AI and Problem Solving

Grade 8-12 Activity Write Up

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AI and Problem Solving

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Actua is creating a Canada where every child has the skills and confidence they need to achieve their full potential. As a leading science, technology, engineering and mathematics (STEM) outreach organization, Actua includes over 40 universities and colleges, engaging 500,000 youth in 600 communities each year. For 25 years, Actua has focused on identifying and removing the barriers for entry into STEM and now have national programs dedicated to engaging Indigenous youth, girls and young women, Black youth, those facing economic barriers and youth in Northern and remote communities. For more information, please visit us online at www.actua.ca and on social media: Instagram, LinkedIn, Facebook and YouTube! For more information, please visit us online at www.actua.ca and on social media: Instagram, Facebook, LinkedIn, TikTok and YouTube!

AI and Problem Solving

Activity Summary

In this activity, participants act as investigators to solve the mystery of a canceled fishing derby, exploring the responsible use of AI in problem-solving. Using a provided dataset and a simulated AI, they learn the importance of asking specific, hypothesis-driven questions to get useful results. The activity also highlights the unique skills humans bring to problem-solving, like the ability to spot missing information and collaborate, which are crucial for complex tasks where AI falls short. Ultimately, the goal is to show that an AI is only as effective as the instructions it's given, with human agency being the key to success.

Developed by Actua, 2025.

Delivery Environment	Activity Duration	Intended Audience	Tech
In Person	55 minutes	Grades 8-12 (*Ages 13-18*)	**Facilitators should have access to a laptop, projector, speakers, and a screen or blank wall to project onto.** • Projector • Speaker • Screen/Blank Wall • Laptop/Tablet

Achievement Goals

Learning Goals

Following this activity, participants will:

- **Understand** the capabilities and limitations of AI for problem-solving and data analysis.
- **Identify** the importance of formulating effective prompts to get useful results from AI systems.
- **Recognize** unique human skills, like collaboration and the ability to detect missing information, that are essential for complex problem-solving.
- **Reflect** on the ethical implications of using and creating AI, particularly concerning data bias and accountability.

Success Criteria

Following this activity, participants can express:

- **I can generate effective prompts** that are specific and hypothesis-driven for AI data analysis.
- **I can describe the difference** between problems most efficiently solved by AI and those requiring human skills.
- **I can explain why AI can produce biased results** and the role humans play in mitigating that bias.

Logistics (Timing, Group Sizing, Materials)

Section Title	Est. Time	Group Size	Materials
Opening Hook	5 minutes	*Whole Group*	**Facilitators** • AI and Problem Solving - Activity Slide Deck (*Appendix C*)
Section 1: Data Analysis	15 minutes	*Small Groups (3) or Pairs*	**Facilitators** • AI and Problem Solving - Activity Slide Deck (*Appendix C*) **Per Small Group or Pairs** • Whispering Waters - News Article (*Appendix C*) • Whispering Waters - Water Data (*Appendix C*) • Writing utensils • Calculator (optional)
Section 2: Searching for Clues	25 minutes	*Small Groups (3) or Pairs*	**Facilitators** • AI and Problem Solving - Activity Slide Deck (*Appendix C*) **Per Group** • Whispering Waters - Dossier ○ ***Note:*** Each group gets either one the three versions prepared (A, B, and C) (*Appendix C*) • Writing utensils
Reflection & Debrief	10 minutes	*Whole Group*	**Facilitator** • Writing Surface (e.g. Whiteboard) • Writing Utensil (e.g. Marker)

Safety Considerations

Safety considerations have been provided below to support safety during this activity, however they are not necessarily comprehensive. It is important that you review the activity and your delivery environment to determine any additional safety considerations that you should be implementing for the delivery of these activities.

Emotional Safety

- This activity discusses a fictionalized example of environmental harm done to a community's water supply. This may upset some participants. Emphasize that Whispering Waters is not a real place, and that real-life community members, investigators and scientists are doing work like this every day to understand and mitigate environmental harms.
- Facilitators should understand that participants have different lived experiences and prior knowledge about AI safety, AI, and digital citizenship. This activity may involve or lead to discussions of sensitive topics, such as ethical implications of AI. Facilitators should encourage open, respectful discussions and acknowledge all perspectives. Facilitators should always keep the participants' emotional safety in mind in these discussions, and defer to training from their institution and training received.

Curriculum Links

This activity aligns with these components found in the UNESCO AI Competency Framework for Students:

Human-Centered Mindset: Human Agency

- Learners are expected to be able to recognize that AI is human-led and that the decisions of the AI creators influence how AI systems impact human rights, human-AI interaction, and their own lives and societies (p. 29-30).

Human-Centered Mindset: Human Accountability

- Learners are expected to be able to recognize that human accountabilities are the legal obligations of AI creators and AI service providers, and understand what human accountabilities they should assume during the design and use of AI. They should also foster an awareness that human accountability is a legal and social responsibility when using AI to assist decisions that affect humanity and uphold the principle that humans should not cede the determination to AI when making high-stakes decisions. They are also expected to enhance their judgement on, and attitudinal resilience to, the illusive claims on the use of outputs and as well as predictions that AI can usurp humans' thinking and decision-making (p. 37-38).

Ethics of AI: Embodied Ethics

- Learners are expected to be able to develop a basic understanding of the ethical issues around AI, and the potential impact of AI on human rights, social justice, inclusion, equity and climate change within their local context and with regard to their personal lives. They will understand, and internalize the following key ethical principles, and will translate these in their reflective practices and uses of AI tools in their lives and learning: Do no harm, Proportionality, Nondiscrimination, Sustainability, Human determination, and Transparency (p. 31-32).

Ethics of AI: Safe and Responsible Use

- Learners are expected to be able to carry out responsible AI practices in compliance with ethical principles and locally applicable regulations. They are expected to be conscious of the risks of disclosing data privacy and take measures to ensure that their data are collected, used, shared, archived and deleted only with their deliberate and informed consent. They are also expected to be conscious of typical AI incidents and the specific risks of certain AI systems, and be able to protect their own safety and that of their peers when using AI (p. 39-41).

AI Techniques and Applications: AI Foundations

- Learners are expected to develop basic knowledge, understanding and skills on AI, particularly with respect to data and algorithms, and understand the importance of the interdisciplinary foundational knowledge required for gradually deepening understanding of data and algorithms. They should also be able to connect conceptual knowledge on AI with their activities in society and daily life, concretizing a human-centred mindset and ethical principles through an understanding of how AI works and how AI interacts with humans (p. 32-34).

This activity can be connected to the following subject areas:

Science

- Understanding the role of science and technology in society and daily life.

Mathematics

- Collecting, organizing, and interpreting qualitative and quantitative data.

Community Connections

Community connections are suggestions from Actua, grounded in our approach, on how facilitators can adapt the activity to reflect the strengths, interests, and priorities of the community where or with whom it is delivered. Consider the following guiding questions to adapt the activity in meaningful ways:

- **Consult with community:** Are there local organizations, Knowledge Keepers, or community members who could contribute insight or context to this topic?
- **Draw on youth experience:** How can you give participants opportunities to share, reflect on, and apply how this learning is relevant to them or their community? Invite participants to identify what knowledge, who, and where they already learn from.

- **Integrate local examples:** How can you tailor this activity to local or regional interests, industries, or community priorities (e.g. land and environment, health, technologies)?

Activity Procedure

To Do in Advance

Section	Preparation

General	• **Think ahead and be ready to adapt:**
	  ◦ Determine your **delivery method** and leverage ideas from the delivery recommendations and adaptations sections.
	  ◦ While **estimated times** are provided, it will be helpful to think about how much time you would like to spend on different activities and discussions.
	  ◦ While **group sizes** (individual, pairs, groups) are suggested, many activities are flexible for whatever will work in your classroom.
	• **Prepare for the content:**
	  ◦ Have **answers in mind** to share with participants for the various reflection questions asked.
	  ◦ Examine the provided materials to determine if they are **suitable** for your participants.
	• **Equipment:**
	  ◦ Ensure device, screen and projector are set up.

Section 1: Data Analysis	• For each group, print a copy of the Whispering Waters - News Article and Whispering Waters - Water Data (*Appendix C*)

Section	Preparation
Section 2: Searching for Clues	• Print the documents needed for each Whispering Waters - Dossier (A, B, and C) (*Appendix C*). Each group will get one dossier, but all three should be represented. • Paperclip the documents together for each dossier. • Place the documents in folders or use a labeled cover page. Using different colors for each dossier can help participants differentiate them and signal that they should investigate further.

Opening Hook

1. Put participants into small groups of 2 or 3.
2. Distribute the Whispering Waters - News Article and Whispering Waters - Water Data (*Appendix C*) to each small group.
3. Using the AI and Problem Solving - Activity Slide Deck (*Appendix C*), introduce the mystery of the abruptly canceled Whispering Waters Fishing Derby (a fishing competition). The cancellation was due to "unforeseen environmental concerns" and "declining fish health".
4. Explain that participants will act as forensic analysts, using artificial intelligence (AI) to figure out what's wrong with the water and who is responsible.

Section 1: Data Analysis

1. Give participants five minutes to look over the Water Data (*Appendix C*) and try to solve the problem. Use the countdown timer from the Activity Slide Deck (*Appendix C*).
    a. ***Note:*** You can optionally give them calculators.
    b. ***Note:*** Hint that this task will be frustrating and challenging.
2. Once time is up, explain that the task is virtually impossible to complete in this time frame because the data is too dense and large to parse quickly.

    a. They likely will have picked up on rainfall having something to do with the disturbances.
3. Define AI and prompt engineering:
    a. AI: Algorithms created by people that help machines act smart, they can learn, solve problems, and make decisions. These algorithms teach computers to use the data they have, like pictures, sounds, or repeated experiences, to recognize patterns, make predictions, and improve over time.
    b. Prompt Engineering: The process of writing effective instructions for Generative AI tools.
4. Tell participants they will use a simulated "watershed health AI" to help.
5. **Iteration 1:** Ask participants if the broad question "what is the problem with the lake?" will be successful and why. Reveal the response by clicking “send”. Explain that this prompt failed because it was too open-ended and AI models require specific instructions.
6. **Iteration 2:** Move to the next slide. Have participants discuss and vote on which of two more specific prompts to submit. Reveal the response by clicking “send”.
    a. If participants chose **Prompt A**: Explain that "Analyze the Hemlock Mill data. Is it causing the pollution?" was too presumptive. The AI looked for a direct cause that wasn't in the data and didn't find the real pattern. The lesson is to not assume the answer.
    b. If participants chose **Prompt B**: Explain that "Find any correlation between rainfall events and water quality readings at specific locations" was successful because it was hypothesis-driven. The lesson is to focus on correlations and patterns, not culprits.
7. Summarize by explaining that the problem wasn't a lack of data or a flaw in the AI. The solution was found by asking the right question in the right way, highlighting that the human ability to think critically and formulate a precise query is the key to success with AI.
    a. This is called prompt engineering, which is what participants just did!

Section 2: Searching for Clues

1. Keep participants in their groups. Distribute one Whispering Waters Dossier (A, B, or C) (*Appendix C*) to each group, ensuring all three dossiers are represented.
2. Explain that participants will now act as forensic analysts to figure out what caused the problem.
    a. Encourage them to mark up their pages.
3. Emphasize that they can use any problem-solving method they want.
    a. The goal is for them to ultimately realize they are missing data and need to collaborate with their peers.
    b. ***Note:*** Hint to the need for collaboration with other groups if they don't reach this conclusion on their own.
4. Once they've finished, have each group share their conclusions.
5. Discuss who bears responsibility for the water contamination. Any answers validated by the data are acceptable. Examples may include:
    a. The Mill is disposing chemicals improperly.
    b. The Ridge Development Group's storm runoff vulnerability.
    c. Inadequate government oversight.
6. Show the Google Gemini responses in the slides.
7. Using the AI and Problem Solving - Activity Slide Deck (*Appendix C*), explain that when an AI is fed just one incomplete dossier, it doesn't have the human intuition to know that data is missing, leading to different conclusions depending on the dossier.
8. Ask participants: "What led them to believe that they were missing data?"
    a. Answers may include overhearing other groups, seeing that other groups had different colour/labeled dossiers, or intuiting that the clues in their dossier all pointed to one culprit.
    b. This may have been a conscious decision, or it may have been intuitive. Humans are exceptionally good at pattern recognition and extrapolating learnings from past experiences in new situations.
        i. For example, you may have extrapolated from past experiences that seeing a lettered item (A, B, C) means that there may be

companions labeled with other letters. We often take this sort of intuition for granted.

9. The lesson is that while humans can be given biased data, they are better at intuitively picking up on missing information than AI, which is critical for complex problem solving.

Reflection & Debrief

1. Debrief the following questions with the whole group:
    a. Ask participants: “Why is it important to feed specific prompts into AI systems?”
    b. Ask participants: “What ways can AI help or hinder problem solving?”
2. Draw a Venn diagram with “human skills” and “AI skills” on each side.
    a. Ask participants: “What uniquely human skills make us great problem solvers? What about AI?”
        i. List similarities and differences.
3. Discuss the different careers listed in *Appendix A: Career & Mentor Connections*.

Delivery Adaptations

How might you adapt the time, space, materials, group sizes, or instructions to make this activity more approachable or more challenging? **Modifications** are ways to make the activity more accessible, **extensions** are ways to make the activity last longer or more challenging.

Modifications

SECTION 1: DATA ANALYSIS

- Explicitly state that the analysis task will be virtually impossible to complete and that they should just try their best to get what information they can.

SECTION 2: SEARCHING FOR CLUES

- Explicitly tell participants to discuss their ideas with their classmates (even those outside of their group).

Extensions

SECTION 1: DATA ANALYSIS

- Have participants brainstorm possible prompts after the initial rejected prompt.
- Iterate on the prompt even further. Generate the best prompt you can as a group.

SECTION 2: SEARCHING FOR CLUES

- Once participants have finished reviewing their clues, tell them that the clean-up effort is going to cost $100,000. How much should The Ridge Development Group, the Township of Whispering Waters, the Hemlock Lumber Mill, and the Wistful Waters Conservation Club pay for by percentage? Why?

References & Gratitude

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Appendices

Appendix A: Career & Mentor Connections

AI/MACHINE LEARNING ENGINEER

- Builds and trains artificial intelligence systems that can learn from data to make predictions or perform complex actions. They support the machine learning researcher.

COMPUTER PROGRAMMER

- Computer programmers write, modify, and test code and scripts in a variety of programming languages that allow computer software and applications to function properly.

MACHINE LEARNING RESEARCHER / DATA SCIENTIST

- Machine learning researchers or data scientists clean and interpret data while building models using a combination of that data and machine learning algorithms.

FORENSIC INVESTIGATOR

- A forensic investigator uses scientific methods to examine evidence at a crime scene. Their role involves meticulous data collection, analysis of samples, and reconstruction of events to determine the cause of an incident and identify the parties responsible. They are skilled at connecting seemingly unrelated pieces of information to form a complete picture.

ENVIRONMENTAL SCIENTIST

- Environmental scientists are experts in the natural world. They study environmental systems, monitor environmental conditions, and assess risks to human health and ecosystems. They are uniquely equipped to understand the complex interactions between different variables, such as rainfall, pH levels, and industrial runoff, as they relate to water quality.

POLICY ANALYST

- A policy analyst assesses and shapes public policy. They research the social, economic, and environmental effects of laws and regulations. In this activity, a policy analyst would examine the existing rules and agreements related to the development and conservation of the area to determine if flaws in the policies allowed the pollution to occur.

Appendix B: Background Information

DATA AND DATASETS

Data comes in many forms, including numbers, images, words, and other types of information. They provide insights about individuals, groups, and the world around us. It is a key resource for understanding patterns, making decisions, and predicting outcomes. Specifically, data can be used to:

- Identify correlations and trends that might not be obvious at first glance.
- Develop a deeper understanding of complex systems and behaviors.
- Inform decisions in real time or future planning.
- Make decisions based on past patterns or observed information.

Datasets are also essentials for creating algorithms, which are sets of instructions or rules that a computer follows to solve problems or make decisions. By analyzing and learning from data, algorithms can help humans understand and act on information more effectively.

Some applications of how data drives algorithms include:

- **Traffic and navigation apps:** Analyzing road and traffic patterns to suggest the fastest routes.
- **Outer space and weather systems**: Studying patterns to predict astronomical events or weather changes.
- **Shopping and media recommendations**: Using purchase and viewing history to suggest products or content that people may like.
- **Healthcare and diagnostics**: Analyzing medical data to identify health risks, suggest treatments, or support research.

COMPUTATIONAL THINKING AND ALGORITHMS

As is described by its name, computational thinking is an approach and a way of thinking. It is structured and systematic and therefore lends itself well to computer science. However, computational thinking is useful beyond computer science as an

approach to learning and problem solving. The four stages of computational thinking are:

- **Decomposition:** Breaking down the information into manageable parts.
- **Pattern Recognition:** What is the data doing?
- **Abstraction:** Identifying the rules that dictate the observed patterns.
- **Algorithm Design:** Developing the steps to solve the problem.

An **algorithm** is a set of steps to be taken in order to complete a task. Think of it like a recipe: a set of precise steps that, if followed correctly, will lead to a desired outcome, whether it's baking a cake or sorting a list of names.

In computer science, these are created with a programming language (a language that a computer can understand) in order to input commands and write complex programs. They are the logical blueprints that tell computers how to do things. Algorithms make up our search engines (like Google), our GPS systems, the video games we play and even control our homes.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a branch of Computer Science that deals with a machine's ability to simulate intelligent behaviour. This includes cognitive functions we associate with human minds, such as perceiving, reasoning, learning, and adapting. AI is becoming increasingly vital in our lives. From digital assistants, GPS navigation, and autonomous vehicles to tools like Siri/Google Home and generative AI tools (e.g., OpenAI's Chat GPT), its impact on our daily lives is growing. AI plays a crucial role in various aspects of work, enhancing efficiency, and taking on hazardous or monotonous tasks. As AI applications grow, discussions on AI ethics and responsible practices are increasingly important.

AI and How it Senses the World

For a machine or devices to be artificially intelligent, it can usually do some or all of these five things:

Day of AI. (2024). What is AI?: Ages 8-11 - Teacher Slides. dayofai.org/curriculum/basic-ai-literacy/

1. **Perceive:** How does AI notice things around it?
    a. Machines such as robots can "see" or "hear" their surroundings using special tools called **sensors**. Similar to how our eyes help us see and ears help us hear. These sensors help the robot understand what's happening nearby.
2. **Reason:** How does AI decide what to do or how to react?
    a. Machines keep a mental picture of the world around them. This helps them understand the situation and make decisions, much like how you remember where you put your belongings so you can find them later.
3. **Learn:** How does AI acquire new knowledge?
    a. Machines learn by analyzing data, similar to how we get information from books or listening to others. The more data they receive, the better they become at understanding and solving problems.
4. **Interact:** How does the AI communicate or respond to its environment?
    a. Machines use different kinds of knowledge to engage naturally with people and surroundings. This involves understanding context, recognizing cues, and responding appropriately - similar to how humans adapt their communication depending on the situation.
5. **Impact:** How does AI affect individuals and society?
    a. AI can influence society in many ways, both positive and negative. It's important to consider the ethical and social consequences of AI technologies, including how they shape behaviors, decisions, and everyday life.

PROMPT ENGINEERING

Prompt engineering is the process of carefully designing the input, or "prompt," that is given to a generative Artificial Intelligence (AI) model—such as a large language model (LLM) or an image generator—to get a desired or more accurate output.

Think of it as the new language of communication with AI. Just as programmers use a specific programming language to write an algorithm and instruct a computer, users use prompt engineering to effectively instruct a complex AI model.

The goal of prompt engineering is to maximize the AI's ability to reason, follow instructions, and produce high-quality, relevant results. A well-designed prompt often includes elements like:

- **Role-Playing:** Asking the AI to act as a specific persona (e.g., "Act as a historian," or "You are a professional editor").
- **Context**: Providing necessary background information the AI needs to understand the request.
- **Constraints:** Specifying limitations on the output, such as length, format (e.g., "in a bulleted list"), or tone (e.g., "use a professional tone").
- Examples (Few-Shot Learning): Giving the AI a few examples of desired input/output pairs so it can better grasp the pattern and task.

Prompt engineering is important because AI models are sensitive to the phrasing of the input. A poorly worded or vague prompt can lead to an irrelevant, confusing, or biased response—similar to the "data bias" problem mentioned earlier, but stemming from the user's input rather than the training data. Prompt engineering is a skill that directly addresses the "Interact" capability of AI, allowing users to guide the AI to meet their specific needs, thereby making the use of generative AI tools more effective and efficient.

ETHICS AND AI

Artificial intelligence offers powerful tools and new possibilities. As these systems learn from data, make decisions, and shape our world, it is important to consider their ethical impacts.

Actua has developed a resource (*Appendix C*) to support facilitators in leading discussions with youth about ethics and responsible AI use. Facilitators are encouraged to engage youth in meaningful conversations that empower them to think critically about how AI is designed, used, and experienced in the world around them. This resource emphasizes human agency and responsibility, supports values-based reflection, and creates space for curiosity, dialogue, and informed decision-making as digital citizens.

Appendix C: Additional Resources

GENERAL

Activity Slide Deck

- AI and Problem Solving - Activity Slide Deck
    - ***Note:*** This link will automatically download to your device.

Supporting Resource

- AI in Context: Responsibility and Ethics in Artificial Intelligence

SECTION 1: DATA ANALYSIS

Activity Page(s):

- Whispering Waters - News Article (refer below)
- Whispering Waters - Water Data (refer below)

SECTION 2: SEARCHING FOR CLUES

Activity Page(s):

- Whispering Waters - Dossier A (refer below)
- Whispering Waters - Dossier B (refer below)
- Whispering Waters - Dossier C (refer below)

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AI and Problem Solving

Whispering Waters - News Article

BREAKING NEWS

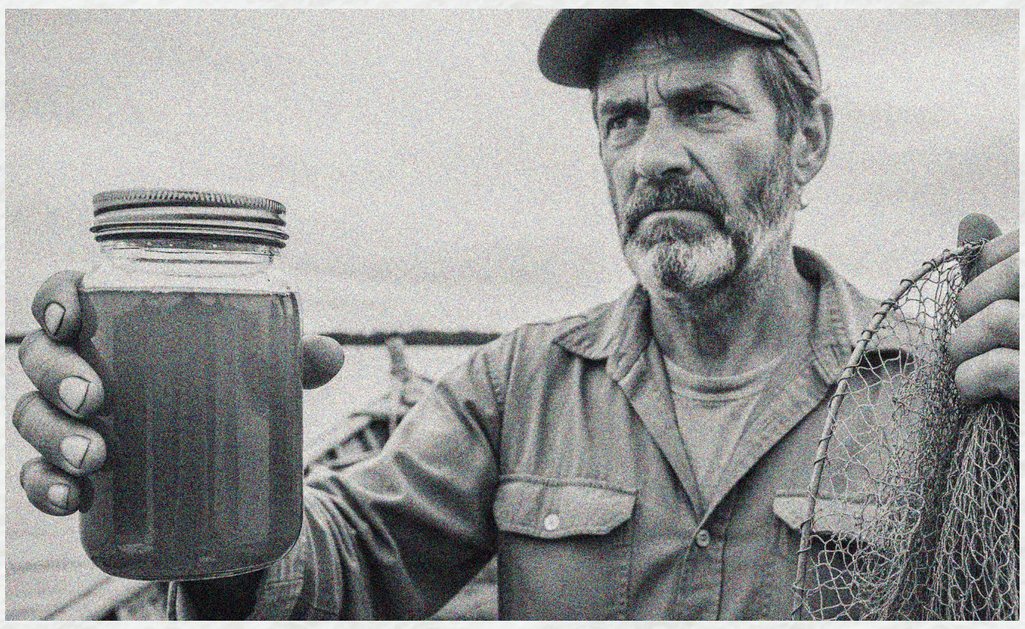
Daily Dogfish

SPECIAL EDITION

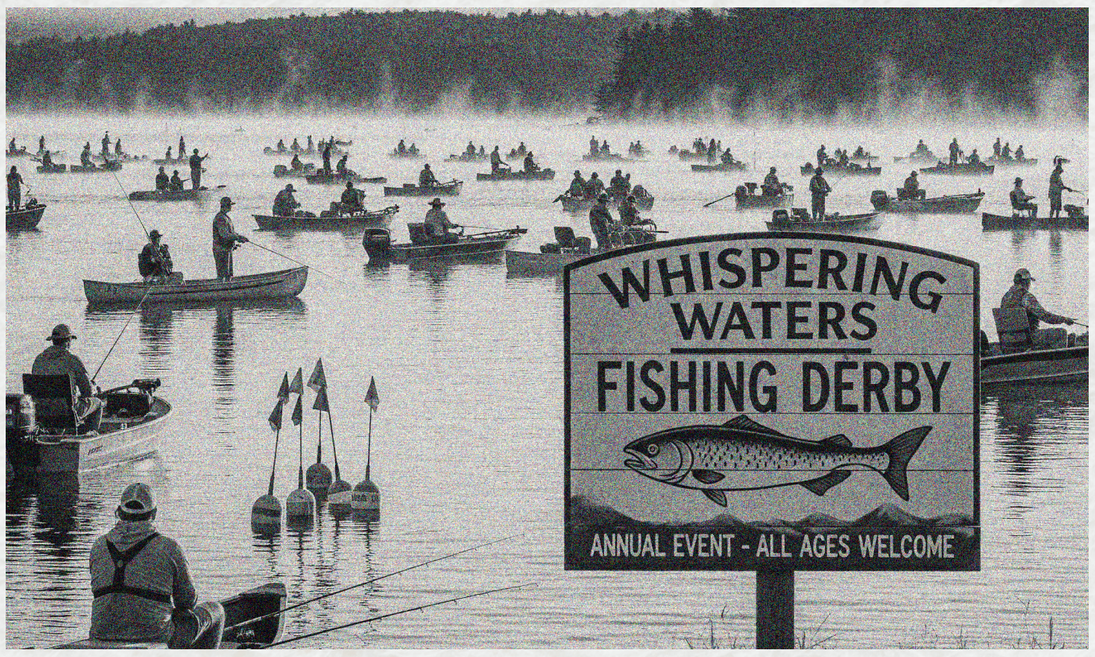
LOCAL ANGLERS OUTRAGED

FISHING DERBY CANCELED

WHISPERING WATERS – For the first time in over fifty years, the annual Whispering Waters Fishing Derby has been abruptly canceled, leaving hundreds of local anglers and businesses reeling. The decision, announced late last week by the Township Parks Department, cites "unforeseen environmental concerns" and "declining fish health" in Whispering Waters Lake. While the Township has been tight-lipped about the exact nature of the "environmental concerns," speculation is rampant among residents.



"It's a disgrace, that's what it is," fumed long-time resident and derby participant, Frank "Guppy" Peterson, holding up a murky sample of lake water. "This used to be the cleanest lake in the county. Now look at it – green slime everywhere, and the fish... they look sick. We deserve answers!"



The cancellation has sent shockwaves through the community, particularly among local bait shops, tackle stores, and restaurants that rely on the influx of visitors the derby typically brings. "This is our busiest weekend of the year, hands down," said Maria Rodriguez, owner of "The Lure & Line" bait shop. "Without the derby, we're looking at a huge loss. Someone needs to take responsibility for this."

The Township Council has issued a brief statement urging calm and assuring residents that "all possible resources are being deployed to investigate the situation." However, with the lake's health visibly deteriorating and a beloved tradition shattered, the community's patience is wearing thin. The question on everyone's mind remains: What is truly happening to Whispering Waters Lake, and who will be held accountable?

SCALE MAIL: LETTERS FROM OUR READERS P.2

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Whispering Waters - Water Data

Turbidity_NTU: This is a measure of the clarity or cloudiness of the water. It is measured in Nephelometric Turbidity Units (NTU), which quantifies how much light is scattered by suspended particles in the water. High turbidity can be caused by silt, clay, organic matter, algae, or microorganisms. Elevated levels can indicate pollution from runoff and may affect aquatic life by blocking sunlight and clogging gills.

pH_Level: This parameter measures the acidity or alkalinity of the water on a scale from 0 to 14. A pH of 7 is neutral, with values below 7 being acidic and values above 7 being alkaline (or basic). Species have their own optimal pH range, and falling outside it can be stressful or even fatal to fish and other organisms.

Conductivity_uS/cm: This measures the ability of water to conduct an electrical current. It is measured in micro-Siemens per centimeter (uS/cm). Conductivity is an indirect measure of the concentration of dissolved ions (salts and inorganic materials). Higher conductivity can indicate pollution from sources like industrial discharges, road salt, or agricultural runoff.

Dissolved_Oxygen_ppm: This is a critical indicator of water quality, measuring the amount of oxygen gas dissolved in the water. It is measured in parts per million (ppm). Oxygen is essential for the respiration of fish, invertebrates, and microorganisms. Low dissolved oxygen levels (hypoxia) can stress aquatic ecosystems and lead to fish kills, while supersaturation (too much oxygen) can also be harmful.

Timestamp	Sensor_ID	Weather_Event	Temp_C	Turbidity_NTU	pH	D_Oxygen_ppm	Conductivity_uS/cm	Rainfall_mm	Technician_Notes
2025-05-18 08:30:00	NW_Inlet_001	None	15.2	5.1	7.1	8.3	254	0	
2025-05-18 09:00:00	WW_Center_002	None	16	4.8	7.2	8.5	261	0	
2025-05-19 12:15:00	SW_Creek_004	Light Rain	14.8	6.2	7	8.1	249	2.5	Minor runoff visible
2025-05-20 08:00:00	Hemlock_Outflow_005	None	15.5	12.5	6.9	7.9	321	0	Slightly elevated turbidity
2025-05-20 09:10:00	Ridge_Stream_003	None	15.9	5.5	7.1	8.2	288	0	
2025-05-21 11:45:00	WW_Center_002	Light Rain	16.5	5	7.2	8.4	265	5.1	
2025-05-21 13:00:00	WWC_Club_006	Light Rain	16.1	5.3	7	8.3	295	5.1	
2025-05-22 08:30:00	Ridge_Stream_003	None	16.4	6	7	8.1	290	0	No rainfall since last check
2025-05-23 15:00:00	NW_Inlet_001	None	17.1	5.8	7.1	8	258	0	
2025-05-24 10:20:00	Ridge_Stream_003	None	16.8	5.9	7	8.1	292	0	
2025-05-25 07:00:00	WW_Center_002	Heavy Storm	17.5	6.5	7.1	7.8	270	45.2	Strong winds and heavy rain
2025-05-26 09:30:00	Ridge_Stream_003	None	16.9	25.3	6.5	7.5	350	0	Sediment and runoff visible
2025-05-26 10:00:00	Hemlock_Outflow_005	None	17	14	6.9	7.6	330	0	
2025-05-27 11:00:00	SW_Creek_004	Light Rain	16.5	7.1	7	7.9	255	1.2	Water is clearer today
2025-05-28 08:45:00	NW_Inlet_001	None	17.2	6	7.1	8.1	260	0	
2025-05-29 14:00:00	WWC_Club_006	None	17.5	6.5	7	8	301	0	
2025-05-30 09:30:00	Ridge_Stream_003	Light Rain	17.1	7.2	7	7.9	295	3.5	Minor runoff noted
2025-05-31 08:00:00	Hemlock_Outflow_005	None	17.8	15.1	6.9	7.7	325	0	
2025-06-01 11:00:00	WW_Center_002	None	18	6.9	7.2	8.1	272	0	
2025-06-02 16:30:00	Ridge_Stream_003	None	17.8	6.1	7.1	7.9	291	0	
2025-06-03 08:00:00	Hemlock_Outflow_005	None	18.2	16.4	6.8	7.5	335	0	
2025-06-04 12:15:00	WWC_Club_006	Light Rain	18.1	7	7	7.8	305	8.5	Minor runoff after rain
2025-06-05 06:45:00	WW_Center_002	Heavy Storm	18.5	7.2	7	7.6	275	52.1	
2025-06-06 09:00:00	Ridge_Stream_003	None	17.9	28.1	6.5	7.4	355	0	Significant runoff and debris
2025-06-06 10:30:00	Hemlock_Outflow_005	None	18	18.2	6.9	7.5	340	0	
2025-06-07 11:45:00	SW_Creek_004	None	17.5	8.5	7	7.7	262	0	Water levels receding

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Whispering Waters - Dossier A

This dossier contains the following documents:

- Watershed Assessment
- Internal Chemical Disposal Log
- Operating Permit - Extension of Compliance
- Drone and Social Media Images

WHISPERING WATERS WATERSHED ASSESSMENT & PRELIMINARY HAZARD ANALYSIS

Prepared by: Dr. Evelyn Reed, Environmental Consultant

FILED

Executive Summary: A preliminary assessment of the Whispering Waters watershed reveals several areas of concern. The primary focus of this report is the long-term health of the ecosystem surrounding the Hemlock Creek tributary, which flows into Whispering Waters Lake. Data collected over the past two years suggests a gradual but persistent decline in water and soil quality in this region.

Findings: The Hemlock Lumber Mill, a long-standing business on the tributary, utilizes a variety of wood treatment agents, including several a-type phenols and preservatives. While the Mill's current waste management practices are not in violation of existing regulations, they are noted as suboptimal for long-term environmental sustainability. The site's containment measures are passive and have shown evidence of a slow, cumulative release of these chemicals into the surrounding soil and groundwater.

This slow release has led to a measurable, low-level chemical stress on the tributary's aquatic life and a slight, but persistent, acidification of the surrounding soil. The effects are not acute or immediately visible, but the cumulative impact over decades could lead to a more severe and irreversible environmental degradation.

Recommendations: It is the professional recommendation of this consultant that the Township implement a more robust, town-led monitoring program for the Hemlock Creek tributary, to include:

1. Quarterly water and soil sampling near the Hemlock Lumber Mill site.
2. Mandatory upgrades to the Mill's waste containment and disposal systems.
3. The establishment of a long-term environmental health fund.

May 15, 1996

HEMLOCK LUMBER MILL INC. INTERNAL CHEMICAL DISPOSAL LOG

DEPARTMENT: Wood Treatment & Preservation

LOG PERIOD: January 2020 – December 2024 (Selected Entries)

MAINTAINED BY: 

Date	Chemical Type	Quantity Used (Liters)	Disposal Method
2020-03-10	Creosote Mix-A	500	On-site drainage
2020-06-25	Creosote Mix-A	480	On-site drainage
2020-09-18	Copper Azole	350	On-site drainage
2021-01-05	Creosote Mix-A	520	On-site drainage
2021-04-22	Copper Azole	380	On-site drainage
2021-08-15	Creosote Mix-A	510	On-site drainage
2022-02-01	Creosote Mix-A	490	On-site drainage

STILL DOING IT THIS WAY.

OFF-SITE DISPOSAL COSTS ARE RIDICULOUS.

CAN'T AFFORD IT WITH NEW REGULATIONS.

2022-05-19	Copper Azole	360	On-site drainage
2022-09-07	Creosote Mix-A	505	On-site drainage
2023-01-10	Creosote Mix-A	515	On-site drainage
2023-04-03	Copper Azole	370	On-site drainage
2023-07-20	Creosote Mix-A	495	On-site drainage
2023-11-12	Creosote Mix-A	500	On-site drainage
2024-02-28	Copper Azole	385	On-site drainage
2024-06-15	Creosote Mix-A	510	On-site drainage
2024-09-01	Creosote Mix-A	490	On-site drainage

OPERATING PERMIT AMENDMENT & EXTENSION

PERMIT HOLDER: Hemlock Lumber Mill Inc. ID: HLM-2023-001

ISSUE DATE: March 15, 2023

The original operating permit for Hemlock Lumber Mill Inc. (issued January 1, 2020) requires compliance with all federal, provincial, and Township environmental regulations concerning timber processing, waste byproduct management, and water discharge into the Hemlock Creek tributary. This includes adherence to updated chemical containment and disposal standards, effective January 1, 2023.

Upon review of the application submitted by Hemlock Lumber Mill Inc. and consideration of their long-standing contributions to the Township's economy and heritage, the Township Council has approved the following amendment:

1. **Extension of Compliance Period:** Hemlock Lumber Mill Inc. is hereby granted a two (2) year extension to achieve full compliance with the updated chemical containment and disposal standards that came into effect on January 1, 2023. The new deadline for full compliance is January 1, 2025.
2. **Rationale for Extension:** This extension is granted in recognition of the Mill's historic role in the community and its current financial hardships as documented in their recent fiscal reports. The Township acknowledges the significant costs associated with upgrading existing infrastructure to meet the new standards.
3. **Interim Measures:** During this extension period, the Mill is required to continue its current waste management practices and provide quarterly reports on its progress toward future compliance.

This amendment is issued under the authority of the Township Council. Any violation of the original permit conditions or the terms of this extension may result in fines or permit revocation.

Elizabeth Thorne
Council Chair, Township of Whispering Waters

DJI Mini Drone capture
06.21.2025

Photo posted to Facebook by user @BigFish
06.21.2025

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Whispering Waters - Dossier B

This dossier contains the following documents:

- Development Agreement
- Meeting Minutes
- Official Runoff Management Plan & Engineering Schematics
- Drone and Social Media Images

TOWNSHIP OF WHISPERING WATERS DEVELOPMENT AGREEMENT

This Agreement is made and entered into this **25th day of February, 2024**, by and between the **TOWNSHIP OF WHISPERING WATERS**, a municipal corporation (hereinafter referred to as the "Township"), and **THE RIDGE DEVELOPMENT GROUP, LLC**, a limited liability company (hereinafter referred to as the "Developer").

WITNESSETH:

WHEREAS, the Developer intends to construct a residential subdivision known as "The Ridge" within the Township; and

WHEREAS, the Township has approved the Developer's application for a zoning change and the issuance of a building permit, subject to the terms and conditions herein.

SECTION 1: RUNOFF MANAGEMENT AND ENVIRONMENTAL OVERSIGHT

1.1. The Developer agrees to implement and maintain a storm water management and drainage system in full compliance with all federal, provincial, and Township regulations. The final system, which includes a series of retention ponds and subsurface drainage, is scheduled for completion within eighteen (18) months of construction commencement.

1.2. Notwithstanding the provisions of Section 1.1, the Township agrees to allow the Developer to utilize **alternative and temporary methods** for storm water runoff management during the **first twelve (12) months** of the construction period. These temporary methods shall be inspected quarterly by the Township's contracted engineer.

1.3. In consideration for the Township's approval of said alternative and temporary runoff methods, the Developer shall make a **one-time, non-refundable contribution of $100,000** to the Township's general fund, to be designated for the new Community Center fund. This contribution is payable

upon the signing of this Agreement and is non-contingent on the timely completion of the final storm water management system.

SECTION 5: SIGNATURES

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

FOR THE TOWNSHIP OF WHISPERING WATERS:

Elizabeth Thorne, Council Chair

FOR THE RIDGE DEVELOPMENT GROUP, LLC:

Arthur Finch, Managing Partner

TOWNSHIP OF WHISPERING WATERS TOWNSHIP COUNCIL MEETING MINUTES

DATE: February 22, 2024

TIME: 7:00 PM

LOCATION: Township Hall - Council Chambers

PRESENT: Council Chair Elizabeth Thorne, Councilor Robert Vance, Councilor Sarah Chen, Councilor David Miller, Councilor Liam Henderson (Junior Member)

ABSENT: None

CLERK: Margaret Finch

7:15 PM - AGENDA ITEM #4: PROPOSED THE RIDGE DEVELOPMENT APPROVAL

Council Chair Thorne: We will now proceed with the motion to approve the zoning change and permit for The Ridge Development. We have a representative from the development here to answer any final questions.

Mr. Arthur Finch (The Ridge Development): Thank you, Madam Chair. As we've discussed in our previous sessions, this project represents a significant investment of over $20 million into our township. It will bring 200 new homes, increase our tax base by 15%, and create dozens of construction jobs over the next two years. We are confident it will be a positive and modern addition to our community.

Councilor Chen: Mr. Finch, can you confirm your storm runoff plan meets all current federal and provincial guidelines?

Mr. Finch: Yes, Councilor. Our plan has been reviewed and is fully compliant. We've designed a system of retention ponds and drainage to manage a 10-year storm event, as per the regulations.

Councilor Miller: Madam Chair, I move that we approve the motion. The economic benefits are undeniable and we are seeing significant support from the business community.

Councilor Thorne: Thank you, Councilor Miller. Is there a second?

Councilor Vance: I second the motion. I would also like to propose an amendment to the 2024 budget. Given the increase in tax revenue from this development, I move that we reallocate the $50,000 currently budgeted for the Environmental Inspection Office to the new Community Center fund. We can rely on the developers to follow through on their plans without needing a full-time, dedicated inspector.

Council Chair Thorne: Thank you, Councilor Vance. The motion on the floor is now for the approval of The Ridge development and the proposed budget amendment.

Councilor Henderson: Madam Chair, I must speak in opposition. While I support the new community center, I believe it is a mistake to cut our environmental inspection budget. Relying solely on a developer's word is shortsighted and leaves the township exposed to unforeseen risks. Our responsibility is to the long-term health of our community, and the potential for environmental issues from a project of this scale is too great to ignore. I urge my colleagues to find a different source of funding.

Council Chair Thorne: Your dissent is noted, Councilor Henderson. Let us call for a vote.

VOTE ON MOTION:

- Council Chair Thorne: For
- Councilor Vance: For
- Councilor Chen: For
- Councilor Miller: For
- Councilor Henderson: Against

Motion carries 4-1.

7:45 PM - ADJOURNMENT

- The meeting is adjourned.

THE RIDGE DEVELOPMENT STORMWATER RUNOFF MANAGEMENT PLAN & ENGINEERING SCHEMATICS

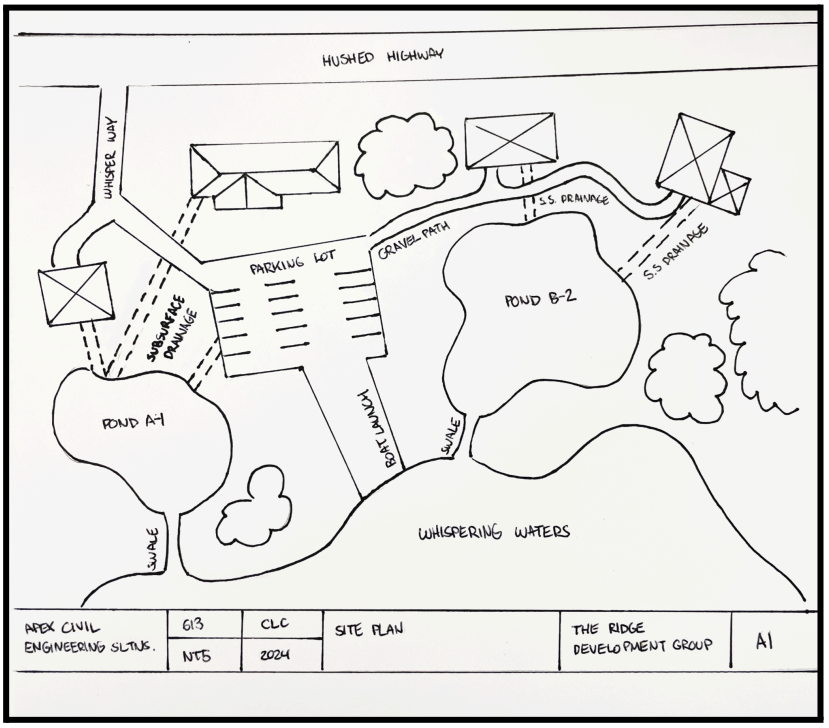
SUBMITTED TO: Township of Whispering Waters Planning Department

DATE OF SUBMISSION: January 15, 2024 PREPARED BY: Apex Civil Engineering Solutions, LLC

The Ridge Development Group is committed to responsible land development and adherence to all environmental regulations. This comprehensive Stormwater Runoff Management Plan outlines the proposed system for managing surface water runoff from the new residential subdivision.

Our design incorporates a series of interconnected elements, including:

- **Retention Ponds:** Two primary retention ponds (Pond A-1 and Pond B-2) designed to capture and slowly release stormwater, mitigating peak flow rates.
- **Subsurface Drainage Network:** A network of perforated pipes and gravel beds intended to collect and convey runoff from impervious surfaces (roads, rooftops) to the retention ponds.
- **Vegetated Swales:** Grass-lined channels designed to slow down and filter runoff before it enters the main drainage system.



This system has been engineered to meet all current federal, provincial, and Township stormwater discharge regulations, specifically designed to manage runoff from a 10-year storm event. Our calculations demonstrate compliance with all mandated outflow rates and water quality parameters.

INTERNAL EMAIL

TO: Arthur Finch, Managing Partner, The Ridge Development Group

FROM: Dr. Lena Sharma, Lead Civil Engineer, Apex Civil Engineering Solutions

DATE: January 10, 2024

SUBJECT: Risk Assessment: Stormwater Management System Design

Arthur,

Following our final review of the stormwater management system for The Ridge, I wanted to provide a candid assessment regarding its resilience.

The current design, as submitted to the Township, is fully compliant with all existing regulations. We have met every specified parameter for a 10-year storm event.

However, it is imperative to note a potential vulnerability in the system. While designed for compliance, the margin of safety for events exceeding the 10-year storm threshold is minimal. In the event of an unusually heavy or prolonged rainfall event – specifically, a 25-year storm or greater – there is a low-probability but high-impact risk of system overwhelm.

Should such an event occur, the retention ponds may exceed their capacity, leading to uncontrolled surface runoff and potential erosion, particularly in the un-vegetated areas of the development's perimeter during the initial construction phases. This could result in significant sediment and potentially other construction-related materials entering the adjacent watershed.

We have designed for compliance, as per your directive. Any additional measures to mitigate this specific "black swan" scenario would increase costs and extend the design phase.

Please acknowledge receipt of this assessment.

Best regards,

Lena Sharma, Ph.D., P.Eng. Lead Civil Engineer

DJI Mini Drone capture
06.21.2025

Photo posted to Facebook by user @BigFish
06.21.2025

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Whispering Waters - Dossier C

This dossier contains the following documents:

- Hydrologist Report
- MSDS and Receipt
- Small Project Grant Application
- Drone and Social Media Images

HYDROLOGY ASSESSMENT

TO: Concerned Citizen, Whispering Waters Township
FROM: Dr. Anya Sorten, Independent Hydrologist, AquaSolutions Environmental Consulting
DATE: June 15, 2025
SUBJECT: Preliminary Assessment: Whispering Waters Lake Fish Health & Water Chemistry

Dear Concerned Citizen,

Thank you for commissioning this assessment of the recent fish health issues and water quality concerns in Whispering Waters Lake. My analysis, based on the water samples you provided and a review of publicly available data, indicates a complex interaction of pollutants.

Specifically, my findings suggest a synergistic effect between two distinct types of contaminants:

1. **Elevated Nitrate Levels:** Consistent with agricultural or horticultural runoff, the samples show high concentrations of nitrates. While nitrates themselves can contribute to eutrophication (algae blooms), their direct toxicity to fish at these levels is typically moderate.
2. **Intermittent Acidity Spikes:** The water samples also show periods of significantly lower pH (increased acidity), particularly following heavy rainfall events. This acidity is consistent with runoff from disturbed soil, such as that found at construction sites.

Crucial Finding: **Synergistic Toxin Formation**

My most significant finding is the potential for a novel toxic compound to form when these two conditions (high nitrates and increased acidity) occur simultaneously. When high concentrations of certain nitrates are introduced into an acidic aquatic environment, a chemical reaction can occur, leading to the formation of a compound that is particularly lethal to native freshwater fish species, even at relatively low concentrations.

It is important to note that this specific compound, and its synergistic formation under these conditions, is not typically listed or accounted for on standard Material Safety Data Sheets (MSDS) for common fertilizers or construction materials. Its toxicity is a result of the unique combination of pollutants present in the Whispering Waters ecosystem.

Further, more extensive testing would be required to confirm the exact chemical composition of this synergistic toxin and its long-term effects.

Sincerely,

Dr. Anya Sorten

Independent Hydrologist

AquaSolutions Environmental Consulting

Receipt

GreenThumb Agricultural Supplies

RECEIPT #2023-09-12345

Date: September 15, 2023

Customer: The Wistful Waters Conservation Club

P.O. Number: WGGC-F-2023-09

Item Description	Quantity (Bags)	Unit Price (CAD)	Total (CAD)
High-Nitrate Turf Booster	200	$45.00	$9,000.00
Delivery Fee	1	$150.00	$150.00
Subtotal			$9,150.00
Tax (13% HST)			$1,190.00
TOTAL DUE			$10,340.00

Thank you for your business! Your Material Safety Data Sheet (MSDS) for High-Nitrate Turf Booster is attached.

Material Safety Data Sheet (MSDS)

Product Name: High-Nitrate Turf Booster (30-0-10 NPK)

Product Code: HNTB-3010

Revision Date: August 28, 2023

1. Product and Company Identification

- Manufacturer/Supplier: GreenThumb Agricultural Supplies
- Emergency Phone: *** - *** ****

2. Hazard Identification

- GHS Classification: Not classified as hazardous under normal use.
- Potential Health Effects:
    - Inhalation: May cause respiratory irritation.
    - Skin Contact: May cause mild irritation.
    - Eye Contact: May cause irritation.
    - Ingestion: May cause gastrointestinal upset.
- Environmental Hazards:
    - High Nitrogen Content: This product contains a high concentration of nitrogen. Excessive application or runoff into waterways can lead to **nutrient pollution**, promoting algal blooms and oxygen depletion, which is harmful to aquatic life.
    - Runoff Potential: Due to its solubility, this product has a **high potential for runoff**, especially on sloped terrain or during heavy rainfall, if not properly managed.

3. Composition/Information on Ingredients

- Chemical Name: Urea, Ammonium Sulfate, Potassium Chloride
- CAS No.: Various (Proprietary Blend)
- Concentration: Nitrogen (N): 30% (primarily as Urea and Ammonium Sulfate)
    - Phosphorus (P): 0%
    - Potassium (K): 10%

4. First-Aid Measures

- Inhalation: Remove to fresh air. If symptoms persist, seek medical attention.
- Skin Contact: Wash thoroughly with soap and water.
- Eye Contact: Flush eyes with plenty of water for at least 15 minutes. Seek medical attention if irritation persists.
- Ingestion: Do NOT induce vomiting. Drink plenty of water. Seek medical attention.

5. Fire-Fighting Measures

- Flammability: Non-flammable.
- Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or foam.
- Hazardous Combustion Products: May release ammonia, nitrogen oxides, and sulfur oxides when heated to decomposition.

6. Accidental Release Measures

- Personal Precautions: Wear appropriate personal protective equipment (gloves, eye protection, dust mask).
- Environmental Precautions: **Prevent runoff into drains, ditches, or waterways. Contain spill.**
- Cleanup Procedures: Sweep up or vacuum spilled material. Place in appropriate container for disposal. Avoid dust generation.

7. Handling and Storage

- Handling: Avoid breathing dust. Avoid contact with skin and eyes.
- Storage: Store in a cool, dry, well-ventilated area. Keep containers tightly closed. Store away from water sources to prevent accidental runoff.

8. Exposure Controls/Personal Protection

- Engineering Controls: Ensure adequate ventilation.
- Personal Protective Equipment (PPE):
    - Respiratory Protection: Dust mask recommended for dusty conditions.
    - Hand Protection: Chemical-resistant gloves.
    - Eye Protection: Safety glasses with side shields.
    - Skin and Body Protection: Long-sleeved clothing.

9. Physical and Chemical Properties

- Appearance: Granular solid, various colors (e.g., white, green)
- Odor: Slight ammonia odor
- pH (1% solution): 6.0 - 7.0
- Solubility in Water: Highly soluble
- Melting Point: Not applicable (decomposes)

10. Stability and Reactivity

- Stability: Stable under normal conditions.
- Incompatible Materials: Strong oxidizing agents, strong acids, strong bases.
- Hazardous Decomposition Products: Ammonia, nitrogen oxides, sulfur oxides.

11. Toxicological Information

- Acute Toxicity: Low acute toxicity.
- Chronic Effects: Prolonged exposure to dust may cause respiratory irritation.

12. Ecological Information

- Ecotoxicity: High nitrogen content can be detrimental to aquatic ecosystems if released in large quantities.
    - Aquatic Toxicity: Excessive nutrient loading can lead to eutrophication, causing algal blooms, reduced dissolved oxygen, and harm to fish and other aquatic organisms.
    - Persistence and Degradability: Nitrogen compounds are generally mobile in soil and water.
- Environmental Fate: This product is designed to dissolve and release nutrients. Improper application or runoff will lead to environmental contamination, particularly in water bodies.

13. Disposal Considerations

- Waste Disposal: Dispose of in accordance with local, provincial/state, and federal regulations.
- Container Disposal: Non-reusable containers should be disposed of in accordance with local regulations.

14. Transport Information

- DOT/TDG Classification: Not regulated for transport.

15. Regulatory Information

- Canadian Regulations: WHMIS (Workplace Hazardous Materials Information System) compliant.
- U.S. Regulations: OSHA (Occupational Safety and Health Administration) compliant.

Disclaimer: The information provided in this MSDS is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

TOWNSHIP OF WHISPERING WATERS OFFICE OF GRANTS & COMMUNITY PROJECTS

DATE: May 10, 2024

TO: The Wistful Waters Conservation Club **ATTN:** Grant Application Committee

FROM: Township Grants Administration

RE: Small Project Grant Application - File # G-24-0510

Dear Members of the Wistful Waters Conservation Club,

Thank you for your recent application for a Small Project Grant to support the purchase of eco-friendly fertilizer for your native plant restoration project. The Township of Whispering Waters appreciates your dedication to the preservation of our natural spaces.

Your application was reviewed by the Grants Review Committee. We regret to inform you that, due to **current budgetary constraints**, we are unable to approve your request for funding at this time. We received a high volume of applications this year, and our limited funds were allocated to projects that more directly align with our core strategic goals for the fiscal year.

We encourage you to seek alternative funding and to apply again in the next grant cycle. We wish you the best of luck with your valuable work.

Sincerely,

Township Grants Administration

They'll find a way... not our problem. -E.T.

DJI Mini Drone capture
06.21.2025

Photo posted to Facebook by user @BigFish
06.21.2025