APPENDIX 3 LAKE ROTORUA SHORELINES

Several authors have defined where the highest water level (high-stand) of Lake Rotorua was at different times (Table A3.1). Kennedy et el (1978), Manville et al., (2007) and Marx et al. (2009) determined the reasons ("origin" in Table A3.1) for the different lake water levels. Infill and emptying of the lake is mainly related to: large eruptions and tectonic events (e.g., faulting, subsidence) that block and unblock the lake outlet; progressive lowering of water level through erosion of the outlet (generally Holocene fluvial incision in the landscape outside the lake which erodes the lake outlet); or unknown reasons. These authors could also determine the time of the high-stands using the ages of known local volcanic ash found in sediments exposed around the lake. Note that some literature references are old, and thus we have adopted the results from the newer ones. On occasions, we have combined shorelines from different authors that we thought may either be the same one, or that merging them may not make a difference to our interpretations of landscape ages.

We constrained the age of the area of land that is located between two lake high-stands with the ages of the high stands. Information relevant to all high-stand is compiled in Table A3.1 and their location shown with respect to the study sites in Figures A3.1 and A3.2.

Table A3.1 Shoreline elevations and ages around Lake Rotorua. Shorelines from: [1]Kennedy et al. (1978; Note that heights are corrected from current water level); [2]Manville et al. (2007); [3]Marx et al. (2009). Ages from: [A] Gravely et al. (2007), [B] Wilson et al. (2007); [C] Jurado-Chichay & Walker (2000); [D] Lowe et al. (2008).

Name	Height (m asl)	Age (ka)	Origin
Mamaku Ignimbrite	415[3]; 414–387[2]	c.240[A]	Mamaku Ignimbrite eruption formed the basin and a lake developed. Sometime later (undetermined) the water level dropped to heights similar to current level.
Rotoiti	380[3]; 380–370[2]; 370[3]	c. 60[B]	Water level rose after two coeval volcanic eruptions, the Rototiti and Earthquake Flat eruptions, through blockage of the outlet. The high-stand lasted at least ~20,000 year and then dropped to ~320m.
Hauparu	349[3]	c. 36[C]	The high-stand caused by blockage of the north-western lake outlet by volcanic sediments from Hauparu eruption. This high-stand was short lived.
Oruanui	293[1]	27 [D]	Rapid water level fall, post-Oruanui Tephra, possible breaching through the current outlet.
Te Rere/ Okareka	260[3]/278[1] (below current level)	25/21.8[D]	Progressive lowering of the water levels to levels below current level. With some high-stands: e.g. growth of Haroharo Complex Dome during Te Rere eruption[3] (equivalent Okareka Tephra level from [1]).
~9000	280[1] (same as present level)	c. 9[1]	Based on radiocarbon ages of drowned forest.
Rotoma[3]/Mamaku[1]	290[1]	c. 8[D]	Level rose immediately after the Mamaku eruption blocked the outlet.
Rotokawau	286[1]	c. 3.7	Progressive lowering of the water level (dated with Rotokawau Tephra).
Taupo	285[1]	1.7 [D]	Progressive lowering of the water level (dated with Taupo Tephra).

Name	Height (m asl)	Age (ka)	Origin
Kaharoa	283[1]	0.64 [D]	Progressive lowering of the water level (dated with Kaharoa Tephra).
Current	280		

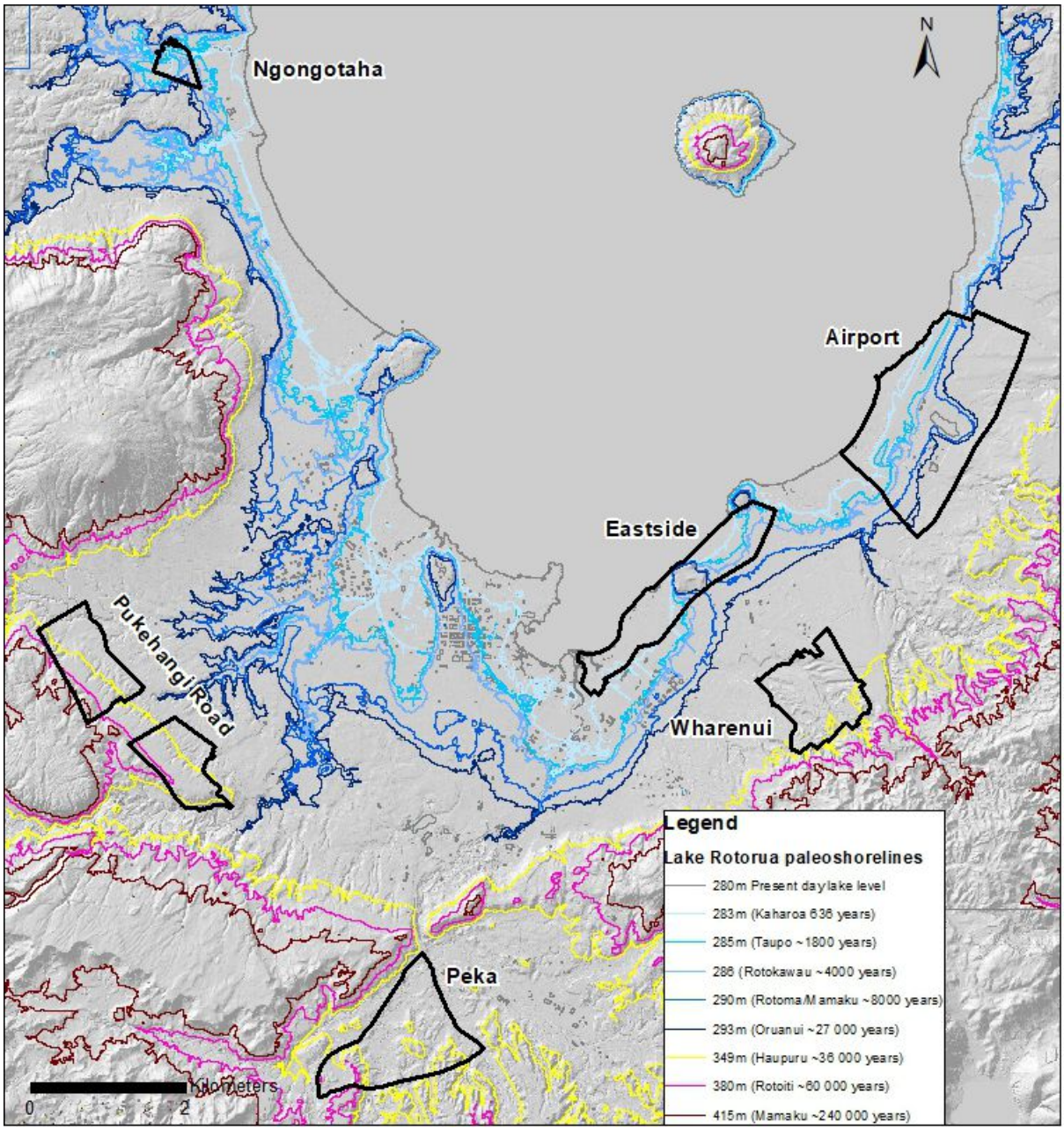

Figure A3.1 Paleoshorelines of Lake Rotorua (compiled from Kennedy et al. 1978, Manville et al. 2007, Marx et al. 2009) that correlate to changes in lake levels following volcanic activity dating back 240 000 years. The development sites at Ngongotaha, Wharenui, Pukehangi Road, Peka, Airport and Eastside lie predominantly on these old lake deposits. Buildings and other human-made structures distort the contours in built up areas.

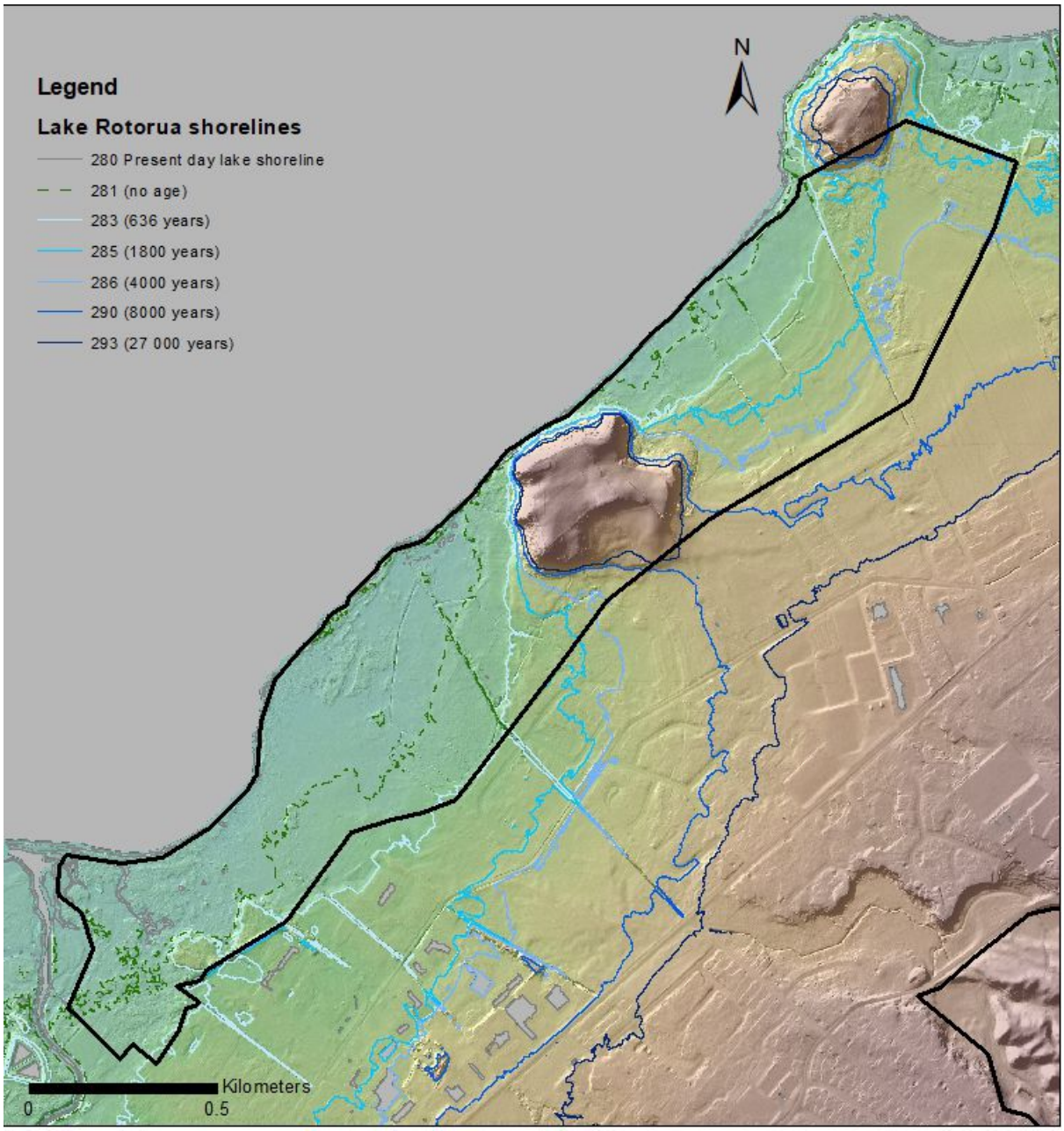

Figure A3.2 Shorelines on the Airport development site. The landscape at this site has been modified so the lake shorelines will not show their original positions. Contours 296 and 301 (light and dark green dashed lines) may approximately represent the lineation's shown in Inset A.