Introduction to Engineering Communication and the Engineering Observation

Presented by Ted Nolan
Engineering Strategies and Practice
University of Toronto
Posted: September 08, 2025

L1.3 - ENGINEERING COMMUNICATION AND ENGINEERING OBSERVATION

APS111: ENGINEERING STRATEGIES & PRACTICE
SEPTEMBER 08, 2025
PROF NOLAN

Readings
- "Seeing like an Engineer:"
- Assignment Reference Handbook
- The Documentation and Formatting Guide

- Textbook: "Implementing a project, Communication": "Basic Concepts" (P 293-299) "Diagrammatic Elements" (P 330-338) and "Using Pictures and Photos" (P 339-343)

Learning Objectives

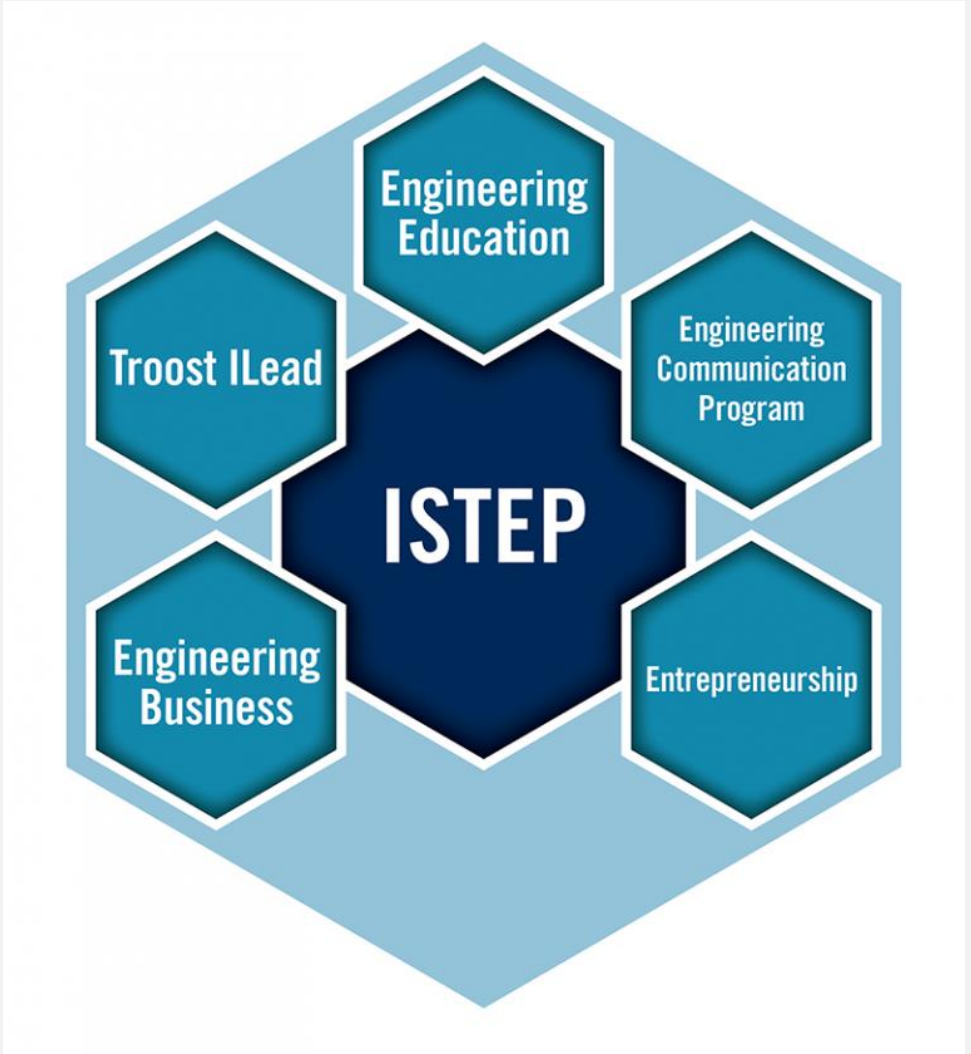
- Introduce engineering communication and discourse
- Introduce primary and secondary research (focus on site visits)
- Introduce engineering argument
- Understand EO and PS Quiz process, support and requirements

Assignments
- Engineering Observation
- PS Quiz
- Project Requirements

Playlist:
- Playlist:
- "Water" by Tyla
- "In Your Eyes" by the Weeknd
- "Snowblind" by Tanya Tagaq

Twenty-plus years of engineering communication at University of Toronto

- Communication is taught differently here
  - Why? To solve a problem: Engineers' communication skills needed improvement
- Other universities: "Technical Writing" as a separate course
- Engineering Strategies and Practice: Communication *in* design projects
- Engineering Communication Program
- Institute for Studies in Transdisciplinary Engineering Education and Practice (ISTEP)



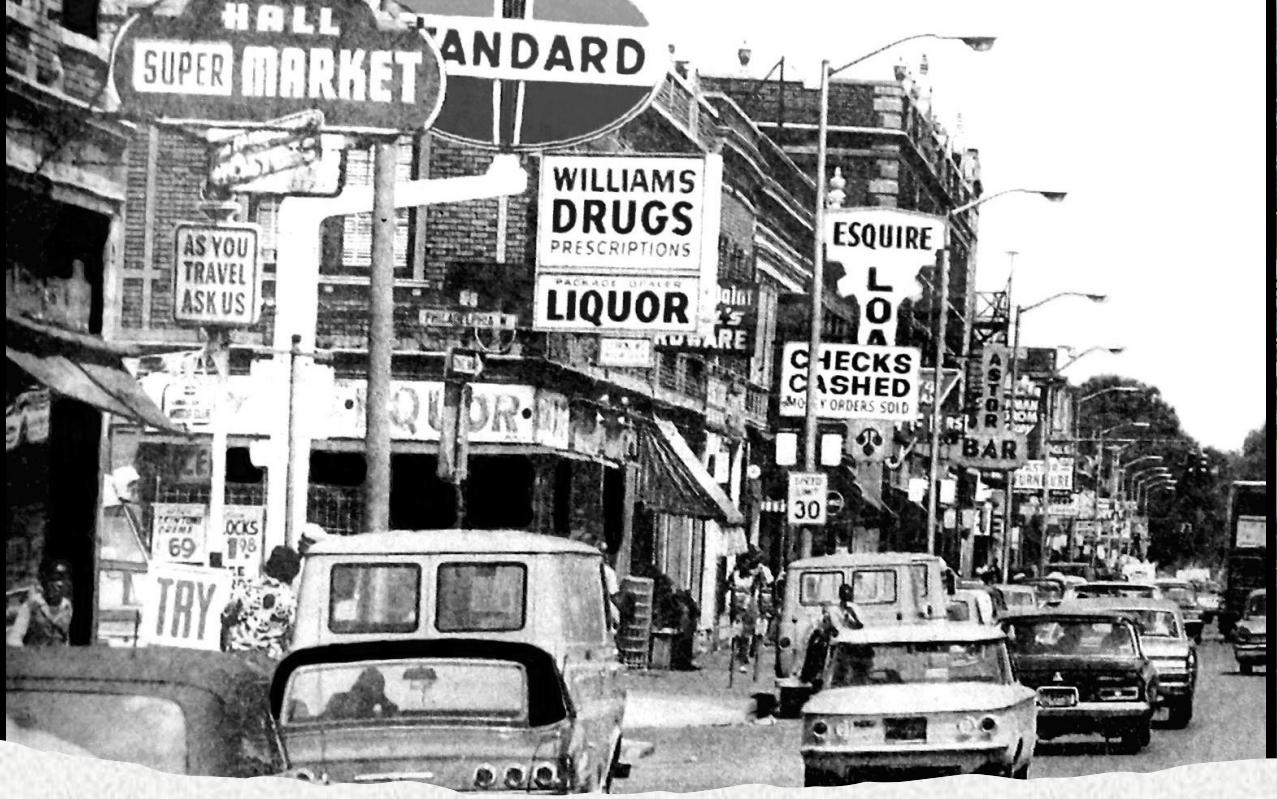
Introducing myself: Writer/Poet, Applied Linguist and Engineering Educator

- MA in Creative Writing from the University of Toronto
- PhD Candidate in Applied Linguistics at York University
  - Studying the role of multimodality and communication in engineering design student teams
- Sixth year coordinating communication in ESP I & II
- 14th year teaching in the Engineering Communication Program

Detroit: Built by engineering design

- 1900 population: ~ 300,000
- 1950 Population: ~ 2,000,000

Images: https://www.assemblymag.com/articles/94799-fords-rouge-assembly-plant-turns-100



Detroit: Hurt by engineering design

- 2024 Population: ~600,000
- Causes of population decline include freeways (among other things)
- Still a great city! You should visit!

https://glass.hfcc.edu/2016/03-06/black-bottom-road-between-past-and-future

https://www.freep.com/story/news/local/michigan/detroit/2023/08/31/detroit-black-bottom-paradise-valley-reparations-freeway-375/70712024007/

Hurricane Katrina: New Orleans, LA, USA. 2005 (my fourth year of undergrad)

https://www.nola.com/curious_louisiana/how-did-second-lines-start-in-new-orleans-here-s-the-history-behind-their-name/article_a7ea7f2a-400d-11ed-b80e-cb327f0bbcc0.html

- New Orleans in the mid-20th century: Engineering marvel of flood protection and land reclamation (mostly below sea-level)
- Now: Constant severe risk from hurricanes
- Still a great city—you should visit!

https://www.theatlantic.com/technology/archive/2015/09/the-lessons-america-never-learned-from-hurricane-katrina/403750/

Engineering design is world-building
Engineering design matters deeply

- Prof Nolan's personal design philosophy:

Design for Resilience

As you go through this course, reflect:

How has engineering design impacted your life and your world?

What will your personal design philosophy be?

The Engineering Observation and Engineering Design Discourse

- Discourse: “the rules, conventions and guidelines by which specific groups of people communicate with each other.” (From the assignment)
- Discourse is related to activity (what groups of people do together)
  - Music discourse is related musical activity
  - Gaming discourse is related to gaming activity
  - Forestry discourse is related to forestry activity
- Discourses are specific to their related groups and activities
  - Music students talk about rhythm, melody,
  - Gamers talk about strategy, scores, etc. (and neologisms like “ragequit”)
  - Foresters talk about selective harvesting, regeneration, fire hazards, etc.

What did you expect engineering discourse to be like? What attributes of it will you encounter in ESP?

Muddiest Point

- How do we prepare for the PS Quiz? What can we expect?
- Check Quercus for resources to practice for the quiz

Couse Theme: Engineering communication and discourse involves *technical writing*

- The activity of engineering design requires that engineering writing be ***clear, concise, precise and direct***
- Make your meaning explicit, not implicit. Do not assume the reader knows what you are thinking:
  - "The back alley has a standard wi-fi signal".
  - What does "standard" mean? Make it explicitly clear.
- Technical Writing as a tool to convey meaning
- Objective: Accuracy of meaning
  - Goal: Only the writer's intended meaning can be interpreted from the writing
- Objective: Easy to understand meaning
  - Goal: Meaning should be available after one reading

The Problem Statement Quiz is a test of design knowledge, critical reading and interpretation:

- Claim: Technical writers must be able to read, understand and actively engage with technical writing (as in the PS Quiz)

Suggested basic process (reading + answering in the quiz):

- Read, annotate and take notes
  - Adjust to your learning and working style and preferences
- Protect enough time to write the short answer
  - Do the multiple choice first? Do the short answer first?
- The final exam: In-person, long-answer test, based on a design challenge
  - Practicing for the PS Quiz is practicing for the Final Exam

Engineering discourse uses a lot of primary and secondary research

- Primary: evidence you gather yourself
  - Such as from site visits and the EO
  - Prototyping and testing (later in the design process)
- Secondary: evidence others have gathered
  - Scholarly (library), technical, expert, databases, statistics, codes and standards, etc.
  - Argument and Research Lecture: October 2nd
- Engineering design often requires both kinds of research
  - Triangulation: supporting claims with multiple sources of evidence
- Both the EO and the PS Quiz are pre-secondary research. You will do secondary research in your team projects.
- Primary and secondary research (as concepts) are quizzable material
- The conclusion of your EO will ask for a triangulation plan
- Your team's design project will involve a lot of triangulation
  - If you do well, that is!

How do you expect to use primary research in your Fall Project? How do you expect to use secondary research?

Engineering Observation (EO) motivation: Developing the skills of paying attention and documenting an environment

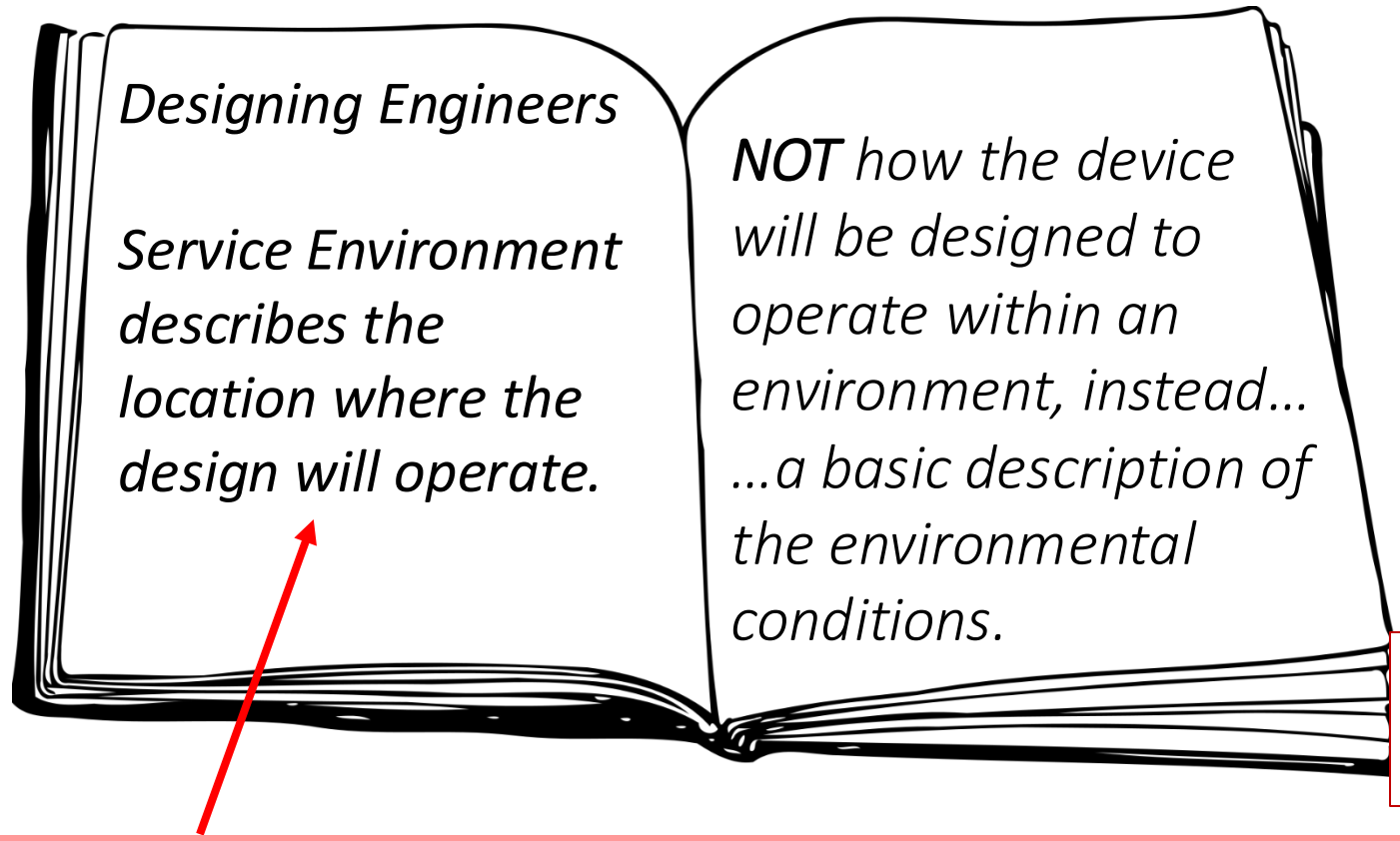
Defining a problem depends on the designer's ability to observe and document its environment.

Figure 1: A typical Engineering Notebook, available at the U of T Bookstore.

What is the Service Environment?

From: Fall 2024 ESP Lecture on Service Environment

Describe and ***SHOW*** the environment



Hint: If the design did not exist, the service environment would still exist.

Therefore, your description should be design independent.

The EO and Service Environment are closely related

Uses Descriptive Language…same as your Engineering Observation assignment.

The EO this year: Picking your site and developing your observation and analysis

- You can observe: **High Park** (project scope or elsewhere in the park) or **any similar environment** (anywhere that pedestrians and the natural environment intersect)
- Be strategic in site selection (see assignment documents):
  - High Park helps with the PR (get a jump on your Service Environment)
  - Other sites might be useful comparisons to High Park
  - Where can you easily get to to observe for 0.5-1 hour?
- Scoping: not too big, not too small (see assignment documents)
- Eng. Notebooks (EN) will be heavily involved
  - Include an excerpt in the appendix, as well a selfie from the site
- Week 3 tutorial: EO and EN
  - TAs: Engineering Notebook
  - CIs: EO assignment (detailed overview)
  - Both: Working on core skills that will inform PR work
- Tools: your phone (and apps) can be very helpful. Distance measurement tools available (ESP Office). Think about what tools you will need to collect your data.

Course Theme: Communication is designed

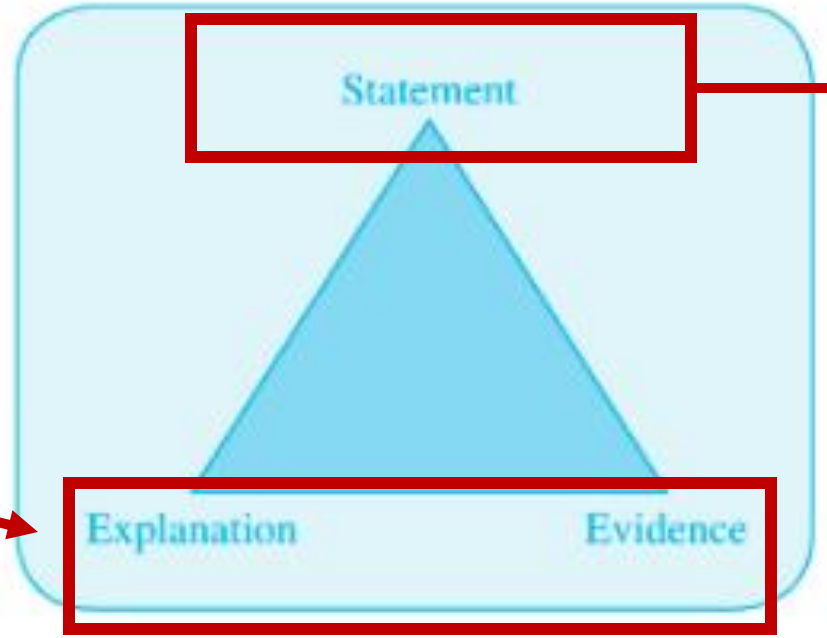
- You only communicate if you have a need to communicate
  - Communication always fills a gap: sharing knowledge and understanding
- You design all of your communication to fit the needs of the situation:
  - Who are you talking to?
  - What are you trying to communicate to them?
  - What is the context of the communication?
- Given those needs, you decide how to communicate
  - Is your audience a peer, your boss/instructor, a stranger, a child?
  - Are you communicating technical knowledge, personal information, a joke, something else?
  - Are you at work/school, at a conference, at a party, on the TTC, or elsewhere?
- How you answer those questions determines the form of your communication: **Content proceeds form**

Course Theme: Engineering communication and discourse uses persuasive claims and arguments

- The Problem Statement quiz requires you to know what a claim is
- Opinions: Can be supported by evidence and explanation
  - Can be subjective, open to interpretation
- Facts: "Statements of truth"
- Claim: The basic unit of argument
  - Arguments are made of claims
- Persuasiveness: the measure of the quality of arguments
- Claims and arguments can be strong, weak, limited, nonsense, etc.

Arguments depend on claims.
Better supported claims are more persuasive.

Support for claim: Potential sources of strength or weakness of claim and argument



Statement = Claim

FIGURE 1 A complete claim has three necessary parts: the claim itself, an explanation of the claim so that someone who is not familiar with the problem can understand its dimensions, and evidence to show that the claim and its explanation have independent, objective support.

Claims in the Engineering Observation

- Introduction: What environment you observed (explain why)
- Description: *Show* and describe what you observed in the environment (supported by evidence)
- Analysis: How you interpret the evidence to make *initial* claims about the entrance
  - Evidence you gather supports the claims you make
  - Refer to the evidence when making these claims
- The EO is *primary* (first-hand) evidence.
  - Important source of evidence to back up claims, but limited

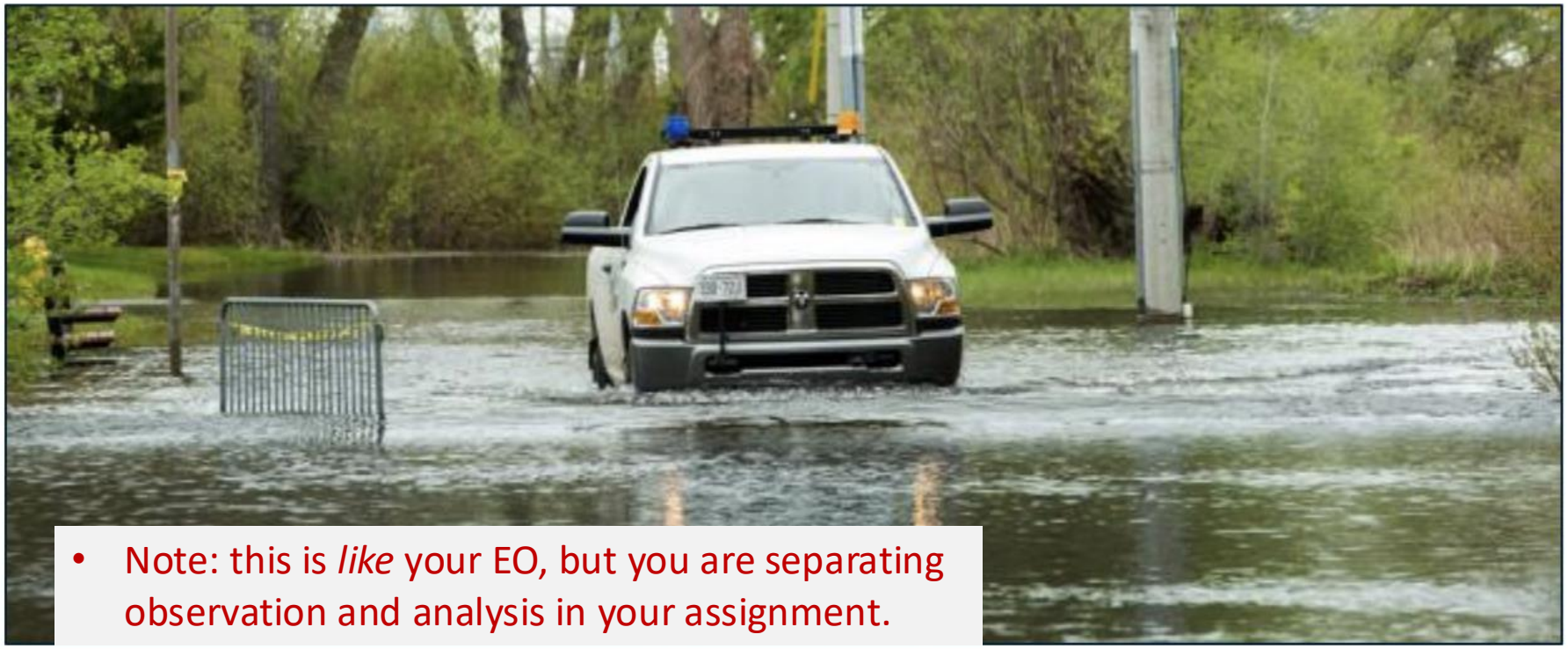
How do the professionals conduct site visits to observe and “see like an engineer?”

Group activity: Assess this example of Professional engineering communication

From a report **observing and analyzing flooding risks** on the Toronto Islands:

Lakeshore and Cibola Avenue are the main road arteries on Toronto Islands and connect the airport with the Island Water Treatment Plant, Island Public/Natural Science School, Fire Station, Ward's Island ferry dock, and residential areas on Ward's and Algonquin Islands. Low spots at Gibraltar Point and south of the Fire Station are vulnerable to flooding (see Figure 6.9). Smaller roads (or pathways) in the residential streets are also vulnerable to flooding.

- How do they show and describe this space?
- What could they add to show this site more completely for the reader?
- Where is the analysis? What claims are there? What evidence supports those claims?



- Note: this is *like* your EO, but you are separating observation and analysis in your assignment.

Figure 6.9: Photograph of Cibola Ave. During 2017 Flood (from National Post, 2017)

From: Baird & Associates Coastal Engineers Ltd., "Toronto Islands Flood Characterization and Risk Assessment Project," 2019. [Online] Available: https://trca.ca/toronto-islands-flood-characterization-risk-assessment/

Support via other modes: Flood map showing Cibola Ave

Flood Map, showing Cibola Ave in a low-lying flood-prone area

- Your EO will not be this sophisticated or advanced
- However, you can do a version of this: using multiple modes to show your environment and support your claims

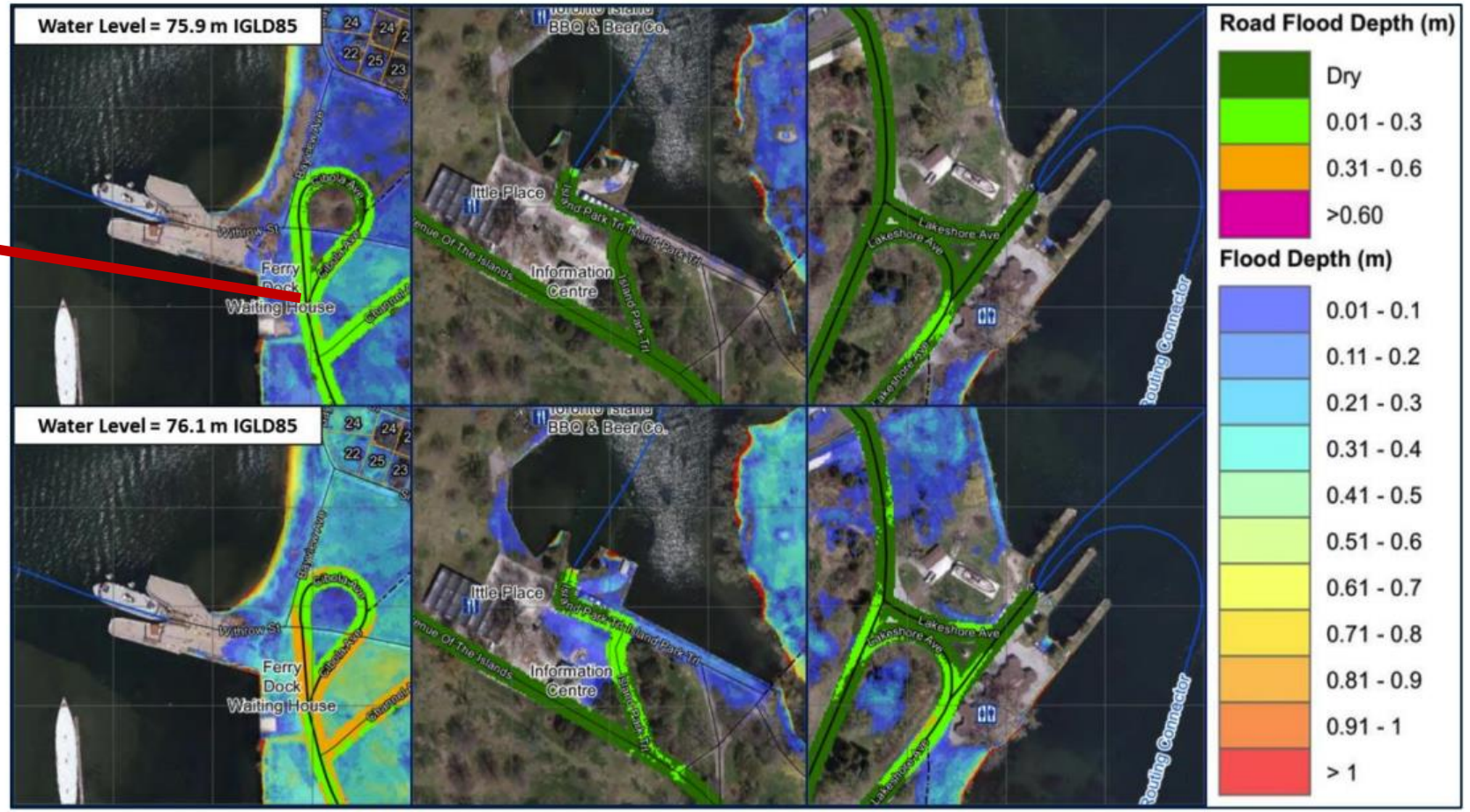
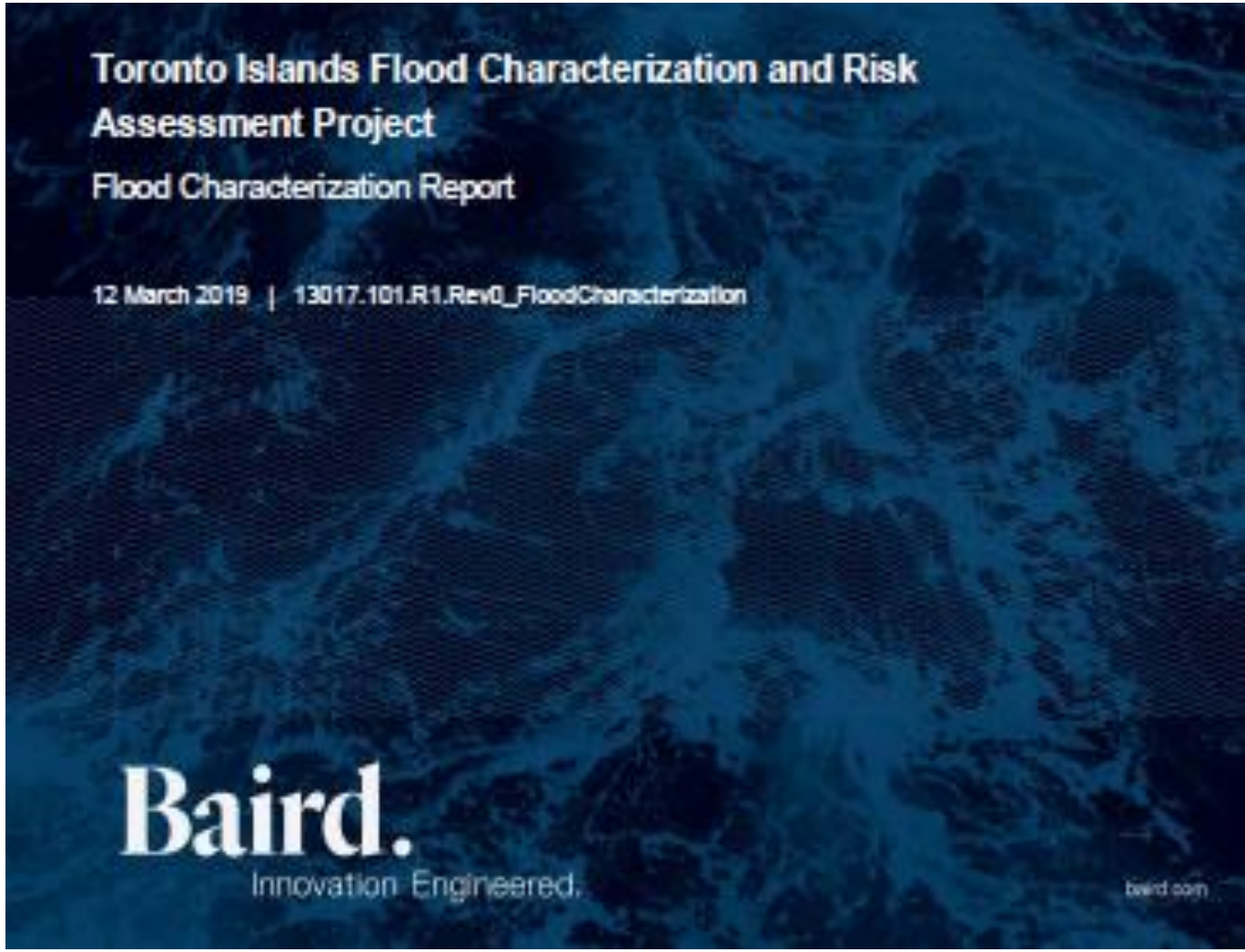


Figure 6.8: Floodwater Depths at Ward's Island Ferry Dock (left), Centre Island Ferry Dock (middle) and Hanlan's Point Ferry Dock (right) at 75.9 m (top) and 76.1 m (bottom)

The full report contains a wide range of multimodal resources used in engineering communication (beyond photos and maps)

- Tables
- Charts
- Diagrams
- How can you use these in your EO?

- Check it out to see more:
- https://trca.ca/toronto-islands-flood-characterization-risk-assessment/



Course theme: Engineering communication is *multimodal*—But what is multimodality?

- **Communication as design:**
- **Multimodality:** Communications as resources to *share* meaning
- **Resources/modes:** talking/listening, reading/writing, visuals, videos, diagrams, measurements, etc.
- **Aptness:** what mode is best to capture and convey the information/ knowledge/ meaning your audience needs?

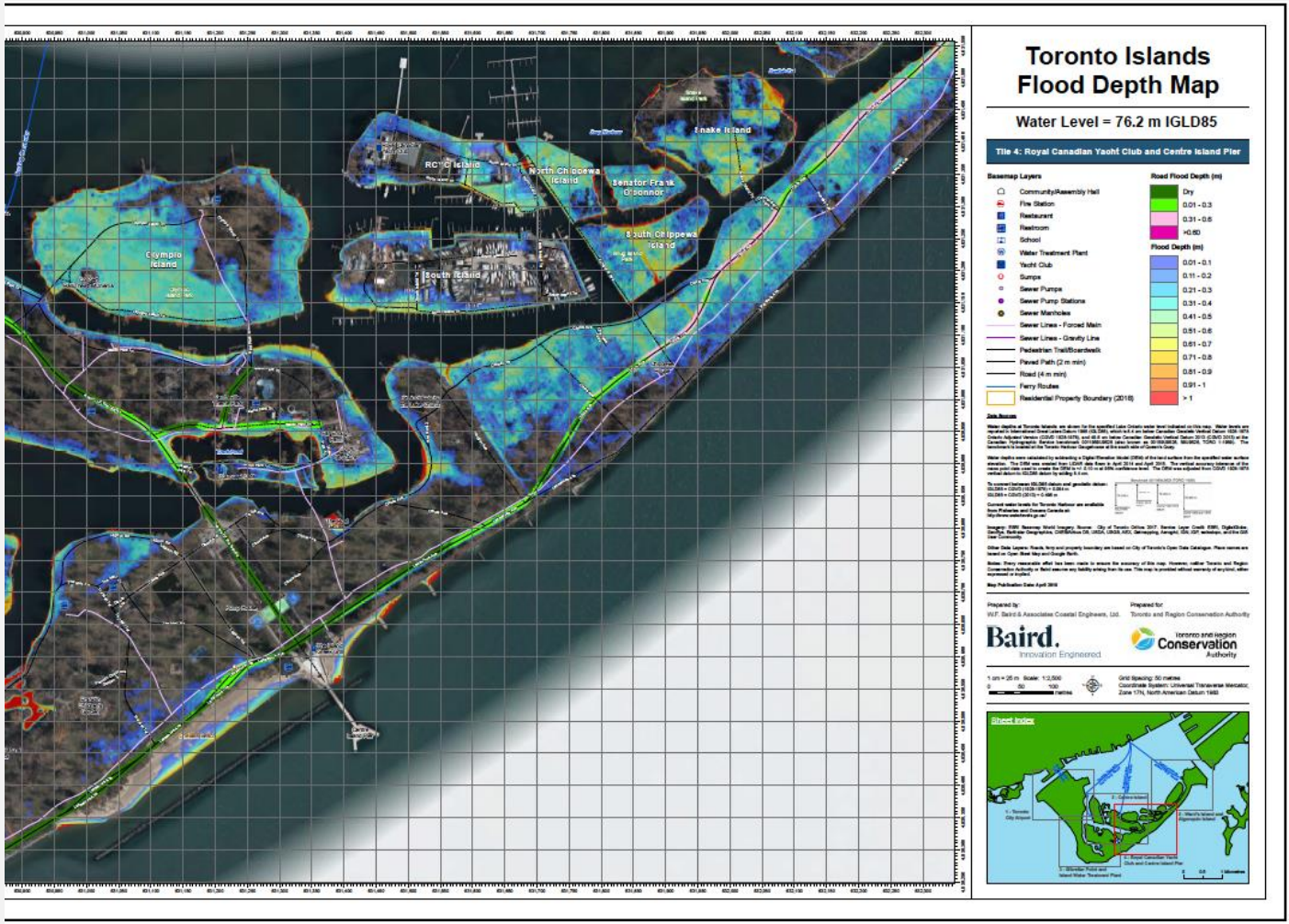


Figure 2: flood depth of a section of Wards Island (Toronto).

From: Baird & Associates Coastal Engineers Ltd., "Toronto Islands Flood Characterization and Risk Assessment Project," 2019. [Online] Available: https://trca.ca/toronto-islands-flood-characterization-risk-assessment/

Multimodality and design for aptness: What mode best conveys your content?

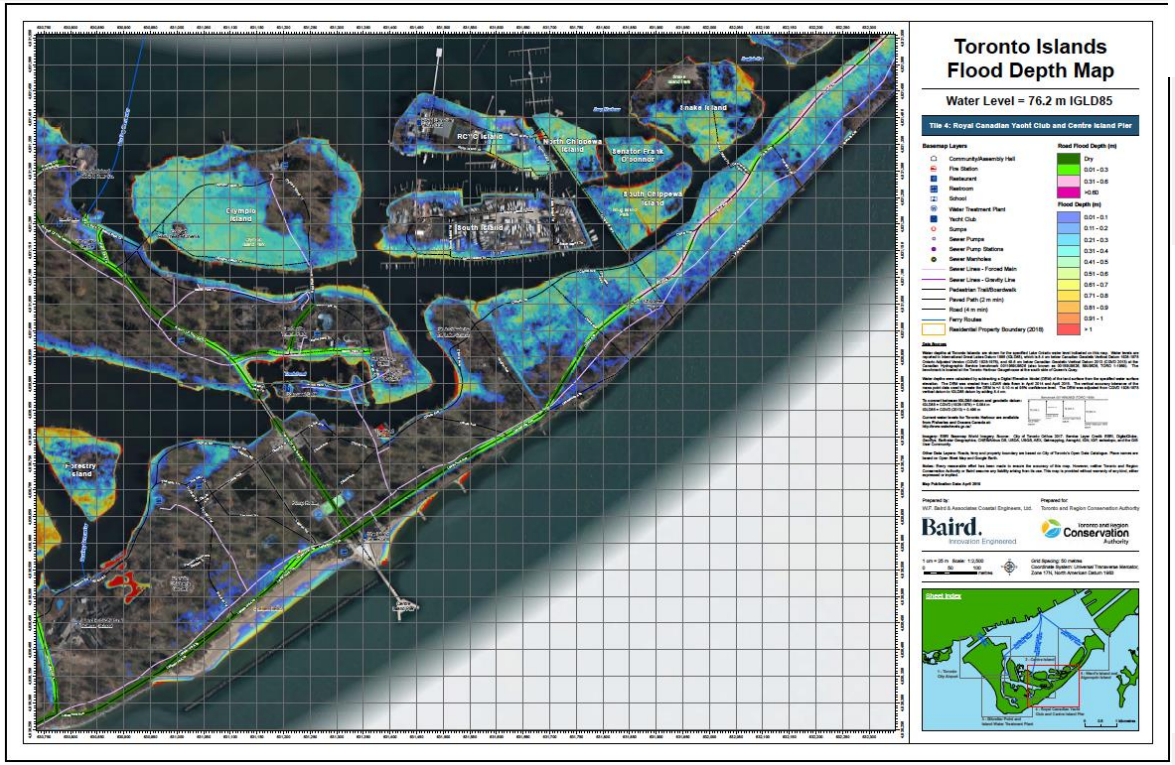


Figure 2: **Visualization** of flood depth of a section of Wards Island, integrated with other modes

4. Lake Ontario Return Period Water Levels

Return period water levels for Ontario locations on the Great Lakes were developed by the Ontario Ministry of Natural Resources (OMNR, 1989). The report defines the 100-year flood level, which is the stillwater level (or peak instantaneous water level) having a 1% annual chance of being equalled or exceeded. The stillwater level is equivalent to the hourly water level.

The return period water level estimates in OMNR (1989) were developed for static lake levels (e.g. monthly average levels), storm surge, and all combinations of static lake levels and storm surge. The statistical analyses were conducted using the HYDSTAT software package developed by OMNR (1982). The combined (or joint) probability approach used in OMNR (1989) is appropriate when the period of record is short.

Figure 3: **Writing** to describe information-gathering process

Table 4.1: Lake Ontario Return Period Static Water Levels

Data Range	Return Period Static Water Level (m IGLD85)							
	2 year	5 year	10 year	25 year	50 year	100 year	200 year	500 year
1900-1960 simulated 1960-1987 observed*	75.05	75.23	75.33	75.44	75.52	75.59	75.66	n/a
1900-1960 simulated 1960-2018 observed	75.09	75.27	75.37	75.49	75.57	75.65	75.72	75.82
1962-2018 observed	**75.14**	**75.34**	**75.46**	**75.60**	**75.70**	**75.79**	**75.88**	**75.99**

*OMNR (1989) study

Figure 4: **Table** showing results of information-gathering

All Figures from: Baird & Associates Coastal Engineers Ltd., “Toronto Islands Flood Characterization and Risk Assessment Project,” 2019. [Online] Available: https://trca.ca/toronto-islands-flood-characterization-risk-assessment/

What are other ways of showing flood conditions?
What modes could you use to show your environment?

Figure 5: A non-operative pump on flooded Wards Island

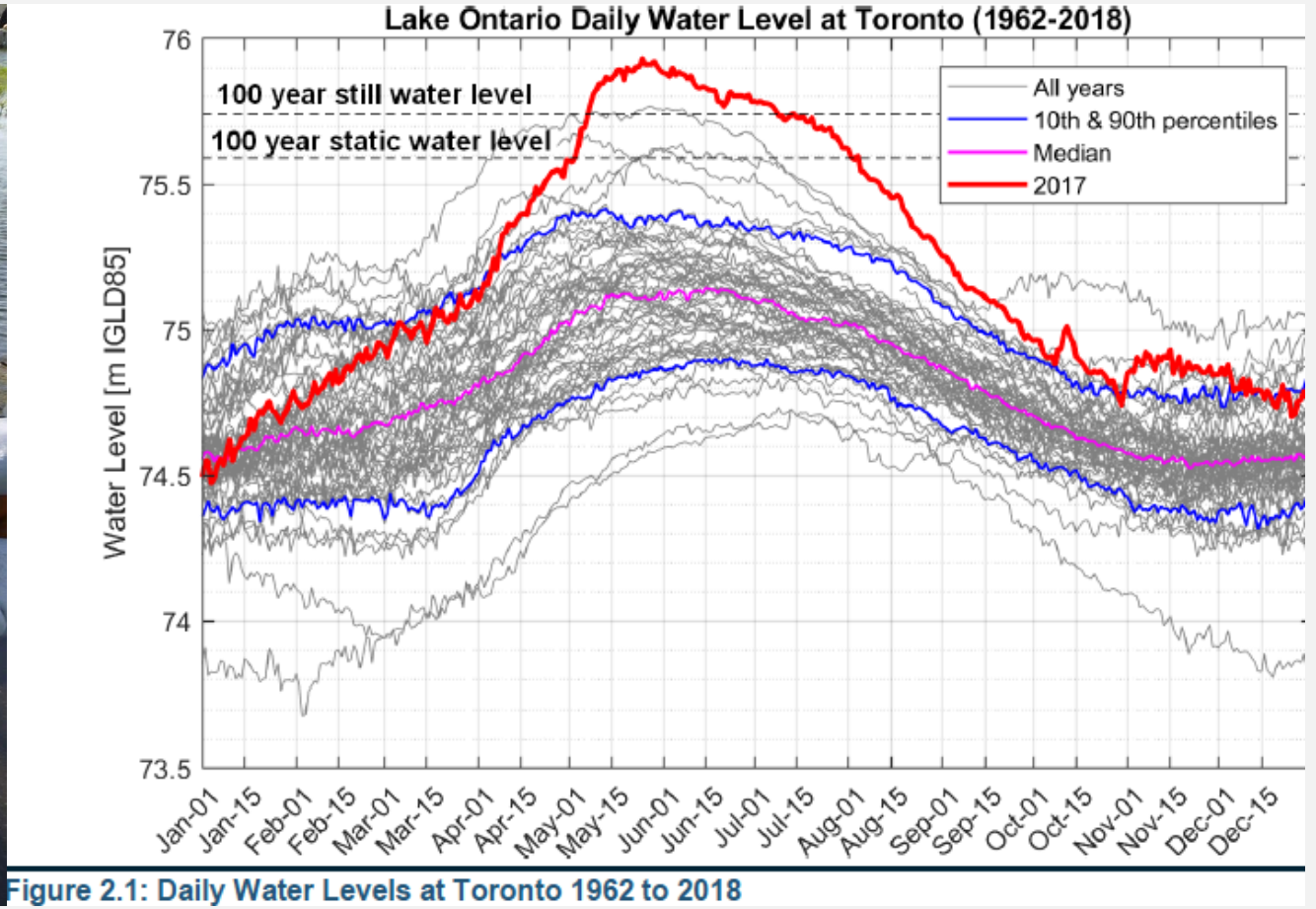


Figure 2.1: Daily Water Levels at Toronto 1962 to 2018

Figure 6: Graph of historical water levels in Lake Ontario

from: Baird & Associates Coastal Engineers Ltd., "Toronto Islands Flood Characterization and Risk Assessment Project," 2019. [Online] Available: https://trca.ca/toronto-islands-flood-characterization-risk-assessment/

The Engineering Observation is a multimodal assignment

- **Investigation:** “Evidence gathering is multimodal.” (“Seeing Like an Engineer” reading)
  - Modes: writing/notes, pictures/videos, drawing/sketching, recording stats, measuring, recording experience of the entrance/environment
- **Documentation:** “Choose the appropriate mix and organization of modes to communicate relevant details of the particular environment you are investigating.” (“Seeing Like an Engineer” reading)
  - Communication involves decision making: How can you best describe and show the environment to your reader?

Communicating Throughout the Process

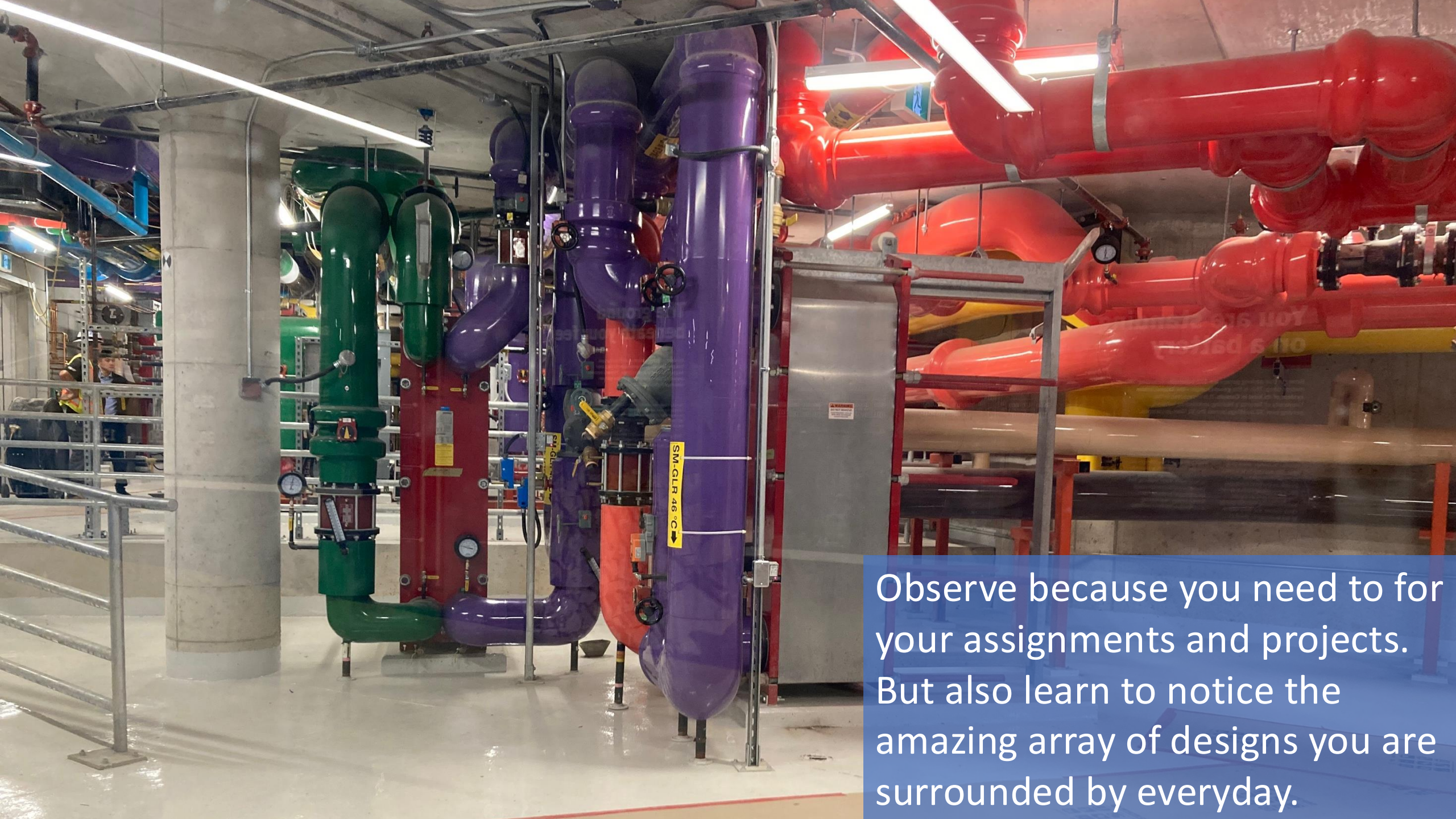
Design work

(non-linear/iterative/messy)

Design document

(linear/stable/narrative)

What’s beneath King’s College Circle?



Observe because you need to for your assignments and projects. But also learn to notice the amazing array of designs you are surrounded by everyday.

Takeaway: Learning to see and communicate as an engineering designer

- Observing and analyzing an environment for a purpose, **to fill a gap in knowledge**
- Identifying **unknowns** in the service environment (and project)
- **Communicating** your findings with others (instructors and teammates)
- Learning to **notice** the engineered world around you

Support for the Engineering Observation

- Questions on Piazza
- Week 3 tutorial: Presentation and guided work session
- Friday (19th) Lecture Help Session and tutorial (CIs there to help)
- Professor Nolan Office Hours: To be announced
- Communication workshops: To be announced
- Ongoing Tutoring Centre support: CIs are available for consultation all year in the Engineering Communication Program's Tutoring Centre.
  - uoft.me/tutoring (can practice writing Problem Statements here!)