

# MEMO

## Appendix H.4.C.3

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**Subject:** **Georgian Bay (Ontario) Pumped Storage – Open AI Query on Climate Change Effects on the Nottawasaga Bay Ecosystem Using Google Gemini 3 AI**

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**1. For Nottawasaga Bay (Georgian Bay), what is the anticipated cumulative effect of climate change on the nearshore fish communities, spawning reefs, prey species, fish-eating birds and the aquatic ecosystem including invasive species, considering implementation of a 500 m<sup>3</sup>/s daily cyclical Pumped Storage at Meaford Department of National Defence Base?**

Evaluating the cumulative effects of climate change alongside the operation of a massive infrastructure asset—like the proposed 1,000 MW Ontario Pumped Storage Project at the Meaford Department of National Defence (DND) base—requires assessing how **thermal shifts, physical stressors, and biological disruptions** intersect.

A daily cyclical flow of up to 500 m<sup>3</sup>/s (pumping water 150 meters up to a 374-acre reservoir and discharging it back down) will create localized hydrodynamic forces. When superimposed onto the broader, macro-level stressors of climate change in Nottawasaga Bay, these factors create a highly complex cumulative impact matrix.

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### **1. Nearshore Fish Communities & Thermal Stratification**

Climate change is driving up baseline water temperatures in Georgian Bay, prolonging summer stratification and reducing the cold-water refuge required by native salmonids (e.g., Lake Trout, Lake Whitefish).

- **The Pumped Storage Compounding Effect:** Drawing and discharging 500 m<sup>3</sup>/s of water daily acts as a massive mechanical blender. During the summer, pumping warm surface water into an unshaded upper reservoir will heat it further before it is discharged back into the bay.
- **Thermal Plumes:** This cyclical discharge can disrupt local thermal layering, creating a localized warm-water plume. This forces cold-water fish out of vital nearshore habitats, while benefiting warm-water species (like Smallmouth Bass), altering the native community structure.

- **Entrainment and Impingement:** The physical force of intake currents poses a direct threat to nearshore fish. Despite proposed exclusion netting, small fish, larvae, and eggs face high mortality rates from the shear stresses and pressure changes inherent to the pumping cycle.
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## 2. Spawning Reefs & Hydrodynamics

Nottawasaga Bay features critical nearshore limestone reefs utilized by Lake Whitefish and Lake Trout for autumn spawning.

- **Siltation and Turbidity:** Climate change is already intensifying severe weather events, leading to increased shoreline erosion and runoff that can smother egg-laying reefs in sediment. The daily intake and discharge of 500 m<sup>3</sup>/s will generate continuous, artificial currents along the lakebed.
  - **Scouring:** These high-velocity currents risk scouring nearby substrates, resuspending fine sediments, and redistributing them over critical spawning shoals.
  - **Egg Suffocation:** If fine silt settles over whitefish eggs during their winter incubation period, it restricts interstitial oxygen flow, leading to localized year-class failures.
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## 3. Prey Species & Primary Productivity

The base of the food web in Georgian Bay—composed of phytoplankton, zooplankton, and prey fish like Cisco, Rainbow Smelt, and Deepwater Sculpin—is already stressed by nutrient structural shifts (oligotrophication) caused by invasive mussels.

- **Physical Destruction of Biomass:** The daily cycling of millions of cubic meters of water will subject plankton and larval prey fish to extreme mechanical shear stress, pressure drops, and turbulence inside the turbines. This creates a localized "sink" for primary and secondary productivity.
  - **Altered Nutrient Cycling:** Climate-induced warming accelerates metabolic rates in fish, meaning they require *more* prey to survive. If the pumped storage facility simultaneously reduces local prey density through entrainment or forces prey species to flee the hydrodynamically active zone, it creates a localized energetic deficit for predatory fish.
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## 4. Fish-Eating Birds & Avian Botulism

Fish-eating birds, such as the Common Loon, Caspian Terns, and Double-crested Cormorants, face a unique, dangerous compounding threat from the intersection of climate change and altered hydrodynamics: **Avian Botulism (Type E)**.

- **The Climate Catalyst:** Higher water temperatures and lower water levels create ideal, anoxic (oxygen-depleted) conditions for the bacterium *Clostridium botulinum* to thrive in rotting macroalgae (like *Cladophora*).
- **The Facility Trigger:** The mechanical destruction of fish and plankton passing through the pumped storage turbines can result in injured, disoriented, or dead biomass settling near the

discharge zone. This creates an artificial feeding ground for invasive Round Gobies, which concentrate the botulinum toxin.

- **Avian Impact:** As waterbirds prey on these toxic, easily caught gobies, outbreaks of Avian Botulism can spike, leading to localized mass mortality events for piscivorous birds in Nottawasaga Bay.

## 5. Aquatic Ecosystem Alterations & Invasive Species

Climate change acts as an environmental accelerator for invasive species, opening up ecological niches as native species decline.

Stressor Factor	Climate Change Trend	Pumped Storage Compounding Interaction
<b>Water Temperature</b>	Warming baseline temperatures.	Artificial warming of reservoir water; disruption of native thermal barriers.
<b>Invasive Zebra/Quagga Mussels</b>	Extended growing seasons, filtering out vital nutrients.	High-velocity currents can facilitate the transport and settlement of veligers (larvae) onto newly engineered structures.
<b>Round Goby Expansion</b>	Prefers warmer water; displaces native benthic fish.	Thrives in disturbed, high-turbidity habitats and exploits injured biomass near the discharge.
<b>Algal Blooms (<i>Cladophora</i>)</b>	Fueled by warmer waters and high sunlight penetrability.	Dislodged algae can clog intake screens; decaying algae on the lakebed exacerbates local anoxia.

Additionally, because the facility is situated on the Meaford DND base—a historical military training ground—the intense physical disturbance of digging the upper reservoir and routing large-diameter conduits raises concerns regarding the mobilization of legacy soil contaminants (such as heavy metals or unexploded ordnance residue) into the nearshore aquatic ecosystem.

### Summary of Cumulative Impact

Ultimately, the proposed pumped storage facility would not operate in a vacuum. It would act as a **localized stress multiplier** on an ecosystem already undergoing a climate-driven transition. While the macro-effects of climate change alter the broad temperature and nutrient baselines of Georgian Bay, the daily physical and thermal disruption of a 500 m<sup>3</sup>/s cyclical flow could anchor those negative impacts to the nearshore waters of Meaford—altering spawning success, escalating invasive species dynamics, and shifting the local food web from the bottom up.

*(Note: The project is currently undergoing a formal federal review by the Impact Assessment Agency of Canada (IAAC), which is tasked with precisely quantifying these site-specific marine and ecological risks before any final approvals are granted).*