

Appendix C – Pingo Canadian Landmark comparison

The Pingo Canadian Landmark is Canada's only Federal landmark, and is co-managed between Parks Canada, the Inuvialuit Land Administration and the people of Tuktoyaktuk. The 16 km² area includes Ibyuk Pingo, Canada's tallest pingo (~49 m, Mackay ,1998) and the second tallest in the world, and the prominent nearby Split Pingo (Fig. C1). In total, eight pingos are presently identified in the Pingo Canadian Landmark area (Fig. C2).



Figure C1. The Pingo Canadian Landmark boundary and location of Ibyuk and Split pingos. Centred on 69.400192 °N; -133.118409 °W

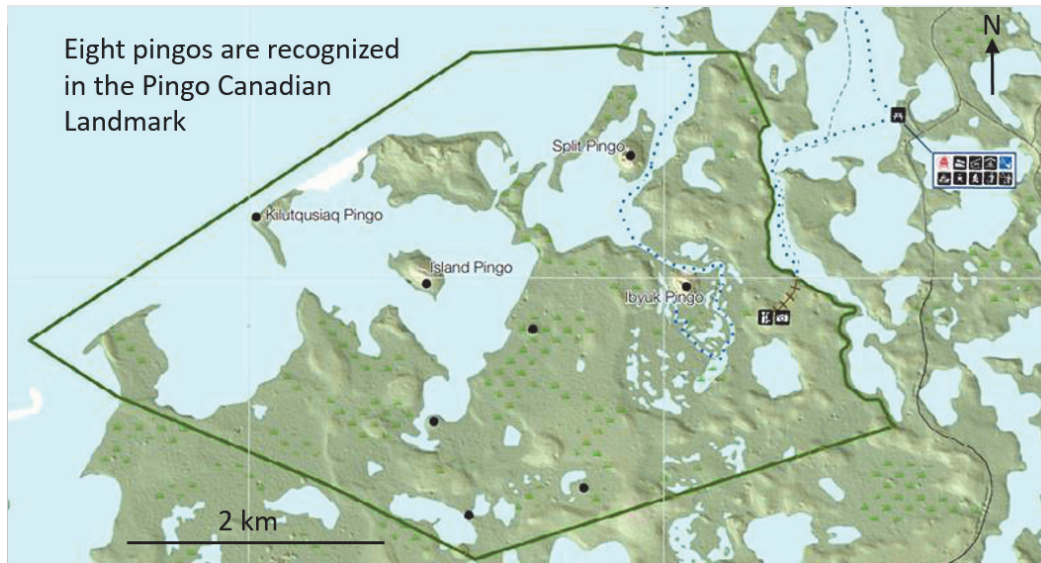


Figure C2. The eight pingos identified in the Pingo Canadian Landmark area (image supplied by Hayleigh Conway, Parks Canada).

Below, we use the 8 pingos identified in Pingo Canadian Landmark as a test of the iterative process we used to identify and test interpretations of pingos and pingo-like features in our study. Without prior identification of the known 8 pingos, Figure C3 shows the location of 16 pingo-like features (green dots) initially identified in the Pingo Canadian Landmark using the HRDEM.

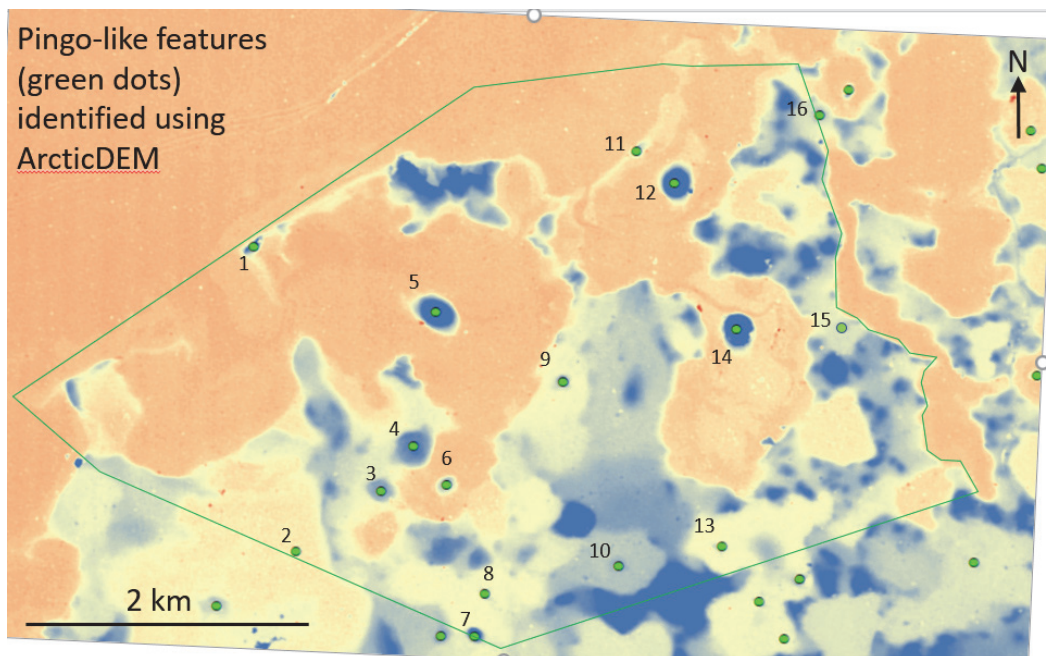


Figure C3. All pingo-like features initially identified in this study using HRDEM within the Pingo Canadian Landmark.

Using an iterative process to examine pingo-like features using Google Earth and ArcGIS Earth, we rejected several pingo-like features in the area. Figure C4 identifies the accepted and rejected pingos after applying the analysis as per the methods section. This process left 13 accepted pingos in the Pingo Canadian Landmark (Fig. C5).

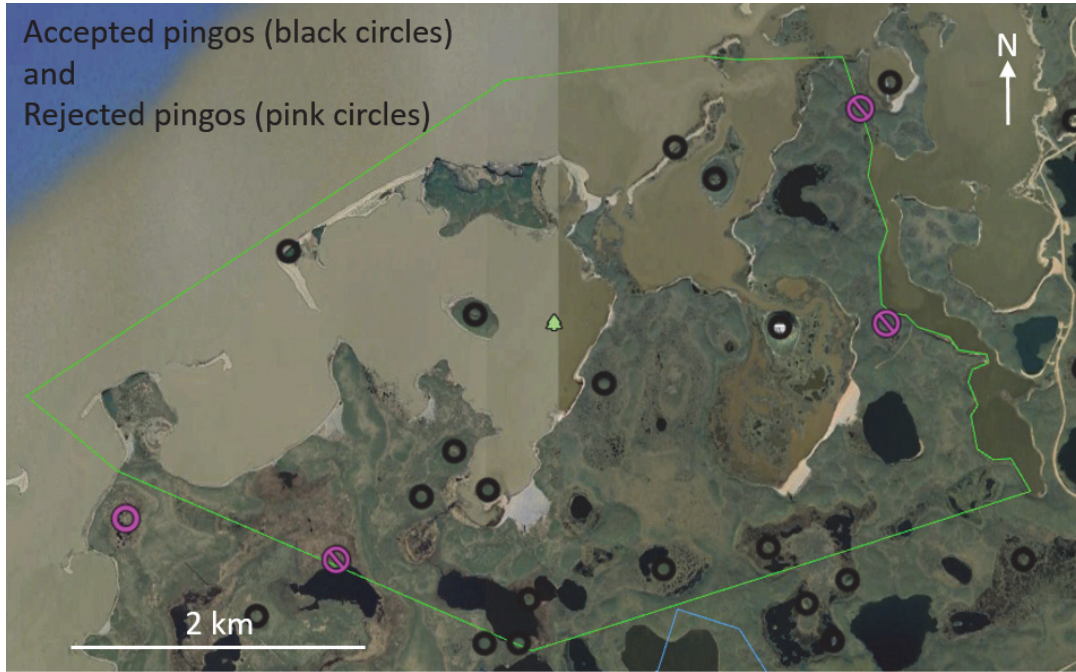


Figure C4. Identification of accepted and rejected pingos within the Pingo Canadian Landmark.

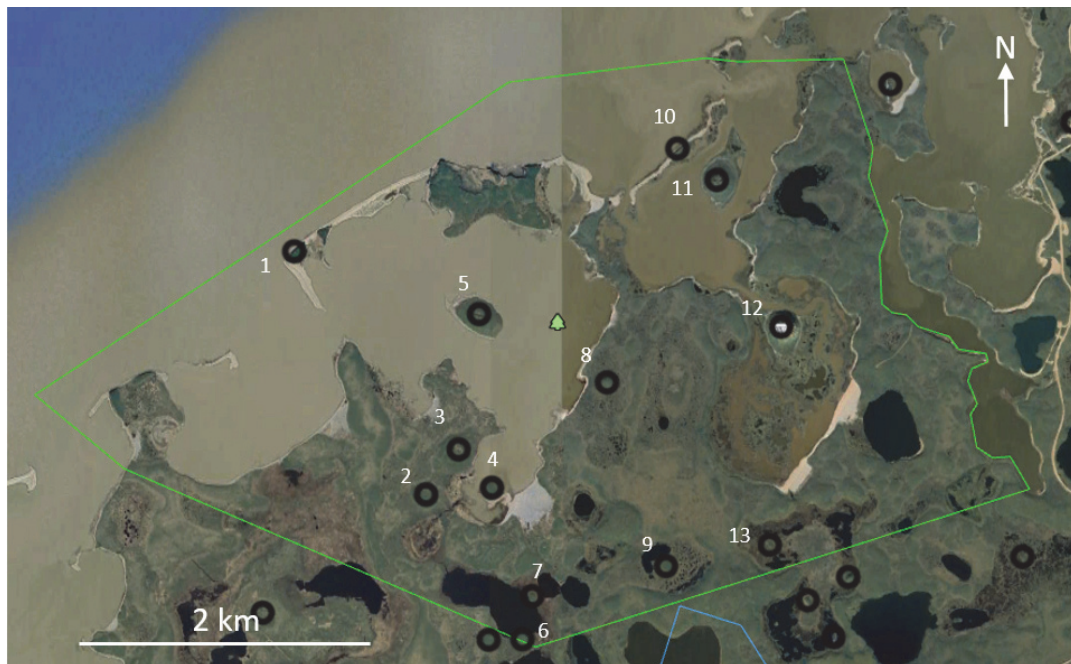


Figure C5. Accepted pingos in the Pingo Canadian Landmark as identified and numbered in this study.

We next examined each pingo feature and assessed it against the pingos recognized by Parks Canada on the Pingo Canadian Landmark map. Pingo 1 is a small eroding pingo along the coast (Fig. C6), known as Kilotqusiaq on the Pingo Canadian Landmark map. Pingos 2, 3 and 4 occur along the shoreline within a former lake basin (Fig. C7). The grey area in bottom right are driftwood logs. Pingo 4 is identified in the Pingo Canadian Landmark map, but pingos 2 and 3 are new.



Figure C6. Pingo 1 identified in this study – also known as Kilotqusiaq Pingo.



Figure C7. Pingos 2, 3, and 4. Pingos 2 and 3 are newly identified in this study.

Pingo 5 is an isolated pingo with its surrounding relict lake basin submerged by rising sea

level (Fig. C8). It is known as Island Pingo on the Pingo Canadian Landmark map. Pingos 6 and 7 are inland on the edge of a modern lake and within a larger former basin, respectively (Fig. C9). Pingo 7 is identified on the Pingo Canadian Landmark but pingo 6, which occurs just inside the southern bounds of Pingo Canadian Landmark, is newly identified.

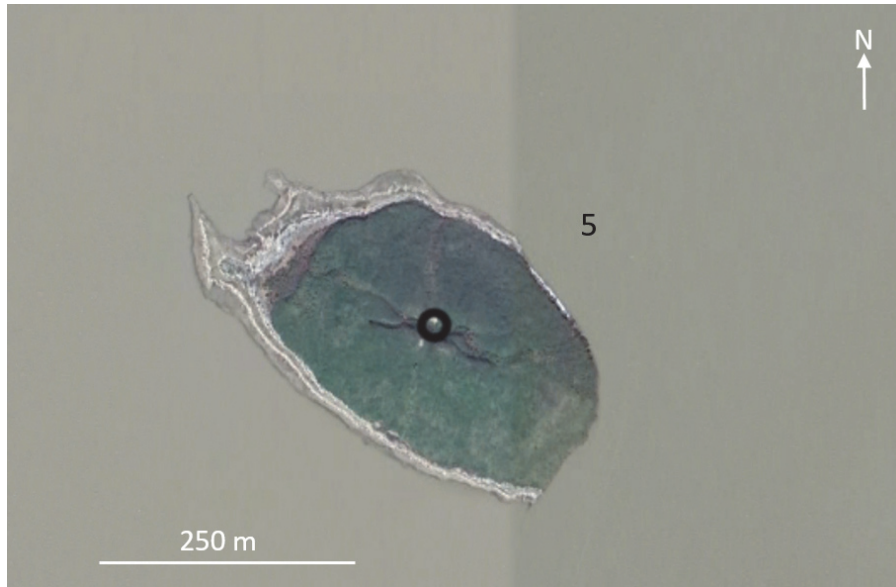


Figure C8. Pingo 5, also known as Island Pingo on the Pingo Canadian Landmark map.

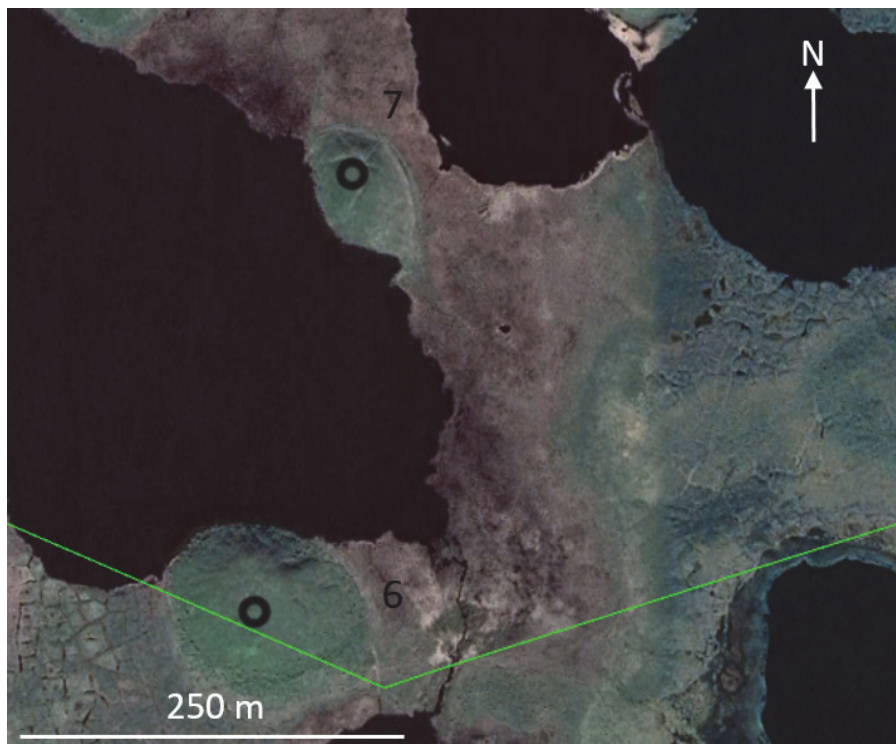


Figure C9. Pingos 6 and 7. Pingo 6 is newly identified.

Pingo 8 occurs in a former lake basin near the modern coastal shoreline (Fig. C10). Pingo 9 is located inland within a former lake basin and adjacent to small modern pond (Fig. C11). Both pingos 8 and 9 are identified on the Pingo Canadian Landmark map.



Figure C10. Pingo 8 is also identified on the Pingo Canadian Landmark map.

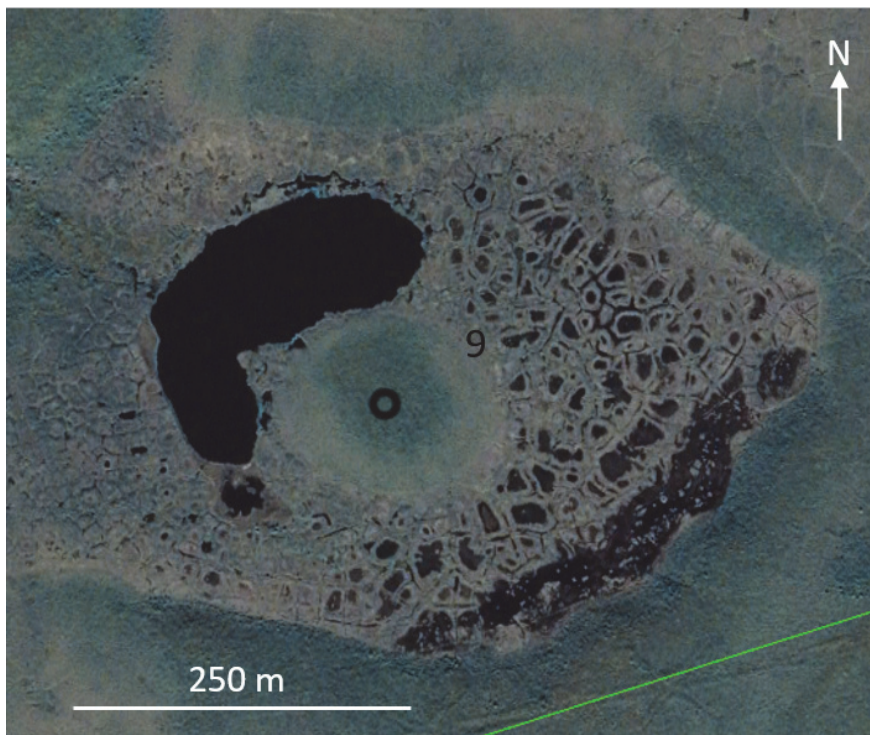


Figure C11. Pingo 9 is also identified on the Pingo Canadian Landmark map.

Pingo 10 is a small eroded (bisected) pingo along modern coast, immediately northwest of Split Pingo, and is a newly-identified pingo (Fig. C12). Pingo 11, also identified on the Pingo Canadian Landmark map, is Split Pingo (Fig. 13).

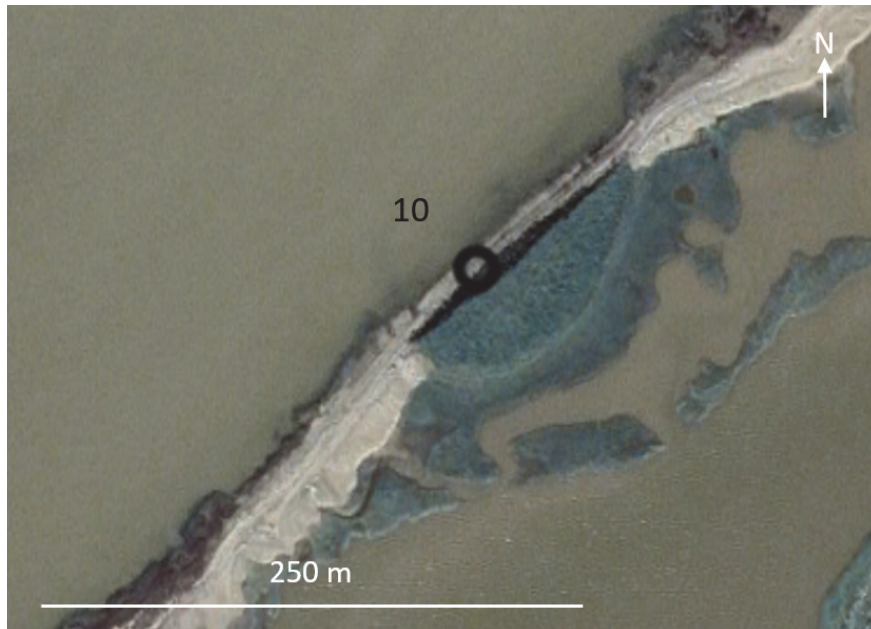


Figure C12. Pingo 10 is a newly-identified eroded pingo.



Figure C13. Pingo 11, also known as Split Pingo.

Pingo 12, identified on the Pingo Canadian Landmark map, is also known as Ibyuk Pingo. (Fig. C14). Pingo 13 is a newly-identified pingo occurring inland in a former lake basin with several small modern ponds (Fig. C15).



Figure C14. Pingo 12, also known as Ibyuk Pingo.



Figure C15. Pingo 13 is a newly-identified pingo in the southeast part of Pingo Canadian Landmark.

Our HRDEM, Google-Earth, and ArcGIS Earth-based mapping analysis successfully identified all eight of the recognized pingos in Pingo Canadian Landmark in addition to 5 additional pingos in the area (Fig. C16). The question may now be asked: are there any more pingos in the Canadian Pingo Landmark than have not yet been identified? Using the Google Earth imagery for the area, we identified 3 additional locations that might be pingos (Fig. C17). We then examined each site remotely.



Figure C16. The 13 pingos identified in the Pingo Canadian Landmark, including 5 new pingos.



Figure C17. The three locations identified (red circles) the may be additional pingos.

In examining the optical imagery in Google Earth, location A is unlikely to be a pingo as it occurs within a former lake basin, but appears similar to the surrounding upland terrain. (Fig. C18). Therefore, it appears to be residual upland terrain. In contrast, in examining the optical imagery in Google Earth, location B may be a pingo as it occurs within a former lake basin and is quite low, elongated, and broad (Fig. C19). The surface cover is similar to surrounding terrain, but its elevation is higher. This may be an example of a low basin-type pingo.

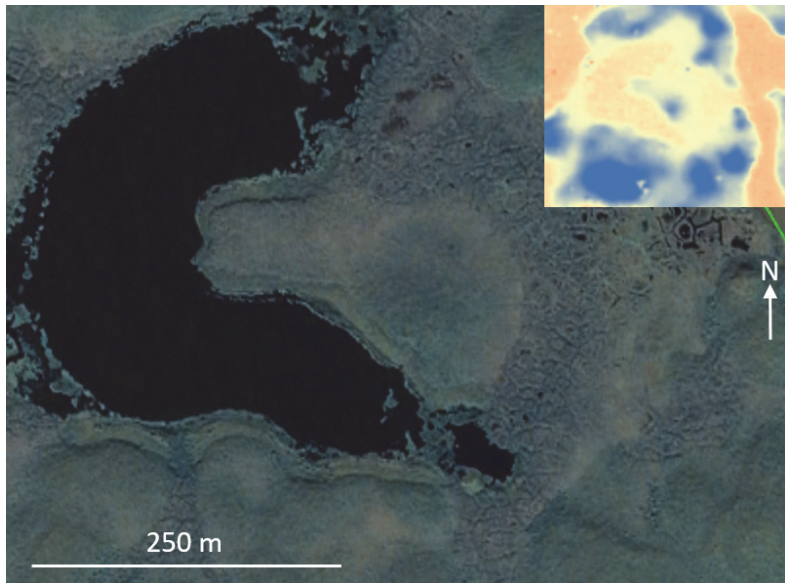


Figure C18. Location A is unlikely to be a pingo.

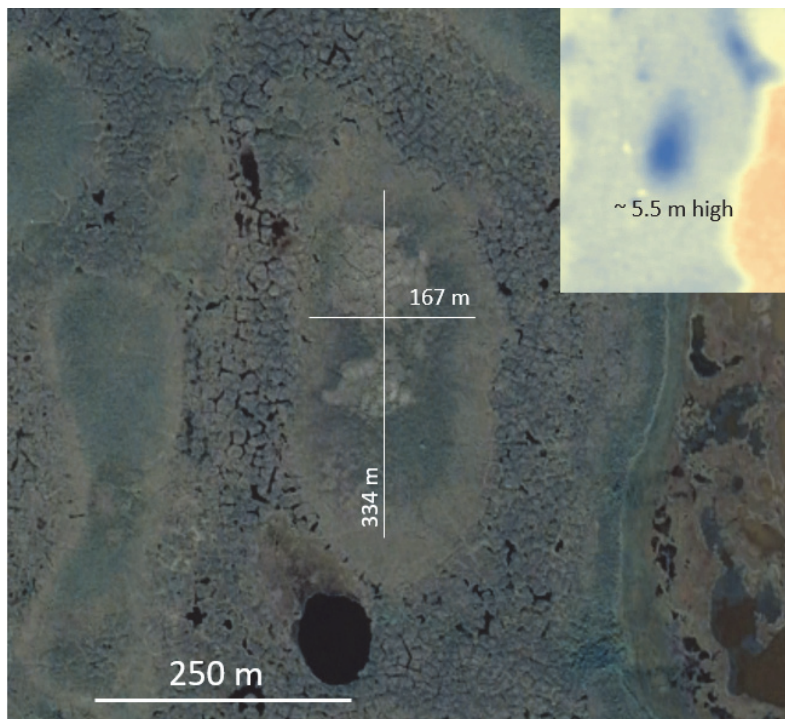


Figure C19. Location B is likely to be pingo.

Lastly, in examining the optical imagery in Google Earth, location C is unlikely to be a pingo as it does not occur within a former lake basin, and appears similar to the surrounding upland terrain (Fig. C20). Therefore, it appears to be residual upland terrain. Consequently, based on the analysis in this study, we suggest there are at least 13 to 14 pingos in the Pingo Canadian Landmark (Fig. C21).

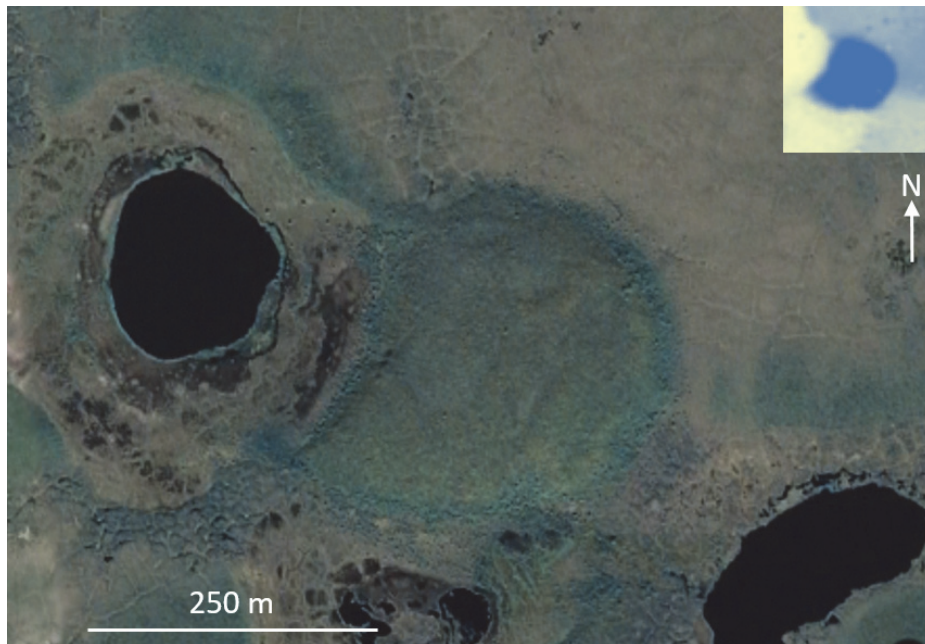


Figure C20. Location C is unlikely to be a pingo.

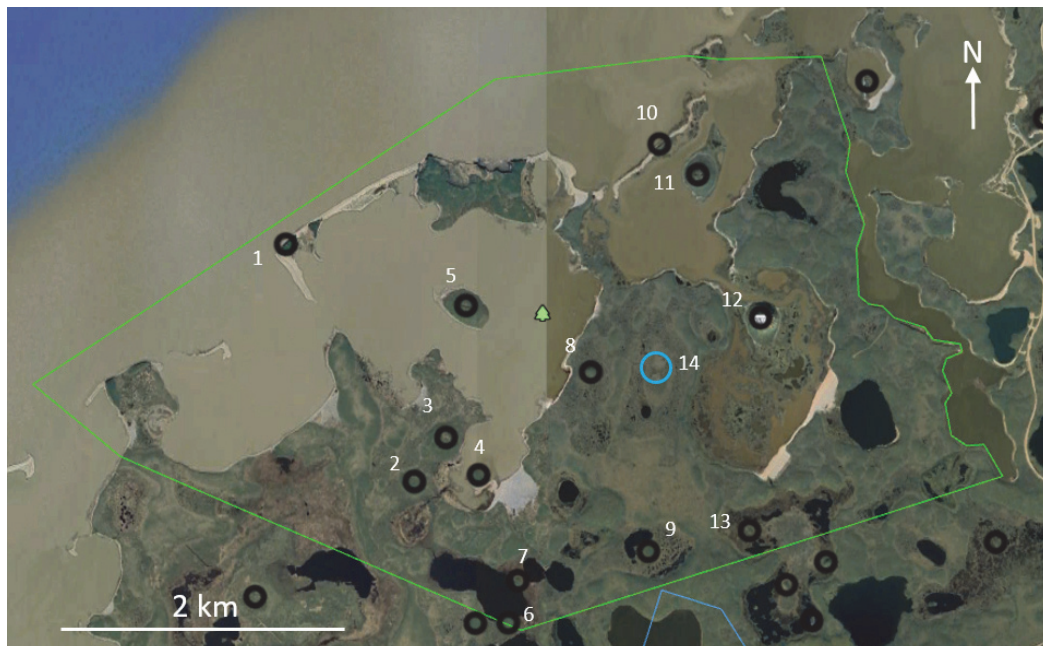


Figure C21. The location of the 13 pingos identified in this study, and one additional possible pingo.

Based on our analysis, we can measure and group the identified pingos. Two pingos have been partially-eroded by coastal erosion. Of the remaining 12, four may be classified as high (>10 m), five as medium (5 – 10 m) and as three low (< 5 m). Most are circular and one is elongated.

Table C1. Location and metadata of pingos identified in the Pingo Canadian Landmark.

Pingo #	Comments	Lat (°N)	Long (°W)	Length (m)	Width (m)	Height (m)	Length/Width	Width/Height	Type
1	Kilutqusiaq Pingo	69.404490	133.163909	175	55	13.5	n/a	n/a	Eroded
2	New	69.389662	133.141291	195	148	5.5	1.3	27	Med circular
3	New	69.392309	133.135897	343	233	7.5	1.5	31	Med circular
4	Known	69.390052	133.129566	147	117	7.5	1.25	15.6	Med circular
5	Island Pingo	69.400622	133.131665	313	207	24.5	1.5	8.4	High circular
6	New	69.380884	133.124509	142	103	16.5	1.4	6.2	High circular
7	Known	69.383457	133.122779	97	64	8.5	1.5	7.9	Med circular
8	Known	69.396528	133.109654	92	83	8.5	1.1	9.8	Med circular
9	Known	69.385463	133.099554	130	118	2.5	1.1	47.2	Low circular
10	New	69.410726	133.097588	127	38	8.0	n/a	n/a	Eroded
11	Split Pingo	69.408808	133.090554	283	220	33.5	1.15	6.6	High circular
12	Ibyuk Pingo	69.399890	133.078989	288	245	43.0	1.18	5.7	High circular
13	New	69.386558	133.081786	107	105	2.0	1.02	52.5	Low circular
14	New	69.396528	133.097815	334	167	6.0	2	27.8	Low elongate

Notes:

Lengths and widths determined from Google Earth imagery
 Heights determined from top of pingo to base using HRDEM
 High >10 m; Medium 5-10 m; Low < 5m
 Circular L/W ≤ 1.5; Elongate L/W > 1.5

References

Mackay, J.R., 1998. Pingo growth and collapse, Tuktoyaktuk Peninsula Area, Western Arctic Coast, Canada: a long-term field study. *Géographie physique et Quaternaire*, 53: 1-53.