

Reclamation Workshop: Towards a Shared Foundation for Innovation and Evolution

Prepared by Enviro Q&A Services

for

Alberta Chapter/Canadian Land Reclamation Association

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TABLE OF CONTENTS

LIST OF FIGURES	vii
REPORT SUMMARY.....	viii
ACKNOWLEDGEMENTS.....	x
ACRONYMS AND SHORT FORMS.....	xi
1 INTRODUCTION	1
1.1 Workshop Format	1
1.2 Workshop Participants	2
1.3 Workshop Moderators and Scribes.....	4
1.4 Report Format	5
2 WHAT DOES CLOSURE LOOK LIKE?.....	6
2.1 Closure	6
2.2 Certification Criteria and Process	7
2.3 Relationship to Remediation.....	8
2.4 Post-certification Monitoring.....	8
2.5 Role of Professionals	8
2.6 Improving Communication.....	8
2.7 Indigenous Engagement.....	8
3 WHAT BEST PRACTICES ARE IN PLACE, AND WHICH ONES SHOULD WE DEVELOP?.....	9
3.1 Definition	9
3.2 Developing Best Practices	9
3.3 New Best Practices Needed	10
3.4 Knowledge Sharing.....	10
4 WHAT LEARNINGS SHOULD BE SHARED ACROSS INDUSTRY SECTORS, AND HOW CAN WE SUPPORT INFORMATION EXCHANGE?	11
4.1 Common Issues.....	11
4.2 Barriers to Sharing Knowledge.....	11
4.3 Existing Mechanisms for Sharing.....	11
4.4 Sharing Mechanisms to be Developed.....	11

5	WHAT NEW TECHNOLOGIES CAN BE USED TO HELP RECLAMATION PROGRAMS (PLANNING, IMPLEMENTATION, AND EVALUATION)?	13
5.1	Drones and Remote Sensing	13
5.2	Data Management	13
5.3	Artificial Intelligence	14
5.4	Getting Technology Approved	14
5.5	ChatGPT’s Replacement Summary for the Technology Session	14
6	OBSERVATIONS AND NEXT STEPS	16
6.1	Common Themes	16
6.2	Additional Observations	16
6.3	Potential Next Steps	17
7	REFERENCES	18
7.1	Additional Reading	18
7.1.1	Closure and Post-closure Care	18
7.1.2	Best Practices	19
7.1.3	Knowledge Sharing	19
7.1.4	Technology	20
	APPENDIX 1: Workshop Discussion Topics	21
	APPENDIX 2: Workshop Participants	25
	APPENDIX 3: Closure Session Notes	27
	A3.1: Closure	27
	A3.1.1: Definition	27
	A3.1.2: Definition Issues	29
	A3.1.3: Equivalent Land Capability and End Land Use	30
	A3.1.4: Alternative Uses / Repurposing	32
	A3.1.5: Public vs. Private Land	34
	A3.1.6: Indigenous Perspective	35
	A3.1.7: Process / Timing	35
	A3.1.8: Progressive Reclamation	37
	A3.1.9: Liability / Cost / Security	38
	A3.1.10: Other	39

A3.2: Relationship to Remediation.....	40
A3.3: Certification Criteria	42
A3.3.1: Are Criteria the Right Tool?	42
A3.3.2: Criteria Design Considerations	43
A3.3.3: What Sectors Need Criteria Developed or Updated?	44
A3.3.4: Process and Decision-makers	46
A3.3.5: Role of Professionals	47
A3.3.6: Criteria for Large Approved Sites.....	47
A3.3.7: Indigenous Perspective	48
A3.4: Monitoring Pre- and Post-Certification	49
A3.5: Improving Communication and Awareness.....	50
A3.6: Closure Implications	52
A3.7: Post-closure Care	52
A3.8: Other	53
APPENDIX 4: Best Practices Session Notes.....	54
A4.1: Best Practice Definition	54
A4.1.1: Drivers for Best Practice Development	55
A4.1.2: Considerations.....	56
A4.1.3: Best Practice Examples.....	57
A4.2: Who Decides if Something is a Best Practice?.....	58
A4.2.1: Authorization of Best Practices	59
A4.3: Scope.....	61
A4.3.1: Need for Regulatory Best Practices	62
A4.3.2: Need for Project/Program Management Best Practices.....	62
A4.4: How Should Best Practices be Developed?	63
A4.4.1: Who Should be Involved?.....	65
A4.4.2: Who Should Pay?.....	66
A4.4.3: Role of Experience.....	66
A4.4.4: Role of Research and Field-testing.....	67
A4.5: How do we Decide if a Best Practice Should be Updated/Developed?.....	68

A4.5.1: What Best Practices Need to be Updated?.....	69
A4.5.2: What Best Practices Need to be Developed?.....	69
A4.5.3: Challenges to Best Practice Development and Implementation.....	72
A4.6: Education / Training / Knowledge Sharing	72
A4.7: Other	75
APPENDIX 5: Sharing Learnings Session Notes.....	76
A5.1: Common Issues.....	76
A5.1.1: Sectors.....	76
A5.1.2: Subjects / Topics.....	77
A5.2: Unique Issues	77
A5.3: Drivers for Sharing	78
A5.4: Existing Sharing Mechanisms.....	78
A5.4.1: Content.....	78
A5.4.2: Methods.....	78
A5.4.3: Organizational / Professional.....	79
A5.4.4: Sharing Examples	79
A5.4.5: Sharing Organizations.....	79
A5.5: Barriers to Sharing	80
A5.5.1: Structural Barriers.....	80
A5.5.2: Non-structural Barriers	80
A5.5.3: Cultural / Regulatory Barriers.....	83
A5.5.4: Audience	84
A5.6: Overcoming Barriers.....	85
A5.6.1: Methods.....	85
A5.6.2: Communication / Collaboration.....	86
A5.6.3: Education / Training / Professional Obligations.....	87
A5.6.4: What to Share.....	88
A5.7: Sharing Mechanisms to Develop	88
A5.7.1: Access to Information.....	89
A5.7.2: Education / Training	89

A5.7.3: Research	89
A5.7.4: Who Should be Involved?.....	90
A5.7.5: Examples to Follow	90
A5.7.6: Specific Methods	90
A5.8: Who Else Should be Involved?.....	92
A5.9: Other	93
APPENDIX 6: Technology Session Notes	94
A6.1: Drones and Remote Sensing	94
A6.1.1: Drones	95
A6.1.2: Remote Sensing	95
A6.1.3: Opportunities.....	96
A6.2: Data Management	97
A6.2.1: Data Accessibility	98
A6.2.2: Improving Electronic Submission Systems	99
A6.3: Artificial Intelligence	101
A6.3.1: Risks.....	101
A6.3.2: Opportunities.....	101
A6.4: Other Technologies	102
A6.5: What Part of Reclamation Needs the Most Technology Innovation?.....	103
A6.6: How to Get Technology Approved?.....	104
A6.6.1: Challenges and Barriers	105
A6.6.2: How to Decide if a Technology Adds Value	106
A6.7: Technology and People.....	107
A6.7.1: Does Technology Replace Field Work?	107
A6.7.2: Interpreting Results.....	108
A6.8: Other	108
APPENDIX 7: ChatGPT’s Take on the Technology Session and Land Reclamation	110
A7.1: Technology Session Notes Summarized.....	110
A7.2: Suggested Content for Messages to the General Public	112

LIST OF FIGURES

Figure 1.	Participant sector.....	2
Figure 2.	Participant years of experience.	2
Figure 3.	Percentage of participants with a given specialization.	3
Figure 4.	Percentage of participants working in specific landuse areas.....	4
Figure 5.	Top two stakeholders identified by participants.	4

REPORT SUMMARY

Seventy-eight reclamation practitioners from government, industry, consulting, academia, and the services sector gathered in Edmonton on March 6, 2024, to highlight and discuss specific issues facing our industry, share potential improvement opportunities, and propose action items to develop solutions.

Workshop participants were asked to address four topic areas and were allowed the opportunity to add comments on other topics during the day.

Five common themes emerged from the discussions:

1. **Communication:** Throughout the four sessions participants consistently flagged the need for greater communication between sectors, provinces, and practitioners. Improved communication will require breaking down silos, changing our view of proprietary information, and acknowledging that while each sector or province has unique issues, many common ones would benefit from a shared knowledge base.
2. **Shared Responsibility:** All stakeholders need to be involved to get buy-in for current and new practices and regulatory requirements. This means we must go beyond the traditional big-three stakeholders (government, industry, and consultants) and embrace landowners, service and equipment providers, and equipment operators. In addition, greater participation by Rights Holders was flagged as critical.
3. **Maximizing Data Value:** Participants identified numerous opportunities to maximize the value of data residing in government databases through data mining projects. Data in OneStop was specifically mentioned, as were the applications and annual reports supplied to EPA related to EPEA-approved activities.
4. **Education and Training:** The advent of new technologies, loss of corporate memory, and entry of new staff all lead to the need for more training, in academic institutions and on the job. The CLRA has an essential role in this space through its traditional role in providing conferences, Lunch N Learn sessions, weekly news updates, and the Canadian Reclamation magazine. Participants flagged other roles and communication methods the CLRA could adopt to support ongoing education and training.
5. **Change:** Participants noted that regulatory requirements, stakeholder expectations, and technology constantly change. Depending on your point of view, this either provides opportunities for developing and deploying new methods and tools or will consume time and resources that would be better spent doing reclamation. Change will happen no matter what your point of view is, so we must figure out a way to adapt.

The Workshop was well received and there appeared to be an appetite for more workshops to tackle specific topics such as:

1. **Remediation:** Participants noted that reclamation and remediation are inextricably linked, so holding a preliminary workshop like this one to scope out remediation issues for future

discussions would be beneficial. This could be done in conjunction with the Environmental Services Association of Alberta as a joint conference.

2. ***Post-closure Monitoring:*** There is agreement that we don't want to wait decades to decide if a site can be certified, and that early assessment requires professional judgement that a site is on a trajectory to achieving its long-term ecological function. Participants identified a need to scope out a long-term monitoring program for reclaimed sites to determine if the expected trajectories are met. The CLRA could compile an inventory of existing long-term monitoring projects/programs, and methods could be developed as a starting point for the discussions.
3. ***Best Practices Inventory and Gaps Assessment.*** Participants noted that many best practices have already been developed but are not as broadly known nor as accessible as they could be. The CLRA could compile an inventory of existing best practices and use that as a starting point for a workshop to identify gaps to focus future development.

ACKNOWLEDGEMENTS

The Alberta Chapter/Canadian Land Reclamation Association's Stewardship Committee ((Diana Dunn – Chair, Amber Flamand, Chris Powter, Corey Zadko, Dean MacKenzie, James Agate, Kelly Howard, and Susan McGillivray) provided funding for this project.

AGAT Laboratories and Matrix Solutions Inc. – a Montrose Environmental Company for sponsored the workshop venue and meals.

The author and Committee wish to acknowledge the table moderators (Adam Dunn, Amanda Schoonmaker, Amber Flamand, Andy Etmanski, Devin Allibone, Diana Dunn, James Agate, Sheila Luther, Susan McGillivray, and Tanya Richens) and scribes (Brittany Porter, Cassandra McKenzie, Craig Nicolay, Katie Howes, Kelsi McKeage, and Taylor Fenton) who volunteered their time to make the Workshop a success. We also thank Michelle Cotton (Solstice Environmental Management) for sharing her workshop notes.

We appreciate the assistance of Dean MacKenzie at Vertex Resource Group Ltd. in providing generative artificial intelligence summaries of the Technology Session notes.

Finally, we are grateful to the Participants for sharing their knowledge, experience, and expertise.

ACRONYMS AND SHORT FORMS

ABMI	Alberta Biodiversity Monitoring Institute
AER	Alberta Energy Regulator
ag	Agriculture
AI	Artificial Intelligence
AIA	Alberta Institute of Agrologists
ARO	Asset Retirement Obligation
ASPB	Alberta Society of Professional Biologists
AUC	Alberta Utilities Commission
BC	British Columbia
BP	Best Practice
C&R	Conservation and Reclamation
CAPP	Canadian Association of Petroleum Producers
CEMA	Cumulative Environmental Management Association
CLRA	Canadian Land Reclamation Association
CNRL	Canadian Natural Resources Limited
COSIA	Canada's Oil Sands Innovation Alliance
CRIN	Clean Resource Innovation Network
CWG	Crested Wheatgrass
DRAS	Digital Regulatory Assurance System
DSA	Detailed Site Assessment
EIA	Environmental Impact Assessment
ELC	Equivalent Land Capability
EM	Electromagnetic (survey)
EPA	Alberta Environment and Protected Areas
EPEA	<i>Environmental Protection and Enhancement Act</i>
GIS	Geographic Information Systems
GOA/GoA	Government of Alberta
GRF	Grassland Restoration Forum
IOG	Indian Oil and gas

LiDAR	Light Detection and Ranging
LOC	Licence of Occupation
MRD	Minimum Required Distribution
MSL	Miscellaneous Surface Lease
NAIT	Northern Alberta Institute of Technology
OSE	Oil Sands Exploration ¹
OWA	Orphan Well Association
PDF	Portable Document Format
PLA	<i>Public Lands Act</i>
PRO	Professional Regulatory Organization
PTAC	Petroleum Technology Alliance Canada
QA/QC	Quality Assurance / Quality Control
R&D	Research and Development
Rec Cert / RC	Reclamation Certificate
Rec/Rem	Reclamation / Remediation
RoO	Record of Observations
ROSC	Record of Site Conditions
SCARG	Salt Contamination Assessment and Remediation Guidelines
SME	Subject Matter Expert
SML	Surface Materials Lease
SOP	Standard Operating Practice (or Safe Operating Practice)
SST	Subsoil Salinity Tool
TFA	Temporary Field Authorization
UofA	University of Alberta
WA	<i>Water Act</i>

¹ Note, proper regulatory term is Exploration Operation (*Conservation and Reclamation Regulation* s. 1(f)).

1 INTRODUCTION

The *Reclamation Workshop: Towards a Shared Foundation for Innovation and Evolution* was held on March 6, 2024, as part of the Alberta Chapter/Canadian Land Reclamation Association's 2024 Annual Meeting in Edmonton. The goal of the Workshop was to highlight and discuss specific issues facing our industry, share potential improvement opportunities, and propose action items to develop solutions.

The Workshop followed a panel discussion titled *Towards a Shared Foundation for Innovation and Evolution*, held at the Alberta Chapter's 2023 Annual Meeting (Powter et al., 2023). The goal of that discussion was to start a broader conversation about what principles should inform where reclamation practitioners want to get to and how we want to get there. Panelists encouraged the audience to discuss and then agree on what our reclamation goal is, what success looks like, how to measure success, and then test if all these together make sense (that is, are they achievable at a reasonable cost in a reasonable timeframe).

The Workshop was organized by the Alberta Chapter's Stewardship Committee (Diana Dunn – Chair, Amber Flamand, Chris Powter, Corey Zadko, Dean MacKenzie, James Agate, Kelly Howard, and Susan McGillivray). The Committee's mandate is to focus on continuous improvement by creating opportunities to facilitate discussions on industry issues, to create spaces for collaboration with other organizations, and to promote to the public what our membership does.

1.1 Workshop Format

Workshop participants were asked to address four topics:

1. What does closure look like?
2. What best practices are in place, and which ones should we develop?
3. What learnings should be shared across industry sectors, and how can we support information exchange?
4. What new technologies can be used to help reclamation programs (planning, implementation, and evaluation)?

Participants were allocated in advance to 10 discussion tables, and table participants were changed for each discussion topic to provide an opportunity to hear different perspectives. Each table was provided a series of questions to help focus discussions (Appendix 1), but participants were free to talk about other points as well.

In addition to the table discussions, Post-It boards were paced throughout the room to allow participants to share additional thoughts on the four topics and other topics of interest. These notes have been incorporated into the session table notes in the Appendices.

1.2 Workshop Participants

Workshop participants (Appendix 2) were selected from 107 practitioners who had expressed interest in participating. The Committee’s selection focused on participants working in Alberta or related industries who had more than 10 years experience.

Slightly less than half of the participants were consultants (Figure 1), reflecting that most reclamation field work is done by contracted third parties.

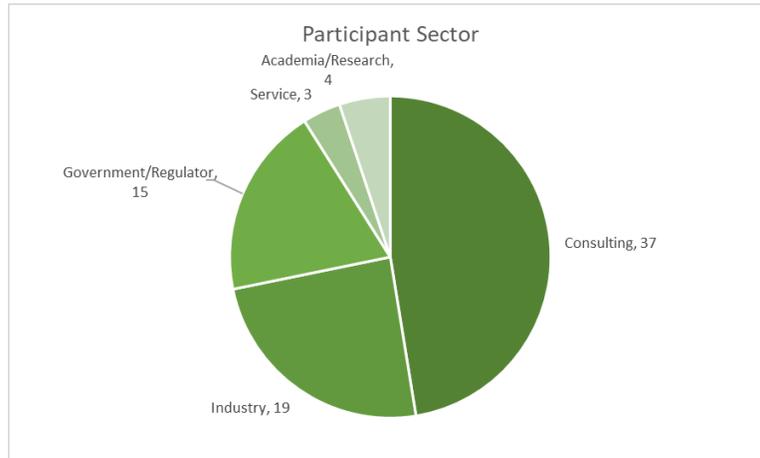


Figure 1. Participant sector.
n=78.

Figure 2 shows that participants brought considerable experience to the table, with 50% of them having been involved for more than 20 years.

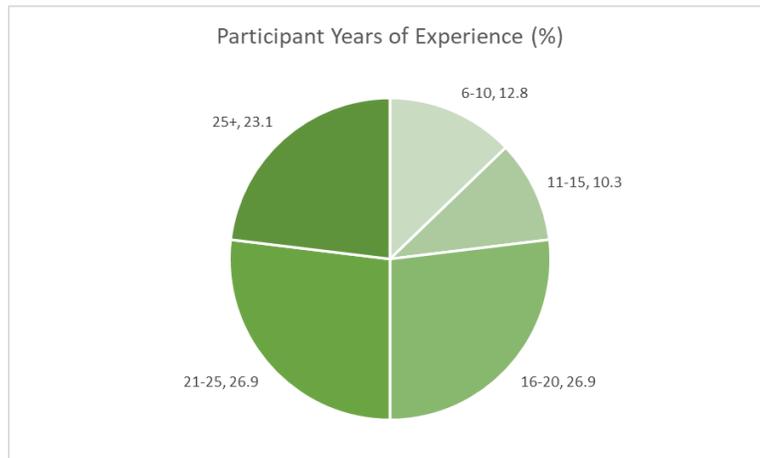


Figure 2. Participant years of experience.
n=78.

Participants had a wide range of specializations (Figure 3). Not surprisingly, reclamation (83% of participants) and remediation (59%) were the most reported specializations. Consultants

selected all 16 specialization options, followed by government (13), industry (12), academia/research (7) and service providers (7).

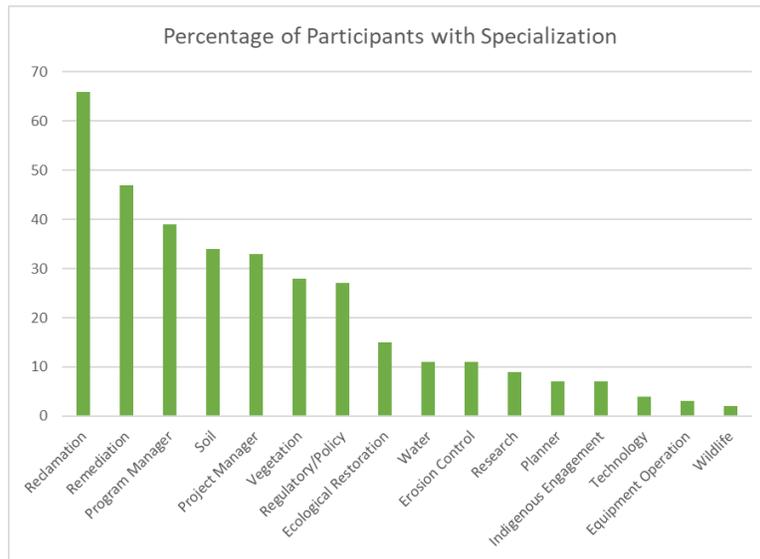


Figure 3. Percentage of participants with a given specialization. Participants could select more than one specialization. The 78 participants identified a combined total of 343 specializations.

Twelve participants selected Other as one of their options and indicated the following specializations:

- Aggregate development.
- Communication.
- Risk assessment.
- Environmental geochemistry.
- Hydrogeology.
- Waste management.
- Liability assessment.
- Construction and development.
- Trucking and transport
- Logistics
- Salinity (chloride) specialist.
- Representing one of five PROs with reclamation/remediation sign-off and understanding the duty of PROs as it pertains to protecting the public interest as mandated by government.
- Coordinating professional for large interdisciplinary projects and programs.

Not surprisingly, forestry (78%), agriculture (77%) and grassland (50%) were the most cited work landuse areas (Figure 4). All sectors reported working in all landuse types, except academia/research participants who did not report working on Indian reserves or traditional land,

and service providers who only indicated working in forestry, agriculture, grassland, and peatland/wetland areas.

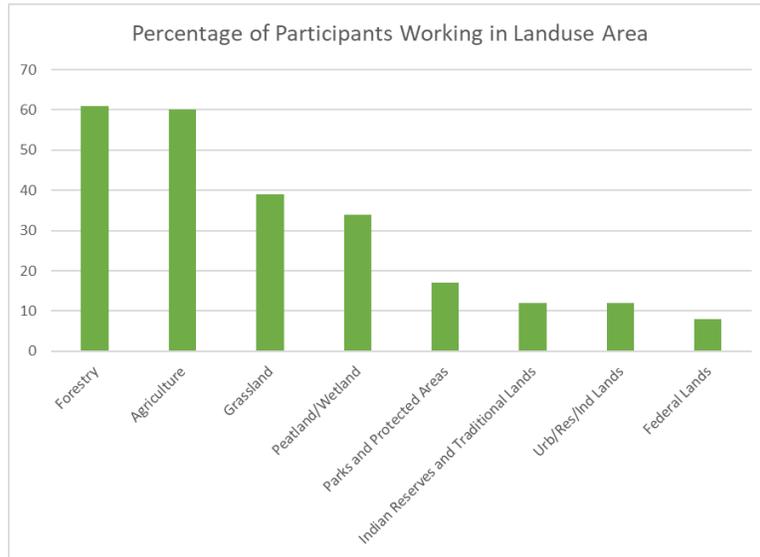


Figure 4. Percentage of participants working in specific landuse areas. Participants could select more than one landuse area they work in. The 78 participants identified a combined total of 243 landuse areas they work in.

In the Workshop, participants were asked to identify their top two stakeholders from a list. Figure 5 shows landowners (31%) and clients (16%) were most frequently identified.

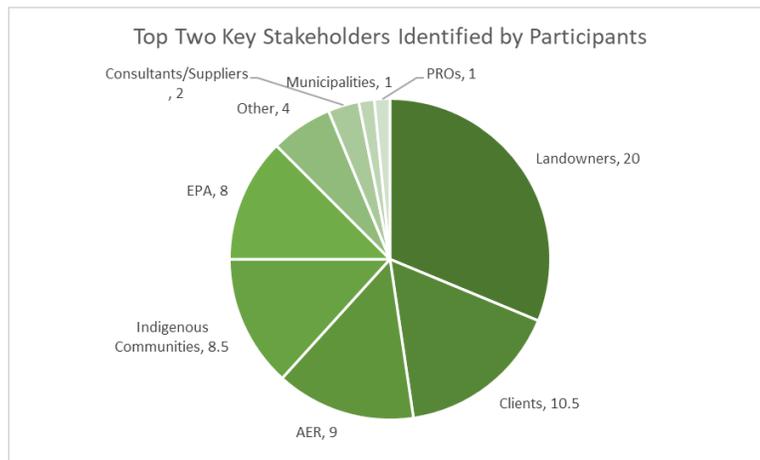


Figure 5. Top two stakeholders identified by participants. n=32. The four participants indicating Other as one of their stakeholders noted future generations (3) and the public (1) as reasons for their selection.

1.3 Workshop Moderators and Scribes

The Committee asked 10 participants to be table moderators. Moderators were to ensure the discussions remained focused on the topic and to actively encourage all participants to engage in

the discussions. Moderators were allowed to contribute to the discussions. The moderators were:

Adam Dunn	Earthmaster Environmental Strategies Inc.
Amanda Schoonmaker	Northern Alberta Institute of Technology (NAIT)
Amber Flamand	Earthmaster Environmental Strategies Inc.
Andy Etmanski	ETCON Environmental Services Ltd.
Devin Allibone	Cardinal Energy
Diana Dunn	Canadian Natural Resources Limited (CNRL)
James Agate	Canadian Natural Resources Limited (CNRL)
Sheila Luther	Matrix Solutions Inc. – A Montrose Environmental Company
Susan McGillivray	Alberta Environment and Protected Areas (EPA)
Tanya Richens	TCR Environmental Consulting Ltd.

The Committee also requested people to be workshop scribes. The goal in selecting scribes was to provide opportunities for junior staff to listen to the discussions and learn from more experienced practitioners. Scribes were assigned to each table to summarize the discussions. The scribes were:

Brittany Porter	North Shore Environmental Consultants Inc.
Cassandra McKenzie	Matrix Solutions Inc. – A Montrose Environmental Company
Craig Nicolay	Earthmaster Environmental Strategies Inc.
Katie Howes	Canadian Natural Resources Limited (CNRL)
Kelsi McKeage	Earthmaster Environmental Strategies Inc.
Taylor Fenton	Trace Associates Inc.

1.4 Report Format

Sections 2 to 5 summarize key results from each of the four discussion topics. Section 6 lists common themes that emerged from the discussions and provides suggested next steps.

Appendices 3 to 6 provide the detailed notes from the 10 tables during each of the sessions. The table notes have been combined under specific sub-topics and have been edited for clarity.

Appendix 7 provides a summary of the Technology session notes in Appendix 6 and responses to a series of questions about improving reclamation communication, also generated by ChatGPT.

2 WHAT DOES CLOSURE LOOK LIKE?

2.1 Closure

Issuance of a reclamation certificate was widely seen as the end of the closure process, which includes abandonment, decommissioning, remediation, surface reclamation, and reclamation performance monitoring.

**Closure is a process
whereas a reclamation
certificate is a thing.**

There was general agreement that successful closure, especially for larger sites such as mines, requires early engagement with stakeholders and Rights Holders², and documentation of the goals.

There was a sense that closure means different things to different people, and that stakeholders, especially landowners, don't understand what it means. There was a suggestion that *closure certificate* replace the term *reclamation certificate* to improve understanding of the implications of the certificate.

It was acknowledged that the understanding of closure has changed over time (and likely will continue to change in the future) but that a mechanism must be in place to accommodate closure of sites that were developed under older regulatory requirements. It is particularly important to ensure that closure for sites with EPEA approvals or other approved reclamation plans place greater emphasis on those approvals and plans than on criteria.

Closure should not be different on public vs. private lands, but there was a sense that companies may prioritize effort on private land because of the lease payments and especially when a change in land use is proposed as it was seen as easier to obtain.

Closure was seen as:

- Ending an operator's work on a site.
- Ending an operator's liability.
- Ending payments to the landowner.
- Beginning a new land use.
- Setting a site on a desired trajectory without further human input.
- Meeting certification criteria (if applicable) or approval conditions (if applicable).
- Achieving equivalent land capability.

There were varying opinions about whether:

- Closure was just a surface issue or a subsurface one as well.
- Closure is achieved for each block of land where progressive certification occurs, or only after the whole site is certified.

² *Rights Holders* was noted as a preferred term for Indigenous persons/communities.

- There should be two different types of closure: unrestricted/pristine and restricted land use (for example, where an abandoned well or pipeline restricts what can be done on the land).

Some sectors (e.g., pipelines, utilities) indicated they had a different measure of closure, which is why they don't see the value of a reclamation certificate.

There was considerable discussion about the terms *end land use* and *equivalent land capability*, and how they are confusing to landowners and stakeholders³. The phrase *equivalent land use* was used frequently by participants, creating further confusion. Generally, though, there was agreement that:

1. Closure is driven by end land use;
2. The end land use must be agreed upon by relevant stakeholders;
3. The end land use can be different than the original/adjacent land use; and
4. Getting approval for a change in end land use can be problematic on public land. However, it was noted that there are guidelines for public land borrow pits (Alberta Environment and Parks, 2022) that show where alternative land uses fit. Participants mentioned repurposing sites for renewable energy projects as one area receiving greater interest and scrutiny.

2.2 Certification Criteria and Process

Certification criteria are well established for upstream oil and gas sites; however, there were several comments about the need to update the wellsite criteria. We need to be proactive as processes take about five years to get the ball rolling and change the criteria. We don't necessarily need a monumental change, but small edits/tweaks along the way that will keep things more up to date and progressive.

It is unlikely we can develop a single set of criteria for all disturbances, but there should be some general principles. Criteria could be grouped based on scale and severity of the disturbance: minimal disturbance, holes in the ground, surface disturbances, linear, small scale, or large scale. We need to make sure the criteria are not so vague they create a lot of loopholes, but also that they are not so complicated and convoluted that they will slow down the reclamation certification process.

Certification criteria need to be developed for:

- Mines.
- Pits.
- Borrow pits.
- Plant sites.

³ Author's Note: See *Equivalent Land Capability Workshop Summary Notes* (Oil Sands Research and Information Network, 2011).

- Renewable energy (solar panels, windmills).
- Brown fields.

There was a suggestion that *construction criteria* may be needed.

There was limited awareness of how post-closure care could apply to reclamation, though there was some sense it might apply to sites requiring remediation. There may be some value in exploring how post-closure care is used in other jurisdictions.

2.3 Relationship to Remediation

The public is confused about the difference between remediation and reclamation, and their associated liability periods. Remediation and reclamation are uniquely intertwined and therefore difficult to separate. While remediation certificates exist, they are used sparingly; they are seen as mostly for spills, not industrial sites.

2.4 Post-certification Monitoring

There was discussion on the need for long-term post-certification monitoring to confirm that sites are indeed achieving equivalent land capability and meeting the expected trajectories. Mention was made about articles and studies that variously showed long term success was or was not being achieved.

Access to sites and the implications and optics of a site *failing* were raised as concerns for long-term monitoring.

2.5 Role of Professionals

There was concern about the use of young professionals in a field that requires considerable professional judgement, particularly where the reclamation assessment is based on a trajectory towards a future state.

2.6 Improving Communication

A considerable amount of time was spent at the tables discussing the need for improved communication with landowners, stakeholders and Rights Holders about the reclamation, remediation, and certification processes, and the implications of closure and certification. Improved communication amongst regulators was also flagged as a need.

There is also a need for government, industry, and the profession to do more to publicise reclamation success stories, locally, nationally, and abroad.

2.7 Indigenous Engagement

More can be done to engage with Rights Holders to understand their needs and desires with respect to reclamation goals. This is particularly true for large disturbances in traditional territory.

Rights Holders want to be at the table for policy and criteria development.

3 WHAT BEST PRACTICES ARE IN PLACE, AND WHICH ONES SHOULD WE DEVELOP?

3.1 Definition

Several best practice⁴ definitions were suggested; many of these incorporated the following common words/phrases:

- Proven.
- Cost-effective.
- Practical.
- Standardized.
- Efficient.
- Safe.
- End goal / outcome.

Best practice is the industry preferred/expected standard.

Proven to achieve an appropriate land outcome.

There were widely different perspectives on who determines what a best practice is, with the majority leaning towards industry and practitioners (i.e., the people who implementing practices on the ground) rather than government.

3.2 Developing Best Practices

Best practices should focus first on common issues, and then as time permits, be expanded to focus on sector- or subject-specific issues. Best practices should be based on field experience and research.

It was generally agreed that best practices are not static – they should be updated periodically based on a review of their utility/success in meeting goals. There was some concern that identifying something as a best practice may stifle future innovation because everyone will be focused on applying the best practice.

Development should involve all stakeholders – specific roles were suggested for government, industry, and academia.

Best practices should not be codified (i.e., in a regulation) to ensure they can be updated quickly. However, there is a need to identify an organization responsible for housing and making the best practices widely available.

Care must be taken to ensure best practices are not too prescriptive and are achievable.

There were varying views on whether a best practice follows from a criteria/guideline or if they serve to develop the criteria/guideline.

⁴ Note, this term was used synonymously with Best Management Practices.

3.3 New Best Practices Needed

Several areas requiring new best practices were mentioned frequently during the session, including:

- Information on seed mixes, especially for native grasslands.⁵
- How can we plan for weather and climate change?
- What should be monitored/assessed and for how long when assessing reclamation performance (i.e., in preparation for reclamation certificate application)?

Should we start by developing *worst practices* – look at what hasn't worked?

3.4 Knowledge Sharing

It isn't enough to develop best practices – they must be shared to increase awareness and uptake. Best practices can be valuable training tools for new staff.

It was acknowledged that many best practices have already been developed, but that they are not as broadly known as they could be. A workshop to discuss existing best practices and identify gaps to focus future development was suggested.

There was some concern that best practices are not being shared because of a perceived competitive advantage in having an in-house best practice. Sharing may also require a cultural shift to allow safe discussions of failures as learning tools, not just successes.

⁵ Author's Note: See *Inventory of Native Species Seed Mixes in Alberta: December 2018 Update* (Powter et al., 2018).

4 WHAT LEARNINGS SHOULD BE SHARED ACROSS INDUSTRY SECTORS, AND HOW CAN WE SUPPORT INFORMATION EXCHANGE?

Participants noted there are significant opportunities to share knowledge across sectors within and outside reclamation, and across provinces. A better focus than sectors or subjects may be ecological (e.g., a Boreal Sharing Network).

4.1 Common Issues

There doesn't appear to be a knowledge gap. It's a communication gap.

There are subjects that are common across sectors, such as soil salvage, erosion control, and vegetation establishment that could be broadly shared. At the same time, participants noted some specific issues that were unique to a particular sector or subject that would require targeted sharing.

4.2 Barriers to Sharing Knowledge

Time, cost, protection of proprietary information, differences between sectors, and a fear of admitting failures were the most frequently mentioned barriers to sharing.

Risk-aversion, missing key audiences, a view that older information/data is not relevant, and figuring out how to best engage with educational institutions were also cited as barriers.

4.3 Existing Mechanisms for Sharing

EPA, AER, CLRA, COSIA, CAPP, Clean Resource Innovation Network (CRIN)⁶, Grassland Restoration Forum (GRF)⁷, CCLM⁸, and SALMTECH⁹ were identified as organizations that currently share information through a variety of mechanisms.

Consultants used by several different companies can share their knowledge with each company.

Mentoring, cross-training, and on-the-job training were also mentioned as methods of sharing knowledge within organizations.

4.4 Sharing Mechanisms to be Developed

Consolidating and repackaging existing knowledge to be more accessible online was identified as a critical need.

Several opportunities for CLRA to lead in knowledge sharing were identified, including enhancing the website to link to other knowledge-sharing platforms, making

It seems right now things are fragmented, and information is spread all over. It may be easier to share/access if it was more centralized.

⁶ See <https://www.cleanresourceinnovation.com/>

⁷ See <https://grasslandrestorationforum.ca/>

⁸ See <https://www.cclmportal.ca/>

⁹ See <https://salmtec.com/>

conference presentations more accessible, expanding outreach to students, offering more awards, using practitioner surveys to gather information, and organizing/hosting focused field trips / short course field schools (e.g., 2- to 4-day focused field training).

Creating opportunities for more cross-sector, cross-jurisdiction sharing sessions was also noted as a way to increase our knowledge base.

5 WHAT NEW TECHNOLOGIES CAN BE USED TO HELP RECLAMATION PROGRAMS (PLANNING, IMPLEMENTATION, AND EVALUATION)?

The general sense was that technology complements other tools, and that there will always be some ground truthing involved; that is, it will not replace boots-on-the-ground. Furthermore, people are still required to interpret the data (the analogy given was that a technician takes your x-ray, but a doctor interprets the results) and new technologies will require new skill sets.

A big part of the technology and new advancements is that we don't know what we don't know.

Participants noted that the technology is rapidly evolving so there is an ongoing need to keep up with new tools. They also cautioned that the increasing sensitivity of sensors could potentially lead to false failures (i.e., we must balance practical decisions against precise decisions).

Determining whether a technology will add value generally involves deciding whether it will be faster, cheaper, or safer and produce scientifically accurate results.

5.1 Drones and Remote Sensing

Drones and remote sensing platforms were seen as very useful for remote sites where access is limited or where a landowner wants people off the land. However, they are limited in the type of data they can provide (e.g., topography, vegetation, soil moisture), so they would not be able to replicate the full suite of information currently required for a wellsite reclamation certificate application.

One of the key benefits of drones is that they allow for a visual display of the entire site from a different perspective than that obtained on the ground. They are also valuable for examining linear disturbances such as pipelines and powerlines.

Participants identified a range of opportunities for increased use of drones, including:

- Identify problem areas for on-the-ground inspection or for selecting audit sites.
- Conduct weed management and seeding/planting.
- Show vegetation development over time (trajectory).
- Carry out wildlife sweeps.
- Map spills.

5.2 Data Management

There was a sense that data isn't being leveraged to the extent it could be. Existing databases, especially OneStop, shouldn't just be considered a 'one-way' stream of information.

There is a lack of good data management that is preventing us from working more effectively.

There were examples of data accessibility problems and acknowledgement that some data is publicly available, if not easily accessible.

Several suggestions for improving OneStop were provided, centred on reducing duplicate information, allowing changes to data already entered, adding the RoO form content, allowing

for batch submissions, incorporating background soil quality data, and improving data entry for variances and unique sites.

5.3 Artificial Intelligence

Participants noted that artificial intelligence showed great promise in streamlining some reclamation reporting work but had reservations about how regulators and stakeholders would be protected against false information.

Artificial intelligence was seen as most valuable for:

1. Mining existing large data sets to identify patterns (e.g., what are the factors most commonly failing sites);
2. Gathering background data for report writing and research; and
3. Planning, scheduling, and tracking the status of reclamation activities and approval requirements.

As there was considerable discussion around the application of artificial intelligence, Dean MacKenzie provided ChatGPT with the draft report and asked it to:

1. Summarize the notes in Appendix 6;
2. Prepare messages to the general public about land reclamation in response to specific questions (see its responses in Appendix 7).

5.4 Getting Technology Approved

While the government is open to more technology use and wants to promote innovation and ensure policy does not encumber innovation, it is not currently the Government's role to approve technology. The government would like to see technologies producing data that are repeatable, reliable, and replicable.

If the regulator can focus on the outcomes and not the process, it leaves flexibility for companies to try new technologies.

Adoption of new technologies will require proof that they will achieve the desired outcomes, which will require research and ground truthing. Technology providers and industry need to be prepared for additional monitoring to support burden of proof. However, how much proof will be required was identified as a concern.

5.5 ChatGPT's Replacement Summary for the Technology Session

Dean MacKenzie asked ChatGPT to prepare a summary to replace the one in this section. Below is its response:

The document provides a comprehensive overview of the current state, challenges, and future directions of technology application in environmental reclamation and monitoring. It emphasizes the importance of integrating technology to improve efficiency, accuracy, and outcomes in reclamation practices, while also highlighting several key themes and areas of concern:

The Human Aspect of Technology: It points out the risk of becoming overly reliant on technology and losing sight of the human and communicative aspects necessary for effective environmental management. The need for enhanced collaboration and communication among stakeholders is stressed, suggesting that technology should serve as a tool to bring people together rather than replace human interaction.

Technological Advancements and Applications: The notes detail various technological tools and methods, such as drones, remote sensing, and LiDAR, and their potential applications in monitoring, data collection, and environmental reclamation. It discusses the advantages of these technologies in accessing remote areas, improving data quality, and supporting decision-making processes. However, the document also addresses limitations, including the need for certification, regulatory challenges, and the potential for technology to miss nuanced details that can be critical in environmental assessments.

Data Management and Accessibility: A significant focus is placed on the challenges of data management and the need for improved systems to collect, store, analyze, and share data efficiently. The notes mention the problems with current practices in data management, including the lack of standardization and the difficulties in accessing and using data stored in disparate systems. The potential of platforms like OneStop for centralizing and streamlining data management is discussed, alongside the need for better integration and accessibility of data for various stakeholders.

Regulatory and Approval Challenges: The document highlights the dynamic nature of technology and the challenges this poses for regulatory frameworks, which may struggle to keep pace with innovation. It suggests that government and regulatory bodies should focus on outcomes rather than prescriptive processes to allow for flexibility in adopting new technologies. The notes also touch on the process of technology approval and the importance of proving the efficacy and reliability of new methods through data and field verification.

Future Directions and Opportunities: There is optimism about the role of artificial intelligence (AI) and other emerging technologies in enhancing environmental management practices. The document suggests that AI could improve data analysis, streamline regulatory processes, and enhance monitoring and compliance checks. However, it also cautions that human oversight will remain essential to ensure accuracy and ethical use of technology.

Challenges of Technology Adoption: Barriers to the adoption of new technologies are discussed, including economic feasibility, the need for buy-in from various stakeholders, and the challenges of integrating new tools into existing systems and practices. The document underscores the need for training, standardization, and supportive policies to facilitate the adoption of innovative technologies.

In conclusion, the document provides a thorough analysis of the role of technology in environmental reclamation, highlighting both its potential benefits and the challenges that need to be addressed to maximize its effectiveness. It calls for a balanced approach that leverages technological advancements while maintaining a focus on human expertise, collaboration, and sustainable environmental practices.

6 OBSERVATIONS AND NEXT STEPS

6.1 Common Themes

Five themes emerged from the discussions:

1. **Communication:** Throughout the four sessions participants consistently flagged the need for greater communication between sectors, provinces and practitioners. Improved communication will require breaking down silos, changing our view of proprietary information, and acknowledging that while each sector or province has unique issues, many common ones would benefit from a shared knowledge base.
2. **Shared Responsibility:** All stakeholders need to be involved to get buy-in for current and new practices and regulatory requirements. This means we must go beyond the traditional big-three stakeholders (government, industry, consultants) and embrace landowners, service and equipment providers, and equipment operators. In addition, greater participation by Rights Holders was flagged as critical.
3. **Maximizing Data Value:** Participants identified numerous opportunities to maximize the value of data residing in government databases through data mining projects. Data in OneStop was specifically mentioned, as were the applications and annual reports supplied to EPA related to EPEA-approved activities.
4. **Education and Training:** The advent of new technologies, loss of corporate memory, and entry of new staff all lead to the need for more training, in academic institutions and on the job. The CLRA has an essential role in this space through its traditional role in providing conferences, Lunch N Learn sessions, weekly news updates, and the Canadian Reclamation magazine. Participants flagged other roles and communication methods the CLRA could adopt to support ongoing education and training.
5. **Change:** Participants noted that regulatory requirements, stakeholder expectations, and technology constantly change. Depending on your point of view, this either provides opportunities for developing and deploying new methods and tools or will consume time and resources that would be better spent doing reclamation. Change will happen no matter what your point of view is, so we must figure out a way to adapt.

6.2 Additional Observations

Even though Equivalent Land Capability as the objective of reclamation has been enshrined in legislation since 1993, and was first introduced in 1983, there remains considerable confusion about its meaning and application, particularly among landowners. As noted in the Closure section, this confusion may be increased when terms such as equivalent land use are used.

Related to this, participants noted concerns about the process for changing land use, especially on public lands, and what would happen if the landowner changed his or her mind after signing off on a land use change.

Although there is a statutory requirement to obtain a reclamation certificate, it was concerning to hear that some sectors (pipelines and utilities were mentioned) still do not see the need to pursue reclamation certificates. While there is often reporting of the number of wellsite reclamation certificates issued each year, there may be value in more extensive public reporting of certificates issued for other sectors to better inform policy makers and stakeholders of the outstanding liabilities that may exist.

Only one person identified the Professional Regulatory Organizations as their key stakeholder (Figure 5), notwithstanding the important role of the organizations in the upstream oil and gas certification process. This, coupled with other comments on the role of Professional Regulatory Organizations, suggests there may be value in convening a meeting/workshop on the subject of Professional Regulatory Organizations in reclamation and remediation.

6.3 Potential Next Steps

The Workshop was well received and there appeared to be an appetite for more workshops to tackle specific topics. The Stewardship Committee should consider surveying members to identify potential future workshop topics. In the meantime, the following seemed to be areas where further discussions are warranted:

1. **Remediation:** Participants noted that reclamation and remediation are inextricably linked, so holding a preliminary workshop like this one to scope out remediation issues for future discussions would be beneficial. This could be done in conjunction with the Environmental Services Association of Alberta as a joint conference.
2. **Post-closure Monitoring:** There is agreement that we don't want to wait decades to decide if a site can be certified, and that early assessment requires professional judgement that a site is on a trajectory to achieving its long-term ecological function. Participants identified a need to scope out a long-term monitoring program for reclaimed sites to determine if the expected trajectories are met. The CLRA could compile an inventory of existing long-term monitoring projects/programs, and methods could be developed as a starting point for the discussions.
3. **Best Practices Inventory and Gaps Assessment.** Participants noted that many best practices have already been developed but are not as broadly known nor as accessible as they could be. The CLRA could compile an inventory of existing best practices and use that as a starting point for a workshop to identify gaps to focus future development.

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APPENDIX 1: Workshop Discussion Topics

Session 1: What Does Closure Look Like?

How do you define “closure”?

Is the definition different when you are progressively certifying a site?

Is the definition different for different land uses (especially when the site is to be repurposed for commercial use)?

Is the definition different for private land vs. public land?

Does/should our definition of closure change if we decouple remediation (and, for mines dam certification) from reclamation?

Are certification criteria the right tool to determine that closure has been achieved?

Are existing certification criteria doing the job?

What sectors need criteria developed?

How can criteria incorporate the upfront commitments in the conservation and reclamation plans and/or requirements in the EPEA approvals/registrations?

How can criteria or policy accommodate alternative land uses?

What are the implications of closure?

Liability / Security / Landowner relations / Other

How do we ensure that regulators and stakeholders see closure as a positive outcome?

How do we ensure the operator sees a positive outcome?

Other jurisdictions have implemented post-closure care programs where long-term site management/maintenance/monitoring is required.

Should we consider that here, and if so, for which sectors?

What would that mean for our closure definition?

Do our stakeholders understand the term closure?

If not, how do we communicate what the end point of reclamation is?

Are there different/innovative pathways to get to closure?

Session 2: What Best Practices are in Place and Which Ones Should we Develop?

How do you define “best practice”?

Who decides what the best practice is?

Do/should best practices change with sector / land use / land ownership?

Should we codify best practices and then require them?

Are best practices for common issues or for unique ones?

Does best practice refer only to field implementation?

Are/should there be regulatory/policy best practices?

Are/should there be project/program management best practices?

How do we develop best practices?

What is the role of research?

How do we capture and value experience?

Does it matter who funds the work or where the practices come from?

How do we ensure best practices stay “best” (continuous improvement)?

What is the role of Professional Regulatory Organizations, educational institutions, and other regulators (e.g., AUC, NRCB) in best practices?

What best practices need to be confirmed or updated?

Justifications/variances

Time to certification (monitoring period)

Sourcing seed and seed mix creation

Applying silviculture principles to activities that don't currently use them on forested land

What issues need new best practices?

What would those best practices be?

Session 3: What Learnings Should be Shared Across Industry Sectors, and how can we Support Information Exchange?

Which sectors share common issues/goals?

Which learnings are common to all sectors?

Which learnings may be common only to select sectors (e.g., upstream learnings, mine/quarry/pit learnings)?

How can we import learnings from restoration work (e.g., seismic)

What mechanisms currently exist for sharing learnings?

CLRA / ESAA / PTAC / COSIA / Professional Regulatory Organizations / Other

Educational and research institutions

Others?

What barriers exist to sharing learnings?

Technical / Time / Money / Attitude / Value / Others

How can we overcome those barriers?

What mechanisms for sharing learnings could we develop?

Conferences / Workshops / Lunch N Learn / Courses / Others

Website content – text, video, online forums, AI answers, etc.

Knowledge bases – CCLM, etc.

Should sharing be push or pull (notice sent to you or you must find it)?

What role does government have in sharing learnings?

Session 4: What New Technology Can be Used to Help Reclamation Programs (Planning, Implementation, and Evaluation)?

What is the best way to get innovative technology “approved” for use?

How do we decide if a technology adds value (time, cost savings, result)?

Where have we been and what are the challenges to implementation?

Is it the role of government to “approve” technology?

What is the role of drones and other remote sensing platforms?

Do/should they replace field work, or are they just an additional piece of information?

Where are they best deployed and where are they not needed?

How do we ensure interpretation of results is being done properly (e.g., is there a Professional Regulatory Organization that needs to be added to the existing suite)?

Can we manage data better?

What is the range of formats that data currently get reported in – e.g., pdfs, spreadsheets, spatial data?

Where does the data currently resided / who holds the data (e.g., consultants, industry, government, regulators)?

How accessible/available is the data now?

What could we do to improve existing electronic submission systems?

What new ones should we build?

How often should electronic submission systems be reviewed to ensure they are working properly, and who should review them?

What role does/will AI play in reclamation?

What datasets do we have or need to get the most out of AI?

How can we mine the existing data (OneStop, EIAs, mine plans, annual reports, etc.) to improve practice?

Which part of reclamation – planning, implementation, or evaluation – needs the most technology innovation?

What new tools/equipment/supplies do we need to improve practice?

How do we get them built?

APPENDIX 2: Workshop Participants

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Chad Hohol	Harvest Operations Corp
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Chris Tenszen	Trace Associates Inc.
Chris Wakelin	Hodgson Contracting Ltd.
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Cory Sommer	Waterline Resources Inc
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Mark Zan	1710459 Alberta Ltd.
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APPENDIX 3: Closure Session Notes

A3.1: Closure

A3.1.1: Definition

Why do we have to define it?

It means different things to different people.

- Is closure rec cert or the process. Stakeholders understand it reasonably well, landowners not so much.
- Operators often have different definitions.

In a lot of cases stakeholders do not understand the term.

- Landowners do not understand the name rec certification, to them it's just surface reclamation. Call it closure certificate and it may help.

Legal, entirely legal, especially in Alberta, completion of rec obligation. Legal document relieving you of your obligation.

- Meager components that can drag you back in post certificate – you should've known about it – has to be to do with your reclamation not the landowner obligation.
- For example, sump sinks 25 years later, the operator has to come back and fix it.

Closure is the point at which we have finished and completely “walk away”. To achieve closure, you need a shared goal. Closure needs to consider and include temporal aspects, stakeholders' perspective, metrics for measurement.

- Is closure described as when the operator shuts the door and walks away? Or beyond that?
- Can “turn your back on it” knowing you've returned it to its previous state.

Closure is the process to move disturbed land to meet the land use objectives and results in the end of an activity or a portion of an activity.

- Closure is the process whereas a rec cert is a thing.

Closure doesn't have to be only regulatory. For there to be closure there needs to be confidence that you've met the expectations.

Don't see closure as being reclamation ... they are separate.

- Reclamation is the equivalent land capability.
- Closure is not rec cert; it is the end of the industrial use.

Closure and “equivalent land capability” should be different terms.

- Closure means reaching equivalent land capability.
- When the site has reached the same state as before industry, manufacturing, etc.

Reclamation process is working, the closure process is not working.

Rec cert is considered closure.

- Rec certification.

- Closure is reclamation certificate received.
- Is it rec cert, some say not for them (e.g., pipeline, utilities).
- Liability closure = giving rec cert.
- Closure is at certification or just before certification.
- Closure can meet RC.

Closure means rec cert. when landowner happy with site, when back to a spot that's "good enough"; work needs to be put into managing expectations. This emphasising how important communication is, establishing understanding. Need a goal, depends on land use.

Closure can mean the liability is gone.

- When does the operator's responsibility end?

Closure means you are good for a while.

The end of the life of the site, if the end of land use changed or not, we are done with it.

- End of one use and start of another.

End of the production life

Closure is the end the previous industrial activity.

- End of the previous activity (mining, agriculture, oil and gas, windfarm, etc.).
- End of the designated activity makes sense, but can't necessarily remove the infrastructure (e.g., tailings ponds).
- In Southern SK, there is a lot of standing infrastructure that has been in place for a long time.

Old wellsites and the trajectory of their lifetime. Differences in closure based on land use. A snapshot of time doesn't necessarily capture everything. Does closure need to have a temporal reference?

- Closure should really be something farther along – beyond the criteria, does it really support the functions we want on these sites.
- Setting a site on its proper trajectory without human input.

When landowner payment is finished and a rec cert is received.

- Closure is the end of the lease payment (spans both private and public).

Closure is when things are done: Many facets that go into that. Temporal, different metrics, ever changing regulatory/criteria/factors.

Closure is meeting regulatory obligation that was set for that goal.

- All obligations and requirements are completed.

Forested White Area land can be tricky to figure out what closure should look like.

Closure includes several objectives to meet an outcome. Who are the primary stakeholders?

- Need to define closure from the perspectives of the operator, landowner, regulator.

Have a plan that includes what the closure expectations are. Have the plan incorporate the future and be able to modify in the future to continue to meet the end goals.

Different levels of closure: regulatory closure, temporal closure, perspective closure.

- Operational closure is different than regulatory closure.
- Liability closure – giving rec cert.
- Perspective of progressive rec - knowing outcomes may change through time.
- Operational perspective – veg may be closed, but GW may not be until the entire site is complete.

What aspects of temporal closure. The definition of closure needs to consider the extent of time from construction all the way through to reclamation.

EPEA approvals; you get an approval list of what you have to do then you get approved -> vague directions, don't have to go back and fix it later. Assessment changes for EPEA.

Utilities don't get a rec cert, it is not what we are after for closure. Pipeline is about ELC but they are not applying for rec cert. EPA is too slow, there is no benefit. Closure is managing liability and reclaiming to ELC.

- Utilities go a different way for closure. AER sites pipeline license site, we go through the rec cert but for sites on EPA they do not go for rec cert, they sell it instead when on Crown.

Pipeline license ELC means different things. We can come back that they are not getting a rec cert. But they are still not doing the certifying process.

- Don't want to get a rec cert for a pipeline because they would need to go back in on the pipeline in 20 years.
 - To get permitting again to hold on to it.
 - Fly over and monitor instead. Ensure everything is okay but they don't want to lose the ROW.

Larger disturbance types, underground mines, how did we quantify?

A3.1.2: *Definition Issues*

Do the AER or EPA have a definition? NO.

Different definitions in the *Public Lands Act* vs. *EPEA*.¹⁰

Different industries held to different standards.

Definition should include how we get to closure.

Definition of closure is evolving in the regulatory space. First Nations, caribou considerations will shift how we define it.

¹⁰ Assume this is a reference to the different definitions of equivalent land capability in the *Public Lands Administration Regulation* and the *Conservation and Reclamation Regulation*.

Does it include ecological function? Biodiversity?

Our definition of “closure” over our careers have changed.

- Initially it was what the regulator defined.
- Now it is what the end landowner defines it as.

Definition needs to consider time of construction (temporal considerations).

Issues with how to deal with 3rd party issues or infrastructure on one of your sites and not being able to get closure due to them.

What about sites that passed using old criteria? Does that now meet closure?

- Is it more damaging to go back in and “fix” it?
- We should be able to use professional judgement to leave it in place based on limited risk.
- Seems to be larger gray areas in the current legislation.

Is closure surface reclamation? Or is it surface reclamation and underneath. Tailings ponds can be rec certified at surface, but what is going on underneath?

- Closure is achieving surface and subsurface regulatory closure which includes acceptance of measurable and attainable expectations of the landowner.
- Certifying a site is surface and subsurface.

Banks have a different idea about remediation closure versus reclamation closure.

Should closure consider scale? Should we allow rec certs on smaller pieces of the mine before the mine is completely reclaimed? Should we separate rec certs from closure of a facility? For example, a mine now has 20 rec certs, but will require 100 rec certs to be closed. Rec certs are a milestone in the process. Closure is the whole process.

Should we have 2 different types of closure? – unrestricted/pristine and restricted land use. Restricted such as land above an abandoned well or pipeline – it restricts what can be done on the land.

A3.1.3: Equivalent Land Capability and End Land Use

Equivalent land capability confuses the public.

- Education on the definition of ELC; many rec professionals think it means it has to be the same as pre-disturbance.
- Who decides what is equivalent and that the proposed land use is appropriate?

Not necessarily what policy or guidelines dictate, but what the next land user/landowner wants.

Return to equivalent land capability.

Equivalent land capability and stakeholder considerations – future generations matter.

Need to return to the agreed to end land use.

ELC for closure is clearer for cultivated lands.

Land use needs to be defined up front and discussed with stakeholders.

Closure driver is end land use. Needs to be separate definitions.

Legal definition tied to land use, once we can remove liability, for different land uses that can mean trajectory, projection (forested vs. cultivated). Land use must be permanent for this to work.

Is closure directly tied to end land use?

- It needs to be. Land use has to be tied, can't change your mind or go back and forth. Industrial zone -> has to be that way forever.
 - Example: sand and gravel pit became parking lot, how to certify? Needs to be flexible.
- Approvals need to be dynamic and can be updated as time goes on. Whatever closed in 80's held to those standards, but need current standards for current closures.¹¹
- Mine closed down 20 years ago, what do you do now to fix it? If people won't listen, you have to have a line. Operational decisions on sites that have been running for years, should be focused on closure - and it's not. From a corporate standpoint, they don't think about closure when establishing their operating guidelines.
- Construction and reclamation people in the same room; environment and abandonment.
 - More time in between operational people and reclamation people -> have closure in mind from the beginning. Include reclamation in construction plans. Have reclamation ideas upfront. Communication is important.
- Construction plans and permitting -> include end of use measure – e.g., storing topsoil in a reasonable place.

Is end land use the correct term to be used in closure? Does end land use or next land use belong in the definition? End land use may not be the best term. The land is not at its end. Will it continue to be functional?

Don't say end land use because it isn't the end.

Interpretation of equivalent land use/policy has changed through time/people. Can change the time of the process, no set thing.

End land use is often resource driven: forested areas, etc. Where do we keep intact land use?

Land use objectives. End of life for the activity that was occurring. Ready for the next generation.

End land use might be different than before.

May be different if starting land use is different from end land use. (i.e., agriculture to commercial).

¹¹ See government position on standard of the day in 1985 (<https://www.cclmportal.ca/resource/reclamation-certification-and-criteria>).

Some in the population are thinking about land use – is it a full forest yet? Often, they are interested in what is adjacent or what was there before.

The site has to meet certain land use objectives.

Depends a bit on the outcome. Closure on an approval site could be different.

How does closure differ from equivalent land capability? Sometimes ranchers want something different. With that in mind, how do other stakeholders consider capability?

Equivalent land capability can be negotiated.

People can use the land for what it was used as before.

Getting land back to a productive land use.

- Not leaving contaminated soil.
- Equivalent land use or better.

Equivalent or agreed to capabilities.

Closure is currently considered the equivalent land use or functioning land use of the adjacent land.

Returning land to equivalent land use.

Specified land, works as long as the operators recognize it.

That's why equivalent capability is the goal as land use changes. At the end of the day there will always be a footprint in the area regardless of the work done. Visual or non-visual.

Engaging First Nations in planning stage of reclamation, they might not want things back exactly the way they were before – for example, have a cleared space, different species mix.

A3.1.4: Alternative Uses / Repurposing

Definition (application) of equivalent land capability needs to ensure we can change land uses.

- How do we ensure alternative land uses as reclamation goals are accepted?
- Would be great if we could allow some reuse of land to a campsite or something. They need an entity to manage this. This is critical.
- Sand and gravel are great examples – they have become golf courses.
- Third party needs to be considered. Governments would be open to this.
- Updating/taking the vagueness out of them.

Policy is there but there are gaps like wetland policy.

Criteria do not always recognize what landowners or other stakeholders may desire.

- Attach the criteria to the right outcome.

From which point of view are you thinking about it - if you are deer, your viewpoint is different than if you are a caribou. These may come in conflict depending on which criteria you are following.

Is it appropriate to certify sites after only 2 years?

Public lands needs some published direction, so practitioners know where the different uses stand in the likelihood of being approved and the amount of justification that will be needed. For example, pre-disturbance plant community takes no justification, locally common – a little justification, alternate land use – show a thorough rationale on public lands on why it is being recommended.

- The *Guidelines for End Land Use Planning for Reclaiming Borrow Pits Supporting Energy Activities on Public Lands*¹² shows were alternative land uses fit in public lands. Sets expectations for holes in the ground. This policy has been successfully used to write C&R Plans for similar disturbances as it captures the desire for as much local plant communities as possible but accepts waterbodies as part of that complex. Alternative uses in this hierarchy, let's you know when it might be appropriate and where alternative uses for public lands sit.

Alternative land uses for private are more straight forward, the landowner will approve it or they wont. Can be handled site by site, landowner by landowner.

Is there benefit in repurposing these lands? Is there a way to get out of that mind set.

- Some are getting repurposed for solar. Some are looking at repurposing for hydrogen.
- People in renewables are open to repurposing.
- Is it easy for companies to figure out how to do it?
- Some of it is education. How do we find a stakeholder who is interested in developing something.
- Some don't want to touch anything.
- There should be a way to redeploy land to something.

Re-development; Buyer beware => do a Phase 1 so you know what you're inheriting. Make sure the site is rec certified. Understand the risk you're taking.

What if a landowner wants features left in place?

- If the landowner is willing to sign off on it, yes, if the landowner is happy.
- Not super clear in the criteria about how much is allowed to be left in place.
- What if the landowner wants to change their mind? Who is then responsible?
 - In BC it is seen as an improvement and once signed they cannot want change
 - If sold to a different landowner, should be buyer beware and they should be aware that it will be left as it.

¹² <https://open.alberta.ca/publications/guidelines-end-land-use-planning-for-reclaiming-borrow-pits-supporting-energy-activities>

- Say a landowner gets what they want, it is possible to revoke the rec cert. This can happen.

What happens when the landowner wants a different land use? For example, grassland species planted in a forest? Will this land be successful in the future? Success as a grassland or as a forested area?

What is equivalent land use? Especially when we are changing the land use? If the landowner agrees to the new land use, what happens when the landowner sells it 25 years from now and the land no longer meets the regulations of the day?

Some (post-reclamation) developers do not want the soil put back before they develop it.

A3.1.5: *Public vs. Private Land*

Closure is the same for all sites how we get there may differ.

- No difference in private vs. public. The closure should be consistent, though the variables may be different, metrics change, but the overall closure should not change.

Focus on where the money is going, more done for the same amount often in private land.

One less landowner when freehold is reclaimed over Green Area.

In private lands, landowner has more say.

- On private lands: It is when it is returned to what the landowner wants.

Ag lands are different than forested lands; closure looks different there.

Timelines might be shorter on private, ag lands.

More likely that a private landowner might change their minds.

- On Public lands, it is harder to get changes authorized.

On public land, the government is the landowner.

Public land often has remote access which costs more to reclaim.

Public land is willing to work with us, landowners influence the process on private.

Public land more stringent compared to private land. Private will sign release for structures to remain in place.

Multiple MSLs, LOC's, landowners, etc. in forested areas

- Need to look at it more holistically at the function of the overall ecosystem. What is the ecosystem health?

Overlap agreements are going to be a huge challenge going forward.

Differences in closure expectations within the regulators as well.

Regulators don't see this as different between public and private lands.

- On public lands, you need to work with the public land officer.

Renewables have been specified land since 2018. There is a criteria for closure.

- The approvals process – AUC issues approvals.
- We have the regulatory components.
- The reluctance is around the liability aspects.
- Transfer surface reclamation liability to the solar group. This requires landowner consent, this is different than overlapping wellsites.
- Repurposing coal mines could be an option. There is no provincial requirements for security in the agreement. Landowner is responsible for decommissioning. There is no equivalent to OWA for renewables. They may get them to post a bond for this.
- It could still happen as there is policy to be developed. Landowners can negotiate security in their agreements – they will then assume liability when they do that. This is the challenge on this aspect.

Re-utilization of disturbed area vs. further disturbance to reclaim a disturbed area. There is flexibility in Rec criteria, regulators regardless of where they sit need to get together and discuss.

A3.1.6: Indigenous Perspective

Traditional and cultural land use – is this part of closure?

Don't want end land use to be limiting First Nation needs.

Traditional land use consultants asking for end land use to be considered in permit issuing.

Some traditional land use folks see the land is in the process of returning to a wild land.

Indigenous groups / traditional knowledge also needs to be measurable, achievable, and realistic like the DSA process is.

What species do the indigenous groups value? This way consultants can plant what the community wants.

FNs may want cutlines kept getting to cabins, trap lines, etc.

Want to see Government and Consultants integrate traditional knowledge.

Overlap between Nations is a concern as it may inhibit sharing traditional knowledge with us.

See Indigenous people as Right Holders rather than Stakeholders.

A3.1.7: Process / Timing

Moving goalposts – the definition of closure changes with time.

You can't change the goal posts in the future.

- You need to acknowledge to the standard of the day.

Regulator and the criteria are not on the same page.

- Trying to deal with producer's mandate to lower the liability and the timelines.

Like the idea of doing progressive closure/reduce liability.

End land use as a stage gate or progressive reclamation. If the land use becomes more sensitive in the future should liability return?

Future land use. How far in the future? 25 years? 150 years? Is the land use unrestricted/pristine?

Does rec cert have to occur after closure or can it happen before?

Paper is challenging and time consuming.

AER has clear lines for RoSC, Phase I and if the path is clear. When the PLA is involved the end land use closure is unclear.

End land use sign off, process gap (no form, no direction) tell us exactly what you want. They are looking at a longer decision, projecting the future use.

Pilot for the clay well pads project uses a decisions support tool to guide the decision, guide the application content requirements. Make it easier for AER to efficiently make a decision.

Who does the change in land use for energy activities. Closure is slowed due to no clear process/requirements for applying. Oil and gas a bit clearer on public lands, private lands there can be more negotiation.

TFA / WA approvals are pretty big steps when needed and more steps affect closure and how it is defined.

Specified lands on different processes, public lands dispositions, EPEA, CRR drive the closure recognition. Disposition process is still a back stop. Change in land uses are challenging. The idea that the land use is not being approved.

Need to consider actions across the life cycle.

It is not always the rigidity of the criteria. Need to consider the criteria as well as the long-term success of the site. When can industry walk away. Is it now or never?

- From a client perspective, they want an end date on when the project is done, from an enviro standpoint, it can go far beyond the end of the project. For example, native prairie takes a long time to get the lichens back.

Should AB have timelines?

- Liability reductions should more from downhole work to rec work.
- Should the liability number change based on the specific sites, yes there is not as much incentive to abandon the high risk/money sites.
- Rental amounts impact decisions. White Area is often prioritized.
- Consider imposing a tighter timeline on reclamation?

Fear in the past was any new changes to regulations/criteria may through the smaller companies into receivership, and we are sort of seeing that.

Mandatory spend goes mostly to abandonment how does it help closure as you get less money on rec side or they overspend and reduces costs to rec. Also, numbers of site/costs to do sites?

- It should be a 50/50 between abandonment/rec but there is not enough equipment/experience.
- How is minimum spend determined for each company? Unsure how it is done.

Mines vs. pits are different.

Can we get to the same spot without stringent/detailed policy and closure?

SK jurisdiction requires request for the landowner sign off.

Do we need to go back to the D56 requirements?¹³

What about really big liability areas – dams, fly ash piles? What is long term closure on these?

- Operator may eventually want to walk away from these?
- What does the liability plan look like? Is it still 25 years? Who pays for this?
- Is it something that is sitting there forever?
- Is there a way to capture costs for this like OWA? There needs to be some assurance for this.
- Do landfills ever get closed? Seems to be a 25-year process that after that the landfill can be closed if stable. Not clear how this is done.

A3.1.8: Progressive Reclamation

Progressive reclamation and progressive certification. Incentives are ESG components.

Does progressive rec/rem count?

- Not as full closure but can be useful and may help incentivize industry to do more env cleanup work.

Progressive reclamation is a challenge for 40-, 50-, 60-year legacy sites.

- Definition of legacy? Government or Consultants may have a different idea of legacy than Indigenous groups.

Need to balance closure with progressive reclamation.

- A lot of reclamation is ongoing.
- Is progressively reclaimed land not closed???

Would like to see OWA do stage gate closure, so that activities can be billed as the work is completed.

- Encouraging operators to get closer to closure,

¹³ See *Directive 056: Energy Development Applications and Schedules* – <https://www.aer.ca/regulating-development/rules-and-directives/directives/directive-056>

With projects with approvals there is the opportunity to do progressive reclamation and certification. There may not be for some sites. This is allowed for sand and gravel.

Wellsites used to have site reductions. This is being piloted for smaller sites. Industry is asking if they can reduce their lease payments for part of the site. Partial certification may be possible.

Perspective of progressive rec - knowing outcomes may change through time.

A3.1.9: Liability / Cost / Security

Disturbance is disturbance, there should be reclamation security for all disturbances. Liability for all disturbances.

- No liability for pipelines. No motivation to rec cert on private land, only on public lands because disposition. Pipelines need liability, no follow up or continued payment to landowner. Class 1 needs EPEA approval but class 2 needs nothing. Corporate response is that there isn't enough money in the world to secure all the pipelines.
- No one has a problem with liability on public land, why not private? Public is only one landowner (AER) vs. expanding it to 1,000s.

Old wellsites, no liability -> land is ruined, now on the landowners.

Renewable disturbance needs to be treated the same.

Closure from an oil and gas perspective, assumes liability and risk associated with that site is no longer there.

Closure is when liability is addressed.

- However, you are still liable with contamination and settling down the road.
- Defined as removal of all liability.

Closure definition is the big idea, not how we are doing. Removing the liability is the end goal for utilities, instead of the traditional land use.

Define it as when liability obligations are gone, ideally. However, with infrastructure issues (gas migration), lifetime liability for contamination is closure ever achieved?

Meeting minimum guidelines and zero to minimum liability.

Meeting zero liability for producers.

Liability may still remain (e.g., soft tailings) but surface reclamation is done.

Some clients don't chase reclamation certs only but look at the full ARO costs. They decide how to spend their ARO and try to progress sites a certain way based on their ARO. May not only prioritize rec certs but overall costs.

Closure is where the land is put back to an economic value.

May go down in costs.

ARO models. D11 values. Estimating remaining closure costs – Surface rec done – then can reduce the costs of the remaining liability.

Closure is anything with a fixed cost that is no longer there along with liability gone.

Payment into security but if companies are close to bankrupt, they won't pay the security so they definitely won't be doing the work.

- Security creates public trust, reduces liability as a whole.
- We have (security) tools, etc. that allow less tie up of capital.
- There is one coal mine that did not collect enough security and now crown is needing to address this.
- Security is not collected for remediation. Regulator has to look into this if not addressed.
- We have activities that don't require mandatory security. Natural gas power plants are an example.
- Other activities should be considered to have to post a security such as slaughterhouse facilities. Brining, nitrate laden water, etc.
- Put some funds in a pool for reversals for anyone doing something risky. This can withdraw from that pool.

Concepts or the objectives need to get to the same point. Could be longer liabilities. Tailing ponds in BC failing is huge consequence. Need to turn to industry, set up a fund. Consider larger than any companies and this can trick us.

A3.1.10: Other

Government used to give licenses to pollute, but now we are aiming towards having zero impact => impossible. No disturbance can be put back to the identical standard of what it was before.

How do we deal with pre-EPEA legacy sites?

Grandfathering stigma keeps coming back on closure, reduces certainty of closure. Will the standard change with time.

- Precedent shows that RC requirements are grandfathered based on construction, reclamation date, or approval date. However, perception matters.

Need to be aware of the urban encroachment.

ESG goals can also weigh into the priorities of industry members.

Typically it means X, Y, Z for closure.

Old sites could benefit from planting, research, etc.

O&G does communicate with the stakeholder that they have a say in “end land use”. How do we ensure that the end land use the landowner wants will be successful?

Crown and private land are coming closer together in BC as it relate to closure requirements.

What about future forest fires and droughts?

Circular economy and future land uses.

What are the long-term impacts of green energy (e.g., what microclimates to solar farms create)?

I would spend funding on the sites that need closure.

A3.2: Relationship to Remediation

Definition of closure for remediation is very rigid but seems to be less-so for reclamation.

There is confusion with the public regarding the difference between remediation and reclamation.

Regulatory definition is different – liability for contaminated sites is forever whereas for reclamation is for 25 years. For upstream oil and gas at least. Different case for EPEA approvals/certification.

Uniquely intertwined.

- Difficult to separate or decoupled.
- Don't see them being separated.

Certified – reclamation certification and remediation certification?

- Certify remediation and then certify reclamation (BC criteria).

Remediation/contamination assessment is key -> make sure you're not inheriting liability. Polluter or OWA inherits the liability.

Example: filling in hole with alternative reclamation material (fill); do a site assessment, found an area furthest from the river that was really salty, someone gave him salty material, was getting roadside material. Remediation plan, assessment plan, he was well above the GW table and away from the river. Now wants to sell the land. When solar farm comes in, they dig up salty area => who's responsible?

- Don't dig it up. Risk management plan is to not dig it up.
- Closure conversation; closing a site because contamination didn't move then it got dug up.
- Get a remediation cert; closure cert in 15 years. Don't dig it up.
- Some guidelines need to be looked at again.
- If soil needs to be moved -> don't get closure.

Some sites can't be remediated, so it is always on the books.

- But is it closed?

Can we decouple reclamation and remediation?

- If we do both at the same there is some steps that help both, i.e., fill from reclamation can be used to fill rem excavation.
- Makes sense from producer side, not from AER and policy.

- Maybe a little bit it might change.
- Needs to involve both rem and rec work being completed.
- When we decouple rem and rec we can more easily talk about closure, as the timeframes for liability can be teased out. If closure is when liability is done, then further decoupling needs to occur for reclamation to cover the different surface liability periods by specified land type (none, 5, 25 years).
- From a regulatory viewpoint – these processes of certification are often decoupled processes. It is an external and internal struggle.
- It might not be as objectionable as it might seem. It is important to protect the public first.
- May be OK to decouple the remediation versus the reclamation.

What is the risk we are mitigating. The risk for dams, etc. – could have groundwater messed up, etc. There are more options for the surface stuff. Time is your friend. But not for damaged geotechnical or groundwater. It is already decoupled.

- Still need to go through all of these steps.

Legacy issue sites, gas migration having to go back into the RC site.

Inexperienced staff create problems.

Remediation certificate more important and has value in commercial land but less so in remote locations.

- Remediation certificate? Is it used – not enough?
- Rem certificate is spill clean ups/gas station, clients don't push for it.
- Don't use the remediation certificate, because it sits with the regulator too long, and they can't get the cost back.
- Tier 2 exists for a reason.

Biggest challenge I am seeing on site closure – the vision of chlorides. We didn't have the same criteria prior to 2019 and it is affecting certification of sites that were reclaimed prior to this that are being subjected to new ways of evaluating chloride levels. There is a criterion for chloride in water and it is being applied pre-emptively to soils now.

Remediation can really narrow down options for reclamation. These can be factors that can affect your success for reclamation. If remediation is done well, you can change what you are doing for the final outcome. There may need to be more education on this. Need best management practices for the transition from remediation to reclamation. Need to consider that these need to be considered from the beginning. Sometimes your options are narrowed by costs. May need to bring in the right people to do the work. That part is tricky. May end up costing more to go out twice as no one planned for reclamation. Options often are narrowed. You need an interim plan to prevent erosion.

Operational perspective – veg may be closed, but GW may not be until the entire site is complete.

No – things won't change if you decouple remediation. Goes back to the metrics, closure as a whole shouldn't change.

- You should be able to walk away, and the site should be able to function on its own essentially. Do you implement closure milestones? This can play into the temporal factor.

Belowground contamination is managed under a separate process.

A3.3: *Certification Criteria*

A3.3.1: *Are Criteria the Right Tool?*

They are not “THE” tool, but “a” tool that should be used.

- Certification criteria are not a full tool. There is an opportunity to justify.
- Criteria is not the end point, it is measuring trajectory as specific estimated years of growth before someone is applying.
- Criteria works as a baseline, but these are not closed systems.
- It's a solid base to work from.
- Criteria works as a baseline, but these are not closed systems.

Does current criteria have the availability to reward 'good enough'?

What is best for Alberta should be the goal. Need a legal stance to make this so that it's held up to.

We don't know. Things are ever changing, and we do the best we can with the knowledge we have. Only time will tell.

Do you want one site have to go through multiple different criteria? Or is an update every 10 years better?

Criteria works could be improved on more often than what is. DSA has assessment information that aren't really needed where other things could be added.

If everyone is 80% happy, then we can get there.

2010 criteria gives us consistent, measurable process/criteria but if we bring in other stakeholders it will get too complicated. Landowners are mad.

Idea of closure different to cultivated vs. forested; when can we remove liability? Can be dragged back if something was found to be done wrong. Forested is difficult because tree growth takes decades.

From which point of view are you thinking about it – if you are a deer, your viewpoint is different than if you are a caribou. These may come in conflict depending on which criteria you are following.

We need to make sure the criteria are not so vague as to make a lot of loopholes.

- Veg should be able to tell the story of the rec. For example, if the veg is strong the soil is probably fine.
 - But, no rain = no veg = no certificate.
- If you make criteria too complicated and convoluted it will slow down the reclamation certification process.
- At the end (DSA Stage), some of the criteria is too stringent.
- The DSA criteria is too stringent and doesn't reflect the overall land capability.

Rec criteria is working for smaller disturbances. But there was a Narwhal article that said the old criteria was not working. But more recently with the latest criteria is working better.

A good comparison was done comparing 1995 versus 2010, they were able to show 2010 was better. Constructed and reclaimed to meet this policy – those can be most effective.

Criteria is working more than its not, is contamination gone, yes. Is topsoil replaced yes. Fall down is landowner communication what they are expecting vs. what we can pass the site on.

Criteria informs on all the steps before it. Clear for everyone e.g., crested wheatgrass problem onsite, wash equipment before entering.

Criteria needs to be plain language -> criteria, parameters, need to consider that the public should be able to easily understand.

- For example, we measure production differently compared to landowner (cultivated) crop productivity.

Elimination of weeds being deal-breaker with reclamation certification. This may also be where the criteria need to be changed/adapted. Big impediment to certification – balance goals.

Reclamation -> landowner who have dealt with everyone else, construction, remediation, assessment.

Takes time, stakeholders need to know it takes time, closer is different for everyone (farmers, forests – tree growth).

BC government – restoration a big thing, restored is a difficult term to use, can we get a site to the right trajectory vs. having a site be 'restored'.

Challenge: getting seed banks, establishing seed banks.

A3.3.2: Criteria Design Considerations

Want to see a site on the right trajectory -> certify it. Can't wait an unreasonable amount of time, only enough to see that its on the right trajectory.

Equivalent land capability replaced productivity comparison -> this change is more reflective of how practical reclamation can be.

Problem forage species in south – crested wheatgrass for example. There should be timelines on how long we manage some of these sites because it can be endless. Public land that has been sold back to private landowners. Some of the most difficult sites – we may do more harm than good in some cases (soil erosion etc.).

The land took hundreds of years to get that way, reclamation trying to put that together.

Criteria could be grouped based on scale and severity of the disturbance. Minimal disturbance, holes in the ground, surface disturbances, linear, small scale, large scale.

Surface liability periods affect risk for each activity type, changing monitoring and the length of time before applying. Time periods like OSE 2 growing seasons, change the indicators as what is expected in 2 years is different than if you have 5 growing seasons.

It is hard to create a criteria to cover everything. Not always black and white.

- One criteria may not be possible, but not industry specific either. Somewhere in the middle might work.

Criteria do not always recognize what landowners or other stakeholders may desire.

- Different landowners have different opinions on what closure means to them.

Maybe criteria should be the same for all disturbances in a land type (e.g., all ag the same, all forested the same)?

A3.3.3: What Sectors Need Criteria Developed or Updated?

That should trigger an action item to find out how things are working, we need to be proactive as processes takes ~5 years to get the ball rolling and actually change the criteria. Are there additional factors we need to now include in the criteria. Not necessarily a monumental change, but small edits/tweaks along the way. More frequent/smaller updates as opposed to large timely changes – this overall will keep things more up to date and progressive.

All sectors could use clearer closure requirement/criteria. But they need to reflect their historical agreements (approvals, PLA dispositions, C&R Plans).

Make sure changes are science based, don't try to meet endings that aren't possible (budget) – practical, criteria needs to be reasonable ->>> landowner should be able to pick up assessment and understand information.

Multiple stakeholders; regulator in a position of forward thinking and tied to the tools at their disposal at the time; landowner, occupant, not a forever thing => other stakeholders, children of the future. So many viewpoints on who the stakeholders are, are we going to have something perfect for everything?

Upfront about how things won't be the exactly the same, will only be 'good enough' -> landowners told it will be the same again by business man but not realistic when being reclaimed by consultant.

Only set criteria is on the oil and gas side.

- Right now we only have upstream oil and gas criteria.
- OSE follow the rec criteria.

Refine criteria, 2010 criteria is a good tool to measure success but it does need to be refined. But tool is only as good as long as you understand your end point.

- Justification and variances: even within the regulator - this is what we are accepting and this is what we are not, can depend on which AER employee you get.

Forested criteria is helpful because it offers flexibility, need to consider the common practice at the time that a site was construction or abandoned and then we re-evaluate our criteria for best practice.

Peatland criteria are an issue.

- You need to have a hand lens to identify the species.
- Wetland restoration or reclamation; peatland rec criteria.

Generally, most sectors that disturb soil should have some criteria – potentially though mining should stay in its own stream (EPEA approval process).

2010 reclamation criteria spread to solar, wind, etc. Does it matter what disturbance is for? OSE wells, geo-tech wells -> from the air cannot distinguish the difference but they have completely different standards. Reclamation goals should be the same no matter the disturbance.

Mining, plants, renewable energy (solar panels, windmills).

How do you determine if a mine or renewable energy operation is being reclaimed right as there is no criteria or guidance to follow.

Brown fields (land that is not ag or forest, something like land in a city)

- Currently there are issues with it being sold.

Pits and mines don't have enough criteria (different from oil and gas).

Borrow pits, sand, and gravel pits = many disturbance types – why should we have separate criteria for all of these very similar disturbance types?

Need to have a balance on criteria.

Are there jurisdictions that regulate on a federal level with one set of criteria (vs. regional criteria)?

Should we have construction criteria to help us get closure?

There could be opportunity for greater consolidation amongst more industries.

AER regulates all the energy streams – we haven't seen any rec certs.

Pipelines in BC is one area that is missed and other infrastructure is not addressed yet.

A3.3.4: *Process and Decision-makers*

Can be a fear to talk to the regulators if they were to make you do more than originally thought.

- Should talk to the AER about potential issues before final decisions are made but there is often a disconnect and they will not always give a clear response.
- Regulators do not want to have to make plans for consultants, should be the other way around.

Should the AER have better info for risk-based closure?

- General idea is yes, there should be a group of people that you can call and discuss these issues. landowner should be involved and need this explained to. Cannot use the 'big words' during landowner meetings.

PLA when the pipeline is removed. But it is going into development and so it has no surface reclamation.

How does the potential bias of not wanting industry to operate impact ability to get closure achieved?

Is it appropriate to certify sites after only 2 years?

Prior to 2003, there used to be an inquiry for all sites. Post-2003 moved to criteria-based assessments and 25-year liability period.

Regulators need to use technology to help screen the submissions – support the audit.

- Do we have the audit anymore?
- I don't think I have ever seen an auditor check the soils?

For IOG sites, they do an inquiry, and they can then veto it if it does not meet the expectations. One time when with a local representative, they looked at 7 to 8 sites, one representative was pissed off as agricultural land was not acceptable. Good to speak to local folks. Closure is only realized at an equivalent of an inquiry.

- It took 60 to 80 years to get to where we are. There is not the resources there to go back to onsite inquiries.

Closure can be being prevented by having active facilities onsite. For example, a plant still being active because of one water injection well is still operating.

- Large backlog of facilities being still one site after abandonment. It has been addressed but is slowly going.

EPA regulated, too long a timeline so they don't apply.

Lack of true link between abandonment and reclamation requirements. No set time from time abandonment happens to when rec has to start (No timeline). Where there is timeline between suspension and abandonment.

Linear, exploration, transmission, more accepting of remote sensing.

Subset approach, break up assessment.

A3.3.5: *Role of Professionals*

Industry uses young professionals to assess sites,

- For younger staff, the criteria is more black and white,
- Don't see the big picture as much as experienced professionals,

Can't have a junior make a decision on the trajectory of the site,

- Need a more senior person to declare responsibility for the site,
- Have the same issue with junior staff at regulators being too stringent,

Should be able to have closure for a site based on our prof judgment if the vegetation is fine.

Professional considerations – why pay for a professional association if we are not using?

- We need the professional associations to act as a backstop to balance what passes criteria in a strict sense vs what we are comfortable signing off on as a professional.
- How do we judge/determine if PROs are doing the job they were assigned?

BC said the third-party professionals were not effective.

- BC assumed this model, relying on third part accreditation, read that.
- Auditor general report in Alberta has flagged this.

How do we focus on experts, what is a good enough solution?

A3.3.6: *Criteria for Large Approved Sites*

Very defined process for upstream oil and gas. Criteria work on very defined disturbances. For very large sites, comparing with off site doesn't really work. Impacts of mining can require a full impact assessment. Need to design the reclamation that is unique. Engineers, hydrologists, etc. all need to define the outcome. The regulator, operator, stakeholders can all get involved and agree on the objectives. Not aware of any full mines that have been fully certified.

- How do we ensure old approval conditions are honoured at certification?
- There have been portions of mines that have been certified. These met objectives in the approvals.
- In the mine site it is hard to understand the approval rules. This can not be very well-defined. You can have many other issues surface water, erosion, etc.
- Approval could be used to make exceptions / be flexible with criteria.
- Expiry on approvals; re-negotiate.
 - Longer term liability period for approval; 25 years post-closure liability.
- Don't throw everything under old approvals / contracts -> should be held to the current best practices.
- EPEA approvals should be an ever-changing document, consistently being updated with best practices.

Contract based on EPEA operating approval, that's all you have to do, don't have to meet 2010 criteria.

- DISAGREE – EPEA approval keep criteria in mind while giving specific goals, EPEA approval has end goal in mind.
- When failing veg -> correlate to soils.
- If we don't include criteria in EPEA, they could go around parameters.
- Can't apply criteria backwards -> vague approvals "duty to reclaim"; disagreements between operator and regulator.
- So, need to go back to front.
- Government should be recognizing that reclamation is not perfect, how these contracts go may not be clear to the public. Old contracts -> not using best practices.

Need early engagement and stakeholder involvement and documentation on it to make sure that it will get approved in the end. Big EIAs etc., require a conceptual plan and stability, etc.

Need ecosystems you are targeting, etc. Within the operation period need to reference that. If you push too far out of scope – pushing it beyond what was done. No mine closure looks exactly what you think. Need to update plan regularly. Need third parties to achieve different outcomes. Large disturbances are tricky to achieve closure. Coal mines west of Edmonton are easier than public lands with lots of stakeholders.

Some are saying the criteria was not working for class 1.

Challenges in forested areas where the topsoil is thin. Larger wellsites should have stricter rules for their reclamation. Large pads for OSEs have to do predisturbance assessments. The trigger depends if the site required an EIA. Depends on the production. If it had an EIA, it falls under the approval. May just have a well licence if smaller.

How can criteria incorporate the upfront commitments in the conservation and reclamation plans and/or requirements in the EPEA approvals/registrations?

- RC variance may help get pre-approval.
- SMLs get worked in. Pre-approved plans.
- Need a goal post that isn't always moving -> makes trust difficult between operator and regulator.

Need to consider big milestones. When did approvals start requiring topsoil salvage, subsoil salvage, pre-disturbance land uses, native species and then set time periods/milestones could be generated for the criteria. These milestones change what is expected for MRD and vegetation.

A3.3.7: Indigenous Perspective

Last update of rec criteria there was no consultation with the indigenous community.

More request from Indigenous communities.

Blueberry supreme court decision relates to cumulative impacts on indigenous lands. May need more consideration.

A3.4: Monitoring Pre- and Post-Certification

How long should reclamation monitoring occur before certification is awarded?

Long-term restoration success measure – do we need to include long term monitoring?

Need some long-term monitoring programs for a variety of disturbance types post-closure for benchmarking and continuous improvement.

Once the final stage of reclamation is complete, how long do we monitor? How long does it take a forest to grow? How do we measure the trajectory of the land use?

Lost opportunity to understand plant community processes with rec certs and future monitoring.

There is opportunity to do post certification monitoring. There is a gap in the policy. It is a crown and industry obligation.

- Monitoring should be a shared responsibility.
- Long-term restoration success measure – do we need to include long term monitoring?

From a business standpoint it may not be feasible to monitor the site for way longer.

Progressive reclamation requires long term, post-closure monitoring and measurement.

Monitoring during closure and final rec cert.

Passive and active monitoring program. When that dig is done, we risk-rank it, move it into passive monitoring for low risk.

Long term monitoring for wellsites don't make sense for vegetation.

Long term monitoring on remediation side, yes it makes sense.

We are not sure if sites will have full success in a forest as it can take 14 years of monitoring to confirm.

There have been projects to study post-closure conditions:

- NAIT, Narwhal study, etc. All the Narwhal article sites were under the previous requirements.
- There is a paper on this topic – NAIT and U of A involved in this study.
- Need to repeat the studies based on 2010 criteria vs. old ones.

Perhaps there needs to be a longer-term monitoring period above the initial responsibility of current framework.

Rec criteria at different timeframes to continue to watch the site. Need research into the long-term data from the old criteria to use the data to inform companies that were closed.

A3.5: *Improving Communication and Awareness*

Communication is key with all stakeholders to manage expectations. Use understandable language, public needs to understand what we are assessing.

Do our stakeholders understand closure? I don't know, some do and some don't.

Needs to be better information available about what the AER/AIA does and how they can help the LOs. More representation is needed.

- Should that be on the producers or on the government.
- Can be seen a bias because the AER and industry is so close.

BC has the 'farmers information service' is 3rd party and kind of like OneStop for landowners. Helps the contact the right people to help them address their concerns.

Average person does not really know about the rec/rem industry and that industry does clean up their wells.

Try to make the public aware of the environmental work industry does do.

It's a complex topic – we need to do a better job of streamlining it and communicating it. There is lots of misinformation out there in media interviews. This is because our system is too convoluted currently.

Should also promote how good our standards are internationally. Canada does very good compared to other countries.

Help talk about env clean up instead of just focusing on emissions in ESG reports. Other things like reusing wastewater should also be included.

Public perspective what information is accessed and how people see it. They only see media, i.e., number of liability/abandoned wells in Alberta not what is being done.

Public knows liability and media reports saying oil and gas will be done in 40 years. Concern...

Landowners are not always willing to sign off because they don't understand the technical content.

- Maybe policy can outline a simplification of the criteria for the landowner.

Oil & Gas don't publicize what they are doing, keep it very quiet.

Public knows about minimum spend but don't know a lot of companies are not meeting those goals.

Public needs to see reduction in number and that sites are being cleaned up.

Public is right to have a distrust because we are not doing what we are saying.

Is BC approach the right way? Only way public companies want to spend money is by a regulatory requirement with teeth.

Need to drive more transparency; it is very complicated.

AER OneStop makes it challenging for the landowners to see everything.

We are not the people using it for future generations.

End land user needs to understand their liability.

Landowners need clear expectations on what they are signing off.

Need to be simpler (not everyone is a P.Ag. or P.Biol.).

Open house.

Townhalls/info sessions are not always attended.

How do we address past-negative landowner experiences?

Need to bring landowners to the point of understanding what we are doing and WHY!

We need to try to do all we can to get buy in.

Come to their level to help them to understand.

Maybe we need to teach what “closure” is at schools.

- We need to do education and industries (aggregate, oil and gas, etc.) needs to advocate to have this in our curriculums.

How do we bring in the landowners into the conversation.

A challenge is that there is a lot of knowledge in reclamation that is not known by all. Difficult for new practitioners to enter the industry and gain sufficient knowledge to be successful.

Mix of grandfathering, discussions and sharing this approach. Fragmented and siloed on moving, current day criteria, fragility, lessons learned. Hoping we can share all the information better and really informed. Better voice and interaction with the government.

Better communication between regulators.

Landowners – closure is losing the lease payment. Closure is *get off my land*.

Landowners do not understand when the liability ends.

One example is a signed letter that the oil and gas company is still accountable.

Send them a fact sheet, but once with the OneStop they don't.

We bring the landowner guides from the AER and provide them.

What happens after the 25-year surface liability and communicating to landowners and giving them the assurance on what closure is and who pays.

Better communication and fine tune the process.

Disconnect between the parties that plan the project and the people that clean up the project. Cost changes things, and some costs are deferred from the start of the project to the end.

Also, better communication with landowners about the steps and what was found. For example:

- They don't understand why you have to rip it up if it seems to be growing.
- Unseeable contamination (Chlorides).

A3.6: *Closure Implications*

Impact to landowners can be significant when multiple wells are certified at once as they lose massive income they expect/count on. They push back more then when only 1 or 2 are done. Or they may not farm area to try and keep payments longer.

On producer side one contaminated site may be the same liability as another clean site.

Regulatory liability if too lenient problems may arise down the road causing problems for the crown.

Closure doesn't just end when the client is finished, it goes far beyond that to total return. It's argued the closure period should extend a little further than it is now (who pays for that if additional work needs to be done and the client has already been able to walk away?)

Hard to hold an operator responsible for the work done in the past as it was up to standard at the time of the project.

How do you build a system that incorporates the ever-changing criteria and standards, should we have to go back and make changes to work already done to create closure?

A3.7: *Post-closure Care*

What is "post closure"?

How is it defined and what long term monitoring is required?

How does monitoring and post-closure get defined?

Are we aware of what are the requirements in other jurisdictions?

- How do we get regulators sharing across their jurisdictions?

Landfills and linear disturbance have defined timelines (1, 3, 5 years).

- Final cap on a landfill starts the closure monitoring period.

Certification of restoration, post-closure care programs, risk-based site.

Perfect sense of pipeline and transmission line. Contamination takes us into other areas but hopefully we risk-rank them. Best indicators is the vegetation, more trust is the vegetation.

Post-closure for gas migration, then it would mean that you could go back in.

Reclamation and rem, and abandoned is entirely different.

Management would still look at as a liability as long there is outstanding liability.

Post closure concept is most suitable to those that have a risk. More around the remediation components. Post closure method, for remediation may be better (e.g., burying F2-F4).

Definition can vary from the technical, but manager will think of the lifetime solvency.

Never get rec cert.

A3.8: *Other*

Large pad in one location versus multiple small pads – what is better?

Going back and delineated by chlorides slightly exceeded.

BC has more risk tolerance.

Certification criteria can release some of the liability, so can contribute to closure.

Some kind of requirements or incentive helps industry do more env work.

- ‘The right thing to do’ does not help cons get budgets.
- BC requires minimum spends.
 - Alberta should do something similar.
 - Should we add decreasing liability as we do rec/rem to help incentivize doing rec/rem?
Yes, other provinces do something like this.
- Definitely once you are in the veg mgmt. stage.
- BC is site-based while other provinces are generally spend-based.
- Look at other provinces and see if there are things we can learn to help increase env clean up.
- Downhole work is the faster and easiest way to spend money so Alberta companies tend to focus on that as it is better ‘bang for your buck.’

The one stop emphasis, is focus on the stop. Finally set down.

No validation, that accepted.

APPENDIX 4: Best Practices Session Notes

A4.1: *Best Practice Definition*

Frustrating term, who decides what it is?

Should we even have them?

- Yes, the bar has to be somewhere. They're not a regulation so its nice to follow, but every site has to be interpreted differently. Hopefully developed by someone who can has looked into industry and other stakeholders.

Best practice is the industry preferred/expected standard.

Proven recommended practices to achieve an appropriate land outcome.

Best practice is how you meet and achieve the guidelines.

Safest, most efficient way to get things done.

Best way to do something.

Best proven way to achieve the desired outcome.

A method that is proven and has backing to it – general agreement if you asked across your peer group, something to define what effective or efficient means.

Best practice is a standardized and recognized standard to achieve an end goal.

Best practice is an industry recognized standard to get to closure.

Best practice is the preferred way to complete a goal which can not always be followed (i.e., deadline vs. season).

The most effective and efficient method to execute a practice or whatever we want it to be.

Should be the most effective technique for that practice, fed into by research and knowledge. Usually specific to the disturbance type and subregion. Usually focussed on an ecological component (e.g., soil, veg, wetlands, weeds, etc.).

Meets or exceeds regulatory expectations but it may not fit the criteria.

Standard, as a minimum, way to do something.

Most effective and efficient method to complete a task.

- PROVEN methods.

Achieve endpoints in the most cost-effective manner that is defensible.

The best practice is the method = criteria is the end point that you are evaluating success.

Do something that is different (not industry standard) because it gets you there. Industry standard, safe and compliant but the BP gets you to the indicator/desired outcome faster, cheaper and better the older practice it is replacing.

This is the general way, with experience you will be able to change it a bit here or there.

Using proven technologies or innovations.

Best practices are management practices (toolbox), and the person on site decides how to apply them.

Should be a combination of following guidelines and experience.

Should it be more of a standardized approach?

Individual to each site. Look at the site as a whole vs. what do the guidelines say, does not cover all sites all the time.

Changes all the time.

BPs can work for remediation and assessment; it doesn't work so well for reclamation.

AER is using a check box.

Different industries have different best practices. Forestry operators are able to roughen it and they create microsites for this.

Do we think one company can reclaim better than another company?

- Some hire companies to reclaim sites – you may ask why do it a certain way.
- Some have more experience in a particular area.
- If another company has a better way to do it, what do they do?
- Everyone is doing it a little bit different.

Most of the time is how you strip it originally versus in the end.

A Phase 1 – do a soil DSA at the beginning. Do that during the Phase 1. Develop a rec plan during the Phase 1.

Standard operating guidelines. It is not right or wrong.

Do they have an SOP for reclaiming an ag site. They have SOPs for Phase 1s, Phase 2s, ag site, etc.

Every site is different though.

The ones that are successful may do better.

You can still have some juniors who don't understand back end.

- That is still happening but not as much.

All information for how consultants are performing is in OneStop. You can see the trends.

There are so many things for earthworks that it is very difficult to make an SOP for this. You can have an SOP for components.

A4.1.1: Drivers for Best Practice Development

Best practices may be tied to professional designations, individual companies.

BPs need to be goal/objective driven.

Driven by proven results.

BPs need to be driven by guidelines.

Understanding of how much the cost saving can drive.

A4.1.2: Considerations

Should be results-based and meet your objective but there can be different ways to get to it.

- Best practice; understanding the context of your work and what will best help you reach your end goal.
- How are we applying best practices? For example, mounding, some people don't understand the purpose. Is it for erosion control? Sediment control? => need to be specific if codifying a best practice.

Should span from cradle to grave of the project.

Should expect continuous improvement vs. 100% compliance.

We are professionals and work with individuals and gov to build criteria to give us an end goal and we should try to meet it considering experience and academia. Should be legislatively driven, based on industry experience.

The bar is the regulation, typically pretty low bar. Below that is best practices for particular environments.

Needs to consider effectiveness vs. cost-effectiveness.

- Should be timely and cost effective.
- Discrepancy between cost effective and what is truly cost effective.
- Who decides what is cost effective.
- Cost effective today, but a bad job will cost more.

Best practices should be simple. For example, in construction you can work those soils wet, but not in reclamation or you ruin them.

Needs to balance prescriptive vs. over prescriptive.

- Can be dangerous if it is too prescriptive. Need to make sure it is still results-based and based on prof judgment.
- Can't be so prescribed that they are not feasible and economic.

Not just doing something because it's the way it has always been done.

Best practices should also be flexible – meet multiple objectives and it is repeatable.

Recognize that best practices may not fit every situation – it may be a good starting point but recognizing that it may not fit all situations (requires thinking about what you are doing). Best practice is the starting point.

Over arching best practices, or sector specific?

BPs change with different stakeholder perspectives.

A BP is only good as what you know today; the best of what is currently known.

There is more than one way to do it well. It is important to recognize different approaches.

It is difficult to develop these types of guidance.

If a best practice cannot be achieved, is it a best practice?

How does the necessity come into the best practices.

As a professional, you are obligated to follow them.

Needs to address a specific problem and be able to change as new information and experience is gathered.

Objectives vs. the destination. Currently it does not matter how you did it as long as it meets criteria at the end.

BPs allow for inspection.

Some industries need direct guidelines, but reclamation is more flexible and each scenario requires more context and depends on who is interpreting them.

- For example, BC has guidelines, but don't tell you how to get there. Don't prescribe certain methodologies. BC provide guidelines and support but do not tell you what to do, not your consultant.

Does ownership matter? No all should be the same.

Landownership – doesn't matter who owns the land.

Land use should change the best practices.

Needs to be changed based on the land use.

Land use – grassland, vs. forested need to be different.

Some similarities but different based on the material type.

Not who creates the disturbance or the same for every sector.

Access roads can be tricky – might have all of the topsoil in just one spot.

Best practices would need to be really sector specific, region specific, land types

A4.1.3: Best Practice Examples

Examples including the CAPP club root document – high profile issues might warrant an industry wide document like this.

The NAIT handouts are an example of a useful tool.

If you go to forestry, they have a system for how to meet their goals.

Something that is a struggle may benefit from a best practice. Such as club root or pads in place project. These were industry driven.

Legislative seed zones (Forest Genetic Standards) is a BP.

Some disagreement on whether GoA requirements are BPs.

Progressive reclamation thrives with adaptations of the criteria.

A lot of best practices are focusing on site prep and construction.

Narrowing the gap between the site preparation/construction and the cleanup process.

A4.2: Who Decides if Something is a Best Practice?

Regulatory defines minimum standard, but best practice is consultants/industry.

Standards/policies/guidelines started out as best practices.

Best practices change by person/company.

Industry should be leading best practices.

The companies are the ones that should be deciding best practices.

Each company should develop what works for them.

Industry will drive the best practices.

These days it seems to be industry folks who are developing best practices.

Should be driven by AER.

Regulator does not want to say use this, they just want to say here are things to consider.

Should a regulator ever be determining what a best practice is?

- It should be the practitioner that is doing the work.
- Regulator should take the results of the best practices and incorporating into criteria.
- Regulator should be consulted to ensure nothing offside is being pursued.
- Regulator should be promoting best practices to drive better criteria.
 - The private operators are able to more quickly react to new technologies.
- Regulators are “a” voice at the table; bring in the SME’s from the regulator at the table.
- Slippery slope on getting the regulator involved and having them issue policy that isn’t aligned.
- Regulators may bring a different agenda.
- Bringing the regulators to the table changes people’s willingness to share and be candid.
- Bring the regulators in later stage (after brainstorming).

Professional regulatory organizations have zero interest and zero goal. Just regulate the profession (ethical).

SME's with slightly different perspectives (producers, gov, practitioner).

Should the landowner have a say in this?

Best practice and industry standard are different terms but get used the same.

- Industry standards are not best practices and are often not current.

What is the determining factor between a guideline and a BP.

Guidelines are sometimes driven by BPs. Once a BP is done by a leader, it shows it can be done. Regulators have an easier time making a supporting requirement, if it is proven that the BP works.

BPs come from subject matter experts. Research can look at those BPs and refine them.

- BPs are subjective based on which field a person is most knowledgeable in.
- How does one consultant know where the "best" soil, veg, etc. BPs can be found?

A4.2.1: Authorization of Best Practices

Should reclamation practitioners take a BP exam?

Should government tell you how to reach an outcome or just tell you the outcome? How much interference is helpful and how much is a hinderance?

They should not be codified, because then they become regulations.

If you codify a BMP does that result in no further research? Does it slow research because the requirement was set and you must do the Code (e.g., when the Directive for Problem Introduced Forages and CWG came out, grandfather and setting the requirements for what to do with introduced forages...research on reclaiming CWG seemed to stop). The problem was gone. But CWG is still spreading and damaging native grassland.

Maybe if best practices become guidebooks?

Not decided by anyone particular organization, it is collective agreement.

GRF specializes in grasslands but bring it to the collective.

Industry continues to improve or decrease.

Is this the best way, need to question. End goal an evolution.

Reviewing 2010 guidelines. Should there be a formalized process?

Evaluate based on the metric/on that PM and results to asses appropriate.

Business decision has to be practical.

Performance- vs. outcome-based feed the criteria.

Performance-based may get adopted for the unique situations.

Reclamation criteria is prescriptive.

Regulators can endorse BPs and make them more easily accessible (e.g., PTAC studies that influenced changes).

They are guidelines, not hard and fast rules.

Is it mandated for how we reclaim a site, for example two lift stripping?

- We need to meet the rec criteria. So, folks know to do two lift stripping now. They didn't always know to do this.

All standards and guidelines, would have some information.

They always have a phrase regarding the director must allow it.

BPs are not true Acts.

It is easier to enforce a criteria. To meet a best practice, it is not easy to enforce.

Something that the gov has not defined ... not a "shall", but rather a recommendation.

BC has more codified information.

This can reduce lack of quality. It could be better to codify it. So, then it could be clearer for folks what is required.

Do best practices mitigate for regulations or replace them?

As they should be frequently updated, they should not be codified.

Criteria are slow moving and hard to adjust; info letters are faster moving.

Paper guidelines not always useful for everyone.

Should not be required but be a knowledge sharing basis. By tying it to regulation, that limits the ability to make quick changes and constantly evolve.

Perhaps best practices need to be less process/procedural-based and more outcome-based.

It would be helpful to have BPs in Regulation. Two sites could be seeded to the same seed mix in 2 separate areas of Alberta, and one may receive certification while the other doesn't.

Codification would give guidelines what we should follow.

Best management practice digital and get it on the web so an AI can be used as they are inevitably needed for work in the future.

Government should regulate that best practices be shared amongst others.

A4.3: Scope

Start with the common issues. The unique sites may not be studied enough to have a defined best practice.

Best practices are more related to common issues. You can't use them for very unique special situations.

You could have for common tasks.

Scale of efficiencies, 30 sites is a simple common issue.

There are common best practices that are used all the time.

Are best practices for common issues or unique ones - we need them for both!

- Should be used for both (common and unique).

Best practices are for unique issues like pad replacement or peatland, caribou land reclamation.

Could we have a more universal one to help folks and then companies can make their own version.

Lots of grey area but should be moving towards the same endpoint.

You shouldn't have a best practice for a super complicated situation.

There are lots of issues and could be very difficult to have best practices for all site and scenarios.

Environment is so unique and diverse, but the practices overlap.

In some sectors there are not hard guidelines so it would be harder to make best practice guides.

Needs to be industry specific as each one has different end goals and issues.

Should there be better best practices for construction?

Should be a shared process with general best practices but needs to have leeway.

Rec is much more subjective compared to rem sites and that is needed.

Should also include what you should not do as well as what to do.

They could help pass knowledge to future cons and industry.

Should be treated a 'tool in the tool kit.'

Communication, approach, and practices change based on Indigenous communities and landowners.

BPs should not vary between sectors (e.g., Alberta Transportation borrow excavations vs. in-situ borrow pits).

Best practice management is developed when see a problem and come up with a way to fix it.

Best practices may be for remediation.

Many don't find reclamation best practices to be an issue.

A4.3.1: Need for Regulatory Best Practices

The government should be held to a standard to regularly update standards/regs (e.g. D58 is so out of date it is too much work to update).

Yes, they should be on a regular review cycle.

Puts more pressure on the gov to make sure the regulators are funded properly.

This would be a challenge to convince the regulator that they should do this.

There are so many government/regulatory bodies.

It is incredibly hard to make this work when it is legislation.

It seems like more of an industry based but some sharing could be good for information. Some components can be beneficial.

A4.3.2: Need for Project/Program Management Best Practices

Yes, but only for the more common projects.

Every project has similar elements in place (budget, schedule, comms plan, etc.).

Data collection in the field is fairly standardized already.

Important pieces need to be included from a project planning level.

You might get too granular on a project if you try to define it.

Project practices and safety practices are very different.

There are commonalities in what needs to be done.

Best practices and project management are different.

Communication plan can be a best practice.

Checklists for executing work could be a best practice.

Our industry is very detail oriented.

Check list is a window into whether there are underlying processes in place.

Is area based closure a BP (rec vs rem)?

- Area based closure is a BP but a different purpose.

A4.4: *How Should Best Practices be Developed?*

Do we need more standardization?

Comes back to professional evaluation – someone applied on a bunch of sites that weren't even abandoned and they suffered no repercussions.

Best practices often arise because they are good business. Where it is practical and feasible it happens.

Start with identifying a problem and use agreed upon science and experience. Should be gov lead. Using think tanks and meetings to help develop them. Needs to be a way to let others know what worked as well as what does not work.

A way we could look for BPs is to make a list of the professional judgement justifications that are being requested during the certification process. Could we mine them from OneStop?

Doing a scan amongst others to see who is doing what, how we can improve.

Focus on meeting an agreed upon goal/outcome, not the process.

Should we start by developing worst practices – look at what hasn't worked?

Can we bring new and more experienced contractors do more efficient/cost effective things in a competitive environment?

We are in a silo right now. We need a table that experts from all fields can come to. A group who will bring government, industry, and researchers together (e.g., like the Grassland Restoration Forum).

Should be a better way to ask for help and see what industry has done that worked and what has not worked.

Can you adopt practices from other industries (e.g., forestry) and between sectors?

Potentially building a broader best practice, in the sense that every site is unique and can't always thrive under similar practices.

Should be a community of practice.

Needs industry buy in but that might be tough.

Should be area- and land use-based and specific.

Each site can be so different a best practice template might not be super useful.

Possibly start by outlining all common industry issues.

Start with common ones.

Unique ones have a specific set of requirements and bring in a room of experts.

Need to involve all different stakeholders.

BPs start in the office/conferences and then are applied in the field.

The issue would be proprietary information and people not willing to share their knowledge. Some push back saying this might be a large issue.

Needs to be vetted and confirm that it works.

Needs to include academia but also field experience.

The issue is who is going to pay for this.

CLRA would be a good starting point. Could be a sub-committee with its own chair.

Should include the newer people as well not just the old people.

Should still be able to push against the guidelines to make sure they are not stagnant.

Only create so much every year, should do a few and focus on them. It will be a long process that will take time.

When codified it stale dates them and they do not evolve with the times.

The goal is to codify best management practices. Industry codifies it.

Government doesn't want to codify due to liability.

Some should be, but not all.

Capture and value experiences through discussion/sharing with other people in the industry.

Funding may influence outcome, there is a bias of what result is wanted.

BPs need to have peer review, formal and informal.

Re-evaluate sites down the road 10-15 years.

Spend time with reading the journals and keeping up with the new science.

Look outside of oil and gas.

Business competition kills sharing of best practice.

Educational institutions have some role in development, and indirectly have to teach the best practice. They are also the only ones that will fund a study that may fail.

Does the regulation come before or after the best practice?

Does best practice contribute to doing due diligence?

- Helps in situations where you may not have met your outcome (i.e. you mounded a site but it didn't turn into forest).

Best practice may allow for the direct path to get to the outcome?

Differences in how best practices are developed based on whether it becomes monetized or not.

We need to better document best practices – it sets forth precedent and what has been expected and what has worked in the past.

Best practices have come out of mistakes.

Best practices come from new people bringing new ideas out of academic training or other industries.

Stakeholder and landowners.

Innovations in equipment are leading to new best practices.

Funder is less important as long as there is accountability – though which companies develop may change how it is.

To manage safe operating procedures (SOP), it is a lot of work.

- SOP's are often accompanied by guidance documents that can be much easier updated.

Best practices need to be living, breathing documents so that they can be adjusted as new learnings emerge.

Being open to sharing processes as well as hear from other developed practices (forestry, etc.).

Look at what industry is doing in practice and the results.

Access existing data from approved plans, rec cert applications, and research results to develop BPs.

A4.4.1: Who Should be Involved?

Need AER involved to build shared outcome and have buy-in.

All the stakeholders need to be involved, not just academia.

There is no organization like CEMA where everyone can work together; it is ad hoc and informal.

The role of the professional organization should be to make the information available and when/how info should be used.

- Would a professional association be responsible for best practices? But reclamation has several different professional designations.
- Professional bodies are all so different from one another.

Collaboration – contractors are called last minute to provide a service; we have lots to offer. Our best projects are the ones where we know what is happening more generally/broadly. Bring the contractor to the table sooner! It's hard to be successful on a last-minute basis. This starts from the top down in recognizing the need. This allows us to bring different expertise to the front end of the project and utilizing that experience.

Regulators only should have to bring people together and moderate the conversation. Regulators can ask details on how something was done and then can share.

- Regulator can input good examples but should not be the owners. If they see a gap between implementation, their responsibility to push it forwards.
- Role of regulator: fill in the gaps, if you know what we're following could be useful.

A4.4.2: *Who Should Pay?*

Funding research shouldn't be a conflict of interest, no predetermined outcome, goes toward the greater good.

- Example – wildlife programs in BC funded by BC Hydro.

Depends if they are trying to push an agenda.

Best practices are always going towards some objective/challenge.

How do you avoid a “leading question” scenario?

Do you fund an impartial third party?

You can't control who funds research.

Does the research funding need to be regulated?

Resources: it may be difficult to make progress and trial/error best practices by companies as they have goals to meet and rec cert goals, so trial/erroring sites when trying to meet deadlines is tough as the time may not be realistic. There may be a need to be another resource that can do the testing and trialing without only relying on companies to do so.

Research is research, doesn't matter who pays for it. BUT public can disagree and be less accepting of results.

- Example – funded by the industry through application fees and fines.
- Research done in an annual report -> might not be seen as actual research. If research was conducted on behalf of an industry -> then would the public interpret it as tainted? Valuable research thrown away due to being beneficial to the industry?

Transparency about funding, tax payers don't want to fund the bill.

A4.4.3: *Role of Experience*

This is a vital component.

- This is another foundation of best practices.

Best practices come over time from learning experience.

- Need to value their perspective and experience.
- The best practices you develop through experience.

May include practitioners and landowners.

Best practices get developed at field level, how do we seize those up and out to share?

A4.4.4: *Role of Research and Field-testing*

Depends on what research and who you are engaging.

Applied research is different than primary/fundamental research.

- Applied research is more practical/useful (how you fundamentally apply fundamental/primary research).

Research occurs before best practices.

- Research informs and feeds into best practices.
- One of the foundations (ground floor) of the best practice, but not the only part of a best practice.

Applied research needs to be somewhat continuous.

Applied research is only specific to where it was applied. Best practices are more overarching.

Scientists speak with authority on what they know.

Best practices from research is a good starting point but not always applicable to the field by not being financially practical or other reasons.

One of the industry representatives mentioned their company has been part of the bench marking group. We have broken the province in different areas. We do share the best practices. The province is broken into different areas. All data is submitted. This information is shared. This allows us to see where we are compared with our peers. This has been on hold since COVID. SRP work is inflated and so want to clean that out and then revisit. This related to who is getting the work done most cost effectively,

There is more information available through OneStop on performance metrics.

- CAPP is helping with this.

There was also a sulfolane working group.

Sometimes it is good to have a candid discussion among industry folks. They are free to chat about these aspects.

Regulators are reviewing the information and can through that see what is happening.

A lot of research is not making it into best practices the way it should. Many researchers are not motivated to understand if their work has practical application and the importance of it.

- Academia has to take the fundamental research to applied research.

Research and academia provide practices, data, quantify.

Academia can help inform guidelines but sometimes too slow.

- You can't always wait for the research in all cases; it takes too long.

Master students have no experience to ask the right question which can create the disconnect.

Practitioners cannot translate the fine scope of the research to BP.

Research can optimize professional experience.

- Need to marry research and field experience.
- There is a disconnect between research and the outcomes.
- There is a concern that we are not building on the research that has been done. We need to use the findings.

Academic research is a good starting point, take their learnings and apply to real world situations. A practice might be expensive at the beginning, but over time become reasonable.

Research is a safer environment to try new technologies, need to do on a control scale.

Government tries out new technologies through its orphan program then shares with industry.

Want to include research in that as well, can we look at the 2010 criteria and go back and see if it was successful.

- Allow research to go to sites and see if the criteria was effective. -> this could come from the regulator, do an audit of reclamation sites and determine if they are actually making things better or if nothing has changes.
- AER should do an audit based on the 2007 criteria.
- Do a great job with checking on sites in the first few years, however that falls away further down the line and the site is off the books/doesn't get revisited. And we don't know the 10+ yr. outcome of the site.

Is there an area where we can do best practice trialing? If we can create more situations where we can trial things.

Demonstration plots.

- Alberta Innovates may not be doing demonstrations.
- Even before, they used to have those demonstration days.
- Those stopped at some point.

Test particular techniques to improve vegetation uptake – how to make it faster and better and then document these. Industry is looking for lower costs to achieve the same outcome – time is money. What is the most efficient way to achieve reclamation. That is what everyone wants.

Allow space for innovation through trial and error and failures.

A4.5: How do we Decide if a Best Practice Should be Updated/Developed?

BPs should have an expiry date.

- There should be a timeline of when they should be evaluated, make sure everything is up to date.
- Use that as an opportunity to confirm if the BP objectives are meeting performance objectives.
- We review and amend SOP every 2-3 years.

Best practices need to have expiration dates and constantly updated to make sure they are still using best knowledge and to help meet to criteria. Needs to be reviewed regularly.

- Consider new knowledge, equipment, and criteria.

Best practice questioning will be dependent on the turnaround of the site (i.e., canola field may come to an outcome faster than forested site).

Review existing BPs to look for overlap and consolidate.

- Hold a workshop to discuss what BPs are available to share (across industries/provinces).
- Look for gaps and use those to focus development.

Timeframe is important – i.e., plains restoration may take a long time to see outcomes vs. cultivated lands.

Regulations may not always tell you the best practice at the time.

Different best management practice depending on your bigger goal (speed or quality).

A4.5.1: What Best Practices Need to be Updated?

Everything. All of them. They always need to evolve.

All need to be reviewed regularly.

Industry has been challenging criteria (e.g., replace 80% soil or 20 cm or rough and loose).

A4.5.2: What Best Practices Need to be Developed?

What wouldn't benefit from having a best practice in place?

Anything with issues, should have a best practice.

Seed mixes should be more site-specific and have a best practice around it. Should be more clear what seed mixes are usable in what areas. Also need to consider native seed availability.

- Same for tree planting.
- Should be think about seed like we do about seed mixes and source the seed well in advance of when we need them, think about it 2-3 years ahead of time.
- Suitable seed mixes.
- Region specific, private vs. public land, regulation for where seed is sourced.
- Most certification is just weed free.
- Seed industry should be managed.
- AB has guidelines / zones for what should be there.
- Grassland – need seed zones to be generated. Could be an important BP to help native grassland reclamation.
- Guidelines changed, used to be green is good now native species are required.

- Maybe not guidelines, maybe just include seed suppliers in the conversation. Communication issue, seed supplier is an outsider, not a stakeholder, not being malicious just not aware.
- Native grass seed availability and quality.

Weather! We need to be proactive and put these things in our budgets.

- Maybe this is some of the work of researchers?
- How do we adjust for future drought and reclamation certification of sites?
- Anticipating the effects of climate change.
- Some sites do take a really long time to reclaim. For example special areas – is there something we can do differently. There is often no rain, what can be done to have more success? Some things we are doing don't make sense. We need to be able to pivot quickly due to weather changes.

How much time is needed to plan a job and the type of team that is needed to execute any given project.

Why are we putting out fires constantly? How do we get away from this last-minute type of process so we can plan properly?

We need to better prioritize and put value on the right things – recognizing scope changes and project creep.

Have more look-backs on projects and develop better best practices.

More soil management / mitigation planning needed for soil practices?

- BP on finding soil onsite vs. bringing in from outside.

BP for reclamation performance monitoring.

- Create a standard, industry could feel they're being taken advantage of "why isn't it done in two years? Regulator says it could be."
- Monitoring frequency and methods.
- Monitoring – vegetation, soils.
- Vegetation assessment – when to do it and what to look at. Needs to be cost effective and realistic.

Standard treatment for soil biology.

Sharing information needs a best practice.

Not that much is proprietary. What to plant, where you create your mounds, where to put the seedling. There is lots of information on this.

Each group's data set is finite.

From the industry side, there is a greater volume of information on how things should be done and what is working – big data could be documented and shared.

Landowners can affect the success, so this becomes a challenge. This can be third party interference.

Renewable energy work also needs best practices. This is critical.

- The company should reclaim the site at the end.

How to assess large disturbances.

- Need criteria for mines on how to assess.

Tree establishment on pipelines adapting.

Applying silviculture principles to activities that don't currently use them on forested land.

- Best practice -> planting trees too early, but someone else will say plant as soon as possible.

Applying BPs to other activities.

How to stratify certain woody species seed (concerns about proprietary procedures not getting shared).

Progressive reclamation, better linkages are needed.

Site preparation and construction.

Weed management.

- Consider if there is something on weeds that should be done. Linear disturbances in the north are an issue. Hydrotech can help.
- Abandonment crews can spread weeds in the north.
- Spraying weeds in the Green Area, don't want a site to fail for sow thistle. Needlessly spraying herbicide and killing desirable vegetation and freshly planted trees.
- Herbicide resistant *Kochia* spp.?

Veg management: monitoring trajectories on forested sites. There is a lot of push from industry to make veg management as inexpensive as possible. Zip into site and spray weeds. No time/budget to assess the veg.

- How do we control grasses that were seeded in the past that have now taken over (e.g., crested wheatgrass)?
- How to transition an area filled with agronomics to forested.

SST, SCARG, ROSC – can we have all the requirements be in either mg/kg or mg/L.

Rec cert assessment using remote sensing.

Reclamation of replaced wetlands.

Renewable energy operations – need some new BPs (e.g., renewables on mine sites facilities).

Review liability period; 25 years is a big warranty.

A4.5.3: Challenges to Best Practice Development and Implementation

Certain practices are becoming more standardized, and that makes the process more streamlined, however that doesn't always allow for innovation.

From a regulatory standpoint, they don't want risk. But to evolve practices and be innovative, processes need to be challenged.

If a company is doing it better, that is proprietary. This is why government needs to get involved.

A lot of historical work is not considered.

- There is a prevalent belief that older work doesn't count.
- Evolution of knowledge from the past.

How do we implement the best practices at the field level?

Sometimes need a minimum standard, but some organizations/companies are seen as doing the minimum.

- Sometimes people are trying to shave corners and it can be a mess.

Good construction is the most important. There is no regulated professional for construction. This is a problem. They are not held to an ethical standard. This would be interesting to look at.

Price of oil can affect how the things are done. But they are not rocking the BP when the prices are high either.

Concern that BPs are implemented based on AER inspector's personal opinion.

Concern that there are regional differences between decision makers.

Current issues with needing to follow forested criteria for grazing leases when the lease holder would rather it just be pasture.

Too variable, trying out to see what works with who but it should be specified. Rec Cert Variances is something that they're trying.

- Hopefully becoming more consistent in responses. The person in charge of reviewing it has the knowledge and experience, up to date with new innovation.
- Disagreements between reviewers, what can be accepted and what cannot.

A4.6: Education / Training / Knowledge Sharing

Lots of people doing reclamation work who perhaps aren't familiar in the industry, could use best practice as a guide.

- Best practices good to use as guides for those unfamiliar with managing complexities of reclamation plan.
- Can help industry (especially new people) and equipment operators do a better job.
- Can really help train people and give them a base starting point.

- There is a need to pass on that knowledge to new practitioners.
- Not enough to just be given a best practices guide and being told to do it, still need supervisor training and experience.
- How do we translate best practices to new workers? Noted that this is where there is a potential need to have more common content and knowledge available for newer people entering the industry?
- Need more mentoring of junior staff.

We need to share learnings.

We need not be afraid to share our best practices with others – we shouldn't be scared of losing work by sharing it with the rest of industry.

- Communication can be inhibited by competition between industry players. Knowledge sharing would help push the industry forward and better serve the industry.

Many companies have standard operating procedures – new people may struggle to find them as new individuals getting started. There are some entities that have interest in putting them out there (CLRA, NAIT).

- Should there be a common set of best practices in a single location for new people entering industry? Likely would be challenges with disagreement on them, liability associated with them.

There probably is a place to put together enough commonality in best practices – however it is constrained by time and money. It might give us a common framework. Some thought that we don't necessarily need this as individual companies have SOPs.

Should be introduced in post-secondary education to help new people.

Communication needs to go back to the construction people; how we can all work together.

It is good to document it. It is good to hear. It is validating. They may say they are already doing something, but it is a big industry.

Communication is key, certain there is a lot of other methods elsewhere but we don't know.

- No one knew about the PTAC variance guide. No one new about Change in Land Use directive on public lands.
- Very low awareness of public land clauses, progressive reclamation requirements were unknown for wellsites on public lands.

Anything published in the last 4 years, awareness was extremely low.

CCLM help for GoA.

CLRA policy presentation/training – Policy overview by activity type and land use type.

Best practices should be more easily transferrable between industries, and shared internally/externally and between sectors through things such as conferences etc.

Central websites.

Continuous learning.

Potential culture shift as companies may not always want to share everything and hesitant to share failures. This is a roadblock to change/innovation and sharing ideas. Keeping an open conversation would be a positive way to share ideas/make better practices.

Who should be the one to house all this information and keep it updated? Who is responsible for that – and who's paying for that.

- You need somewhere that you house this information.
- Where is the best place to house this info that is accessible to everyone that requires it. Potentially conference based, such as CLRA.
- Needs something that has stay power, and won't die out due to lack of funding/maintenance. AbaData for example, started as a small group and now is widely used and contains so much useful information. And that is based on a subscription service to maintain funds. Perhaps a function similar to that for a database of best practices is necessary to bridge the gap of information between parties.
- Alberta Data Partnership has broad funding and longevity.
- Regulators should have a web page for a source of the practices. House the best practices, showcase successful practices.

Sharing practices, sometimes practices only are shared when the outcome is successful. It's equally important to share what fails, as what may not have worked for one area, may work better in another area.

Is more research into BPs needed or is the knowledge already out there and we just don't know where to find it? Example: CRIN – Clean Resource Innovation Network.

- Need a workshop to discuss what BPs are available across all sectors and provinces. Look for gaps, similarities, applicability to Alberta setting.
- No time for more research with the speed industry is going. Let's lean on subject matter experts (the grey haired) to record their knowledge. But how do we distribute that knowledge?
- BPs get lost across sectors and there is lots of overlap – need to pull them together (e.g., COSIA, companies, AER, CEMA).

Are senior reclamation practitioners joining juniors in the field to share their knowledge? How does a junior know what to look for when trying to find topsoil on wellsite that was constructed prior to 1994?

Best practices should be shared within the industry to help others. Exists more in oil sands but much less in conventional oil and gas and mining. Does not always transfer between sectors.

Help organize revision of practices.

Organize new workshops.

Send out information letters with updates/changes.

Not necessary for one body to hold the information.

Information loss is a concern.

A4.7: *Other*

There is a challenge with liability management in that folks are spending funds on abandonment but not the next steps.

Maybe milestone invoicing to OWA.

There is a lot of money on the front end and not so much on the back end for reclamation.

This first budget to get cut is the environmental budget.

Real estate developers don't have any standards. That is not okay, some salvage some don't?!

APPENDIX 5: Sharing Learnings Session Notes

What are learnings? Knowledge over time, failures, knowledge based on failures is harder to share. Efficiency of operations.

- How we move our site forward

Have an open safe space for the sharing of information in this line of work is critical – this room is filled with an encyclopedia of knowledge, it's really important that we have this safe place to evolve and share experiences. We need to bring young people here too and feel free to get engaged and participate.

A5.1: *Common Issues*

A5.1.1: *Sectors*

Lots of overlap between all the industries (O&G, and mining).

- Mining/oil gas/forestry
- Regional based industries – forestry's, mining, oil and gas, transmission, renewables.
- Borrow pits are common across (Alberta Transportation, oil and gas, mining, etc.).
- At the utilities, they use things from oil and gas on the utilities side.
- Transferable learnings, could take something from pipelining, could come back at it and see what worked in that situation.
- Forested – forestry and industrial activities.
- Ag lands – applying farming knowledge.
- Seismic to pipeline right ways and other linear structures.

We assume the sectors differ much more than they do, sometimes the biggest difference is the scale of the project, but the practices and principles are more or less the same.

- Yes, the scale changes between sectors but the practices should be relatively the same.

Sharing with sectors outside “reclamation”.

- Forestry, agriculture, urban.
- Agricultural producers better practices from Ag Fieldman counties.

Mining is about handling larger disturbance and forestry focuses on minimal soil disturbance.

O&G is generally in the middle.

- Large scale vs. small scale applying the learnings across.
- Severity and scale of the disturbance

Construction

- May be issues with knowledge on the construction side.
- What guidelines exist for construction and should there be more regulation for them?
Generally, yes.
- Rec needs to show and educate construction about what we are doing to help them help us when they cause the initial disturbance. Can save rec time and money in the long run.

Any and all learnings that are located in the same land type.

Trying to better streamline the science of reclamation amongst different sectors (how do we better learn from each other).

Relates to the best management discussion. Need to make sure everything is done properly at each step for the project.

Learnings link back to closure, bringing sites to equivalent land capability or the new agreed-upon land end use.

Any thing that creates a disturbance to the soil and requires reclamation.

- Any one with land restoration.

A5.1.2: Subjects / Topics

Learnings should be common when it comes to soil practices, hydrological practices etc. regardless of disturbance type.

Are the common goals the same, site closure, are they the same? If you are planting a tree at a mine site or an oil and gas site, it is the same.

Each industry deals with soil salvage, erosion, vegetation establishment.

Soil handling can be shared across industries.

Site preparation – mounding and cross ripping, forestry to oil and gas.

Soil and vegetation.

Growing grass/other vegetation.

Native grasslands – range agronomists applying their knowledge to reclamation.

A5.2: Unique Issues

Sterile soil from mining and Big Valley oil and gas soil.

Share with agriculture, farmers, ranchers, transport (highway build).

How we restore, revegetation, landscape, etc.

The disturbance type might change industry-to-industry.

Issues with the stakeholders (regulatory, First Nations, landowners).

Differences:

- Upstream, mining, coring, green energy, etc.
- Dependent on the type of disturbance.

Type of contamination.

Remediated closure (beneath the ground) is different, but reclamation is different and driven by end land use.

Ecosite types (geographic).

A5.3: *Drivers for Sharing*

The requirement is escalating. There is getting to be insufficient qualified people.

Regulation is driving this. We don't have the people to do the work.

A5.4: *Existing Sharing Mechanisms*

A5.4.1: *Content*

CCLM – through InnoTech, it's a document sharing.

We have OneStop with decision on variances but we need to be have that available for us to use.

- How to fill out the info and what field data they need to accept or reject the decision.
- Variance requests should be available across the industry to help other with know what is and what is not allowed.

Look up what other organizations covered in their past conferences, need to know they exist.

Best practices (e.g., Forestry BP shared from peatlands).

A5.4.2: *Methods*

Google ... but information is not easy to find.

Webinars.

Field tour – what works well.

Session like this.

Lots of word of mouth.

- Lots of unofficial knowledge transfer helping?

Different companies are using the same contractors – those contractors bring knowledge from different company partners.

Lots of discussions within industry (but not necessarily with consultants where competition starts to become an issue). There could be 50 producers within 10 km of each other – all facing the same issues.

Reaching out to other industry groups (bio, forestry, etc.) at workshops such as today.

Creating relationships between industry sectors and creating bonds and common ground – a challenge of this may be finding the common ground. For example, inviting a forestry person to CLRA may not be in their best interest as it is not broad enough and mainly focuses on oil and gas sectors. What is the incentive to get the industries to mingle. Must be relevant to other sectors, and how to open it up to appeal to other industries.

Instead of meeting with industry crowd also pay attention to what conservation groups are doing. Also need them to come into industry meetings.

- Merging the ecologists with the reclamation practitioners.

Having the correct people talking (right hand to the left hand).

A5.4.3: Organizational / Professional

Secondment.

Mentorship.

- Mentorship – need more formal mentoring programs

Working outside of your area of comfort or in areas that you normally don't work in. Cross train and work in other sectors.

Learn on job through experience of different contractors.

Continuing competence credits for professional regulations (AIA).

A5.4.4: Sharing Examples

Oilsands do a really good job – help new people transition into the industry because they have done lots in information sharing and best practices. 6 major oil sands companies coming together. Could do a better job of sharing outside of their groups - can be hard to find their information. Could be shared and advertised better.

Forestry industry shares best practices well within them but not necessarily across.

Benchmarking (company) – share downhole, pipeline and reclamation costs with other companies that conglomeration of 15 companies, share information and share costs. Knowledge sharing within that group.

In oil sands – Highway 881 meeting; not necessarily about reclamation but about different learnings that are coming out of operations.

A5.4.5: Sharing Organizations

EPA / AER push notifications of updates.

COSIA and CAPP.

CRIN

GRF (Grassland restoration)

- Grassland restoration forum

SALMTECH seminars and lunch learns goes across all industries, fisheries, caribou.

Alberta Innovates.

Organizations similar to CLRA, where people can get together and share ideas and improve collaboration.

A5.5: *Barriers to Sharing*

Difficult to share knowledge.

A5.5.1: *Structural Barriers*

No organization that can bridge between sectors.

- Lots of different guidelines for each industry and may not be well known if you are working in a different industry.
- Doesn't seem to be as much sharing across sectors – missed opportunities.
- Maybe a role for CLRA?
- Need to make CLRA relevant to other (non-oil and gas) sectors.

Need someone to manage, collect, and distribute the information.

A5.5.2: *Non-structural Barriers*

Time to invest in new learnings.

- No time read existing info.
- Not paid to read info.
- May be less willing to share mistakes and what did not work.
- Wish information was easier to get to – it turns into a research afternoon. Lots comes out of the US.
- Time, busy people don't take the time to share and communicate.

To get a conference approved is difficult.

- Any conference requires vice-president approval for some organizations.
- Can be difficult to get out to the classroom for people / practitioners that are field based.

Cost.

- Out of province travel for GoA is a challenge – need to convince management this is important.
- There are cost constraints to doing training activities.
- Profit, who will pay for others to share their learnings?
- CLRA field tour was put on hold due to economics.
- Some people are paying for their own attendance at the conference.
- Budgets + academia => more plans, vs. more corporate less research => less innovation.
- Coal never had as much money as oil.

Proprietary information / Competitive advantage.

- Proprietary information and unwillingness to share information that may impact contracts. Can give someone a competitive edge if they keep it a secret.
- Might have to be more industry driven than consultant driven then.
- Proprietary information is a big barrier.
- Competitive advantage.
- Desire to protect intellectual property.
- Desire to protect competitive advantage.
- Competitive edge/business aspect is a barrier, some ideas don't want to be shared around that could devalue the "competitive edge", why would you want to give that away?
- Competition aspect -> not wanting to share, operators could work in silos -> different environments, don't have the opportunity to meet with one another to share knowledge. Where are we seeing representatives? How can we build bridges to other sectors to share knowledge.
- Landscape has become competitive, learnings are not being shared. Used to be presentations of papers, they needed to be published, with references, details, higher level of scrutiny.
- Its in everyone's best interest to share information and data. The barrier is businesses not wanting to give the information and lose competitive edge, this makes people hesitant to share, and discourages the sharing of information. This also may change with the times, in a time where there is lots of work to go around, this may not be as prominent of an issue.
 - But in a scenario when work is less busy, people may want to keep the knowledge more closely to themselves to keep that edge. Scarcity mindset is a big roadblock for sharing knowledge and innovation.
- Work with different consulting companies, so they compete and don't share.

Language.

Geography.

- There is a gap in sharing resources across BC and Saskatchewan and Alberta.
- Western Canada is nature and farming focused.

Cross-sector

- Not equal amongst sectors, some have had more research done, some have collaboration groups (e.g., coal vs oil and gas). Learnings are fragmented amongst sectors, disproportionate. Different base knowledge in different sectors. Some sectors more community focused compared to provincial or international.
- Less sharing in mining sector compared to oil and gas; also depends what gets more public attention.
- Disparity of learnings between sectors, not common because various sectors don't have the money to share them. Learnings should be common when it comes to soil practices, hydrological practices etc. regardless of disturbance type.
- We need to learn how to share across – forestry.
- It can be hard to share learnings across industries at time due to different goals (forestry = grow trees, oil and gas = closure, renewables = nobody knows yet).

Presentations

- Conferences/presentations aren't recorded or shared beyond the actual event. Finding a way to share the knowledge beyond these events.
- Talks present the end result, not the learnings along the way. Perhaps present long-term projects while working on it, can present issues and learnings along the way instead of just focusing on the end goal.

Technical

- Another potential barrier is knowledge gaps in chlorides, peatlands (regulatory gap in peatland classification and aerial assessment).

Research and teaching.

- It can be a challenge to get academic groups involved as they don't have the background on the details.
- Educational institute may come but they may not know about it.
- They should know about the conference.
- But sometimes best management practices are not shared with students.
- They may not learn about the details of how to do reclamation.
- Instructors should attend conferences and make an effort. Quite often they may not be interested.
- Lack of real interest in sharing their learnings also from academia. Willingness to think beyond the academia published paper.

Lots of intermediates, gap in training and mentorship.

Pace of evolution of technical growth.

A5.5.3: *Cultural / Regulatory Barriers*

Don't want to share negative outcomes.

- People are very willing to share their wins, but not their mistakes and failures. This prevents us from benefiting from our mistakes -> multiple companies making the same mistakes.
- Publish negative results so that we can learn from them.
- Very rarely regulator admits they made a mistake; collaboration required. Difficulty communicating with the regulator, can't establish a relationship.

Social media comes into play taking things out of context and blowing things out of proportion. Lots of misinformation. => Add reclamation processes and information into the education system to better understand what industries do.

Public's lack of awareness about our field which impacts our valuable contributions at federal and provincial levels decisions.

Older data and researched disregarded because age, even though its valuable data.

- Big failure: lack of data management and content management. Reclamation data from 80's and 90's massive records have been thrown away.
- We need to capture and make accessible historical information.

So much transformation in digital systems, are we carrying everything over?

- Need to hold onto records, approvals, licenses, need proof.

Ego gets in the way.

Culture.

- Corporate cultures.
- Cultural shift, need to reconnect again to find opportunities to collaborate.
- Government and industry haven't been great at sharing good news.
- Different knowledge base and different mentality on how to do things among stakeholders.

There is a gap with AIA – used to do a lot of webinars and relevant content but this is disappearing as they refocus their mandate.

GOA Field offices are not aware of the change of policy. Not shared.

Moving goalposts – changes the outcome of sites.

- Changing expectations is a big barrier to sharing.

Government is slow at change so we can't only rely on this for change.

- Practices are changing faster than regulations.

Risk aversion is a barrier. Can't be afraid to fail, or else we don't get anything done.

- Regulators have been branded as risk based; rec isn't black and white; incorporate craftsman approach to reclamation. Regulator provide tools to the industry, gives opportunity to share knowledge. Regulator doesn't want to provide prescription-based

rec work. Can supply tools to industry and practitioners => make problem solving more efficient.

- Lack of action because people don't want to be sued, or exposed. Acting in fear, we're all protecting ourselves and the units we work with.

Different standards across jurisdictions.

Not getting exposure to other sectors because we stay in the same cycle with the same people, not expanding the circle (even without realizing).

Stringent regulation, that doesn't always draw the most appealing energy to someone wanting to enter the sector/participate in the sector.

Institutions like InnoTech and ABMI are commodifying their services in a different way = the ability to learn and share knowledge has changed significantly over time.

Information overload.

Retirement and loss of knowledge.

A5.5.4: *Audience*

Limitations in making the learnings happen as we may know this (as the environmental person) but we may have limitation in the knowledge of operators in implementing best practices. There is a need to have more common knowledge to train those best practices.

- We need more learnings to come to the operators of equipment.
- Research gap = we need to do better in conveying guidance documents to who is implementing them.

A potential barrier in reclamation could be gaps in communication from the construction to the cleanup of the well. Having better communication throughout the lifetime of the well would decrease the differences in information shared.

Another potential barrier is not having a well rounded enough composition of people at conferences and meetings, this creates the knowledge gap. Or regulation catching up to real practices. Making sure when we have a workshop/conference/meeting, that it is well rounded and new opinions and ideas are constantly circulating through to promote innovation and change.

Want to hear from both ends of the Reclamation process -> what the regulator is looking for in reports.

A5.6: *Overcoming Barriers*

A5.6.1: *Methods*

Share Failures

- What went wrong...what not to do...
- Sharing not just goals, issues but also failures.
- OK, to mention the things that failed.
- It is beneficial to know what doesn't work.
- Need humility and trust to be willing to share failures and learnings.
- Explain what you learned from the failure.
- Focus on presenting only in-progress or failed projects.
- Present a failure with a learning => corporate perspective might not like it; present it as a learning. Let next generation know that its ok to make mistakes and who will appreciate hearing learnings and how we can avoid in the future.

Tools

- Use ChatGPT to analyze content.
- YouTube
- Databases such as OneStop making this data accessible to more people/companies.
- Canadian Conservation and Land Management (CCLM) – website that is a repository of reclamation information. Searchable web source for best practices -> CCLM. It's free!
- Canadian Journal of Soil Science has short article sections (Perspectives, Short Communications).

Details are needed when information is shared; e.g., how much mounding is needed, how much mounding is good, when to do mounding, cross-ripping vs mounding, access.

- Finding that mounding is being shared but not in the right place.
- Some activity types do provide what was done vs. what resulted.

Incentives / Drivers / Opportunities.

- Can there be incentives for trying new things? Taking practices developed at the research scale and scaling them up across a variety of research sites?
- Mandatory spend is likely going to reduce some of these barriers – help flatten the consultant sector and reduce some of the constraints of competition/lack of sharing.
- Government (AER) putting out directives. manuals online.
- Look at providing benefits for sharing the work with other people. May help remove the fear of sharing information.
- Mechanism for sharing and learning => everything sent to the AER is a matter of public record (unless confidential), should be available digitally so that you can see what's been done. Would be super expensive, but who else could do this? Should be publicly available and easily accessible.

- Creative sentencing funding to researchers/organizations – share the learnings from those.
- EcoCanada funding for student work programs.¹⁴

Go to international conferences.

- Virtual attendance possibilities

Partial grants/funding for international sharing

AER tells us what the top reasons for rec apps being rejected.

Improved communication within and between company/consultant organizations.

- Some companies ask consultants to share information.
- Some industry members host their own information sharing workshop.
- Oil and gas to their consultants, good info sharing.
- Need to allow consulting companies to share information across clients.

There is not one way to share things. Do you do 6 different presentations over three years? Who is paying for this. Do you keep on a website, who hosts this? There is not just one solution.

- Need a variety of sources.
- You need a variety of places to go to and continue to improve.

A5.6.2: *Communication / Collaboration*

Communication.

- Could improve sharing knowledge with shareholders and landowners, in ways of meetings, indigenous consultations. Better communication overall.
- Communication along all fronts, casual peer to peer basis. Frank casual discussions with peers without the fear of being sued or stealing work. Professional obligation to report dire situations. Apply hypotheticals.
- Relationship and trust to get sharing – Indigenous desired species, reclamation outcomes.

In these groups, we should share common lessons learned.

- You may not be the only company who is working with it.
- Build community in group solving problems = bring back sense of community, consulting community is small => we tend to silo ourselves.
- Communication, between stakeholders, process for statements of concerns.

The regulator has the best shot and internal resources that have people from all sectors that are able to get together and share information. That is not the case for all companies, not everyone has a speaker for each sector.

¹⁴ See <https://eco.ca/environmental-professionals/employment-funding-and-job-board/student-work-placement-co-op/>

It is great to meet different people and it may be possible to learn from others.

You can learn more from talking with people than just reading about it.

Relationships with communities and industry, GRF e.g., Faster Forests.

Need to breakdown competitive barriers – there is a lot of work out there and collaboration will deliver the greatest outcomes.

Ontario Aggregates Association got info into the education system.¹⁵

Collaboration examples.

- ATCO is in an industry research program with InnoTech on sterilants¹⁶. The Soil Sterilant Program committee has funding to share the information. This needs to be part of the research funding and part of what is required.
- OWA is working with student groups to study sage reclamation and do a field tour. This could help students be more sophisticated on this.

If you have developed a relationship, you need to share that.

- Collaboration relies on trust relationship.
- Takes time to build but will deliver better results in the long term.

BC it is very important to work with stakeholders.

Opportunity for interprovincial sharing of knowledge

- Cross-jurisdictional sharing.

A5.6.3: *Education / Training / Professional Obligations*

CLRA is not an expensive conference. We are not pushing our consultants to send people. Why working if you never send anyone. Where are you learning if you are not sending someone.

Always been promoting and educating students at CLRA. Would be great to see more organizations to go beginning to end to share information. Need to understand the basics. If we want a straightforward presentation, just present on that.

Eliminate the label of different “sectors” in CLRA conferences and rework it to focus on the actual material (the soil, the vegetation, the groundwater, etc.) because that applies to most sectors and there’s something to be learned from all.

Field tours.

- Could be done instead of conference. Could pay a bit for this and do field tours.

¹⁵ See, for example, https://www.ossqa.com/student_design_competition/

¹⁶ See <https://www.cclmportal.ca/resource/management-soil-sterilant-impacted-sites>

There should be a requirement to present your knowledge as part of your professional qualification/PDD hours.

- It is your responsibility to train other people. You should always be training others who you work with.
- Safety is supposed to be something we are all responsible for. If we all want learnings to work, we need to push everyone on this.
- Leadership is important. We have a professional responsibility to train others.
- Professional mentorship obligation.
- There is an obligation to share information and grow the industry.

Professional bodies are in place to audit/regulate the profession. The duty is to the public. Holds professionals to a standard.

A5.6.4: What to Share

Greater emphasis on management practices and end goal vs. meticulous details included in reclamation plans. Need to be realistic.

End of life monitoring – Share those, how long before you have touch ups.

Sharing of LiDAR, GIS, this is super cool where we can benefit from government sharing of data.

- BC will be releasing LiDAR.

Indigenous sharing, herbicides are not desirable so sharing information on species specific desires is difficult and typically.

Transferable learnings, could take something from pipelining, could come back at it and see what worked in that situation.

Plot scale research.

Would like to see the reclamation presented more at the beginnings of projects, it seems as an afterthought. Grew in authorization and approvals but hasn't grown beyond that.

Collected knowledge and learnings should be shared with everyone. Upset about it from clients - > government should just make it mandatory.

Everyone likes the really cool stuff.

A5.7: Sharing Mechanisms to Develop

More information sharing is better for everyone.

Any way you can share information and get out to the masses.

There doesn't appear to be a knowledge gap. It's a communication gap.

Teaching and sharing with the public.

A5.7.1: Access to Information

Industry needs a way to access the information.

Make it easy to access – will help with buy in across the industry.

Have a central area that shows all the conferences that go on within the different organizations internationally.

A5.7.2: Education / Training

CLRA is starting to do more outreach to students.

Schools

- Some schools have working groups / advisory boards that are supposed to contribute to the curriculum.
- Educational institutes should be teaching pragmatic approaches to students. Needs to be in interface between academic institutes and industry members. How do we bring them into the fold to share what they are working on.
- Industry needs to partner with institutions to inspire students and instructors to get involved.
- We need to be interacting more with educational institutions. Internships are a great option.
- Summer student experiences are great. Hiring coop students, learning more about these coop programs.
- Getting students to help collect seed resources, how do we attract students to this field.

Mentorship programs put in place to share knowledge/incentives to get people to participate and promote growth in the industry.

A5.7.3: Research

Sometimes there is independent research.

Lots of research is being done but it is not always easily available or clear how to implement it in practice field applications.

- Some kind a searchable database would be useful.
- May be issues with technology, emerging info or proprietary info.

Does industry provide funding for research at the academic institutes.

There are industry programs where research is occurring.

- InnoTech, PTAC – get funding from industry.
- These are central hubs of research.
- They have the avenue towards that funding.
- BC Oil and Gas Research and Innovation Society says come with idea and apply.

Research conditions in approvals.

- Require research sharing in approvals.

A5.7.4: Who Should be Involved?

Needs to be cross industry as a lot of the issues are related and overlap.

CLRA likely better to head it than the AER.

- AER is somewhat restricted in sharing the information but could help.

Who vets this information (may come back to best practices and how they come about?)

The people that make the equipment could develop content in terms of how to use it?

A5.7.5: Examples to Follow

Good example is the SST tool. It has been shared and changed as new information was available.

CAPP is really good at sharing their learnings for producers – it could be a good conduit for sharing more learnings.

A5.7.6: Specific Methods

Role for CLRA.

- Can CLRA's platform be a place.
- Could we record CLRA presentations to share?
 - Presentation videos would be advantageous.
 - Some conferences will share power points or information. Could be charged or not?
- CLRA could promote the Alberta Soil Science Workshop and all of their training.
- CLRA award for “failing with grace “– promote sharing the hard stuff.
- CLRA to send a practitioner survey, challenges.
- Tab on CLRA, AIA website that directs people to relevant areas (CCLM).
- There is the need to market about the information.

We need to take to all these different bodies that have information and consolidate it better.

- How to we get awareness out about what is already online?
- Listing (hyperlinked) of existing public information. People don't even know what to look for and it's hard to find.
- Potentially having a more centralized resource for information, it seems right now things are kind of fragmented and information is spread all over, it may be easier to share/access if it was more centralized.
- Repository could be good – presentations, research, applied research, see how it works.
- Take the best management documents and learning and piece that out altogether. It can be patchwork.
- Put learnings into categories and make it more cohesive.
- Knowledge bases – CCLM, etc. CCLM could be an option for tracking information.
- GOA may need to house more information.
- AI how do we ensure credible sources are being pulled.

Let's share the outcomes of reclamation certificates to see what worked most efficient. Any other data that needs to be collected (full, minimum disturbance, what was technique).

- Data mining – OneStop
- Government sharing that information of how long it takes to reclaim and move through milestones.
- Collecting data for how the work was done.

Needs to involve both research and information distribution.

OWA to share all their learnings through CLRA. They don't have competitive reason to not share like industry.

More virtual opportunities.

- We need to bring people together. Time and money is the issue. Let's start having digital gatherings.
- There needs to be some areas that have less barriers. Do a webinar.

We need to create the content and then know about it. Share through the network!

- Website content is nice – but better to have on a PDF for sharing in the field in the remote setting.
- Website content – text, video, online forums, AI answers, etc.

ASPB has a monthly newsletter that links to new research.

Need to develop a listing of top issues and share it.

- Then invite experts to discuss/share.

Spring meetings.

Conferences.

Lunch N Learn (Cookies N Learn).

- Dragons den-type equivalent, lunch and learn on your highlights.

Case studies, scenarios, workshops.

Coordinated Meetings.

- Instead of Alberta, B.C., Saskatchewan separate meetings. Maybe we have a topic-based meeting. The boreal forest for example.
- Cross jurisdictional (mine in mountains workshop, with BC and AB) to share.
- Need interprovincial workshops on specific topics – e.g., salinity guidelines, boreal forest revegetation. Identify gaps and how to solve them.
- Ecoregion based meetings to catch more people’s eye. If it’s the ecoregion I work in I’ll want to go to that conference. Then within there will be subcategories covering soil, veg, wetlands, etc.
- Association and organization should go to conferences in other areas i.e., agriculture and teach some of are key learning and vice versa.

Promote more fundamental talks – basics – CLRA – ABC back to the basic. There is a whole student related avenue that is the basics.

Tools like virtual reality to teleport the old knowledge to the young in the field.

A reclamation-based Instagram, YouTube, Tik Tok, podcast.

- (CLRA) TikTok channel.

Personal invites to subject matter experts to share their knowledge at conferences and lunch and learns.

- One on one meetups to meet with professionals and discuss ideas.
- Talk to the big players and expert contractors?
- How do we communicate with the consultants doing the work?

Forcing the most experienced to get together and create BPs.

Positive environmental stories shared from government.

A5.8: *Who Else Should be Involved?*

Participants suggested the following groups should be invited to future workshops:

- Canadian Association of Petroleum Producers
- City, Town and Municipality staff.
- AIA and ASPB representatives.
- Farmers/agriculture.
- Alberta Transportation

A5.9: Other

Need a clear problem definition to allow for information pull.

How do we make the information faster and easier to find and get. Get it in their face.

Import IMPORTANT learnings.

Diversity and inclusion.

Working grouping, GRF in each group.

Funding the experts, tap in.

Heavy equipment can do a remote control.

3% of budget goes to R&D, allows us to try new things and develop more best practices. Try to share learnings that come out.

There is very rarely any well quantified data developed in research papers – lots of ‘anecdotally we observe it’ spend the time to prove out the observations with facts (data).

Gravel is rapidly diminishing and non-renewable, gravel is mined but used in absolutely everything. Need to maximize the use of it.

How do we attract new people to the industry?

- Shift to people not wanting to do field work as much.
- Would help to have better education about what the industry does.

Regulations are driven by politics...which is driven by the people who are electing officials.

Helps to have clients that are willing to be flexible and try something new instead of just doing to ‘same old same old’.

Boots on the ground can be most valuable.

Share info, sharing resources; e.g., seed sources, staggering the seeding, seed cooperatives across industry sectors. Planning together for the region of the province that it is in.

APPENDIX 6: Technology Session Notes

A big part of the technology and new advancements is that we don't know what we don't know. Having a place to share learnings across sectors would help share knowledge and practices.

Don't let technology lead you – use it as a tool, it's not your boss.

- Caution against *complacency* (blindly accepting data).

We are missing on the human side of technology – we rely on technology to fix our problems, but we don't spend enough time to communicate. We need to emphasize that we have info to share, it is more common that practitioners that want to share.

- We need to bring the humans together more – we need to use the technology to bring ourselves together.
- Technology can improve collaboration across jurisdictions and sectors.

There may need to be a minimum standard for the equipment used. We are uncertain on a particular certification.

Technology can support mentorship – “I see what you see”.

Can we use technology in subregional planning to get rid of personal opinions and politics?

- Assess disturbance impacts.
- Set appropriate buffers.
- Have everyone use the same base data to start with.

Technology can improve safety (reduced travel) and reduce disturbance resulting from site access.

A6.1: Drones and Remote Sensing

Used to be cost prohibitive to collect the data.

You need to be certified to fly the bigger drones. The AER tells us what we can do with them. Industry best practices could be an option.

Can get more data as sensors and technology becomes more sophisticated.

Uses

- Deployed better in remote sites (winter access).
- When there is no access road.
- Use them where landowners are not friendly.
 - May be useful for landowners who do not want people on their land anymore. Especially if pipeline criteria goes forward.
- Remediation space, salts scans – EM surveys, geophysics.
- Linear disturbance monitoring/assessment.
- Show long-term progression of sites.

Not needed/allowed

- On sites that you have “eyes” on them as well.
- When they are too sensitive, create “false” failures.
- For noxious weeds.
- Not over an airport.

Utilities use way more LiDAR, than oil and gas.

Different sectors need more access to high quality LiDAR.

A6.1.1: Drones

Drones are becoming more and more used in the field.

- Drone imagery cameras can help collect more data to help prove land use equivalency.
- Drones let you see the site differently compared to the ground view.
- Drones may be more useful in remote areas where it is hard to access it.
 - Line of site limitations may be an issue – may still need to drive to the site.

Drones: georeferenced, analyze for veg, stitch photos together.

Drones may be better adapted to help in cultivated zones.

Need good stakeholder communication.

- Landowners may have an issue accepting the data.
- Need proper public participation.

Technology is expensive and often needs ground truthing.

Green Area is by remote sensing/LiDAR as not getting in to by surface access.

- For some seismic restoration programs where we cannot get to them – only used drones but then correlated with ground data as well.

Ground monitoring.

Assessments using drones and remote sensing imagery. Biggest barriers, consensus, research.

Identifying species. Proprietary information. Need to sort out if it can be effective.

A6.1.2: Remote Sensing

Remote imagery can supplement knowledge – gaps in reclamation monitoring for example, year over year.

Use the imagery to look for landscape problem – erosion, landslides and fly it a lot more often than you could site visit.

Satellite imagery/drones – scouting for DSA purposes (veg information for crops) weeds vs. seeded crop, use it 3x and it calculates yields, uniformity.

Remote sensing data is tricky as there can be consultants have a package with a service provider, they use it and report it but only available in the report to the public or government.

Some commercial imagery is getting to be higher quality – may supplement (eventually replace?) drone imagery.

More uses for remote sensing than less.

A6.1.3: Opportunities

Need to figure out what is best but tech changes fast and regulations need to be able to adapt.

- Need minimum requirements (ex. Pixels in the drone) not necessarily specific tech.

Could be potential to use LiDAR, it can show different layers that are present.

Certain applications could be good. We can't get into forested sites; drones could help with getting into remote sites.

Potential uses.

- Do a flyover to look for problems then do a field check if a potential problem is spotted.
 - Focus the onsite to concerned areas. Screening tool to focus on the problem areas.
- Use drones to do weed management. Feds may need to be involved for licensing.
 - May be possible to spray from the drone.
- We might be able to show trajectory or vegetation index values though it cannot necessarily replace assessment.
 - They can be excellent for monitoring to demonstrate a site is getting on a trajectory. It can be cool to see if sites are behaving as expected even after rec cert.
- Use as a proxy for DSAs (soil moisture, vegetation).
- Use for landscape, topography and vegetation but not likely topsoil depth.
- Surveying cropland in canola to see what is happening – drones can work for this.
- There was cribbing but couldn't see it from the ground; could see it from the air.
- Could use drone cameras for wildlife sweeps and thermal sensors to find bear dens, etc.
 - Drones for bird sweeps, can be good. Infrared on the drone is possible. The drone was able to identify the active nests – may be possible to pick up on the infrared. This could be huge.
- Use drones to drop forest plugs.
 - Maybe drones can be used to plant trees.
- If Government were to get 1,200 applications/year, but can only audit 100 of them, imagery can be used as a tool to narrow down trends in vegetation and to find the sites that are outside of the norm and should be assessed.

- Aerial mapping for spills.

Some limitations exist with drones identifying specific species.

- You can get to vegetation but not to the species level. In some cases, getting certain species. One time thought they could identify a species, but they learned it was incorrect. But this could get better over time.
- Can the drone recognize the weed? The technology is there in the ag sector – precision farming.
- Satellite imagery could be used to identify weeds, but herbaceous identification, is tricky.

Need to match sensors to needs (repeatable, reliable, replicable).

A6.2: *Data Management*

We are extremely archaic in industry from regulatory/consultants. There is a lack of good data management that is preventing us from working more effectively. We need to do this better.

This also results in wasted money and effort.

- Should it be a standardized software?

OneStop.

- Should it just be OneStop or should it be a separate database?
- Should reporting to OneStop be mandatory for everything (data, Phase 1, Phase 2) to aid in overall reclamation.
- AER OneStop was aimed to automate – puts emphasis on practitioners to do the thing right to begin.
- AER is a closed IT system.

Are more database better than just one good data base.

- Make OneStop better rather than making a bunch of different ones.
- Currently multiple spreadsheets.

Data entry on cell phones/tablets is much better than paper in field then transcribe.

- Is security a risk? Data corruption or losing data if we rely to much on cloud/intent storages.

Look at example of performance surveys in forest industry.

Someone's DSA may be another person's baseline in the future, therefore need to ensure data remains available.

Data Needs.

- Clean, useful, supportable data.
- Need good metadata.
- QA/QC the data
- Everything needs to be georeferenced.

- Index of vegetation health.
- Not handwritten data.
- If we could better standardize data inputs.
- As an industry – if we had common reporting templates. Particularly relevant to EPEA projects – come as variety of PDFs.
 - OneStop for conventional oil and gas is better this way (standardized) though there are still PDFs.

Opportunities.

- OneStop is becoming a significant repository of data, need to find ways to effectively leverage it rather than just considering it a 'one-way' stream of information (i.e., industry loading reports to meet regulatory approval needs)
- It would be helpful for reclamation to be able to compare data from OneStop rec apps and see what other companies have done to complete recs from various years/various spud dates. Comparing minimal/full disturbance and seeing the processes they used for reclamation.
- How do we use technology to keep track of a site history? Where can we find information on how it was constructed. Could government create an open standard to upload this sort of information?
- If we could create a dashboard of problems (through consolidating data better) then we can have better discussions about how to work through common issues.
- Need to curate data better for making reclamation content available more generally.
- Routine disclosures are taking forever as the data is so difficult to obtain.
- Data security is an issue with regulator data.
- Reclamation monitoring can be better standardized.
- Some discussion on how you would deal with oddball sites.
- Supply chain management.

A6.2.1: Data Accessibility

Websites such as CCLM could be expanded upon to be a central point for data.

Resides within industry, and industry owns it (consultants won't give out information without client's permission).

- Companies need to be willing to open the data.

Not accessible, its hard to get and it's who you know. Very few official channels with more popping up. It's slowly getting better.

Should the raw data and interpreted results be publicly available to help others develop systems and provide LOs an opportunity to review it or have someone else review it for them?

There is spatial data at EPA, but AER can't access it.

When sites are sold, this is a big problem as we can't access applications for new owners.

Having a better way to access the data that's in OneStop and pull reports/spreadsheets of shared data from the OneStop database.

Anything in a rec cert application is publicly available; however, DSA assessments are not publicly available.

- Have to FOIP data.
- Barrier to computer learning.

High resolution Google Earth data is publicly available now. It could assist regional planning if all the folks were pulling from the same data set.

Industry has their own data bases for tracking their information and they sometimes share statistics to see what is working to improve efficiencies and successes. Example of systems: Field Share, SiteView. Field Share is accessible to a cell phone to enter information.

A6.2.2: Improving Electronic Submission Systems

No new ones needed, just need to update.

OneStop is getting better. But it does often crash.

OneStop needs to have a way to pull the information in a meaningful way, used properly. Information is there just need a way to use it. More efficient.

Huge opportunity related to regional data and sharing as it relates to background soil/water data.¹⁷

- The inclusion of background soils data in OneStop. Being able to see background soils data for sites surrounding yours and be able to compare or being able to view which sites used Tier 2.
- Build a CCLM-style database for background samples (similar to ground disturbance requirements).

Doing batch submissions rather than single submission.

- Doing Excel-based data import or database (access) that everyone uses to upload information and tables to it.

BC system is worse than the Alberta system.

- The BC system is currently a very manual internal approval system.

Is there a system that could be used across BC and Alberta?

¹⁷ Author Note: See *Alberta Background Soil Quality System Project: Workshop Summary* (<https://www.cclmportal.ca/resource/alberta-background-soil-quality-system-project-workshop-summary>)

Ability to do minor edits on AER submissions before they are assigned to an AER reviewer.

- Can't delete if there is an error.

What about the RoO form, could there be a way to make it easier to use and easier to mine the data?

- How do we make the RoO data more accessible? Could we update the RoO so it's no longer in an Excel document.
- What about if it was in OneStop or equivalent?
- Peatlands does not have an equivalent RoO form. Shocking that there is no straight forward way to do this. Some companies have their own forms.

Reclamation variances as per current AER instructions are very slow to get reviewed and so people are pulling and re-submitting the old way.

- Workflows are causing each variance to be a different reviewer.
- Need a way to predict rejection process.
- Need a better way to deal with exceptions.
- People are spending \$1,000's to resubmit these things. This is a huge inefficiency.

Improvements to AbaData – GIS feature that allows you to overlay personal data over the map and create layers.

One of the barriers of the electronic submission systems is it may be difficult to submit a site that is unique, if not all the fields are filled out often its flagged and can't be submitted.

- But not all sites have that data and it varies for the unique sites. They are more designed in a cookie cutter way.
- Finding a way to successfully and seamlessly submit sites that have more exceptions.

Non-routine application, deficiency only get sent to operator not consultant. Operator misses response deadline.

Risk of data being used against you.

Remove duplication.

- Fix glitches, repeat information all the time and answering the same question. 10 submissions for 1 rec app.
- Lots of duplicate entry and repetitive tasks.
- DRAS¹⁸ – want the consultant to split out each one, too much duplication.
- DRAS can delete but you must wait for approval.

Potential additional functions.

- Audits surface/tech.
- Random testing.
- Lab data submission.

¹⁸ See <https://www.alberta.ca/digital-regulatory-assurance-system>

- Line locates in a central place.

Very hard to answer how frequently to review; need to know what is the intended use of the database and who is using it.

- Deal with issues as they come in. But also review annually.
- Determine through feedback.

Regulator is not listening to the user on the needs.

A6.3: *Artificial Intelligence*

AI will have a big role!

- It could be quite great.

A6.3.1: *Risks*

Is there a risk AI could provide more accurate/harder to detect fake field notes to fake passing sites.

- Currently audit 15% with the number subject to change based on confidence intervals.
- Might be able to use AI to help find fake data (AI-generated or just people making up fake data).
- AI could create data that is wrong.

Human checks will always be necessary to review. But additional technology updates can always be helpful on the reporting side of things.

A6.3.2: *Opportunities*

Use technology to do routine searches that are done by people, certain searches could be streamlined to be done by technology.

Can be useful to help summarize approvals and make sure all the stipulations are completed.

- Mine existing approvals – what are the variances, what are the best ways to address an issue.
- AI could tie into development plans better – climate change, seeding rates, climate data and see if our sites are transitioning.

AI combs through the data quickly – it will save money and time. Just need to standardize things better.

- Data analytics with AI is becoming much more important.
- Maybe there is a way it can use large data to understand what would work more efficiently. It could look at many variables and see what would work better.
- This could show which variances are no longer relevant as they are always variances.

- How many sites actually fail and why.
- Success rates could be compared between practitioners.
- Efficiencies.
- Access, validate, certify. Follow up on the sites down the road after.
- Sustainability.
- QA/QC.
- AI could help focus the audits onto the most likely issue sites.
 - Most of this should be caught in a field audit regardless.
 - Triage sites for audits (e.g., comb through data and look for greatest variability onsite vs. offsite, or select sites from low/medium/high variability).
- Could be used for planning, scheduling, and tracking progress (e.g., reclamation, performance monitoring, rec cert application).
- Tie big data to understand if the veg is recovering and avoid remediating very small impacts.
 - Could potentially help ensure the sites are on the correct trajectory.
- Develop conceptual site models – inputting data. AI can do that.
- Could help to create models using data from across the industry to create better rare plant and soil maps.
- Could help create species lists for seeding using collected data from the area.

Reporting

- AI will help with reporting and standardization of reporting.
- AI to populate certificates and duplicating reports that need to be uploaded.
- Fill out the OneStop forms.

Predictive modeling.

- Collate and summarize background data.
- Could AI be used to predict background data and save us the time of doing that collection?

Water use in AB is an example – its publicly accessible data, anyone could develop an AI platform to look at water use decision making and future consumption / constraints?

Species migration could be tracked from something like ABMI data?

A6.4: Other Technologies

Potentially alternative options for weed spraying, reduce the amount of herbicide that need to be applied and look into alternative methods.

- Controlled burns for grassland weed management.
- Light-based weed control?

Virtual Reality headset to increase communication between field staff and senior staff for additional guidance.

Learn from infrared gas migration technology.,

Government does not want to see amendments as a technology that will cover underlying issues. Still need to demonstrate success/safety and prove it isn't covering up some issue.

Using GPS on heavy equipment to help with reclamation.

Companies can run financials on each supplier to check costs and compare. This may reflect that there are more efficient ways to progress sites.

A6.5: *What Part of Reclamation Needs the Most Technology Innovation?*

Communication

- We don't need new things; we are not talking to each other.
- Helping each other out, benefitting from sharing information.
- We need to use this technology to improve our communication, more as a tool.
- Education and awareness.

Planning and scheduling

- Planning has the biggest impact. Fail to plan, you plan to fail.
- A lot of reclamation is a physical aspect (pushing dirt essentially), they don't see much use for more technological advancements on that front. But the technology can come in to the planning and prepping.
- Understanding better who is doing what where in a given area. For example, when is Harvest doing reclamation vs. CNRL in building an ice road. Challenge is – companies don't want to share information though they may want to share the cost!
- Optimizing large scale projects.
- We need to make a dashboard for BC and Alberta to be able to better share activities ongoing in different fields (cost share road access etc.).
 - BC regulator may have something like this in the works for dormant sites.
- Utilities need to use them for planning routes, so they have way more emphasis.

Revegetation / Vegetation Management.

- Could use better native seed collecting technologies to help give industry the proper tools properly reclaim sites.
- Drone seeding.
- Using drones and pucks to help seed native plants in remote areas.
- Show productivity of the crop (yield).
- Potentially alternative options for weed spraying, reduce the amount of herbicides that need to be applied and look into alternative methods.

- Drone herbicide application.

Monitoring.

- Could help doing remote monitoring to reduce cost and improve confidence.
- Should we be looking at Crown land sites that were certified years ago to help prove current sites are on the correct trajectory and see what can be done better.
- Could use aerial or drone technology for long term monitoring and evaluating trajectory.
- Winter access sites are tricky and so using technology for those.
- Peatland sites that are hard to access could benefit from technology for monitor them.
- Evaluation of sites, remote sensing analysis.
- Improving reclamation process and using historical sites to see the outcomes 5-7 yrs after the fact. Making advancements to reclamation processes and how much disturbance is necessary.
- Older sites cause issues with past practices not always being optimal.

Some way to alleviate compaction without surface disturbance ... but may not be possible.

Post-iron work.

DSA because of small window.

BC regulator data collection needs improvement!

Remote sensing (including LiDAR) and drone use.

Operate by exception/triaging.

The amount of work that we have industry wide, who is going to do this work. We don't have a big source of young people coming into this industry.

- Good GIS people can result in lots of efficiencies.

Sectors that are not using it.

Better connectivity for remote areas is much easier.

Pre-assessment field tools. Survey, Phase 1, 2, 3 where you build.

RoO app.

A6.6: How to Get Technology Approved?

It is not currently the Government's role to approve technology.

- EPA is open to more technology use.
- Government wants to promote innovation and ensure policy does not encumber innovation.
- Government would like to see technologies that are repeatable, reliable, replicable.
- Who is "approving" it? Regulator? Companies who are implementing the technology?

- If the regulator can focus on the outcomes and not the process on how they got there, it leaves flexibility for companies to try new technologies.
- Pre-approval, engage before you start, make AER part of the study.
- Government role should be approvals for use based on data.
- Government should set the goalposts but not regulate.
- College/university micro-credentials?

Does the tech meet the outcome? Where it meets the equivalency and where the gaps are? We need proof that the new technology is doing the job and working efficiently. Once the technology is proved to be useful, then it can be approved by regulation.

Prove that it does work by field truthing your data. With enough data we can be confident it will be going forward and at that stage can be used. Needs to be reproducible. Not everyone will be willing to change their ways.

- Show the data and results. Needs to be a study. Prove it works.
- Demonstrate it – take the leap but with backup plan.
- Need to show that the new innovation is equivalent to the old process.
- Potentially you use a new technology to do the job, but as a trade off you monitor the site for an additional few years to be more confident in the new technology, while trialing it out.

Tech can be used to replace some steps of the process but needs Gov approval.

Look to other sectors (forestry, precision agriculture) for how they assess and monitor success.

Any company can set it up, prove to regulator, then push eventually into policy.

Industry involvement, bringing ideas to the table. Making people aware of the technologies out there and ability to try them. Having management be open to new innovations and ideas.

How should it be approved? Code of best practice.

EM survey has to be stamped by a Geophysist. Similar you would need to be within that area of practice.

- EM survey is example of where we have been down the path.

A6.6.1: Challenges and Barriers

Getting buy in.

- Need government support by defining the outcomes sought to allow for effective solutioning.
- Need internal company management buy-in for research.
- Need regulators to be open to new technologies.
- Put in the effort in with landowners.
- Other jurisdictions can accept it, so it is more comfortable using.

- Aerial assessment is more acceptable (LiDAR) as people are familiar, data proves it.

There can be technologies but are they economically feasible.

Not ready yet, they need more field work and development before they can be main-stream and accepted.

- The new tech needs to prove it can work before it can be used.
- There still needs to be a QA/QC and best management practice to keep the regulators confidence.
- Need to be open to compromise and be prepared for additional monitoring to support burden of proof.
- But, how much proof is required?
- Does it work, what are the risks, analysis.
- How can we get the regulator to have confidence that the data provided from these outlets are accurate?

What are the secondary issues that may arise from technology adoption?

- Policy needs to be flexible – e.g., what if an assessment results in a failure because of the increased resolution sensors can provide?

Need proper training for it to be useful.

- Need to have proper training available.

Industry needs to request it ... they need to willing to pay for it and adopt it.

- Industry needs to be *pulling* technologies.
- Companies aren't willing to spend the money to test the research/innovation.

We play catch up, regulations change.

Don't always have time/resources to do the research and try new things.

It's difficult if it assumed that each site within the same area is solved with a "cookie cutter" solution, as sites even in the same area can have widely different results.

If industry wants to use a drone and high-resolution drone imagery for assessments, they have to be ready for Government to also use the same technology for compliance.

A6.6.2: *How to Decide if a Technology Adds Value*

Value depends on the stakeholder.

Is it faster/cheaper/safer with the same quality?

Scientifically accurate.

Clients are going to pay for it! If it gets you the results and not an extravagant expense.

Consultants could get more work from it potentially – loss leader.

If you have that barrier, other folks do too – maybe it pays you back to be the trailblazer.

ROI important to consider.

As a consultant you need to see that there is a benefit to doing this – prove that it works, prove its reliability.

We need to be careful about technologies that are offered but may not actually achieve what we need for remediation.

- Some industry organizations evaluate the door knockers that come to company and see if they are effective. Some people came from USA to say they could fix things. Where is the technology from?

A6.7: *Technology and People*

A6.7.1: *Does Technology Replace Field Work?*

No!

- Needs to have some groundwork can't remove field work. Prove it.
- Drones and remote sensing are opportunities that will reduce need for field but not eliminate it!
 - Good screening tool.
 - Could be best used as a combined tool with ground monitoring.
- They are there to assist and improve findings, but not take over. We are not going to be using drones to do all the assessments to verify.
- Improve efficiency but don't replace.
- Should always be some ground truthing involved.
- Complementary to other tools.
- Just an additional piece of information
- Additional piece of information.
- Can be interspersed with human, field data collection.
- Certain landowners or other stakeholders that are concerned about the site. More boots on the ground may be needed.
- Additional piece of information, using drone footage and potential VR aspects, can maybe cut down on the physical manpower needed to be sent out to site, but someone will still need to review and direct the data.
- Remote sensing to supplement boots on the ground.
- Photo assessments without ground truthing is currently not accepted for Reclamation Certification.

Maybe.

- In some cases it is replacing field work, disturbance level and whether it has been ground truthed in the field. In a similar landuse, may be able to just ground truth a portion of the sites. You could just look at a subpopulation of sites.
- But it's not far off to imagine a future where boots on the ground aren't needed.

A6.7.2: *Interpreting Results*

Still require human brain to interpret.

Need to ensure we aren't getting complacent or lazy.

It can be tricky when it gets to in depth interpretation of the data – this is where an expert is required.

- You often need an expert in vegetation and the imagery interpretation to do this effectively.
- Still need to have a professional do an interpretation (similar to a doctor doing an x-ray).
- Simply looking LiDAR data but you are proficient in other you wouldn't need a new professional.
- If there is a written policy that requires more complex interpretation then may need a certification of sorts.

Drones is the first thing that came to mind. 360 was trying it to ground truth it. How do we interpret the results? Identify what we can bring and sit down with the regulator – get everyone to same table. You can send up drones but need a purpose for collecting it.

How do we ensure data aren't being misrepresented?

- Signoff and QA/QC data.
- Training courses.
- Mentoring.
- Added to a practice area.
- Audit a % of the sites with field work.
- Standardize remote sensing data that is submitted to the regulator.
- Needs to be accepted by the public/landowners.

A6.8: *Other*

What happened from the study they did regarding failed a Phase 2.

If you produce 500 m³ of produced water, some will fail or not. How many actually failed from sampling well centre?

Capacity, Cryptocurrency, how do we regulate something so new. Which regulations are applicable.

Varieties – oil sands cold cut, lets approve that and do it vs a eco-blanket, alarm bells should go off.

Investment needs certainty.

APPENDIX 7: ChatGPT's Take on the Technology Session and Land Reclamation

A7.1: Technology Session Notes Summarized

Chat GPT was asked to summarize the Technology Session Notes in Appendix 6. Here is what it produced.

Based on the extensive notes from the "Technology Session Notes" document, a report addressing the question of what new technologies can be utilized to aid reclamation programs (including planning, implementation, and evaluation phases) can be structured as follows:

Executive Summary

This report explores innovative technologies that can revolutionize reclamation programs across various stages, from planning through implementation to evaluation. Emphasizing collaboration, efficiency, and sustainability, it recommends leveraging drones, remote sensing, data management systems, artificial intelligence (AI), and other digital tools to enhance the effectiveness and accountability of reclamation efforts. By integrating these technologies, reclamation projects can achieve more accurate assessments, improved data collection and analysis, and better stakeholder engagement, ultimately leading to more successful restoration of disturbed lands.

Introduction

Reclamation of disturbed lands is an essential process for mitigating environmental impacts, requiring meticulous planning, implementation, and evaluation. The advent of new technologies offers unprecedented opportunities to enhance these processes, making them more efficient, accurate, and cost-effective.

Planning Phase

Drones and Remote Sensing

Use Case: Enhanced site assessment, including topography, vegetation analysis, and identification of sensitive areas, to inform planning decisions.

Benefits: Offers a comprehensive overview of the site conditions without the need for extensive ground surveys, especially in inaccessible areas.

Data Management Systems

Use Case: Centralized platforms like OneStop for the submission and review of reclamation plans, integrating background soil and water data to streamline planning processes.

Benefits: Improves the efficiency of plan submissions and revisions, ensuring that all stakeholders have access to the necessary information for informed decision-making.

Implementation Phase

Drones for Monitoring and Site Management

Use Case: Real-time monitoring of reclamation activities, including soil redistribution, vegetation planting, and erosion control measures.

Benefits: Allows for timely adjustments to the reclamation strategies based on actual site conditions, enhancing the effectiveness of the implementation phase.

Artificial Intelligence and Machine Learning

Use Case: AI algorithms to predict the outcomes of reclamation strategies, optimizing resource allocation and intervention timings.

Benefits: Increases the probability of reclamation success by utilizing data-driven insights to inform implementation efforts.

Evaluation Phase

Remote Sensing for Long-term Monitoring

Use Case: Regular assessment of vegetation health, soil stability, and hydrological conditions through satellite imagery and drone footage.

Benefits: Provides continuous data on the reclamation progress, enabling timely interventions when deviations from expected outcomes are detected.

Data Analytics and AI for Performance Analysis

Use Case: Analysis of large datasets to evaluate the effectiveness of reclamation measures, identifying trends and areas for improvement.

Benefits: Facilitates a comprehensive understanding of the reclamation outcomes, supporting adaptive management and knowledge sharing.

Challenges and Considerations

Implementing new technologies in reclamation programs requires addressing several challenges, including regulatory compliance, data privacy and security, and ensuring the accuracy and reliability of technology-driven assessments. It also necessitates training for personnel and stakeholders to adapt to these technological advancements.

Conclusion

The integration of new technologies into reclamation programs represents a promising avenue for enhancing the planning, implementation, and evaluation of land restoration efforts. By leveraging drones, remote sensing, AI, and robust data management systems, reclamation practitioners can improve the efficiency, accuracy, and sustainability of their projects. However, successful adoption depends on overcoming regulatory, technical, and operational challenges, highlighting the need for a collaborative approach among industry stakeholders, regulatory bodies, and technology providers.

Recommendations

Adopt a phased approach for integrating new technologies into existing reclamation workflows, starting with pilot projects to demonstrate their value and ease regulatory concerns.

Invest in training and capacity building for staff and stakeholders to ensure effective use of technology.

Foster collaboration between technology developers, reclamation practitioners, and regulatory bodies to adapt tools and practices to specific reclamation needs.

Prioritize data security and privacy to protect sensitive information.

Encourage data sharing and transparency among stakeholders to improve reclamation outcomes and foster innovation.

This report underscores the transformative potential of new technologies in reclamation programs, advocating for their thoughtful integration to achieve more sustainable and successful outcomes in land restoration efforts.

A7.2: Suggested Content for Messages to the General Public

ChatGPT was asked specific questions to help prepare messages about land reclamation for the public based on the content of the draft report. This is what it produced.

Q: Please review the following document and tell me what I need to do to help prepare a message to the general public what land reclamation is.

A: To prepare a message for the general public about what land reclamation is, based on the CLRA 2024 Workshop Summary Report, you might want to include several key points and concepts highlighted throughout the document:

Definition and Importance of Land Reclamation:

Emphasize that land reclamation involves restoring disturbed land to its natural state or to a condition that's safe and useful for human activities, with the ultimate goal of achieving equivalent land capability. Highlight how this process contributes to environmental stewardship, sustainable development, and the mitigation of industrial impacts.

Processes and Stages of Reclamation:

Describe the stages involved in the reclamation process, including planning, implementation, and monitoring. Mention how these stages are designed to ensure that the land can support its intended future use, whether for agriculture, conservation, or development.

Best Practices and Innovations:

Share insights on the best practices that have been developed in the field of land reclamation, including the use of technology such as drones and remote sensing for monitoring reclamation

progress. Explain how these practices and technologies help improve the efficiency and effectiveness of reclamation efforts.

Collaboration and Shared Responsibility:

Highlight the importance of collaboration among various stakeholders, including government, industry, Indigenous communities, and landowners, in the reclamation process. Discuss how shared responsibility and engagement are crucial for the success of reclamation projects.

Success Stories and Ongoing Education:

Provide examples of successful reclamation projects to illustrate the positive outcomes that can be achieved. Mention the role of ongoing education, training, and knowledge sharing in advancing land reclamation practices.

Adaptability and Continuous Improvement:

Acknowledge that reclamation practices must evolve to address new challenges and incorporate advancements in technology and understanding. Emphasize the industry's commitment to continuous improvement and adaptability.

Public Engagement and Understanding:

Stress the importance of improving public communication and awareness regarding the reclamation process, its benefits, and its challenges. Invite the public to learn more and get involved where possible.

By incorporating these points into your message, you can provide a comprehensive overview of land reclamation that educates, informs, and engages the general public. Remember to use language that is accessible and avoids technical jargon to ensure the message is clear and understandable to a broad audience.

Q: How can we as a reclamation industry gain trust in the general public what we do? Where are we falling short?

A: Gaining public trust in the reclamation industry involves addressing both where the industry excels and where it falls short, based on insights from the CLRA 2024 Workshop Summary Report. Here are strategies for building trust, along with areas for improvement:

Where We Excel:

Innovation and Best Practices:

The industry is continuously adopting new technologies and best practices, such as drones for monitoring reclamation progress and AI for data management. Sharing these innovations with the public can demonstrate commitment to improving outcomes.

Collaborative Efforts:

Collaboration among government, industry, Indigenous communities, and other stakeholders is strong. Publicizing these partnerships can showcase the industry's commitment to inclusivity and shared responsibility.

Educational Initiatives:

Efforts in education, training, and knowledge sharing, particularly through conferences and publications, help advance the field. Highlighting these initiatives can show the industry's dedication to professional development and continuous improvement.

Where We Fall Short:

Public Communication and Awareness:

The industry needs to improve communication with the general public, making complex reclamation processes more understandable and transparent. Simplifying language and using various media can help demystify industry practices.

Showcasing Success Stories:

There is a gap in effectively publicizing reclamation success stories. Regularly sharing these stories through media, social platforms, and community events can help highlight the positive impacts of reclamation work.

Engagement with Indigenous Communities:

While collaboration is highlighted as a strength, there's always room for deeper engagement with Indigenous communities, ensuring their knowledge and perspectives are integral to reclamation planning and implementation.

Data Accessibility and Sharing:

Maximizing the value of data through improved accessibility and sharing can be better communicated to the public, demonstrating transparency and accountability.

Strategies for Building Trust:

Enhance Public Engagement: Regularly involve the community in reclamation projects through open days, workshops, and consultations. This direct engagement can foster a deeper understanding and appreciation of reclamation efforts.

Increase Transparency: Publish detailed reports on reclamation outcomes, challenges, and the steps taken to address them. Transparency about both successes and failures builds credibility.

Strengthen Indigenous Partnerships: Deepen relationships with Indigenous communities by integrating traditional ecological knowledge into reclamation practices and recognizing these communities as key stakeholders.

Utilize Media and Social Platforms: Create informative content that explains reclamation processes, showcases ongoing projects, and celebrates achievements in formats that are engaging and accessible to a non-technical audience.

Monitor and Adapt Practices: Continuously evaluate the effectiveness of reclamation efforts, being open to adapting practices based on new research, technology, and stakeholder feedback.

Focus on Education and Outreach: Expand educational initiatives to reach schools, universities, and community groups, raising awareness about the importance of land reclamation from an early age.

By addressing these areas and implementing these strategies, the reclamation industry can build stronger trust with the general public, demonstrating its commitment to environmental stewardship, community engagement, and sustainable development.

Q: Provide me a great elevator speech that I can use to a landowner that describes what I do as a reclamation practitioner and scientist and why the Canadian Land Reclamation Association is an important and trusted body.

A: Certainly! Crafting an elevator speech that succinctly captures the essence of your role as a reclamation practitioner and scientist, along with the importance of the Canadian Land Reclamation Association (CLRA), can be pivotal in building understanding and trust with landowners. Here's a suggestion:

"Hi, I'm [Your Name], a reclamation practitioner and scientist dedicated to restoring disturbed lands to their natural state or even better conditions. My work involves using science-based practices to heal the land after industrial activities, ensuring it can thrive again for agriculture, wildlife, and future generations. I'm part of the Canadian Land Reclamation Association, a respected organization that leads the way in innovative reclamation techniques and best practices. The CLRA is a trusted body because it brings together experts from government, industry, academia, and Indigenous communities to share knowledge, advance reclamation science, and promote sustainable land management. Our goal is to make sure the land we borrow is returned in a condition that respects the environment and community needs. Your land's health and legacy are at the heart of what we do, ensuring it remains productive and vibrant for years to come."

This speech aims to communicate the key aspects of your role and the value of the CLRA in a relatable and concise manner, emphasizing the shared goal of land stewardship and the collaborative approach to achieving it.

Q: Ok revise and only use the word reclamation not restoration. Also, we, as a reclamation practitioner, do not borrow land; we are the ones who help plan, evaluate, monitor and certify lands. Also, review the report again and help me find a more interesting way to describe equivalent land capability that can be understood by someone in the general public.

A: Absolutely, let's refine the speech with your feedback in mind:

"Hello, I'm [Your Name], a reclamation practitioner and scientist focused on reinvigorating lands impacted by industrial activities. Through careful planning, evaluation, monitoring, and certification, my role ensures that these lands are returned to a state where they can sustain future use and ecological functions. I'm aligned with the Canadian Land Reclamation Association (CLRA), a cornerstone organization that pioneers in the field of land reclamation. The CLRA is instrumental because it unites a diverse group of professionals to push the envelope on reclamation practices, ensuring we're always at the forefront of science and sustainability. Our mission is centered around the concept of 'equivalent land capability'—it's about transforming impacted lands to a condition that supports various uses, from farming and wildlife habitats to recreational spaces. This doesn't just mean bringing the land back to its former state; it's about ensuring the land holds the same value and potential for communities and nature alike. It's a promise that the footprint left behind is not just erased but replaced with opportunities for growth and vitality."

For describing "equivalent land capability" in an engaging and understandable way, I aimed to convey the idea as not merely a technical goal but as a commitment to community, nature, and future resilience. This approach helps to demystify the term and emphasize the positive outcomes of reclamation efforts.