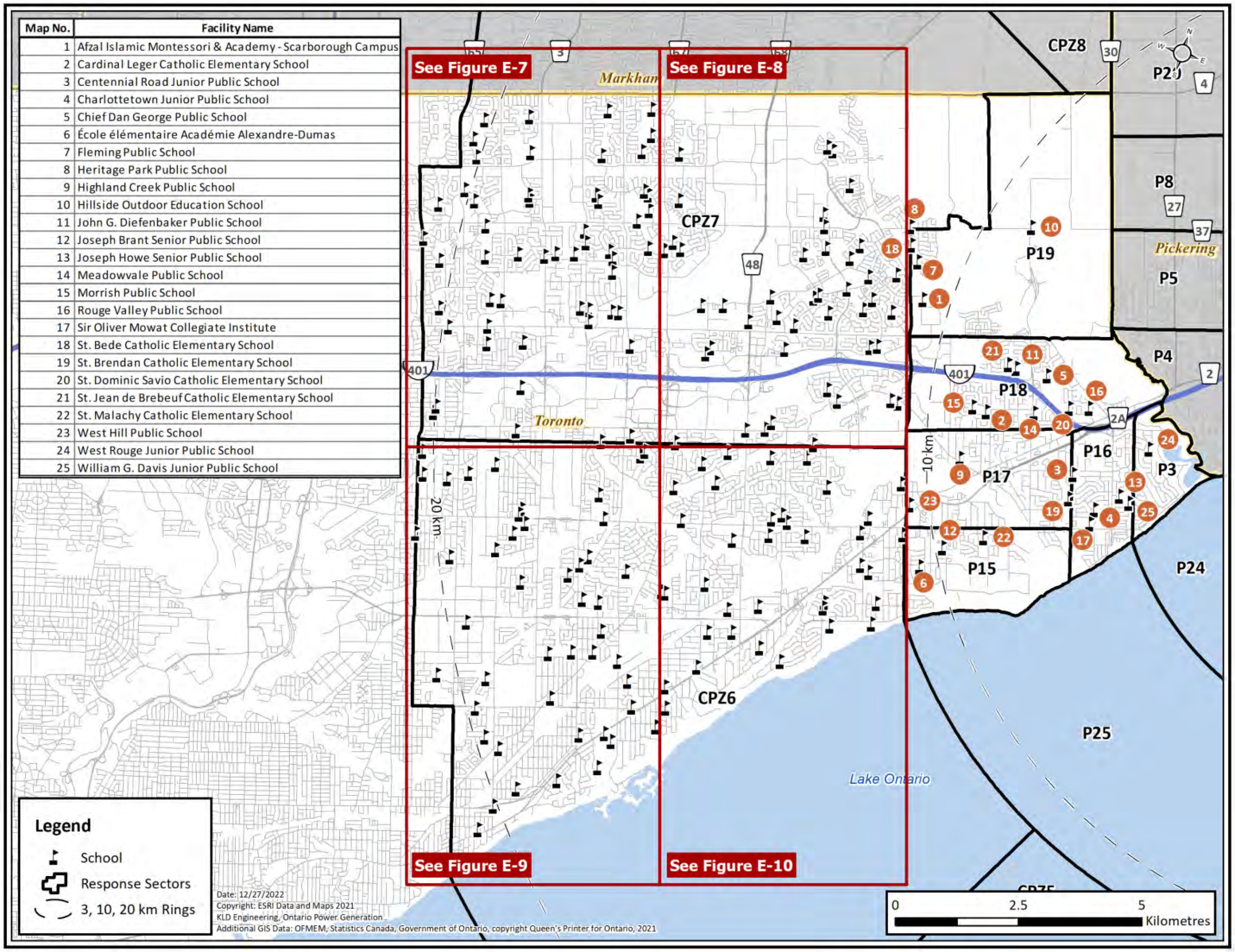


Figure E-5. Schools within the Pickering Portion of the PNGS PZ



Map No.	Facility Name
1	Afzal Islamic Montessori & Academy - Scarborough Campus
2	Cardinal Leger Catholic Elementary School
3	Centennial Road Junior Public School
4	Charlottetown Junior Public School
5	Chief Dan George Public School
6	École élémentaire Académie Alexandre-Dumas
7	Fleming Public School
8	Heritage Park Public School
9	Highland Creek Public School
10	Hillside Outdoor Education School
11	John G. Diefenbaker Public School
12	Joseph Brant Senior Public School
13	Joseph Howe Senior Public School
14	Meadowvale Public School
15	Morrish Public School
16	Rouge Valley Public School
17	Sir Oliver Mowat Collegiate Institute
18	St. Bede Catholic Elementary School
19	St. Brendan Catholic Elementary School
20	St. Dominic Savio Catholic Elementary School
21	St. Jean de Brebeuf Catholic Elementary School
22	St. Malachy Catholic Elementary School
23	West Hill Public School
24	West Rouge Junior Public School
25	William G. Davis Junior Public School

Figure E-6. Schools within the Toronto Portion of the PNGS PZ (1 of 5)

Map No.	Facility Name
1	Agincourt Collegiate Institute
2	Agincourt Junior Public School
3	Agincourt Montessori School
4	Agnes Macphail Public School
5	Albert Campbell Collegiate Institute
6	Alexmuir Junior Public School
7	Banting & Best Public School
8	Beverly Glen Junior Public School
9	Bridlewood Junior Public School
10	Brimwood Boulevard Junior Public School
11	Brookmill Boulevard Junior Public School
12	C D Farquharson Junior Public School
13	Chartland Junior Public School
14	David Lewis Public School
15	Delphi Secondary Alternative School
16	Dr. Norman Bethune Collegiate Institute
17	Edgewood Public School
18	Ellesmere-Statton Public School
19	Francis Libermann Catholic High School
20	Glamorgan Junior Public School
21	Henry Kelsey Senior Public School
22	Highland Heights Junior Public School
23	Holy Spirit Catholic Elementary School
24	Inglewood Heights Junior Public School
25	Iroquois Junior Public School
26	Kennedy Public School
27	L'Amoreaux Collegiate Institute
28	Laure Riese Elementary School
29	Lynngate Junior Public School
30	Lynnwood Heights Junior Public School
31	Marilake Academy
32	Mary Ward Catholic Secondary School
33	Mary Ward LINC & ESL Centre
34	Milliken Public School
35	Msgr Fraser College - Midland Campus
36	New Oriental Technology Education Group
37	North Agincourt Junior Public School
38	North Bridlewood Junior Public School
39	Our Lady of Grace Catholic School
40	Our Lady of Wisdom Catholic School
41	Pauline Johnson Junior Public School
42	Port Royal Public School
43	Silver Springs Public School
44	Sir Alexander Mackenzie Senior Public School
45	Sir William Osler High School
46	Smart Start Montessori School
47	St. Aidan Catholic School
48	St. Bartholomew Catholic School
49	St. Marguerite Bourgeoys Catholic School
50	St. Sylvester Catholic School
51	St. Victor Catholic School

Map No.	Facility Name
52	Stephen Leacock Collegiate Institute
53	Terraview-Willowfield Public School
54	Terry Fox Public School
55	Timberbank Junior Public School

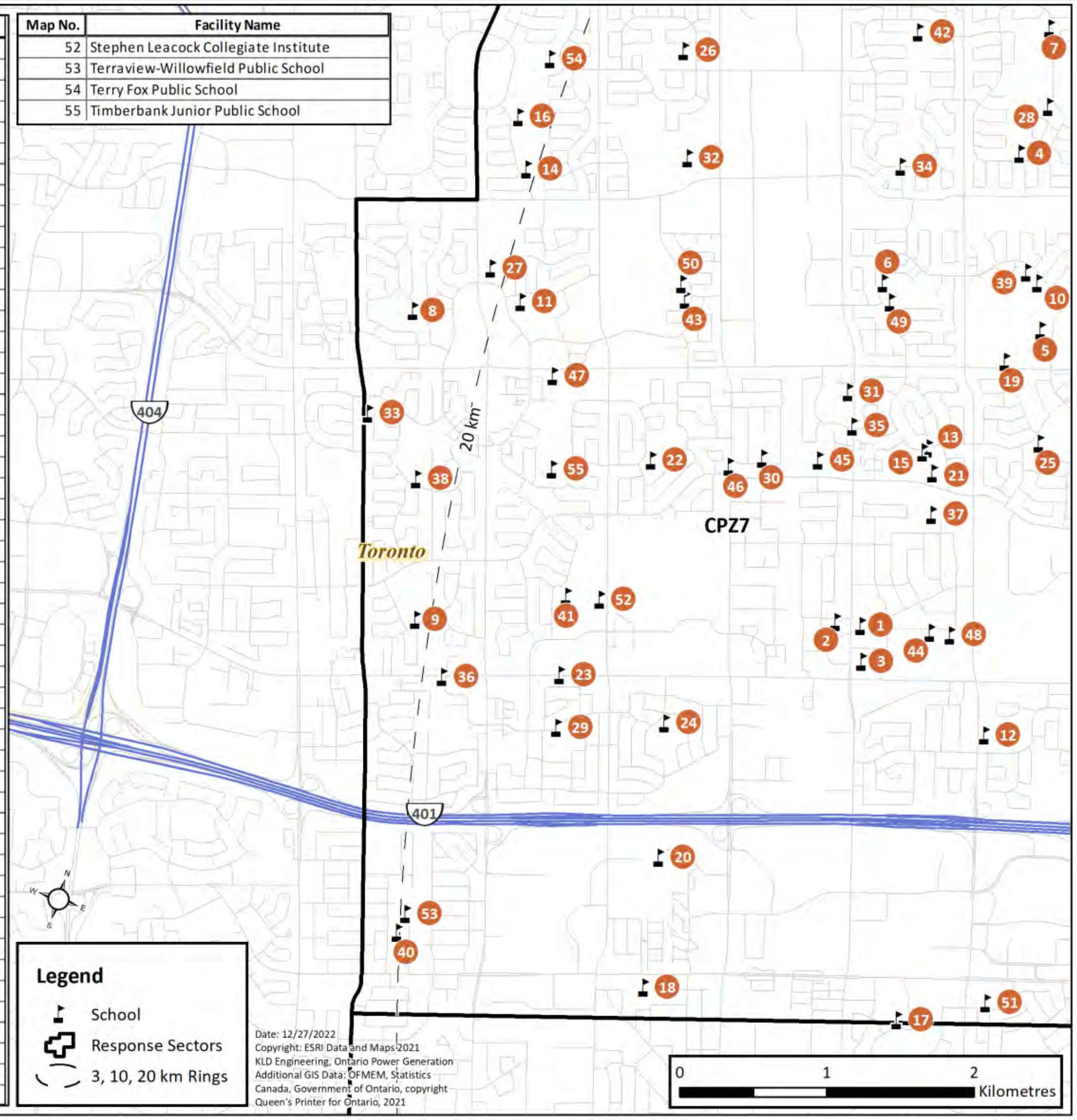
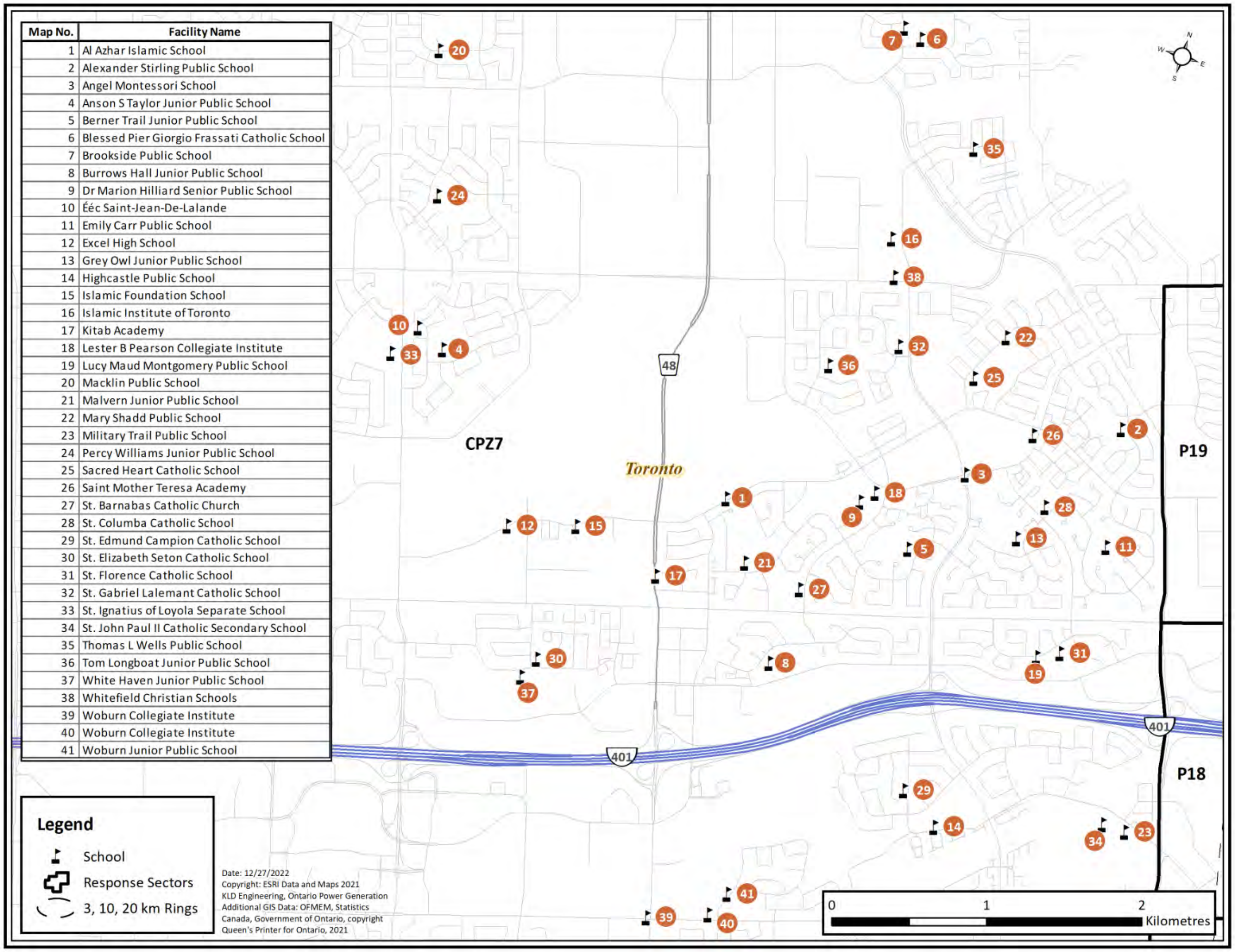
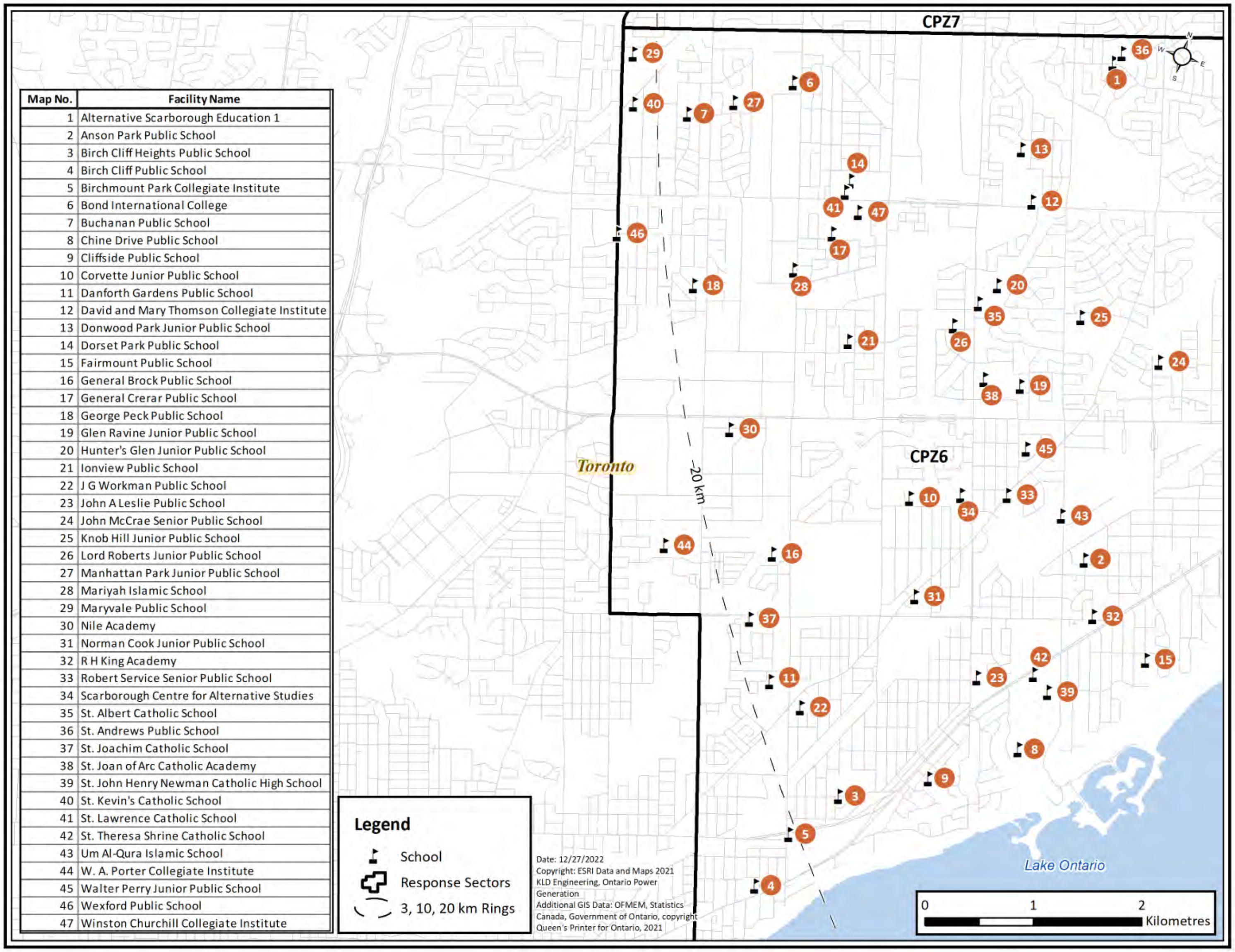


Figure E-7. Schools within the Toronto Portion of the PNGS PZ (2 of 5)



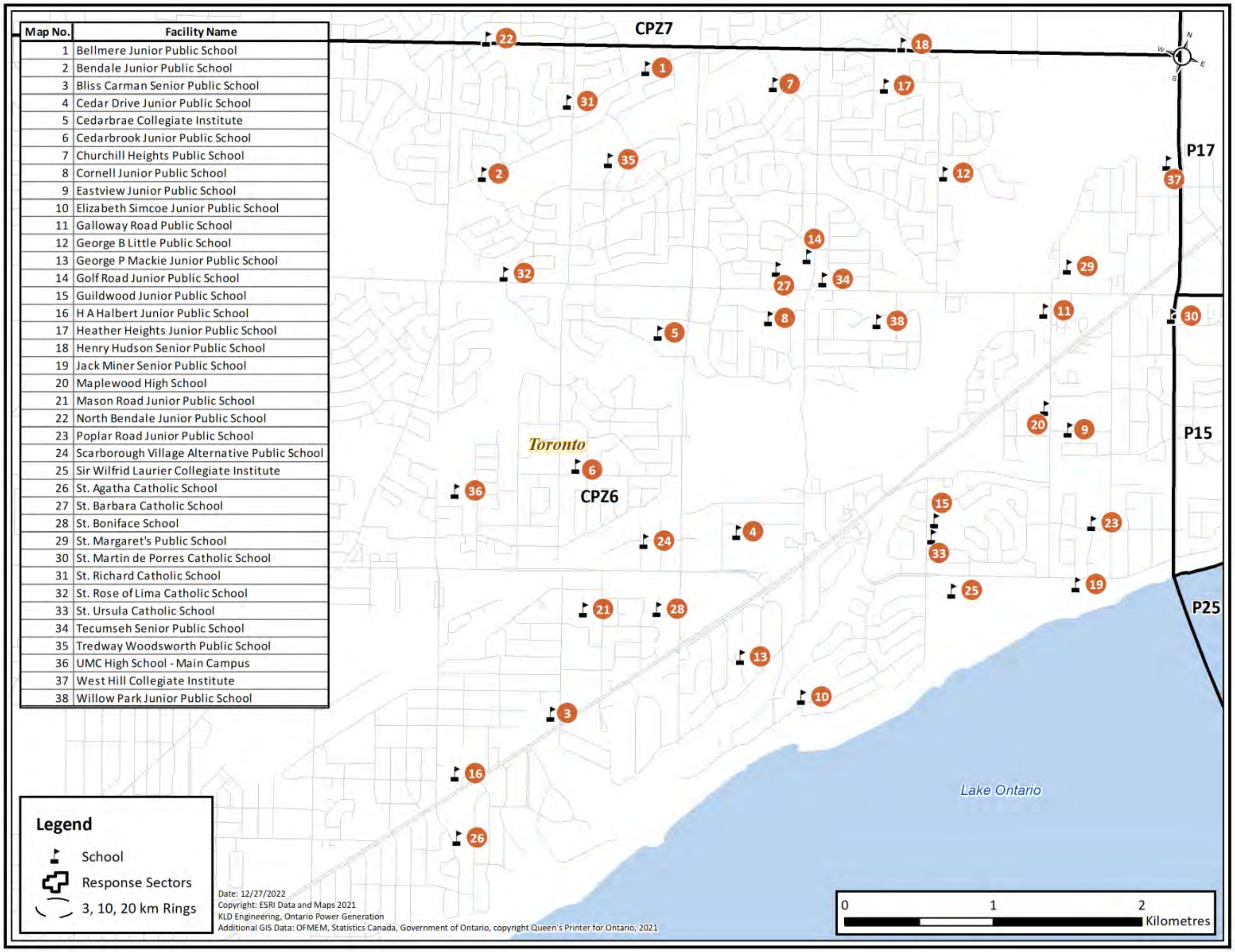
Map No.	Facility Name
1	Al Azhar Islamic School
2	Alexander Stirling Public School
3	Angel Montessori School
4	Anson S Taylor Junior Public School
5	Berner Trail Junior Public School
6	Blessed Pier Giorgio Frassati Catholic School
7	Brookside Public School
8	Burrows Hall Junior Public School
9	Dr Marion Hilliard Senior Public School
10	Éëc Saint-Jean-De-Lalande
11	Emily Carr Public School
12	Excel High School
13	Grey Owl Junior Public School
14	Highcastle Public School
15	Islamic Foundation School
16	Islamic Institute of Toronto
17	Kitab Academy
18	Lester B Pearson Collegiate Institute
19	Lucy Maud Montgomery Public School
20	Macklin Public School
21	Malvern Junior Public School
22	Mary Shadd Public School
23	Military Trail Public School
24	Percy Williams Junior Public School
25	Sacred Heart Catholic School
26	Saint Mother Teresa Academy
27	St. Barnabas Catholic Church
28	St. Columba Catholic School
29	St. Edmund Campion Catholic School
30	St. Elizabeth Seton Catholic School
31	St. Florence Catholic School
32	St. Gabriel Lalemant Catholic School
33	St. Ignatius of Loyola Separate School
34	St. John Paul II Catholic Secondary School
35	Thomas L Wells Public School
36	Tom Longboat Junior Public School
37	White Haven Junior Public School
38	Whitefield Christian Schools
39	Woburn Collegiate Institute
40	Woburn Collegiate Institute
41	Woburn Junior Public School

Figure E-8. Schools within the Toronto Portion of the PNGS PZ (3 of 5)



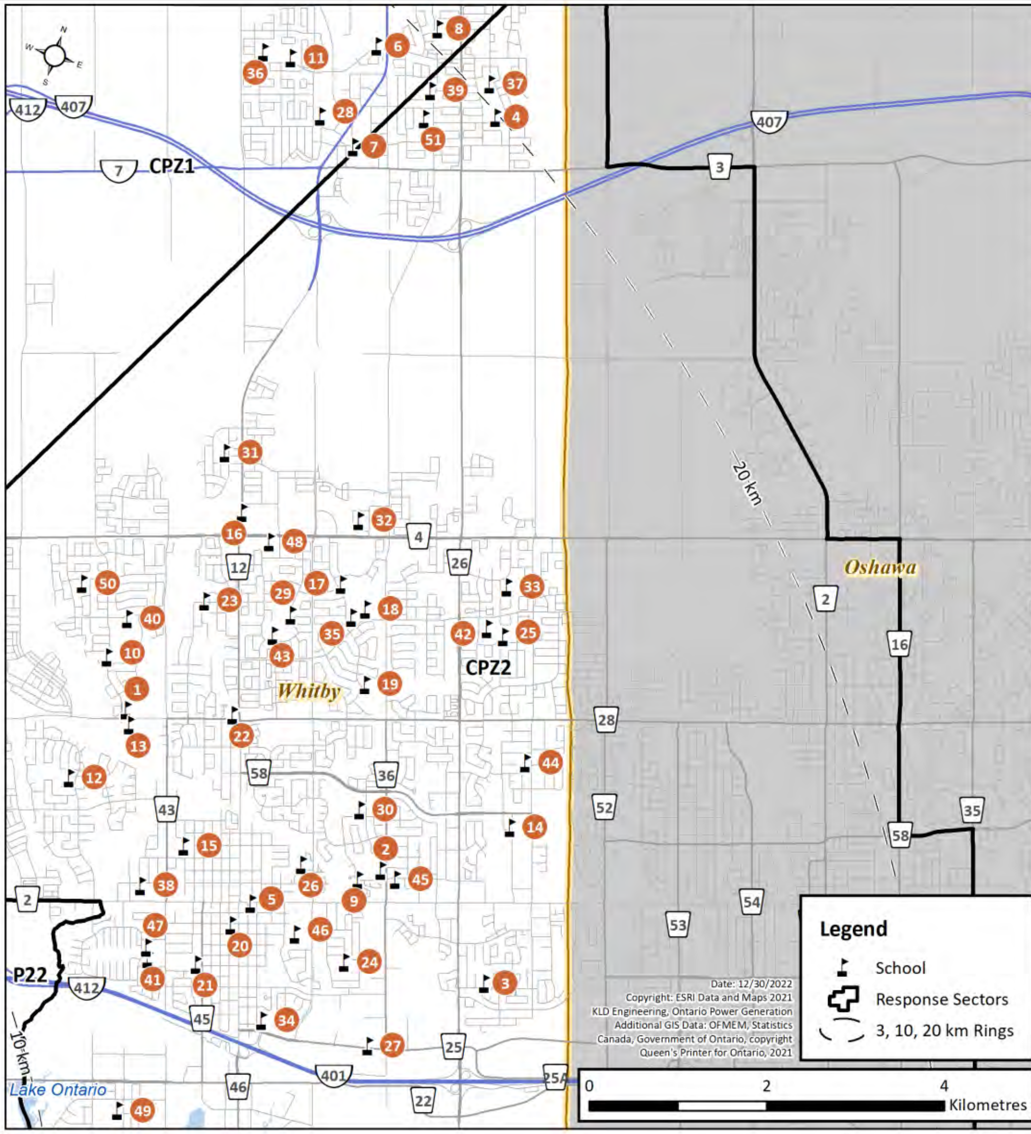
Map No.	Facility Name
1	Alternative Scarborough Education 1
2	Anson Park Public School
3	Birch Cliff Heights Public School
4	Birch Cliff Public School
5	Birchmount Park Collegiate Institute
6	Bond International College
7	Buchanan Public School
8	Chine Drive Public School
9	Cliffside Public School
10	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

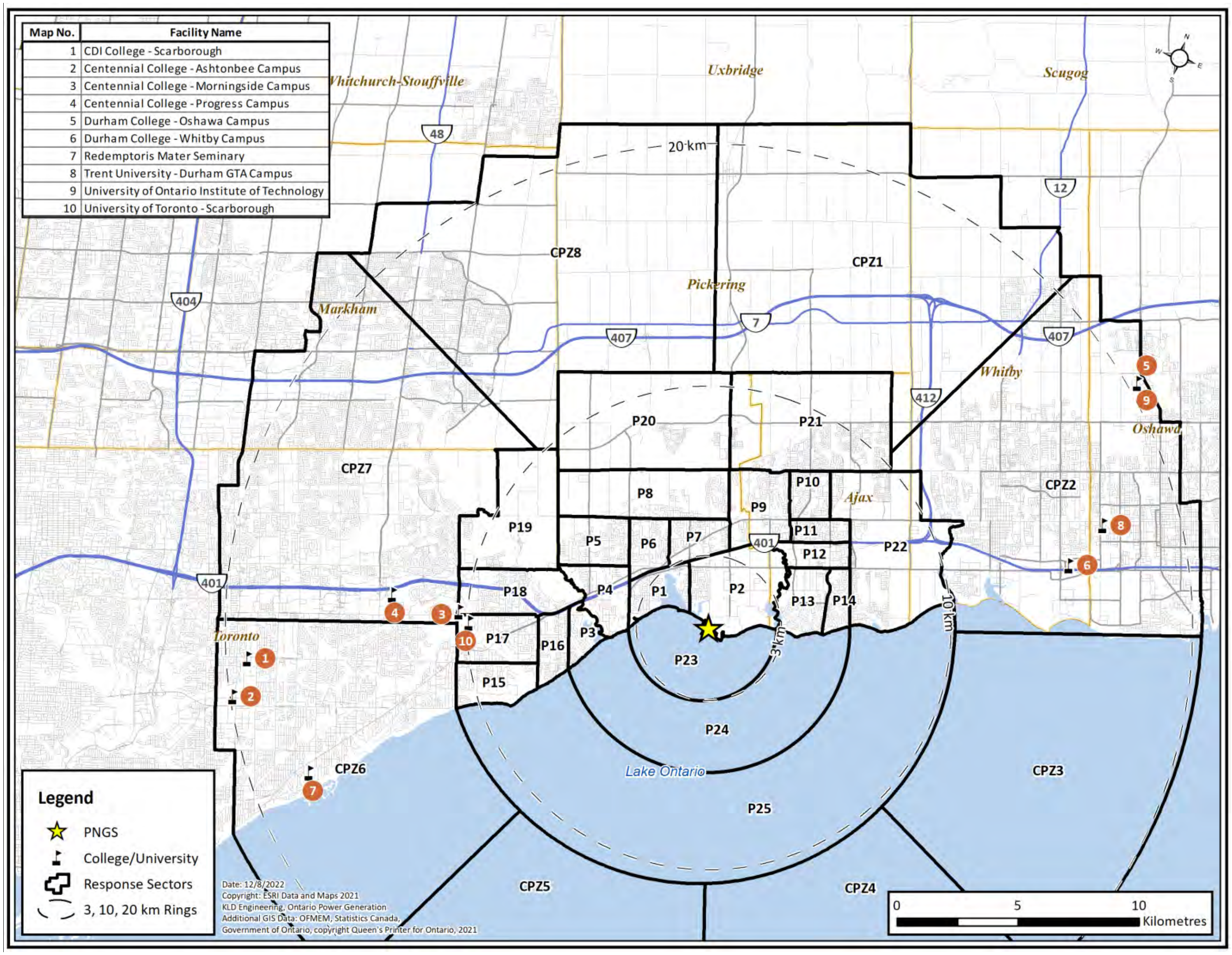


Figure E-12. Colleges and Universities within the PNGS PZ

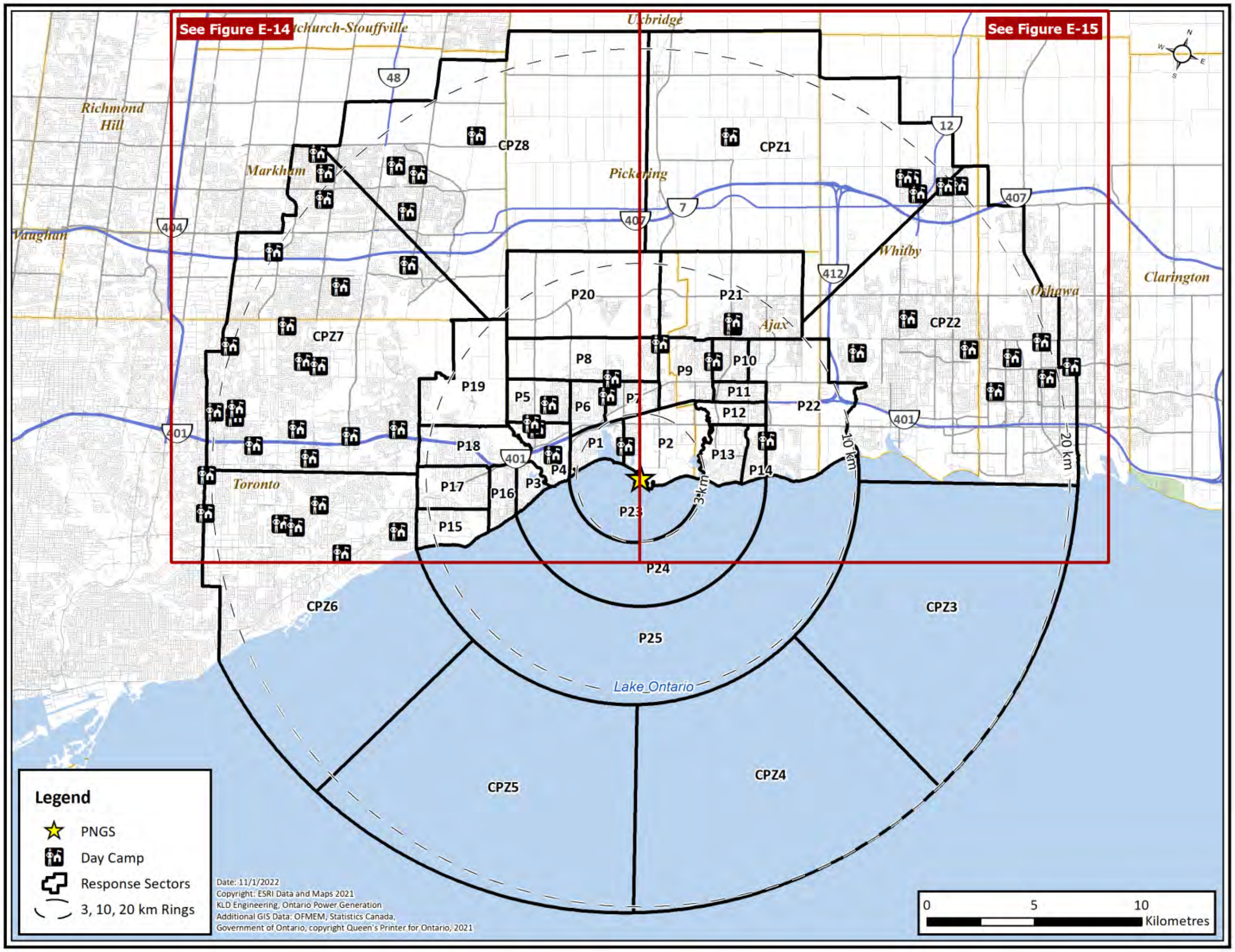
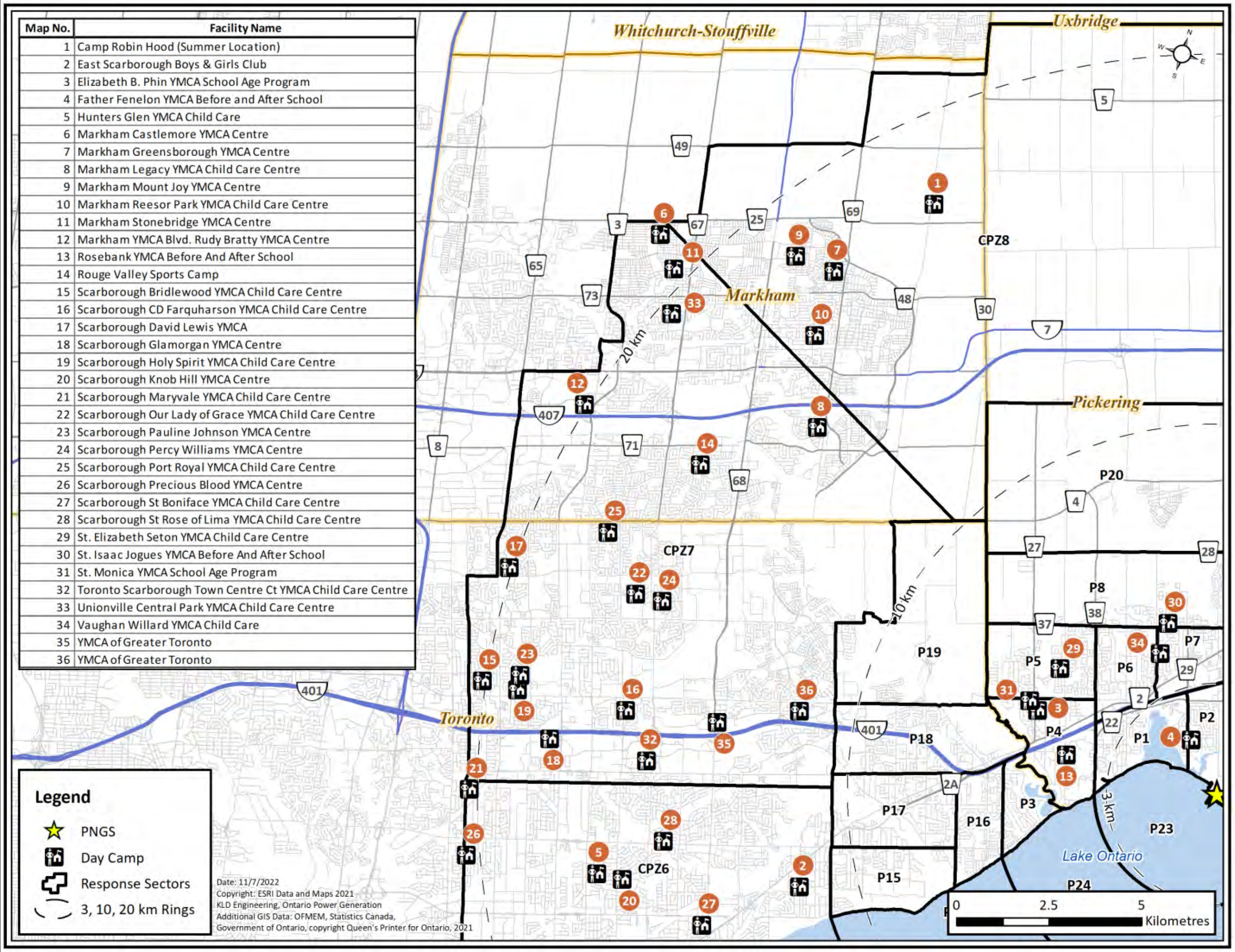


Figure E-13. Day Camps within the PNGS PZ – Overview



Map No.	Facility Name
1	Camp Robin Hood (Summer Location)
2	East Scarborough Boys & Girls Club
3	Elizabeth B. Phin YMCA School Age Program
4	Father Fenelon YMCA Before and After School
5	Hunters Glen YMCA Child Care
6	Markham Castlemore YMCA Centre
7	Markham Greensborough YMCA Centre
8	Markham Legacy YMCA Child Care Centre
9	Markham Mount Joy YMCA Centre
10	Markham Reesor Park YMCA Child Care Centre
11	Markham Stonebridge YMCA Centre
12	Markham YMCA Blvd. Rudy Bratty YMCA Centre
13	Rosebank YMCA Before And After School
14	Rouge Valley Sports Camp
15	Scarborough Bridlewood YMCA Child Care Centre
16	Scarborough CD Farquharson YMCA Child Care Centre
17	Scarborough David Lewis YMCA
18	Scarborough Glamorgan YMCA Centre
19	Scarborough Holy Spirit YMCA Child Care Centre
20	Scarborough Knob Hill YMCA Centre
21	Scarborough Maryvale YMCA Child Care Centre
22	Scarborough Our Lady of Grace YMCA Child Care Centre
23	Scarborough Pauline Johnson YMCA Centre
24	Scarborough Percy Williams YMCA Centre
25	Scarborough Port Royal YMCA Child Care Centre
26	Scarborough Precious Blood YMCA Centre
27	Scarborough St Boniface YMCA Child Care Centre
28	Scarborough St Rose of Lima YMCA Child Care Centre
29	St. Elizabeth Seton YMCA Child Care Centre
30	St. Isaac Jogues YMCA Before And After School
31	St. Monica YMCA School Age Program
32	Toronto Scarborough Town Centre Ct YMCA Child Care Centre
33	Unionville Central Park YMCA Child Care Centre
34	Vaughan Willard YMCA Child Care
35	YMCA of Greater Toronto
36	YMCA of Greater Toronto

Figure E-14. Day Camps within the Western Portion of the PNGS PZ

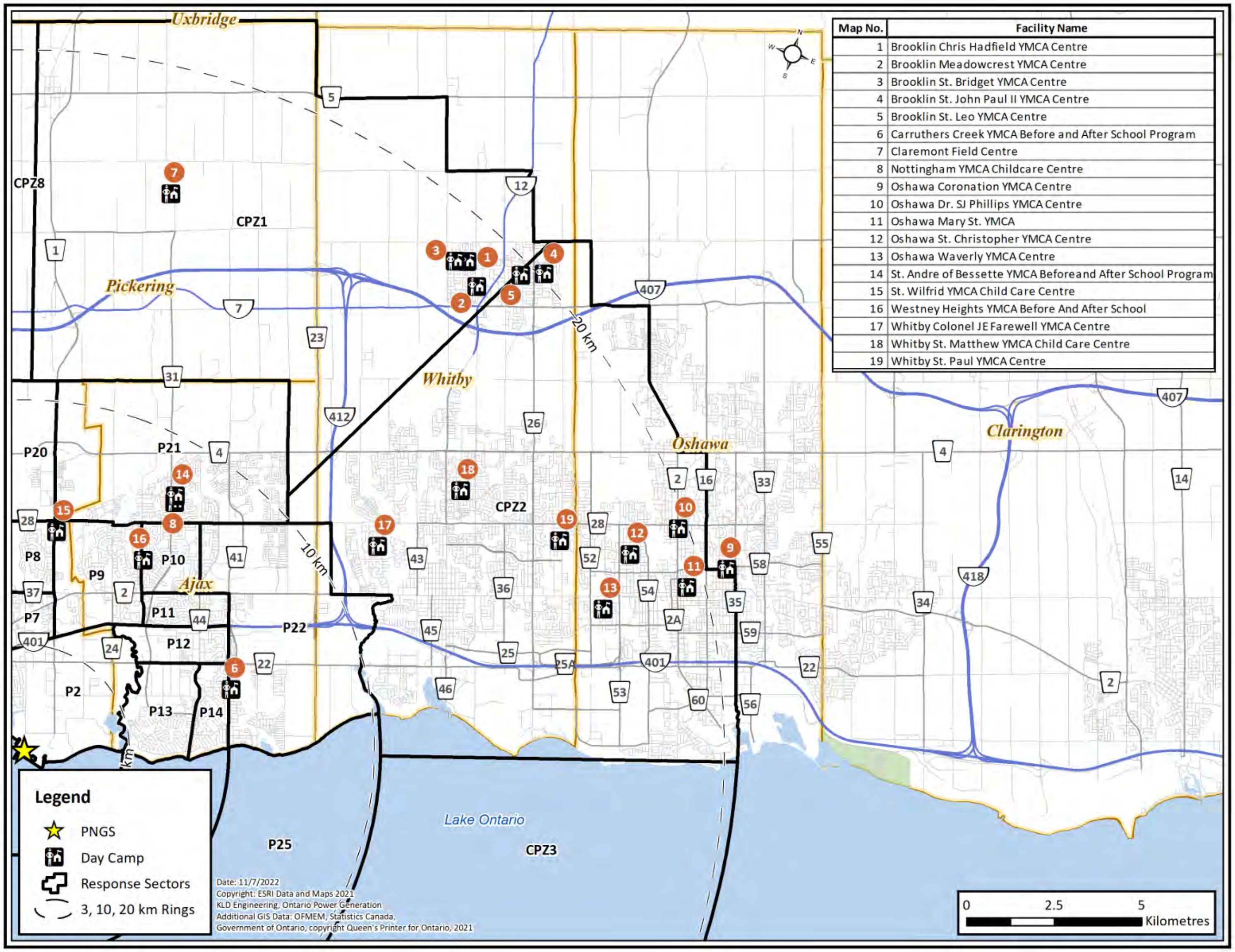


Figure E-15. Day Camps within the Eastern Portion of the PNGS PZ

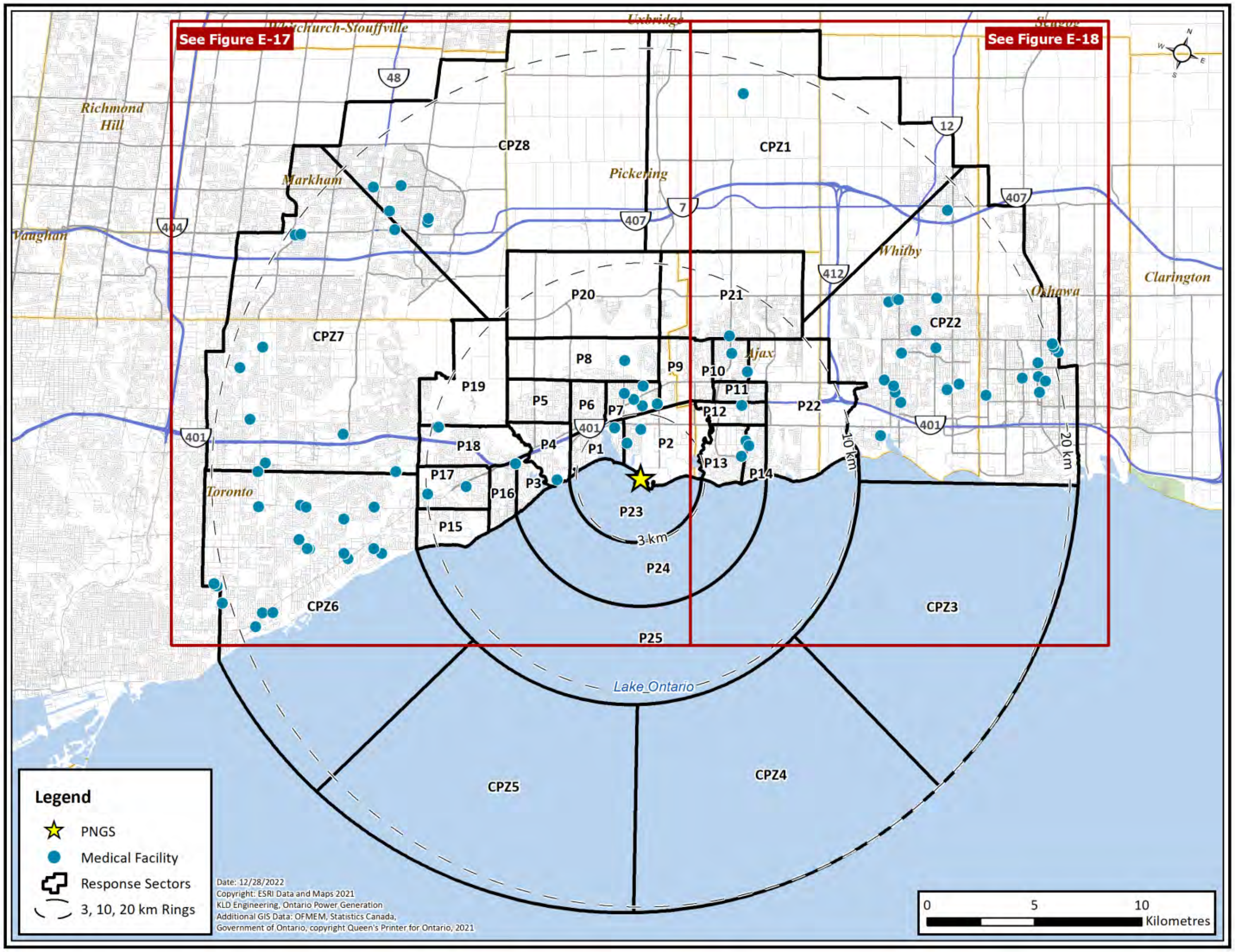


Figure E-16. Medical Facilities within PNGS PZ – Overview

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

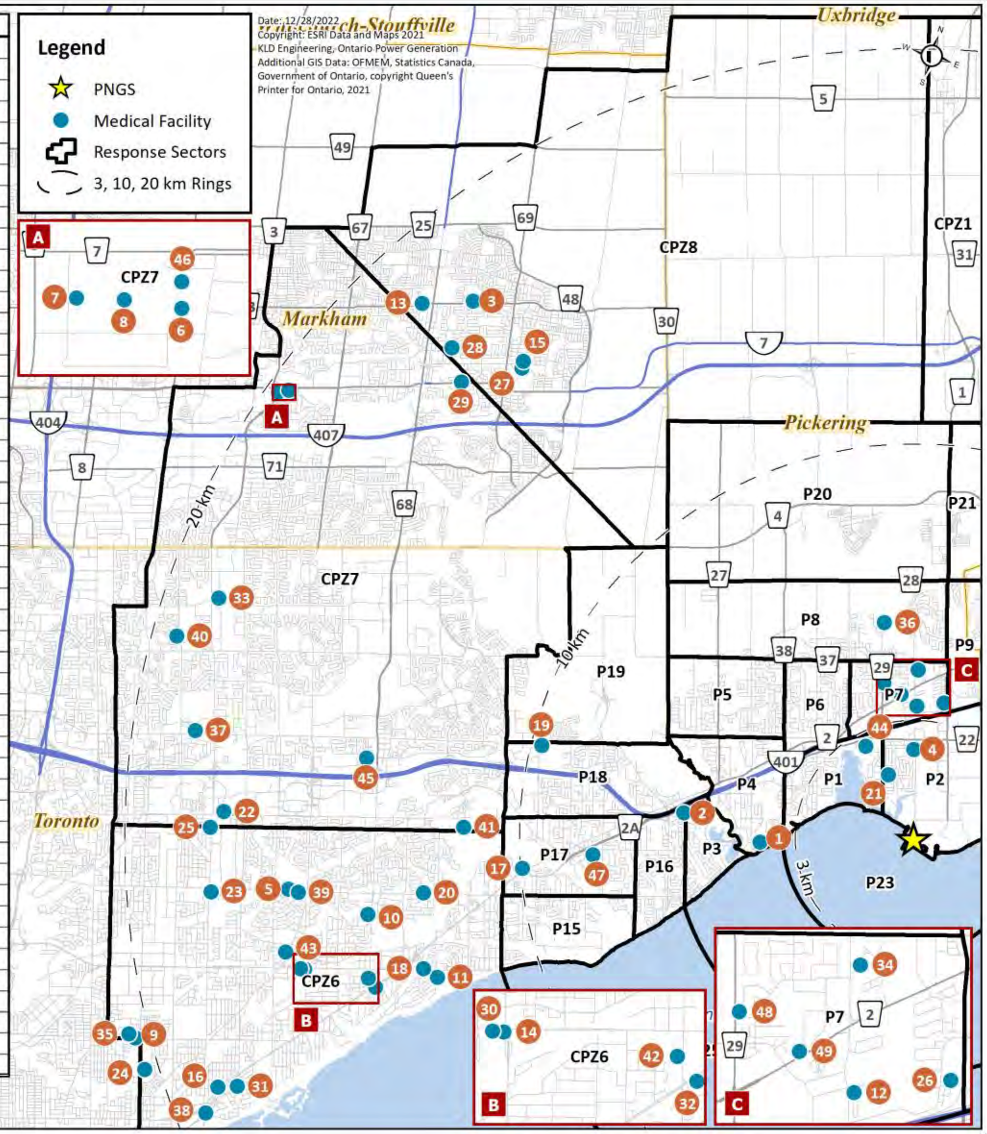
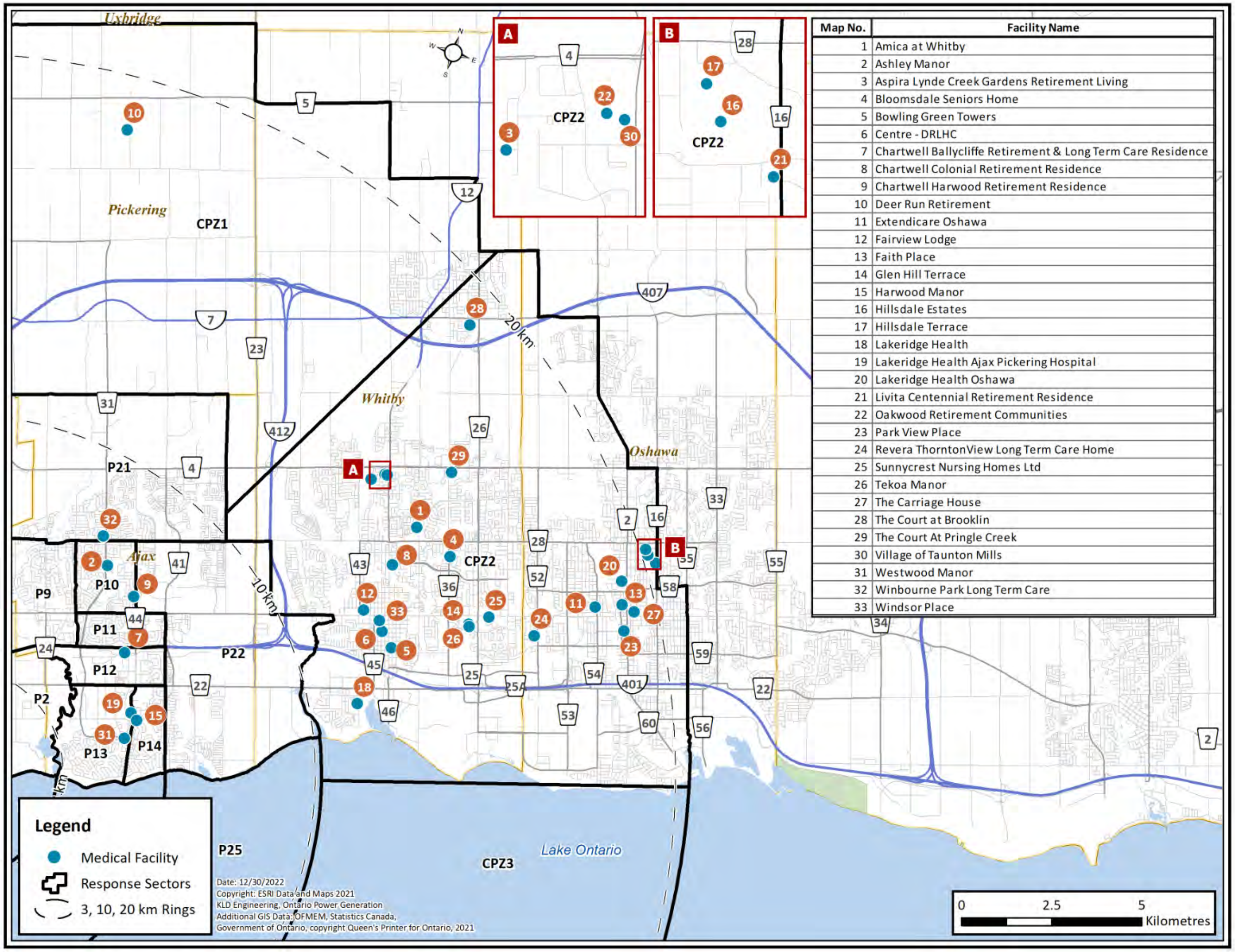


Figure E-17. Medical Facilities within the Western Portion of the PNGS PZ



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

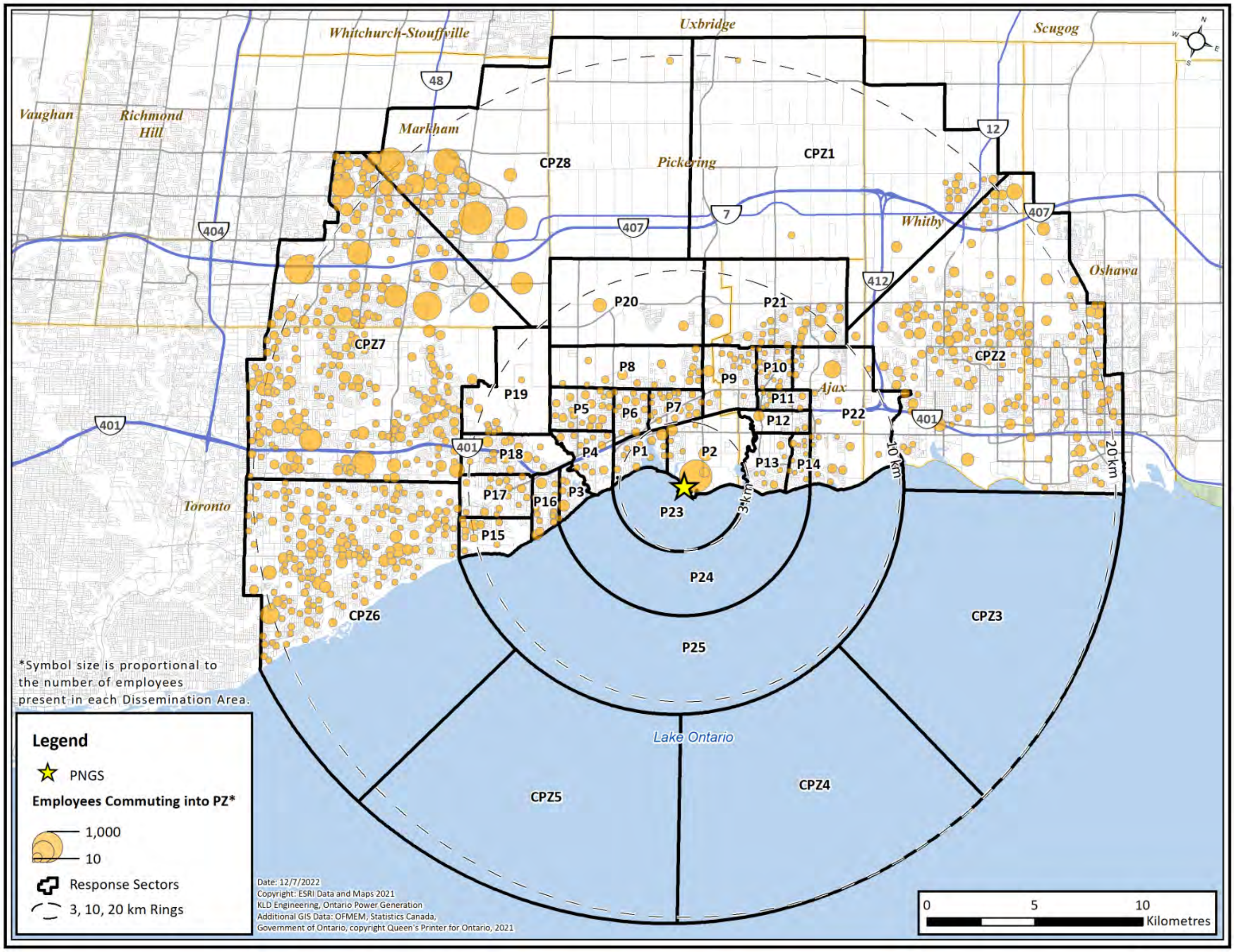


Figure E-19. Major Employers within the PNGS PZ

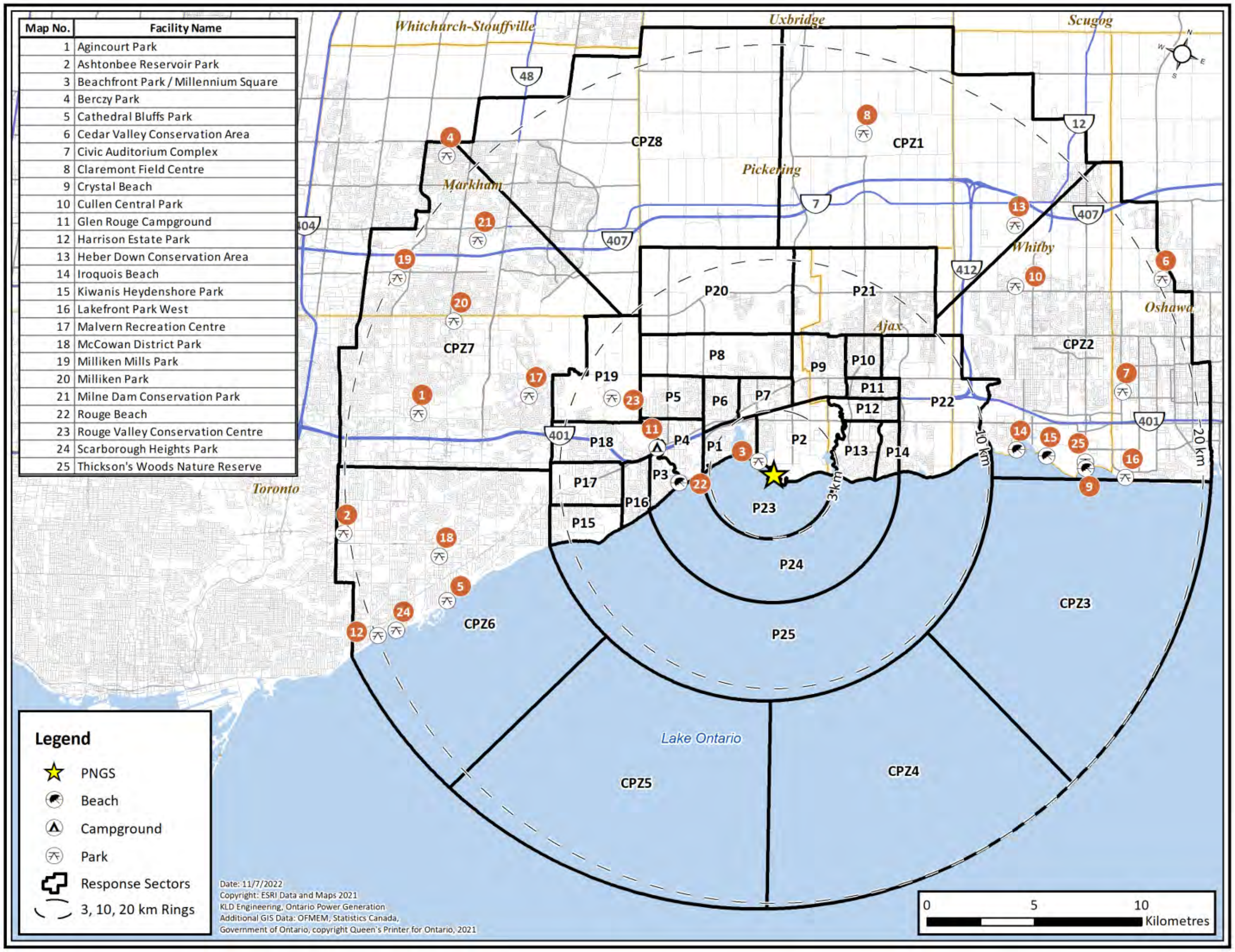


Figure E-20. Beaches, Campgrounds and Parks within the PNGS PZ

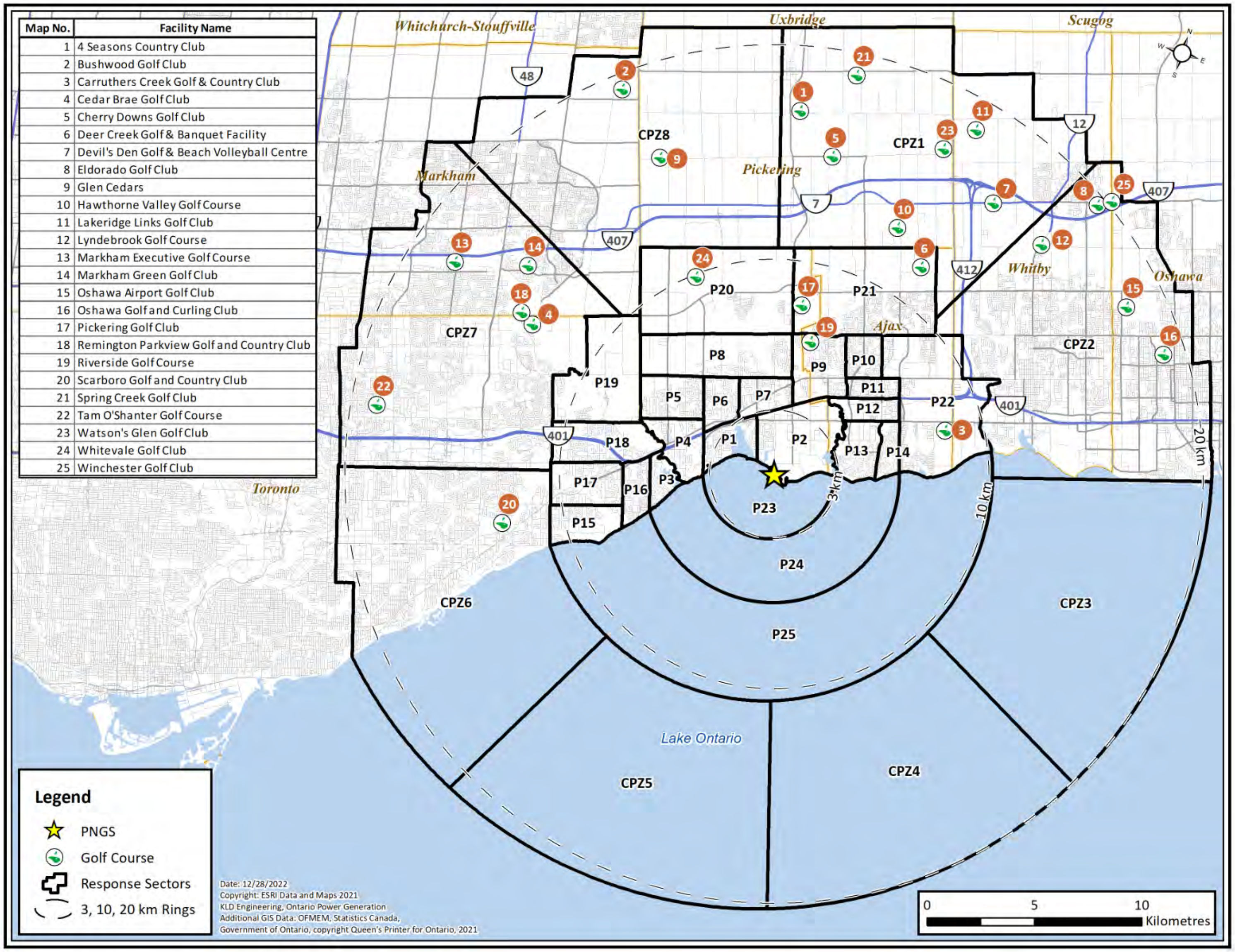


Figure E-21. Golf Courses within the PNGS PZ

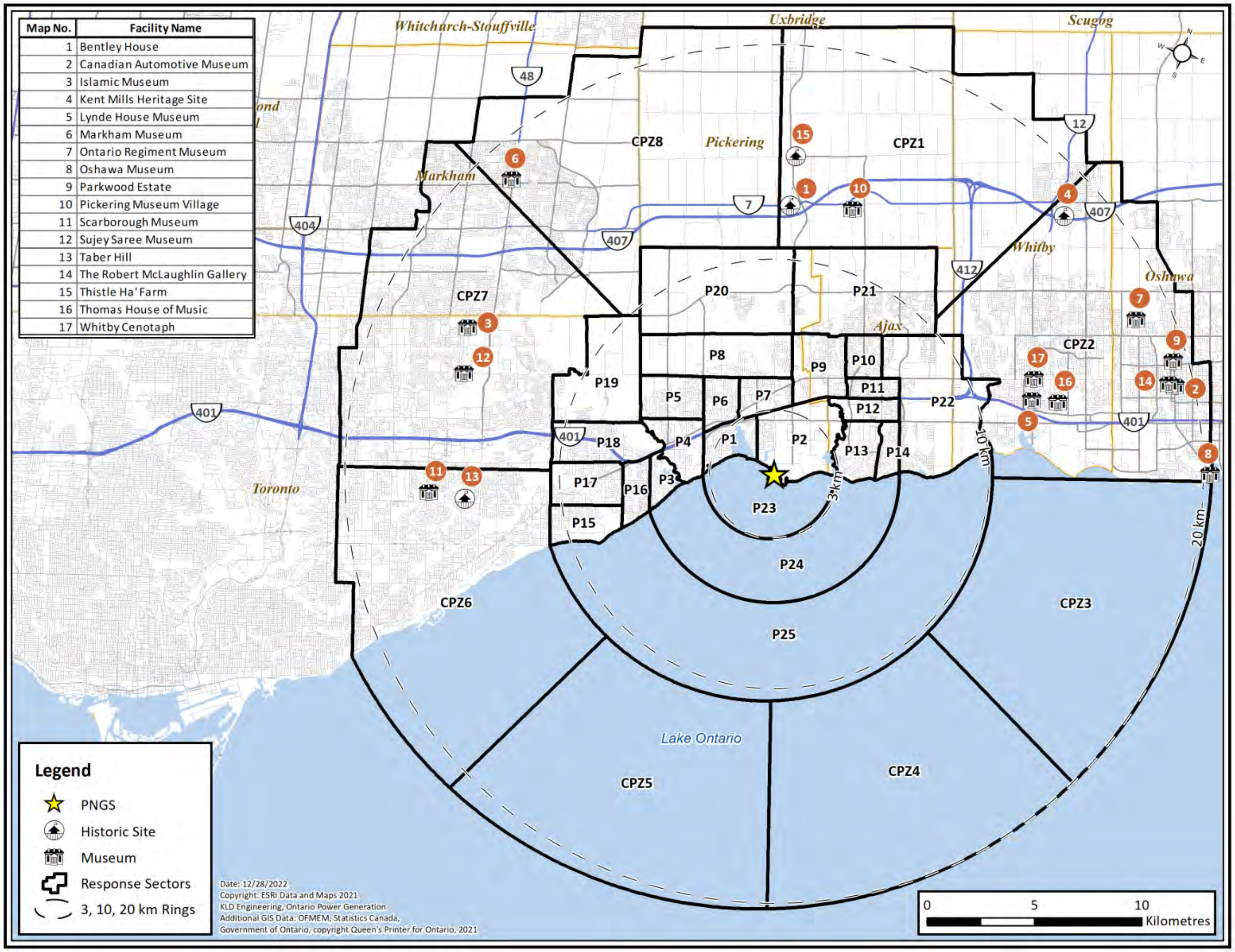


Figure E-22. Historic Sites and Museums within the PNGS PZ

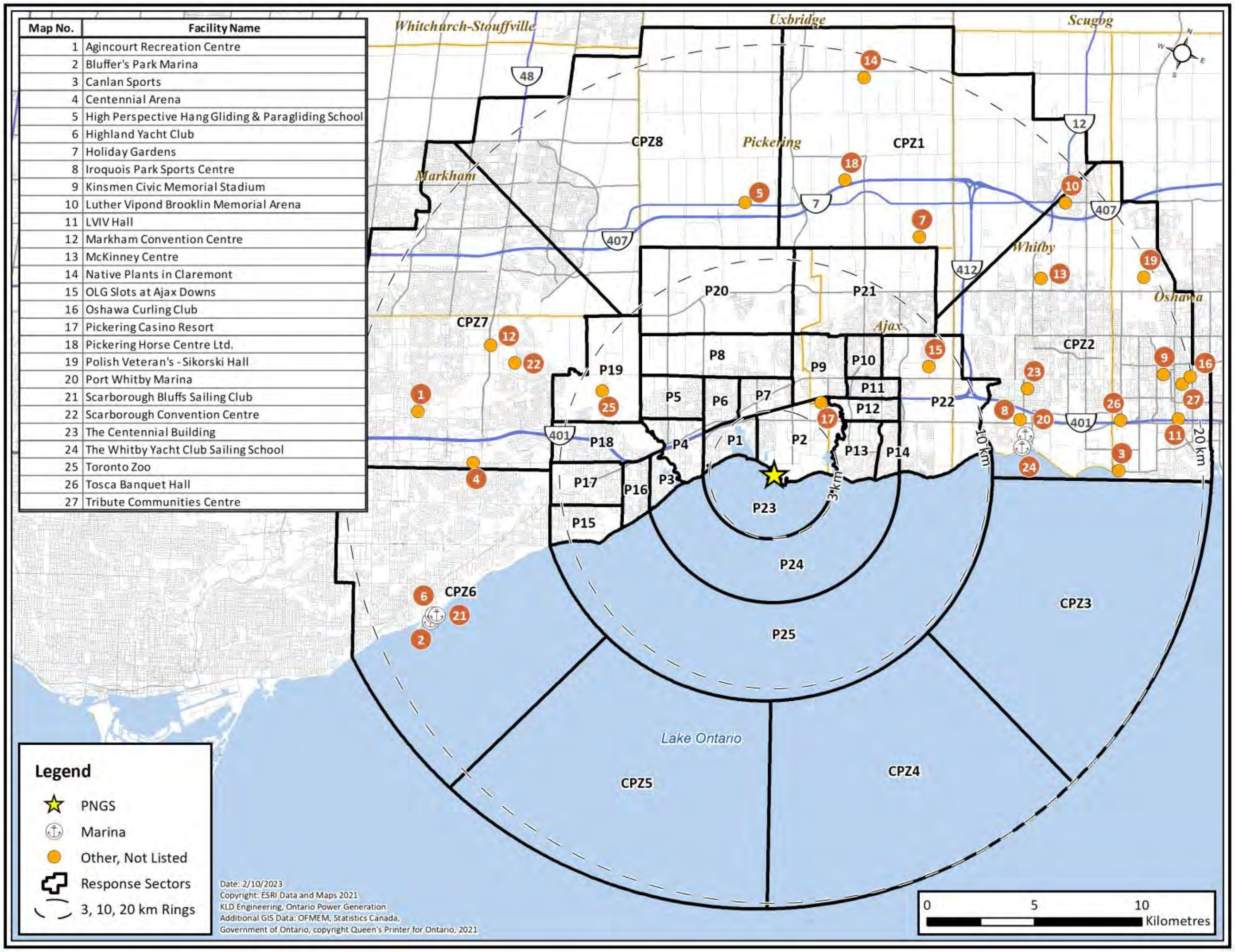


Figure E-23. Marinas and Other Recreational Areas within the PNGS PZ

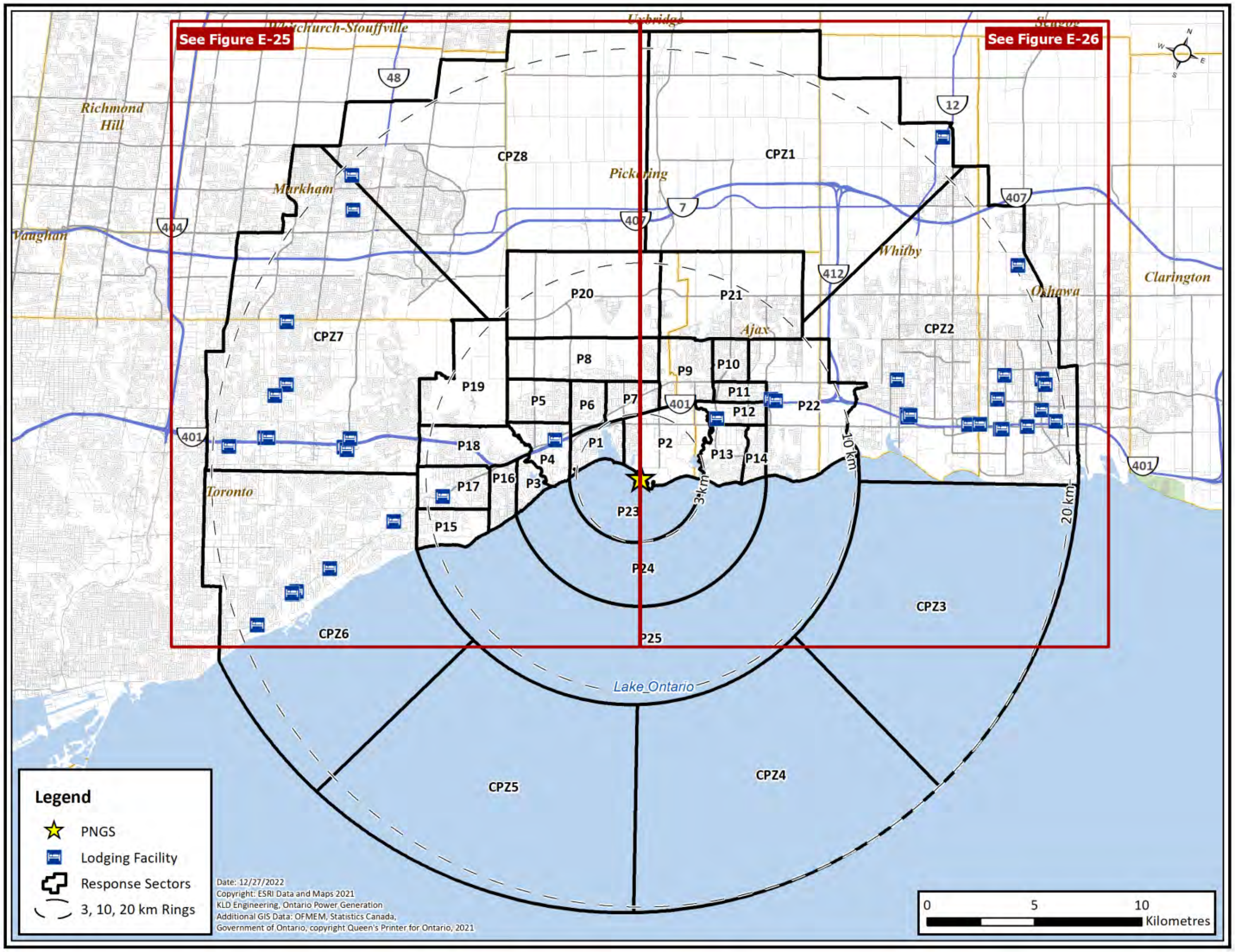


Figure E-24. Lodging Facilities within the PNGS PZ – Overview

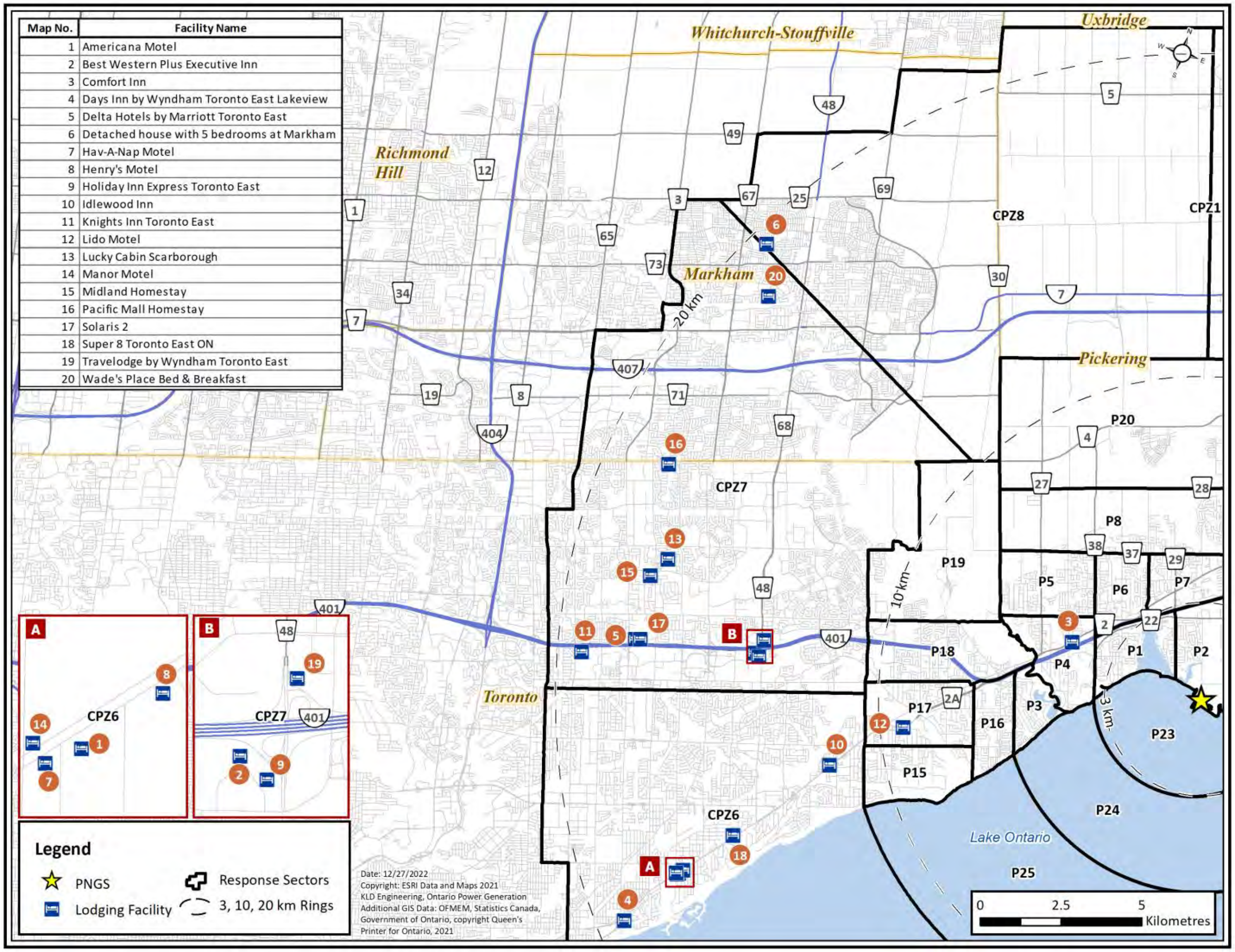


Figure E-25. Lodging Facilities within the Western Portion of the PNGS PZ

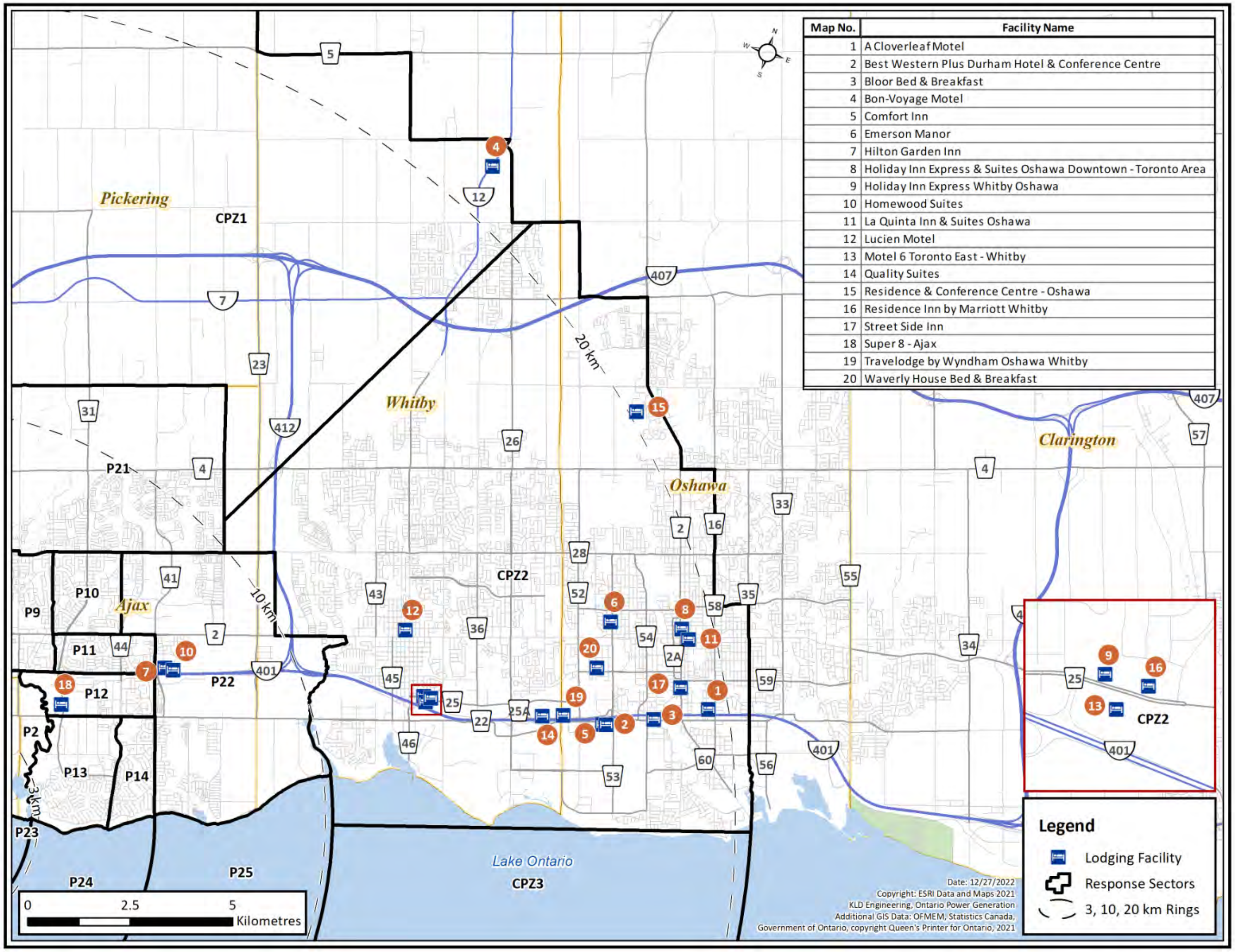


Figure E-26. Lodging Facilities within the Eastern Portion of the PNGS PZ

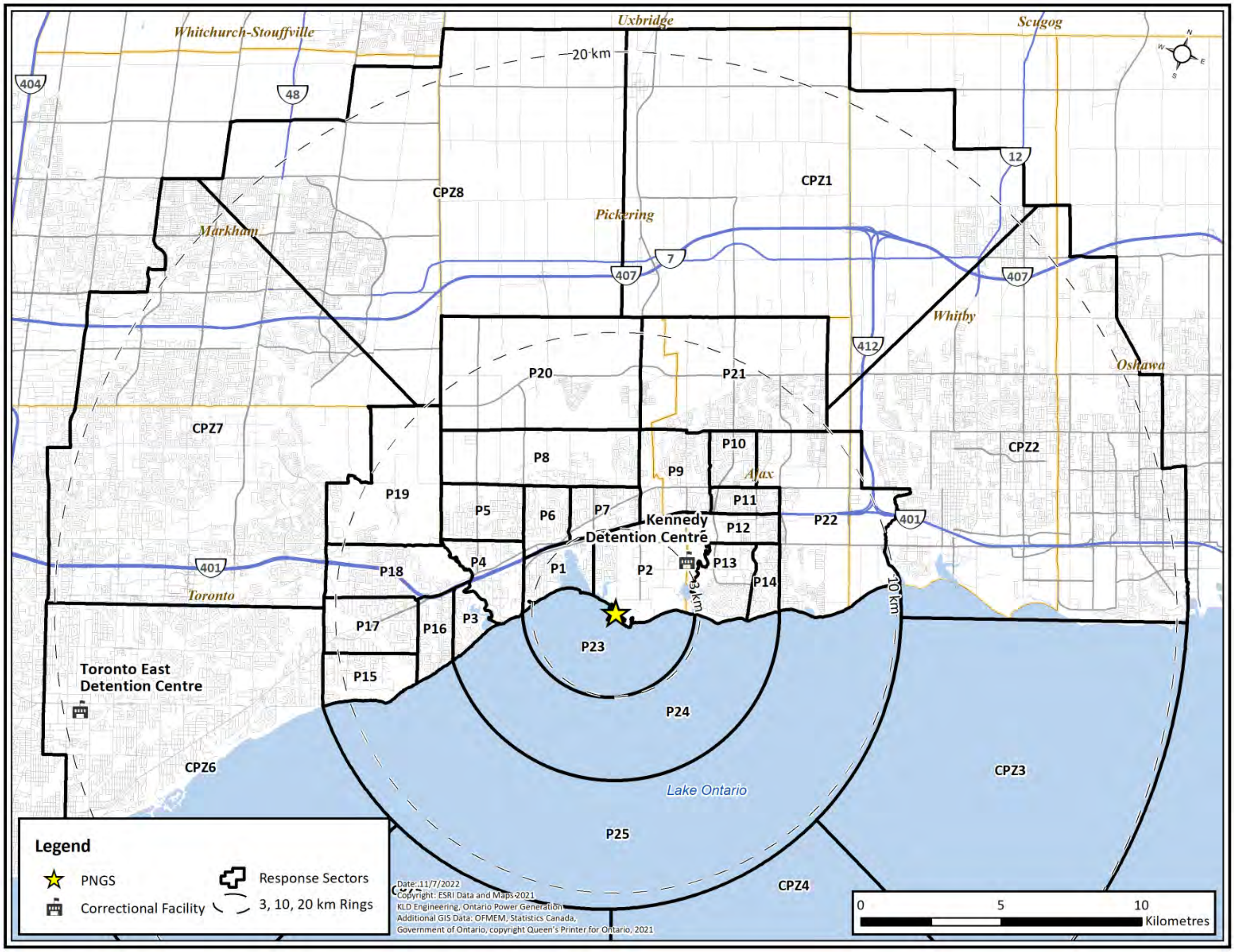


Figure E-27. Correctional Facilities within the PNGS PZ

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

<u>Household Size</u>

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.)

<u>Automobile Ownership</u>

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**			

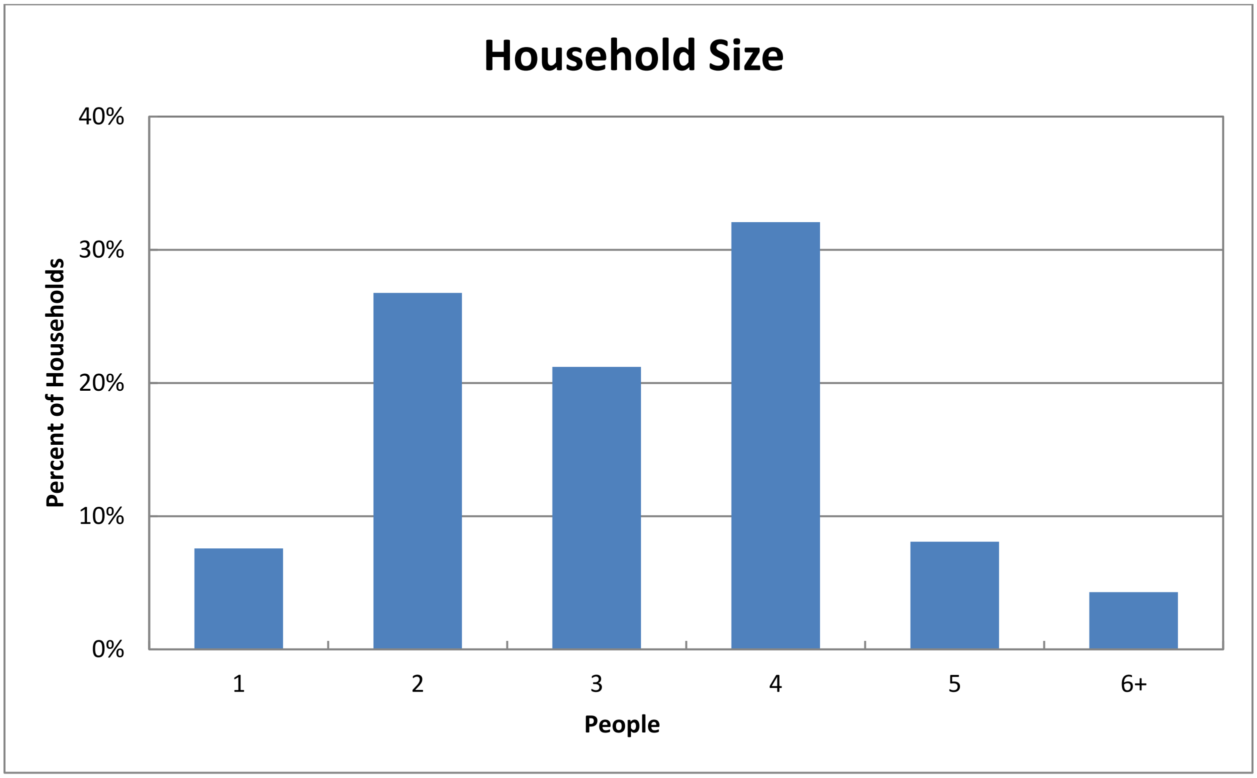


Figure F-1. Household Size in the Planning Zone

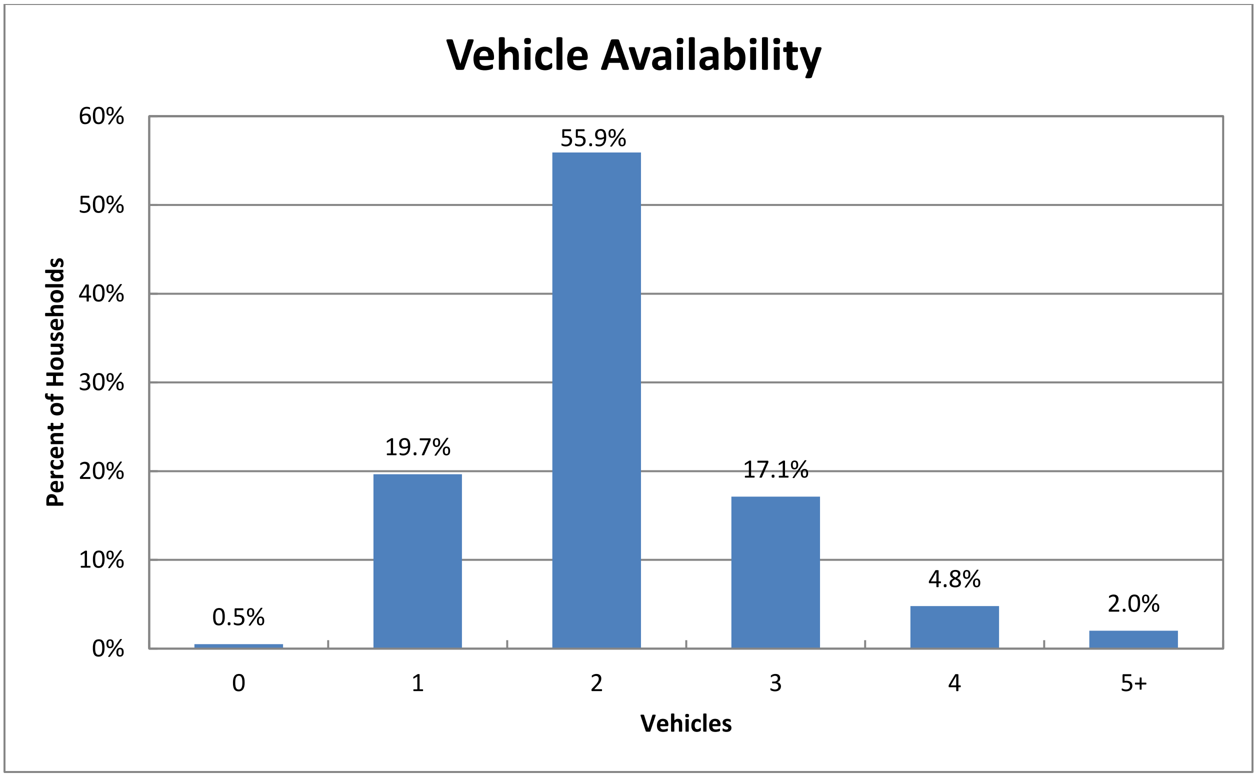


Figure F-2. Household Vehicle Availability

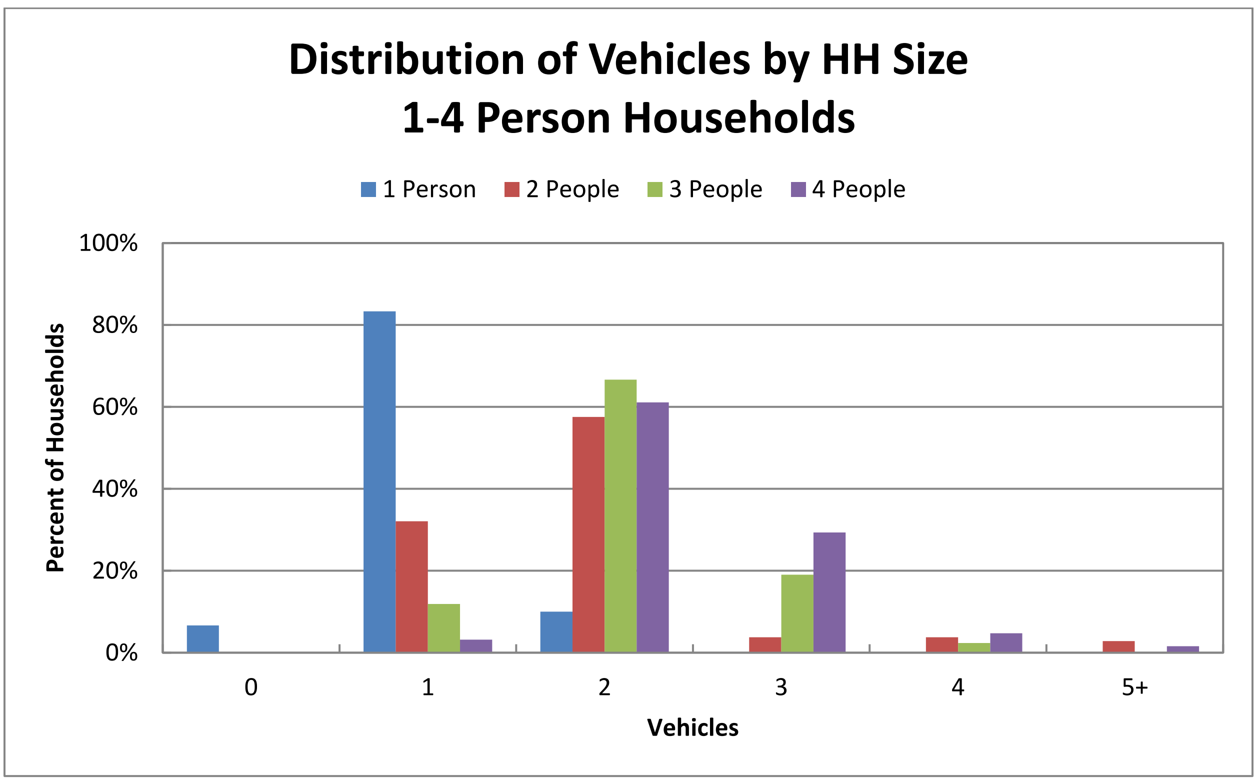


Figure F-3. Vehicle Availability - 1 to 4 Person Households

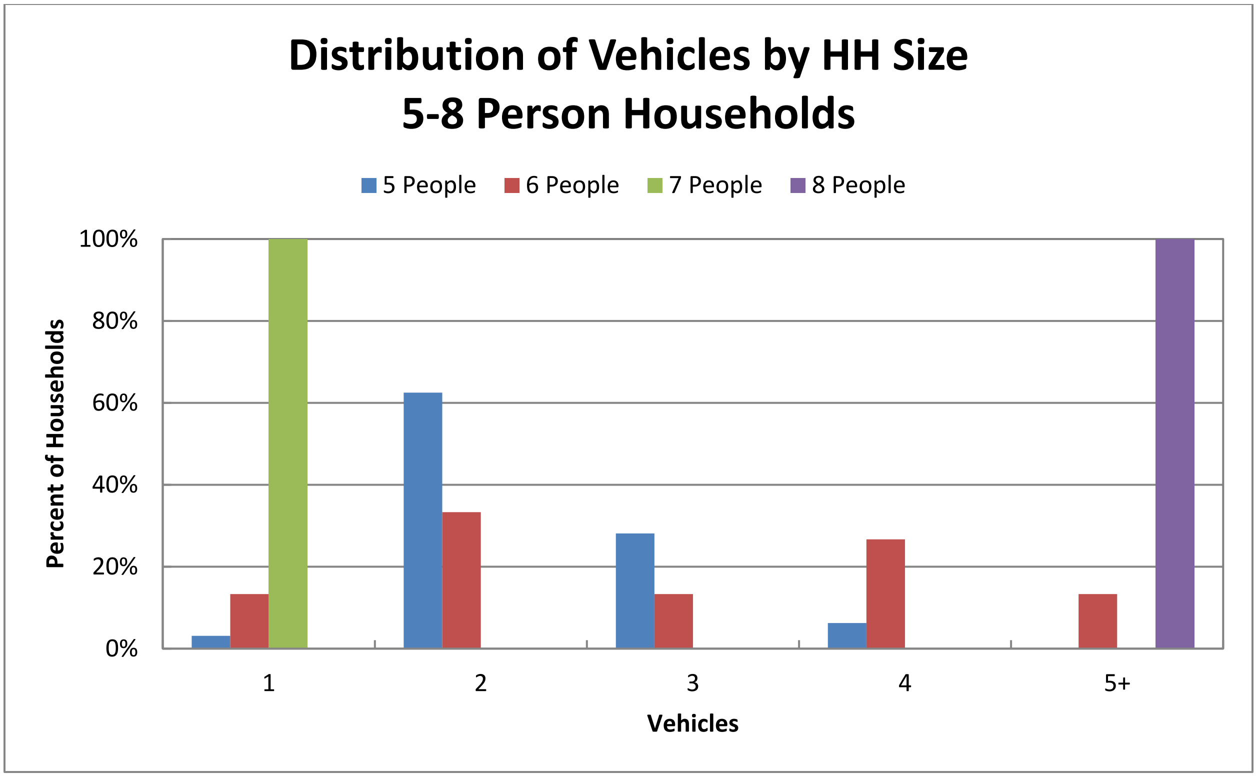


Figure F-4. Vehicle Availability - 5 to 8 Person Households

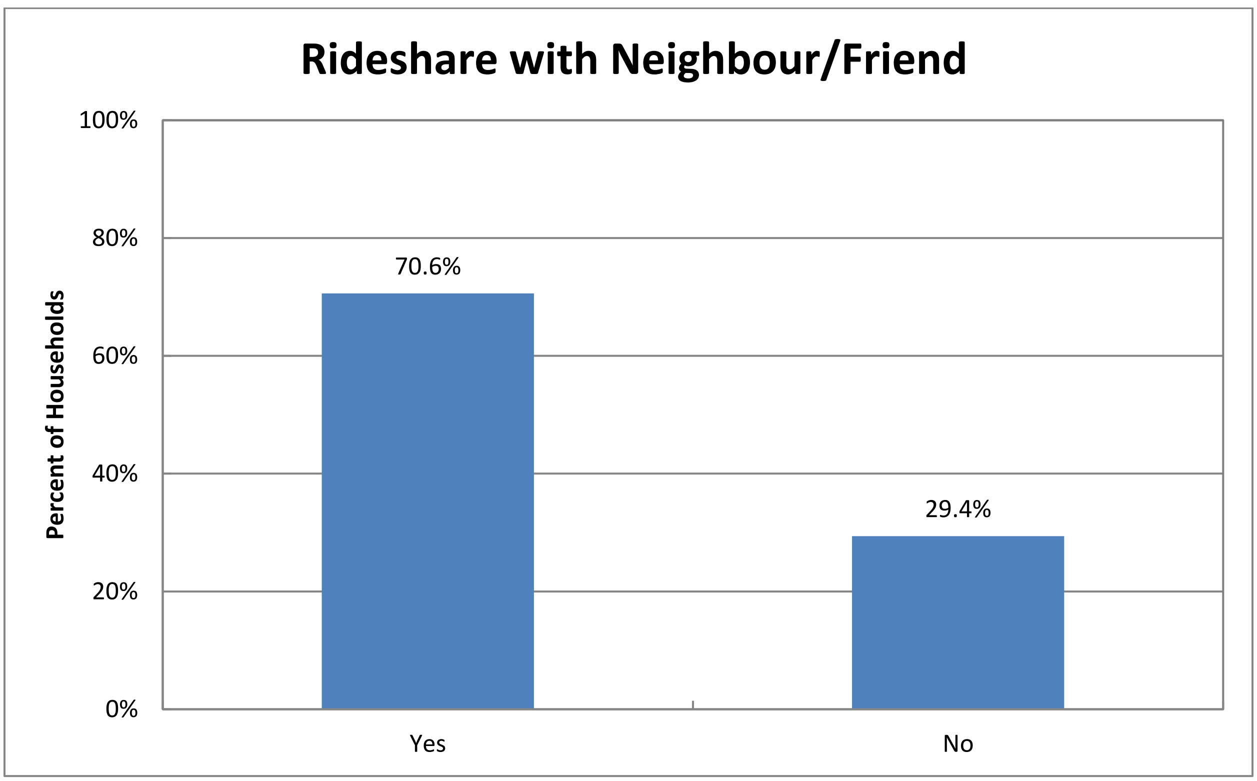


Figure F-5. Household Ridesharing Preference

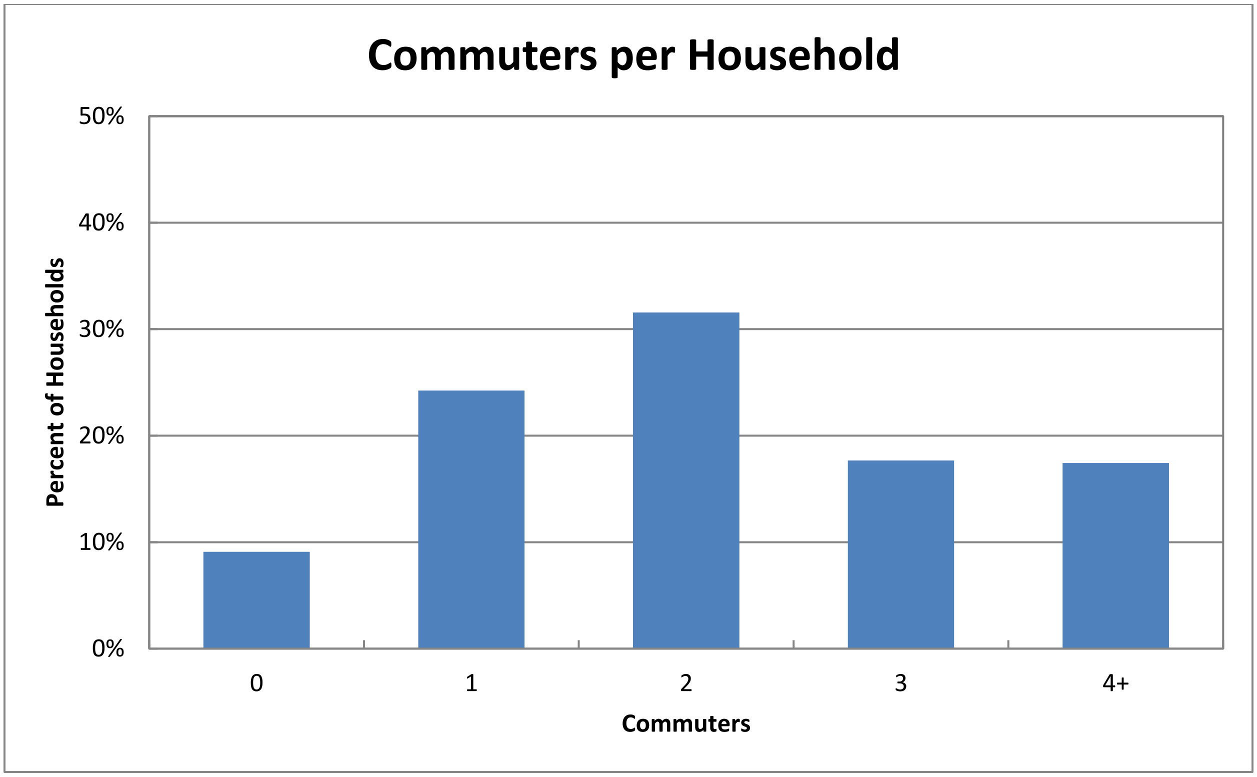


Figure F-6. Commuters in Households in the Planning Zone

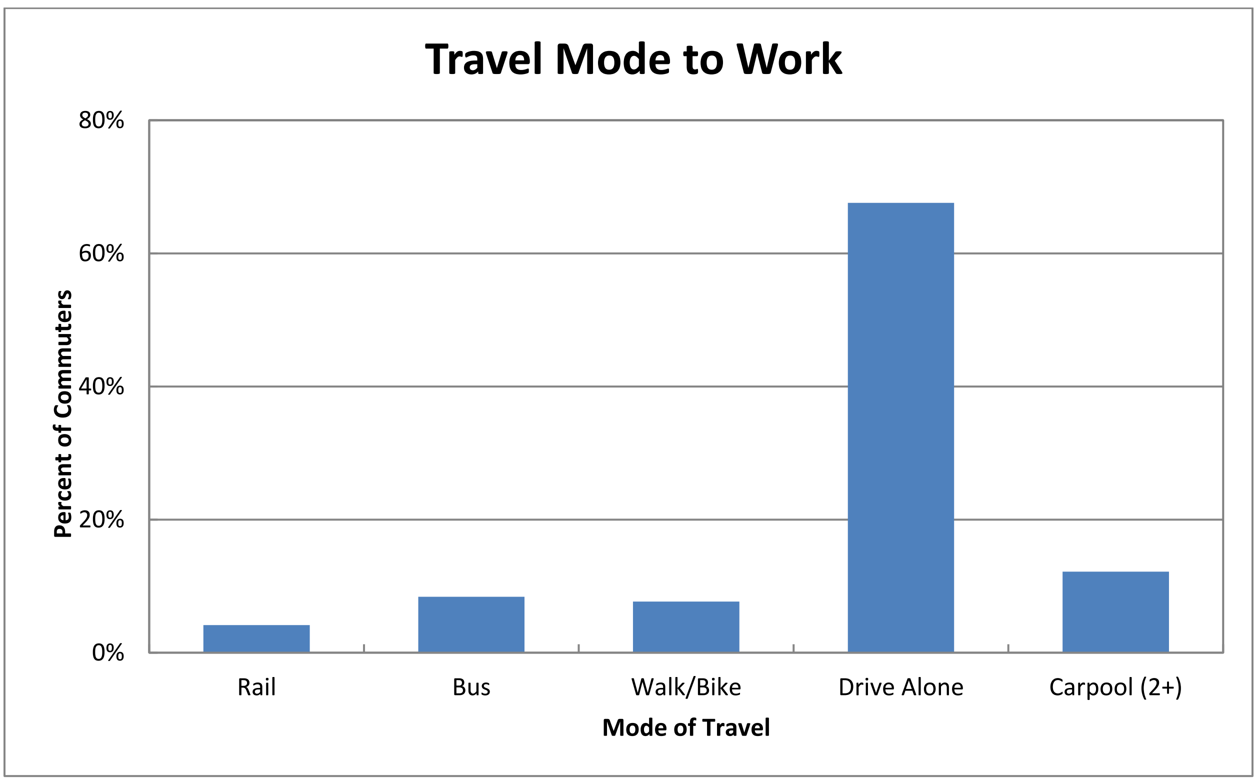


Figure F-7. Modes of Travel in the Planning Zone

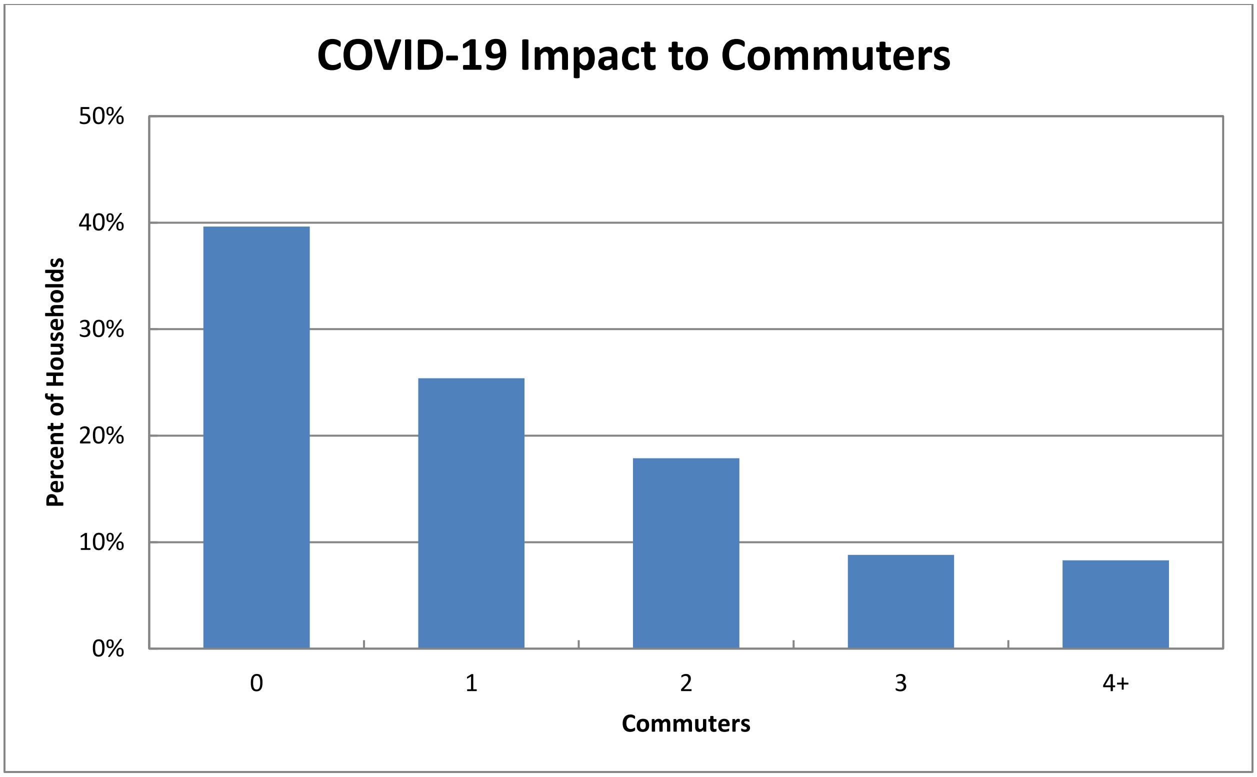


Figure F-8. Impact to Commuters due to the COVID-19 Pandemic

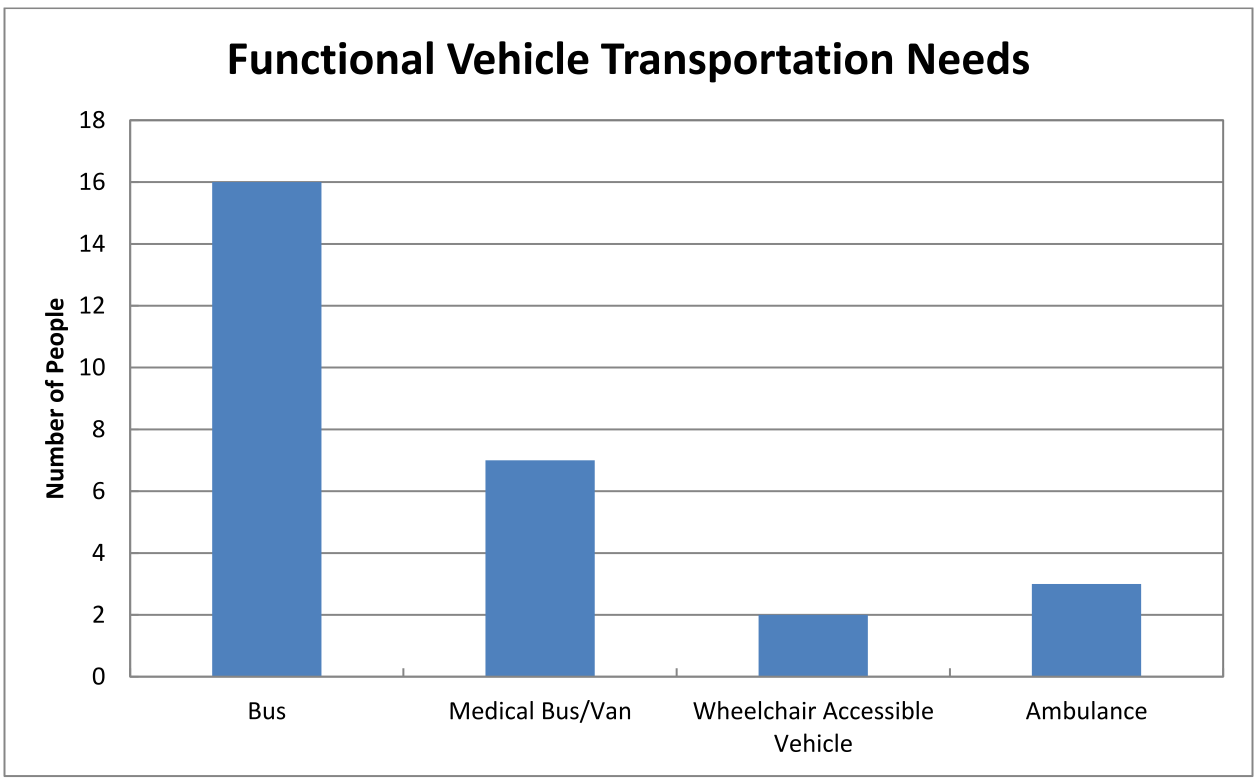


Figure F-9. People with Functional or Transportation Needs

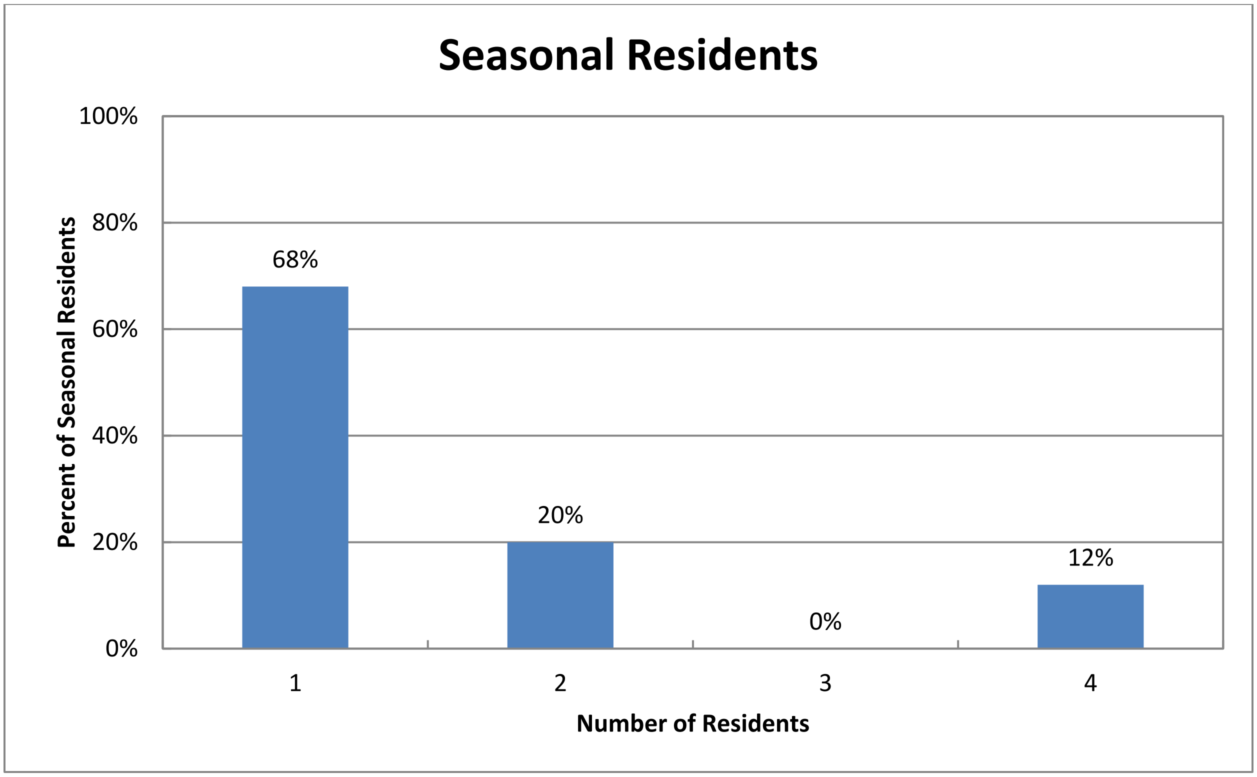


Figure F-10. Households with Seasonal Residents

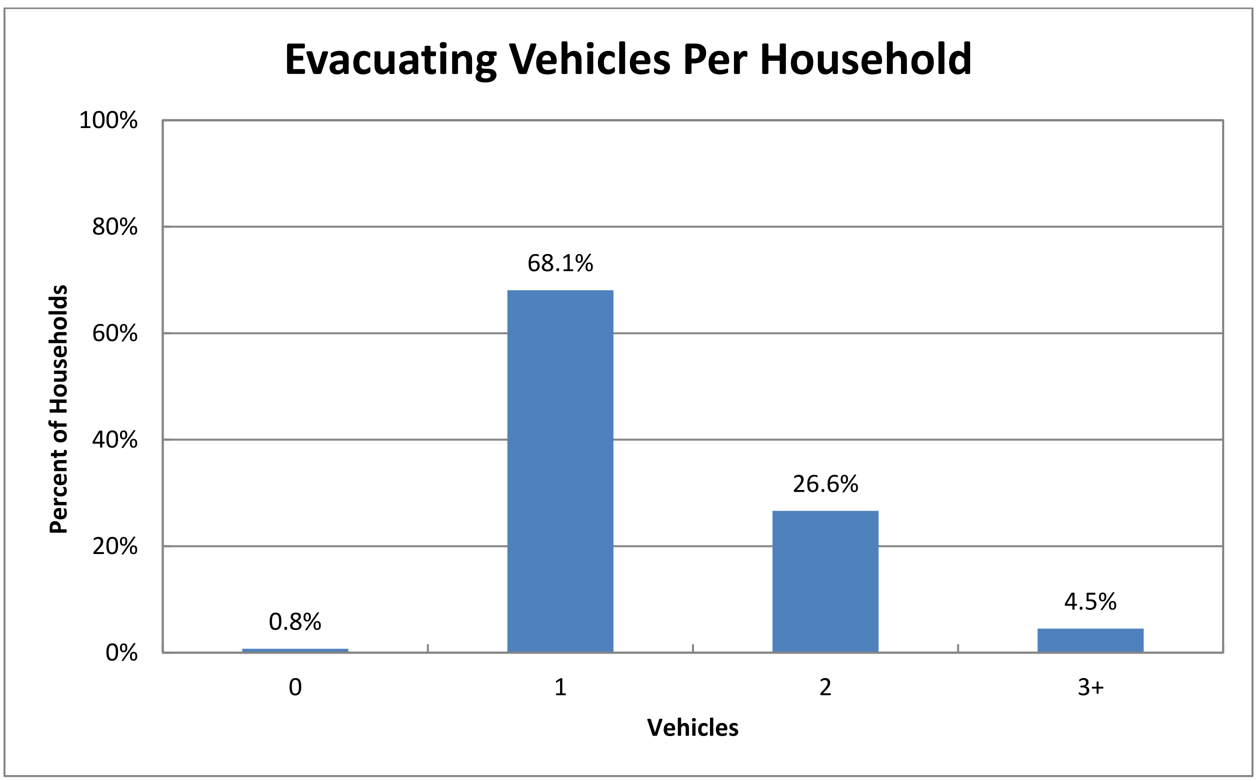


Figure F-11. Number of Vehicles Used for Evacuation

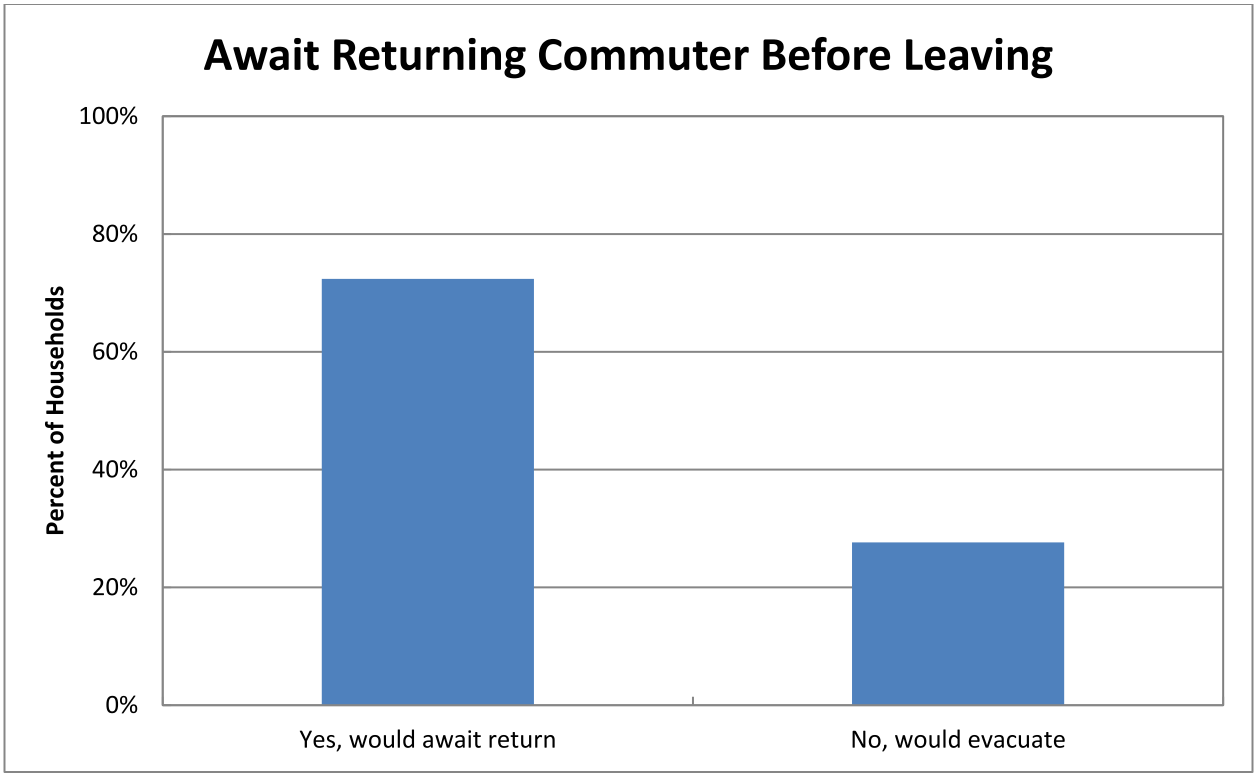


Figure F-12. Percent of Households that Await Returning Commuter Before Evacuating

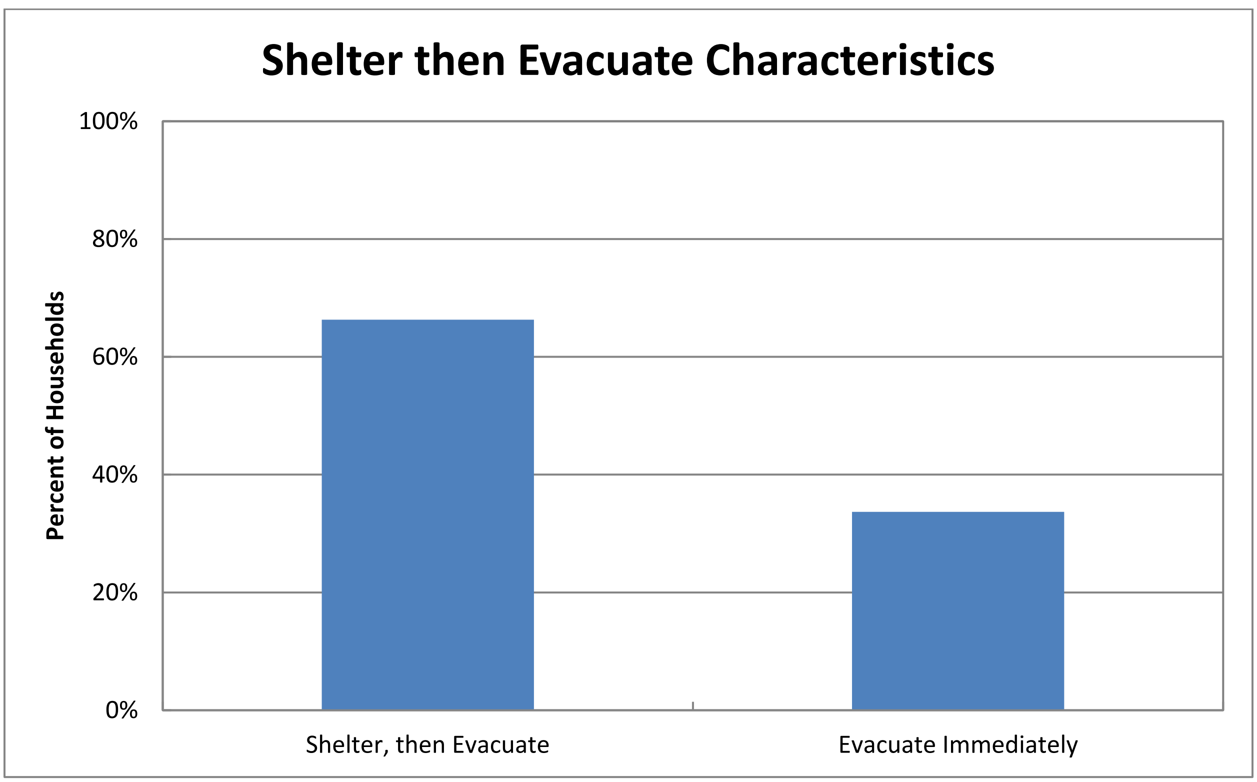


Figure F-13. Shelter then Evacuate Characteristics

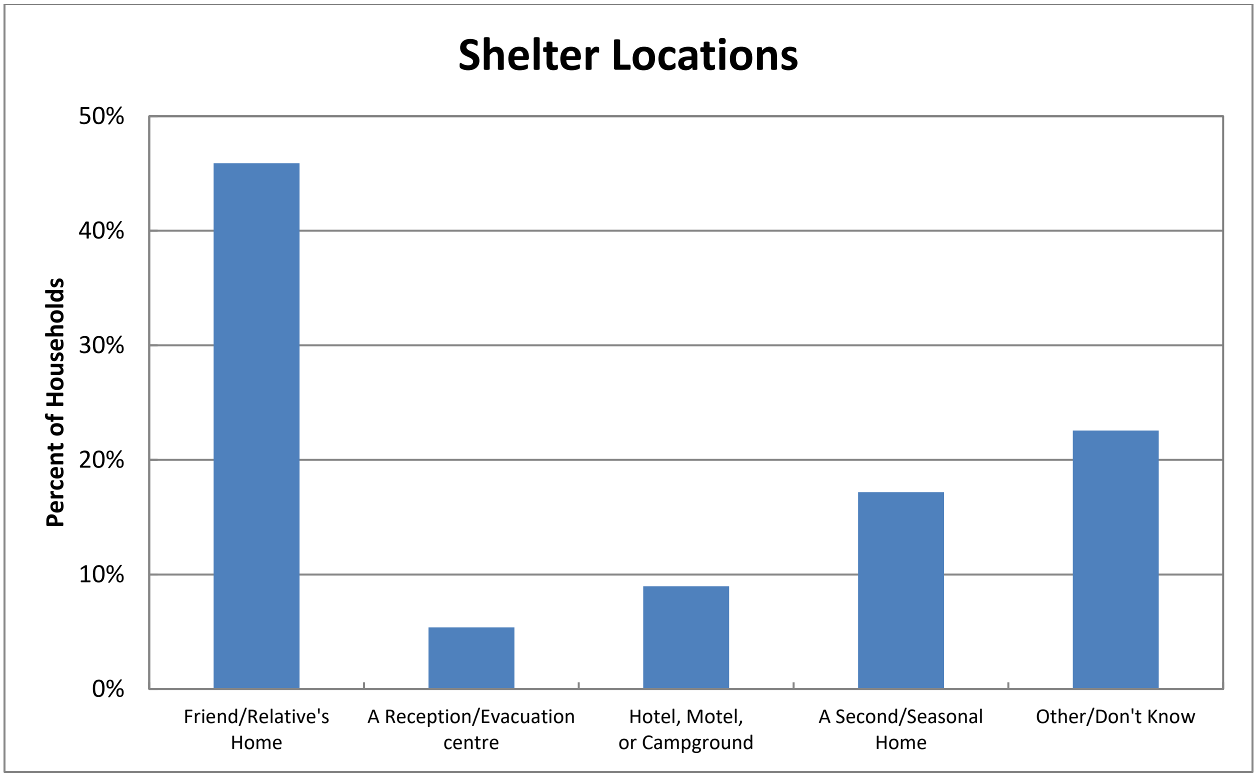


Figure F-14. Planning Zone Evacuation Destinations

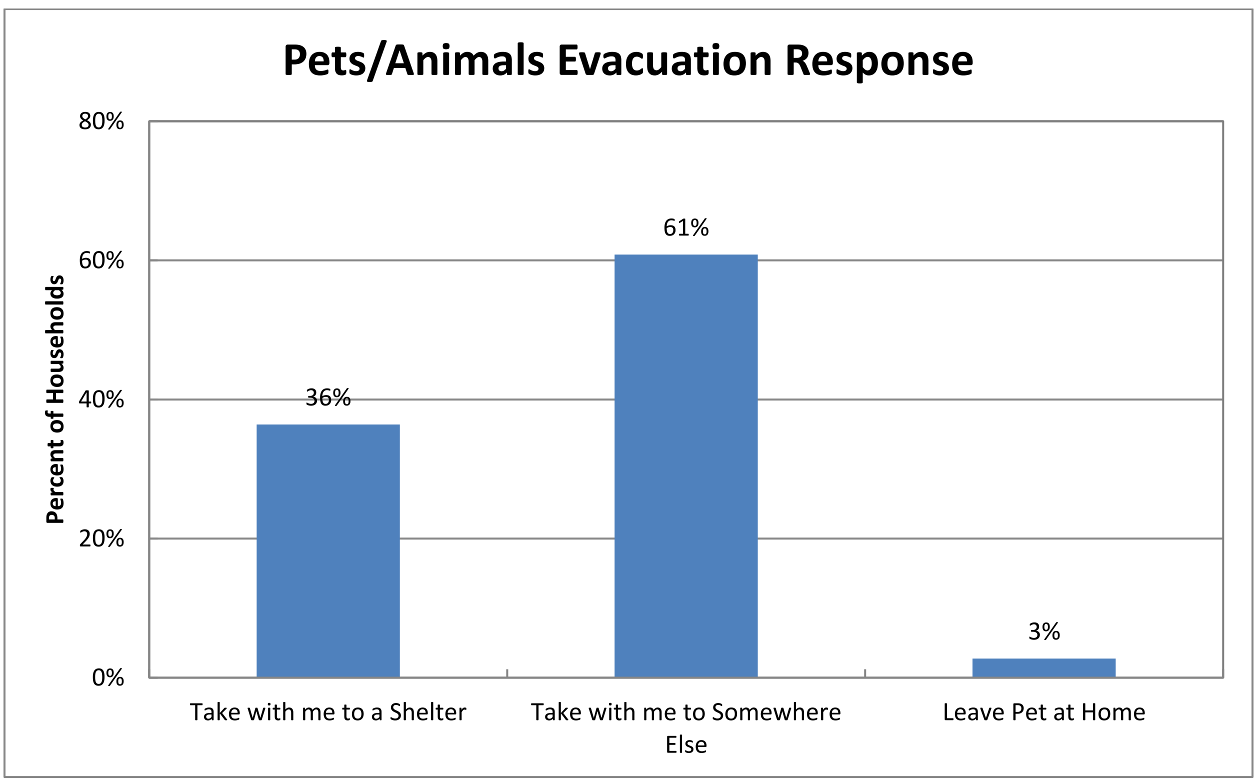


Figure F-15. Households Evacuating with Pets/Animals

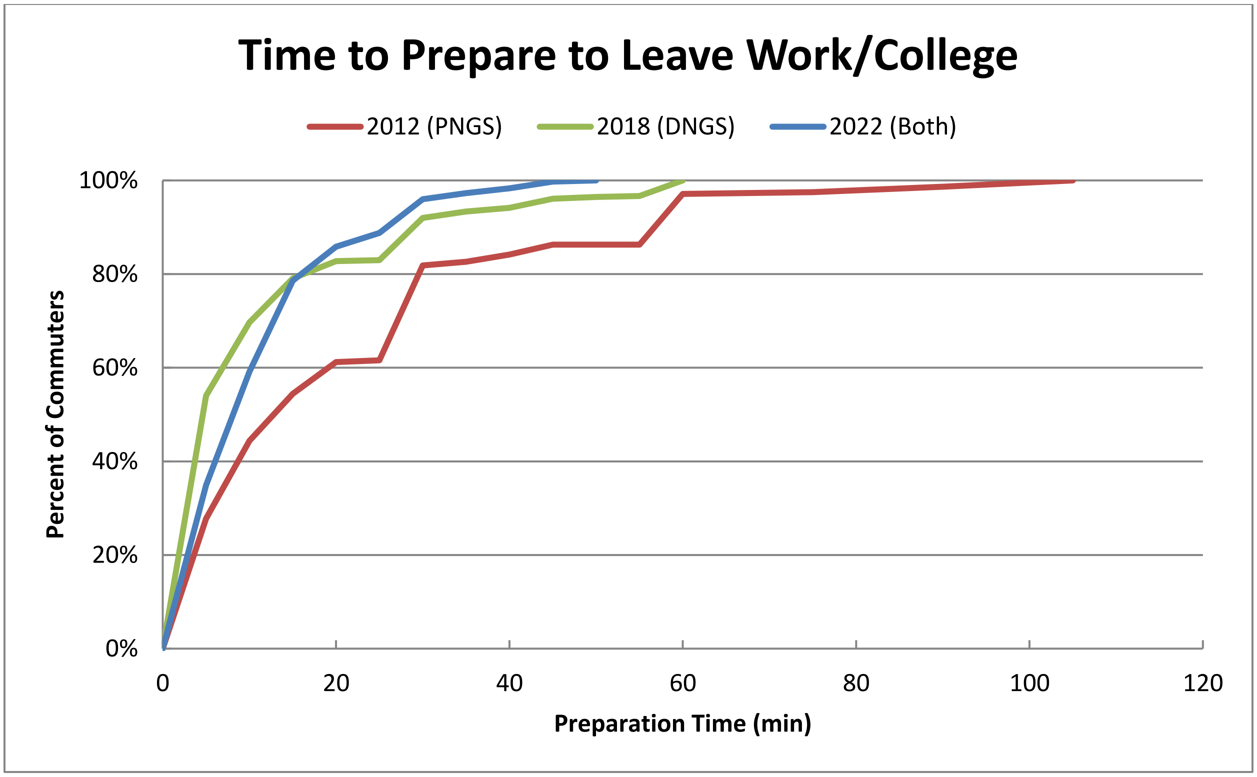


Figure F-16. Time Required to Prepare to Leave Work/College

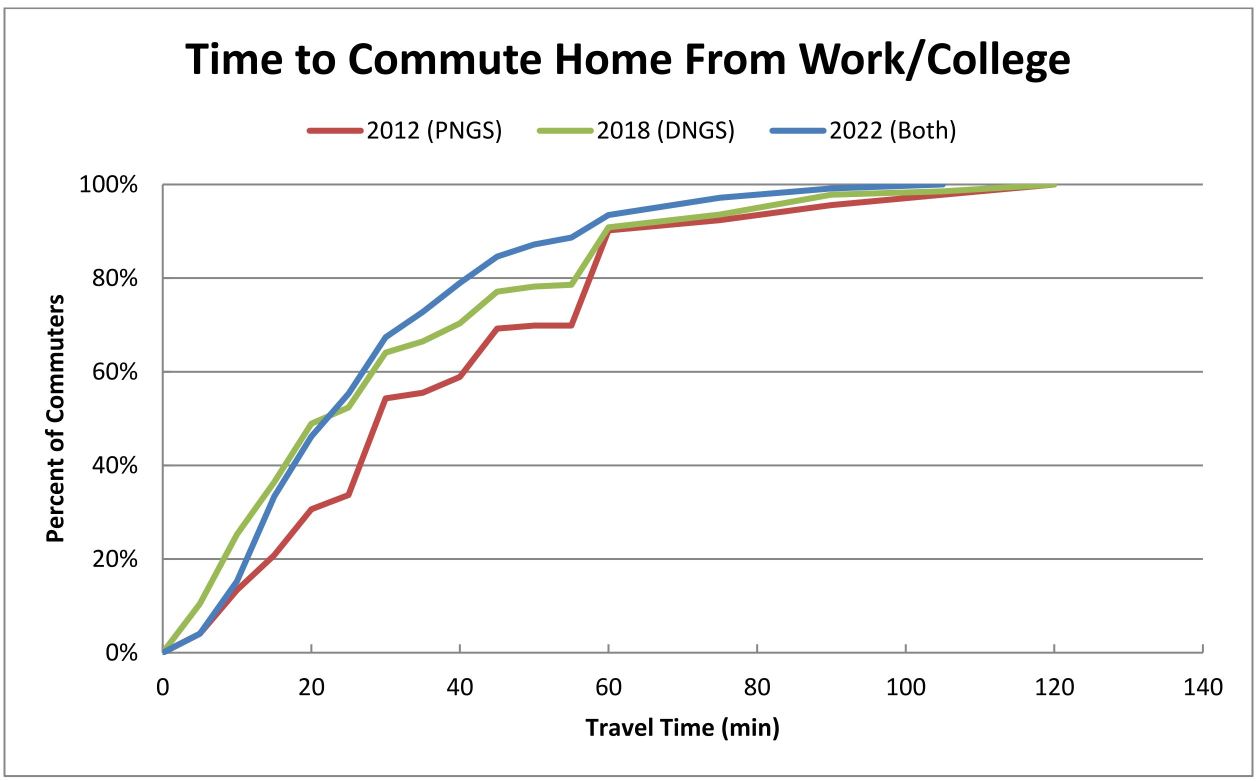


Figure F-17. Time to Commute Home from Work/College

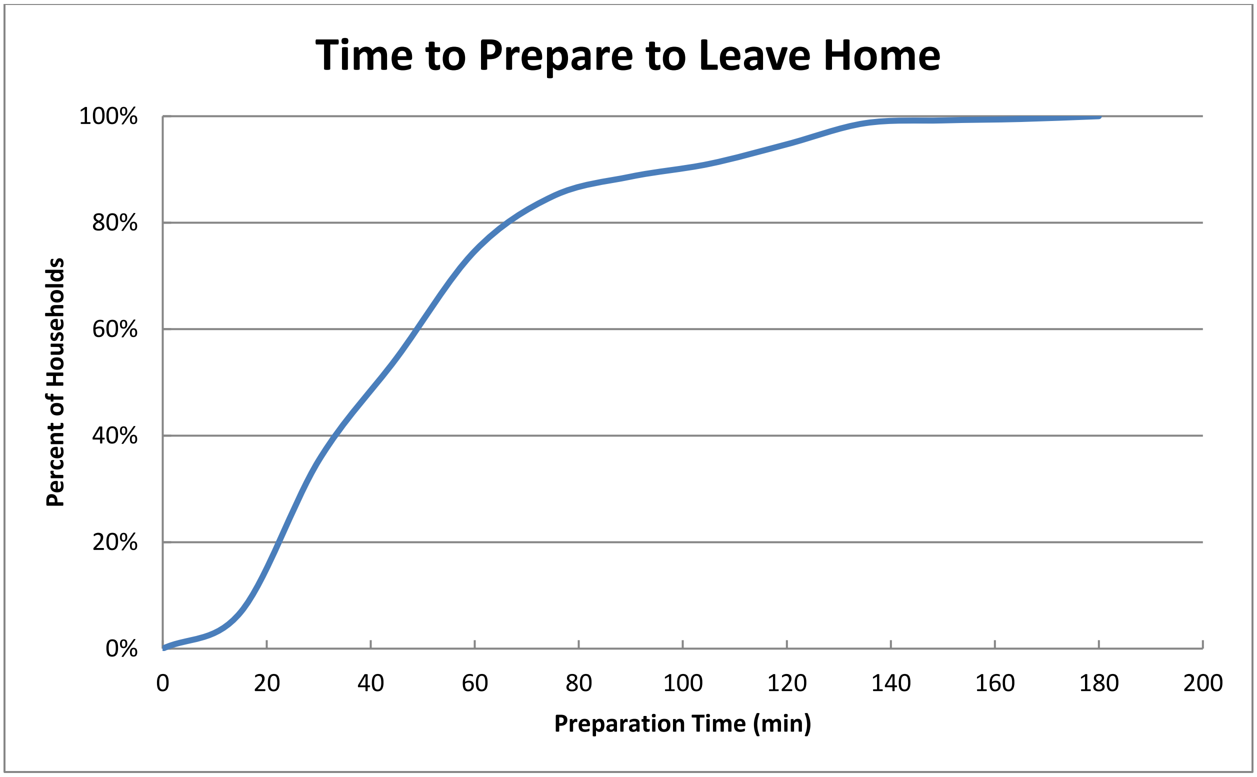


Figure F-18. Time to Prepare Home for Evacuation

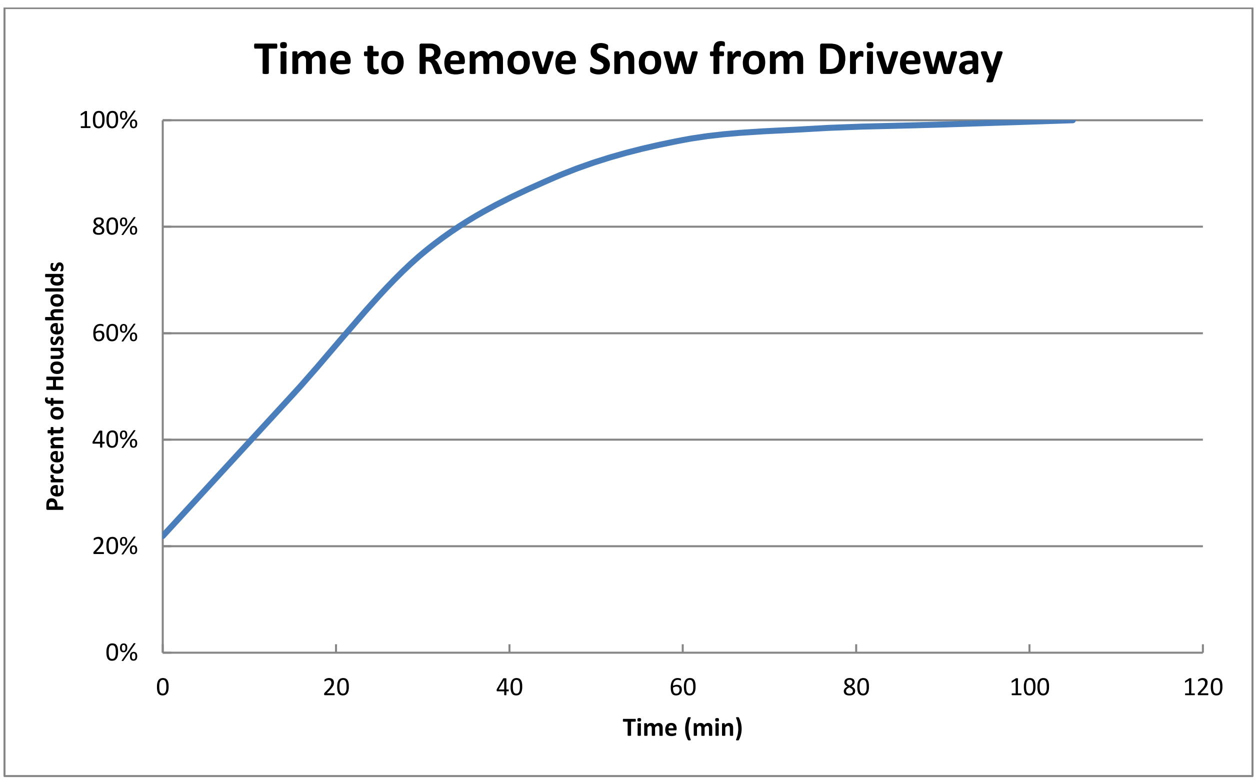


Figure F-19. Time to Clear Driveway of 15-20 cm of Snow

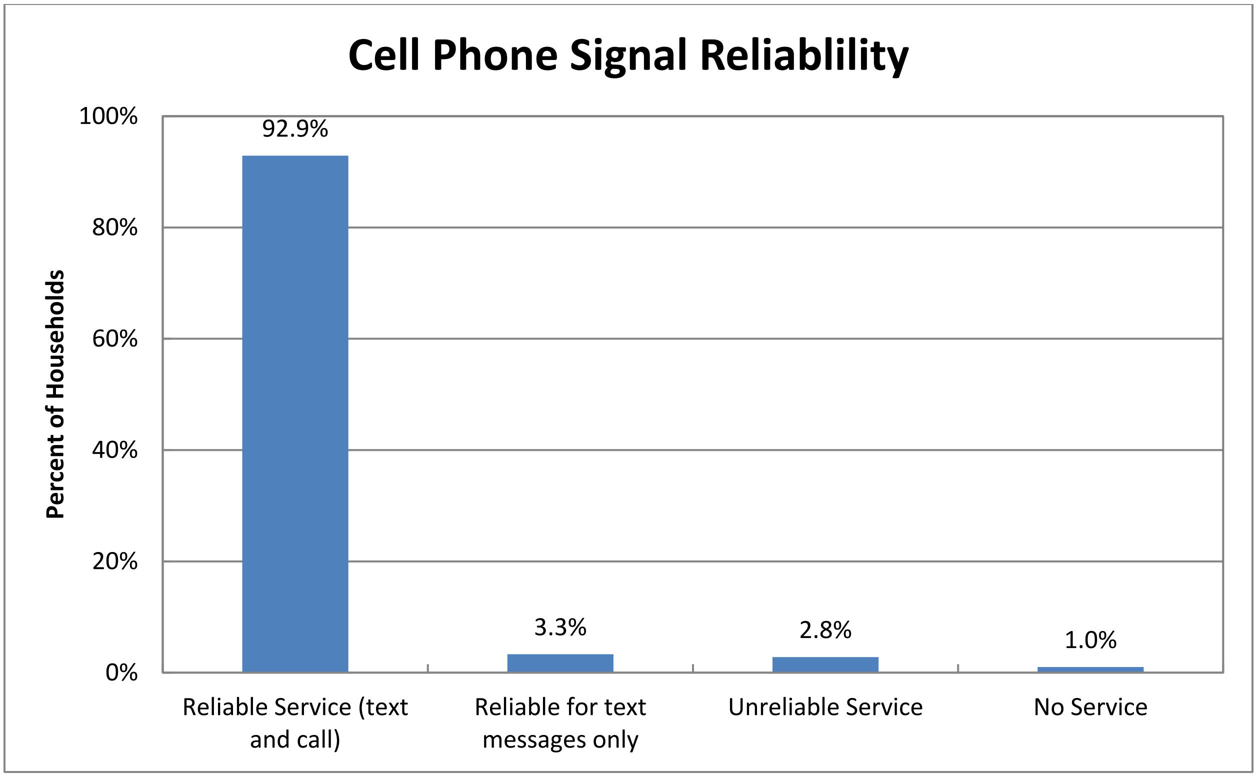


Figure F-20. Cell Phone Signal Reliability (for Phone Call and/or Text Message)

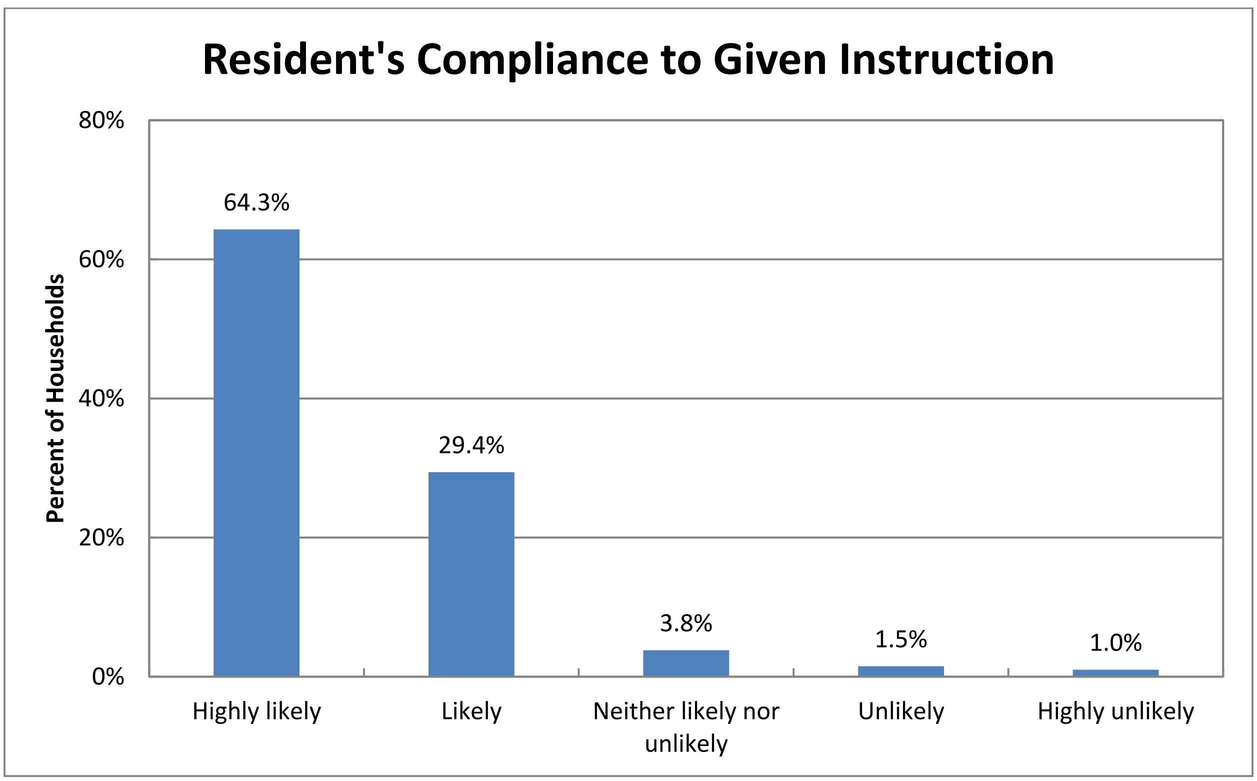


Figure F-21. Resident's Compliance to Given Instruction (by Emergency Management Officials)

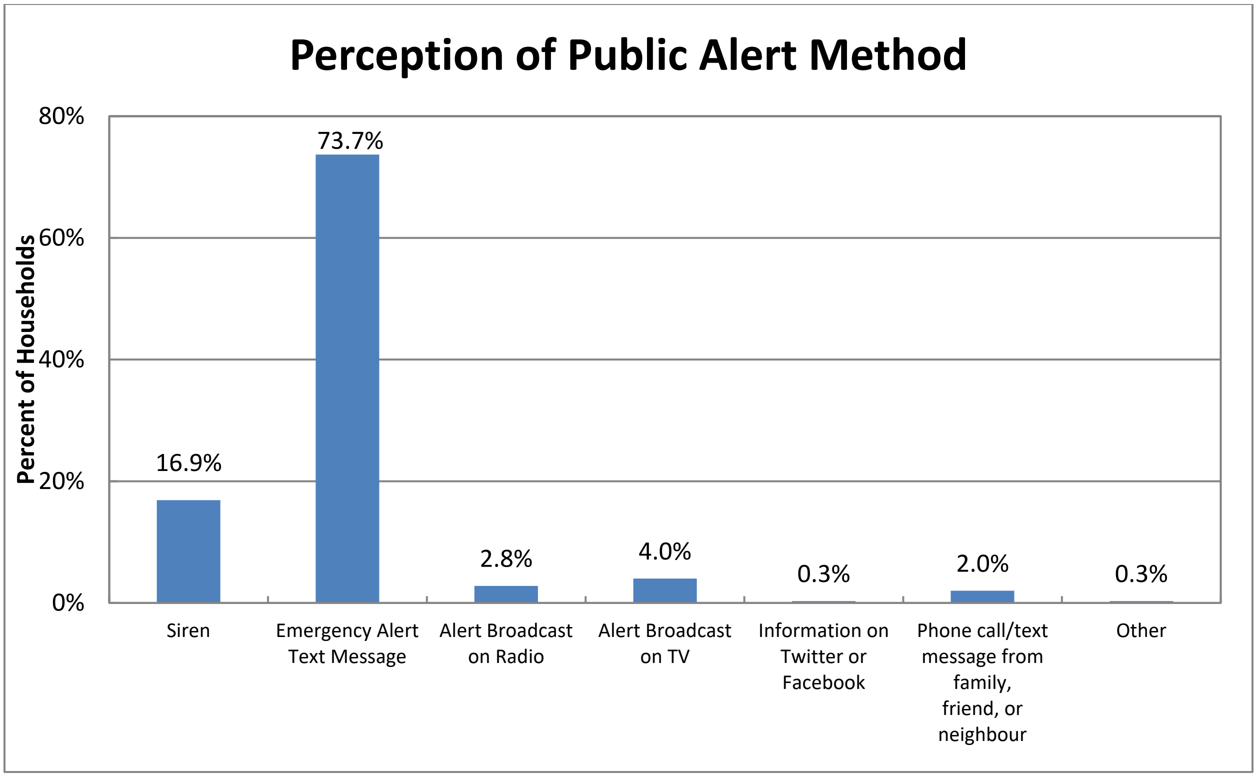


Figure F-22. Perception of Public Alert Method

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	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:	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:	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

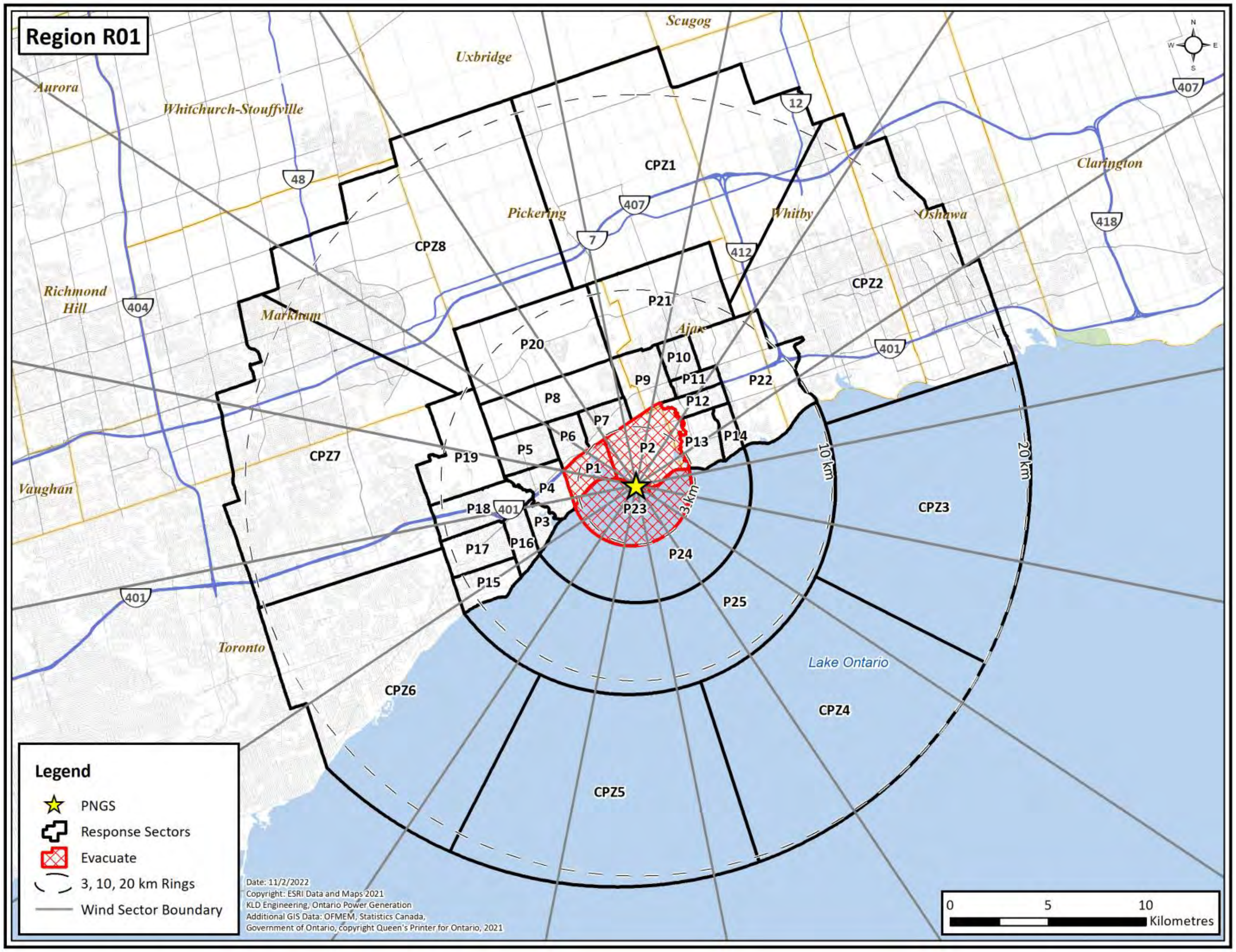


Figure H-1. Region R01

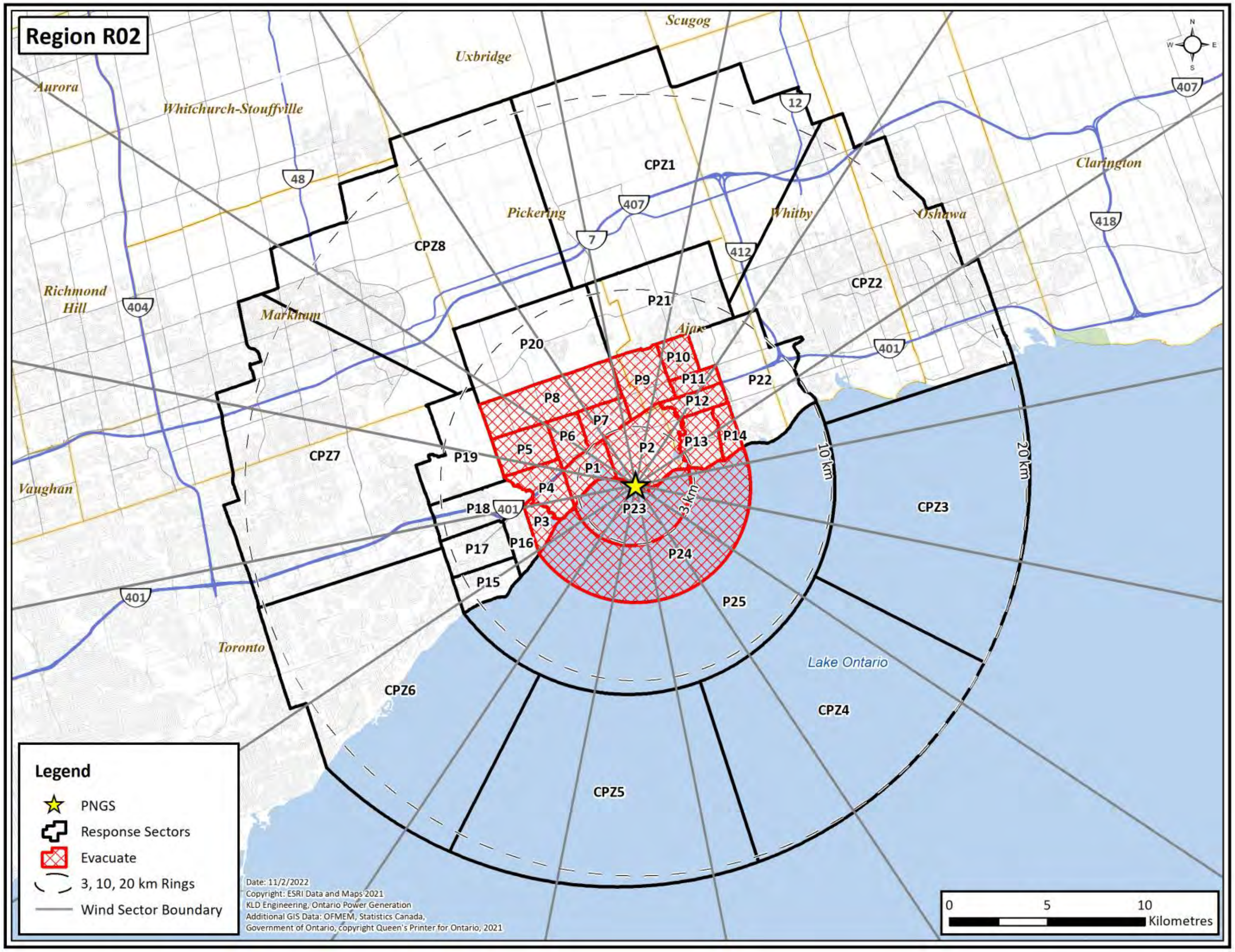


Figure H-2. Region R02

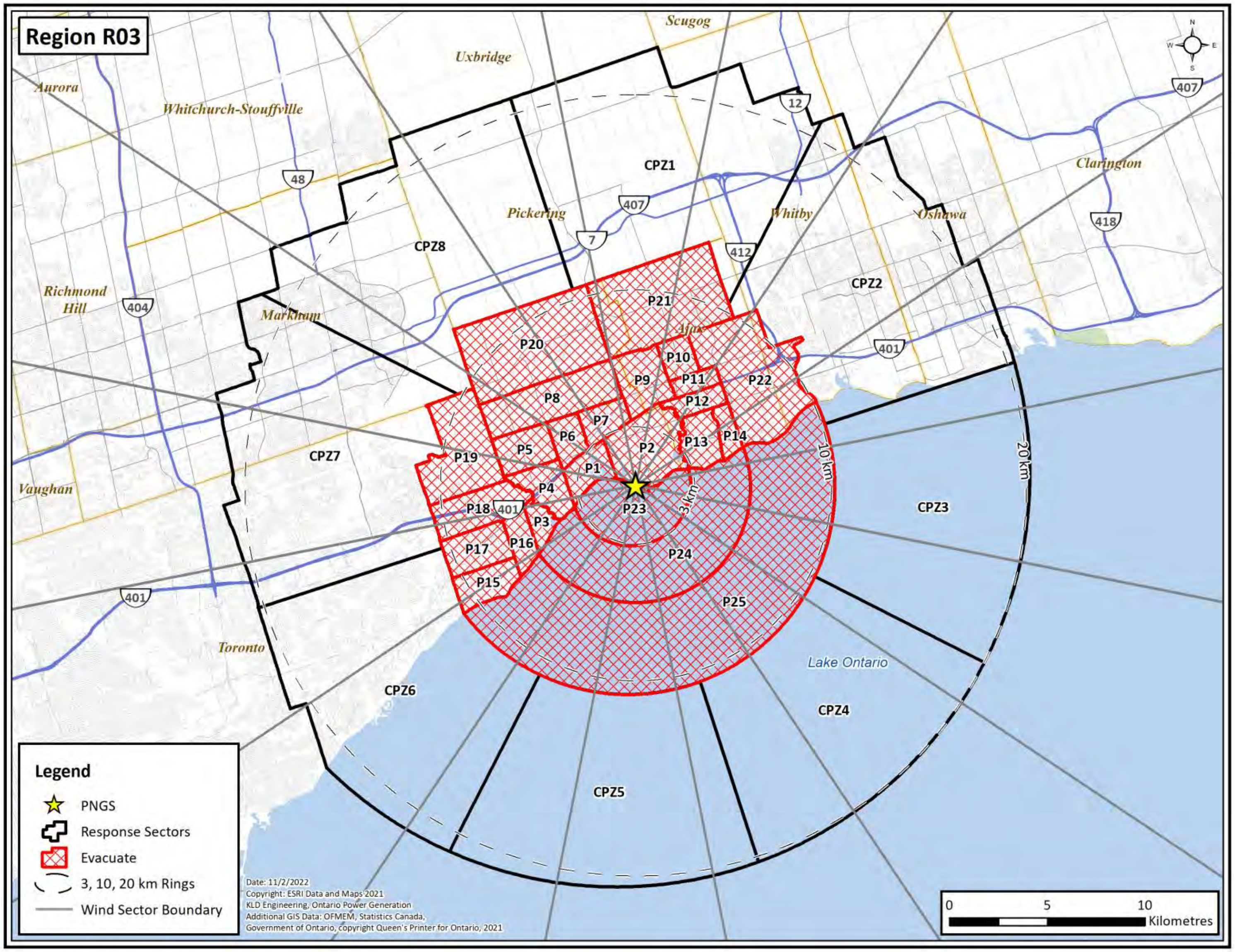


Figure H-3. Region R03

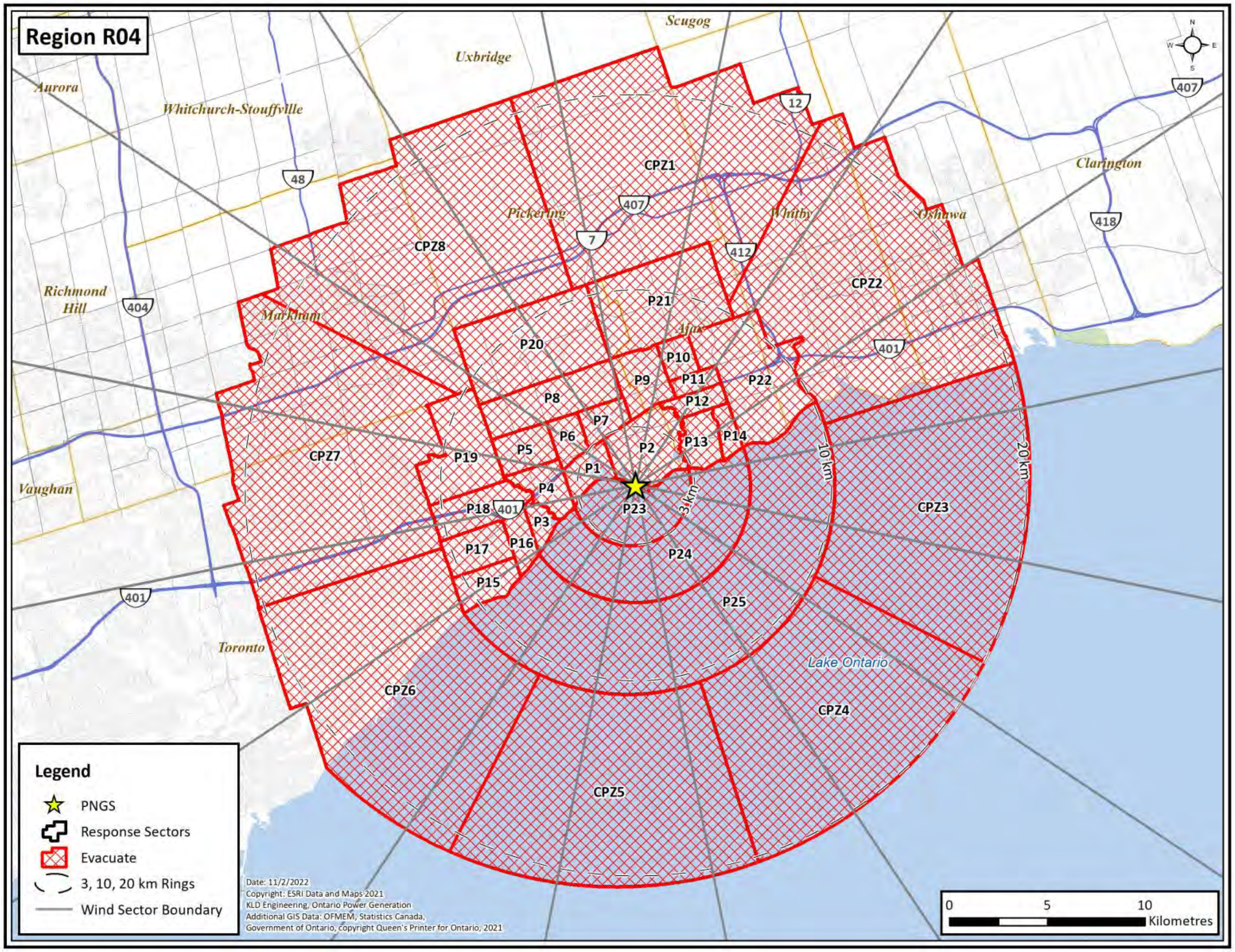


Figure H-4. Region R04

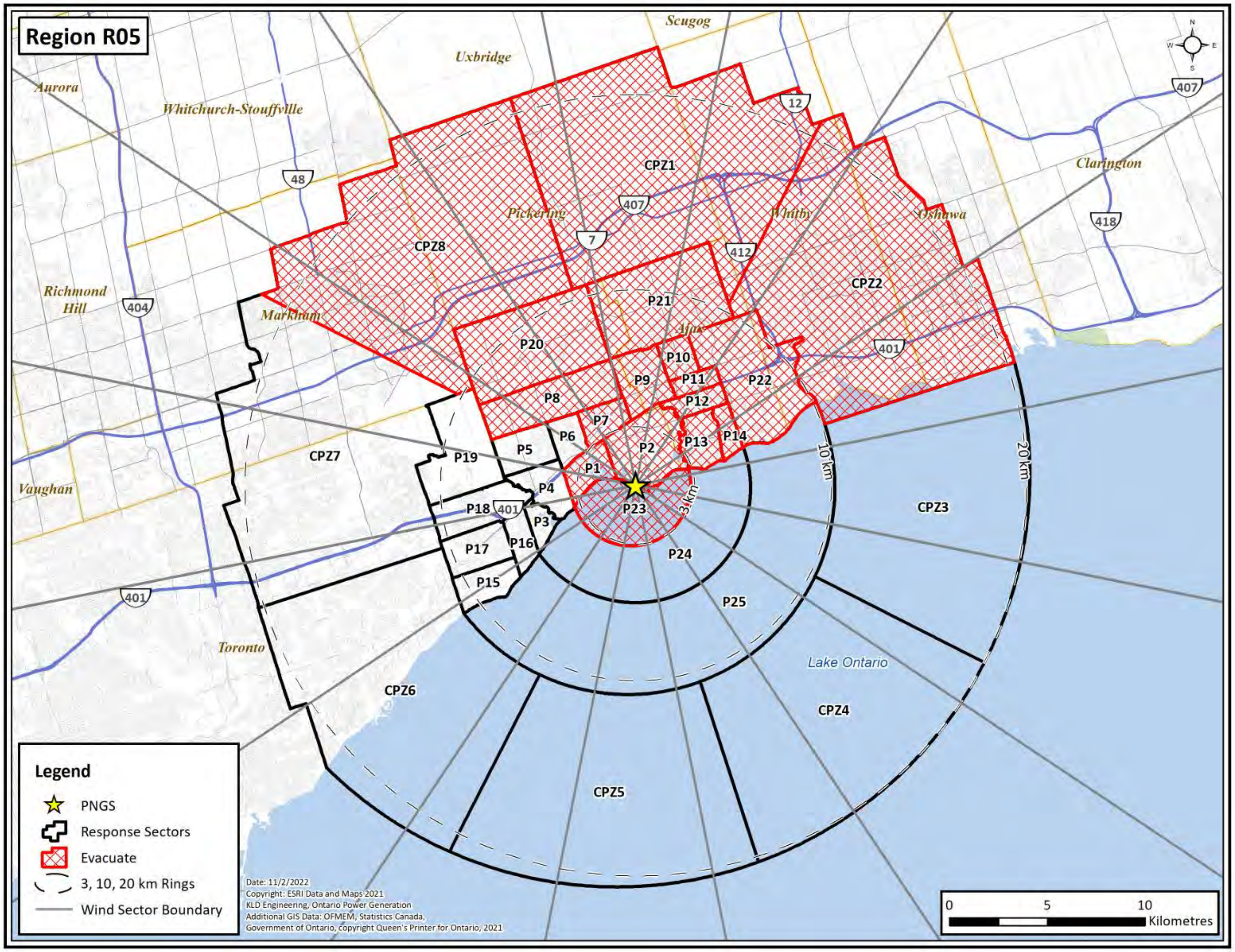


Figure H-5. Region R05

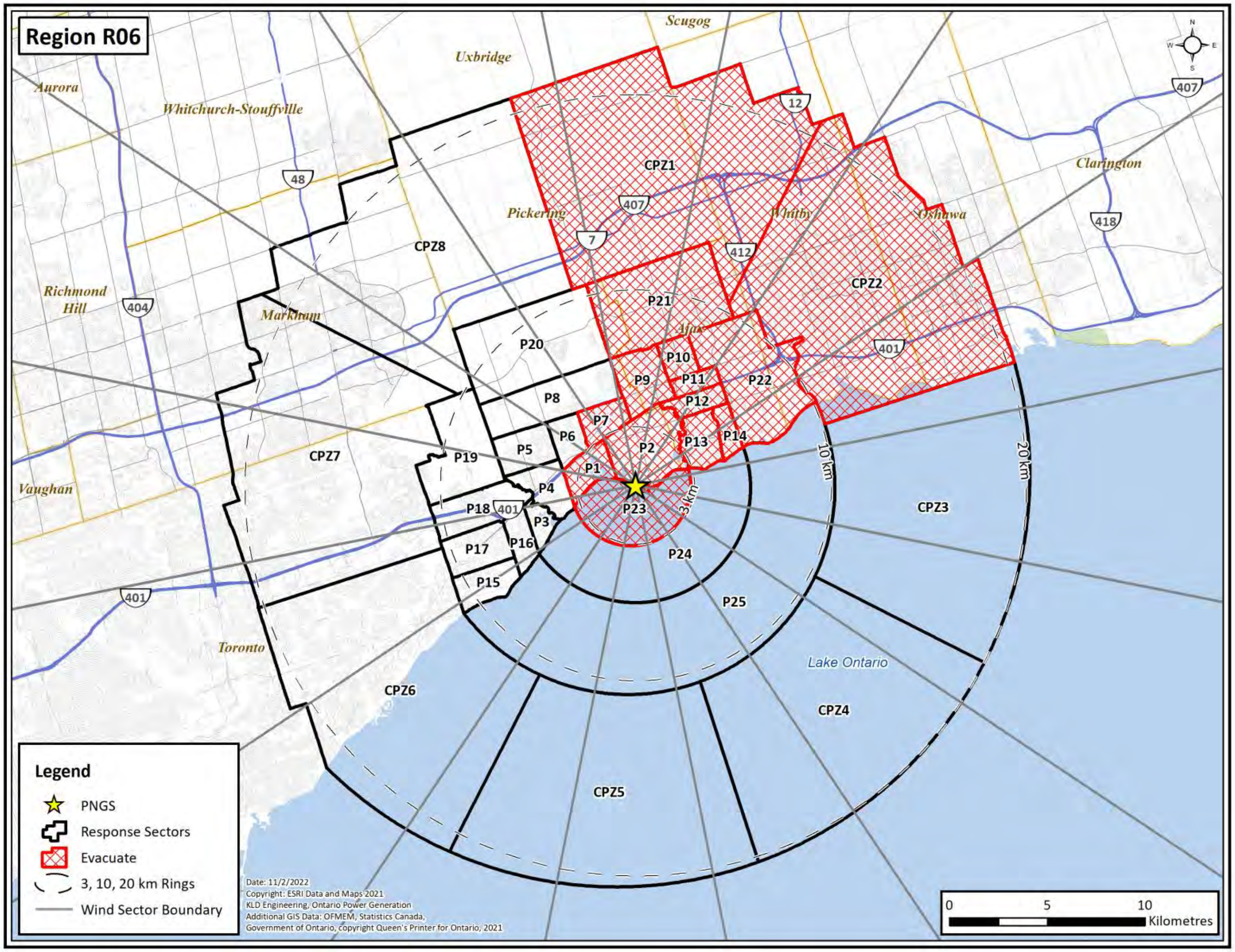


Figure H-6. Region R06

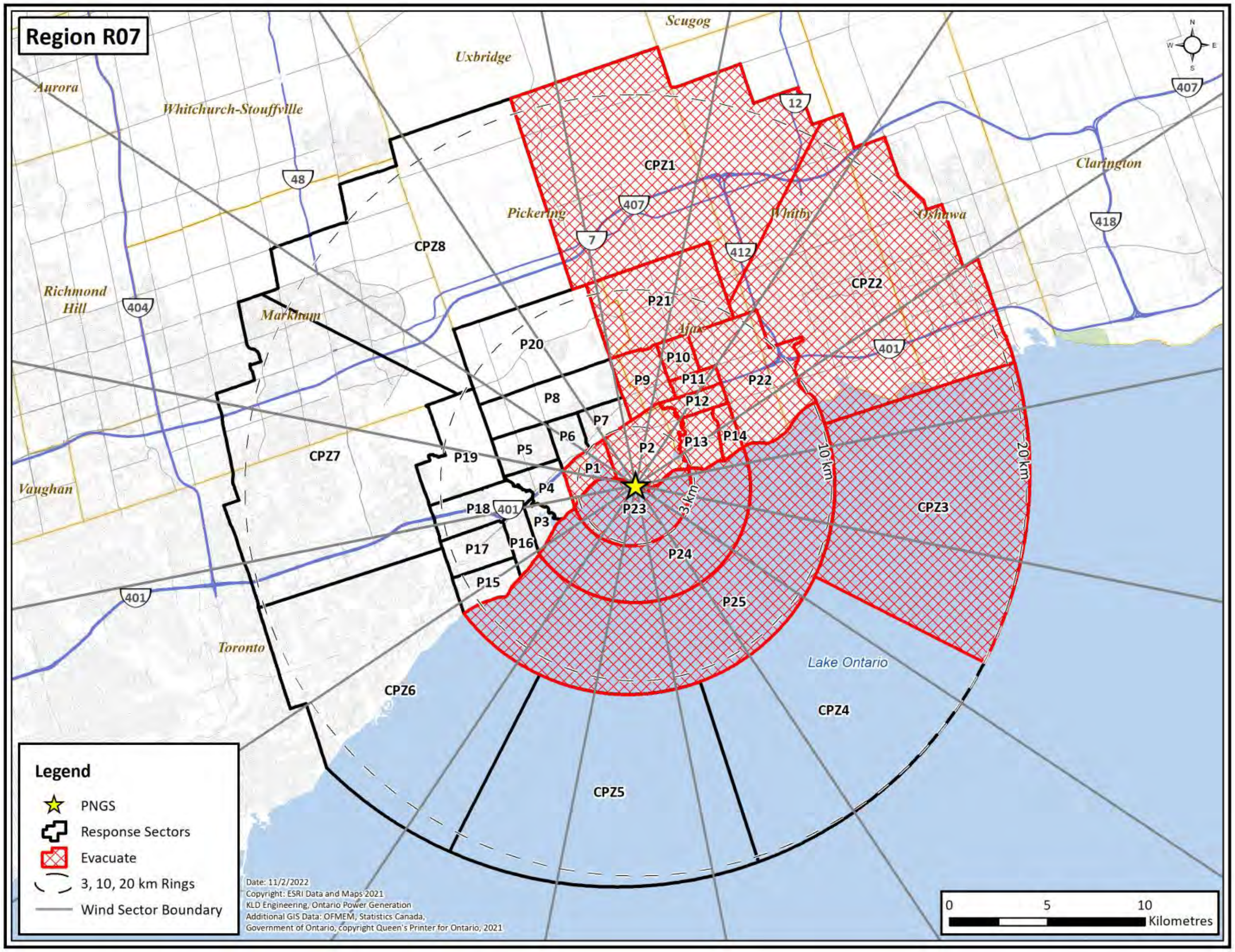


Figure H-7. Region R07

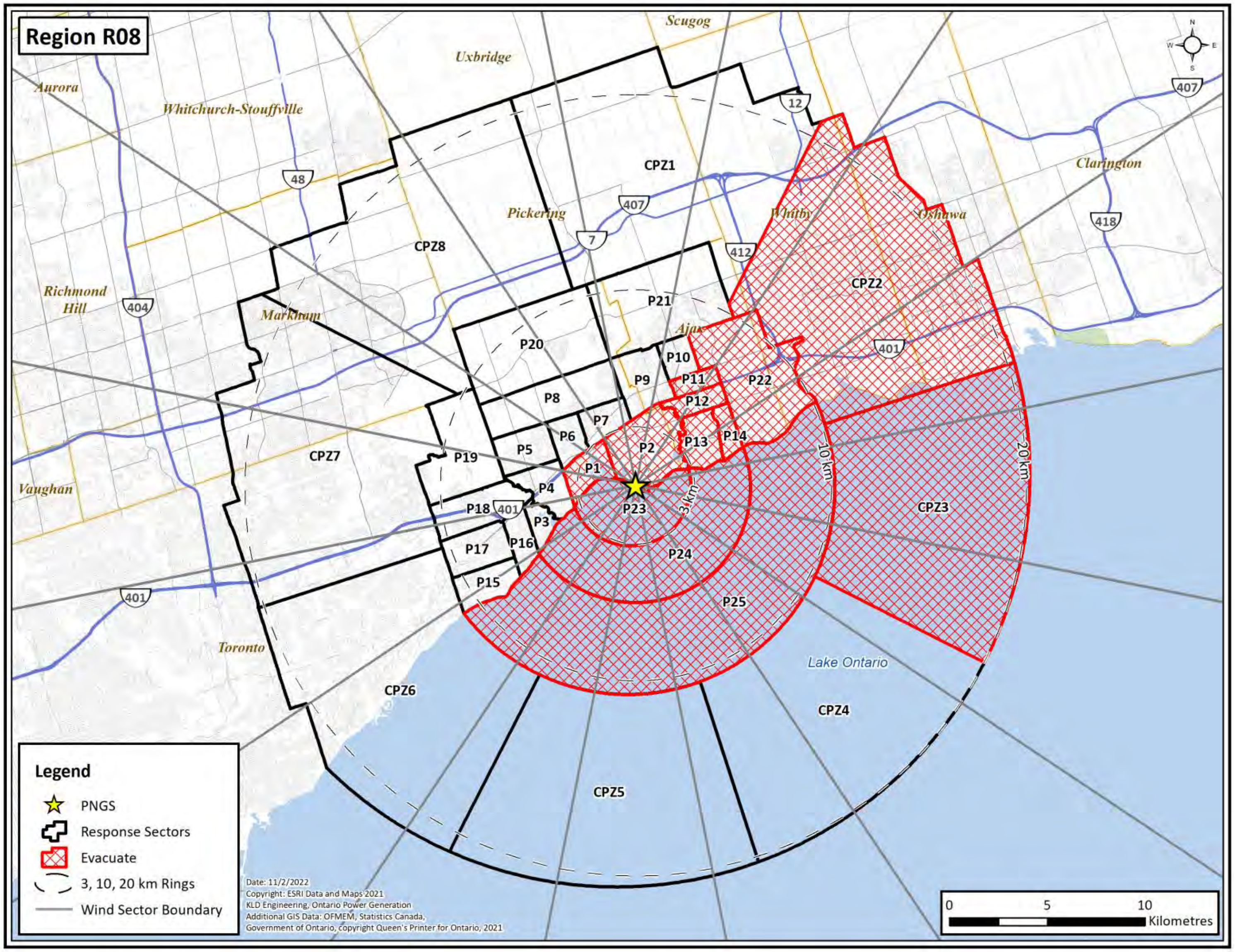


Figure H-8. Region R08

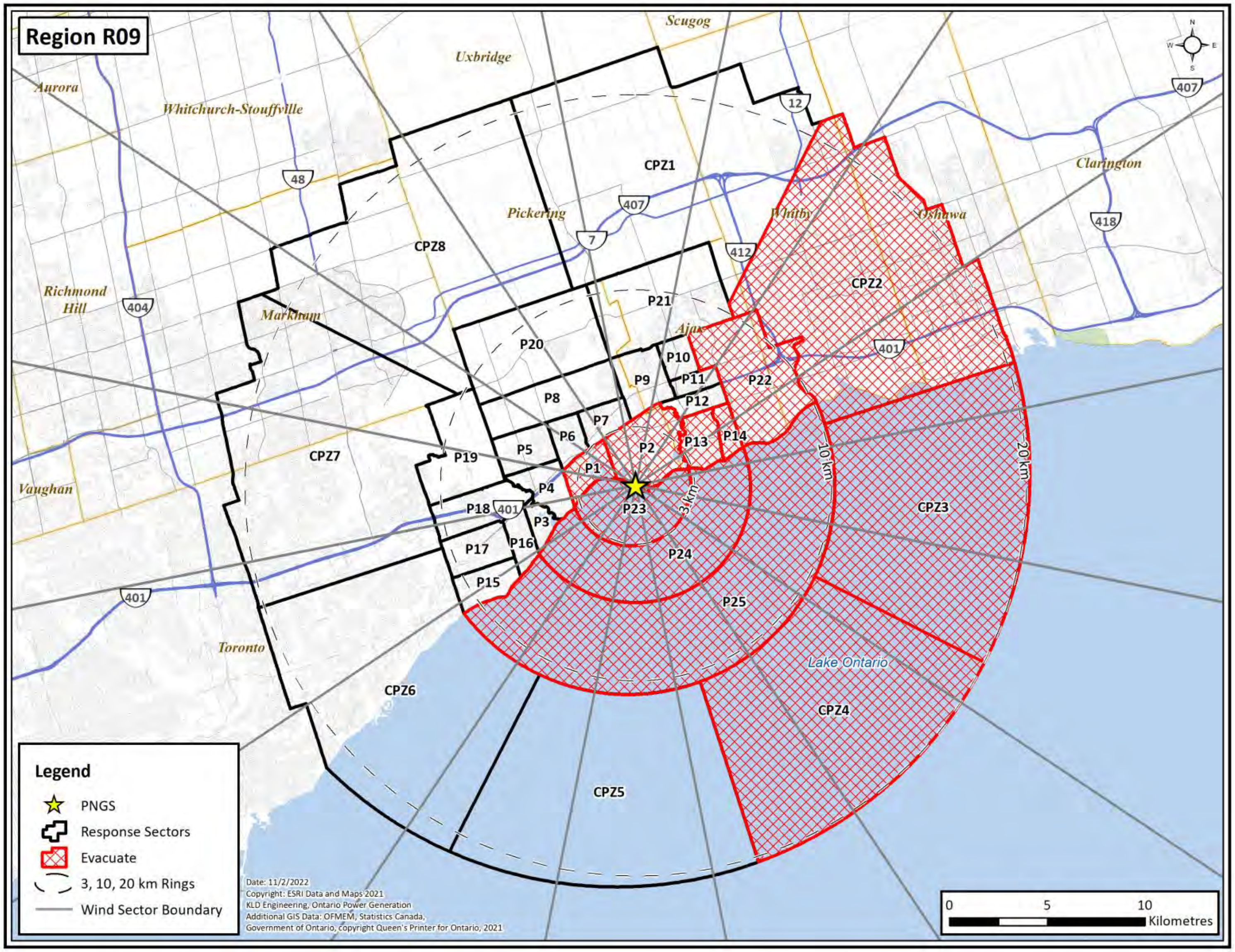


Figure H-9. Region R09

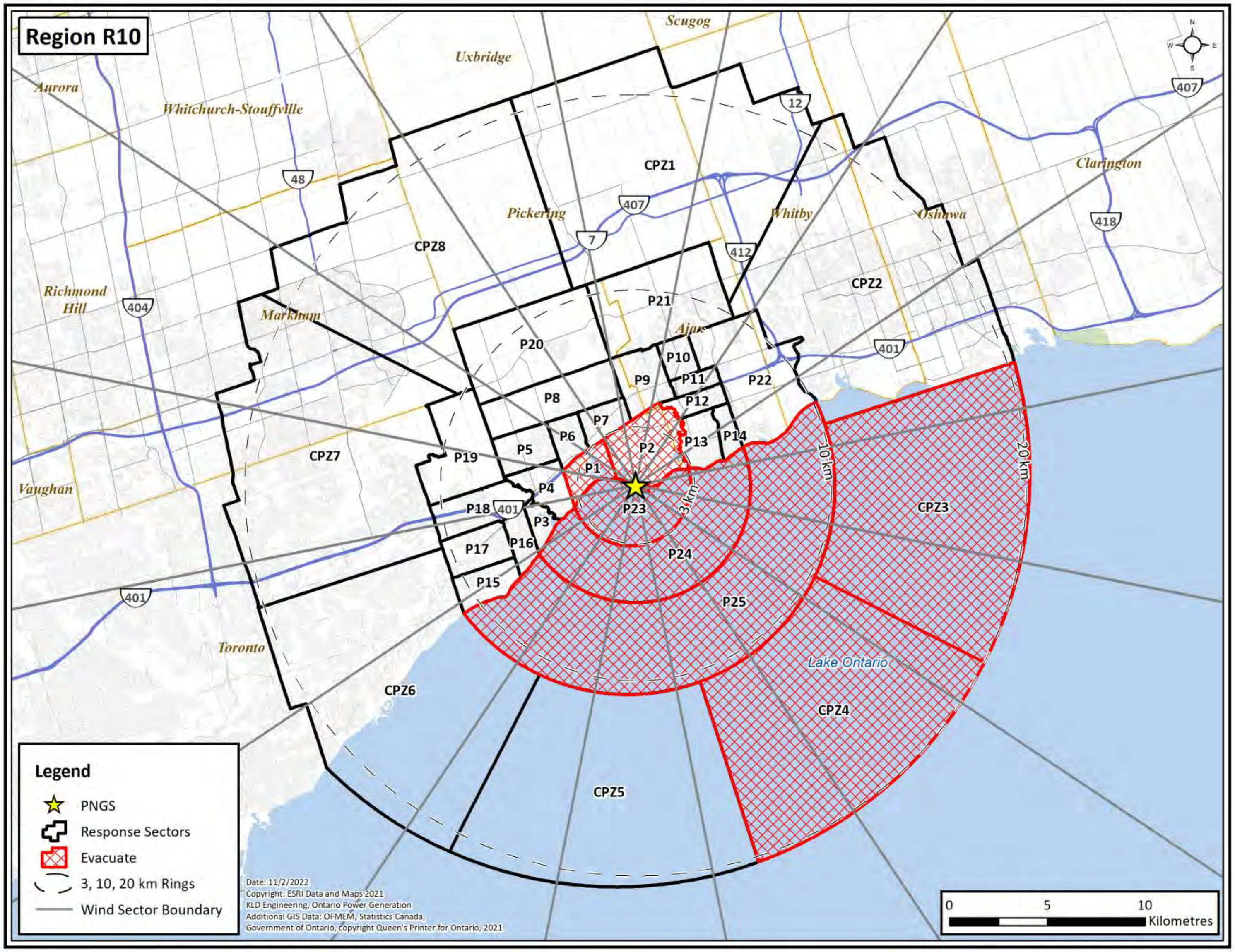


Figure H-10. Region R10

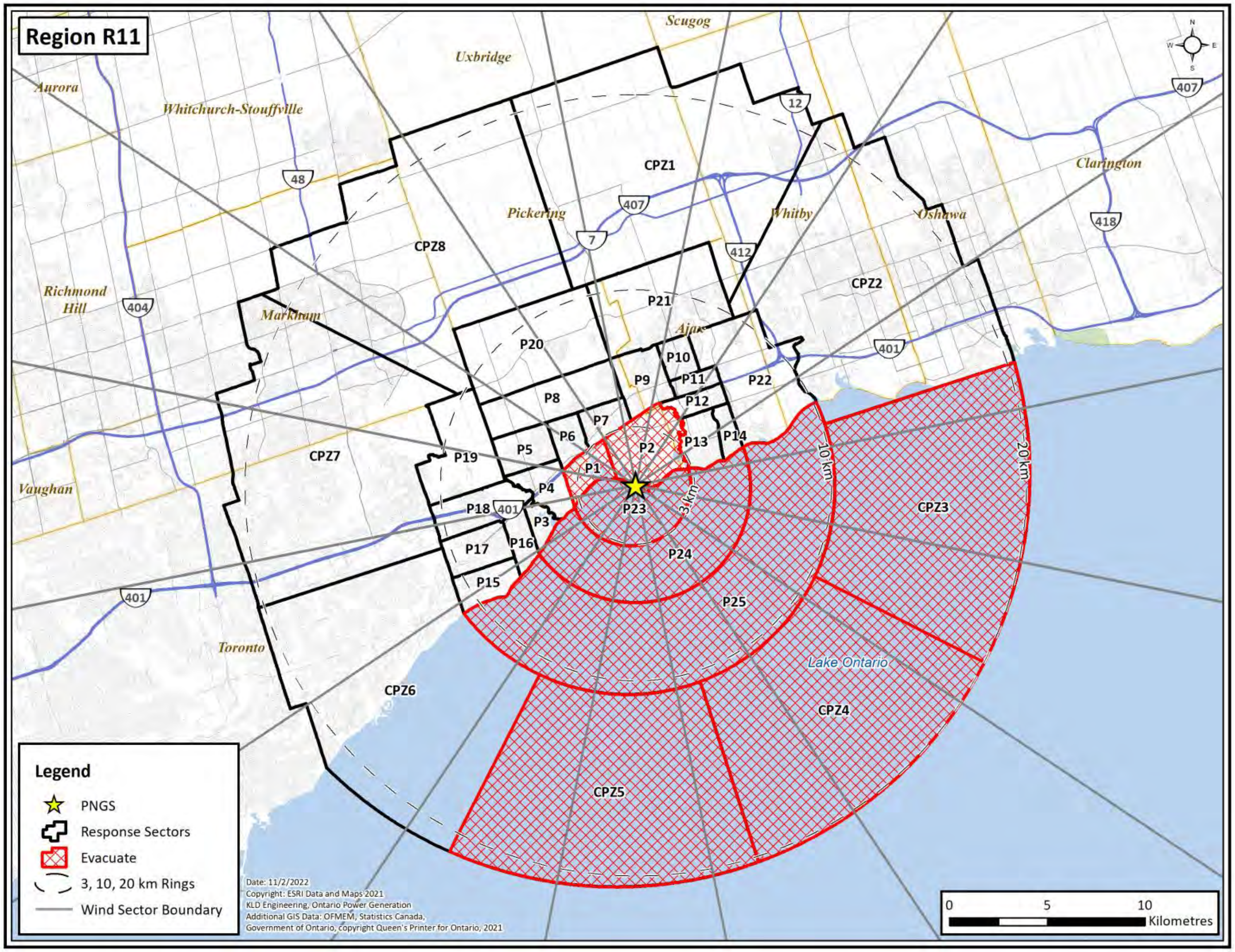


Figure H-11. Region R11

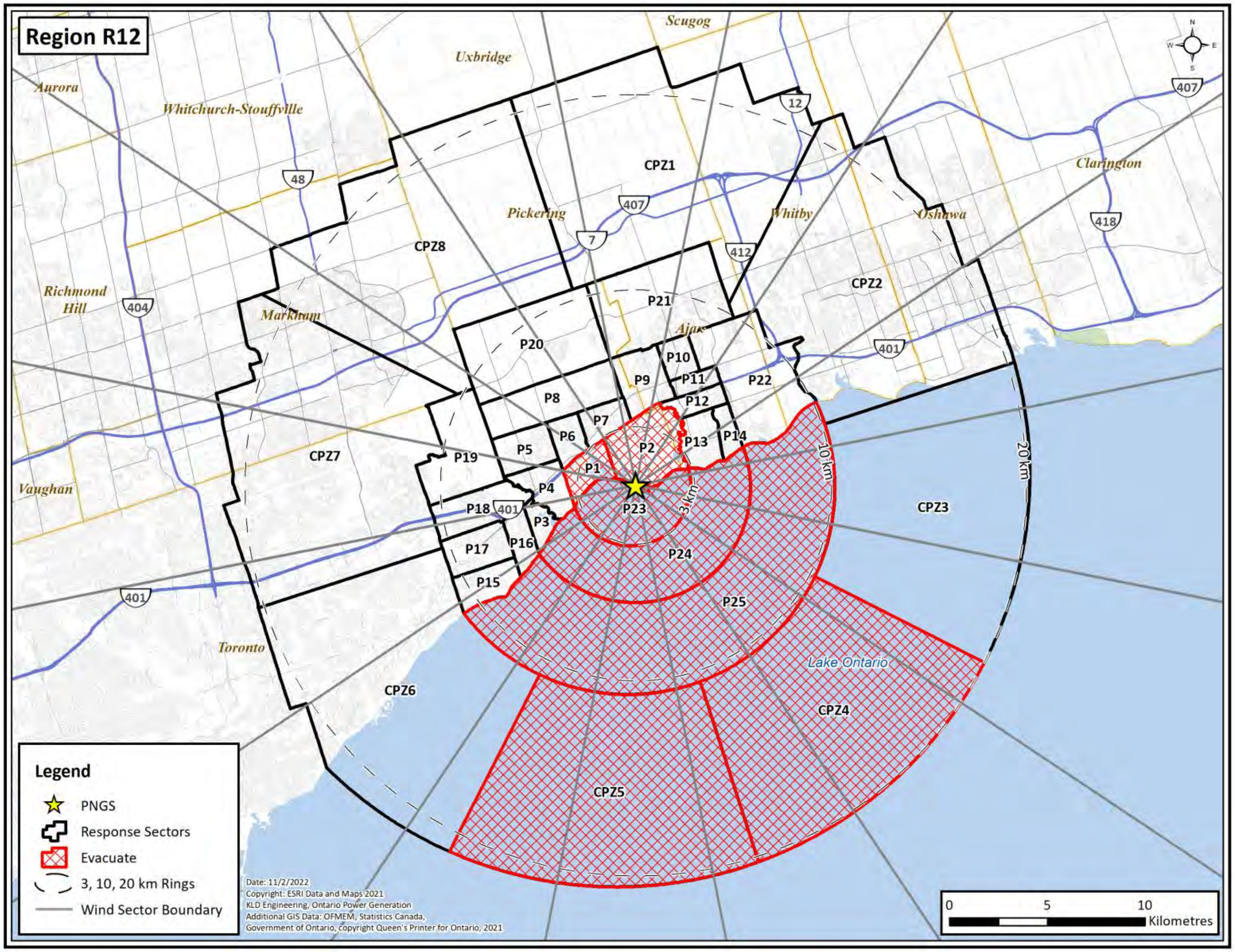


Figure H-12. Region R12

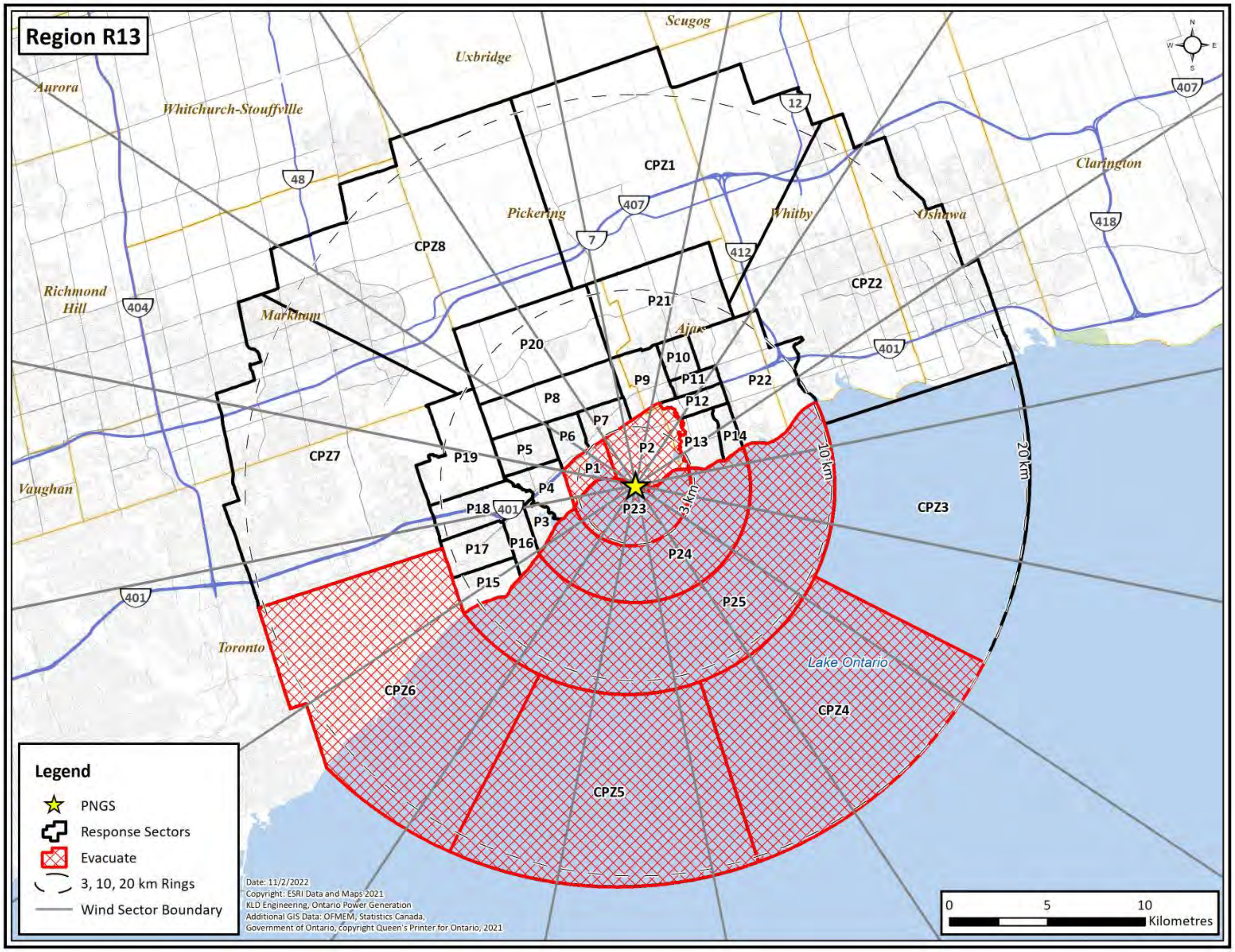


Figure H-13. Region R13

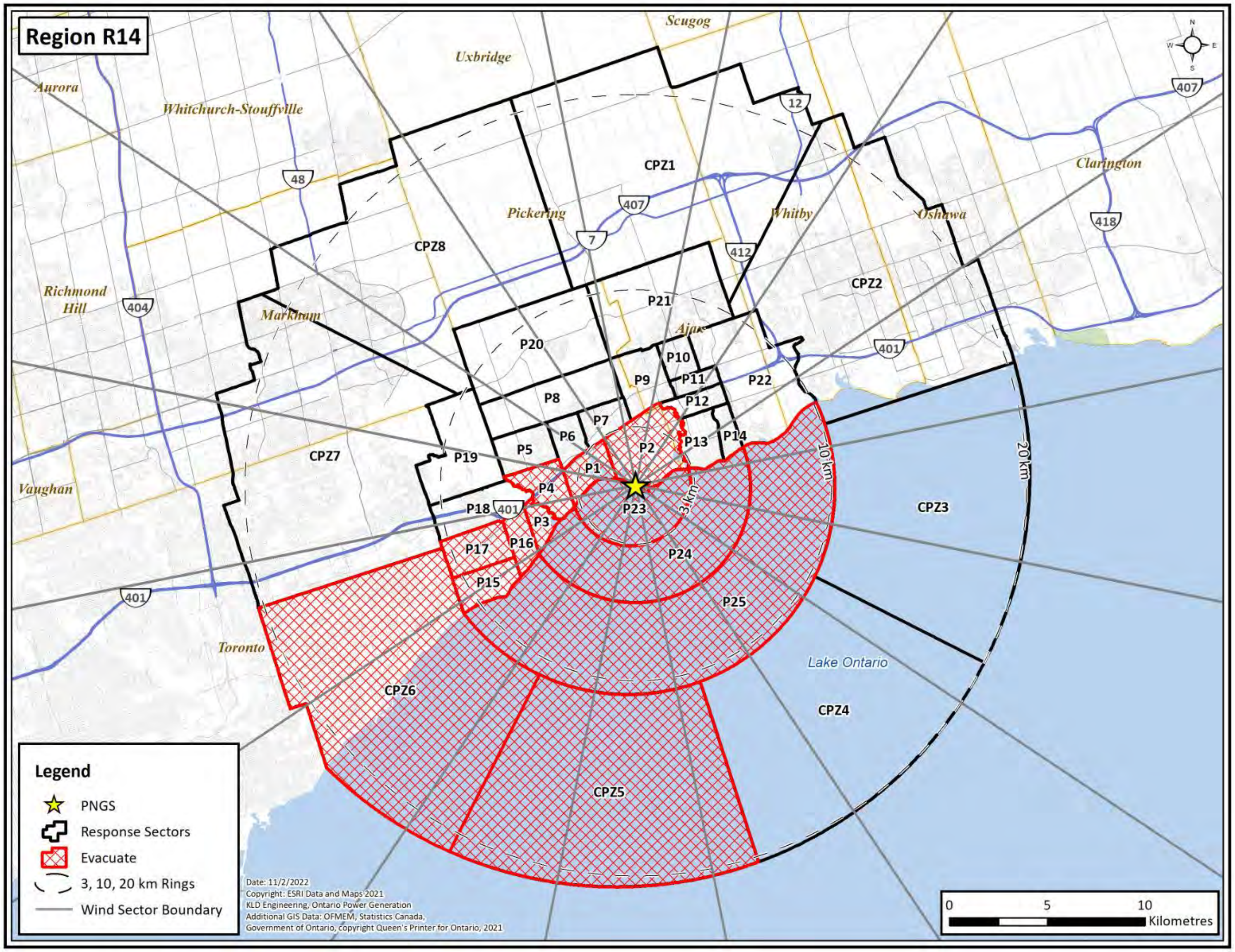


Figure H-14. Region R14

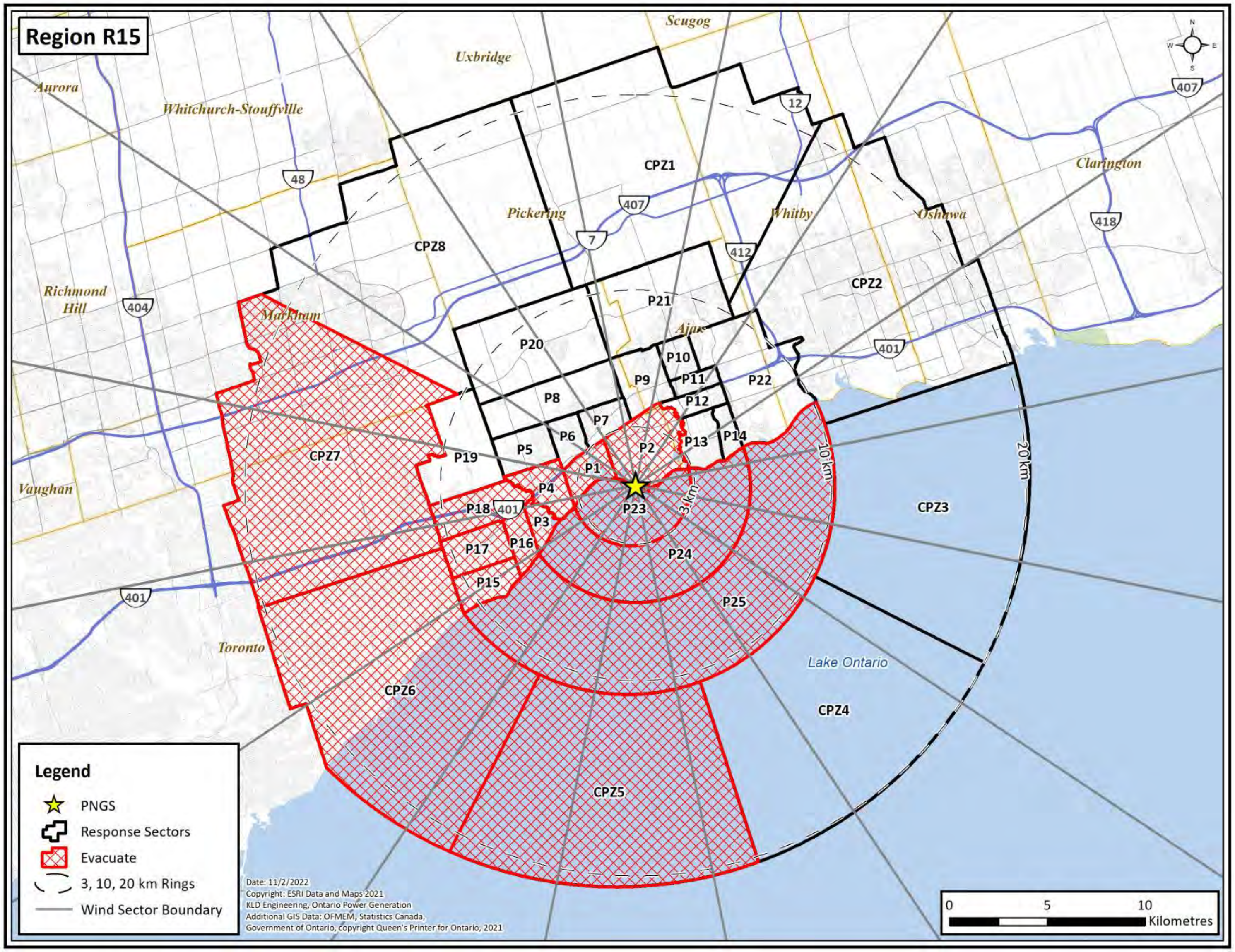


Figure H-15. Region R15

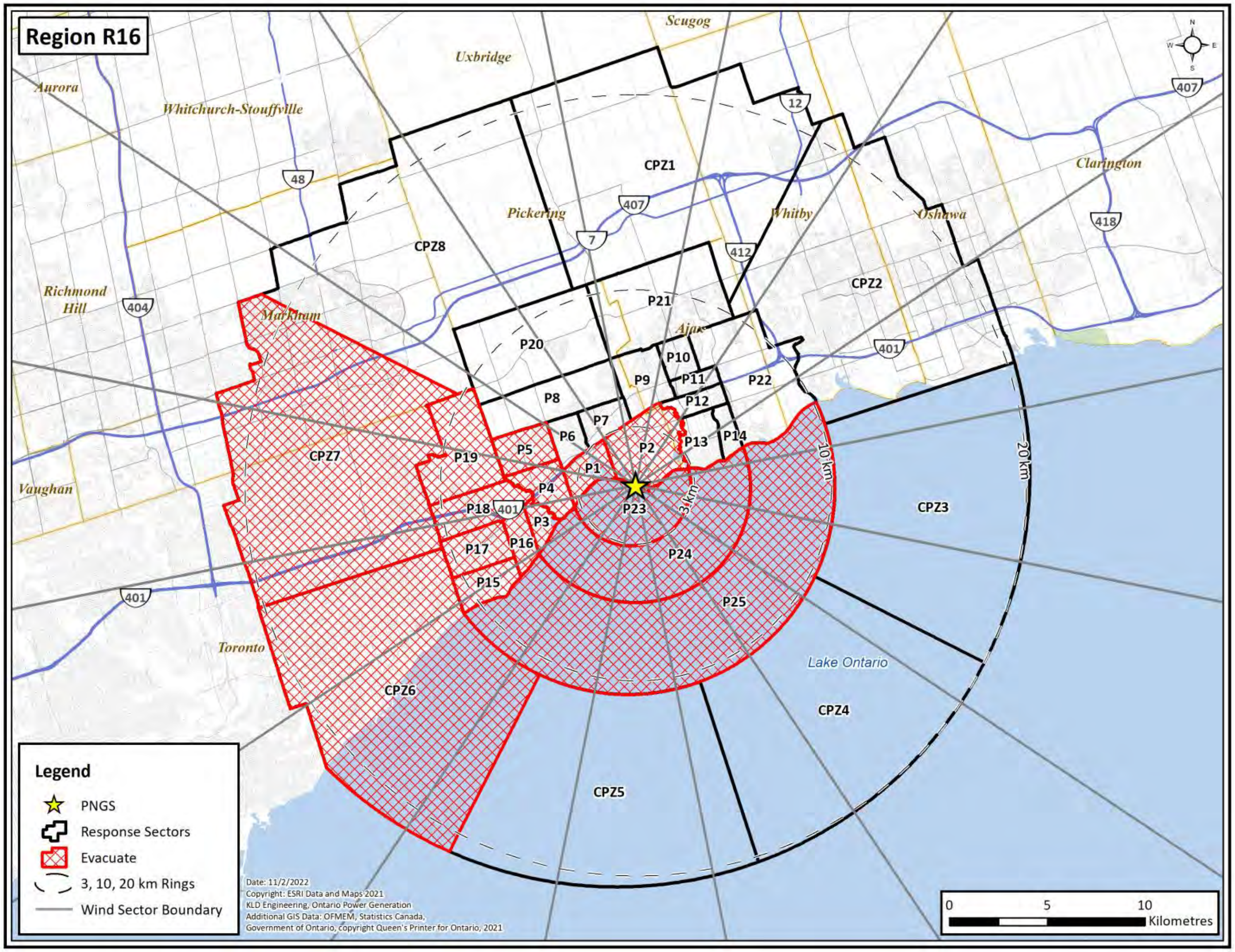


Figure H-16. Region R16

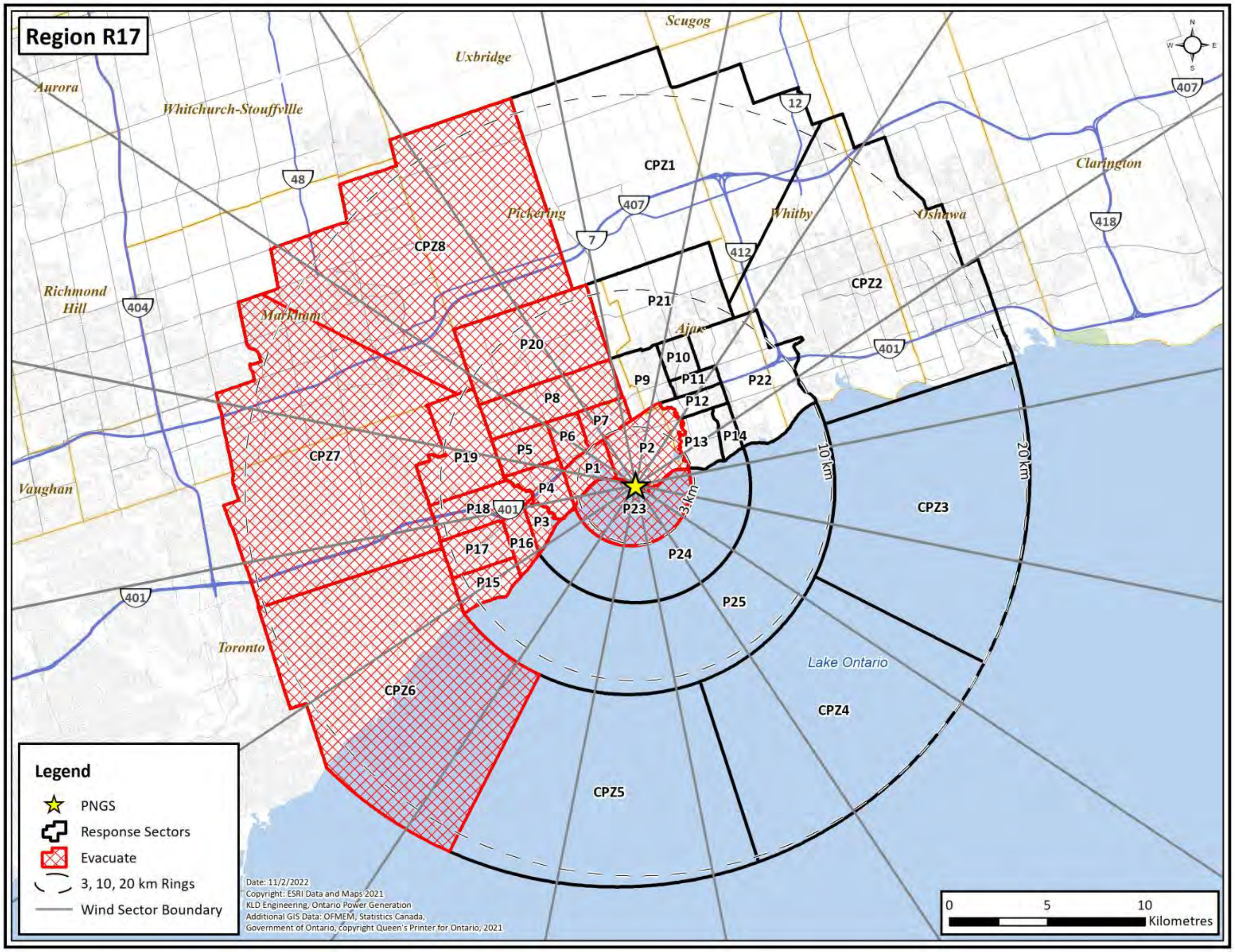


Figure H-17. Region R17

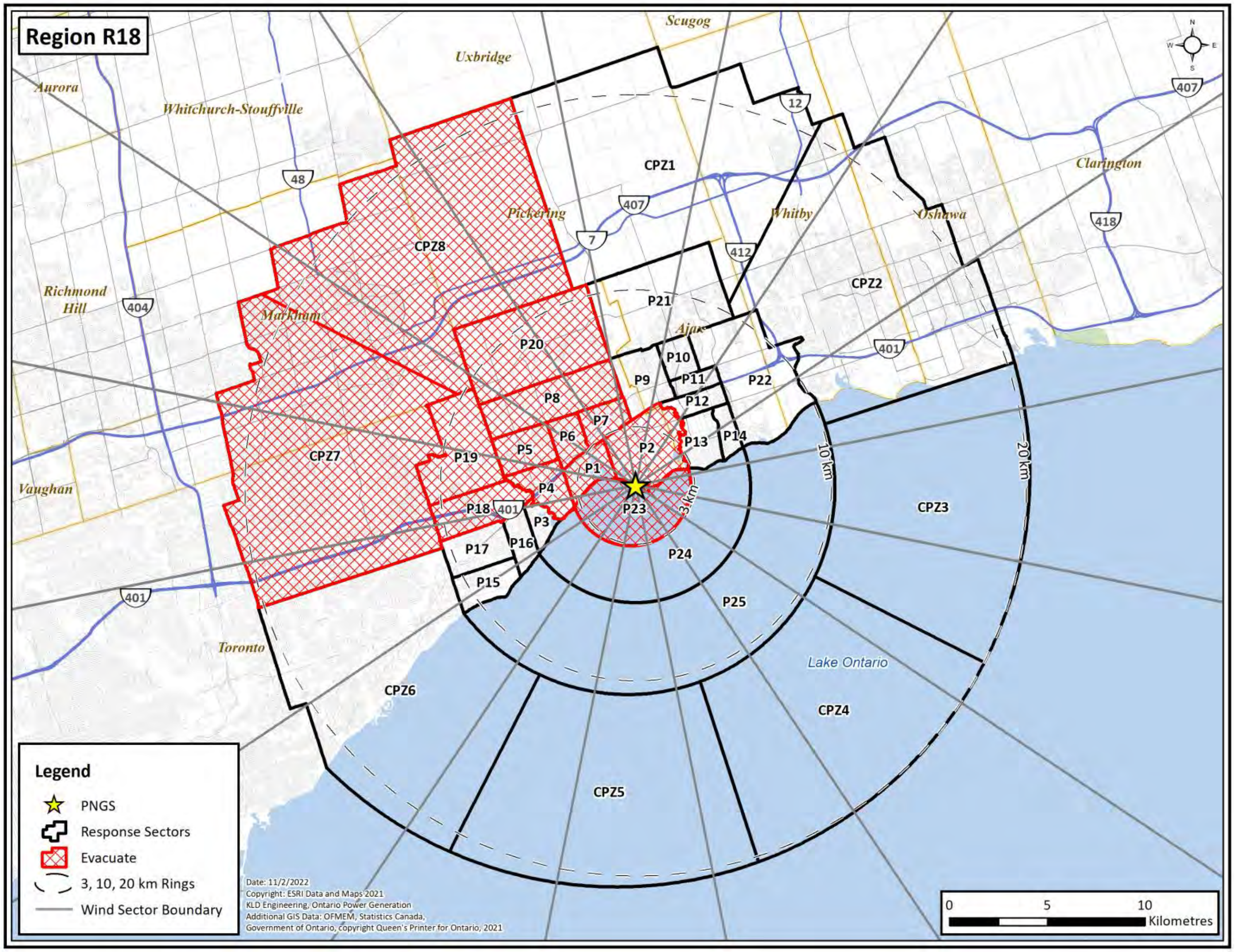


Figure H-18. Region R18

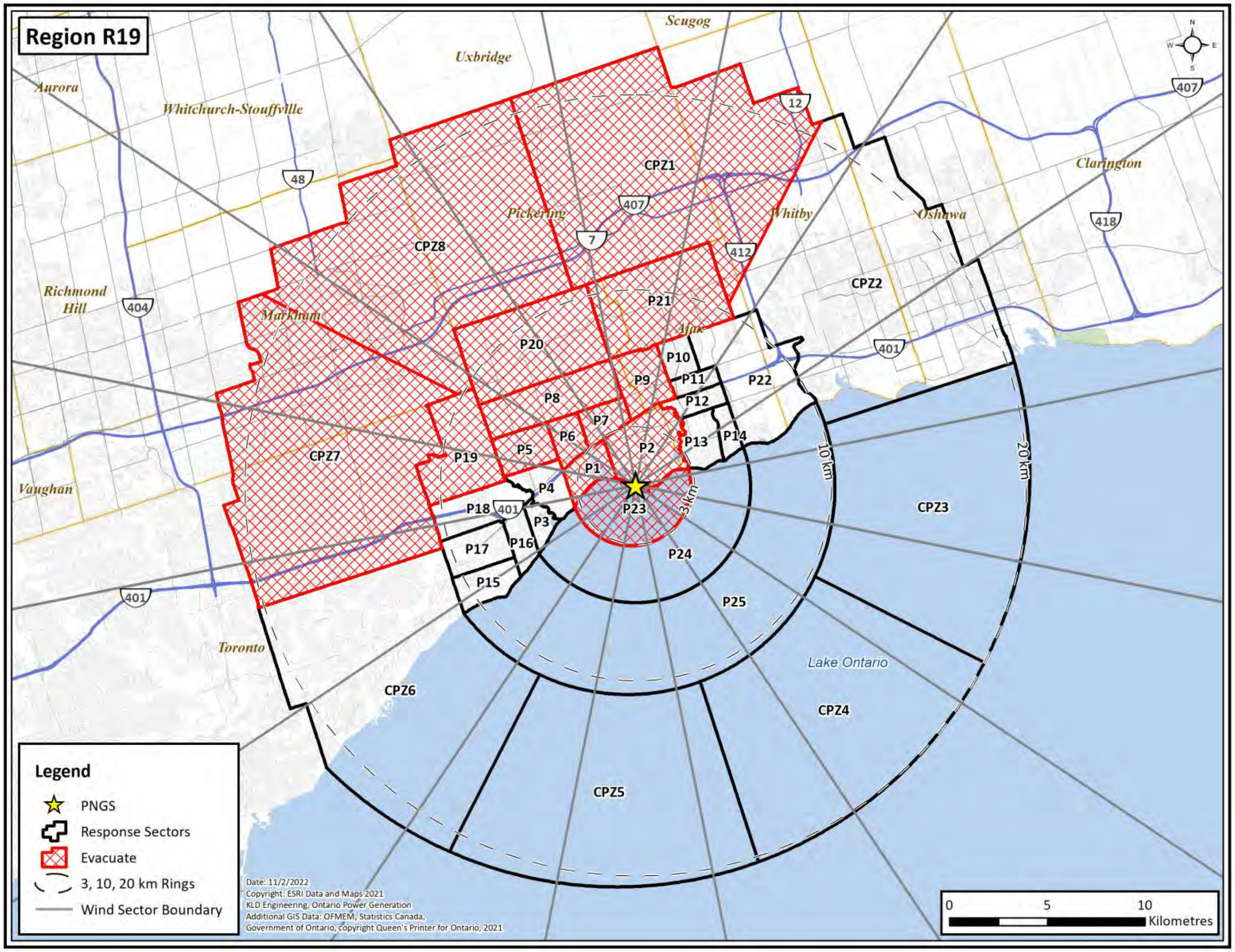


Figure H-19. Region R19

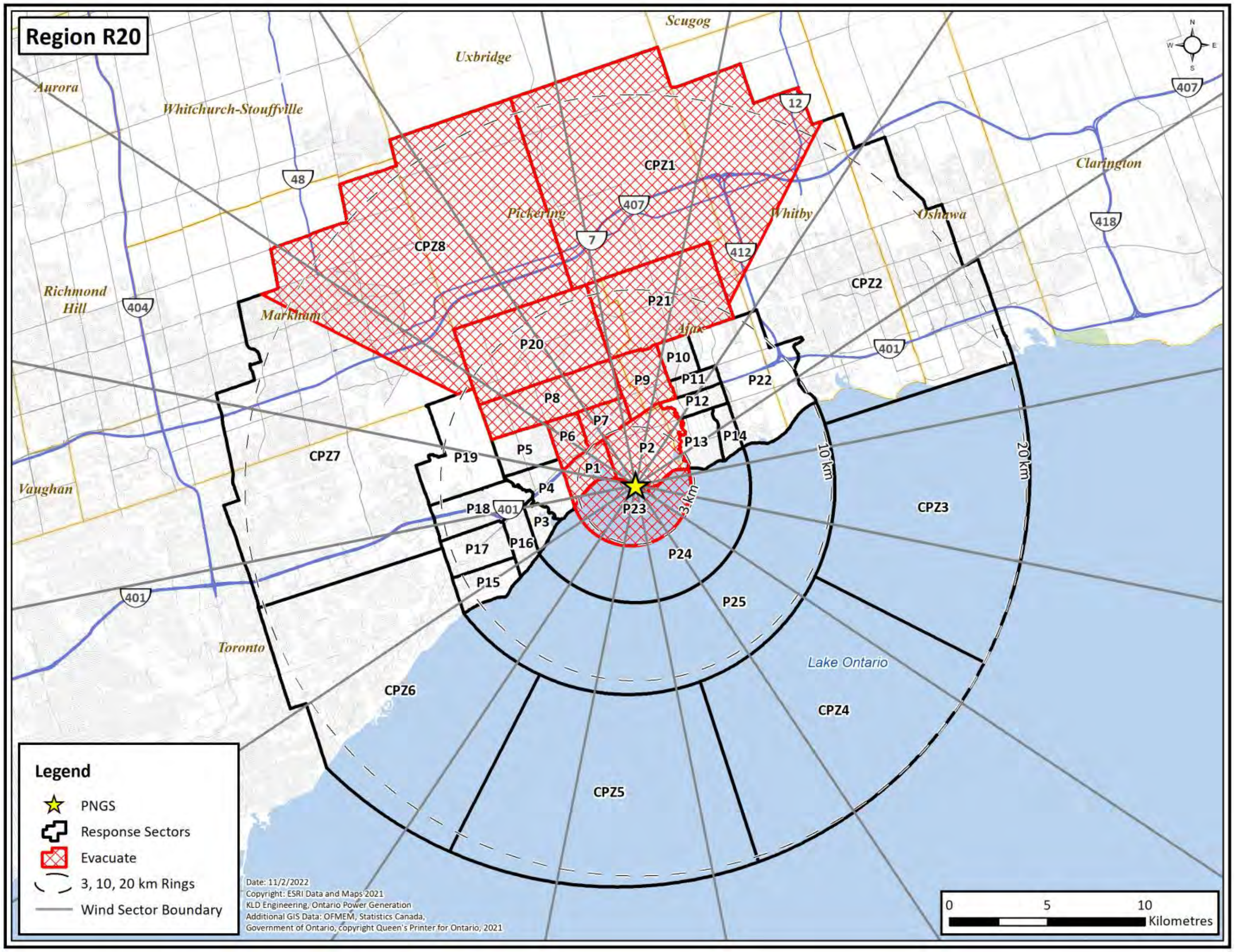


Figure H-20. Region R20

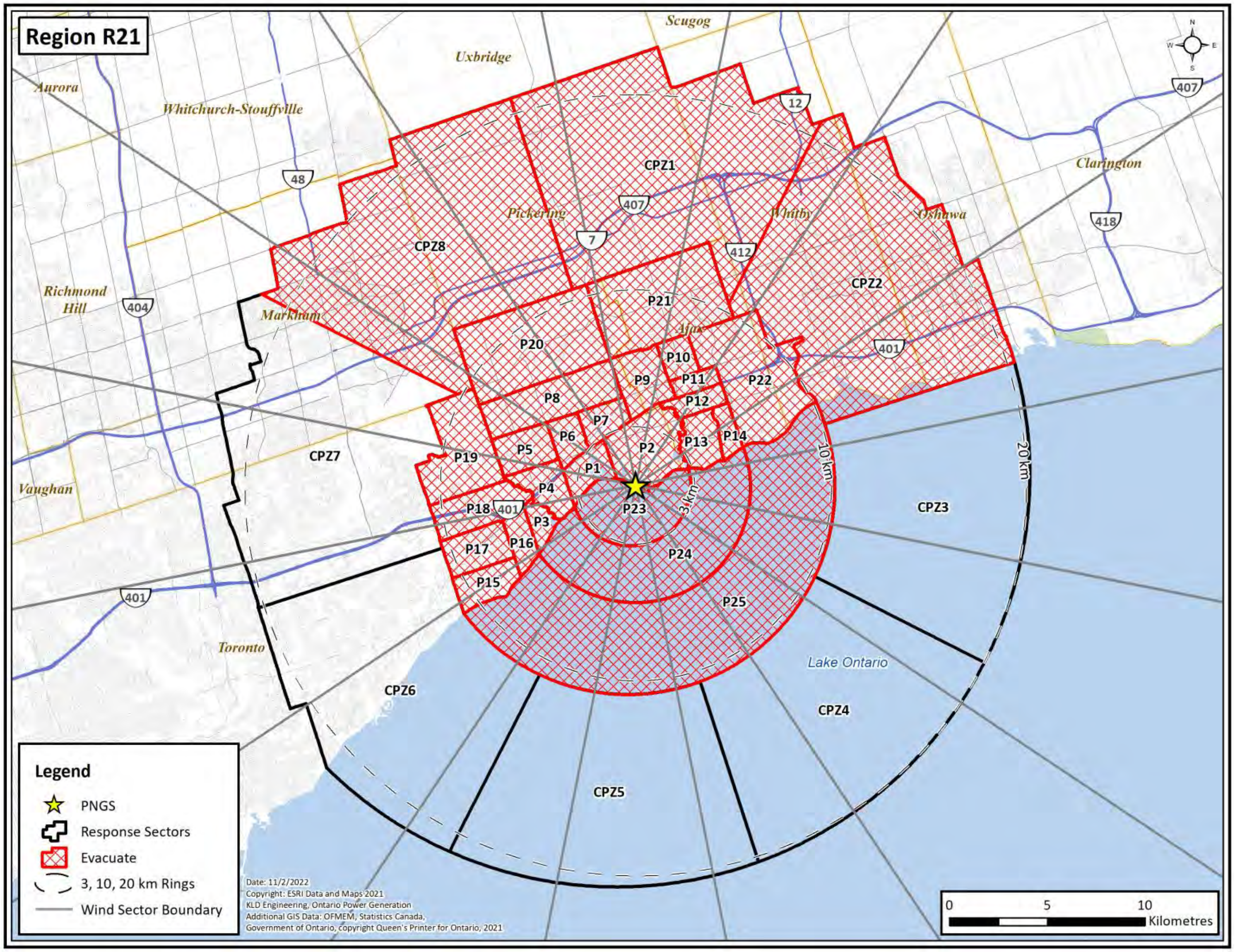


Figure H-21. Region R21

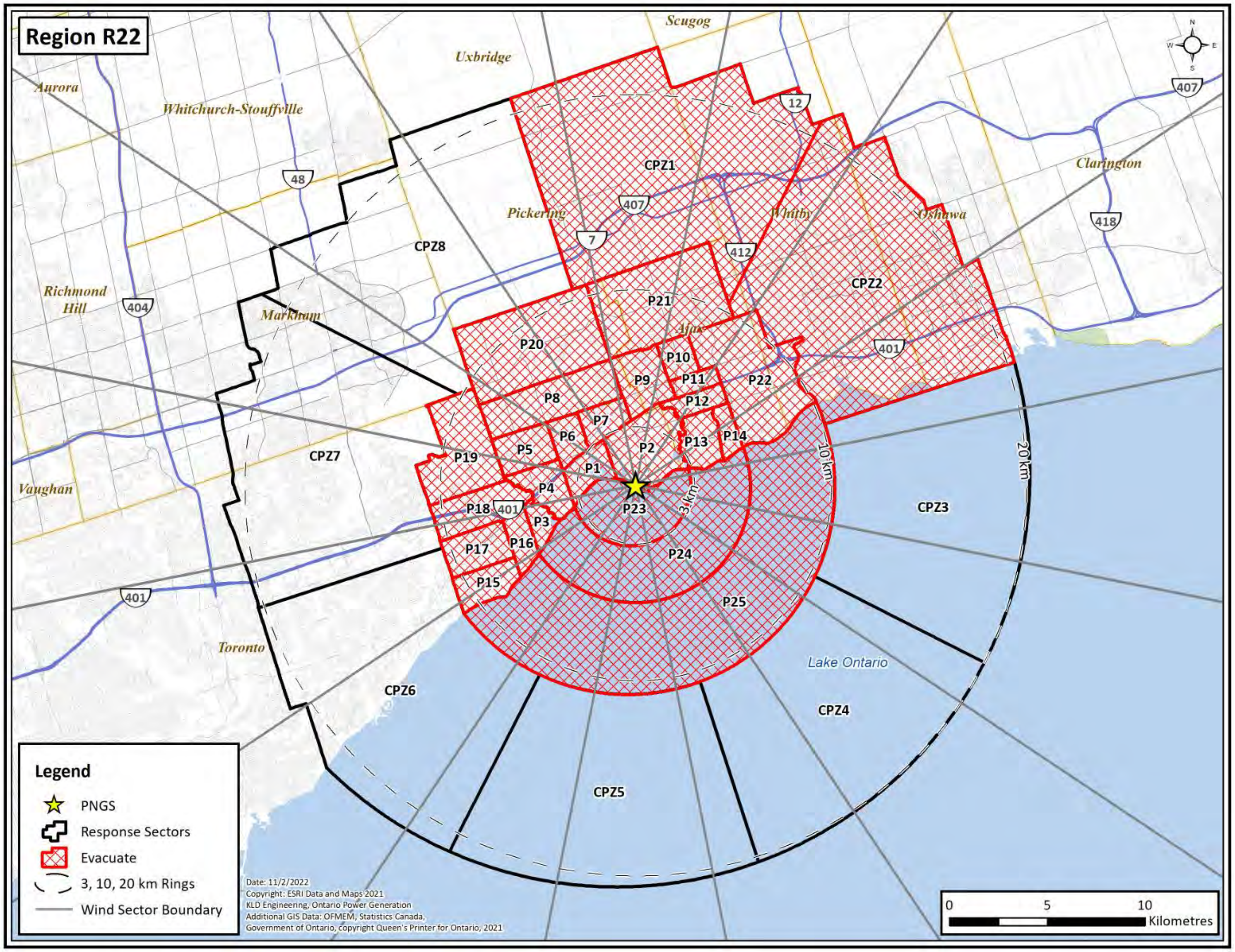


Figure H-22. Region R22

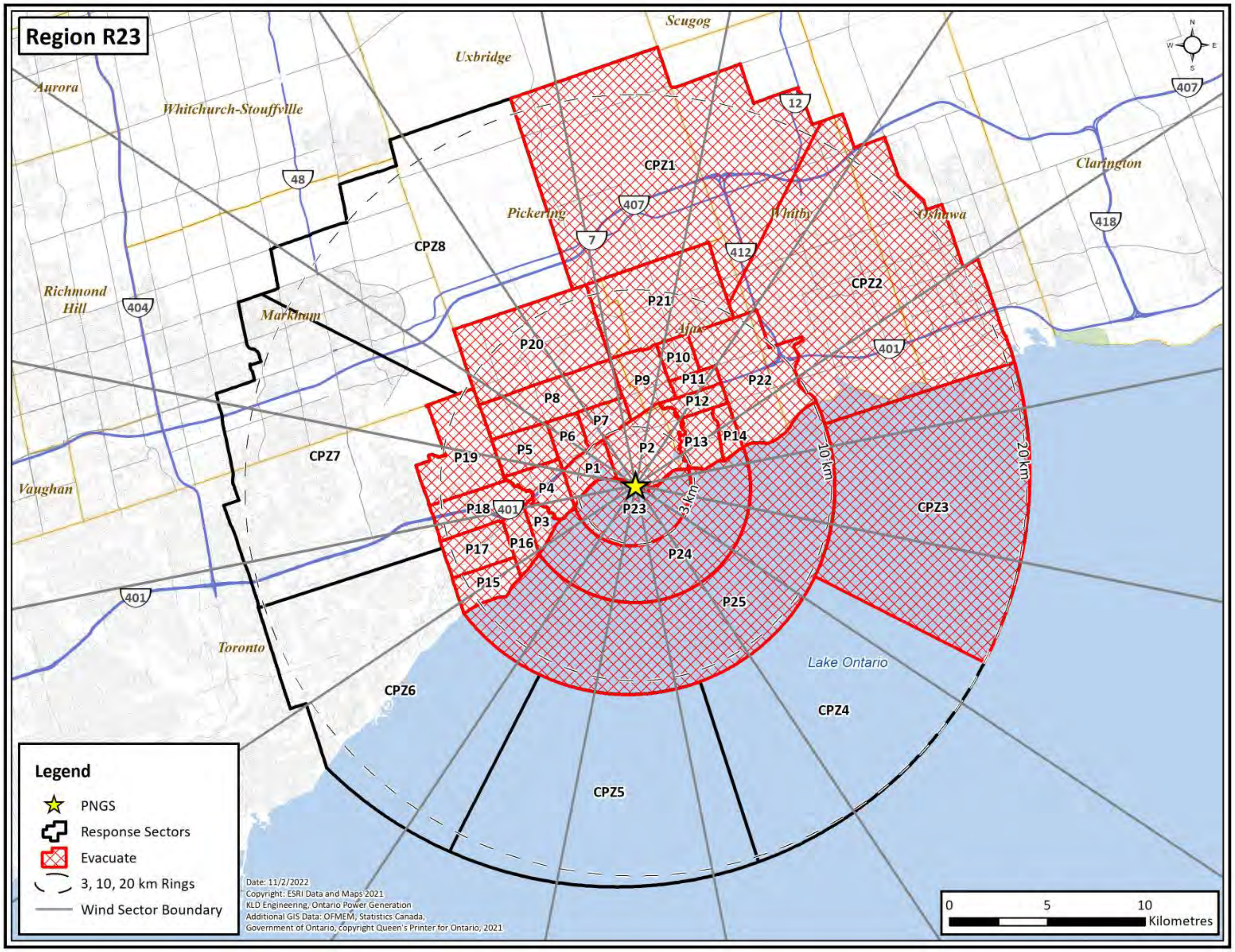


Figure H-23. Region R23

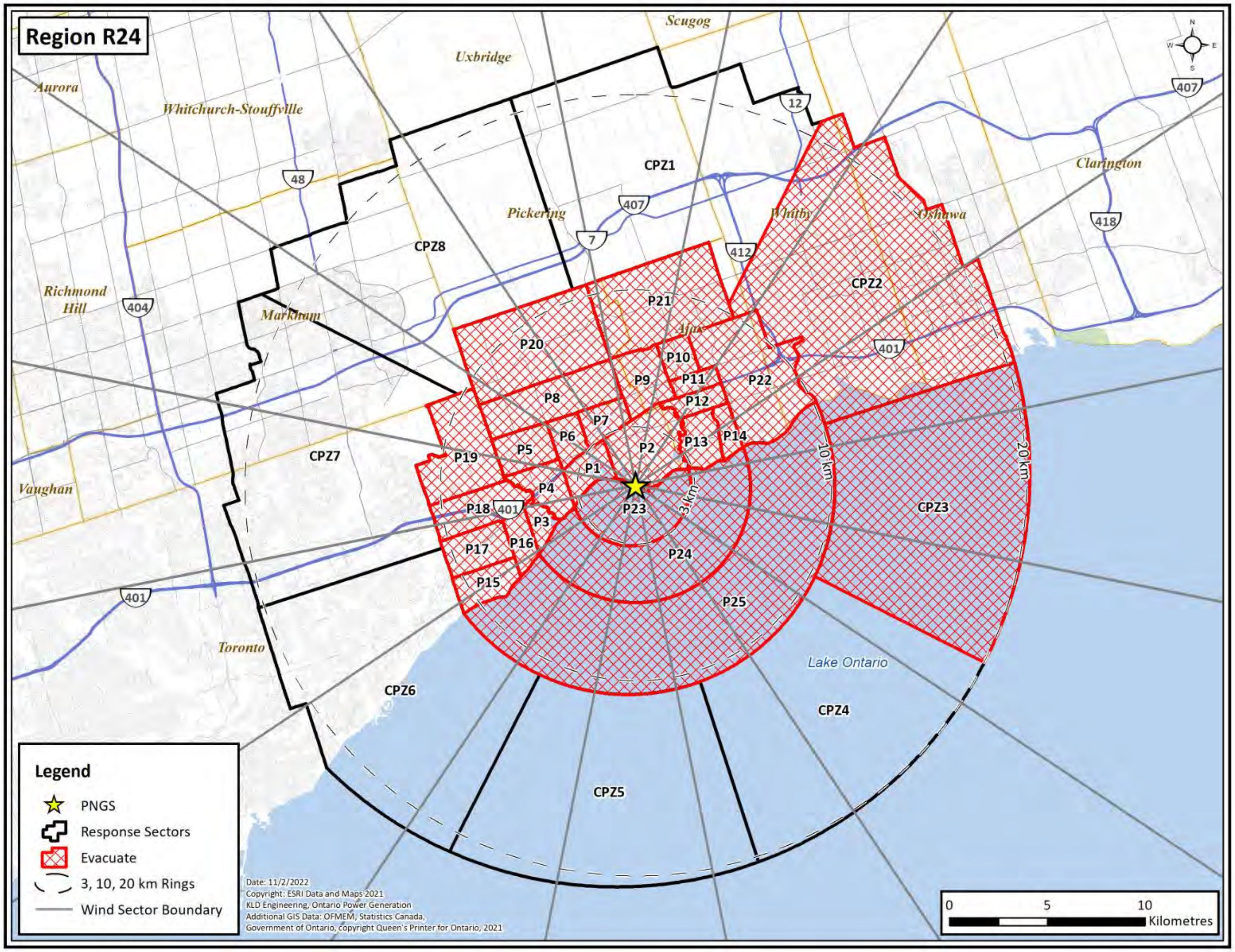


Figure H-24. Region R24

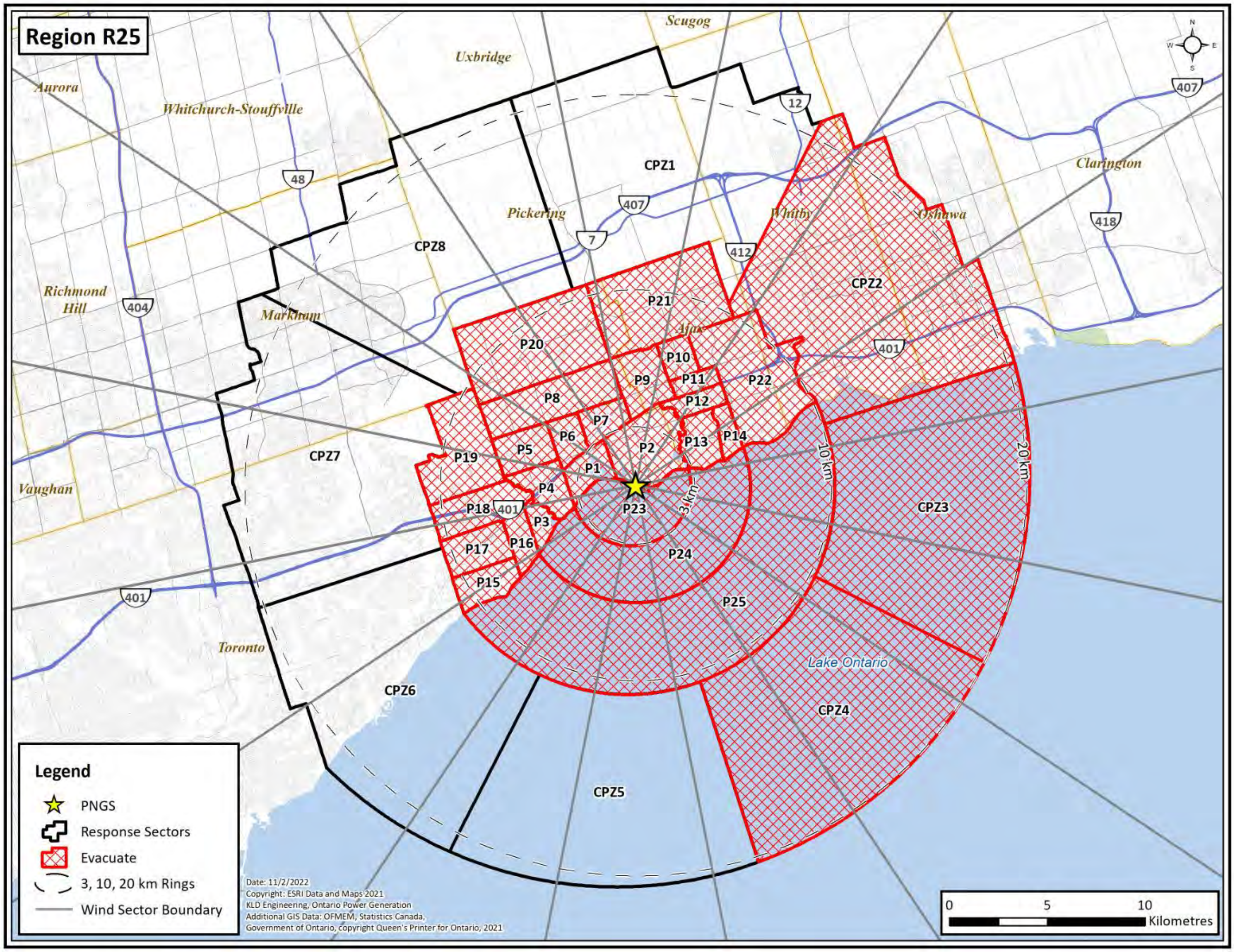


Figure H-25. Region R25

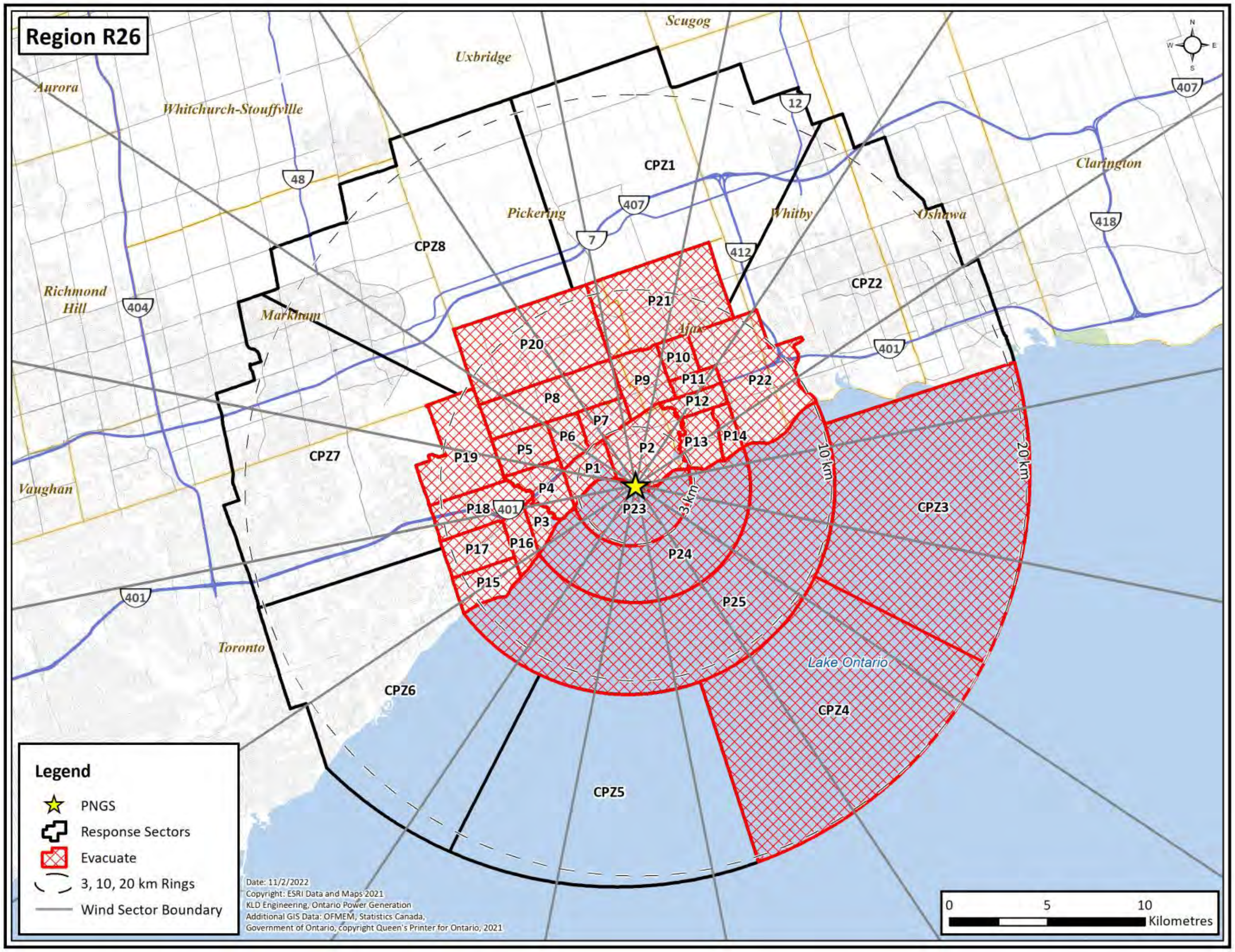


Figure H-26. Region R26

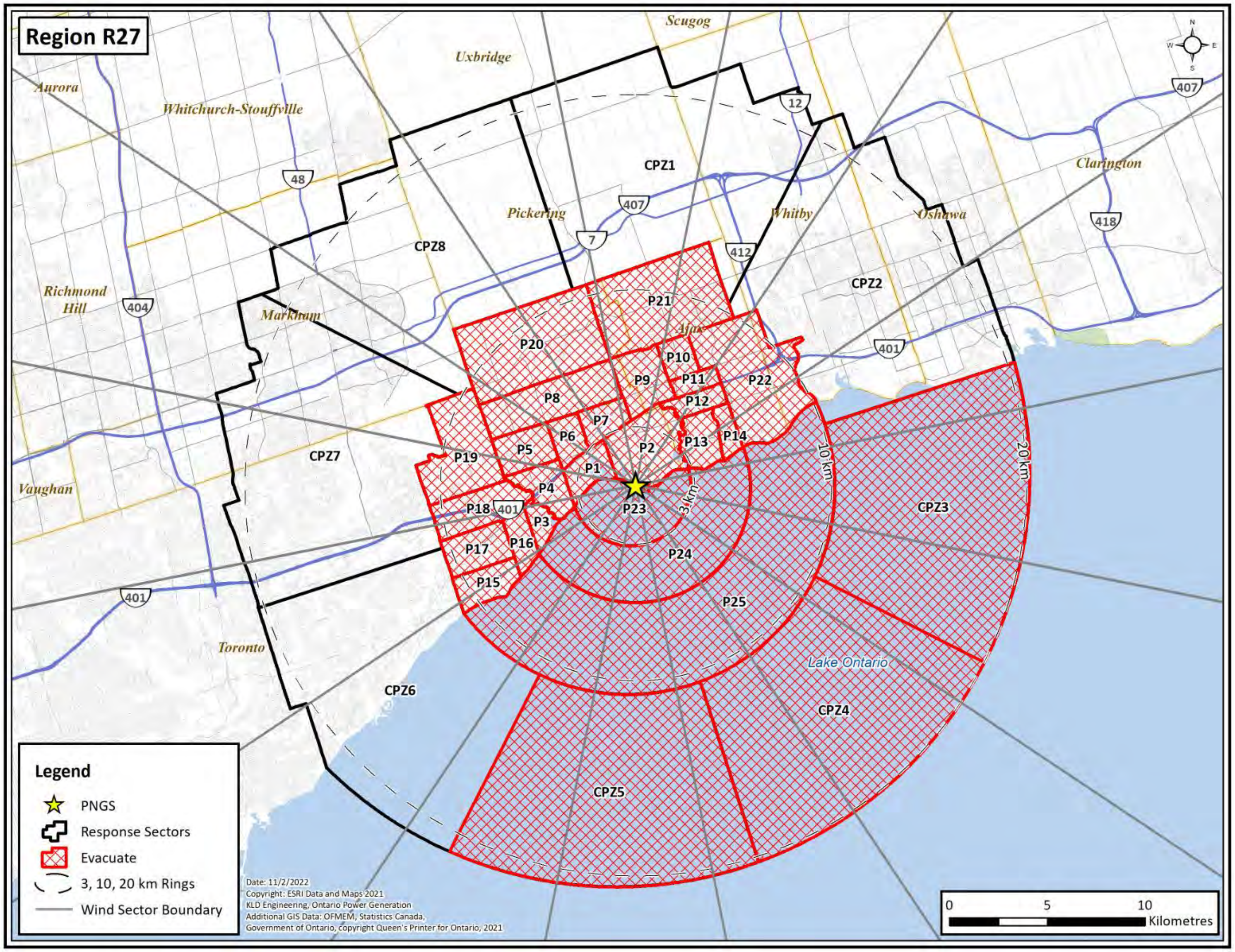


Figure H-27. Region R27

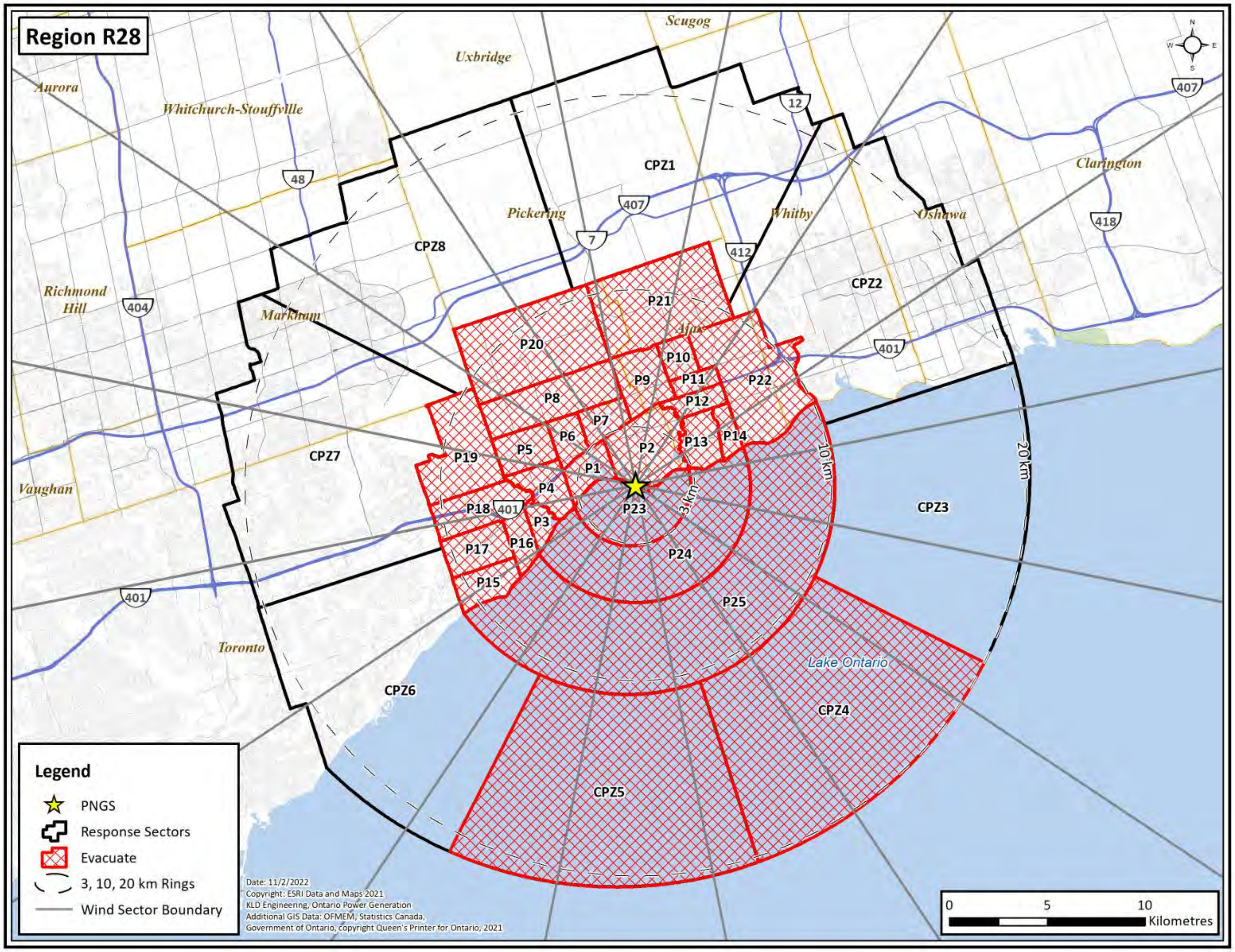


Figure H-28. Region R28

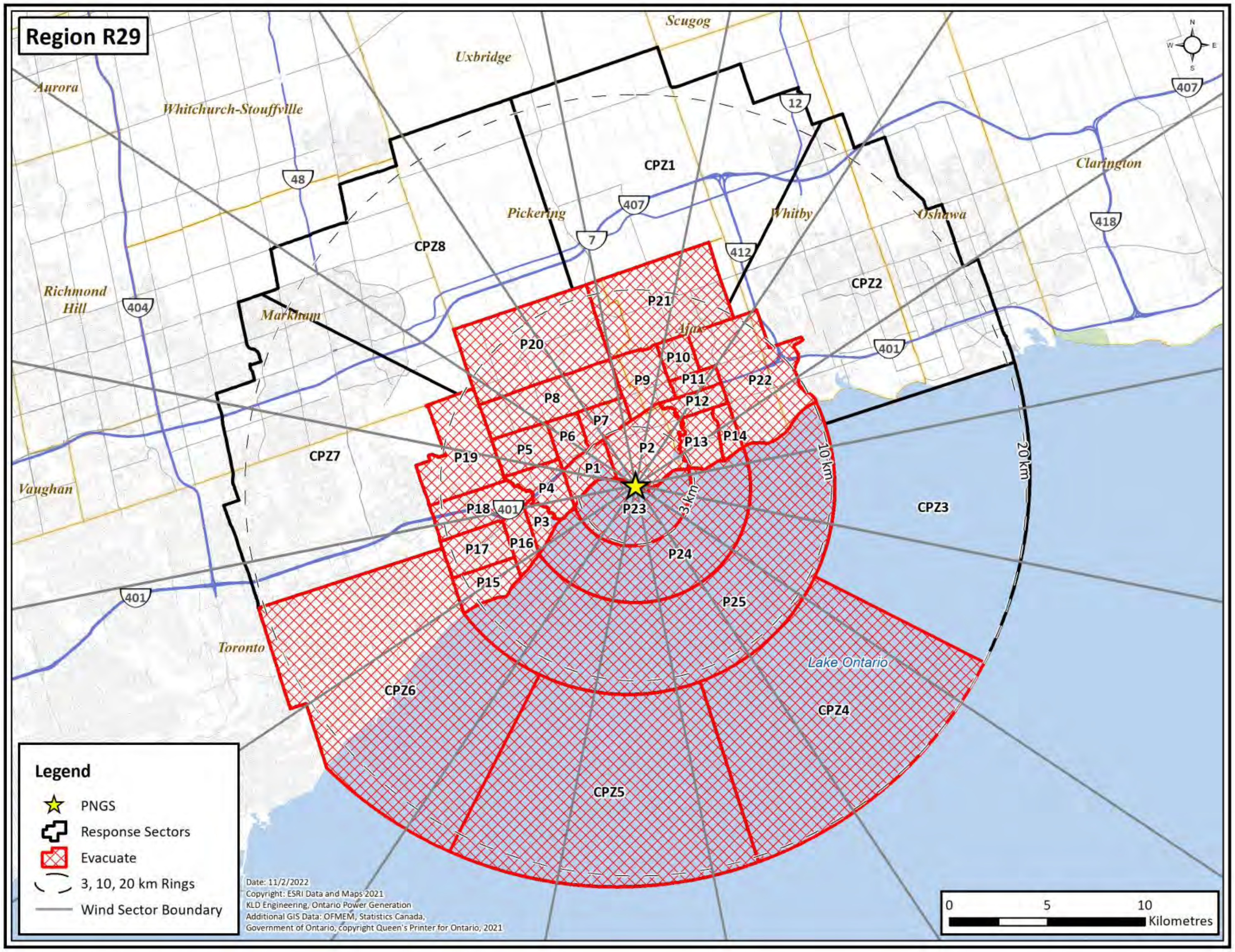


Figure H-29. Region R29

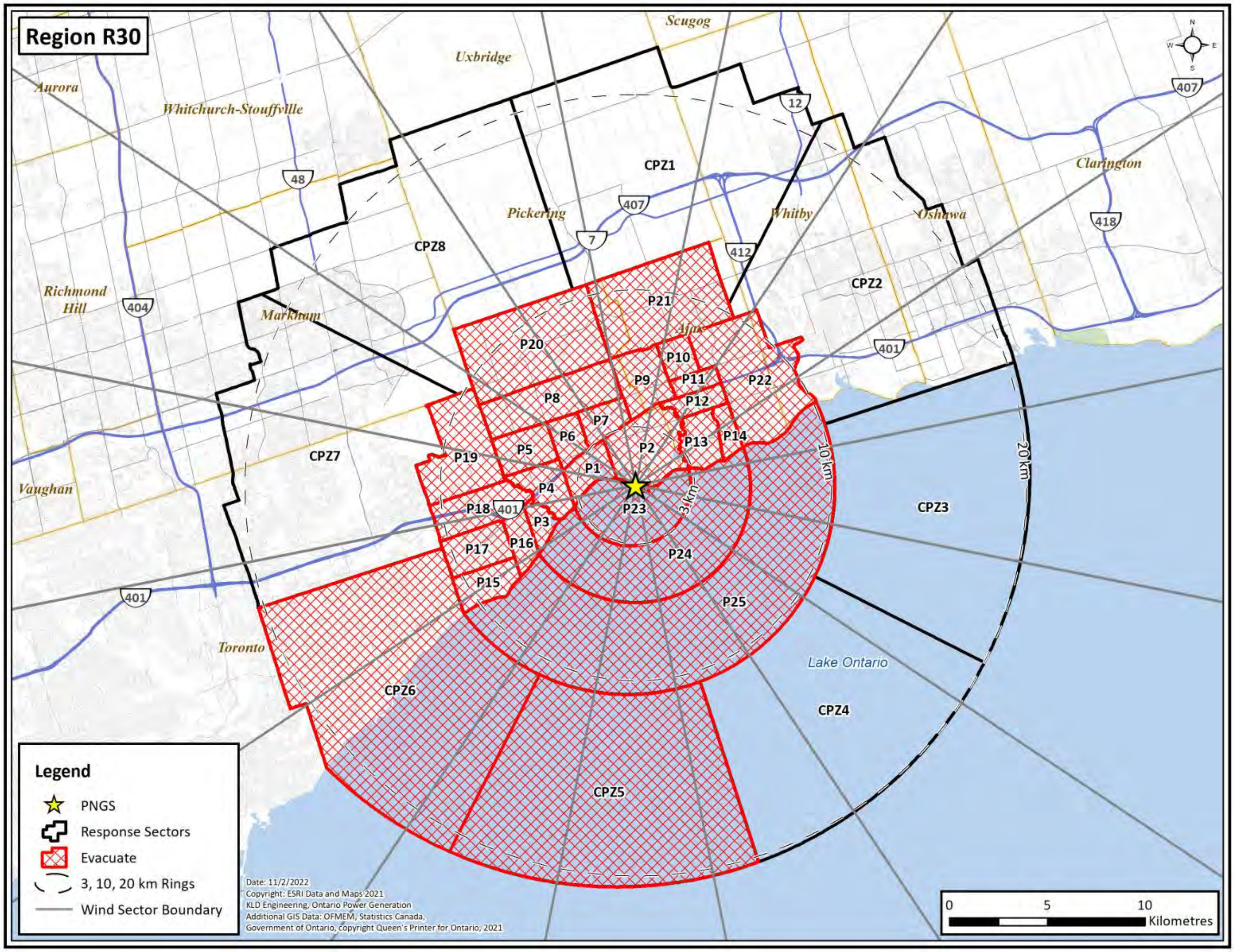


Figure H-30. Region R30

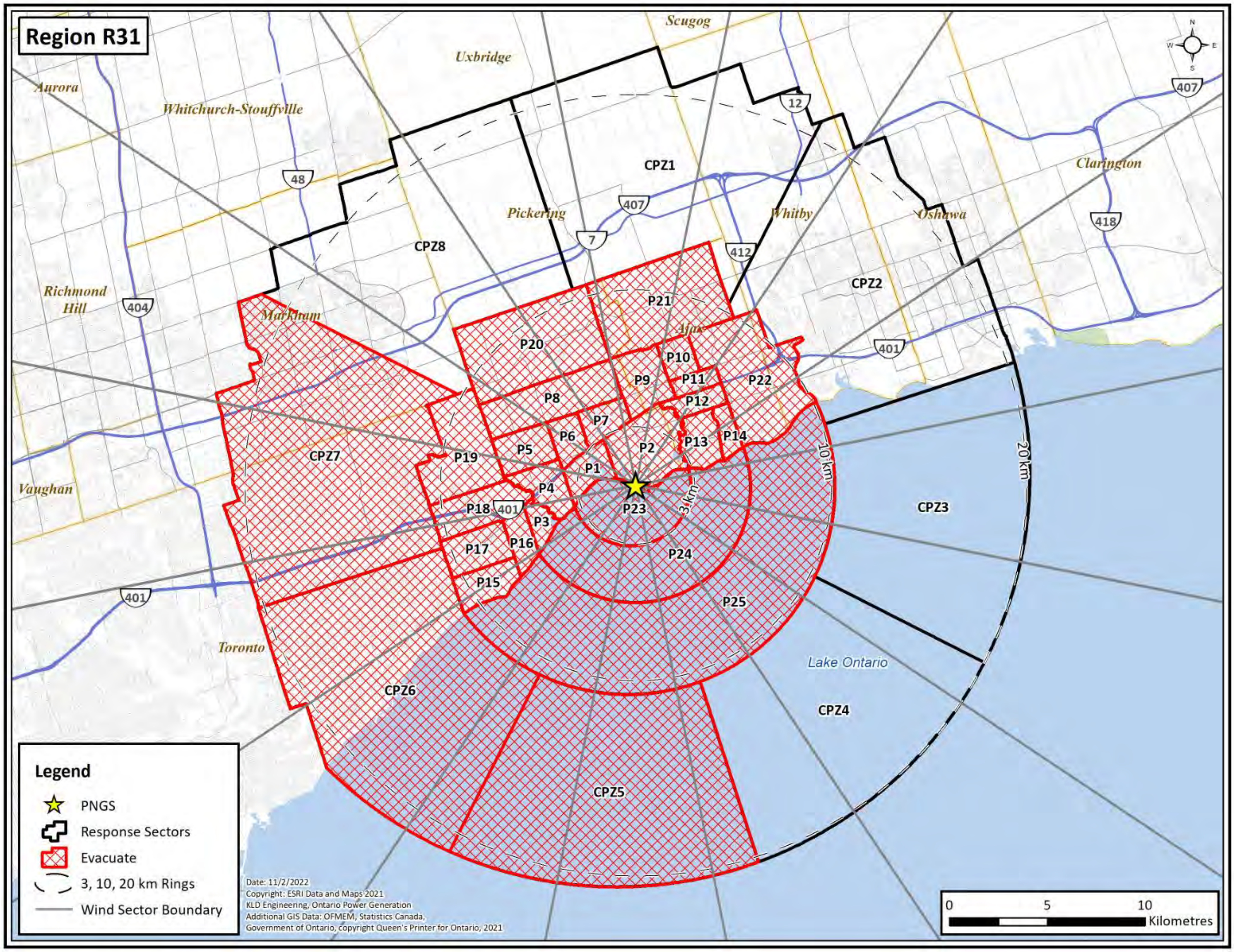


Figure H-31. Region R31

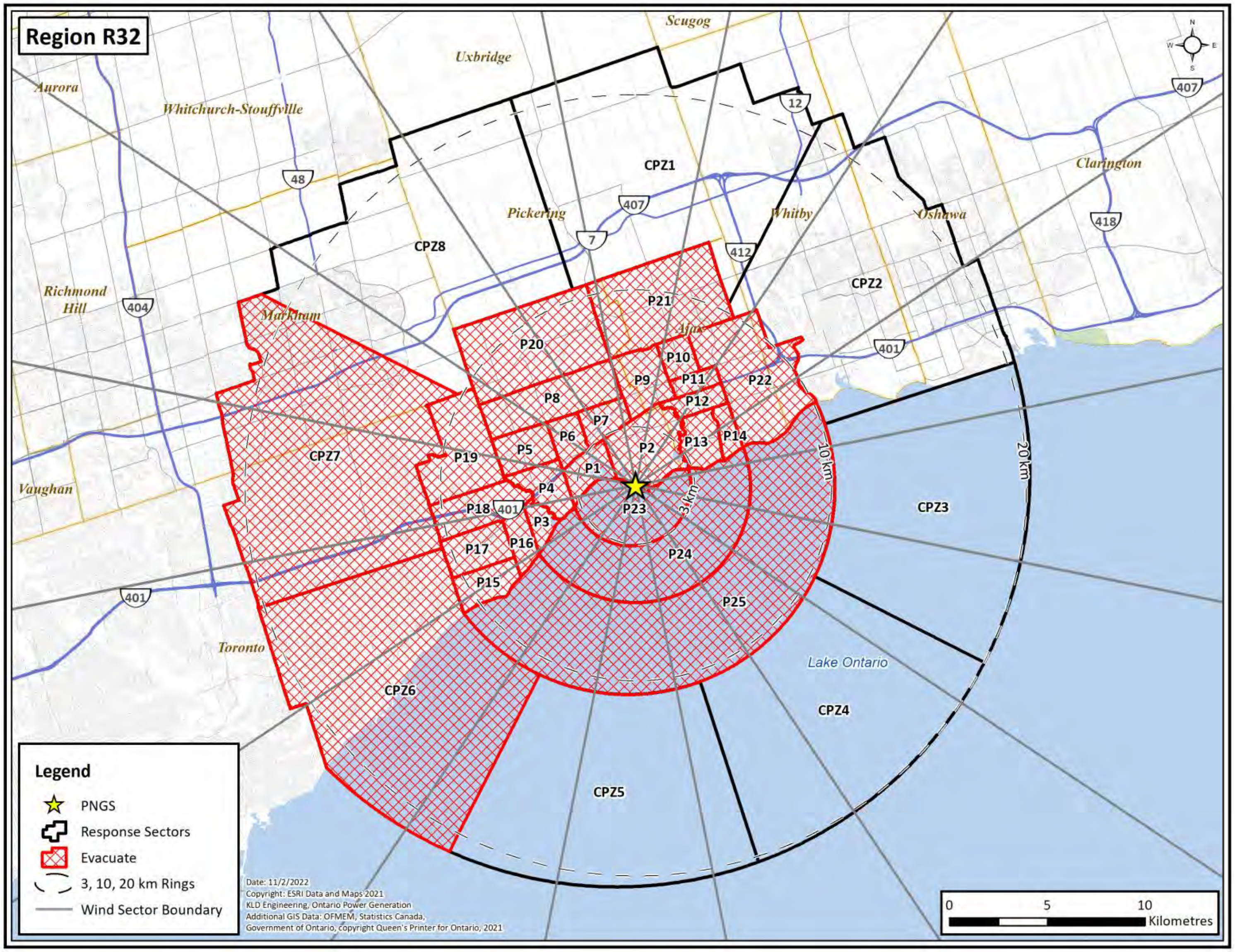


Figure H-32. Region R32

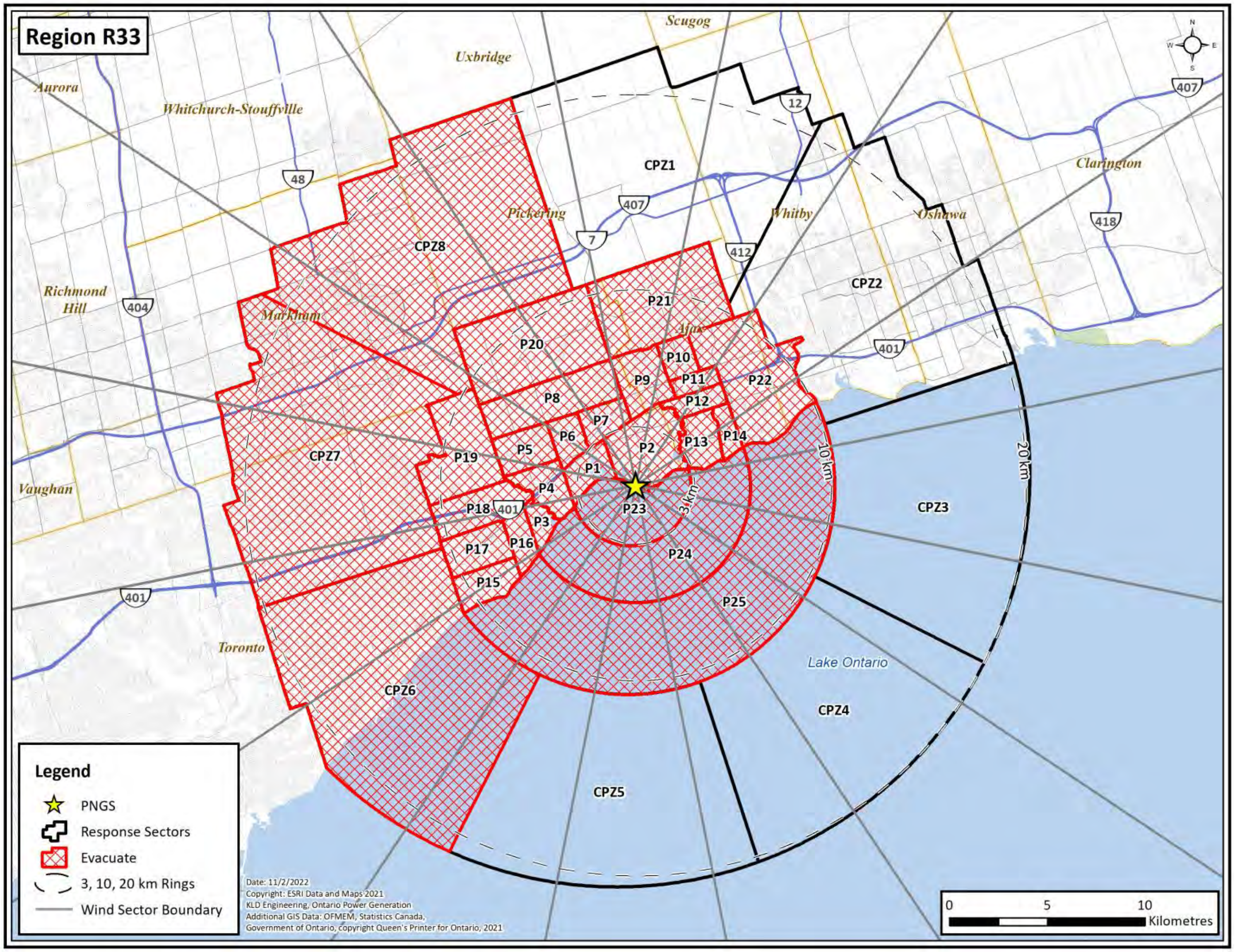


Figure H-33. Region R33

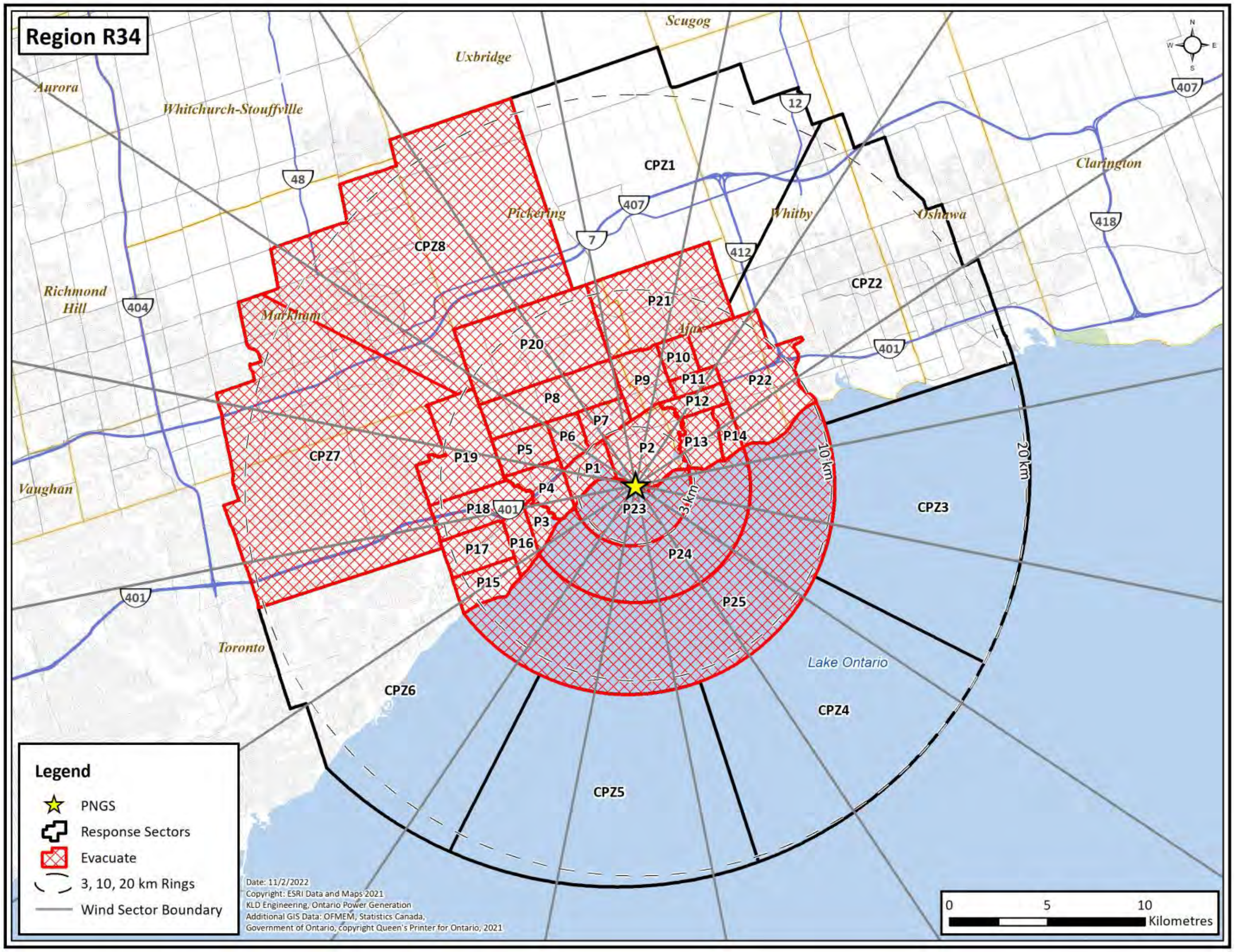


Figure H-34. Region R34

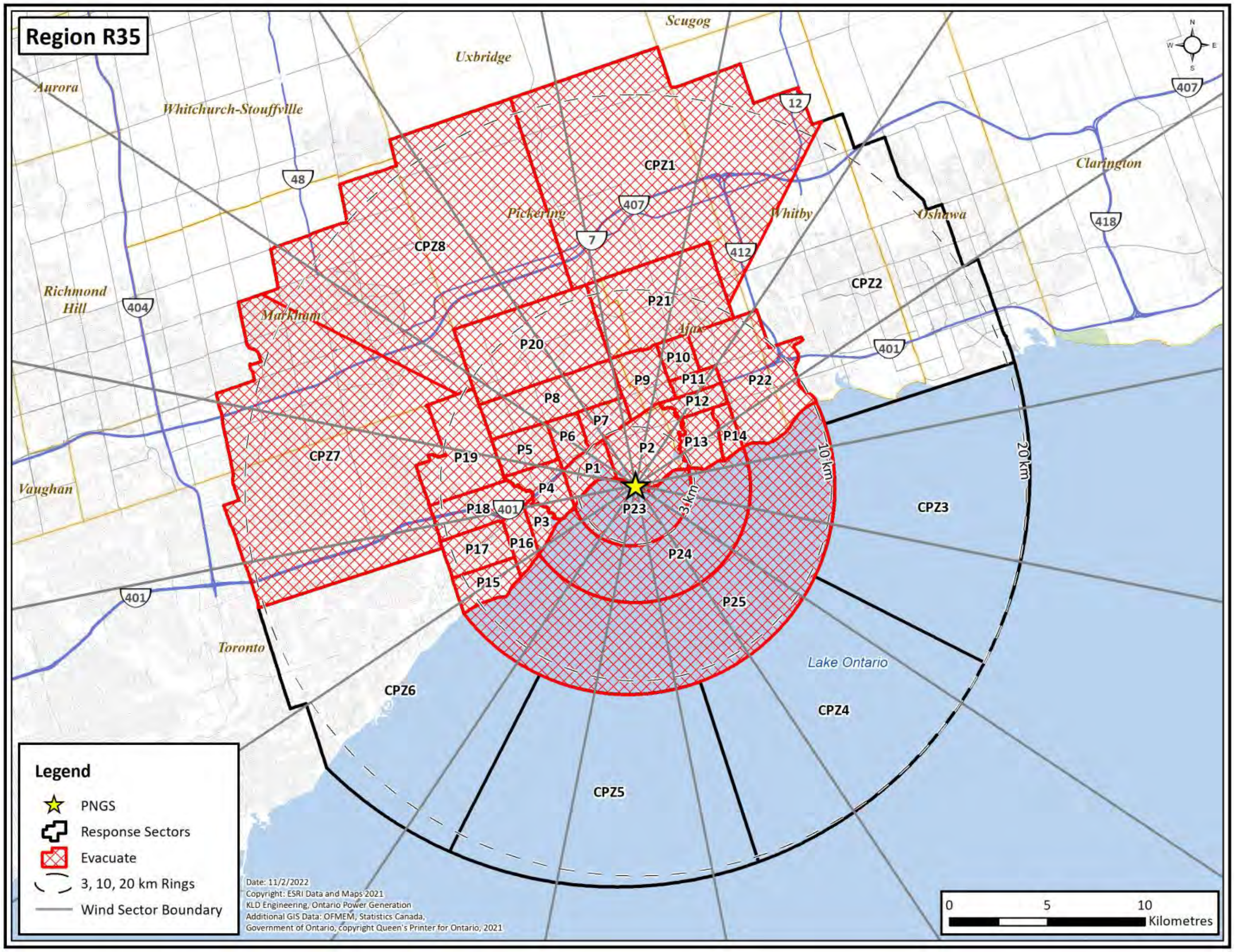


Figure H-35. Region R35

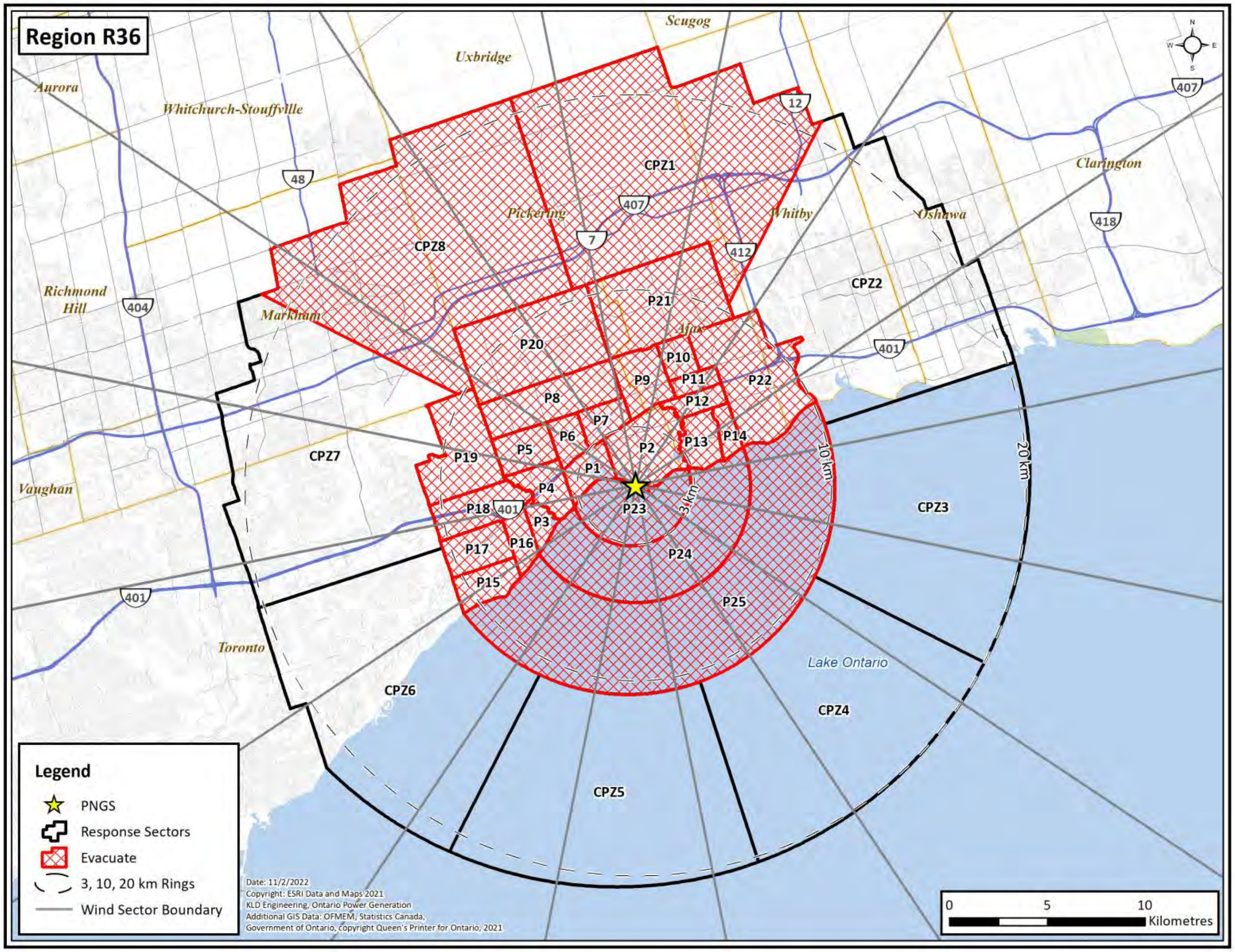


Figure H-36. Region R36

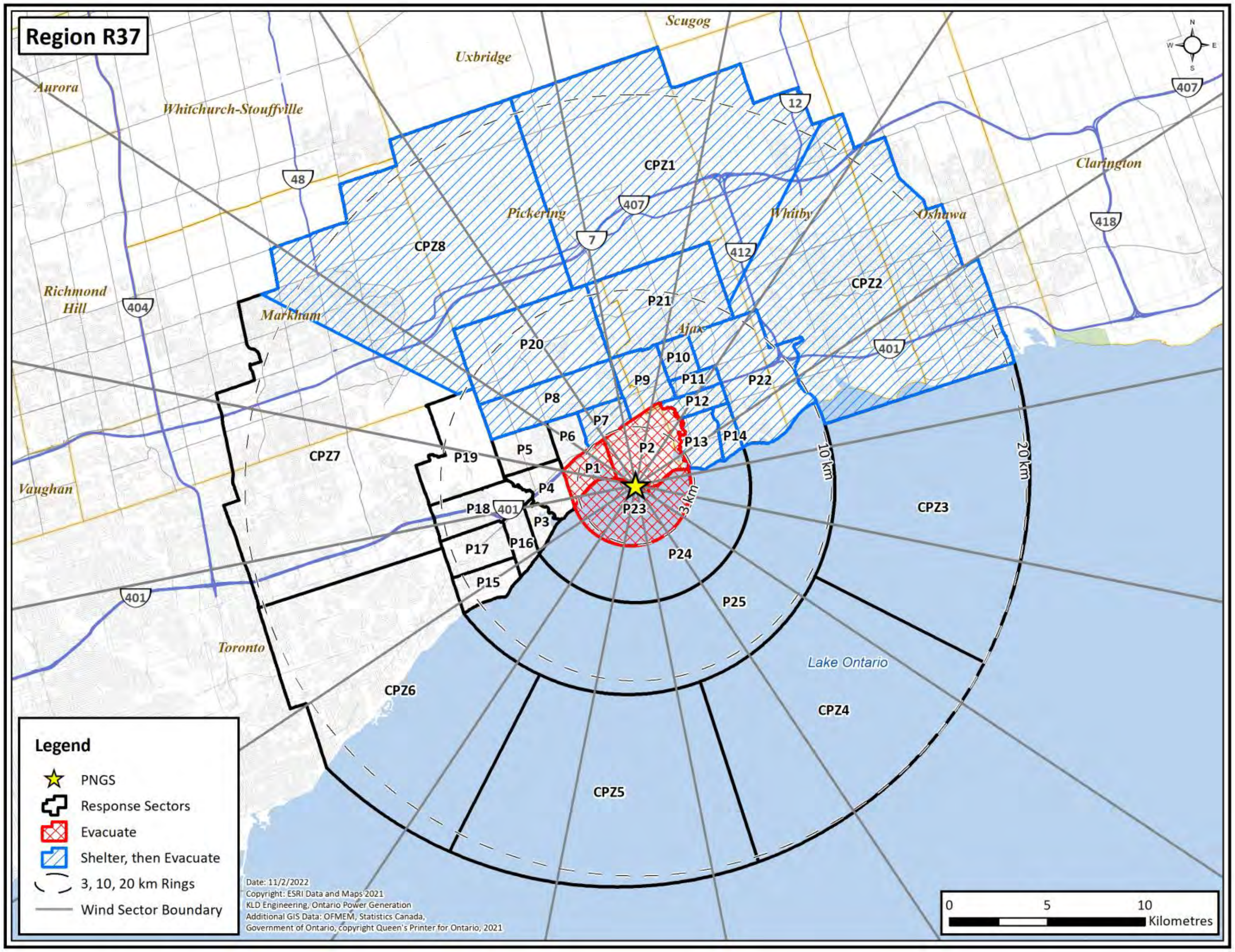


Figure H-37. Region R37

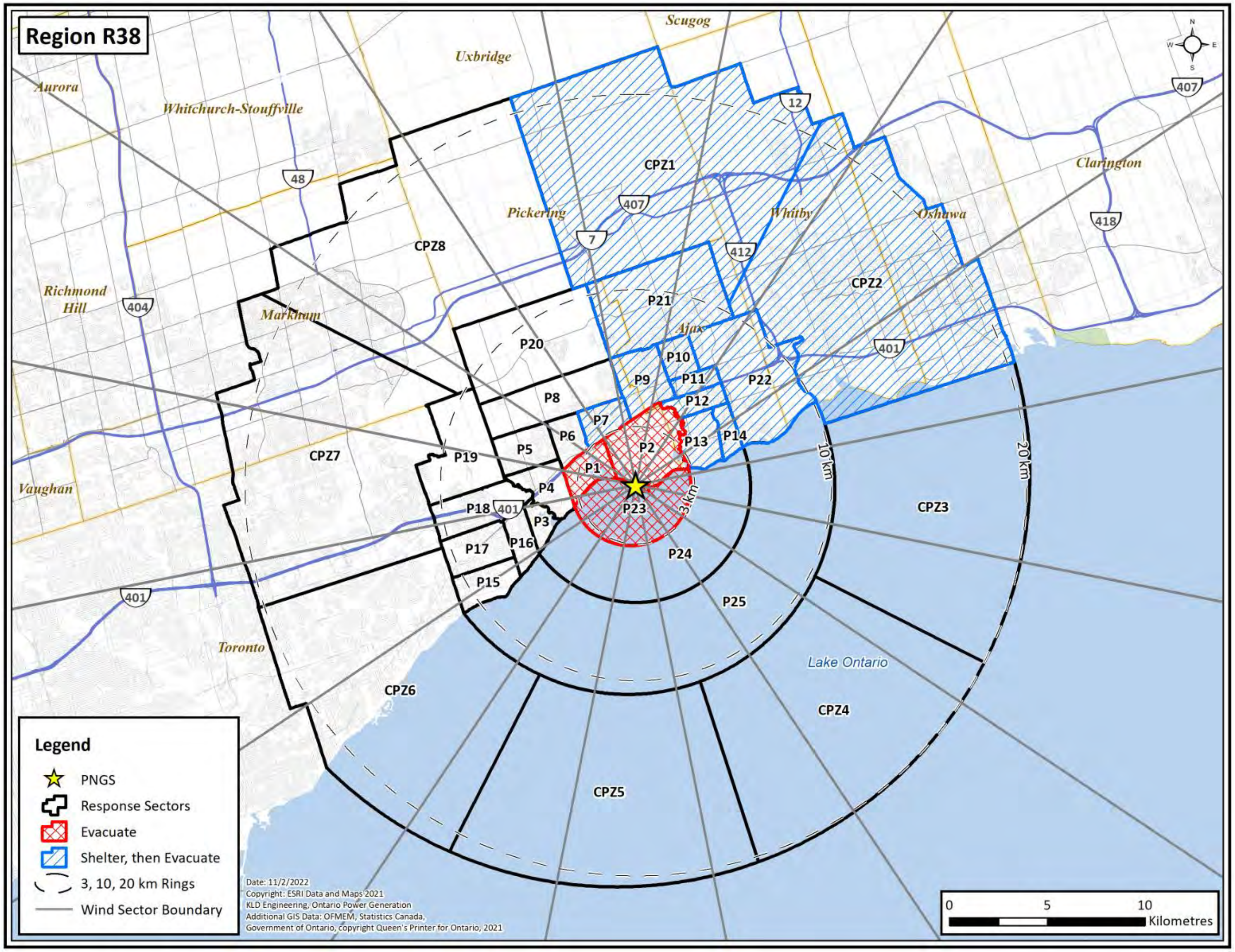


Figure H-38. Region R38

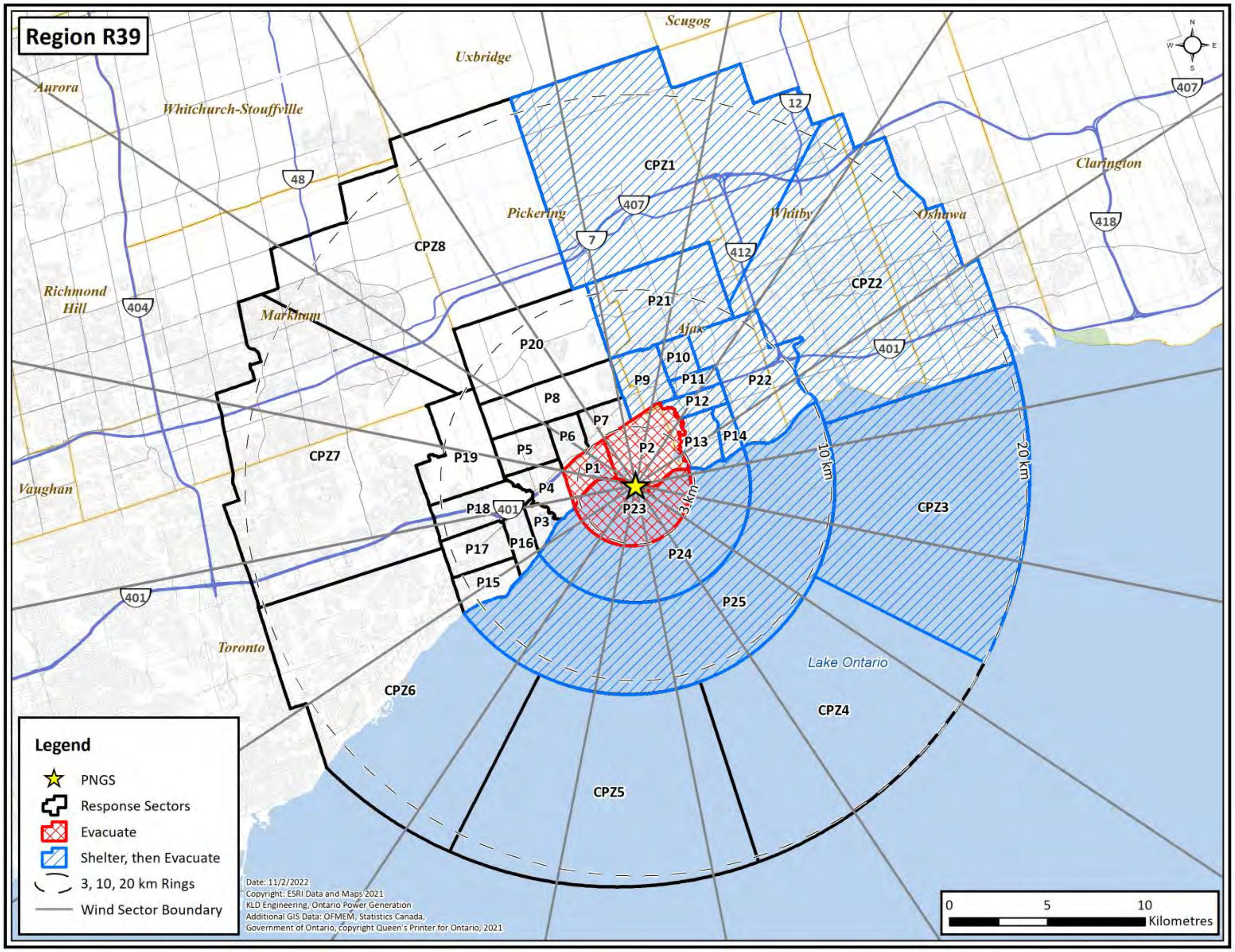


Figure H-39. Region R39

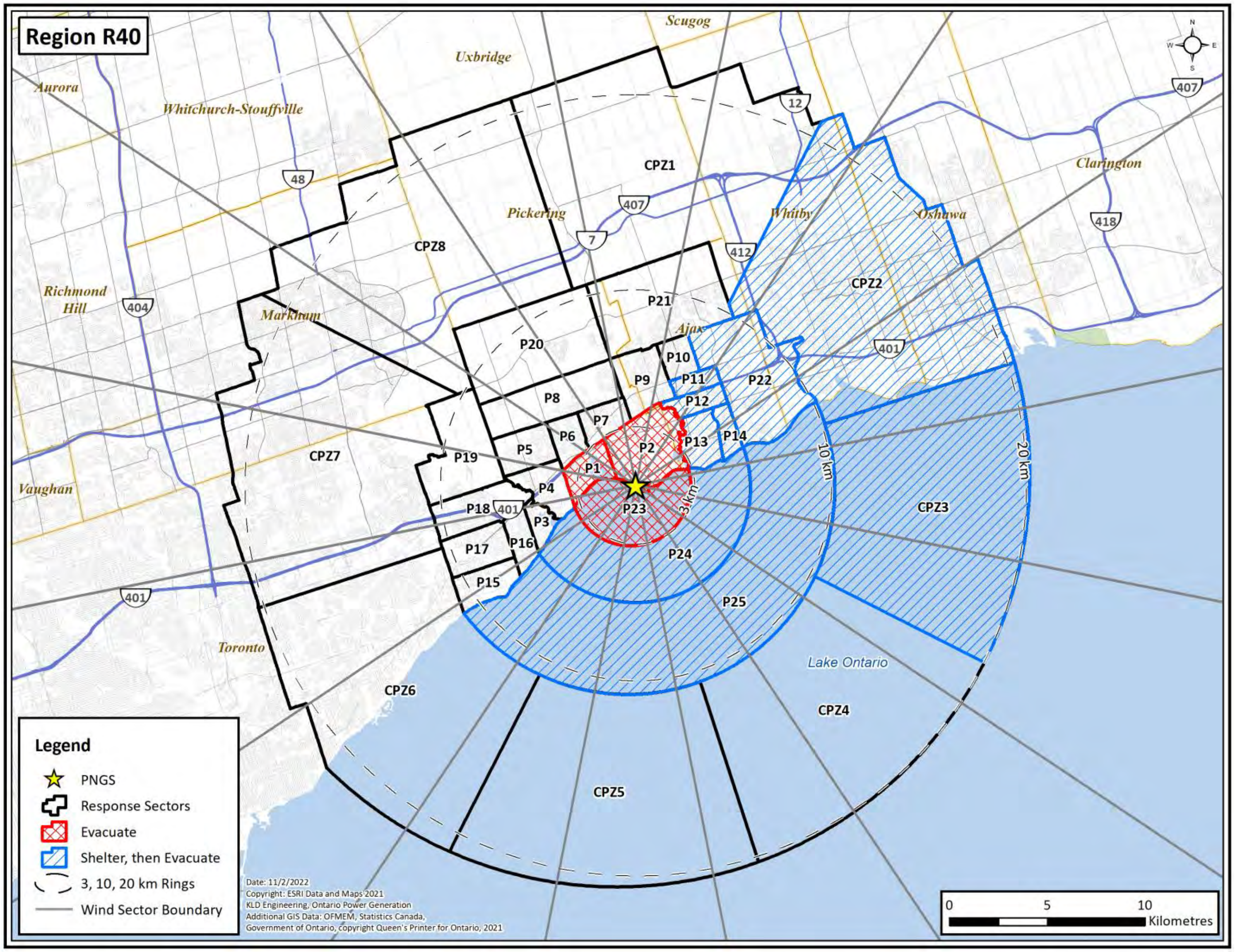


Figure H-40. Region R40

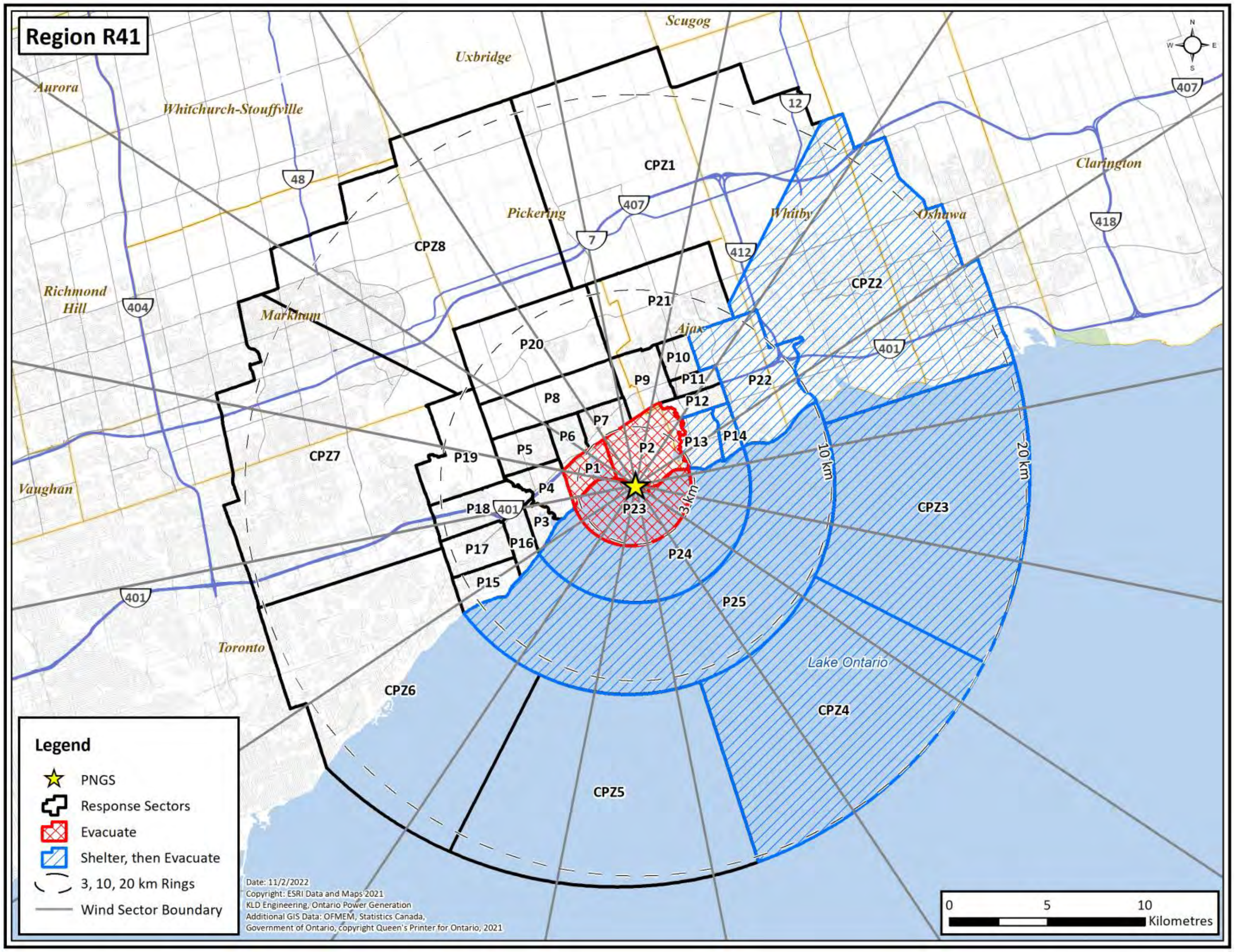


Figure H-41. Region R41

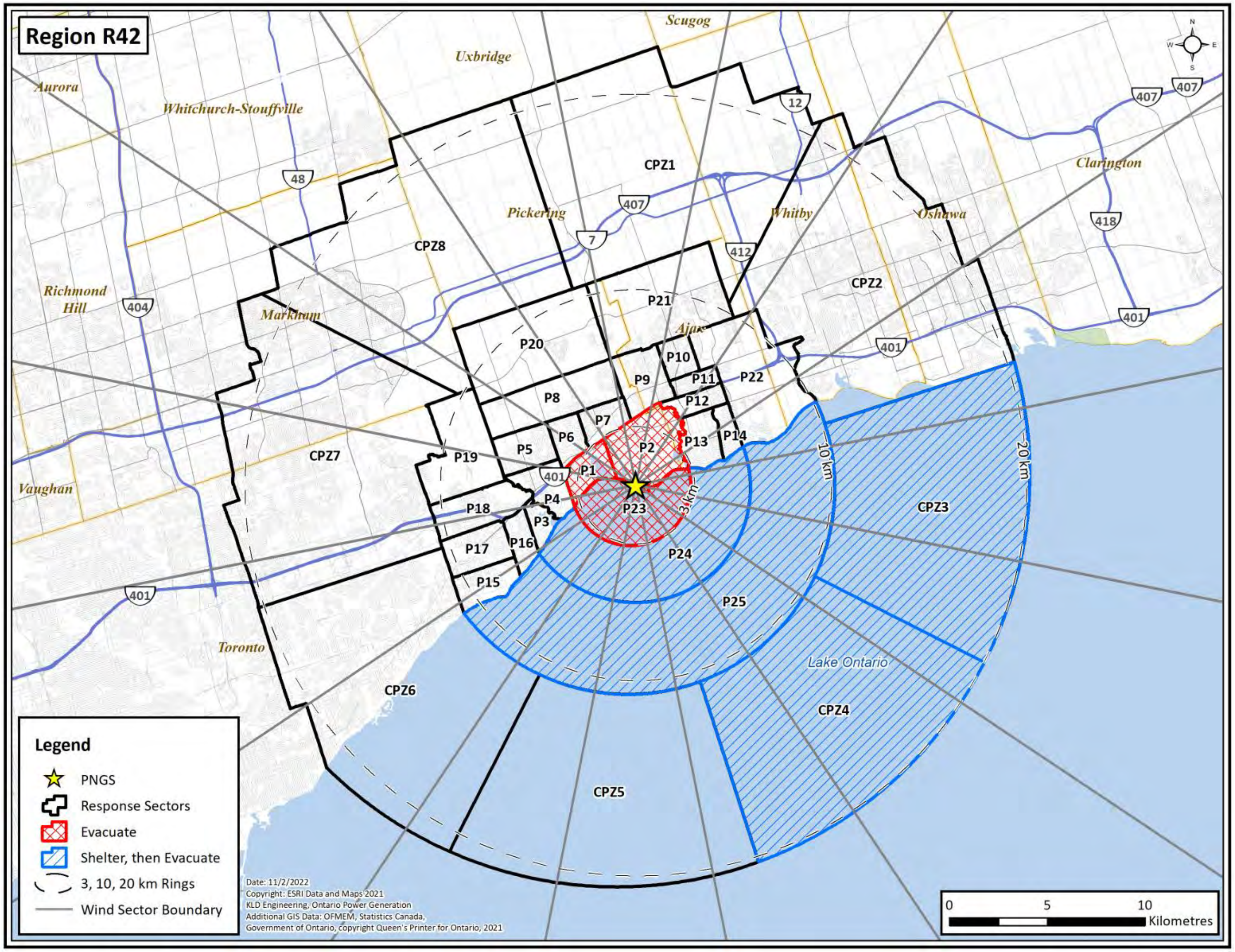


Figure H-42. Region R42

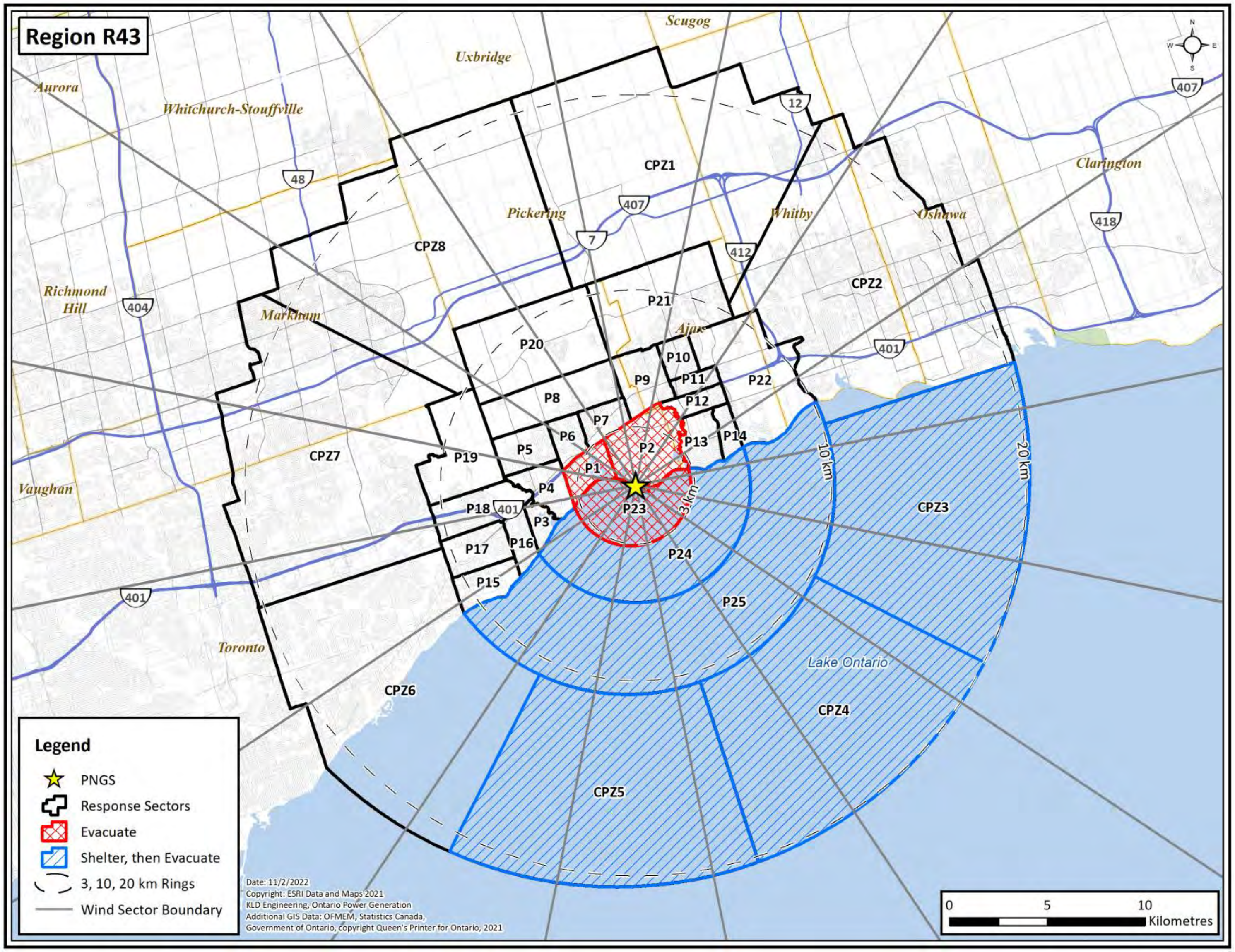


Figure H-43. Region R43

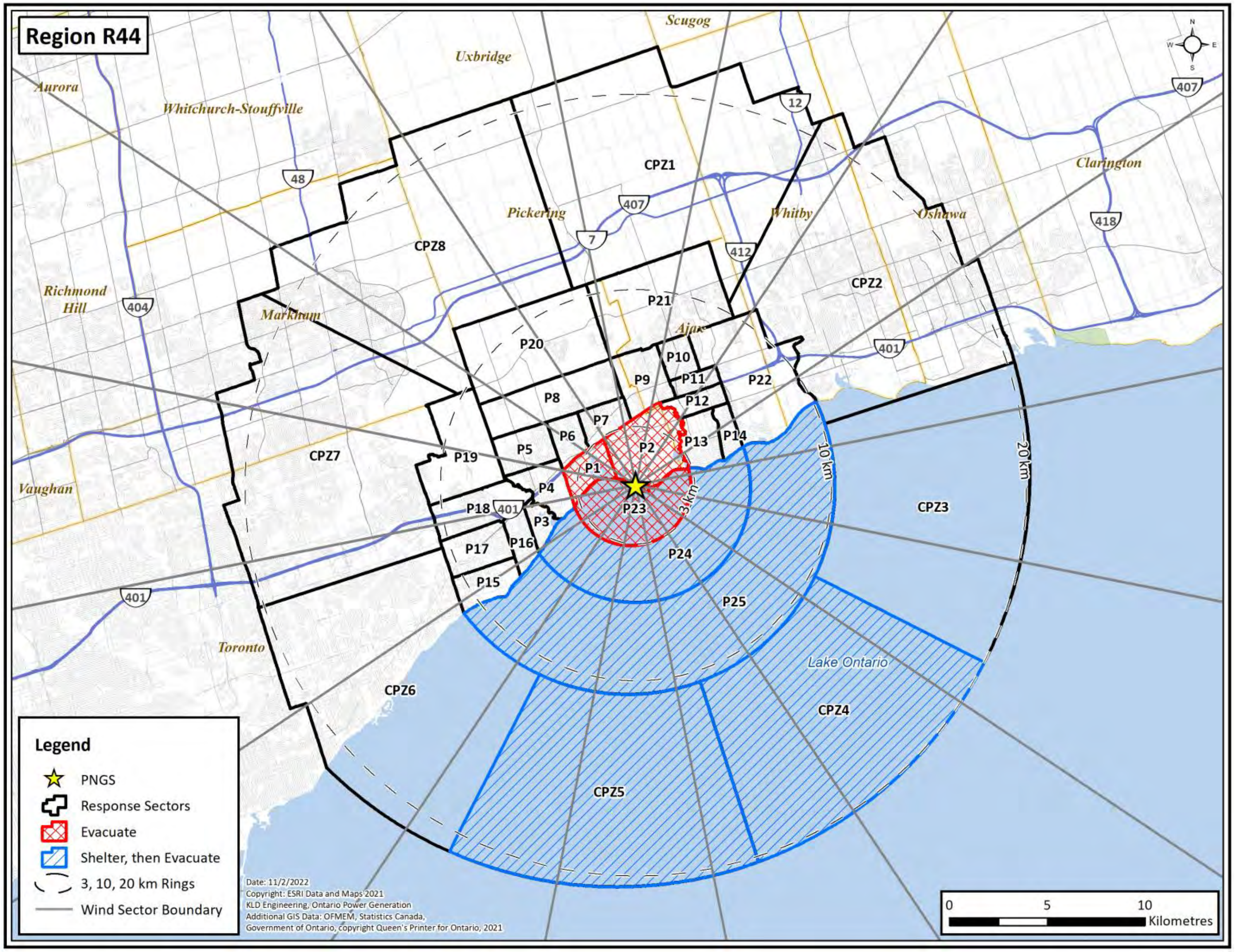


Figure H-44. Region R44

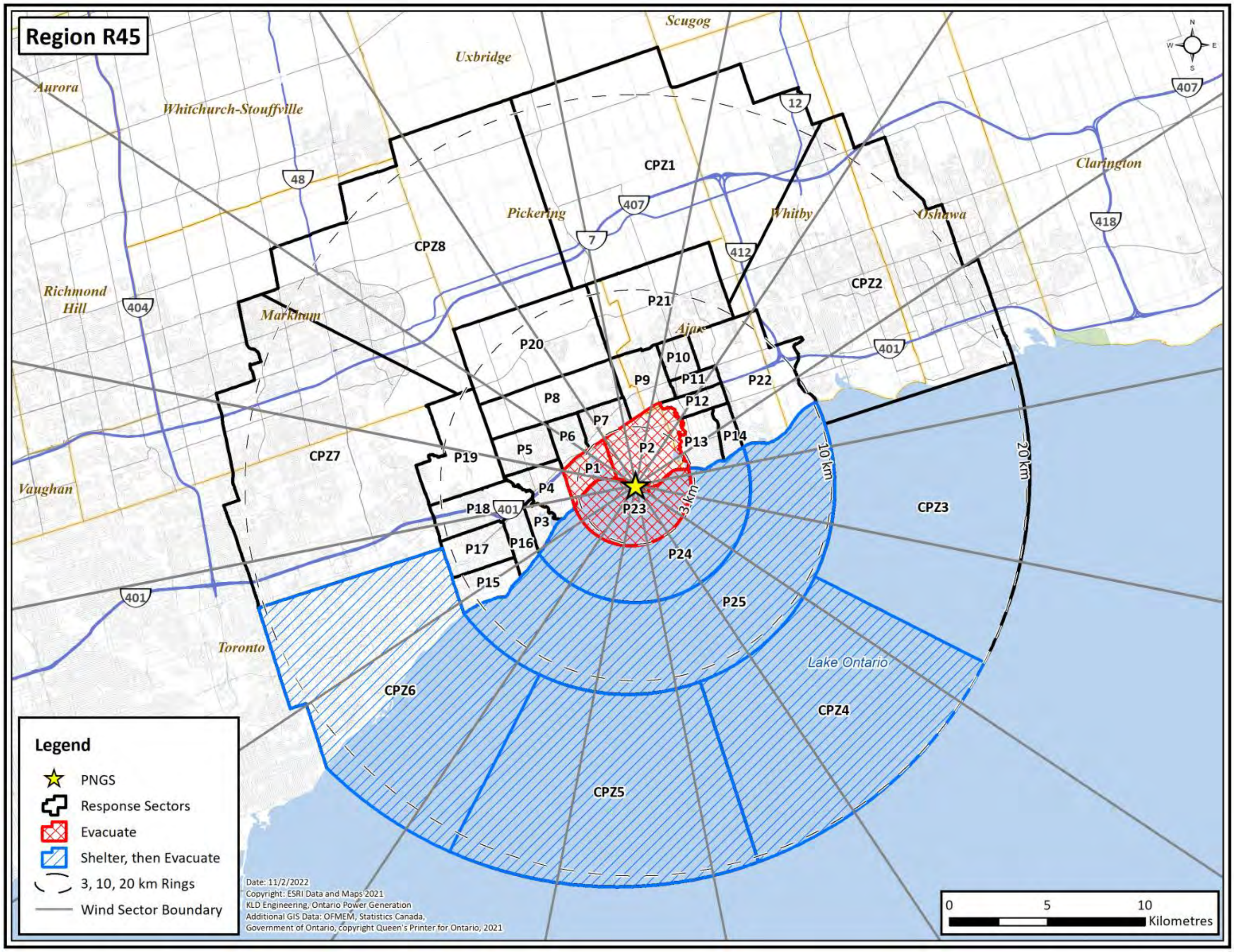


Figure H-45. Region R45

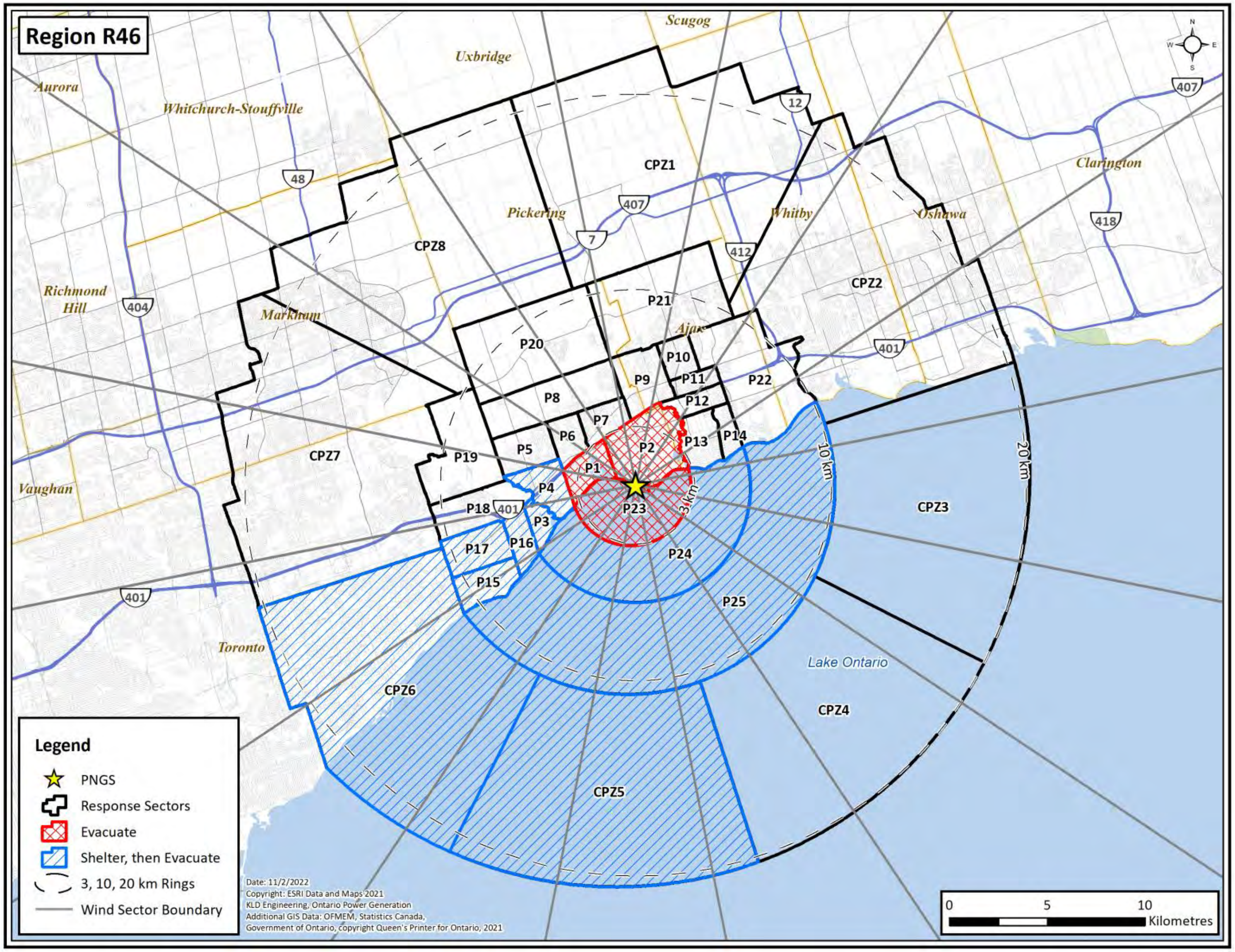


Figure H-46. Region R46

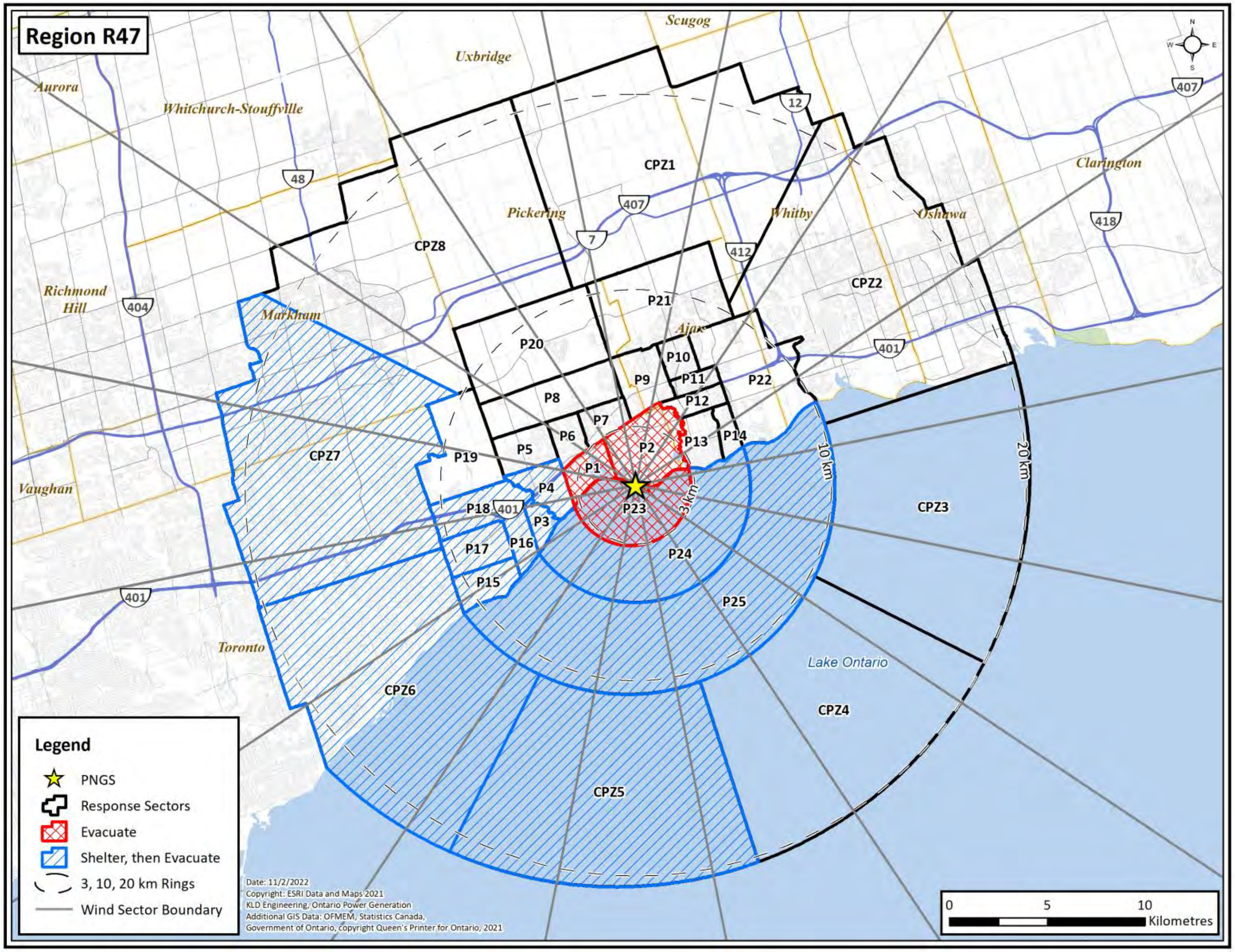


Figure H-47. Region R47

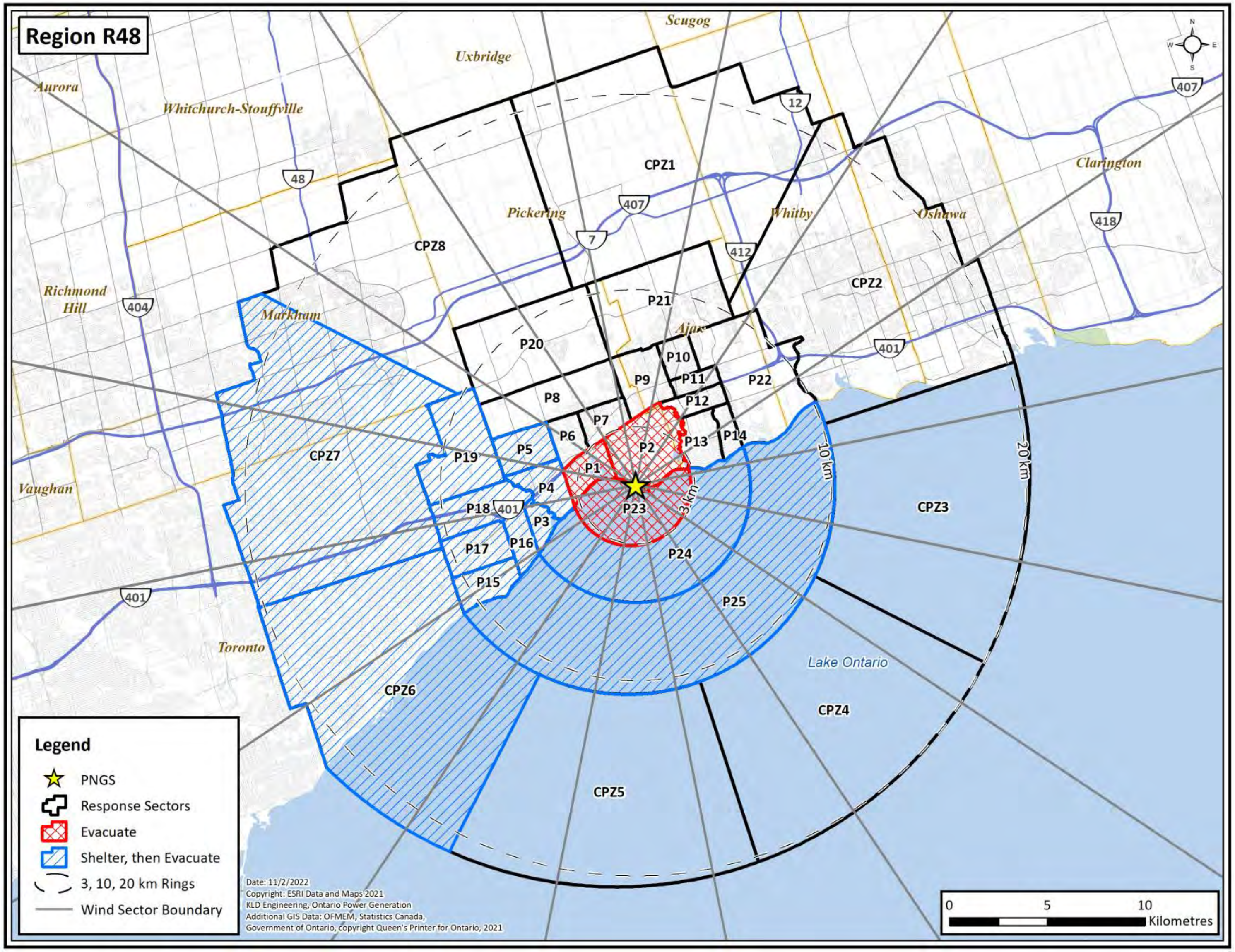


Figure H-48. Region R48

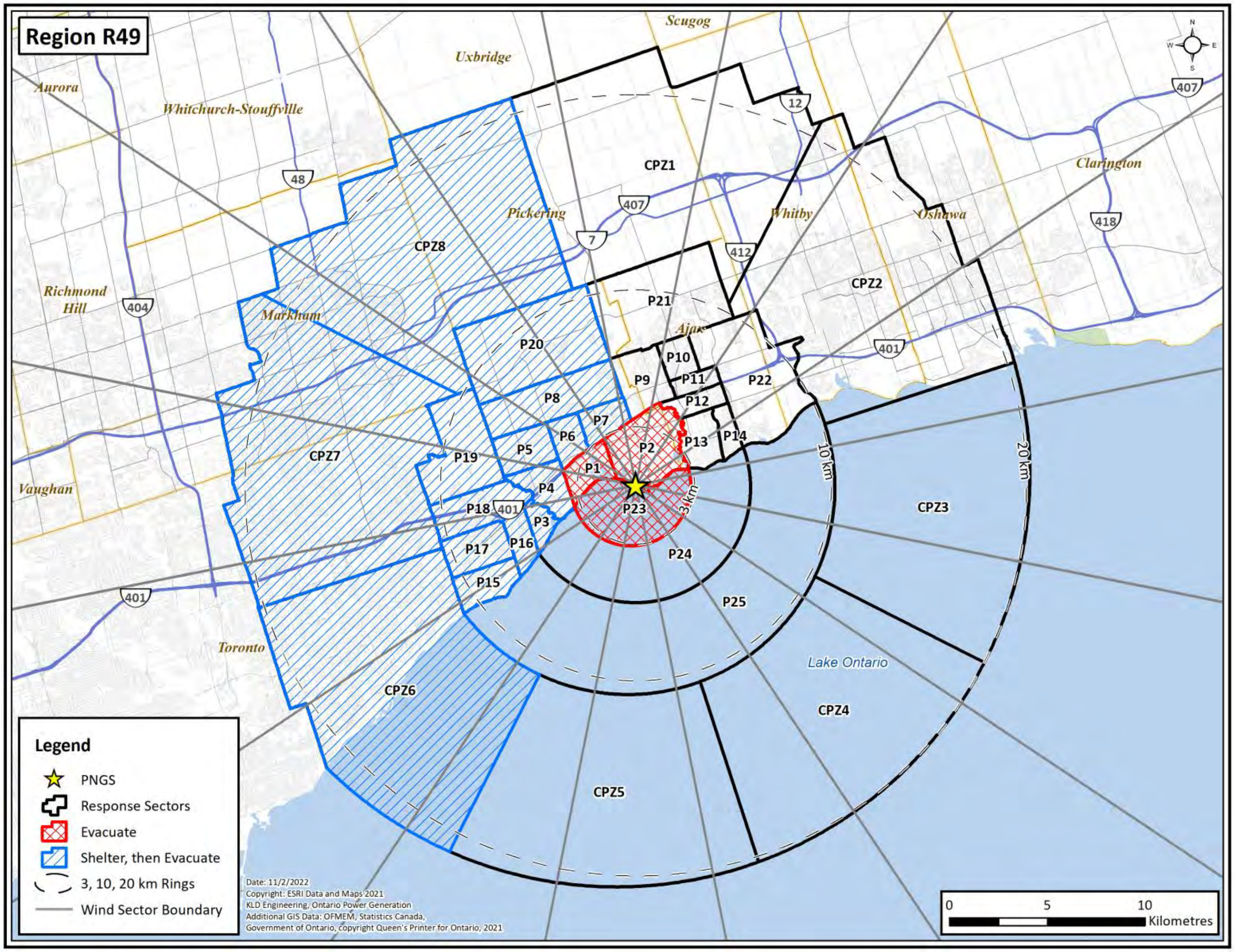


Figure H-49. Region R49

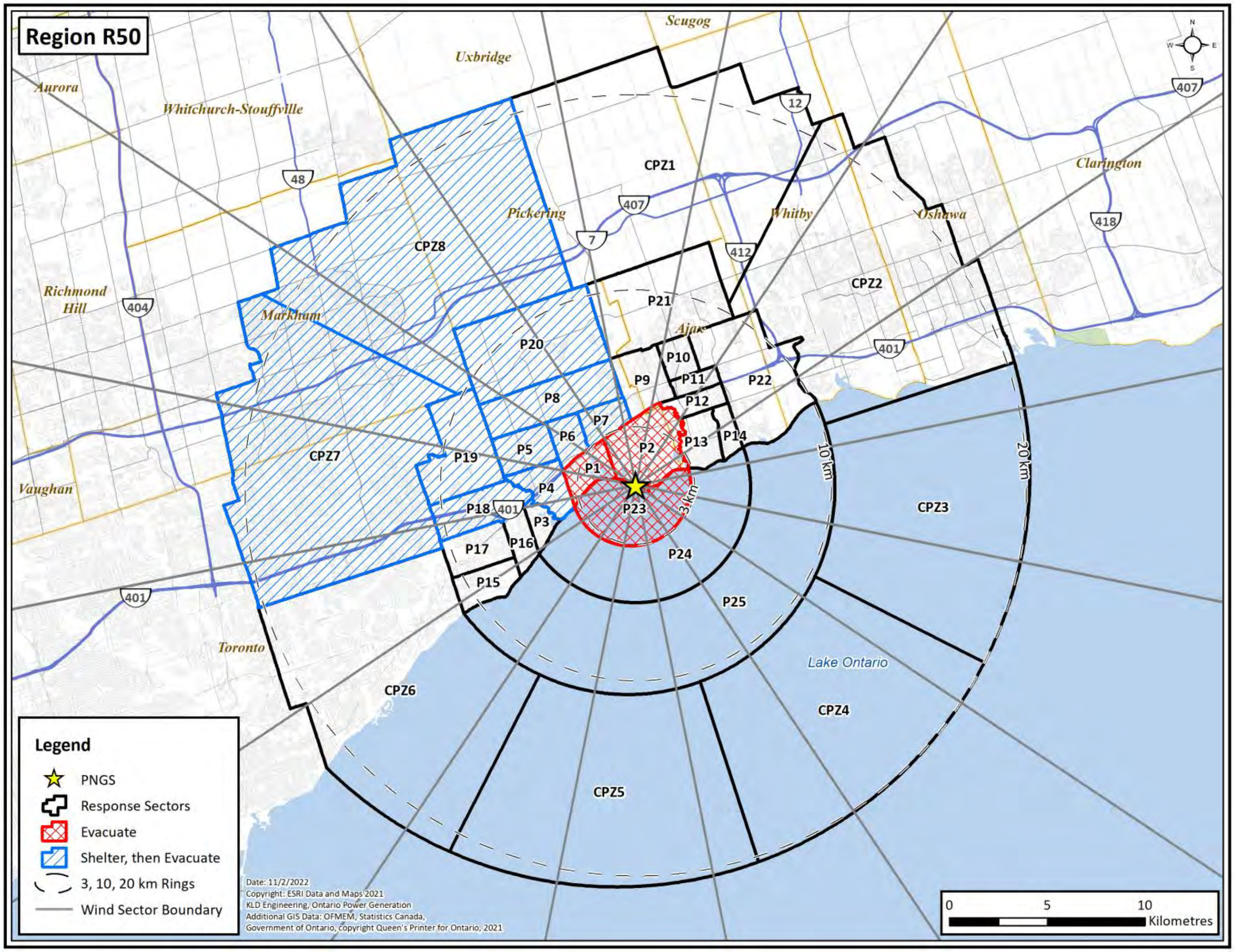


Figure H-50. Region R50

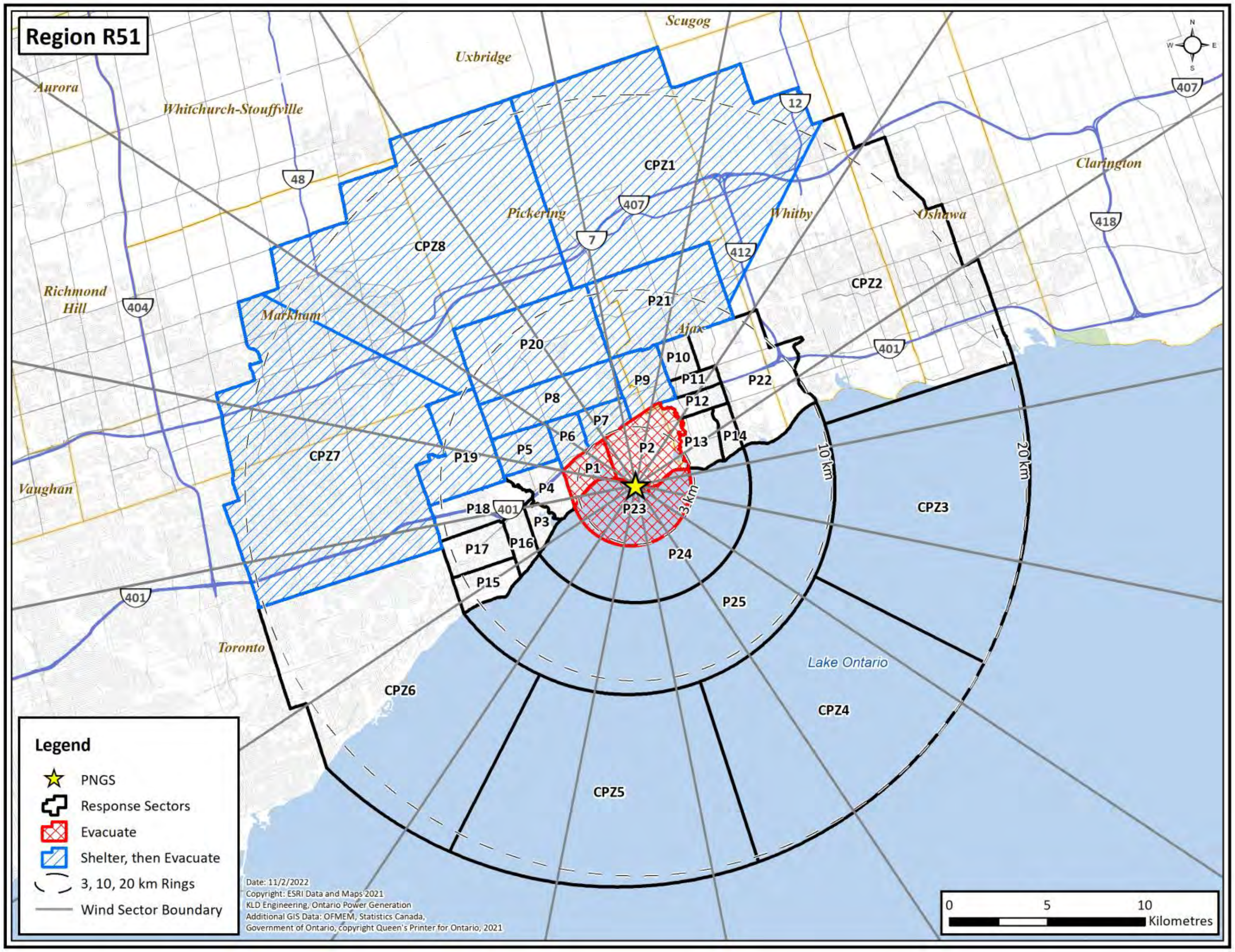


Figure H-51. Region R51

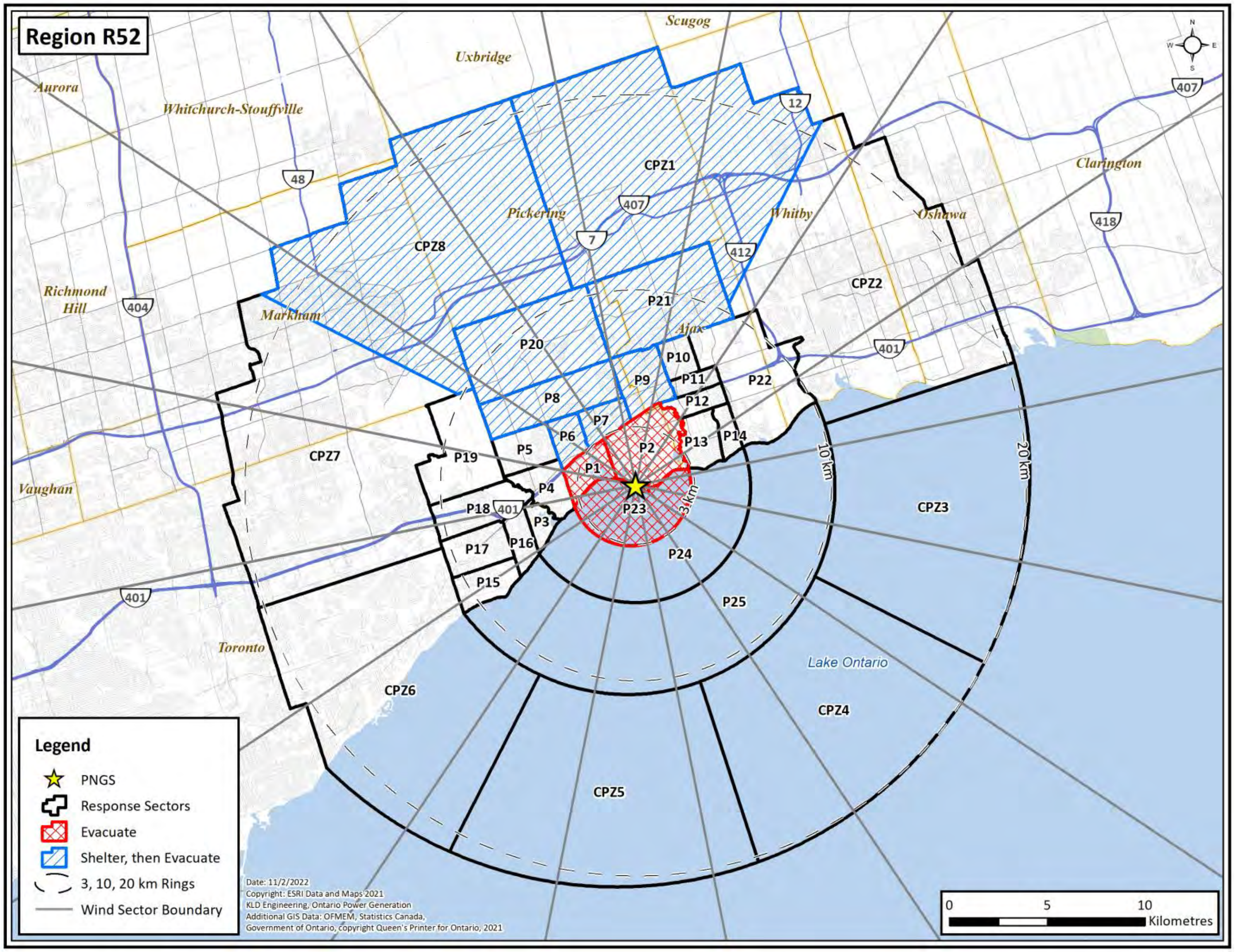


Figure H-52. Region R52

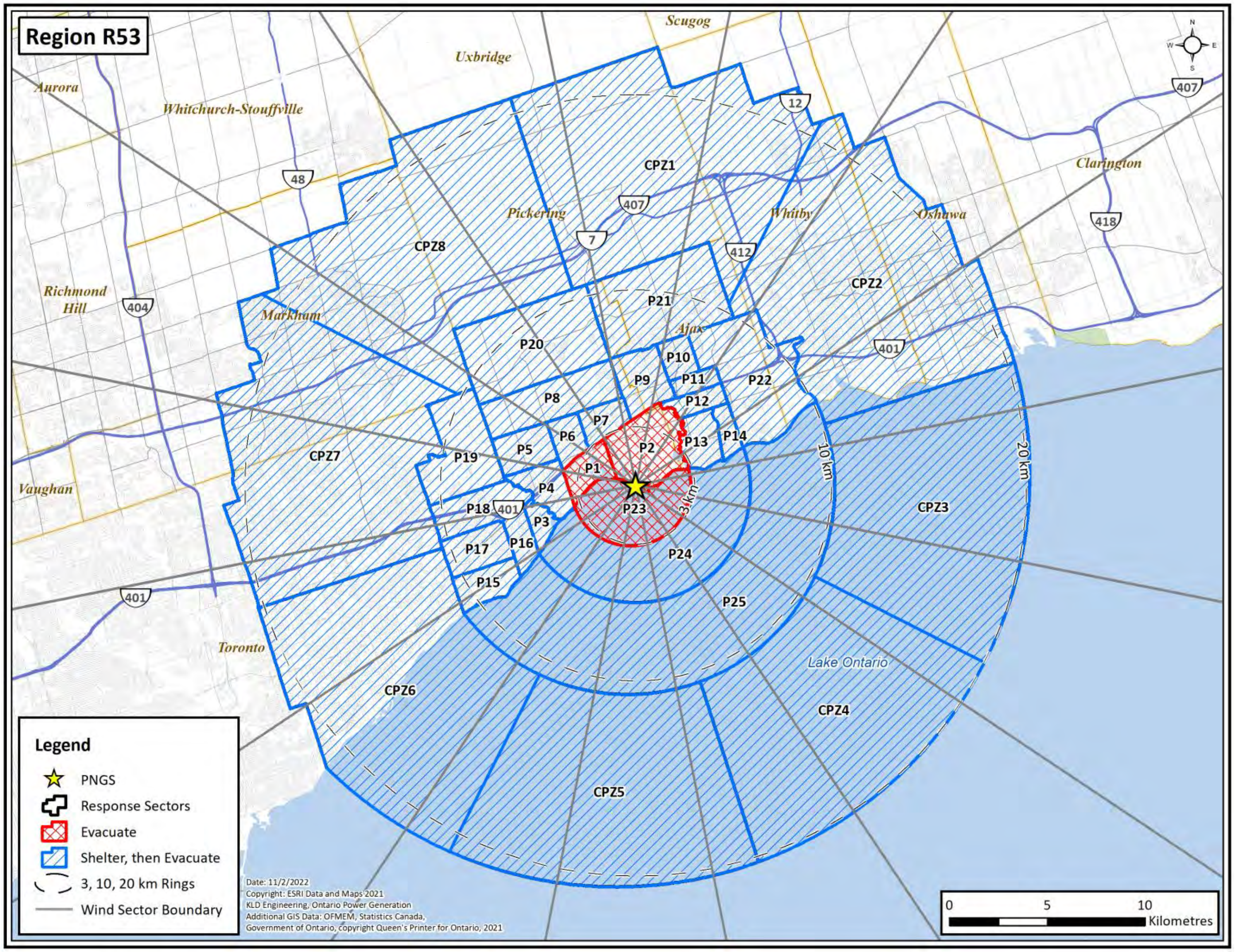


Figure H-53. Region R53

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%

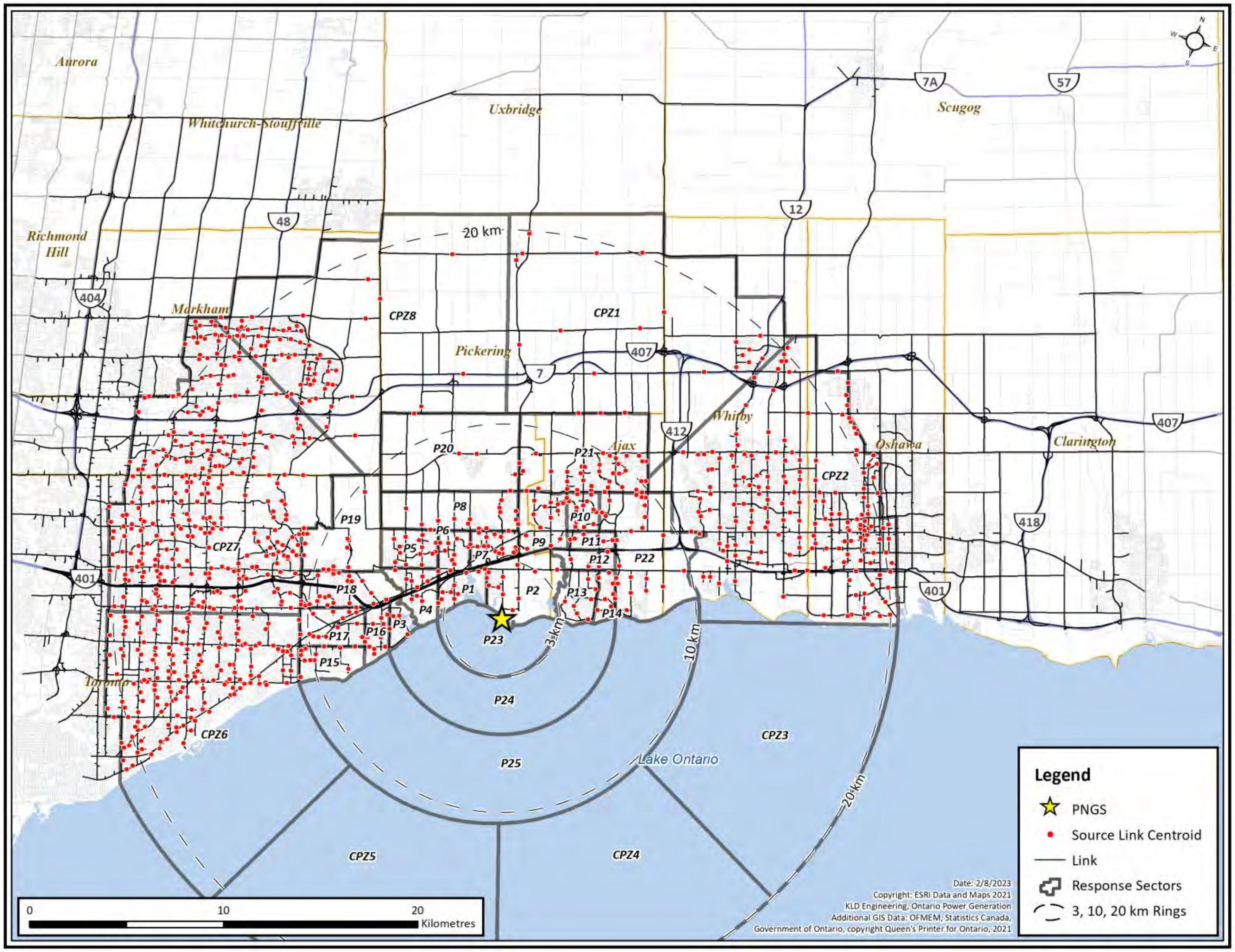


Figure J-1. Network Sources/Origins

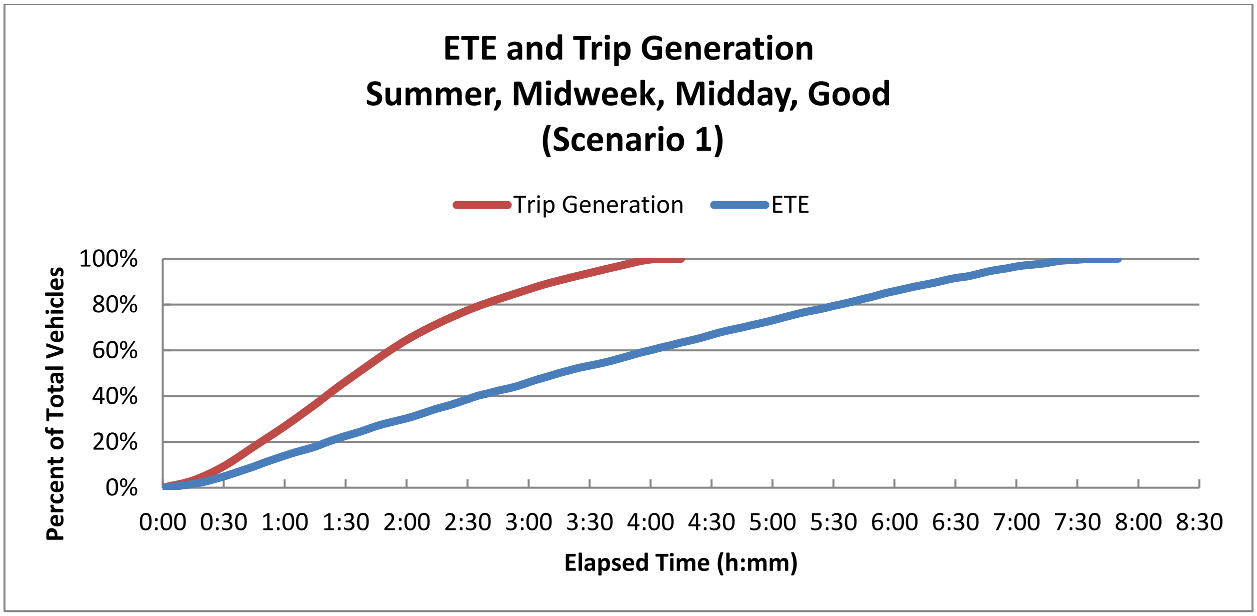


Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)

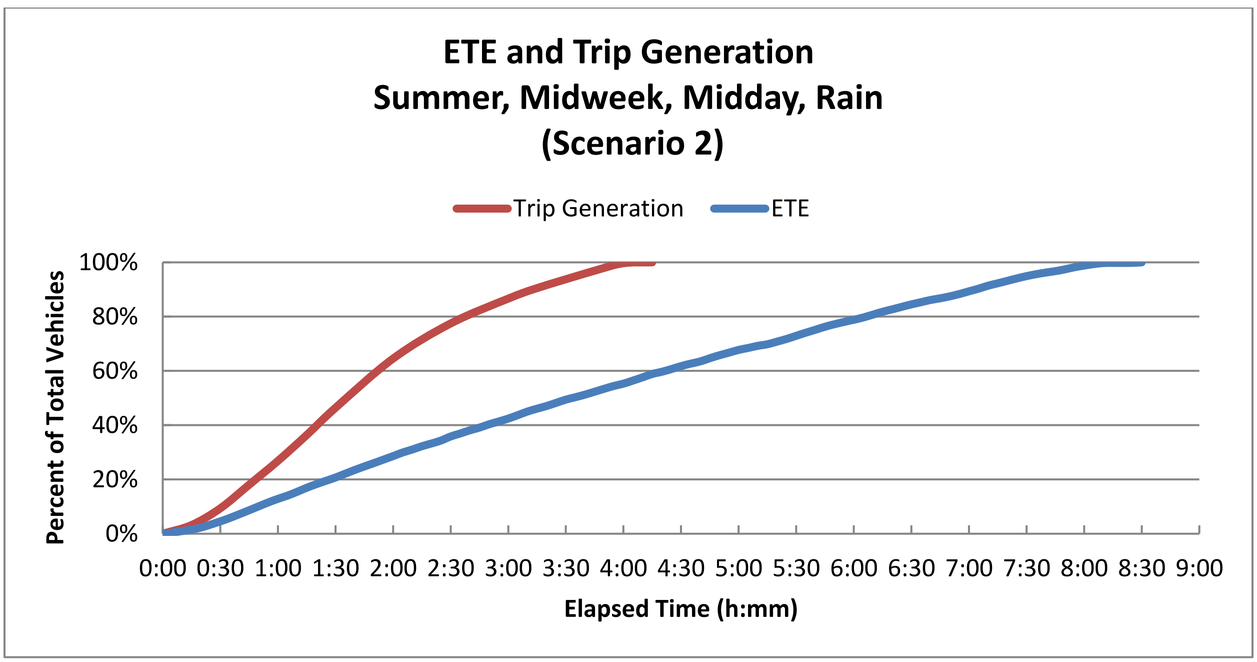


Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)

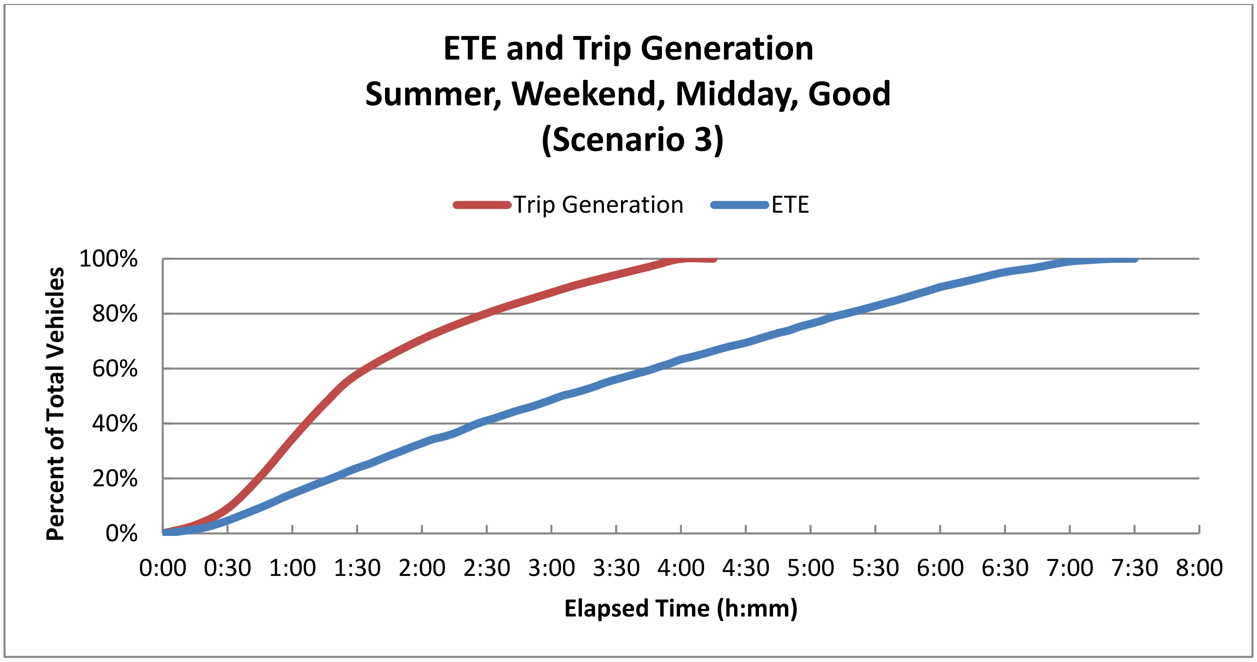


Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

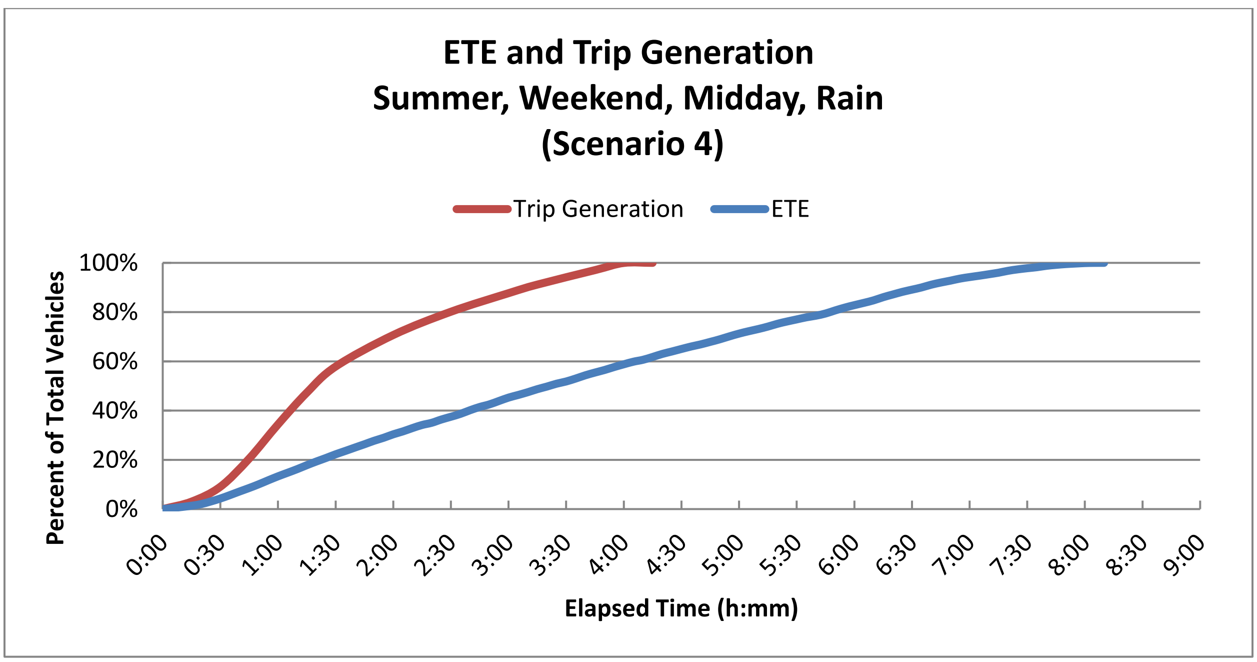


Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

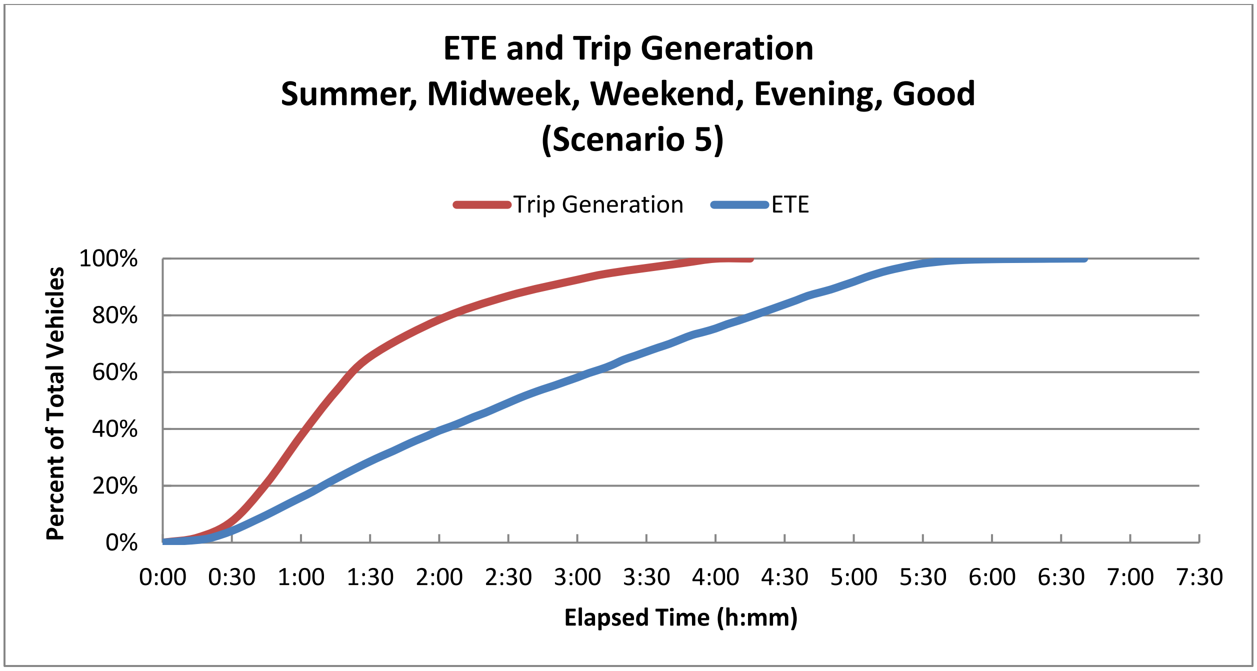


Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

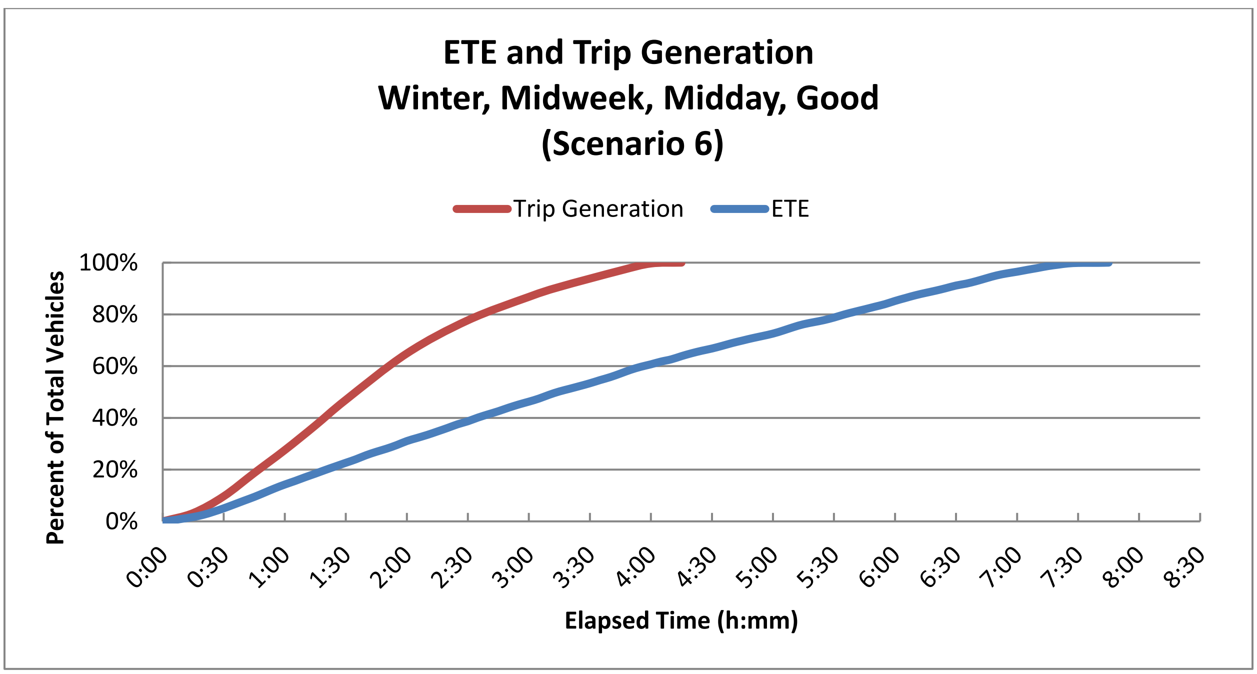


Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

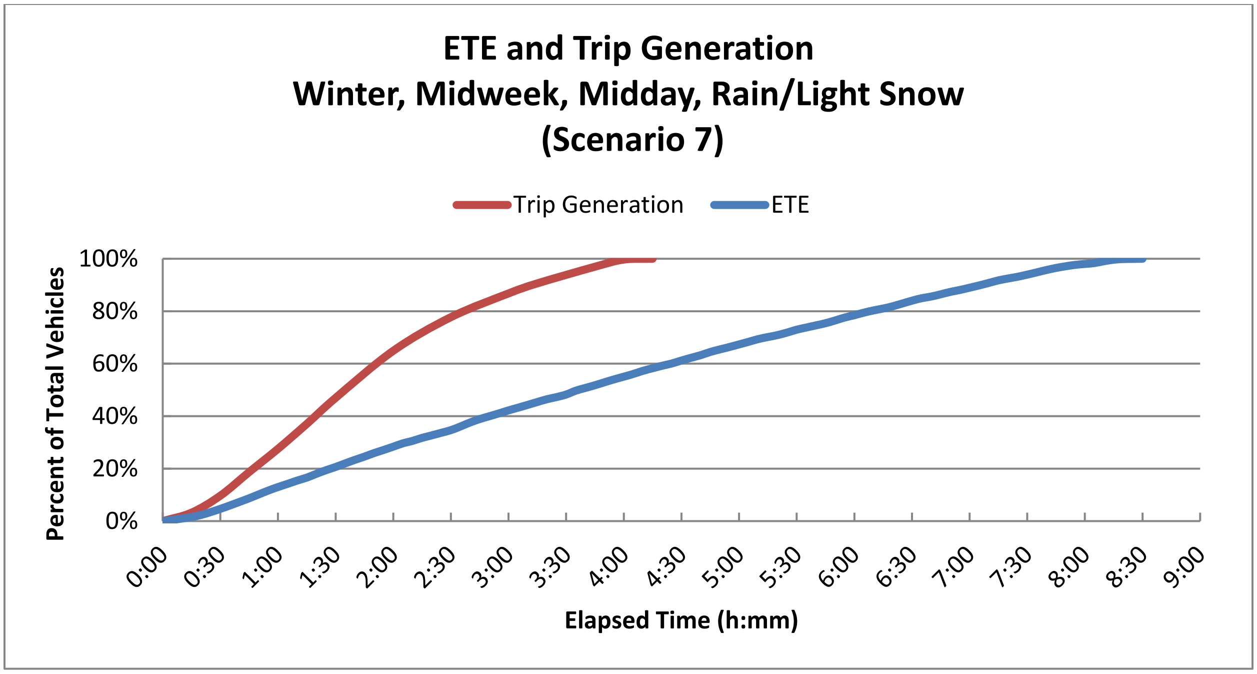


Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain/Light Snow (Scenario 7)

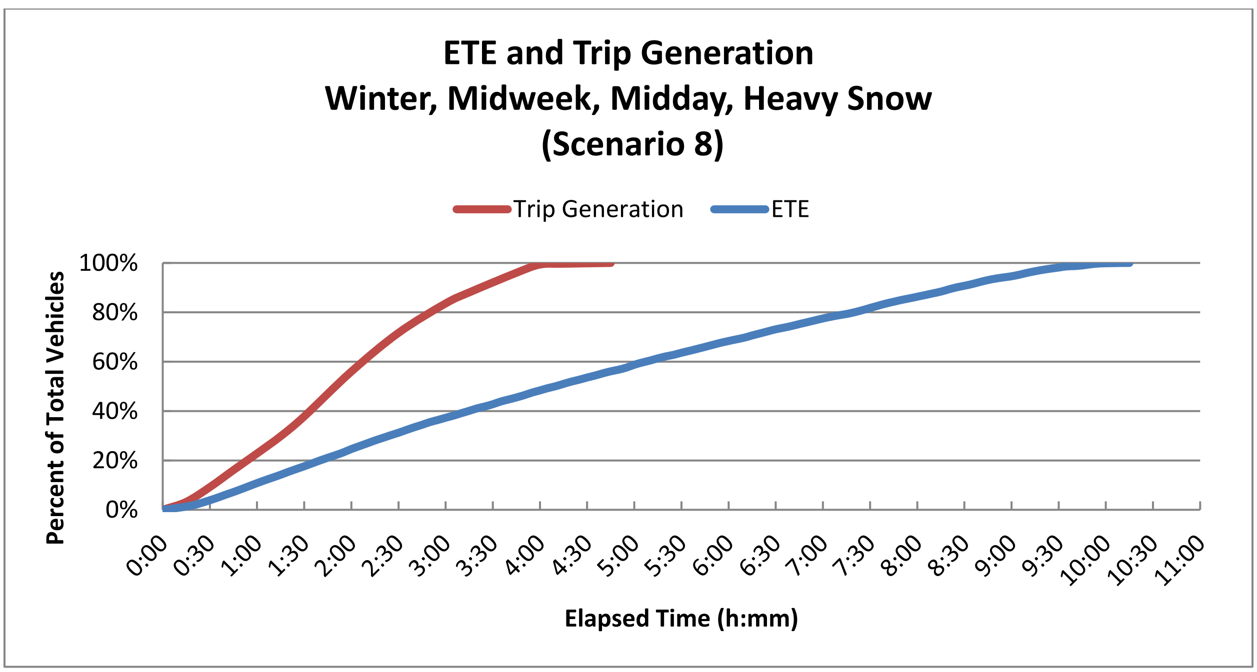


Figure J-9. ETE and Trip Generation: Winter, Midweek, Midday, Heavy Snow (Scenario 8)

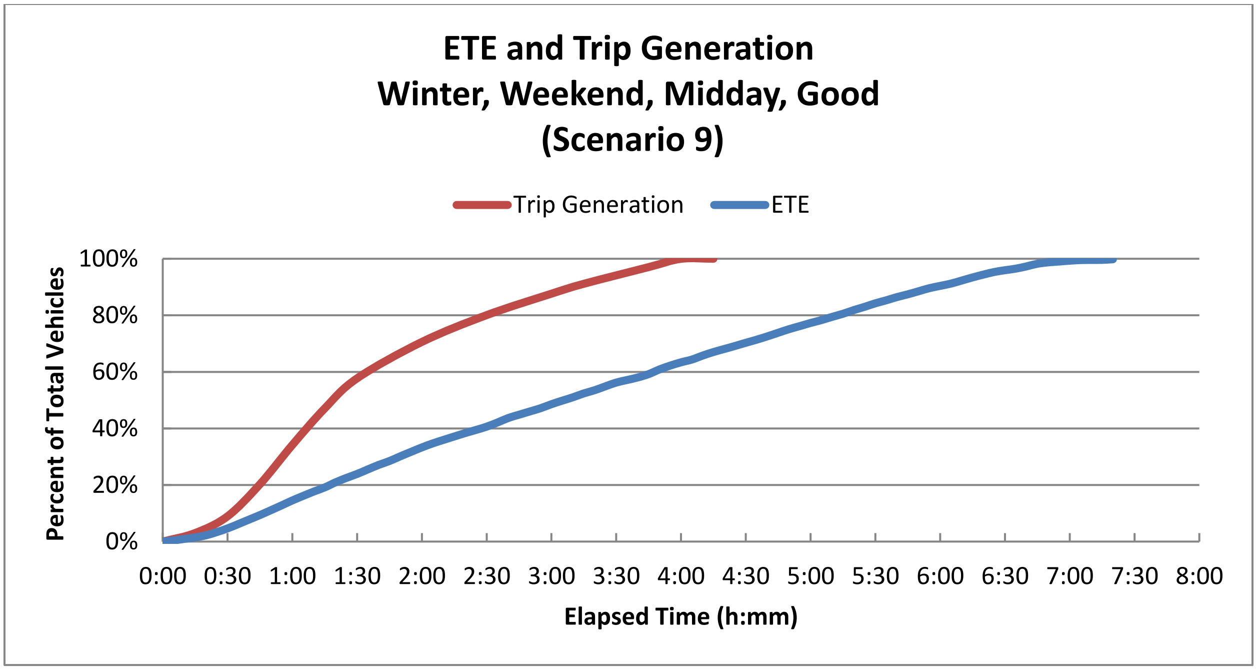


Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)

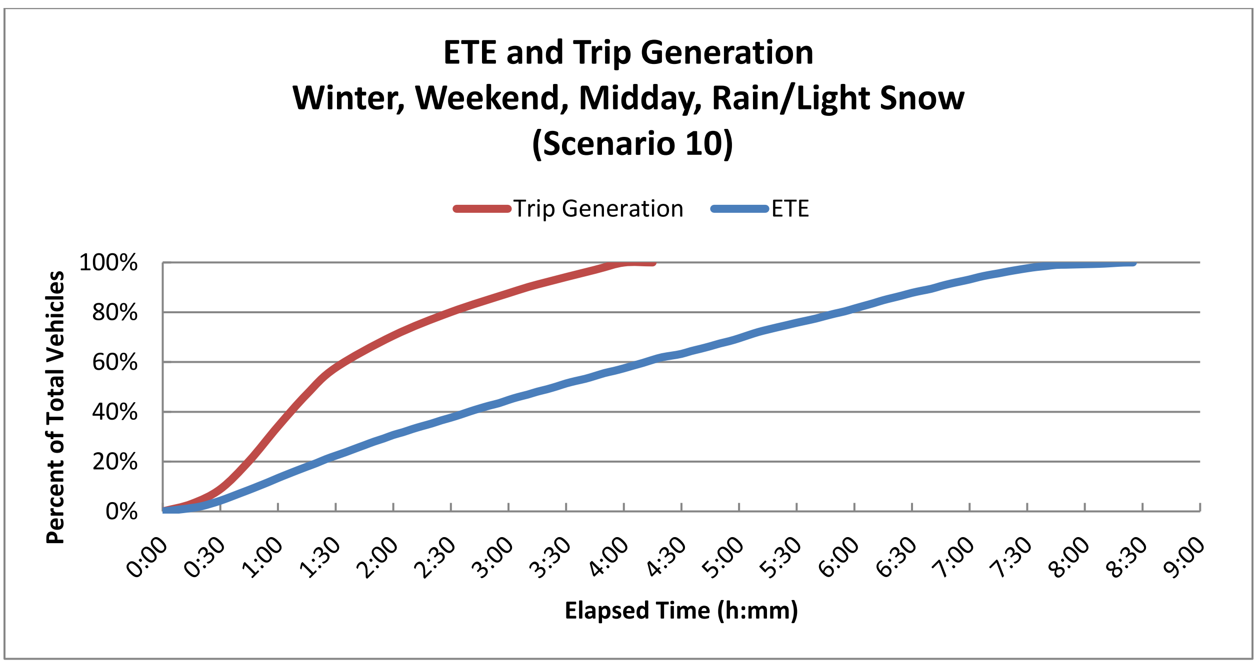


Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Rain/Light Snow (Scenario 10)

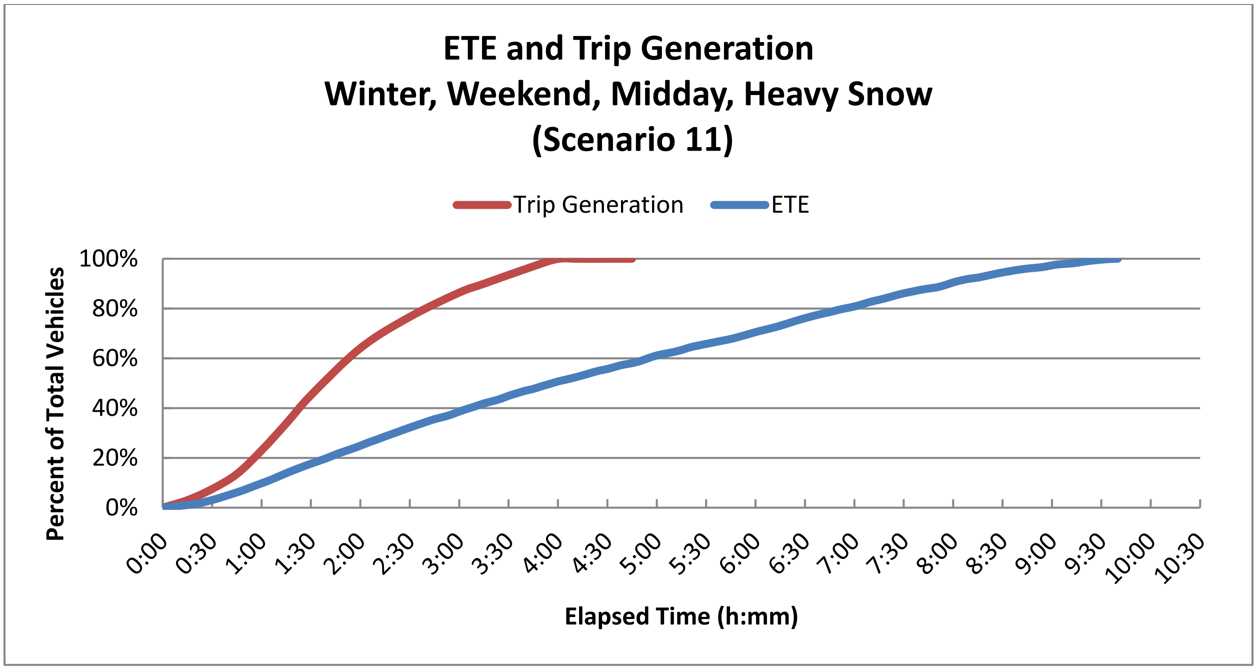


Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Heavy Snow (Scenario 11)

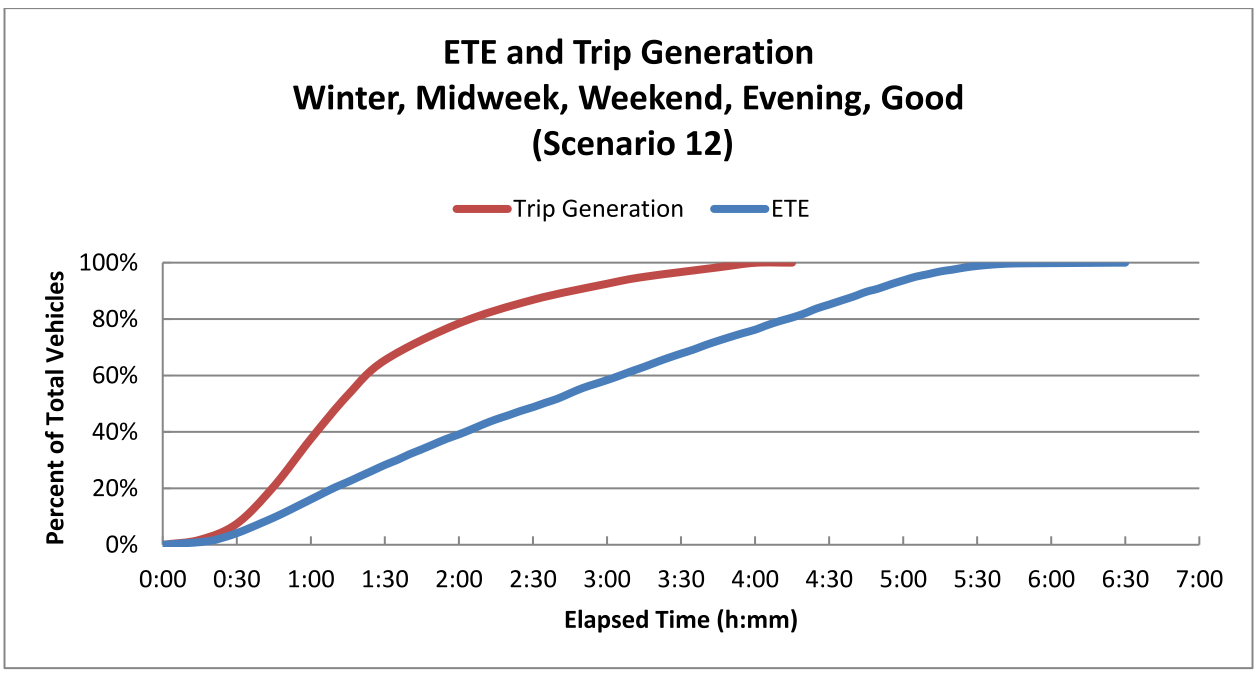


Figure J-13. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)

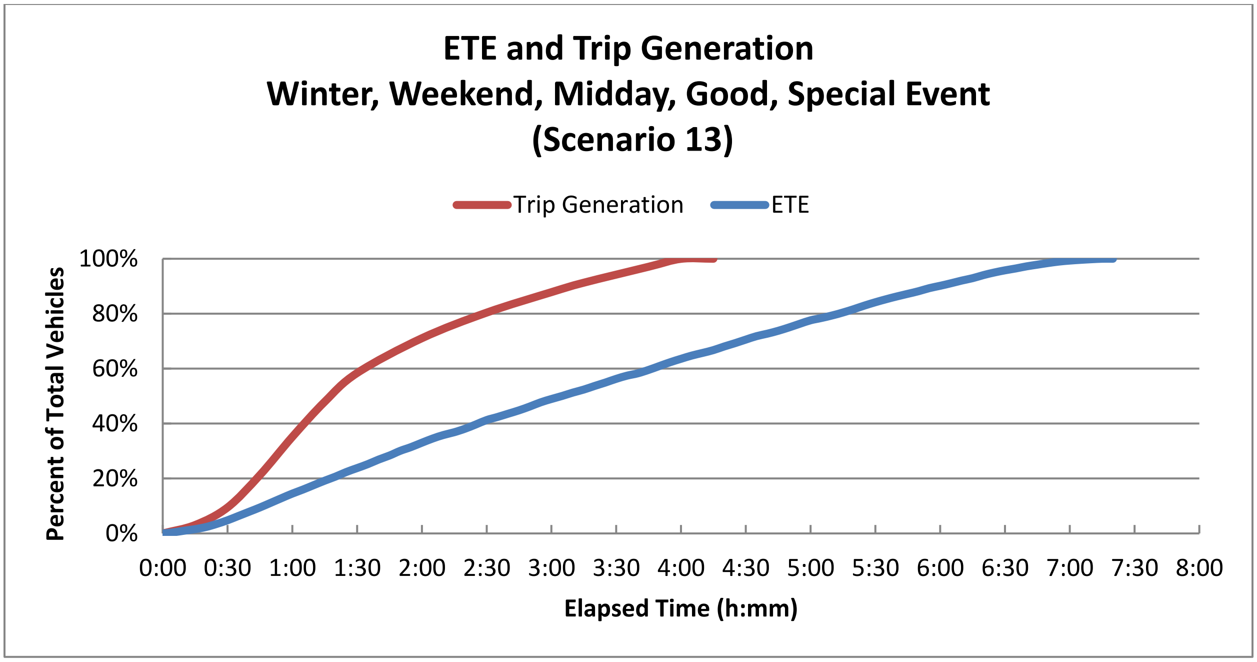


Figure J-14. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather, Special Event (Scenario 13)

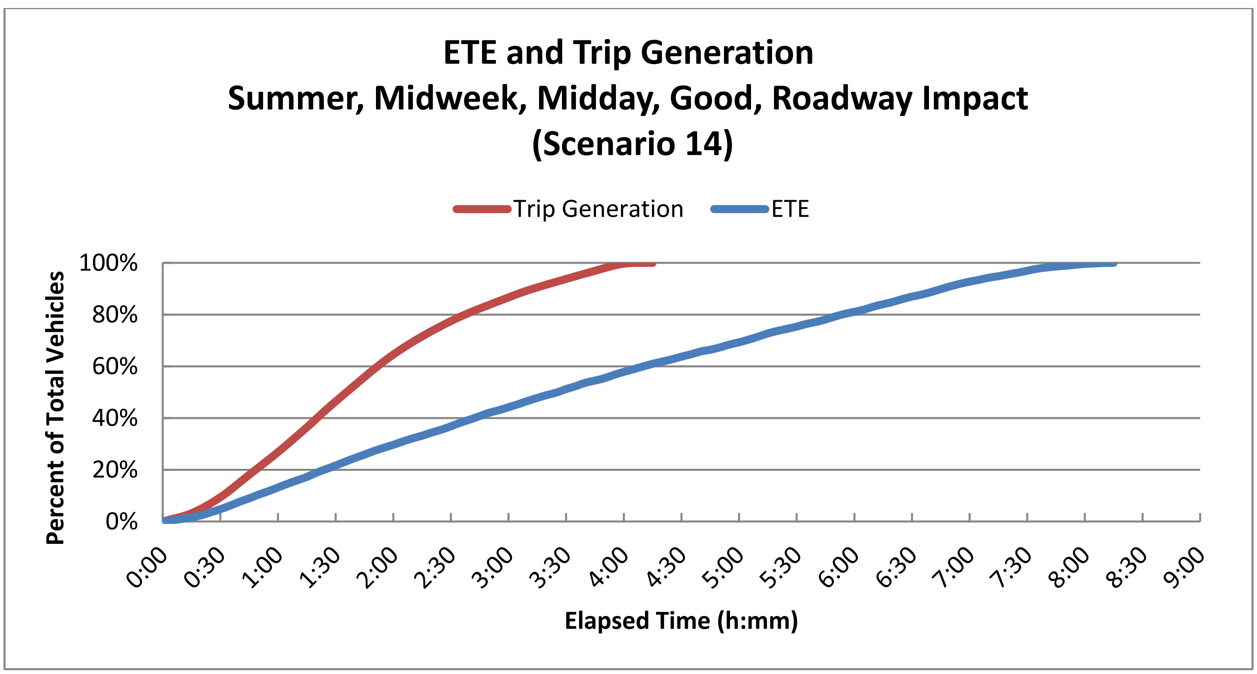


Figure J-15. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)

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**

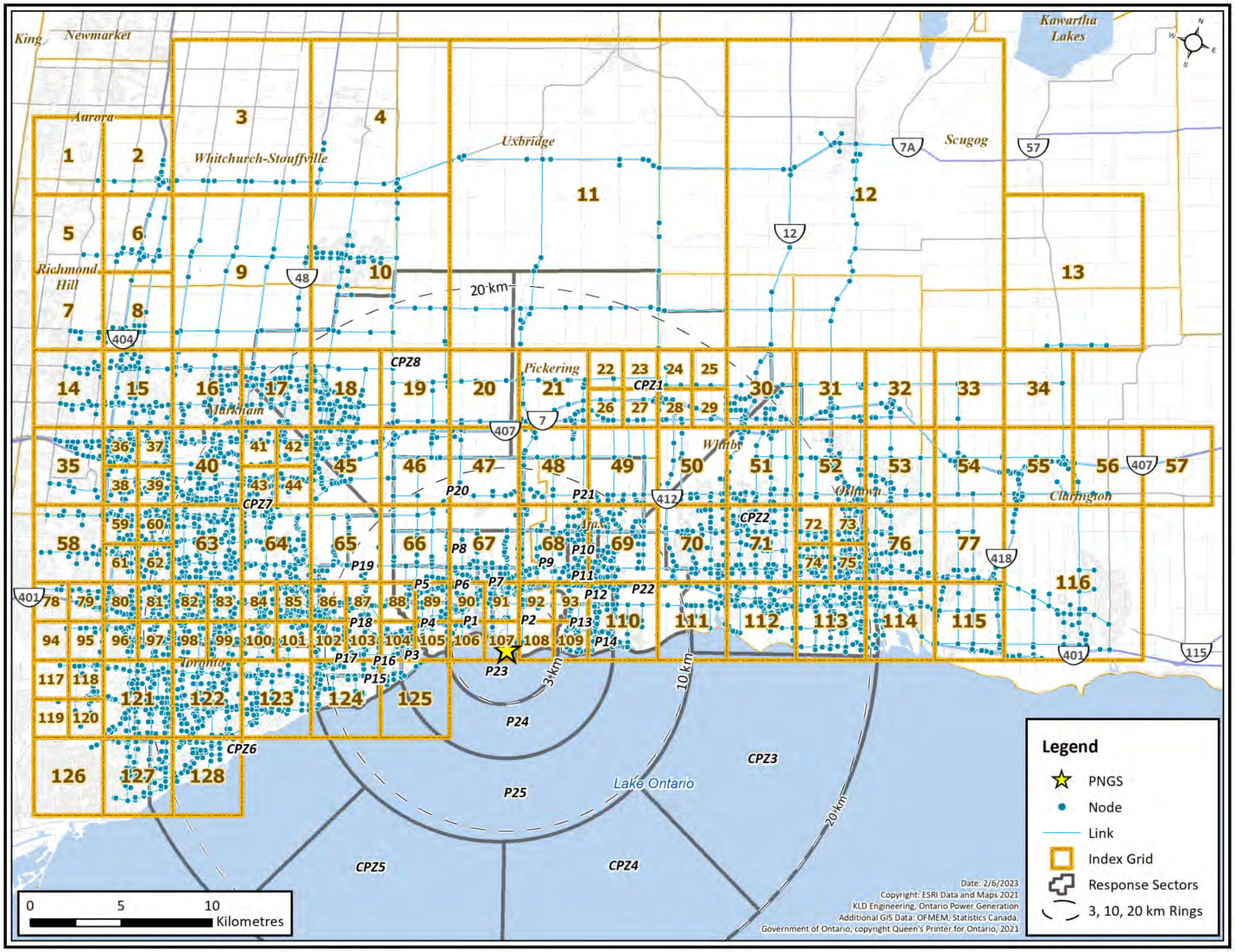


Figure K-1. PNGS Link-Node Analysis Network

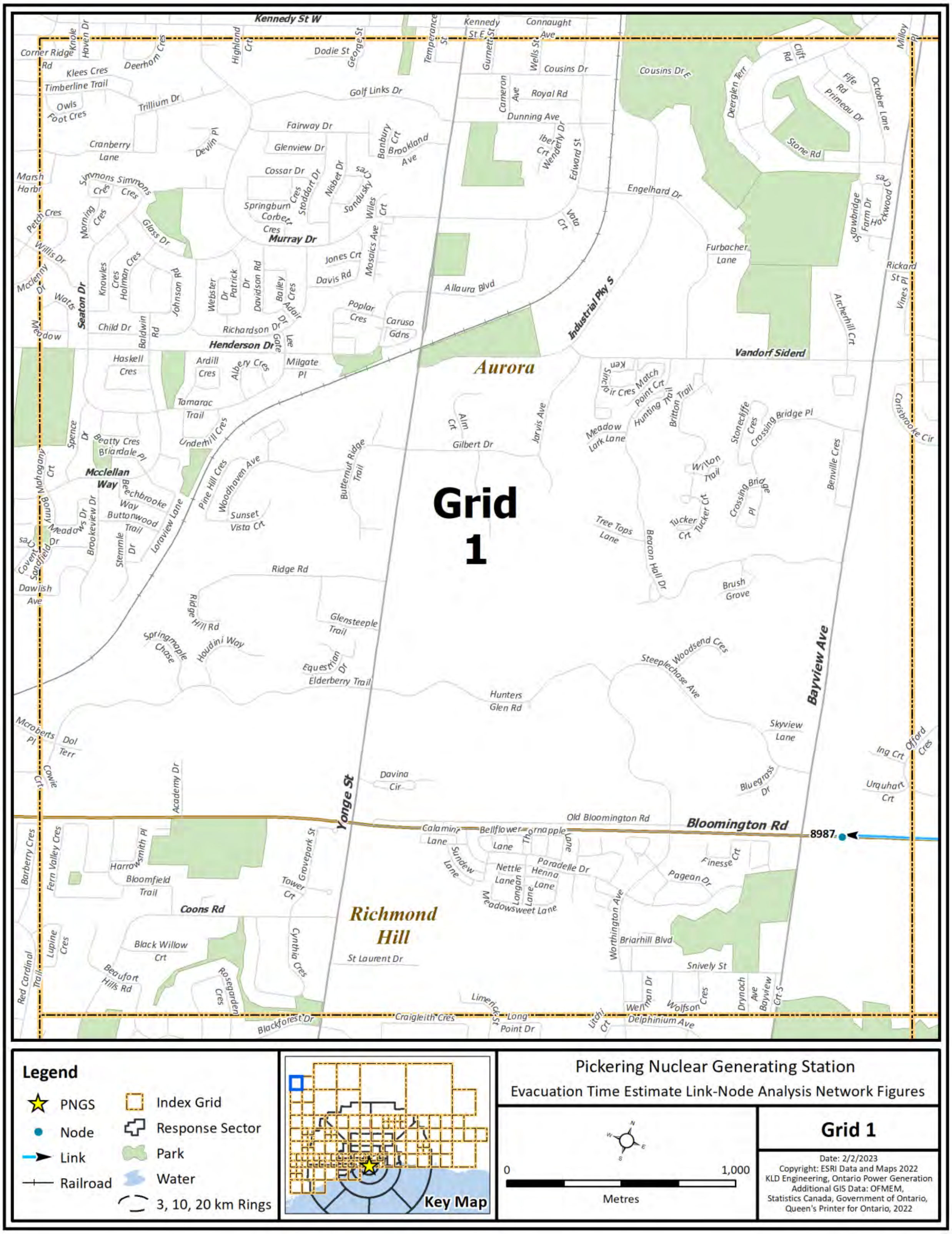


Figure K-2. Link-Node Analysis Network – Grid 1

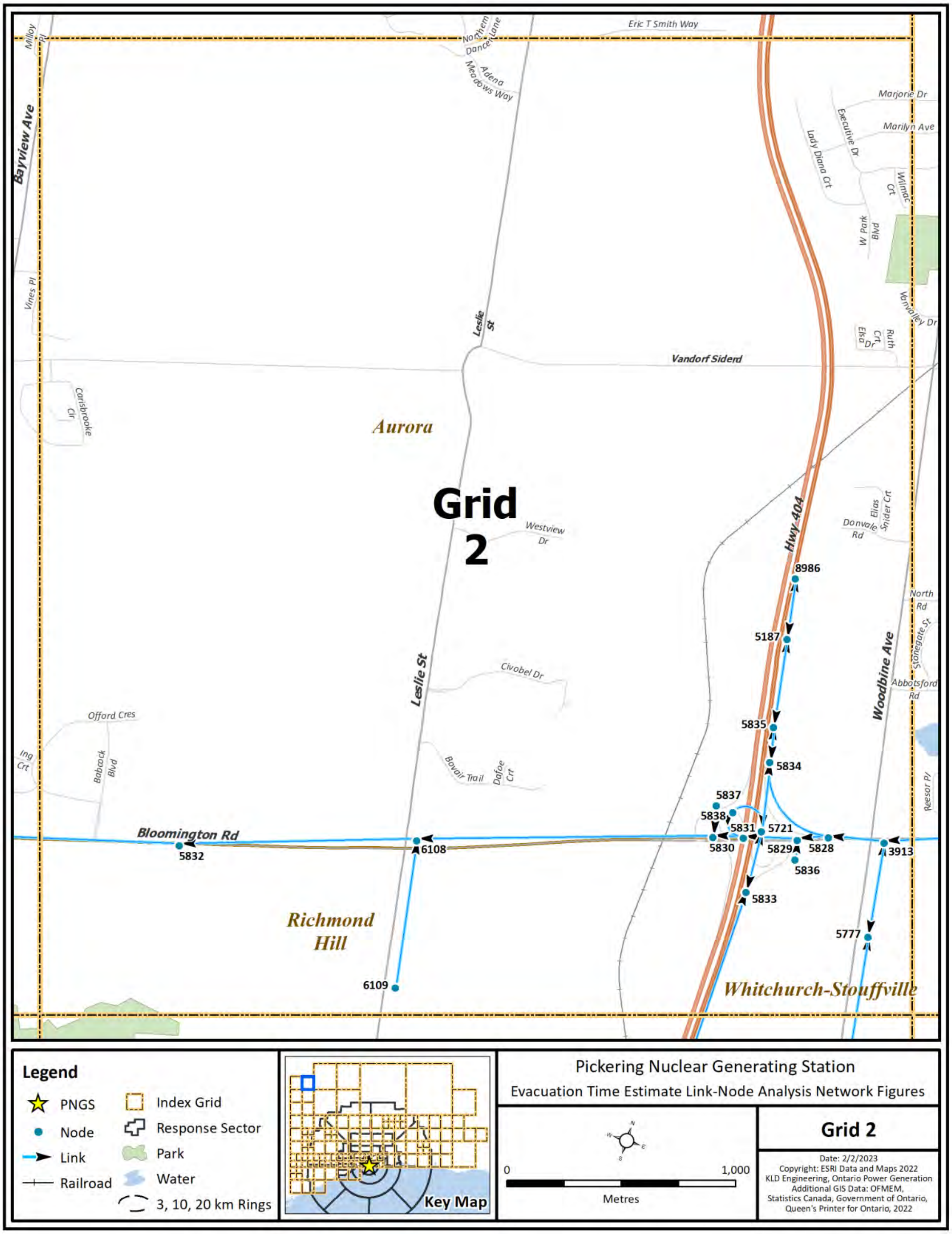


Figure K-3. Link-Node Analysis Network – Grid 2

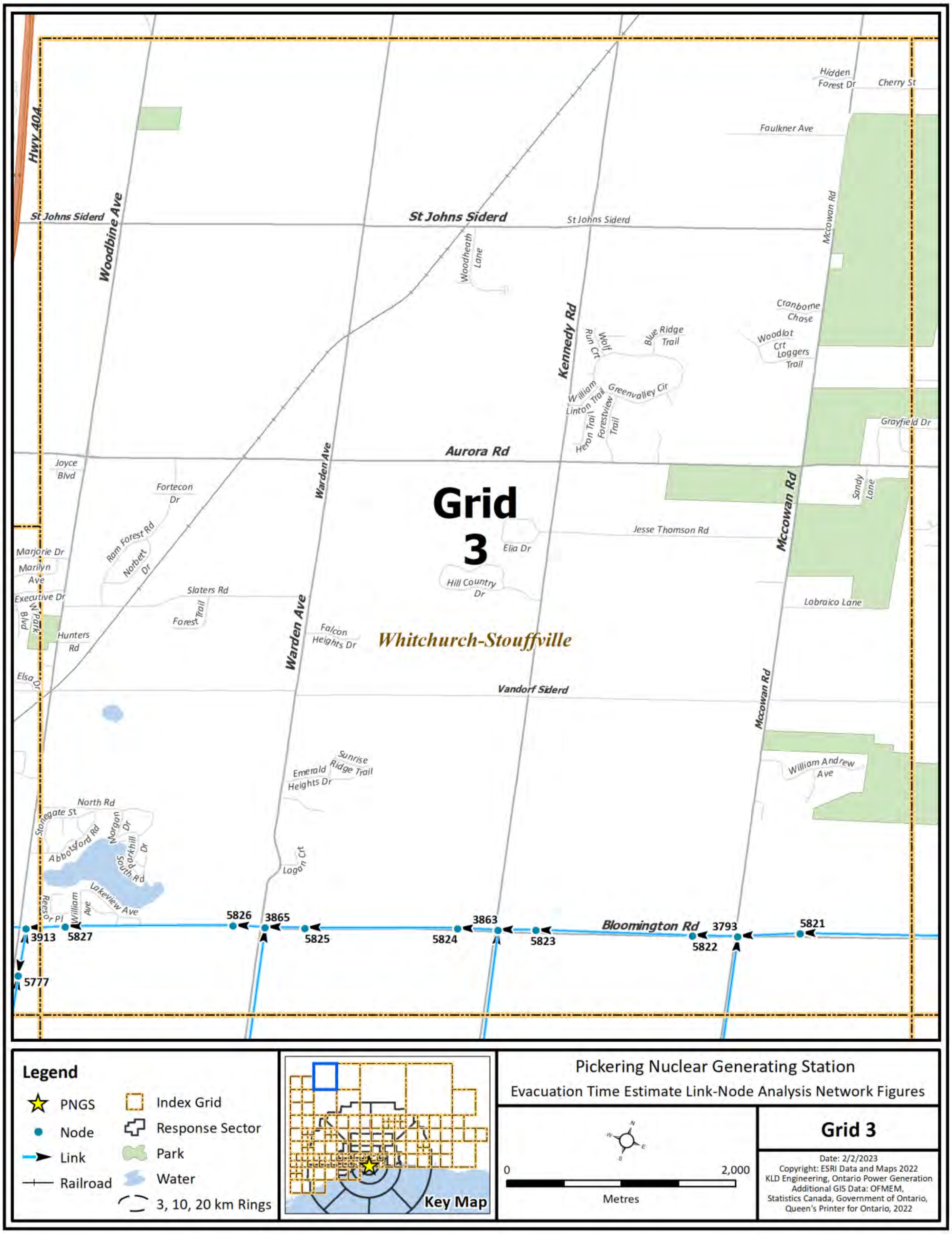


Figure K-4. Link-Node Analysis Network – Grid 3

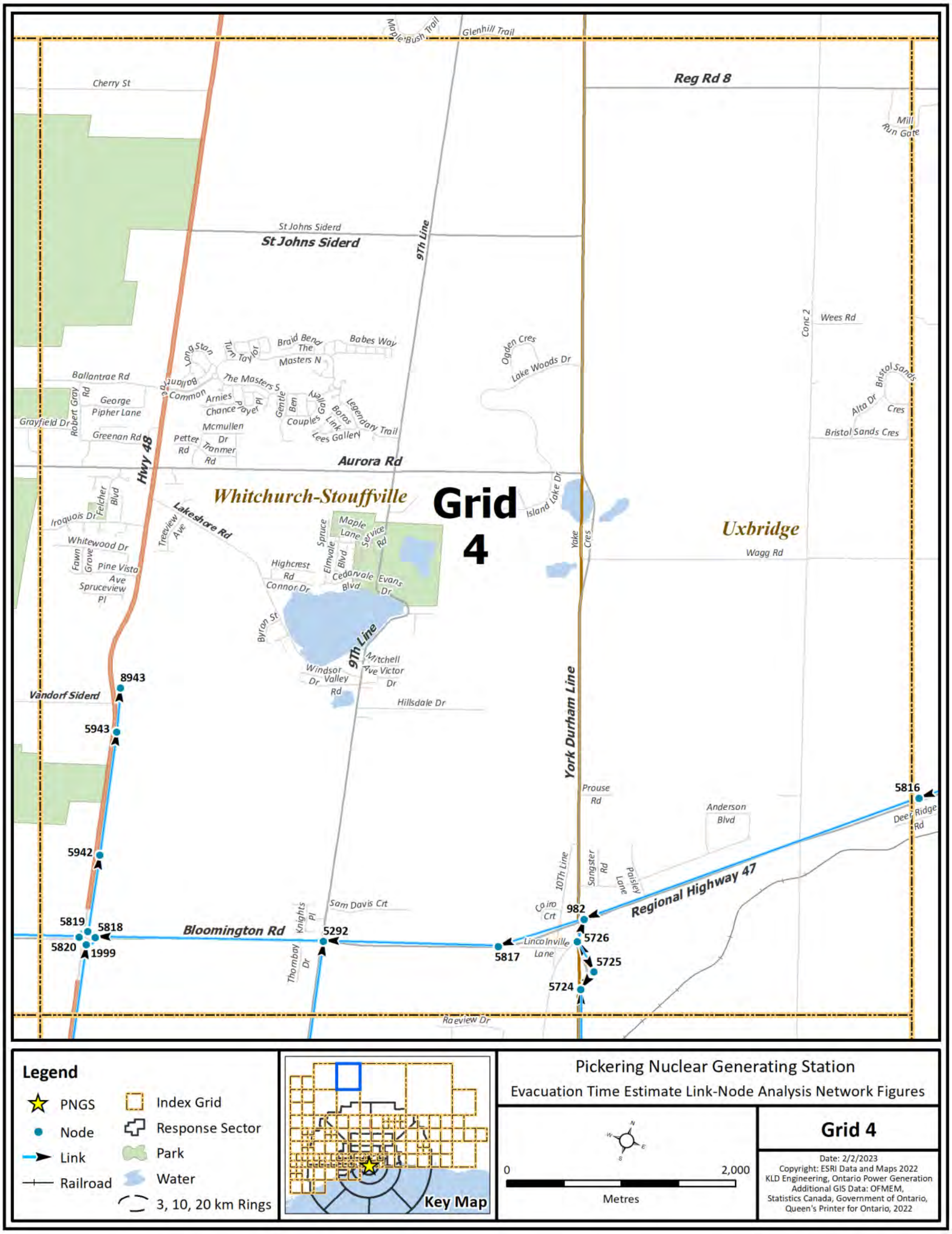


Figure K-5. Link-Node Analysis Network – Grid 4

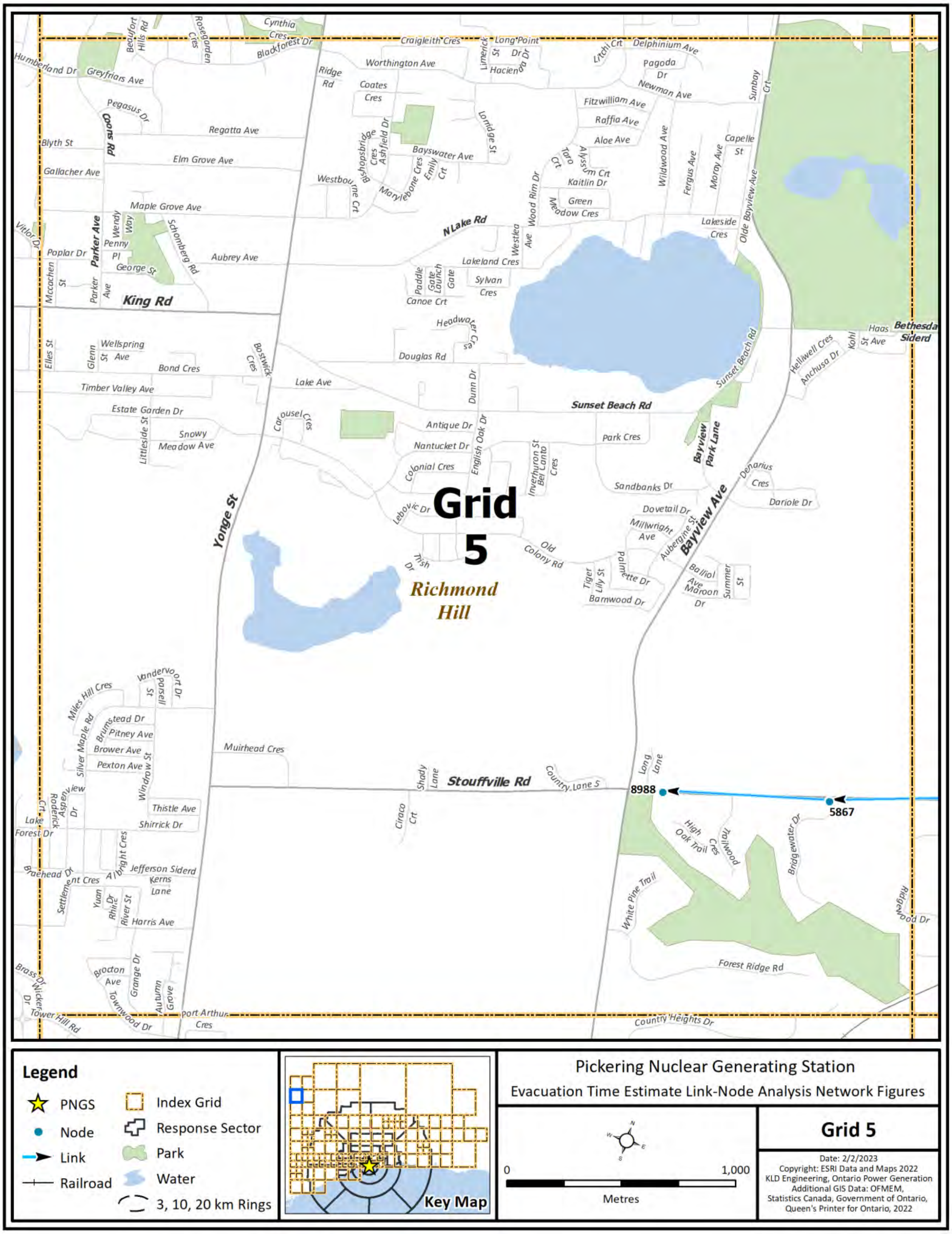


Figure K-6. Link-Node Analysis Network – Grid 5

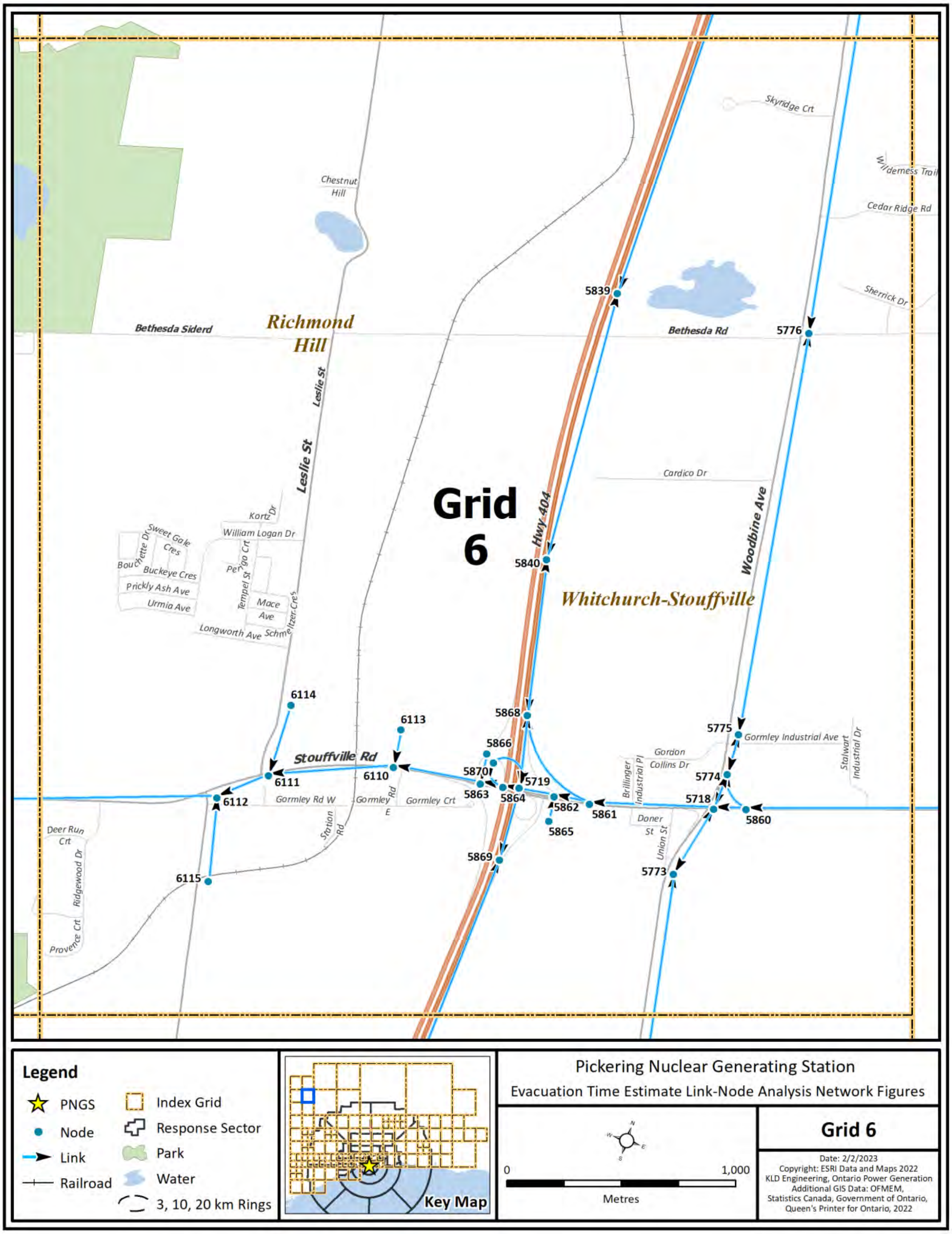


Figure K-7. Link-Node Analysis Network – Grid 6

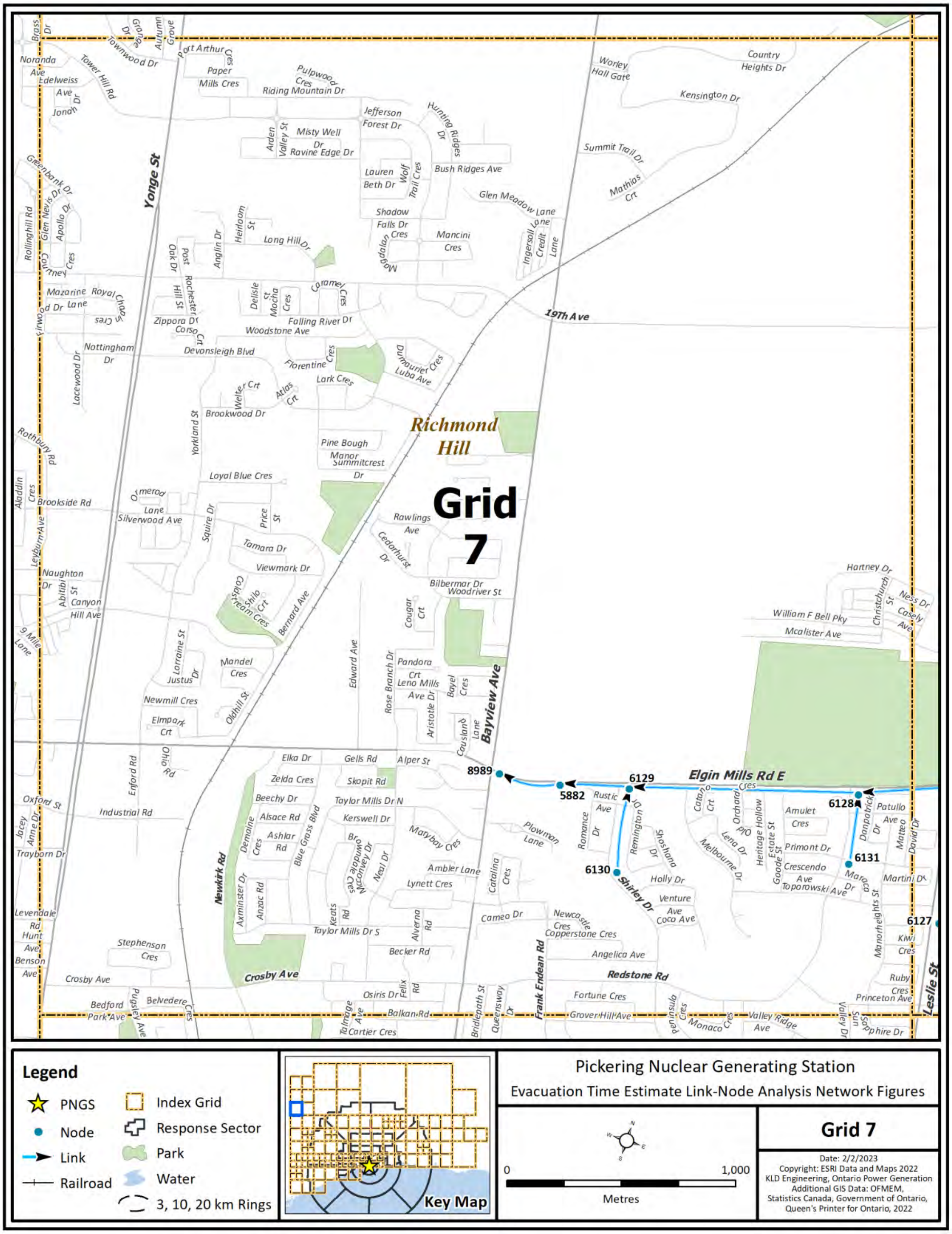


Figure K-8. Link-Node Analysis Network – Grid 7

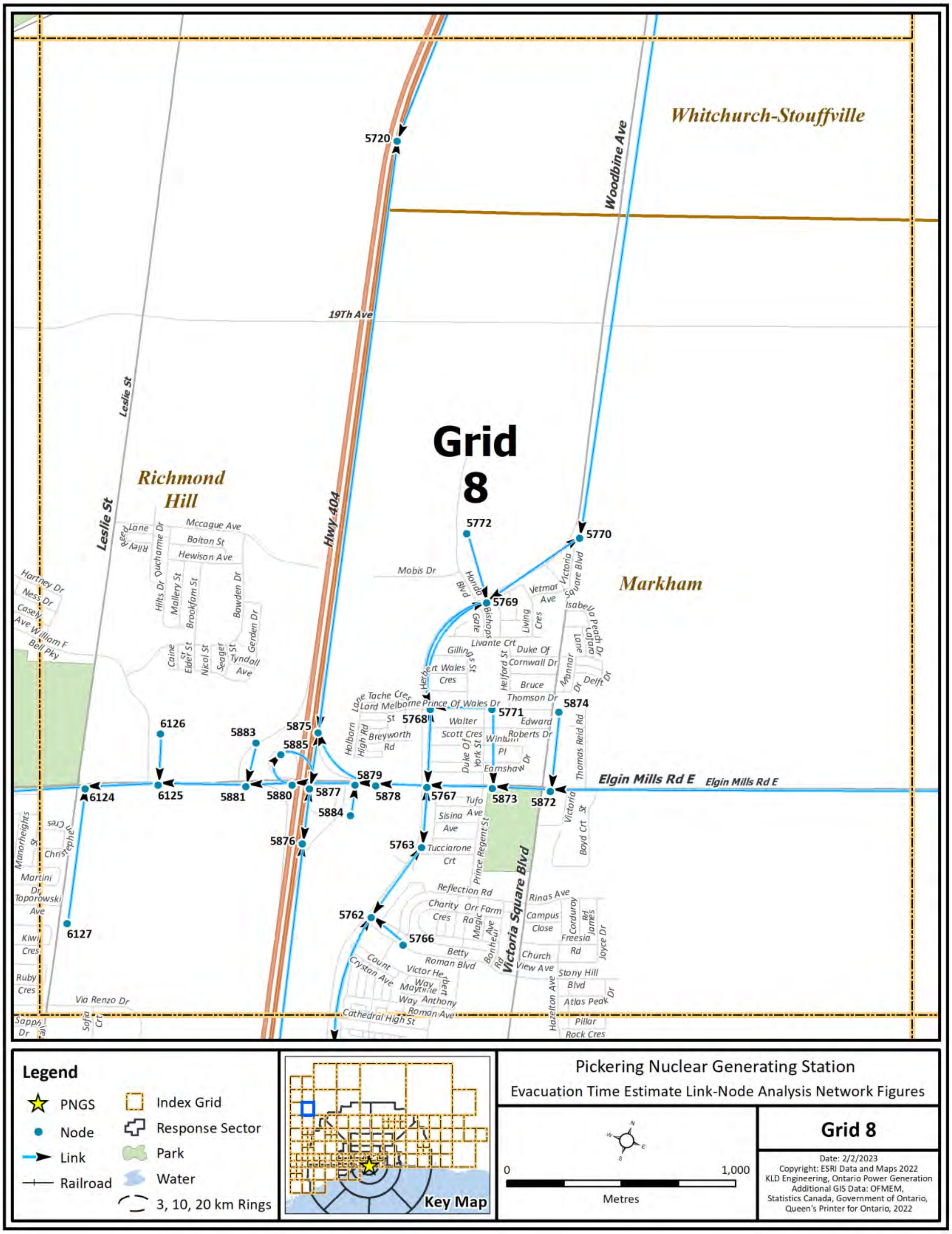


Figure K-9. Link-Node Analysis Network – Grid 8

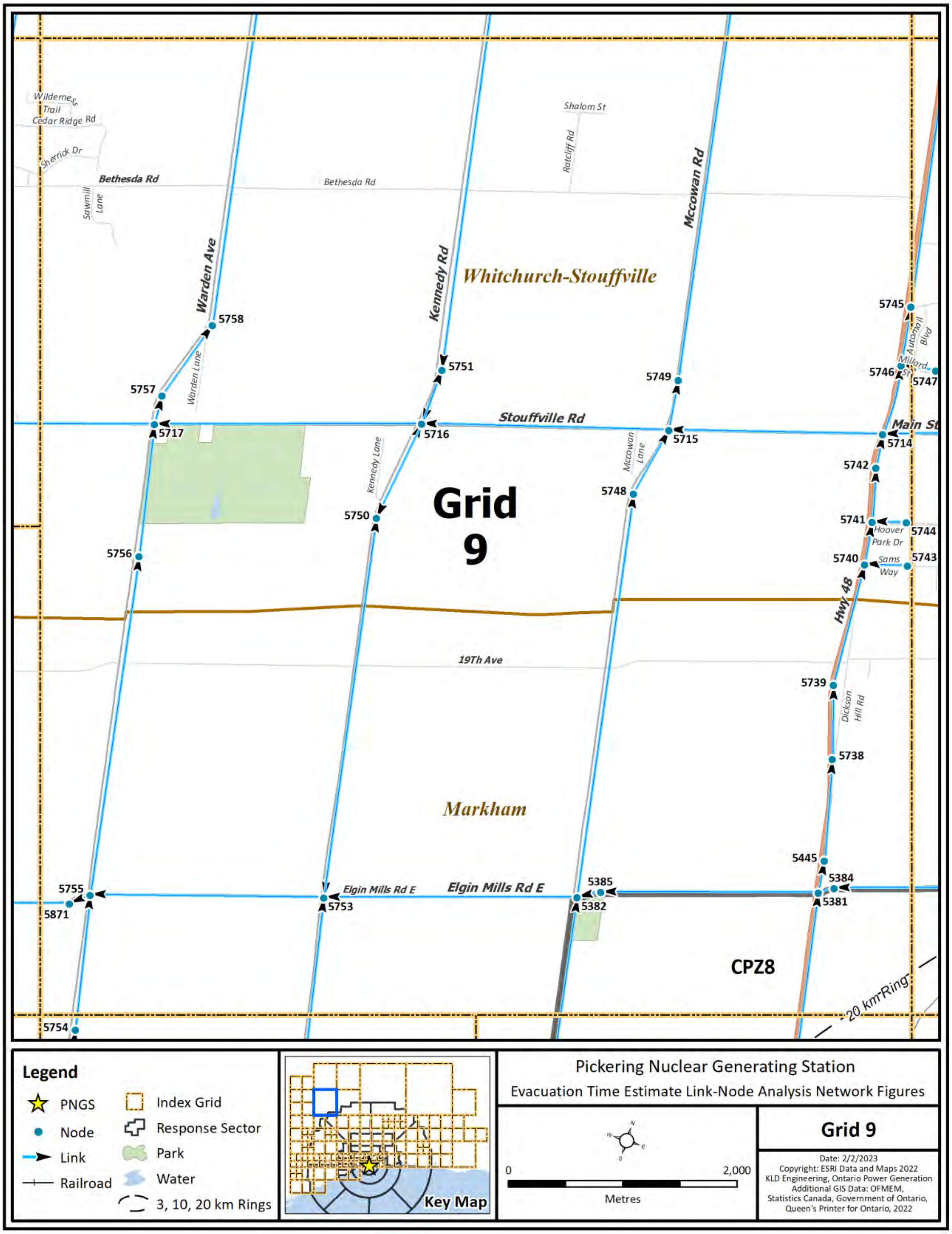


Figure K-10. Link-Node Analysis Network – Grid 9

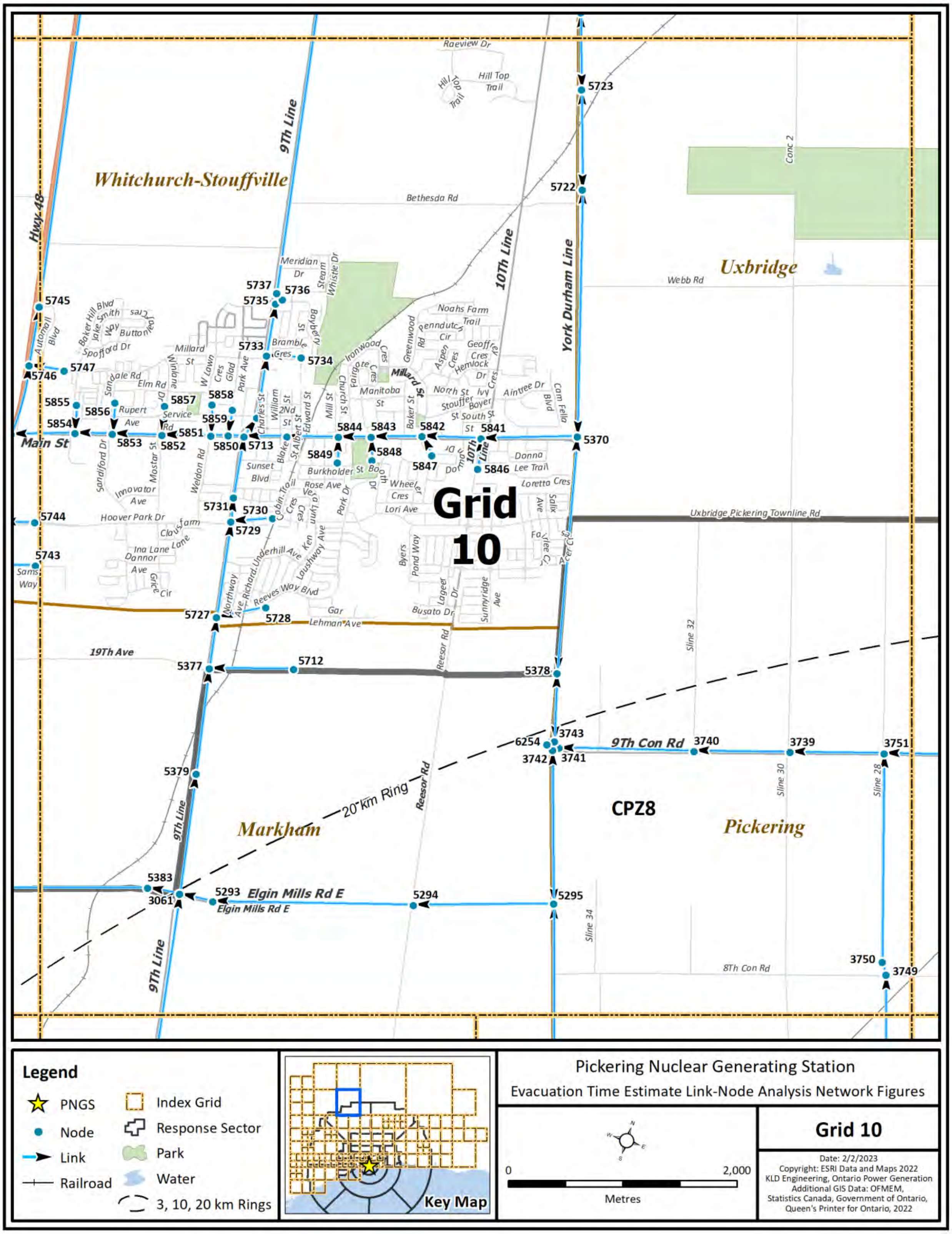


Figure K-11. Link-Node Analysis Network – Grid 10

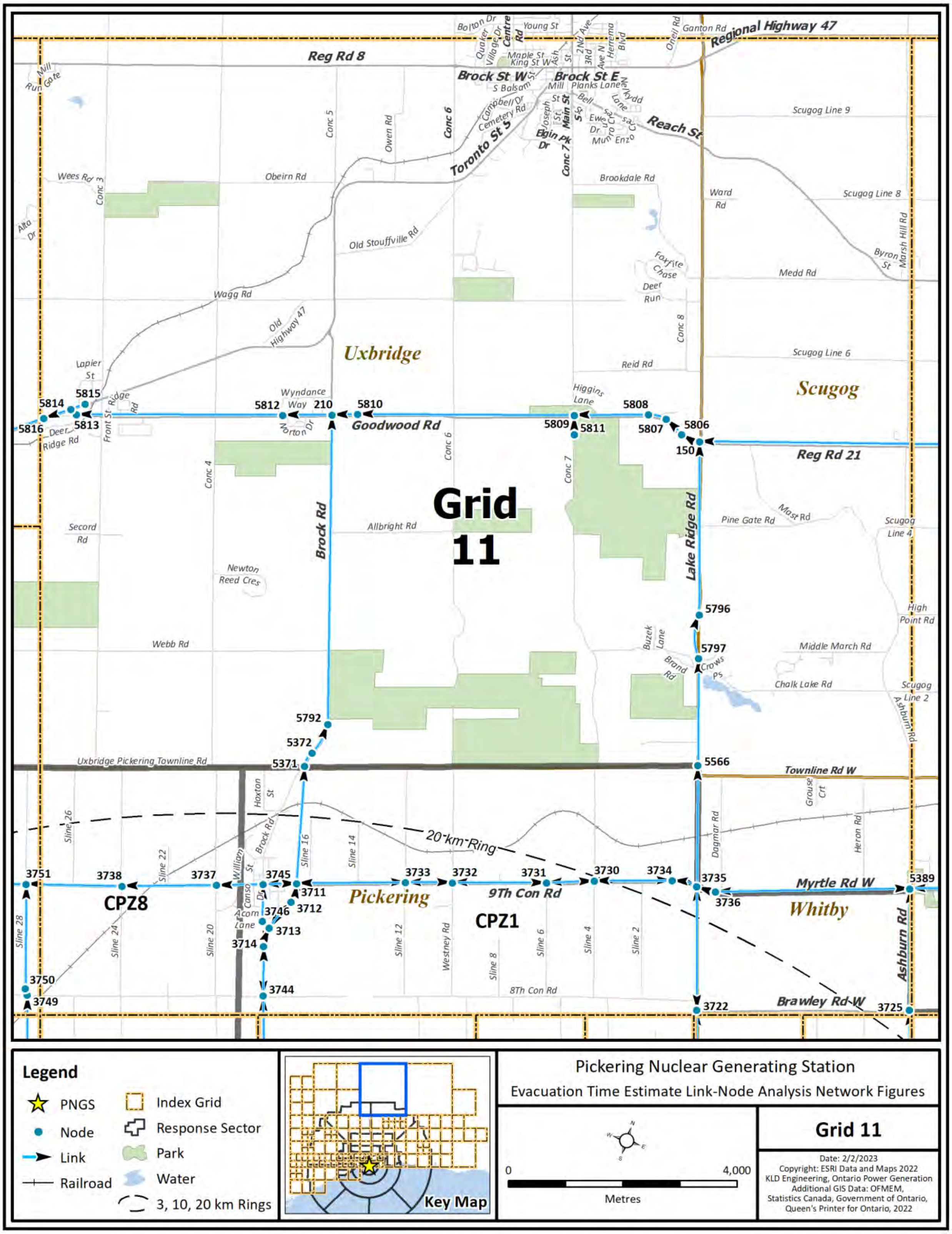


Figure K-12. Link-Node Analysis Network – Grid 11

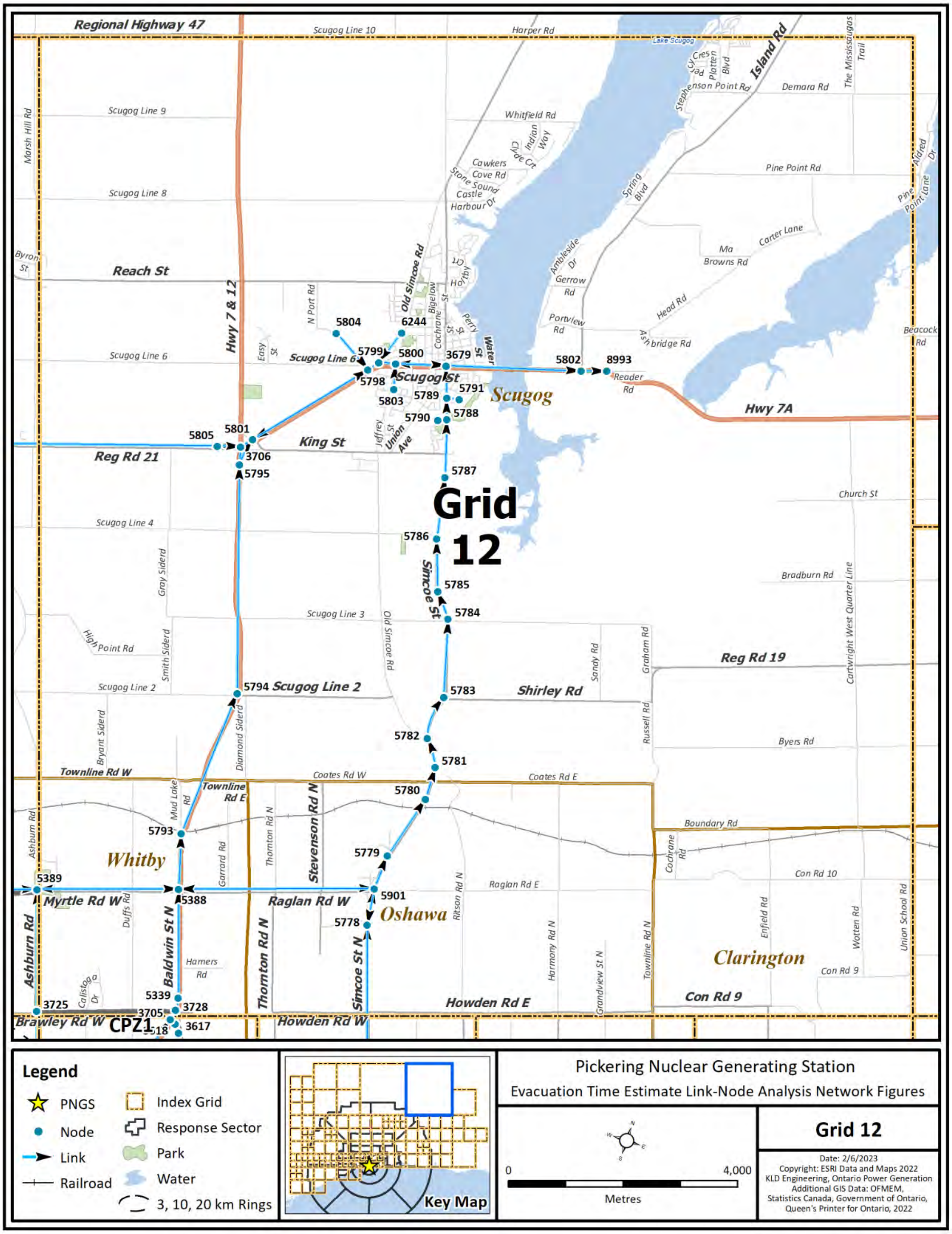


Figure K-13. Link-Node Analysis Network – Grid 12

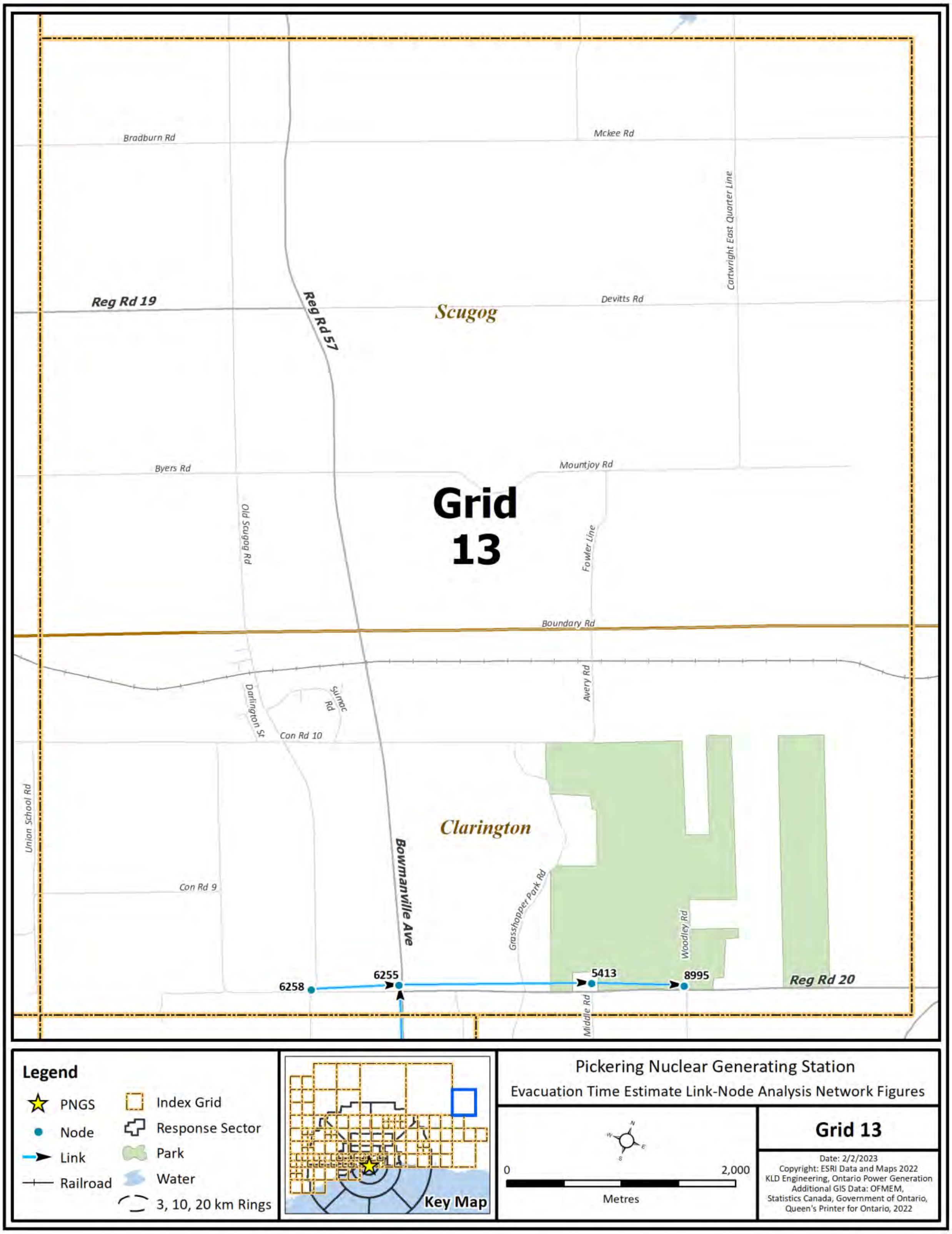


Figure K-14. Link-Node Analysis Network – Grid 13

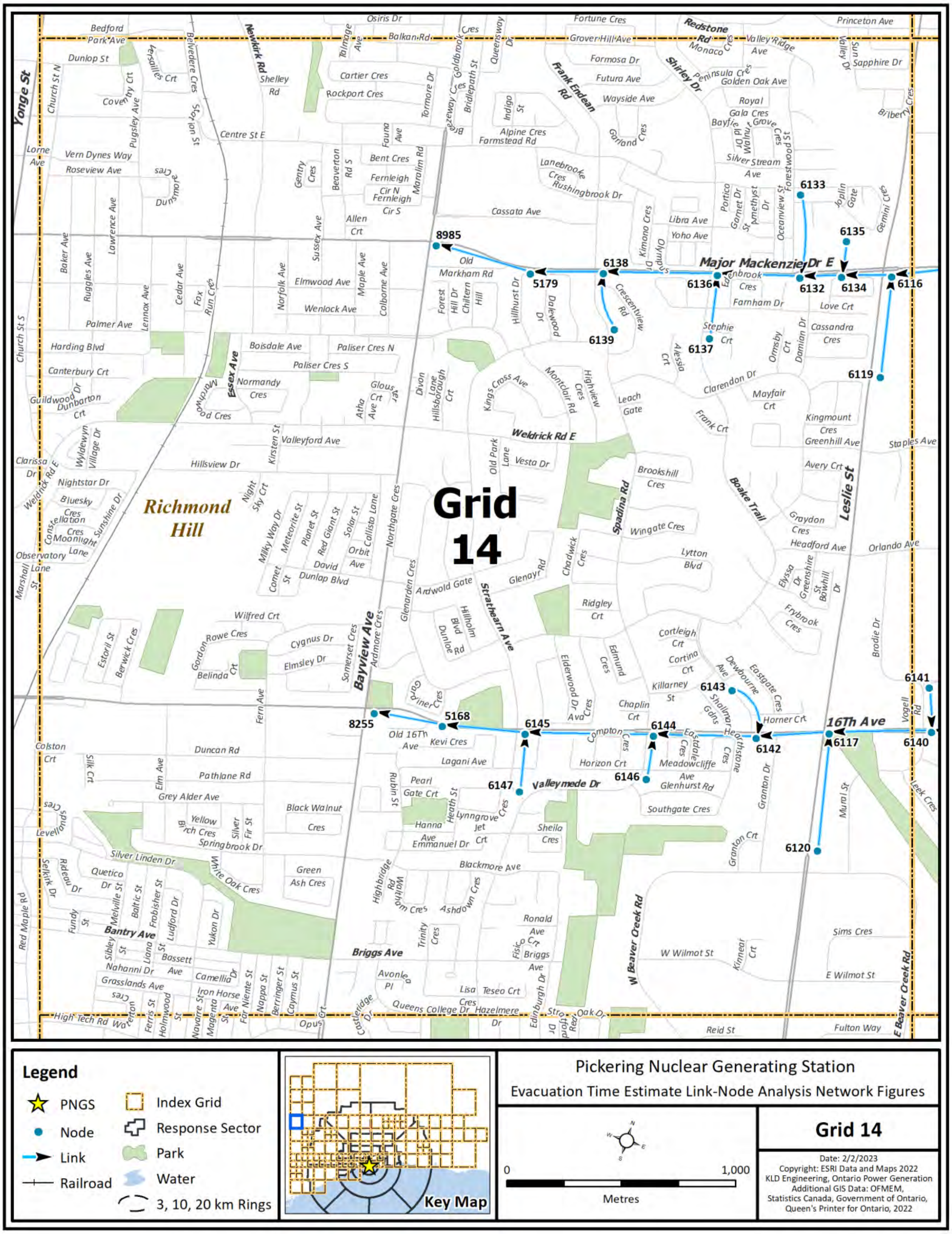


Figure K-15. Link-Node Analysis Network – Grid 14

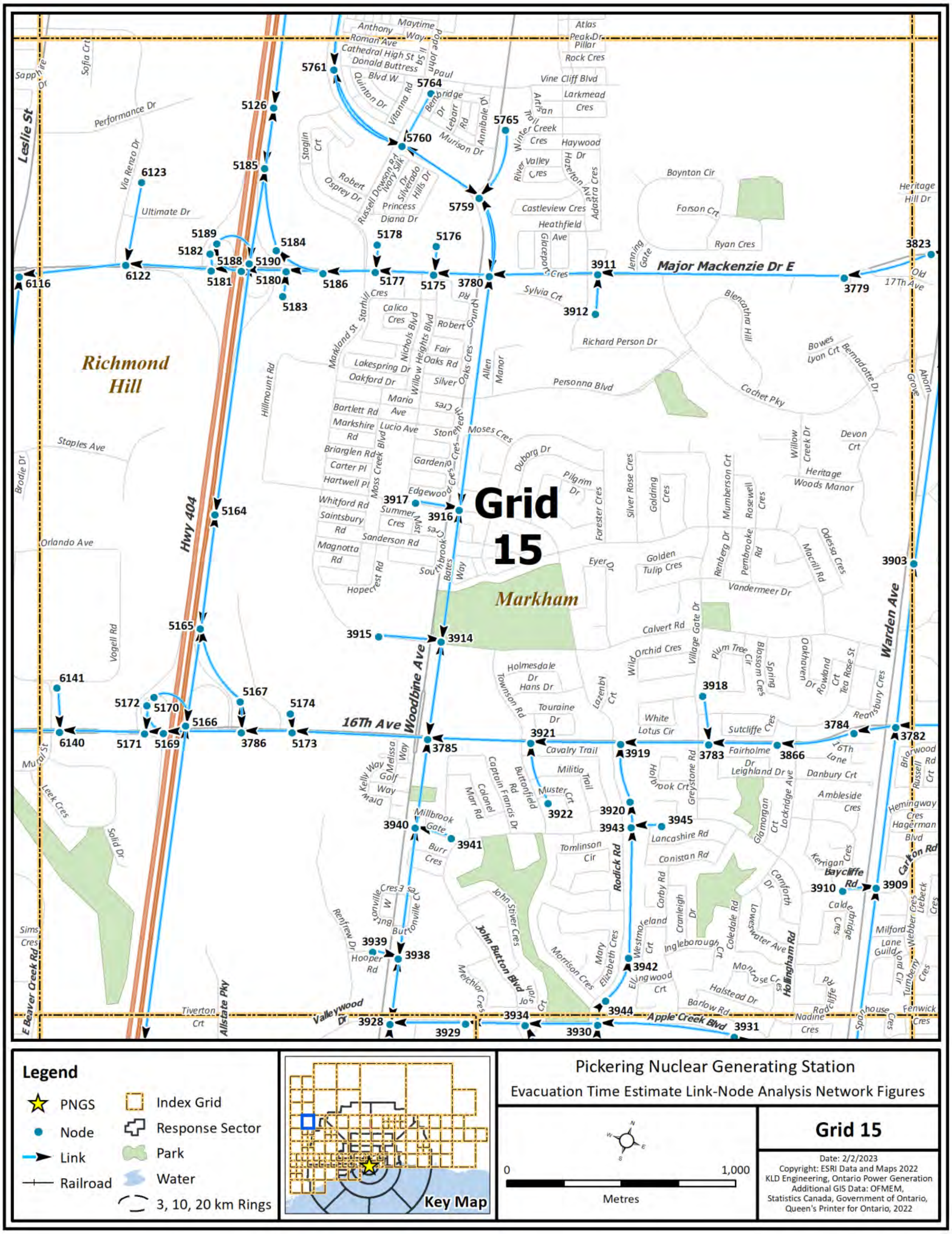


Figure K-16. Link-Node Analysis Network – Grid 15

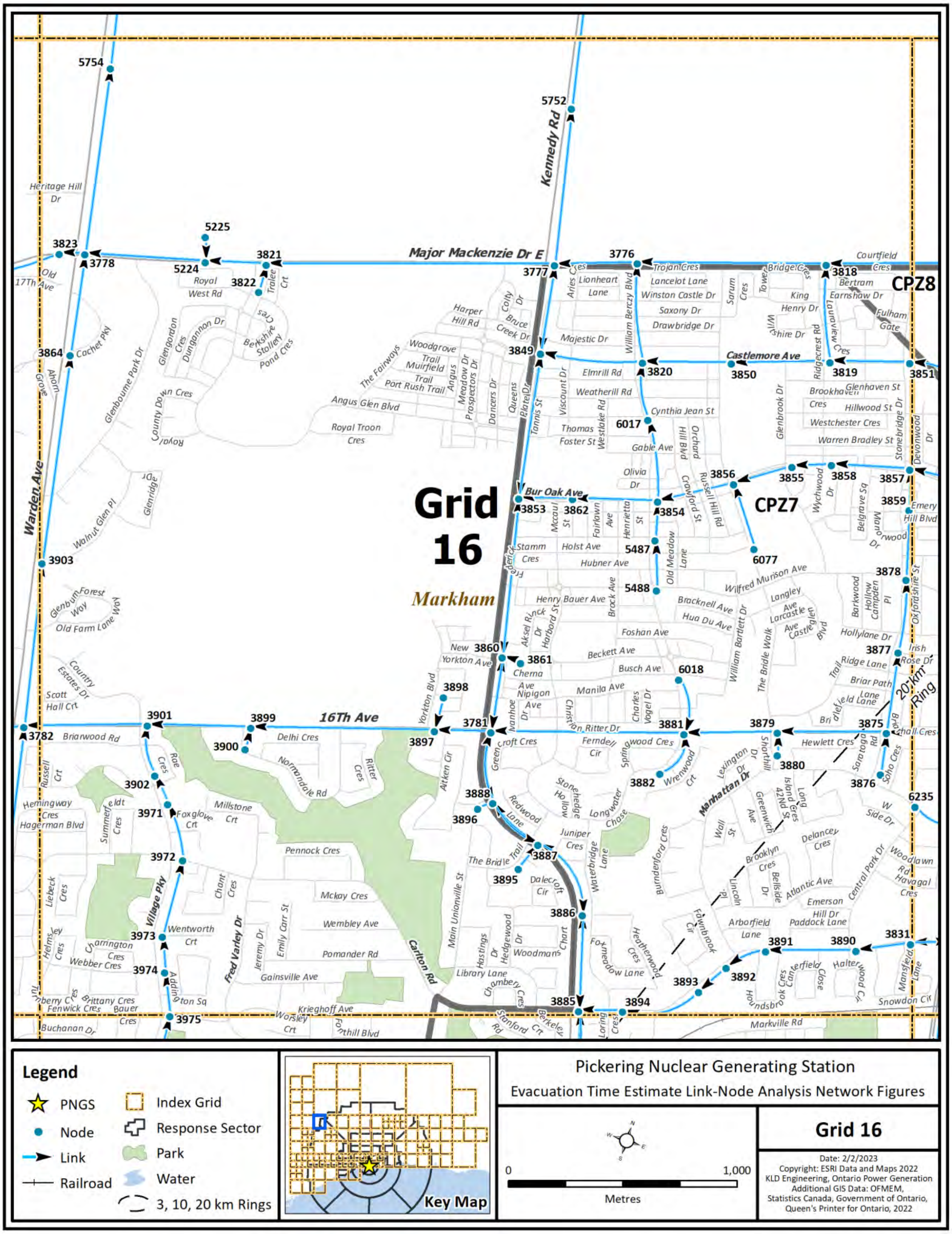


Figure K-17. Link-Node Analysis Network – Grid 16

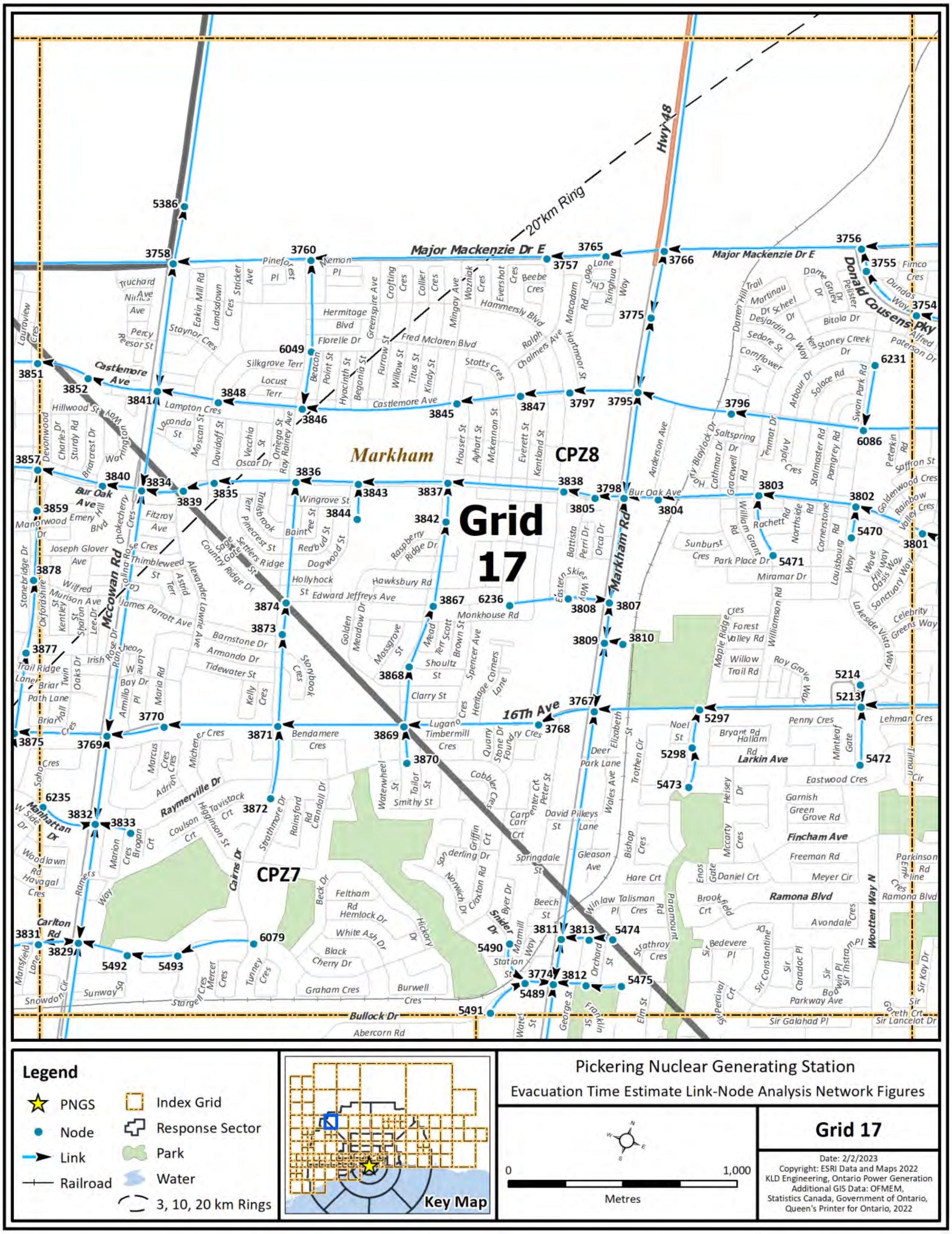


Figure K-18. Link-Node Analysis Network – Grid 17

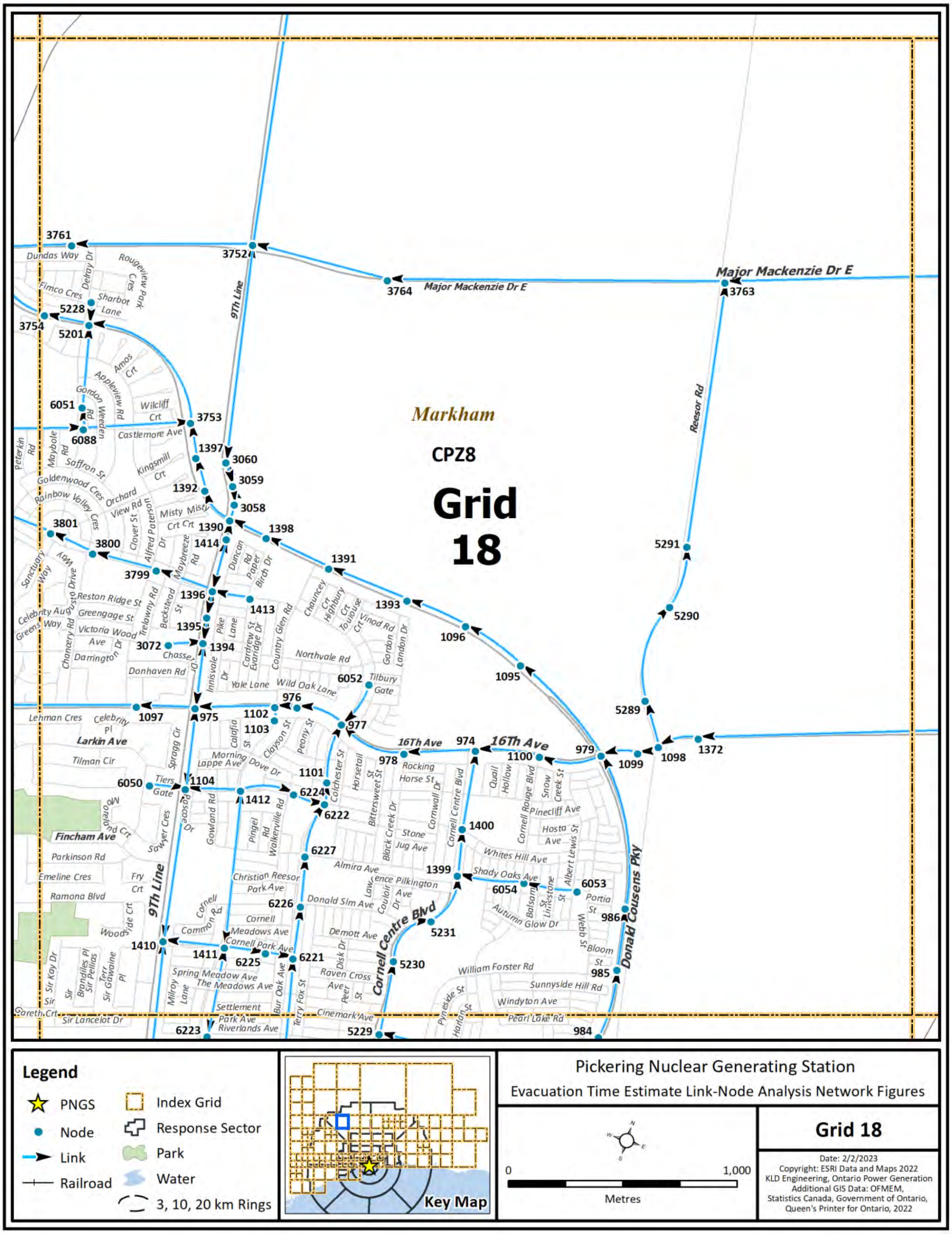


Figure K-19. Link-Node Analysis Network – Grid 18

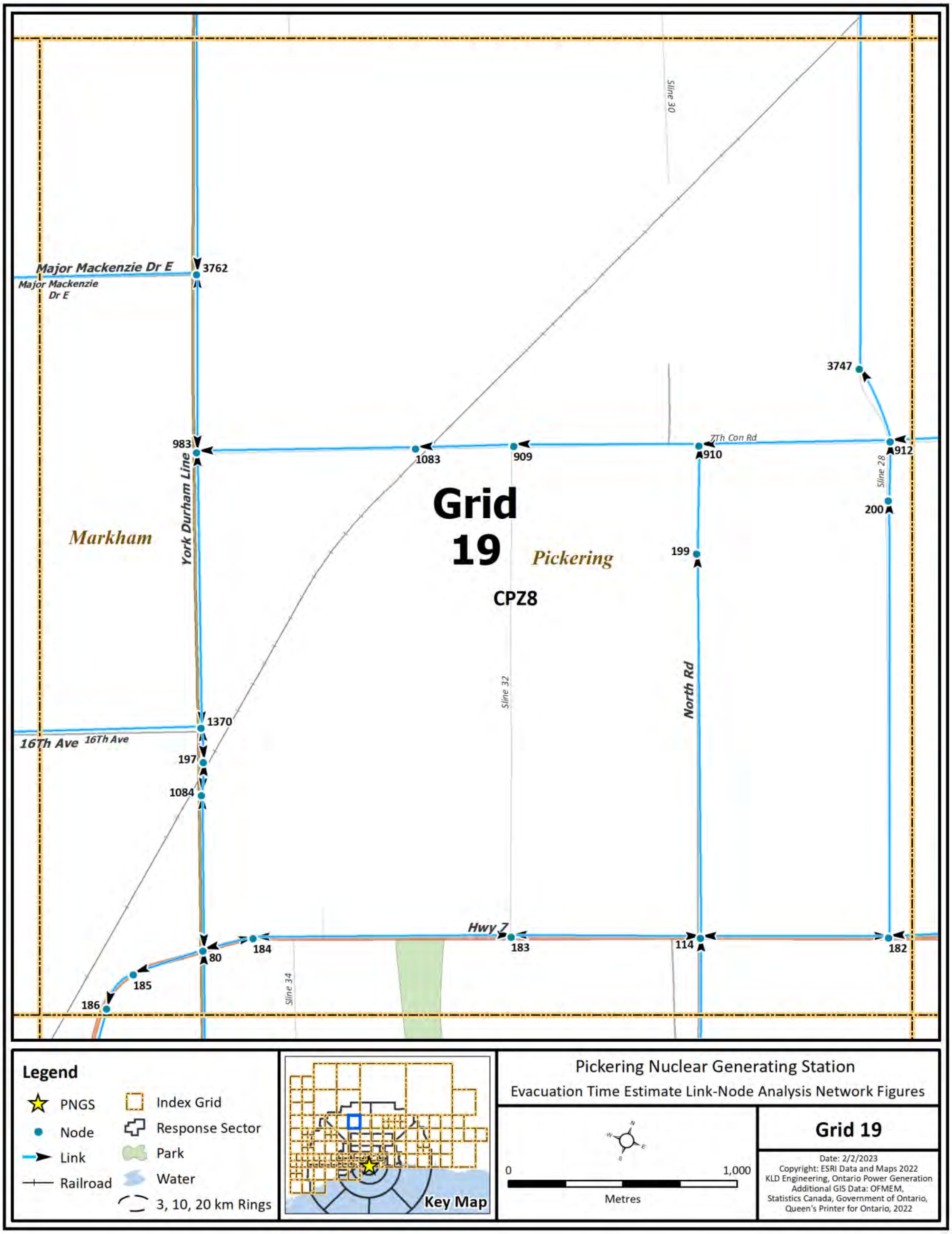


Figure K-20. Link-Node Analysis Network – Grid 19

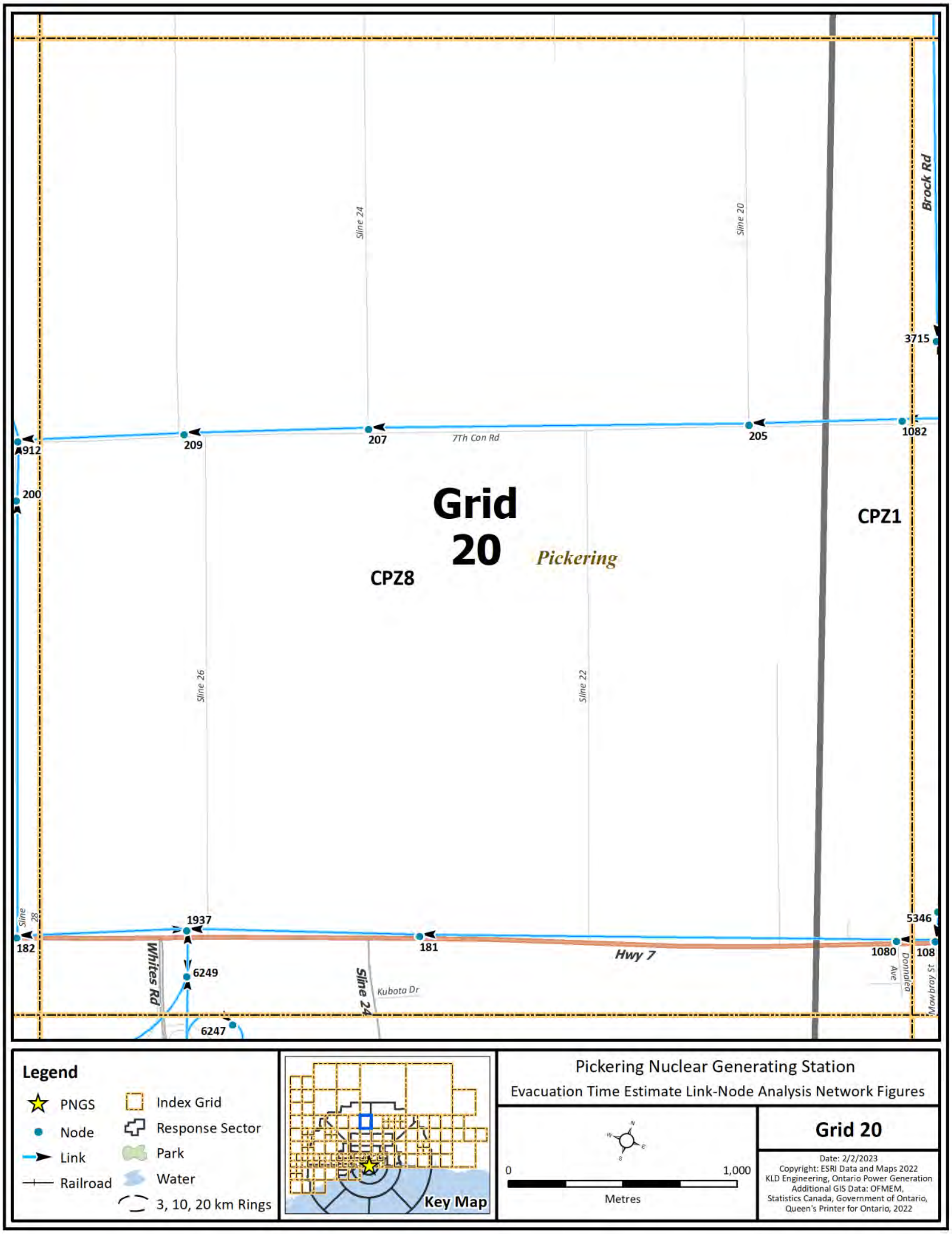


Figure K-21. Link-Node Analysis Network – Grid 20

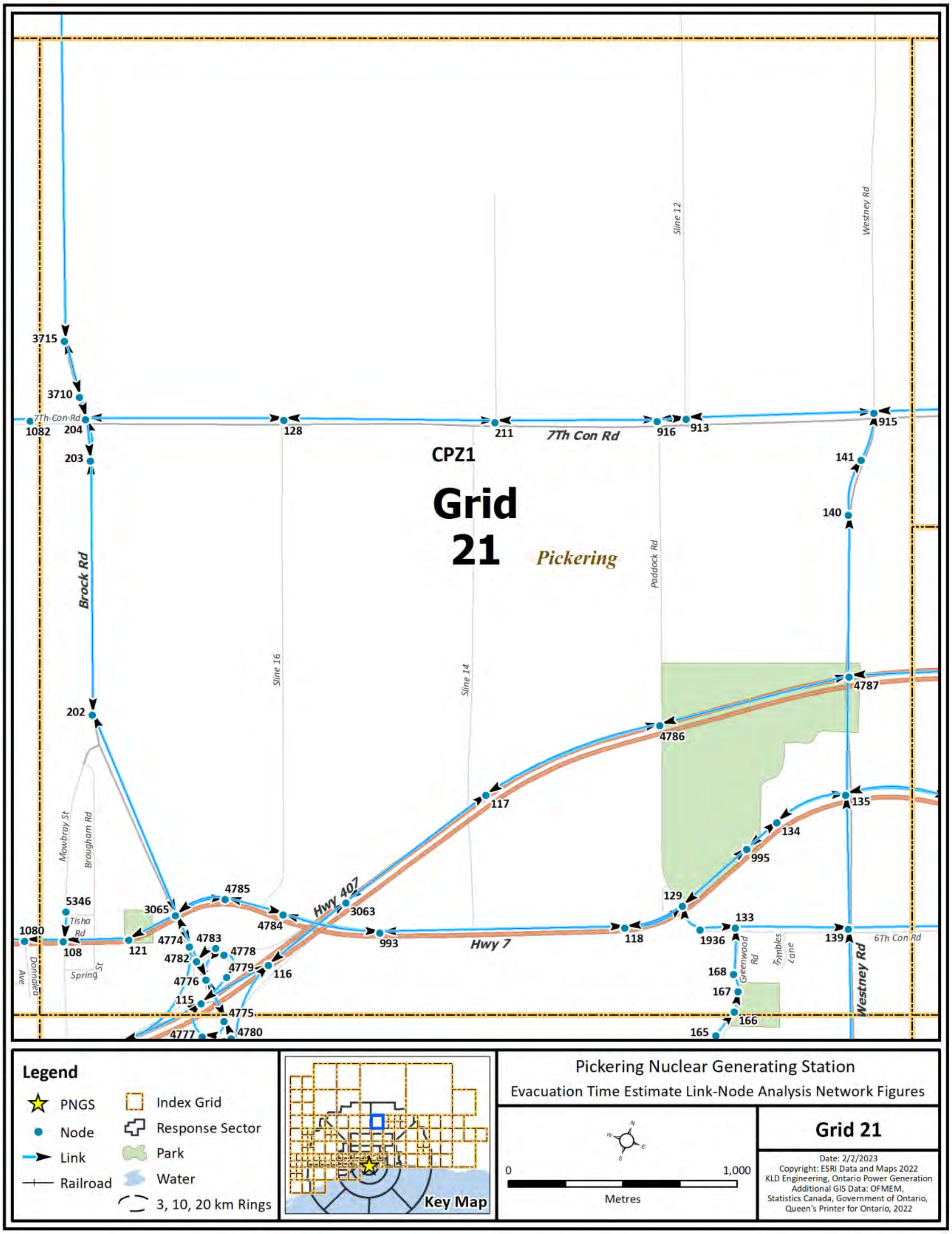


Figure K-22. Link-Node Analysis Network – Grid 21

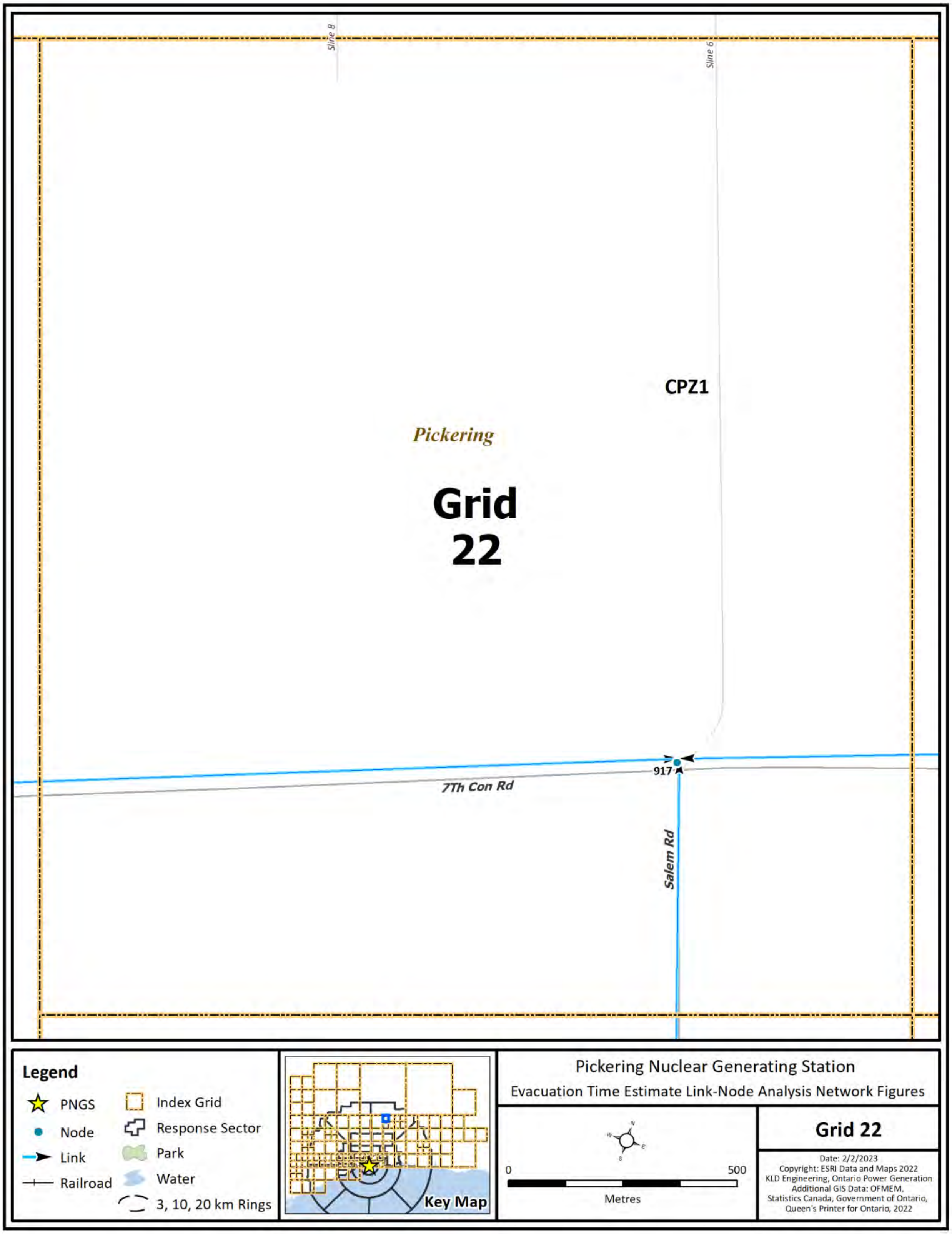


Figure K-23. Link-Node Analysis Network – Grid 22

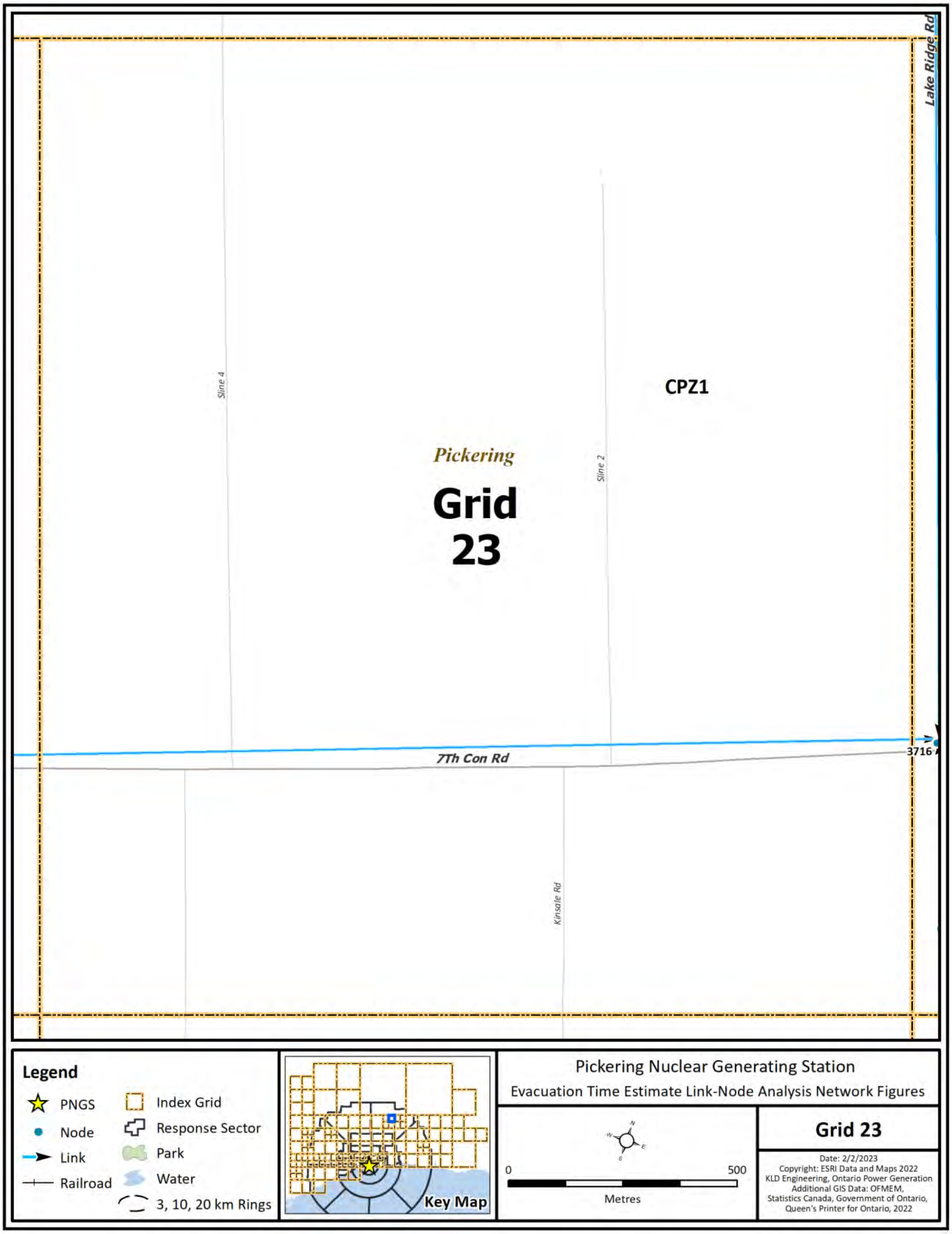


Figure K-24. Link-Node Analysis Network – Grid 23

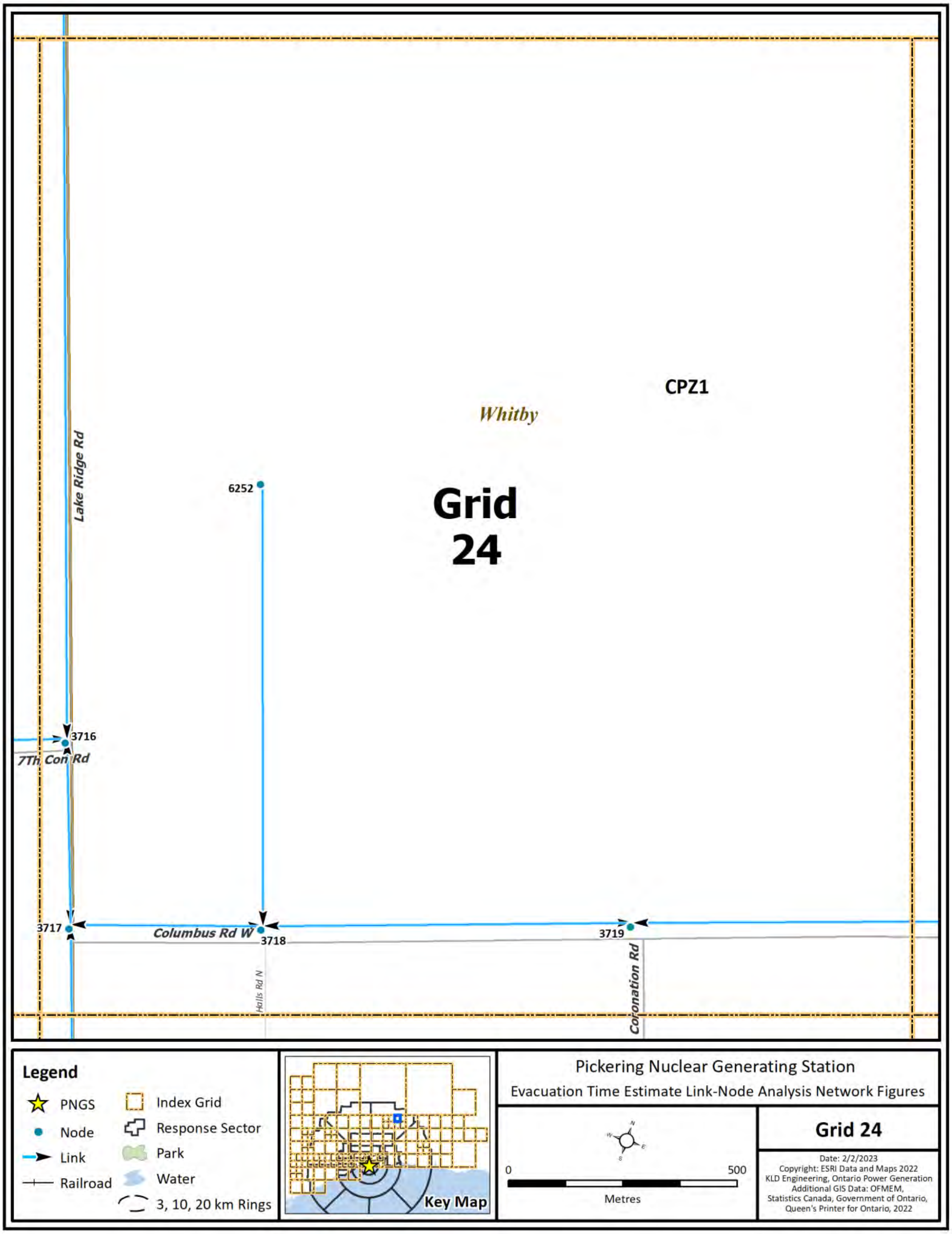


Figure K-25. Link-Node Analysis Network – Grid 24

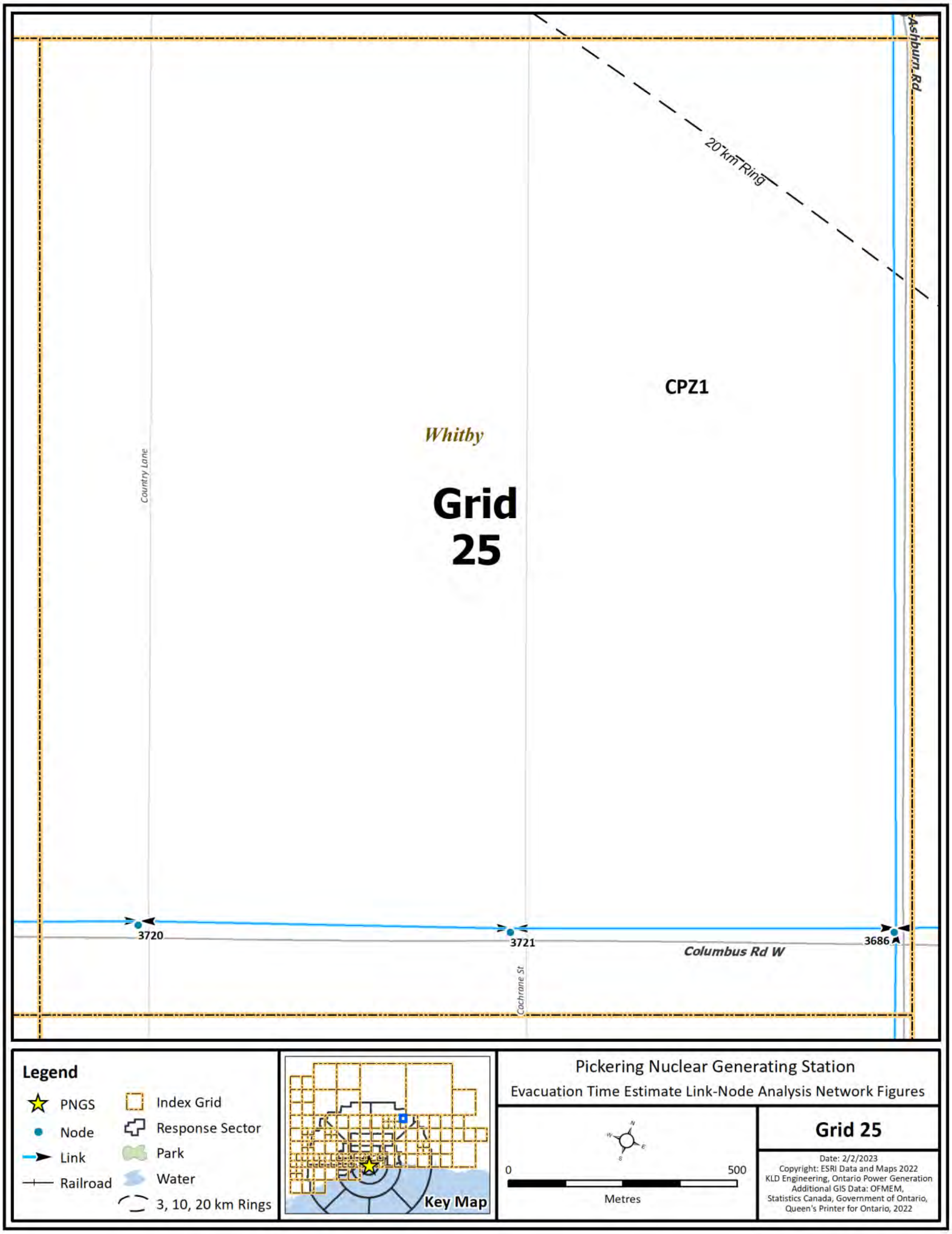


Figure K-26. Link-Node Analysis Network – Grid 25

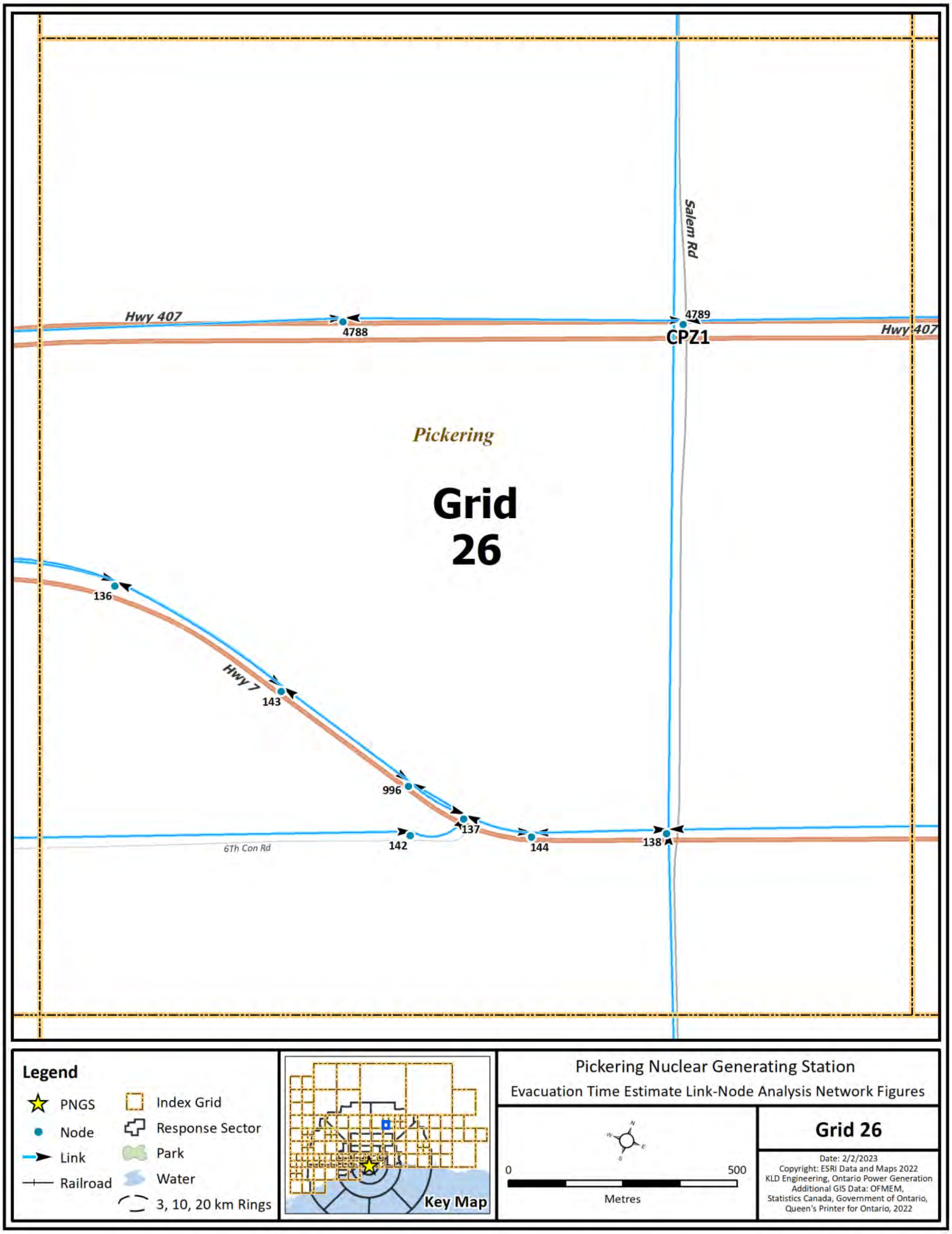


Figure K-27. Link-Node Analysis Network – Grid 26

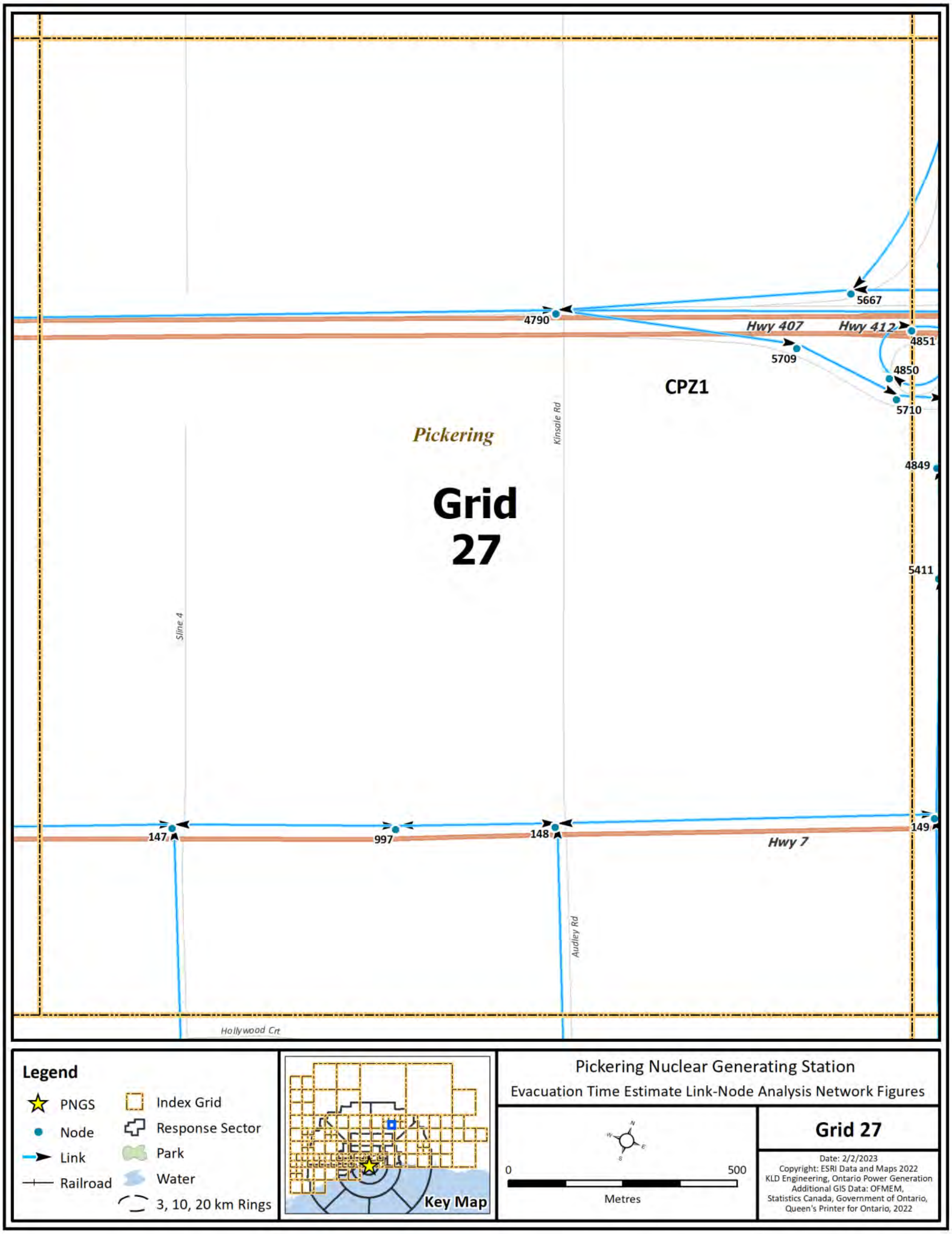


Figure K-28. Link-Node Analysis Network – Grid 27

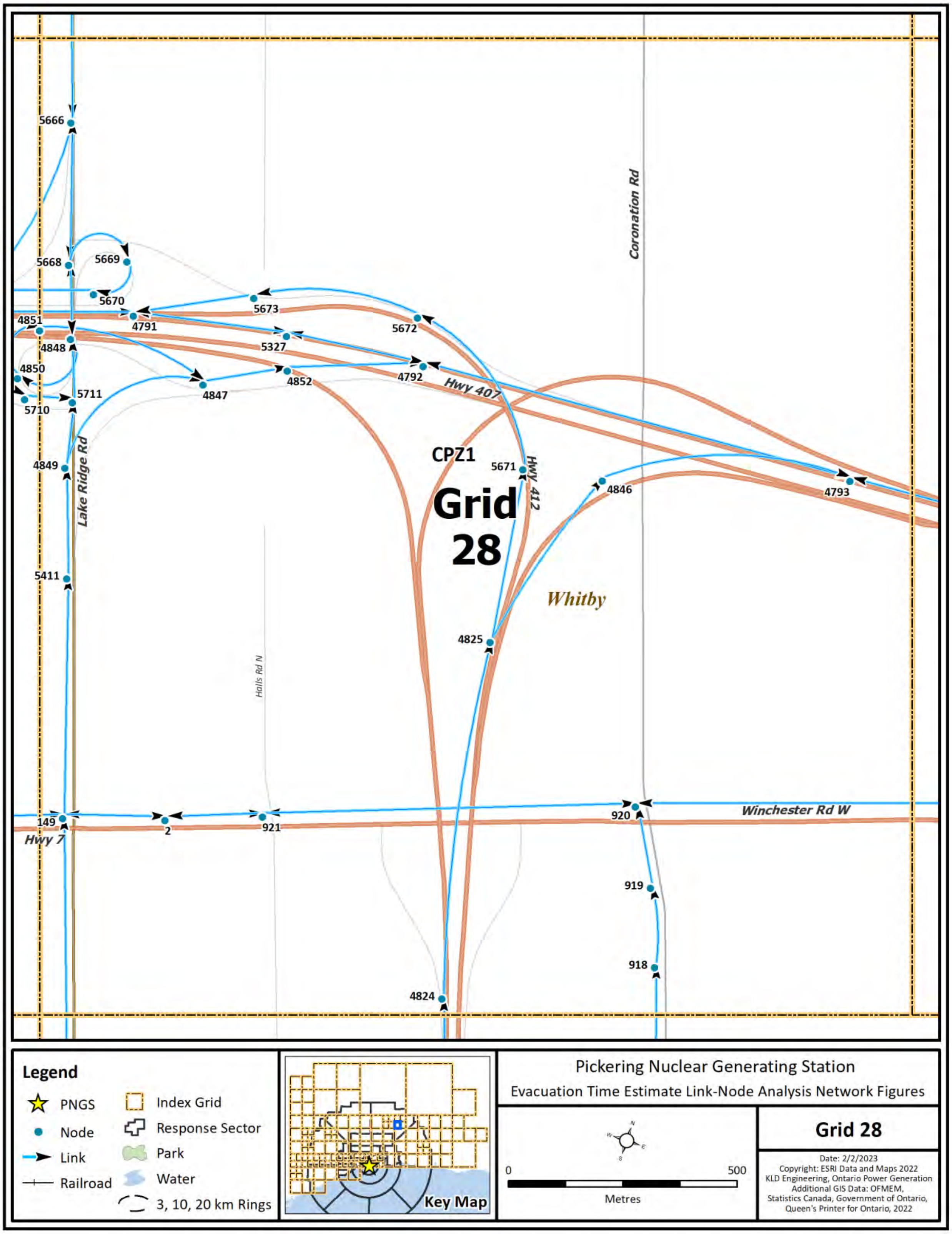


Figure K-29. Link-Node Analysis Network – Grid 28

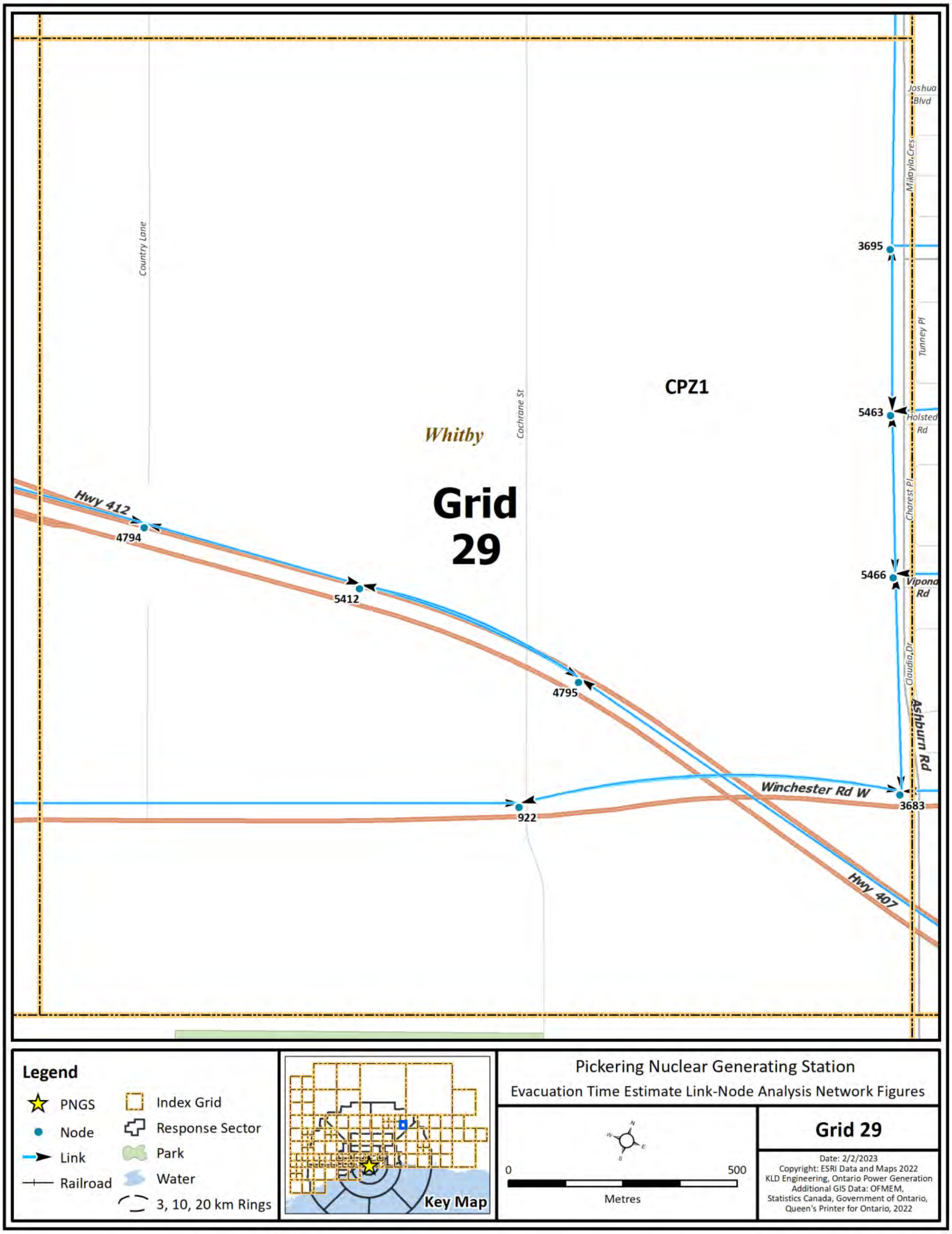


Figure K-30. Link-Node Analysis Network – Grid 29

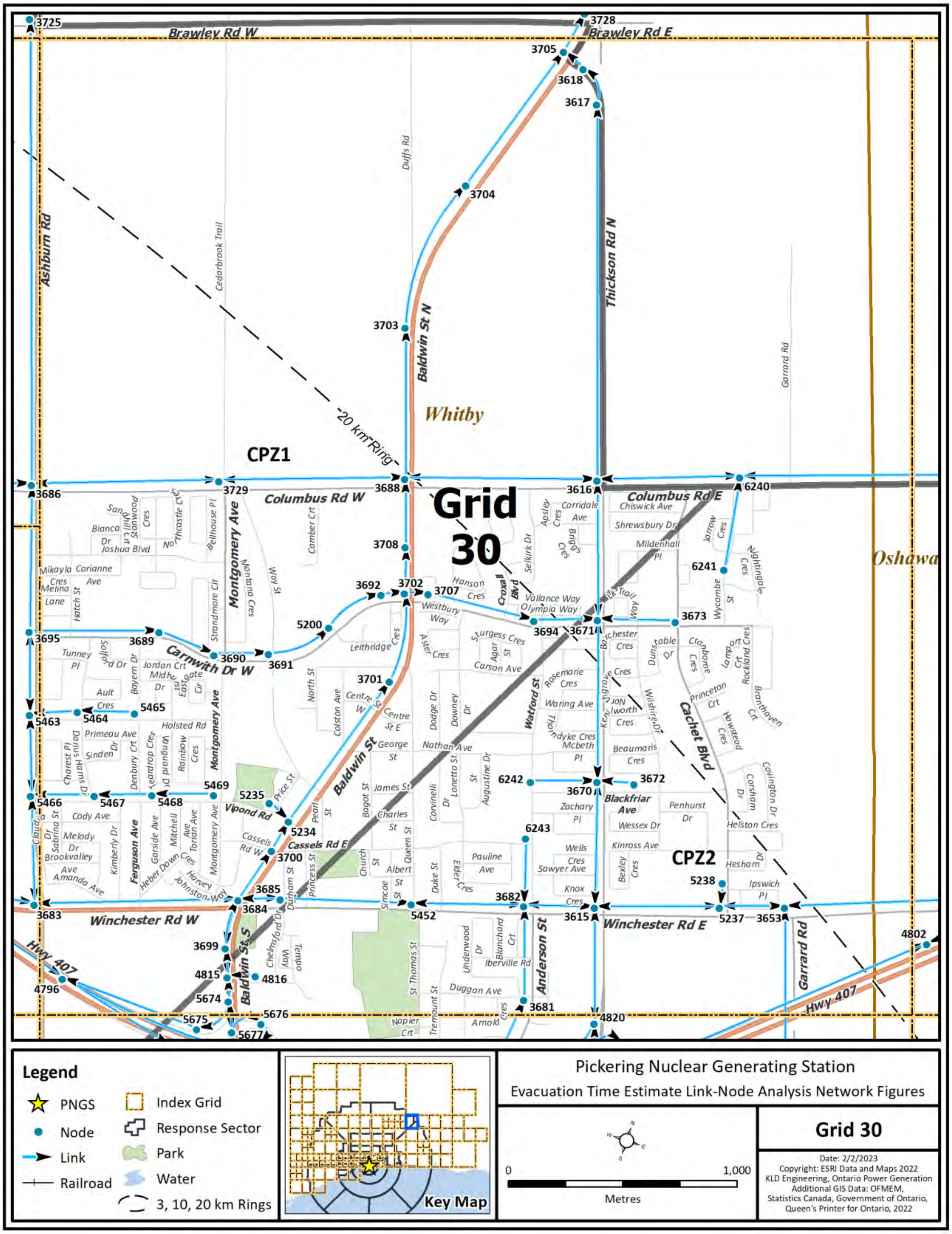


Figure K-31. Link-Node Analysis Network – Grid 30

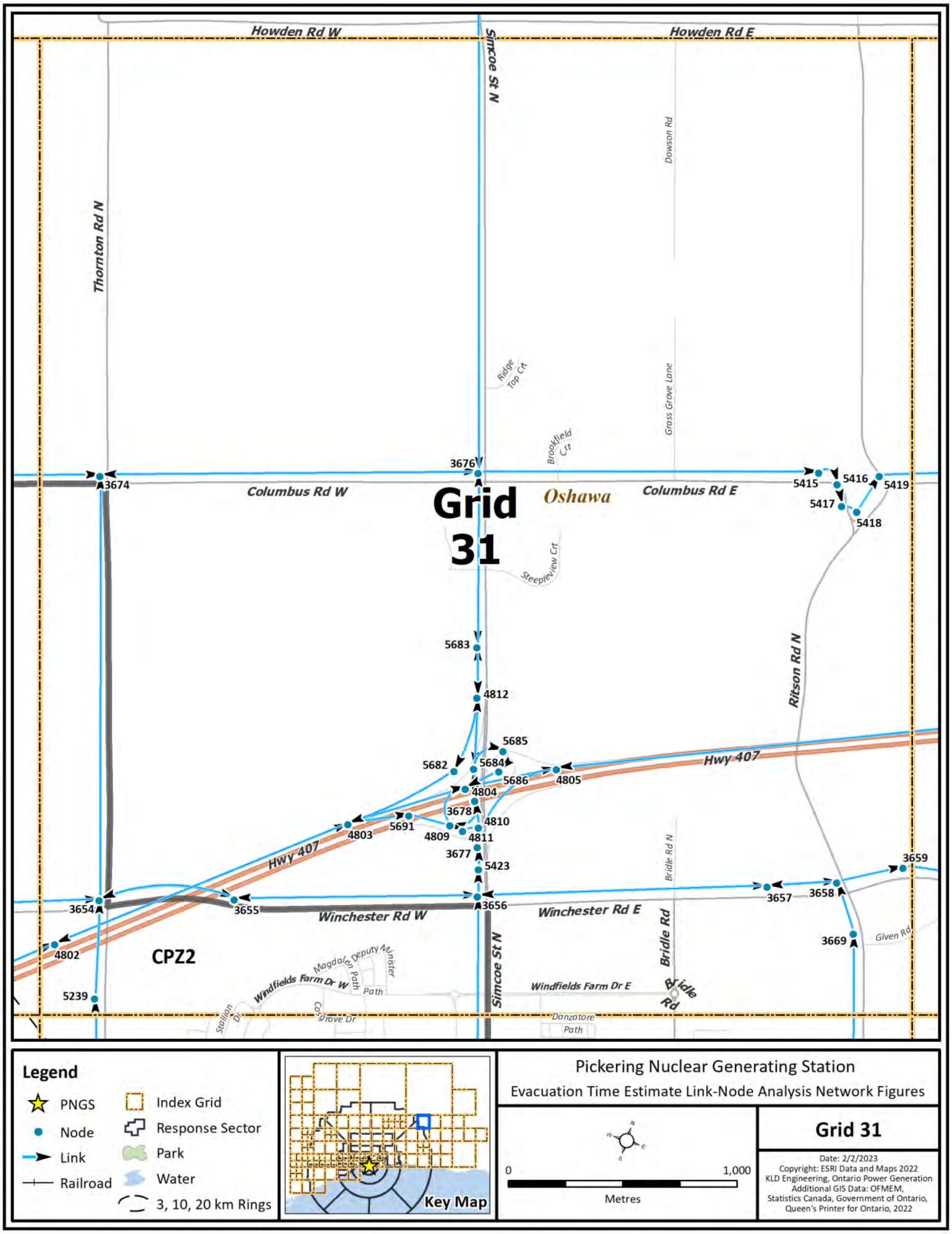


Figure K-32. Link-Node Analysis Network – Grid 31

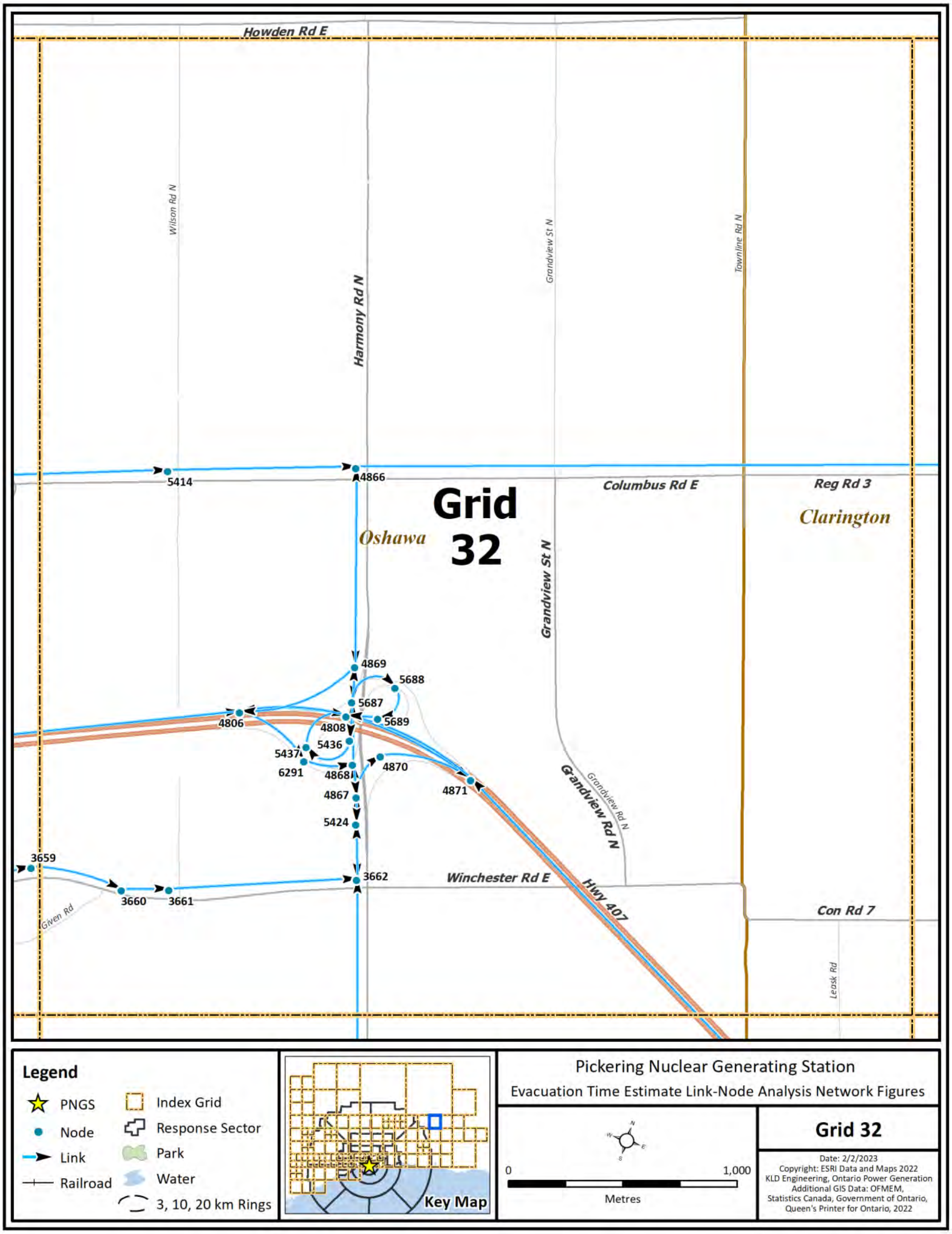


Figure K-33. Link-Node Analysis Network – Grid 32

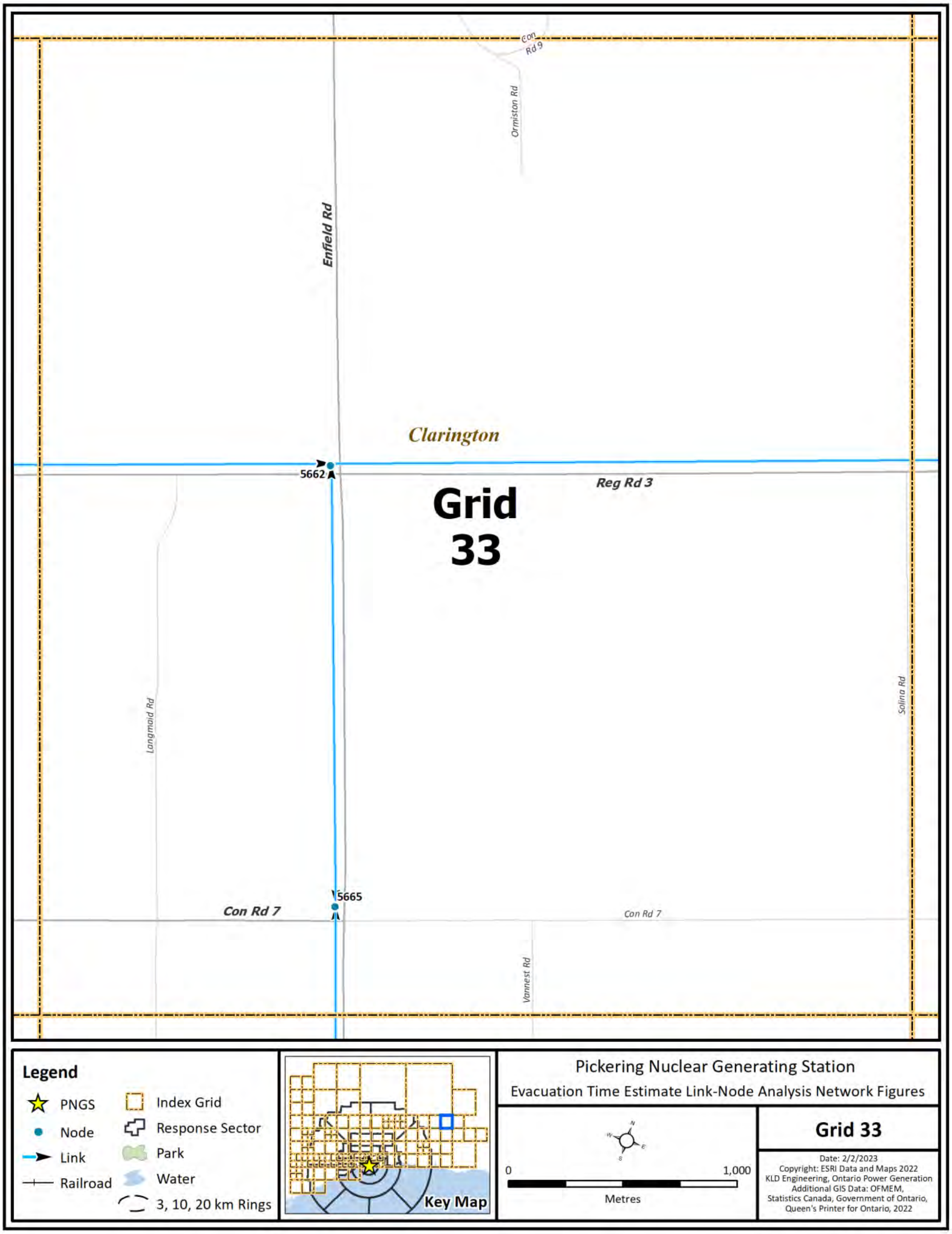


Figure K-34. Link-Node Analysis Network – Grid 33

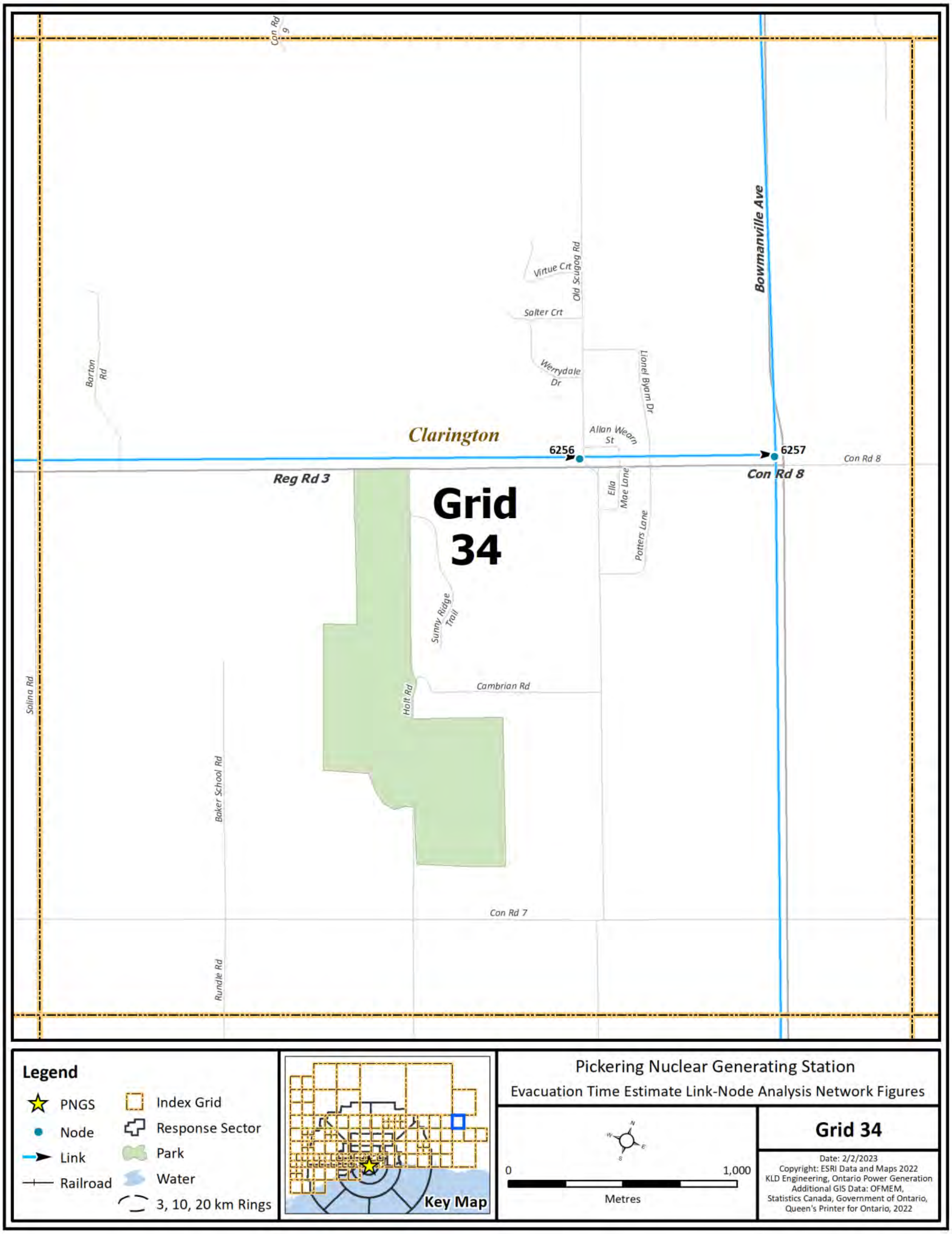


Figure K-35. Link-Node Analysis Network – Grid 34

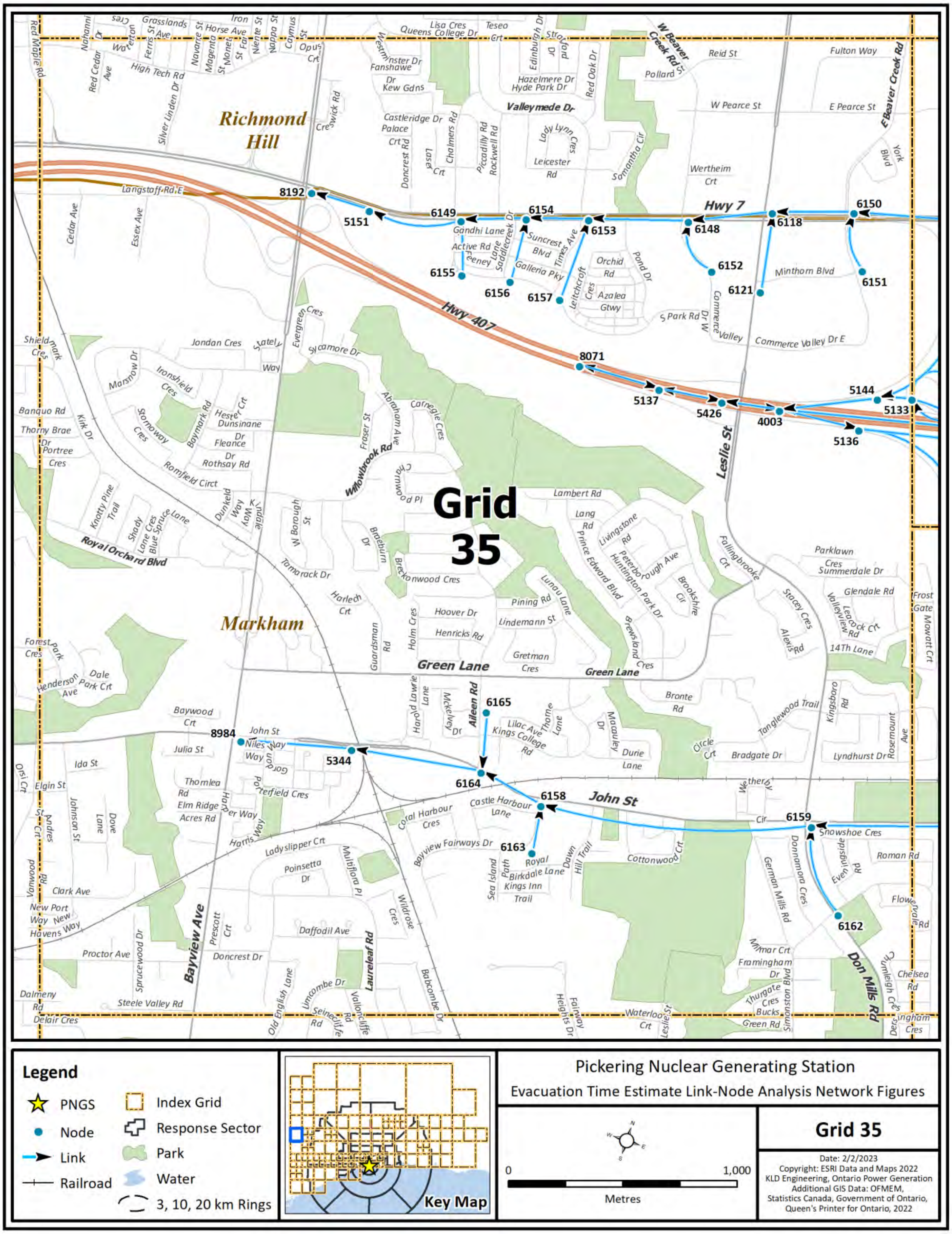


Figure K-36. Link-Node Analysis Network – Grid 35

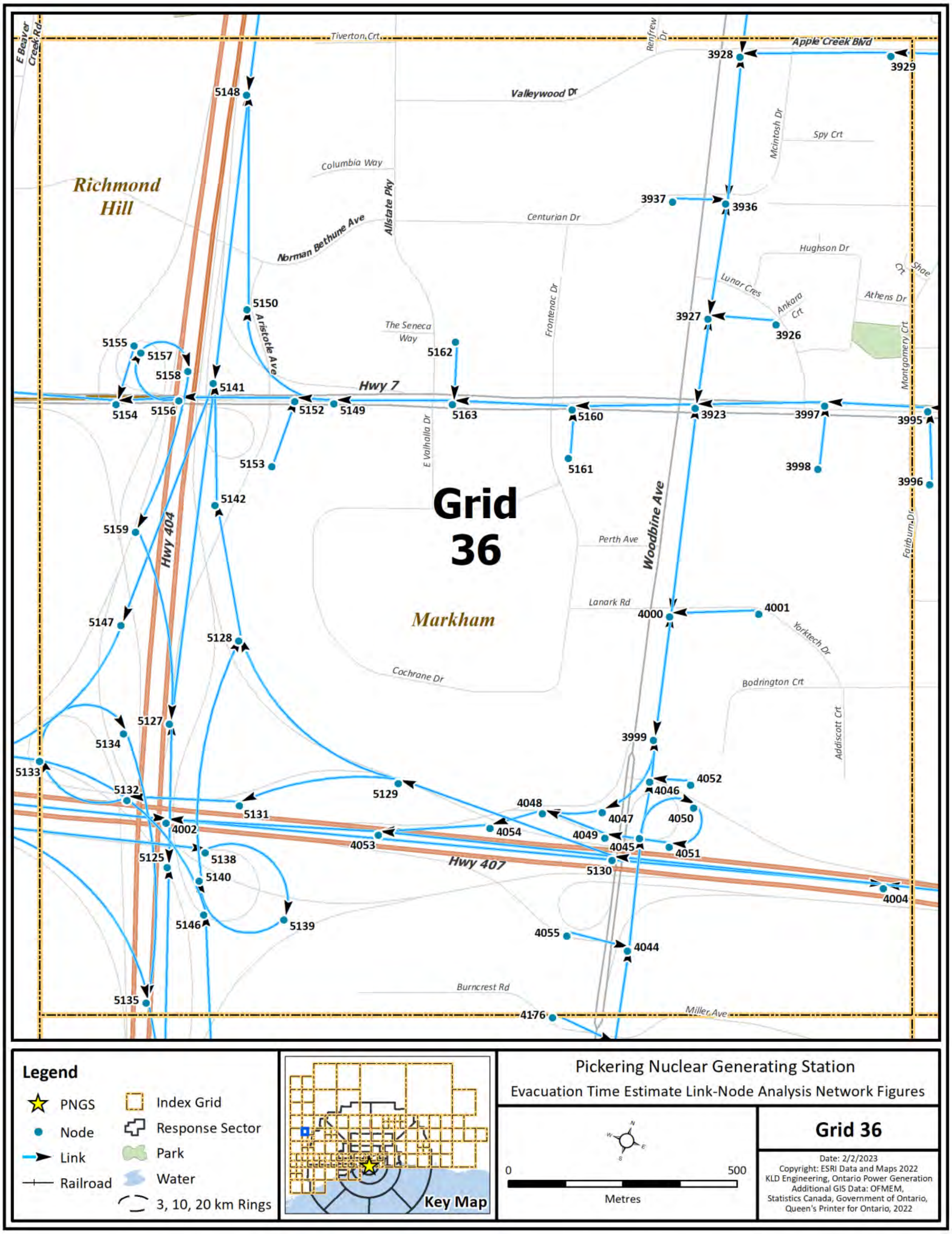


Figure K-37. Link-Node Analysis Network – Grid 36

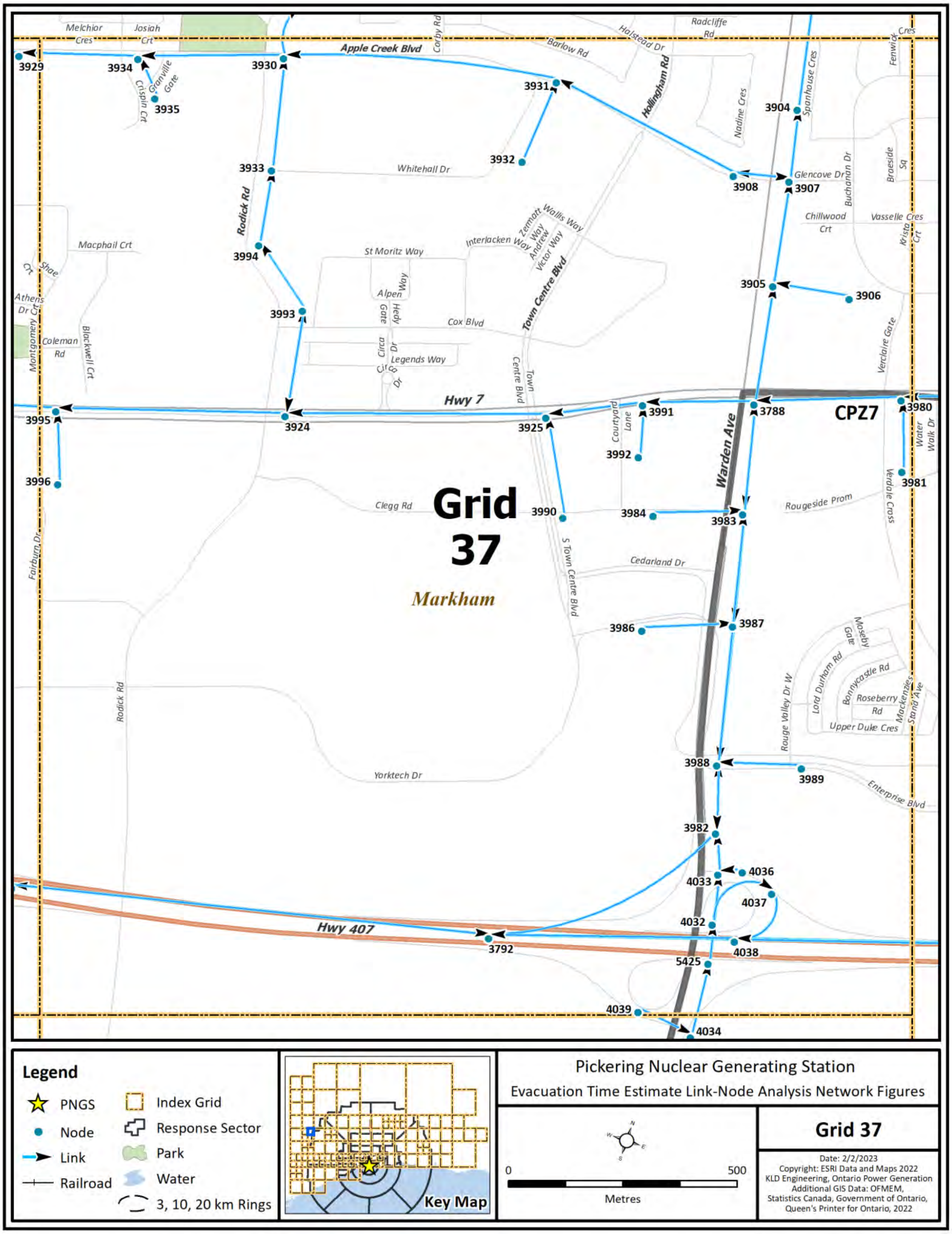


Figure K-38. Link-Node Analysis Network – Grid 37

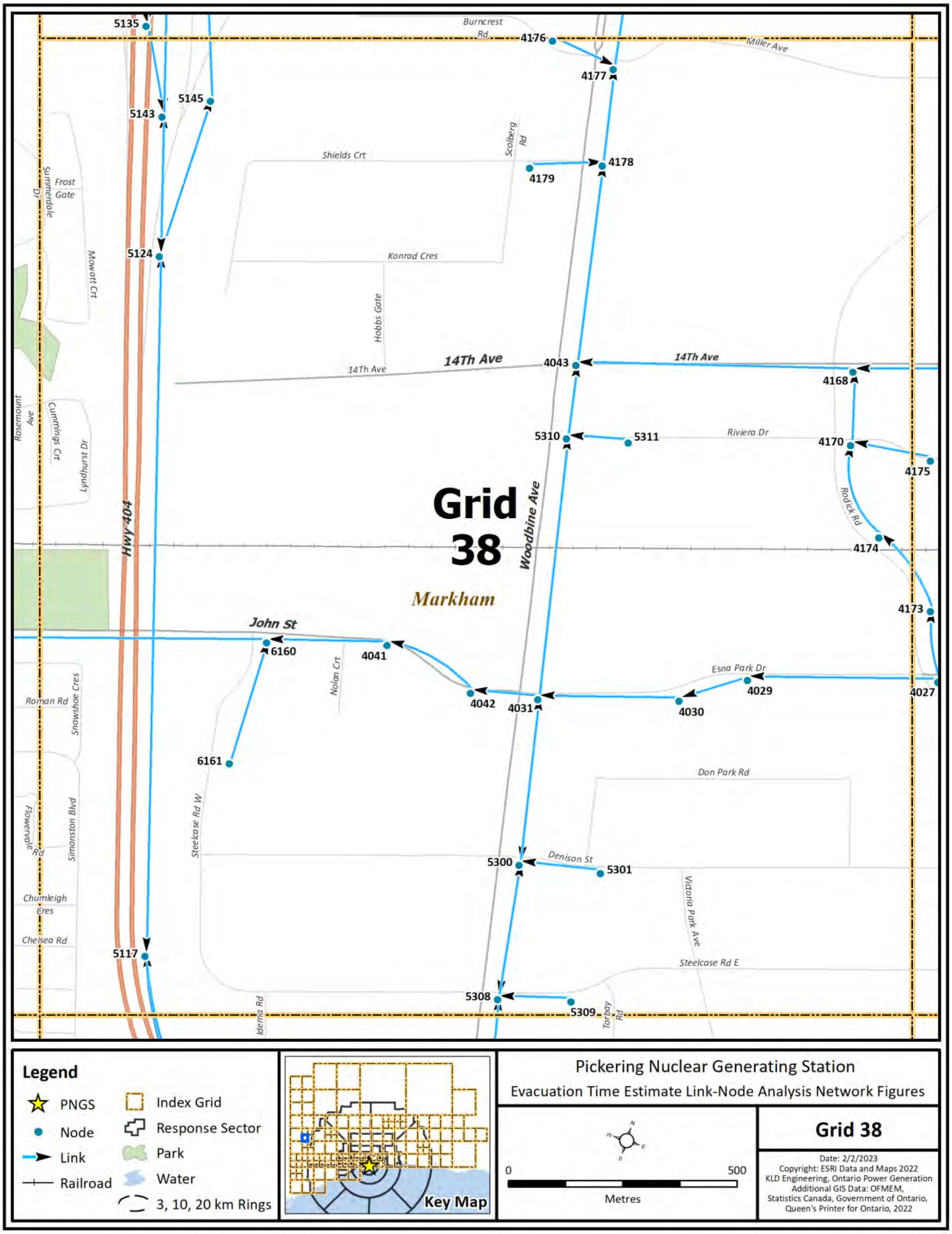


Figure K-39. Link-Node Analysis Network – Grid 38

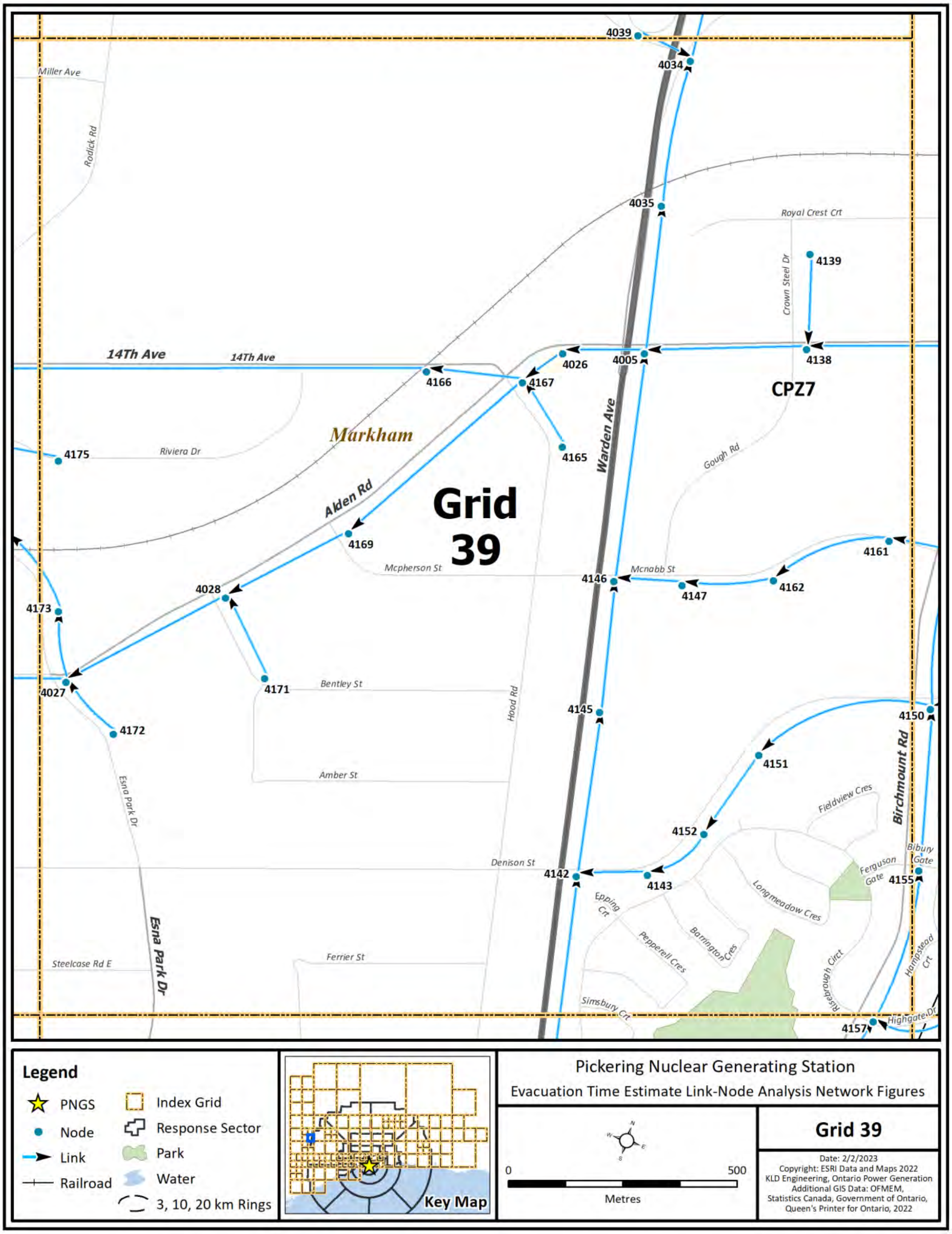


Figure K-40. Link-Node Analysis Network – Grid 39

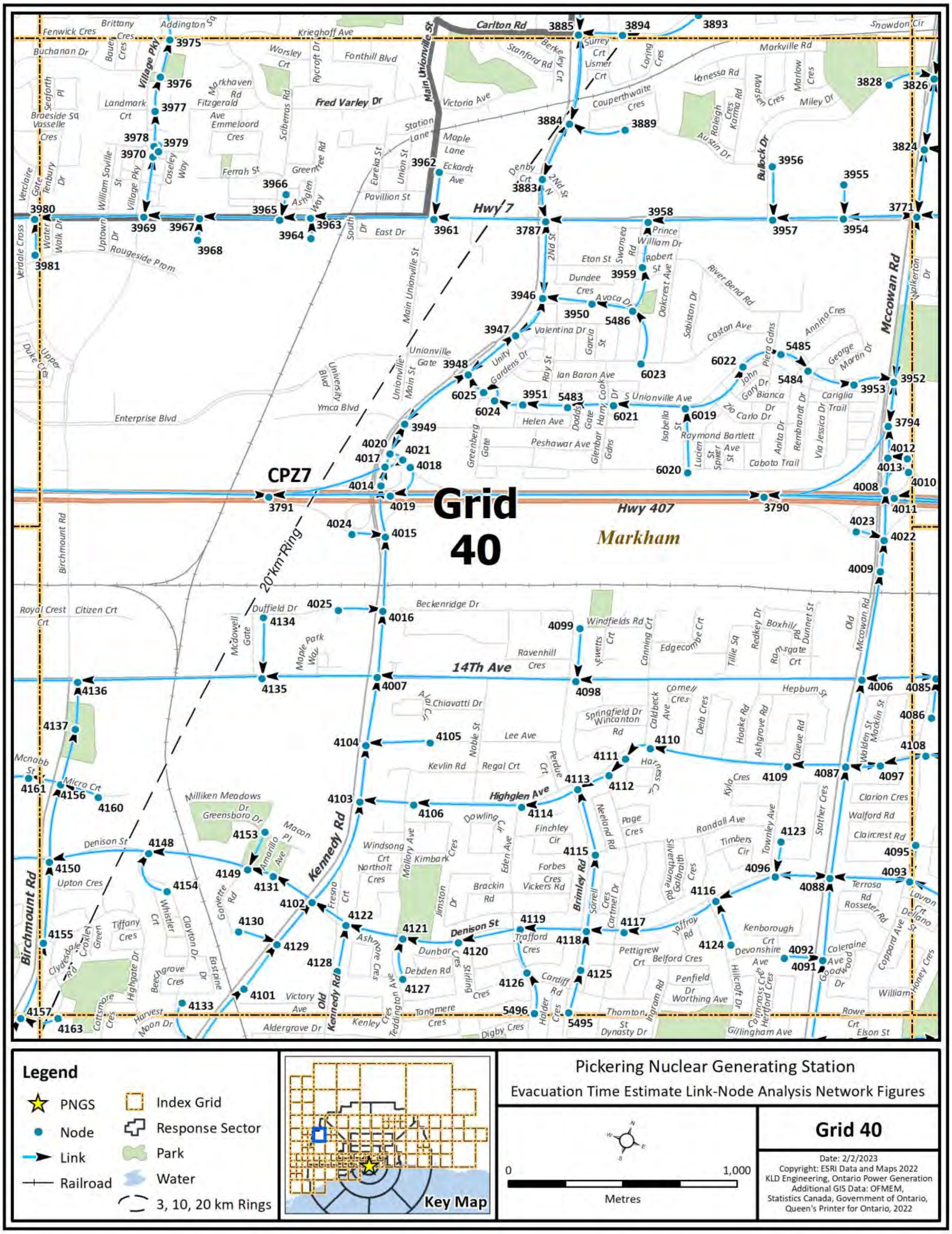


Figure K-41. Link-Node Analysis Network – Grid 40

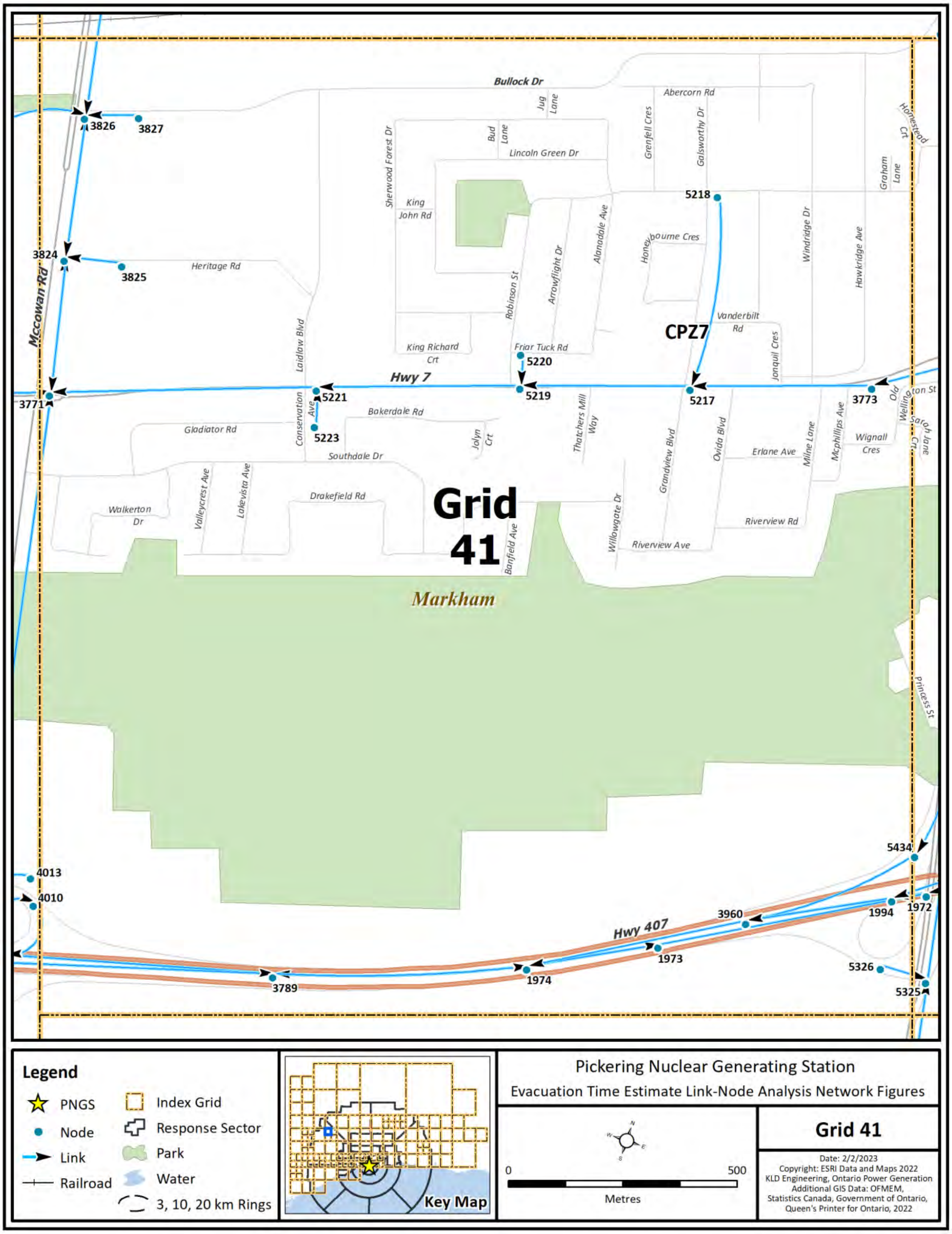


Figure K-42. Link-Node Analysis Network – Grid 41

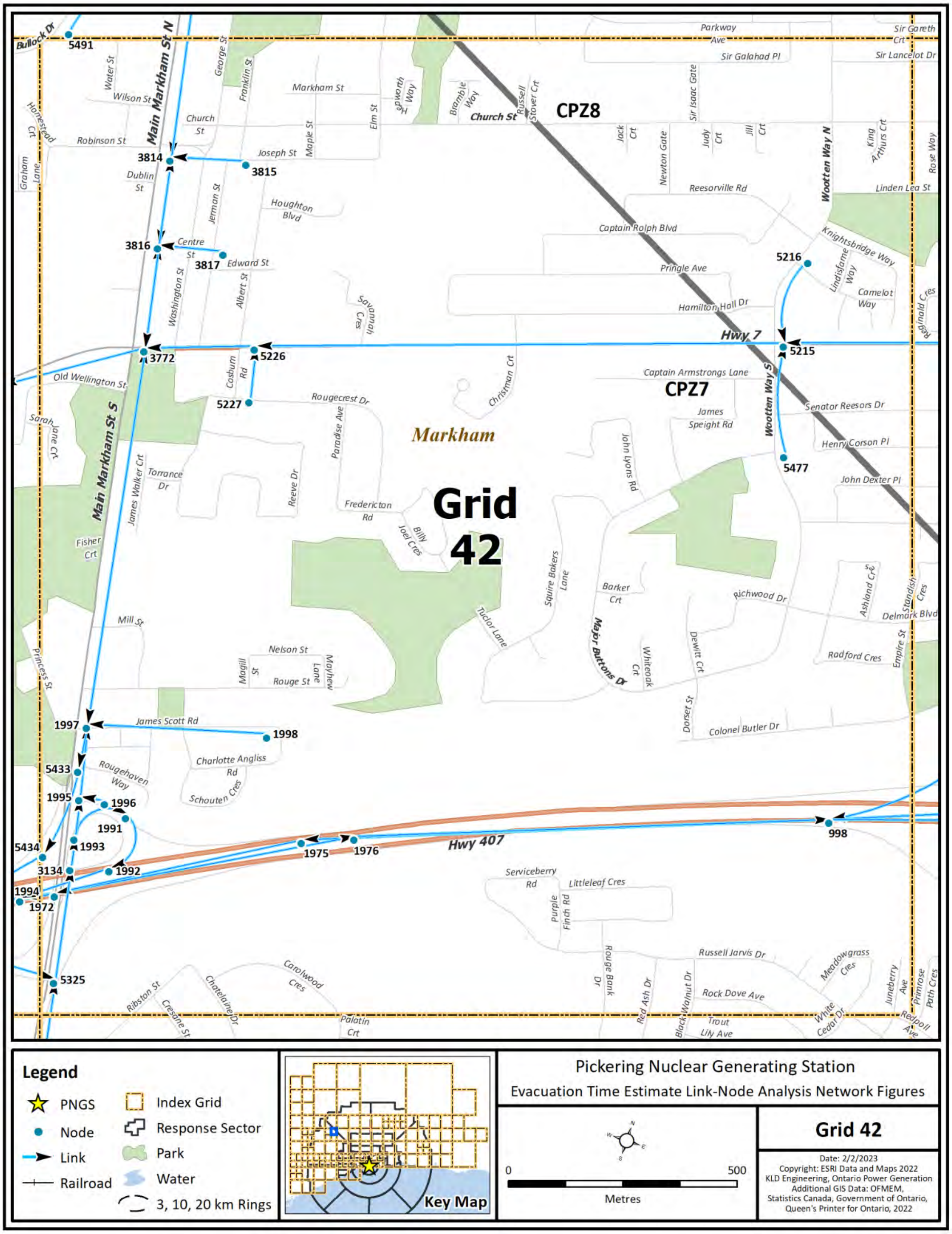


Figure K-43. Link-Node Analysis Network – Grid 42

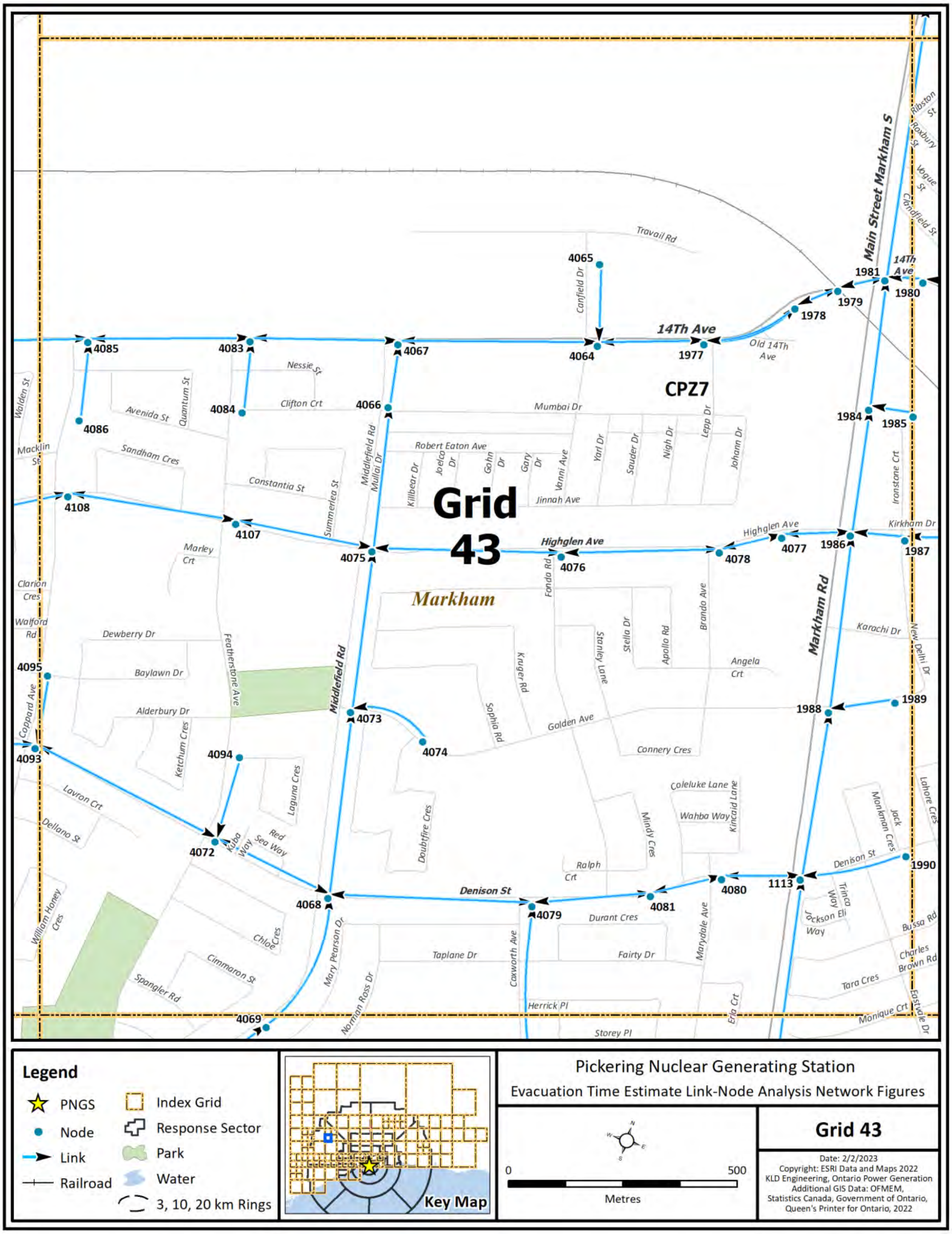


Figure K-44. Link-Node Analysis Network – Grid 43

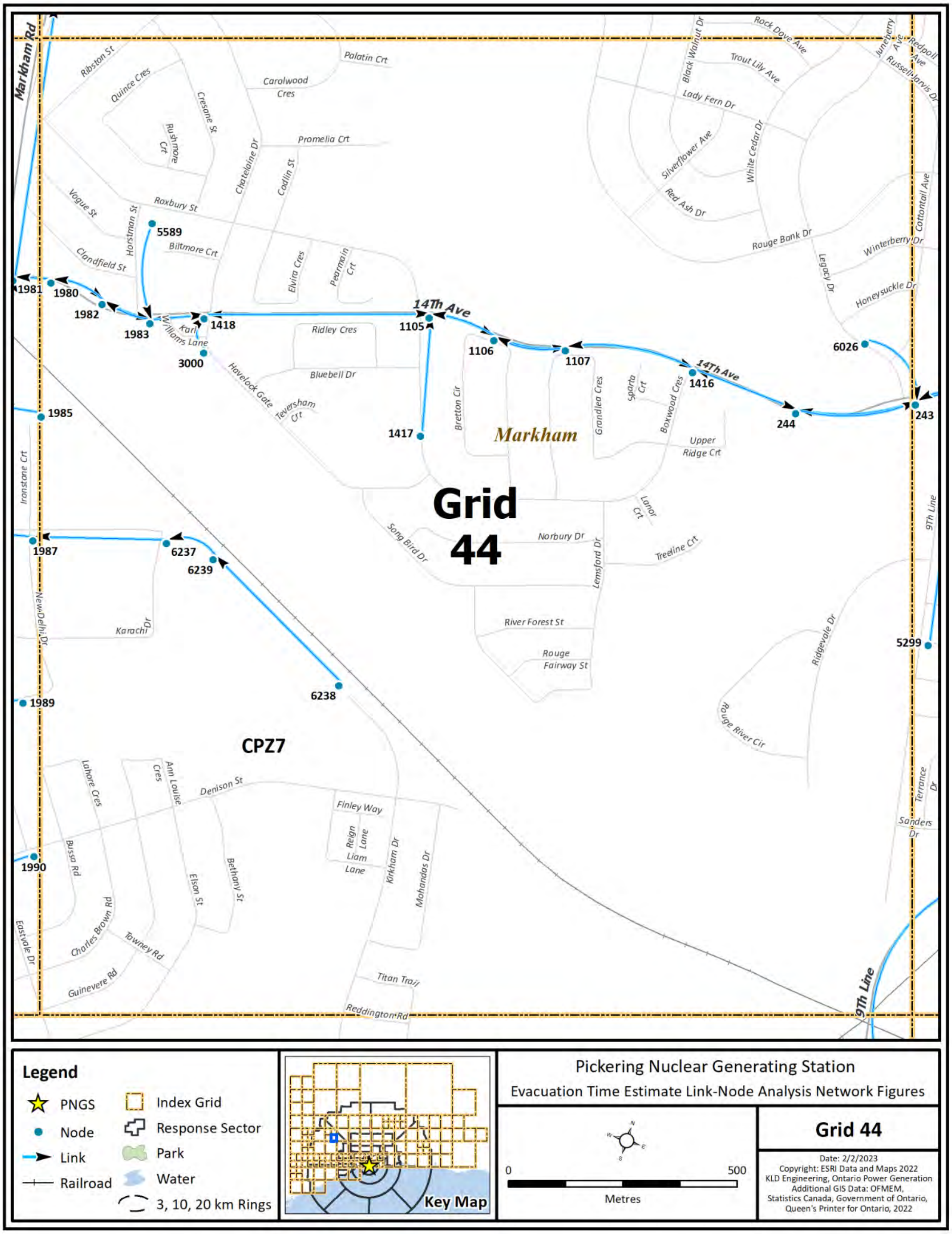


Figure K-45. Link-Node Analysis Network – Grid 44

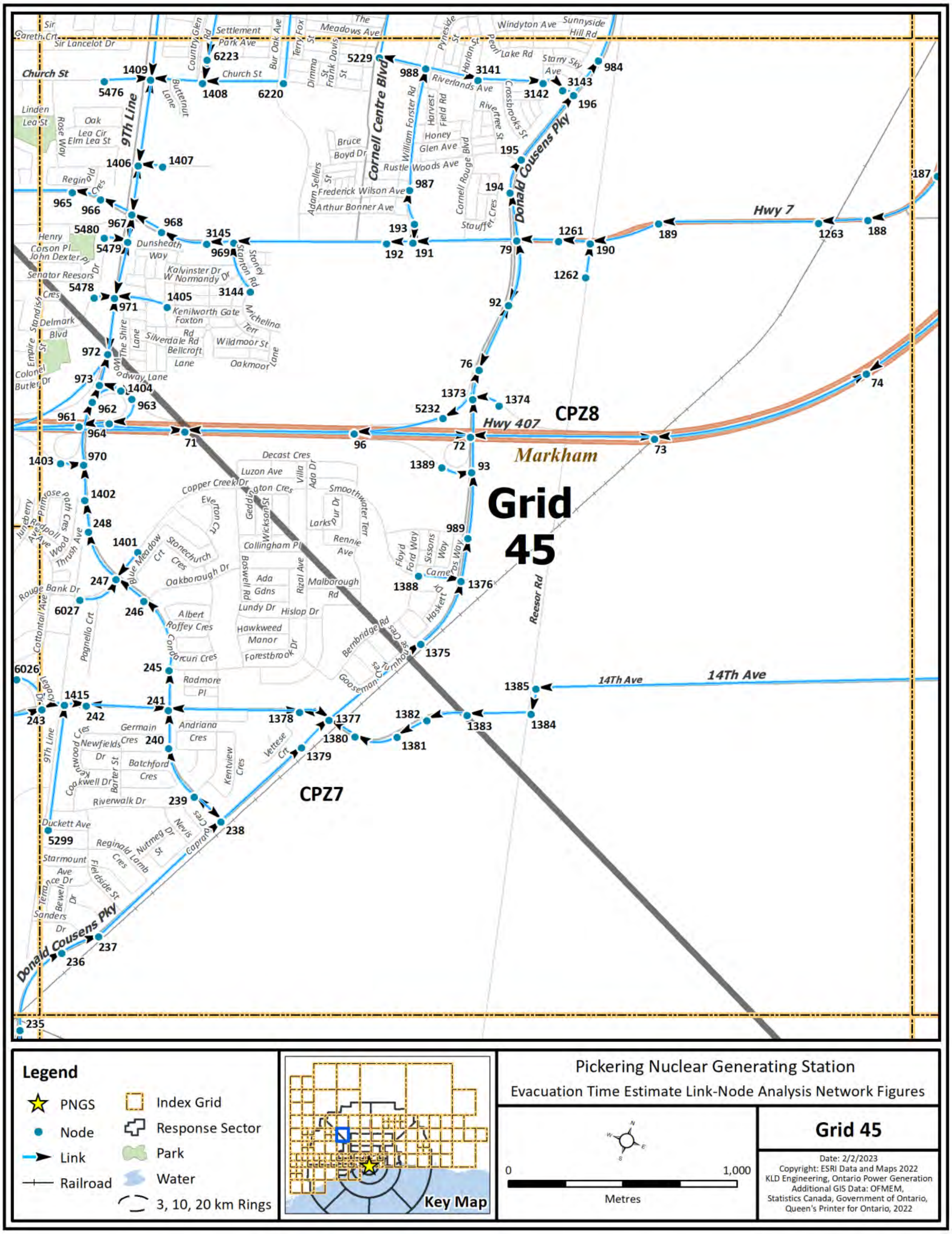


Figure K-46. Link-Node Analysis Network – Grid 45

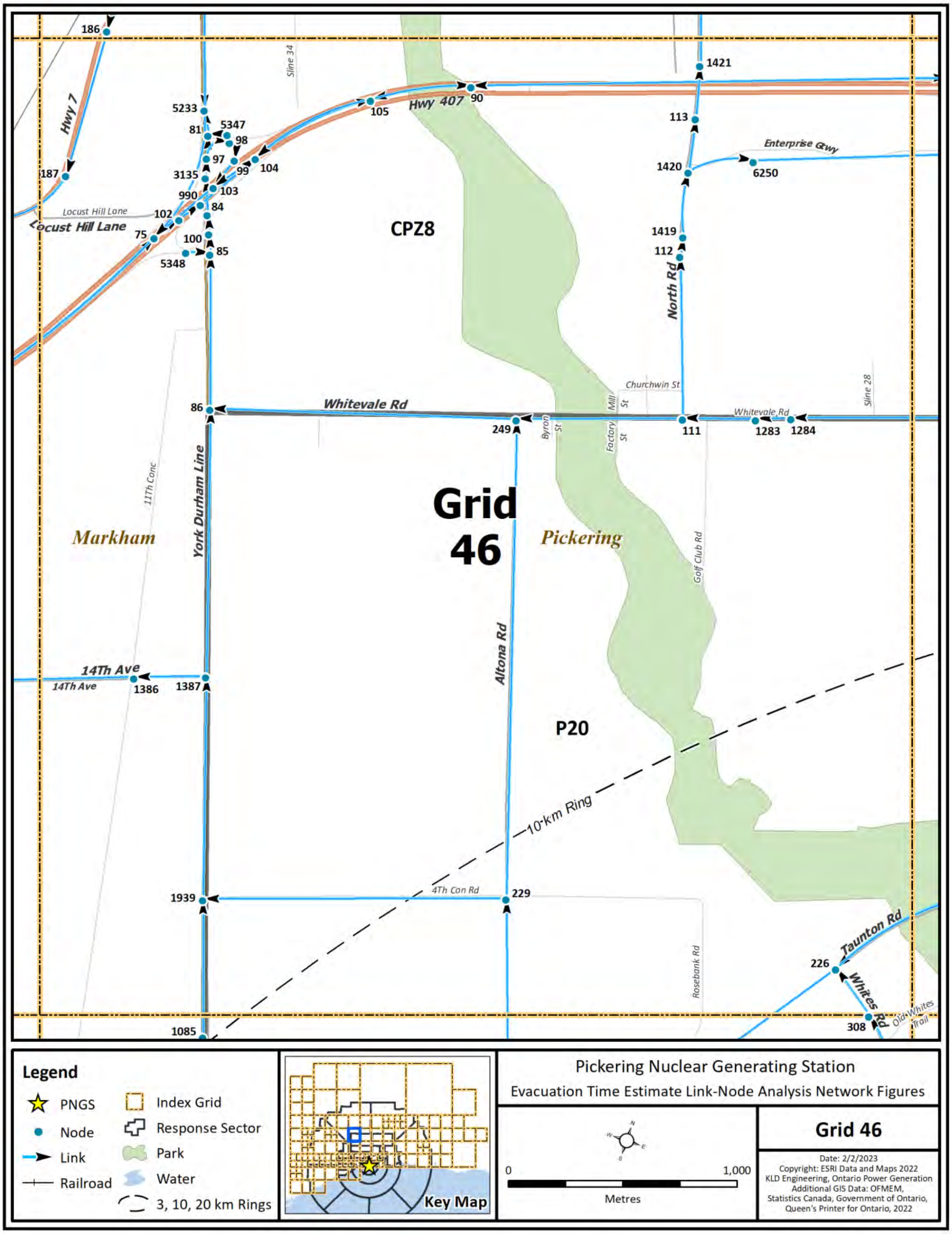


Figure K-47. Link-Node Analysis Network – Grid 46

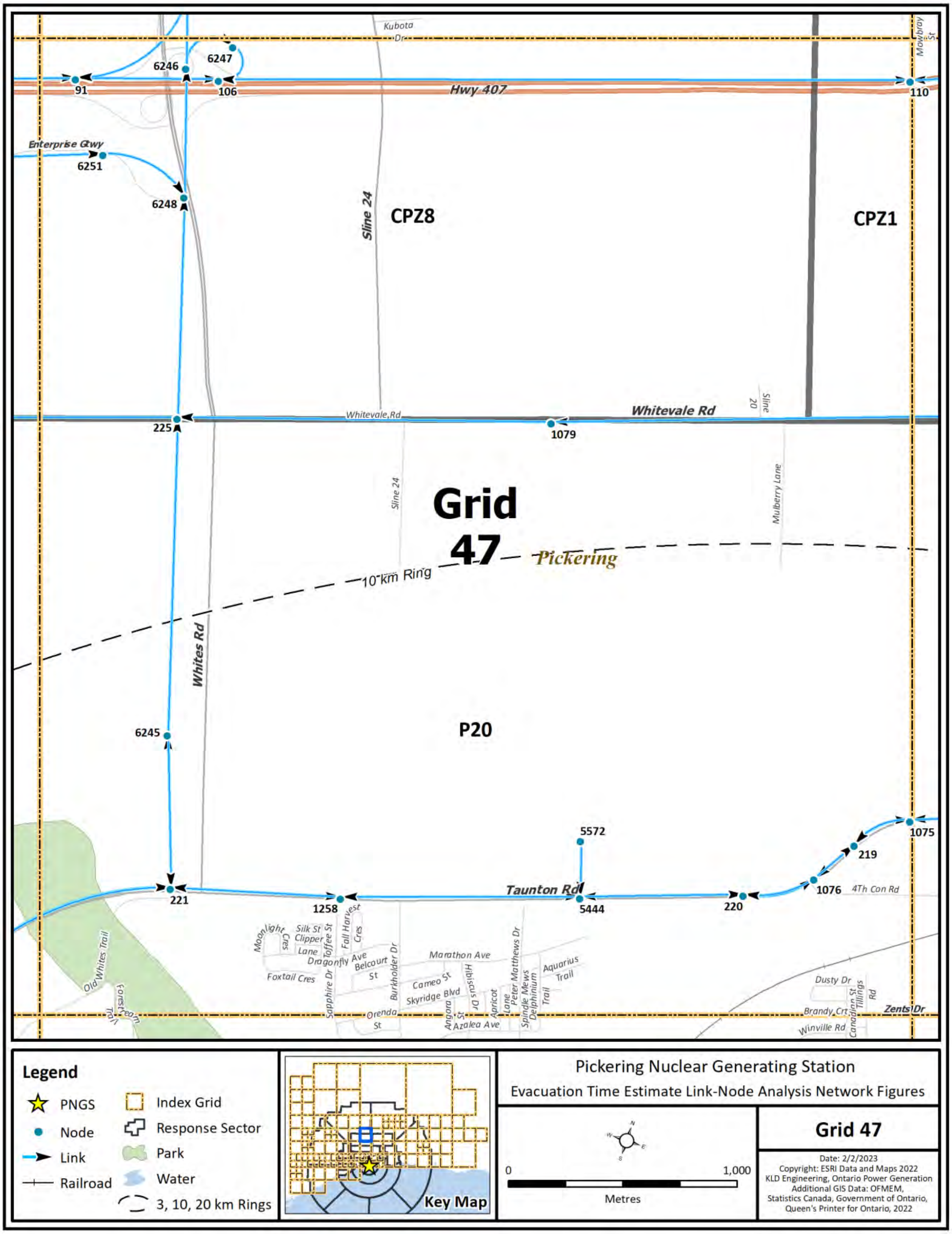


Figure K-48. Link-Node Analysis Network – Grid 47

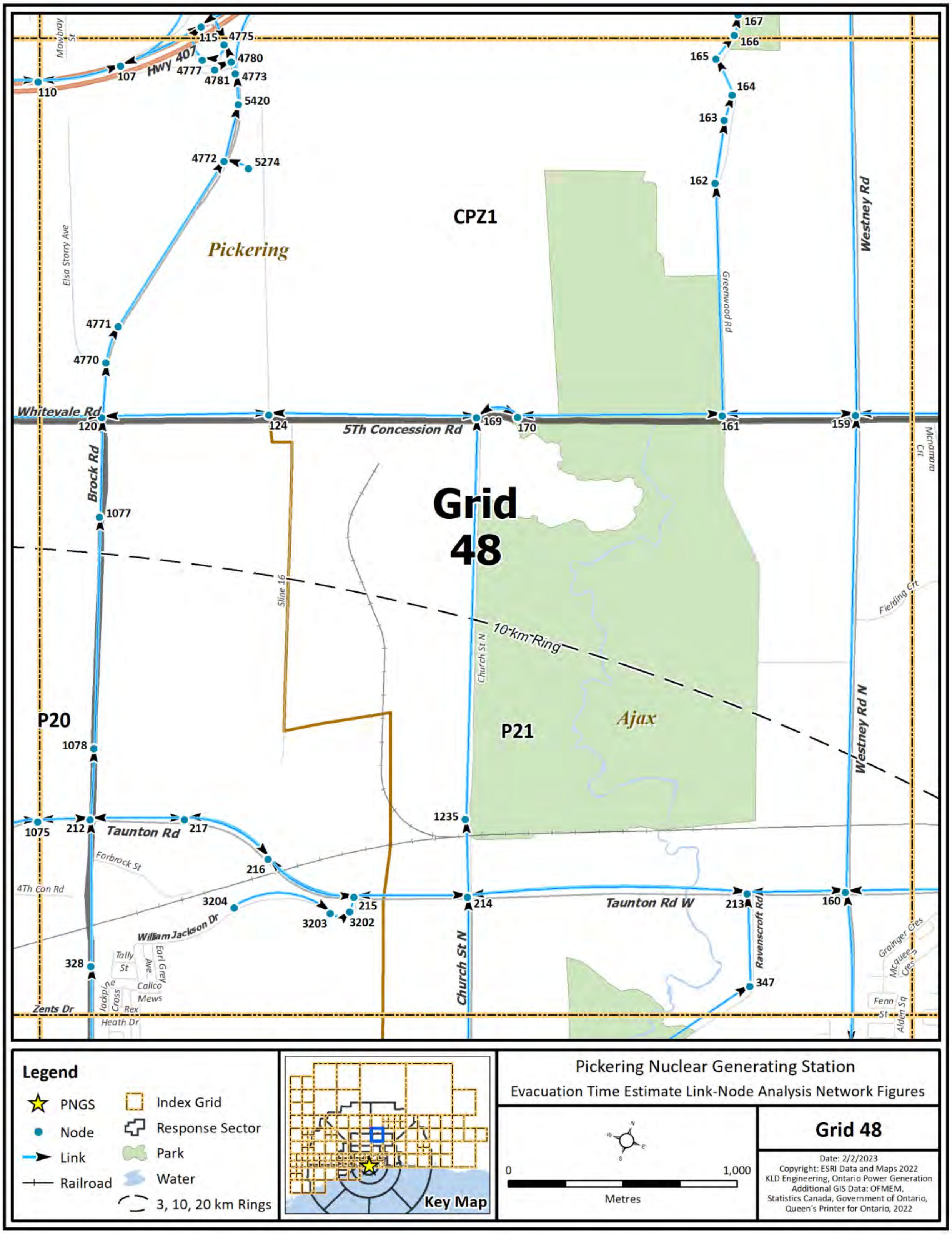


Figure K-49. Link-Node Analysis Network – Grid 48

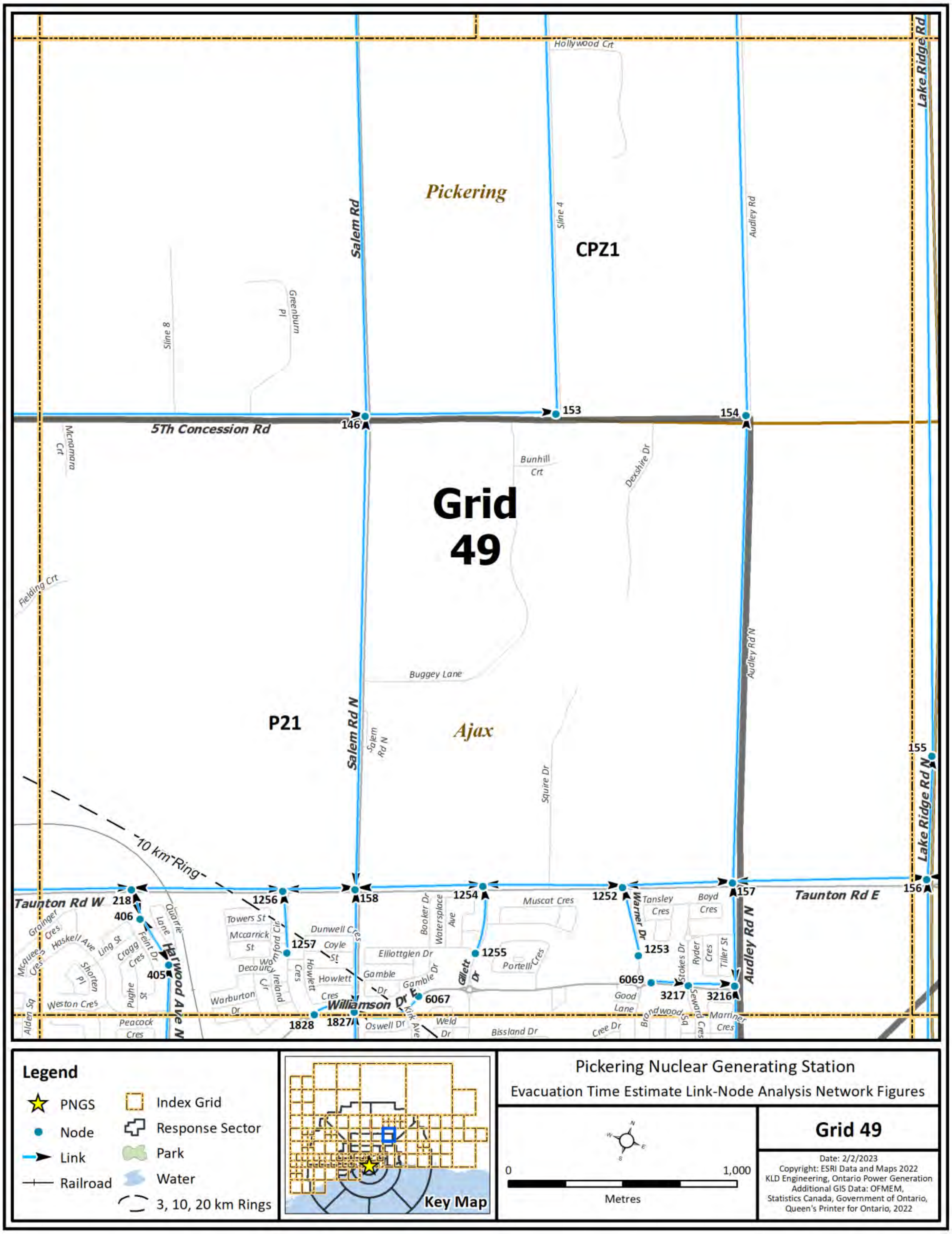


Figure K-50. Link-Node Analysis Network – Grid 49

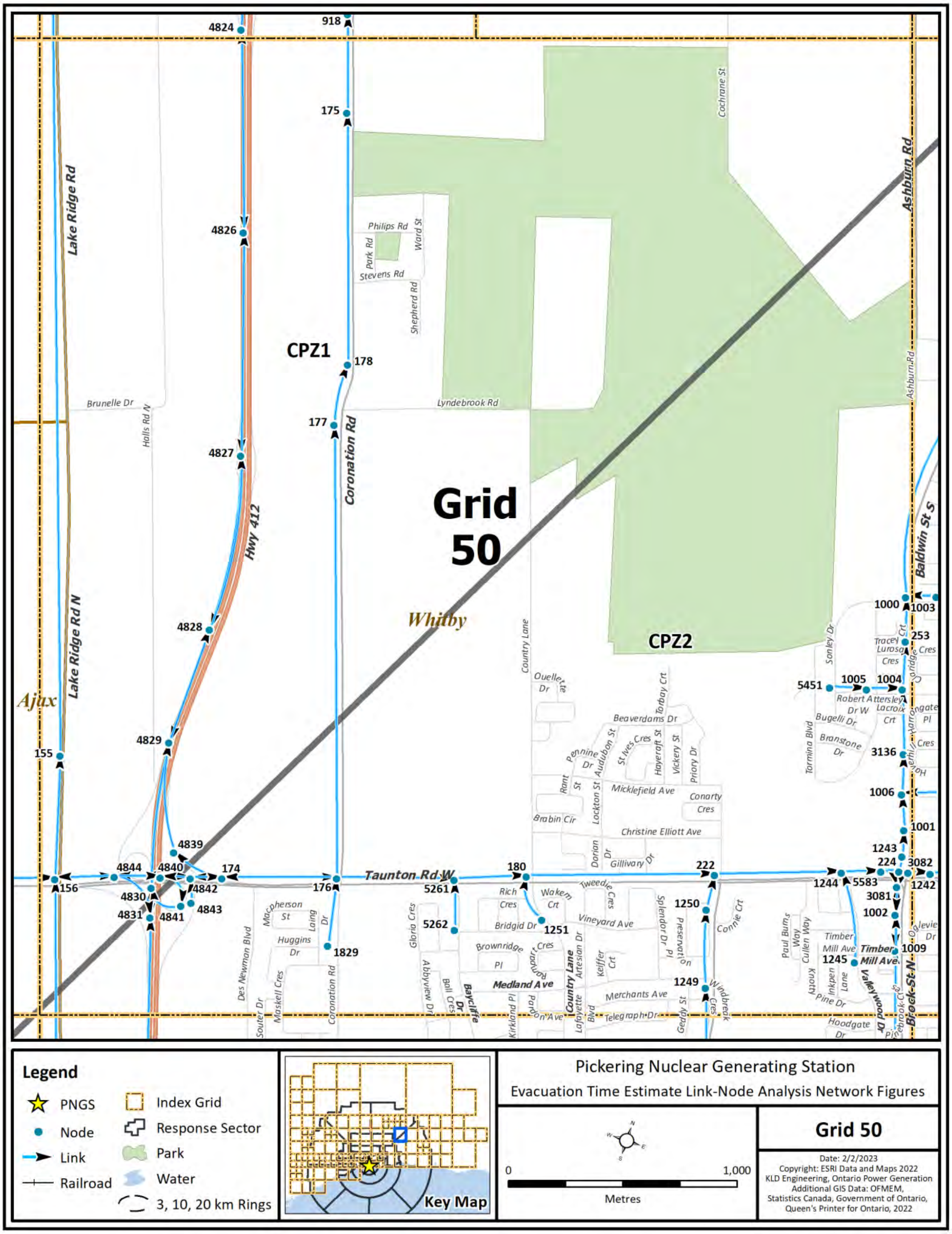


Figure K-51. Link-Node Analysis Network – Grid 50

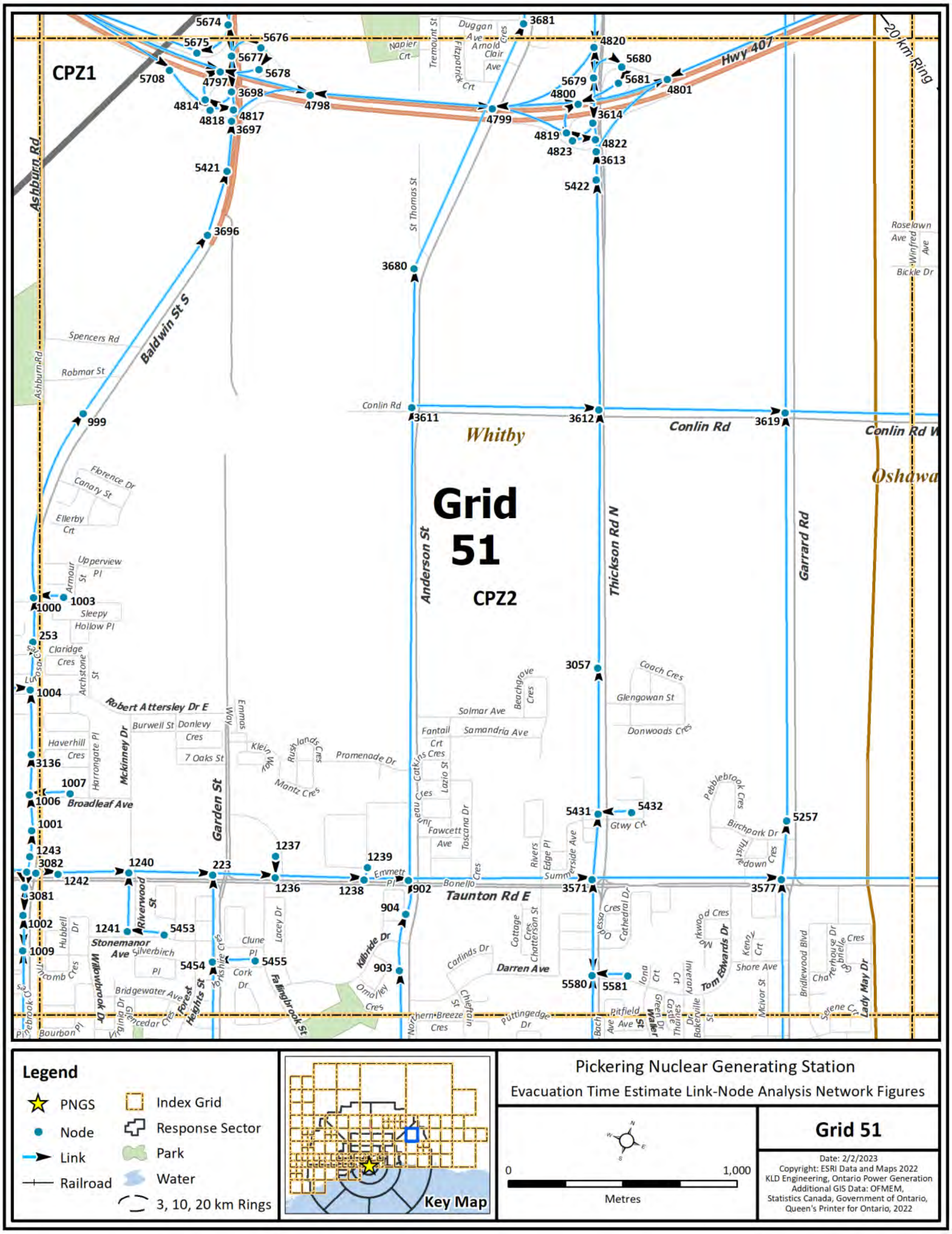


Figure K-52. Link-Node Analysis Network – Grid 51

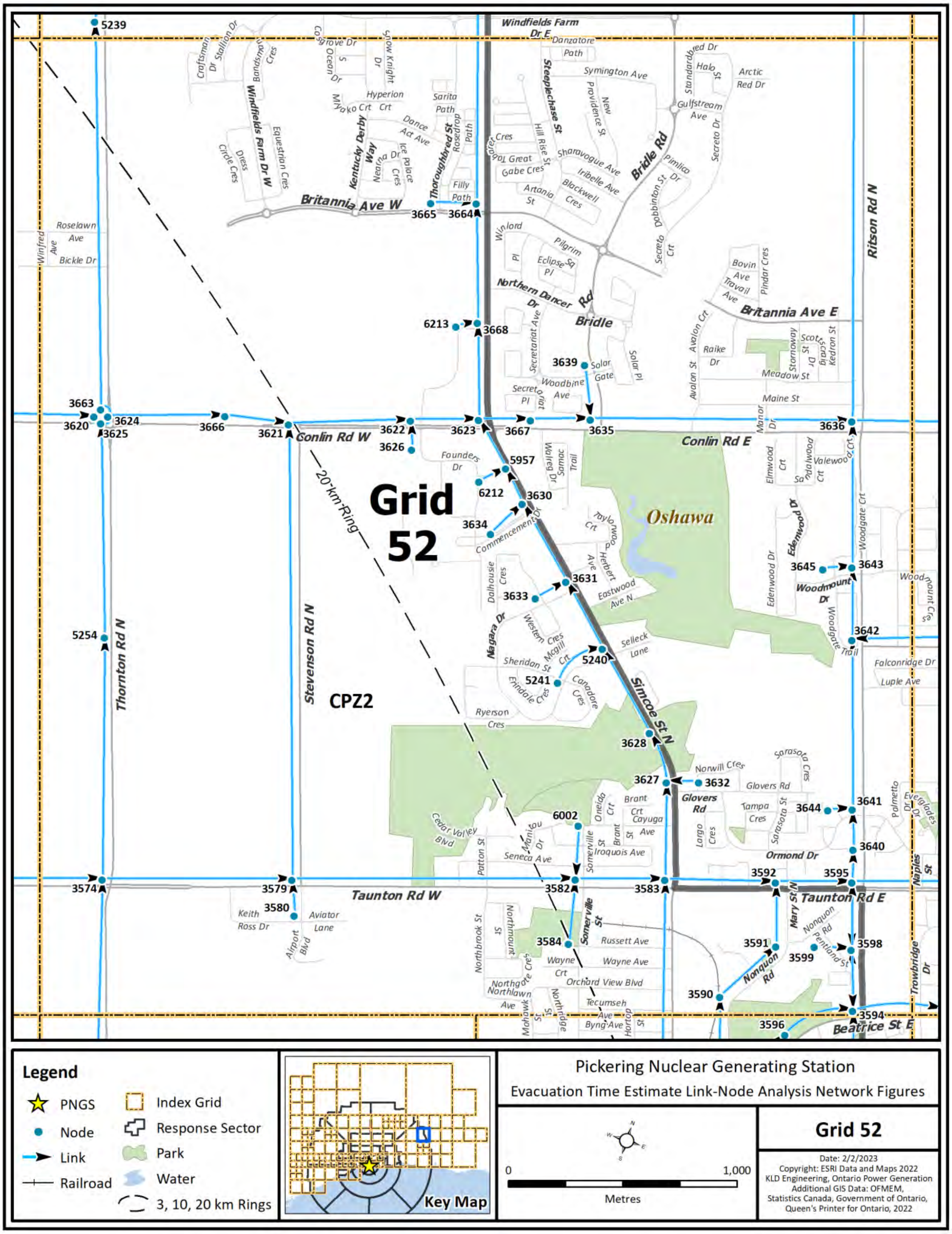


Figure K-53. Link-Node Analysis Network – Grid 52

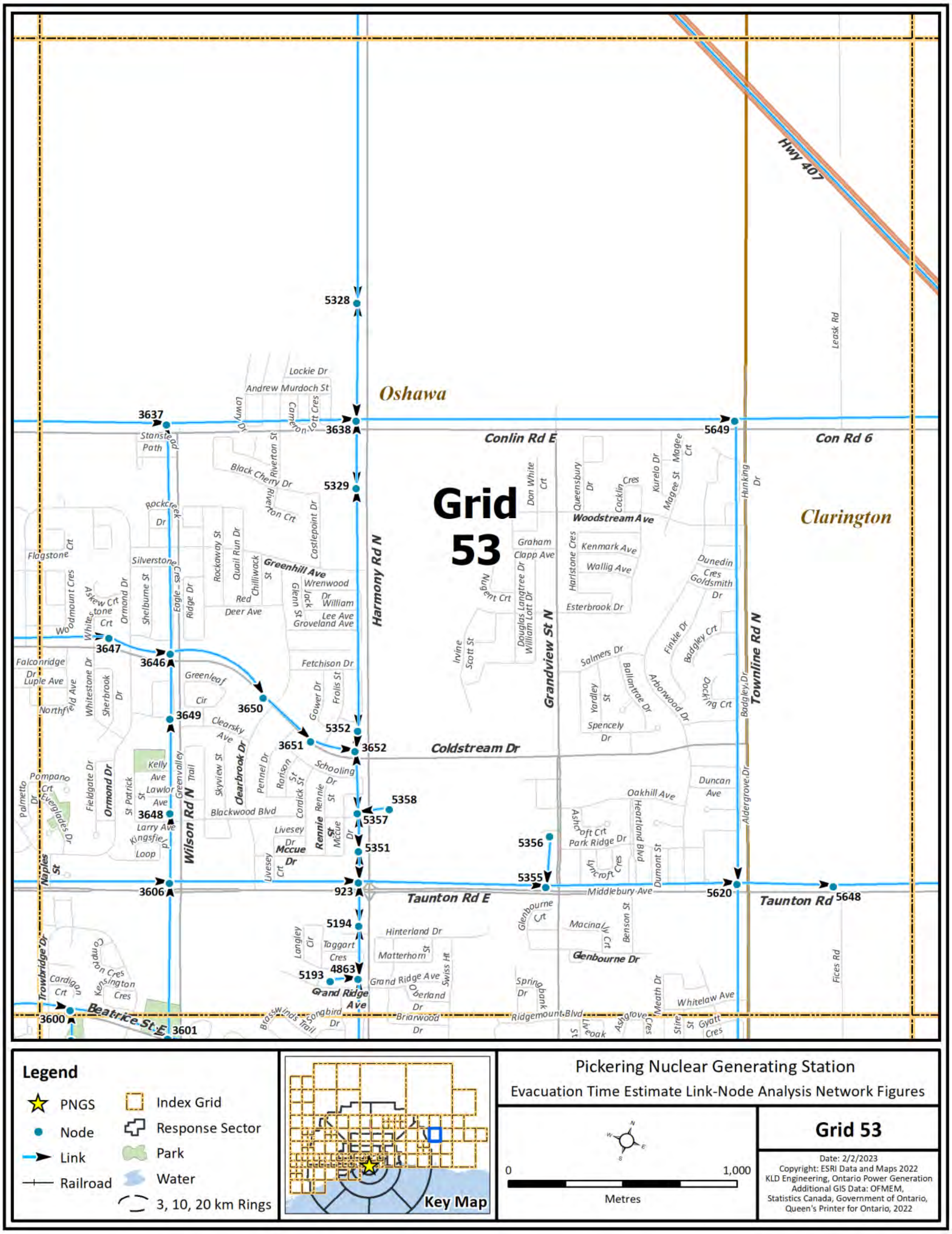


Figure K-54. Link-Node Analysis Network – Grid 53

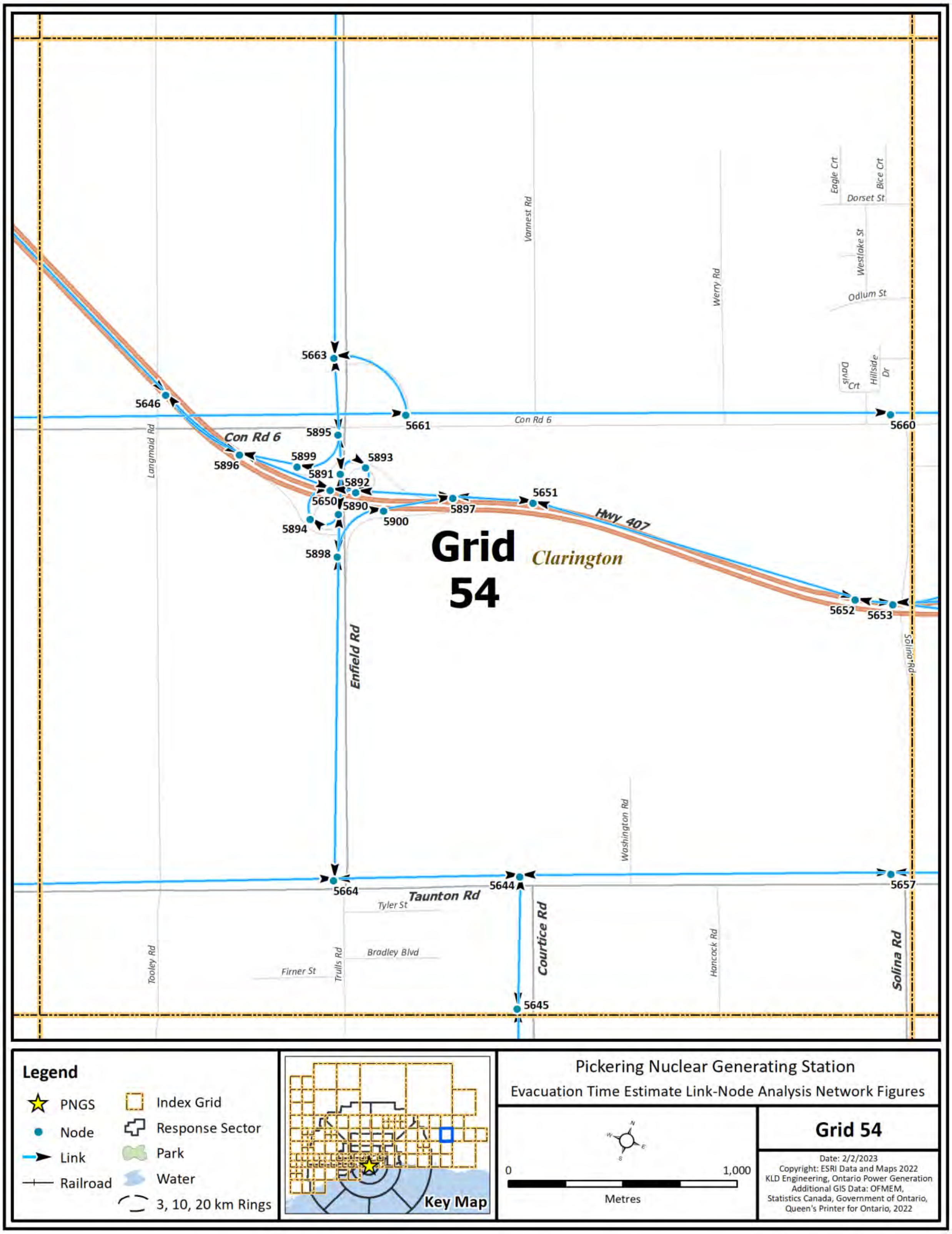


Figure K-55. Link-Node Analysis Network – Grid 54

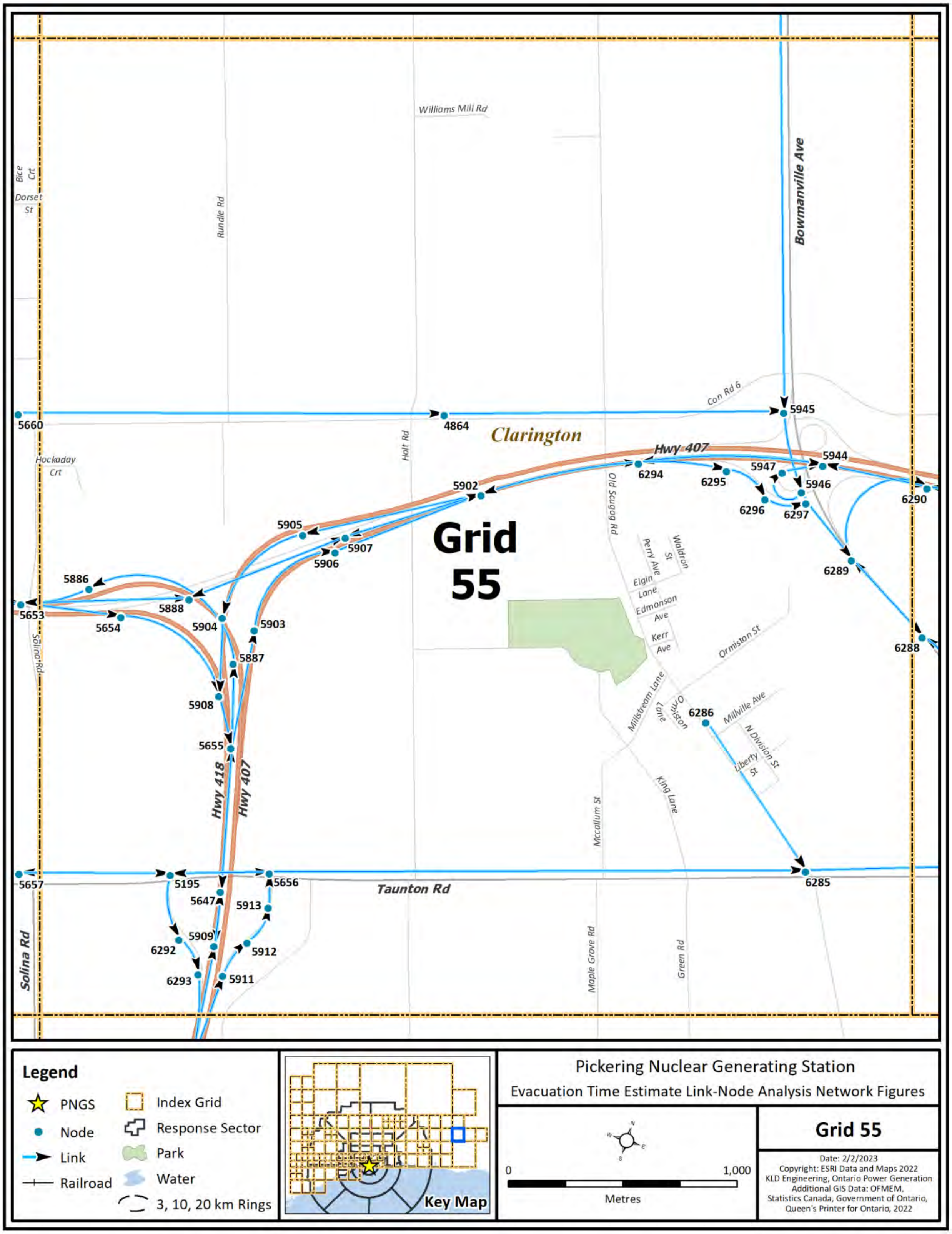


Figure K-56. Link-Node Analysis Network – Grid 55

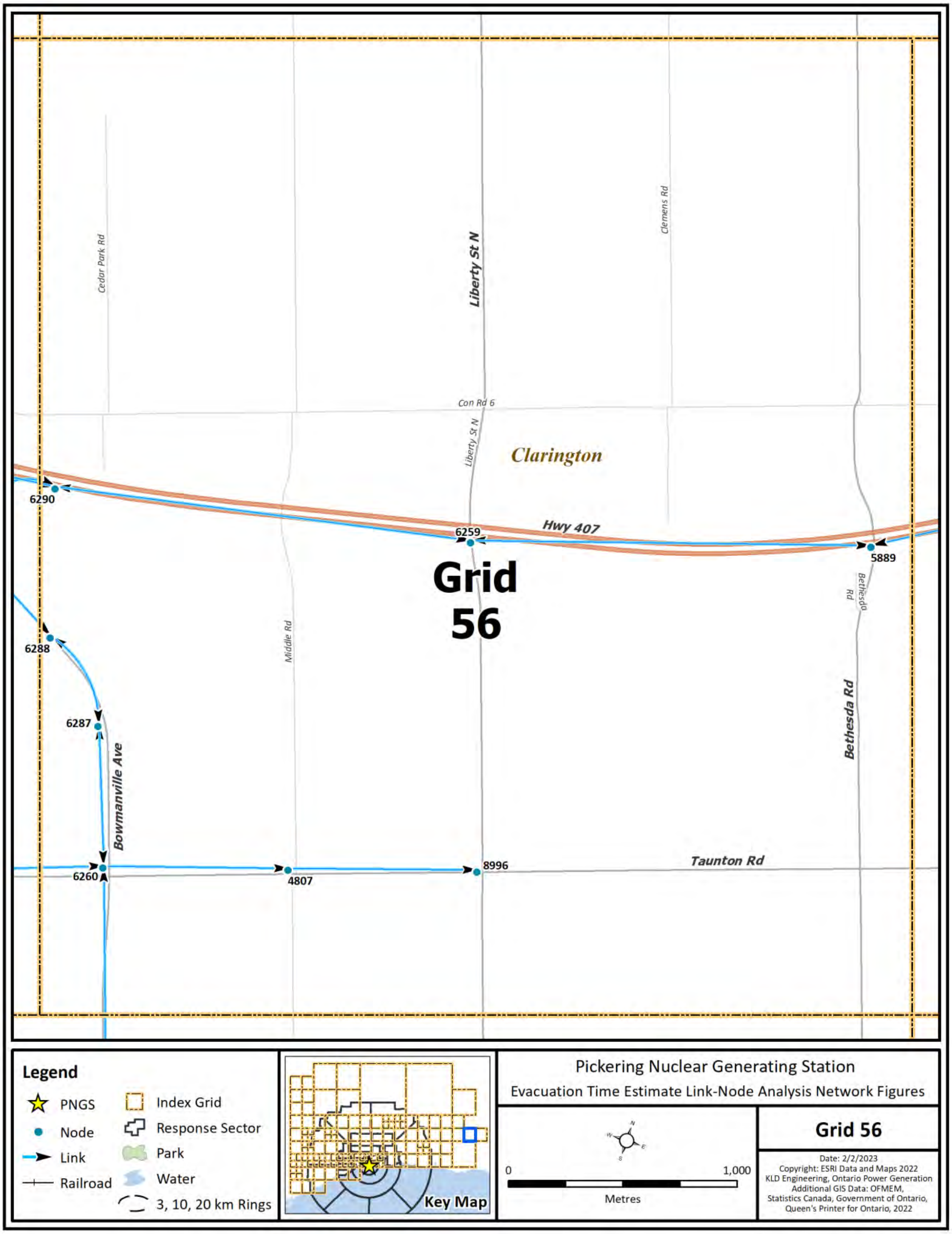


Figure K-57. Link-Node Analysis Network – Grid 56

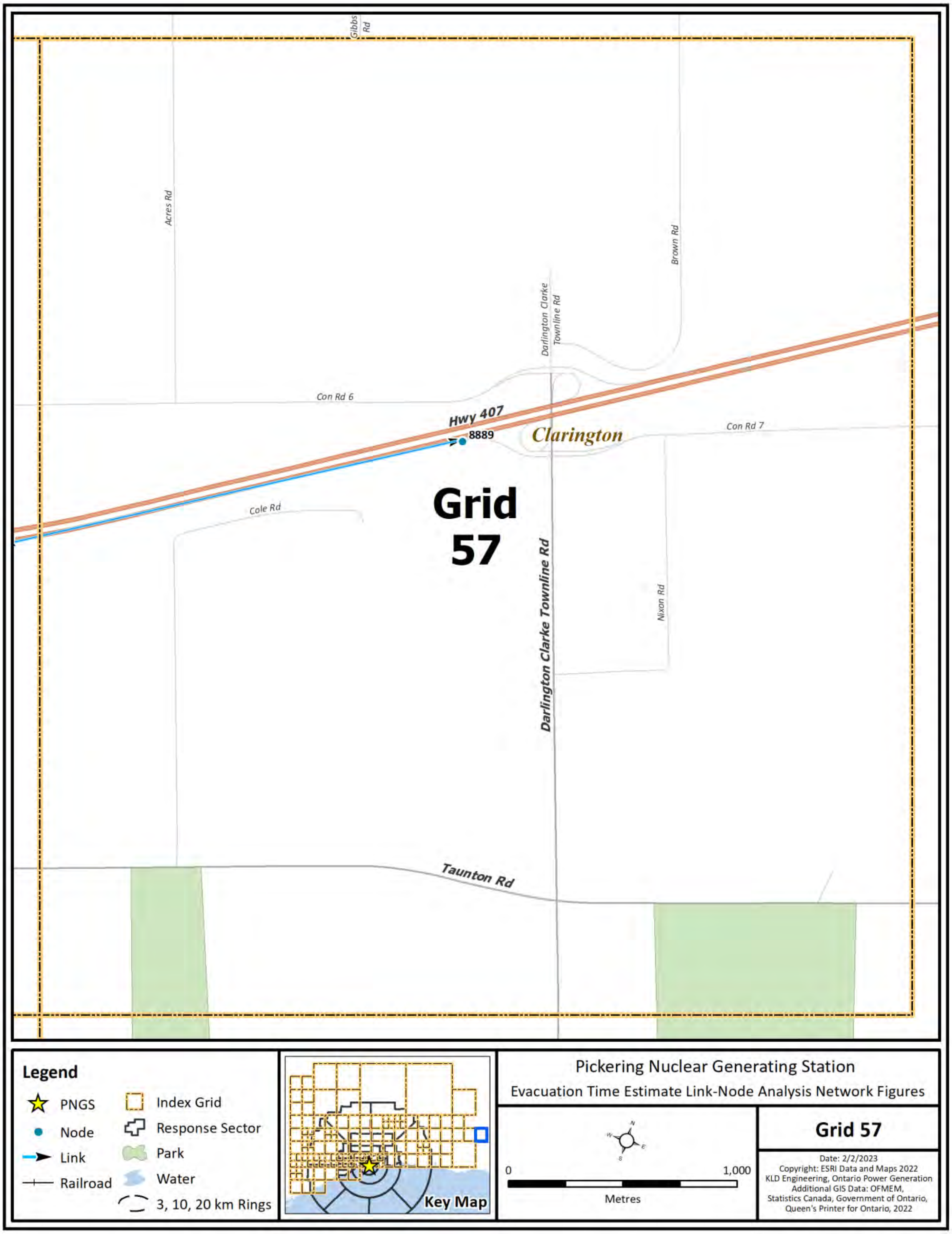


Figure K-58. Link-Node Analysis Network – Grid 57

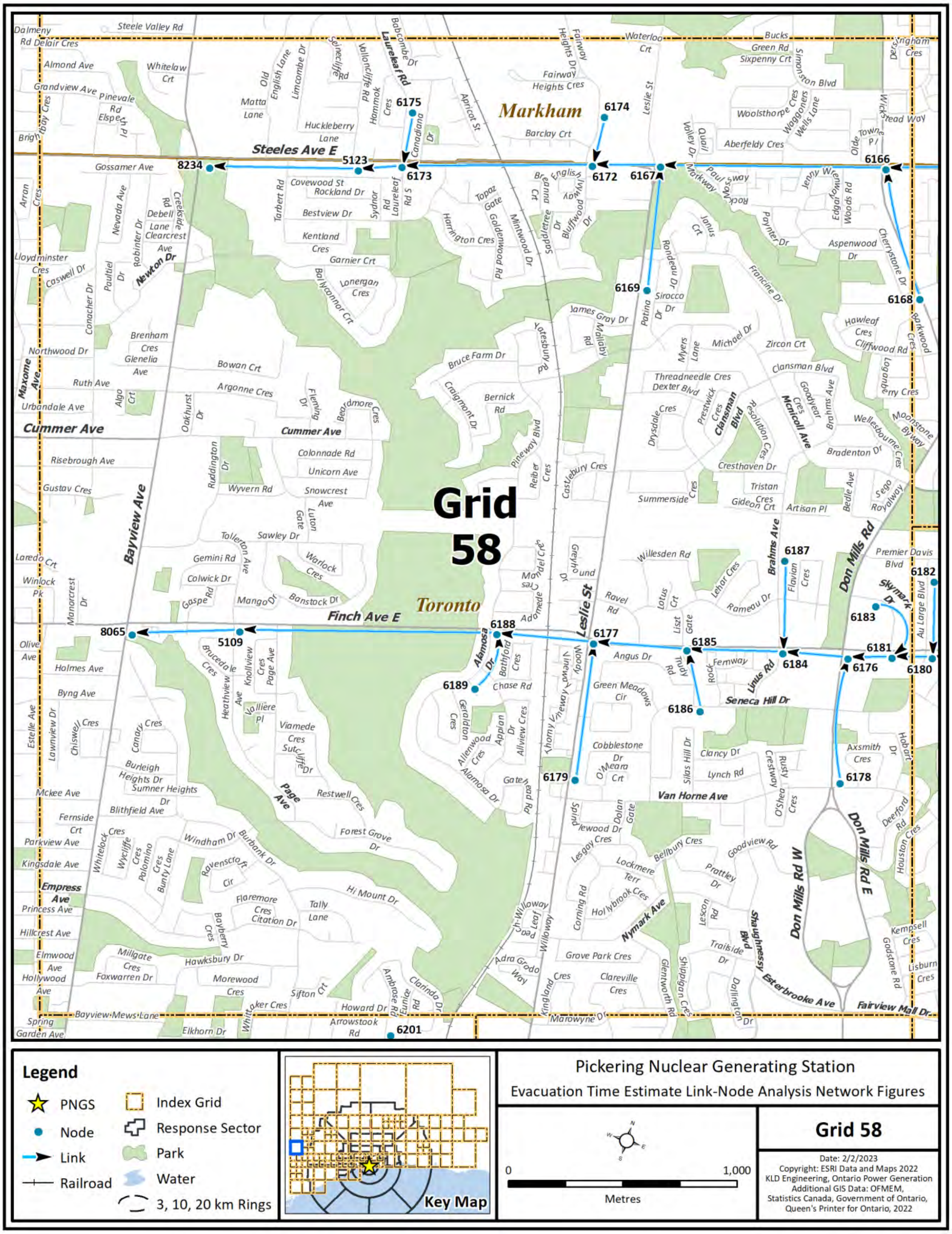


Figure K-59. Link-Node Analysis Network – Grid 58

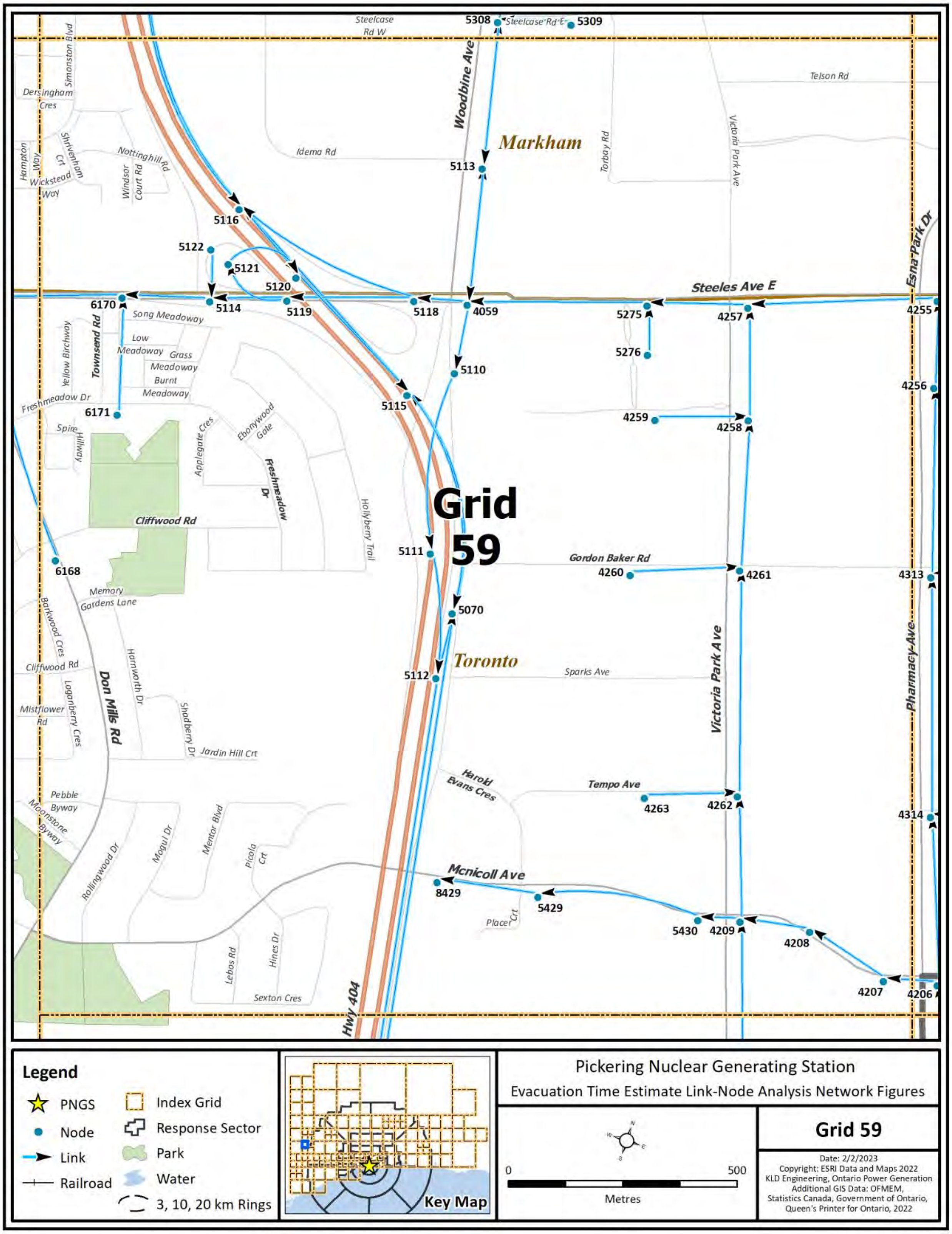


Figure K-60. Link-Node Analysis Network – Grid 59

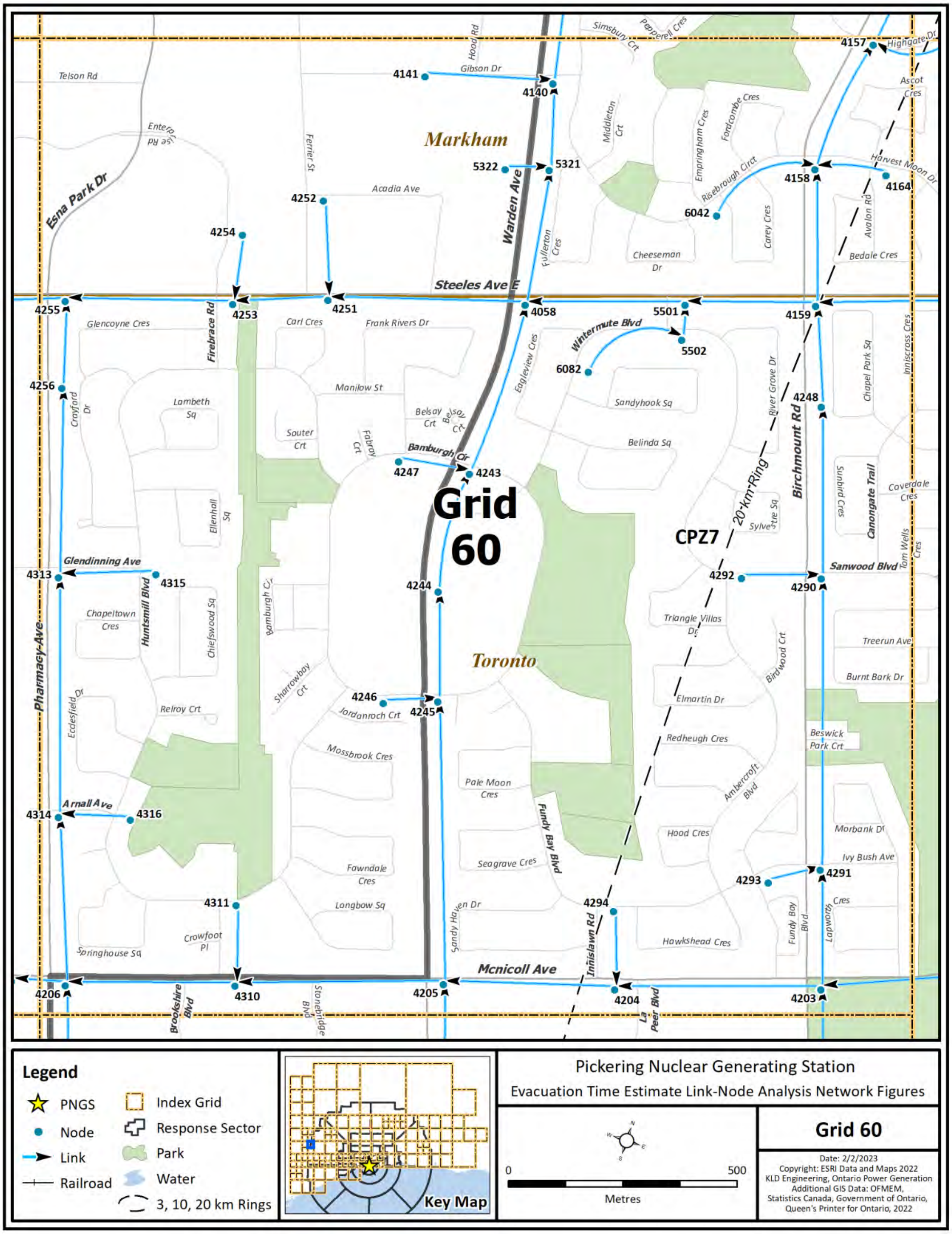


Figure K-61. Link-Node Analysis Network – Grid 60

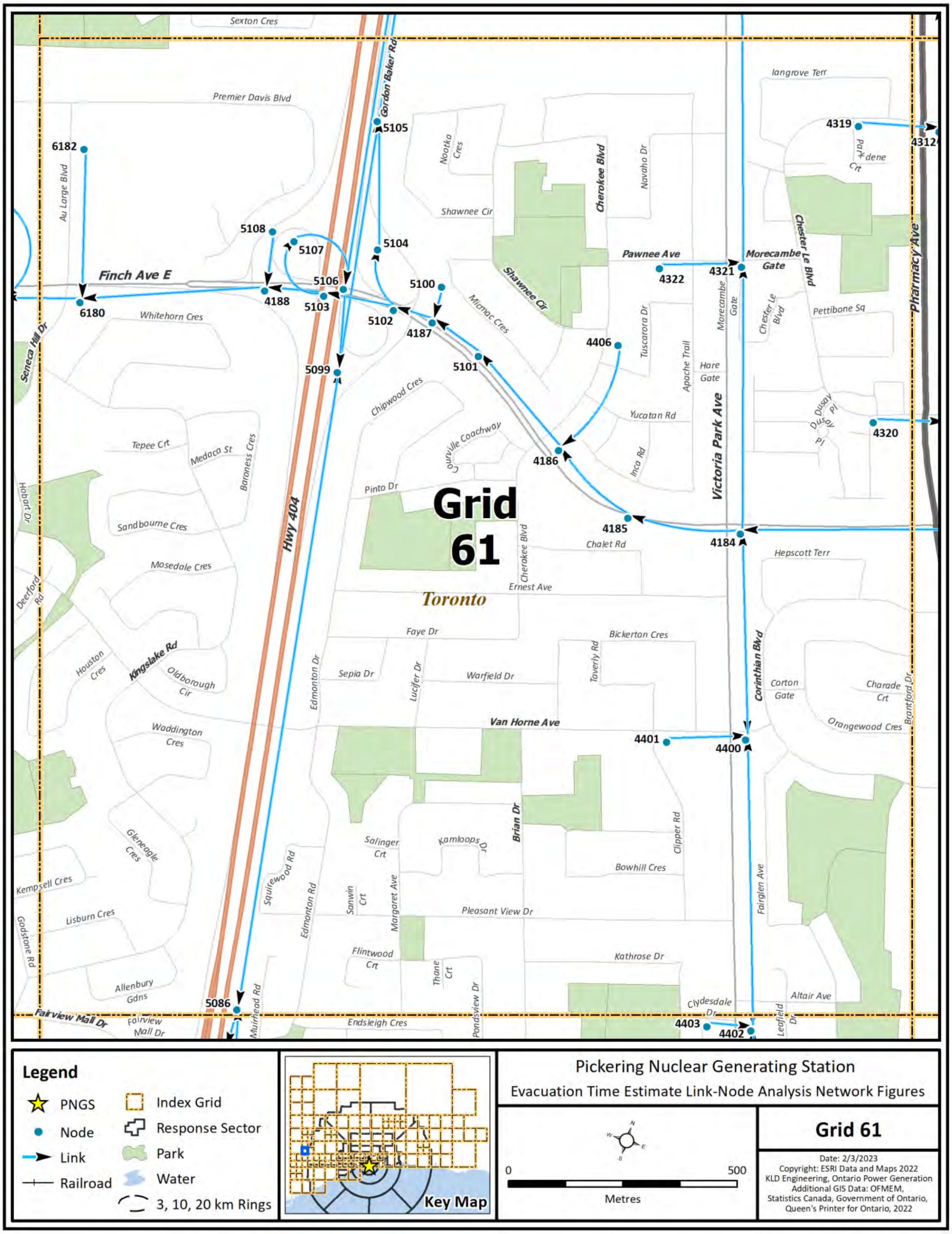


Figure K-62. Link-Node Analysis Network – Grid 61

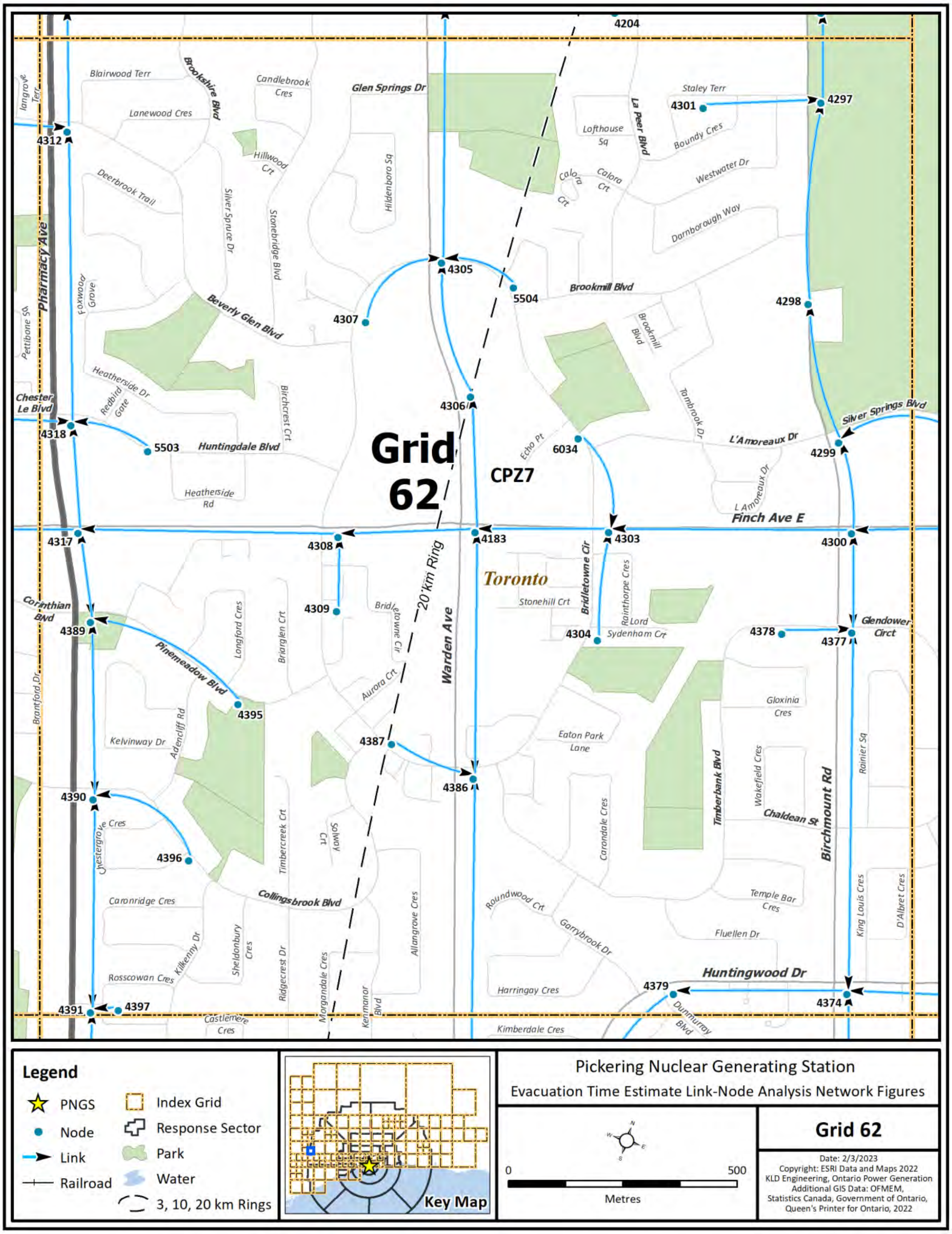


Figure K-63. Link-Node Analysis Network – Grid 62

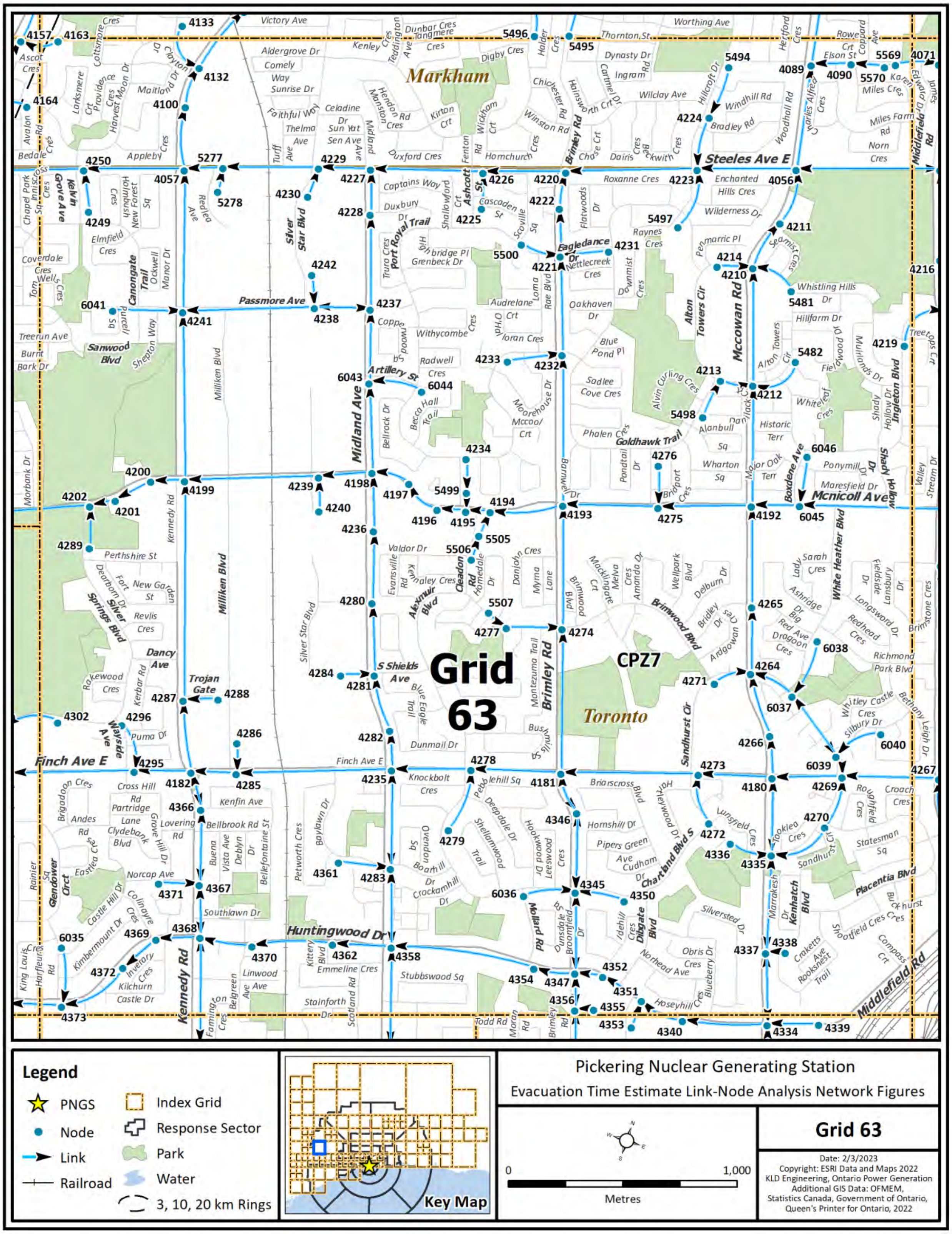


Figure K-64. Link-Node Analysis Network – Grid 63

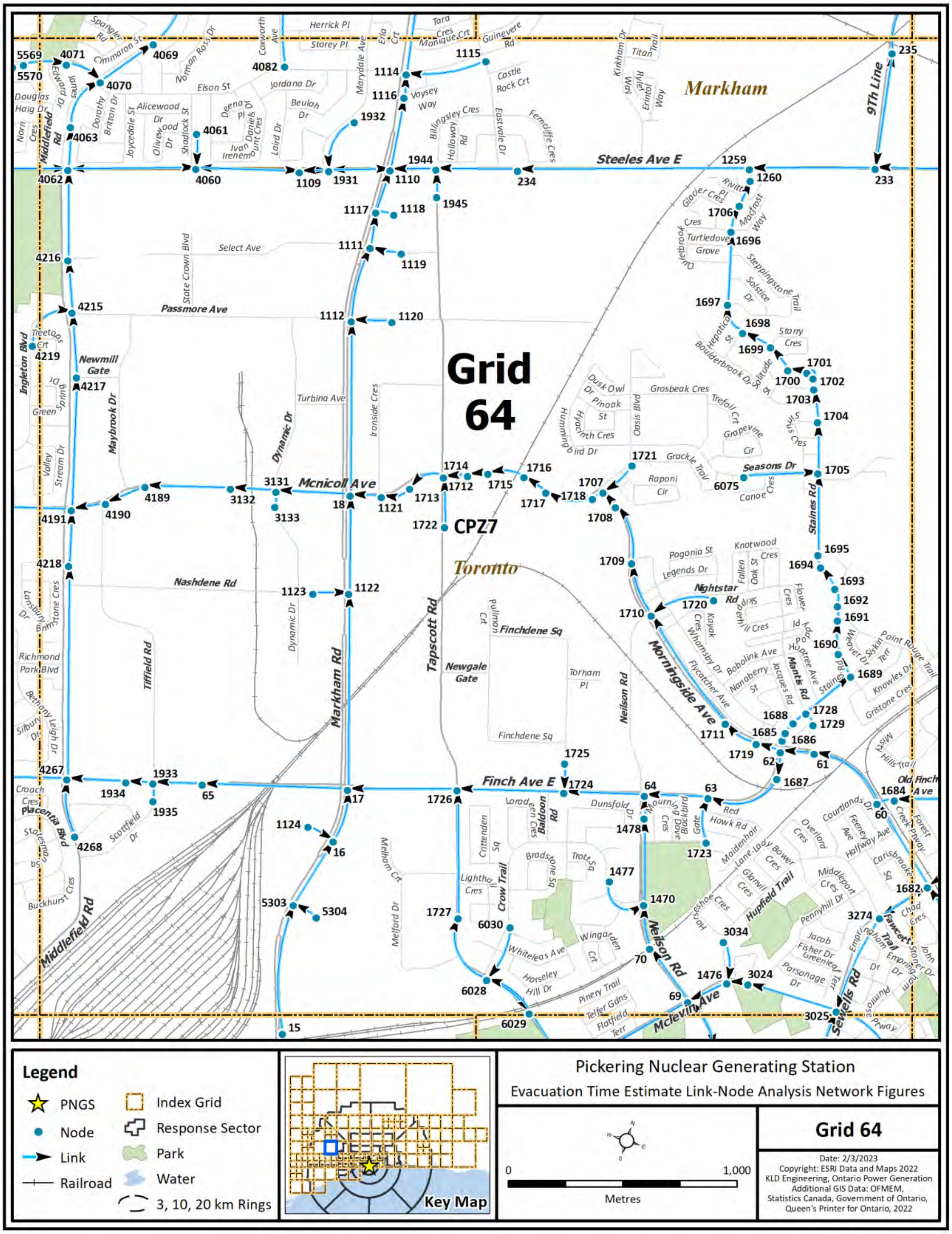


Figure K-65. Link-Node Analysis Network – Grid 64

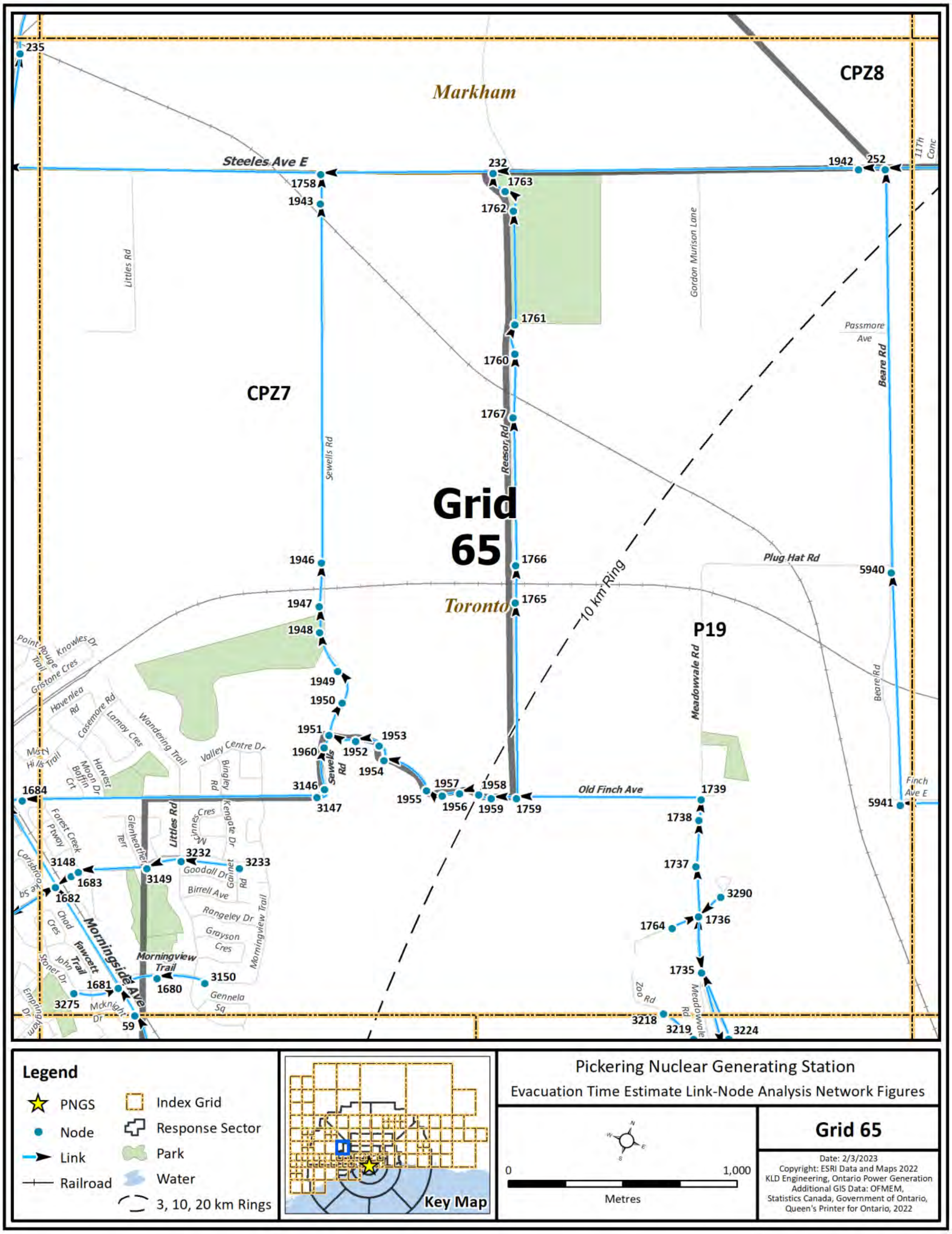


Figure K-66. Link-Node Analysis Network – Grid 65

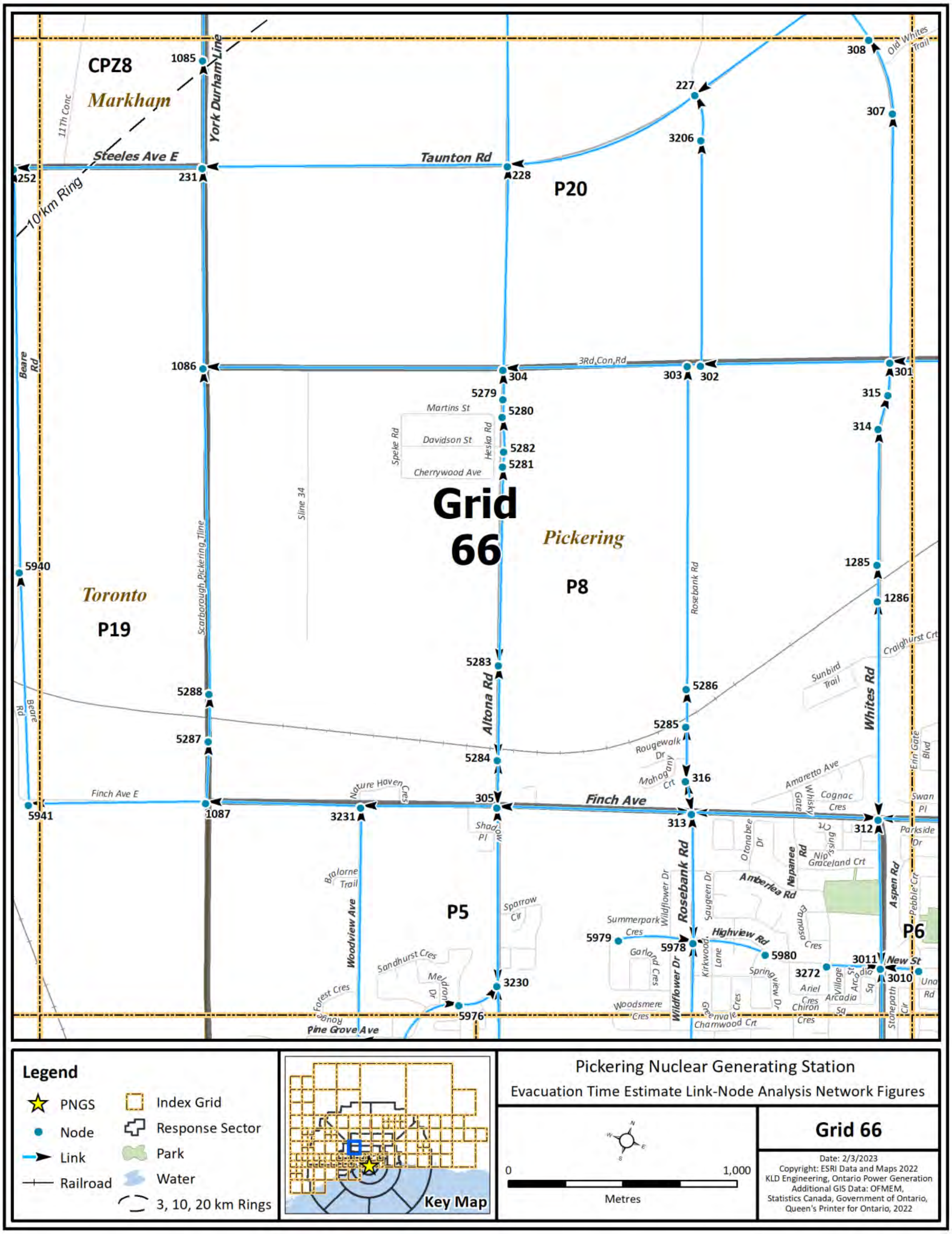


Figure K-67. Link-Node Analysis Network – Grid 66

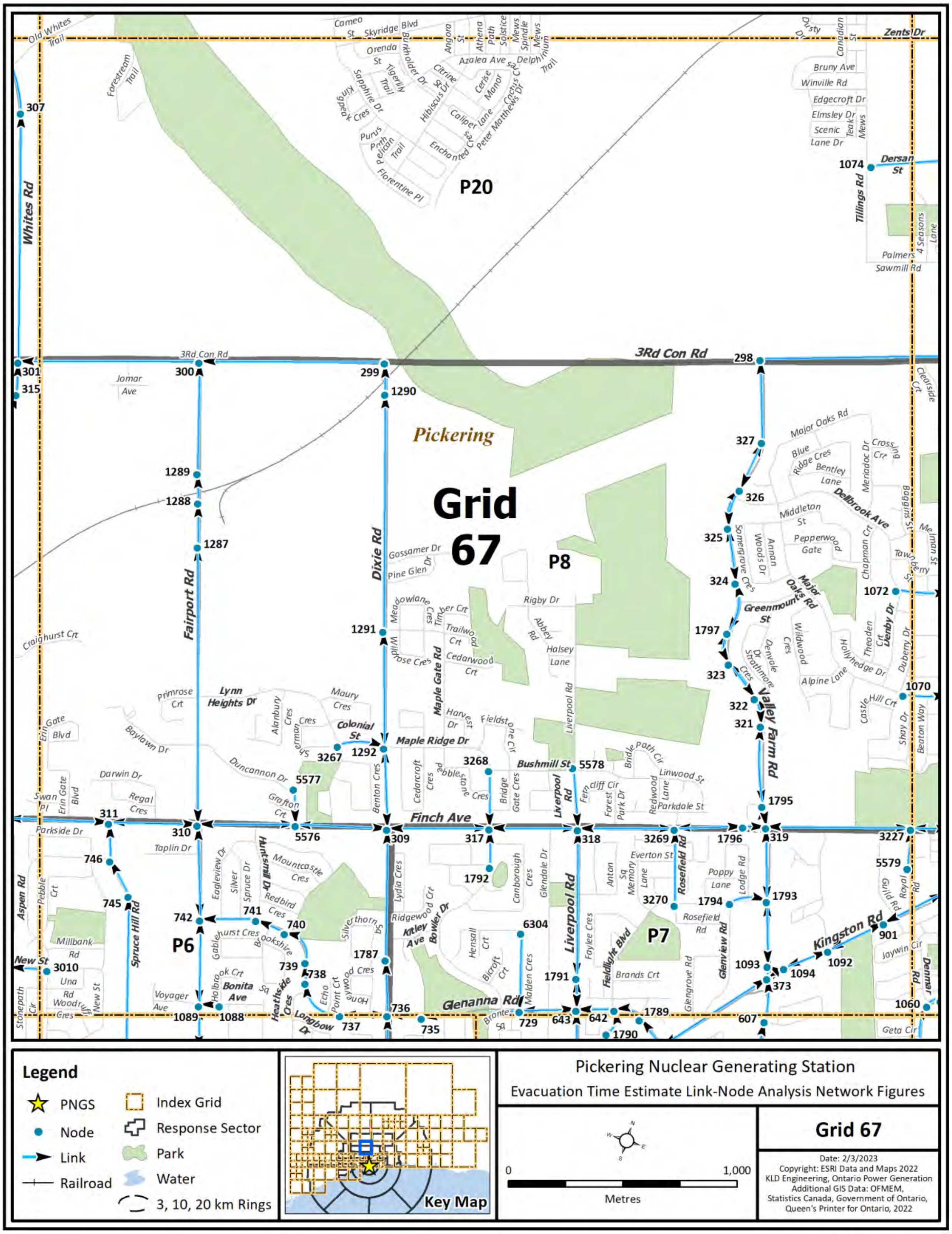


Figure K-68. Link-Node Analysis Network – Grid 67

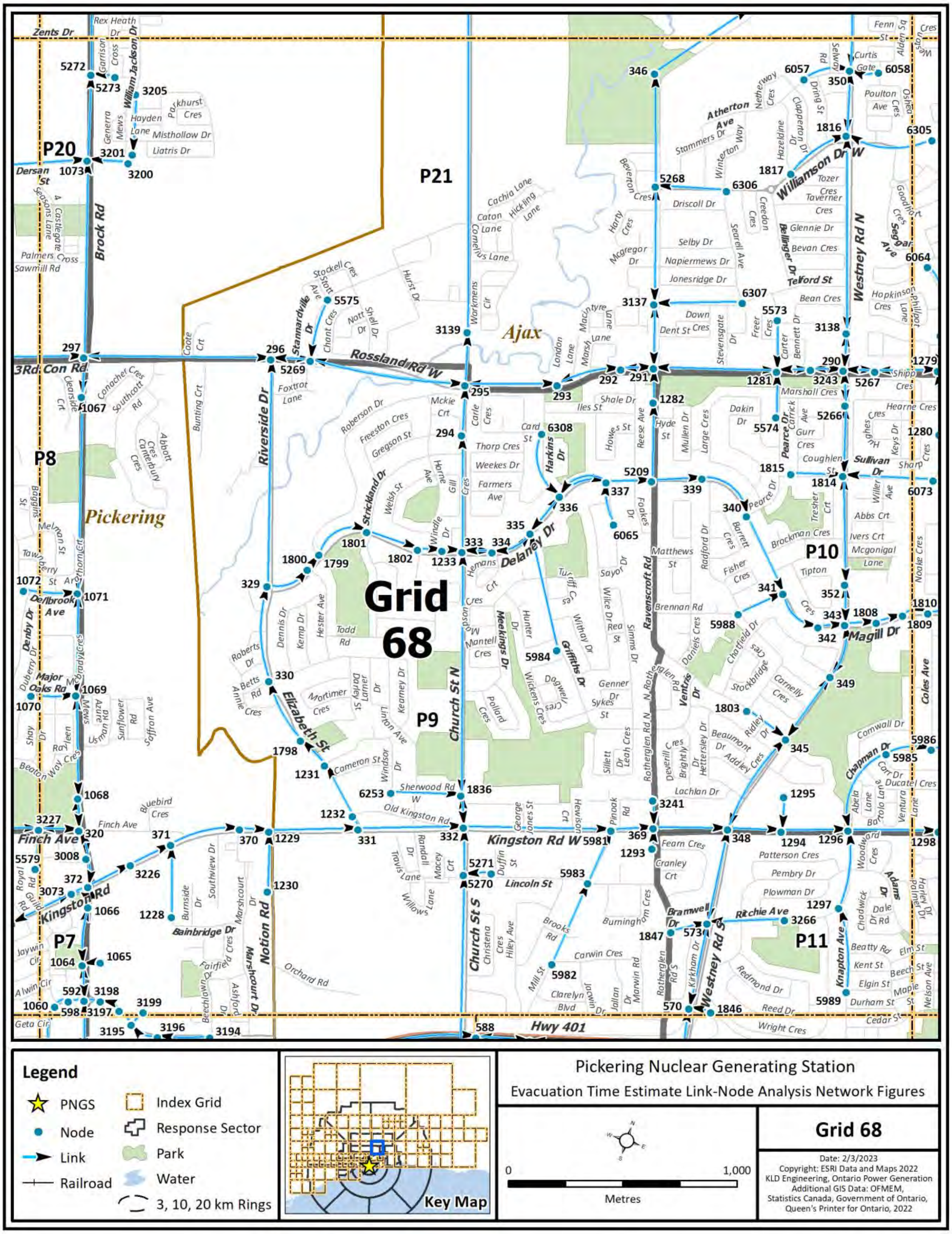


Figure K-69. Link-Node Analysis Network – Grid 68

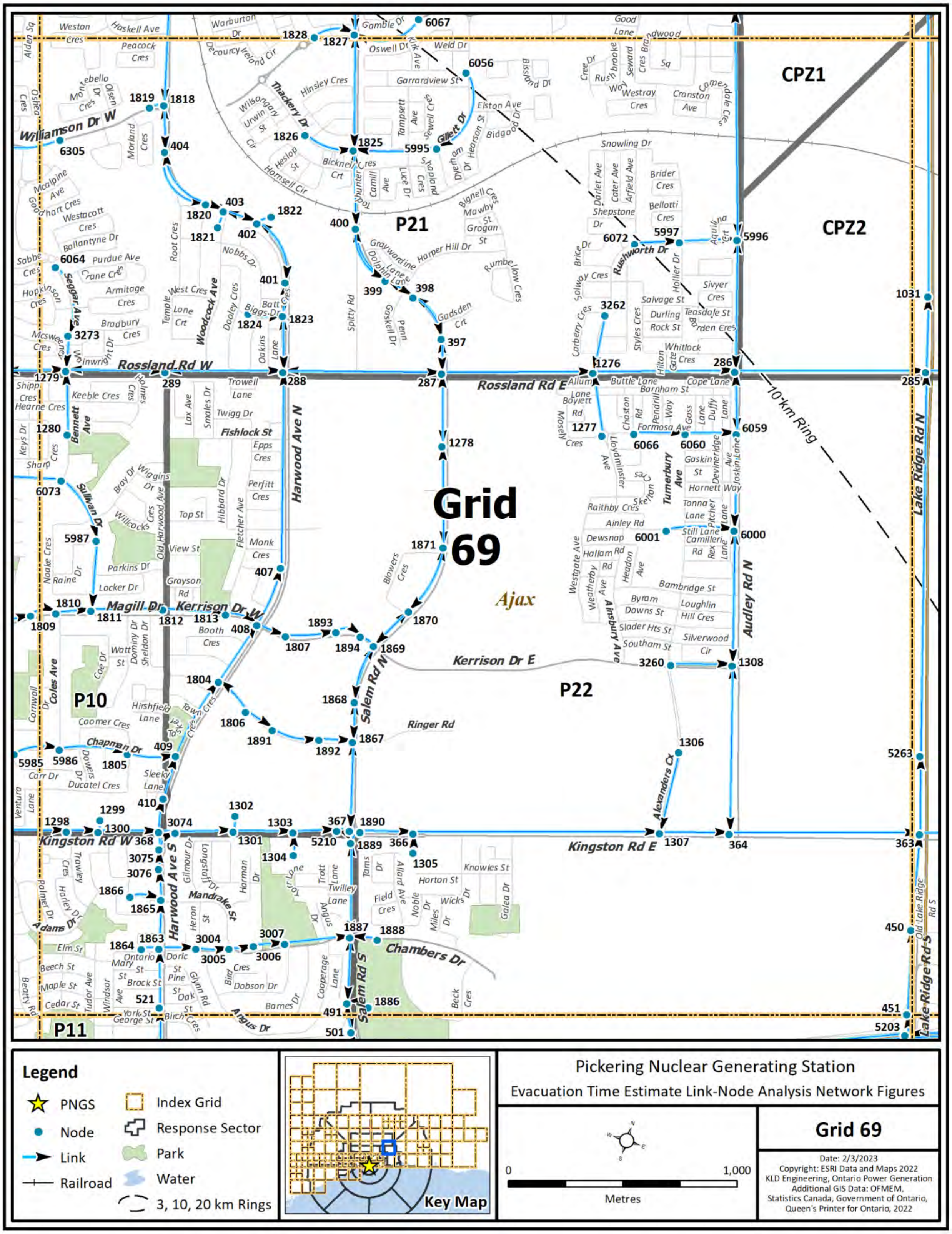


Figure K-70. Link-Node Analysis Network – Grid 69

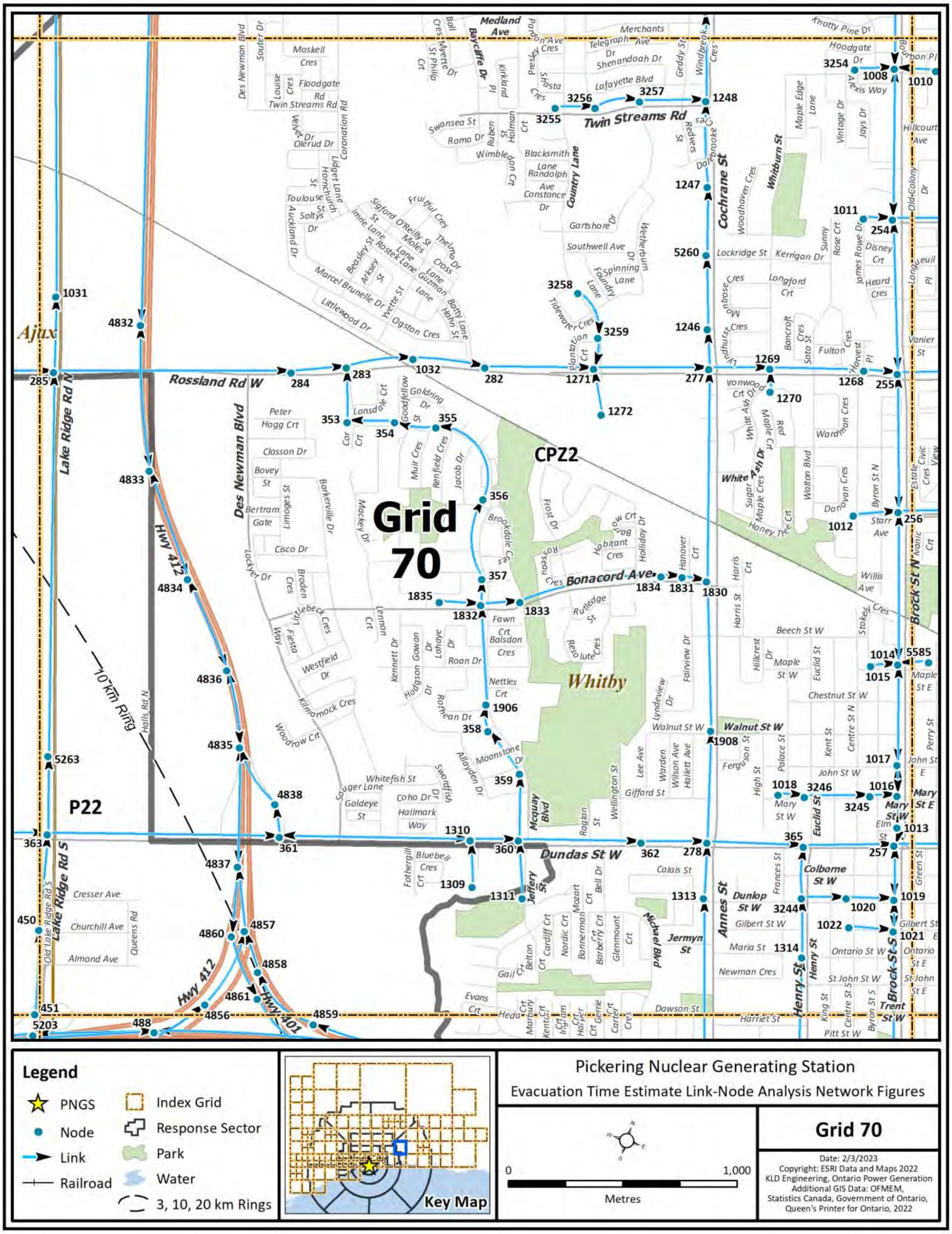


Figure K-71. Link-Node Analysis Network – Grid 70

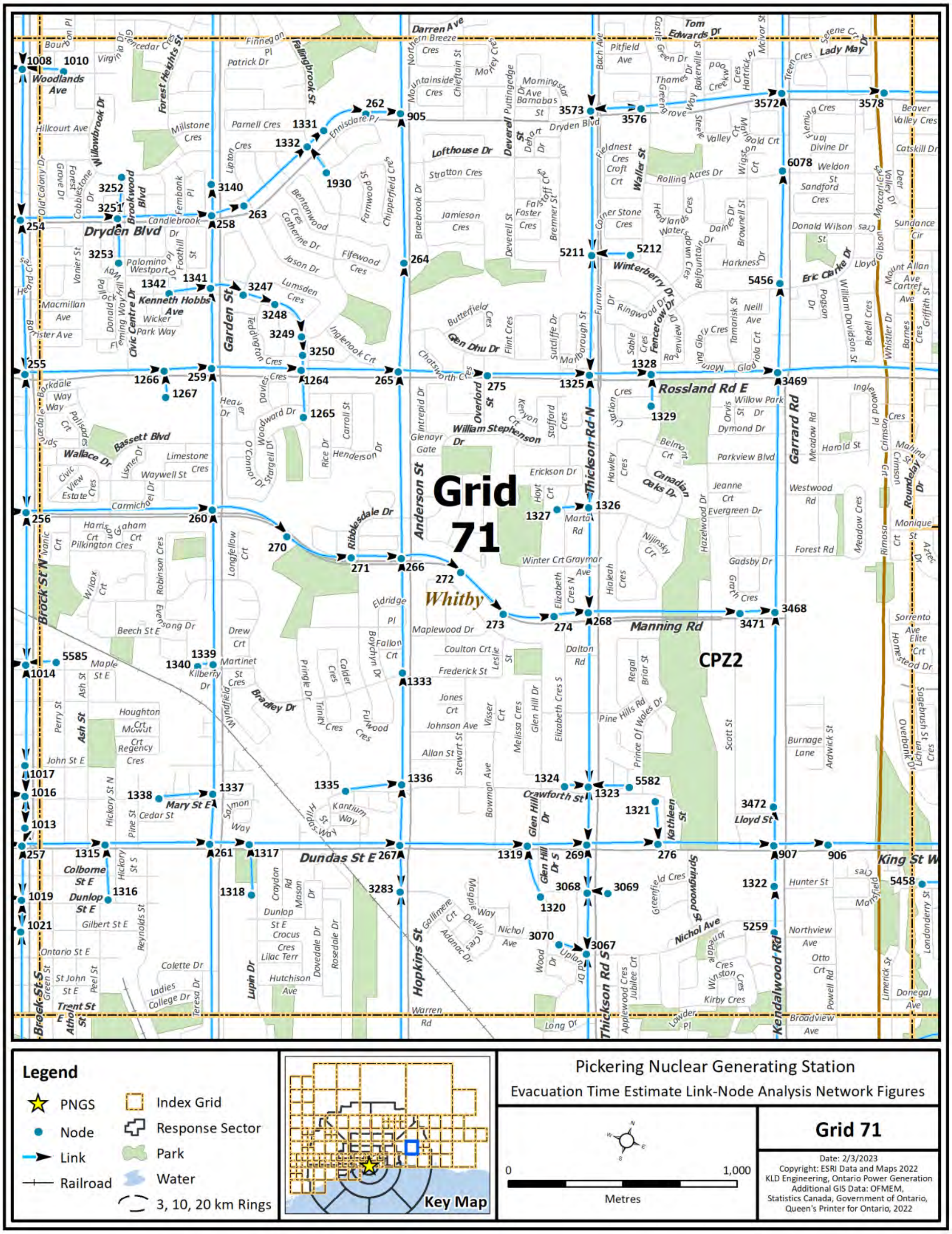


Figure K-72. Link-Node Analysis Network – Grid 71

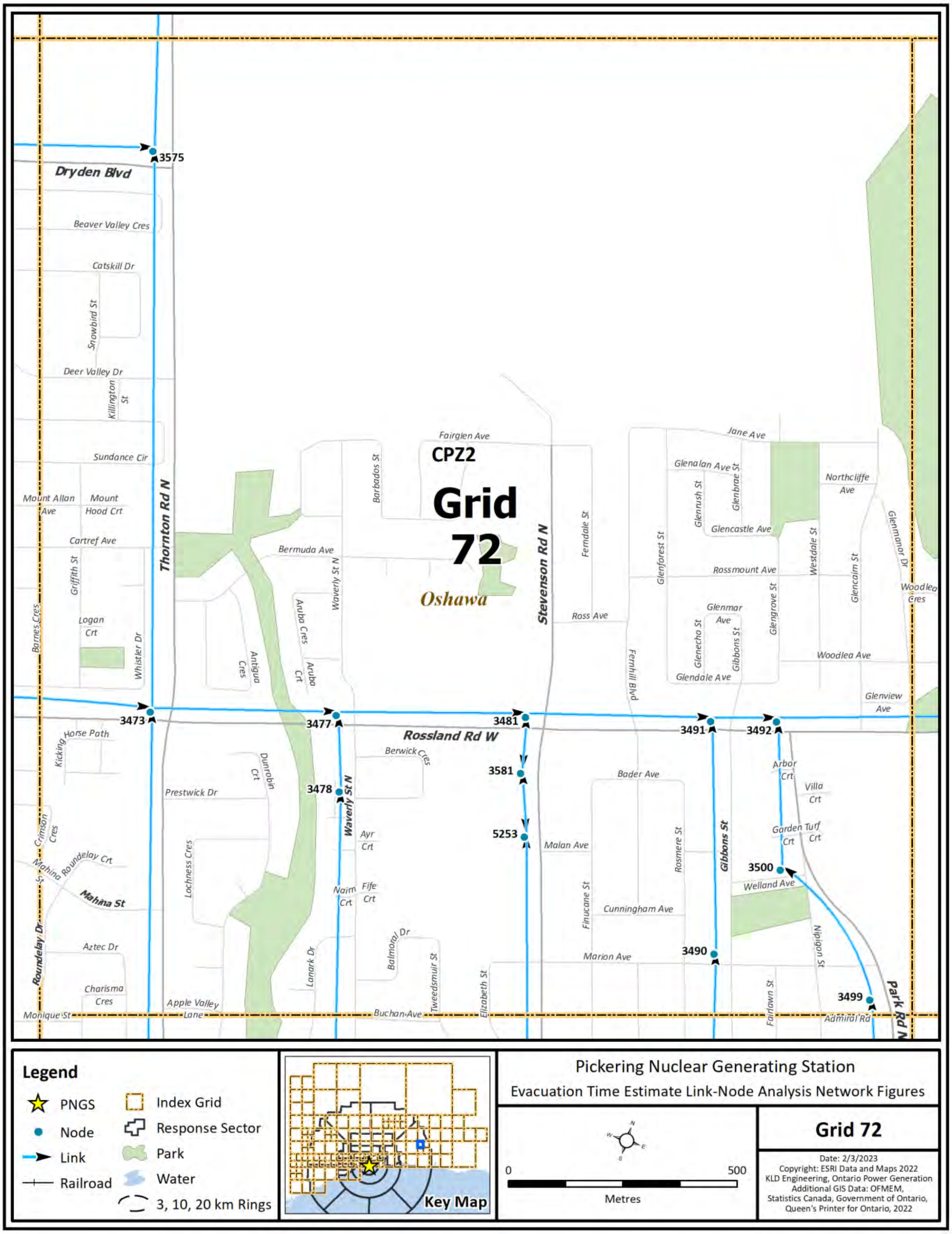


Figure K-73. Link-Node Analysis Network – Grid 72

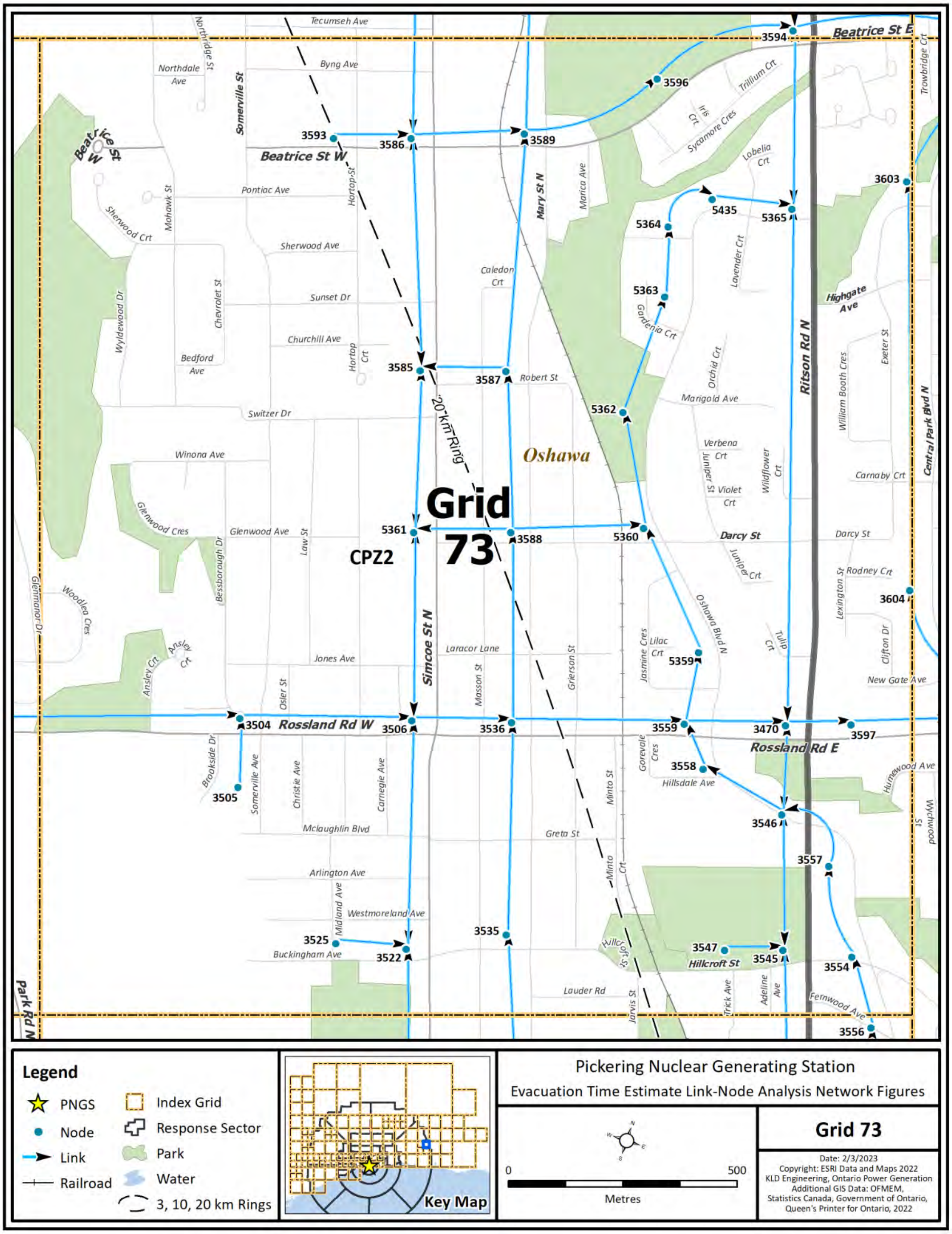


Figure K-74. Link-Node Analysis Network – Grid 73

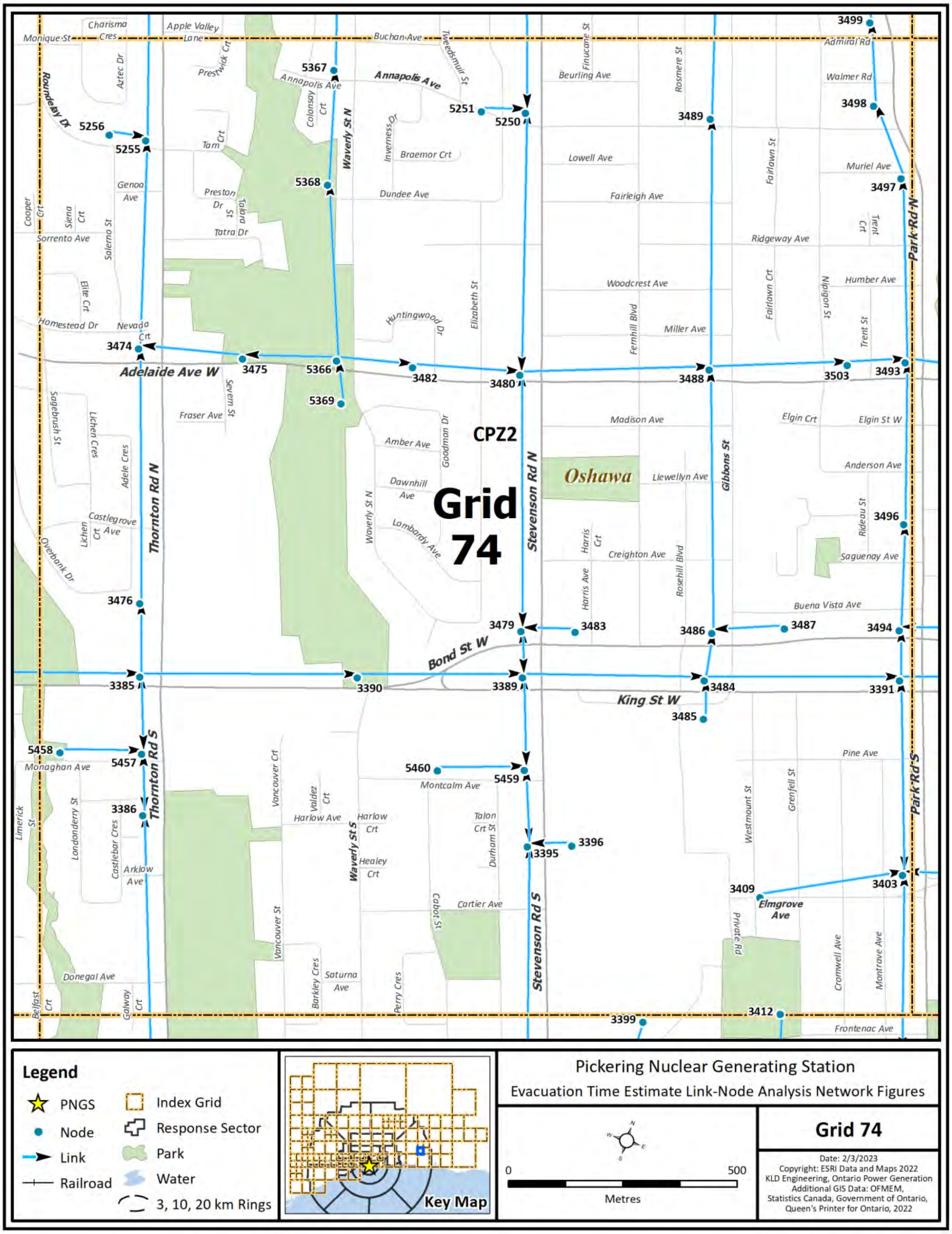


Figure K-75. Link-Node Analysis Network – Grid 74

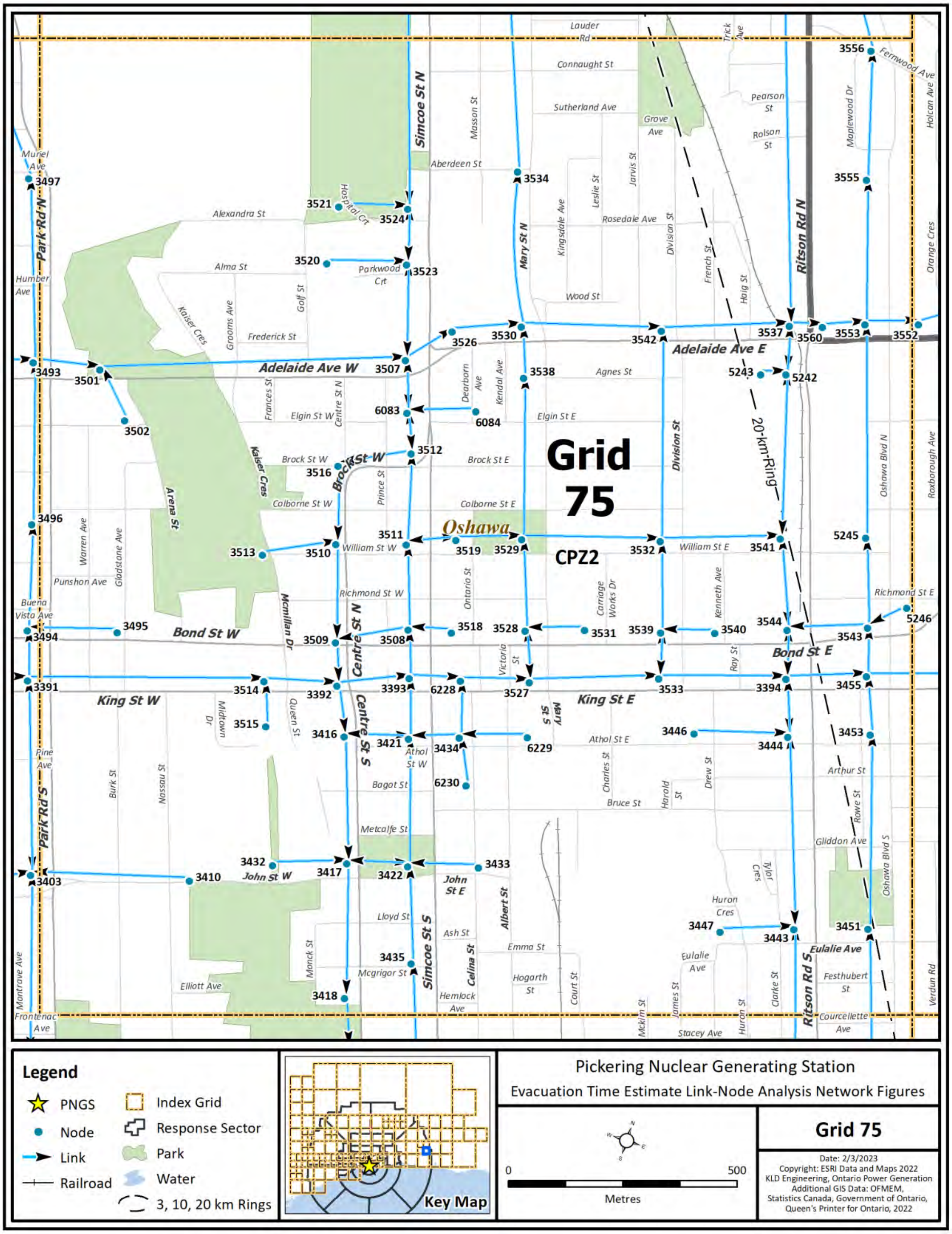


Figure K-76. Link-Node Analysis Network – Grid 75

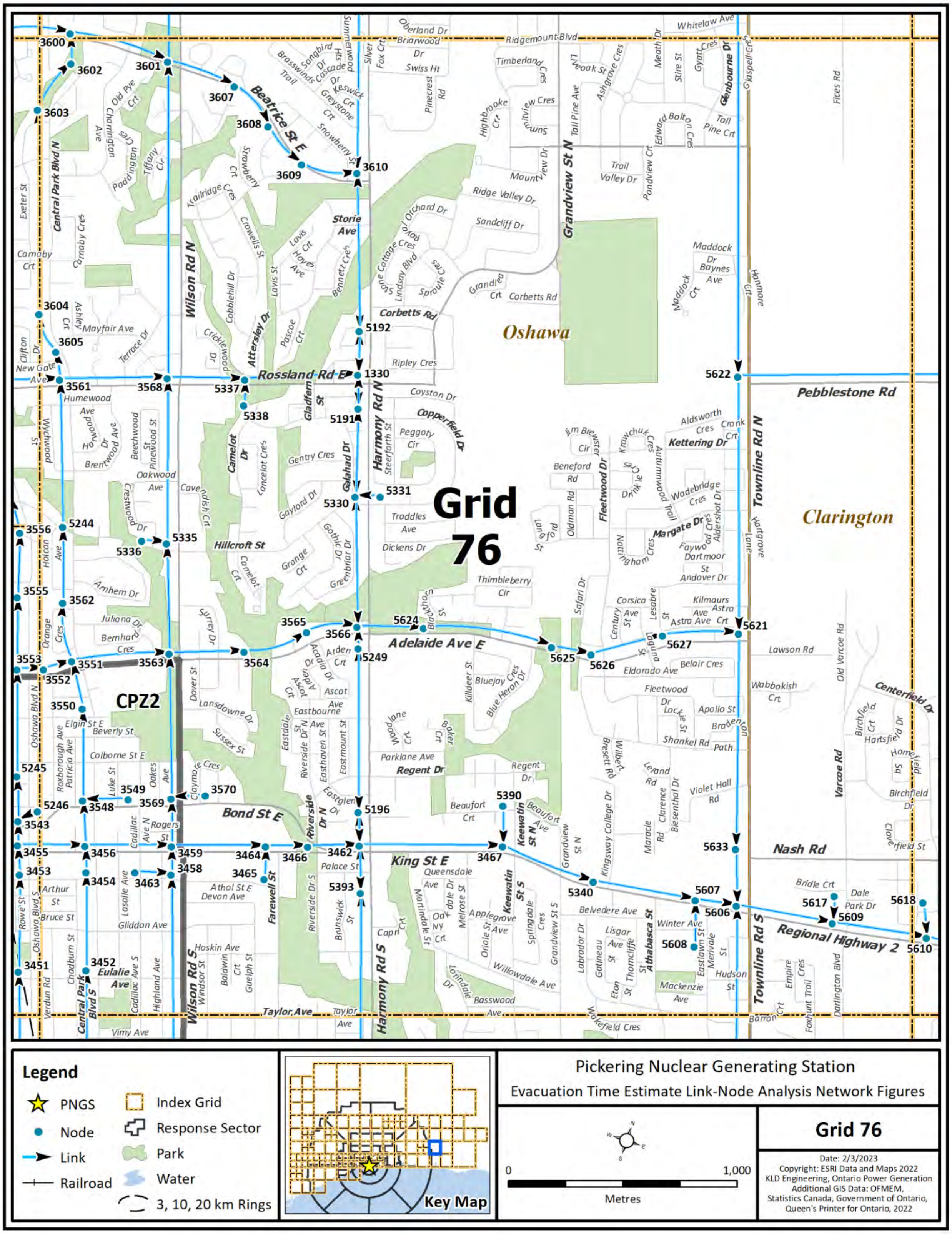


Figure K-77. Link-Node Analysis Network – Grid 76

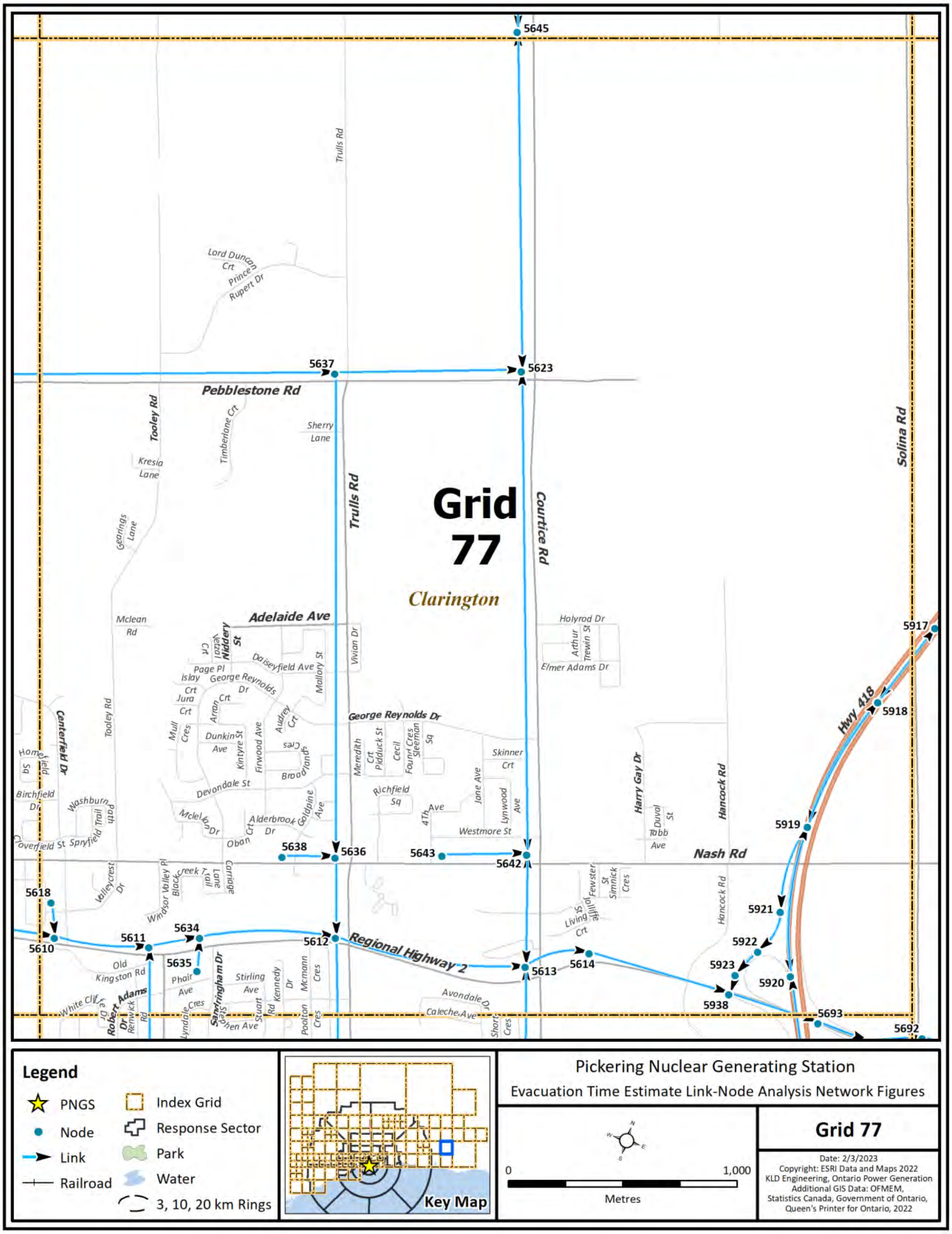


Figure K-78. Link-Node Analysis Network – Grid 77

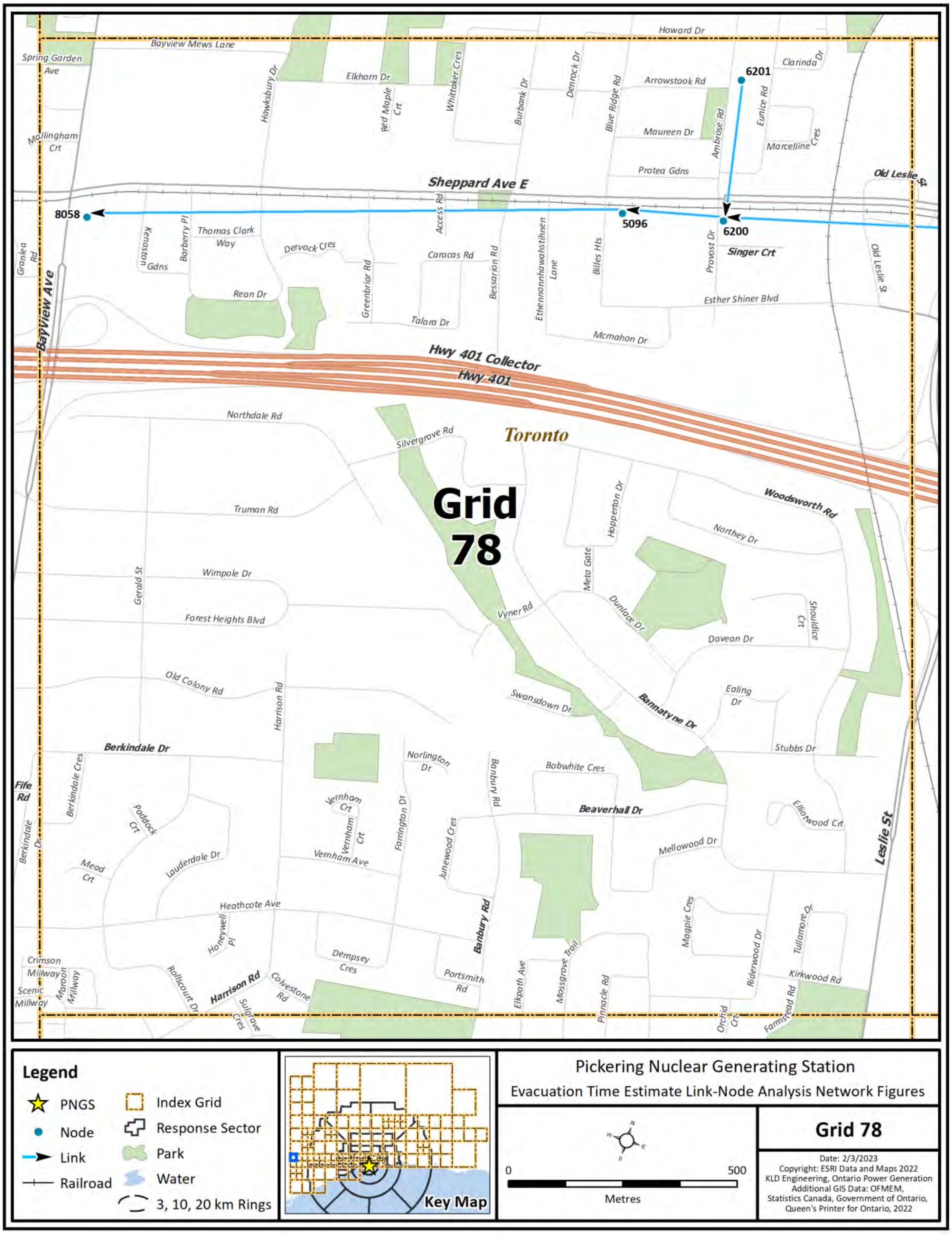


Figure K-79. Link-Node Analysis Network – Grid 78

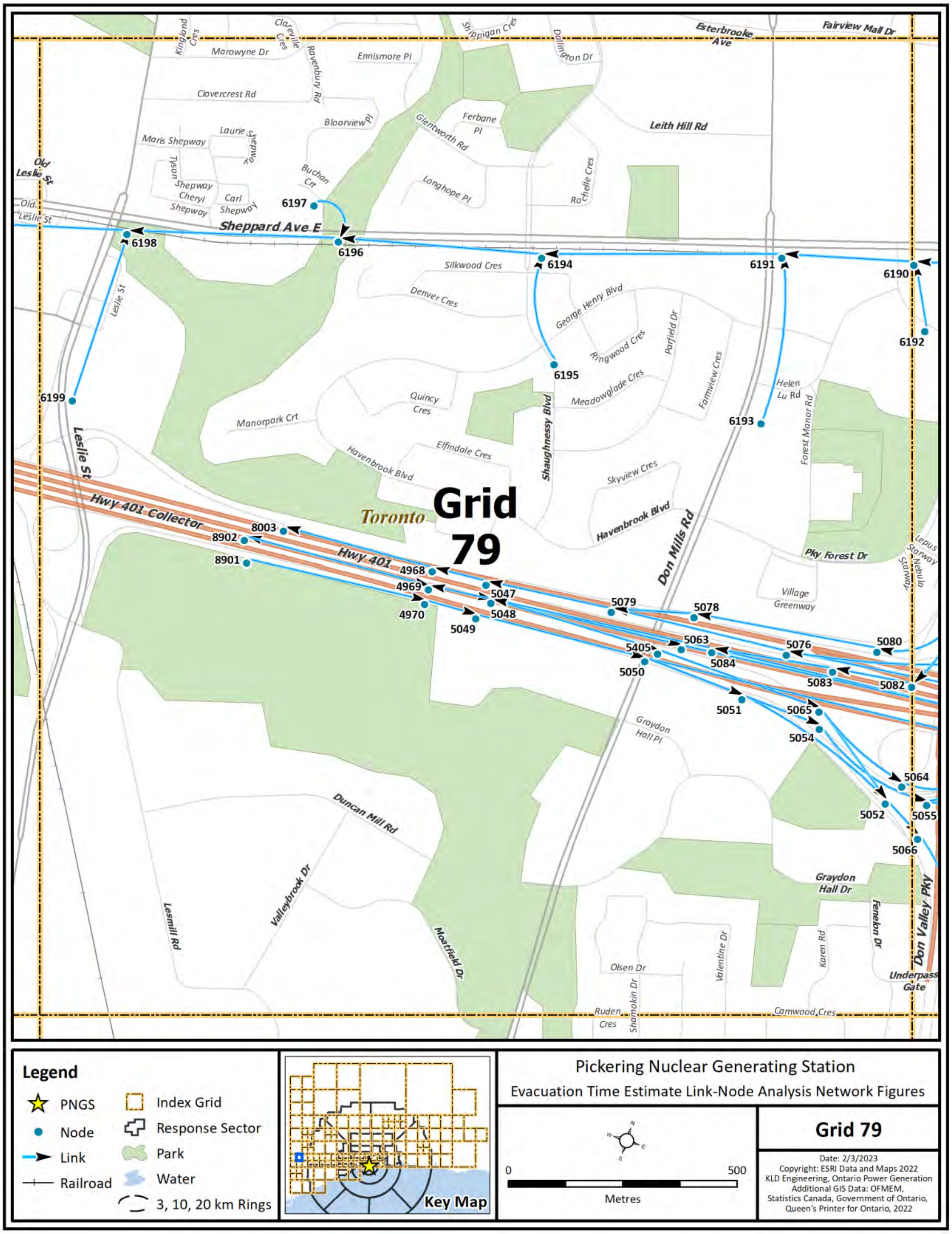


Figure K-80. Link-Node Analysis Network – Grid 79

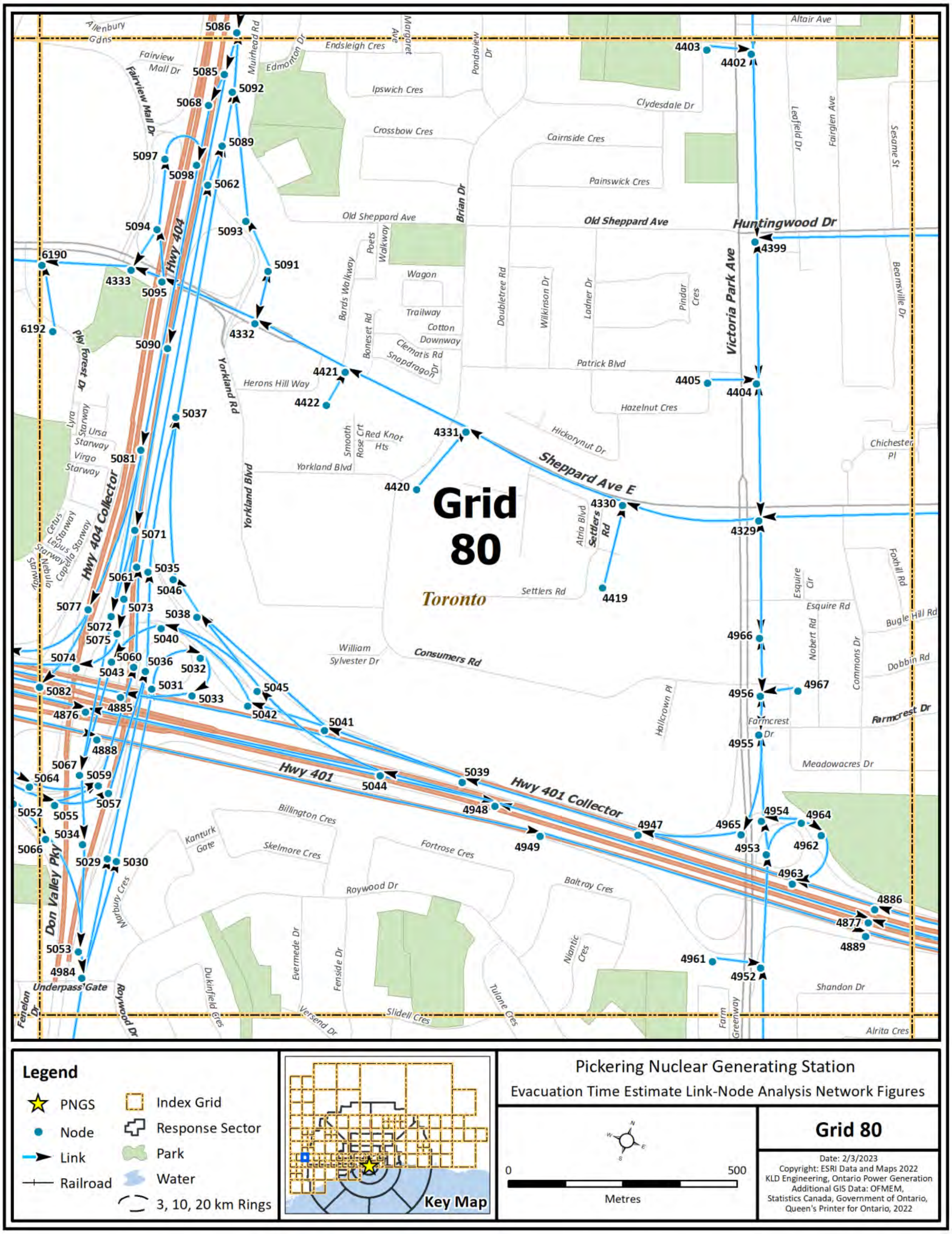


Figure K-81. Link-Node Analysis Network – Grid 80

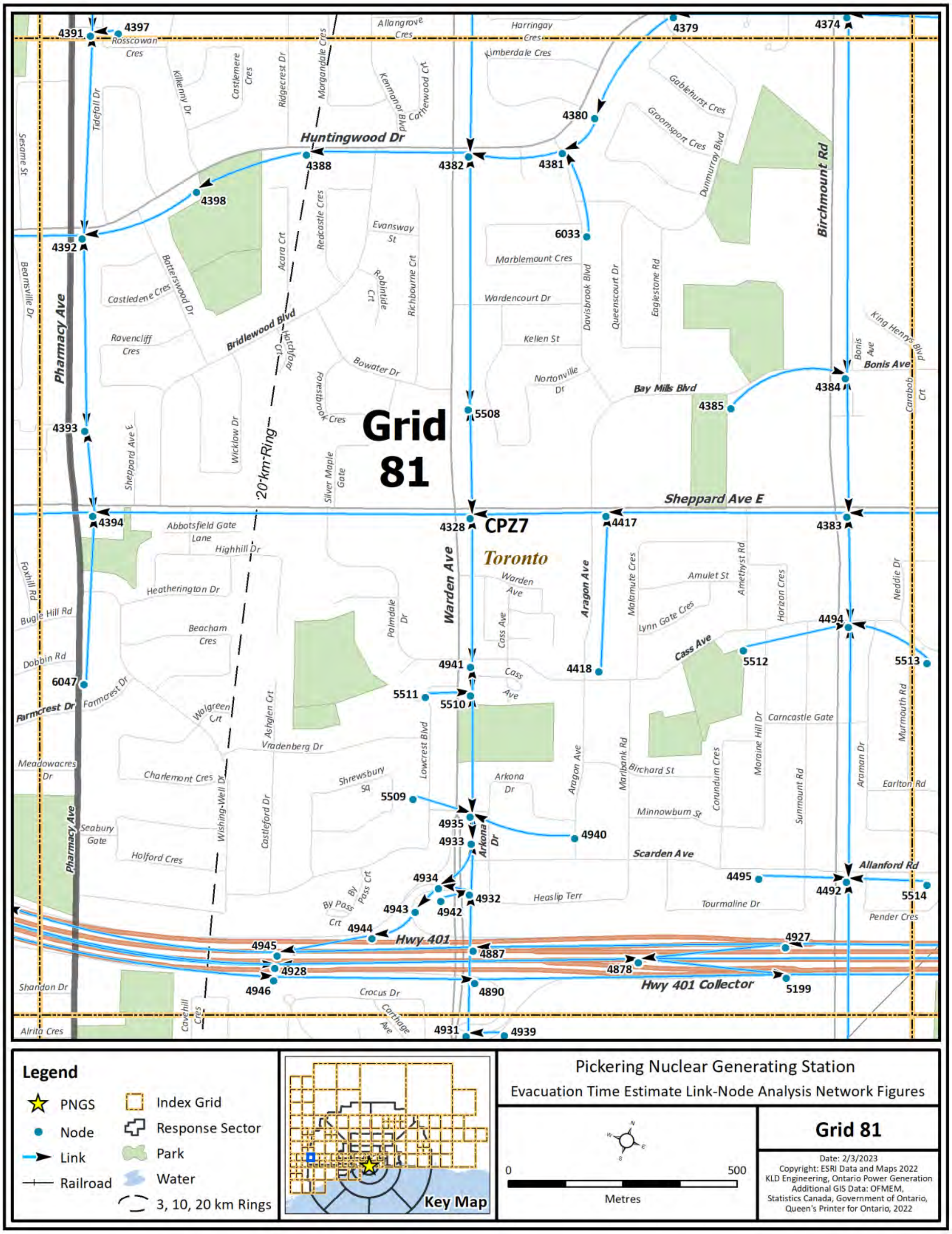


Figure K-82. Link-Node Analysis Network – Grid 81

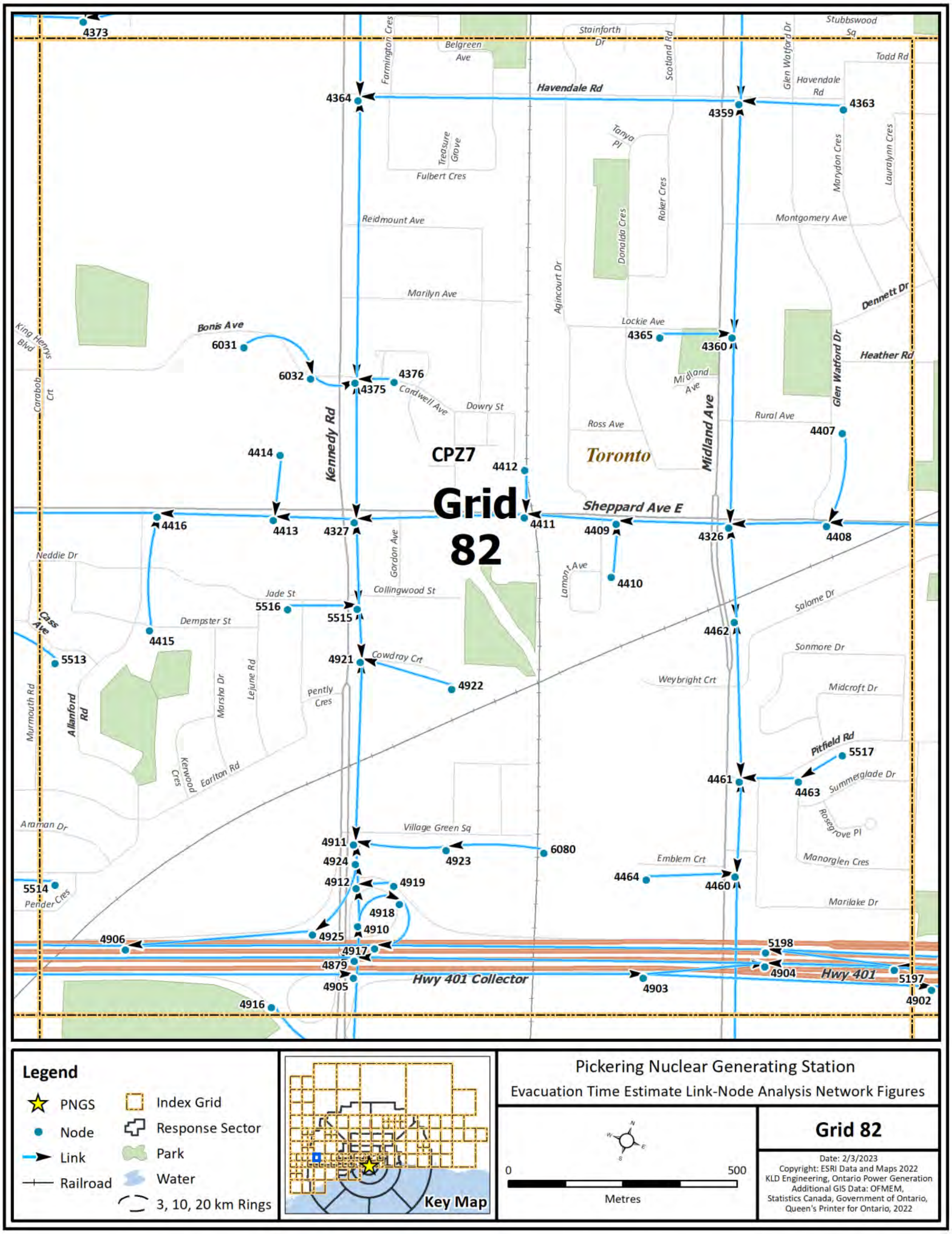


Figure K-83. Link-Node Analysis Network – Grid 82

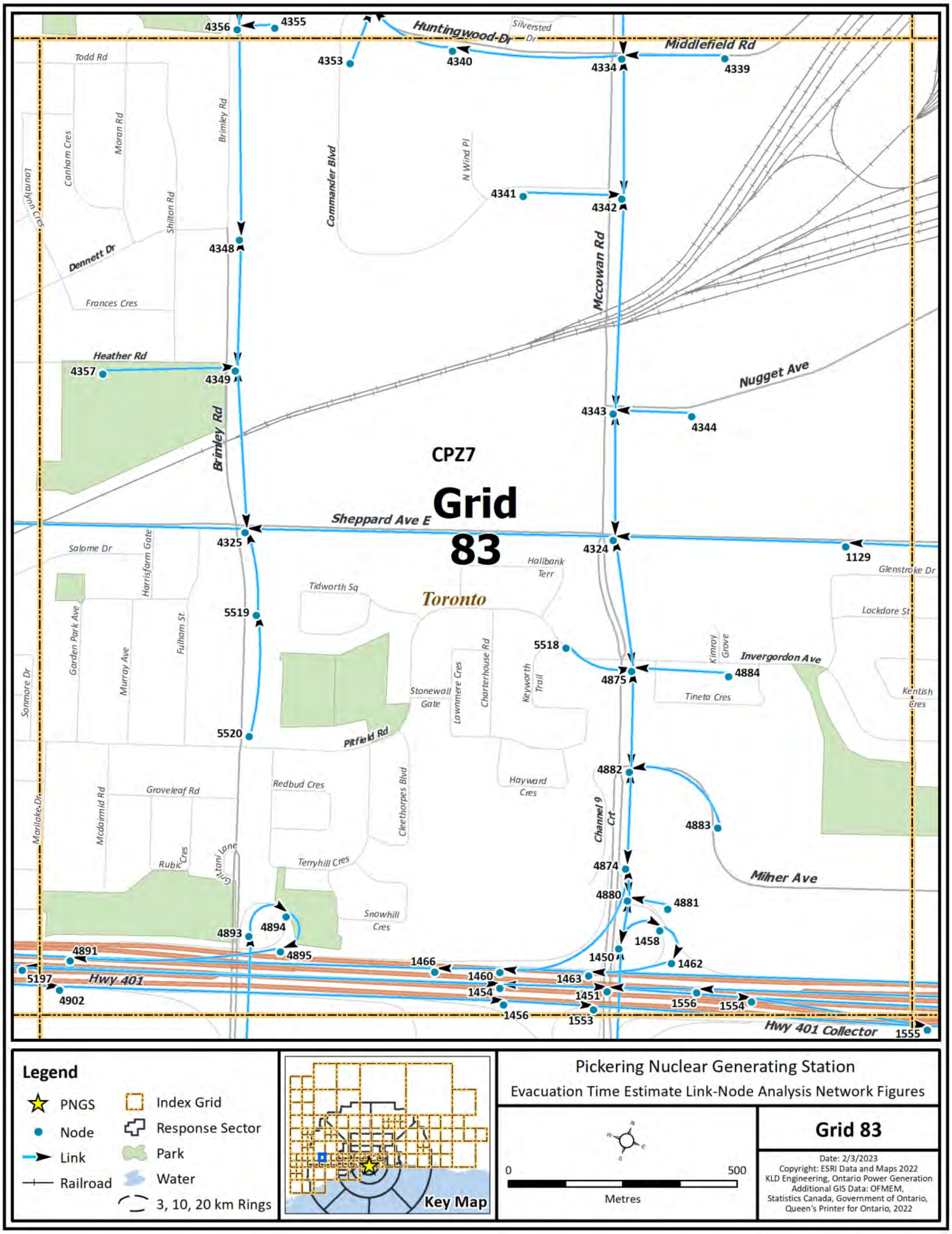


Figure K-84. Link-Node Analysis Network – Grid 83

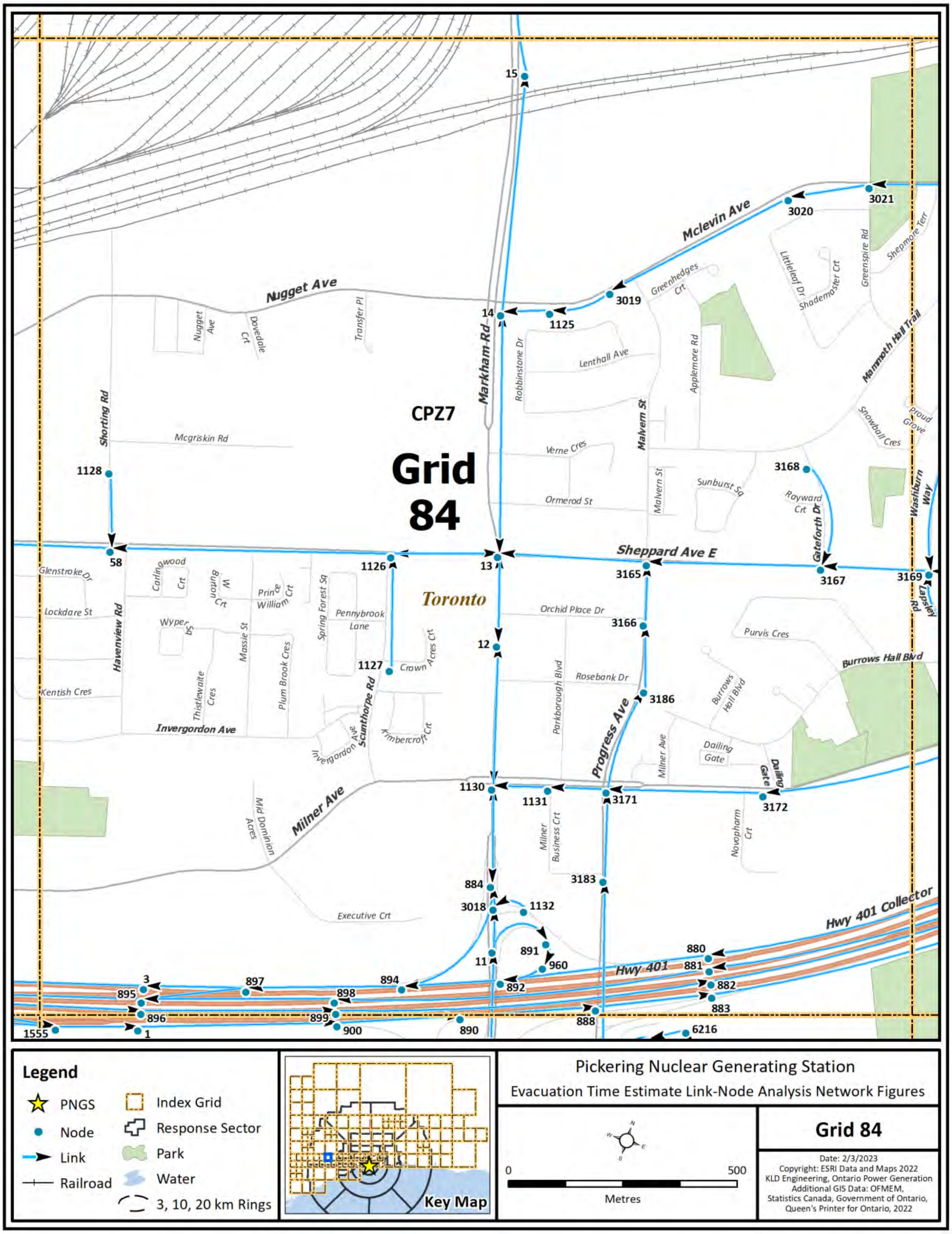


Figure K-85. Link-Node Analysis Network – Grid 84

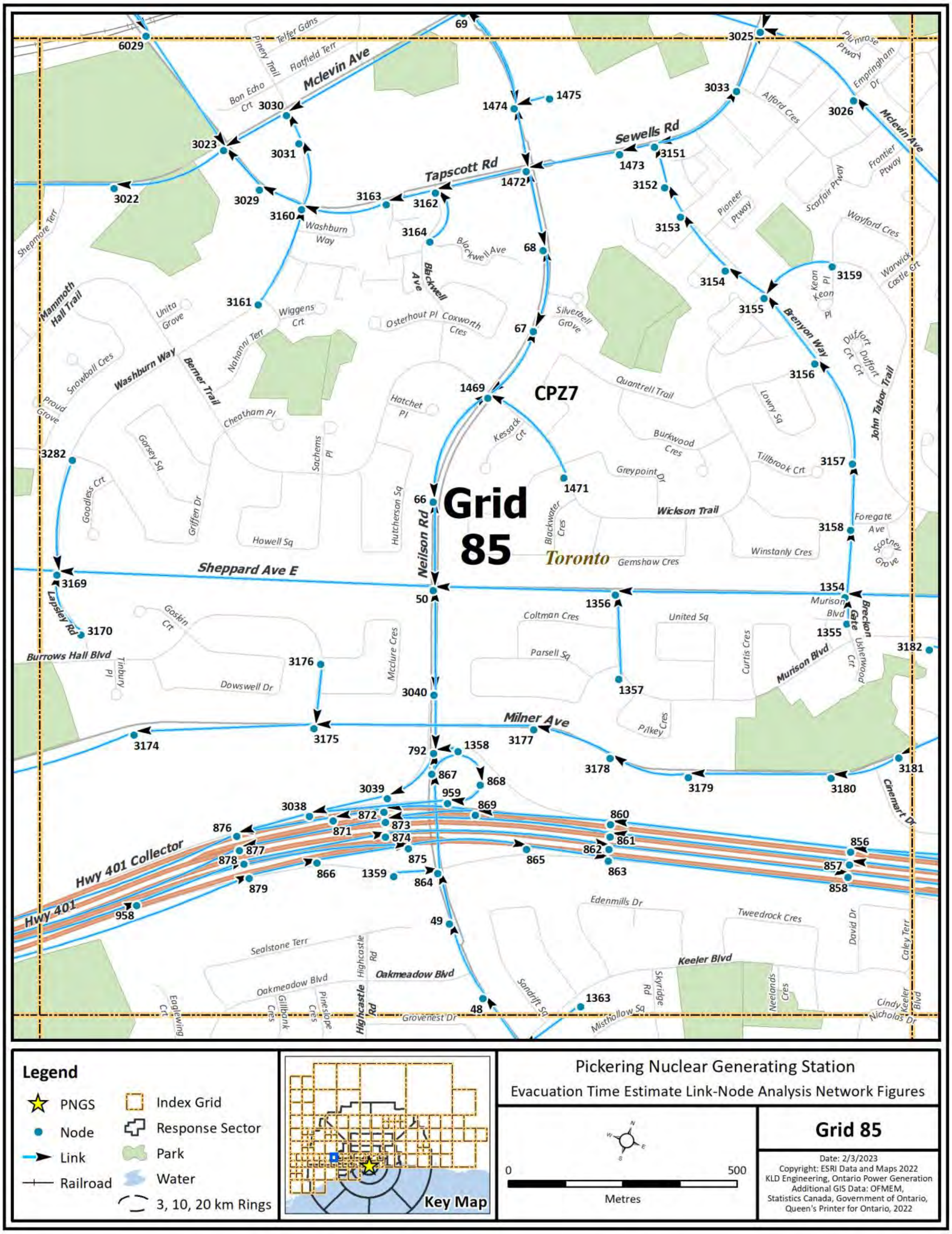


Figure K-86. Link-Node Analysis Network – Grid 85

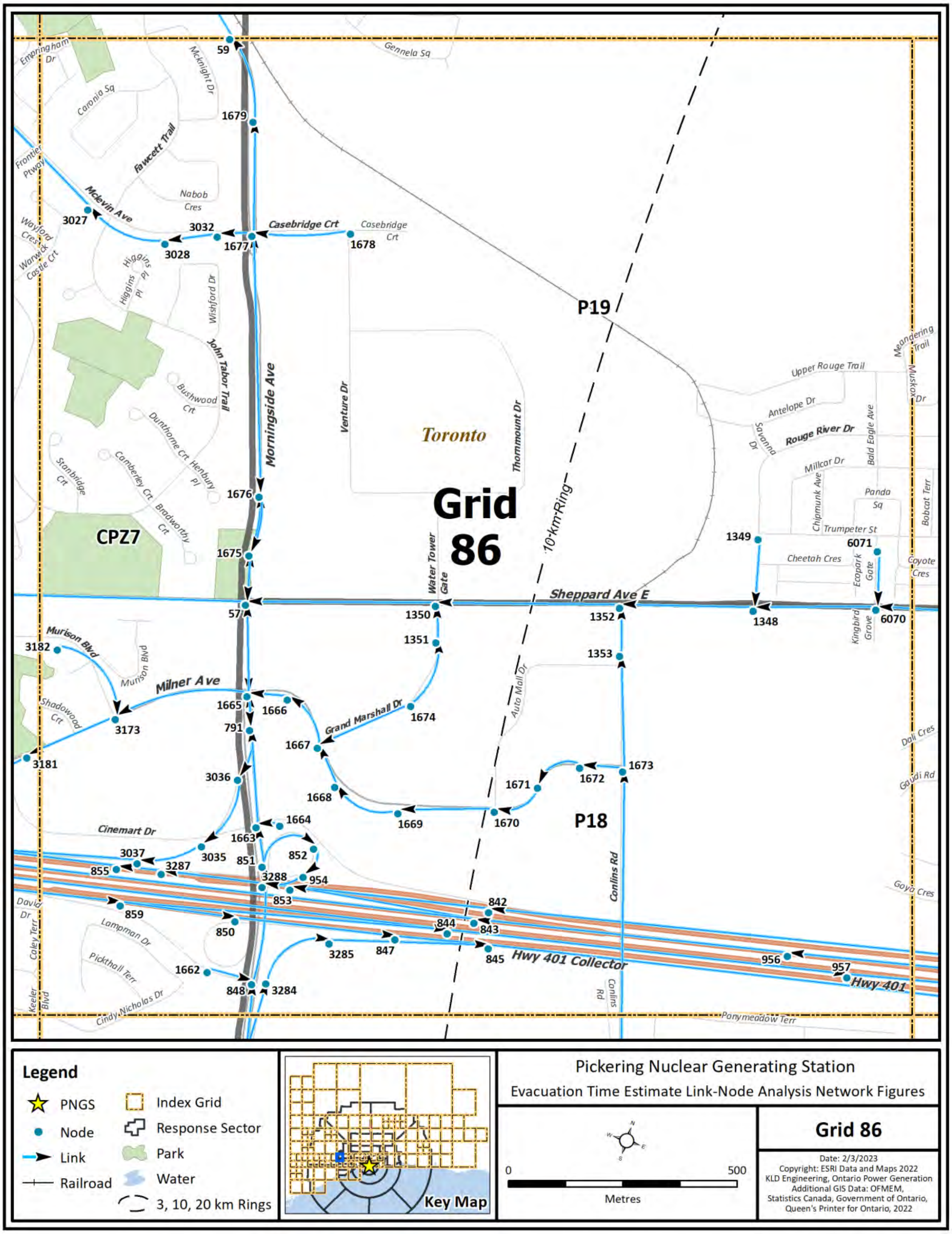


Figure K-87. Link-Node Analysis Network – Grid 86

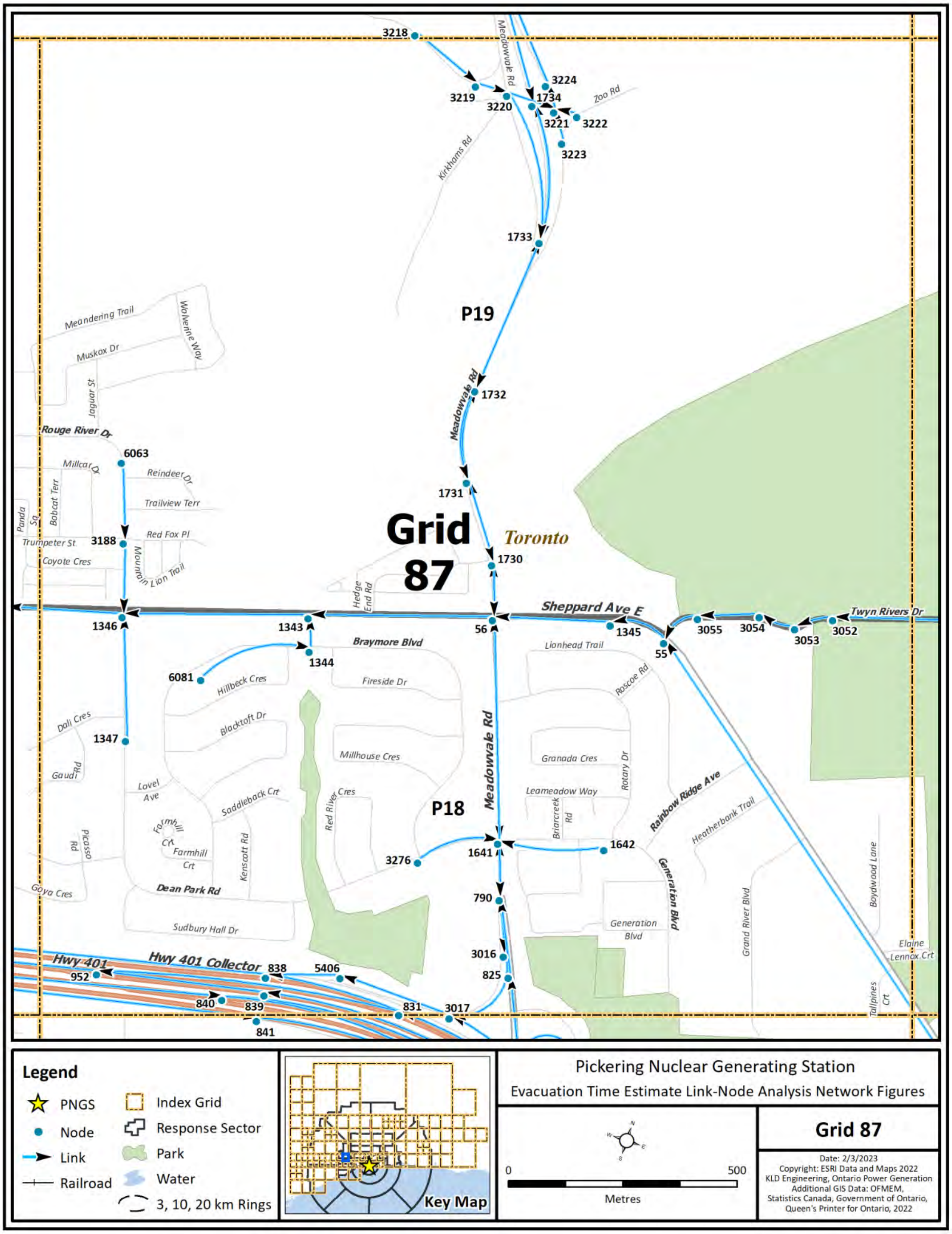


Figure K-88. Link-Node Analysis Network – Grid 87

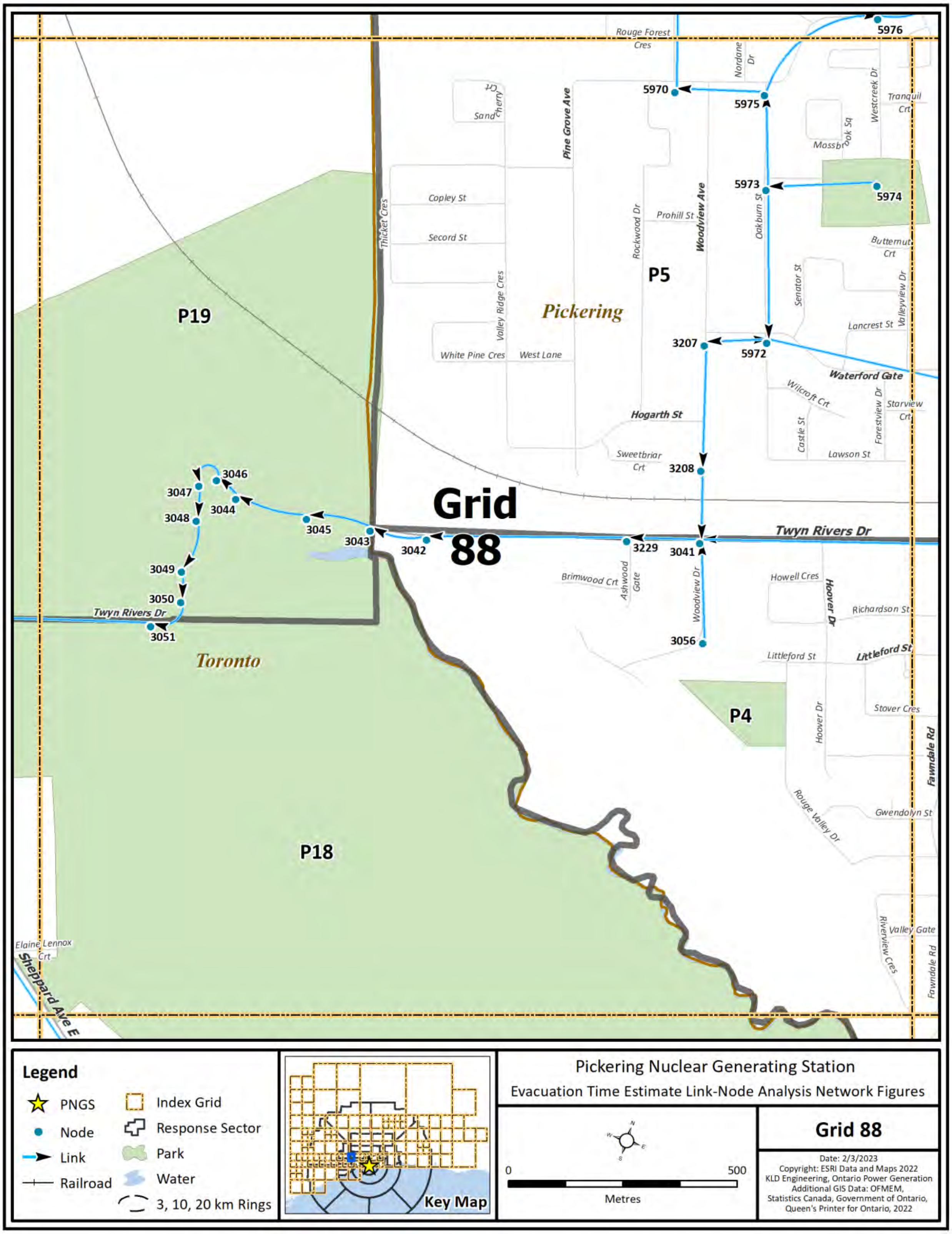


Figure K-89. Link-Node Analysis Network – Grid 88

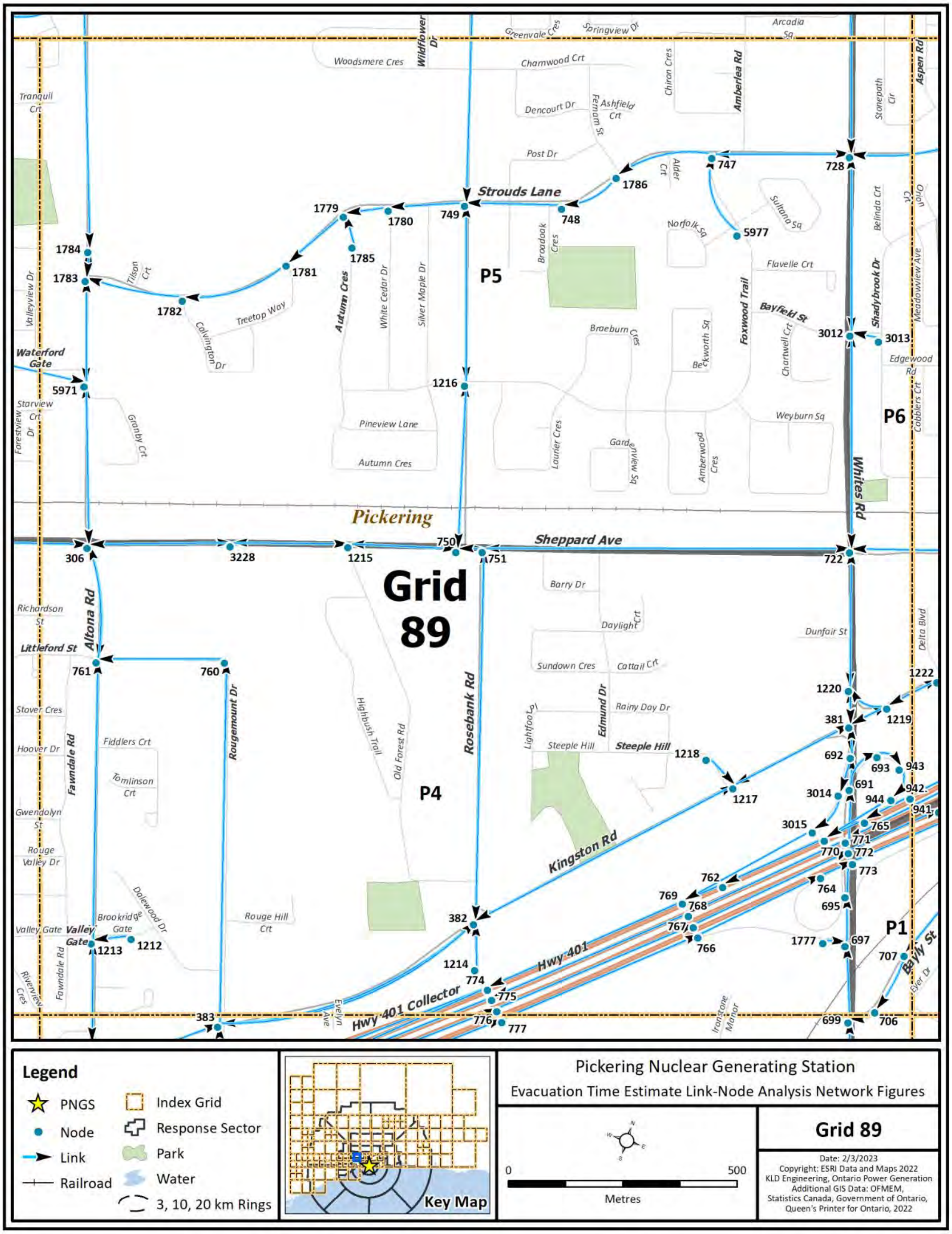


Figure K-90. Link-Node Analysis Network – Grid 89

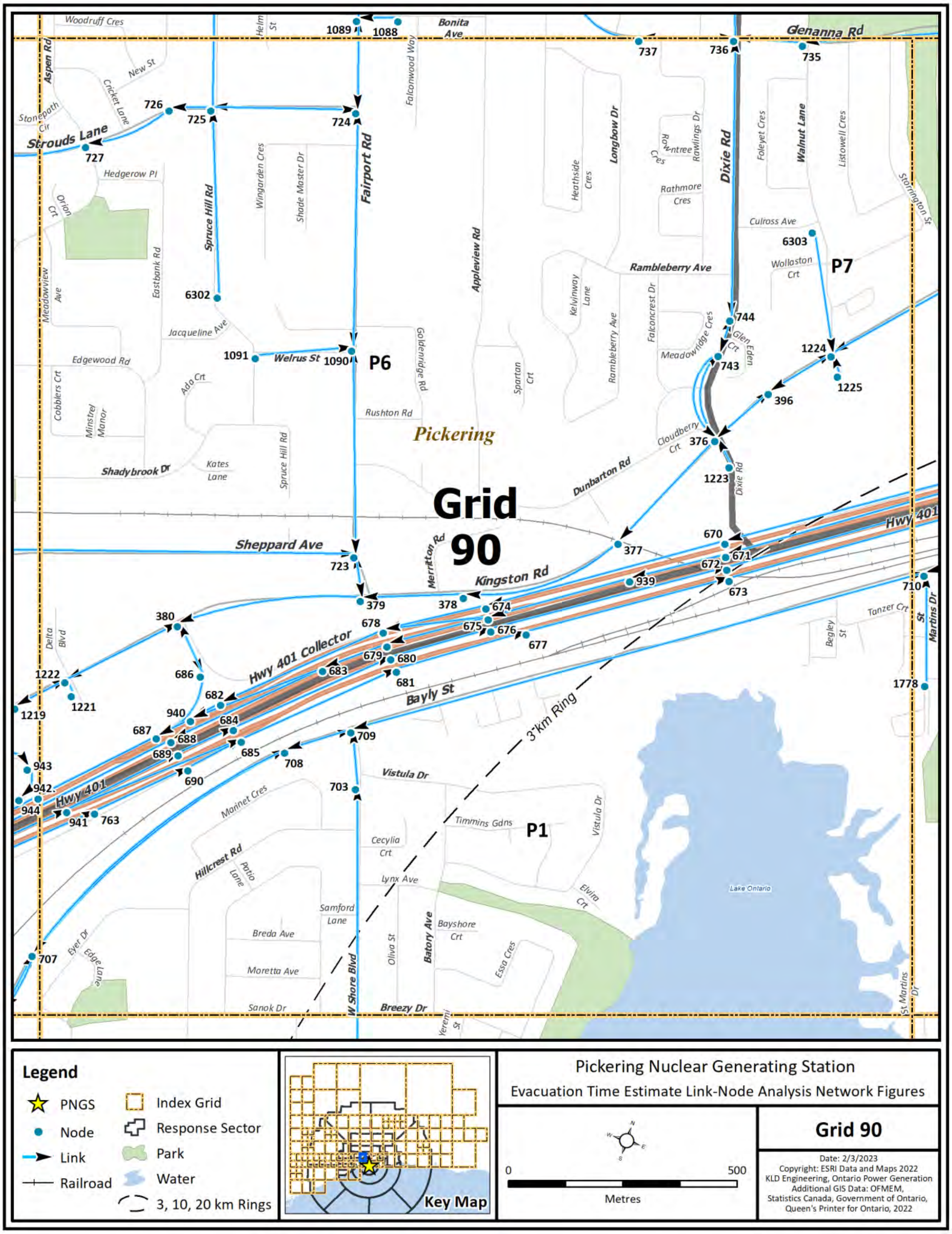


Figure K-91. Link-Node Analysis Network – Grid 90

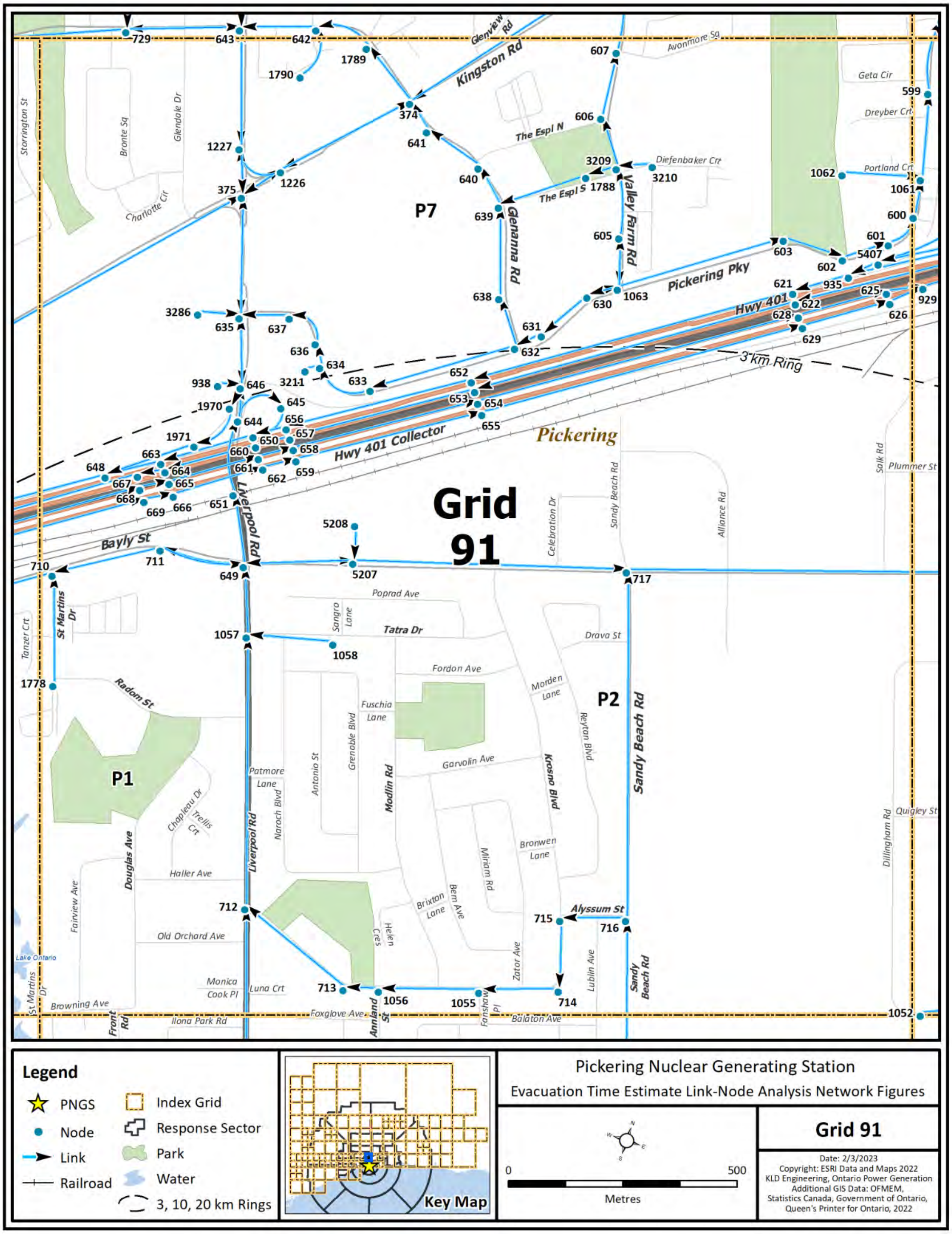


Figure K-92. Link-Node Analysis Network – Grid 91

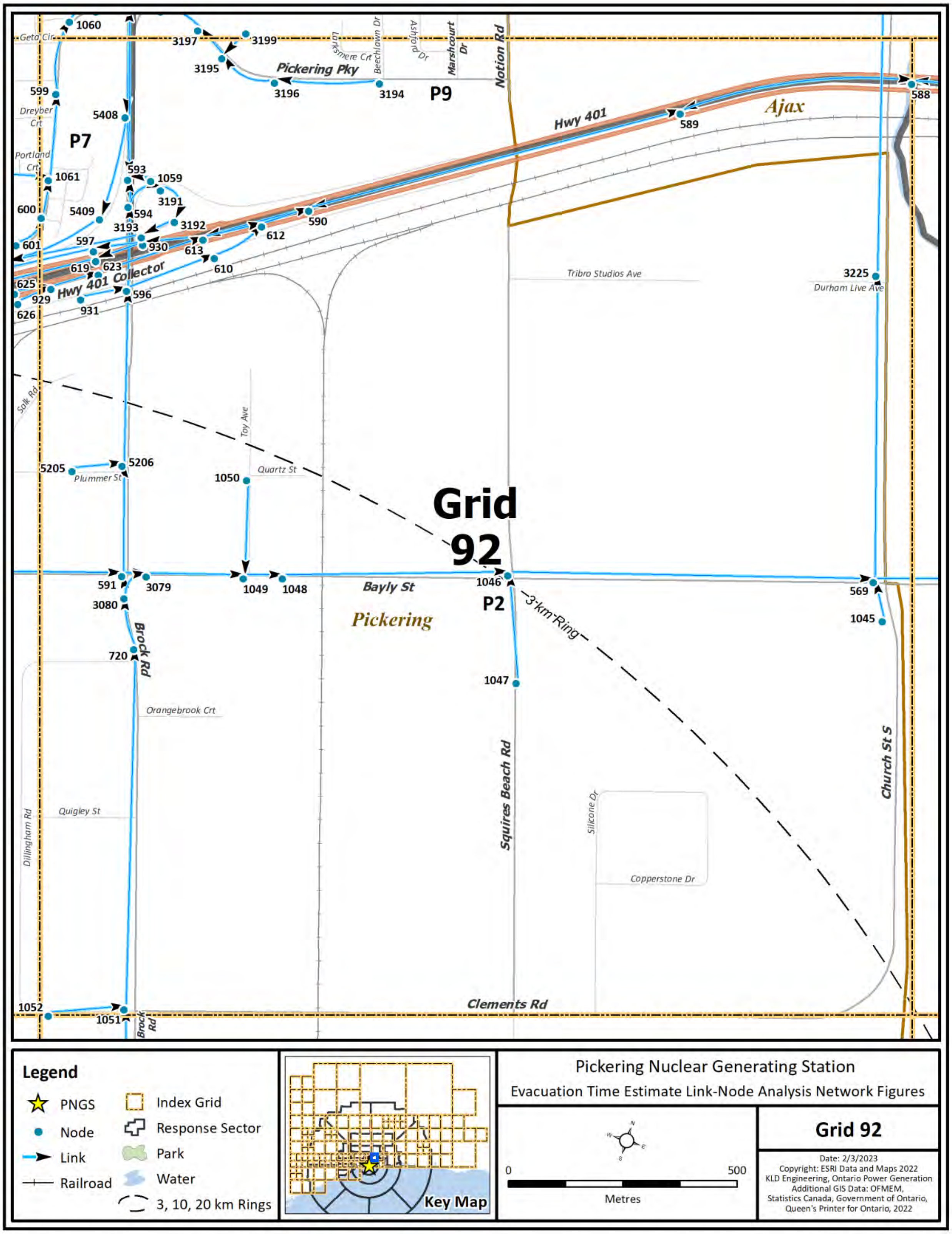


Figure K-93. Link-Node Analysis Network – Grid 92

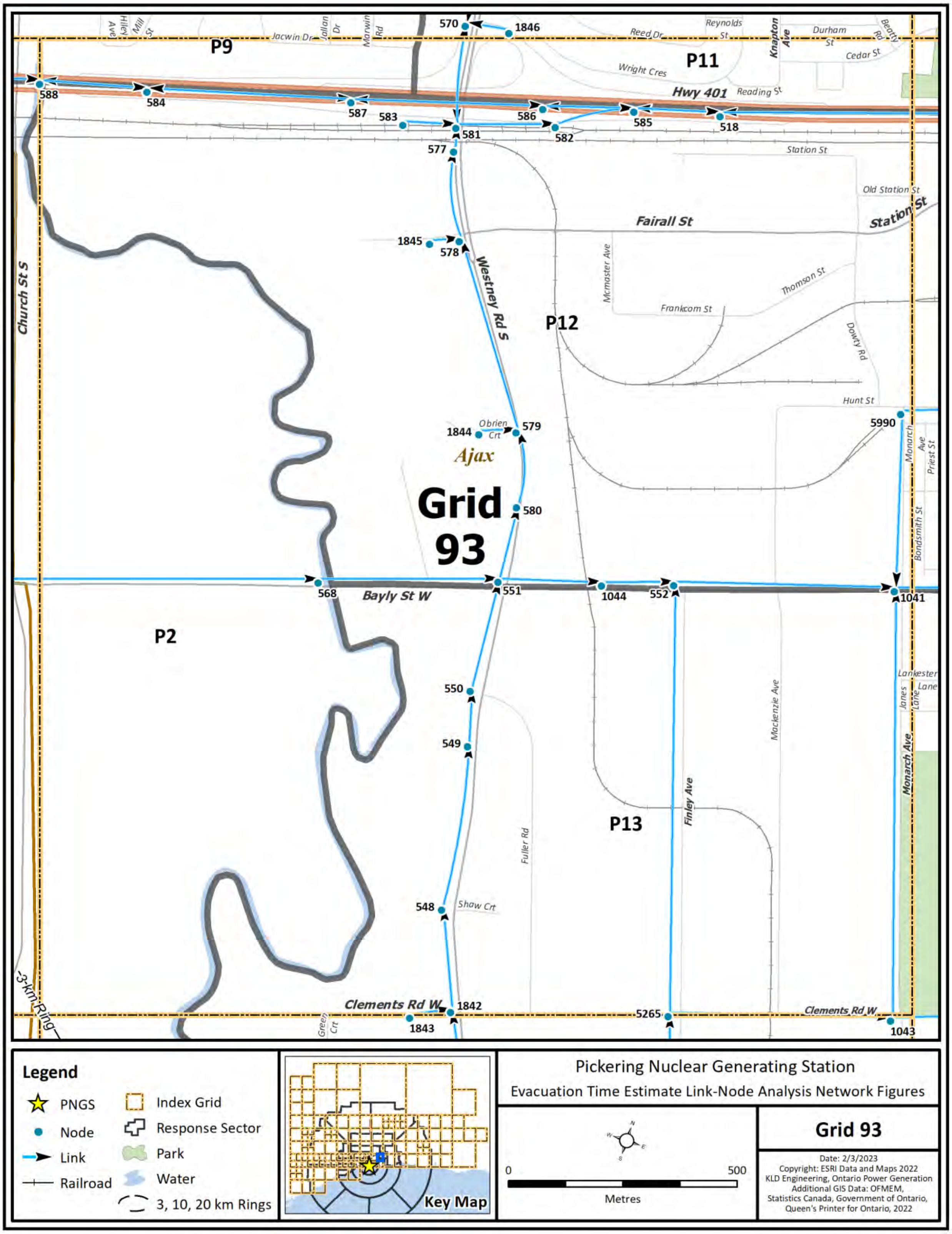


Figure K-94. Link-Node Analysis Network – Grid 93

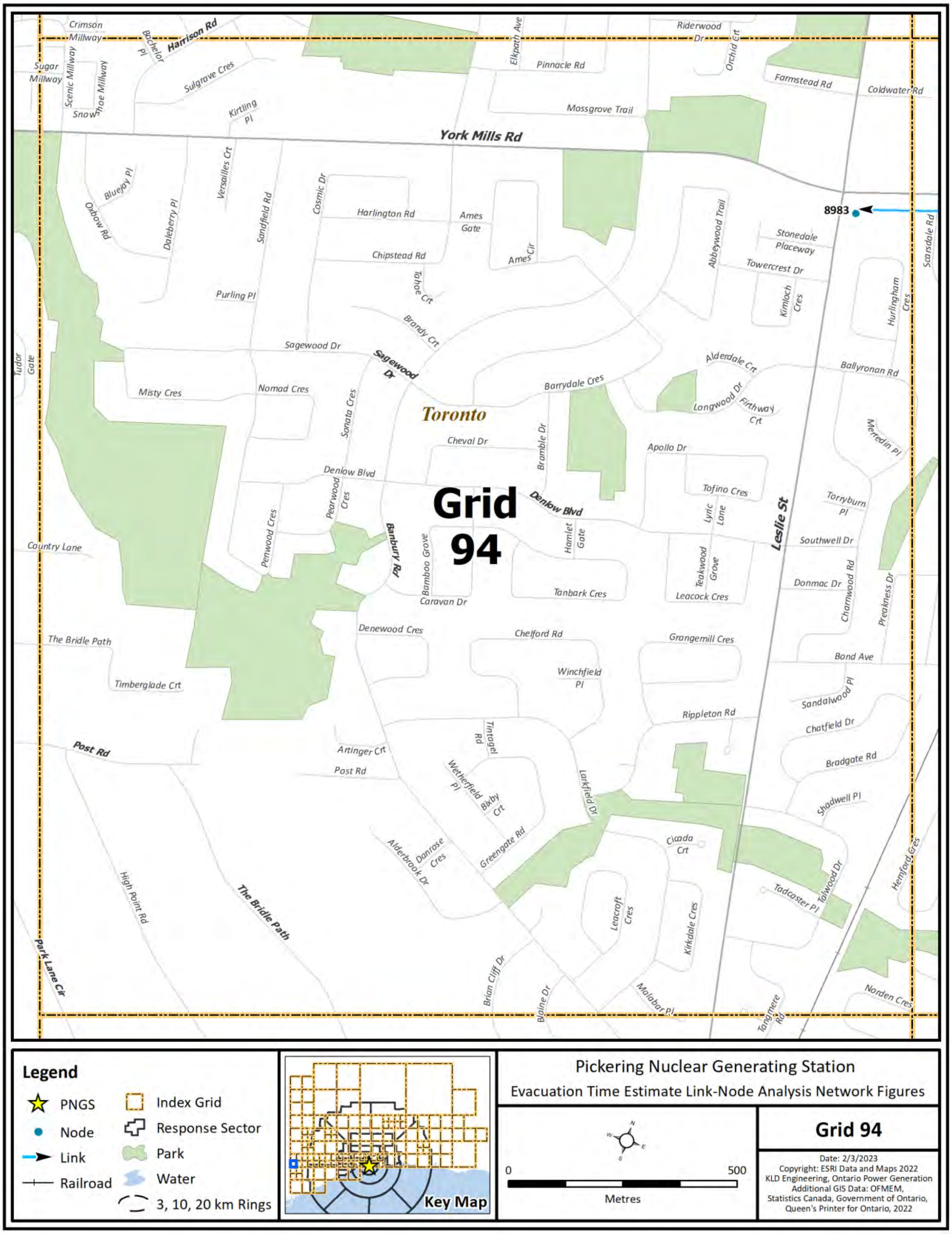


Figure K-95. Link-Node Analysis Network – Grid 94

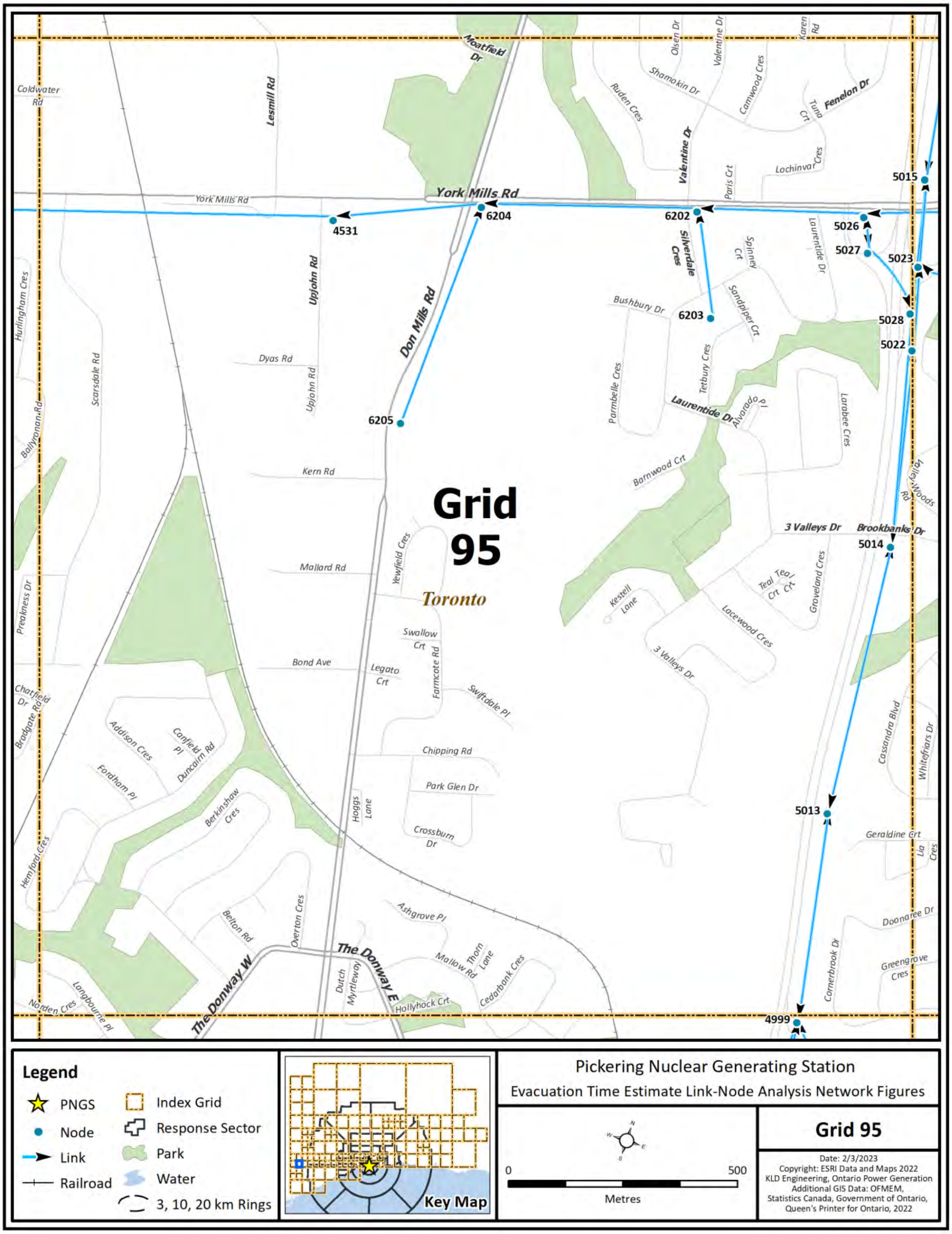


Figure K-96. Link-Node Analysis Network – Grid 95

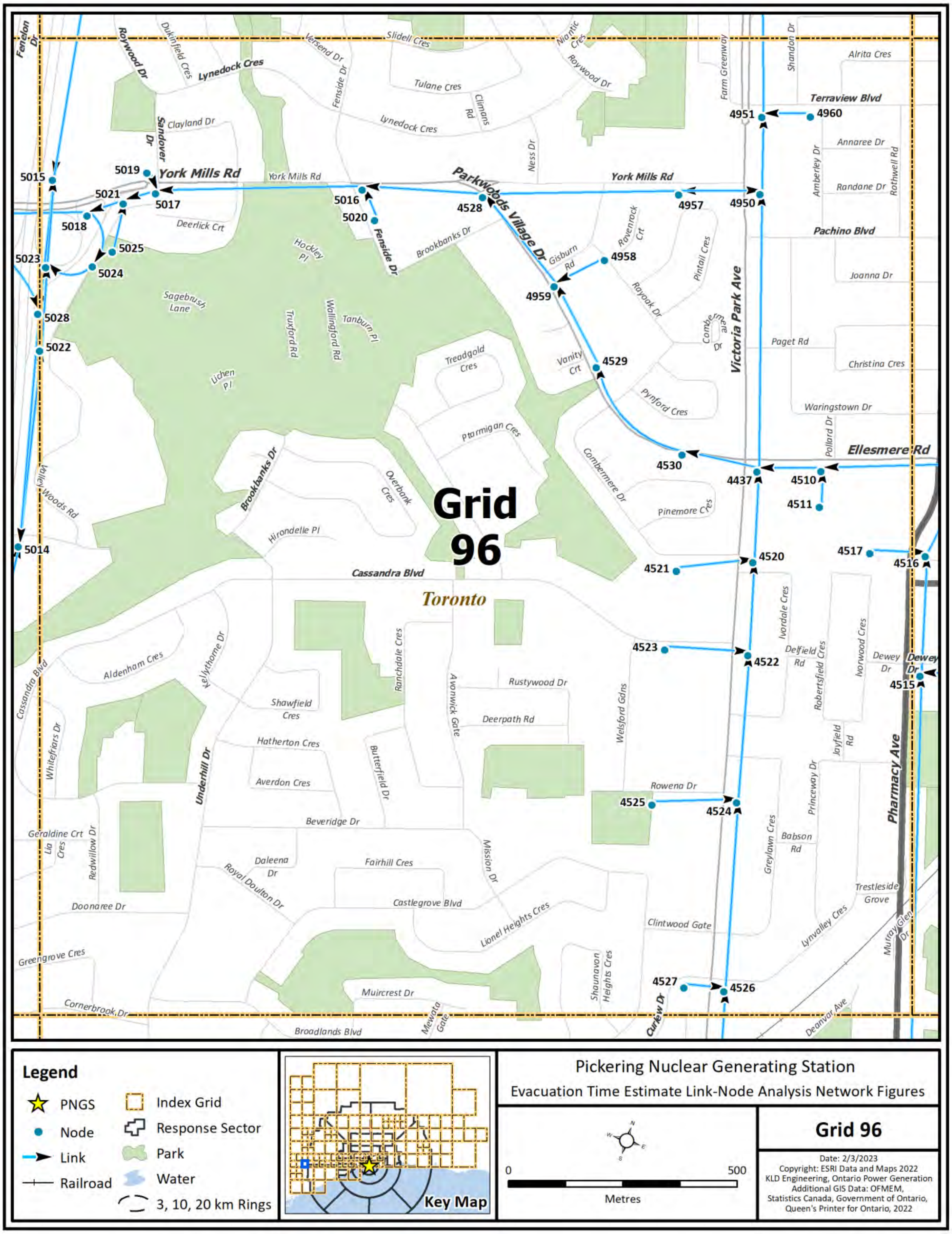


Figure K-97. Link-Node Analysis Network – Grid 96

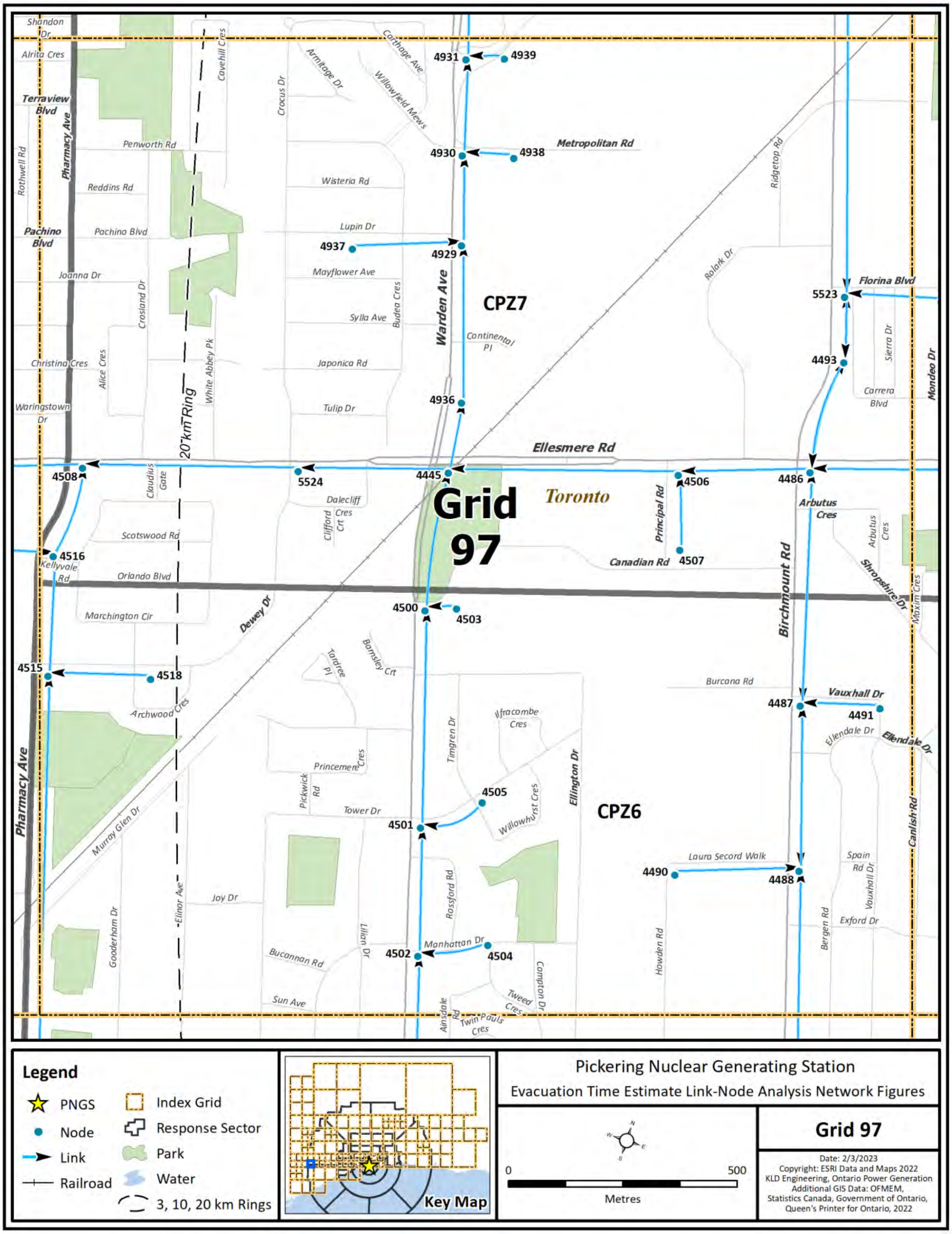


Figure K-98. Link-Node Analysis Network – Grid 97

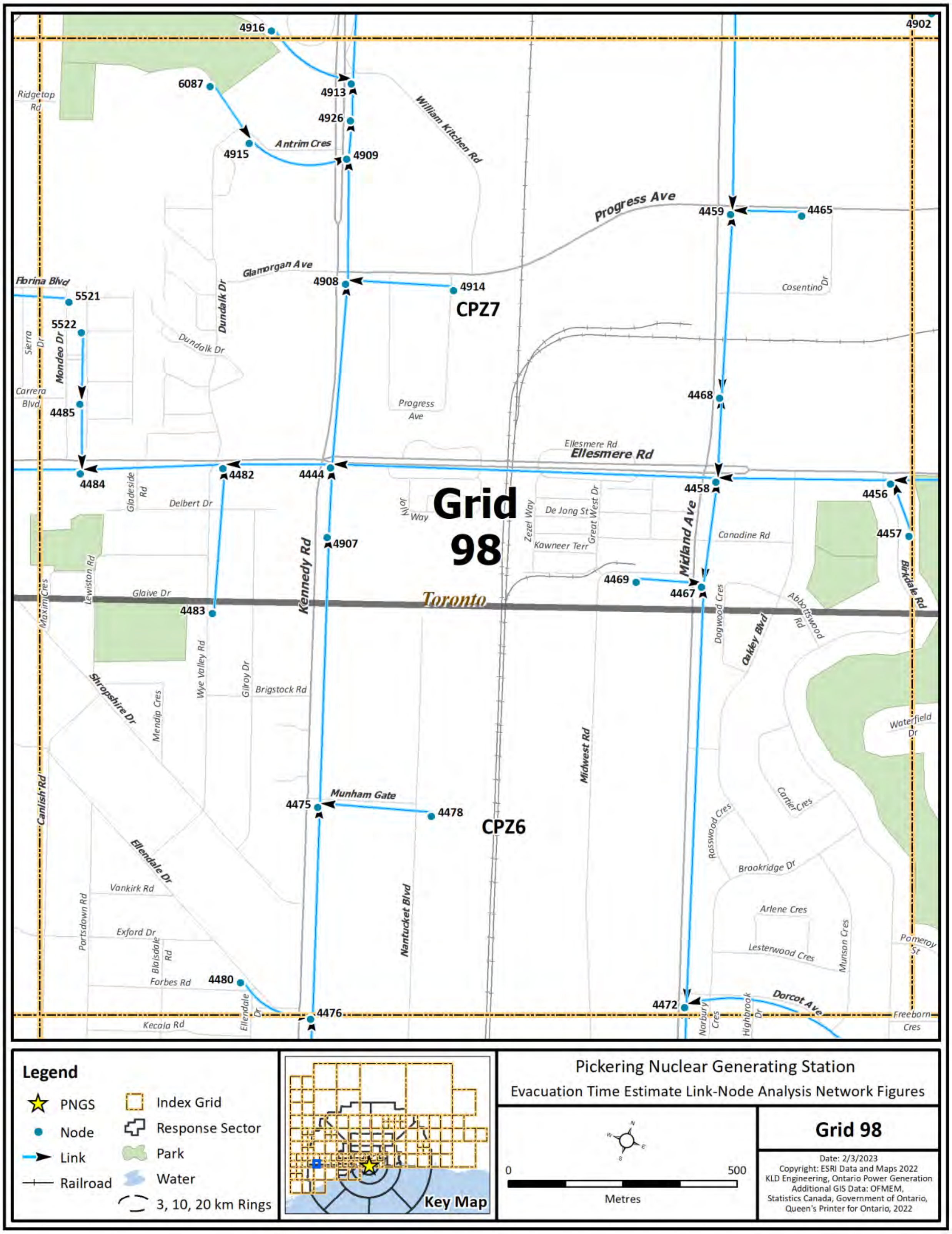


Figure K-99. Link-Node Analysis Network – Grid 98

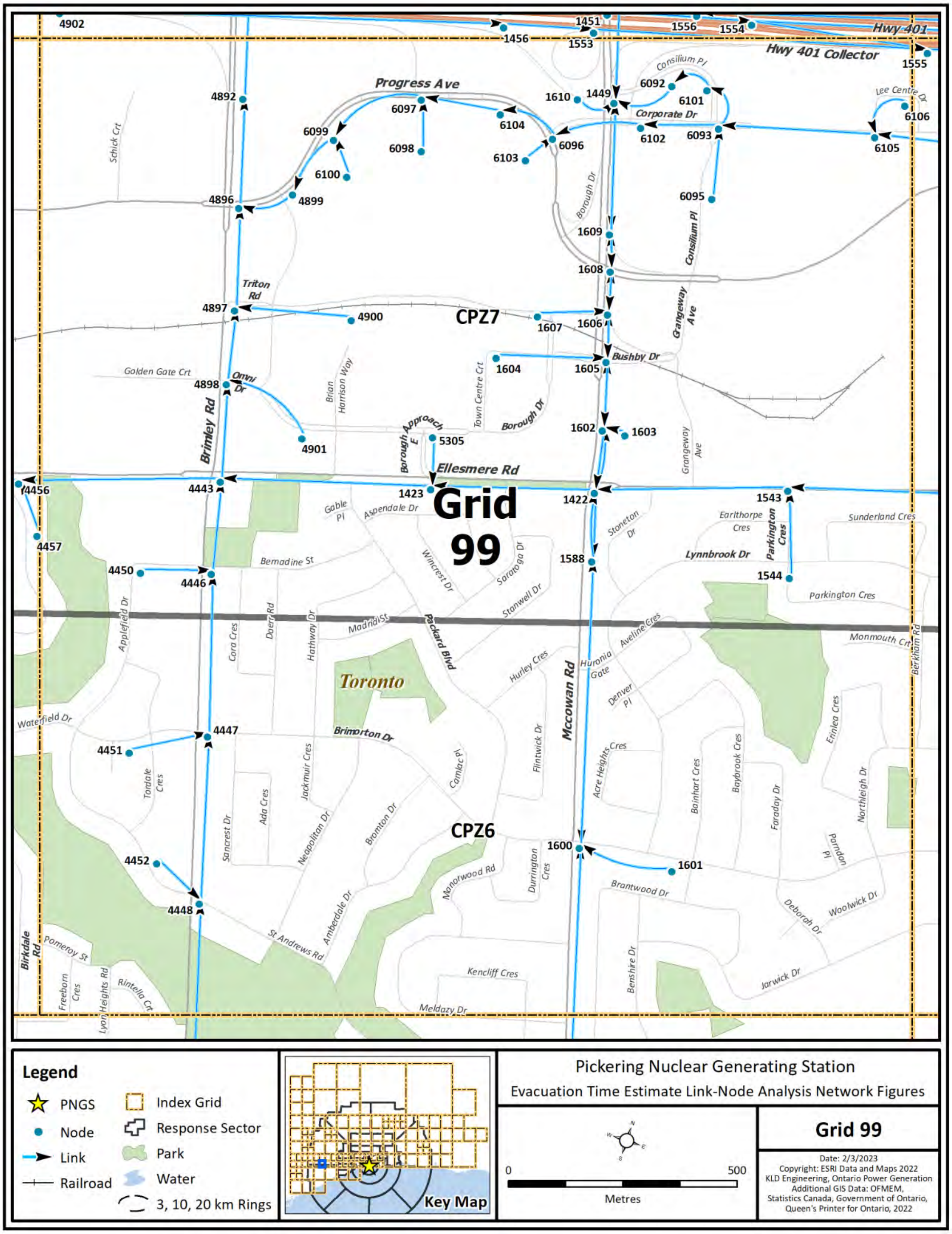


Figure K-100. Link-Node Analysis Network – Grid 99

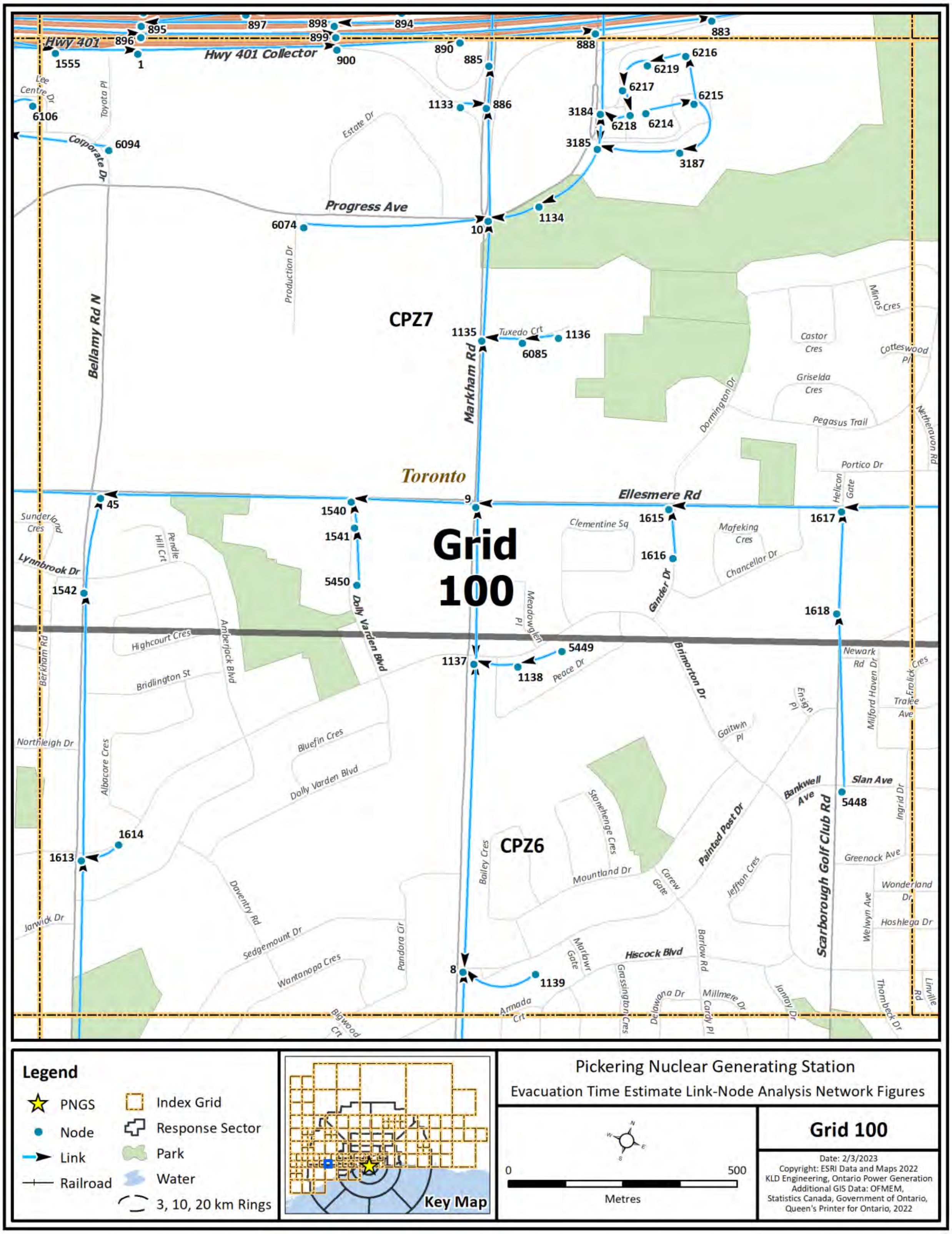


Figure K-101. Link-Node Analysis Network – Grid 100

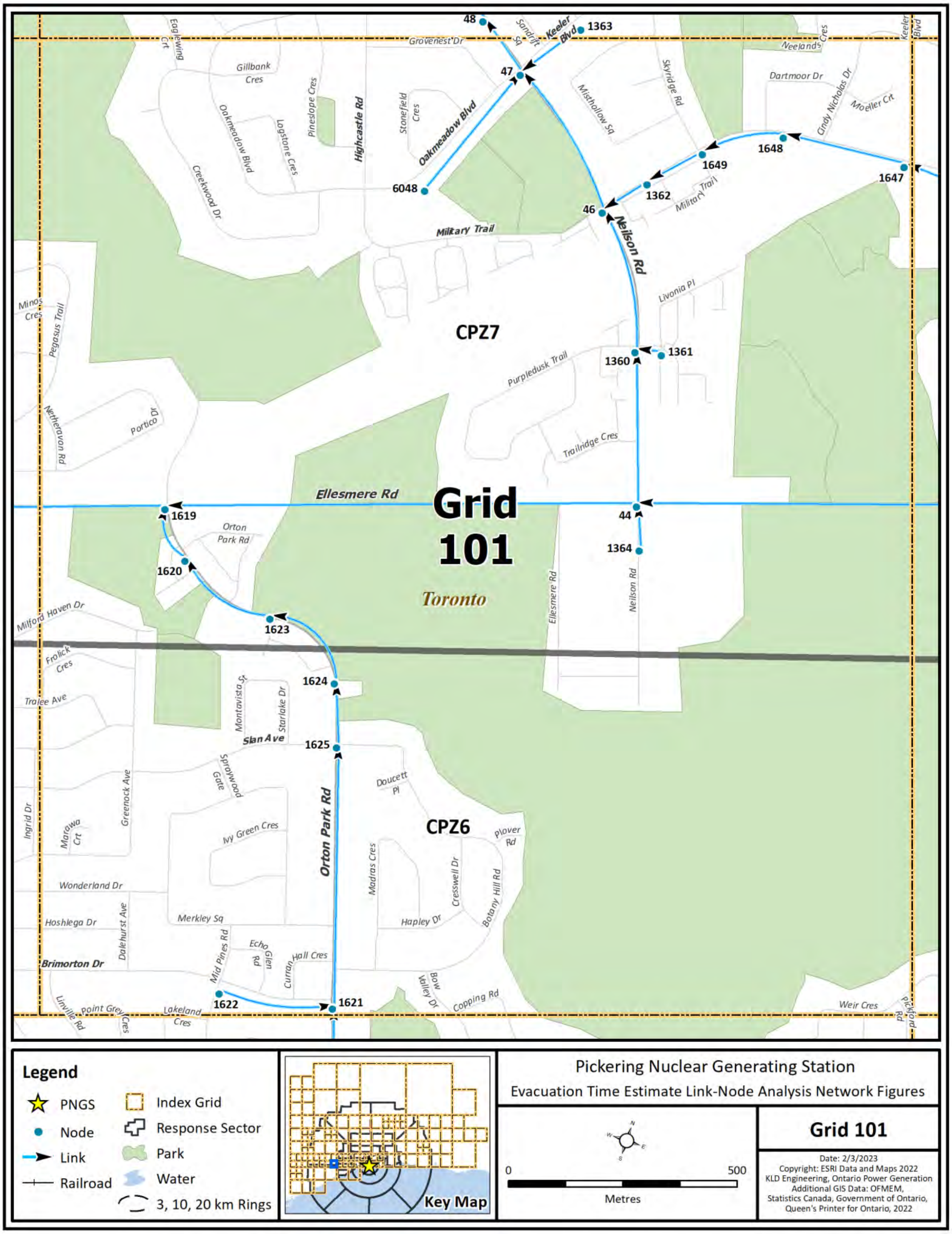


Figure K-102. Link-Node Analysis Network – Grid 101

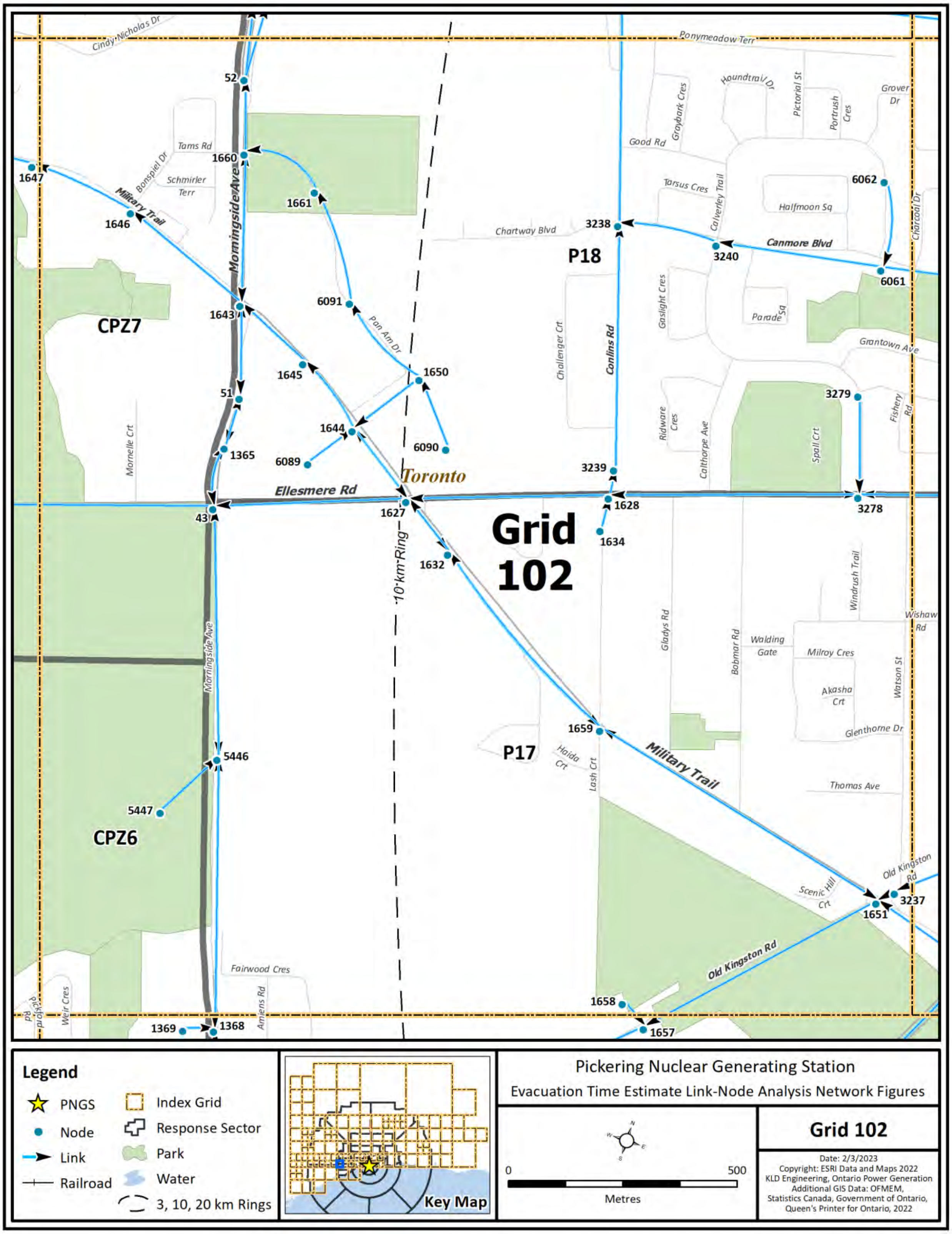


Figure K-103. Link-Node Analysis Network – Grid 102

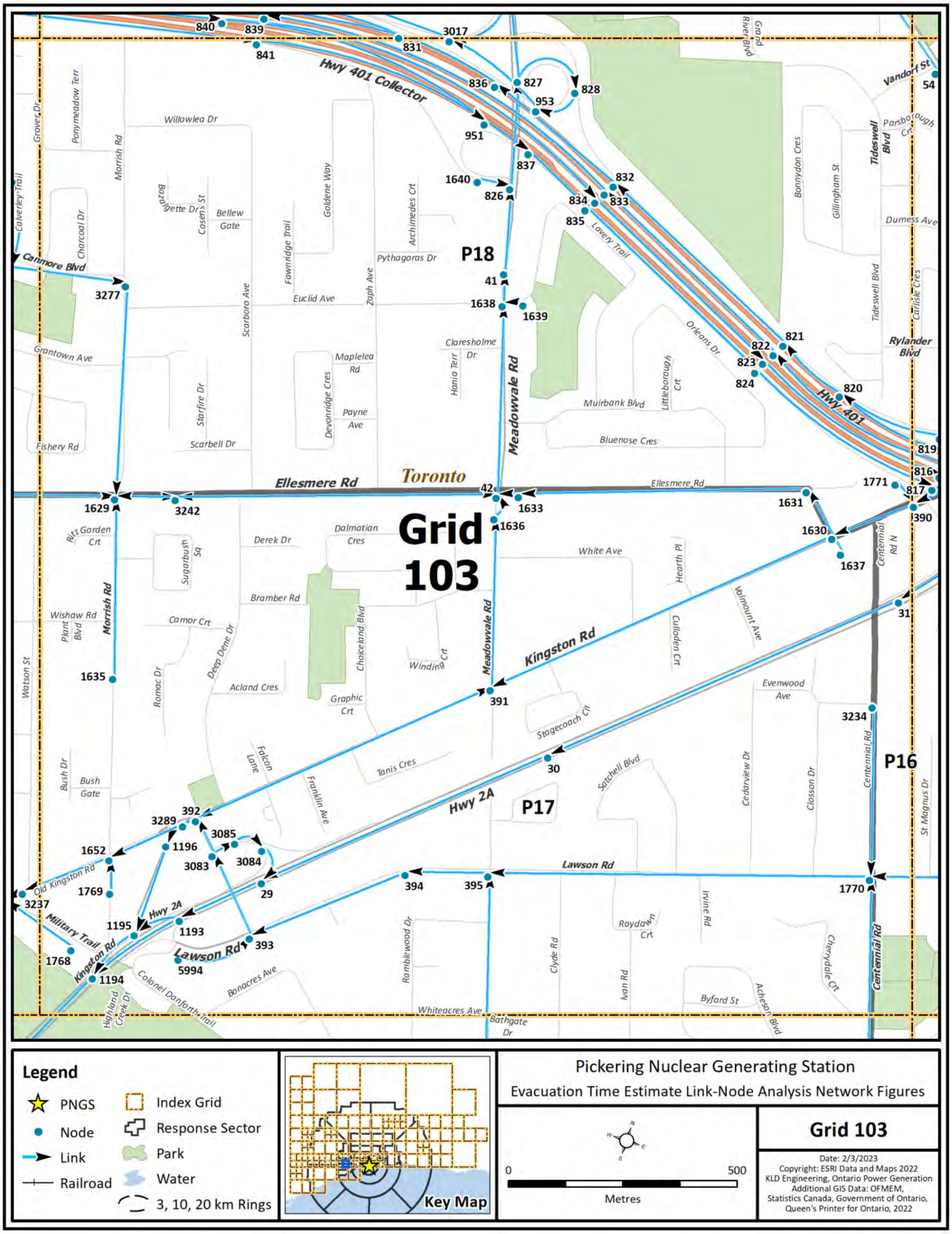


Figure K-104. Link-Node Analysis Network – Grid 103

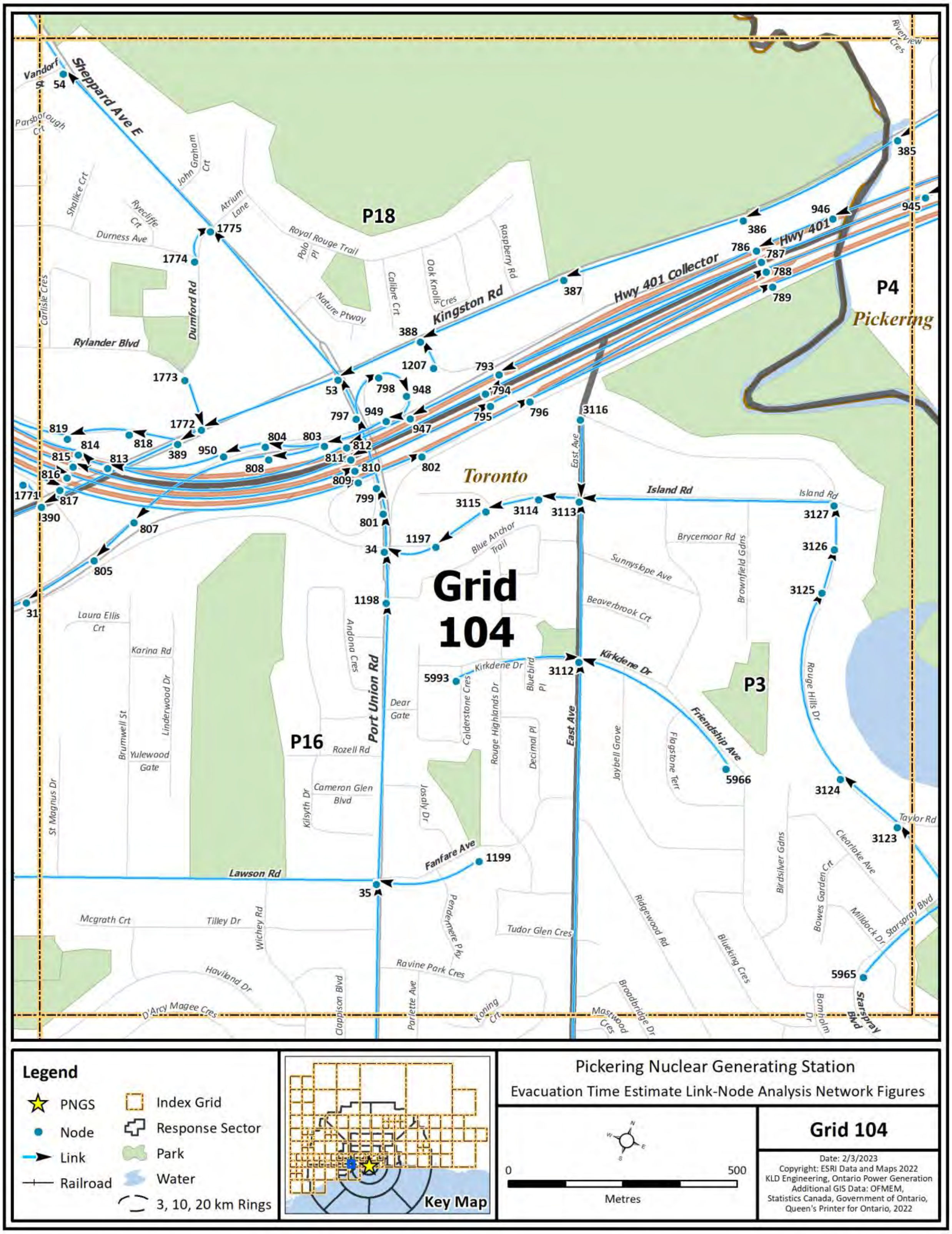


Figure K-105. Link-Node Analysis Network – Grid 104

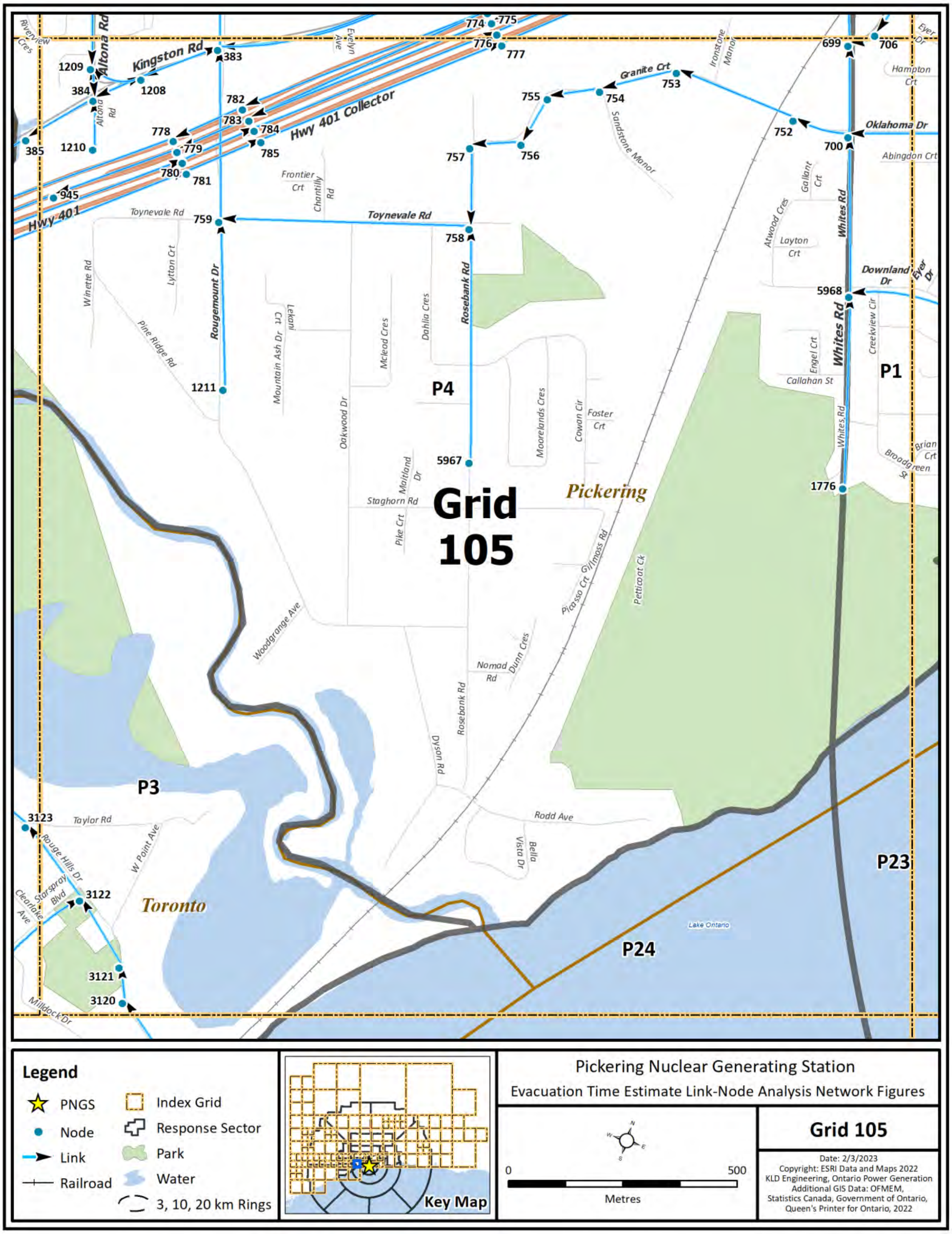


Figure K-106. Link-Node Analysis Network – Grid 105

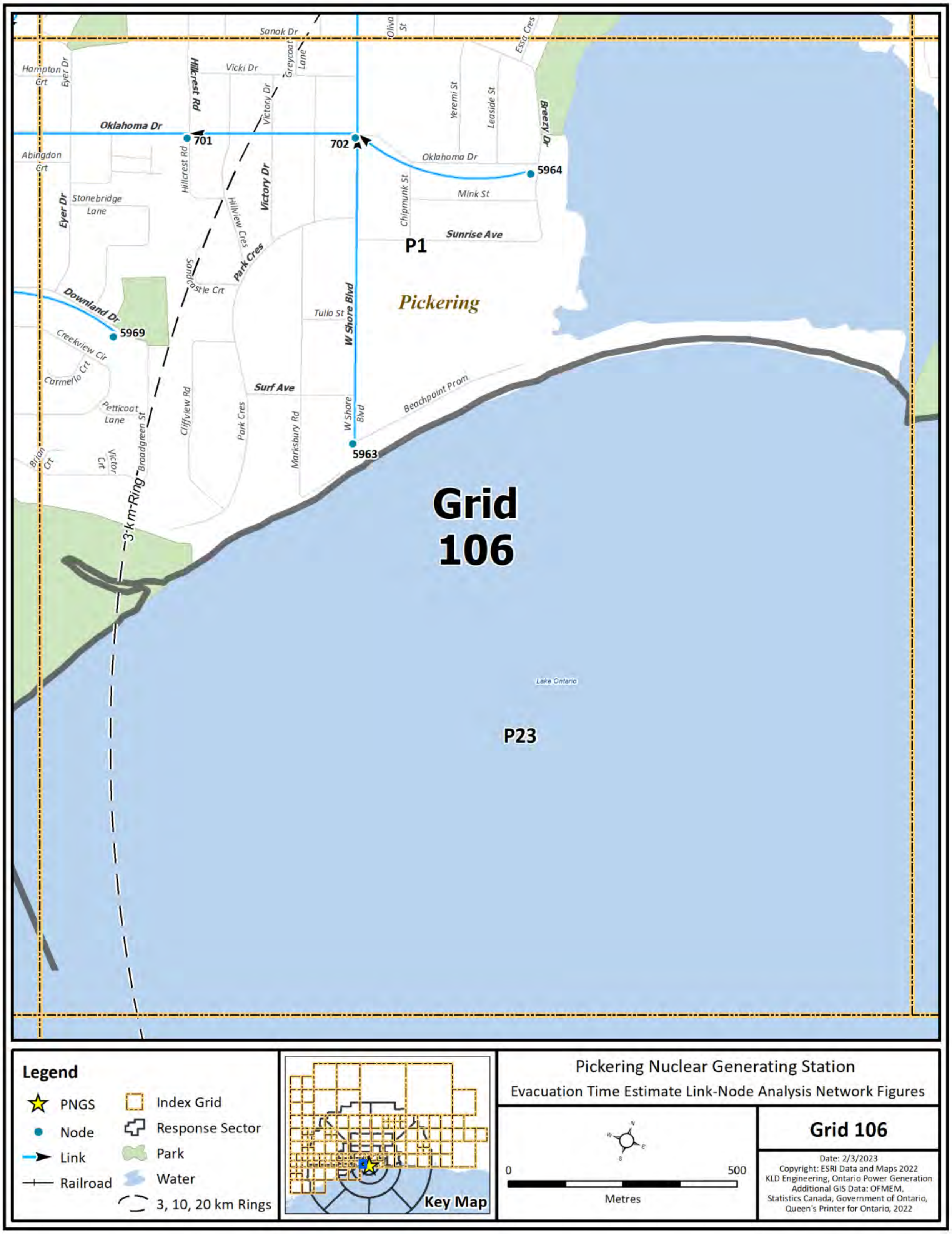


Figure K-107. Link-Node Analysis Network – Grid 106

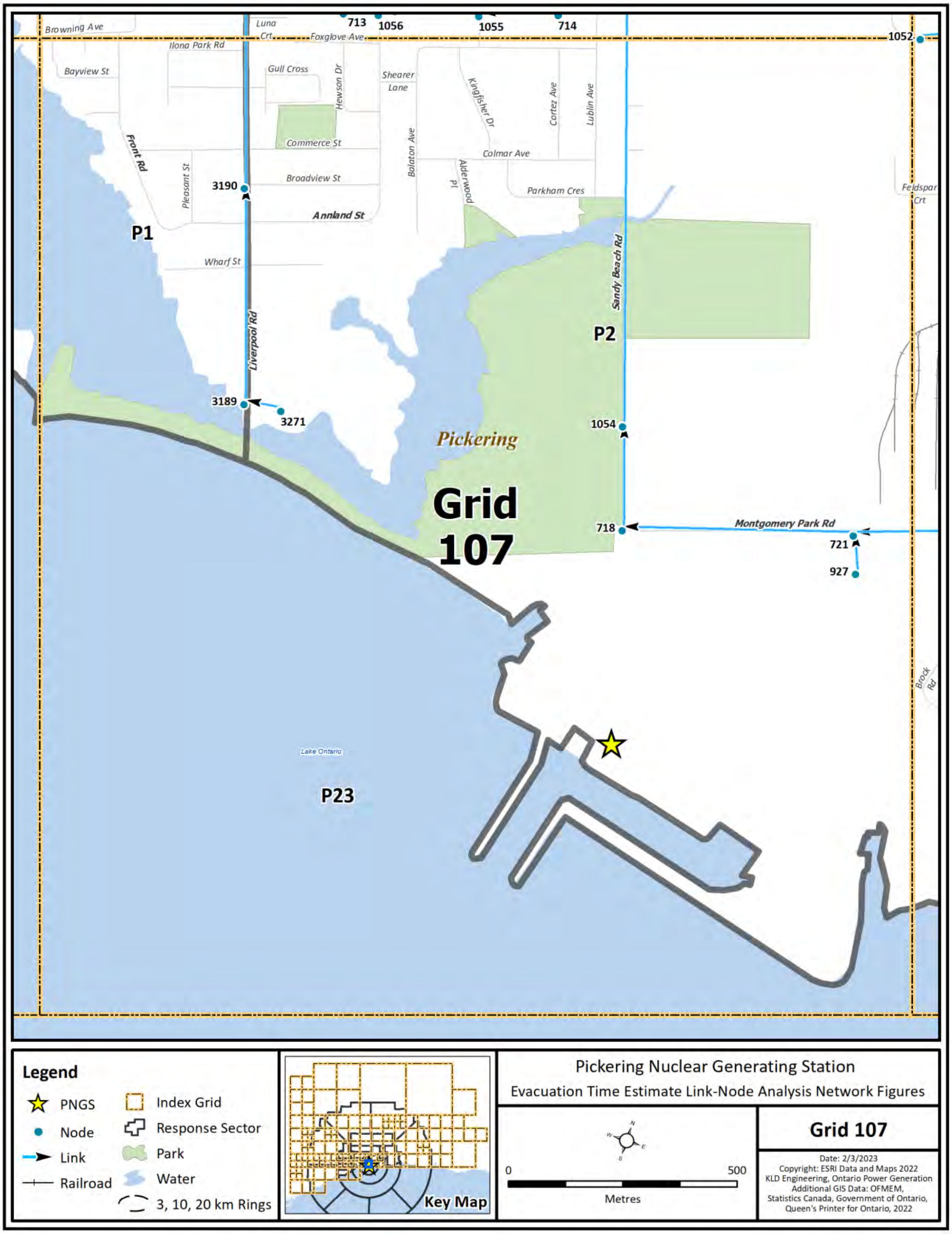


Figure K-108. Link-Node Analysis Network – Grid 107

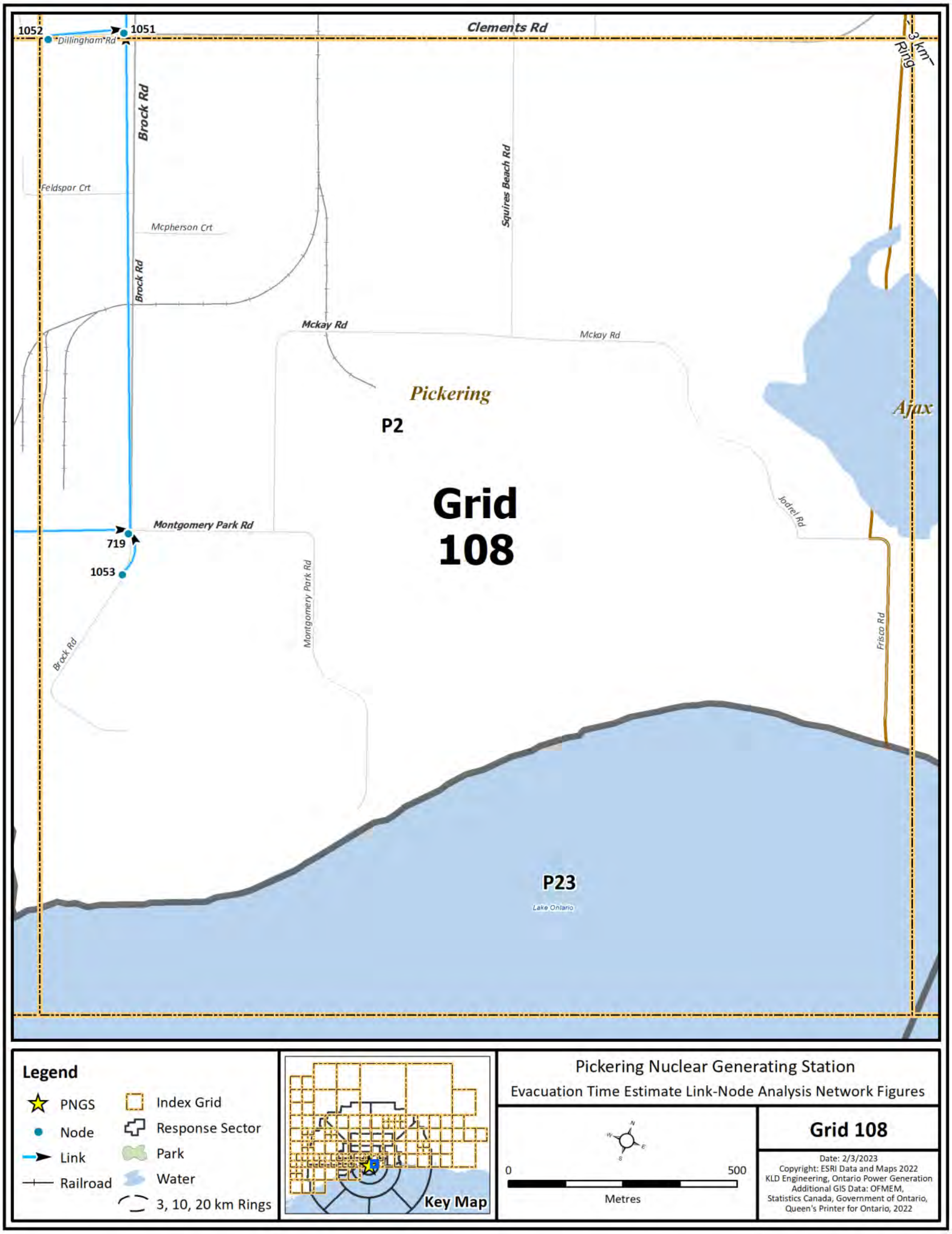


Figure K-109. Link-Node Analysis Network – Grid 108

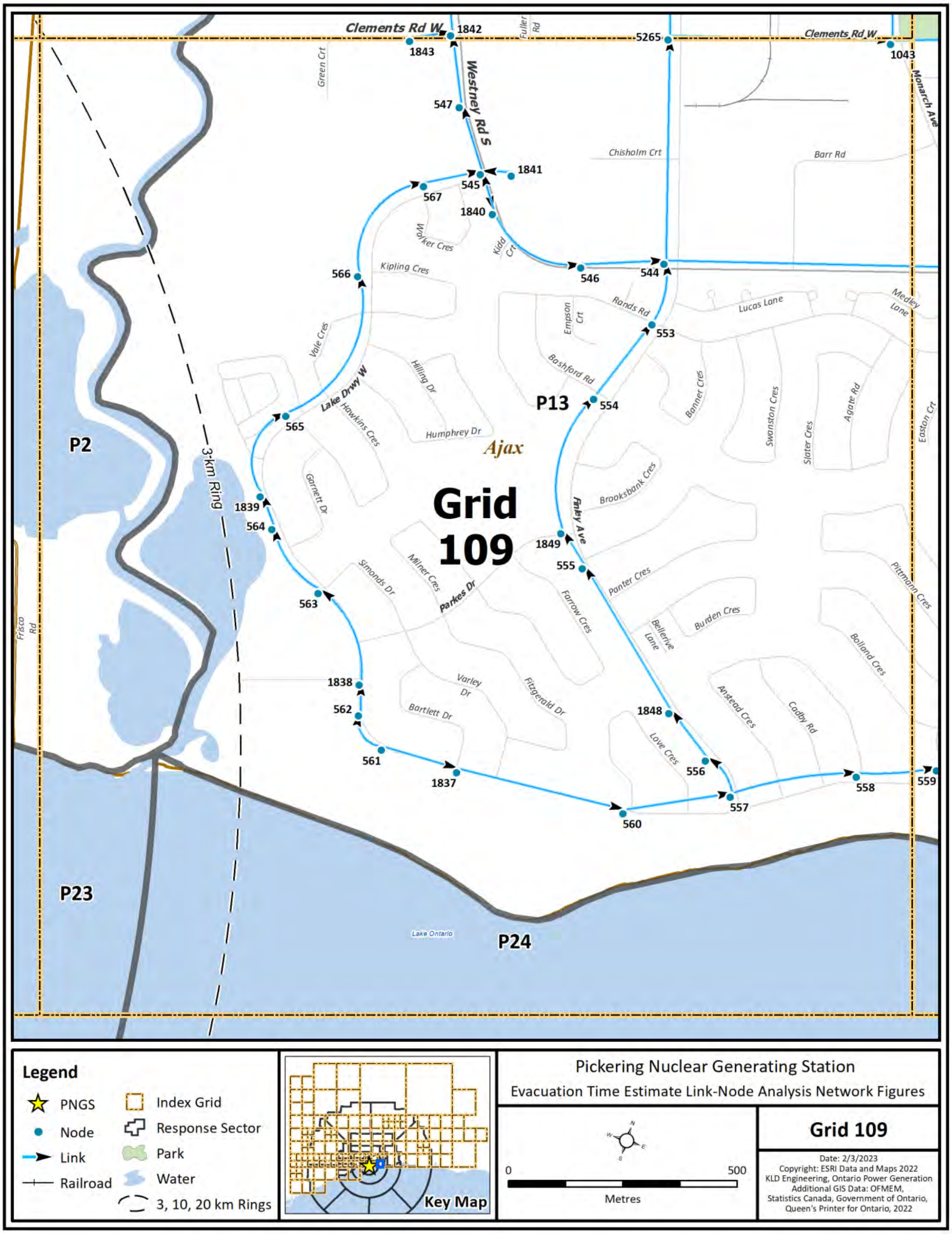


Figure K-110. Link-Node Analysis Network – Grid 109

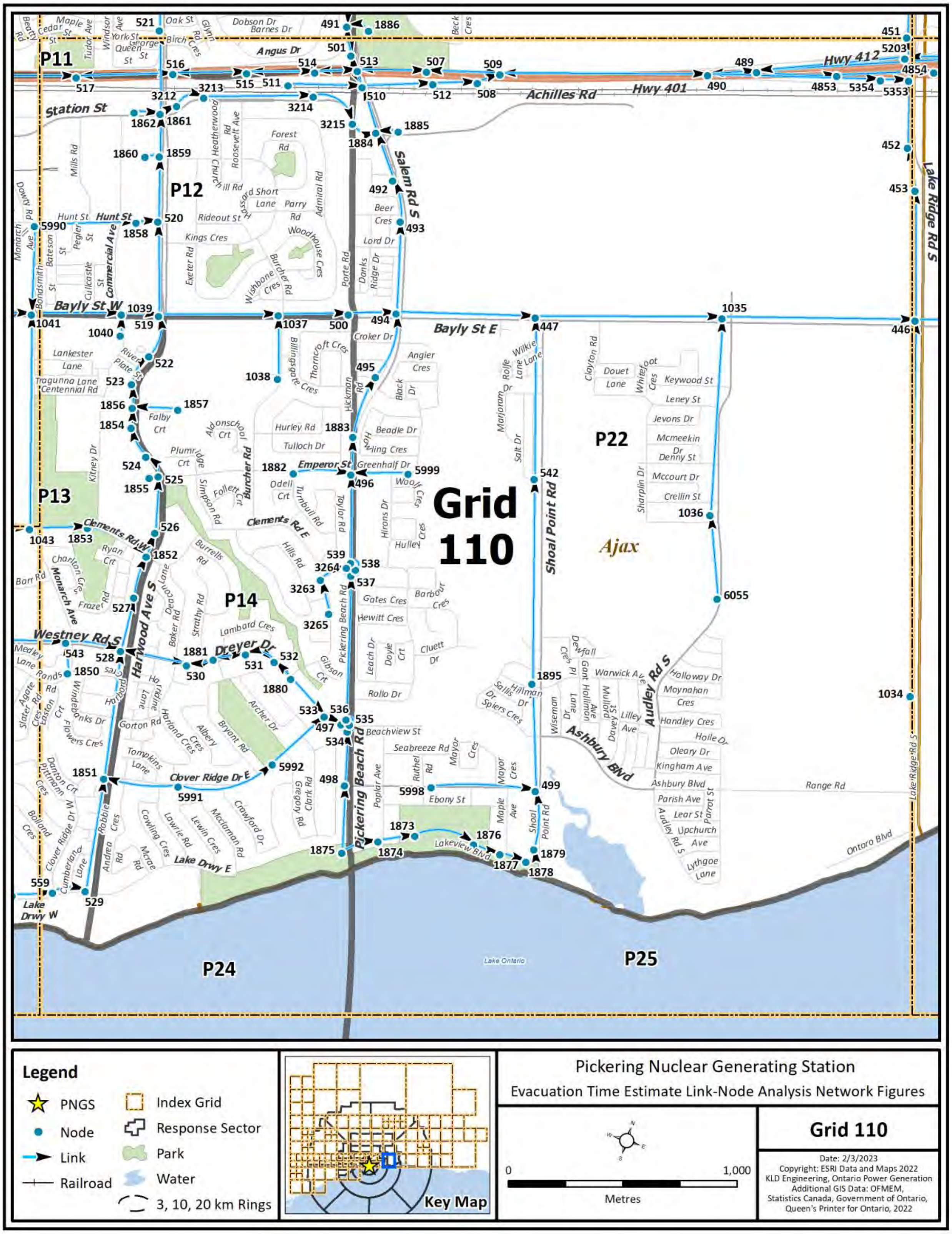


Figure K-111. Link-Node Analysis Network – Grid 110

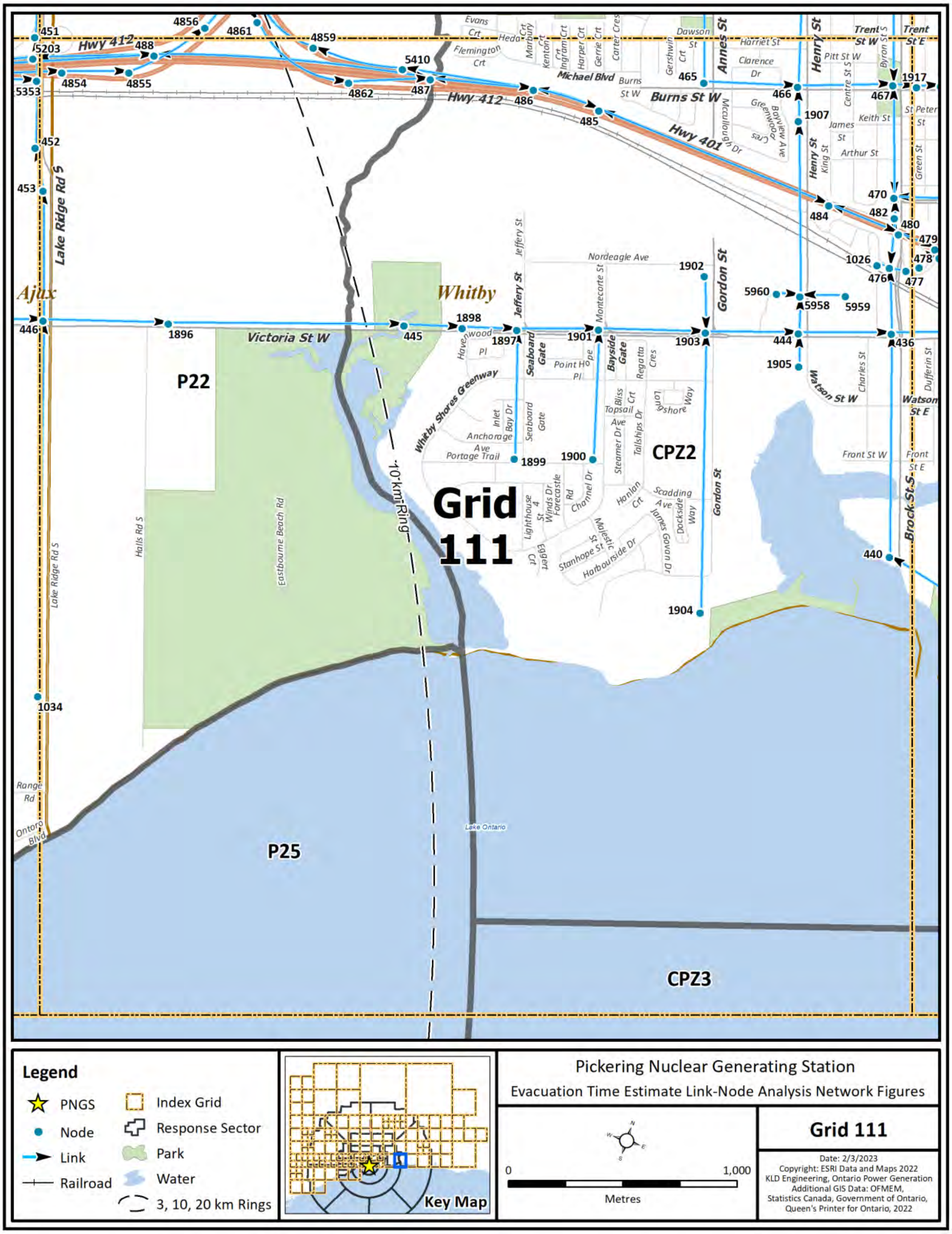


Figure K-112. Link-Node Analysis Network – Grid 111

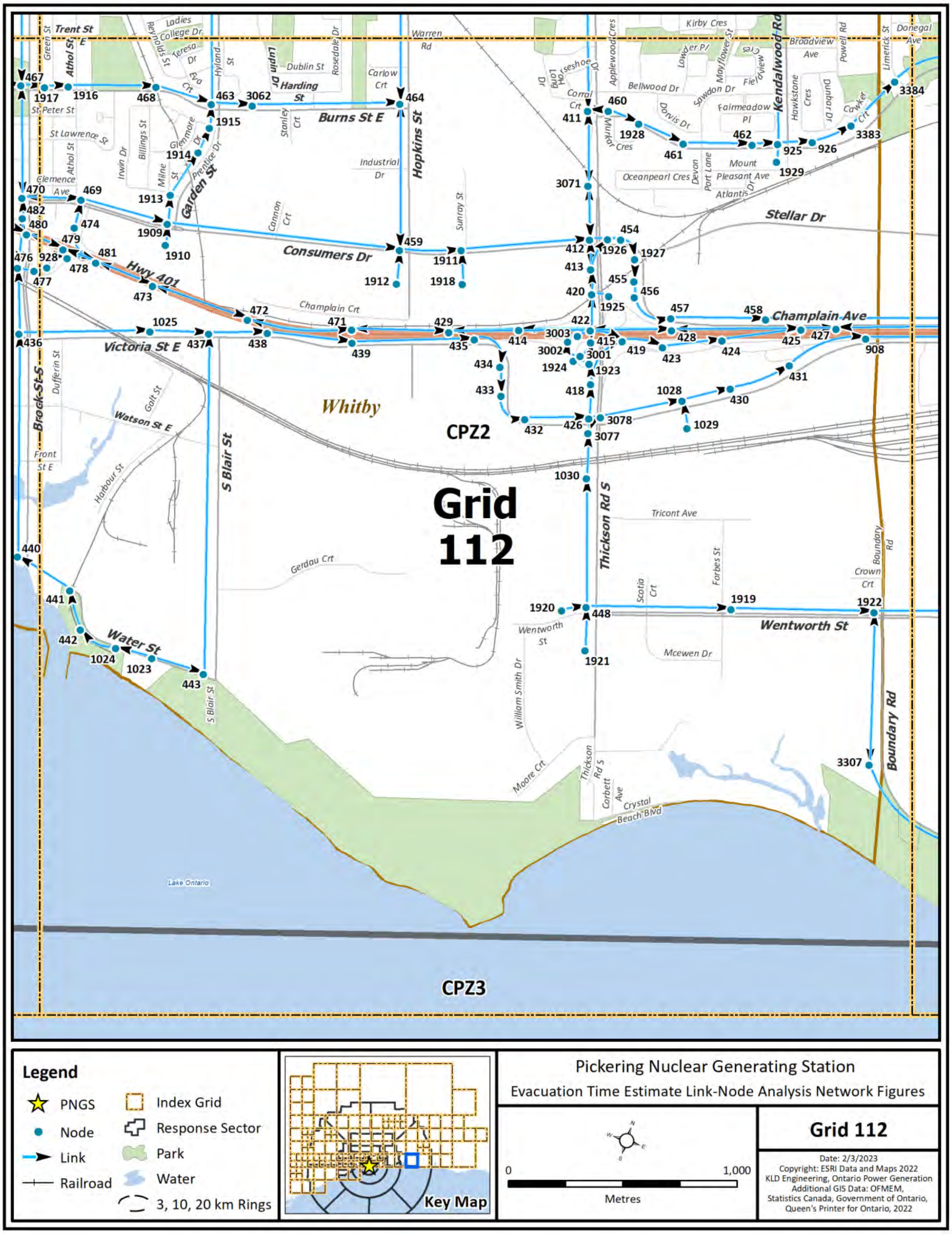


Figure K-113. Link-Node Analysis Network – Grid 112

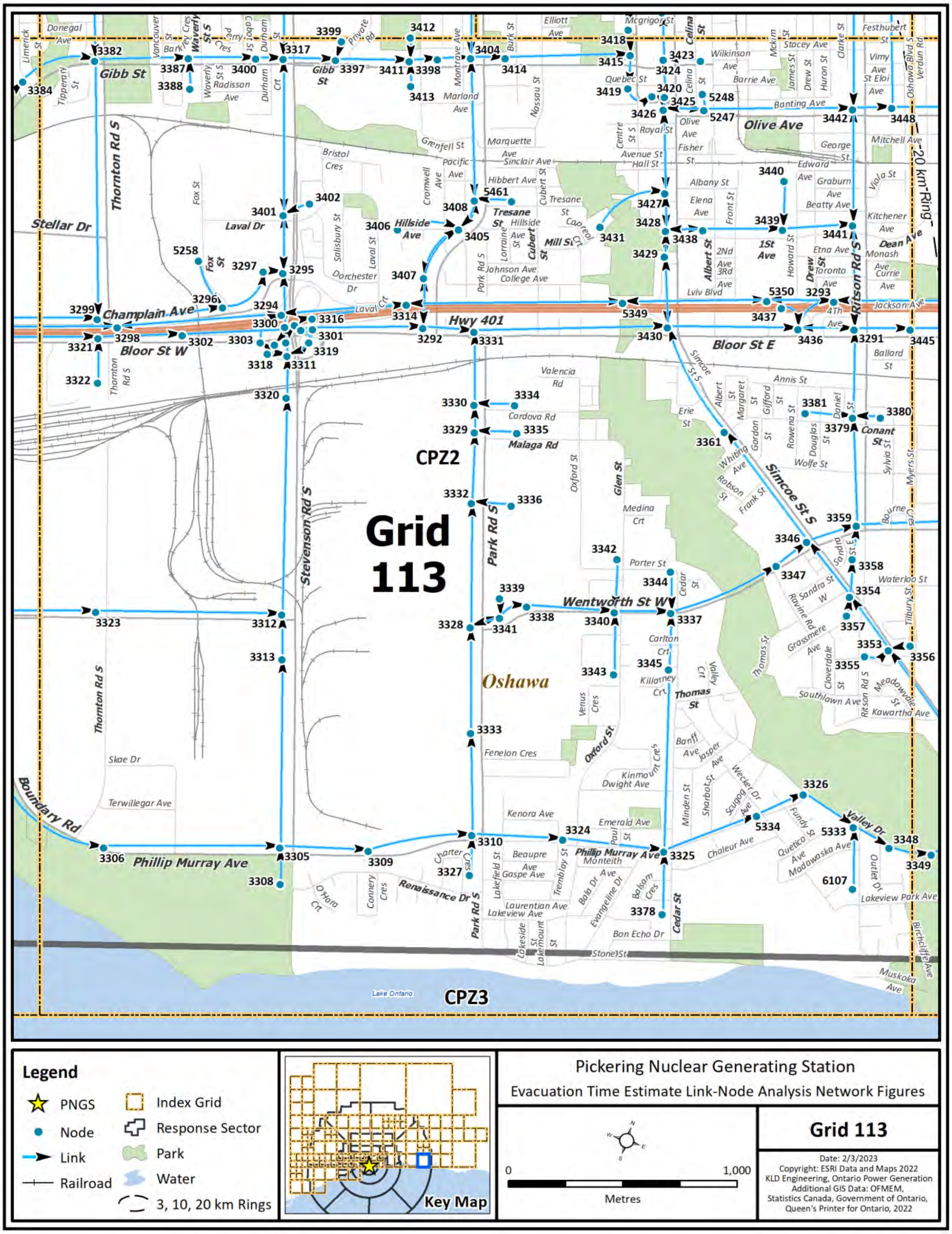


Figure K-114. Link-Node Analysis Network – Grid 113

Figure K-115. Link-Node Analysis Network – Grid 114

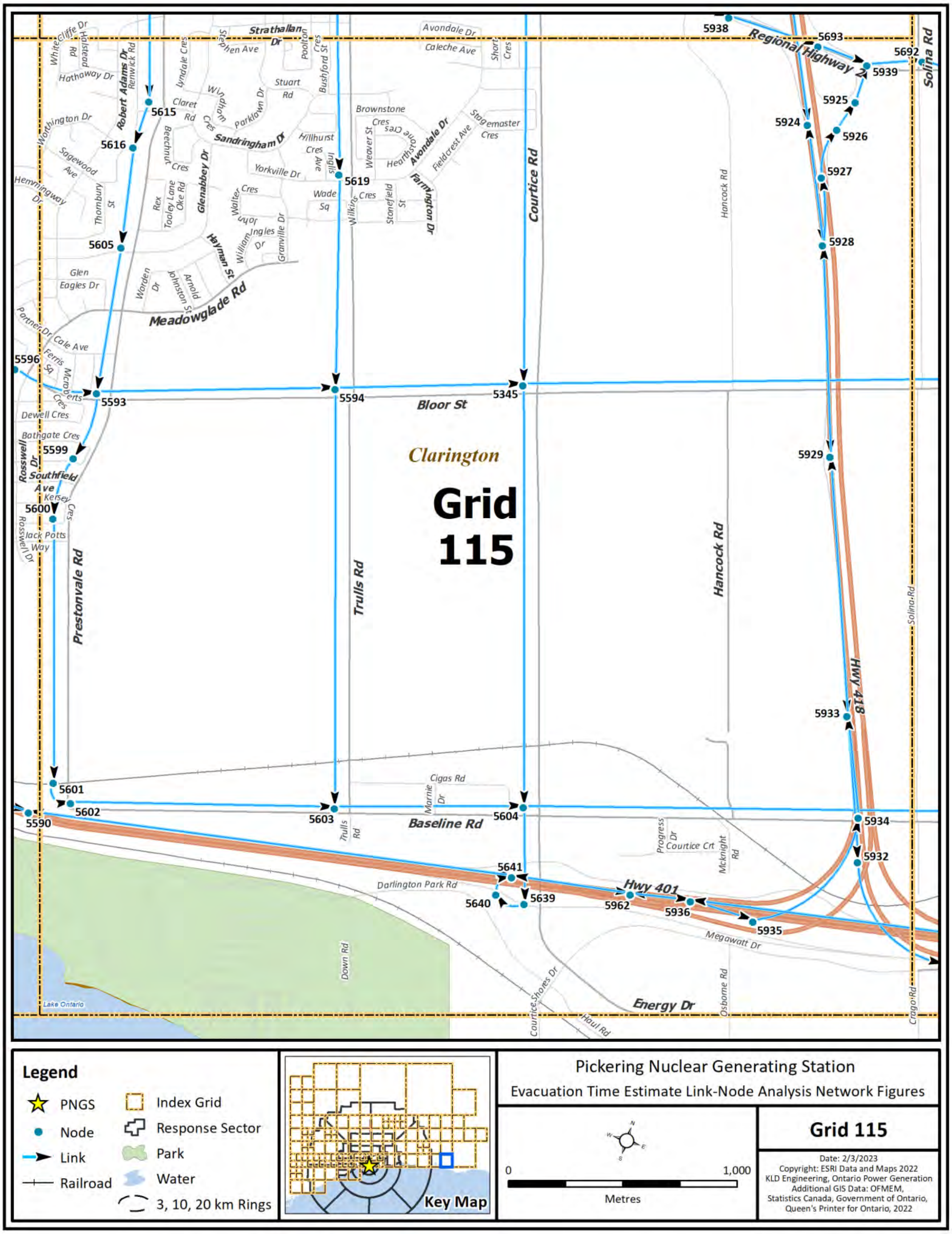


Figure K-116. Link-Node Analysis Network – Grid 115

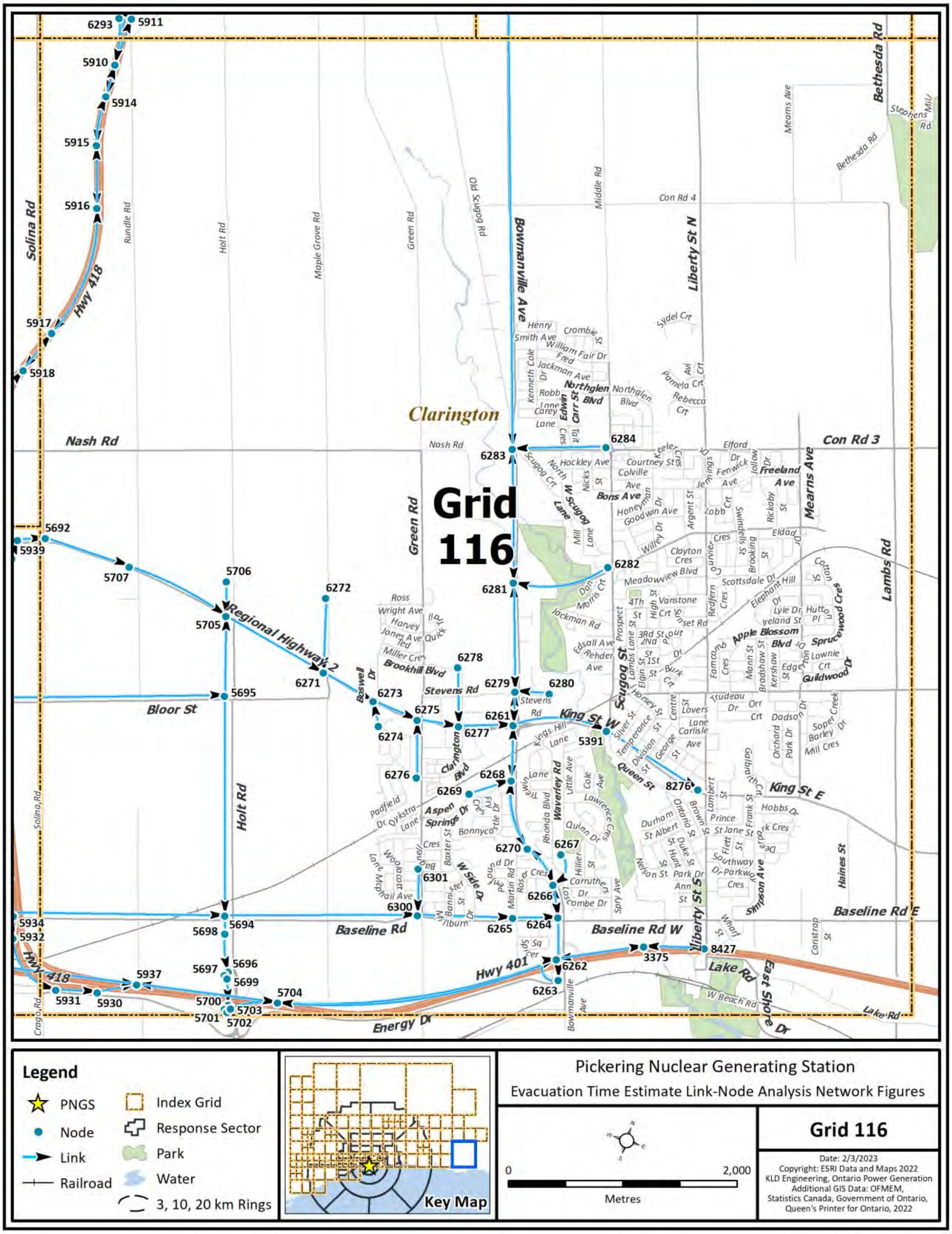


Figure K-117. Link-Node Analysis Network – Grid 116

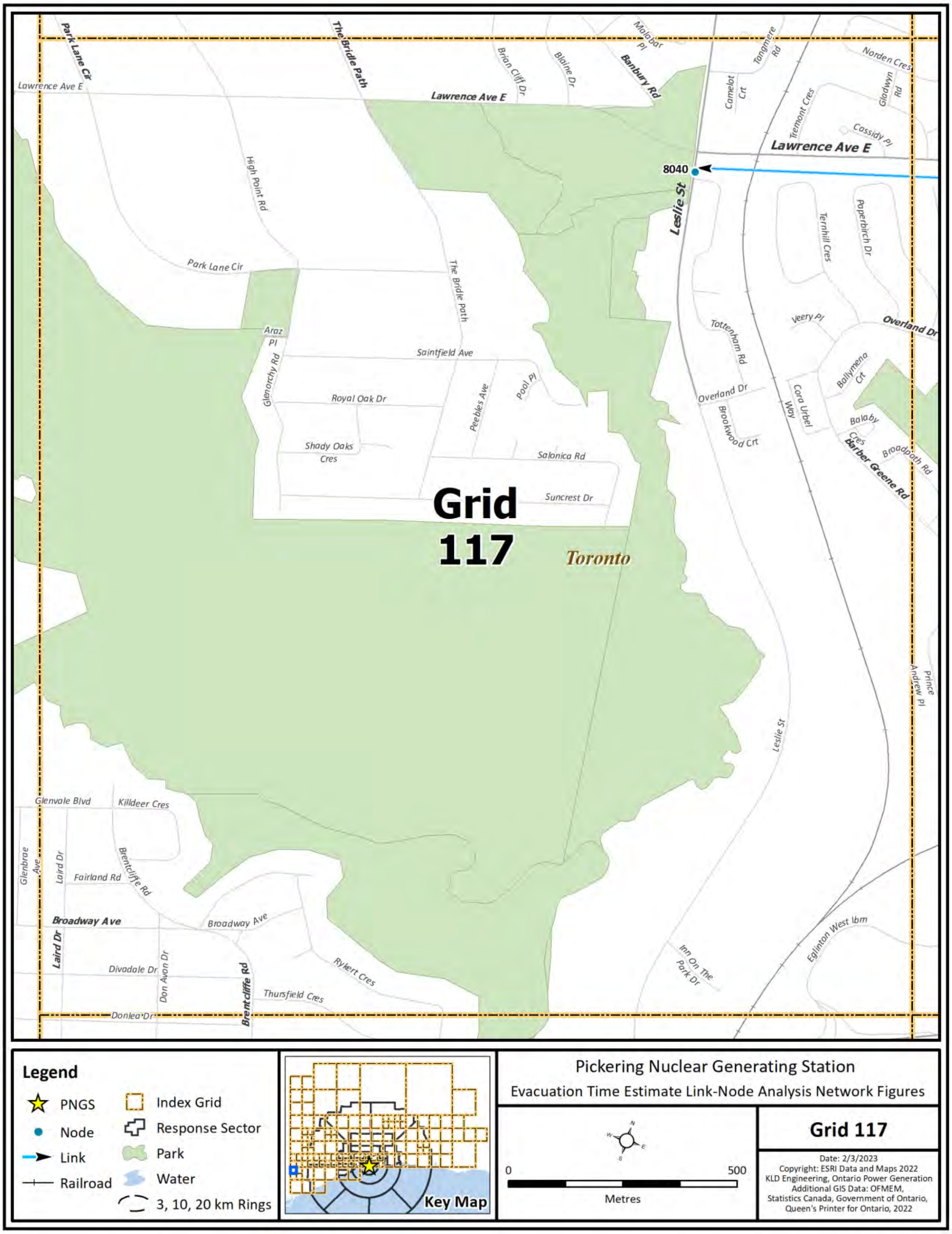


Figure K-118. Link-Node Analysis Network – Grid 117

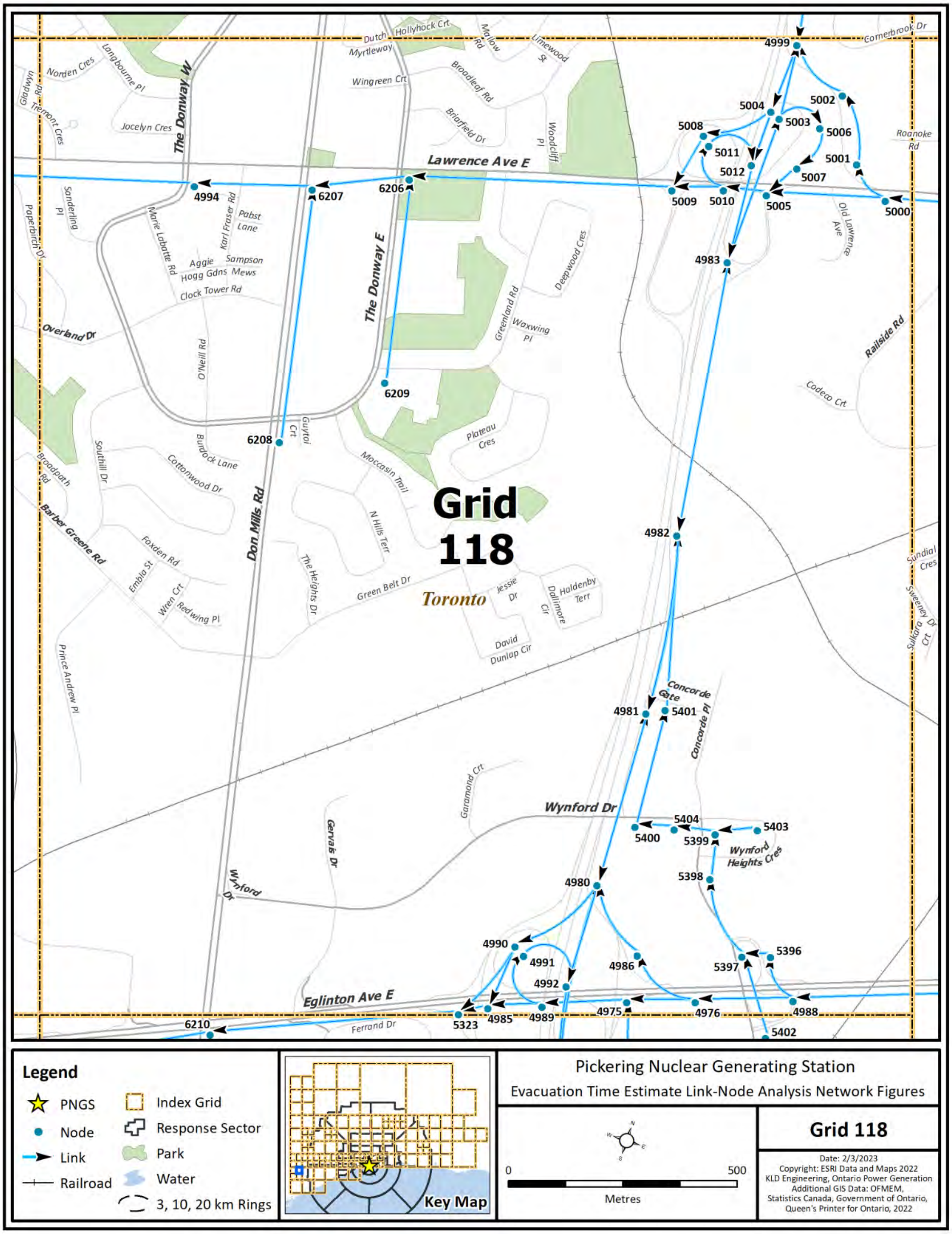


Figure K-119. Link-Node Analysis Network – Grid 118

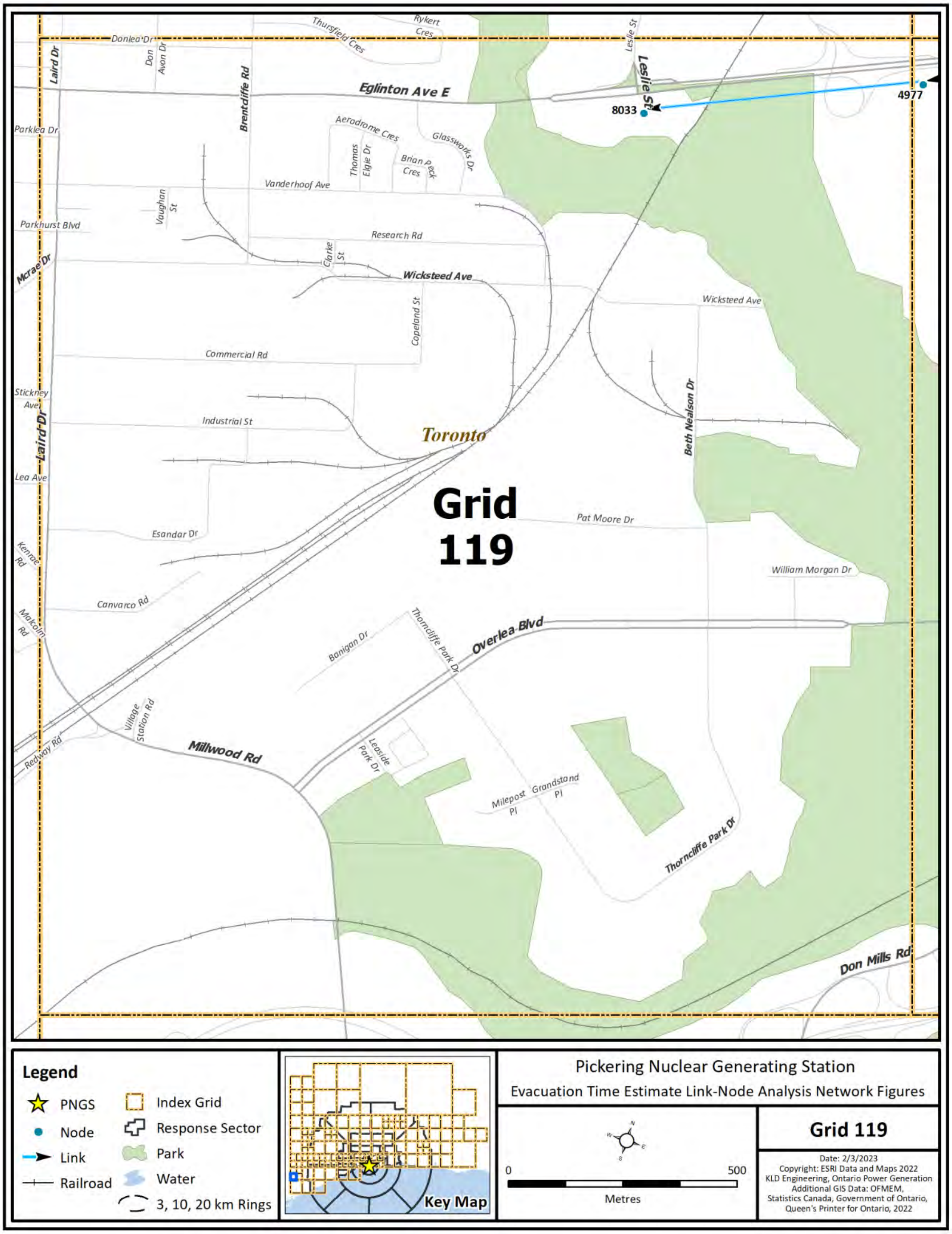


Figure K-120. Link-Node Analysis Network – Grid 119

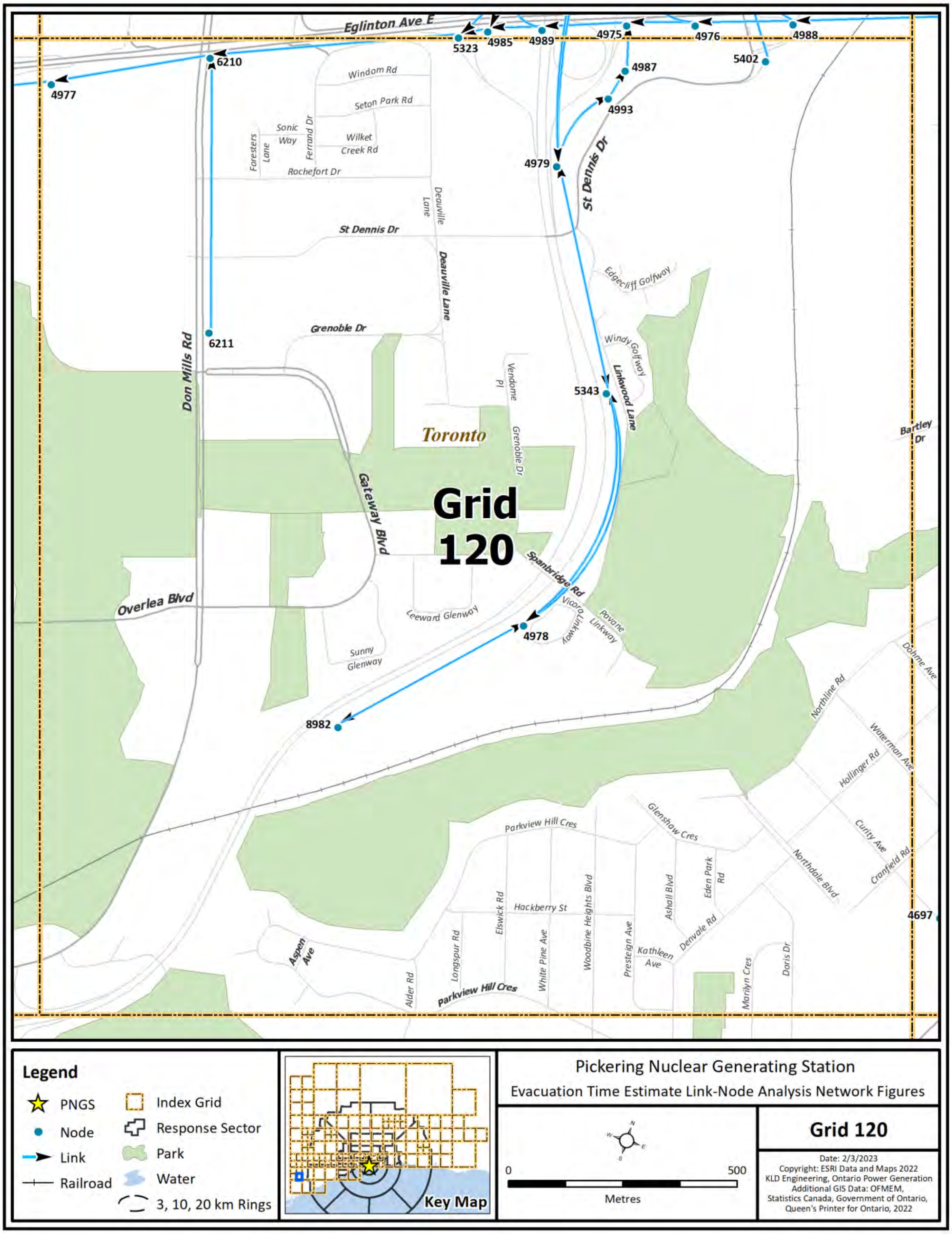


Figure K-121. Link-Node Analysis Network – Grid 120

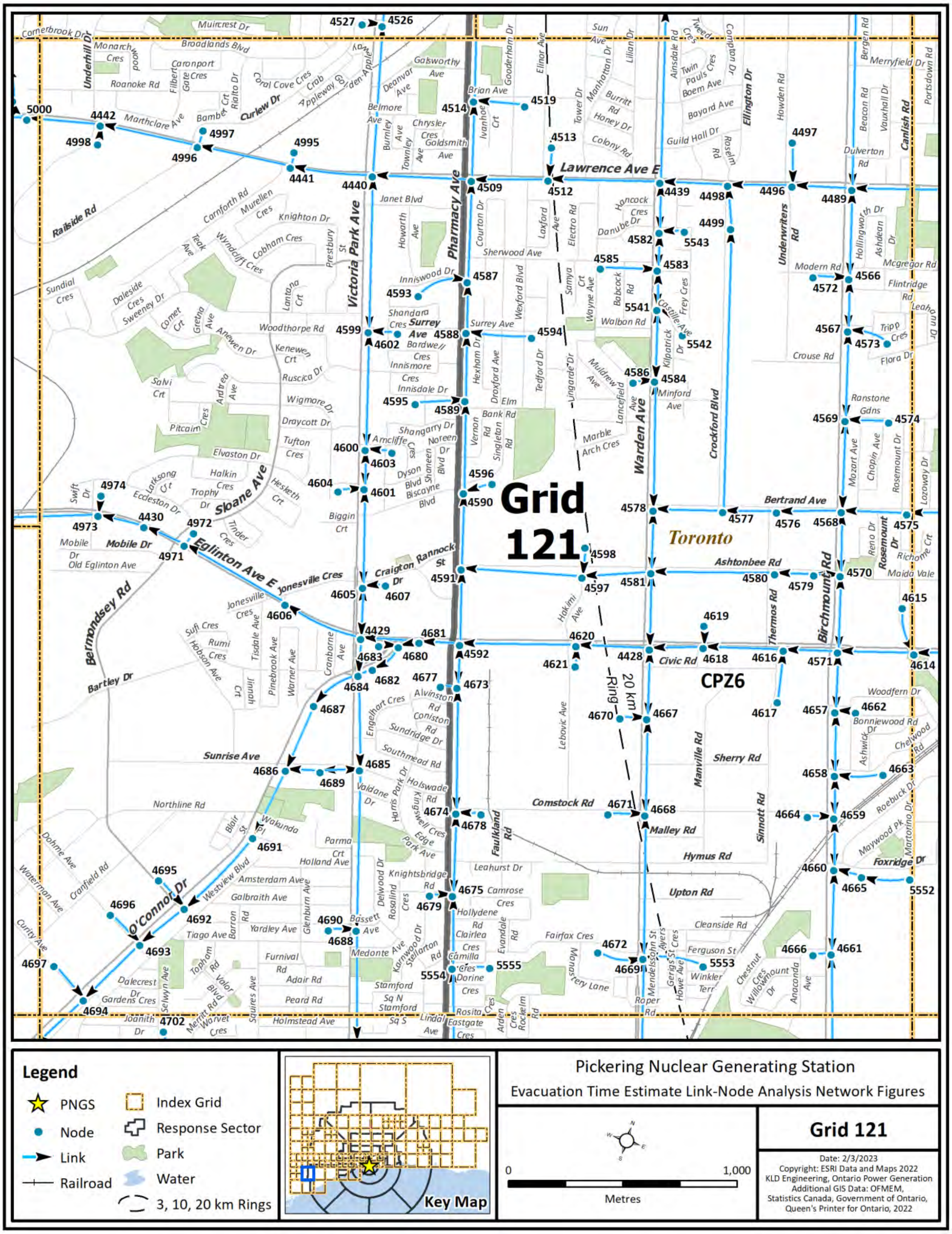


Figure K-122. Link-Node Analysis Network – Grid 121

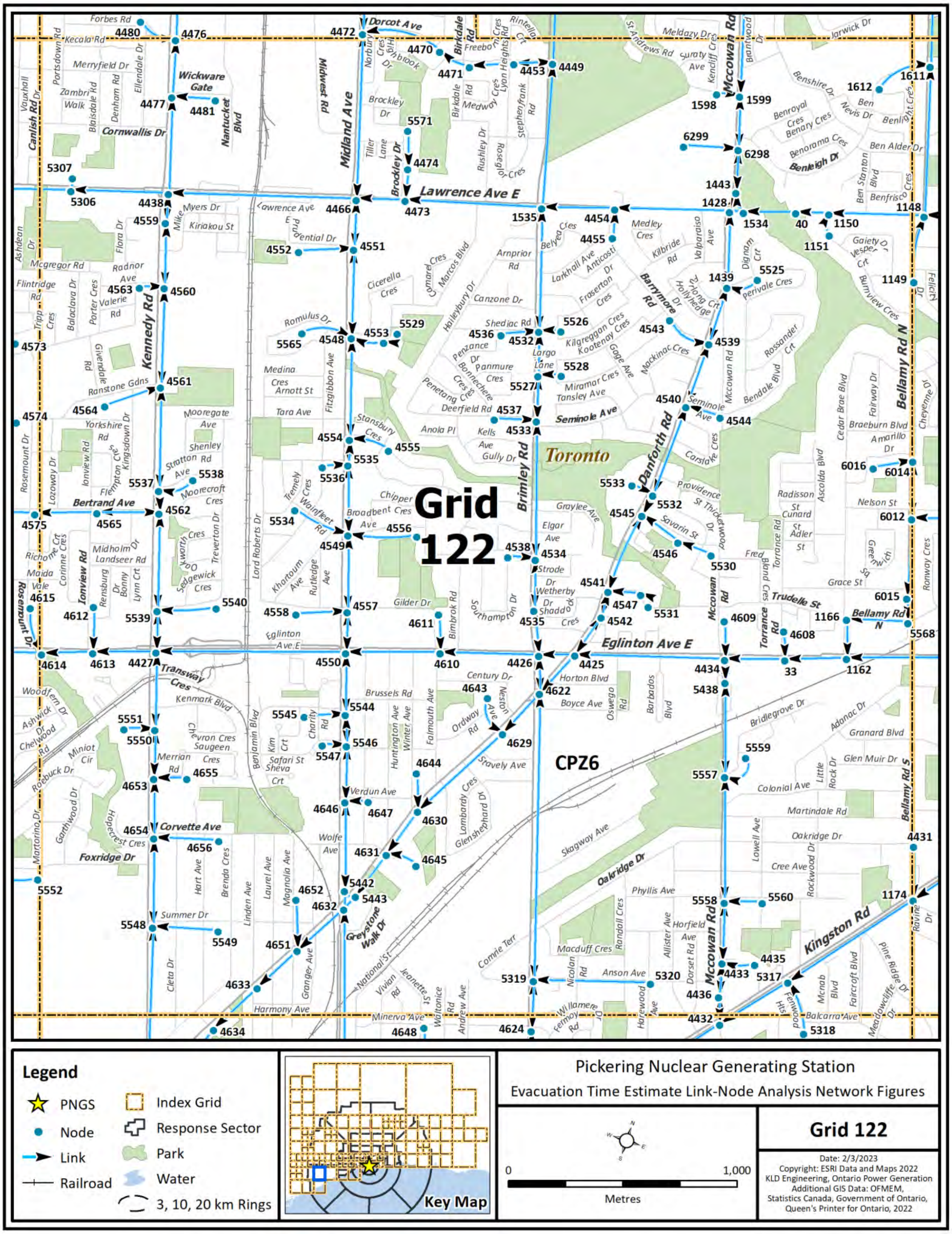


Figure K-123. Link-Node Analysis Network – Grid 122

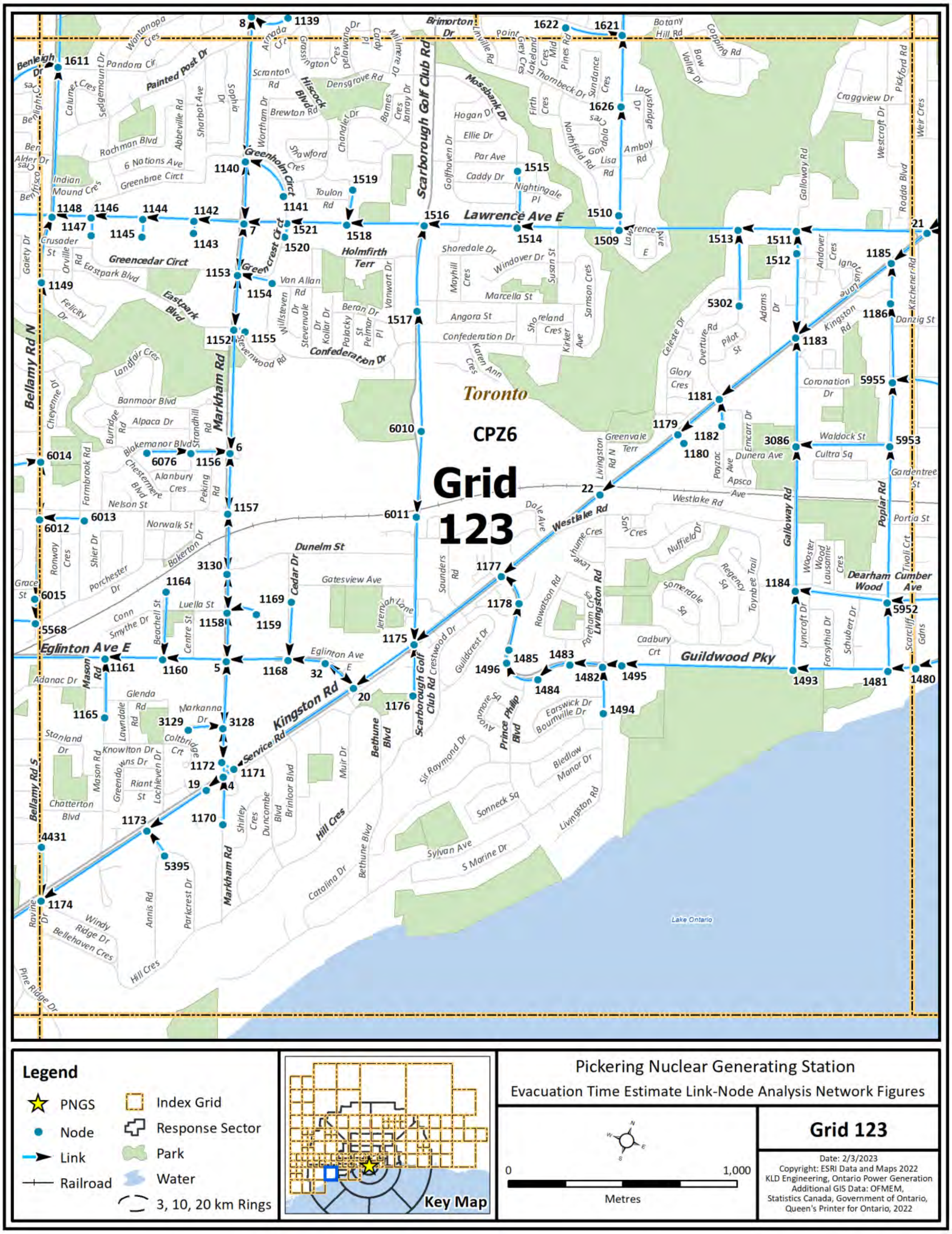


Figure K-124. Link-Node Analysis Network – Grid 123

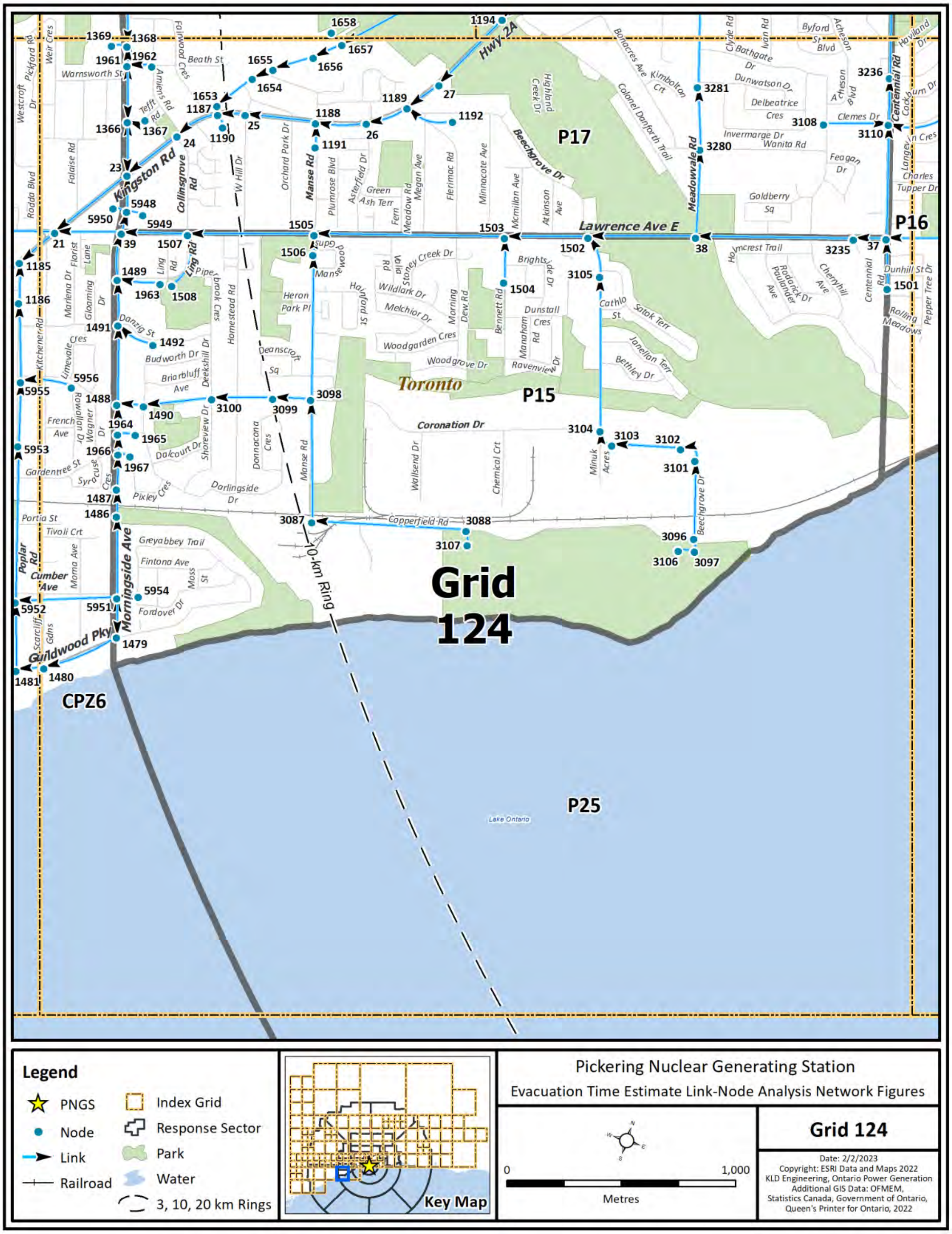


Figure K-125. Link-Node Analysis Network – Grid 124

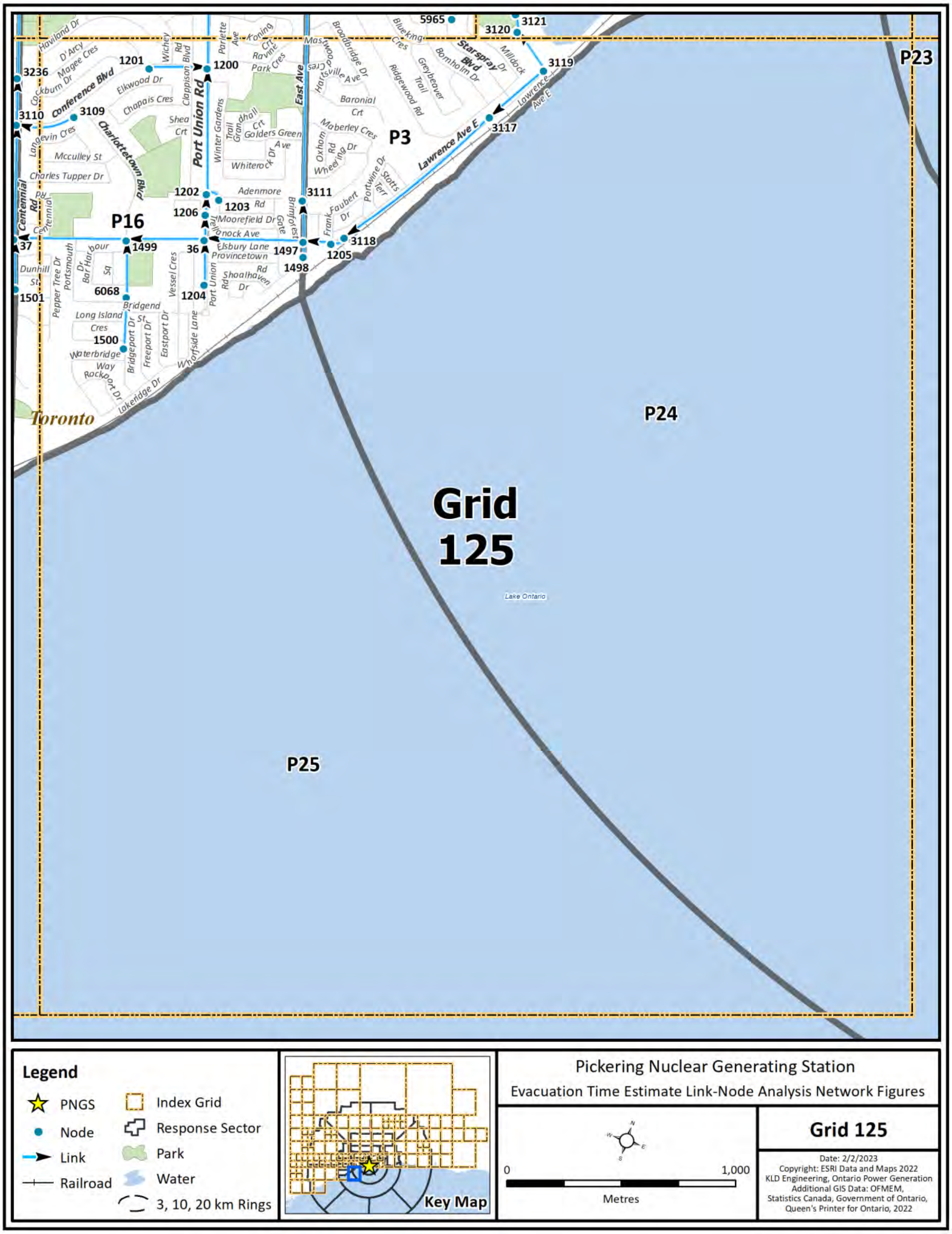


Figure K-126. Link-Node Analysis Network – Grid 125

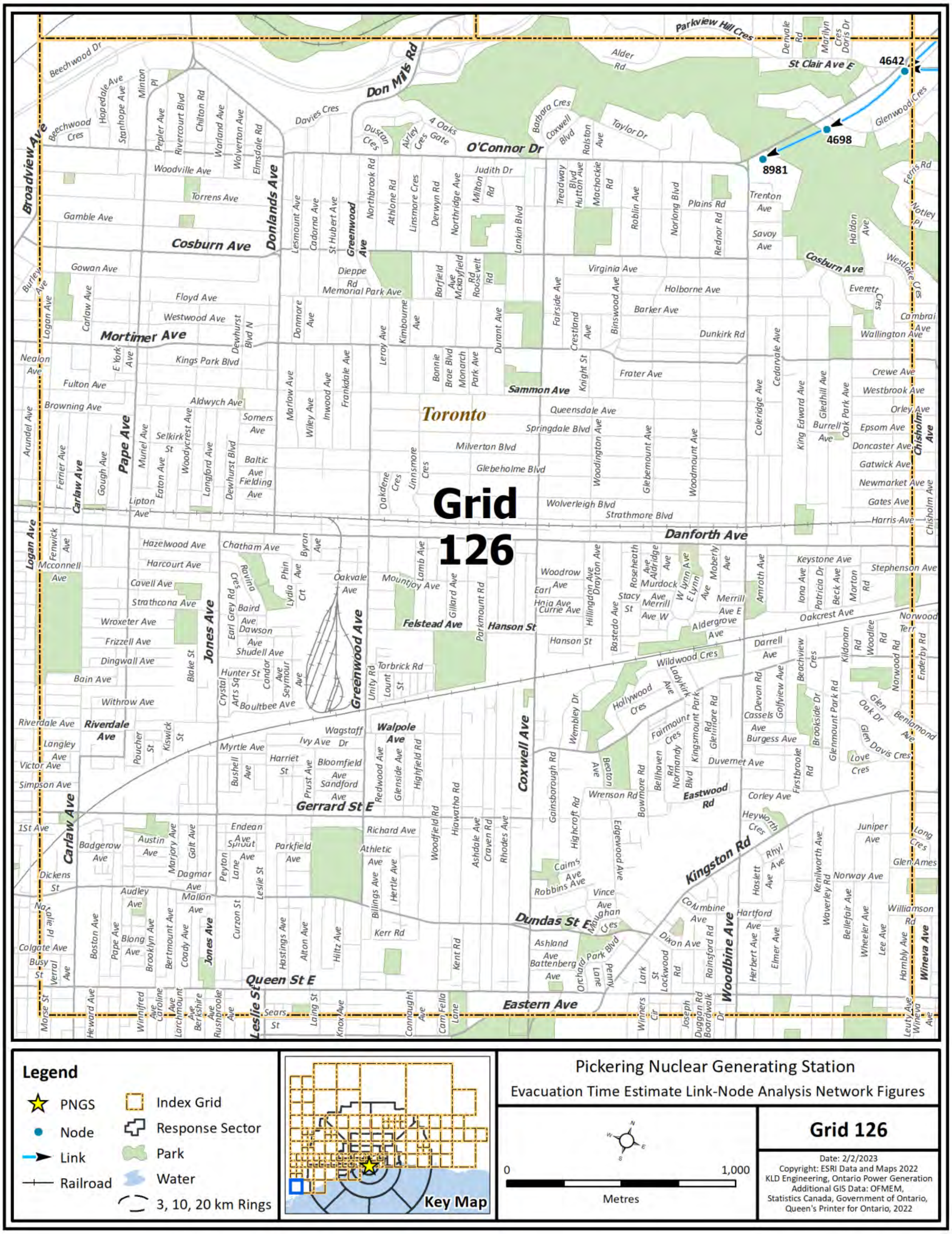


Figure K-127. Link-Node Analysis Network – Grid 126

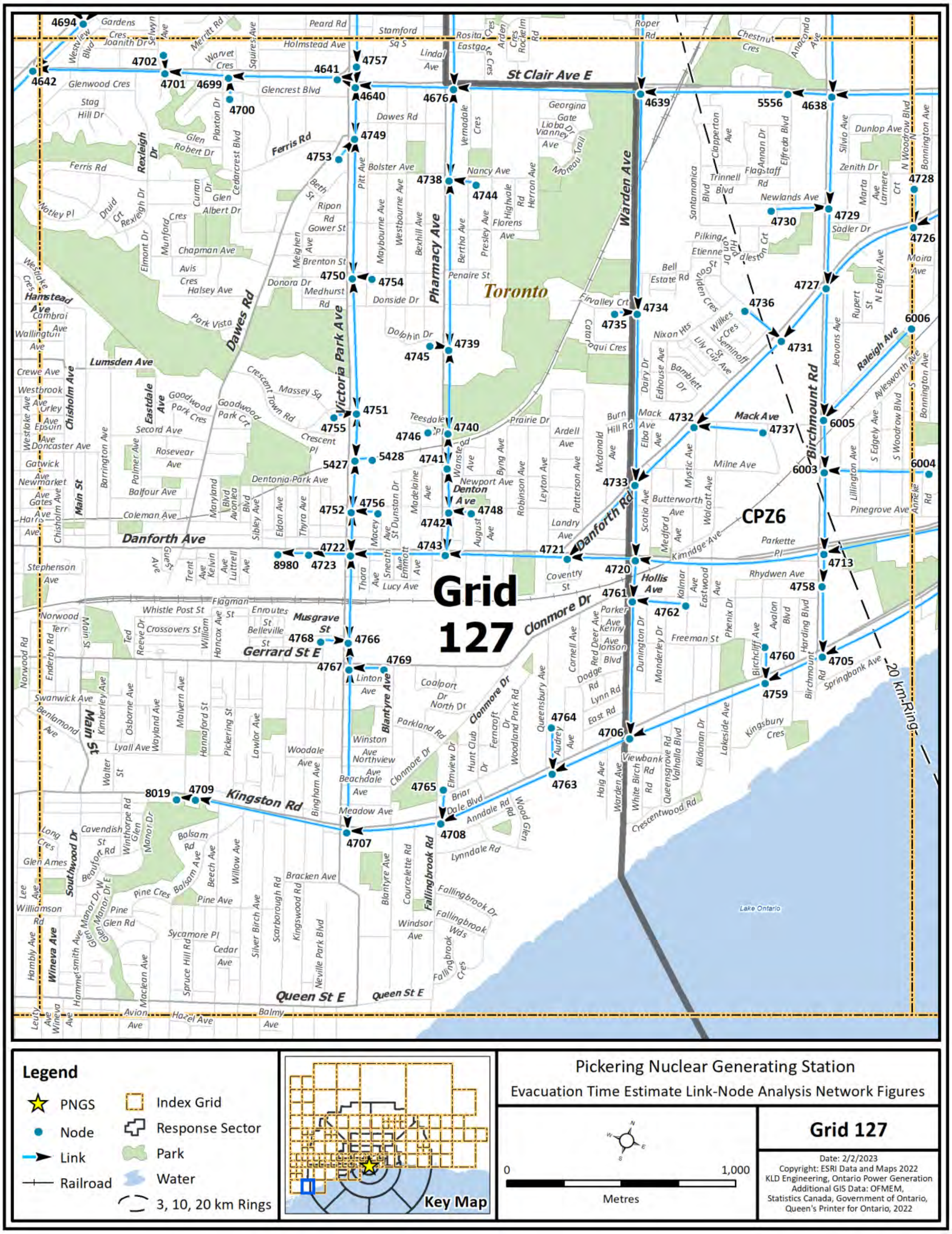


Figure K-128. Link-Node Analysis Network – Grid 127

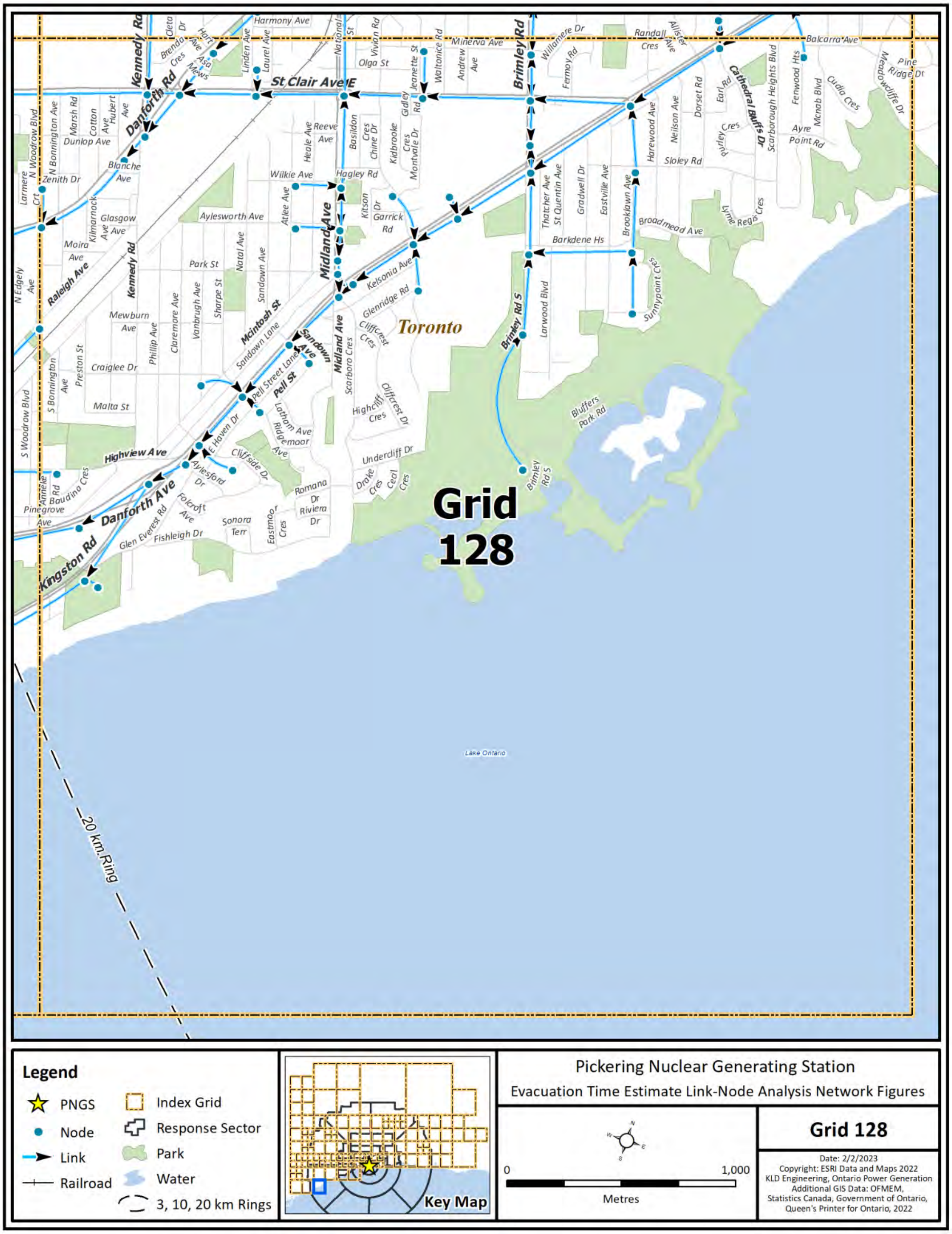


Figure K-129. Link-Node Analysis Network – Grid 128

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 Defined as the area within the following boundary: Highway 401; Liverpool Road; Lake Ontario; Whites Road/RR38
Response Sector P2	Region: Durham Defined as the area within the following boundary: Highway 401; Duffin's Creek; Lake Ontario; Liverpool Road
Response Sector P3	Region: City of Toronto Defined as the area within the following boundary: Highway 401; Rouge River; Lake Ontario; East Avenue
Response Sector P4	Region: Durham Defined as the area within the following boundary: Sheppard Avenue; Whites Road/RR 38; Lake Ontario; Rouge River
Response Sector P5	Region: Durham 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 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 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 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 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 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 Defined as the area within the following boundary: Kingston Road/Highway 2; Pickering Beach Road; Highway 401; Rotherglen Road
Response Sector P12	Region: Durham 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 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 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 Defined as the area within the following boundary: Lawrence Avenue; Centennial Road; Lake Ontario; Morningside Avenue
Response Sector P16	Region: City of Toronto Defined as the area within the following boundary: Highway 401; East Avenue; Lake Ontario; Centennial Road
Response Sector P17	Region: City of Toronto Defined as the area within the following boundary: Ellesmere Road; Centennial Road; Lawrence Avenue; Morningside Avenue
Response Sector P18	Region: City of Toronto Defined as the area within the following boundary: Sheppard Avenue; Little Rouge River; Ellesmere Avenue; Morningside Avenue

Response Sector P19	Region: City of Toronto 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 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 Defined as the area within the following boundary: Whitevale Road; Audley Road; 3rd Concession (Rossland); Brock Road/RR 1
Response Sector P22	Region: Durham 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 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 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 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 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 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 90th and 100th percentile ETE. As discussed in Section 7.3, traffic congestion persists within the DPZ for almost 8 hours. As such, congestion dictates the 90th and 100th 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 90th and 100th percentile by 15 minutes and 25 minutes respectively. Doubling the shadow (60%) percentage increases the 90th percentile ETE by 30 minutes and the 100th percentile ETE by 55 minutes. Full evacuation (100%) of the Shadow Region increases the 90th percentile ETE by 1 hour and 50 minutes and the 100th percentile ETE by 3 hours and 10 minutes – a significant change. The significant increase in the 100th 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 90th and 100th 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 90th and 100th percentile projected ETE for 2028, respectively. The 90th percentile ETE for the AAZ ranges from 3 hours and 40 minutes to 6 hours and 40 minutes. The 90th percentile ETE for the DPZ Inner Ring ranges from 3 hours and 55 minutes to 7 hours and 45 minutes. The 90th percentile ETE for the DPZ Outer Ring ranges from 5 hours and 10 minutes to 8 hours and 45 minutes. The 100th percentile ETE ranges between 4 hours 30 minutes to 10 hours 35 minutes. Similar to 2023 results, majority of the 100th percentile ETE results are dictated by congestion within the DPZ for 2028.

Compared to the 2023 ETE results, the 90th percentile ETE increased by as much as 30 minutes and the 100th 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 100th 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 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 Section 2.5 Section 3.9 and Section 3.10 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. Table 6-3 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters. Appendix F presents the percent households who will await the return of commuters. 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 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: 1. Evacuee average travel distance and time. 2. Evacuee average delay time. 3. Number of vehicles arriving at each destination node. 4. Total number and percentage of evacuee vehicles not exiting the study area. 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. 6. Average speed for each major evacuation route that exits the study area.	Yes	1. Appendix J, Table J-2 2. Table J-2 3. Table J-4 4. None and 0%. 100 percent ETE is based on the time the last vehicle exits the evacuation area 5. Figures J-2 through J-15 (one plot for each scenario considered) 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 Table 7-2 – 100th 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.