Field Skills & NB Test Preparation

This final module is your competition toolkit. It covers the **Envirothon NB station format, species identification, data reading, and oral presentation** — everything you need to walk into the provincial competition in May ready to perform.

1. Envirothon NB — what to expect

Envirothon NB is the provincial team competition held each spring (early May). Your team will rotate through the field stations, each testing on the different subject areas.

Understanding the station format and scoring logic is itself a competitive skill — teams that know what judges are looking for consistently outperform teams with the same knowledge but less strategy.

Station	Subject and typical format
Aquatic Ecology	Macroinvertebrate ID, fish ID, water quality data interpretation, watershed concepts, species at risk, NPS pollution. Written + hands-on specimen identification.
Forestry	Tree ID, forest management, silviculture, species ecology. Tree specimens / leaf samples typically present.
Soils & Land Use/ Geology	Soil texture, horizon ID, land capability, agricultural practices. Geology rocks and minerals, Soil cores / samples typically present.
Wildlife	Bird and mammal ID, habitat assessment, population ecology. Photos, mounts, or calls typically used.
Current Environmental Issue	Non-point source pollution (2026 focus). Written test on NPS concepts from both general and NB-specific perspectives.

STATION TIME IS SHORT

Each station is typically 1 hour for the whole team. Designate roles before competition day: who leads on aquatic ID, who reads the data table aloud, who keeps time. Practice rotating through stations with a timer — the pressure of the clock changes how you perform.

2. Macroinvertebrate identification

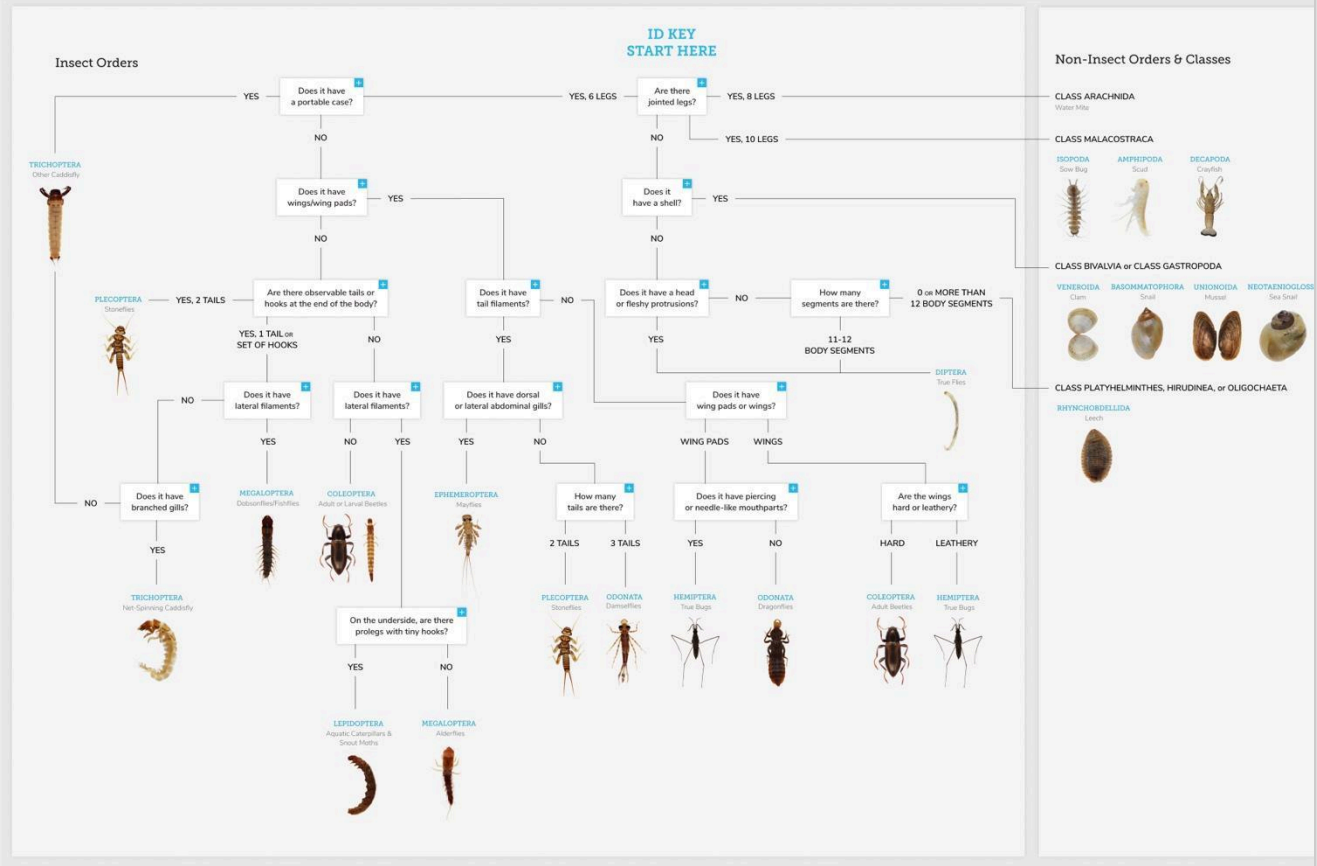
Specimen identification is almost always present at the NB aquatic ecology station. You may get preserved specimens in trays, photographs, or both. For each specimen you typically need to: (1) name the order or group, and (2) assign the correct pollution tolerance group (1, 2, or 3).

The instant recognition guide — what to look for first

Look for …	Order / group	Tolerance	Confirm with …
3 tails	Mayfly (Ephemeroptera)	Group 1	Gills on abdomen; wing pads; 3 pairs legs near head
2 tails only	Stonefly (Plecoptera)	Group 1 — most sensitive	Flat body; 2 tarsal claws; found under rocks in riffles
Silk case OR rear hooks	Caddisfly (Trichoptera)	Group 1	Case of sand/leaves/sticks; OR bare larva with 2 rear hooks
Flat oval disc	Water penny	Group 1	Oval, segmented; underside of rocks in fast water
Large, fierce; side gills	Dobsonfly larva	Group 1	Up to 8 cm; curved tail hooks; predatory
Slender; 3 leafy tail gills	Damselfly	Group 2	Thin body; 3 oar-like gill tails
Stocky; no tail gills	Dragonfly	Group 2	Internal gills; wide abdomen; large eyes
10 legs; big claws	Crayfish	Group 2	Classic crustacean; large pincers
Tiny C-shape; worm-like; no legs	Midge larva (Chironomidae)	Group 3 — tolerant	Often red (bloodworm); writhing motion
Long thin worm; segmented	Aquatic worm (Tubificidae)	Group 3	Thrashes when disturbed; lives in fine sediment
Suckers at both ends	Leech (Hirudinea)	Group 3	Looping movement; flat body
Long snorkel tail	Rat-tailed maggot	Group 3	Breathes air through extended tail; lives in polluted mud

THE THREE-QUESTION ID SHORTCUT

How many tails? → 3 tails = mayfly; 2 tails = stonefly. Any silk or hooks? → caddisfly. Everything else: is it worm-like / leech-like / midge-like? → Group 3. With practice, 90% of specimens can be placed with these three questions alone.



Macroinvertebrate ID reference sheet for competition.

https://www.macroinvertebrates.org/

Scoring a sample — the weighted method

Once you've identified the organisms in a sample, calculate a water quality score using the weighted method. This may appear directly on the station test or be embedded in a scenario question.

Calculation	Score range and interpretation
Count distinct Group 1 taxa × 3	Total > 22 = Excellent
Count distinct Group 2 taxa × 2	Total 17–22 = Good
Count distinct Group 3 taxa × 1	Total 11–16 = Fair
Add all three totals together	Total < 11 = Poor

WORKED EXAMPLE

Sample contains: 3 stonefly taxa + 2 mayfly taxa + 1 caddisfly taxon (Group 1) = 6 × 3 = 18 points. 2 dragonfly taxa + 1 crayfish taxon (Group 2) = 3 × 2 = 6 points. 4 midge/worm taxa (Group 3) = 4 × 1 = 4 points. Total = 28 points = Excellent water quality. EPT richness = 6 (3 stonefly + 2 mayfly + 1 caddisfly). This stream is in good ecological health.

3. Reading water quality data

Station tests frequently present a table of water quality readings from one or more stream sites and ask you to interpret them. Work through every table with the same systematic method.

The six-step interpretation method

Step	What to do
1	Check units for every column (mg/L, ppm, NTU, °C, pH, µS/cm). A wrong unit assumption will cost you marks.
2	Compare each value to the healthy range in your memory (or on a reference card if allowed). Use the CCME guidelines from Module 3.
3	Flag any value outside the acceptable range — circle it. Note whether too high, too low, or in the concern zone.
4	For each flagged value, write one sentence about the specific ecological impact: what organism is harmed and how.
5	Look for parameter interactions: high temperature + low DO = double stress; high nutrients + warm water = bloom risk.
6	Predict what the macroinvertebrate community would look like at this site — and what you'd expect to find if you sampled.

Practice data table — Site A vs. Site B

Practice with this example. Identify all problems, explain their causes, and predict the macroinvertebrate community at each site.

Parameter	Healthy range	Site A (farm field downstream)	Site B (forested headwater)	Unit
Temperature	< 18°C (salmonids)	24.5	11.2	°C
Dissolved oxygen	> 9.5 (ideal); > 6.5 (spawning)	4.1	10.8	mg/L
pH	6.5–9.0	6.0	7.1	pH units
Turbidity	< 8 NTU above background	47	3	NTU
Phosphate	< 0.02 ppm	0.28	0.01	ppm
Nitrate	< 0.2 ppm (pristine)	3.8	0.08	ppm
Conductivity	< 200 (pristine)	640	85	µS/cm
E. coli	< 200 CFU/100 mL	480	< 10	CFU/100 mL

ANSWER GUIDE — SITE A

Problems: Temperature 24.5°C (fatal for salmon); DO 4.1 mg/L (fish kills likely); turbidity 47 NTU (smothers eggs, blocks light); phosphate 0.28 ppm (algal bloom imminent); nitrate 3.8 ppm (above CCME limit); E. coli 480 (health advisory triggered); pH 6.0 (borderline for sensitive species).

Likely cause: Agricultural NPS pollution — fertilizer runoff (N & P), livestock stream access (E. coli, turbidity), loss of riparian shading (temperature), impervious surfaces or road runoff (conductivity).

Predicted macroinvertebrates: Group 1 (EPT) absent or very rare. Dominated by midges (Chironomidae), aquatic worms, and possibly leeches. Low EPT richness. Weighted score likely < 10 = Poor quality.

Site B: All parameters within healthy ranges. Predict high EPT richness, multiple stonefly and mayfly taxa, good score — excellent water quality typical of an undisturbed forested catchment.

4. Watershed and mapping skills

You may be given a map and asked to identify watershed boundaries, stream order, or land uses that represent NPS pollution sources. These are fast points if you've practised.

Watershed delineation on a topo map

- Ridgelines are the watershed boundary — trace the high points surrounding the drainage.
- Water always flows perpendicular to contour lines — following the V-shape of contour lines pointing uphill tells you flow direction.
- All water within the ridge boundary drains to the same outlet point.
- Tributaries always join the main channel at an angle pointing downstream (never upstream).

Stream order on a map

- First-order streams have no tributaries flowing into them.
- When two streams of the same order join, the order increases by one.
- When a lower-order stream joins a higher-order one, the higher order is maintained.
- The critical question: identify points A, B, C on a map and state the stream order at each.

Reading NPS sources on a land-use map

Land use shown on map	NPS pollutants to identify
Agricultural fields (crop symbols)	Fertilizers (N & P), pesticides, sediment from tillage, livestock waste (E. coli) if animals shown
Clear-cut / logging area	Sediment, temperature increase (loss of canopy), pesticide (herbicide application)
Urban / suburban (buildings, roads)	Road salt, oil/grease, lawn fertilizers, stormwater, bacteria from pet waste and septic systems
Construction site (disturbed ground)	Sediment — highest per-acre erosion rate of any land use
No buffer at stream edge	Identify as missing BMP — riparian buffer absent = heightened NPS risk for all adjacent land uses

5. NB species and sites to know

The NB competition tests NB-specific knowledge. These are the most commonly tested species, sites, and ecological facts for the aquatic ecology station.

Aquatic species at risk in NB

Species	Status	Why it matters for Envirothon
Atlantic salmon (inner Bay of Fundy)	Endangered (SARA)	Cold-water indicator; sensitive to temperature, sedimentation, and DO. Miramichi watershed is nationally significant.
Brook trout	Not at risk federally, but declining	Cold-water indicator species; benchmark for healthy NB headwater streams.
Brook Floater mussel	Special Concern (COSEWIC/SARA)	Found in Petitcodiac River; filter feeder; sensitive to silt and low DO; 2025 PWA monitoring confirmed 5 NB species.
Yellow Lampmussel	Special Concern (COSEWIC)	Found in Wolastoq (Saint John River) system; depends on host fish for larval stage.
Dwarf Wedgemussel	Extirpated from Canada	Was found only in Petitcodiac River; eliminated by 1967–68 causeway; key case study in Module 6.
Wood Turtle	Threatened (SARA)	Uses riparian zones of NB rivers; directly impacted by streambank loss and agricultural encroachment.
Zebra Mussel	Invasive (arrived NB 2023)	Confirmed in Madawaska River; threat to native mussels and infrastructure; eDNA monitoring underway.

Key NB sites and watersheds

Site / watershed	What it illustrates
Petitcodiac River	Causeway (1967–68) → ecosystem collapse → gate opening (2010) → restoration. Case study for legislation, species at risk, and habitat recovery.
Miramichi River	World-class Atlantic salmon watershed; cold-water ecology; importance of riparian cover and headwater stream quality.
Wolastoq (Saint John River)	NB's longest river; agricultural NPS issues; cyanobacteria blooms; $2.3M federal investment (2026); Wolastoqey treaty rights.
Bay of Fundy	World's highest tides; semipalmated sandpiper migration; salt marshes; Musquash Estuary MPA; blue carbon.
Musquash Estuary	Atlantic Canada's first marine protected area (2006); undisturbed Bay of Fundy estuary; habitat for Species at Risk.
Grand Lake (Jemseg watershed)	CyanoTracker real-time monitoring; cyanobacteria research; Jemseg Grand Lake Watershed Association.
Kennebecasis watershed	2026 NPS BMP project (federal funding); riparian buffers, rotational grazing, alternative livestock watering.

6. NPS oral presentation preparation

Oral scenarios typically describe an area or watershed with: specific land uses (agriculture, urban, forestry); a set of water quality problems (algal blooms, turbidity, species decline); and a stakeholder context (farmers, municipalities, First Nations, developers). You might need to diagnose the NPS sources, explain the ecological impacts, and present realistic, evidence-based BMP solutions.

The DIAG–LINK–SOLVE framework

Stage	What you do	Example for a farm watershed scenario
DIAGNOSE	Identify all NPS sources present in the scenario description.	Fertilizer runoff (N & P), livestock access to stream (E. coli, turbidity), bare soil from tillage (sediment), no riparian buffer.
LINK	Connect each source to specific water quality and ecological impacts.	High P → algal blooms → DO depletion → fish kills; turbidity → smothers macroinvertebrates and spawning gravel.
SOLVE	Propose specific, layered BMPs. Prioritize by effectiveness and feasibility.	Immediate: livestock exclusion fencing + off-stream watering. Medium: plant 30 m riparian buffer. Long-term: nutrient management plan + cover crops.

Integrating all five subject areas

Judges reward teams that connect their NPS answer to all five Envirothon subjects. Try and think how to use these links:

Subject area	How to connect it to NPS pollution in your oral
Aquatic ecology	Species impacted (EPT taxa, fish, mussels); water quality parameters affected; stream monitoring results.
Forestry	Riparian buffer as forestry BMP; streamside management zones; how logging roads contribute NPS sediment.
Soils & land use	Soil erosion as sediment source; soil health from no-till; land capability class affecting NPS risk.
Wildlife	Species at risk affected (salmon, turtle, mussel); habitat loss from NPS; predator-prey disruptions from fish kills.
Current issue (NPS)	Use precise NPS vocabulary: point vs. non-point, first flush, impervious surface, cultural eutrophication, BMPs.

7. Master knowledge checklist

Use this as your final study checkpoint before the NB competition. Tick each item when you can answer it confidently without notes.

Module 1 — Watersheds & the Water Cycle

☐	Can define: watershed, tributary, ridgeline, headwaters, floodplain, estuary
☐	Can trace a water molecule through all 6 stages of the water cycle
☐	Can explain Strahler stream order rules — including the rule about same-order joins
☐	Can name NB's three major watersheds and a key fact about each
☐	Can explain what makes the Bay of Fundy unique and why it matters ecologically

Module 2 — Aquatic Environments & Wetlands

☐	Can name and describe the four lake zones (littoral, limnetic, profundal, benthic)
☐	Can compare oligotrophic vs. eutrophic lakes — including human acceleration
☐	Can distinguish bog from fen from marsh from swamp with key features for each
☐	Can list at least 4 functions of riparian zones and explain the mechanism of each
☐	Can describe the River Continuum Concept and how energy sources shift from headwaters to large rivers
☐	Can explain the semipalmated sandpiper's Bay of Fundy connection (*Corophium volutator*, doubling weight, 3,000+ km flight)
☐	Knows the 2020 WAWA update: all wetlands protected by presence, not mapping

Module 3 — Water Quality & Monitoring

☐	**Knows CCME thresholds for: temperature, dissolved oxygen (DO) (at least 3 levels), pH, turbidity, phosphate, nitrate, conductivity, E. coli**
☐	Can explain why DO drops at night in eutrophic water (the daily cycle)
☐	Can describe the complete eutrophication chain from nutrient input to fish kill
☐	Understands CABIN: what it is, why biomonitoring, how RCA works, what EPT richness means
☐	Can describe the two types of cyanobacteria blooms in NB and what to do if you see one
☐	Can name the CyanoTracker (Grand Lake) and explain what phycocyanin measures

Module 4 — Benthic Macroinvertebrates

☐	**Can rapidly ID: stonefly (2 tails), mayfly (3 tails), caddisfly (case or hooks), midge (red worm), aquatic worm**
☐	Can calculate a weighted pollution score and state the water quality category
☐	Can define EPT richness and explain the EPT:Chironomidae ratio
☐	Can describe the 5 functional feeding groups and where each dominates
☐	Knows the NB freshwater mussel situation: Brook Floater (special concern), Dwarf Wedgemussel (extirpated), Zebra Mussel (arrived 2023)
☐	Can explain why freshwater mussels are sensitive bioindicators (filter feeders, host fish dependency, silt sensitivity)

Module 5 — Non-Point Source Pollution

☐	**Can define NPS vs. point source with NB examples of each**
☐	Can explain the 3 transport pathways (surface runoff, leaching, atmospheric deposition)
☐	Knows Atlantic Canada has highest pesticide runoff risk in Canada (42 runoff days/year)
☐	Can trace the complete eutrophication chain from fertilizer to fish kill (8 steps)
☐	Can name and explain at least 6 agricultural BMPs with effectiveness data
☐	Can name and explain at least 4 urban green infrastructure BMPs
☐	Knows the 2026 Kennebecasis/Wolastoq federal NPS funding ($2.3M, 14 projects)
☐	Can explain what the ‘first flush effect’ is

Module 6 — Legislation & Water Governance

☐	Can state which level of government owns water and which protects fish habitat
☐	Knows the NB Clean Water Act (1989) and its key regulations: WAWA, Watershed Protection Orders, Water Classification Regulation
☐	Knows the WAWA 30 m rule and can list 5 activities that require a permit
☐	Can explain Fisheries Act ss. 35 and 36 (HADD and deleterious substances)
☐	Knows SARA's role: COSEWIC assessment → Schedule 1 listing → prohibitions and recovery plans
☐	Knows the Canada Water Agency Act came into force October 15, 2024
☐	Can explain s.35 Constitution Act (Indigenous water rights) and UNDRIP Act (2021)
☐	Knows the Musquash Estuary MPA (2006) and Petitcodiac causeway case study

8. Rapid-fire NB fact sheet

These are the specific numbers and facts most commonly tested. Know them cold.

Fact	Value / answer
NB riparian buffer minimum (WAWA)	30 metres from any watercourse or wetland
CCME DO guideline (cold-water fish)	9.5 mg/L or higher (ideal); minimum 6.5 mg/L for spawning
DO level causing fish kills	Below 3 mg/L
CCME pH range for aquatic life	6.5 to 9.0
Phosphate concern threshold	Above 0.1 ppm triggers algal bloom risk
CCME nitrate guideline	Below 3 mg/L N
E. coli health advisory trigger (NB beaches)	Above 200 CFU per 100 mL
CCME salmonid temperature maximum	18–19°C
% of world's semipalmated sandpipers in Bay of Fundy	Up to 75% of global population each August
Bay of Fundy maximum tidal range	Up to 16 metres (Minas Basin)
NB wetland protection rule update	2020: all wetlands protected by presence, not just mapped wetlands
Petitcodiac causeway construction year	1967–68; gates opened 2010
Musquash MPA designation year	2006 — Atlantic Canada's first marine protected area

NB's protected drinking water watersheds	29 watersheds protected under Clean Water Act (2001)
Canada Water Agency Act in force	October 15, 2024
Zebra Mussel confirmed in NB	August 2023 — Madawaska River (first in NB waters)
Wolastoq federal investment (2026)	$2.3 million, 14 NPS-focused projects
CABIN launched nationally	2006 by Environment and Climate Change Canada
NB surface runoff days per year	42 days (highest in Canada; doubles Ontario/Quebec)
Brook Floater conservation status	Special Concern under COSEWIC and SARA
Dwarf Wedgemussel status in NB	Extirpated — gone from Canada since ~1984
NB rivers and streams total length	Approximately 60,000 km
Stream order rule	Two streams of the SAME order joining increases order by 1
Macroinvertebrate weighted score: Excellent	Above 22 points

← **Previous:** Module 7: Legislation & Water Governance

→ **You're ready. Good luck at the Envirothon NB!**