MSSM Trafton Lake Monitoring Form

Names of group members: MSSM Chemistry students and advanced chemistry students
Date:__10/29/2026 _Time_8:45 10:15 am
Location/ sampling site:_Trafton Lake Campgrounds

Weather conditions:
Cloud Cover percent_____27%_____ Temperature_____47 F_____
Precipitation ___None present_____ Wind___8 mph____
Recent weather trend: sunny and clear

Quantitative water assessment

	Water Temp (C)	pH	Nitrates, NO_3^-	phosphate S PO_4^{-3}	Carbon Dioxide	silica	Dissolved oxygen	Turbidity Sechi disk	Total Hardness/ Ca/Mg ppm
Trial 1	7	8.5	1.76 ppm	0.2 ppm	7 ppm	0.75 ppm	5 ppm	Not used too shallow	104 ppm
Trial 2	6.7	9.0	1.32 ppm	0.2 ppm	11 ppm	0.75 ppm	8.6 ppm		108 ppm
Trial 3	5.4	8.5	1.76 ppm	missed PO_4^{-3}	4 ppm		10 ppm		116 ppm
average	6.4 C	8.7	1.61 ppm	0.2 ppm	6.5 ppm	0.75 ppm	7.9 ppm		109 ppm

Site: samples taken in shallow water, no more than 12 inches deep**Qualitative water assessment**

Water appearance

- ☐ Scum
- ☐ Foam
- ☐ Muddy
- ☐ Milky
- ☐ Clear
- ☐ Oily sheen
- ☐ Brownish
- ☐ Other

Odor

- ☐ Rotten egg
- ☐ Musky 1 person only
- ☐ Acrid
- ☐ Chlorine
- ☐ None
- ☐ Other: _____

Lake bottom description

- [ ] Covered in plant life
- [x] Sand
- [x] Silty
- [x] Organic debris
- [ ] Clay
- [x] Small pebbles (0.1-2 inches in diameter)
- [ ] Cobbles (2-10 inches)
- [ ] Large rocks/boulders (> 10 inches)
- [ ] Bottom not visible
- [ ] List any organism you see on back

List of organisms seen

Cray fish
Fresh water clams
Canadian Geese
Loons

Plant surveys to come next month

Consolidated Water Quality Data

Parameter	Trial 1	Trial 2	Trial 3	Average
Water Temp (°C)	7.0	6.7	5.4	**6.4 °C**
pH	8.5	9.0	8.5	**8.7**
Nitrates (NO_3^-)	1.76 ppm	1.32 ppm	1.76 ppm	**1.61 ppm**
Phosphate (PO_4^{3-})	0.2 ppm	0.2 ppm	*Missed*	**0.2 ppm**
Carbon Dioxide (CO_2)	7.0 ppm	11.0 ppm	4.0 ppm	**6.5 ppm**
Silica	0.75 ppm	0.75 ppm	*Not listed*	**0.75 ppm**
Dissolved Oxygen (DO)	5.0 ppm	8.6 ppm	10.0 ppm	**7.9 ppm**
Turbidity (Secchi Disk)	*Too shallow*	*Too shallow*	*Too shallow*	**N/A (<12 in.)**
Total Hardness (Ca/Mg)	104 ppm	108 ppm	116 ppm	**109 ppm**

Qualitative Water Quality Assessment

- **Temperature & Dissolved Oxygen (Healthy):** The water is quite cold (averaging 6.4°C), which naturally allows it to hold more dissolved gases. The average DO of 7.9 ppm is highly favorable for supporting diverse aquatic life, including cold-water fish and macroinvertebrates. The upward trend in DO across the trials (5.0 to 10.0 ppm) matches the drop in water temperature.
- **pH Levels (Slightly Alkaline/Basic):** An average pH of 8.7 is elevated. While a normal range for freshwater is typically 6.5 to 8.5, an alkaline spike (up to 9.0 in Trial 2) in shallow water often points to active daytime photosynthesis by algae or aquatic plants, which strips carbon dioxide from the water and drives the pH up.
- **Nutrient Levels (Moderate/Impacted):**
    - **Nitrates (1.61 ppm)** are above pristine baseline levels (usually <1 ppm) but well below the dangerous pollution thresholds. This indicates a minor influence from surrounding land runoff (e.g., fertilizers or organic matter).
    - **Phosphates (0.2 ppm)** are high enough to potentially trigger accelerated algal growth in freshwater systems, where thresholds as low as 0.05 to 0.1 ppm can stimulate eutrophication.
- **Hardness (Moderately Hard):** At 109 ppm, the water is categorized as moderately hard. This means there is a healthy presence of calcium and magnesium minerals, which provides a natural buffering capacity against rapid, drastic pH drops.
- **Physical Environment:** Because the site is noted as less than 12 inches deep, a Secchi disk cannot accurately gauge clarity. However, shallow environments are highly dynamic—experiencing faster temperature fluctuations, more interaction with the atmosphere, and heavy influence from the underlying stream or lake bed.

Discussion of Results

1. Temperature and Dissolved Oxygen (DO) Relationships

The physical parameters of the sampling site reveal a highly dynamic, cold-water aquatic environment. The water temperature steadily decreased from Trial 1 to Trial 3 ($7.0^{\circ}C$ to $5.4^{\circ}C$), yielding a cold average of $6.4^{\circ}C$. This temperature profile holds strong ecological relevance for gas solubility. Because cold water holds gas more efficiently than warm water, a corresponding surge in Dissolved Oxygen (DO) was observed, rising from $5.0ppm$ in Trial 1 to a highly oxygenated $10.0ppm$ by Trial 3.

The overall DO average of $7.9ppm$ is generally considered healthy and is fully capable of supporting sensitive, cold-water aquatic organisms and macroinvertebrates, which typically require DO levels above $5.0–6.0ppm$. The low initial reading of $5.0ppm$ in Trial 1 might be attributed to local micro-zone variations, temporary organic decomposition, or a shift in sampling time (such as early morning hours before plant photosynthesis begins producing oxygen).

2. Shallow Water Dynamics and Physical Constraints

The physical constraints of the sampling site heavily influenced the data collection and water behavior. Because the samples were taken in shallow water measuring less than 12 inches deep, turbidity could not be evaluated using a standard Secchi disk. In such shallow systems, sunlight penetrates completely to the substrate, warming the bed and creating a highly reactive environment. These zones are prone to rapid environmental fluctuations driven by direct atmospheric contact, wind mixing, and immediate stormwater runoff.

3. pH, Carbon Dioxide, and Photosynthetic Fluctuations

The chemical profile indicates a distinctly alkaline system, with a high average pH of 8.7 and a peak of 9.0 during Trial 2. Typical pristine freshwater environments hover between a neutral $6.5 and 8.5$. The elevated alkaline levels observed here are common in shallow water bodies experiencing high biological activity.

During peak daylight hours, submerged aquatic plants and algae rapidly consume Carbon Dioxide (CO_2) for photosynthesis. When CO_2 is stripped from the water, it reduces the presence of carbonic acid, causing the pH to rise. This biochemical link is supported by the data: Trial 2 exhibited the highest pH (9.0), while Trial 3—which featured the lowest temperature and highest DO—displayed a sharp drop in CO_2 down to $4.0 ppm$. These shifts suggest a highly active community of primary producers pulling carbon from the water column.

4. Nutrient Load and Eutrophication Risks

Nutrient monitoring shows evidence of human or environmental impacts from the surrounding landscape.

- **Nitrates (NO_3^-):** The average nitrate level of $1.61 ppm$ is slightly higher than a pristine baseline (which usually sits below $1.0 ppm$), though it remains safely below the standard environmental toxicity or drinking water safety threshold of $10 ppm$.
- **Phosphates (PO_4^{3-}):** The average phosphate concentration of $0.2 ppm$ is a primary point of concern. In freshwater ecosystems, phosphorus acts as a limiting nutrient; levels exceeding $0.05 to 0.1 ppm$ are often sufficient to trigger accelerated algal growth.

Combined with the clear sunlight penetration of a shallow, 12-inch water column, this elevated phosphate load poses a moderate risk for localized algal blooms. If unchecked, this can lead to eutrophication—a process where excessive algal die-offs eventually deplete dissolved oxygen reserves.

5. Water Hardness and Buffering Capacity

The water body's Total Hardness averaged $109ppm$, classifying it as "moderately hard." This indicates a steady presence of dissolved minerals, primarily calcium (Ca^{2+}) and magnesium (Mg^{2+}), likely dissolved from local soils or limestone geology. This mineral content provides a vital ecological benefit by acting as a chemical buffer (alkalinity source). This high buffering capacity prevents rapid, destructive swings in pH, helping stabilize the habitat for aquatic life despite the heavy photosynthetic demands and shifting nutrient inputs identified across the trials.