Overview of Karst Program Activities 2025-2026

K-D. MacRae, A. Ryan, and J. Beckwith

Karst topography develops where groundwater and surface water interact with soluble bedrock, producing distinctive landforms such as sinkholes, caves, springs, disappearing streams, and solution-sculpted rock surfaces. Karst features in Nova Scotia are most associated with evaporite and carbonate rocks of the Mississippian Windsor Group, including gypsum, halite, anhydrite, and limestone, which are highly susceptible to physical and chemical dissolution processes (Tizzard, 2021). Karst investigations in Nova Scotia are critical for identifying sinkhole hazards, protecting groundwater resources, and informing safe land-use and infrastructure planning in karst-prone areas.

Field investigations during the 2025 season were conducted in Hants, Cumberland and Victoria Counties, integrating geological mapping, Remotely Piloted Aircraft (RPAS) surveys, LiDAR analysis, and field verification to document karst features and refine interpretations of structural controls influencing karst development.

Geological mapping revealed previously undocumented bedrock consisting of Windsor Group lithologies exposed along the River Philip and within sinkholes at Slade and Vickery lakes. Structural measurements indicate predominantly northeast-oriented bedding, folding, and fracture systems consistent with regional interpretations of an evaporite-cored anticline, suggesting strong structural influence on groundwater flow pathways and localized dissolution (Figure 30).

LiDAR analysis played a central role in identifying previously undocumented karst features concealed beneath vegetation and surficial deposits. Field verification confirmed numerous sinkholes ranging from shallow vegetated depressions to large collapse features associated with lake basins. This work allowed for the enhancement of the Nova Scotia karst inventory database, resulting in the addition of approximately 2,800 new sinkhole occurrences, primarily from karst-prone areas across the province, to the provincial database through LiDAR interpretation and preliminary field validation. These newly compiled datasets enabled the development of preliminary sinkhole susceptibility maps, integrating geological, structural, and terrain variables to identify areas of elevated karst potential and support early-stage hazard assessment and land-use planning (Figure 31). Standardized digital geospatial workflows were implemented to ensure consistent data collection and facilitate long-term monitoring. Future work will include field verification of the occurrences added to the database to confirm they are karst related features, as well as continued work towards developing and releasing susceptibility maps.

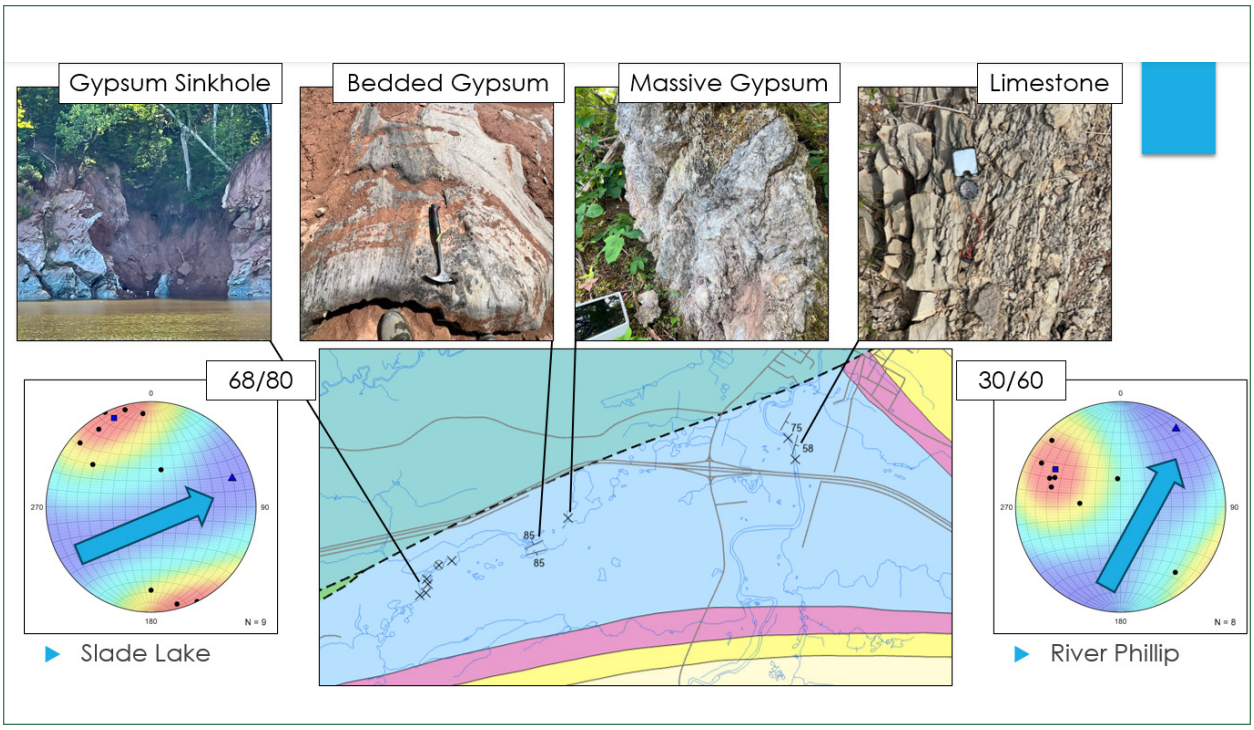

Figure 30. Newly documented bedrock outcrop, with corresponding structural measurements. Stereonets for Slade Lake (068/80) and River Phillip (030/60) indicate predominantly northeast-oriented bedding, folding, and fracture systems (J. Beckwith, unpub. rept., 2025).

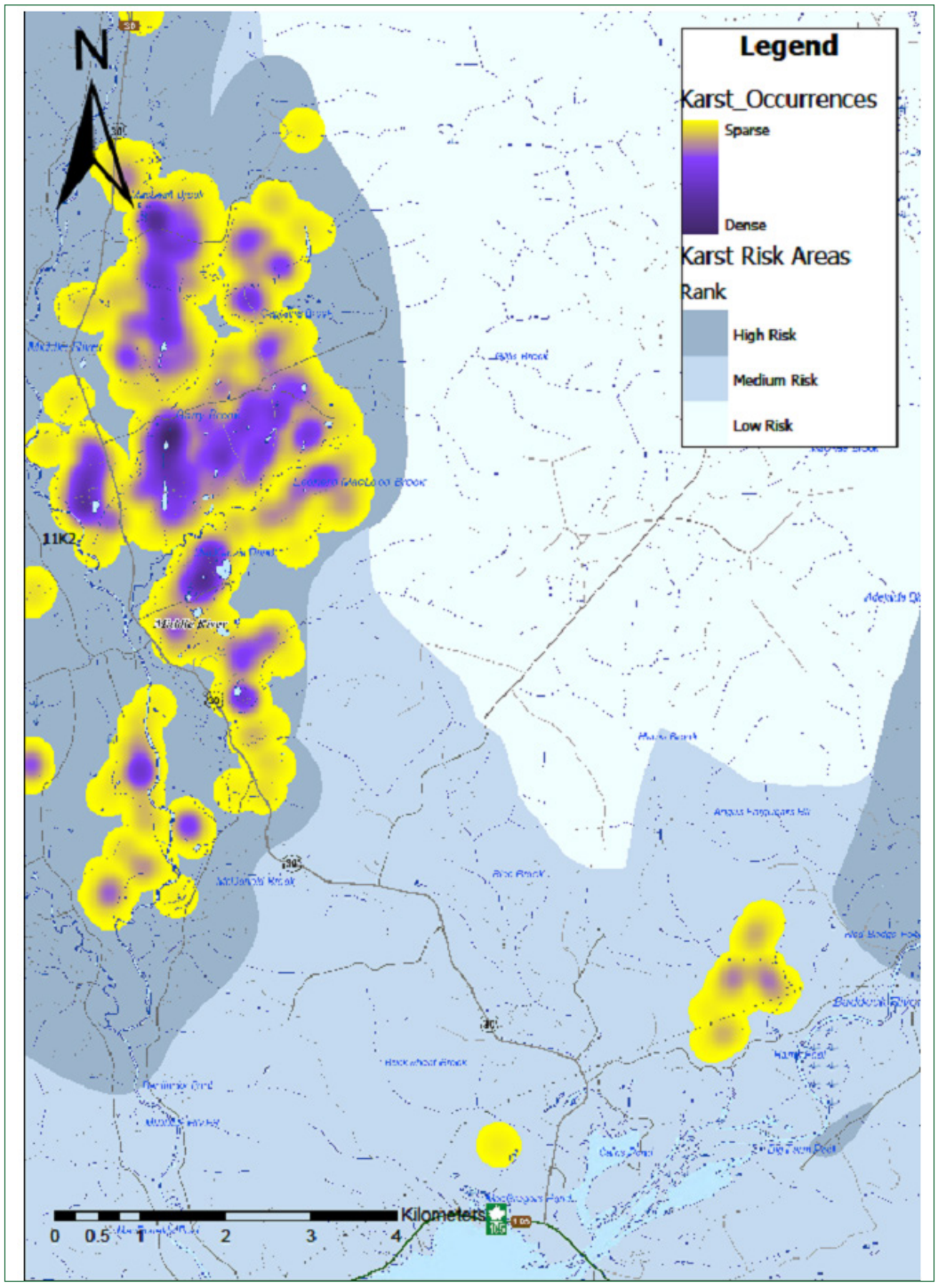

Figure 31. Preliminary sinkhole susceptibility map from Middle River, Victoria County showing the spatial distribution and density of LiDAR identified karst occurrences and associated risk ranking. Areas are classified into low, medium, and high susceptibility zones based on karst occurrence density and geological controls.

Water level monitoring at Slade Lake continued throughout 2025 to assess hydrological changes associated with active karst drainage. Follow-up LiDAR and photogrammetry surveys expanded earlier investigations from 2021 (Tizzard and Horne, 2021) and provided high-resolution elevation data for monitoring active karst features. These surveys consisted of Real-time Kinematic (RTK) equipped RPAS mounted with LiDAR. RPAS missions utilize a grid pattern with a 75% nadir overlap and supplemental oblique imagery. The surveys were flown to a mean altitude of 75 m above the ground. To ensure georeferencing accuracy, ground control points (GCPs) were surveyed via a GNSS RTK receiver before the flight.

RPAS LiDAR surveys were completed in early summer and early fall under controlled conditions, with each survey conducted following a minimum of three consecutive days without rainfall to minimize the influence of precipitation and surface runoff on measured water levels. Survey results indicate significant water-level decline across multiple areas of the lake. Along the eastern margin, where drainage activity is most pronounced and water levels are lowest, lake levels decreased by approximately 0.5 m between June and October 2025. Comparison with a previous survey conducted in 2021 (Tizzard and Horne, 2021) shows a cumulative water-level decline of 2.7 m in this area, corresponding to an estimated loss of approximately 12,700 m^3 of water (Figure 32).

A substantial decrease in water level was also observed in the southwestern portion of the lake, where levels declined by approximately 7 m between the 2021 and 2025 surveys. Complete spatial coverage of this area was not achieved during the June survey; however, volumetric estimates suggest approximately 93,400 m^3 of water loss. Other areas of the lake exhibited minor decreases in water level, likely influenced in part by the warm, dry conditions experienced during the summer months.

Future work will expand field verification, refine geological contacts, and advance hydrological investigations. Monitoring of Slade Lake will continue during summer 2026 alongside development of a regional lake sampling program targeting approximately 55 sinkhole and karst lakes in the Oxford area. Planned sampling of surface waters for temperature, salinity, pH, and conductivity will establish baseline hydrogeochemical conditions and improve understanding of hydraulic connectivity within karst systems. These investigations aim to better assess the likelihood and risks associated with inland saltwater contamination in karstic regions of Nova Scotia.

Figure 32. Nadir UAV image of Slade Lake near Oxford, Nova Scotia acquired in October 2025. Lake edge mapped from November 2021, June 2025, and October 2025 surveys are shown, illustrating progressive reduction in lake surface area associated with declining water levels.

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References

Tizzard, A., and Horne, P., 2021. A Preliminary Volumetric Analysis of Water Draw-Down in Active Karst Terrain, Slade Lake, Cumberland County, 2020; *in* Report of Activities 2020-2021. p. 65-71. <https://novascotia.ca/natr/meb/DATA/pubs/21re02/12ROA_2021_Tizzard&Horne.pdf>