Welcome to Geological Engineering (GEOE)
GEOLOGICAL ENGINEERING

The Earth is our classroom...
and our responsibility.

https://youtu.be/aj9OlTQo0a0

Intro Video
The Earth is our Classroom and our Responsibility

VIDEO: EARTH SYSTEMS OVERVIEW AND GEOE

https://youtu.be/J5gwNsK_dmA

“The Earth is our Classroom and our Responsibility”
Welcome to Geological Engineering (GEOE)

What is GeoEng?

Dr. Jennifer Day, PEng, PGeo
Assistant Professor
What is Geological Engineering?

Combines the concepts and techniques of the geological sciences with the tools of engineering to create designs that responsibly satisfy human needs.

Any engineering project that interacts with the Earth or Earth materials requires the input of Geological Engineers.
The Earth is our Classroom and our Responsibility

GEO-Hazard Engineering

Identifying Hazards and Designing Engineering Solutions for Threats to Our Infrastructure, Safety, and Economy
GEO-Hazard Engineering

Building 4D Virtual Worlds of Hazards to Analyze Stability of Terrain We Can’t Safely Reach

Applications Developed at Queen’s GEOE are Now Industry Standard

“The Earth is our Classroom and our Responsibility”
Protecting and Managing Groundwater and the Environment

Subsurface Contamination Investigation

Remediation and Sustainability

Groundwater Investigation and Management

Mine Waste Management

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Large-scale Monitoring of Contaminants in groundwater & drinking water systems

Environmental Impacts of Mine Waste

Scientists find gold worth $2 million in Swiss sewage

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GEO-Exploration and Design in Minex and Mining

Applying Modern Tools and Geological Concepts to the Search and Sustainable Extraction of Mineral Resources
GEO-Expertise for Energy Resources

Applying Modern Tools, Geological and Geophysical Concepts to the Search and Sustainable Extraction of Oil & Gas Resources

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GEO-Technical and Soil Engineering

Engineering Projects

**Surface:**
- Constructed slope stability
- Dam stability
- Building foundations

**Subsurface:**
- Foundations, Shafts
- Open Cut excavations
- Retaining Walls

**Underground:**
- Tunnels in soil
- Underground Caverns
  - subway stations,
  - urban expansion,
  - critical services
GEO-Technical Rock Engineering

Engineering Projects

Surface:
Landslides / Rockfalls / Debris Flows
Dam Foundations

Subsurface:
Rock Foundations and Deep Excavations
Shafts and Boreholes
Open Pit Mine stability

Underground:
Underground Mine stability
Tunnels in Rock
Large underground caverns
  train stations, power generation
  nuclear and hazardous waste storage
  energy and water storage
  recreation
Engineering GEO-Physics
Our “Eyes and Ears” to the Subsurface

Using physics and non-destructive techniques to understand the subsurface for engineering input and monitoring.

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Diverse Work Environments
Welcome to Geological Engineering (GEOE)

Why GEOE at Queen’s?

Dr. Vicki Remenda, PEng
Department Head & Assoc. Professor
Why Geological Engineering at Queens?

Leader in Canadian GEOE Programs

Well rounded education, skill set, & confidence

PEng & PGeo eligibility

Friendly department

Strong alumni network & industry collaborators
World-Class Expertise
Integrated GEOE & GEOL Professors
Gender Balance
Applied Research Focus
Licensed Professionals
VIDEO: Sample of Professor Driven Research in GEOE

https://youtu.be/qSMlHFpwsp8

“The Earth is our Classroom and our Responsibility”
Welcome to Geological Engineering (GEOE)

What will you study?

Dr. Mark Diederichs, PEng, FEIC
Professor
GEOE Curriculum

Knowledge and Skillset to take on the Earth’s Challenges

SITE INVESTIGATION and MEASUREMENT

DESIGN of Geological Models

DESIGN of Engineered Solutions

ANALYSIS

Fully Accredited by Canadian Engineering Accreditation Board (CEAB)

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GEOE SECOND YEAR
FUNDAMENTAL KNOWLEDGE
LAB AND FIELD SKILLS
INTRO TO GEOE

Mathematics

MTHE 225   Ordinary Differential Equations
(The Math of Change)

CHEE209   Analysis of Process Data
(The Math of Variability)

CIVL230   Solid Mechanics
(The Math of Stability)

APSC221   Economics
(The Math of Sustainability)

Science

GEOE 207 History of Life
(Deep Time)

GEOE 232 Mineralogy
(Basic GEO Building Blocks)

GEOE235 Solid Earth Materials
(Rocks—Nature’s Primary Composite Materials)

GEOE 238 Sedimentation
(Recycled Earth Materials)

GEOE 249 Earth Physics
(The Dynamic Earth)

Engineering

GEOE281 INTRO TO GEOLOGICAL ENGINEERING

GEOE221 GEOLOGICAL ENGINEERING FIELD METHODS
(Site Investigation)

APSC200 ENGINEERING DESIGN (GEOE)
(First chance to do a GEOE Design Project)

APSC293 ENGINEERING COMMUNICATION
(Reports, Memo, Presentations)
Rigorous Field Training

GEOE 221 – Field Methods
Learn field skills to observe and analyze rocks in Kingston area

GEOE 300 – Field School
Team-based geological field mapping & office analyses

GEOE 410 – Sudbury & Timmins
Minerals Life Cycle – Exploration, Extraction, Remediation

GEOE 419 – Geophysics Field School
Design & Implement an engineering geophysics site investigation project

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GEOE THIRD YEAR
ENGINEERING INVESTIGATION & ANALYSIS

GEOE Analysis
- GEOE359 Numerical Analysis for GEOE
- GEOE333 Terrain & Spatial Analysis

GEOE Engineering Investigation...
- GEOE300 GEOE Field School
- GEOE319 Applied Geophysics
- GEOE345 Site Investigation & Engineering Design

...and Design
- GEOE321 Rock Structures
- GEOE313 Geomechanics & Rock Engineering

Soil and Water Engineering
- CIVL340 Geotechnical Engineering
- GEOE343 Groundwater Engineering

GeoChemistry and Mineral Engineering
- GEOE365 Geochemistry
- GEOE362 Ore Deposits & Mineral Resource Engineering
State-of-Art Laboratory Facilities

Optical and Electron Microscopes

Geochemistry

Mass Spectrometry

Geoenvironmental Testing Lab

Environmental Scanning Electron Microscope (ESEM)

Isotope Lab

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State-of-Art Laboratory Facilities

**Computer Labs:**
GIS, 3D Visualization

Geophysics Analysis & Remote Sensing

Geomechanics Lab

Hazard Simulation

Geotechnical Modelling

Superconducting Gravimeter

Lidar Imaging and Autonomous Geophysics

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GEOE FOURTH YEAR
APPLICATION, DESIGN, SPECIALIZATION

Advanced Field Schools

GEOE410
Geomechanics and Geoenvironmental Engineering

OR

GEOE419
Advanced Engineering Geophysics

GEOE DESIGN

Fall
GEOE446
DESIGN PROJECT (Initial Design)

Winter
GEOE447
DESIGN PROJECT (Final Design)

+5 Technical Electives
Advanced Geophysics
Advanced Rock Engineering (Slopes, Tunnelling & Mining)
Geo-Environmental & Water Resource Engineering
Advanced Mineral Resource Engineering
Advanced Geoscience & Geochemistry
Energy/Mining Engineering
Geotechnical Engineering
Advanced Geo-statistics & Big Data Analysis
Geographic Information Systems (GIS)
Sustainability Physics
+ many more streams
70+ Tech Electives to choose from

+ 3 Complimentary Studies Electives
(to keep you human!)
Open-ended problems that require creative engineered solutions

Real projects proposed and supported by industry advisors

4th Year Team Design Projects

Diamond Mine Expansion

Landfill Remediation

Artificial Intelligence Applied to Rock ID

Deep Foundation Walls

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GEOE Curriculum

Knowledge and Skillset to take on the Earth’s Challenges

Fully Accredited by Canadian Engineering Accreditation Board (CEAB)
Department undergraduate student club that plans regular social, academic & networking events

Executive Team acts as liaison between students and faculty

@MillerClub
@millergeologyclub

Remote Activities 2020:
Weekly Zoom Meetings
Trivia night
Photo Scavenger hunt
Professor Ask Me Anything
...and more!
VIDEO:
Queens’ GEOE Student Experience and Perspective

https://youtu.be/-mB75zDJMH4

“The Earth is our Classroom and our Responsibility”
Welcome to
Geological Engineering
(GEOE)

Career Opportunities

Dr. Jean Hutchinson, PEng, FCAE, FEIC
Professor
Welcome to
Geological Engineering (GEOE)

Career Opportunities

Endless and Broad Career Opportunities Straight Out of Undergrad GEOE

Want to DIG a Lot Deeper?
Applied Research Grad Opportunities at Masters and PhD Level
Employment Opportunities

Queen’s Undergraduate Internship Program (QUIP)

12-16 month paid, full-time internship

Real world experience

Many GEOE companies involved with QUIP

GARNET
Geo-Alumni Resource Network

Bringing current Queen’s GEOE students together with GEOE Alumni

- Career Mentoring
- Resume Review
- Cover Letter Help
- Speaker Series

“The Earth is our Classroom and our Responsibility”
Career Opportunities?
You bet!

Our GEOE grads are employed across Canada and around the world in a wide range of sectors:

- Infrastructure
- Environmental Firms
- Construction Consultants
- Energy Sector
- Site Investigation
- Space Exploration
- Mineral Resources Exploration
- Tunnelling and Underground Works
- Universities
- NGOs
- Investment
- Geophysical Investigation
- Mining Industry
- Risk Management
- Government Offices
- Business & Finance
- ...and more!

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Teck

Victoria Sterritt
GEOE 2004

Lead, Technology and Innovation - Teck

Masters of Economic Geology, UBC, 2006

MBA, Queen’s 2015

Resource Engineering
Matt Lato  
GEOE 2006  
PhD 2010

Senior Geotechnical Engineer – BGC Engineering

Laser (Lidar) Surveying and Terrain Analysis for Geotechnical Engineering

Virtual Reality and GeoEnvironmental Engineering

Awarded Queen’s Alumni Association’s “The One to Watch” Award in 2015
Gillian Gardhouse
GEOE 2008
Manager,
Operations Strategy
Kinross Gold Corporation
Connor Langford
GEOE 2008
PhD 2013
Principal Tunnel Engineer
Mott MacDonald
2020 Young Tunneller of the Year
Canadian Tunnelling Association
Sarah Sternbergh
GEOE 2009

Now:
Project Manager,
Government of Yukon
& Councillor, Engineers Yukon

Previously:
Geological Engineering, EBA
Hydrogeological Engineering, EBA
Mineral Exploration, True North Gems

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Gabe Walton

GEOE 2011
PhD 2014

Geophysics and Rock Mechanics
Assistant Professor
Colorado School of Mines

Construction, Tunnel, and Mine Stability

Nuclear Safety

Geophysical Surveying

Experts to Advise WIPP on Worker Safety, Regulatory Compliance

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Adrienne Joaquim

GEOE 2013

SRK Consulting Inc (Vancouver)

Site investigation, geotechnical analysis, stability and risk assessment for underground and surface mining operations
Max Howarth
GEOE 2014
Managing Consultant

Queen’s Engineering Excellence Award Winner

Alex Harvey
GEOE 2014
MASc 2016
Consultant

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Natalie Blacklock
GEOE 2015
MASc 2018

Geotechnical/Mining EIT
Teck Greenhills Operation, BC
Callum Walker
GEOE 2016

Currently completing PhD Research to improve....

“Design, Integration and Application of UAV-Borne Aeromagnetic Surveys for Improved Mineral Exploration”

Walter et al. 2019 Geophys Prosp. 67: 465-479
Shelby Yee
GEOE 2016
Co-Founder & CEO at RockMass Technologies

Won the Queen’s Innovation Connector Summer Initiative (QICSI) Venture Pitch Competition in 2016

Remote Scanning and Mapping tools for surface and underground

CBC News Feature:
3D Printing Face Shields for COVID-19 Support

"The Earth is our Classroom and our Responsibility"
Michelle Thompson
GEOE 2011
Planetary Scientist and Assistant Professor at Purdue

Drew Feustel
GEOE PhD 1995
Commander of the International Space Station, June – October 2018

“The Earth is our Classroom and our Responsibility”
Graham Swarbrick
GEOE 2019

HATCH

Tunnelling Engineer in Training (EIT)

Annacis Outfall Project, BC

2020 TAC Tunnelling Award

“The Earth is our Classroom and our Responsibility”
• GRAHAM SWARBICK

• GEOE’20

Live Chat on the job site with Graham
“The Earth is our Classroom and our Responsibility”

https://youtu.be/D_FJO-I448A
THANK YOU!

QUESTIONS?

See where curiosity can lead you at engineering.queensu.ca/curiositycreates

GEOLOGICAL ENGINEERING

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Instagram:  @queens_geol
Email:  geoluqrd@queensu.ca
Also  diederim@queensu.ca and  day.jennifer@queensu.ca