CSAP

SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

CSAP Scholarships

Christine Thomas, M.Sc., R.P.Bio.
Chair: Technical Review Committee

WWW.CSAPSOCIETY.BC.CA

CSAP scholarships

- Each year, up to three scholarships are awarded to applied science and engineering graduate students whose studies are relevant to the assessment and remediation of contaminated sites.

- Applications are reviewed and successful applicants chosen by an independent selection panel comprised of Technical Review Committee members

CSAP scholarships

Congratulations to this year's winner of the Mike Macfarlane Memorial Scholarship:

Jeffrey Lam

CSAP scholarships

Jeffrey is pursuing a Master's degree in Environmental Toxicology at Simon Fraser University.

M.Sc. Thesis: ecological risk assessment evaluating the impact of pharmaceuticals and personal care products on the aquatic and terrestrial wildlife at the Alaksen National Wildlife Area.

core6 ENVIRONMENTAL

Climate Change Impacts on Contaminated Sites in BC

CSAP PD Workshop – June 1, 2023

Virginie Brunetaud, *PAg*
Project Hydrogeologist

OUTLINE

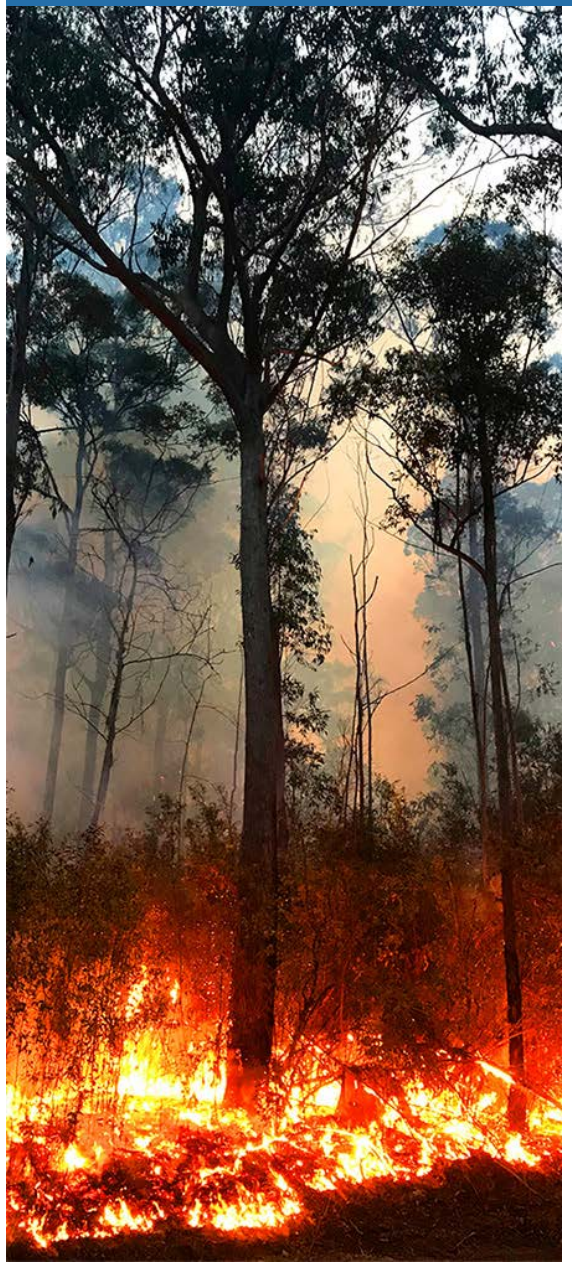
1. Introduction
2. Project Approach
3. Identified Climate Change Hazards and Regional Projections
4. Site-Specific Factors Increasing/Decreasing Site Vulnerability to Climate Change
5. Potential Climate Change Impacts on Contamination
6. Data Gaps and Uncertainties
7. Climate Change Conceptual Site Models
   - Coastal Region
   - Interior Region
8. Conclusion

INTRODUCTION

BACKGROUND

- Different regions of BC expected to experience varying effects of climate change => climate change hazards
- Climate change hazards have the potential to affect contaminated sites, leading to stabilization or mobilization of contaminants.
- The degree climate change hazards may affect a contaminated site and the resulting impacts are highly site specific, complex and difficult to assess.
- No existing guidance in BC for assessing potential impacts of climate change on contaminated sites.

Introduction



OBJECTIVE

- Develop a framework for environmental practitioners to answer the following questions:
  - What climate change hazards are applicable to a specific contaminated site?
  - What are the climate projections associated with those hazards?
  - What site-specific factors may increase or decrease site vulnerability to the hazards?
  - How the identified hazards may influence contaminants concentrations and distribution, mobility and fate and transport?

FRAMEWORK APPROACH

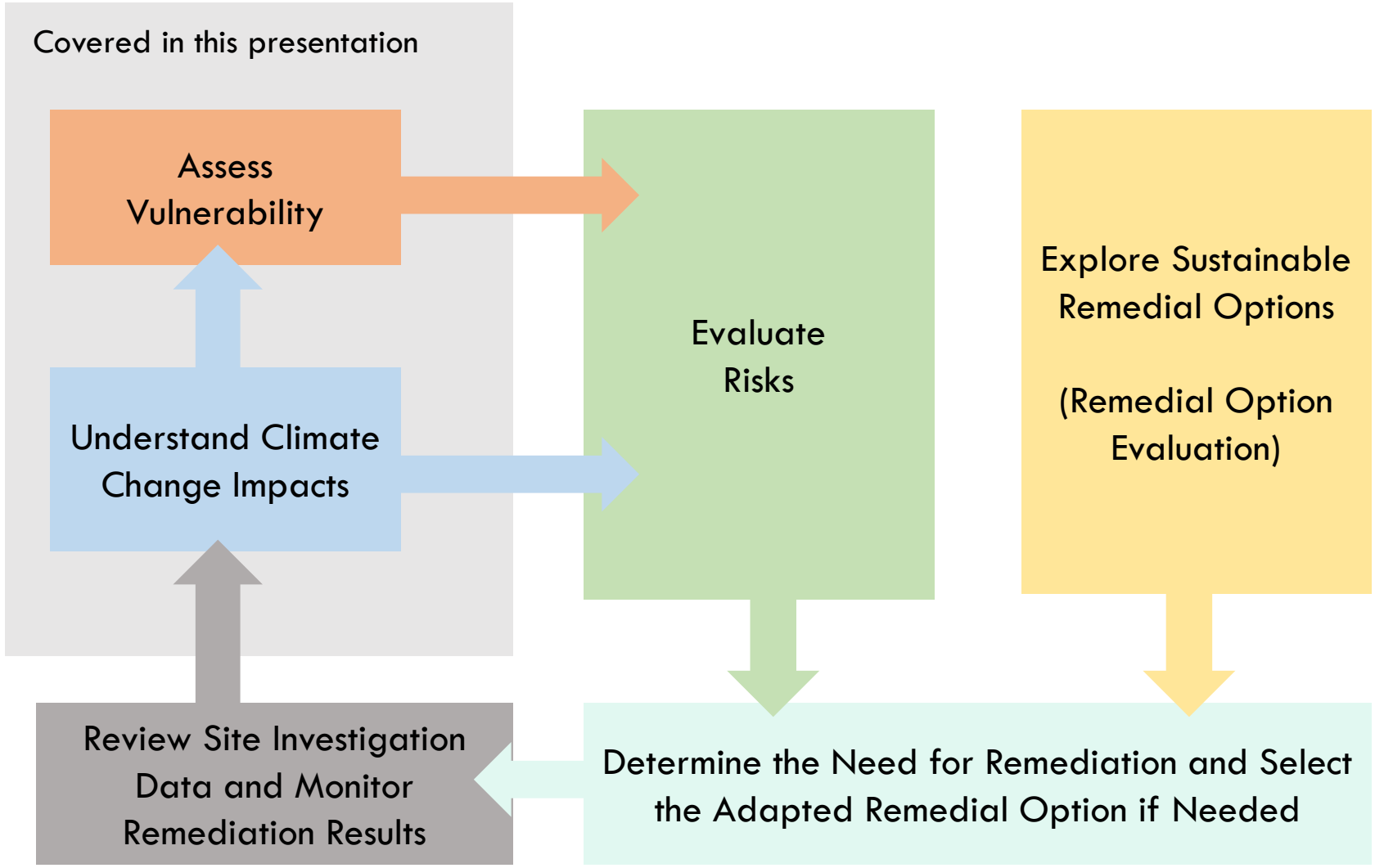
EMISSION SCENARIO

- It is recommended that practitioners consider the worst-case scenario (RCP 8.5 or SSP5-8.5) as a first priority.
- Other GHG emission scenarios (e.g. RCP 4.5 or SSP2-4.5) may be used for comparative purpose.
- It is not recommended to use the lowest GHG scenario (RCP 2.6 or SSPE1-1.9).

TIME HORIZON

- The long-term time horizon should be considered at a minimum but mid-term and short-term may also be considered:
  - Depending on the climate change hazard, long-term horizon not necessarily the worst-case scenario;
  - As site conditions may change at various time horizons;
  - To select the most cost-effective, sustainable and resilient remedial option.

PROJECT APPROACH



Identified Climate Change Hazard and Regional Projections

- Identify climate change hazards that may affect contaminated sites in BC:
  - Flooding
  - Drought
  - Wildfires
  - Increased temperatures / heat waves
  - Extreme storm events / precipitation
  - Erosion / landslide
  - Sea level rise

Four Regions of BC

Identified Climate Change Hazard and Regional Projections

Examples of Regional Projections

Hazard	South + West Coast Region	Skeena Region	Okanagan + Boundary Region	Northeast, Omineca & Cariboo Region
Flooding	Today's 500-year Fraser River flood up to five times more by 2050	Increased frequency of moderate and major events by 2050s		
Wildfires	4% increase annual area burned by 2050s	Longer fire season	More smoke days	Increased severity of wildfires by 2050s
Extreme weather / precipitation	By 2050, 15% less summer rain, 10% more rain in fall	By 2050, 7% increase annual precipitation, 15% more rain in fall	By 2050, 10% less summer rain, 15% more rain in spring	By 2050, 30% more rain in fall and spring
Increased Temperatures / heat wave	2.5 to 3 times as many days over 25°C by 2050	8 times as many days over 25°C by 2050	3 times as many days over 30°C by 2050	2 to 3 times as many days over 25°C by 2050

Site-Specific Factors Increasing / Decreasing Site Vulnerability

Location

- Low-lying area vs upland
- Coastal regions
- Floodplains

Topography

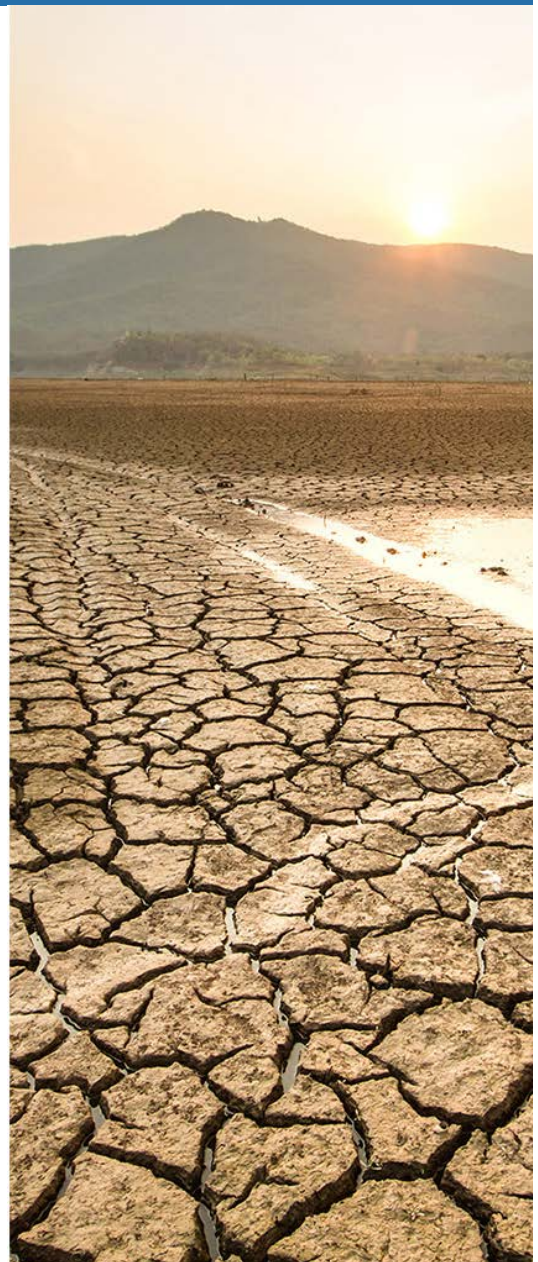
- Steep hillsides or slopes
- Valleys and depressions

Geology

- Porous and permeable geology
- Bedrock

Contamination

- Type of contaminant
- Contaminants concentration and extent



Site-Specific Factors Increasing / Decreasing Site Vulnerability

Physical Hydrogeology

- Groundwater table elevation
- Direction of groundwater flow
- Groundwater recharge

Infrastructure

- Lacking, aging or poorly maintained infrastructure
- Flood prevention infrastructure: pipes, dikes and drainage
- Pavement

Vegetation Cover

- Type of vegetation
- Density of vegetation

Site-Specific Factors Increasing / Decreasing Site Vulnerability

Examples of Site-Specific Factors

Climate Change Hazard	Site-Specific Factor	Considerations	Resources
Flooding	Location	Is the site located: • Within a 50-, 100- 500-year floodplain? • Near a river/stream or alluvial fan? • Near the oceanfront? • In an area that have already experienced flooding?	• BC Floodplain maps by region • iMapBC • Climate Data website
	Topography	Is the site located in a low-lying area?	• iMapBC
	Geology	• Does the lithology consists of fine-grained soil that can retard infiltration? • Are the soils permeable to support an unconfined aquifer that can reach saturation quickly?	• Geological maps • iMapBC • Borehole logs from site assessment
	Physical Hydro-geology	• What depth is the water table? • Where does groundwater discharge? • What is the groundwater flow direction?	• BC Water Resources Atlas • Historical data

Potential Climate Change Impacts on Contamination

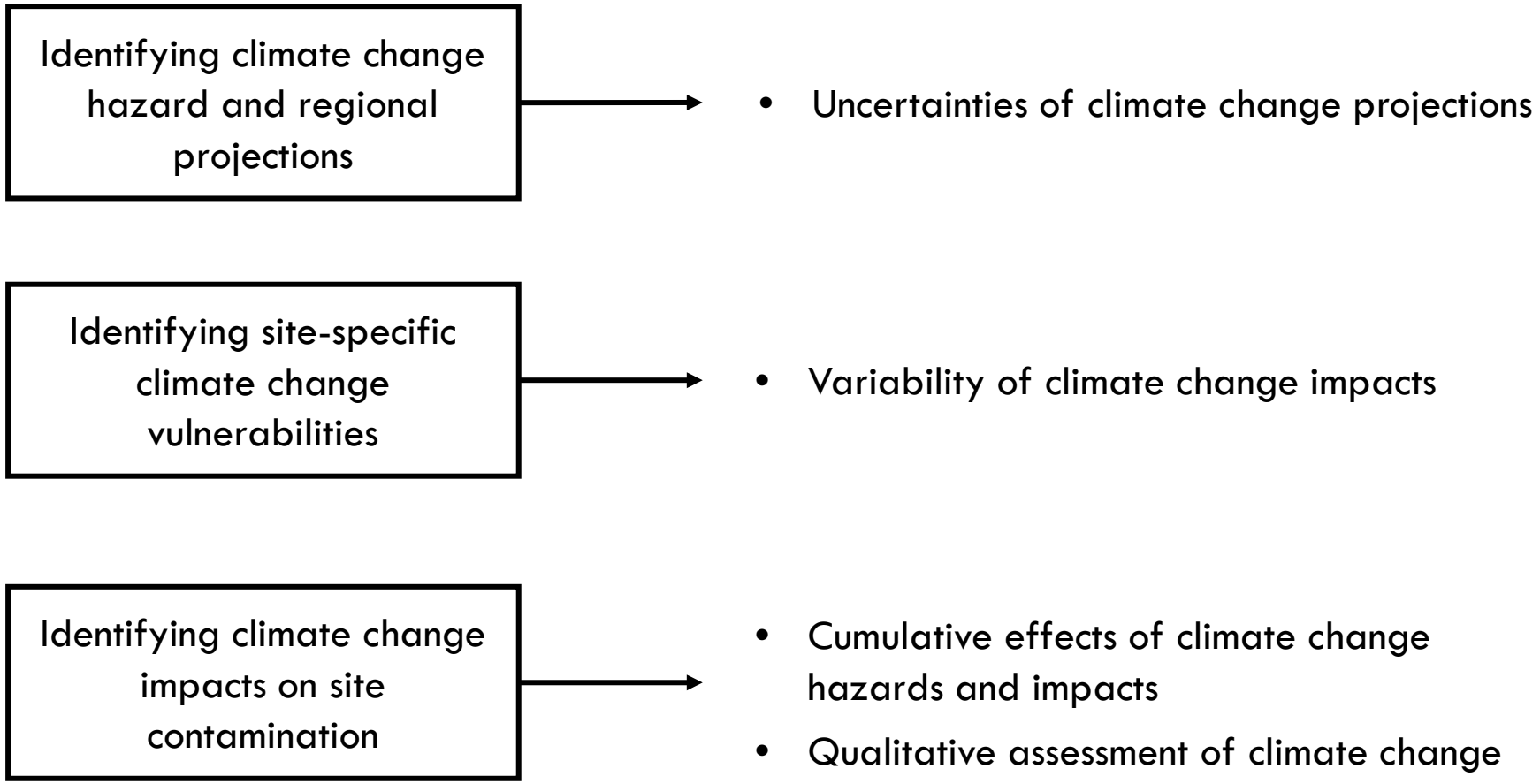
- Identify climate change impacts on site contamination.
  - For each hazard
  - Subsurface effects / changes
  - Contaminant properties / transport processes
  - Mobilization / stabilization of contaminants
  - Metals vs petroleum hydrocarbons
  - Complex and difficult => site-specific
  - Non comprehensive
  - Tabulated format

Potential Climate Change Impacts on Contamination

Examples of Potential Effects on Inorganics Contaminants

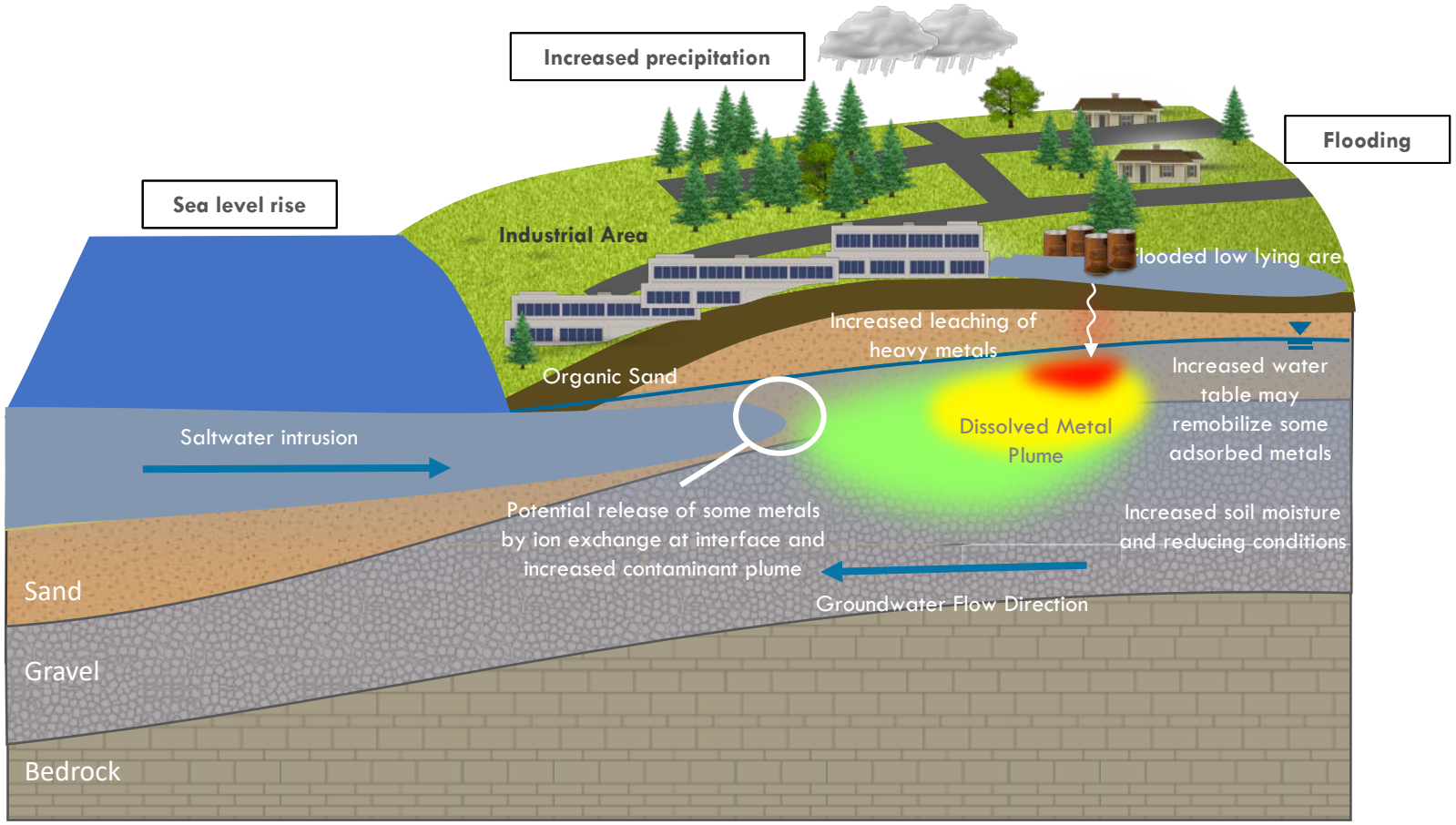
Climate Change Hazard	Physical Effects	Media Affected	Effects on Contamination
Flooding	• Saturation of previously unsaturated soils (increased soil moisture) • Overland flow in flooded area • Change in high water marks position of surface water body • Change in water table position • Increased water infiltration • Mixing of water chemistry (surface water and/or runoff mixing with groundwater)	• Soil (may become fully saturated) • Groundwater (increase of saturated thickness) • Vapour (may become non-existent)	• Increase in contaminant leaching from unsaturated zone. Could affect seasonal groundwater concentrations • Change in groundwater physico-chemistry (pH, redox, DO) may mobilize of stabilize certain inorganic contaminants • Potential transport via overland flow of contaminants (dissolved or in suspension) • Possible dilution of dissolved phase constituents

Data Gaps and Uncertainties



Climate Change Conceptual Site Models

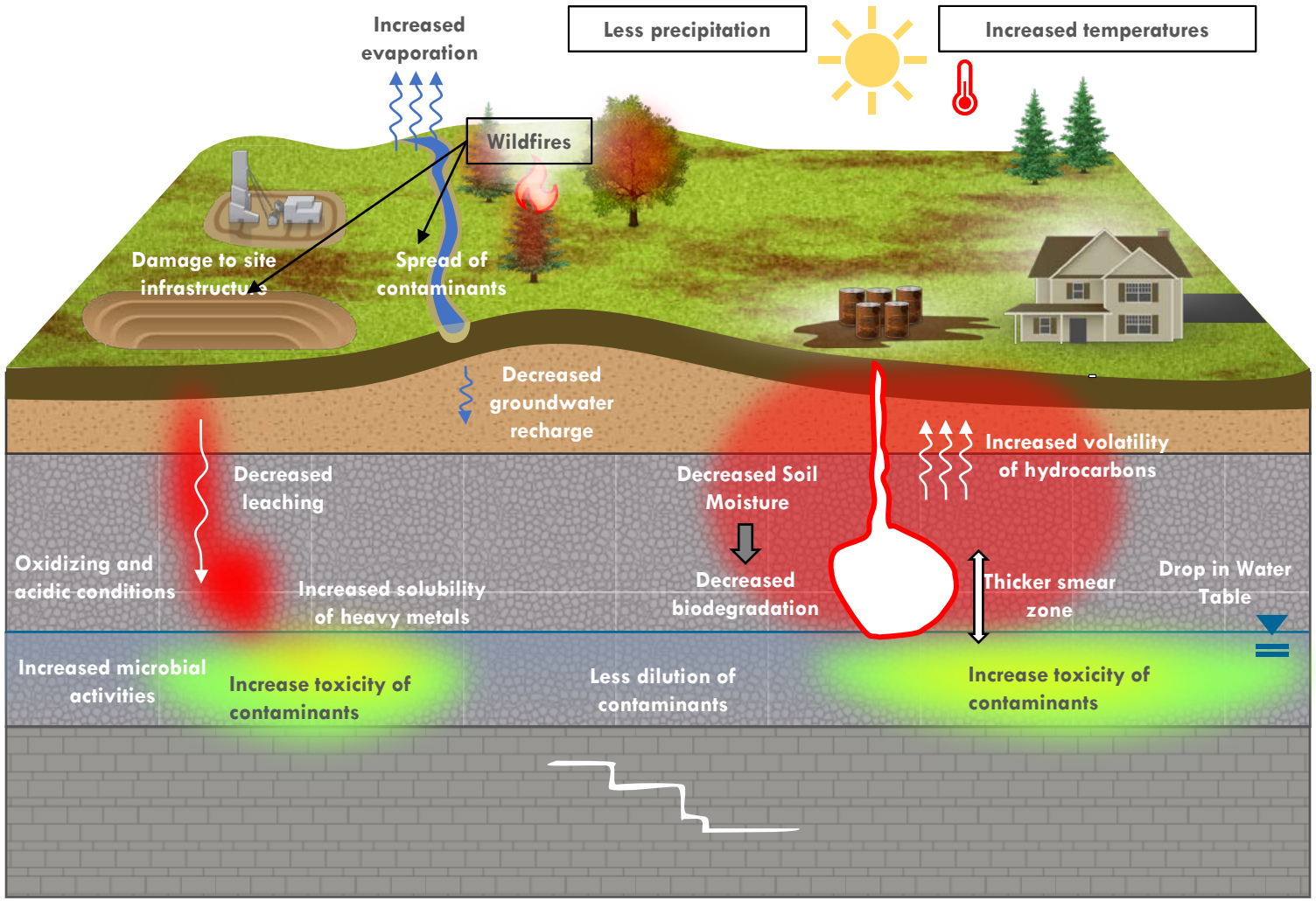
Examples of CSM in Coastal Region (Inorganics)



*Modified from the Health Canada CSM Builder Tool (2015)

Climate Change Conceptual Site Models

Examples of CSM in Interior Region (Inorganics + Petroleum Hydrocarbons)



*Modified from the Health Canada CSM Builder Tool (2015)

CONCLUSION

- Potential impacts of climate change on contaminated sites are:
  - Complex
  - Difficult to predict
  - Highly site-specific
- A good understanding of site conditions, including existing contamination is essential.
- Qualitative vs quantitative evaluation.
- Data and information collected can then be used in a climate change vulnerability and risk evaluation.

Resources

Alkorta, I., Epelde, L., Garbisu, C. 2017. *Environmental parameters altered by climate change affect the activity of soil microorganisms involved in bioremediation*. FEMS Microbiology Letters, 364, 2017, fnx200 doi: 10.1093/femsle/fnx200

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV), 2019. *Preliminary Strategic Climate Risk Assessment for British Columbia*. Report prepared for the Government of British Columbia, Victoria, BC.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV), Land Remediation Section, 2022. Discussion Paper – *Making Contaminated Sites Climate Ready*.

Canadian Council of Ministers of the Environment (CCME), 2015. *Implementation Framework for Climate Change Adaptation Planning at a Watershed Scale*.

Canadian Council of Ministers of the Environment (CCME), 2021. *Guidance on Good Practices in Climate Change Risk Assessment*.

Federal Contaminated Sites Action Plan (FCSAP), 2022. *Integrating Climate Change Adaptation Considerations Into Federal Contaminated Sites Management*. Version 1.0

Hansen DJ, McGuire JT, Mohanty BP. *Enhanced biogeochemical cycling and subsequent reduction of hydraulic conductivity associated with soil-layer interfaces in the vadose zone*. J Environ Qual. 2011 Nov-Dec;40(6):1941-54. doi: 10.2134/jeq2011.0112. PMID: 22031578; PMCID: PMC3809095.

Resources

IPCC, 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

IPCC, 2022. *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

Jarsjö, J., Andersson-Sköld, Y., Fröberg, M., Pietroń, J., Borgström, R., Löv, Å., Kleja, D.B. 2020. *Projecting impacts of climate change on metal mobilization at contaminated sites: Controls by the groundwater level,* Science of The Total Environment, Volume 712, 2020, 135560, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2019.135560.

Radhapyari, K., Datta, S., Dutta, S., Barman, R. 2021. *Chapter 11 - Impacts of global climate change on water quality and its assessment*, Editor(s): Binota Thokchom, Pengpeng Qiu, Pardeep Singh, Parameswar K. Iyer, Water Conservation in the Era of Global Climate Change, Elsevier, Pages 229-275, ISBN 9780128202005, https://doi.org/10.1016/B978-0-12-820200-5.00011-7.

CSAP

SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

Performance Assessment Committee Update

Chair: Chuck Jochems, P.Eng.

WWW.CSAPSOCIETY.BC.CA

PAC Agenda

- Overview of PAs and Submissions
- PA Lessons Learned
- Metes and Bounds Descriptions
- Detailed Screening Sub-committee Update
- Review Services Sub-committee Update

PAC Fiscal Summary

2022-2023 Summary (as of March 31, 2023)

Item	Number	Percentage	Notes
Active PAs	8	33%	
Sufficient	15	25% 38%	6 at Stage 1 Findings 9 with clarifications
Deficient	1	4%	
Total PAs	24	100%	Including 4 NRPAs

- Total of 155 Submissions received by CSAP

PAC Fiscal Summary

- Total of 5 Focused Reviews (FRs) conducted by PAC
    - 3 FRs from DS
    - 2 FRs at request of ENV
    - 2 FRs resulted in Non-Random Performance Assessments (NRPAs)
- Total of 5 NRPAs conducted
    - 2 from Focused Reviews
    - 1 from Measures (i.e. Deficient Submission)
    - 1 was a Re-submission
    - 1 at request of ENV

PA LESSONS LEARNED

PAC Tracking of Lessons Learned

- Spreadsheet of potential issues provided to DM
- Categories follow the Stage 1 Findings letter template
- Feedback from PA panel members possible during PA
- DM(s) to provide Lessons Learned feedback to CSAP when finalizing DS of the Submission
- Provide feedback in Members' Updates

PA Lessons Learned - Standards

	Yes	No	Summary of Issue
Stage 1 Preliminary Site Investigation			
Missed APECs/PCOCs			
Missed PCOCs			
in adequate summary of other sources			
Other:			
Stage 2 Preliminary Site Investigation			
Missed flagged PCOCs			
Missed flagged APECs			
Poorly screened wells			
Poorly located BHs/MWs/VWs			
Sampling density			
Screened vapours incorrectly			
Didn't tabulate/include historical data			
Missing CSM (text or table)			
Inadequate Investigation			
Other:			
Standards (Incorrect Application)			
Soil			
Groundwater			
Vapour			
No description of all 4 gw std applicability			
Other:			

	Yes	No	Summary of Issue
Detailed Site Investigation			
Inadequate Characterization			
Poorly screened wells			
Poorly located BHw/MWs/VWs			
Delineation density			
Missing CSM			
Insuffficient seasonal sampling			
Insufficient trend analysis			
Other:			
Remediation			
Inadequate Remediation			
Missing PCOC sampling			
inadequate gw sampling			
Inadequate vapour Sampling			
Other:			
ENV policy			
Doesn't qualify for P6			
Should have been Arm's Length			
Protocols/guidance potentially not followed			

PA Lessons Learned - Risk

	Yes	No	Summary of Issue		Yes	No	Summary of Issue
Problem Formulation				**Risk Characterization**			
Current and Future Scenarios				Risk Calculations			
COPC Screening				WoE Approach			
Receptor Screening				Additive Effects			
Exposure Pathway Analysis				Other:			
Conceptual Site Model							
Other:				**Uncertainty Analysis**			
				Other:			
Exposure Assessment							
Exposure Point Concentrations				**General and Regulatory**			
Receptor Characteristics				Other issues, per Numerical Stds PA			
Dose/Intake Calculations				Requirements for RA			
Food chain modelling				(e.g., complete DSI, plume stability)			
Other:							
				Risk Management			
Toxicity/Effects Assessment				Risk Controls			
Toxicity Reference Values				Performance Verification Plans			
Other:							

PA Lessons Learned

- Examples provided in the following slides are from a cross-section of PAs
- Examples presented may not have resulted in a ‘Deficient’ Finding
- Additional context will be provided as needed to assist the membership in understanding the issues raised during PAs

PA Lessons Learned

Category	Item	Details
Stage 1 PSI	Missed APECs	Strip drain next to Garage identified as APEC, but no sampling conducted. Fill only sampled for metals and no hydrocarbons.
Stage 1 PSI	Missed PCOCs	Missed sulfide in groundwater for a battery recycling facility that had noted battery acid spills, lead contaminated soil and poor housekeeping.
Stage 1 PSI	Missed PCOCs	Did not sample for fuel additives such as 1,3,5-TMB or TEL. However, hydrocarbons were heavily weathered with majority of BTEX results < DL. Expected that fuel additives would be less than standards.
Stage 1 PSI	Missed APECs	Question raised whether large diameter concrete patches were former inground hoists in an active auto service garage.

PA Lessons Learned

Category	Item	Details
Stage 2 PSI*	Missed flagged PCOCs	Drycleaner identified as an off-site APEC, but drycleaning VOCs not evaluated in vapour onsite.
Stage 2 PSI*	Poorly screened wells	One MW was dry and only two MWs were initially monitored for groundwater potentiometric surface. Gw flow direction could not be established.
Stage 2 PSI*	Poorly located BHs/MWs/VWs	BHs/MWs were installed at the site perimeter, away from onsite APECs, with no locations installed through the building slab or immediately adjacent to the building for an auto servicing garage.
Stage 2 PSI*	Sampling density	Only one MW at the southern extent of the property was used to evaluate vapour for the entire site. Following Stage 1 Findings, a new VW was installed, and an additional location was sampled.

*** The above issues were all associated with one Performance Assessment found to be 'Deficient'.**

PA Lessons Learned

Category	Item	Details
Stage 2 PSI	Sampling density	Very large site with only 3 locations used to characterize soil vapour. The initial rational for the spacing was that they were spaced only marginally greater than the 30 m specified in TG4, which is an incorrect application of guidance.
DSI	Inadequate Characterization	Inadequate delineation of a deep solvent plume. Only two deep wells with no lateral delineation to north and south. AP relied on shallow groundwater data to delineate plume.
DSI	Delineation density	Lack of lateral soil and groundwater delineation on the site, but delineation was achieved at the property line with the exception to the neighboring property to the south that was also over excavated. Site was fully excavated for 3 levels of underground parking.

PA Lessons Learned

Category	Item	Details
Stage 2 PSI	Missed PCOCs	TEL not analyzed in soil where DW does not apply to groundwater, but soil standard still applies at a former service station.
DSI	Poorly located BHw/MWs/VWs	Poor delineation of off-site groundwater contamination (i.e. coarse delineation) left questions as to whether numerical remediation was achievable given uncertainties with extent of contaminated groundwater beneath an off-site building for a numerical AiP application (i.e. no bldg demo). Also, shallow vapour probes did not properly assess groundwater contamination at depth.
DSI	Inadequate Characterization	Groundwater plume stability assessed from a mix of wells across 3 different plumes, but each individual plume may not have been assessed as being stable.

PA Lessons Learned

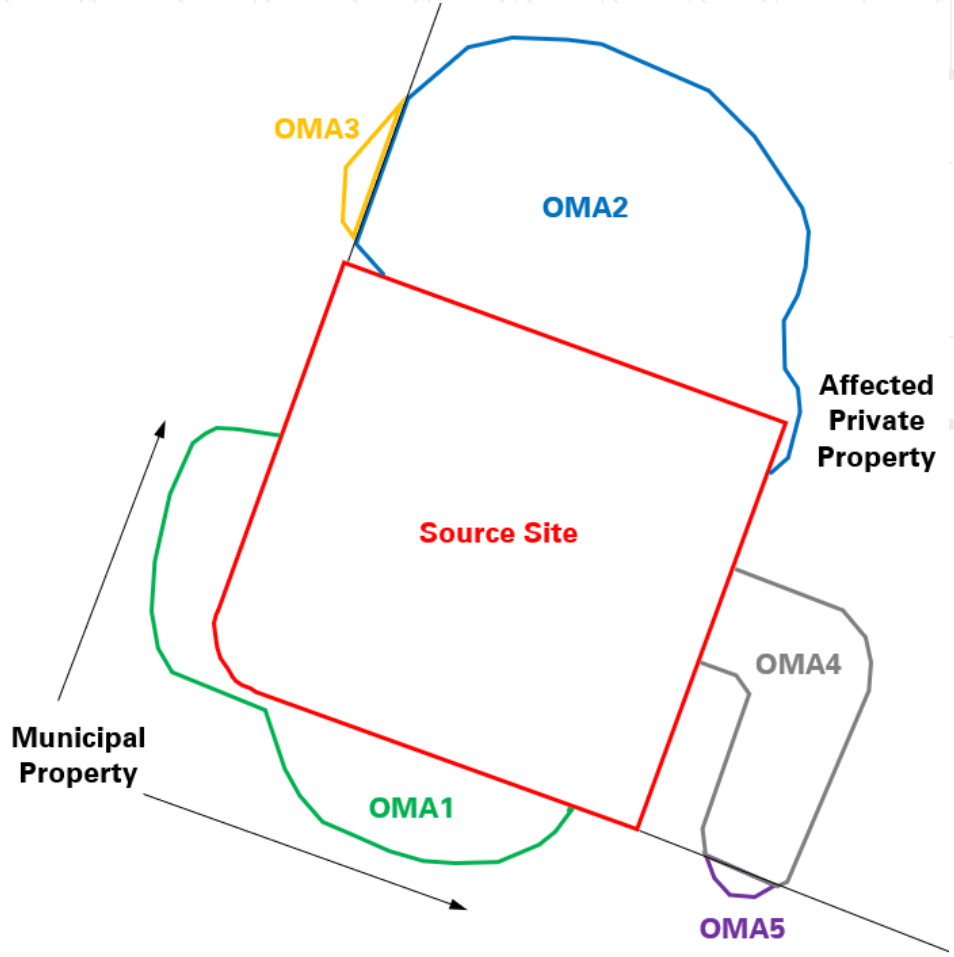
Category	Item	Details
Standards (Application of)	Groundwater	AP relied on 2013 letter from ENV that drinking water use does not apply, prior to P21 coming into effect.
Remediation	Missing PCOC sampling	Old data (more than 20 years) relied upon for COC application. Site had little or no recent data. ENV advised that recent data was required in support of the COC recommendation.
ENV Policy	P6 Eligibility	AiP for a site that did not appear to have any CSR exceedances, but the site was not well investigated due to existing building coverage of the entire site.
ENV Policy	Protocols / Procedures not followed	COC included an active Schedule 2 activity (Maintenance Garage). ENV advised that this was not acceptable. A metes and bounds description was used to remove the area.

METES & BOUNDS DESCRIPTIONS

Metes & Bounds Descriptions

- Legal metes & bounds are typically used to describe Off-site Management Areas (OMAs) related to migrated contamination
- Although plume stability is required, given the fact groundwater flows, some buffer should be provided within the areal extent
- Two recent examples provided for context
- Best to keep M&B descriptions simple

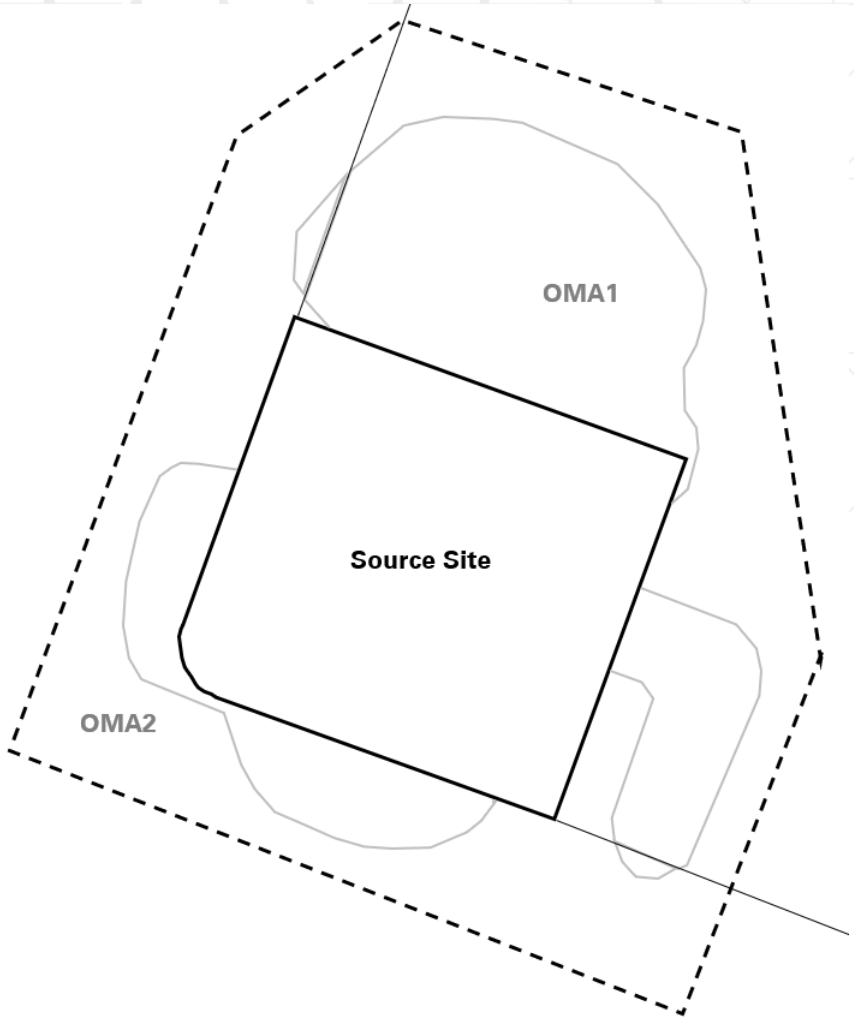
M&B Descriptions - Examples



Example 1

- Multiple groundwater plumes
- 2 Affected Parcels
- 5 individual OMA descriptions
- Nearly 4 pages of meets and bounds descriptions

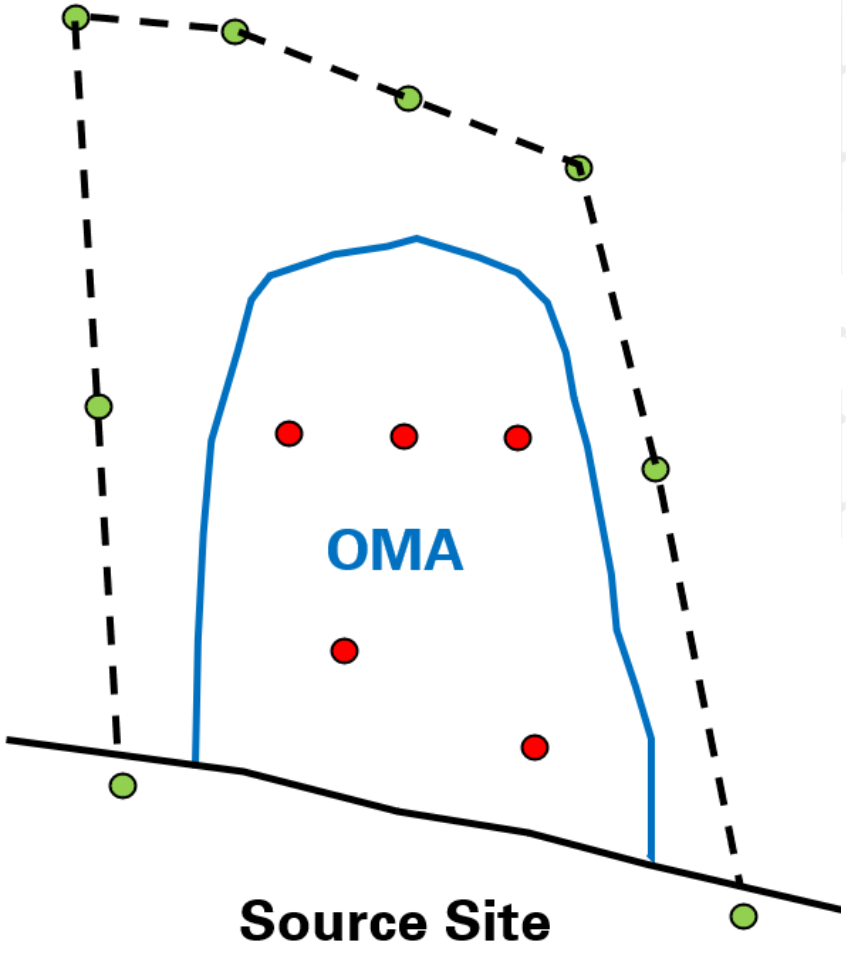
M&B Descriptions - Examples



Example 1

- Suggest only 2 OMAs instead of 5
- Multi-sided polygons now reduced to only two 7-sided shapes
- Utilizes line bearings from site legal lot plan
- Only covers migrated contamination within each OMA
- Buffer provided

M&B Descriptions - Examples



Example 2

- Groundwater plume
- One Affected Parcel
- M&B involved a multi-sided polygon interpolation of extent
- Better to use simplified version to sentinel wells

DETAILED SCREENING

Detailed Screening

- In 2022-2023, the Detailed Screening Sub-Committee updated the Detailed Screening (DS) Worksheets to align with the 2021 regulatory changes.

- Minor updates were made to the DS worksheets to improve clarity, and the Submission Screening Guidelines were updated. The guidelines, which include the Worksheets as an appendix, are available on the CSAP website.

Detailed Screening - Fiscal Summary

- We have seen fewer comments from ENV statutory decision makers that review submissions, indicating that the overall quality of submissions is improving.

- Two new Detailed Screeners were added to the roster this year to ensure that screenings are completed in a timely manner.

- 3 Focused Reviews were initiated from issues identified during Detailed Screening.

REVIEW SERVICES

Review Services

- As of January 31, 2022, ENV specified that a subset of reports must be forwarded to CSAP for review, as opposed to ENV.
- Types of monitoring reports identified for review by the Review Services Committee (RSC) were associated with the Director's reporting requirements.
- Typically reporting requirements are specified in regulatory Instruments, such as AiPs, CSRAs and some COCs.
- For example, all AiPs require an annual report be submitted with respect to remedial progress in the context of a Remedial Plan.

Review Services

- Members of the RSC provide technical reviews of the submitted Monitoring Reports
- Reviews confirm that the work completed was consistent with the requirements of the Instrument and supporting documents (e.g., as required by a PVP or Remedial Plan).
- Reviews are forwarded to ENV, where the Statutory Decision Maker (SDM) considers the information and makes the final decision on the adequacy of the work.

Review Services - Fiscal Summary

- Processed 27 Monitoring Reports in the past year.
- Anticipate a similar number of submissions in 2023-2024.
- May explore ways to expand review service offerings with ENV.

QUESTIONS?

pac@csapsociety.bc.ca

Groundwater Protection Regulations

- for Contaminated Sites Professionals

CSAP AGM and PD Workshop

2023-06-14

ACTIVE EARTH

ENGINEERING LTD

We are meeting and learning today on the unceded traditional territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh) Nations

A short intro

- Masters of Applied Science (UBC) in hydrogeology
- 5 years in contaminated sites (URS), 10 years in classical hydrogeology (Piteau)
- 5 years non-profit (BCGWA)
- 5 years consulting (Active Earth)
- Aquifer protection and development: groundwater quality and quantity

What I have learned from water well drillers

Water well drilling is like environmental drilling on steroids

Rigs are bigger

Parts are bigger

Flow rates are greater

Stakes can be higher - livelihoods rely on a sustainable resource

Acting sustainably protects drillers too

Adhering to groundwater protection regulations:

- Prevents undercutting by unqualified contractors
- Prevents costly mistakes
- Prevents resource contamination/depletion
- Makes information available for all

About the Water Sustainability Act

- Became provincial law in 2016
- Intended purpose – protect aquifers and streams as water sources for future generations, preventative in nature
- Highlights –licensing of groundwater withdrawals, updated Groundwater Protection Regulation (GWPR)

Resources

Groundwater Protection Regulation

What the GWPR means to you

- Who you work with
- How you prepare for a drilling job
- How wells are constructed
- How wells are decommissioned
- What needs to be reported to the Province

Who you work with

Three classifications of driller: water well, geoexchange, and **geotechnical/environmental**

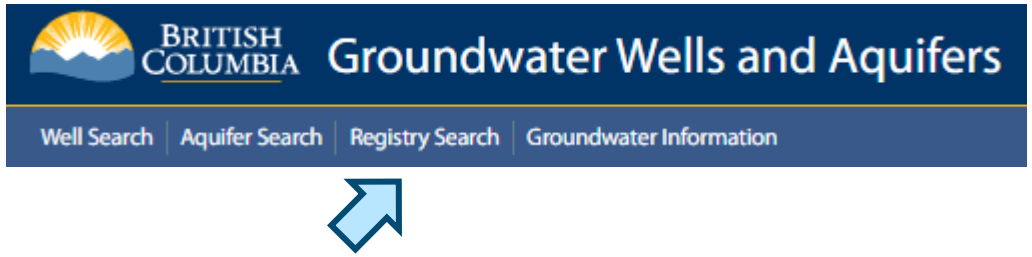
Many classes of well: water supply, geotechnical, **monitoring**, recharge, injection, dewatering, drainage, remediation, closed loop geoexchange

Contaminated Sites	GWPR
Borehole	Geotechnical Well
Test Pit	Geotechnical Well
Monitoring Well	Monitoring Well
Pumping Well (Pump & Treat)	Remediation Well

- Only a registered water well or geotech/enviro driller can install monitoring wells (>15m deep) or a person acting under supervision of a registered driller or a professional with competency in hydrogeology or geotechnical engineering
- Same for geotechnical wells and remediation wells

Geotech/Enviro drillers need to be listed on the Province's Register of Well Drillers

GWELLS



Choose professional type:

Well Driller Well Pump Installer

Choose classification(s):

Water Well Driller Geotechnical/Environmental Driller

Geoexchange Driller

Community:

All
BC
100 Mile House
150 Mile House
Abbotsford
Agassiz

- To be listed on the register you need to be certified through the SkilledTradesBC (formerly Industry Training Authority) or hold an equivalent certificate issued by another province/territory
- To be certified by SkilledTradesBC, need 4,860 hours (~2.5yrs) of work experience and achieve 70% on certification exam

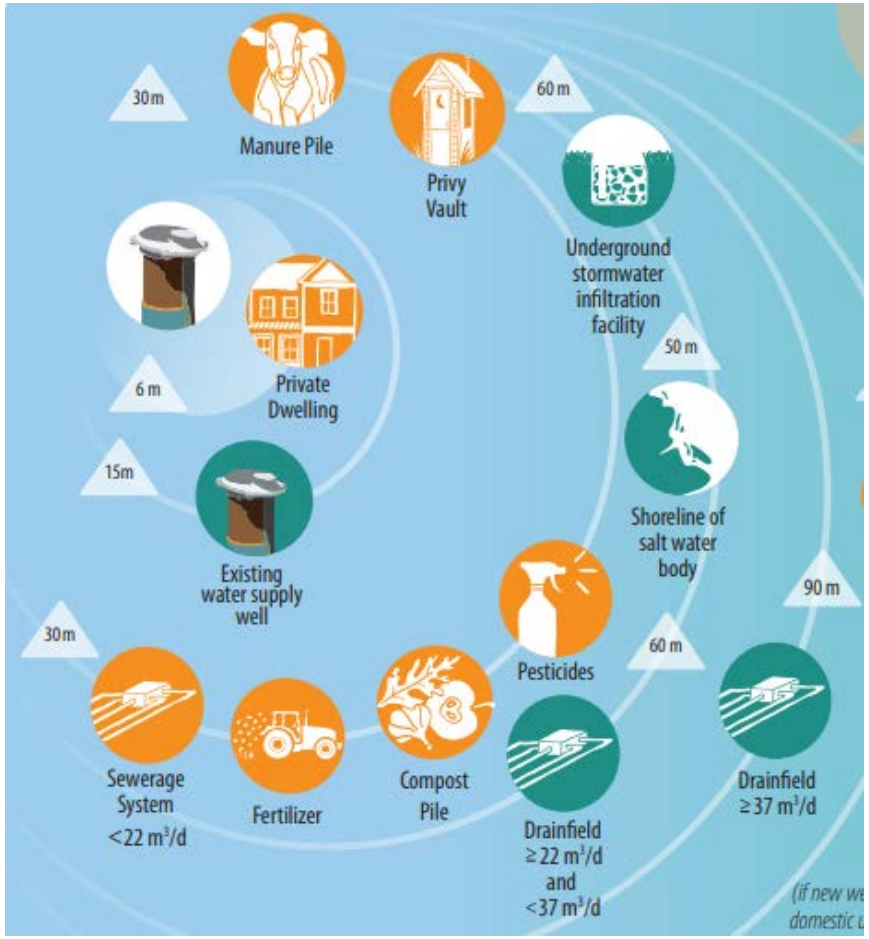
Why work with qualified trades / professionals

- Basic knowledge of:
  - aquifers (incl. flowing artesian)
  - well drilling & monitoring methods
  - drilling / environmental hazards
  - well closure
  - regulations
  - safety practices
- For many projects, it is a team effort

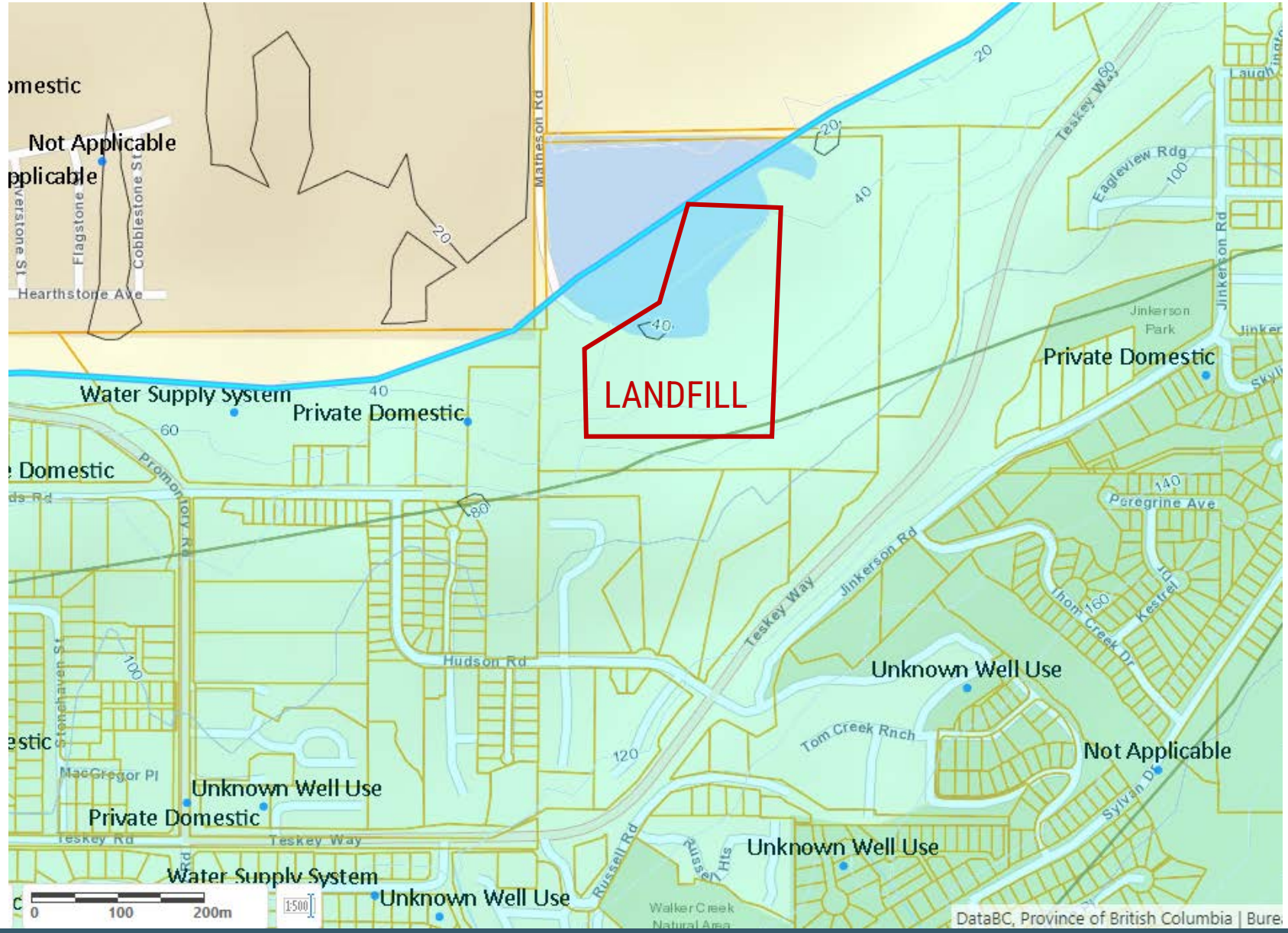
How you prepare for a drilling job

Siting of water supply wells relative to potential contaminant sources

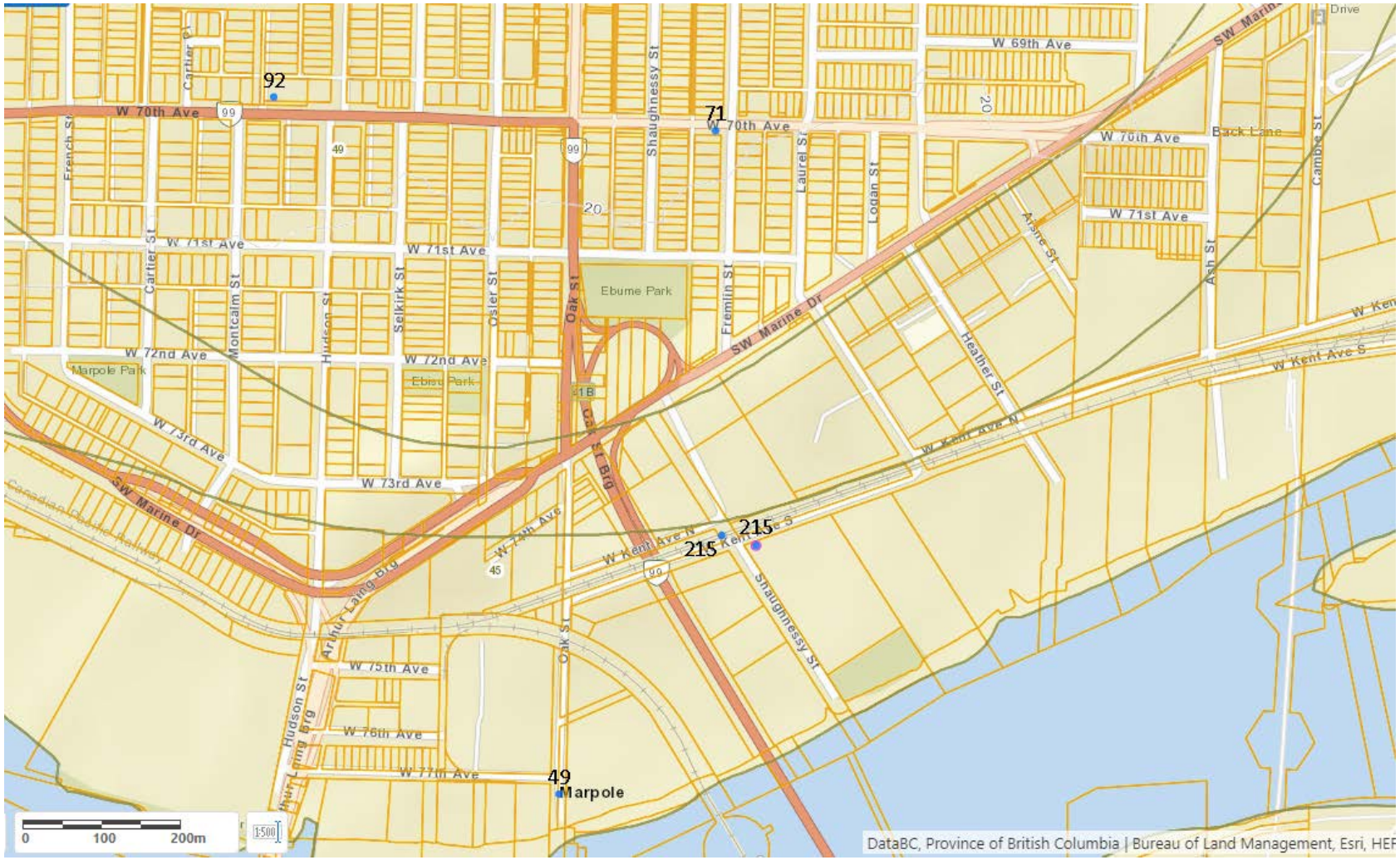
- Awareness of water wells , drinking water aquifers near to your contaminated site



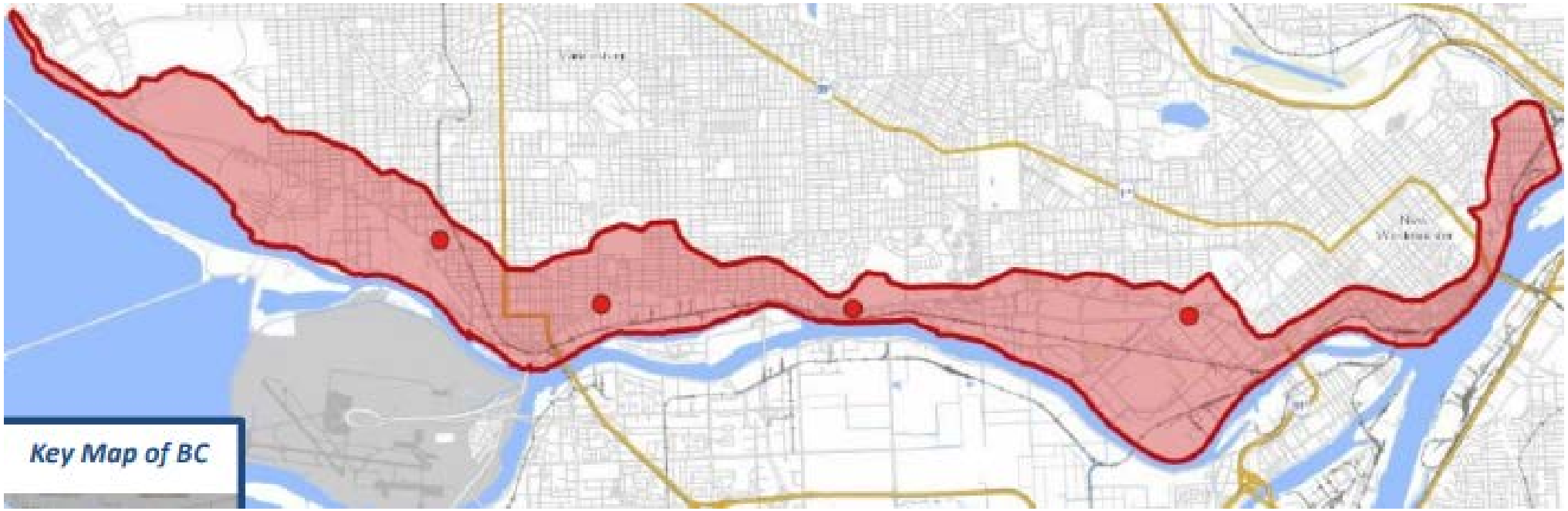
BC Water Resources Atlas



- Siting wells in potentially flowing artesian aquifers
- Advance planning can prevent $$ uncontrolled flowing well scenarios



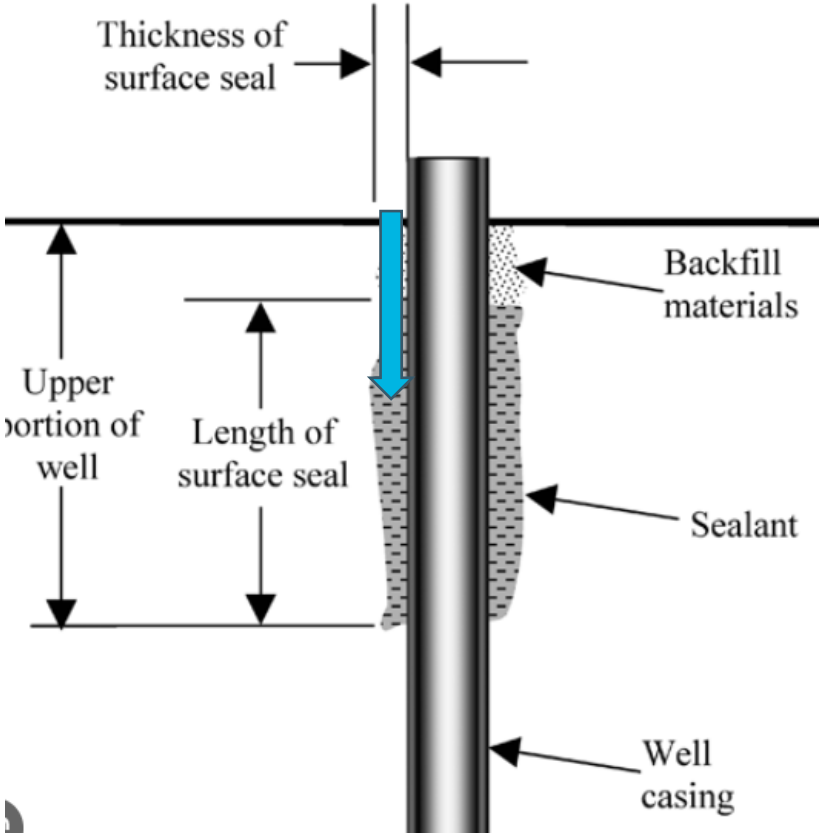
Flowing Well Advisories – there to give you the ‘heads up!’



How wells are constructed

Use of surface seal to

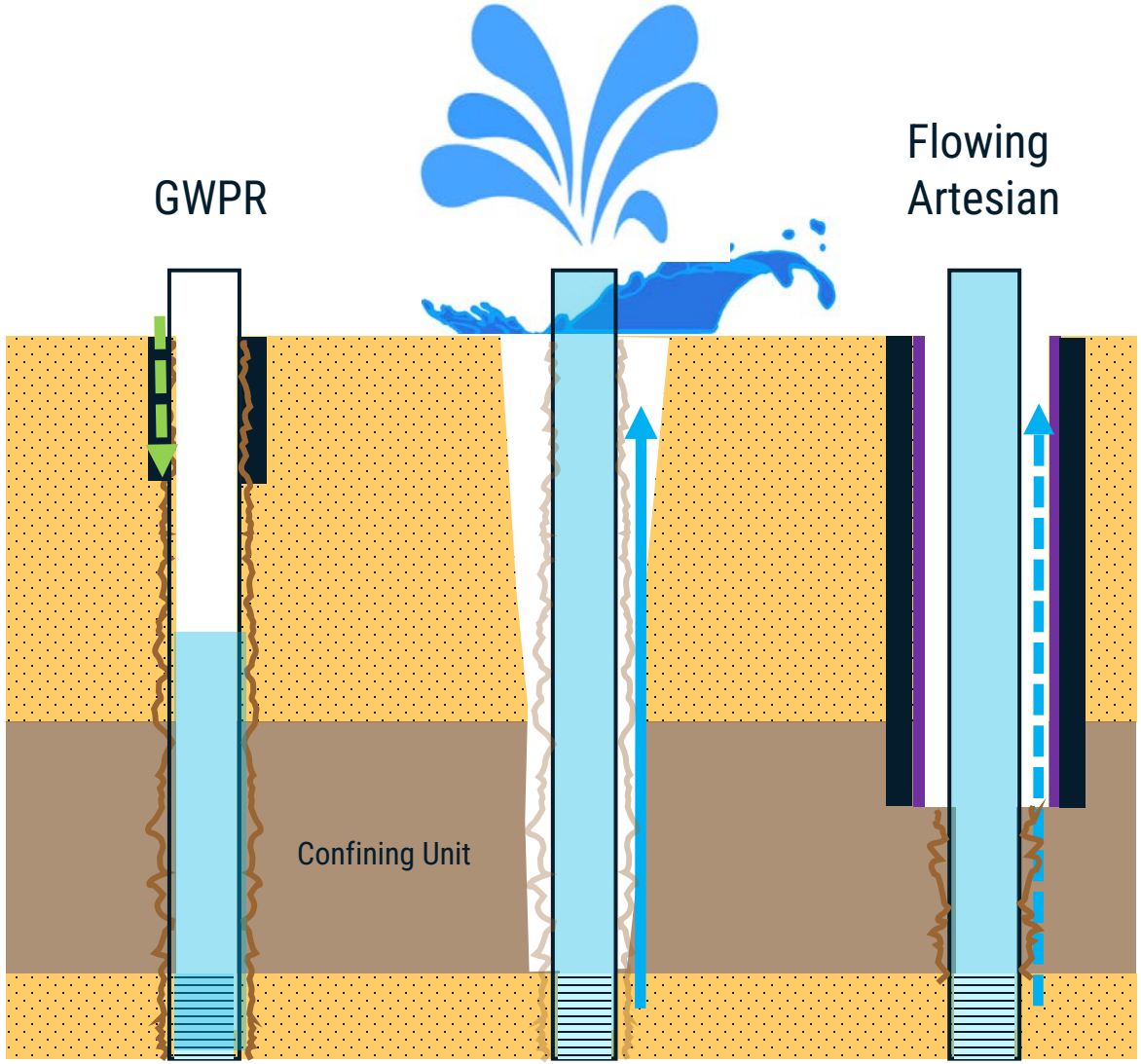
- 3ft minimum for monitoring wells



Controlling flow in flowing artesian settings:

- No flow on outside of casing,
- No flow into other aquifers,
- Can be shut-in without leakage, no risk to public safety/property/environment

Use surface casing and artesian seal to prevent upward flow outside well casing

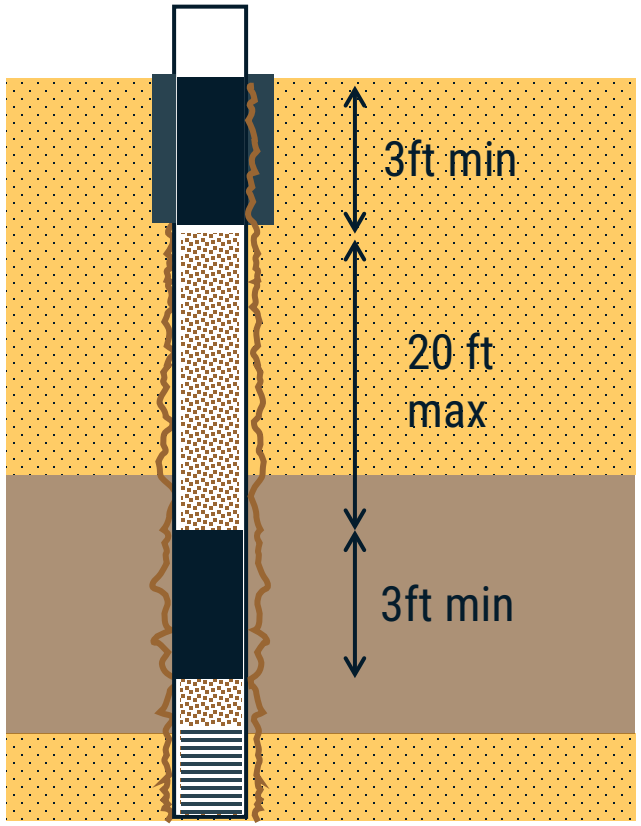


Why is well construction important??

- Prevent downward migration of surface-sourced contaminants (e.g. pathogens, salt, hydrocarbons)
- Prevent uncontrolled artesian flow
  - Prevent depletion of water supply
  - Prevent land & stream damage (e.g. subsidence, erosion)

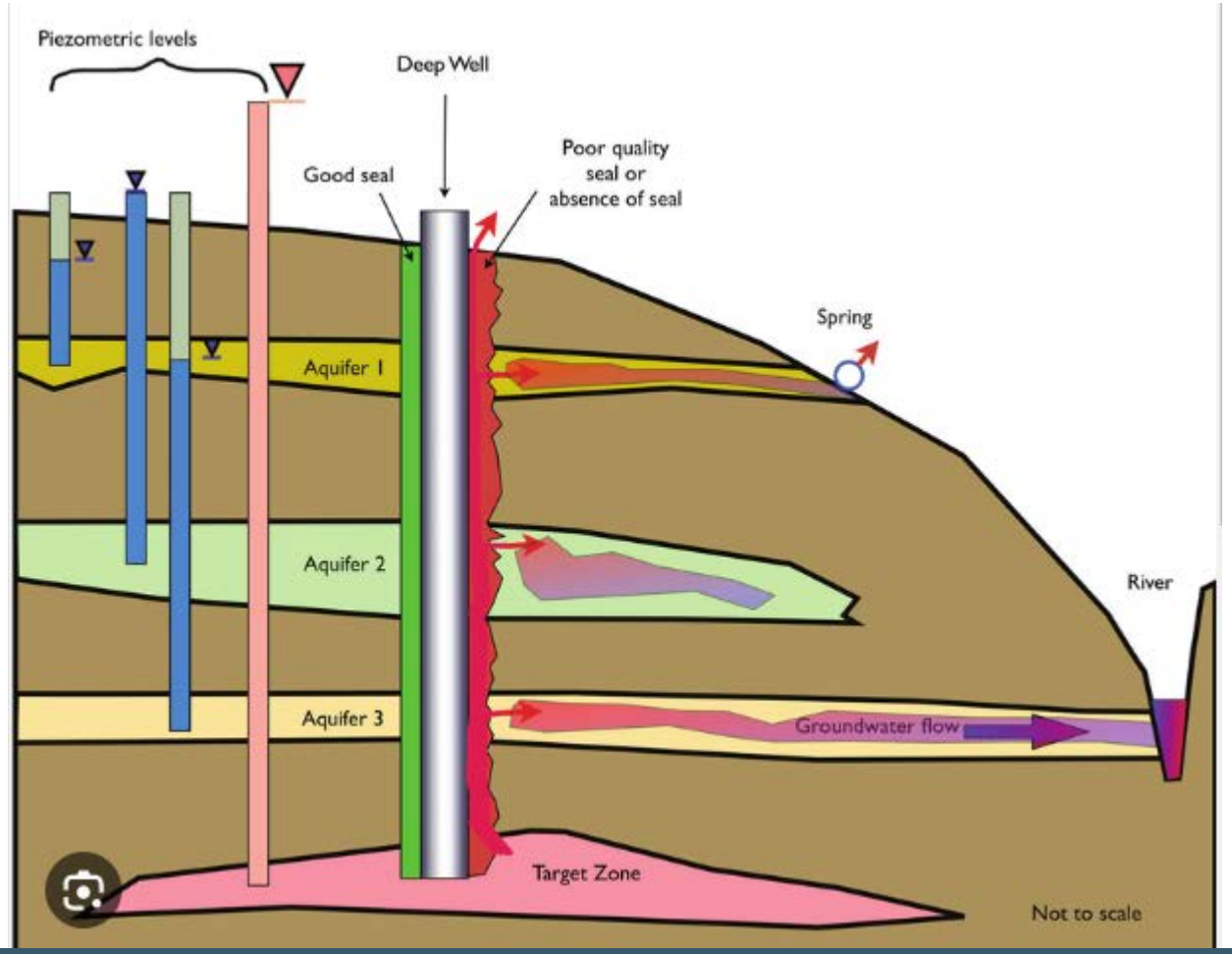
How wells are decommissioned

- If monitoring well not used in 5yrs, should be deactivated
  - Remove monitoring equipment
- If monitoring well not used for 10yrs, should be decommissioned
  - Fill well casing, remove well casing, or combination thereof
  - Sealant layers at least 3ft long, no more than 20ft apart
  - Flowing artesian wells require specialized competency / experience



Why is well decommissioning important??

Close conduits into vulnerable aquifers: prevent aquifer contamination

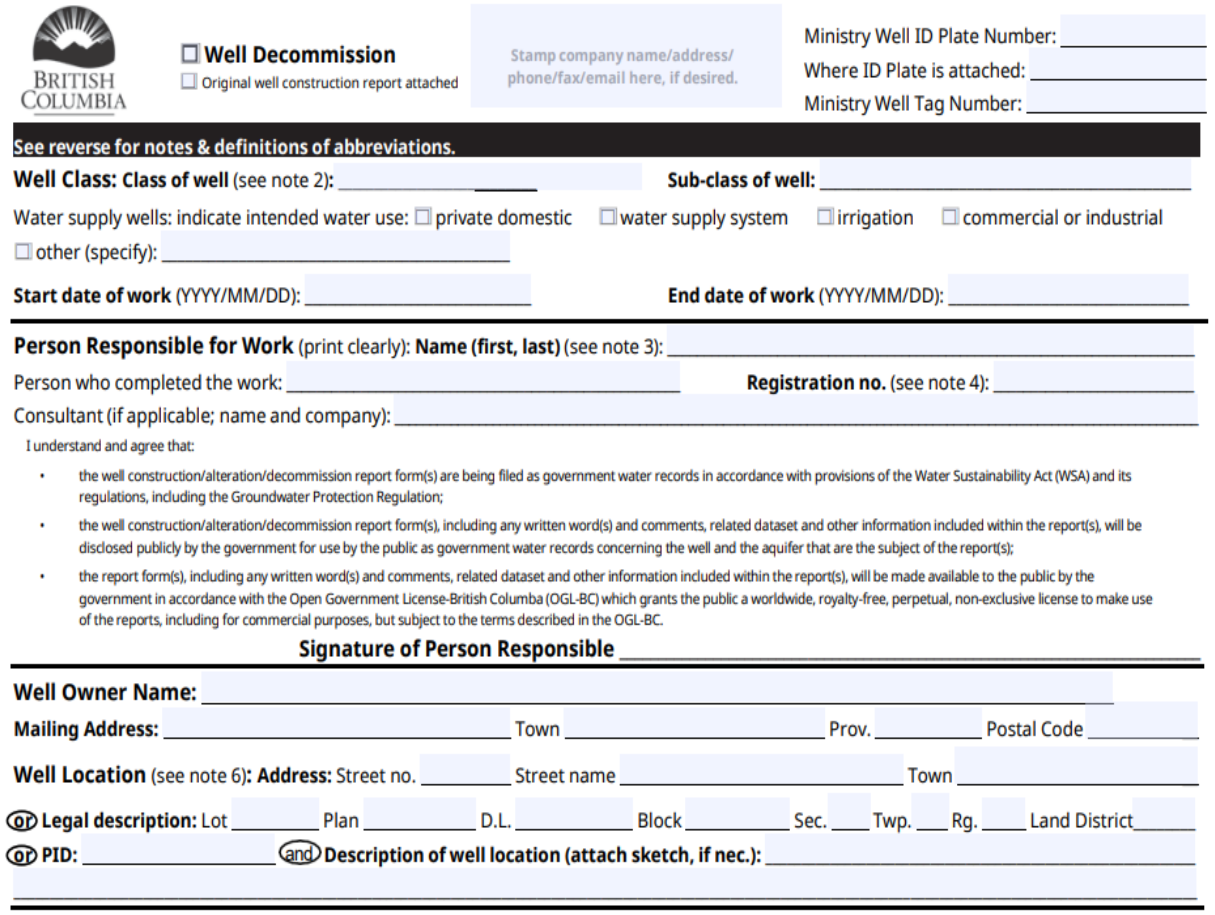


Flowing artesian aquifers: prevent aquifer depletion, lingering liability

How / when wells are reported

- Well construction and decommissioning for permanent (>90d) monitoring wells must be reported to the well owner (client) within **90d**
- No requirement to report construction/decommissioning monitoring wells to Ministry (comptroller of water rights) unless they are flowing artesian
  - Location, geology, well construction metrics, driller, dates, etc.

Well construction/closure report



BRITISH COLUMBIA

☐ **Well Decommission**
☐ Original well construction report attached

Stamp company name/address/ phone/fax/email here, if desired.

Ministry Well ID Plate Number: _____
Where ID Plate is attached: _____
Ministry Well Tag Number: _____

See reverse for notes & definitions of abbreviations.

Well Class: Class of well (see note 2): _____ **Sub-class of well:** _____

Water supply wells: indicate intended water use: ☐ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial
☐ other (specify): _____

Start date of work (YYYY/MM/DD): _____ **End date of work** (YYYY/MM/DD): _____

Person Responsible for Work (print clearly): **Name (first, last)** (see note 3): _____

Person who completed the work: _____ **Registration no.** (see note 4): _____

Consultant (if applicable; name and company): _____

I understand and agree that:

- the well construction/alteration/decommission report form(s) are being filed as government water records in accordance with provisions of the Water Sustainability Act (WSA) and its regulations, including the Groundwater Protection Regulation;
- the well construction/alteration/decommission report form(s), including any written word(s) and comments, related dataset and other information included within the report(s), will be disclosed publicly by the government for use by the public as government water records concerning the well and the aquifer that are the subject of the report(s);
- the report form(s), including any written word(s) and comments, related dataset and other information included within the report(s), will be made available to the public by the government in accordance with the Open Government License-British Columba (OGL-BC) which grants the public a worldwide, royalty-free, perpetual, non-exclusive license to make use of the reports, including for commercial purposes, but subject to the terms described in the OGL-BC.

Signature of Person Responsible _____

Well Owner Name: _____

Mailing Address: _____ Town _____ Prov. _____ Postal Code _____

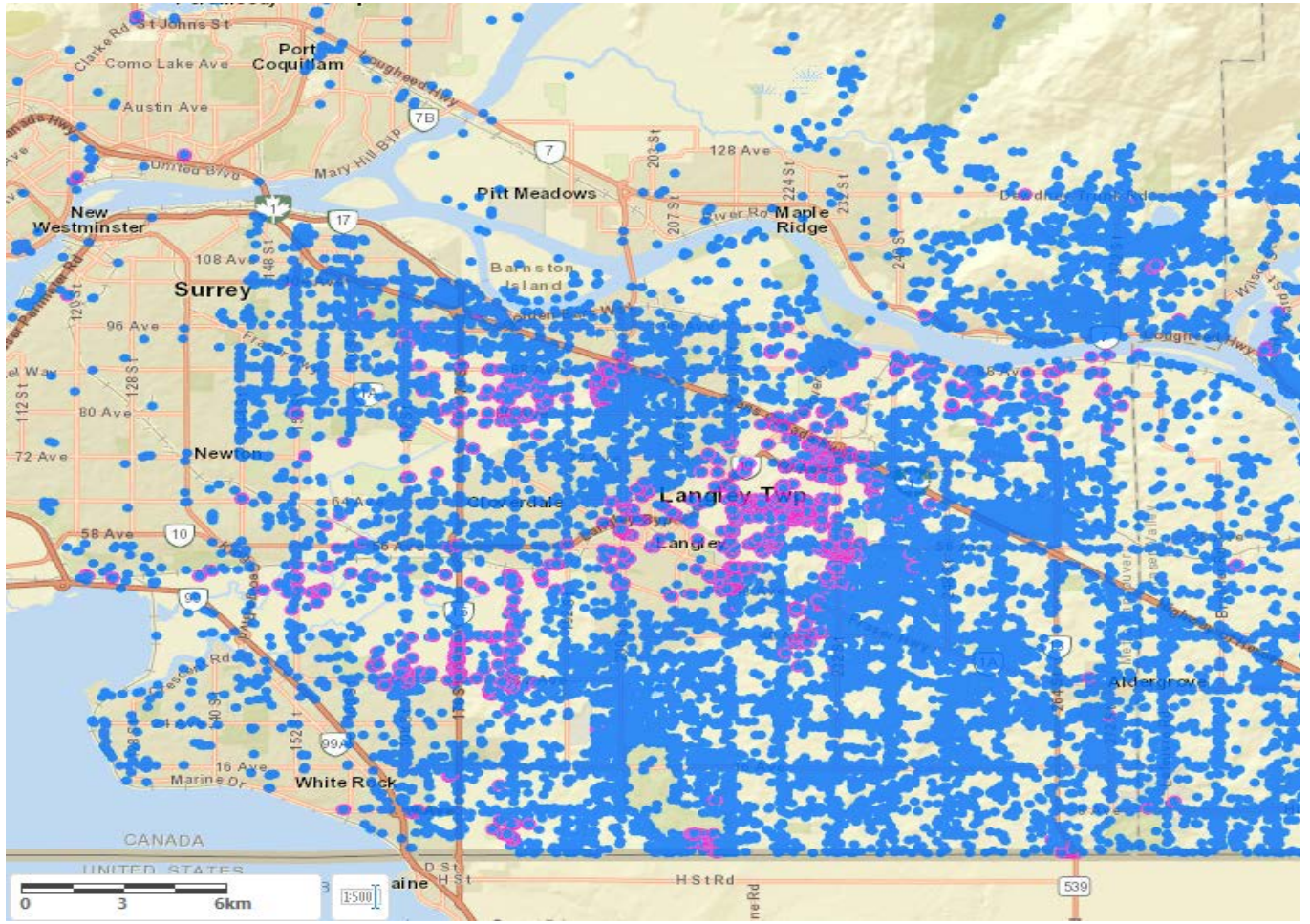
Well Location (see note 6)**: Address:** Street no. _____ Street name _____ Town _____

(or) **Legal description:** Lot _____ Plan _____ D.L. _____ Block _____ Sec. ____ Twp. ___ Rg. ____ Land District_____

(or) **PID:** _____ (and) **Description of well location (attach sketch, if nec.):** _____

Why is well reporting important?

- Information is key to water resource stewardship and good project planning
- We have a great wells database for this!



Concluding remarks

- Fortunate to have had both contaminated sites and water well drilling experience
- There are lots of rules out there (some easier to follow than others)
- There are lots of resources too (people)
- We all have a role to play in groundwater sustainability

CSAP

SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

Improvements to the CSAP Webmap

Michael Gill, P.Eng.
Technical Review Committee

WWW.CSAPSOCIETY.BC.CA

CSAP Webmap

- The CSAP Webmap shows instruments mostly processed since 2015, and a number of instruments from prior to 2015
- Includes Protocol 2, 4, 6, 9 and P21 approvals
- Includes borehole logs (though you can also get this information on iMapBC)
- Need to be a CSAP to access it

CSAP Webmap

- Instruments list the submitted reports in Schedule D
- Submitted reports can be requested through ENV's **Site Information Request Application**

CSAP Webmap

- Improvements in the P4 and P9 layers:
  - Before there were three layers:
    - older P4 and P9 approvals grouped together
    - more recent P4 approval on a separate layer
    - more recent P9 approval on a separate layer
  - Now:
    - All P4 approvals that have been submitted CSAP are on one layer
    - All P9 approvals are on a second layer
    - Includes a number of approvals listed in the October 2017 Director's Approval Workbook

CSAP Webmap

Also have:

- P2 site specific numerical standards approvals layer (no P2 approvals)
- P6 approval layer
- P21 approval layer

CSAP Webmap

Numerous applications:

- What has ENV accepted as sufficient information to get a P21 DW exemption in the past?
- Any soil and groundwater background concentrations in the area?
- Was drinking water excluded on adjacent sites?
- Was an adjacent site remediated?
- What kind of remediation (risk-based, numerical)?
- Did they analyse for the same PCOCs? Maybe they have the same issue you do!

CSAP Webmap

Did you find any errors – let us know!

Please email TRC@csapsociety.bc.ca with any errors you find.

CSAP

SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

Exam Sub-committee Update
CSAP Technical Exam Process

Chair: Mandeep Purewal, MET, R.P.Bio., P.Ag.

Background

- Historically CSAP has held three exams to qualify new applicants
  - Regulatory Exam → Unchanged
    - Used to assess regulatory knowledge of new candidates
    - Used to re-qualify members without a recent submission
  - Technical Exams → New Assessment Process
    - Numeric and Risk-Based
    - The multiple-choice format for the technical exams is replaced with an Oral Assessment
    - Used to assess new candidates

Background

- Path to changing the current process
  - Findings of an independent jurisdictional review

Background

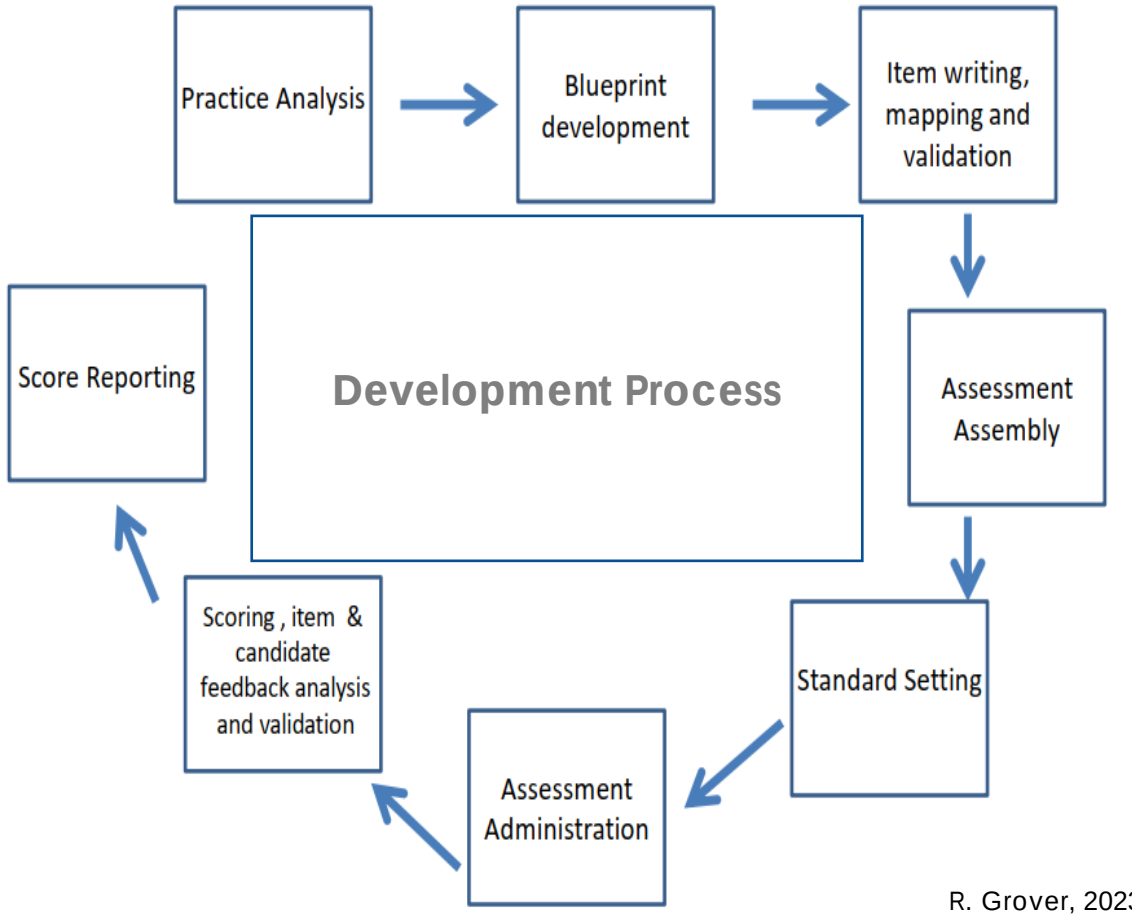
- Path to changing the current process
  - Findings of an independent jurisdictional review
  - Membership Committee Proposal
    - New applicants can complete qualification process in same year
    - Cost savings
  - Discussions with ENV
    - Support move to Oral Assessment
  - Consultation with Psychometric Expert
- Proposal Approved by the CSAP Board of Directors
  - Approved in 2022
  - Change in Format of Technical Assessments for 2023

Development Process

- CSAP's goal for exam development:
  - Produce exams that are of high quality, legally defensible, produce reliable and valid score interpretations.
    - Used as one of the elements to determine eligibility of candidates
  - Exam Development must follow appropriate testing standards:
    - The Standards for Educational and Psychological Testing (AERA, APA & NCME, 2014)
    - National Commission for Certifying Agencies (NCCA) Standards (2015)
    - International Test Commission (ITC) Guidelines

Overview of Development Process

- Psychometric Consultations
  - Practice Analysis
    - Reviewed and updated
  - Blueprint Development
    - Design of the Oral Assessment process
    - Ensure credibility
    - Maintain objectivity
    - Assess technical decision-making
  - Item writing workshops
    - As with multiple choice exam



R. Grover, 2023

Practice Analysis

- Specifies key tasks performed by an AP and the critical knowledge, skills and competencies required to perform these tasks.
  - Statement of Purpose
  - High level tasks
    - Tasks performed by Approved Professionals
      - Protocol 6
  - Primary Tasks
    - Technical areas
      - Similar to Multiple Choice Exam Syllabus

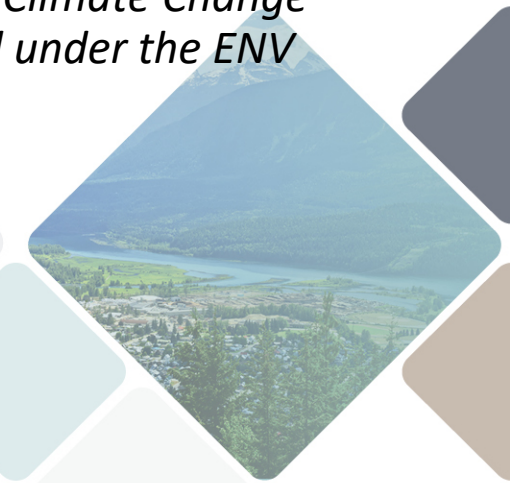
Statements of Purpose

• Numerical Standards

The purpose of the Numerical Standards Oral Assessment is to determine whether an examinee has sufficient technical knowledge in the assessment and remediation of contaminated sites, and the ability to make sound technical interpretations, judgements and decisions within the Contaminated Sites Regulation framework to conduct work as a Numerical Standards Approved Professional, including the submission of applications to the BC Ministry of Environment and Climate Change Strategy (ENV). Eligible work is defined under ENV Protocol 6.

• Risk-Based Standards

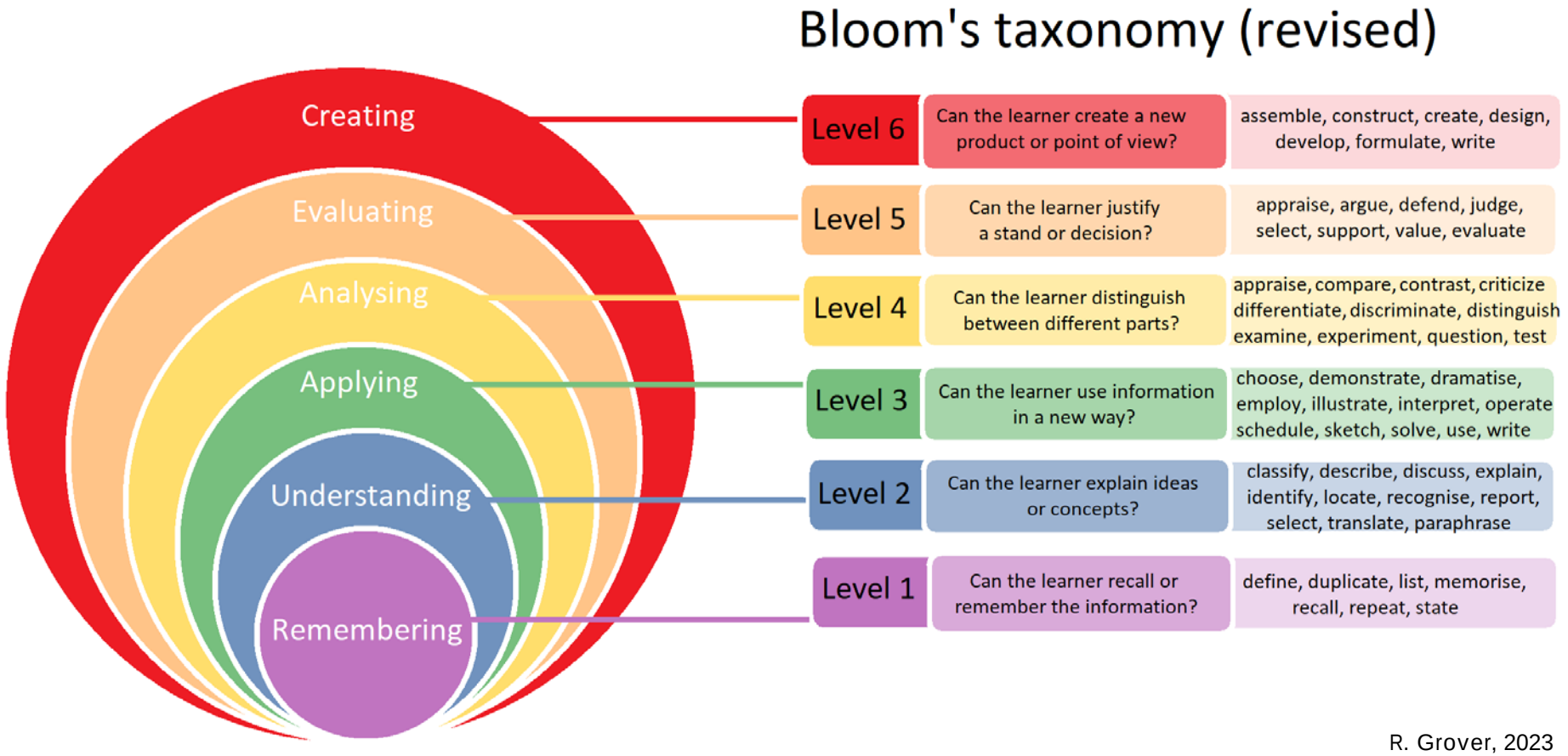
The purpose of the Risk-Based Standards Oral Assessment is to determine whether an examinee has sufficient technical knowledge in the risk assessment of contaminated sites, and the ability to make sound technical interpretations, judgments and decisions within the Contaminated Sites Regulation framework to conduct work as a Risk-based Standards Approved Professional, including the submission of applications to the BC Ministry of Environment and Climate Change Strategy (ENV). Eligible work is defined under the ENV Protocol 6.



Blueprint Development

- Ensure credibility of process
- Focus on:
  - Fairness
  - Objectivity
  - Application of Technical Knowledge
  - Decision Making
- Development
  - Psychometric Consultant
    - Raman Grover, Ph.D.
  - Technical Exam Team Leads
    - Numerical - Ian Mitchell
    - Risk-Based – Mandeep Purewal

Development Process



R. Grover, 2023

Oral Assessment

- Overview of Technical Oral Assessment
  - Format
    - Scenario-based
    - Reference Material
    - Assessment Security
  - Evaluation Team
    - Same as the Content Creation Team
  - Scoring
    - Defined answer key
    - Training of evaluators

Oral Assessment - Format

- Scenario-Based
- Candidates provided with:
  - Reference List
  - Syllabus
    - As with multiple choice exam
- Timed Evaluation
  - Review of scenarios
  - Assessment by evaluators
  - Scoring
- Test security
  - As with multiple choice exam

Oral Assessment – Evaluation Team

- Subject Matter Experts
  - Team of four members per technical assessment
    - Includes:
      - Member from PAC
      - Former Exam Development member
      - Experience Reviewer
      - Alternate in case of conflict
  - Potential for Conflict of interest

Oral Assessment – Content Creation

- Item Writing and Content Development
  - Develop Scenarios
    - Objective answer key for each scenario
  - Item Writing Workshops
    - Conducted before item writing
      - As with multiple choice exam
  - Scoring
    - Evaluation team
      - As with multiple choice exam

Oral Assessment vs Multiple Choice Format

- How it differs:
  - Oral Assessment
    - Ability to test decision-making ability
    - Tests the application of technical knowledge
    - Reduces wait-times for the certification of new candidates
    - Part of an overall effort by the Membership Committee and the CSAP Board of Directors to streamline the qualification process

Oral Assessment - Progress

- Blueprint
  - Developed
- Practice Analysis
  - Completed
    - Incorporated feedback
- Item Writing Workshops
  - Conducted
- Content Creation
  - In progress
- Technical Assessments
  - Scheduled

CSAP

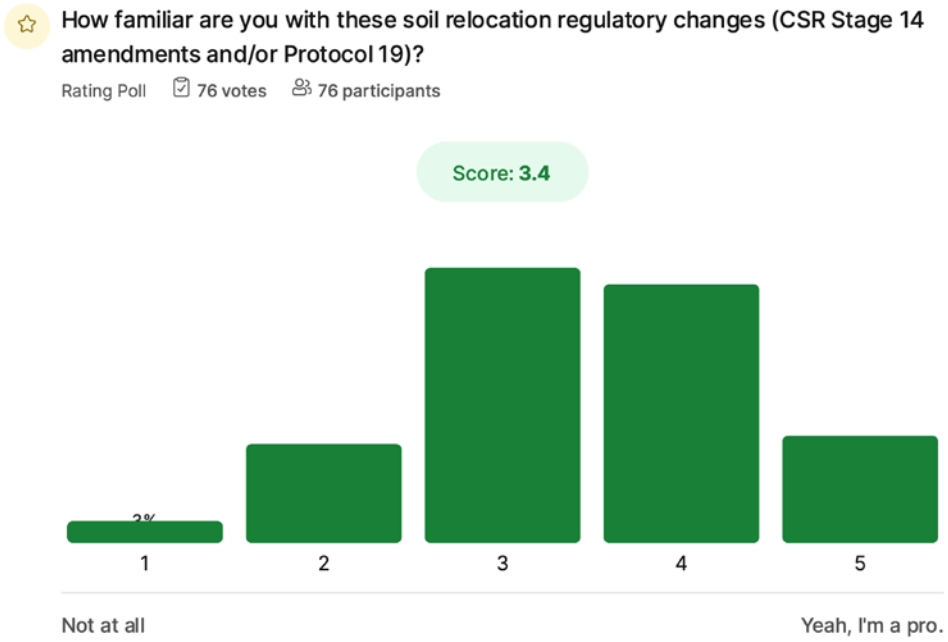
SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

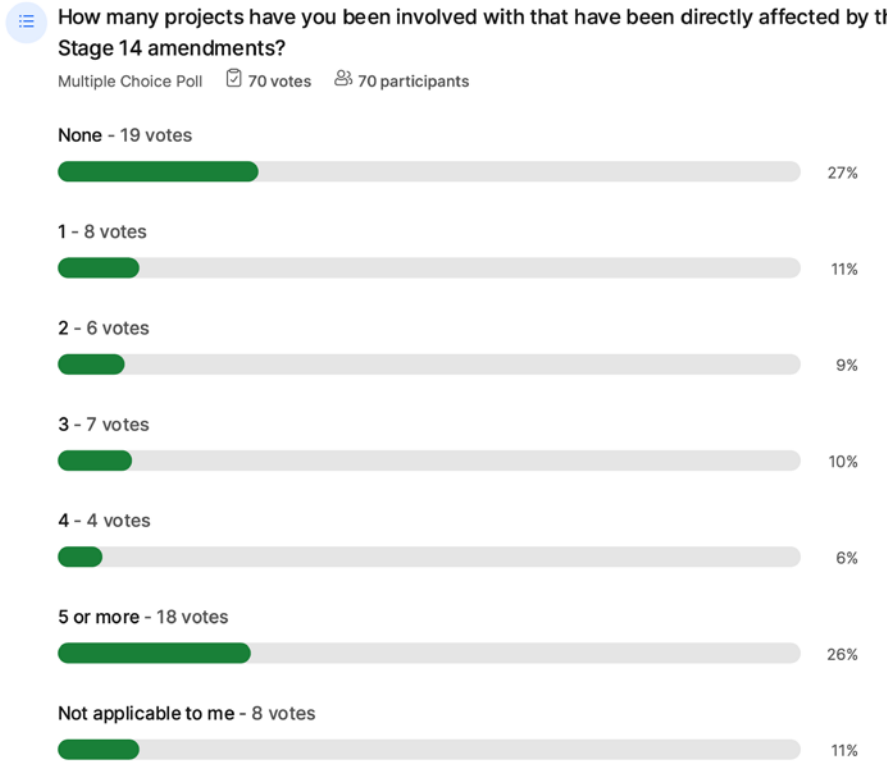
Post Stage 14 Amendments Panel Discussion

- Travis Deeter, EP, P.Ag., CSAP, Senior Environmental Scientist, Thurber Engineering
- Brenda Hatch, P.Eng., Pollution Prevention Team Lead, BC Hydro
- J. David Ross, P.Eng., VP, Excavation & Shoring, Hall Constructors
- Kerri Skelly, P.Ag., Acting Manager, Site Identification Unit, Ministry of Environment and Climate Change Strategy

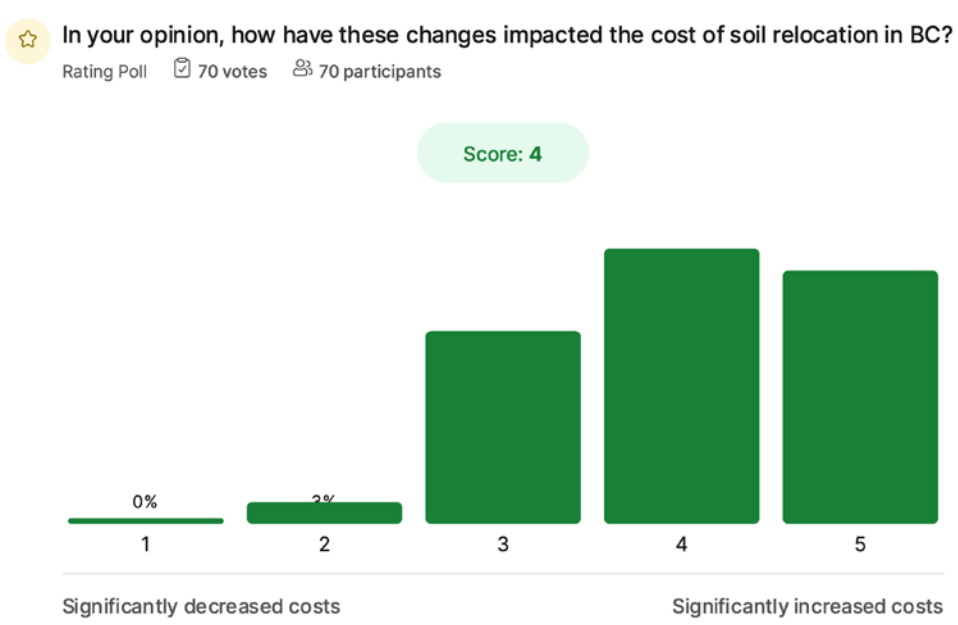
WWW.CSAPSOCIETY.BC.CA

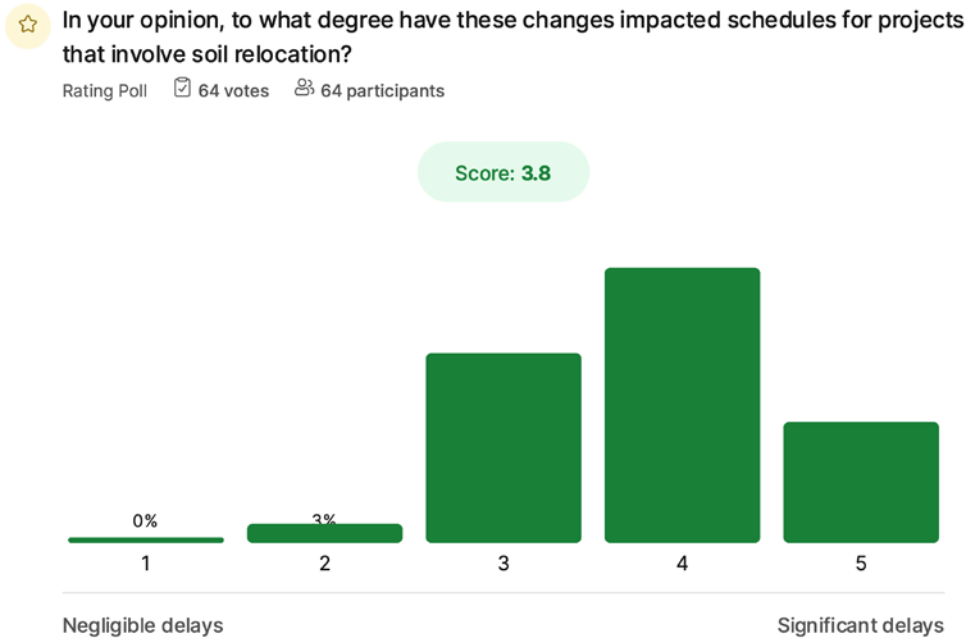
Post Stage 14 Amendments Survey (BEST)





Post Stage 14 Amendments Survey (BEST)

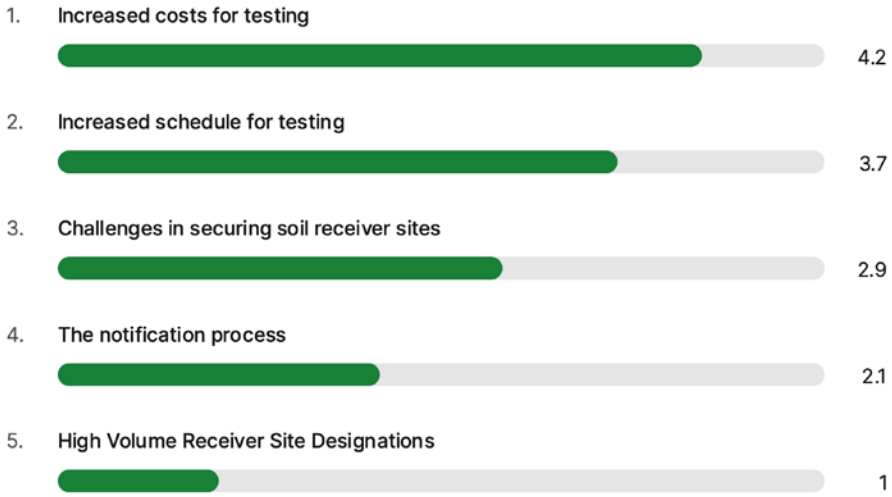




Post Stage 14 Amendments Survey (BEST)

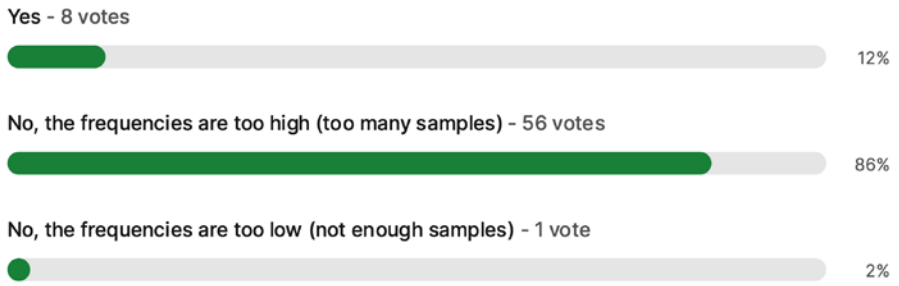
Please rank the following factors in terms of your opinion of their impact to soil relocation projects

Ranking Poll · 63 votes · 63 participants

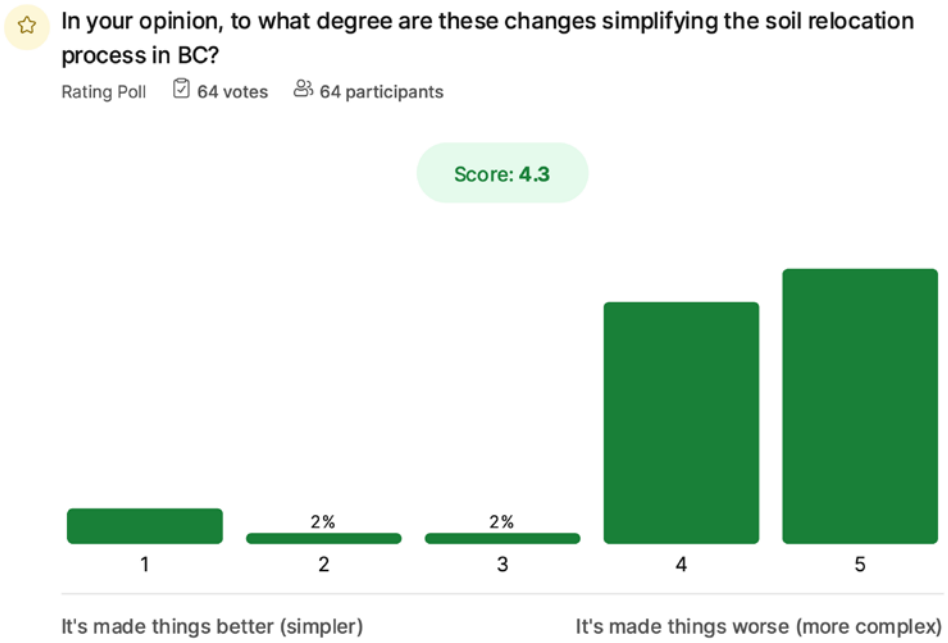


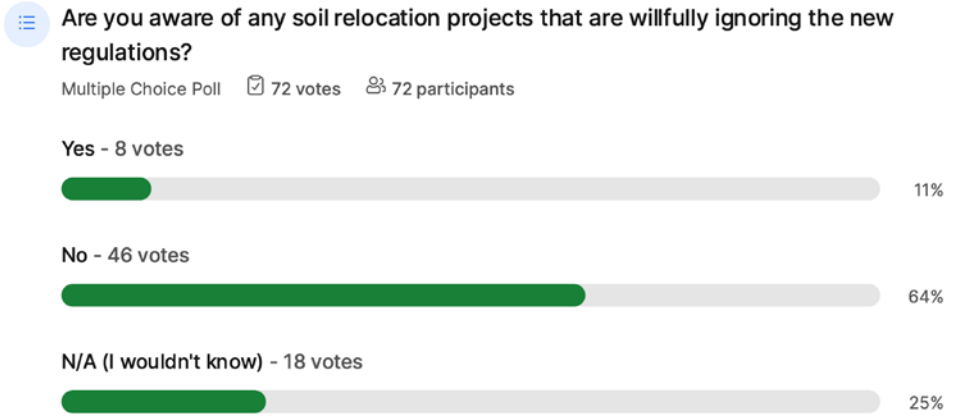
In your opinion, are the new sampling frequencies appropriate for characterizing non-waste soil?

Multiple Choice Poll · 65 votes · 65 participants

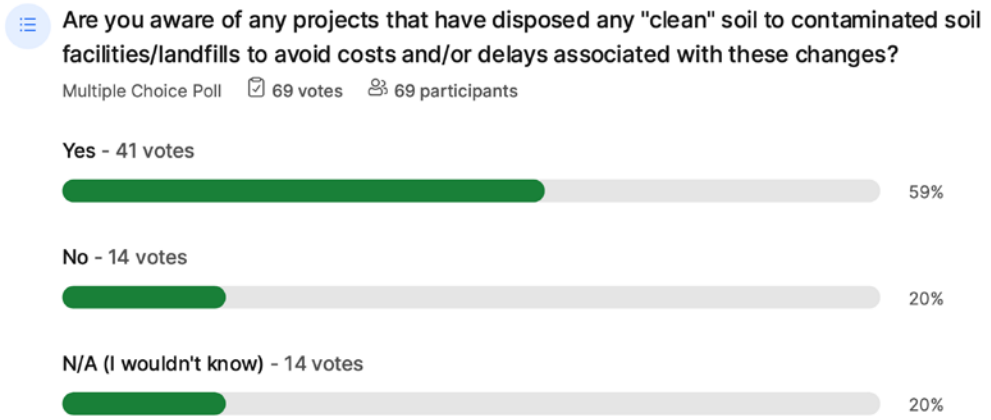


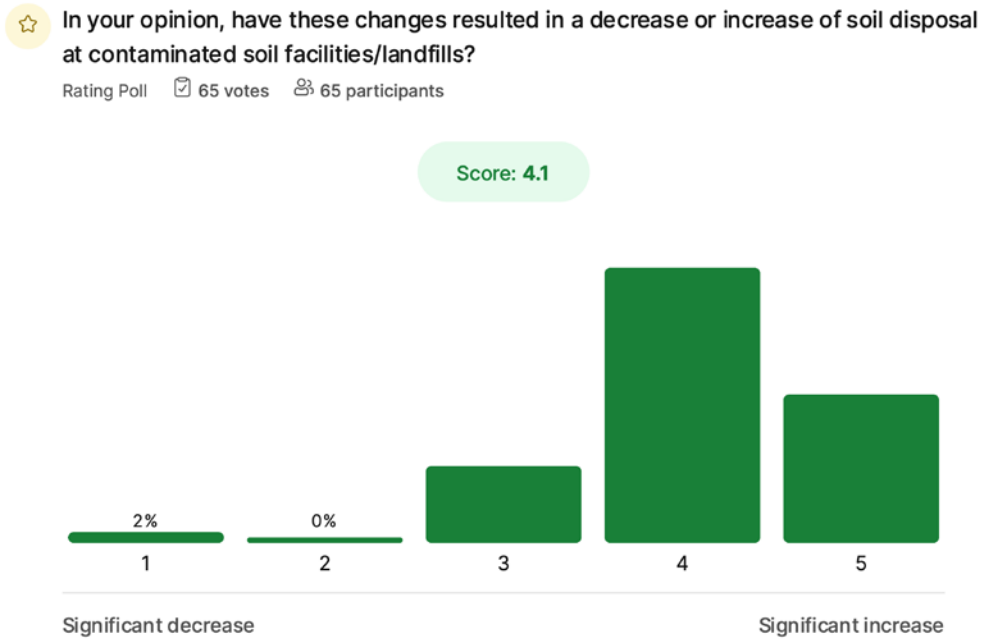
Post Stage 14 Amendments Survey (BEST)





Post Stage 14 Amendments Survey (BEST)

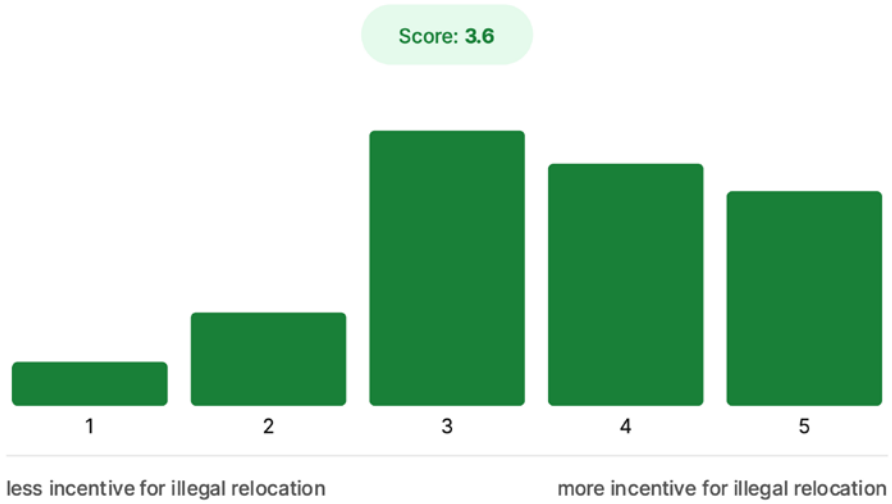




Post Stage 14 Amendments Survey (BEST)

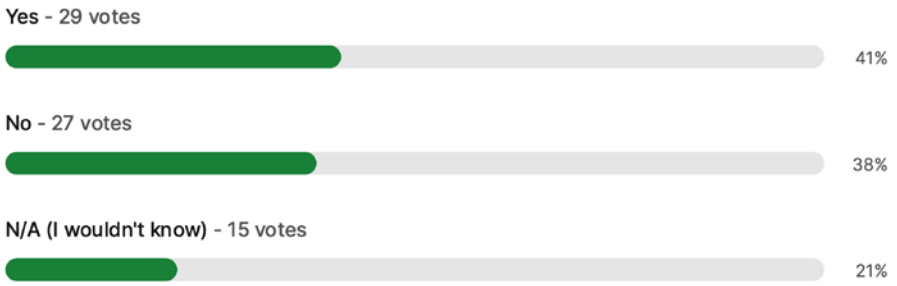
In your opinion, are these changes incentivizing more or less illegal soil relocation?

Rating Poll · 65 votes · 65 participants

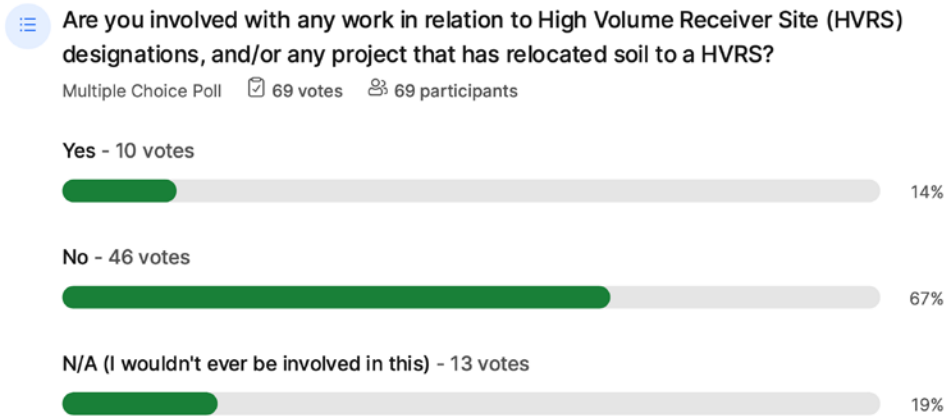


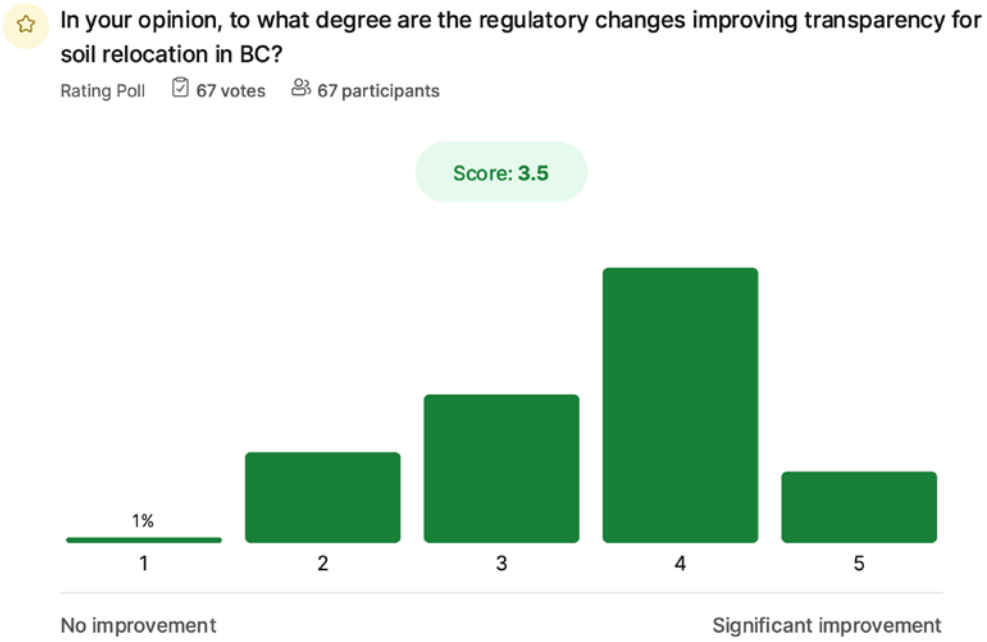
Are you aware of any projects that have pursued (or are considering) Disposal at Sea in direct response to these new soil relocation testing and notification requirements?

Multiple Choice Poll · 71 votes · 71 participants



Post Stage 14 Amendments Survey (BEST)





Closing remarks

Duncan Macdonald, P.Eng.
CSAP President

THANK YOU

613 - 744 West Hastings Street
Vancouver, BC

604 451 4555

info@csapsociety.bc.ca

CSAP