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Managing uncertainty: An examination of adaptive management and progressive reclamation in Alberta's mineable oil sands

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International Environmental Studies

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Declaration

I, Clayton Gouin, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

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Abstract

Alberta's oil sands are large, naturally occurring deposits of bitumen, a non-renewable, mineral resource. One problem Alberta faces is the scale of ecological disturbance from oil sands mining. Alberta's current reclamation law for oil sands requires land to be reclaimed to a state of *equivalent land capability* and reclamation responsibilities are placed on oil companies. Reclamation publications from oil sands mine sites are currently limited. Additionally, less research on stakeholders' reclamation perspectives has been published. Understanding stakeholder's perceptions of reclamation management is necessary to understand if reclamation produces acceptable outcomes for stakeholders. Qualitative data was gathered through semi-structured interviews based on grounded theory approaches to determine stakeholders' reclamation management perceptions. Results were analyzed using grounded theory and symbolic interactionism. Adaptive management and progressive reclamation appear to be management options for oil sands mine reclamation, but current management frameworks obscure their application. Distrust and uncertainty spread across stakeholder groups because progressive reclamation and adaptive management remain undefined and open to interpretation in Alberta. Without clear, agreed upon definitions, progressive reclamation and adaptive management may be unsuitably applied to oil sands mine reclamation.

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1. Motivation

Ecological reclamation publications from oil sands mine sites are currently limited, most only published recently. Less research on stakeholders' reclamation perspectives has been published. With the ecological impacts from oil sands mining, understanding stakeholder's expectations for reclaimed end land-uses appears useful to investigate. Initially, this research intended to compare stakeholders' expected reclamation outcomes against current scientific literature on ecological reclamation to determine if, and how, knowledge gaps between stakeholder groups were present. The grounded research methodology applied in data collection shifted the initial research purpose, as data uncovered knowledge gaps not in expected ecological outcomes, but in how progressive reclamation and adaptive management were operationalized. Reflecting on new insights, the research purpose shifted towards uncovering and understanding how and why knowledge gaps between stakeholders exist around progressive reclamation and adaptive management. Data provides suggestions to improve stakeholders' perceptions of these two concepts, and how progressive reclamation and adaptive management can be improved to create trust and reduce uncertainty in oil sands mine reclamation. Additional literature review appears to support this finding.

Understandings stakeholders' perceptions of reclamation outcomes and reclamation management is necessary because mined lands will inevitably be returned to the public after mining ceases. Debate about the acceptability of oil sands mine reclamation is occurring within Alberta, however limited research has explored how socio-political mechanisms can be improved to incorporate public participation and viewpoints more fully in reclamation decision-making. Alberta's current reclamation legislation is arguably vague and how this unclear wording impacts reclamation activity and the acceptability of reclaimed land for Albertan stakeholders requires more attention. Clearly, there are challenges surrounding oil sands reclamation, and understanding what stakeholders' perceive about current reclamation legislation and practice may be beneficial to strengthen regulations and create more desirable reclamation goals and outcomes. Therefore, a more thorough examination of stakeholder perceptions on reclamation practices, assessment, outcomes and management frameworks is required.

1.1 Introduction

Through the 19th and 20th centuries, humans developed an exceptional capacity to physically alter the biosphere (Cortina & Vallejo, nd). The Industrial Revolution changed human-environment interactions, profoundly reshaping how societies live and interact with nature. Changing lifestyles, technologies and growing populations have only increased our

reliance on natural resources, particularly fossil fuels. Modern history's oil booms have been unquestionably linked to human alteration of the global biosphere, and our industrial activities have had unparalleled impacts on global ecology.

Canada's oil sands extraction has received significant attention in this regard. Global media focus made Alberta's oil sands industry a prominent environmental debate. Reports on the environmental disturbances caused by oil sands mining question Albertan environmental policies. Within Alberta, debate about ecological disturbance and environmental impacts continues. Oil sands mining effects on Alberta's boreal biome demonstrate human capacity to impact ecological systems and process. These effects present complex ecological challenges for Albertans that must be addressed.

Alberta's oil sands are naturally occurring deposits of a non-renewable mineral resource - bitumen - and extractive methods cause large-scale environmental disturbances. Ecological impacts from the rapid development and extraction of bitumen have caused the loss of wetlands, forest areas and plant and animal species, all of which pose serious, long-term problems that are being inadequately addressed (CIA, 2013 as cited in Brandt, Flannigan, Maynard, Thompson & Volney, 2013). Properly planning, implementing and managing environmental consequences through public policy mechanisms is required to return ecological systems' natural health and function, but also to protect the health and livelihoods of Albertans relying on the region's ecosystem functions. One problem Alberta faces is the scale of ecological disturbance during the lengthy process of oil sands extraction. Industrial bitumen extraction is relatively new, and ecological reclamation efforts in Alberta's mining sites remain understudied (Wellstead, Rayner & Howlett, 2016). To better understand this predicament, we should examine how human thinking about environmental impacts has shifted.

In 1935, Aldo Leopold initiated what is considered to be the first concerted attempt to recover an ecological community, and from his efforts the field of restoration ecology emerged (Cortina & Vallejo, nd.). Restoration ecology, and reclamation practice,[1] is considered a young scientific field, however the field is an essential study and practice. It allows us to recognize and mitigate negative environmental impacts, where possible, and when development impacts are unavoidable, restoration ecology provides a means to return

[1] The province of Alberta uses the term *reclamation* in most legislative documents and discussions on oil sands restoration. Cortina and Vallejo (nd.) explain that *reclamation* focuses on re-establishing ecosystem function, whereas *restoration* can be understood in terms of both ecosystem function and composition, while some authors consider reclamation to be part of the restoration continuum. This thesis will use reclamation to be consistent with Albertan legislation.

ecosystems to a functioning state. Our understanding of negative impacts on natural ecosystems has grown. Oil sands mining continues to cause significant ecological problems that will require future reclamation action. At the moment, there is little evidence proving how successful oil sands reclamation will be.

Albertan environmental regulations governing oil sands extraction have changed over time. Regulations improve, or change through political and social pressures, better reclamation practices, increased ecological knowledge, and from unforeseen consequences of industrial development. While much public and academic attention has been given to oil sands mining impacts in Alberta's boreal region, less attention, either publicly or scientifically has been given to reclamation policies, practices and outcomes until recently. Albertans are acutely aware of the damage oil sands mining causes, but few are knowledgeable about how these mine sites will be re-integrated into natural landscapes and what final reclamation outcomes may be.

Currently, oil sands mine reclamation is legislated by the *Environmental Protection and Enhancement Act* and guided by other guidance documents. Alberta's current reclamation law requires land to be returned to a state of equivalent land capability. Mine approvals, granted to oil companies by the Alberta Energy Regulator, and additional guidance documents, (ex. *Lower Athabasca Regional Plan*, *Criteria and Indicators Framework for Oil Sands Mine Reclamation Certification* and the *Tailings Management Framework*) place reclamation responsibilities upon oil companies. Guidance documents and approval conditions encourage reclamation to be conducted using progressive reclamation and adaptive management. However, the industry-led reclamation approach, and recent Provincial political changes have discouraged multistakeholder participation in reclamation processes, casting distrust and uncertainty over how progressive reclamation and adaptive management occur, and whether these approaches can produce successful, or acceptable reclamation outcomes.

The primary challenges surrounding progressive reclamation and adaptive management, as reclamation tools, appear to stem from distrust in industry-led reclamation practices and uncertainty around definitions of adaptive management. Differing social, cultural, economic, political and environmental perspectives of stakeholders complicate these problems. Adaptive management and progressive reclamation appear to be two beneficial management options for oil sands mine reclamation, but without proper definition and legislation, their use may poorly or unevenly applied. Creating legal definitions and

frameworks around progressive reclamation and adaptive management may improve public trust in industry-led reclamation, and reduce uncertainty around reclamation outcomes.

2. Alberta's oil sands: boreal ecology and mining history

2.1 General ecology

Alberta is a province located in western Canada. Northern Alberta is classified as part of Canada's boreal region: a broad, circumpolar vegetation zone of high northern latitudes, primarily forested by cold resistant tree species (genera of *Abies, Larix, Picea, Pinus, Populus* and *Betula*), but also containing lakes, rivers, wetlands and treeless areas (Brandt, 2009 as cited in Brandt et al, 2013). Canada's boreal forest covers 5.52 million km^2, accounting for 28% of the global boreal zone (Natural Resources Canada, 2016a, 18.10) (Figure 1). The boreal forest is Alberta's largest natural region, totalling 381,046 km^2, covering 58% of the province and includes eight natural subregions (Downing & Pettapiece, 2006). The province's mineable oil sands deposits are located within the Central Mixedwood Natural Subregion; the largest natural subregion, accounting for 167,856 km^2 of the Boreal Forest Natural Region (44%) and occupying 25% of Alberta's total land area (Alberta Parks, 2014).

Figure 1: Canadian boreal forest zone (North American boreal zone map, 2016)

A mosaic of upland forest expanses characterizes the Central Mixedwood Natural Subregion, with wetlands occurring on level, gently undulating plains (Alberta Parks, 2014;

Downing & Pettapiece, 2006). As a northern latitude zone, summers are short and winters are long and cold. Annual diurnal patterns, temperatures, precipitation, elevation, soil types, soil moisture content and soil nutrient gradients influence vegetative species.[2] The subregion has various upland forest stands, ranging from aspen forest, aspen and white spruce, to white spruce and jack pine (Alberta Parks, 2014). Grasslands are rare; occurring mostly as patches in jack pine or spruce forests, with aspen stands displaying more understory shrub diversity (Alberta Park, 2014).

Wetlands occupy nearly half of the Central Mixedwood subregion (Downing & Pettapiece, 2006). Small lakes, fens, bogs and associated vegetation are common features. Lakes are less dominant in the region, accounting for only 3% of the Central Mixedwood area (Downing & Pettapiece, 2006). Species-poor site types are most common, hosting black spruce fens with common Labrador tea, peat moss, feathermosses, willow-dwarf birch shrub lands, sedges and bluejoint grass, while wetlands with better nutrient supplies contain tamarack, golden moss, and a variety of forbs and sedges (Downing & Pettapiece, 2006).

Annual temperatures, precipitation and drainage encourage slow vegetation growth rates and decomposition, affecting topsoil development. Cool annual temperatures result in precipitation exceeding evaporation, which promotes nutrient and mineral leaching, slows biological activity in forest litter layers, and retards mineral humus layer development (Downing & Pettapiece, 2006). Under-litter soil is commonly luvisolic - a dominant soil type in forested landscapes comprising of sand, silt and clay mixtures in different proportions overtop of sedimentary rocks (Soils of Canada, nd.). Organic soils develop in wetlands and poorly drained soils, where slow decomposition results in high organic matter accumulation (Downing & Pettapiece, 2006). Organic soils, particularly sphagnum peat moss, accumulate over thousands of years because cold temperatures reduce plant growth rates and decomposition.

The Central Mixedwood Natural Subregion, with its topographic, vegetative and climatic diversity, hosts a range of wildlife communities and species compositions.[3] Alberta recognizes several notable species - whooping cranes, woodland caribou, and wood buffalo - as either threatened or endangered (Downing & Pettapiece, 2006). The region provides habitats for various fish, amphibian, bird, reptile and insect species; several species are

[2] For more detailed information on the Central Mixed Natural Subregion soil types, geology/geomorphology and climate see Downing and Pettapiece (2006) pages 136-140 and Soils of Canada (nd.).
[3] For detailed species list and habitats, see Downing and Pettapiece (2006) pages 124-125.

currently listed as: of special concern, threatened or endangered.[4] Biodiversity is shaped by biogeochemical cycles, sub-humid and subarctic climates and natural disturbances (ex. fire and floods), with anthropogenic disturbances from mining being a significant driver of regional change (Bergeron et al., 2002; Gosselin et al., 2010, as cited in Audet, Pinno & Thiffault, 2014).

Our understanding of the boreal region's ecological sensitivity has sparked debate and scientific analysis. Habitat fragmentation, climate change and human activities all affect biodiversity within the boreal region. Recognizing biodiversity's importance, Alberta has already labelled numerous flora and fauna species *at risk*.[5] Mining drives ecological change within Alberta's boreal forest, and creates longstanding ecological consequences for plants, animals, ecosystem functions and cycling, and other human-environment interactions. Ecological disturbance and degradation are ongoing effects of open-pit bitumen mining.

2.2 Oil sands and bitumen

Alberta's oil sands are a naturally occurring fossil fuel deposit. The oil contained in oil sands deposits is a sand-clay-water-heavy petroleum mixture called bitumen (Government of Alberta, 2008). Alberta's oil sands deposits spread across 140,200 km^2 of boreal forest, comprising the third largest known oil reserve in the world, and represent the largest energy extraction project on the planet (Alberta Energy, 2017a; Alberta Environment and Sustainable Resource Development, 2013; Mech, 2011; Yeh et al., 2015). Approximately 20% of Alberta's land area is covered by bitumen (Wellstead, Rayner & Howlett, 2016), spread over three main deposit regions: Athabasca, Peace River and Cold Lake. These deposits contain an estimated 1.7 trillion barrels of bitumen (Richens, 2010; Government of Alberta, 2008).

Bitumen extraction plays a vital role in Alberta and Canada's economy. While Aboriginal communities in the region had used the resource for centuries, industrial development only began in the mid-1900s. The first viable, large-scale commercial mine and refining plant were constructed in 1967 (Alberta Culture and Tourism, 2017). Oil sands research, investment and development have since continued. Proactive Government encouragement of oil sands development has been ongoing for over 35 years; in 2013, total investments broke a record of 32.7 billion Canadian dollars (CAD) (Alberta Energy, 2017a).

[4] For complete list of Threatened, Endangered and Special Concern species is available through Alberta's *Species at Risk Guide*: http://aep.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/documents/SpeciesAtRiskGuide-Jan-2015.pdf

[5] See *Species at Risk Guide*

The oil sands represent a larger economic resource than any other Canadian economy sector, outweighing mining, forestry, agriculture and fisheries (Wellstead, Rayner & Howlett, 2016). Alberta maintains bitumen extraction as an economic priority. While oil sands development is a major Albertan policy topic, national policy agendas also affect bitumen extraction. Alberta's oil sands are subjected to a great deal of politicization for Canadian energy export markets.

The United States, along with other countries (Norway only recently removed Stat Oil investments in late-2016) are invested in Alberta's oil sands. With China becoming a major player in international energy imports, and financial and political stability a serious concern for American import markets, Alberta's bitumen appears a stable investment. The term *North American energy security* is a common phrase in North American energy politics. Alberta's oil sands represent reliable, long term energy reserves within a politically stable governance system, making bitumen appealing for American and international companies (Government of Alberta, 2009). With oil reserves larger than those of Iran, Iraq and Russia, the Government of Alberta (2009) estimates that the oil sands could produce 3 million barrels of oil per day for over 150 years.

While Alberta's position politically and economically is extraordinary, the oil sands are an *extra*-ordinary resource. Bitumen cannot be extracted using conventional oil technologies. Instead, bitumen extraction occurs in one of two ways: shallow deposits are surface mined and recovered through open pit mines up to 80 m deep, whereas deeper deposits use *in-situ* technologies - cyclic steam stimulation or steam assisted gravity drainage - to extract and pump bitumen to the surface[6] (Richens, 2010). In-situ extraction is suitable for approximately 80% of oil sands operations, while surface mining is feasible for 20% of deposits (Government of Alberta, 2008). However, in 2011 60% of all oil sands production came from open pit mining (Polaris Institute, nd. as cited in Mech, 2011).

Mineable bitumen deposits total only 0.2% of Canada's boreal forest (Natural Resources Canada, 2016b, 24.08.) Spread over 4800 km^2 of Alberta, in 2011 only 663 km^2 of mineable deposits were being excavated, or cleared for excavation, accounting for only 0.16% of Alberta's boreal forest area (Government of Alberta, nd., as cited in Perry & Saloff, 2011). This increased to 767 km^2 - 0.2% of Alberta's boreal region - two years later (Alberta Environment and Sustainable Development, 2013), an increase of 106 km^2. Oil sands mining expansion is only expected to continue. VanderKlippe (2012) estimates that over the next 20

[6] The specific methods for cyclic steam stimulation and steam assisted gravity drainage: http://www.energy.alberta.ca/OilSands/1719.asp

years, oil sands production may double, from 3 million barrels/day in 2010 to over 6 million barrels/day by 2030 (as cited in Wellstead, Rayner & Howlett, 2016).

While 2016-2017 oil prices are slowing production rates, past actions may be a clear indication of the future. In 2010, seven mine operations were approved by the Alberta Government, with numerous applications for new mines, facilities, mine expansions and mine renewals moving through the regulatory process (Richens, 2010). In 2011, one year later, ten mines were granted approval, requiring approximately 1670 km^2 of land for planned expansions and new mining areas (Rooney, Bayley & Schindler, 2011). Such an estimate may be considered conservative, as the authors state that the 1670 km^2 area excludes roads, seismic lines, pipelines and other supporting infrastructure. Yeh et al. (2016) estimate that surface mining disturbance will increase by another 500 km^2 from 2016 until 2030. Combined with new mine proposals, mines in operation and expected future expansions to 2030, there could be 1970 km^2 of boreal forest disturbed, to some degree, by oil sands mines.

Oil sands mining disturbance to boreal ecology is immense, in both scales of geography and time. Mining bitumen is a lengthy and complicated operation involving many different activities with varying environmental impacts (Richens, 2010). Open pit mining, while an effective recovery method, it is highly disruptive (Wellstead, Rayner & Howlett, 2016). The mining process begins with a mine plan and conservation and reclamation planning, leading to mine approval. Upon approval from the Alberta Energy Regulator (AER), bitumen deposits are exposed by diverting rivers, clearing trees, draining wetlands, and removing and storing muskeg, topsoil, overburden (biomass, soils and other earth minerals), underlying clay, silt and gravel with heavy equipment (Mech, 2011; Perry & Saloff, 2011; Yeh et al., 2016). Surface bitumen can be mined as far as 70-80 m below the earth's surface, and bitumen excavation and processing produces massive amounts of overburden and mine tailings that also require storage on adjacent land, causing further disturbance (Yeh et al., 2016).

Bitumen processing creates other ecological problems. Methods to separate bitumen from the sand, clay and water mixture require immense amounts of fresh water and chemical inputs. Sodium hydroxide is added during processing to improve bitumen separation, which causes water salinity to increase (Roy, Foote & Ciborowski, 2016). This process-affected water, or tailings water, also contains arsenic, cyanide, naphthenic acids,[7] mercury, sulphuric acid and polycyclic aromatic hydrocarbons (Mech, 2011). Provincial law prohibits releasing

[7] See https://pubchem.ncbi.nlm.nih.gov/compound/Naphthenic_acids#section=Inhalation-Symptoms 10.1.16 *Toxicity Summary* for detailed description of naphthenic acids

process-affected water, so it is stored in large tailings ponds (Government of Alberta, 2009). Tailings ponds contain contaminated process-water, coarse and fine tailings, and are designed to allow water to separate from sands and fines over time (Richens, 2010).

Figure 2: Proportion of mineable oil sands relative to in-situ, and Alberta and Canada's boreal zone (Natural Resources Canada, 2016b, 24.08.)

The rate at which process-affected water is created is remarkable. In 2010, tailings ponds increased by 262,000 m^3 per day (Roy, Foote & Cibrowski, 2016). While much of this water can be recycled, meeting nearly 90% of a company's water demands, tailings pond management remains an environmental challenge, with tailings ponds and related tailings management infrastructure occupying approximately 220 km^2 of land (Alberta Energy, 2013; Alberta Energy, 2017a). Tailings ponds will eventually be re-integrated into post-mining landscapes once mines close, although there is much uncertainty about their safety and success.

Estimated mining disturbance places cleared, disturbed and mined lands at 895 km^2 (Alberta Energy, 2017a). While this represents only 0.2% of Alberta's total boreal forest region, Alberta's provincial law requires all disturbed land to be reclaimed. Provincial law places reclamation responsibility on the mine operator before land can be returned to Crown (public) control (Wellstead, Rayner & Howlett, 2016). Land reclamation is governed by the Alberta Environmental Protection and Enhancement Act (EPEA), which holds the foundation for both environmental conservation and reclamation for all mined lands in Alberta (Macdonald et al., 2015). The EPEA informs mine approvals, other legislation and guiding documents designed to enhance land reclamation.

Land reclamation occurs after bitumen extraction and processing ceases. In a general sense, oil sands mine reclamation involves land reconstruction by using overburden and tailings material to fill mine pits, placing stockpiled soil overtop of sites, and re-vegetating afterwards (Richens, 2010). Once reclamation activities are completed, sites are monitored to collect data and track progress towards a desired goal. If a reclaimed site meets Alberta Government criteria, land becomes certified 'reclaimed,' and returned to the Crown. If monitoring indicates that criteria is not met, the *Criteria and Indicators Framework for Oil Sands Reclamation Certification,* a reclamation guidance document, can trigger an adaptive management action and reclamation intervention.

In 2009, the Alberta Government introduced new reclamation classifications to better track land disturbance levels and reclamation progress (Alberta Environment and Sustainable Resource Development, 2013). Disturbed land is classified as follows: *cleared,* land has had terrestrial vegetation cleared and removed, but the soil remains relatively undisturbed; *disturbed,* any land used under active mine operations; *ready for reclamation,* land no longer required for mine operations, but reclamation has not yet begun; *soil placement*, direct soil placement is completed, based on the operator's reclamation plan and the action has been approved by Government regulators; *temporary reclamation,* land that has been reclaimed or re-vegetated for soil stabilization or erosion control only, and may experience future disturbance; *permanent reclamation,* landform design, soil placement and re-vegetation of an area have been completed, and the land undergoes ongoing monitoring for 15+ years (no future land disturbance should occur on this land); and *certified reclaimed,* land has met reclamation certification criteria and has been officially returned to the Crown. The latest available data, from 2013, demonstrates the small scale of reclamation relative to the size of current oil sands mine disturbance (see Table 1).

Clearly, reclamation activities and certification have not kept pace with mining disturbance rates. Despite continued investment by the oil industry and the Alberta Government to improve reclamation techniques and technologies (Alberta Environment and Sustainable Resource Development, 2013), today's mining industry demonstrates little reclamation. This is primarily due to ongoing investment and development of new mining operations, active mining occurring, and lengthy mine lifespans. The oil sands industry differs from other resource extraction industries, having longer investment time horizons and exploration and resource extraction periods (Wellstead, Rayner & Howlett, 2016), making reclamation a distant activity. Oil sands mines operate for decades and subsequent reclamation activities and monitoring will also require decades to complete (Alberta Environment and Sustainable Resource Development, 2013). Regardless, current Provincial law requires all disturbed land must be returned to a state of *equivalent land capability* (ELC).

Table 1: Current Albertan Land Classification Standings for Oil Sands

Land Classification	**Land Area (km^2)**
Cleared	204.35
Disturbed	559.02
Ready for reclamation	3.72
Soil placement	14.47
Temporary reclamation	12.27
Permanent reclamation	50.42
Certified reclaimed	1.04

Land disturbance relative to reclamation in Alberta's oil sands (Adapted from Alberta Environment and Sustainable Resource Development, 2013)

3. Oil sands reclamation

3.1 Understanding reclamation in the mineable oil sands

Ecological restoration is the process of assisting ecosystem recovery after degradation, damage or destruction (Society for Ecological Restoration International, 2004). The Society for Ecological Restoration (SER) International states that an ecosystem is recovered, and thereby restored, when it contains sufficient abiotic and biotic resources to continue ecological development without further human assistance. The ecosystem should sustain itself structurally and functionally, demonstrating resilience to normal degrees of environmental stress and natural disturbance, and interact in biogeochemical cycles with surrounding systems. In Alberta, restoration is not legislated, and reclamation is used instead. Reclamation's proposed end land-use goal includes self-sustaining, locally common boreal forest (Powter & Polet, 2012), however end land-use is ultimately defined by ELC.[8]

Questions remain over why Alberta chooses reclamation instead of restoration. For many ecologists, reclamation is part of the restoration process. Restoration includes reclamation, rehabilitation, mitigation, ecological engineering and various other forms of natural resource management (SER International, 2004). SER International (2004) also states reclamation is a commonly used term in the context of North American mined lands, and its main objectives usually include: stabilizing terrain, re-vegetating sites, assuring reclaimed lands are safe for public use, aesthetic improvements, and/or returning land to a useful or valuable state. Under Alberta legislation, reclamation towards ELC may allow for restoration in some cases, but is not required, leaving restoration outside of legal contexts.

Humans are strong ecosystem engineers, and oil sands mines create large-scale environmental alterations with severe environmental consequences (Cortina & Vallejo, nd.), necessitating reclamation activities. Surface mining in the boreal region disturbs organic materials, subsurface hydrology and ecosystem service provisions, while generating large quantities of process-affected material (tailings), all of which legally requires reclamation (Kovalenko et al., 2013). Ecological reclamation is used in projects with large land disturbance because spontaneous, natural recovery in degraded or disturbed ecosystems is unlikely, and may be too slow to meet human management objectives (Cortina & Vallejo, nd). Reclamation is intended to expedite ecological recovery after disturbance, however in the case of Alberta's oil sand mines, ELC is reclamation's goal.

[8] More detail on ELC is provided in the next chapter.

According to the EPEA, mine reclamation can require any of the following practices: removing equipment, buildings or other structures or appurtenances; decontaminating buildings, structures or other appurtenances; stabilizing, contouring, maintaining, conditioning or reconstructing land surface; or any other procedure, operation or requirement specified in regulations such as mine approval documents (EPEA, 2014). Oil sands reclamation involves reshaping and re-contouring land by bulldozing and moving soils to recreate topographic landforms similar to a pre-disturbance state, while aiming to prevent, remove, control and remedy degradation to soils, surfaces and vegetation (Wellstead, Rayner & Howlett, 2016). MacDonald et al. (2015) provide a sense of the efforts involved in post-mining landscapes. Landform reconstruction is necessary and should be modeled on natural systems to create topographic heterogeneity at a variety of scales. Overburden, capping materials and organic amendments must be properly used and placed afterwards to facilitate soil development processes to create a suitable rooting medium for trees and other vegetation. Target ecosystems should be diverse in type, while aligning different landforms, topography, overburden, soil placement and tree species planting is ecologically beneficial. Once reclamation is complete, natural regeneration should be monitored, and intervention through ongoing management practices may assist developing sites towards desired trajectories. For the size and scale of oil sands mines, these reclamation efforts will be immense. Oil sands mines spatial disturbance exceeds typical reclamation project scales (Kovalenko et al., 2013) making these mine sites a challenging new frontier for reclamation ecology.

Cortina and Vallejo (nd.) explain that reclamation faces problems from identifying roles and responsibilities, and from varying stakeholder definitions and expectations of reclamation. They write that for most definitions of reclamation, using pre-disturbance ecological states for a site, or using a reference site, aids in developing reclamation goals. Theoretically, this approach makes sense, however reclaiming ecosystems to a specific goal, or end land-use, is not so simple. Issues regarding which pre-disturbance time period is viable for reclamation goals, problems of who defines what suitable reclamation goals should be, and how natural change and dynamics within ecosystems should be accounted for pose operational challenges to pre-disturbance targets being met.

Dynamic ecosystems also complicate project managers ability to precisely anticipate reclamation outcomes (Cortina & Vallejo, nd.). For the oil sands, long mine operation periods, compounded by long reclamation timelines, may make reclaiming towards pre-

disturbance states either unrealistic or unattainable. Numerous scientists[9] have stressed that climate change and cumulative environmental impacts will affect future boreal ecosystems, and regional dynamic change is expected. Further complicating reclamation planning, current knowledge suggests that ecological succession on a site may not result in a single stable end point, but in several metastable[10] end-points (Cortina & Vallejo, nd.). Albertan legislation recognizes that oil sands reclamation may lead to different, although possibly overlapping end land uses, which may make ELC a flexible measurement to gauge oil sands mine reclamation success when pre-disturbance states are unlikely to be returned.

3.2 Reclamation regulations: Interpreting equivalent land capability

Under EPEA, ELC defines reclamation goals, or end land-uses, for disturbed land in Alberta. EPEA was introduced in 1993 to address land, air, and water protection issues in Alberta, and to improve, clarify and better define older Provincial reclamation legislation (Wellstead, Rayner & Howlett, 2016). ELC is described under the Conservation and Reclamation Regulation section of EPEA as "the ability of the land to support various land uses after...reclamation... similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical" (EPEA, 2014, p. 2-3). Reclaimed land should have similar capacity to support activities and uses after oil sands mines close (Government of Alberta, 2009; Oswald & Carey, 2016), without requiring land to be structurally or functionally identical.

Capability was chosen because it was described as a scientifically grounded definition of the land's physical, chemical and biological characteristics (Wellstead, Rayner & Howlett, 2016). In 1993, ELC was considered as a scientifically based approach to define successful reclamation, based on developed criteria and capability indicators. ELC shifted the role of Provincial regulators from being on the ground as reclamation implementers to becoming planners and auditors of reclamation end land-uses (Wellstead, Rayner & Howlett, 2016). ELC placed reclamation responsibilities upon private companies that disturbed land. The definition of ELC has been left sufficiently vague so Government regulators can define a wide range of end land-uses as acceptably reclaimed.

The vague standards of ELC suggest that reclamation may support different land uses: traditional land uses, wildlife habitat, recreation or commercial forestry (Rodrigues-Eztival &

[9] See http://www.oilsandsmoratorium.org/ Reasons 1 and 9 for brief description. There have been numerous scientific articles written on how climate change is affecting, and is expected to affect boreal ecosystems in the future.

[10] Metastable: the system is stable provided it is subjected to no more than small disturbances (Google Definition. Retrieved February 14, 2017)

Smits, 2016). The Alberta Government (1998, as cited in Audet, Pinno & Thiffault, 2014) previously encouraged ELC to produce land-use conditions with ecosystem processes supportive of commercial forest goods and services, which was considered as consistent with the goods and services that existed before disturbance. This definition was primarily guided by returning land use that was economically beneficial to the Province. However, end land-uses producing economically viable forests for commercial forestry use (Audet, Pinno & Thifault, 2014) can be limited by a variety of factors, such as reclaimed soil conditions, over-story planting densities and operability constraints (Alberta Environment, 2010). Therefore, other ELC definitions interpret end land-uses as near natural mixture of canopy cover, or to develop ecological habitats adequate to support native species composition, richness, structure and ecological function (Norris, Dungait, Joynes & Quideau, 2013; Audet, Pinno & Thiffault, 2014). This definition would drive reclamation towards creating wildlife habitats capable of providing pre-disturbance conditions that are adequate for native wildlife (Audet, Pinno & Thiffault, 2014). Lastly, while recreational end land-uses meet ELC criteria for successful reclamation, Alberta Environment (2010) identifies that directing reclamation towards recreation is not principally driven by ecology. As can be seen, ELC presents a wide rubric to determine successful reclamation, however these broad definitions can create conflicting viewpoints of what outcomes reclamation should ideally produce.

Perceptions of post-mining reclamation success hinge on the level of human use that reclaimed end land-uses produce (Hanus, 2004). Different stakeholders in the oil sands region hold varying conceptions of what end-land uses are acceptable. The various ELC interpretations create conflicting end land-use desires and expectations for Albertan stakeholders. Nationally, Canadian law mandates disturbed land to be reclaimed to an ecologically sustainable state, requiring boreal reclamation to return land to self-sustaining boreal forest ecosystem-states that support local vegetation and wildlife (Rodriguez-Estival & Smits, 2016; Natural Resources Canada, 2016b). Yet, Albertan mine reclamation legislation (ELC) appears designed to encourage mine site reclamation to either *natural* or *economically valuable* landscapes (Badiozamani & Askari-Nasab, 2014). Diverging legal definitions of reclamation between the Canadian and Albertan Governments stems from jurisdictional independence, allowing Alberta to define its own legislative framework for oil sands mines reclamation outcomes.

The problems associated with ELC interpretations began with ELC's creation and adoption. Perry and Saloff (2011 as cited in Wellstead, Rayner & Howlett, 2016) write that Provincial legislation for reclamation processes and standards was not initially designed for

the oil sands mining industry. Instead of introducing new legislation to govern oil sands mines, existing agricultural and forestry legislation was amended to fit oil sands development. As the oil sands industry developed, policy changes have been implemented from time to time based on those agricultural and forestry metrics. The authors explain that by augmenting, instead of creating wholly new laws for oil sands reclamation, legislators are constantly playing catch-up to new, industry-specific developments.

According to the Albertan Government, end land-uses are not always entirely separate. Many end land-uses can overlap, instead of being wholly independent from other reclamation outcomes: commercial forestry may provide wildlife habitat and support traditional land-uses, wetlands in non-commercial forest sites can create recreation opportunities while supporting wildlife and traditional land-uses (Richens, 2010). This creates challenges for the Government and mine operators when attempting to communicate reclamation objectives, and when determining which reclamation criteria should be applied during reclaimed site assessment (Richens, 2010). Clear communication is necessary to ensure public stakeholders understand reclamation outcomes and to minimize conflicting expectations of end-land uses.

Essentially, ELC is used to accept a wide range of reclamation end land-uses that may or may not match pre-disturbance ecological states. In fact, ELC's definition emphasizes that end land-uses *need not* be similar or identical to pre-disturbance states and uses (Wellstead, Rayner & Howlett, 2016). The definition itself points towards reclamation's inability to reproduce pre-disturbance ecological states,[11] thereby allowing the Alberta Government flexibility to choose what it accepts as suitable end land-uses. However, Alberta is home diverse stakeholder groups, each holding different perceptions of what acceptable end land-uses are. These stakeholders debate ELC's ambiguity, with each group interpreting ELC's definition and acceptability as a reclamation criteria differently.

3.3 Stakeholders' views of ELC for reclamation

The Alberta Government claims to place high value on the environment and Albertans' connection to the land (Government of Alberta, 2008). Land is viewed in multiple ways: as a source of pride, recreation, forestry, energy development and agriculture. Alberta's boreal forest provides a range of provisioning, regulating, cultural and supporting services to both natural systems and humans, with bitumen representing only one of many natural benefits (Bonan, 2008; Brandt et al., 2013). A serious challenge for the Government is to try

[11] This will be covered in more detail in subsequent chapters

to balance social and economic development with environmental protection. According to a 2015 survey, Albertans placed a high priority on the environment in the oil sands region. While past provincial Governments have typically favoured rapid expansion of the oil sands, Albertans' opinions are different: 48% believe that production should remain unchanged or be reduced, 25% respond that oil sands production should be increased slightly, while 18% believe that oil sands development should be developed at an even higher rate (Rudny, 2015). The remaining 8% are undecided.

The same survey examined oil sands environmental regulation strictness and enforcement. 60% of respondents believed the previous Albertan Government did not strictly enforce existing environmental regulations, compared to 33% who believed that the Government adequately enforced environmental laws (Rudny, 2015). 32% of Albertans believed that the former Government was not at all strict in their environmental regulation enforcement, compared to only 7% who claimed the Government had been very strict with regulations. This evidence demonstrates Provincial divisions towards oil sands development and environmental protection. Differing viewpoints arise from people's relationship to the oil sands region and their preferred balance between social development, economic gain and environmental protection. Under ELC, citizens in Alberta also perceive reclamation and end land-uses differently. Understanding the diverse social and cultural identities in Alberta illuminates challenges for determining ELC in reclaimed oil sands mine sites.

According to Gosselin et al. (2010 as cited in Perry & Saloff, 2011), reclamation interpretations shape the decisions and actions stakeholders make. This allows criticism that oil sands companies have not reclaimed land to acceptable, or appropriate standards, because ELC interpretations can be vastly different between Provincial regulators, companies and the public. Gosselin et al. describes that the same interpretive process allows mine operators to reclaim land based on what can be accomplished in a timely and financially acceptable manner. This is important, considering that reclamation is oil sands operators' responsibility, while reclamation success remains based on the Government's ELC definition. Other stakeholders also have vested interests in oil sands reclamation outcomes, and often hold contrasting ELC interpretations to what both Government and industry deem acceptable.

Under Provincial law, all Albertans own the bitumen resource, and the oil industry merely leases rights to explore, extract and develop the oil sands (Government of Alberta, 2008). The Government, oil sands companies and communities become stakeholders with responsibilities to protect the environment throughout oil sands development (Government of Alberta, 2009). Communities of local people living within the oil sands region, including

Aboriginal[12] groups, public research institutions, university researchers and environmental non-governmental organizations are also invested stakeholders in oil sands development and reclamation. The Alberta Government has tried to enhance stakeholder environmental stewardship and improve environmental protection through the Lower Athabasca Regional Plan (LARP); a regional development, regulatory framework designed with stakeholder contributions.

The LARP was approved in 2012 as a comprehensive and legally binding roadmap, designed to improve Alberta's environmental management while addressing growth pressures and supporting economic development in the Lower Athabasca region where mineable oil sands are located (Alberta Parks and Environment, 2016). In practice, the LARP considers cumulative effects of all activities in the region and their associated impacts on air, water and biodiversity, while acting as a long-term, land-use planning document. The LARP states that Alberta should set desired economic, environmental and social outcomes and objectives for the region, including oil sands development and reclamation (Alberta Government, 2012). In the document, oil sands reclamation is encouraged to be completed in a timely and progressive manner, through the Progressive Reclamation Strategy. The document defaults to the EPEA legislation for reclamation end land-uses based on ELC.

For some stakeholders, the LARP and Progressive Reclamation Strategy seem too little, too late. Rapid oil sands development during the 1990s and 2000s may have surpassed ecological limits before environmental issues were identified and publicly acknowledged, and before any early opportunities to establish specific environmental policies and standards were adequately developed for oil sands mining (Kennet, 2007 as cited in Perry & Saloff, 2011). As previously mentioned, while ELC is the guiding point for oil sands reclamation, it was merely been adopted into legislation surrounding oil sands mine reclamation, instead of being specifically tailored to the industry. This, with ELC's arguably vague definition, is another cause for public stakeholder apprehension. The LARP Review Panel Report (2015) expressed concern about recent mine expansions, stating that reclamation remains a mitigation measure for oil sands projects because there is insufficient evidence demonstrating that reclamation currently works, or will work as intended in the future. This challenge is not limited to a single project, but symptomatic of the entire industry.

Alberta's oil sands mines must also handle Aboriginal communities' concerns about ecological disturbance and reclamation. According to the Canadian Association of Petroleum

[12] Aboriginal is umbrella term encompassing First Nations, Métis and Inuit persons.

Producers (CAPP), the Regional Municipality of Wood Buffalo - the municipal district where mineable oil sands are located - is home to 12,000 Aboriginal people, five First Nations and seven Métis Locals (CAPP, 2014). Two federal treaties apply to 40 First Nations groups who live within the oil sands region (Treaty 6 and Treaty 8) and both treaties ensure that the Government of Canada will allow First Nations to retain hunting, trapping and fishing rights in perpetuity (Mech, 2011). However, each treaty contains a rider giving Government the right to exclude tracts of land as required, when the Government sees fit, to be used for settlement, mining, logging or other purposes (Mech, 2011).

Aboriginal groups are impacted by reclamation and hold a vested interest in reclamation activities and outcomes (Powter, Doornbos & Naeth, 2015). For these communities, their culture and the landscape cannot easily be separated, because their heritage is inextricably linked to the land. Values and culture are expressed, transmitted and preserved through traditional land-use, and cultural histories and identities are linked to specific landscapes and locations within the oil sands region (Lower Athabasca Regional Plan Review Panel Report, 2015; Powter, Doornbos & Naeth, 2015). Several First Nations have expressed worry over the slow pace of oil sands reclamation and ELC as a reclamation measure.

The Chipewyan Prairie Dene First Nation and the Athabasca Chipewyan First Nation[13] put forward recommendations during the LARP Review Panel, expressing distresses over ELC. Both communities criticized oil sands mine reclamation to ELC standards as weak, and expressed desires for a stricter metric that could produce ecological states consistent with Aboriginal Traditional Land Use and Treaty Rights exercise (LARP Review Panel Report, 2015). In their view, reclamation approaches do not mitigate the impacts oil sands mining places on First Nation's land-use rights. Homer-Dixon et al. (2016), have called for a moratorium on oil sands development, claiming mining is inconsistent with Aboriginal peoples' land titles and rights. Other First Nations groups reiterate the LARP recommendations put forth by the Chipewyan Prairie Dene and Athabasca Chipewyan First Nations. The Fort McKay First Nation stress that reclamation certification will not occur for several generations (LARP Review Panel Report, 2015), further reducing land access. Many First Nations communities are being permanently and adversely affected through intergenerational knowledge loss because they are unable to use land while it is under active

[13] For complete overview of all First Nation and Métis communities viewpoints of reclamation and other issues related to oil sands development, see the Lower Athabasca Regional Plan Review Panel Report, 2015.

mining and reclamation. In addition, many are uncertain if ELC is a suitable metric to return reclaimed sites to a culturally appropriate state.

The Government is trying to improve stakeholder involvement and encourage positive perceptions of oil sands development. They hope to improve regulations and legislation by working with stakeholders in industry, municipalities, environmental organizations and Aboriginal groups to develop sustainable environmental laws (Government of Alberta, 2008). Alberta lifted some wording about sustainable development from the Brundtland Report of 1987, by discussing the balance between economic, social and environmental development (Angelstam et al., 2004). However, sustainable development may be a misnomer for oil sands mines, since sustainability implies that the extraction and consumption rate of a natural resource does not exceed the resource's renewal rate (Floyd, 2002 as cited in Brandt et al., 2013). Bitumen is a non-renewable resource, yet the term sustainable development has been applied in oil sands development. More recently, Alberta has moved away from branding oil sands development as sustainable, opting for the term *responsible development.* The issue is similar to differing stakeholder perceptions about ELC: each stakeholder's understanding of sustainability is unique, being guided by their culture, education, perception of present conditions and their personal experiences (Brandt et al., 2013).

There are clearly conflicting viewpoints on oil sands development and how reclamation success should be judged. Alberta faces serious interpretation issues between stakeholders since ELC and responsible development are unclearly defined. Regardless of how the Alberta Government chooses to develop the oil sands and environmental policy around that development, if ELC remains unchanged in legislation, conflicting viewpoints will persist. These differing perceptions create divergent expectations for reclamation management and what end land-uses may be considered acceptable.

3.4 Ecological challenges: reclaiming land in a post-mine closure landscape

Ecological disturbance from oil sands mining is unprecedented. Numerous reclamation concerns for the post-mine closure landscape exist. Re-creating landform complexity and variation in ecosystem structure, redeveloping soil function and compositions, and ensuring that resilience against natural and anthropogenic disturbance is established in reclaimed sites are significant technical challenges (MacDonald et al., 2015). Reclamation is a lengthy process, and success is not guaranteed. The Alberta Government (2008) recognizes that land reclamation may take long time periods, up to or over fifty years, before disturbed land may be returned to a natural state.

The largest technical challenge reclamation will face will be to effectively reclaim tailings ponds. Tailings ponds may take decades, or even centuries to settle enough to be safely incorporated into terrestrial landscapes (Fine Tailings Fundamentals Consortium, 1995 as cited in Richens, 2010). To date, no tailings pond has been successfully reclaimed and there is no proof that tailings ponds are an effective, long-term method to deal with liquid mine tailings (Gosseling et al., 2010; Mech, 2011). However, industry and Government remain undeterred, investing heavily in tailings research and technology development. New technologies have increased tailings settlement, through mixing mature fine tailings or thickened tailings with chemical coagulants to produces consolidated tailings (Richens, 2010). This approach reduces tailings consolidation times in tailings ponds to 3-5 years, and increases water separation from tailings fines in small-scale trials, yet it remains largely unproven at the scales present in today's mine sites and has not been tested over long time periods (Richens, 2010).

Despite considerable effort to develop remediating technologies and management options for process-affected tailings water, there are no clearly agreed upon guidelines for this process (Powter & Polet, 2012). This is alarming, considering that tailings pond inventories continue to grow (Gosselin et al., 2010). Even with financial investment and improvements in environmental performance in tailings ponds, technology alone cannot reduce mining's environmental footprint to zero (Gosselin et al., 2010). A major challenge for reclamation will be not only to adequately reclaim these ponds, but also to safely incorporate them into the surrounding landscape. Considering that tailings volumes and by-products from upgrading exceeds mine pit size, post-closure landscapes will have numerous end-pit lakes scattered through a hilly, re-contoured landscape, instead of resembling a level, wetland dominated pre-disturbance landscape (Rooney, Bayley & Schindler, 2011). End-pit lakes with residual mature fine tailings placed at the bottom, and capped with fresh water are part of many end-of-life reclamation plans. This tailings management approach is unproven, uncertain and still undergoing research, but remains incorporated in many mine reclamation plans (Richens, 2010). End-pit lakes, regardless of success or failure as safe and self-sustaining water bodies, will interact with the landscape's surrounding hydrological regime and ecosystems (Richens, 2010), creating new challenges and unforeseen consequences.

Similar to tailings management concerns, peatland and wetland reclamation demonstrate unique complexities. Alberta's boreal region contains between three to four thousand years worth of peat accumulation (Mech, 2011). The disturbance caused by bitumen mining irreversibly alters biological and ecological processes, making peatlands practically

impossible to reclaim (Foote, 2012, Johnson & Miyanishi, 2008 as cited in Homer-Dixon et al., 2016; LARP Review Panel Report, 2015). Hydrological-regime reconstruction for peat formation is likely unattainable with current reclamation strategies (Hanus, 2004), and reclamation practitioners must cope with saline groundwater, overburden materials and other pollutants changing hydrological and biogeochemical functioning (Oswald & Carey, 2016). Considering the problems with reclaiming peatlands, reclamation may require more pragmatic approaches. Currently, no mine closure reclamation plan requires peatland reclamation (Rooney, Bayley & Schindler, 2011). The cost of peatland reclamation appears prohibitively expensive, and there will likely not be enough salvageable material available for peatland reclamation. Typical practice simply replaces peatlands with constructed upland forests (Rooney, Bayley & Schindler, 2011). About 295.55 km^2 of peatland is expected to be lost to currently approved mine sites (Rooney, Bayley & Schindler, 2011), and this number will increase if mining operations expand.

Other wetland ecosystems are disturbed by oil sands operations, and non-peat generating wetland reclamation is also difficult. The complexities of re-contouring land to create suitable wetland sites, re-establishing wetland hydrology and connectivity, and incorporating oil sands process materials are challenges that may hinder successful wetland reclamation. Raab and Bayley (2013) and Rooney, Bayley and Schindler (2011) suggest that post-closure landscapes will be channelled for quick drainage to ensure geotechnical stability, making wetlands most likely to occur opportunistically where conditions allow, such as in the depressions between re-contoured landforms. Since the area overlying mineable bitumen deposits are primarily wetland ecosystems, ELC could prioritize wetland reclamation.

Despite 95% of Albertans supporting a one-for-one wetland offset for wetlands disturbed or destroyed by oil sands mining (Rudny, 2015), only 20-30% of reclaimed oil sands mine areas (750 km^2) are expected to become wetlands (Raab & Bayley, 2013). This is a lower land coverage percentage than is natural within the region. Raab and Bayley (2013) describe oil sands reclamation will be one of the largest wetland reclamation efforts in history. Yet, oil sands wetland reclamation currently has no well-defined steps (Wellstead, Rayner & Howlett, 2016). Knowledge and reclamation success with trajectories towards self-sustaining wetlands has lagged behind other protocols for terrestrial systems reclamation (Kovalenko et al, 2013). Government, industry and non-governmental organizations are investing in wetland reclamation research; however, there is little evidence that wetland reclamation is capable of producing ELC. Also, no wetlands have been certified reclaimed by

the Alberta Government (Rooney & Bayley, 2011), and no standardized assessment method to gauge ecological health for reclaimed wetlands exists (Raab & Bayley, 2013).

Some wetlands have been intentionally constructed for research purposes (Raab & Bayley, 2013). These sites offer useful opportunities to study and assess wetland reclamation success. In the oil sands, limited public information is available to measure constructed wetlands ability to achieve similar ecosystem process or functions as natural sites (ex. food web structure and carbon flows). Constructed wetlands on reclaimed sites may have wider littoral zones and narrower, steeper basin slopes than natural wetlands, which may impact vegetation establishment and composition, possibly producing physical and chemical characteristics atypical of natural wetlands (Roy, Foote & Ciborowski, 2016). Some trail studies on constructed wetlands have been designed to test effects from the expected incorporation and continual accumulation of oil sands process materials (OSPM) (Kovalenko et al., 2013). Kovalenko et al. (2013) found from a 20-year study that constructed wetlands containing OSPM have been unable to achieve equivalent functional levels to those found in reference wetlands. OSPM wetlands produce functionally different ecosystems than reference sites in the oil sands, and there remains uncertainty about their viability as ecosystems capable of maintaining carbon balances and biodiversity over long time periods (Kovalenko et al, 2013). Rooney and Bayley (2011) and Roy, Foote and Ciborowski (2016) found similar results. Current trail wetland sites have experienced some success, however these sites may not be suitable references for future projects. Many trail constructed wetlands do not utilize stockpiles of OSPM that will be used in future wetland reconstruction, making today's trial wetlands poor projections of future reclamation outcomes (Raab & Bayley, 2012).

While contaminants naturally occur in the oil sands (Rodrigues-Estival & Smits, 2016), OSPM in sites can permeate through reclaimed ecosystems and have longitudinal effects on overall system health. A healthy ecosystem should have appropriate species, populations and communities capable of supporting ecological processes at appropriate rates and scales (Dale & Beyeler, 2001 as cited in Raab & Bayley, 2013). Research from outside the oil sands region suggests that reclaimed wetlands are well-documented to struggle achieving equivalent health levels, relative to natural wetlands, through the first 5-10 years after reclamation (Gutrich, Taylor & Fennessy, 2009). Kovalenko et al. (2013) found older constructed wetlands became more similar to reference wetlands in the region, however the age effect was not statistically significant. There are several reasons why OSPM constructed wetland sites function differently and support different species compositions. Wastes and pollutants from oil sands mining activities can overwhelm natural systems' abilities to

process wastes (Brandt et al., 2013). OSPM wetlands have significantly higher water salinity, conductivity, dissolved oxygen concentration and lower oxidative potential than natural wetlands, creating distinct environmental conditions that negatively affect vegetative species richness and composition, creating unrepresentative vegetative communities (Roy, Foote & Ciborowski, 2016). Wetlands with OSPM simply demonstrate different ecological health, which may impact their ability to become certified reclaimed sites.

Raab and Bayley (2012) studied 20 different reclaimed oil sands wetlands and measured ecological health. They discovered that 14 of 20 sites were in poor ecological health, and site age had little influence on site health. Bare ground around reclaimed wetland landscapes was often indicative of contamination stress, and several sites had a viscous oil layer or other tailings material present on surface soils. They believe that barren ground not caused by contamination developed from unsuitable substrates used during reclamation or possibly limited vegetative propagule dispersal. Naphthenic acids, polycyclic aromatic hydrocarbons, other contaminants and high salinity were present in many of the sites, being potential causes of lowered site health.

Naphthenic acids, salts, polycyclic aromatic hydrocarbons, trace metals and phenols from process-affected water and OSPM within these wetlands cause toxicity (Mackinnon & Boerger, 1986; Puttaswamy et al., 2010 as cited in Kovalenko et al., 2013). The cascading effects from environmental toxicity can occur across an entire wetland ecosystem (Kovalenko et al, 2013), impairing macro-invertebrates and predators. Impacts on food webs can reduced energy flow diversity, and diminish ecosystem resilience (Dunne Brose, Williams & Martinez, 2005; Vinebrooke, Schindler, Findlay, Turner, Patterson & Mills, 2003). Evidence suggests that most natural wetlands support dissimilar species compositions compared with constructed OSPM wetland sites (Roy, Foote & Ciborowski, 2016). Stakeholders should not expect equivalent wetland function to return, and ELC may be gauged by other supporting functions or services that constructed and reclaimed wetlands may provide, should these sites be considered safe.

Despite 65% of disturbed mine land formerly supporting wetlands and wetland vegetation, compared to 23% of the mineable land having supported upland vegetation (Oswald & Carey; Rooney & Bayley, 2011; Rooney, Bayley & Schindler, 2011), the general reclamation trend favours upland forest-type landscapes. Alberta has no wetland policy mandating compensation for lost wetlands (Rooney, Bayely & Schindler, 2011), despite public support for one. Wetland areas are expected to decrease by 117.61 km^2, being replaced by either upland sites, or end-pit lakes with littoral habitat uncommon for the region (Rooney,

Bayley & Schindler, 2011). Reclaiming towards upland forests has proven to be more successful, however this end land-use trajectory is not without its challenges, nor without debate about if ELC is achieved on them.

Unlike wetlands, dry upland reclamation has a longer history and clearer guidelines in the oil sands region. Upland reclamation follows structured steps, beginning with gathering reclamation materials and placing it on a site (BGE Engineering, 2010, as cited in Wellstead, Rayner & Howlett, 2016). Landforms and landscape features are then created, and fertilizer and plant vegetation is applied. After, sites are monitored for several years. If the site is on track to meet Alberta's reclamation criteria (ELC), the mine operator may then apply for a reclamation certification.

While these steps appear simple, the actual process is more complex. Reclaiming upland sites must contemplate contamination presence that can remain within the site. Re-establishing soils and proper hydrological regimes to support forests and vegetation is arduous, and reclaimed sites may experience water tables and runoff carrying residual tailings and additional contamination into sites, which can affect vegetation productivity (Hanus, 2004). Purdy, Macdonald & Lieffers (2005) state that reclaimed landscapes typically have more saline soil conditions than pre-disturbance sites, yet Alberta's reclamation guidelines encourage sites to support similar biodiversity and productivity as pre-disturbance sites. These conditions may impede some vegetative establishment and productivity on reclaimed sites. Sites are also intended to have similar soil profiles as pre-disturbance sites, but reclamation may not produce identical soil profiles or functions (Perry and Saloff, 2011). Tailings materials can alter soil fertility profiles and hydrologic performance (Audet, Pinno & Thiffault, 2014), and subsoil permeability increases after bitumen has been removed, affecting groundwater flow, direction and quality (Perry & Saloff, 2011). Re-establishing adequate soil profiles, while challenging, is necessary for upland reclamation's success in supporting locally common, boreal forest species.

Sufficient soil reconstruction that incorporates native soils and industrial by-products will be key to upland reclamation success (Norris, Dungait, Joynes & Quideau, 2013). Reclaiming uplands sites and soil foundations at large scales will be a remarkable task, considering salvaged overburden is often mixed and stored with other removed earth, displacing stratigraphic, sedimentary layers that cannot be replaced or reconstructed (Hanus, 2004; Perry & Saloff, 2011). Soil storage creates novel soil substrates and reshuffles spatial structures both above and below ground, and may require decades before soils recover (Gupta, MacKenzie & Quideau, 2015). While stockpiles are stored during active mining

operations, topsoil degrades - losing fertility and biological viability - and later, land reconstruction using heavy machinery further degrades soil quality (Gardner & Bell; Smith & Nichols, 2011, as cited in Audet, Pinno & Thiffault, 2014). Soil mixing homogenizes soil profiles, which can impact future reclaimed landscape productivity (Hanus, 2004). There is limited research on how upland reclamation site soils impact soil microbial organisms or aboveground and belowground interactions. Microbes are essential to facilitate healthy soil development and heterogeneity. Nitrogen, phosphorus and sulphur are mediated by soil microbes, which directly regulate plant nutrient availability (Gupta, MacKenzie & Quideau, 2015). Reclaimed soils will need to support locally common boreal forest vegetation communities, as defined by Albertan reclamation law (Alberta Environment, 2010), yet reclaimed soils capability to do so is highly uncertain. Salt concentrations will also impact re-vegetation processes, and while higher-than-average saline soils have demonstrated some vegetation community establishment, those species rarely reflect pre-disturbance assemblages and communities (Purdy, Macdonald & Lieffers, 2005). Upland reclamation will be dependent on these uncertain soil profiles.

Before soils can be placed, mines must be reformed and reshaped. Mine operators are aware that backfilling mine pits adds more volume than was mined out (Hanus, 2004) making land re-contouring and levelling difficult (Perry & Saloff, 2011). During storage, overburden dumps and tailings piles change local topography features, which may not be recreated when soils are replaced (Audet, Pinno & Thiffault, 2014), and backfilling mine pits will create altered landscapes. Reclaimed pit sites will exhibit different features than surrounding, undisturbed areas. Integrating reclaimed sites into surrounding natural landscapes must ensure connectivity, but operators must also consider integrating sites with surrounding, active mines.

Integrating both spatial and temporal reclamation with adjacent operators is another challenge. The Government, non-governmental organizations and environmental consultants have vocalized this concern (Richens, 2010). Cross-operation landscape integration is problematic because the independent planning, operational scheduling and mine liability operators hold restricts larger, landscape-level designs from integrating drainage, landform features and vegetation across mine sites (Richens, 2010). Reclaimed sites will most likely be situated near active surface mines for long periods during reclamation and monitoring (Rodriguez-Estival & Smits, 2016), and mature reclamation sites may be negatively impacted by contamination from neighbouring mines. While law states that mine approval holders must reclaim land so that soils and landforms are capable of supporting self-sustaining,

locally common boreal forest ecosystems, regardless of the end land use, stakeholders are uncertain about how this can be practically implemented and enforced when reclamation faces these challenges (Powter & Polet, 2012).

Larger reclamation considerations must also include re-establishing sites for wildlife. 197 bird species, 22 mammal species, 23-27 fish species, over 191 taxa of phytoplankton and over 50 taxa of benthic invertebrates have been identified in the oil sands region, with species diversity related directly to habitat diversity across the region (Hanus, 2004). While the biodiversity is impressive, numerous species are declining from industrial development: lynx, marten, fisher, wolverine and woodland caribou - a species considered threatened across Canada and Alberta (Mech, 2011). Extensive knowledge gaps exist for how many species populations will re-occupy reclaimed lands and use resources found on reclaimed sites, including priority species such as the boreal owl, mixed-wood forest birds, red-backed voles, fisher, old growth forest birds, black bears, ruffed grouse, snowshoe hare, lynx, moose, woodland caribou, beaver, muskrat and the Canadian toad (Alberta Environment, 2009).

Wildlife movement in the area is not restricted to undisturbed sites, and reclaimed areas will experience wildlife visitation at all reclamation stages. Data is lacking about how water and soil salt concentrations affect survival rates, site vegetation's palatability where salts, metals and acids may be over regional averages, and the extent that gaps between forest stands will restrict wildlife movement (Alberta Environment, 2009). Ecosystems where wastes and contaminants readily accumulate will face degradation, and flora and fauna can reduce in complexity and productivity towards assemblages of lesser ecological, economic and social value (Brandt et al., 2013). Significant research is required to fill these gaps and improve knowledge about reclaimed lands' ability to support native, valuable and/or characteristic species. Currently, only limited research on small mammals has been undertaken to understand how wildlife may be affected by reclaimed sites conditions.

Rodriguez-Estival and Smits (2016) researched wildlife exposure to OSPM in upland reclaimed and natural reference sites around active mines. Deer mice were examined because mice are prone to heavy metal accumulation, thereby acting as a sentinel species to establish potential OSPM effects on other regional species. While Alberta requires environmental risks assessments on reclaimed sites, these do not typically include evaluating toxic effects on local wildlife. Cobalt, selenium and titanium were found to be above background averages for mice found in some reclaimed areas. The authors indicate that wildlife OSPM exposure and metal accumulation in muscle tissue may move up food chains, possibly affecting humans who eat hunted meat from reclaimed sites. How environmental pollutants affect species

fitness levels - their ability to survive to sexual maturity, mate and produce viable offspring - has been understudied, and wildlife exposure to OSPM could cause physiological and behavioural cascades (Wijnhoven et al., 2008; Sanchez-Chardi et al., 2013 as cited in Rodrigues-Estival & Smits, 2016).

The total cumulative effects from oil sands mining are still being studied. Reclamation success appears mostly limited to upland sites, although contamination may remain present. The net effects of transformed landscapes and wetland loss on biodiversity and ecosystem function remain understudied (Rooney, Bayley & Schindler, 2011). Achieving identical post-disturbance landscapes via reclamation is not always possible or even practical (Doley & Audet, 2013), reducing the likelihood of pre-disturbance ecological states. Most post-mine closure reclamation will require further site transformation and incorporation of end-pit lakes in an altered boreal landscape. Evidence strongly points towards novel ecosystems being the expected outcome for many post-mining reclamation projects. ELC as a guideline may be sufficiently vague to allow these novel ecosystems and landscapes to be considered acceptable by the Government, although public stakeholders may not accept novel sites.

3.5 Reclamation trajectories towards novel ecosystems

Novel ecosystem is a newer ecological concept. The term was introduced by Chapin and Starfield in 1997 and has drawn considerable expert attention within ecology. Initially, a novel ecosystem was a generalized term describing any ecosystem that had abiotic and/or biotic characteristics altered by humans (Morse et al., 2014), however the definition has changed with time. A novel ecosystem can be better understood as the spontaneous and irreversible response ecosystems produce to anthropogenic land changes, species introductions and/or climate changes, that produce ecosystem structures and functions that do not historically correspond to native ecosystems (Murica, Aronson, Kattan, Moreno-Mateos, Dixon & Simberloff, 2014). Novel ecosystems are characterized by novelty: new species combinations and changes in ecosystem functions resulting from deliberate or inadvertent human actions (Hobbs et al., 2006). Researchers recognize that oil sands mining could potentially force boreal ecosystems over ecological thresholds, leading to irreversible ecological damage and biodiversity loss (Mech, 2011; Audet, Pinno & Thiffault, 2014). Reclamation trajectories may inevitably move towards novel ecosystems comprised of new physical and biological components (Doley & Audet, 2013; Homer Dixon et al., 2016).

Even with careful planning, practice and management, reclamation may be unable to reproduce enough physical, chemical and biological similarity when disturbances are so large (Koch & Hobbs, 2007). Higher soil salt concentrations represent one limiting factor that may create novel reclamation outcomes. Purdy, Macdonald and Lieffers (2005) suggest that expecting pre-disturbance plant communities to re-establish in identical form on all reclaimed sites is unrealistic. The majority of salt affected sites will be wetland and riparian (river banks), although upland sites can experience elevated salt concentrations through overburden dumping (Alberta Environment, 2010). Diverse plant communities can thrive in both upland and riparian sites where soil salinity exceeds normal regional levels, however these communities experience higher variability and are significantly different from equivalent non-saline landscapes (Purdy et al, 2005 as cited in Alberta Environment 2010).

Oil sands mining creates consequences that render novel ecosystems unavoidable in certain reclamation situations. Functionally similar, but characteristically different abiotic and biotic conditions may represent the best possible outcome following mining's large-scale environmental disturbance (Audet, Pinno & Thiffault, 2014), but future site function remains an educated guess at best. Novel ecosystems may present their own sets of management challenges in a changing global climate. Boreal ecosystems store large amounts of carbon in soil, permafrost and wetlands, making the region an important for climate change mitigation (Bonan, 2008). Some specialists argue that land reclamation should consider reclaimed sites role in reducing greenhouse gas emissions and atmospheric carbon concentrations (Yeh et al., 2016). Carbon emissions arise from land-use change: clearing trees and vegetation and exposing soils diminishes land's carbon sequestration potential (Yeh et al., 2016). Alberta's reclamation policies and frameworks do not currently incorporate global change phenomena (Audet, Pinno & Thiffault, 2014), nor do they require reclamation to re-institute lost carbon from soils or vegetation (Rooney, Bayley & Schindler, 2011). Evolving environmental drivers will influence reconstructed landscapes, and could create different ecosystem recovery processes and trajectories relative to neighbouring sites (Audet, Pinno & Thiffault, 2014). How changing environmental drivers will influence reclamation trajectories requires more research before we can establish, with any certainty, how these sites will function in the future. The degree of ecological resilience to natural disturbance patterns and changing climates on reclaimed sites is also unknown, especially if these sites progress in novelty.

There have been some reclamation successes in oil sands sites. Reclamation research and field trials have been occurring in the region for decades, and there have been breakthroughs (Macyk & Kwiatkowski, 2008). As of 2009, 67 km^2 of land was under

reclamation (Government of Alberta, 2009), an increase of 2 km^2 from 2008 (Government of Alberta, 2008). The Canadian Association of Petroleum Producers (2014) states that 10% of active mining footprints have been, or are undergoing reclamation. One study on forest stand reclamation shows that soil treatments using repeatedly-fertilized, peat-mineral mixtures placed overtop of clean overburden can develop into functioning forest soil capable of supporting similar ecosystem processes to natural boreal forests (Rowland, Prescott, Grayston, Quideau & Bradfield, 2009). Other studies identify that some highly disturbed ecosystems can successfully reclaimed, yet many recognize that the number of sites currently undergoing reclamation exceeds those that have been successfully reclaimed, by a large margin (Audet, Pinno & Thiffault, 2014; Mech 2011). Research states that upland reclamation is quite achievable, and will be able to simultaneously support a wide variety of end land-uses for stakeholders (Alberta Environment, 2010). Despite these successes, overall reclamation fails to match land disturbance rates caused by oil sands mining (Gosselin et al., 2010) and few sites have been certified reclaimed and accepted as natural.

Currently, the Government has only certified one site as reclaimed. Gateway Hill, a 1.04-km2 section of land, and the first certified reclaimed site in Alberta's oil sands (Government of Alberta, 2009), stands as a testament to reclamation success. However, this site represents a novel ecosystem, reclaimed using the best practices-of-the-day, and is not necessarily representative of a self-sustaining, locally common boreal ecosystem. Non-native species such as Sitka spruce are evident in the site. The site is a recreational walking area and wildlife habitat located in between a major highway and several active mining sites. Recreational end land-uses, while recognized as valid outcomes, are not driven by ecological principles, making such end land-uses novel (Alberta Environment, 2010). Updated best practices more strongly encourage locally common, boreal forest reclamation instead of recreational sites, however with limited certified reclamation, other future end land-uses and novelty of those sites is still uncertain.

Novel ecosystems in post-mining landscapes should be expected in some circumstances. Returning sufficient landscape components to pre-disturbance ecological integrity may not follow direct trajectories, be ecologically possible using current reclamation techniques, or be economically viable (Choi, 2007; Perring et al., 2014 as cited in Audet, Pinno & Thiffault, 2014). Doley and Audet (2013) suggest that instead of attempting to recreate historic ecological states, more pragmatic approaches should be taken to ensure conditions are safe, stable and non-polluting while providing suitable environments for vegetative establishment and habitat development, regardless of novelty. While this approach

may seem reasonable and pragmatic, many Aboriginal stakeholders are unwilling to accept this outcome. Without well-defined reclamation management and Aboriginal involvement in designing, implementing and monitoring reclamation, end land-uses may become culturally inappropriate. The importance of clearly defined reclamation management frameworks is equally important to other stakeholders, all of whom hold different perceptions of what ELC and successful reclamation mean. Reconciling these viewpoints is integral to creating effective, transparent and successful reclamation certification.

3.6 Lack of certification: Roadblocks delaying reclamation

Despite oil sands mining for nearly forty years, reclamation certification is limited. While industry claims that some sites can be returned to previous natural states, no such site has been certified to date (Homer-Dixon et al., 2016). As of December 31, 2012, Alberta Environment and Sustainable Resource Development (2013) indicated that 77 km^2 of oil sands sites were under active reclamation - an increase of 12 km^2 from 2008 (Government of Alberta, 2008), with significant investments made by industry and the Government. Steps are being made to reclaim land in post-mining sites, and there are several valid reasons why sites remain un-reclaimed or uncertified.

Due to mining operation's longevity, the Government encourages progressive reclamation to expedite reclamation. Progressive reclamation is understood as reclaiming areas or sites that are no longer under active mine footprints. However, mine operators often do not progressively reclaim, because ongoing operations in the vicinity may negatively impact reclamation processes. Companies may later require access to sites that could be progressively reclaimed, or sites may need to be re-disturbed in the future, further preventing reclamation (Richens, 2010). The average costs for reclamation, expenses held by the oil company, range between 10,000.00-250,000.00 CAD per hectare for upland reclamation and approximately 50,000.00 CAD per hectare for wetland sites (Foote, 2012), so mine operators have an economic incentive to withhold reclaiming areas that they believe may be used for future mine activities. Oil sands operations are sensitive to economic fluctuations because of high operation costs, and safeguarding mine financial viability results in reclamation deferral to protect profit.

Companies regularly update their mine plan, altering reclamation plans initially made when an operator applies for mine approval. Legally, companies must file a Conservation and Reclamation Plan as part of any project approval (Government of Alberta, 2013), but these plans are not static. Mine reclamation plans are updated every three years, to address

changing site conditions and commitments in other mine operation areas (Alberta Environment and Sustainable Resource Development, 2013). These updates are supposed to support adaptive responses to environmental changes, to accommodate mine operation expansion and changes in extraction rates, or to implement new reclamation technologies and techniques. The Government uses mine reclamation plan updates to incorporate changes in best practices[14] and implement new technologies to encourage successful reclamation outcomes (Alberta Environment and Sustainable Resource Development, 2013). However, the Pembina Institute, an environmental non-governmental organization, explains that while oil sands proponents are expected to use the best available reclamation technologies, there is no legal requirement to do so (Grant, Dyer & Woynillowicz, 2008).

The time requirements for reclamation activities are quite long. After sites have been backfilled, soils placed, land re-contoured and vegetation planted, vegetation establishment towards locally common, boreal ecosystems takes years, or decades, to mature. During this time, ecological monitoring of site progress determines if the site's trajectory appears successful. If not, adaptive management actions to encourage site development towards acceptable outcomes can be triggered. Reclamation certificates are only issued after long-term monitoring demonstrates that a reclaimed site meets ELC criteria (Mech, 2011). As mentioned, reclamation may be deferred for economic or practical reasons, reducing reclamation opportunities, and postponing long-term monitoring. Additionally, the Government is not directly responsible for monitoring reclaimed sites. Instead, oil sands companies are self-monitoring, leaving Alberta Environment and Parks and the AER responsible for enforcing legislation, regulations and guidelines (Hanus, 2004). Mine operators provide their own reclamation status in self-reported annual *Conservation and Reclamation Reports* and *Sustainability Reports*, creating stakeholder distrust and uncertainty about the actual data companies submit (Mech, 2011). No large-scale reclamation project has been independently evaluated, and there are discrepancies between public statements regarding the extent and success of reclamation activities and the details in official reports submitted, without transparent public access, to the Government (Rooney, Bayley & Schindler, 2011).

Since no specific reclamation criteria exists for the oil sands, and ELC loosely interprets reclamation success, public stakeholders have a difficult time understanding how each company defines and applies reclamation activities. Data contained in *Conservation and*

[14] *Best practices* are procedures that are accepted and prescribed as being most effective and correct based on current reclamation knowledge.

Reclamation Reports and *Sustainability Reports* are submitted directly to the Government, and are not readily accessible to the general public (Grant, Dyer & Woynillowicz, 2009). With industry self-regulating, voluntary environmental corporate policies may be used only to mitigate negative financial repercussions from operations, to create an image of sustainable development, or to generate positive views and local support of project expansions (Hanus, 2004). What companies promote publically and claim privately to the Government may not be identical, sustaining stakeholder uncertainty and distrust about reclamation processes and outcomes.

Reclamation is expensive, time consuming and prone to negative effects from active mining. These form incentives for mining companies to defer reclamation until after mining ceases. Prior to 2011, there was little requirement to demonstrate progressive reclamation on sites. Companies were not legally required to meet reclamation timelines and milestones identified in their Conservation and Reclamation Plans, nor were binding reclamation timelines set in EPEA and mine approvals (Grant, Dyer & Woynillowicz, 2008). This was particularly troublesome for the Province, because the oil sands industry is a volatile market where companies can, and often do, go bankrupt. Bankruptcy places undue reclamation liability upon the public. Across Canada, historic evidence demonstrates that the minimum mine financial security, or investments made by companies to a public financial security fund that protects taxpayers from cost-transfers, has been chronically underestimated (Gosselin et al, 2010). In many occasions, companies have gone bankrupt and reclamation costs have fallen to the Government (Hanus, 2004). In an attempt to prevent financial liabilities, the Alberta Government has worked through several legislative iterations to ensure stronger financial security for Albertans as insurance against reclamation cost-transfers.

The Pembina Institute issued several reports through the late 2000s, explaining the weakness of Alberta's environmental reclamation security fund. Alberta legally required oil sands operators to deposit funds into the Environmental Protection and Security Fund, protecting the public from bearing reclamation costs in the event of company bankruptcy and mine abandonment (Grant, Dyer & Woynillowicz, 2008; Hanus, 2004). Companies would post securities equivalent to reclamation costs, and security holdings would increase as the company disturbed more land (Government of Alberta, 2009). The Government would return the funds after a reclamation certificate was issued for a reclaimed site (Hanus, 2004). Grant, Dyer and Woynillowicz (2009) state that this approach was problematic because it lacked transparency about reclamation costs; calculations of liability bonds and the frequency of third party validation of companies' reclamation plans were not publically available or

readily accessible. Operators were to submit security deposits based on estimated costs for a third party to reclaim sites, without detailing reclamation activities or expenses. In 2010, Pembina suggested the reclamation security fund was woefully inadequate, claiming that the financial security held by the Government in 2009 was 820 million CAD, although projected reclamation costs for disturbance levels was 1.4-3.7 billion CAD for land, and 8-10 billion CAD for tailings reclamation (Pembina Institute, 2010).

Alberta and Canada have long been criticised for weak environmental protection legislation. Canada has been ranked second to last in the Organization for Economic and Cooperative Development countries for its environmental performance since 2001 (Mech, 2011). Previous legislation around oil sands mine reclamation granted the Director of Alberta Environment wide discretion to determine what the required security amount mine operators should post should be, and this decision was done without formal public policies, regulations or guidelines standardizing how security assessments or calculations should be done (Perry & Saloff, 2011). Due to public pressure, mounting evidence of the taxpayer burden abandoned mines create, and internal understandings that mine financial security was lacking, in 2011 new legislation was put into place to govern oil sands reclamation security funds.

The Mine Financial Security Program (MFSP) is currently regulates oil sands mine reclamation securities. MFSP still holds EPEA designation that an approval holder - the company - is responsible for reclamation until a land reclamation certificate has been issued. It also regulates that the approval holder must have the financial resources to complete these obligations (Alberta Energy Regulator, 2014a). The MFSP should protect Albertans from liability costs of oil sands developments, if mines become abandoned, by retaining the existing oil sands mine security fund, while enhancing existing documentation and reporting practices, and providing additional requirements that include extending liability coverage for bitumen extraction processing facilities, upgrading plants and related oil sands infrastructure (Alberta Energy Regulator, 2014a). As of 2013, the Province held over 1 billion CAD in reclamation securities (Alberta Environment and Sustainable Resource Development, 2013). Of course, if companies cannot undertake the necessary reclamation actions, even with the new MFSP provisions, the Alberta Government will hold final responsibility for reclaiming sites, including any costs above what the Government has in financial security (Gosselin et al., 2010). Progressive reclamation is used to encourage more timely reclamation to reduce these potential public liabilities from mine bankruptcy.

3.7 Progressive reclamation: New policy, new problems

Since oil sand mines present unique reclamation circumstances, it is impractical to wait for all mining activities to cease before beginning reclamation (Alberta Government, 2012). Powter (2002) describes progressive reclamation "as any interim or concurrent land reclamation undertaken during, following or in connection with construction or development, and ongoing operations associated with active disposition" (p. 58). Essentially, progressive reclamation attempts to reclaim land as soon as possible, preventing all reclamation from occurring at the mine's end-of-life. Over time, when sites are no longer required for mining or processing purposes, progressive reclamation can occur (Alberta Government, 2013). The LARP presents a Progressive Reclamation Strategy to encourage reclamation in a timely fashion, using an enhanced certification process, transparent public reporting system and through the progressive reclamation financial security program of the MFSP, all of which is designed to "enhanc[e] the suite of policies, strategies and reporting mechanisms used to drive progressive on-going reclamation of mining operations" (Alberta Government, 2012, p. 26).

In order to implement the Progressive Reclamation Strategy, a new Government agency was established in 2011. The AER was created to act as an arms-length agency, with part of its mandate being to guide, enhance and enforce Government policies in the oil sands. However, how the AER is supposed to enforce the 2011 Progressive Reclamation Strategy is currently unclear (Wellstead, Rayner & Howlett, 2016). While the Progressive Reclamation Strategy is designed to achieve better reclamation outcomes, it has largely remained an internal departmental planning exercise for the AER (Wellstead, Rayner & Howlett, 2016).

The MFSP also encourages progressive reclamation in oil sands mines by financially incentivizing mine operators to reclaim as they operate (Perry & Saloff, 2011). Under MSFP, progressive reclamation is loosely described under the Outstanding Reclamation Deposit (ORD), whereby mining companies are required to proactively manage their reclamation liabilities and to reclaim any disturbed land that is ready-to-reclaim through the active mine life (Alberta Energy Regulator, 2014a). The AER identifies that reclamation programs consist of sequential activities conducted at different times before land is considered for certification. In 2011, Alberta presented the aforementioned categories to track reclamation (Table 1), as a means to better report reclamation progress and determine which areas were suitable for progressive reclamation.

The ORD should prevent reclamation deferral to the end of a mining project, thereby reducing liability costs of future reclamation. ORD operates as "an immediate and continuous

incentive, by making the cost of deferring reclamation greater than the cost of reclaiming" (Alberta Energy Regulator, 2014a, p. 24). Mine operators must calculate Annual Reclamation Balances by determining the difference between Planned Reclamation and Actual Reclamation in a given year, and can receive credit if Actual Reclamation is greater than Planned Reclamation. Refunded securities can be withheld if reclamation balances are not met.[15] These calculations are included in mine reclamation plans that companies must update and submit to the AER every three years. Annual reports to the AER document mines' annual reclamation plans and progress, planned adjustments, alternative reclamation approaches, thresholds and standards for a specific site, reclamation progress based on monitoring and audits, and progressive reclamation milestones that have been (Alberta Government, 2013).

While annual reporting and the ORD should advance reclamation activities, issues regarding how progressive reclamation should occur remain. This research has been unable to find guidelines or legislation mandating specific progressive reclamation timelines. The Government either does not have standardized timelines regulating when progressive reclamation must occur, or that information is not publically available. According to the *Guide to the Mine Financial Security Program*, "[a]pproval holders are expected to schedule reclamation activities as soon as possible to meet the intent of progressive reclamation" (Alberta Energy Regulator, 2014a, p. 24), although no definitive timeline is mentioned. However, if the AER believes that an operator is postponing reclamation, they can require the company to begin reclamation work through an approval and inspection process, forcing the operator to begin reclamation unless they can otherwise prove that starting reclamation would be either "contrary to good reclamation practices or the efficient and economic development of the resource" (Alberta Energy Regulator, 2014a, p. 24). Stakeholders have expressed concern with this wording since it implies that mine operators may easily defer reclamation and face little to no punitive action for delaying progressive reclamation.

Evidently, there are challenges facing progressive reclamation activities. Progressive reclamation is a newer requirement for oil sands operators, but it is not the only approach the Government and oil companies promote. Both progressive reclamation and adaptive management have become regularly used concepts when discussing reclamation, although these terms are ill defined, and their implementation and enforcement remains unclear.

[15] The ORD is outside of this research's scope. For complete details on how ORD operates and economic calculation, see Alberta Energy Regulator's *Guide to Mine Financial Security Program* (2014) pp. 24-28

3.8 Managing uncertainty: Adaptive management in oil sands reclamation

Uncertainty around oil sands reclamation actions and outcomes is evident; therefore managing stakeholder uncertainty should be a necessary task for the Government. As of June 2009, approximately 60% of oil sands areas had been leased to extraction companies without prior land-use planning or environmental assessment (Mech, 2011). To limit reclamation uncertainties, large data pools are required to improve understandings of ecological impacts and reclamation management after disturbance. Homer-Dixon et al. (2016) express grave concern that Alberta's current environmental protections and baseline data for the oil sands are largely lacking; current protection policies are too seldom enforced and oil sands development is often presented as inevitable, superseding environmental protection options. Improved regulatory certainty has been built into the MFSP, however reclamation standards and timelines remain unclear, particularly for progressive reclamation (Perry & Saloff, 2011). The Government will have a difficult task managing public uncertainties about future oil sands reclamation.

Identifying biological and ecological relationships that drive resource- and system-dynamics can improve diagnostic management tools and decision making for reclamation (Rist, Felton, Samuelson, Sandström & Rosvall, 2013). Improved decision-making can reduce stakeholder uncertainties about reclamation practices and end land-uses. This is important, considering Alberta's stakeholder diversity: each group holds unique perceptions and expectations for reclamation activities and end land-uses. Uncertainty extends to how reclaimed sites will respond to natural disturbances at any point in their development. At the moment, there is no consultative process with local communities to determine how reclamation should proceed if fire, weather or insects threaten to undo reclamation efforts (Alberta Environment, 2010). This is one example of why minimizing uncertainties is central to foster optimistic perceptions of reclamation success where limited reclamation has been publically proven.

Successful reclamation after mining disturbance should be facilitated by a regulatory framework that acknowledges and accepts variation in ecological, economic and social objectives and outcomes (Macdonald, et al., 2015). Many ecologists and researchers believe adaptive management may meet the diverse objectives and outcomes expected of reclamation. Adaptive management can be a decision-making framework used to define resource management objectives, management options, and possible activities designed to meet those objectives. Learning arises from examining a management approach over time and re-evaluating the management activity's success or failure. A critical examination of an

activity or approach's results can inform resource managers' future decision-making, based on learning that develops through understanding management outcomes. Adaptive management is generally described as a formal, systematic, and rigorous learning approach based on management outcomes that improve ecological management and reduce uncertainty (Nyberg, 1999). Adaptive management can also develop social learning in large ecosystems over decades-long time periods, in order to help move reclamation trajectories towards socially acceptable and sustainable outcomes (Angelstam et al., 2004). Both ecological and social learning are important for oil sands reclamation, in order to keep stakeholders informed of what reclamation can achieve and to better define satisfactory reclamation outcomes.

Since its theoretical emergence in the 1970s, adaptive management has emphasized the role of uncertainty, complexity, management adjustments, monitoring and stakeholder involvement, with scientific and social learning being a core focus (Williams & Brown, 2014). For the purpose of reclamation, adaptive management is a management approach involving decision-making, monitoring and evaluation of a reclaimed area's performance to inform future actions that will help sites achieve intended performance objectives (Powter, 2002). This approach allows information to be fed back into reclamation planning and design processes, allowing reclamation managers to change approaches and intervene based on new information (Powter, 2002). Using reclaimed sites as learning opportunities benefits ecological understanding, improves reclamation practices and interventions, develops knowledge about future uncertainties and how to minimize them, and develops clearer understandings of what end land-uses stakeholders can, and should expect.

One approach to reduce stakeholder uncertainties involves updating them about reclamation trajectories. Previous ecological management theory assumed that ecosystems existed in indefinitely resilient, steady states (Folke, Carpenter, Walker, Scheffer, Elmqvist, Gunderson & Holling, 2004). Today this theory is no longer accepted as true. Reliably determining long-term reclamation trajectories is difficult to predict because the boreal ecosystem has complex natural disturbance and succession regimes, which can alter site development; natural states may be too narrow a definition to reclaim towards since pre-disturbance states themselves are not static systems (Audet, Pinno & Thiffault, 2014). Ecologists believe reclamation must accept different stages of dynamic equilibrium - where biodiversity and system functions remain relatively stable while undergoing gradual, continual changes as succession occurs on a site (Cortina & Vallejo, nd). Informing stakeholders about these ecological viewpoints may improve their understanding of reclamation. Continued monitoring and information exchange is another way to reduce

stakeholders' uncertainty about plausible reclamation trajectories. Many reclamation ecologists believe that there is a responsibility not only to notify stakeholders, but to encourage their input so that reclamation interventions can produce more desirable outcomes (Cortina & Vallejo, nd; Williams & Brown, 2014; Rist, Felton, Samuelsson, Sandström & Rosvall, 2013). Audet, Pinno and Thiffault (2014) claim that how reclamation goals are defined, and how natural or novel sites may be are not clearly answered by current reclamation legislation.

Creating more favourable outcomes, when novel ecosystems may be expected, requires reclaiming some degree of ecological resilience, not only capability. Resilience is a system's capacity to absorb or withstand perturbations and other stressors in such as way that the system remains within the same regime - with its structures and functions remaining unchanged after disturbance (Holling, 1973). Oil sands mining makes ecosystems more vulnerable to perturbations (natural disturbance patterns, climate change, human impacts, etc.) that could otherwise be absorbed. This threatens shifts from desirable to less desirable states that reduce an ecosystem's capability to generate ecosystem services (Folke, Carpenter, Walker, Scheffer, Elmqvist, Gunderson & Holling, 2004). Regime shifts may be exacerbated by mining activities if reclaimed sites may lack resilience (Folke, Carpenter, Walker, Scheffer, Elmqvist, Gunderson & Holling, 2004). Weakened resilience may shift trajectories towards novel outcomes that are undesirable for some stakeholders. Under ELC, ecosystem regimes can change as long as end land-uses are no less capable, but who defines ELC end land-uses remains an obstacle for stakeholders. Adaptive management may be a suitable starting point to inform stakeholders about reclamation trajectories and involve them in reclamation decisions, possibly creating more positive perceptions of post-mining sites (Doley & Audet, 2013).

Keeping stakeholders informed, but also involved in reclamation management seems critical. Evidence demonstrates that stakeholder participation can enhance environmental protection decisions (Reed, 2008). How adaptive management is designed and implemented in the context of Alberta's oil sands reclamation will determine how successful adaptive management will be. Uncertainty remains around how adaptive management is applied in oil sands reclamation. In order to develop insight into Alberta's adaptive management approach, it is necessary to examine adaptive management theory and its practical application.

3.9 Understanding adaptive management in theory and practice

Adaptive management attempts to reduce uncertainty in the future by actively experimenting with management decisions, monitoring outcomes, and adapting decision making and planning based on new learning. Since ecosystems are complex, adaptive systems, characterised by non-linear dynamics, threshold effects, multiple basins of attraction and limited predictability (Levin, 1999), adapting management strategies to reduce reclamation uncertainty is vital. While the purpose of adaptive management appears clear, its application in oil sands mine reclamation is not.

Many researchers have created their own adaptive management definitions, making an already complex management system more diffuse. Despite these differences, several core themes appear across definitions. Walters and Holling (1990) identify that adaptive management serves a dual purpose: managing a resource and learning from management actions. Managing can be better described as learning-by-doing, where management decisions are decided and implemented, and learning arises from reflecting on information gathered from those decisions. New information is then evaluated and fed into future management decisions. A learning-oriented context is argued as the best method to gain insight and improve management efficiency (Williams et al., 2007 as cited in Williams & Brown, 2016). Nearly all adaptive management definitions emphasize reducing uncertainty by experimenting with different management actions (Rist, Felton, Samuelsson, Sandström & Rosvall, 2013; Williams & Brown, 2016; Williams, 2011). Modeling or experimenting with management actions, and monitoring outcomes, are encouraged to develop knowledge that reduces structural uncertainty (Williams & Brown, 2016). These key tenets - management for learning, adapting management based on learning, and identifying and reducing uncertainty through experimental management and learning - seem to run through nearly all interpretations of adaptive management.

Lee (1993) argues that science should act as a navigational aid for policy, and using adaptive management through deliberate long-term experiments within reclaimed ecosystems could build a better understanding of what works and what does not. While adaptive management encourages learning through cyclic feedback loops between field research and management implementation, this does not always occur (Angelstam et al., 2004). With the poor track record of reclamation success, using learning feedbacks in adaptive management appropriately could improve oil sands reclamation activities and outcomes.

Walters and Holling (1990) identify ways in which adaptive management can be implemented. The first approach is considered evolutionary, or trial and error, where

management choices are haphazard and decision-making is based off of what seems to produce suitable outcomes. Little learning or management improvement occurs with this method, because alternative management choices may cease once a practice has been deemed 'good enough.' This approach may also be considered passive adaptive management, and learning is often an unintentional by-product of decision-making instead of a goal. Another approach, called active adaptive management, considers that data is made available each time a management action occurs, and the information gathered from the action should be used to inform all future decisions and actions. This approach is iterative; where each successive management action is informed by the previous and learning is constantly strived for and applied in improve future management.

The key difference between passive and active adaptive management is the role that learning plays in the management process. Williams (2011) believes active adaptive management intentionally pursues uncertainty reduction through management interventions and explicit experimentation, thereby reshaping management actions based on new learnings. This occurs through two phases: a deliberate phase where stakeholders frame objectives, management alternatives, models and monitoring protocols, and an iterative phase, which is the ongoing application and technical learning cycle about system structures and functions (Williams & Brown, 2014). The iterative phase can lead to institutional learning and re-evaluation of project objectives, management alternatives, ways to incorporate stakeholder engagement and other elements, which can improve the deliberative phase. Intentional perturbation experiments to understand how systems respond to changes provide an active method to better understand how management practices can be amended (Walters & Holling, 1990). Using experiments could develop learning that enhances reclamation planning and actions. A cyclic management structure that intentionally and constantly updates itself may greatly reduce ecological and social uncertainty in oil sands reclamation.

On the other hand, passive adaptive management focuses primarily on resource objectives, and learning is not the intended outcome of decision-making (Williams, 2011). Passive management generally assumes that the most plausible management hypothesis is true, and management actions are implemented based on such assumptions (Nyberg, 1999). Trial-and-error may be applied and management would only be altered if a suitable outcome were not achieved; if a practice appears to work, no further investigation or alteration is done. Williams and Brown (2016) believe that trial-and-error is not actually adaptive management. Instead, they consider it contingency planning. Without a desire to reduce uncertainty, contingency planning appears unsuitable for oil sands mine reclamation. Trial-and-error has

also been called wait-and-see management, which could more correctly considered non-adaptive management (Williams & Brown, 2014). Management, refraining from experiments and interventions and that only monitors as an adaptive management technique, assumes that natural variation and time alone will provide enough information to understand management consequences. People may assume that monitoring alone is enough to make their management approach adaptive, however this assumption is incorrect (Williams & Brown, 2014).

With such distinction between the two, one choice may be more inviting than the other for oil companies. Passive adaptive management is a far more attractive option because it is more affordable. Active adaptive management is costly because it requires higher financial investments and time commitments to consult with stakeholders, design management responses, monitor and analyse outcomes and integrate learning into future reclamation actions (Williams, 2011). The added cost of experimentation to test new approaches may reduce oil companies' willingness to apply active adaptive management, particularly because management experiments may fail to produce useful results. While passive adaptive management and non-adaptive management offer cheaper solutions, they inevitably slow learning and management improvement (Williams, 2011). While active adaptive management would be a better approach to reduce reclamation uncertainties, passive adaptive management or non-adaptive management may be applied instead.

Despite adaptive management being a forty-year-old concept, its global application has seen minimal success, often due to research and management being treated as mutually exclusive activities where learning is absent in planning frameworks (Williams & Brown, 2014). Turning science into useful practice involves lengthy collaboration between different stakeholders, building mutual understanding over time, fostering the willingness to change management practices as new information comes to light, and clearly presenting the trade-offs involved when choosing new management practices (Angelstam et al., 2004). Adaptive management is a concept with a wide array of definitions. These definitions can also create uncertainty about which adaptive management approach should be used and when adaptive management is appropriate, feasible or successful (Rist et al., 2013 as cited in Rist, Felton, Samuelsson, Sandström & Rosvall, 2013).

The Alberta Government describes adaptive management as an approach that involves monitoring and evaluating a reclaimed area's performance, followed by any necessary actions to achieve the intended performance objectives, while allowing information to be fed back into planning and design processes so that future reclaimed areas meet their intended

objectives (Alberta Environment, 2010; Powter, 2002). While this approach suggests learning-based feedback loops, it avoids directly encouraging active experimentation. An arguably more suitable description would define adaptive management as a systematic approach involving deliberate designation of control areas that enable management action's results to be researched and better interpreted, thus allowing for the continual assessment and correction of management actions to encourage mutual learning by scientists, policy makers, managers and others until specific targets have been reached (Gunderson et al., 1995; Meffe et al., 2002 as cited in Angelstam et al., 2004).

Nyberg (1999) has worked to provide a stronger framework for applying active adaptive management. While the framework was originally designed for forestry management, the concepts apply to oil sands reclamation. This framework involves six steps as part of an iterative cycle: problem assessment, design, implementation, monitoring, evaluation and adjustment. Assessing the problem involves having stakeholders define a management issues' scope, forecast possible reclamation outcomes and decide which actions will most likely meet those management objectives. Next, managers can design management and monitoring plans to provide feedback about the chosen actions' effectiveness. The design phase should evaluate multiple plan options, costs, risks, informative ability and the ability to meet management objectives. Once completed, reclamation actions can be implemented and monitored for effectiveness. Evaluating outcomes and reclamation trajectories can be used to adjust current reclamation practices, while creating future objectives and models to create new forecasts. These evaluations are then returned to stakeholder groups who assess new problems that may become apparent.

Williams (2011) stresses these steps are important and suggests how adaptive management can be further improved. All stakeholders should understand that decision-making is necessary, even if management actions may create uncertain consequences for end land-uses. Objectives must be clearly defined, measurable and agreed upon to guide decision-making and evaluate success. Learning must be applied in future decisions, which requires that management structures are flexible and allow for adaptive learning. Monitoring should be focused and continual in order to produce data needed to build strong understandings. Lastly, sustained stakeholder involvement is crucial, with means that involvement should be constant, consultation should be regular and management actions should be transparent.

It is unclear if Alberta's adaptive management approach meets the requirements to be considered active adaptive management. Under Alberta Environment and Parks (2016) Cumulative Effects Management System (CEMS) guidelines, adaptive management is

vaguely described. CEMS aims to establish a functioning system of knowledge and performance-based management, designed to set outcomes, continually assess outcomes and determine when management actions are required. Performance-based management is described as using adaptive approaches to ensure results are measured and achieved, however little information on how this will occur, and the degree of stakeholder participation is described. The *Criteria and Indicators Framework for Oil Sands Mine Reclamation Certification* identifies that an adaptive management response cycle may be triggered when a Government audit or monitoring result shows that a reclamation indicator threshold was not achieved (Alberta Government, 2013). The document further suggests the proponent should collaborate with the AER and stakeholders, but professional judgement should be applied to identify the best adaptive management response. Stakeholder involvement in this case is present, but roles and participation levels are ill defined.

In the *Criteria and Indicators Framework*, examples of adaptive management options are provided. These include remedial work, continued monitoring, reclassification of an ecosite, declaring indicators inapplicable to a portion of a reclaimed mine site and/or claim current reclamation certification indicators inapplicable because they are unrepresentative of previous reclamation work done using previous 'standards of the day' (Alberta Government, 2013). These hardly demonstrate ideas of active adaptive management and learning-based outcomes. Adaptive management is claimed to be implemented in mine reclamation, yet Government guidelines do not overlap with scientific descriptions of adaptive management. Additionally, oil companies are responsible to implement adaptive management strategies for reclamation, but its application remains obscured by changing reclamation plans, deferring progressive reclamation and unclear frameworks for continued stakeholder involvement after initial consultations. Most glaringly, while adaptive management is being increasingly claimed to be a useful management strategy, the Alberta Government has not legally defined adaptive management, ultimately reducing its definition and application to oil company interpretations.

While adaptive management and progressive reclamation appear in mine approvals and public documents promoting oil sands reclamation, how adaptive management and progressive reclamation are defined and implemented remains unclear. The role of stakeholder involvement, uncertainty reduction, experimentation, and learning-based management are equally ill defined. Adaptive management's effectiveness is questionable if companies choose *passive* or non-adaptive applications. Passive adaptive management has been criticised for its failure to detect opportunities to improve management processes

(Walters & Holling, 1990), and therefore acceptable reclamation may not be achieved. Understanding stakeholders' perceptions of adaptive management and progressive reclamation is therefore critical to determine if current application is suitable or not.

4. Methodology

The original research design was intended to understand oil sands stakeholders' views on reclamation and end land-uses. The purpose was to uncover possible knowledge gaps between expected end land-uses and current ecological literature. Since large-scale reclamation remains unproven in oil sands mined sites, stakeholders' perspectives may have differed from current ecological research. During data collection, stakeholders appeared aware of reclamation outcomes, however knowledge gaps regarding progressive reclamation and adaptive management were evident. The initial research question was incorrect, and the research was redirected towards understanding how and why divergent understandings of progressive reclamation and adaptive management are present. The research design provided sufficient flexibility to accommodate such a change.

4.1.1 Research Design

Alberta's oil sands industry and relevant reclamation legislation are part of a complex web of socio-cultural, environmental, and economic interactions. Different stakeholders constantly subject reclamation activities and end and-uses to interpretation. Ongoing debate around oil sands mine reclamation practices and end land-uses occurs within this interactive web, therefore the research design required methods capable of uncovering social interactions and perceptions. Qualitative methods were determined applicable to understand stakeholders' knowledge-base regarding reclamation processes and outcomes.

The Canadian Institutes of Health Research, Natural Science and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada ([Canadian Institutes of Health Research], 2014) state that qualitative studies can generate inductive understandings of how people view their actions, and the world around them. In this sense, individual and cultural knowledge should be treated as socially constructed, meaning that knowledge is interpretive and dependent on social context (Canadian Institutes of Health Research, 2014). Analytic understanding of how research participants perceive both their actions and the world around them allows researchers to develop insights from participants' thoughts and perceptions, providing a deeper understanding of the role reclamation serves for stakeholders.

Qualitative research practices and methodologies involve researching humans, and a research project must adapt criteria to the specific subject matter, context and epistemological assumptions about knowledge in a specific research area (Canadian Institutes of Health Research, 2014). Knowledge emerges through the research process, requiring continued, reflective approaches and critical analysis on the researcher's behalf (Canadian Institutes of

Health Research, 2014). Trustworthiness of findings can be demonstrated through a range of methodological strategies, including flexibility, reflexivity and responsiveness, which provide strength to the research during data collection and analysis (Canadian Institutes of Health Research, 2014).

Flexibility, reflexivity and responsiveness were of particular importance since the research was conducted with a grounded theoretical approach. Using a grounded approach requires flexibility, reflexivity and responsiveness because data collection and analysis are an interrelated process. Grounded research systematically and sequentially collects and analyses data to effectively capture relevant research aspects as soon as they are perceived, making understandings grounded within the data (Strauss & Corbin, 1990). Constant effort to expand research questions and collect more data as new, relevant concepts emerge creates a flexible research design that responds to data. Such expansion requires flexibility and responsiveness, but also reflexivity on the researcher's part: understanding that the researcher willing chooses *what* to pursue in further data collection.

This study sought knowledge gaps between stakeholders in order to improve understandings of reclamation processes and outcomes. Collected data from participants guided subsequent research when similarities and differences in responses were noted. Analysing data through the research process allowed constant comparisons of data, presented similarities and differences, and developed patterns of understanding (Strauss & Corbin, 1990). Strauss & Corbin (1990) believe the research hypothesis must be constantly refined to develop stronger understandings from the data. Research, data collection and analysis are part of ongoing, iterative processes that constantly inform the next step of data collection and analysis.

Research and data trustworthiness are key requirements to strong qualitative research. Lincoln and Guba (1985, as cited in Bryman, 2015) proposed trustworthiness in qualitative research as being the equivalent of validity in quantitative research. Trustworthiness requires credibility (believability of data), transferability (application of data to other contexts), dependability (application of data to other times) and confirmability (limiting degree of researcher's values intruding on data). The research, data and analysis have taken care to try to satisfy trustworthiness criteria.

4.1.2 Grounded theory

The expected knowledge gap between ecological science and stakeholders did not appear. Instead, an emergent trend demonstrated knowledge gaps across the concepts of progressive reclamation and adaptive management. The research question was redefined according to grounded theoretical methodologies. Grounded theory was chosen because research on stakeholders' views of oil sands reclamation outcomes was limited. The flexibility of a grounded approach uncovered knowledge gaps and divergent perspectives between stakeholders, which altered the initial research question. This allowed for pursuit of data around progressive reclamation and adaptive management. This research aimed to understand whether knowledge gaps exist between stakeholders, why such gaps may exist and how scientific literature may serve to reduce those gaps.

Grounded research shares some similarities with social constructivism. Social constructivism asserts that reality is constructed through human activity; thereby any knowledge or understanding is a human product of social and cultural interactions and understandings (Kim, 2001). These understandings create a social construct that defines an individual's worldview. Charmaz (2008) describes social constructivism as understanding social interactions and knowledge through a combination of questions regarding *what* and *how* those interactions and understandings occur. However, what social constructivism lacks in social research is engaging thoroughly with questions of *why*. Charmaz continues that grounded theory is a more suitable theoretical approach to understand both questions of *why* and *what/how* regarding social constructions of reality.

Grounded theory was a suitable theoretical approach to use when examining different stakeholders' perceptions because it seeks to uncover relevant conditions of social and cultural interaction and determine how individuals respond to those conditions (Strauss & Corbin, 1990). In the context of oil sands mine reclamation, grounded theory was useful to develop an explanatory theory of social processes between stakeholders in the context where various social processes occur (Glaser & Strauss, 1967, as cited in Starks & Trinidad, 2007). Theory development may arise through careful study of causes, contexts, contingencies, consequences, covariance and conditions to understand patterns and relationships of responses within and across stakeholder groups (Straus & Corbin, 1998, as cited in Starks & Trinidad, 2007). Grounded research also examines how social structures and processes influence how things are accomplished in a set of social interactions (Starks & Trinidad, 2007), making grounded theory a beneficial tool to navigate the complex social, environmental and economic web surrounding stakeholders' perceptions of reclamation.

Bryman (2015) articulates the process and outcomes of grounded theory are iterative, from the research question to theory generation. Research begins by formulating a research question, which informs theoretical sampling of relevant people for the study. Data is collected from research subjects and is coded by themes or concepts. Concepts, a label given to discrete phenomena, are outcomes of analysis and data coding (Bryman, 2015). Concepts are the basic unit of analysis (Strauss & Corbin, 1990), and inform later steps by forming categories. There is a continual movement between these first steps, as early data directs subsequent information collection, returning the researcher to the research question, revising it as necessary, and theoretically sampling new subjects. Continual comparison of themes and concepts should present categories, and each category may become saturated with data. Categories can be understood as a concept with enough elaboration to be viewed as a real-world phenomenon (Bryman, 2015). Categories act as larger information collections of a concept, and develop relationships between data. The theoretical saturation of categories, and examining relationships across categories allows the researcher to develop and test a hypothesis. The hypothesis develops by drawing connections, patterns and relationships between concepts and categories. Should the hypothesis be tested and reasonably held, the research develops a substantive theory, which is separate and independent from other cases. A substantive theory provides a framework explaining the relevant social phenomena that is uncovered by examining the relationships between well-developed categories (Strauss & Corbin, 1998, as cited in Bryman, 2015). A formal theory may only be generated if the hypothesis can apply and hold in other cases, which rarely occurs in grounded research, since the study typically focuses on a single, particular context.

4.1.3 Limitations and criticisms of grounded theory

Criticism of grounded research comes from researcher reflexivity during data collection and analysis. Some question whether grounded theory can be conducted without bias or without preconceiving concepts (Bryman, 2015). Critics also suggest that concepts and categories are subjective in meaning and importance. This is not necessarily an issue limited to grounded research, however. Many qualitative research projects fall prey to this criticism. Bryman (2015) states that qualitative researchers are typically knowledgeable of a multitude of theories within their field, and therefore, theory-neutrality is rarely accepted as feasible or practical. Since qualitative research is naturally inclined towards some degree of subjective interpretation, concepts and categorical importance emerges through saturation of responses provided by different research subjects. While data collection and analysis are

iterative, the research may focus on what becomes subjectively important to the researcher, but that importance remains grounded in data, as subjectively important from the respondent's standpoint.

Another criticism against grounded theory is if the approach generates social theory. Concept generation alone may not warrant a complete explanation of social phenomena (Bryman, 2015). However, other scientific research methods do not always produce theory. Instead, non-theory generating research contributes evidence to slowly build to support or undermine a prevailing theory. It was not the intention of this research to necessarily produce a formal theory, more so to identify potential knowledge gaps between stakeholders and attempt to explain why such gaps might exist. Even if a theory for why knowledge gaps exist cannot be generated, discovering knowledge gaps may be equally useful to improve reclamation policies in the oil sands.

4.1.4 Sampling

Qualitative research often places more emphasis on the depth of meaning provided by respondents, instead of on the total number of responses collected. Response depth creates diverse and overlapping data by limiting respondents to those who can provide rich and deep information about the research topic (Canadian Institutes of Health Research, 2014). While the results may not create statistical significance, the focus of interview-based data collection is to develop saturation or thematic redundancy across interview responses (Canadian Institutes of Health Research, 2014).

This research required sampling methods suited to uncover deeper meaning and perspectives that could develop thematic saturation. Therefore, participant sampling was based on respondents' potential to generate response patterns that could produce thematic saturation. For this reason, several purposive sampling techniques were applied. Purposive sampling selected individuals relevant to the research. This approach placed the investigation's questions at the forefront of sampling considerations (Bryman, 2015).

Targeted stakeholder groups were selected based on their involvement in reclamation planning or activities, or from close ties to the mineable oil sands. Identified groups included:

- Oil sands companies operating within the mineable oil sands
- Provincial Government officials and relevant Provincial Government ministries/departments
- Local Government within the Wood Buffalo Regional Municipality
- Public Researchers (University researchers/professors in Alberta)

- Environmental Consultants
- Professional Reclamation Practitioners
- First Nations, Aboriginal and Métis organizations
- Environmental non-governmental organizations

These stakeholder groups were believed to be well informed about oil sands mining and reclamation. Diversity between groups was considered important to ensure representativeness through the study, and respondents were actively sought for their possibly dissimilar perspectives and backgrounds.

Once these stakeholder groups were identified, individuals within these groups were purposively sampled. The sample size required enough respondents to develop data saturation, but not so many as to make data analysis complicated or impossible to process within the allotted research time (Onquebuzie & Collins, 2007 as cited in Bryman, 2015). Opportunistic sampling was initially used to establish contact with relevant participants, and to begin establishing the sample size.

Opportunistic sampling - collecting data based on opportunities with individuals that are largely unseen (Bryman, 2015) - produced useful respondents and allowed initial interviews to be arranged. This method was practical for several reasons: limited previous contact with any identified stakeholder group, no Canadian telephone number during the initial phase of research, and being outside of Canada when stakeholder groups were being identified. Appropriate organizations and individuals across Alberta were identified and contact by telephone, by e-mail or by office walk-ins, to inquire about respondents' interest in participation. Examples of purposive, opportunistic sampling included: reviewing institutions or organizations staff directories and contacting individuals by telephone; contacting individuals within organizations who had published research on reclamation; Internet searches for Government departments, companies, and organizations associated with the oil sands; and contacting authors of other publications relevant to the research. These initial forms of contact were less fruitful than expected, as many people felt unsuitable to participate in the research. However, several relevant interviews were initiated through opportunistic sampling.

Many people first contacted did suggest potentially relevant people to speak with. This provided access to names, telephone numbers, or e-mail addresses of people believed to be more knowledgeable on the subject. Bryman (2015) defines such a sampling method as snowball sampling; the initial sampled group, often small in number, propose other participants with experience or characteristics more relevant to the research. Snowballing

participants resulted in interviews with more potential respondents. This method was also used during interviews with respondents, who advised on additional participants that could be contacted.

In total, nineteen interview participants were sampled, although only sixteen interviews were included for analysis. Two interviews with individuals from the AER were omitted from analysis because these interviews did not follow the interview guide (see Appendix C). One additional interview was excluded because the respondent did not follow-up and give final approval for their data to be used. Participants were sampled across nearly all of the targeted stakeholder groups, however their dispersal was not equal (see Table 1 in *Results* section). Excluded from targeted stakeholder groups were:

- Oil sands company representatives: 4 companies approached, all declined to be interviewed
- Local Government:
    - 1 interview arranged, but the respondent experienced a personal issue and was unable to reschedule an interview at a mutually convenient date
- First Nations, Aboriginal and Métis:
    - Many regional offices were unoccupied due to fire or flood damage that occurred prior to my arrival. Telephone calls, messages and e-mails were not responded to. Two First Nations organizations were contacted, however no mutually convenient date could be arranged for interviews
- Current Minister of Parks and Environment for Alberta:
    - Office was contacted however an interview with the active Minister was not granted

4.2 Data Collection

4.2.1 Theoretical approach

Data was collected through semi-structured interviews. This format allowed for concept and theme emergence from the data, while informing future interviews. A semi-structured interview based on ten fixed questions provided flexibility while guiding the scope of data collection. This narrowed the inquiry scope while allowing variation in question sequence, but also provided room for additional, follow up questions to points-of-interest presented by respondents. Since diverse stakeholder groups were targeted, semi-structured interviews provided each respondent with identical questions, but different departure points to capture varying viewpoints, experiences and knowledge. A semi-structured interview also

provided enough flexibility to allow both the researcher and respondent to jump between questions, following a more natural, conversational direction. This created better rapport between researcher and respondent, often leading to long, in-depth interviews that were directed by the interview guide, but open enough to draw out themes and concepts each interviewee found to be most important to discuss.

Semi-structured interviews also reflected grounded theoretical approaches. All respondents were asked identical questions, but inquiry focus in successive interviews placed more emphasis on thematic areas from previous interviews. This iterative, back-and-forth between the data and the interview drove subsequent interviews towards issues of progressive reclamation and adaptive management. Each interview was recorded to allow for transcription, and notes were taken during the process. Interviews were conducted either in-person, or as telephone interviews.

4.2.2 Private interviews

Interviews were arranged with both opportunistically- and snowball-sampled respondents. Prior to the interview, each respondent was informed by either a telephone conversation or e-mail explaining the purpose and rationale for the research in which they would be participating (Bryman, 2015). In several cases, where the interview would be in person, at a much later date, or at the behest of the respondent, the interview questions were forwarded to the respondent by e-mail. This approach ensured clear understanding of the research intent. Preliminary telephone conversations or e-mails informed respondents about the research, but also developed rapport. Bryman (2015) describes rapport as the quickly established relationship that encourages the respondent to want to participate in the research. Strong rapport was developed and maintained with each respondent, prior to, during and after the interview, through follow-up e-mails.

After private interviews were established, each respondent provided verbal agreement and consented to having their interview recorded and data collected as part of the research. All interviews were privately conducted between the respondent and researcher. Respondents participated in interviews ranging from twenty-five minutes to approximately two hours, depending on their time availability, through which ten interview questions were asked, as well as additional follow-up and probing questions on issues and topics the respondents brought up.

During interviews, the conversations were digitally recorded on a private, password protected cell phone and notes were written down. Interview notes were taken for two

reasons: in the event that audio was improperly captured, a reliable response form would be available for later analysis, and also to provide an immediate document that could be reviewed, analyzed and used to inform the next interview. Interview notes helped identify specific concepts of particular interest, and acted as a preliminary coding method. Of all private interviews conducted, only two telephone interviews experienced audio recording issues (one being an omitted interview).

All recordings were checked immediately after the interview to ensure the recording was properly captured. The two interviews that were not properly recorded were both immediately written down in an electronic word document based off the written notes taken during the interview. The purpose was to ensure that responses were accurately reflected without distortion or distant time lags between the initial interview and the noted answers.

4.2.3 Transcription

Each interview was manually transcribed. Transcriptions were vital as part of the grounded approach and would be used for later data analysis. The process involved several months of listening to each audio recording at a reduced playback rate, and responses were manually typed into a digital word document. All transcriptions were kept in a private, password-protected storage server. Sections of transcriptions were omitted - sections deemed irrelevant or where audio interruptions made responses incomprehensible. Due to a recording issue with two telephone-based interviews, no audio was captured. Those two participants were sent an informative e-mail about the issue and were provided with a typed document based on the interview notes. These respondents were asked to provide more detailed responses if the notes did not adequately represent, or inaccurately captured their responses.

Each respondent was informed after the interview that they would receive a digital copy of their own interview transcription for review and clarification purposes. Respondents were provided the opportunity to review transcriptions for quality purposes, to clarify ideas, to improve sentence structure, to add any relevant information, or to omit or demand anonymity to any information. Each respondent was recommended to review and respond using a different colour text from the original transcription, while an original transcription was kept unaltered in a separate file to allow for comparison and ensure trustworthiness between original and reviewed responses. The review process was also conducted to continue rapport with respondents, to fulfill ethical commitments that their information would be returned for review purposes prior to their information being published (as part of the consent process). Four additional follow-up questions based on emergent themes from initial analysis

conducted during the transcription process were also sent to respondents with their transcript (see Appendix C).

4.3.1 Analysis methods

Manual analysis was chosen over qualitative data analysis software. While computer-assisted data analysis is praised for its timesaving capabilities and potential to improve validity of results, my data sets were not so large or cumbersome to suggest my time would have been better spent learning a program to reduce my analysis schedule. Additionally, grounded research begins concept emergence from the onset of the first interview. My data analysis was already an ongoing, iterative process during interviews, transcription, additional follow-up and later coding. Many concepts and thematic areas emerged before entire data sets were complete, further reducing the perceived need to use data analysis software.

Coding formed the core of the results analysis. Bryman (2015) discusses coding as an essential process in grounded theory, where data is labeled into thematic elements that recognize potential theoretical significance. Charmaz (2006 as cited in Bryman, 2015) identifies two steps to coding: initial and selective. Initial coding involves making highly detailed analysis of first impressions the researcher has of the data, in order to begin to make sense of the results. After, selective coding emphasizes the most common codes developed from initial coding, allowing the research to become focused around core concepts and ideas. This data was continually compared during the data collection and analysis phases in order to identify central concepts.

Initial coding took place during and immediately after interviews, forming a basis for which ideas and concepts should be discussed in subsequent interviews. It became clear that progressive reclamation and adaptive management were central ideas that all stakeholders discussed with varying viewpoints. Initial coding directed the research towards these concepts after respondents provided different perceptions of both concepts. Selective coding was a more beneficial analysis method during and after transcribing the interviews, allowing for data categorization.

Charmaz (2006 as cited in Bryman, 2015) states that selective coding requires decisions about which initial codes should be prioritized to accurately categorize data. However, the researcher should be aware that transcribing and analyzing data could result in two different perspectives. Transcriptions reflect the perspectives of the respondents, yet coding can result in a different worldview based on the researcher's biases (Charmaz, 2006 as cited in Bryman, 2015). In order to subvert bias as much as possible, coded transcriptions

with comments in the margins were sent back to each respondent to verify their responses and inform them about which information was particularly interesting. Follow-up questions were used to inquire into further into adaptive management and progressive reclamation, also useful to subvert bias in initial interview coding.

Several coding steps were taken during analysis. Bryman (2015) provides several criticisms to the grounded coding analysis, which are useful to keep in mind. He states that coding may cause a loss of context, as certain information is being selected while the rest is being ignored. To avoid major data omission, participants were informed prior to the interview that the research's motivation was to uncover potential knowledge gaps about reclamation processes and end goals. In this way, the research topic was sufficiently narrow at the onset to avoid omitting narrative flow, since the respondents were aware of the research objectives. Bryman (2015) furthers this concern, saying that themes may blur within a narrative, making coding concepts difficult to clearly separate. This presented challenges to data analysis, as response-overlap across different concepts did occur (see Appendix B). As part of the analysis process, coding produced themes, and sub-themes, which organized data for further coding.

4.3.2 Symbolic interactionism

Grounded theory shares theoretical connections with symbolic interactionism (Strauss & Corbin, 1990), making symbolic interactionism a useful method to understand why respondents focused on particular topics, definitions or ideas. Symbolic interactionism is the way an individual continually interprets the symbolic meaning if their environment, and how people act on the basis of the meaning they create through this interpretation (Bryman, 2015). Bryman further elaborates that individuals make sense of phenomena and construct meaning around it, and since people do not live in isolation from each other nor their environment, a researcher should account for an individual's interpretation based on their social environment. Symbolic interactionism helped to explain how particular stakeholders viewed oil sands reclamation, progressive reclamation and adaptive management.

Symbolic interactionism breaks down into three main principles. 1) People act towards things and others based on meanings they hold; 2) meaning is established through continual social interactions; and 3) meanings are continually transformed through interpretation, allowing people to make sense of objects constituting their social realities (Bulmer, 1969 as cited in Snow, 2001). Snow (2001) claims that analytic attention is central to understanding respondents' meanings and interpretations, and accounting for an

individual's social pretext can help to understand and analyze their responses. Benzies and Allen (2001) believe that human research should regard respondents within the context of their culture and environment. In this way, by understanding that not all Albertans hold the same viewpoint or have similar social or cultural backgrounds, their responses should be analyzed as such.

By identifying stakeholder groups, it was an easier task to analyze similarities and differences within and between groups. Symbolic interactionism was used during analysis to code responses, as well as respondents, into categories for comparison. This was useful considering respondents included Government officials, public university researchers, Aboriginal and Métis representatives, and others. Each group's views of reclamation issues were better analyzed through symbolic interactionism, because cultural groups define and relate to symbolic environments in nature, conferring their own meaning onto those environments (Benzies & Allen, 2001; Greider & Garkovich, 1994).

Symbolic interactionism was beneficial because each stakeholder group holds a different understanding of the natural resources available in the area - a major cause of debate around oil sands development. The landscape reflects divergent self-definitions of people within particular cultural and social contexts. Landscape transformations from mining affects not only the environment, but also the way in which individuals and groups identify and define themselves (Greider & Garkovich, 1994). These self-definitions surround culture, and culture drives social meaning; when cultures face change, they must negotiate between the current view of a landscape and the direction new landscapes will lead the culture (Greider & Garkovich, 1994). Disputes over land-use change and how cultures ascribe meaning to oil sands region can be understood as consequences of different, competing cultures' defining the same landscape (Greider & Garkovich, 1994). These conflicts and continual negotiations in the face of environmental change are central to understanding oil sands reclamation. Since Alberta holds many different cultures and viewpoints regarding oil sands mine reclamation, symbolic interactionism allows comparison within and between stakeholder groups to improve analysis.

4.4.1. Ethical considerations

Ethical issues must be recognized during every phase of social research, since ethics impact the results integrity (Bryman, 2015). Ethical considerations were informed by two main sources: the Canadian Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans* and the Social Research Association (SRA) *Ethical Guidelines* document.

The SRA (2003) states the obligations a researcher holds during social investigation, including: obligations to society, obligations to colleagues, and obligations to subjects. Societal obligations require the researcher maintains high scientific standards in data collection methods, data analysis and impartial assessment and dissemination of results, while conforming to the researched society's ethical standards, laws and legislation (SRA, 2003). The Canadian Tri-Council Policy Statement was a relevant document to ensure the research conformed to ethics laws in Canada.

In Canada, there are particular obligations a researcher must adhere to. People should be treated justly, with respect, and with concern for a subject's welfare (Canadian Institutes of Health Research, 2014). Justly implies fair treatment of subjects, and equal respect and concern is granted to prevent research benefits or burdens from unduly harming or excluding participants. Respect for persons is required through the research process, accounting for the intrinsic value of all human beings, and requesting fair and equal treatment through the research process. Lastly, welfare for subjects accounts for privacy and controlling information via obtaining participants' consent, and ensuring the research does not impact physical, mental or spiritual health, or physical, economic or social circumstances. Research in Canada must also not conflict with the Canadian Charter of Rights and Freedoms (Canadian Institutes of Health Research, 2014). This research obeyed such ethics.

Researchers also have wider social considerations. Social research should be sufficiently wide enough in scope to open social enquiry and communicate findings in order to benefit the widest possible community, while avoiding any undue risks or unfair benefits from the research (SRA, 2003). It is difficult to imagine this research causing undue risks to social groups, as the oil sands are a publicly debated topic. In this way, this research falls under the minimal risk category: the magnitude of possible harms from respondents' participation is no greater than what they encounter in their everyday life (Canadian Institutes of Health Research, 2014). No potential benefits that could be excluded from certain groups occurred. This research merely provides knowledge, which could be considered beneficial to society, without potentially harming or causing undue burden (Canadian Institutes of Health Research, 2014).

The SRA (2003) provides additional insight for researchers. Remaining entirely objective during social research is difficult, and research design and implementation should avoid reinforcing personal bias, which may mislead or misinform the public. The document continues that research should advance knowledge. To ensure unbiased responses, data collection, analysis and results published in this study included many relevant social groups,

and each respondent was provided identical core research questions. Results were compared across interviews and against public policy documents and scientific research articles to further limit personal bias.

Social researchers must also abide by responsibilities to research subjects. Informed consent is required for social research in Canada. Each respondent voluntarily gave consent, and they had opportunities to withdraw consent at any time during the research process. All participants were informed with full disclosure of all necessary information about the study, allowing for an informed, consenting decision about their participation in the project prior to interviews and data collection. This was done in accordance with the Tri-Council Policy statement, and included a plain language statement of the voluntary nature of the research, the process, duration, expectations of respondents and how their results would be used. All consent was provided through verbal agreement, included as part of the recorded interview, as well as in written format through the e-mail follow-up questionnaire. All respondents were informed of how their data would be collected, stored and used prior to interviews. Consenting participants understood their data would be recorded over the telephone or with an audio recording device, that all data would be securely stored in a password-protected server storage, no data would be shared or published until they reviewed and gave final consent to use of their data, and that anonymity could be provided at any time prior to publication. Consent was an ongoing process maintained by e-mail with each respondent after data collection, transcription, and follow-up were conducted.

Two final notes are worth mentioning. No groups were unduly omitted from the research process, however one stakeholder group voluntarily refused to be researched. No oil company was willing to participate in the research, despite attempts to include them. Lastly, there were minimal ethical obligations to colleagues. This research was independently conducted, with no other researchers involved. The research included in this Master's thesis adhered closely to all the mentioned ethical obligations, establishing trustworthy results through maintaining high research standards.

5. Analysis and results

5.1 Interview analysis, coding and categories

Sixteen interviews were conducted with respondents across a variety of stakeholder groups, often with multiple and sometimes overlapping connections to the oil sands. Respondents are listed anonymously, in a random order in Table 1. Only two respondents requested complete anonymity, and several others requested anonymity to sections of their responses. To ensure privacy, all respondents have been anonymously listed through this research to protect identity, current professions, future employment or funding opportunities.

Table 1: Respondents and respective stakeholder group(s) interviewed (order is not representative of order in which interviews were conducted)

Respondent	**Stakeholder Group** (Primary identifier listed first, additional affiliations listed thereafter)
Respondent 1	Biologist, Oil company reclamation practitioner
Respondent 2	Environmental NGO
Respondent 3	First Nation/Aboriginal Consultant
Respondent 4	First Nation/Aboriginal Consultant, CEMA
Respondent 5	Public Researcher, University of Calgary
Respondent 6	First Nation/Aboriginal Consultant
Respondent 7	Environmental NGO (former employee)
Respondent 8	Alberta Government Employee, Upstream oil and gas
Respondent 9	Ecologist, First Nation/Aboriginal Consultant, CEMA
Respondent 10	Public Researcher, University of Alberta
Respondent 11	Environmental Consultant
Respondent 12	University Professor, Former oil company employee
Respondent 13	Environmental Consultant, Botanist
Respondent 14	Public Researcher, University of Calgary
Respondent 15	Alberta Government Employee
Respondent 16	Métis Consultant, CEMA

Grounded theory aims to produce social theory as an end product. Theory emerges from the data first by coding and constant comparative analysis (Willig, 2013). Continual coding and comparison produced various interview analysis iterations. To begin, interview notes were taken while each interview was conducted. These notes developed areas of

interest for later interviews, focusing on emerging topics presented by a respondent. From these key areas, the first level of coding began: identifying core themes useful for improving subsequent interviews. These core themes shifted research away from stakeholders' ecological understanding of end land-uses towards stakeholders' perceptions of how progressive reclamation and adaptive management are applied.

During the transcription process, each interview underwent a round of comparison against initial interview notes. Open coding of notes and transcriptions produced several tentative codes. Tentative codes emerged as core thematic areas of interest within and across each interview. Constant comparison produced several broad areas of overlap. Overlap was useful to fit data into generalized themes for later comparison, analysis and specific coding. Four tentative core themes were produced: ELC; trade-offs and altered/novel ecosystems; progressive reclamation; and adaptive management.

After transcription analysis, a four-question follow-up was sent to respondents with their transcribed interview. The follow-up provided an opportunity to probe into the latter two tentative core themes, and used theoretical sampling where more research was needed. Since the tentative core themes of progressive reclamation and adaptive management emerged from subsequent interviews, follow-up questions were necessary for earlier respondents, but also useful for more complete theoretical data saturation from all respondents. Follow-up questions were sent to each of the sixteen respondents (see Appendix C Table C.2). Thirteen follow-up responses were collected for analysis, with a Métis consultant, Environmental NGO and Public Researcher not providing responses.

The tentative core themes organized coded interview and follow-up responses. Organized content analysis assisted in iterative analysis rounds. Each interview transcript and follow-up response was compared against the four emergent themes and colour-coded to visualize relevant data for compilation into thematic data sets. This method broke respondents' data into smaller data sets linked to the tentative core themes, allowing for more direct comparison and coding of responses in the next stage. After all interviews and follow-up responses had been coded and organized into tentative core themes, data was placed into four separate documents for direct comparison and analysis.

The next coding round was manually conducted and sentence-level data was analyzed. Respondents' core theme sections were selectively coded. Selective coding produced concepts and tentative core sub-themes emerged within the four tentative core themes (Table 2). This would later produce data categories. Each tentative core theme was useful to organize and compare individual responses within the core theme, producing similar

or different concepts within and across interviews. Sub-themes within each tentative core theme emerged during coding, and were useful to further organize data for comparison and analysis. Once organized in tentative core sub-themes, concepts could be easily examined for similarities and differences. Organizing concepts by sub-theme was useful to more clearly visualize data, and to develop understandings about which stakeholder groups held what perceptions on topics. All concepts and the relevant sub-themes have been organized and presented in Appendix B.

Table 2: Concepts produced tentative core categories linked to tentative core themes

Tentative core theme	Tentative core sub-themes	Concept examples
Equivalent Land Capability	- Importance of reclaiming land - Desired end reclamation outcomes (end land-uses) - ELC definitions and perspectives - ELC acceptability for reclamation - Reclamation achievement of ELC	- Responsibility - Uncertainty - Social Utility - Altered State - Vague - Improving standards - Power imbalance
Trade-offs and altered/novel ecosystems	- Sustainable development and trade-offs - How and why trade-offs occur - Likelihood of novel ecosystems/landscapes as reclamation outcomes - Acceptability of novel ecosystems or altered landscaped as reclamation outcomes	- Sustainable development not occurring - Environmental trade-off - Uncertain outcomes - Pragmatic reclamation - Financial liability - Who determines acceptable outcomes?
Progressive reclamation	- Progressive reclamation definitions and perspectives - Progressive reclamation occurrences - Challenges limiting progressive reclamation - Suggestions to improve progressive reclamation	- Buzzword/Public Relations language - Not deferring reclamation - Active mining prohibits - Cost hinders reclamation - Improving standards
Adaptive management	- Adaptive management definitions and perspectives - How adaptive management is perceived as occurring - Challenges limiting adaptive management - Suggestions for improving adaptive management	- Applying learning - Buzzword - Participation - Cost hinders adaptive management - Balance power - Distrust - Improve regulations

Once concepts within tentative core themes were evident, data was compared within a theme to develop categories. Categories are designated groupings of instances that share characteristics or features with others (Bryman, 2015; Willig, 2013). In order to produce categories, they must be rooted in the data; therefore coded data with a tentative core theme

was compared to produce categories. Tentative core sub-themes concepts were tallied together, based on their similarity. All concepts were manually written down and similar/identical concepts were tallied together to produce a sum total of each concept within each sub-theme. The sum total of a concept produced a category. Categories are presented within their relevant tentative core theme and will be described through the *Results*.

Categories are best presented in relation to their tentative core sub-theme. Although some categories and concepts overlap between core themes, it is difficult to visualize data relationships in such a way. It was decided to present categories at a sub-theme level to demonstrate complexity within a sub-theme, however relationships across sub-themes will be discussed. Sub-themes are presented in the *Results* in an order that allows relationships to cascade through.

Through symbolic interactionism, a respondent or stakeholder group may tend towards one category of a sub-theme, while others tend towards a different category. A respondent's worldview, based on their connection to the economic, social and/or environmental state of Alberta's oil sands is more clearly reflected through each sub-theme category, allowing for direct response comparisons to understand how similar and different viewpoints occur within and between stakeholder groups.

5.2 Analysis limitations

To properly build grounded theory, theoretical data saturation must occur. Theoretical saturation is accomplished when no new categories can be identified and new instances of variation no longer emerge, although theoretical saturation acts more as a guide than a goal (Willig, 2013). Analysis results did not completely achieve theoretical saturation, however certain categories did achieve higher levels of saturation than others. Some negative fit categories, those categories that do not fit with others or did not achieve high levels of saturation, are also included because those results demonstrate variations and complexity in stakeholder perceptions.

The subjective nature of grounded theory analysis presents a limitation. Concepts, categories and theories are exposed to the researcher's own bias or subjective interpretation. It is important to note that subjective bias cannot be entirely removed from analysis, however, the benefit of personally conducting this research accounts for conversational context, which may strengthen primary data analysis. Some subjective analysis can be expected in such research, however the context in which these interview took place demonstrates that the

direction data collection took was a result of the concerns, questions and perceptions of the respondents themselves.

The results are also a product of a small sample group, purposefully selected for this research topic. The benefit of a smaller sample size allowed deeper contextual meaning to be provided by respondents, based on their interpretations of oil sands reclamation. However, a small sample size may not necessarily be representative in *all* contexts, and any theory derived from this research may be inapplicable in situations or contexts outside of which the data was collected from. The goal of grounded research is not particularly to develop a theory that can be evenly applied across different social contexts. Instead, since any produced theory is grounded in the data, that theory would be applicable only to the context in which it emerged from.

5.3 Results

Final data analysis created eleven pages of results, formulated in sixteen three-column tables around a tentative core sub-theme. Every table included *Category, Number of Responses,* and *Respondent*. A partial list of all results is presented within this section, based on relevant connections between each table. A complete listing of results is available in Appendix A. Each presented table is accompanied by a brief description and interpretation below, in order to present connections across and/or interesting findings within the categories. Connections may not be easily seen between sub-themes, and the reader is encouraged to see Appendix B for a complete list of concepts that helped define categories. Appendix B contains direct respondent quotes and concepts derived from responses, and acts in conjunction with the *Results* presented below.

Table 3: Importance of reclaiming land

Category	No. of Responses	Respondent
Citizen Importance	10	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public researcher x2 - Environmental NGO - Alberta Government employee x2 - University Professor/Former oil employee - Environmental Consultant
Ecologically Important	9	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x2 - Alberta Government employee x2 - Ecologist/Aboriginal Consultant - Public researcher - Environmental Consultant

Legal Obligation	13	- Biologist/Oil Company reclamation practitioner - Environmental NGO x3 - Public researcher x3 - Alberta Government employee - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal Consultant - Environmental Consultant - Métis Consultant
Aboriginal Importance	6	- First Nation's/Aboriginal Consultant x3 - Environmental NGO - Ecologist/Aboriginal consultant - Métis Consultant

Respondents presented a variety of perceptions for the importance of reclamation. Nearly all respondents fit into a citizen's perspective, believing that reclaiming land is a social value of Albertans. Nine respondents felt that reclamation was ecologically valuable, and this can act as an extension of social values, legal obligations and/or Aboriginal importance. The highest response was reclamation as a legal obligation. The smallest number, and almost entirely dominated by First Nations, Aboriginal and Métis Consultants was that reclamation was important to Aboriginal land users.

Table 4: Expected and desired reclamation outcomes

Category	No. of Responses	Respondent
Expected outcome: Altered Landscape	7	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public researcher x2 - Environmental NGO - University Professor/Former oil employee
Expected outcome: Pragmatic reclamation outcomes	5	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Environmental NGO - Alberta Government employee - University Professor/Former oil employee
Desired Outcome: Similar Ecological Function Returned	8	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Alberta Government employee - Ecologist/Aboriginal consultant - Public researcher - Environmental Consultant x2 - University Professor/Former oil employee
Desired outcome: Representative Landscape Returned	9	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Alberta Government employee x2 - Ecologist/Aboriginal consultant - Public researcher - Environmental Consultant x2 - University Professor/Former oil employee
Desired outcome: Aboriginal Utility	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3

Returned		- Environmental Consultant - Alberta Government employee - Métis Consultant
Desired outcome: Culturally Appropriate Landscape Returned	6	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - Environmental Consultant - Métis Consultant
Desired outcome: Social Utility/Social Value Returned	5	- Public researcher x2 - First Nation's/Aboriginal Consultant - Alberta Government employee - Métis Consultant

The majority of respondents expressed that altered landscapes or pragmatic reclamation outcomes were to be expected. Respondents believe reclamation is unlikely to recreate pre-disturbance states. Expected outcomes are contrasted by what stakeholders desire as outcomes. Ecological function return, reclamation towards representative landscapes and reclaimed end land-uses that are useful and culturally appropriate for Aboriginal land users appear important to many stakeholder groups. The category Social Utility/Social Value Returned received lower response rates and is a weaker category, likely representing the shift of reclamation from commercial forestry metrics and valuation towards locally common boreal forest criteria.

Table 5: ELC definition and perceptions of ELC use

Category	No. of Responses	Respondent
Definition: ELC means similar, but not the same state returned	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Alberta Government employee x2 - Public researcher - Environmental Consultant - University Professor/Former oil employee
Definition: ELC is vague	8	- Environmental NGO - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public researcher x2 - University Professor/Former oil employee - Environmental Consultant - Métis Consultant
Reason ELC is used: ELC is a legal mechanism	7	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - Alberta Government employee x2 - Ecologist/Aboriginal consultant - University Professor/Former oil employee
Reason ELC is used:	4	- Biologist/Oil Company reclamation practitioner - Public researcher

Guidance and measurement mechanism		- Alberta Government employee x2
Reason ELC is used: Provides flexibility or non-specificity when gauging reclamation success (responses ranged from positive use, ie. pragmatic outcomes, to negative use ie., useless tool)	6	- Public researcher x3 - Ecologist/Aboriginal consultant - Environmental Consultant x2 - Métis Consultant
Power Imbalance: Who defines ELC?	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

Categories of ELC definitions demonstrate wide response variation. What appears most interesting is that while numerous responses fit into ELC as a legal mechanism, a large amount of respondents believe that ELC is vague. Missing from the ELC is vague category are the Alberta Government Employees (also absent in the Power Imbalance category). The Power Imbalance category arose from responses questioning if ELC adequately or properly accounts for all stakeholders interpretations of equivalency. Eight respondents developed this category, consisting entirely of non-Government and non-industry stakeholders.

Table 6: ELC acceptability for reclamation planning and end land-uses

Category	No. of Responses	Respondent
Who defines ELC: ELC is vague	6	- Public Researcher x2 - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Environmental Consultant
Who defines ELC: Power Imbalance	8	- Public Researcher x2 - First Nation's/Aboriginal Consultant - Environmental NGO - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Environmental Consultant - Métis Consultant

Power Imbalance questions the applicability and acceptability of ELC for reclamation. When examined more closely, who defines ELC was a contentious issue and produced two distinct categories. The connection between ELC being vague and ELC representing a power imbalance stresses the importance of examining who determines how

ELC is defined and applied when measuring reclamation success. Again, mostly non-Government and non-industry stakeholders raise concerns about ELC as the legal framework for oil sands mine reclamation. Concerns stemming from ELC definitions and application trickle down into how respondents view reclamation's ability to achieve ELC, but also introduce forms of uncertainty and distrust regarding how reclamation activities may be implemented in practice versus how reclamation is portrayed publicly.

Table 7: Reclamation achievement of ELC

Category	No. of Responses	Respondent
ELC can be achieved	5	- Biologist/Oil Company reclamation practitioner - Alberta Government employee x2 - Environmental Consultant - Public Researcher
ELC cannot be achieved	4	- First Nation's/Aboriginal Consultant x2 - Public Researcher - University Professor/Former oil employee
ELC can potentially/arguably be achieved	7	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public Researcher - Environmental Consultant - Métis Consultant
Distrust/Uncertainty surrounding ELC achievement in reclaimed sites	7	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Métis Consultant

Categories about ELC achievement are divergent. Some respondents, most clearly Alberta Government Employees and one industry respondent, are confident that ELC can be achieved. This category is linked to conversations regarding successful reclamation trials, improved reclamation standards, and continued research. However, higher responses regarding ELC to potentially be achieved, or arguably achieved is evident. This category is linked to who defines ELC and the vagueness of ELC as a legal mechanism. Associated with ELC's potential to be achieved, there is an overlap between respondents in the ELC potential to be achieved and distrust or uncertainty surrounding ELC achievement. While not listed here (see Appendix A Table A.6), ten respondent responses formed a category questioning who decides the values of trade-offs in reclamation. This category lends additional support to categories of distrust and uncertainty in the reclamation process. Similar sentiments and categories emerge when examining which reclamation outcomes stakeholders believe are acceptable.

Table 8: Acceptability of reclamation outcomes

Category	No. of Responses	Respondent
Novel/Altered ecosystems/landscapes are acceptable, if they work	6	- Biologist/Oil Company reclamation practitioner - Alberta Government Employee x2 - Environmental Consultant - University Professor/Former oil employee - Public Researcher
Pragmatic reclamation outcomes are acceptable	9	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - Public Researcher - Alberta Government Employee x2 - University Professor/Former oil employee
Novel/Altered ecosystems/landscapes are inevitable, regardless of acceptability	3	- First Nation's/Aboriginal Consultant x2 - Public Researcher
Altered ecosystems/landscapes are acceptable. Novel ecosystems/landscapes are not	3	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public Researcher
Novel/Altered ecosystems/landscapes are unacceptable	3	- Environmental NGO - Environmental Consultant - Métis Consultant
Who and how are acceptable outcomes determined?	15	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Alberta Government Employee x2 - Ecologist/Aboriginal consultant - Public Researcher x2 - Environmental Consultant x2 - University Professor/Former oil employee - Métis Consultant

Acceptability of reclamation outcomes produced weaker response rates, but negative fit categories represent diverse perceptions. It is evident that numerous respondents believe that pragmatic reclamation outcomes are acceptable, but often because pragmatic reclamation may represent the best possible outcome. While pragmatic reclamation may not be inherently inappropriate, considering the scale of ecological disturbance, the issue of who determines acceptable outcomes emerges as a category. This category, by far, arose from nearly all interview data and follow-up questions. Who determines acceptable reclamation outcomes and how those outcomes are decided is hotly debated in Alberta.

The aforementioned ELC concerns connect with progressive reclamation as a tool for expediting reclamation on active mining sites. How respondents understand progressive reclamation was as follows: fourteen respondents described progressive reclamation as not

deferring reclamation until the end-of-mine life. In this circumstance, respondents were well-informed about the terminology, however their perceptions on progressive reclamation's application in oil sands mines varies.

Table 9: How respondents view progressive reclamation occurring

Category	No. of Responses	Respondent
Limited progressive reclamation occurring	10	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x3 - Public Researcher - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Alberta Government Employee - Métis Consultant
Some useful progressive reclamation occurring	4	- First Nation's/Aboriginal Consultant - Environmental NGO - Public Researcher - Métis Consultant
Distrust/Uncertainty around if progressive reclamation is actually occurring	4	- Environmental NGO - First Nation's/Aboriginal Consultant - Public Researcher - Environmental Consultant
The Government does not clearly communicated limitations to progressive reclamation	10	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x3 - Public Researcher - Ecologist/Aboriginal consultant - Environmental Consultant x2 - University Professor/Former oil employee

Over half of the respondents understand that progressive reclamation is limited, indicating that reclamation is not happening as fast as possible. Four respondents are distrustful or uncertain that progressive reclamation is actually occurring, a sign the uncertainty about reclamation is not limited to ELC. Many respondents believe the Government fails to clearly communicate the limitations progressive reclamation faces, which also highlights public distrust regarding progressive reclamation. Alberta Government Employees, however, believe that the Government communicates progressive reclamation challenges openly, a clear difference to other stakeholder groups.

Table 10: Challenges facing progressive reclamation

Category	No. of Responses	Respondent
Active mining limits progressive reclamation opportunities	4	- Biologist/Oil Company reclamation practitioner - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Alberta Government Employee

Companies are unwilling to progressive reclaim areas if they are not required to	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - University Professor/Former oil employee
No proof/limited proof that progressive reclamation is occurring/can create functioning sites	5	- Environmental NGO - First Nation's/Aboriginal Consultant - Public Researcher x2 - Métis Consultant
Distrust/Uncertainty around companies progressive reclamation practices	5	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Public Researcher - Métis Consultant
Power Imbalance: Too few restraints or regulations on industry	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Métis Consultant
Limited regulations and limited enforcement of progressive reclamation regulations	4	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

The challenges facing progressive reclamation are widespread, and do not produce well-defined categories. However, these weaker categories suggest several emerging issues: active mining prohibits successful progressive reclamation opportunities, which is well connected to the category that companies are unwilling to progressively reclaim areas. This stems from the cost of reclamation and companies' unwillingness to commit to reclamation spending if they believe a site may come back under active mining operations at a later date. Many respondents understood this impasse, although other categories - no proof progressive reclamation is occurring, distrust and uncertainty, and power imbalances - seem to indicate that stakeholders outside of industry and Government are uncertain of oil companies' reclamation practices. These are weaker categories with no strong saturation, however response variation highlights social complexity surrounding progressive reclamation. These differences are demonstrated more evidently when one examines categories of adaptive management.

Table 11: Adaptive management definitions

Category	No. of Responses	Respondent
Involves applying learning	8	- Biologist/Oil Company reclamation practitioner - Public researcher x3 - Environmental NGO - Alberta Government Employee - Ecologist/Aboriginal consultant - Environmental Consultant
Involves active engagement	6	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant

		- Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Involves researching	5	- Biologist/Oil Company reclamation practitioner - Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Involves cycles	5	- Biologist/Oil Company reclamation practitioner - Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Contingency planning/Adapting to new situations	7	- First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Public Researcher - University Professor/Former oil employee - Environmental Consultant
Involves stakeholder participation	4	- First Nation's/Aboriginal Consultant x2 - Environmental NGO - Métis Consultant
Involves rigorous, intensive application	1	- Public researcher
Involves experimenting	2	- Alberta Government Employee - Public Researcher
Involves managing uncertainty	2	- Public researcher x2
Is unclearly defined	4	- First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Environmental Consultant
Is unclearly applied	3	- Environmental NGO - Ecologist/Aboriginal consultant - Métis Consultant

Adaptive management's application in oil sands reclamation, and how respondents' perceive adaptive management is diverse. Several negative fit categories are included because of their relation directly to adaptive management literature, but are also because they are testament to the varying understandings respondents have. Eight responses suggested adaptive management involves applying learning, which is a primary goal in active adaptive management. Seven responses credited adaptive management as contingency planning/adapting to new situations, which is a passive adaptive management form. The opposing directions of these categories will be further discussed later. Active and passive adaptive management may have similar end-goals, but their approach is completely different. How stakeholders see adaptive management being applied may shed light on why their definitions of adaptive management vary.

Table 12: Stakeholders' perceptions on how adaptive management is applied

Category	No. of Responses	Respondent
Unclear in practice	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - University Professor/Former oil employee
Industry-led	10	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x3 - Public Researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Métis Consultant
Cost hinders adaptive management use	7	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Environmental Consultant - Métis Consultant
Limited stakeholder participation in adaptive management	3	- First Nation's/Aboriginal Consultant x2 - Métis Consultant
Uneven application	2	- First Nation's/Aboriginal Consultant x2
Adaptive management is not legally required	1	- University Professor/Former oil employee
Passively applied	1	- Ecologist/Aboriginal consultant
Actively applied	3	- Biologist/Oil Company reclamation practitioner - Alberta Government Employee x2
Passively and actively applied	6	- First Nation's/Aboriginal Consultant - Public Researcher x2 - Environmental Consultant x2 - University Professor/Former oil employee
Mostly applied passively, although some active application	3	- First Nation's/Aboriginal Consultant x2 - Public Researcher
Mostly passively applied. Active adaptive management is only used in technology development	1	- Métis Consultant

Wide divergence in categories and numerous negative fit categories have been included to demonstrate the response spectrum in Table 12. The most notable is that adaptive management is industry-led. Following closely to that, cost hinders adaptive management presents a connection to industry-led adaptive management. Overall, adaptive management appears to be both passively and actively applied. Respondents presented a broad array of responses towards active and passive application, and connections can be drawn to some

negative fit categories: unclear in practice, limited stakeholder participation, uneven application. These negative fit categories are most likely results of each respondent's role in, or connection to oil sands mine reclamation, as well as a product of their own understanding and definition of adaptive management.

Table 13: Challenges facing adaptive management implementation

Category	No. of Responses	Respondent
Distrust	7	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Ecologist/Aboriginal consultant - Métis Consultant
Limited stakeholder participation	5	- First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Public Researcher - Métis Consultant
Power imbalance	6	- First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Public Researcher - Métis Consultant
Regulations are weakly enforced	6	- First Nation's/Aboriginal Consultant - Public Researcher x2 - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Métis Consultant
No standardization in application	5	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Public Researcher - Métis Consultant
Uncertainty about how adaptive management or its research is used/applied	8	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

Uncertainty and distrust categories top the challenges facing adaptive management implementation. This sub-theme generated stronger categories, arising from many respondents' criticism about oil sands reclamation practices. Alberta Government Employees did not provide responses that fit within this sub-theme's categories. As Government officials, respondents would be more directly connected to regulation enforcement, policy and oil company document submissions than other respondents. This would give Government employees different insight into how adaptive management is used, and how adaptive management is being improved (see Appendix A Table A.16).

Other respondents demonstrated stronger criticism of adaptive management. There appears to be uncertainty surrounding how adaptive management is actually applied, and whether or not research being produced by adaptive management is operationalized. Distrust is connected to uncertainty, as well as the issues of regulations being unstandardized and weakly enforced. This unstandardized approach impacts stakeholder's ability to participate in adaptive management and reclamation planning. These challenges are also represented by a power imbalance, and appear related to adaptive management being led by industry.

While respondents seemed well aware of likely ecological reclamation outcomes, the results demonstrate that confusion and knowledge gaps surrounding progressive reclamation and adaptive management are present. These gaps and divergent understandings are cause for concern, since the Alberta Government expects oil companies to progressively reclaim mined lands and apply adaptive management practices. Ultimately, oil companies' success or failure to implement adequate adaptive management strategies and progressively reclaim sites will directly impact outcomes and end land-use acceptability. As the results show, there appears to be little public trust or certainty that oil companies can, or will under current regulations, use progressive reclamation and adaptive management accordingly.

5.4 Emergent hypothesis from grounded theory

Grounded theory attempts to use categorical data to produce a hypothesis, instead of attempting to test a theory by collecting data. A grounded hypothesis emerges from relationships between categories, and aids in theory development. Relationships between categories developed the hypothesis that distrust and uncertainty result from poor definitions of ELC, progressive reclamation and adaptive management. ELC has already been addressed for causing distrust and uncertainty around reclamation and will not be thoroughly examined in the *Discussion*. However, divergent interpretations of progressive reclamation and adaptive management arise from several factors. When these feelings of distrust and uncertainty are compared against additional literature, a substantive theory that progressive reclamation and adaptive management require legal definition to reduce stakeholder distrust and uncertainty appears to hold. No formal theory is claimed, since additional case studies of reclamation, progressive reclamation and adaptive management would be required to test substantive theory in different contexts. Such a task is beyond this research's scope.

6. Discussion

6.1 Reclamation importance to stakeholders

The results demonstrate the complex nature of reclamation planning and management. Reclamation management appears an important topic for stakeholders across the oil sands region. With reclamation being legally guided by EPEA's ELC and ingrained within mine approvals, the Alberta Government has a vested interest in ensuring that ecological disturbance is properly treated after mining ceases. The legal obligation is clearly pronounced by various stakeholders, yet reclamation appears necessary beyond the legal standpoint, as stakeholders have presented multiple viewpoints on why reclamation is important.

Citizen perspectives and social values are evidently important. As Albertans, respondents value the environment, socially and culturally. While Albertans benefit economically from resource extraction, a citizen perspective argues that there is inherent value in reclaiming land, if not ecologically restoring what was lost. These values come from a sense of social responsibility, from protecting taxpayers against reclamation liabilities, and from valuing natural areas. Alberta's oil sands reclamation laws are a reflection of this citizen perspective, valuing both economic and social development derived from resource extraction, while recognizing that Albertans value environmental reclamation as well.

Nine respondents discussed the importance of reclaiming land from an ecological standpoint. This view extends the citizen perspective; a manifestation of social and corporate responsibility to "clean up our messes", as an Environmental Consultant said. A diverse range of stakeholder groups believe reclamation is ecologically important after mining disturbance, often in overlapping, but also divergent ways. One Alberta Government Employee states that reclamation must return disturbed lands to a valuable ecological state for Albertans, while an Environmental Consultant believes that reclamation is critically important to protect land against further degradation. The legal framework surrounding reclamation encompasses ecological value-return after mining, however *who* determines what that value is not representative across all stakeholder perceptions.

Aboriginal viewpoints on reclamation are essential in any discussion regarding oil sands mining end land-uses. Respondents who directly identified the importance of reclamation for Aboriginal groups were limited mostly to First Nations/Aboriginal Consultants and one Environmental NGO respondent. What is interesting is that many other stakeholder groups indirectly articulated the importance reclaimed land holds for Aboriginal land users. Aboriginal communities are severely impacted by oil sands development, compared to most other Albertan stakeholder group, through land-use loss during extraction

and reclamation periods. Practical land-use is absent during these timeframes, reducing communities' ability to conduct livelihoods and transmit their culture. In their perspective, not only does ecological reclamation need to take place, but as an Ecologist and Aboriginal Consultant claims, cultural reclamation must also occur. If Aboriginal perspectives are not fully integrated into reclamation planning, outcomes of *who* decides reclamation plans and activities may negatively affect these communities in the future. First Nations/Aboriginal Consultants expressed grave concern that their communities, the end land-users of many reclaimed sites, risk facing cultural loss if reclamation is not timely and directed towards their desired outcomes. One respondent, an Environmental NGO, stressed this when saying "there is a need to give a fair amount of priority to the needs of local communities who are going to have to deal with these issues for one-hundred years."

What challenges Aboriginal perspectives is that their views may not be firmly embedded in Alberta's reclamation assessments. This represents ongoing issues that must be addressed, while highlighting the complexity of incorporating different social and cultural views into reclamation law. Reclamation end land-uses may exhibit values held by those reclaiming land, and not Aboriginal values, which is problematic for a number of reasons. Mine Closure and Reclamation Plans are individually submitted by companies and constantly change through the life of each mine, reclamation responsibility is held by mine operators, and the Alberta Government assesses ELC. Therefore, reclamation decisions can be based off completely different cultural and social values and interpretations of ELC. Some respondents expressed distrust and uncertainty around current decision-making frameworks. When it comes to end land-uses, Government and industry perspectives directly affect reclamation outcomes, and those outcomes may not necessarily be what all stakeholders desire or accept. The trade-offs that must occur to reclaim land require a balancing act between social, economic and environmental values, which are clearly different between stakeholder groups.

6.2 Reclamation trade-offs

Respondents understand that mining disturbance is so massive that reclaiming pre-disturbance conditions is unlikely. With hydrologic, geologic layers, soil profiles and entire landscape topography disturbed, re-establishing identical landscapes and ecosystems remains difficult. Respondents acknowledge this challenge. A Public Researcher described reclamation trade-offs as part of the widely accepted fact that reclamation cannot recreate and restore what was once there, but proposing something legitimate could create a suitable land-use in the post-closure landscape.

Pragmatic reclamation activities may be the most viable option if reclaiming towards locally common, self-sustaining boreal forest ecosystems is reclamation's goal. To exemplify pragmatic reclamation, interviewee responses are illuminating. An Environmental NGO respondent states that there are serious technical challenges surrounding wetland restoration, with real gaps and risks because we may be unable to replicate lost wetland types. Several other respondents have expressed similar challenges, particularly around wetland reclamation. An Alberta Government Employee recognizes that the oil sands region is dominated by muskeg, which takes thousands of years to develop, making it unreasonable to expect reclamation to replace or restore muskeg. A Public Researcher describes wetland reclamation as "an outrageously difficult challenge." Of course, this does not mean that wetland reclamation is not being attempted, and an Environmental NGO respondent discussed how Suncor's Pond 1 site is paying particular attention to wetland reclamation. However, it remains a challenge, and the trend towards upland and dryland sites at the expense of wetlands will drastically alter future ecosystem ratios in the region. This may represent one pragmatic reclamation trade-off.

End pit lakes contribute to changing landscape outcomes. As an Ecologist explains, mining transforms a previously flat landscape into a hilly landscape with integrated pit lakes. Essentially, reclamation will create lakes that were not present before. Respondents have expressed concern about these end pit lakes and are uncertain of their successful function. A Public Researcher states that there is not a single example of a successfully reclaimed oil sands mine pit, and these lakes will raise a host of issues in the future. The Alberta Government is attempting to solve this issue with the Tailings Management Framework[16], acknowledging challenges end pit lakes create for a post-closure landscape. The difficulty is that for all Closure and Reclamation plans from companies such as Syncrude, Suncor, Shell, Imperial, Total, Petro Canada, all incorporate end pit lakes into reclamation plans. Clearly, end pit lakes will be present, and in high quantities across the region, however, there is no proof that these plans will work.

While altered landscapes are expected, there is hope that certain desired outcomes may also be achieved. Alberta encourages reclamation trajectories towards locally common boreal forest ecosystems with similar ecological function representative of regional ecosystems and landscapes. This is certainly an improvement over previous criteria. The Government admits that previous reclamation was guided by primary productivity principles;

[16] See http://aep.alberta.ca/lands-forests/cumulative-effects/regional-planning/documents/LARP-TailingsMgtAthabascaOilsands-Mar2015.pdf for more detail

successful reclamation meant land was returned with a capability to produce something of value, typically commercial forests. Ecosystem valuation was previously based on forestry and agricultural metrics, not on other social or environmental values. According to a University Professor and former oil company employee, wetlands and muskeg were previously rated as having zero capability and deemed unproductive or useless, whereas upland sites were more strongly preferred. This respondent claims that mindsets have changed, and oil companies pay more attention to valuation, often attempting to compensate for wetland loss. A Government Employee also discusses how a wide array of end land-uses, representing different social values and utility, are also now encouraged, shifting away from productive upland forest sites. Such valuation shifts demonstrate changing social values for reclamation in the Province.

Still, reclamation must also account for culturally appropriate landscapes and Aboriginal utility on reclaimed land. Culturally appropriate landscapes are desired by Aboriginal Consultants, Environmental NGOs and mentioned by one Alberta Government Representative. Culturally speaking, reclamation must account for social, cultural and environmental values of Aboriginal communities expecting to use reclaimed sites. The challenge is that altered landscapes, while inevitable, may not be acceptable to certain communities or individuals. As one First Nations/Aboriginal Consultant puts it, "I don't know if accept is the right term. I'm not sure that [communities] are going to have a choice." This begs the question of whether pragmatic reclamation efforts and altered landscapes, even if they produce functionally similar ecosystems, are truly acceptable outcomes for all end land-users. Clearly, Aboriginal viewpoints should be more fully incorporated into reclamation planning, and the Government should consider gauging ELC in conjunction with Aboriginal representatives.

Table 8 demonstrates a wide range of viewpoints on whether or not altered ecosystems or landscapes and pragmatic reclamation are appropriate. Pragmatic reclamation appears acceptable for numerous stakeholder groups, including industry, Government, some First Nations/Aboriginal Consultants, Public Researcher and Environmental NGOs. Responses vastly differ over the acceptability of altered, or even novel ecosystems or landscapes. What is most interesting is that six respondents are willing to accept altered or novel ecosystems and landscapes, as long as they function properly, supporting pragmatic reclamation.

However, today's reclamation examples may not accurately reflect how future sites will develop and function. The one certified reference site in the region was based on out-

dated best practices for reclamation. Gateway Hill is the only certified reclaimed site that has been returned to Alberta, and some criticizes its reclamation outcome. First Nations/Aboriginal Consultants talk about the sites novelty, that Gateway Hill is not part of a natural, regional continuum of ecosystems. One Public Researcher shared the view that Gateway Hill could be a testing ground for prescribed burns, to gauge the natural resilience of the site, however the Government seems tentative to risk such an experiment, should the site not recover from the damage. If the site were unable to naturally recover, the Government would be responsible for reclamation costs to return ecological function to the site. There seems to be faith that reclamation will produce functioning ecosystems, although there is uncertainty that landscape-level reclamation can create self-sustaining ecosystems. As one Government employee stated, "There is a high degree of difficulty and uncertainty in the process...Hopefully [sites] will evolve over time into an ecosystem that is similar to the pre-disturbance state that functions in a similar manner." If reclamation does work, many non-Aboriginal stakeholders seem willing to accept these altered landscapes. Yet, faith in reclamation alone does not reduce all uncertainties.

For non-First Nations and non-Aboriginal stakeholders, environmental trade-offs in oil sands development and reclamation may be acceptable. Different cultural perspectives regarding how successful reclamation emerges are the likely cause of this acceptance. However, some believe that reclamation does not do enough to ensure function is returned. One respondent, from an Environmental NGO says, "there are just so many important environmental values to consider that I think [ecological] restoration is appropriate, particularly given the scope and scale of development." Alberta does not legally require ecological restoration, which would involve attempting to restore pre-disturbance conditions, where possible. This presents another challenge when planning and implementing reclamation. Despite various viewpoints, *who* determines what is acceptable ultimately resides with the Alberta Government's interpretation of ELC. The question remains if the Government can adequately integrate differing viewpoints of success and acceptability.

6.3 ELC and reclamation: whose definition?

Fifteen respondents questioned who determines what acceptable reclamation outcomes are, and how those decisions are made. ELC is the current legal mechanism to make such a decision, and decision-making power resides in Government regulators. Yet, numerous viewpoints on what reclamation outcomes are desired and acceptable persist. How these viewpoints can be addressed and considered when post-closure sites come up for

reclamation assessment is unanswered at this time. Workshops and task forces have been previously used in Alberta to more clearly define ELC as a reclamation metric, but it is outside this research's scope to address those activities. What is important is that stakeholders are aware of the challenges ELC presents, particularly its vague wording.

Respondents discussed why the Government continues to use ELC, despite confusion around it. Common responses were that ELC already exists within law, meaning that any alteration would require serious overhauls of environmental legislation. The Government continues to use ELC simply because it is there. A notable response comes from the Biologist and Oil Company Reclamation Practitioner: ELC is an artefact of the tools that were available when the EPEA legislation was written. Respondents in Government, industry and one Public Researcher present ELC as a useful guidance and assessment system: expected end land-uses may be similar, but not the same to pre-disturbance conditions. With the valuation shift from productivity metrics, ELC can be flexibly interpreted, which may actually improve reclamation standards. The Biologist and Oil Company Reclamation Practitioner claims that over the last ten years, a noticeable shift from a results-based, productivity characterization of ELC has occurred, and movement towards more holistic integration of aesthetic values, traditional land use values, recreational values, wildlife values and ecological function is apparent. This overlaps with both positive and negative responses stating that ELC is a flexible tool for gauging reclamation success. Obviously, ELC based on improved reclamation standards is a sign of positive flexibility - the law does not hinder shifting valuation metrics - but others claim ELC negatively impacts reclamation success by allowing non-specificity through vagueness, which prevents firm reclamation outcomes. Despite positive flexibility, ELC imprecisely defines reclamation for some stakeholder groups.

Non-specificity and vagueness creates unclear reclamation standards, reducing stakeholder trust in ELC. A Public Researcher claims that ELC leaves flexibility and open-endedness for both the AER and oil companies to come to terms with what is actually possible for post-closure reclamation, allowing them to promise some kind of high standard without being tied to specific metrics or reclamation objectives. Another Public Researcher comments, reclamation is industry-driven by Government mandate, and the Government has historically sided with industry perspectives on ELC and reclamation. The Government has not adopted stricter regulations because such directives would run counter to what industrial partners demand. One respondent went so far as to call the Government-industry relationship incestuous, with industry demanding fewer regulations and the Government abiding.

Additionally, the Ecologist and Aboriginal Consultant states that the AER has a directive prohibiting bitumen sterilization, and the Minister of Energy wants to sell as many leases as possible. A power imbalance emerges from this Government-industry relationship, weakening many stakeholders' faith in ELC as an acceptable legal instrument for reclamation.

Understanding Government-industry relations' shows one-way ELC may be interpreted, but *who* within the Government assesses ELC can also shape what end land-uses are deemed acceptable. Certainly, there are Government employees within the AER and Ministry of Environment and Parks who genuinely want to improve reclamation standards and incorporate stakeholders' viewpoints. Nevertheless, some respondents expressed the nearly dogmatic belief some Government officials hold towards ELC. A Public Researcher describes that old reclamation thinking, based on agriculture and forestry paradigms, remains present within the Government. A status quo is difficult to change and ELC as a guidance system appears firmly entrenched. An Ecologist and Aboriginal Consultant explains advancing new ideas is difficult because of the pre-existing 'old school' reclamation mentality: there remains a group of reclamation specialists who created the Province's reclamation infrastructure and are dedicated to the idea of ELC. The respondent continues, these people are in leadership roles and changing ELC paradigms will be difficult or impossible until these people retire. The concern is that different perspectives and understandings of acceptable reclamation outcomes may not be incorporated into ELC assessments because a status quo is deeply established. The end result being that many stakeholders outside of Government feel the ELC is inappropriate, likely because they feel disempowered by ELC vagueness and dogmatic decision-making being left in Government hands. Table 7 shows that, most notably, Government and Industry believe ELC will be achieved, while other stakeholder groups believe that ELC can be potentially or arguably achieved, which depends on *who* defines ELC. Table 7 also demonstrates that primarily Aboriginal Consultants, along with Environmental NGOs are distrustful or uncertain about ELC being achieved. Power imbalances, vague definitions and non-specific flexibility in reclamation law generate considerable distrust and uncertainty in Alberta's reclamation management system.

For Aboriginal land users, ELC reclamation outcomes not only impact their cultural traditions and livelihoods, but also their legal rights. One First Nations/Aboriginal Consultant says that ELC is a legal term utilized by Government and industry and does not originate from any indigenous land user. This research is not appropriately prepared to discuss Treaty

Rights and Constitutional obligations, however these legal issues are embedded in oil sands development debates. Aboriginal communities have varying degrees of capacity to deal with development and reclamation. Certain Aboriginal Consultants have expressed that power imbalances surrounding ELC exist because the Alberta Government does not adequately address Constitutional issues. A Métis Consultant states that Métis communities, an ethnic group with Indigenous and European ancestry, experience fewer rights and opportunities to contribute to discussions on ELC and reclamation planning. This power imbalance further exacerbates conflicts about ELC between Aboriginal communities, Government and industry.

When future oil sands development slows, ELC's challenges will become more evident as reclamation begins to outpace mining activities. For many respondents, uncertainty over financial liabilities being transferred to taxpayers is disturbing (see Appendix B). Several respondents state that the current MFSP is not strict enough to protect taxpayers from sub-standard reclamation. These beliefs arise from reclamation as an all-cost activity for companies, and respondents worry that the number of viable companies likely to remain as oil sands become less profitable will decrease when reclamation activities ramp up. This presents serious challenges of the future. Will current financial regulations sufficiently protect taxpayers from reclamation that does not achieve ELC? Will there be enough companies economically viable to fulfill reclamation commitments? Will the Government alter their definition of ELC and accept sub-standard reclamation outcomes to prevent cost shifting? Without adequate reclamation practices occurring in a timely manner today, Albertans are left with an uncertain reclamation future.

Utilitarian resource development may be justified, and has improved social and economic development for Albertans, yet unanswered questions around reclamation remain a source of uncertainty for stakeholders outside of Government and industry. There are many trade-offs that need to be openly discussed when talking about reclamation. Pragmatic reclamation and ELC may be unsuitable when reclamation disproportionately impacts Aboriginal stakeholders. Reclamation is limited by current knowledge and technical abilities, and stakeholders should be made more aware of reclamation limitations. ELC may be too vague to create clear, acceptable end land-uses that all stakeholders can sign off on. More effort is needed on behalf of oil companies and the Government to reduce financial uncertainty around reclamation. Uncertainty and distrust are present around ELC-assessed reclamation and other regulations, impacting stakeholders' perceptions of progressive reclamation and adaptive management.

6.4 Progressive reclamation: Challenges and limitations

Alberta encourages oil companies to progressively reclaim inactive mine areas. Respondents described progressive reclamation as not deferring reclamation actions to the end-of-mine life, or more succinctly, reclaiming when sites become available. Progressive reclamation is necessary for several reasons. Companies want to present a positive public image by demonstrating reclamation actions. The Government wants companies to progressively reclaim to reduce financial liabilities associated with reclamation. Environmental and Public Research stakeholders want lands reclaimed quickly to prove reclamation works. Community stakeholders desire progressive reclamation to expedite site reclamation. These different progressive reclamation viewpoints present complexities that should be addressed in reclamation planning, management and regulations.

Numerous respondents agree that oil companies' use progressive reclamation in limited ways. Four respondents suggest that progressive reclamation is a public relations attempt by oil companies. One Government respondent supports this view, stating that progressive reclamation is a buzzword (see Appendix A Table A.9). This suggests limited trust in oil companies' progressive reclamation intentions. Distrust and uncertainty pervade responses, indicating that companies are often unwilling to progressively reclaim sites for numerous reasons: associated costs, no regulated timelines requiring progressive reclamation, regulations being weakly enforced, justifying deferred reclamation because future activities may take place on potentially reclaimable sites, and limited reclamation opportunities being available in active sites.

Some progressive reclamation limitations are valid from industry and Government points-of-view. An Alberta Government Employee states that while the Government wants operators to continually reclaim as they go, progressive reclamation is challenging because a lot of site infrastructure needs to remain active until after mining ends, so by nature, oil sands reclamation is back loaded. Companies cannot reclaim all disturbed sites if sites are being, or will be used for mining operations. Four respondents support this view (see Table 10). However, other respondents describe progressive reclamation opportunities that are not being taken, where companies unjustifiably defer reclamation. Many non-industry and non-Government stakeholders believe this occurs because the associated costs and/or lack of regulatory pressure disincentivizes timely progressive reclamation.

Cost hindering and limited regulatory enforcement of progressive reclamation are recurring concepts across numerous themes and sub-themes. Several respondents believe that companies are unwilling to spend money reclaiming land that might be disturbed again in the

future. What is problematic about deferral is that long-standing disturbances continue to affect local land users, particularly Aboriginal communities. When low-cost markets reduce production rates, sites can remain unused and un-reclaimed for years, possibly decades. As one First Nations/Aboriginal Consultant explains, for community members wanting to use the land, these sites continually limit their ability to do so. Community members do not want to see disturbed land left sitting un-reclaimed. One reason for this view is that many community members hold traplines in the region, and to meet Government requirements to continue holding traplines becomes difficult when land remains disturbed and inactive. Respondents believe the Government is tentative to place additional regulations on oil sands companies. Outside of the recent Tailings Management Framework, there appears to be, to the best of my knowledge, no legislated timeline requiring disturbed land to be reclaimed. As on Environmental Consultant suggested, without prescribed reclamation timelines, a site could sit un-reclaimed for eternity. When disturbed sites are left un-reclaimed, reclamation horizons are postponed and technical challenges increase.

As reclamation becomes deferred, not only are community land users affected, but reclamation success itself becomes more uncertain. One respondent discusses uncertainty around stockpiled soil for terrestrial reclamation, a topic that is understudied. A Public Researcher argues that in reclamation trial sites today, only freshly salvaged soils are being directly placed, with soil biota alive and intact. Conversely, stockpiled soils will experience decreasing biota biomass (microbial communities, organisms, seed and root propagules), which are essential for properly functioning soil. After approximately six months in stockpile, biota die and the soil becomes depressed. Soil health and fertility will directly impact re-vegetation success. Ultimately, oil sands mine reclamation will use almost exclusively stockpiled soil at the end-of-mine life. As the Researcher says, "the future reclamation environment is going to have to rely on a material from with we have no information. We have no research." As reclamation is deferred, uncertainty increases.

Some stakeholder distrust and uncertainty also stems from whether progressive reclamation is being actively or passively pursued. While only three respondents mentioned passive reclamation actions, or natural re-vegetation instead of actively reclaiming, these responses are worth noting. Since reclamation is an all-cost endeavour, some respondents described tendencies to passively reclaim sites, likely as a cost-saving measure but possibly because regulations may not be strictly enforced. The Métis Consultant, a First Nations/Aboriginal Consultant and one Public Researcher expressed that companies may only progressively reclaim sites after a certain period, should natural re-vegetation fail to

deliver desirable results. These responses should not be considered universal, but do express distrust and uncertainty about companies' independent reclamation methods. Passive progressive reclamation may be the exception and not the rule, however this research cannot confirm that with certainty. A Métis Consultant explains problems with individual reclamation approaches, stating Albertans have not really seen, or have a good idea of what the final reclamation landscape will look like because companies submits plans on a lease-by-lease basis.

Without some form of standardization, regulated reclamation timeframes and active progressive reclamation across leases, other problems emerge. Companies are only legally required to reclaim within their lease sites. An Ecologist/Aboriginal Consultant says that companies know much about their own projects, but do not necessarily know what company is operating next to them. Creating a natural continuum of ecosystems with proper connectivity and biogeochemical cycling is another challenge for future reclamation in the absence of regional planning. Progressive reclamation that excludes stakeholders' desires for connected and integrated ecosystems is unlikely to produce acceptable outcomes for local community stakeholders. Without improved reclamation planning at a regional level, a challenge the Province tries to address with the LARP, uncertainty will persist. In the future, many mines may end around the same time, and will require constituent material for reclamation of which there may not be enough of, according to a University Professor and former Oil Company Employee. Competition for reclamation materials may weaken reclamation integration or ELC achievement. All these provide reasons for stricter and more standardized progressive reclamation regulations to encourage companies to actively pursue and achieve reclamation sooner than later.

Currently, reclamation is industry-led and monitored, with annual reports presented to the AER. Companies report their annual progressive reclamation to annual land disturbance ratios, but stakeholders distrust such self-reporting. A First Nations/Aboriginal Consultant explains that through the whole regulatory system - how approvals happen and how reclamation is dictated - everything is put on industry to follow regulations, and the Government does not have the capacity to monitor all activities in oil sands mines. According to one Environmental NGO respondent, companies self-report their numbers and the public should have no confidence in those reports. Several other respondents discussed how a third-party, independent of Government and Industry, should monitor and/or reclaim sites to improve progressive reclamation and reporting transparency. Clearly, the industry-led model for progressive reclamation, monitoring and reporting is a cause of uncertainty, distrust and

perceived power imbalances among stakeholder groups.[17] As demonstrated in Table 9, this industry-led arrangement could explain sentiments that the Government does not clearly communicate progressive reclamation limitations.

Claiming that no progressive reclamation occurs would be incorrect. Progressive reclamation is occurring, although many justifiable and unjustifiable limitations exist. Reclamation deferral can exist because many mine operations are in early stages of approval or development. For older sites, such as Syncrude and Suncor, which have had forty to fifty years of operating history, there are some progressively reclaimed sites. These sites offer opportunities to test reclamation and management actions, and useful research has emerged from these sites. Several respondents have given credit to the time, money and effort spent on progressively reclaimed sites. A Public researcher describes that the earthen dams holding back tailings are sites that are being progressively reclaimed, and those sites provide much-needed research opportunities. However many respondents also admit that even with longer operating histories, Syncrude and Suncor have not yet proven reclamation activities at a large scale, further casting uncertainty upon future reclamation success and outcomes at landscape scales.

Without doubt, reclamation faces complex challenges and limitations in oil sands mines. Yet, encouraging progressive reclamation may reduce future uncertainty and restore stakeholders' trust in the process. The potential research opportunities offered by disturbed sites to test management actions, technologies, and understand which approaches expedite or improve reclamation success, are crucial for future success. Paraphrasing a Public Researcher, companies need to build and demonstrate reclamation technologies and approaches now, because at least ten to fifteen years of base monitoring data is needed to figure out what is going on, or to say with any confidence what is working and what is not. Progressive reclamation fits hand-in-glove with adaptive management to address this challenge. Adaptive management may be the most suitable option available to improve oil sands reclamation, but its current implementation by oil companies is unclear.

6.5 Adaptive management: Potential and problems

Uncertainty surrounds oil sands mine reclamation from multiple contexts: social, political, cultural, economic and environmental. Managing this uncertainty, and the distrust around reclamation policies and practices, deserves more attention. Adaptive management is

[17] Corporate science and industry-led monitoring, reporting and research have been well articulated in other mining cases around the world. This issue will be addressed in more detail in 6.5 *Adaptive management: Potential and problems.*

suggested as a practical tool or management framework to address reclamation uncertainty. The Albertan Government and oil companies claim to be adaptively managing oil sands reclamation, yet many stakeholders remain uncertain about how adaptive management is implemented.

Adaptive management's primary purpose is to reduce uncertainty through management decisions, actions, assessment, and re-evaluating decisions. Adaptive management is generally seen as a six-step, iterative process requiring active stakeholder involvement (Figure 3). Williams (2011) writes that adaptive management can also be defined as learning through management, and adjusting practices as understandings improve. However, various interpretations of what adaptive management entails and how resource decisions should be managed cause challenges. Non-uniform definitions can create practical problems when applying adaptive management to oil sands reclamation.

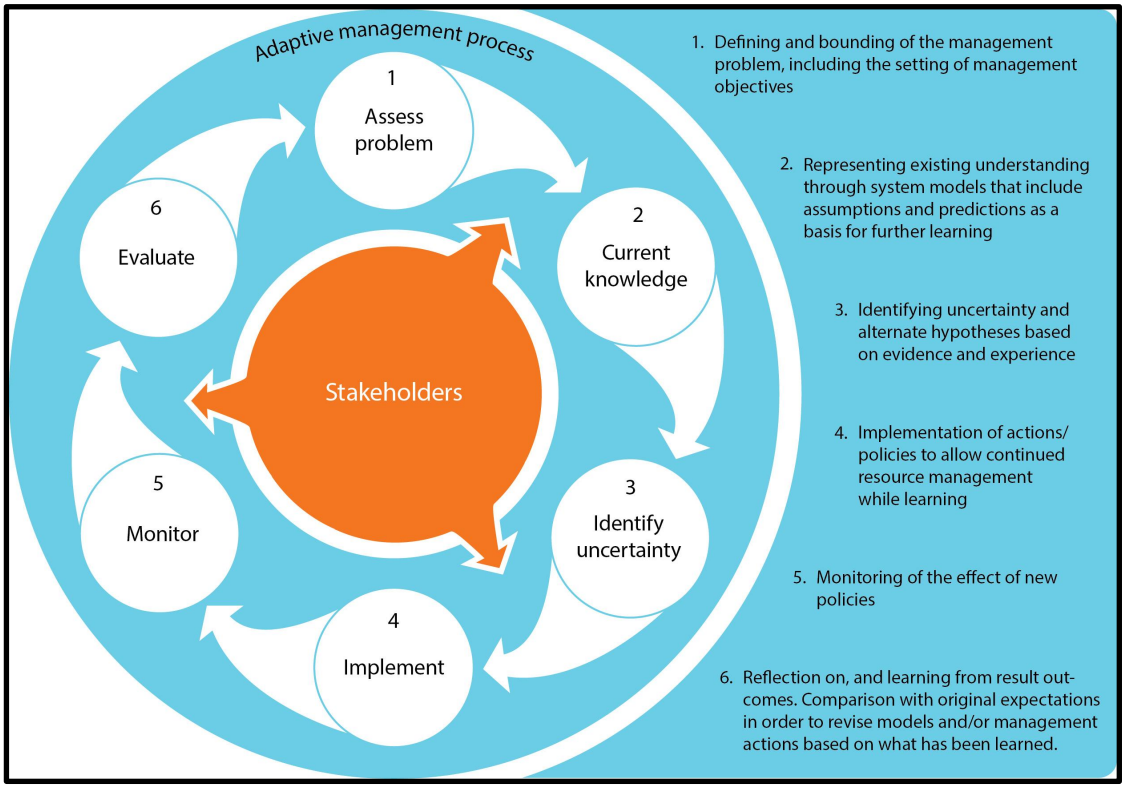

Figure 3: The adaptive management process (Rist, Felton, Samuelsson, Sandström & Rosvall, 2013)

Table 11 demonstrates that non-uniform definitions about adaptive management are present. Under the LARP, the Alberta Government (2012) addresses adaptive management through an adaptive Cumulative Effects Management System.[18] In the document, the closest

[18] The Cumulative Effects Management System (CEMS) is part of a larger regional planning initiative with the Alberta Government under Alberta Environment and Parks. This research has not addressed

adaptive management definition appears as "the system can change in order to adapt to unachieved performance results or outcomes, or when there is a risk of not achieving outcomes in the future, or when circumstances change" (Alberta Government, 2012, p. 3). The definition appears ambiguous and remains open to wide degrees of interpretation. Adaptive management also appears, without definition, in another guidance document: the *Criteria and Indicators Framework for Oil Sands Mine Reclamation Certification* (Alberta Environment and Sustainable Resource Development, 2014). Within the *Criteria and Indicators Framework*, adaptive management responses can be triggered if monitoring identifies that reclamation indicators or criteria are not being achieved. The *Framework* suggests adaptive management responses (more in line with contingency planning than active adaptive management). These include: requiring remedial work, continued monitoring to allow more time to pass and data to be accumulated, reclassify an ecosite, or even declare an indicator non-applicable. The *Criteria and Indicators Framework* does little to provide a definitive sense of what adaptive management is, or to suggest a complete framework for how it should be applied.

Without clear definitions of an adaptive management framework, confusion, uncertainty and distrust around adaptive management will most likely continue. Important aspects regarding how experiments, research and learning should occur and how learning is implemented in decision-making are not addressed. This produces mixed understandings across and within stakeholder groups. Four respondents have described adaptive management as being unclearly defined, and three believe that it is unclearly applied in oil sands reclamation. A closer examination of respondents' adaptive management perceptions exposes obstacles to its use as a reclamation planning and management tool.

Many respondents agree that adaptive management involves applying learning, yet many view adaptive management as contingency planning or adapting to new situations. Applying learning may be hindered if adaptive management is used as contingency planning. A Public Researcher provides an insightful analogy of contingency planning in uncertain reclamation environments: if a dam has a leak, you may have only twenty minutes before the dam breaks; adaptive management as contingency planning therefore becomes ineffective, because adapting management actions may not be implemented in time. The Researcher explains that industry usually ignores this observation, simply stating, "if bad things happen, we will do [*x*]." Learning application in this circumstance may not be able to adapt

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CEMS application in oil sands reclamation. For more information on the initiative, see http://aep.alberta.ca/lands-forests/cumulative-effects/default.aspx

management responses in time to be effective, or worse, the company may be unable to afford to take immediate actions. This demonstrates why contingency planning should not be considered an appropriate form of adaptive management to deal with reclamation uncertainties.

Aside from contingency planning, there were mixed responses about whether passive or active adaptive management was implemented. Some respondents expressed that passive adaptive management is occurring. Passive adaptive management for reclamation may include 'trial and error,' hedging or any management form that does not focus on reducing uncertainty through learning (Williams and Brown, 2016). Table 12 shows responses cluster around adaptive management being both passively and actively applied. Four respondents also considered that passive adaptive management was mostly applied, or preferred, over active adaptive management. The respondents suggesting only active adaptive management forms are used were from Government and Industry, compared to non-Government and non-Industry respondents who suggested a mix of passive and active approaches. The disconnect between these stakeholder groups suggests that either information on adaptive management practices is limited to Government and industry, or that Government and industry respondents perceive and define adaptive management differently than other stakeholders. This calls into question *who* defines adaptive management.

In oil sands reclamation, it is Government and industry expressing adaptive management as a management strategy. Two important points must be made to understand *who* defines adaptive management's use: law does not require adaptive management, and adaptive management is industry-led, but guided by Government. First, and as one respondent identifies, adaptive management is not legally required outside of tailings management,[19] although it is often invoked for reclamation. Adaptive management may appear as a mine approval condition, however the requirements to adaptively manage are unstandardized across approvals. What is contained in one approval may not appear as approval conditions for a different company. The relationship between industry and Government when approvals are granted calls into question the unstandardized approval conditions across sites. As mentioned, without standardized regulations of some form, there is no guarantee that adaptive management will be an approval condition in all mine sites.

I was granted access to a mine approval document for closer examination (Alberta

[19] During the time of research and writing, new Directives have come into action in Alberta regarding tailings management. This research does not adequately cover these changes. For more information, see https://www.aer.ca/about-aer/spotlight-on/alberta-tailings-managment-framework

Energy Regulator, 2014b). Upon review, adaptive management was discussed in relation to the bird deterrent program (preventing waterfowl from landing in tailings ponds), and as a subset of Wildlife Mitigation and Monitoring plans. The latter condition only required adaptive management *as necessary*. Adaptive management use in the approval seems poorly defined and left entirely in the hands of the operator. A part of the company's original approval conditions was to contribute to development and revision of upland reclamation guidelines through an adaptive framework by participating in the Integrated Task Group and Terrestrial Sub-Group of CEMA. However, CEMA, a multistakeholder organization, is no longer in operation due to Government funding cuts.[20] It is unclear how this approval condition to engage with public stakeholders will be addressed. At the time of writing, adaptive management appears entirely industry-led and public stakeholders are uncertain about their role.

With industry interpreting, defining and applying adaptive management as they see fit, uncertainty, distrust and power imbalances are represented in public stakeholder perceptions. Several recurring challenges around reclamation come through in an industry-led adaptive management environment, primarily the cost concern. Similar to how associated reclamation costs limit progressive reclamation opportunities, respondents from all non-Government and non-industry stakeholder groups identify that certain forms of adaptive management may be prohibitively costly for companies. As an Environmental NGO respondent states, companies prefer the lowest cost option. There is no incentive and little regulatory consequences for companies to invest more than necessary into adaptive management. A Métis Consultant describes the cost issue as a driving force behind adaptive management use: as long as adaptive management actions do not drive up costs and does not impact production rates, that is when voluntary adaptive management will occur. Sentiments like this are common; a First Nations/Aboriginal Consultant also suggest that oil companies pursue the area of least resistance and cost. However, companies' financial strength varies between mine operators, and an Environmental Consultant suggests that companies with better funding may be able to focus more on adaptive management than smaller companies.

Keeping cost in mind, let us examine the uncertainty and distrust about whether adaptive management is being passively or actively conducted. Companies seem free to pursue whatever actions they deem appropriate. According to a Public Researcher, active

[20] CEMA's funding loss has reduced stakeholder participation in adaptive management planning and decision making. The recent funding loss leaves gaps in many mine approval conditions, and it is currently unknown if these conditions will be fulfilled or disregarded.

adaptive management requires too much rigor and effort for many companies to fully pursue. The respondent continues that there are no additional pressures on mine operators to deliver on adaptive management mine approval conditions. There is no transparency at the regulatory level in terms of what adaptive management actions are incorporated in approvals or what adaptive management results are reported on. Without clear definition, Williams and Brown (2014) warn that operators may believe that they are engaging in adaptive management when they are not: projects simply involving ongoing monitoring, under the mistaken assumption that monitoring alone makes a project 'adaptive,' could be one way a company claims they are adaptively managing. Again, passive adaptive management appears unacceptable for many stakeholders, and may reduce decisions-making efficiency and effectiveness for reclamation.

Another concern respondents expressed was if learning is actively pursued in adaptive management research, and whether new learning is actively applied. Technical issues can stifle adaptive management, but limited desires to engage in active adaptive management further reduces learning opportunities. As Angelstam et al. (2004) explain, while adaptive management is regularly called for, ideal application is hindered by numerous factors, primarily insufficient care during experimental design in the active adaptive management phase, and a disconnection within the adaptive management cycle (applying learning, altering management decisions). These gaps can occur from a lack of knowledge in how to apply learning, lack of resources (cost of implementing learning) or lack of will. Currently, oil companies are required to pay a percentage of their revenues towards research, through the Canadian Oil Sands Research Alliance (COSIA). COSIA is tasked with researching and developing new reclamation techniques and technologies, and sharing findings, although several respondents do not believe this approach is appropriate.

According to one Public Researcher, COSIA's scientific advisory panel is made up of industrial reclamation specialists. While a Biologist and Oil Company Reclamation Practitioner states that COSIA heavily focuses research on developing technologies, providing research grants and sharing information, other respondents have questioned this industry-led advisory panel design, since it omits public stakeholder perspectives. A Métis Consultant believes that COSIA research is conducted too privately, whereby companies can simply purchase science projects and buyout universities to conduct research. This respondent's distrust of adaptive management under COSIA relates to whether or not research becomes publicly shared, or if research may remain hidden from the public. An Environmental Consultant expresses this distrust, claiming research work is not shared in the

same manner at a scientific level with the broader community, and instead research may remain at the managerial level of companies.

Kirsch (2014) describes this as *corporate science*, claiming that mining along with other industrial sectors (ex. pharmaceuticals and tobacco industries) have long histories of controlling research and information flows to frame their work more positively. Corporate science, according to Kirsch, is systematically biased to produce favourable outcomes for the industry conducting research, while limiting public criticism by tightly controlling research opportunities and information disbursement. While this thesis has limited insight into COSIA operations, respondents express some distrust and uncertainty about COSIA's role as the primary adaptive management research body. A Public Researcher believes that the scientific advisory board is not properly formed around a multi-stakeholder design, and non-industry stakeholders are omitted from adaptive management planning, evaluation and decision-making.

Without adaptive management encompassing various stakeholder groups, non-industry and non-Government groups feel left outside of reclamation planning and decision-making stages. The *Criteria and Indicators Framework* establishes adaptive management responses as "professional judgement...and collaboration between the operator and Regulator [to] determine the appropriate management response" (Alberta Environment and Sustainable Resource Development, 2014, p.16), further reducing stakeholder participation. This isolation presents a power imbalance in decision-making and management. Limited stakeholder participation in adaptive management cycles appears to weaken oil sands reclamation acceptance by public stakeholders. Reed (2008) writes that stakeholder participation in planning has benefits for resource management, by allowing for local and scientific knowledge to be integrated into complex socio-ecological systems. Stakeholder participation also requires empowerment, trust, equity and learning, and participation can increase public trust in decisions. Reed continues that decisions may be viewed as more holistic and fair, if they account for the diverse values and needs of various stakeholders. Stakeholder participation is necessary within adaptive management frameworks, although respondents express that involvement in the adaptive management process remains limited.

Participation should be encouraged as early as possible in the adaptive management process, and must be maintained throughout if trust is to be fostered (Reed, 2008). This is particularly important for Aboriginal communities who are past, present and future land users. First Nations/Aboriginal and Métis Consultants identify that there are limited opportunities for them to participate in reclamation adaptive management. An Ecologist and

Aboriginal Consultant discusses how, in 2015, the Alberta Government's decision to make industry participation in CEMA[21] voluntary, drastically reduced Aboriginal communities chance to have equitable input into policy recommendations. With the unstandardized, individual mine approval structure, and without CEMA, community participation fluctuates between companies and lease sites. An Ecologist and Aboriginal Consultant explains that while oil companies take on community consultation responsibilities from the Crown, different companies engage differently with Aboriginal communities. If community consultation during the approval phase is the only opportunity for Aboriginal communities to be involved in adaptive management planning, suitable reclamation outcomes may not be created. Mine reclamation plans change and reclamation becomes deferred, and additional participation opportunities may not be required, pushing community viewpoints further to the margins of decision-making. Aboriginal involvement in adaptive management cycles and reclamation planning is critical, not only to develop trust between communities and companies, but to incorporate diverse ecological management perspectives into reclamation.

Berkes, Colding and Folke (2000) explain how Aboriginal groups developed alternative knowledge and perspectives that are locally understood through long-term resource use. Traditional ecological management systems, the authors state, have similarities to adaptive management - emphasizing feedback and iterative learning to understand and treat uncertainty and predictability. Additionally, social mechanisms to transmit this knowledge are already present within local community institutions, and these perspectives may improve reclamation and guide trajectories towards more acceptable end land-uses. Many respondents discuss the importance of Aboriginal perspectives within reclamation planning and adaptive management cycles to improve reclamation outcomes (see Appendix B.4). Within the current consultation and reclamation-planning framework, Métis communities are left outside of the participatory process because there is no Métis consultation policy in Alberta. This further excludes local perspectives and knowledge from a cultural community that could contribute ecological management knowledge. Without balancing power and encouraging Aboriginal and other public stakeholder involvement in reclamation planning and adaptive management cycles, public stakeholders will continue to be distrustful and uncertain of Government decisions and industry-led reclamation management.

Limited trust towards adaptive management is further exacerbated by adaptive

[21] CEMA was organized as a multistakeholder body tasked with producing recommendations to Government and industry around oil sands development and reclamation activities

management plans being unstandardized. Any adaptive management plans present at a mine's outset are easily altered by a company. One First Nations/Aboriginal Consultant describes the situation: a mine approval is generally given without having a hard, firm final plan in place. While adaptive management is capable of flexibility, without concrete frameworks, adaptive management actions seem questionable. The non-standardized, individual approval format the Government uses, with the influence oil companies have during the approval stage, is likely to create different adaptive management actions between companies. Individual approaches and interpretations of adaptive management across different leases, dependent on different approval conditions, may explain why respondents believe both active and passive adaptive management is occurring.

Many respondents feel that more regulation and enforcement could improve adaptive management. If companies are not pressured to pursue active adaptive management, are prone to taking less costly approaches, and are granted operational approval before they firmly describe their adaptive management framework, stakeholders cannot be certain of reclamation's success. This will perpetuate distrust in *how*, or *if,* companies pursue adaptive management. In the oil sands, adaptive management may be actively pursued, passively applied, or simply evoked without any actual management action occurring. Without more clearly, even legally defined adaptive management frameworks, uncertainty surrounding reclamation will continue.

Certainly, in the best interests of most stakeholders, active adaptive management should be pursued. Encouraging oil companies to progressively reclaim and use adaptive management may reduce novel ecosystem emergence, improve reclamation outcomes and expedite reclamation progress. As one Government employee states, novel ecosystems should only be considered an interim; monitoring and intervention should allow systems to develop towards natural paths and desired end goals. The key idea expressed in this statement is that reclamation should require active interventions. Another Government employee described how active adaptive management is in a company's best interest as well, since the company must demonstrate acceptable reclamation for certification by the Province. Both seem to agree that adaptive management in reclamation is suitable, yet there are still systematic challenges, uncertainty and distrust surrounding adaptive management's application. The Alberta Government must work to improve stakeholders' trust and faith in reclamation processes if they wish to have reclaimed sites accepted by local communities and the Albertan public.

6.6 Recommendations

Respondent provided suggestions to improve adaptive management and progressive reclamation.[22] Several categories emerged and these recommendations should not be considered an exhaustive list. They provide tangible options to address present challenges in oil sands reclamation adaptive management. The most common recommendations include:

- Continue to improve and apply adaptive management learnings, new reclamation standards and reclamation success criteria
- Strengthen and enforce adaptive management and reclamation regulations
- Balance power
- Improve stakeholder participation in adaptive management cycles and reclamation planning
- Respect Aboriginal Constitutional rights; improve and enhance Aboriginal participation in adaptive management and reclamation planning
- Use an independent, third party separate from industry and Government to conduct reclamation planning and activities
- Better define and clarify adaptive management frameworks and implementation

Encouraging experimentation through progressive reclamation, as an adaptive management action, is immediately needed. The time lengths required to work with stakeholders in planning phases, to implement reclamation activities and monitor reclamation trajectories require years, if not decades. While costly and time consuming, experimentation can improve scientific understandings of reclamation techniques and technologies to produce better outcomes. Experiments should encourage stakeholder participation along each step, to update and re-inform stakeholders of reclamation trajectories and new learning. Without active experimentation, uncertain outcomes pervade oil sands mine reclamation, and faith in contingency planning may be an unacceptable approach.

The varying definitions respondents provided of adaptive management uncover uncertainty regarding its application in reclamation. Williams and Brown (2014) discuss the challenges of applying adaptive management when interpretations are unclear. They state that variation in adaptive management definitions and implementation causes ambiguity and confusion, which limits effective management. Olszynski (2017) confirms that different adaptive management conceptions are a long-standing problem in Alberta. He writes that varying definitions allow mine proponents to erroneously invoke adaptive management as a

[22] For complete list of Results, see APPENDIX A Table A.12

general, or routine strategy for effective mitigation. Additionally, Olszynski says, “there is a yawning gap between the number and type of issues for which proponents propose adaptive management...[and] where adaptive management is ultimately required, the relevant terms are generally vague and seemingly unenforceable.” Benson and Schultz (2015 as cited in Olszynski, 2017) suggest that without legal definition and enforceable regulations, adaptive management is merely a smokescreen allowing open-ended and discretionary decision-making that fails to meet legal standards, that ignores proper adaptive management aspects, and that will lack accountability.

To overcome these failings, the Alberta Government should consider legally defining and mandating active adaptive management, along with progressive reclamation timeframes. Working with all involved stakeholders to develop legal wording and requirements for adaptive management may improve trust and reduce uncertainty of reclamation actions and outcomes. Using prescribed timelines to regulate progressive reclamation of unused sites could create more opportunities for experimentation. Experimentation can improve scientific and ecological understanding, and findings could be presented to public stakeholders to re-develop their expectations of reclamation. Alberta’s current approach to responsibly development the oil sands is utilitarian in focus, however reclamation’s end land-uses must include the values and desires of non-industry and non-Government stakeholders in order to strengthen acceptance of reclaimed sites. A legally defined framework for adaptive management and progressive reclamation, while no easy task, has the potential to reduce stakeholder uncertainties and improve trust in the system.

7. Conclusion

Alberta's mineable oil sands have received international attention for their scale of environmental disturbance. Unprecedented in size, oil sands mines present long-term environmental challenges, which are yet completely addressed. Canada's boreal region is home to a diverse and complex array of ecosystems, species and environmental functions, and current mining operations must reclaim disturbances in the region. Environmental reclamation at landscape levels, with longitudinal and temporal consequences, complicates reclaiming ecological function, stability and continuity. While small in size relative to Canada's total boreal area, oil sands mine disturbances extend up to 895 km^2 (Alberta Energy, 2017b). With the extent of geologic, hydrologic and biogeochemical cycle disturbance caused by mining, reclaiming landscapes to pre-disturbance conditions is unlikely.

Reclamation's success is defined by ELC. Government and industry describe ELC as a suitable and flexible tool to assist reclamation, and improve assessments as ecological understandings develop. ELC, as a reclamation guidance mechanism, is vague enough to incorporate new ecological valuations, however, for public stakeholders, vagueness and flexibility weaken ELC. These stakeholders believe that ELC is not defined firmly enough to properly guide reclamation towards acceptable outcomes, and leaves reclamation's success to Government specialists' definitions. Government and industry definitions may appear dissimilar to other stakeholders' desires. A sense of uncertainty and distrust around industry-led reclamation and Government-defined ELC is evident.

Many stakeholders acknowledge reclamation's inability to return all disturbed land to pre-disturbance ecological states. However, expected reclamation outcomes do not necessarily match desired end land-uses. For many stakeholders, particularly Aboriginal communities, reclamation's end land-uses may be foisted upon them, regardless of acceptability. Lacking public participation in reclamation planning compounds this difficult situation. The closure of CEMA, as a multistakeholder forum for integrating non-industry perspectives, contributes to reduced participation. The Government's decision to remove mandatory industry participation in CEMA weakened public participation within progressive reclamation planning and adaptive management frameworks.

Reducing Aboriginal and other public stakeholder participation in mine reclamation planning is not limited to northern Alberta. Global instances of local communities being disenfranchised and ignored by mining companies appear to be the norm for the mining industry. What is most surprising in the Canadian oil sands context is that this

disempowerment is occurring within a democratic and politically stable state, where Constitutional Treaty laws are not being properly upheld. Alberta, and Canada hold legal obligations towards Treaty Rights holders and must not marginalize these communities in reclamation planning, since these very communities will continue to be the primary land users in the region. Their desires for acceptable reclamation outcomes need to be considered and fairly incorporated into reclamation planning and assessment.

Reclamation within Alberta and as an ecological study has significant potential to grow and develop. The challenges presented in Alberta's oil sands are wholly unique and opportunities to expand and improve scientific understanding of ecological functions, interactions, and resilience after large-scale disturbance are present if reclamation is directed to enhance learning. Encouraging progressive reclamation could contribute to enhancing ecological understanding. However, progressive reclamation appears more limited than publicly acknowledged by Government and industry. Reclamation costs, active mining, and weak or unenforced reclamation regulations prevent progressive reclamation from keeping pace with new disturbances. Some stakeholders believe progressive reclamation actions may not be actively pursued, but applied only when pressured by Government or when natural re-vegetation fails to produce acceptable results. Alberta's apparent lack of prescribed timelines for progressive reclamation further reduces reclamation progress. While progressive reclamation appears limited, evidence shows some reclamation is occurring. Progressive reclamation sites can serve as experimental units capable of generating scientific data. Without more progressive reclamation occurring, Alberta risks losing useful information that could improve knowledge for future reclamation.

Progressive reclamation overlaps with active adaptive management. Risk taking, experimenting with different reclamation and management approaches, monitoring, and evaluating results could improve reclamation knowledge and management. Active adaptive management is ill defined and current guidelines leave too much responsibility with industrial operators. Olszynski's (2017) analysis identifies limited active adaptive management in practice, supporting this research's findings. Adaptive management remains undefined and outside of legal requirement, leaving interpretation and implementation with oil companies while public stakeholders are omitted from participating. Industry-led adaptive management contributes to stakeholder uncertainty and distrust.

Alberta must reconsider several aspects of how oil sands mine approvals and reclamation are conducted. The importance of involving stakeholders in decision-making has been identified as both necessary and integral to encourage positive views of reclamation

activities and decisions. It appears evident that too much power is within the hands of industry. Power in decision-making should be balanced more justly, and this can be done by defining adaptive management frameworks for oil companies and mandating public participation within that framework. Public involvement, along with increased transparency around adaptive management and progressive reclamation could significantly improve stakeholders' trust in oil sands mine reclamation. Additional public discussion and stakeholder review of industry-led decision-making and Government-based ELC assessments of reclamation may also be vital to create more suitable end land-uses for all stakeholders. Reclamation is crucial to return ecological, social and economic value to all Albertans after mining operations cease, however under the current reclamation management model, public distrust and uncertainty of outcomes will only continue.

Adaptive management's purpose is to address uncertainty, and use new learning to improve management systems. At the moment, uncertainty is being exacerbated instead of reduced because adaptive management for reclamation is neither legally defined nor required. A clear, agreed-upon definition of adaptive management, formulated by a multistakeholder forum, could strengthen Alberta's reclamation success and generate more public acceptance of outcomes. Alberta is in a unique position, with global attention on how uncertainties will be managed. There is potential for Alberta to demonstrate improved environmental regulations by mandating active adaptive management. By addressing meaningful stakeholder participation and constructing a legal definition that clarifies what adaptive management is, what goals it should achieve and how those goals should be achieved, Alberta could improve perceptions around oil sands mine reclamation provincially, nationally and globally. Such a definition, and definitive framework for adaptive management application may benefit Albertans, while demonstrating adaptive management implementation for other countries experiencing ecological management challenges.

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Appendix A

Results Categories Tables

Table A.1: Importance of reclaiming land

Category	No. of Responses	Respondent
Citizen Importance	10	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public researcher x2 - Environmental NGO - Alberta Government employee x2 - University Professor/Former oil employee - Environmental Consultant
Ecologically Important	9	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x2 - Alberta Government employee x2 - Ecologist/Aboriginal Consultant - Public researcher - Environmental Consultant
Legal Obligation	13	- Biologist/Oil Company reclamation practitioner - Environmental NGO x3 - Public researcher x3 - Alberta Government employee - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal Consultant - Environmental Consultant - Métis Consultant
Aboriginal Importance	6	- First Nation's/Aboriginal Consultant x3 - Environmental NGO - Ecologist/Aboriginal consultant - Métis Consultant

Table A.2: Expected and desired reclamation outcomes

Category	No. of Responses	Respondent
Expected outcome: Altered Landscape	7	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public researcher x2 - Environmental NGO - University Professor/Former oil employee
Expected outcome: Pragmatic reclamation outcomes	5	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Environmental NGO - Alberta Government employee - University Professor/Former oil employee
Desired Outcome: Similar Ecological Function Returned	8	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Alberta Government employee - Ecologist/Aboriginal consultant - Public researcher - Environmental Consultant x2 - University Professor/Former oil employee

Desired outcome: Representative Landscape Returned	9	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Alberta Government employee x2 - Ecologist/Aboriginal consultant - Public researcher - Environmental Consultant x2 - University Professor/Former oil employee
Desired outcome: Aboriginal Utility Returned	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Environmental Consultant - Alberta Government employee - Métis Consultant
Desired outcome: Culturally Appropriate Landscape Returned	6	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - Environmental Consultant - Métis Consultant
Desired outcome: Social Utility/Social Value Returned	5	- Public researcher x2 - First Nation's/Aboriginal Consultant - Alberta Government employee - Métis Consultant

Table A.3: ELC definition and perceptions of ELC use

Category	No. of Responses	Respondent
Definition: ELC means similar, but not the same state returned	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Alberta Government employee x2 - Public researcher - Environmental Consultant - University Professor/Former oil employee
Definition: ELC is vague	8	- Environmental NGO - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public researcher x2 - University Professor/Former oil employee - Environmental Consultant - Métis Consultant
Reason ELC is used: ELC is a legal mechanism	7	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - Alberta Government employee x2 - Ecologist/Aboriginal consultant - University Professor/Former oil employee
Reason ELC is used: Guidance and measurement mechanism	4	- Biologist/Oil Company reclamation practitioner - Public researcher - Alberta Government employee x2
Reason ELC is used: Provides flexibility or non-specificity when gauging reclamation success (responses ranged from positive use, ie.	6	- Public researcher x3 - Ecologist/Aboriginal consultant - Environmental Consultant x2 - Métis Consultant

pragmatic outcomes, to negative use ie., useless tool)		
Power Imbalance: Who defines ELC?	8	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

Table A.4: Reclamation achievement of ELC

Category	No. of Responses	Respondent
Who defines ELC: ELC is vague	6	- Public Researcher x2 - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Environmental Consultant
Who defines ELC: Power Imbalance	8	- Public Researcher x2 - First Nation's/Aboriginal Consultant - Environmental NGO - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Environmental Consultant - Métis Consultant
Challenges to using ELC: Cost hinders reclamation	6	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Public Researcher - Métis Consultant
Challenges to using ELC: Wetland loss and altered landform ratios are unacceptable under ELC	9	- First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Environmental NGO - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Alberta Government employee - Métis Consultant
Improvements to ELC: Past reclamation has improved ELC standards	9	- Biologist/Oil Company reclamation practitioner - Environmental NGO - Alberta Government employee x2 - Ecologist/Aboriginal consultant - Public Researcher - Environmental Consultant x2 - University Professor/Former oil employee

Table A.5: Will ELC be achieved through reclamation?

Category	No. of Responses	Respondent
ELC can be achieved	5	- Biologist/Oil Company reclamation practitioner - Alberta Government employee x2 - Environmental Consultant - Public Researcher
ELC cannot be achieved	4	- First Nation's/Aboriginal Consultant x2 - Public Researcher - University Professor/Former oil employee

ELC can potentially/arguably be achieved	7	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public Researcher - Environmental Consultant - Métis Consultant
Distrust/Uncertainty surrounding ELC achievement in reclaimed sites	7	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Métis Consultant

Table A.6: Stakeholders' views on how trade-offs for reclamation are decided

Category	**No. of Responses**	**Respondent**
Environmental trade-offs are likely to occur	8	- Biologist/Oil Company reclamation practitioner - Environmental NGO - Public Researcher x2 - Alberta Government employee x2 - Ecologist/Aboriginal consultant - Métis Consultant
Uncertainty of reclamation outcomes/trade-offs	4	- Environmental NGO - Alberta Government employee - Public Researcher - Métis Consultant
Power Imbalance determining trade-offs	6	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant
Who decides the values of trade-offs?	10	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Public Researcher x2 - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Environmental Consultant
Pragmatic reclamation trade-off as opposed to restoring pre-disturbance state	5	- Environmental NGO - Alberta Government employee x2 - Ecologist/Aboriginal consultant - Environmental Consultant

Table A.7: What reclamation outcomes are most likely expected?

Category	**No. of Responses**	**Respondent**
Altered landscapes are an expected reclamation outcome	10	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Environmental NGO - Alberta Government Employee x2 - Public Researcher x2 - Environmental Consultant x2
Novel ecosystems are an expected reclamation outcomes	5	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public Researcher - University Professor/Former oil employee

		- Environmental Consultant

Table A.8: Acceptability of reclamation outcomes

Category	No. of Responses	Respondent
Novel/Altered ecosystems/landscapes are acceptable, if they work	6	- Biologist/Oil Company reclamation practitioner - Alberta Government Employee x2 - Environmental Consultant - University Professor/Former oil employee - Public Researcher
Pragmatic reclamation outcomes are acceptable	9	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - Public Researcher - Alberta Government Employee x2 - University Professor/Former oil employee
Novel/Altered ecosystems/landscapes are inevitable, regardless of acceptability	3	- First Nation's/Aboriginal Consultant x2 - Public Researcher
Altered ecosystems/landscapes are acceptable. Novel ecosystems/landscapes are not	3	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - Public Researcher
Novel/Altered ecosystems/landscapes are unacceptable	3	- Environmental NGO - Environmental Consultant - Métis Consultant
Who and how are acceptable outcomes determined?	15	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Alberta Government Employee x2 - Ecologist/Aboriginal consultant - Public Researcher x2 - Environmental Consultant x2 - University Professor/Former oil employee - Métis Consultant

Table A.9: Progressive Reclamation Definitions

Category	No. of Responses	Respondent
Not deferring reclamation until the end-of-mine life	14	- Biologist/Oil Company reclamation practitioner - Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Alberta Government Employee x2 - Ecologist/Aboriginal consultant - Public Researcher - Environmental Consultant x2 - University Professor/Former oil employee - Métis Consultant
Buzzword/Public Relations terminology	4	- Environmental NGO - Public Researcher - First Nation's/Aboriginal Consultant

		- Ecologist/Aboriginal consultant

Table A.10: How respondents view progressive reclamation occurring

Category	No. of Responses	Respondent
Limited progressive reclamation occurring	10	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x3 - Public Researcher - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Alberta Government Employee - Métis Consultant
Some useful progressive reclamation occurring	4	- First Nation's/Aboriginal Consultant - Environmental NGO - Public Researcher - Métis Consultant
Distrust/Uncertainty around if progressive reclamation is actually occurring	4	- Environmental NGO - First Nation's/Aboriginal Consultant - Public Researcher - Environmental Consultant
The Government does not clearly communicated limitations to progressive reclamation	10	- Biologist/Oil Company reclamation practitioner - Environmental NGO - First Nation's/Aboriginal Consultant x3 - Public Researcher - Ecologist/Aboriginal consultant - Environmental Consultant x2 - University Professor/Former oil employee

Table A.11: Challenges facing progressive reclamation

Category	No. of Responses	Respondent
Active mining limits progressive reclamation opportunities	4	- Biologist/Oil Company reclamation practitioner - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Alberta Government Employee
Companies are unwilling to progressive reclaim areas if they are not required to	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - University Professor/Former oil employee
No proof/limited proof that progressive reclamation is occurring/can create functioning sites	5	- Environmental NGO - First Nation's/Aboriginal Consultant - Public Researcher x2 - Métis Consultant
Distrust/Uncertainty around companies progressive reclamation practices	5	- Environmental NGO x2 - First Nation's/Aboriginal Consultant - Public Researcher - Métis Consultant
Power Imbalance: Too few restraints or regulations on industry	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Métis Consultant
Limited regulations and limited	4	- First Nation's/Aboriginal Consultant

enforcement of progressive reclamation regulations		- Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

Table A.12: Suggestions to improve progressive reclamation

Category	No. of Responses	Respondent
Examine what reclamation practices have worked/have not worked to improve standards	6	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Alberta Government Employee x2 - Environmental Consultant x2
Strengthen, enforce and update current reclamation regulations	12	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x3 - Public Researcher x2 - Ecologist/Aboriginal consultant - Environmental Consultant x2 - University Professor/Former oil employee - Alberta Government Employee
Improve stakeholder participation in reclamation planning and activities	4	- First Nation's/Aboriginal Consultant x2 - Environmental NGO - Ecologist/Aboriginal consultant
Improve communication between stakeholders	4	- First Nation's/Aboriginal Consultant x2 - Public Researcher - Ecologist/Aboriginal consultant

Table A.13: Adaptive management definitions

Category	No. of Responses	Respondent
Involves applying learning	8	- Biologist/Oil Company reclamation practitioner - Public researcher x3 - Environmental NGO - Alberta Government Employee - Ecologist/Aboriginal consultant - Environmental Consultant
Involves active engagement	6	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Involves researching	5	- Biologist/Oil Company reclamation practitioner - Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Involves cycles	5	- Biologist/Oil Company reclamation practitioner - Public researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant
Contingency planning/Adapting to new situations	7	- First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Public Researcher - University Professor/Former oil employee - Environmental Consultant

Involves stakeholder participation	4	- First Nation's/Aboriginal Consultant x2 - Environmental NGO - Métis Consultant
Involves rigorous, intensive application	1	- Public researcher
Involves experimenting	2	- Alberta Government Employee - Public Researcher
Involves managing uncertainty	2	- Public researcher x2
Is unclearly defined	4	- First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Environmental Consultant
Is unclearly applied	3	- Environmental NGO - Ecologist/Aboriginal consultant - Métis Consultant

Table A.14: Stakeholders' perceptions on how adaptive management is applied

Category	**No. of Responses**	**Respondent**
Unclear in practice	4	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - University Professor/Former oil employee
Industry-led	10	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x3 - Public Researcher x2 - Alberta Government Employee - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Métis Consultant
Cost hinders adaptive management use	7	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Environmental Consultant - Métis Consultant
Limited stakeholder participation in adaptive management	3	- First Nation's/Aboriginal Consultant x2 - Métis Consultant
Uneven application	2	- First Nation's/Aboriginal Consultant x2
Adaptive management is not legally required	1	- University Professor/Former oil employee
Passively applied	1	- Ecologist/Aboriginal consultant
Actively applied	3	- Biologist/Oil Company reclamation practitioner - Alberta Government Employee x2
Passively and actively applied	6	- First Nation's/Aboriginal Consultant - Public Researcher x2 - Environmental Consultant x2 - University Professor/Former oil employee

Mostly applied passively, although some active application	3	- First Nation's/Aboriginal Consultant x2 - Public Researcher
Mostly passively applied. Active adaptive management is only used in technology development	1	- Métis Consultant

Table A.15: Challenges facing adaptive management implementation

Category	No. of Responses	Respondent
Distrust	7	- Environmental NGO - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Ecologist/Aboriginal consultant - Métis Consultant
Limited stakeholder participation	5	- First Nation's/Aboriginal Consultant x2 - Ecologist/Aboriginal consultant - Public Researcher - Métis Consultant
Power imbalance	6	- First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - Public Researcher - Métis Consultant
Regulations are weakly enforced	6	- First Nation's/Aboriginal Consultant - Public Researcher x2 - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Métis Consultant
No standardization in application	5	- First Nation's/Aboriginal Consultant - Ecologist/Aboriginal consultant - University Professor/Former oil employee - Public Researcher - Métis Consultant
Uncertainty about how adaptive management or its research is used/applied	8	- Biologist/Oil Company reclamation practitioner - First Nation's/Aboriginal Consultant x2 - Public Researcher x2 - Ecologist/Aboriginal consultant - Environmental Consultant - Métis Consultant

Table A.16: Suggestions to improve adaptive management

Category	No. of Responses	Respondent
Continue to improve and apply adaptive management learnings, new reclamation standards and reclamation success criteria	8	- Biologist/Oil Company reclamation practitioner - Environmental NGO - Public Researcher x2 - Alberta Government Employee x2 - University Professor/Former oil employee - Environmental Consultant
Balance power	7	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - University Professor/Former oil employee

		- Environmental Consultant - Métis Consultant
Strengthen and enforce adaptive management and reclamation regulations	7	- First Nation's/Aboriginal Consultant x3 - Public Researcher x2 - Ecologist/Aboriginal consultant - Environmental Consultant
Improve stakeholder participation in adaptive management cycles and reclamation planning	6	- Environmental NGO x2 - First Nation's/Aboriginal Consultant x2 - Alberta Government Employee - Métis Consultant
Respect Aboriginal Constitutional rights, improve and enhance Aboriginal participation in adaptive management and reclamation planning	5	- First Nation's/Aboriginal Consultant x3 - Ecologist/Aboriginal consultant - University Professor/Former oil employee
Independent, third party reclamation planning and implementation	3	- Public Researcher x2 - University Professor/Former oil employee
Better define/clarify adaptive management	3	- Biologist/Oil Company reclamation practitioner - Public Researcher - Métis Consultant

Appendix B

Results Concepts Tables

Appendix B.1.: Equivalent Land Capability Themes and Concepts

Table B.1.1: Importance of reclaiming land

Respondent	Concepts

Respondent 1
- Biologist
- Oil company reclamation practitioner
	- **Responsibility**
	  - Environmental responsibility
	  - Responsible development
	- **Ecological perspective**
	  - Mining disturbs environment
	  - Responsibility to reclaim environment
	- **Citizen perspective**
	  - Albertan values
	  - Extraction done responsibly
	- **Legal obligation**
	  - Professional responsibility of company to reclaim to ELC
	  - Stakeholder agreements
	  - Approval regulations
	  - Commitments/requirements as a company

Respondent 2
- Environmental NGO
	- **Legal Obligation**
	  - Reclamation is the law
	  - Cost-benefit analysis based on assumption of ELC return after extraction
	  - Companies must demonstrate ELC
	- **Ecological perspective**
	  - Scale of operations so large there must be demonstrated return of ELC by company

Respondent 3
- First Nations Consultant
	- **Citizen perspective**
	  - Canadian citizen values reclaimed land
	- **Safety**
	  - Land not contaminated
	  - Safe for human use
	- **Utility perspective**
	  - Useable land after reclamation
	  - Aboriginal/Community utility after reclamation
	- **Aboriginal Perspective**
	  - Communities are impacted
	  - Land use loss

Respondent 4
- Aboriginal Consultant
- CEMA
	- **Legal obligation**
	  - Protect Province against financial liabilities of reclamation
	- **Uncertainty**
	  - Financial resources may not be properly collected to protect taxpayers from financial liabilities
	- **Citizen perspective**
	  - Public must be protected from ineffective reclamation practices
	- **Safety**
	  - Financial safety against failed reclamation
	  - Land not contaminated
	- **Financial protection**
	  - Improper reclamation costs must not be transferred to taxpayers

Respondent 5
- Public researcher
	- **Legal obligation**
	  - Government and industry must manage reclamation
	  - Environmental disasters spur activity in environmental law/policy

	- **Uncertainty**
	  - Oil sands represent uncertain ecological outcomes
	  - How does Government and industry manage uncertainty?
	  - Risk management
	- **Responsibility**
	  - Accountability in reclamation and uncertainty management
	  - Transparency of management
	- **Safety**
	  - How are environmental uncertainties managed in respect to the public?
	  - Uncertain environmental effects
	- **Citizen perspective**
	  - How is public informed about uncertainties, risks and management?

Respondent 6
 	
- Aboriginal consultant
	- **Legal obligation**
	  - Reclamation and ELC are part of the Provincial process
	- **Utility perspective**
	  - Reclaim land so it can be used similarly after extraction
	  - Useful to Aboriginal communities after reclamation
	- **Aboriginal perspective**
	  - Focus of reclamation and ELC should be to provide Aboriginal utility because they are the primary end land-users after reclamation
	  - End land-uses from reclamation should move towards Aboriginal utility
	  - Knowledge and culture loss
	  - Land use loss
	- **Reclamation and Restoration**
	  - Cannot return land to previous state
	  - Land is not restored, but reclaimed instead
	- **Ecological perspective**
	  - Return land to ecologically sustainable landscape

Respondent 7
 	
- Environmental NGO
	- **Citizen perspective**
	  - Canadians and Albertans value reclamation and environment
	  - Pride in how the Province develops resources
	- **Responsibility**
	  - Industrial development must be done responsibly
	  - Industry has responsibility to reclaim or even restore land
	  - Reduce or remove detrimental impacts on the landscape
	- **Reclamation and Restoration**
	  - Land must be reclaimed, but restoration should occur to some extent as well
	  - Restoration is more important than reclamation to benefit Aboriginal communities
	- **Aboriginal perspective**
	  - First nations are most impacted by disturbance and reclamation because they live there
	  - Practice traditional land use in the area
	  - *Restoration is more important because it suggests returning land to previous state* (Author interpretation)

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Legal obligation**
	  - Reclamation and ELC required in legislative framework of Alberta
	- **Citizen perspective**
	  - Albertans value the environment
	- **Ecological Perspective**
	  - Reclamation should return disturbed site to some state of **productivity or ecological function** similar to pre-disturbance state

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Aboriginal perspective**
	  - Cultural view that disturbed lands are **homelands** for multiple communities
	  - Culture and community use of land is site specific
	  - Cultural reclamation needs to occur
	  - Reclamation should use Aboriginal values and desires for end land-use goals

	- **Legal obligation**
	  - Reclamation planning does not use Aboriginal land use context
	- **Ecological perspective**
	  - Reclamation needs to restore ecological function
	  - Disturbance so large the landscape is transformed
	  - Fragmented landscape

Respondent 10
 	
- Public researcher
	- **Responsibility**
	  - Industry is responsible to reclaim ecosystem function
	  - Industry has **social license** to develop oil sands
	- **Legal obligation**
	  - ELC and reclamation are mandated
	  - Government approval system requires reclamation to some level of natural function
	- **Ecological perspective**
	  - Ecosystems must be reclaimed to have some level of natural function

Respondent 11
 	
- Environmental Consultant
	- **Legal obligation**
	  - Reclamation requires return of equivalent land capability
	- **Responsibility**
	  - Clean up our messes

Respondent 12
 	
- University teacher
- Former oil company employee
	- **Citizen perspective**
	  - Reclamation is important as an Albertan and environmental scientist
	- **Responsibility**
	  - Reclamation is critical and necessary because of operations' size and scale
	- **Safety**
	  - Without proper reclamation, environmental damage will be significantly adverse

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Citizen perspective**
	  - Reclamation is extremely important as an Alberta citizen
	- **Ecological perspective**
	  - Land can further degrade if improperly reclaimed
	  - Improper reclamation may encourage non-native elements to pervade and disrupt natural, undisturbed forests

Respondent 14
 	
- Public Researcher
	- **Citizen perspective**
	  - Resident of Alberta and Canada
	  - Values environment
	- **Legal obligation**
	  - Reclamation is a condition of license approval to mine

Respondent 15
 	
- Alberta Government employee
	- **Ecological perspective**
	  - Reclamation must return disturbed lands to state of ecological value for Albertans
	- **Citizen perspective**
	  - Reclamation should have ecological value or utility for Albertans
	- **Responsibility**
	  - Operators disturb the land, therefore they are responsible for reclaiming value
	  - Operators must not leave Albertans financially responsible for reclamation
	- **Safety**
	  - Financial safety from improper reclamation
	- **Financial protection**
	  - Taxpayers should not inherit or be responsible for outstanding reclamation costs

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Responsibility**
	  - If you destroy the landscape for profit, materials or the greater good, you should not impose long-term harm on people who use the land
	  - Development and reclamation are part of **social contract**
	- **Aboriginal perspective**

	- Long-term land users should not be exposed to long-term harm from development or reclamation
	- **Safety**
	  - Land should not harm end land-users
	- **Legal Obligation**
	  - Reclamation is part of the approval process

Table B.1.2: Desired Reclamation Outcomes (End land-uses)

Respondent	**Concepts**

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Altered landscape**
	  - Returning ELC is necessary
	  - ELC does not mean 'we put back what was there before'
	  - Landscape will look different
	- **Ecological function**
	  - Return something that exists within boreal forest, that represents continuum of landscape in the region
	  - Representative of what exists in nature
	  - Mimics natural activities and functions provided by landscapes in region
	- **Pragmatic outcomes**
	  - Landscape changes due to swell factors and materials being replaced
	  - Cannot jam all the dirt back in the hole
	  - Landscape will look different, but should function similarly to natural areas
	- **Representative landscapes**
	  - Reclamation should produce sites/landscapes representative of boreal forest

Respondent 2
 	
- Environmental NGO
	- **Culturally appropriate**
	  - Priority should be given to needs of local communities
	  - 'I'm not a local community member. I don't live there and deal with this.
	- **Aboriginal Utility**
	  - Aboriginal communities will be the end land-users
	  - Will need to deal with environmental issues in the region for decades/centuries after reclamation is complete
	- **Uncertainty**
	  - More honesty needed when discussing end land-uses and reclamation outcomes
	  - Would appreciate more honesty about challenges facing reclaiming post-mining sites
	  - Failure to produce functioning, reclaimed wetlands
	- **Promises**
	  - Companies could be overpromising on reclamation outcomes

Respondent 3
 	
- First Nations Consultant
	- **Aboriginal Utility**
	  - Reclamation should provide what the communities want to see because they will use the land after reclamation
	  - Outcomes should provide Aboriginal communities the ability to use the land as they have done in the past
	- **Culturally appropriate**
	  - Return land for traditional land use
	- **Pragmatic outcomes**
	  - It may be unreasonable to reclaim to previous state considering climate change and duration of mining operation (50-60+ years)
	- **Altered landscape**
	  - Landscape may drastically, but naturally change in the future due to climate change, and reclamation should consider this when planning outcomes

Respondent 4 - Aboriginal	- **Culturally appropriate** - Reclamation should reproduce **homeland** landscape for Aboriginal communities

Consultant
- CEMA
	- **Aboriginal Utility**
	  - Reclamation conversations should include Aboriginal views
	  - Recognizable landscapes as outcome
	- **Uncertainty**
	  - Reclamation is so far down the road that Aboriginal communities cannot picture what they want or do not want as outcomes

Respondent 5
 	
- Public researcher
	- **Altered landscape**
	  - Does not expect reclaimed sites to be fully integrated landscape features
	  - ELC does not recreate lost features (wetlands, peatlands, biodiversity, etc.)
	- **Social utility**
	  - Best case scenario: recreation park or sites covered with grass
	  - Sites should not pose significant risk to human use
	- **Safety**
	  - Ecosystems or landscapes should not be exceedingly dangerous to humans or wildlife
	  - No leaching should occur

Respondent 6
 	
- Aboriginal consultant
	- **Ecological function**
	  - Priority should be making sure the land is ecologically sustainable in the face of land change and climate change
	- **Representative landscapes**
	  - Reclaimed sites should be ecologically sustainable and comparable with the area around it
	  - This should be a priority
	  - Biodiversity present
	- **Altered landscape**
	  - Disturbed land changed from lowland to upland will be a different landscape
	  - Macro-perspective change in regional ecology
	  - Changed ecology alters biodiversity and use by humans/wildlife
	- **Aboriginal utility**
	  - Reclaimed sites should be useful for Aboriginal communities
	- **Social utility**
	  - Reclamation should return productivity and resource value to Province

Respondent 7
 	
- Environmental NGO
	- **Culturally appropriate**
	  - Wants to see agreements signed off and approved by local First Nations so they are happy with outcomes
	  - Responsibility of industry and Government to attempt some degree of land restoration to return what was lost
	- **Aboriginal Utility**
	  - Local stakeholders are most directly impacted
	  - Outcomes should be useful for them
	- **Altered landscape**
	  - Challenges to restoring wetlands
	  - Thousands of years before natural wetlands re-emerge
	  - Will not have same volume/ratio of wetlands afterwards
	- **Restoration instead of reclamation**
	  - Province must mandate some degree of restoration to return what has been lost
	  - Responsibility to restore, not just reclaim
	- **Pragmatic reclamation**
	  - Understands mechanical challenges of reclaiming wetlands
	  - Government and industry should attempt some degree of restoration goals to improve reclamation outcomes

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Pragmatic reclamation**
	  - Reclamation should make systems work naturally
	- **Ecological function**
	  - Landscapes should function properly and maintain function and resilience
	- **Representative landscapes**
	  - Biodiversity should be present
	  - Return landscapes to similar, pre-disturbance function

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Representative landscapes**
	  - EPEA approvals state that reclamation should re-establish locally common, diverse boreal forest ecosystems
	  - Return biodiversity
	  - Adequate plants, ground and shrub cover, diversity of younger and older trees
	  - Species match positions on the landscape
	- **Ecological function**
	  - Reclaimed sites should have locally common functions similar to natural boreal forest ecosystems

Respondent 10
 	
- Public researcher
	- **Altered landscapes**
	  - Reclamation is creating strange soil environments
	- **Representative landscapes**
	  - Locally common species
	  - Quantifiable ecosystem function similarity to natural sites
	- **Ecological function**
	  - Resilience returned and reclaimed sites respond similarly to natural sites after disturbance (fires/floods)
	  - Similarity in function to natural sites

Respondent 11
 	
- Environmental Consultant
	- **Representative landscapes**
	  - Capability to return, over realistic time period, to similar topography and function
	  - Return to rolling topography
	- **Ecological function**
	  - Supports healthy ecosystem functions that were there previously
	- **Safety**
	  - No contamination
	  - Supports healthy ecosystem development and functions

Respondent 12
 	
- University professor
- Former oil company employee
	- **Representative landscapes**
	  - Comparative ecological stage after reclamation
	  - May be difficult to achieve because ELC does not require identical return
	- **Ecological function**
	  - Comparative ecological condition
	- **Pragmatic reclamation**
	  - Create land use so the land is capable of producing and maintaining an ecological capability
	  - Main idea of ELC to is produce ecological capability/function; even if end land-use is different, capability is maintained
	- **Altered landscape**
	  - Closure and Reclamation Plans determine how many hectares will be upland, lowland, etc.
	  - Post-closure landscapes will look different

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Representative Landscape**
	  - Sites returned to something that closely resembled what was there before mining
	  - This would be ideal, but is certainly more than we know how to do at this time
	- **Ecological function**
	  - Return self-sustaining ecosystem functions
	- **Safety**
	  - Ecosystems that are non-threatening
	- **Culturally appropriate**
	  - Sites returned to a similar state so First Nations can use the land they way they did before disturbance
	  - Trapping, food stuffs, medicine, spiritual quests
	- **Aboriginal Utility**
	  - Can be used to maintain cultural and traditional land uses
	  - Trapping, food stuffs, medicine, spiritual quests

Respondent 14	- **Social utility**

- Public Researcher	- Reclaimed sites should create an alternative land use that is desirable for society

Respondent 15
 	
- Alberta Government employee
	- **Social utility**
	  - Diverse, nice mix of land uses
	  - Some upland forests for commercial use, some wetlands, grasslands, areas for berry harvest
	  - Important that many different uses are created through reclamation
	  - Different land uses that appeal to a wide range of individuals
	- **Aboriginal utility**
	  - Berry harvest
	- **Representative landscape**
	  - Diverse land uses that represent different ecosystems and ecological functions in the area to allow for different uses

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Aboriginal utility**
	  - Something local communities and the Government can agree upon should be put back
	  - Land can provide goods and services for local communities
	- **Culturally appropriate**
	  - Land could have uses for consuming goods, berries, or harvesting animals appropriate for traditional land use
	  - Use and function can return that is culturally appropriate
	- **Social utility**
	  - Something local communities and Government can agree should be put back
	- **Safety**
	  - Safe landscape where use and function can return
	  - No deficiencies like high salt, contamination risks or is unsafe in any way
	- **Uncertainty**
	  - Challenges to reclamation outcomes:
	  - Company reclamation plans are constantly changing and are unclear
	  - Expected timelines for operation have not concluded and reclamation that was expected has not occurred
	  - **Individual** lease-by-lease plans are submitted, with no **regional plan for reclamation**
	  - No real idea of what final reclamation landscapes will look like because there has been minimal reclamation completed and certified

Table B.1.3: ELC Definitions and Perspectives

Respondents	**Concepts**

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **ELC Definition: Measurement tool to determine capability**
	  - Measurement system, ranking tool, system to define capability of pre-disturbed land to determine a return of same capability after disturbance
	- **Reason to use ELC: Legal**
	  - Historic precedence
	  - It is the law, contained within legislation
	  - An artefact of tools that were available to guide reclamation when EPEA was originally written
	- **Altered state**
	  - ELC does not return identical land uses or functions, but using measurement systems, we can identify equivalent functions or uses
	- **Improvements to ELC and reclamation**
	  - Mine approval system has changed with new findings from reclamation over the last 40 years
	  - Recognition of more values that land can provide than before
	  - Move away from timber/fibre-centric towards ELC that includes wetlands, and other values

	- Move from site-specific towards landscape as a whole when reclaiming to ELC
	- **ELC Challenges**
	  - Time lag between understanding and policy creation
	  - Legislation needs to catch up to realities

Respondent 2
 	
- Environmental NGO
	- **ELC Definition: Equivalent potential, but not exact same potential**
	  - Land would be returned to provide equivalent potential, although not exactly the same potential
	- **Reasons to use ELC: Social utility**
	  - Social utility
	  - **Utilitarian term** in legislation
	- **Vague definition**
	  - The term is pretty vague
	  - Disconnect between what is legally required under ELC
	  - Government does not want to draw attention to poor reclamation track record so ELC remains vaguely defined
	- **Altered state**
	  - Not identical potential for land
	  - Different patterns of wetlands to uplands and different habitats are created
	- **ELC Challenges**
	  - Companies return land that is quite different than what was **promised** in environmental assessments to communities
	  - Poor reclamation track record to achieve reclaimed mined land
	  - Most conversations on ELC are academic and not always applied to policy
	  - Inertia in regulatory process to change ELC (time lag)
	- **Power imbalance**
	  - What companies promise is not always what they deliver with reclamation
	  - *Who decides what ELC means and when it has been achieved?* (Author's comment)

Respondent 3
 	
- First Nations Consultant
	- **Reasons to use ELC: Return equivalent biodiversity**
	  - Government wants to show that they're going to reclaim sites to be equivalent in terms of supporting biological diversity
	- **ELC definition: Returning biodiversity**
	  - Means returning similar biological diversity after reclamation to what was present before
	- **ELC Perspective**
	  - Frustrated
	  - Biodiversity metrics used to define ELC may have different meanings to Alberta Government than to community members
	- **ELC Challenges**
	  - It really depends on how you define equivalence and that creates contention
	- **Power Imbalance**
	  - Who considers or decides what is equivalent, what that equivalency is, or who that equivalency is relevant to?
	  - Community member live here, not Calgary or Edmonton-based camp workers or executives
	  - First Nations will be living and using ELC land
	  - When you talk about number of species and biodiversity, it really depends on how it is measured and who measures it
	  - Biodiversity metrics decided by Government employees who may never set foot in the region
	  - **Economic > Environment and Social**

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Power imbalance**
	  - Government doesn't take local community concerns into account as much as community would like
	  - Decisions made in Calgary or Edmonton, local people fall out of the loop
	  - **Economic > Environment and Social**
	- **ELC Challenges**

	- Where does the community fit in once all the money is gone? - If companies pick up and leave, what happens to the land?

Respondent 5
 	
- Public researcher
	- **ELC perspective: Acknowledging Uncertainty**
	  - An explicit acknowledgement at the outset that restoration to previous condition is highly uncertain
	  - Opens the door to not requiring strict restoration policies
	  - ELC is a 'second-best' option
	- **Altered state**
	  - Deciding to not restore to previous condition usually means that it cannot be done
	- **Reasons to use ELC: Measurement tool**
	  - Equivalency is a measure of ecological goods and services being reclaimed to some level, although not identical to pre-disturbance
	- **ELC Challenges**
	  - Reclamation is done instead of restoration
	  - ELC departs from requiring strict restoration or reclamation practice

Respondent 6
 	
- Aboriginal consultant
	- **Power imbalance**
	  - Essentially Government and industry use the term. Coined and used by industry and Government
	  - ELC does not come from any Indigenous land user
	  - Terms are coined and used but not on a level playing field
	  - What equivalent means is not fairly defined, and does not fairly determine who benefits from ELC reclamation
	- **Reasons to use ELC: Buzzword**
	  - Public relations term for Government and industry
	  - **Buzzword**
	- **Vague definition**
	  - Green washing
	  - Looking at legislation, how it is enacted, where they are applied and who benefits, these words (ELC, balance, sustainability) are not used with the intention that they should be
	  - Doe not believe ELC is well understood or used within oil sands context
	- **Definition of ELC: Must accommodate all users**
	  - Equivalent should mean for all land users - historic, current and future
	- **Perspectives of ELC: Not occurring**
	  - Does not believe ELC is being returned
	- **ELC Challenges**
	  - Equivalency is not being fairly defined by what the Government calls 'stakeholders' and that includes **Aboriginal Rights Holders**

Respondent 7
 	
- Environmental NGO
	- **ELC definition: Return land utility**
	  - Returning land to a useful state
	  - Described in legislation
	- **ELC Perspective: More economic tool/criteria for rec.**
	  - Defined by Government as making land productive/economically viable after reclamation
	  - Based more around economic drivers than inherent ecological value for the land
	- **Reasons to use ELC**
	  - Utilitarian term to make land economically useful after mining
	- **ELC Challenges**
	  - Incentivized conversion of wetlands to uplands (commercial forestry)
	- **Improvements to ELC and Reclamation**
	  - ELC should make land safe for use after reclamation
	- **Power imbalance**
	  - Incentivized conversion of wetlands to uplands
	  - ELC used to make an economically viable landscape, not inherently ecologically driven
	  - Based more around economic drivers than inherent ecological value for the land
	  - **Economy > Environment**

Respondent 8	- **ELC definition: Similar function and ecosystems**

- Alberta Government employee
- Upstream oil/gas
	- ELC should produce similar ecosystems and functions for what existed before disturbance
	- **ELC Perspectives: Similar but not identical**
	  - Sites will not be identical but should have similar functions
	  - If a wetland is lost, a wetland should be replaced. If a forest is lost, a forest should be replaced
	- **Reasons to use ELC**
	  - It is in legislation
	  - ELC guides reclamation processes to try and restore equivalent ecosystem functions
	- **Improvements to ELC and Reclamation**
	  - Reclamation was originally about making land safe and productive for human use
	  - Previously ELC used agricultural metrics to produce economic value and use
	  - Currently ELC aims towards returning natural ecosystems and restoring ecological function
	  - **Environment and Social > Economic**
	- **Altered state**
	  - Reclaimed sites will not be identical, but will function similarly

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Reasons to use ELC: Legal**
	  - It is legal language
	  - Can use ELC legal language to support Aboriginal-based reclamation goals
	  - Would require major overhaul of Provincial legislation to change ELC
	- **ELC perspective: Non-commitment to returning identical conditions**
	  - Government policy makers, regulatory body and industry people use ELC to proceed with reclamation without being committed to re-establishing pre-disturbance conditions
	- **Vague definition**
	  - Allows Government and industry to not commit to firm reclamation goals or restoration to pre-disturbance state
	- **Power imbalance**
	  - Government still has, to some degree, the idea that once oil is extracted and land is reclaimed, sites will be a resource base (productive commercial forests)
	  - **Economic > Environment and Social**
	  - Trying to use ELC as a legal mechanism to promote meaningful reclamation outcomes for Aboriginal communities because ELC can be covered in that context, however it is not really used that way by Government

Respondent 10
 	
- Public researcher
	- **ELC Definition: Return similar function**
	  - Reclamation should return equivalent ecosystem functions
	- **ELC Perspectives: Can be interpreted many ways**
	  - ELC can interpreted differently by industrial partners
	- **Vague Definition**
	  - It is not clear what ELC means to the Alberta Government
	  - ELC can be interpreted differently by industrial partners
	- **Reasons to use ELC: Limits to reclamation, not restoration actions**
	  - Reclamation is trying to reclaim an area that has nothing there, zero capacity, and attempting to reclaim some capability to produce biomass or function
	  - Reclamation can act as one part of restoration ecology to restore ecological function
	- **Altered state**
	  - Reclamation may not produce identical to native, natural ecosystems, and it may result in novel ecosystems, but with come capability to produce biomass or function

Respondent 11 - Environmental Consultant	- **ELC Definition: Land returned without limiting factors present** - Having land put back to a state with no limiting factors that hinder returning it to whatever stage it was previously, or what could have been there previously - **ELC Perspective: Returning healthy ecosystems**

	- Nothing should be left from operations that would limit healthy ecosystem returning afterwards - Reclamation be done in a reasonable timeframe so that it can be returned back to functioning ecosystem with nothing inhibiting that return - **Reasons to use ELC: Flexibility** - It gives leeway to reclamation and provides more realistic expectations around reclamation - Flexibility due to long time-lengths for things like peatlands and old growth forest to return - Keeps reclamation outcomes from being unrealistic - **Pragmatic reclamation** (Author's comment)
Respondent 12 - University professor - Former oil company employee	- **ELC Definition: Similar land productivity** - When land is disturbed and when it is reclaimed, it will have equivalent capability, or it will be able to produce as it did before - **ELC Perspectives: ELC has not properly evolved** - Easy to say the equivalent productivity will be returned, but harder to do in practice - Agrologists wrote the rules for reclamation based on what they understood about land productivity. ELC has not really changed since then. - **Reasons to use ELC: Legal** - ELC as a legal mechanism has been around for 40 years in Alberta - **Vague definition** - There is a wide variety of different terms, conditions and approvals that are covered by ELC - **ELC Challenges** - It is difficult and challenging to understand ecosystem capabilities of muskeg wetlands compared to boreal forest or upland sites
Respondent 13 - Environmental Consultant - Botanist	- **ELC Definition: Useless tool** - Respondent does not describe it because it is too unspecific - **ELC Perspective: ELC is useless** - Believes the term is useless - Government double-speak - **Vague definition** - Nonspecific term - **Reasons to use ELC: Flexibility and non-specificity** - Government uses it to be nonspecific, as a way to say that land will not be returned to what it was - **Power imbalance** - We could get farmland, or productive forest, or a parking lot if that was something that could be useful - ELC is Government speak, or double-speak for 'we can...do what we want and call it equivalent.' - *Who decides what is useful?* (Author's comment) - Alberta Government
Respondent 14 - Public Researcher	- **ELC Perspective: Open to Gov. interpretation** - ELC is whatever the Government of Alberta says it is - **ELC Challenges** - Has not seen any specific guidance on what it means - As an operator, respondent would like to fully know what the Government (Alberta Environment and AER) mean when the company writes a reclamation plan - **Reasons to use ELC: Gov. needs some form of criteria** - Government needs some form of criteria they can use to direct operators' reclamation activities. They call it ELC - **Vague definition** - *Gives Government flexibility* (Author's interpretation)
Respondent 15 - Alberta Government	- **ELC Definition: Return similar function** - Expectation that oil sands operators will reclaim lands to have similar, but not identical, ecological functions to what existed prior to disturbance

employee	- Reclaimed sites should have equivalent value
	- **ELC Perspectives: Produce something of value**
	  - Aim is towards locally common, self sustaining boreal forest ecosystems across the closure landscape
	  - Reclamation should produce something of value
	- **Reasons to use ELC: Legal**
	  - It is in the legislation
	  - Contained in EPEA and various regulations
	  - To guide operators to reclaim landscapes towards something that has value for, and can be used by Albertans
	  - ELC does not let operators off the hook
	- **Altered state**
	  - Sites will not be identical, but will have equivalent value or ecological function

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **ELC definition: Poor standard**
	  - A cop out for doing substandard reclamation
	- **ELC Perspectives: Unsuitable to gauge success**
	  - A sidebar, or scapegoat process where the Government can determine a particular land use based on what can be achieved versus what should be achieved
	  - Changing apples to oranges
	- **Altered state**
	  - Not necessarily reclaiming like for like
	  - If trees cannot be planted because soil is too salty, a stripmall could be built and considered equivalent
	- **Vague definition**
	  - Allows for 'like for like' to not be produced by reclamation
	- **Power Imbalance**
	  - Government determines what equivalent land capability is
	  - Creates substandard reclamation outcomes

Table B.1.4: ELC acceptability for reclamation

Respondents	**Concepts**

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Improved standards**
	  - Last 10 years there has been a shift from productivity results-based reclamation to now include a more holistic view
	  - Inherent ecological functions and potential land uses that weren't previous included in rudimentary estimates are now being used
	  - Shift from productivity towards ecological function
	  - Reclamation practices/understandings have evolved
	  - Improved **Standards of the Day**
	  - Won't use agronomics, non-native species
	  - Stepped away from previous techniques
	  - Moved away from commercial forestry has most highly valued end land-use
	  - Strive towards locally common boreal forest species and ecosystems
	- **Valuation shifts**
	  - Recognizes there are aesthetic values, traditional use values, wildlife values, recreational values for reclamation
	  - Wetlands were previously ranked zero for capability but now seen as significantly valued
	- **Multistakeholder value**
	  - Use for many different stakeholder groups
	  - Aesthetic values, traditional use value, wildlife value, recreation value, commercial forestry value

Respondent 2
 	
- Environmental NGO
	- **Financial liability**
	  - MFSP is not strict enough. Companies are not required to provide serious security money until the last 15 years of mine life, and can use assets as surety against liability
	  - Albertan taxpayers are going to be left holding the bag with a very

	significant unreclaimed landscape with tailings. We actually need to fix this.
	- **Irresponsible management**
	  - Liabilities may get so big and when companies are in the last 20% of mine life, those companies can disappear
	- **Bare minimum**
	  - Companies will do bare minimal of reclamation activities
	- **Cost hinders reclamation**
	  - Companies will do bare minimum with as little financial expense as possible
	- **Uncertainty**
	  - Has low confidence that we're going to see any suitable reclamation regardless of ELC end trajectory

Respondent 3
 	
- First Nations Consultant
	- **Safety**
	  - ELC needs to produce safe landscapes
	  - Level and intensity of disturbance is so large, what will be scientifically safe may not be seen as safe for local communities
	- **Uncertainty**
	  - Unsure of what results might end up being scientifically unsafe
	  - With level and intensity of disturbance being so large in mines, it is difficult to know what ELC will be acceptable and unacceptable
	- **Acceptable reclamation**
	  - Some sites will be reclaimed very successfully (cut lines, seismic lines)
	  - There are lots of reclamation areas that can be quickly reclaimed in areas of small disturbance
	- **Wetland loss/Changing landscape ratios**
	  - Nobody knows how to reclaim muskeg
	  - Natural landscape that takes thousands of years to form
	  - No one has successfully returned a wetland yet
	  - Economic driver because reclaiming wetlands is expensive and not guaranteed to be successful
	- **Cost hinders reclamation**
	  - No companies are going to return wetlands or muskeg/peatland because it is too expensive
	  - Landscape will change because it is expensive to move dirt and earth
	  - Really, it comes down to an economic driver
	  - **Economy > Environment**

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Community participation**
	  - Involve communities in planning and do it on a broader scale
	  - This is challenging because every project and EIA is independent
	- **Regional planning is weak**
	  - Prior to LARP there was no regional plan to address independent approval and EIA of each mine
	  - Today, LARP remains weak
	  - Each company builds their own reclamation plan with cost being front and centre
	- **Bare minimum**
	  - Economy > Environment and Social
	  - Everyone wants the easiest path to reclamation
	  - No reclamation of wetlands, fens, muskeg because it is difficult and expensive
	  - Commercial forests are likely outcomes because they are built simply
	- **Cost hinders reclamation**
	  - Reclamation is expensive
	  - No one will reclaim ELC of wetlands because it is complex and costly
	- **Wetland loss/Changing landscape ratio**
	  - No one wants to replace wetlands because it is complex and costly

Respondent 5
 	
- Public researcher
	- **Who defines ELC?**
	  - **Power imbalance**
	  - **Vague definition**
	  - Fairly ambiguous term because who is to say what is equivalent and on what basis?
	  - Unclear definition that leave flexibility and open-endedness

	for regulators and proponents (companies) to come to terms with what is actually possible for post-closure reclamation - Fundamentally it comes down to regulators and proponents not wanting to promise something they cannot deliver. Equivalency allows them to promise some kind of high standard without being tied to a specific metric or objective - Amorphous and ambiguous term, but does not see how anything will resemble equivalency - **Irresponsible management** - Reclamation is seen as a distant thing, so most operators are not seriously thinking about it now, even though they should - **ELC Reclamation instead of Restoration** - It is clearly a notch down from restoration and reclamation to a previous state - **Wetland loss/Changing landscape ratios** - Peatlands take thousands of years to develop - Lost wetlands and peatlands cannot be reclaimed, and there is no equivalency for what is lost
Respondent 6 - Aboriginal consultant	- **Who defines ELC?** - **Power imbalance** - **Vague definition** - Who is going to be deciding what ELC means in 80 years (when reclamation activities start picking up)? - **Irresponsible management** - The land is being disturbed and reclamation plans are made for the future, then waiting 80 years until that reclamation plan can be acted on and completed. The difference in those 80 years is, who is going to be deciding what ELC means 80 years out?
Respondent 7 - Environmental NGO	- **Wetland loss/Changing landscape ratios** - Let's get restoration of wetlands and not rely on having things like terrain parks - **ELC Reclamation instead of Restoration** - There are so many important environmental values to consider that ecological restoration is appropriate given the scope and scale of development - **Improving standards** - Restoration should be a goal of ELC guidelines, regulations and legislation, not only reclamation - **Who defines ELC?** - **Power imbalance** - **Unacceptable outcomes** - That you can have picnic tables in this completely transformed landscape, and that is considered acceptable. That is not acceptable to local First Nations or to the majority of Albertans - **Multistakeholder values** - First Nation's use - Many environmental values to consider as important
Respondent 8 - Alberta Government employee - Upstream oil/gas	- **Uncertainty** - We are not recreating sites, but entire landscapes. There is a high degree of difficulty and uncertainty in this process - **Improving standards** - Post-reclamation landscape will not be identical to pre-disturbance landscape, but focus is now on returning ecological function
Respondent 9 - Ecologist - Aboriginal Consultant - Formerly CEMA	- **Who defines ELC?** - **Power imbalance** - Group of people still in reclamation business who produced research in the 1970s. Extensive expertise and created reclamation infrastructure, but they are dedicated to the idea of ELC - Difficult to advance new ideas because of old-school

	mentalities in the reclamation field - These people are in leadership roles and it is going to be basically impossible to change the idea - **Vague definition** - Does not require commitment to pre-disturbance condition - **Unacceptable outcomes** - Changing landscape rations and losing wetlands is unacceptable in Alberta - **ELC Reclamation instead of Restoration** - Difficult to advance restoration to replace reclamation because of the ELC definition - ELC could honestly mean ecological restoration - **Multistakeholder values** - ELC that included restoration ecology would be more meaningful to Aboriginal communities - **Improving standards** - Prioritize re-establishing biodiversity beyond simply growing trees - **Irresponsible management** - Big weakness in system: no wetland reclamation policy that forces wetland reclamation or recreation after disturbance - **Wetland loss/Changing landscape ratio** - ELC is a cop out because there is no push on industry to do a better job of reclaiming wetlands - No investment in wetland reclamation because there is no policy enforcing it - Not acceptable to have a 50-50 wetland dominated wetland and claim ELC in a 20-80 wetland/upland reclaimed landscape and Government approves tens of thousands of hectares of development - **Bare minimum** - Industry is not held to a high standard for wetland reclamation - **Cost hinders reclamation** - No investment in wetland reclamation because there is minimal enforcement or push on industry to do it
Respondent 10 - Public researcher	- **Valuation shift** - Reclamation has moved from ELC aiming at primary productivity towards ELC achieving restored ecosystem function - More recent approvals require ELC involving ecosystem function - Reclamation historically rooted in agriculture, silviculture, and forestry, but movement is shifting towards natural ecosystem function, and locally common boreal forest systems - **Uncertainty** - Are approvals paying lip service to ecosystem function ELC? We will see in the future - Resilience is not included in ELC - **ELC reclamation instead of restoration** - Reclamation is a subset of restoration - There is no reason why ELC cannot include land restoration as a final goal - **Who defines ELC?** - **Power imbalance** - Industrial vs. scientific division: industry wants land reclamation, whereas more ecological scientists believe that land restoration may be more appropriate - Old-school reclamation practitioners in Government still using the same ELC language that they are comfortable with - Dogma of old reclamation thinking (agriculture, silviculture) are still present and it is difficult to change minds - Belief in Government that ELC system works, so status quo remains - Reclamation is industry driven by Government mandate. Government has historically sided with industry on what industry perspectives on ELC and reclamation are - **Vague definition** - ELC remains vague because Government does not know how to monitor anything else or use different systems that generate

	clearer language/definitions
	- **Cost hinders reclamation**
	  - Corporate top-down pressure to not spend money
	  - Changing reclamation practices is equated as increased expenses
	  - Government has not applied stricter regulations because they follow what industrial partners want
	- **Bare minimum**
	  - Industry want a rule book of easily measurable methodologies, although easily measureable methodologies based in agriculture and silviculture are not appropriate for reclaiming and restoring wild ecosystems

Respondent 11
 	
- Environmental Consultant
	- **Improving standards**
	  - ELC should not equate to an altered/novel state
	  - ELC should produce beneficial ecosystems

Respondent 12
 	
- University professor
- Former oil company employee
	- **Improving standards**
	  - Over time, reclamation certificates have become harder to get because of requirements for pre-disturbance assessments, reclamation plans and post-disturbance assessments
	- **Irresponsible development**
	  - Government and regulators are supposed to maintain assessments on a hectare by hectare basis, which has not happened
	  - Also, what occurs when assessed land does not meet ELC? It is too late
	  - There are hundreds of thousands of hectares that there is currently no ELC for, and no plan to fix that
	- **Who defines ELC?**
	  - **Power imbalance**
	  - Individual stakeholders have looked into ELC assessment and clearly shown that ratios (of land assessment by Regulators) are off
	  - No plan is currently known about to fix these ELC assessments ratio discrepancies
	- **Wetland loss/Changing landscape ratios**
	  - Way, way, way too much muskeg that has been taken out and it is impractical to return the same ecological state
	  - There will be different ratios of habitat types and much less wetland and muskeg than before

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Improving standards**
	  - Land needs to be returned to a functional state suitable for First Nations use
	- **Multistakeholder values**
	  - Reclaimed land will mostly be used by First Nations and they deserve to have land being returned to something that is functional for them
	- **Who defines ELC?**
	  - **Power imbalance**
	  - **Vague**
	  - Not sure anyone knows what ELC really means
	  - There are many ways to argue that ELC has been achieved, making ELC seem like a cop out

Respondent 14
 	
- Public Researcher
	- **Wetland loss/Changing landscape ratios**
	  - Reclaiming ELC of wetlands is extremely difficult
	  - There is a wide acceptance that wetlands cannot be recreated or restored
	- **Irresponsible management (contradictions in Provincial/National legislation)**
	  - Environment Canada has no net loss of ecological function associated with wetlands

Respondent 15
 	
- Alberta Government employee
	- **Wetland loss/Changing landscape ratios**
	  - Wetlands, peatlands and muskeg take thousands of years to develop
	  - ELC reclamation will produce more uplands than wetlands in final landscape
	  - It is unreasonable to expect operators to develop peatlands/wetlands because of the long time required for them to fully develop

	- **Who defines ELC?**
	  - Government wants more ecological areas post-mining, that have land use value and resemble kind of the boreal forest in the region
	- **Changing valuations**
	  - Shift towards ecosystem function and locally common boreal forest
	- **Improving standards**
	  - Continue monitoring to ensure performance targets are met on sites and they are moving towards targeted ecological end use
	  - There are so few reclaimed sites because monitoring and ELC standards have become stricter to protect taxpayers against reclamation liabilities of certified sites that become problematic in the future
	  - Taking cautious approach to reclamation certification and ELC to keep Albertans off the hook for future reclamation costs after certification

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Wetland loss/Changing landscape ratios**
	  - Building swamps, muskeg and peatlands is difficult, if not impossible and expensive
	  - More upland commercial forests than wetlands will be reclaimed under ELC
	- **Cost hinders reclamation**
	  - Reclaiming ELC of wetlands is expensive
	  - The cost of moving material around, smoothing it out and putting soil layers back together is expensive
	- **Multistakeholder values**
	  - The problem is that people in the area have been used to a landscape that has been primarily wet and pretty flat and their traditional land uses and species are accompanied with that type of landscape. That is all changing, and the culture is changing
	- **Who defines ELC?**
	  - **Power imbalance**
	  - Reclamation was based around Socially Responsible Development and public landowners had, as a main goal, commercial forests.
	  - Local Aboriginal communities are having their culture changed by ELC to altered landscapes

Table B.1.5: Reclamation achievement of ELC

Respondents	**Concepts**

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **ELC will be achieved**
	  - Value and function can be returned if we have a good understanding of what ELC is, then they are confident that reclamation can do that
	- **Altered landscapes**
	  - It won't be exactly the same, it may have the same proportions of landscapes or ecological function but it will be equivalent to what is here
	- **Ecological function**
	  - Confident that functions and equivalence can be returned, but in different proportions and different ratios

Respondent 2
 	
- Environmental NGO
	- **ELC can be selectively/arguably achieved**
	  - The term is vague enough that if there was successful reclamation, you could argue ELC was achieved
	- **No evidence of success**
	  - We've had no opportunity to review detailed ecological performance of reclaimed sites in the oil sands
	  - The one certified site's reclamation certificate is not publically available and does not provide enough information to determine how the Government of Alberta concluded that ELC had been achieved
	- **Distrust/Uncertainty**
	  - The Government and industry have a responsibility to demonstrate suitable and successful reclamation, but have not yet done so
	  - There is an expectation that land will be returned to ELC, but reclamation plans often change from the original approval assessment and may be returned differently

Respondent 3
 	
- First Nations Consultant
	- **ELC has potential, but is currently uncertain**
	  - There is potential to achieve ELC, but the proof will be in the pudding in terms of how drastically climate change affects the landscape from when a project starts to when reclamation activities end
	- **Uncertainty**
	  - Once things have changed it is hard to get it back to how it was, especially in oil sands mines

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **ELC will not be achieved**
	  - Does not think equivalence will ever occur because mining transforms the land into something else and doesn't think that it will be recognizable to community members
	- **Uncertainty**
	  - What are the baselines to reclaim to? That is a huge challenge reclamation faces
	  - Climate change will be occurring over the period of mine operations and reclamation will face challenges in a warmer future

Respondent 5
 	
- Public researcher
	- **ELC will not be achieved**
	  - At the end of the day, peatlands, bogs, boreal forest is lost
	  - Peatlands take thousands of years to develop
	  - There is no way these kinds of landscapes will be reclaimed, so there is no equivalency the respondent is aware of to account for this

Respondent 6
 	
- Aboriginal consultant
	- **ELC will not be achieved**
	  - Not at all
	  - They don't have all the information or all the right perspectives/understandings to make that claim
	  - Sites will not be returned to previous ecological state
	  - ELC will not be achieved for Aboriginal communities today, or in the future. They will not recognize the land in several generations
	- **Uncertainty**
	  - Climate change and industrial cumulative effects will present challenges to reclamation and ELC
	  - Long time periods of operation and reclamation will not occur for another several decades
	- **Ecological function**
	  - Functioning habitat or ecology may be returned but it will not be the same
	- **Altered state**
	  - Function may return, but ecosystems and landscape will be different

Respondent 7
 	
- Environmental NGO
	- **ECL can be selectively/arguably achieved**
	  - Upland commercial forests that produce economic outlet can probably be achieved
	  - Can we get a state that locals are content with? Probably not
	- **Uncertainty**
	  - Not optimistic based on what they have read
	  - Development pace needs to be slowed down until these questions are answered and agreed upon

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **ELC can be achieved**
	  - The goal is either functioning ecosystems or productivity
	  - Sites will be different but function and productivity will be there
	- **Altered state**
	  - Some sites can be returned to similar states, although some cannot
	  - As long as ecological function is returned, sites can look different

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly
	- **ELC can be selectively/arguably achieved**
	  - If you define ELC in a limited way, from the perspective of policy makers, than yes, ELC can be achieved
	  - It is a completely different perspective for First Nations and Métis communities, so ELC may not be achieved from their perspectives
	  - ELC has not been achieved anywhere to support Aboriginal

CEMA	Constitutional Rights
	- **Uncertainty**
	  - ELC may produce some kind of ecological function that is acceptable, but it does not support exercising Constitutional Rights of Aboriginal people
	- **Altered state**
	  - Mining is transforming pretty flat landscapes into hilly landscapes and end-pit lakes will create a new lake landscape that was previously non-existent

Respondent 10
- Public researcher
	- **ELC can be achieved if ecosystem function is achieved**
	  - We should be looking for certain thresholds of similarity and natural function
	  - 100% natural function will not be achieved, there will always be a novel element to the landscape
	  - Gateway Hill was certified as ELC reclaimed because land capability measurements and functioning levels were adequate for certification acceptance

Respondent 11
- Environmental Consultant
	- **ELC can be achieved**
	  - Proper reclamation techniques should be able to create ELC in reclaimed landscapes
	  - No contamination or hindering elements can be present, so good reclamation must account for this and work to remove inhibiting elements
	- **Altered state**
	  - Altered ecosystems will not match was there before, but they could still be viable ecosystems

Respondent 12
- University professor
- Former oil company employee
	- **ELC can not be achieved**
	  - Returning land to equivalent ecological states is the plan, but that is not going to happen because of wetland/muskeg loss that cannot be returned to equivalent states
	  - There will be a drier landscape with poorer quality forests and a lot less muskeg and wetland ratios than before
	  - Different ratio of ecological habitats is a fact of life for oil sands mine reclamation

Respondent 13
- Environmental Consultant
- Botanist
	- **ELC can be selectively/arguably achieved**
	  - ELC can be produced, but respondent does not think it is being produced currently
	- **Uncertainty**
	  - Is uncertain if reclaimed sites will be sustainable in the long term

Respondent 14
- Public Researcher
	- **ELC can be achieved**
	  - ELC for forests can be achieved, but sometimes things cannot be reclaimed to pre-disturbance conditions, but some form of equivalency should be produced
	  - Sites will be become self-sustaining in time, but may be different than what existed before

Respondent 15
- Alberta Government employee
	- **ELC can be achieved**
	  - Signs that ELC achievement is on track for sites undergoing reclamation monitoring over the last 30 years
	- **Altered state**
	  - Peatland reserves will be lost and those cannot be recreated in post-closure landscapes
	  - Higher percentage of functioning upland boreal forests than wetlands, but they will become natural environments

Respondent 16
- Métis Consultant
- Former CEMA
	- **ELC can be selectively/arguably achieved**
	  - It depends on what you reclaim towards and how you define ELC
	  - Some sites can be easily reclaimed
	  - It depends on if we're building Wal-Mart parking lots or big box stores, or re-establishing wildlife populations to support biodiversity

	expectations that can sustain local populations. We'll see. - **Uncertainty** - ELC success depends on who determines ELC and how they apply it

Appendix B.2: Trade-offs and altered/novel ecosystems themes and concepts

Table B.2.1: Sustainable development and trade offs

Respondent	Concepts

Respondent 1
- Biologist
- Oil company reclamation practitioner
	- **Sustainable development not occurring**
	  - Finite resource cannot be sustainably developed
	- **Unsustainable development**
	  - Not a firm believer of Sustainable Development
	  - Resource extraction industry is not sustainable
	  - Finite resource cannot be sustainably developed, but can be responsibly developed
	- **Responsible development**
	  - Draw out resource extraction over a long period of time
	  - Make sure the resource is developed responsibly
	  - Be environmentally, economically and socially responsible
	  - Protect people, communities and meet commitments and promises made to stakeholders
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Responsible development
	  - First meet commitments to stakeholders and fulfill promises
	  - Albertans and local communities should benefit from the resource development
	  - At the end of the day, after meeting stakeholder commitments, resource development should benefit the shareholders
	- **Economy and Social > Environment**

Respondent 2
- Environmental NGO
	- **Sustainable development is not occurring**
	  - Another term that has become something of a buzzword
	  - Not sure development of a finite fossil fuel resource can ever be sustainable
	- **Responsible development**
	  - You can have responsible development, but the respondent does not think the oil sands can ever be sustainable

Respondent 3
- First Nations Consultant
	- **Sustainable development is not occurring**
	  - It is just smoke and mirrors, really. It's green wording to make it look better because there really is nothing sustainable about oil extraction
	- **Unsustainable development**
	  - Finite resource
	  - There may be ways to extract more efficiently so it becomes less environmentally impacting, but it doesn't mean that it's sustainable

Respondent 4
- Aboriginal Consultant
- CEMA
	- **Sustainable development is improperly applied**
	  - It means something different to everybody
	  - Would like to see it applied as a way of managing the impacts of oil sands development to the benefit of the community
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Look at projects through the lens of impacts
	  - All environmental impacts could be social/cultural impacts, but at different degrees
	  - If you are unable to balance the pros and cons of a project in a way that adequately benefits local communities, the project should not be approved
	  - We're going to have a lot of degradation, at least let's make sure that we're able to compensate

Respondent 5
- Public researcher
	- **Sustainable development is not occurring**
	  - There is nothing about the current approach that leads to the conclusion that oil sands mining is consistent with sustainable development
	  - Sustainable development is supposed to meet the needs of today while

	preserving the needs of tomorrow and deal with social issues along the way, and accounting for environmental protection
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Oil sands development can be **utilitarian** if:
	  - Government sacrifices a corner of the province for the better economic good of everyone else
	  - Maybe at some level protecting land somewhere else, ensuring water quality and quantity, then maybe you can say these trade offs are an inevitable part of sustainable development
	- **Competition with other land users**
	  - There is no sustainable development for First Nations and their Treaty Rights
	  - Has a hard time accepting that oil sands are consistent with sustainable development for those who live in the Lower Athabasca region

Respondent 6
 	
- Aboriginal consultant
	- **Sustainable development is misused**
	  - Government public relations term
	  - The term is misused by Government and industry
	  - Economic priority is given over the environment, so that is a clear example that s
	  - It is easy to blame industry, but the buck really stops with the Government
	- **Balancing Environmental, Social and Economic Trade offs**
	  - There is always talk about balancing the environment, the economic and the social
	  - That is fine and balance means you do your best, and that balance doesn't mean all trade offs are equal
	  - Balance implies give and take, and putting priority over one or the other
	- **Economy > Environment**
	  - The Government has always prioritized economic development over the environment
	  - Economic policy is a priority and does not balance environmental priorities because ecological thresholds that are needed in the environment are not created because that does not balance with the Government's dreams of economic extraction from the oil sands

Respondent 7
 	
- Environmental NGO
	- **Sustainable development is not occurring**
	  - Oil sands are not a sustainable resource. We cannot replace oil reserves
	- **Unsustainable development**
	  - It is inherently unsustainable because the resource is finite
	- **Responsible development**
	  - Must include progressive reclamation and restoration of disturbed land
	  - Many people think sustainable development and responsible development are synonymous, and it can be if you make it

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Sustainable development is sustainable reclamation**
	  - Sustainable development means reclaiming the land to as close to a pre-disturbance state as possible
	  - A philosophical approach that guides Government policies and practices
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Trade offs will always occur when land is disturbed

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Sustainable development is not occurring**
	  - It is not occurring. There is no sustainable development
	  - Oil prices inadvertently slow development pace right now, but increased oil prices increase development rates
	- **Balancing Environmental, Social and Economic Trade offs**
	  - High oil prices will lead everyone to get as much oil out of the ground as possible
	  - The Alberta Energy Regulator has a directive that prohibits the sterilization of bitumen. The Minister of Energy sells as many leases

	as they can, so there is no sustainable development
	- **Who defines sustainable development?**
	  - Oil companies want the world to think they are using sustainable development, although they are not
	  - Alberta Government does not require adaptive management practices from companies, and they are fine with companies defining adaptive management practices without sustainable development
	- **Economy > Environment**
	  - Sustainable mining practices would cost way too much money

Respondent 10
 	
- Public researcher
	- **Sustainable development is sustainable reclamation**
	  - Sustainability and resilience are the same thing in reclamation
	- **Sustainable reclamation is not occurring**
	  - Sustainable reclamation is untested and ignored because it is hard to test due to time lengths of reclamation
	  - No one wants to do reclamation, then test resilience with a prescribed burn of the area. That is expensive
	  - Oil companies do not want to spend millions of dollars on reclamation, then test areas with disturbance to see if reclamation was a success or not
	- **Economy > Environment**
	  - Reclamation is cost driven
	  - Sustainable reclamation is untested

Respondent 11
 	
- Environmental Consultant
	- **Sustainable development is unclear**
	  - The word sustainable is thrown around often, and when people talk about sustainability, it is unclear what they are speaking to
	  - Has problem with the term sustainable

Respondent 12
 	
- University professor
- Former oil company employee
	- **Sustainable development is unclear**
	  - The term has changed in Alberta over time
	  - Unclearly understood in terms of oil sands mines
	- **Unsustainable development**
	  - The question if these mines are sustainable over time has not been tested or fully discussed by the Government
	  - Government has failed to bring multistakeholder views into a fulsome, forward-looking discussion about oil sands sustainable development
	  - Government is implementing sustainable development in policy and programs without clear evidence how these programs are developed and rolled out
	  - Sustainable development is conceptual, and the Province has fumbled in making concrete plans to protect the Government, stakeholders and industry from criticism
	- **Competition with other land users**
	  - There are lots of opinions on sustainable development between stakeholders
	  - Proponents, Indigenous people, environmental groups, etc.
	  - Government has failed to bring these views into clear policies

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Sustainable development is sustainable reclamation**
	  - On a global scale, sustainable development is applied in ecological-economic situations
	  - For the oil sands, it is used in the context of once areas are mined, they will be put back in sustainable ways. Land will sustain itself
	  - Economically, development should not occur beyond what we can handle at one time
	  - More an economic term than ecological
	- **Responsible development**
	  - We can mine oil sustainably over time, but we are not doing that
	  - Development should occur so that the ecology can be sustained, as well as economic development
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Environment should not be so severely impacted that it cannot sustain itself

	- Reclamation should create sustainable ecosystems - **Economy > Environment**
Respondent 14 - Public Researcher	- **Sustainable development is normal industry operation** - It is what the industry always says it is doing and there is nothing unique about sustainable development in the oil sands compared to anywhere else

Respondent 15
 	
- Alberta Government employee
	- **Sustainable development is Responsible Development**
	  - Making sure development does not become so rapid it overwhelms ecosystems in the area
	  - Makes sure the Athabasca river is not adversely affected by development
	  - Maintain emissions levels that match Albertan standards
	- **Balancing Environmental, Social and Economic Trade offs**
	  - There are always impacts from industrial development, but those impacts should not be so extensive that they overwhelm local ecosystems
	- **Economy and Social > Environment**
	  - However, environmental impacts should be minimized where possible

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Sustainable development is not occurring**
	  - Oil sands are unsustainable
	- **Unsustainable development**
	  - Oil sands is a free-for-all
	  - Not sustainable
	  - Would not describe as sustainable in a 'green way'
	  - Every company makes their own plans and there is a lot of competition
	  - Short-term views of development
	  - Develop as quick as possible with the least amount of regulation, fees, royalties to Province, least cost and most return to shareholders
	- **Responsible development**
	  - No way oil sands are sustainable, unless we can sustain the industry for a 200 year people and develop it in a reasonable way
	  - This is not occurring because every company is in it for themselves and their shareholders
	- **No standardization**
	  - Every company makes their own development and reclamation plan
	  - Land use framework does not use thresholds that are really based in science
	  - LARP process is weak. Not enough research has been done to understand how reclamation and land use can be improved
	  - Little is done to regulate development timing, phasing of projects, location of camps, infrastructure placement
	- **Who decides standards and acceptable development/trade offs?**
	  - Industry looks only at their own projects
	  - Economically driven development
	- **Competition with other land users**
	  - Aboriginal Treaty rights are not respected
	  - People are competing for different resources on the land (moose, berries, etc.) and not only bitumen
	- **Balancing Environmental, Social and Economic Trade offs**
	  - Development is completely shareholder driven, not stakeholder driven
	- **Economy > Environment or Social**
	  - Companies want the least amount of costs, royalties, regulations, fees, and want the most return for shareholders
	  - Economically driven, not socially or environmentally driven development

Table B.2.2: How and why trade-offs occur

Respondent	**Concepts**

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Environmental Trade Off**
	  - We can't put back exactly what was there before
	  - Changes in the landscape due to swell factors and the materials we're digging
	  - Cannot fit all the material back in
	- **Social outcomes**
	  - I am very careful when I deal with stakeholders and anyone I have the opportunity to interface with. I share the fact that we can't put back what was exactly there before
	- **Environmental Outcome of reclamation**
	  - Altered states
	  - Mimic natural functions
	  - Sites represent a continuum of landscapes natural in the region

Respondent 2
 	
- Environmental NGO
	- **Who decides trade off values?**
	  - Heard Government bureaucrats casually talk about reclaiming to a massive off-road park or something, which would be a significant change from what is being promised to First Nations in terms of outcomes for the landscape
	- **Social outcomes/Power Imbalance**
	  - The risk is these projects are approved under false pretences
	  - Reclamation may be significantly different than what is being promised to First Nations
	- **Environmental outcomes**
	  - Altered landscapes
	- **Uncertain outcomes**
	  - Top soil and geo-engineering is difficult
	  - Uncertainty around incorporating tailings into landscapes
	  - Minimal or no demonstrated performance of these reclaimed sites with tailings incorporated in them

Respondent 3
 	
- First Nations Consultant
	- **Social outcomes/Power imbalance**
	  - First Nations teachings and culture are passed down generationally and those are often site-specific
	  - You talk to a lot of community members and once land is disturbed, even if it is reclaimed, they don't feel comfortable to go back there
	  - The value system is different: Government looks at things that in in the public interest, which is tax dollars and jobs, an economic definition of public interest
	  - Once land is disturbed and reclaimed, sacred land is not sacred anymore
	- **Who decides trade off values?**
	  - Communities have a lot of trust issues because of value system differences between them and Government/Industry
	  - Government looks at public interest through economic definition
	  - Government has a one-track mind when it comes to development and that is the economy of Alberta
	- **Economy > Environment**

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Financial liability**
	  - Liabilities need to be managed for the foreseeable future
	  - Previous lax approach to reclamation and reclamation planning may leave Albertan taxpayers with the financial responsibility to reclaim after the oil boom
	- **Economy > Environment**
	  - Each company makes their own reclamation plan with cost being centre
	  - No one wants to reclaim muskeg because it is hard and expensive
	- **Who decides trade off values?**
	  - Each company makes their own reclamation plan with cost being centre
	  - Everyone wants the easiest path towards reclamation
	  - No one wants to reclaim muskeg because it is hard and expensive

Respondent 5	- **Environmental outcomes** - Fragmented landscape

- Public researcher	- Not fully integrated landscape features
	- **Social outcomes/Power imbalance**
	  - First Nations complaints against LARP stating that it does not adequately protect their Constitutional Treaty rights and traditional land uses
	  - A framework to address this was spoken about since 2009, and still to this day there is no Traditional Land Use framework for the Lower Athabasca region
	- **Financial liability**
	  - Transitioning towards a low carbon economy will make projects less viable and less profitable. We may see operator's walking away, filing bankruptcy
	  - Albertans may be on the hook for dealing with scarred landscapes
	- **Who decides trade off values?**
	  - Money should be set aside for future reclamation done by an independent third party not tied to industry or government, with it's own objectives (**Improving standards)**
	  - The independent third party should have a contract with the Province and deliver on that contract, and be very clear on what is deliverable and what success will look like (**Pragmatic reclamation)**

Respondent 6
 	
- Aboriginal consultant
	- **Social outcomes/Power imbalance**
	  - The difficulty for Aboriginal folks, regulatory wise, is that reclamation plans are not set in stone. They are not complete when projects are undergoing approval
	  - Approval is generally given without hard, firm final plans to reclamation mines
	- **Uncertain outcomes**
	  - Mine operators have reclamation plans, but again, it's all unproven and it's 'here is our best guess for how this is going to happen'
	  - It is an uncertain process and the Government regulators cannot wait 80 years to make a decision on if the reclamation plan is going to work or not because the proponent wants to start development now
	- **Economic > Environment**
	  - Reclamation plans aren't finalized until after approval has been given
	- **Who decides trade off values?**
	  - It is an uncertain process and the Government regulators cannot wait 80 years to make a decision on if the reclamation plan is going to work or not because the proponent wants to start development now

Respondent 7
 	
- Environmental NGO
	- **Who decides trade off values?**
	  - Previous land use planning incentivized the conversion of wetlands to uplands for fibre production
	  - Government determined economic utilitarian outcomes before when considering how ELC could make land more useful
	- **Pragmatic reclamation**
	  - Either you can spend a lot of money to remove mined material to get a wetland to precipitate, or you make a planned forest
	  - This type of planning was more around utilitarian outcomes than inherent ecological value

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Environmental outcomes**
	  - Altered state
	  - We are not recreating sites, but entire landscapes
	- **Uncertain outcomes**
	  - We are resetting landscapes back to zero
	  - High degree of uncertainty
	- **Pragmatic reclamation**
	  - Reclamation is difficult, these areas cover square kilometers and many factors must be taken into account
	  - Hopefully, they will evolve over time into ecosystems similar to pre-disturbance states with similar functions

Respondent 9	- **Who decides trade off values?** - A reclamation area at Syncrude along the bank of the Mildred lake

- Ecologist - Aboriginal Consultant - Formerly CEMA	settling dyke looks like a Christmas tree plantation - Nothing grows between the trees except grass. There is no diversity in shrubs or ground cover - They've never been told to fix it - They've never been told to do something better even though it does not resemble a diverse boreal forest ecosystem by any means - **Improving standards/Pragmatic reclamation** - Water recycling systems in tailings ponds reduce water consumption, but severely limit progressive reclamation opportunities - **Environmental outcomes** - All reclamation is done at the stand level. Mine closure plans are done at the lease level, but it is rudimentary. Companies don't need to do planning at a base level that is detailed in anyway that is more than rudimentary - Altered states - **Social outcomes/Power imbalance** - Re-establishing capability to support Aboriginal people's exercise of Constitutional rights needs to be done - Reclaim with Aboriginal perspective to re-establish wildlife habitat from a landscape perspective, beyond one lease site. Right now, no planning effort thinks about that kind of stuff
Respondent 10 - Public researcher	- **Who decides trade off values?** - The approval system is good, but it doesn't really touch on how to measure ecosystem function - Industrial partners and Government keep saying 'we need easy indicators of success, pass/fail, yes/no' but we need complicated indicators of success. - Ecosystems are complex systems - **Social outcomes** - The Government needs to promote training of highly qualified personnel for the future and to incorporate different measurements of reclamation success - **Environmental outcomes** - ELC and ecosystem function in reclamation does not take resiliency into account
Respondent 11 - Environmental Consultant	- **Pragmatic reclamation** - Altered state - Does not think sites will return to identical state in a generation, but reclamation can give a kick start - **Prescribed timelines are needed** - Government should demand prescribed timelines for reclamation activities to begin - Today there are no such regulations, so a site can site unreclaimed for a long time. This is a big folly by the Government - The longer it is left, the harder reclamation is to do - **Financial liability** - The number of companies that are viable to reclaim sites are likely to decrease with time and the burden can be shifted to Albertan taxpayers
Respondent 12 - University professor - Former oil company employee	- **Social outcomes** - Oil sands production isn't necessarily a very profit focused business because of high overheads. Miners are always looking to be efficient and not overspend when they can. - How much is avoidance and how much is good business? That is where regulations come into play - **Who determines trade off values?** - To attain equivalent capability, trade-offs are made. Some of those trade offs are not very well thought out over time - Wetland sites were previously considered unproductive and unuseful, so many companies did not include wetland reclamation in their C&R plans because uplands sites were considered more valuable - When we get to those challenges we haven't faced yet, the questions of trade offs of what ecological state of reclaimed lands will be will

	hit us, and it is coming
	- **Changing standards**
	  - Shell Jackpine and Kearl are more recent mines and they compensate for wetlands now
	  - Alberta has a wetland policy that now gives a different kind of priority to wetlands

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Social Outcomes/Power Imbalance**
	  - Shareholders don't live in the community. They have for the most part no idea what is happening up there
	  - Government needs to be stricter in approvals of mines
	  - First Nations spiritual and medicinal use of the land has not been considered
	  - There is a lot for First Nations that is not thought about by non-First Nations stakeholders
	- **Who determines trade off values?**
	  - There are plants of value to First Nations that are not food stuffs, so they are not considered in reclamation plans
	  - 'We don't eat it, we don't sell is, so why would we worry about it? That's not an important species.' The fact is, it is important to somebody and that somebody doesn't have a voice very often
	- **Economy > Environment**
	  - All they need is their dividends, and I think we really need to have the Government look at what's available and say 'your approval depends on this.' The Government could be more responsive, more quickly to what's there and to the science coming out of it

Respondent 14
 	
- Public Researcher
	- **Uncertain environmental outcomes**
	  - You have a mix of oil, sand and so on in end pit lakes. You've got a bunch of hydrocarbons screwing up water quality
	  - 50 years after the first oil sands mines, there are no pit lakes functioning
	  - There is no convincing evidence that you can do this sort of reclamation on pit lakes and in the context of wetlands

Respondent 15
 	
- Alberta Government employee
	- **Environmental outcomes**
	  - Altered state
	  - Drastic differences in topography from pre-disturbance state
	- **Pragmatic reclamation**
	  - Unreasonable to expect mine operators to reclaim muskeg and peatland
	- **Shifting standards**
	  - Move away from economic outcomes to include social benefits
	  - Shift from reclamation to commercial forests towards a diverse array of ecosystems
	- **Social outcomes**
	  - Post-closure of diverse ecosystem array came from engaging stakeholders
	  - First Nations expressed desire to hunt and harvest berries, so that has been integrated into reclamation thinking
	  - Reclamation goals are adapted from feedback received through stakeholder engagement

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Environmental outcomes**
	  - Altered state
	  - Reclamation and ELC mean to put something back. It doesn't need to be identical or have the same function or ecological value. It can be completely different
	- **Uncertain outcomes**
	  - We haven't really seen or have a good idea of what the final reclamation landscape is going to look like here
	  - We're waiting to see how can we plan out, because right now everyone submits their plans on a lease-by-lease basis
	- **Social outcomes/Power Imbalance**
	  - The only thing that is going to make a difference of the reclamation

	trajectory is how much power local communities can achieve, either by the regulatory process, exertion of rights or through research and reducing costs - Some companies have proper investments for reclamation, and some will just put money in offshore accounts or distribute it amongst their board of shareholders - **Financial liability** - If we go into low-cost environments, long-term, I'm worried that defaults at the end of mining processes, or the scuttling off of money, and skirting the issues at the end is going to leave the taxpayers and Albertans on the hook for clean-up.

Table B.2.3: Likelihood of novel ecosystems/landscapes as reclamation outcomes

Respondent	Concepts
Respondent 1 - Biologist - Oil company reclamation practitioner	- **Altered Landscape** - **Reclamation does not need to create novel ecosystems** - We should not expect to design new landscapes and new landscape features and novel ecosystems - We have enough understanding of natural processes and systems to reconstruct something that does not need to be novel
Respondent 2 - Environmental NGO	- **Reclamation creates unsuitable outcomes** - I have very low confidence we're going to see any suitable reclamation regardless of it's trajectory
Respondent 3 - First Nations Consultant	- **Reclamation recreates altered landscapes** - You're never going to see it go back to exactly what it used to look like - Wetland loss because no company wants to attempt to recreate wetlands or muskeg - **Economy > Environment** - It is too expensive to recreate pre-disturbance landscapes - Economic driving force
Respondent 4 - Aboriginal Consultant - CEMA	- **Reclamation creates altered landscapes** - Land will not be equivalent because of landscape transformation - **Reclamation creates unrecognizable outcomes** - Community members will unlikely recognize the landscape afterwards
Respondent 5 - Public researcher	- **Uncertain outcomes** - No successfully reclaimed mining pits - No reason to think that end pit lakes will work - Loss of peatlands and wetlands means that function will be completely different in reclaimed
Respondent 6 - Aboriginal consultant	- **Reclamation creates novel ecosystems** - Management of landscapes and ecosystems removes nature's capability of its own systems to adapt to change - Taking away nature's ability to adapt - Very sceptical that sites will be similar to what was there before, but can probably return functioning state
Respondent 7 - Environmental NGO	- **Reclamation will create altered landscapes** - We may not be able to replicate those peat wetlands types - Suncor is trying, they are pursuing wetland reclamation - Is it possible? Probably not, but can you get close? Potentially. Is that good enough? I don't know
Respondent 8	- **Reclamation will create altered landscapes**

- Alberta Government employee - Upstream oil/gas	- Novel ecosystems are an interim, not a goal
Respondent 9 - Ecologist - Aboriginal Consultant - Formerly CEMA	- **Reclamation creates novel ecosystems** - Because of how much the landscape is being transformed, transforming what was previously a pretty flat landscape into a hilly landscape and the pits are all going to be made into end-pit lakes, they are creating this lake country that wasn't there before

Respondent 10
 	
- Public researcher
	- **Reclamation creates altered landscapes with novel features**
	  - Won't get 100% natural function because disturbance is so significant on the soil environment, but we should look for a certain threshold of similarity. If it is 60-70% similarity, it's good enough
	  - Reclaimed sites will have novel elements because they are man-made ecosystems at a massive scale. There is always going to be a novel element to it
	- **Reclamation may not recreate resilience**
	  - Peat-mineral soil for forest reclamation is highly combustible. We do not know if these ecosystems will be resilient to natural disturbance and can regenerate naturally from fire
	- **Reclamation can create similar ecosystems**
	  - Reclamation's go-to soil prescription is a peat-mineral mix. Use in forest reclamation, salvage material functions very much like a natural ecosystem. It is definitely the best reclamation soil type but there is nowhere near enough of it to cover the area that needs to be reclaimed in the future

Respondent 11
 	
- Environmental Consultant
	- **Reclamation will create altered landscapes**
	  - Viable ecosystems, but maybe different
	  - Altered landscape ratios
	  - A lowland before, converted to uplands would be an altered ecosystem

Respondent 12
 	
- University professor
- Former oil company employee
	- **Reclamation creates novel ecosystems and landscapes**
	  - Novel ecosystems are written into Closure and Reclamation plans
	  - The C&R plans for all of the sites have these novel reclamation sites. All of them
	  - There is absolutely no way that these sites are going to go back to what was previously there, which was boreal forest.
	  - Loss of old growth forest cannot be reproduced
	  - There won't be boreal forest because these pits are going to be permanent landscape features
	  - There is no way that there is going to be the same equivalent land capability with the same ecological state there. That isn't going to happen
	  - These novel ecosystems, I would call them **new landscapes**...because they will be new landscapes

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Novel ecosystems may occur**
	  - I don't doubt that there will be novel ecosystems. They are going to happen, but I don't want them to happen
	  - There may be novel systems, but it will be a system as opposed to a monoculture or something that won't sustain itself
	- **Reclamation will create altered landscapes**
	  - Communities may look slightly different but most of the elements should be there
	  - Sites will heal themselves and become self-sustaining
	  - Altered landscape ratios (fewer wetlands)
	  - Ecosystems will not be identical, but similar to natural ecosystems

Respondent 14	- **Reclamation will create altered landscape**

- Public Researcher	- Not necessarily hybrid, just different - Sites will undoubtedly evolve over time to some sustainable system - To suggest that it is unnatural is not correct, just different

Respondent 15
 	
- Alberta Government employee
	- **Reclamation will create altered landscapes**
	  - Areas and landscape ratios will be different
	  - Functions should be similar
	  - Sites will become more natural over time

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Reclamation does not need to create novel ecosystems**
	  - Mine dumps can be easily returned to an upland forest
	- **Uncertainty of novel ecosystem development**
	  - Some of those other ones, not having end pit lakes, or trying to return organic wetlands...we'll see.

Table B.2.4: Acceptability of novel ecosystems or altered landscapes as reclamation outcomes

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Novel/Altered landscapes are acceptable if ELC exists**
	  - Willing to accept that we won't get back exactly what existed before
	  - We want to put back something valuable, useful and matches natural systems
	  - Consultation about reclamation limitations with stakeholders may produce different outcomes that originally intended
	  - Reclamation to a golf course, quad track or parking lot should be acceptable as long as the underlying land capability and capacity is still there
	- **Who decides acceptable outcomes?**
	  - Consultation with stakeholders
	  - Return ELC first, and secondly something that is useable and accepted by the people of Alberta
	- **Pragmatic reclamation is acceptable**
	  - Folks need to recognize that we can do a lot with land forming, land recontouring, and soil placement, but things will be different at the end of reclamation

Respondent 2
 	
- Environmental NGO
	- **Altered/Novel landscapes should be more honestly discussed**
	  - You need a big discussion about this and some honesty
	  - It could be companies are over-promising
	- **Pragmatic reclamation**
	  - We need more honesty that it might not be reasonable to use millions of dollars to reclaim wetlands
	  - It may be better to accept these permanent losses and at least do so with our eyes open...than trying and failing to get back a state that is not possible to achieve
	  - More honesty and transparency in assessing the environmental assessments for projects and of the benefits versus the impacts is needed
	- **Who defines acceptable outcomes?**
	  - There is a need to give fair amount of priority to the needs of local communities who are going to have to deal with these issues for 100 years
	  - It is frustrating to read environmental assessments that are extremely optimistic and talk about zero residual effects
	  - If you dip into some of the reclamation sections (of project environmental assessments), they talk about net positive outcomes by setting the definition with things like more potential for commercial forest than wetlands

Respondent 3	- **Altered/Novel landscapes are likely inevitable, regardless of acceptance** - The reality is that (communities) won't have any choice in what they

- First Nations Consultant	see - They're not going to necessarily feel safe or comfortable, especially if they have prior knowledge of what was taking place there - **Pragmatic reclamation** - There are a lot of things that can be quickly and successfully reclaimed because disturbance was minimal - Communities might not be able to tell, down the road, that a site was disturbed if reclamation is done properly - **Who determines acceptable outcomes?** - Community members want areas where they can hunt and pick berries, but they probably won't go back to some reclaimed sites for safety reasons - If communities see signs of disturbance, or manmade, anthropogenic activities, they won't want to go there and enjoy their rights - Almost guarantee that no community members will want to go to Syncrude's reclaimed tailings ponds because they will know what occurred on those sites
Respondent 4 - Aboriginal Consultant - CEMA	- **Altered/Novel landscapes are likely inevitable, regardless of acceptance** - Local communities will not have a choice. Accepting these sites is not really the right term - **Who determines acceptable outcomes?** - The greatest fear of the community is that the next reclamation level won't produce something that is recognizable to them. There won't be enough landforms to do what they need for a successful community - There will be cultural loss from generational land use gaps. How do we keep the culture alive in between the time when reclamation isn't happening?
Respondent 5 - Public researcher	- **Altered/Novel landscapes are likely inevitable, regardless of acceptance** - Prepared to accept, only because that is what is most inevitable - **Uncertain outcomes** - Concern is that we've gone ahead and proceeded and developed these mines and given the Albertan public the impression that 'this will be fine afterwards and that we will achieve equivalency' - **Who determines acceptable outcomes?** - I would be prepared to accept novel ecosystems/landscapes if that had been the clear understanding from the outset - (Novel landscapes) are not what people were sold. Therein lies my problem - This is not what Albertans were sold (by Government and Industry) when asked to buy into and accept these decisions to approve these projects and allowed them to occur in the manner and speed it has occurred
Respondent 6 - Aboriginal consultant	- **Altered landscapes may be acceptable, novel landscapes are unacceptable** - Cannot restore pre-existing ecological state - Probably, ecological function can return - It will have some kind of ecology - **Pragmatic reclamation** - Ecological state is changing around very specific disturbances on individual sites based on project-specific activities - Some lands will be changes (lowlands to uplands) and it might produce ecological function, but it will be different - **Who decides acceptable outcomes?** - First Nations are losing the ability to pass down knowledge for generations while land is disturbed or being reclaimed - For Indigenous folks, land reclamation must return cultural purposes and land use and subsistence
Respondent 7 - Environmental NGO	- **Altered/Novel landscapes are unacceptable** - Companies should be required to do some restoration activities to try and return what was lost - It is unacceptable to have picnic tables in a completely transformed landscape, for both the majority of Albertans and for local First

	Nations
	- **Pragmatic reclamation**
	  - Accepts that some trade offs are inevitable, but determining acceptable trade offs should be based around development that respects ecological or scientifically-based limits for climate, water and terrestrial systems
	  - Absolute perfection in restoration/reclamation is not fair, but it needs to be better than it is now
	- **Who decides acceptable outcomes?**
	  - Restoration should be partially required of companies
	  - Need to know what ecological limits are and regulate them accordingly so that thresholds are not surpassed
	  - Improve the system to produce reclamation outcomes suitable for First Nations, suitable to reclaim wetlands to similar ratios, and keep ecological function

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Altered/Novel landscapes are acceptable if they function**
	  - The goal is to return functional ecosystems or productivity
	  - Some reclamation can produce similar ecosystems functions and biodiversity, whereas others will need to become different types of ecosystems
	- **Pragmatic reclamation**
	  - Some reclamation can produce similar ecosystems functions and biodiversity, whereas others will need to become different types of ecosystems
	  - Trajectories towards ELC is acceptable, even if sites are different post-reclamation
	- **Who decides acceptable outcomes?**
	  - Government via ELC EPEA definition

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Altered may be acceptable, but novel landscapes are not acceptable**
	  - Does not think that any project was approved with the assumption that it would be acceptable to reclaim to novel ecosystems
	  - All approvals were based on the assumption that reclamation would produce ELC, and their personal interpretation of ELC does not included novel ecosystems
	  - Novel ecosystems will not provide necessary resources to animal or land users, so ELC would not be met
	- **Who defines acceptable outcomes?**
	  - If you define ELC in a very limited way, which is basically how it's used from the perspective of policy makers, if they walked out to Gateway Hill, they'd say 'yeah, this is ELC.'
	  - A group of Métis elders would not accept Gateway Hill. They have a completely different perspective
	  - Some Aboriginal communities are clear that they expect reclamation to re-establish pre-disturbance conditions, even though they know it is unlikely to happen. They still want companies to work towards that.

Respondent 10
 	
- Public researcher
	- **Altered landscapes are acceptable. Novel ecosystems/landscapes are unacceptable**
	  - It depends on how novel and what percentage of the environment you're talking about. A novel ecosystem really means something completely different. I don't think that's acceptable
	  - Replacing jackpine forest with something that functions very much like a jackpine forest may be okay
	- **Who decides acceptable outcomes?**
	  - The argument right now is you cannot rebuilt natural ecosystems. It's always going to be a novel ecosystem.
	  - The ethical worry is that industrial partners are just going to take that and say 'I can't do this, so whatever I do is fine.' They're going to justify not putting in more effort and trying to create a higher level of similarity. That is possibly true, for sure.

Respondent 11	- **Novel/Altered landscapes are acceptable if they are beneficial** - In certain circumstances, an altered ecosystem that allowed

- Environmental Consultant	commercial crops can help people. Would be worth the trade off - If you alter it to something that would be beneficial and still an ecosystem, that provides usefulness, I think it would be acceptable - **Who decides acceptable outcomes?** - Utilitarian/useful/beneficial outcomes
Respondent 12 - University professor - Former oil company employee	- **Novel/Altered landscapes are acceptable if they work** - That is a tough question. Acceptable if they work - Acceptable if done properly. It won't look the same. - **Uncertainty of outcomes** - Not sure that we know enough currently in these approved plans that reclaimed sites will work - Will the plans work on the ground? If they don't we've got problems - **Pragmatic reclamation** - If you fly over, you're going to be impressed by how large these are on the ground (mine sites), but in the big picture of the boreal forest of Canada, it is a very small change - **Who decides acceptable outcomes?** - Utilitarian trade offs - Small area of total boreal forest actually disturbed
Respondent 13 - Environmental Consultant - Botanist	- **Novel/Altered landscapes are unacceptable to Aboriginal communities** - First Nations use the land, and land will be returned to First Nations - Cannot speak for First Nations, but believes that mining has changed who they are forever - Anything planted would not be equivalent or useful to First Nations in the same way the natural world would - Real concern of generational culture loss because land is inaccessible and will not be acceptable to them after reclamation - Reclaimed land will not be used by First Nations in the same way - **Who decides acceptable outcomes?** - **Economy > Social and Environmental** - Land will not likely be acceptable for First Nations traditional and cultural use
Respondent 14 - Public Researcher	- **Novel/Altered landscapes are acceptable if they are in the public interest** - The AER is charged with whether a proposal is in the public's interest - It is in the public interest if projects regard environmental, social and economic matters. There will be trade offs. - If what is lost cannot be replaced and creates such a loss to Albertans than the project is not in the public's interest - **Who decides acceptable outcomes?** - Alberta Energy Regulator and public interest criteria - Cost/benefit, weighing outcomes and EIA
Respondent 15 - Alberta Government employee	- **Novel/Altered landscapes are acceptable** - It is a must - The cost associated with restoring land (to pre-disturbance conditions) is too expensive to keep the industry viable - Albertans value the revenue from oil sands development - Government of Alberta tries to balance the environment, social and economic development to make all three viable - We give a little bit on the environmental side by allowing ecological reclamation instead of restoration. It is a give and take - **Who decides acceptable outcomes?** - Reclamation instead of restoration to keep the economic side viable - **Economy > Environment** - **Pragmatic reclamation** - Reclamation instead of restoration is used because restoration is too costly
Respondent 16 - Métis Consultant	- **Novel/Altered landscapes are unacceptable to Aboriginal communities** - The people who use the area have been used to primarily wet, flat landscapes. Their traditional uses and species are accompanying

- Former CEMA	those landscapes. Changing the landscape changes their culture - How can you restore spirituality of the landscape? That is a hard concept for people who have a certain belief to understand or to agree with. - **Over-promising** - Companies set the expectation that the land would be put back better than the way it was. At least as good, if not better - **Distrust/Uncertainty** - Companies set the expectation that the land would be put back better than the way it was. At least as good, if not better. - Community members have not seen promises lived up to - **Who decides acceptable outcomes?** - How can you restore spirituality of the landscape? That is a hard concept for people who have a certain belief to understand or to agree with. That's a difficult conversation.

Appendix B.3: Progressive reclamation themes and concepts

Table B.3.1: Progressive reclamation definitions and perspectives

Respondent	Concepts

Respondent 1
- Biologist
- Oil company reclamation practitioner
	- **Progressive reclamation is not deferring reclamation**
	  - Reclaim as you go
	  - Conducting reclamation on landscapes or landforms or structures that are available as they become available
	  - Opportunity to reclaim as you go and to demonstrate that you're taking on the reclamation commitment and not deferring to the end-of-life
	- **Progressive reclamation as financial security from reclamation liability**
	  - Not deferring reclamation costs, but reclaim progressively while you're receiving income and developing the operation, instead of trying to pay for it at the end when there is no income

Respondent 2
- Environmental NGO
	- **Buzzword/Public Relations language**
	  - It is a buzzword
	- **Progressive reclamation is not deferring reclamation**
	  - Planting and reforesting on areas you've previously disturbed

Respondent 3
- First Nations Consultant
	- **Progressive reclamation is not deferring reclamation**
	  - Replanting, revegetating, you know, as soon as you can to turn the area back into a natural, useable state
	  - Actively doing things on the land. Reclamation is actually doing something
	- **Passive reclamation is unacceptable**
	  - Passive reclamation is maybe like throwing old trees on a cutline and just waiting and watching to see what happens
	  - Passive reclamation is not really reclamation at all

Respondent 4
- Aboriginal Consultant
- CEMA
	- **Progressive reclamation is not deferring reclamation**
	  - The idea of rolling reclamation: that you reclaim as you go
	- **Progressive reclamation can assist making recognizable landscapes**
	  - With the idea of progressive reclamation, getting cutlines to grow back is going to be key to helping stop changes to the landscape that is going to make it unrecognizable down the road

Respondent 5 - Public researcher	- **Buzzword/Public Relations language** - Progressive reclamation is invoked as a pretext

Respondent 6
- Aboriginal consultant
	- **Progressive reclamation is not deferring reclamation**
	  - Reclaiming as we go, behind ourselves
	  - Not waiting to the end of mining to begin reclaiming
	  - Reclaiming sooner instead of later
	- **Buzzword/Public relations language**
	  - It becomes a PR term like stewardship, or sustainability, or balance

Respondent 7
- Environmental NGO
	- **Progressive reclamation is not deferring reclamation**
	  - Urging companies to not put reclamation on hold until they close the mine
	  - Reclamation is actively pursued through the life of the mine
	- **Progressive reclamation as financial security from reclamation liability**
	  - Prevents accruement of large financial environmental liabilities for Albertans and Canadians

Respondent 8 - Alberta Government	- **Progressive reclamation is not deferring reclamation** - The process of reclaiming portions of a site as they are no longer actively used - **Progressive reclamation as financial security from reclamation liability**

employee - Upstream oil/gas	- Companies must take responsibility to take all precautions and measures to excavate with the clear intention that they are able to reclaim those sites afterwards - Actively mitigate may damage, returning soil, re-establishing land contours, and revegetating with appropriate species
Respondent 9 - Ecologist - Aboriginal Consultant - Formerly CEMA	- **Progressive reclamation is not deferring reclamation** - As soon as land is available to reclaim, it should be reclaimed - **Buzzword/Public Relations language** - It's all for public relations - The Canadian Association of Petroleum Producers spent tons of money doing all this work to brand the oil sands as sustainable - **Distrust/Uncertainty** - Thinks it is disingenuous how progressive reclamation is thrown around by Government and industry - In theory, progressive reclamation is a very good concept, but in reality, the opportunities for it are really limited and I don't think that anybody honestly communicates that very well
Respondent 10 - Public researcher	- **Progressive reclamation is not deferring reclamation** - Reclaiming areas within the active mining footprint - Reclaiming as they see fit. Not waiting 25 years after disturbing a site - **Progressive reclamation is informative to research** - All the research from the oil sands is based on progressively reclaimed sites, while mines are still active
Respondent 11 - Environmental Consultant	- **Progressive reclamation is not deferring reclamation** - Completing reclamation in a timely manner on active sites - If there is an opportunity to reclaim lands no longer in use, you can being, before the end of the project - Expedites the reclamation process
Respondent 12 - University professor - Former oil company employee	- **Progressive reclamation is not deferring reclamation** - Doing reclamation in a sort of semi-circle around active mine areas
Respondent 13 - Environmental Consultant - Botanist	- **Progressive reclamation is not deferring reclamation** - Doing something other than letting nature run its course - Somebody is doing the reclamation when mining is partially completed - Something is done when the land is able to be reclaimed
Respondent 14 - Public Researcher	- **Progressive reclamation is ongoing activities to achieve reclamation certificate** - Just means that the company has not yet gotten a reclamation certificate
Respondent 15 - Alberta Government employee	- **Progressive reclamation is not deferring reclamation** - The government and the public do not want reclamation deferred to the end of mining - Operators should be continually reclaiming as they go - **Legal definition** - Progressive reclamation is used through Government Acts and regulations
Respondent 16 - Métis Consultant - Former CEMA	- **Progressive reclamation is not deferring reclamation** - What it should mean is that you're trying to limit the amount of downtime between end of production and hitting reclamation trajectories - Actively facilitating growth, like a garden - **Reclamation is active** - Take ownership of what they are reclaiming, cultivating it and planning it

Table B.3.2: Progressive reclamation occurrences

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Pragmatic deferral**
	  - We have good plans, we have good progress on those plans, but rather than disturb a new area, it makes more sense to use existing land rather and disturb new land
	  - Better to use one site that is already disturbed and repurpose it than progressively reclaim it
	- **Limited progressive reclamation occurring**
	  - Reclamation gets delayed based on land use decisions by the operator
	- **Does the Government clearly communicate the limitations for progressive reclamation?**
	  - No. Does not feel that they do.
	  - Recent changes that established the AER and regulatory changes in the Land Stewardship and REDA have helped move this discussion forward

Respondent 2
 	
- Environmental NGO
	- **Distrust/Uncertainty**
	  - Companies self-report what is actually reclaimed. We have no confidence in (those numbers)
	  - Does not think there is any real evidence that (progressive reclamation) is happening, or that the Government is holding companies to it
	  - Tailings Management Framework has identified any financial penalties for companies that don't meet the framework's requirements
	- **Limited progressive reclamation occurring**
	  - Does not think there is any real evidence that (progressive reclamation) is happening, or that the Government is holding companies to it
	- **No regulatory enforcement on progressive reclamation**
	  - Does not think there is any real evidence that (progressive reclamation) is happening, or that the Government is holding companies to it
	  - Tailings Management Framework has identified any financial penalties for companies that don't meet the framework's requirements
	- **Does the Government clearly communicate the limitations for progressive reclamation?**
	  - The Alberta Government does not clearly communicate the state of reclamation generally, or the challenges and time lags around it
	  - The Government and industry do not benefit from highlighting the complexity or challenges of reclamation

Respondent 3
 	
- First Nations Consultant
	- **Limited progressive reclamation occurring**
	  - Most projects coming across our desks are only in the approval application stage, projects just being built or are only five years into their life. There really is no reclamation happening
	  - There is a lot of need for progressive reclamation on old cutlines and seismic lines that exist on company leases, but this is not happening
	  - If you look at the pace of development and the rate of reclamation on legacy disturbances, there is a huge disconnect
	- **No regulatory enforcement on progressive reclamation**
	  - There are a lot of opportunities for reclamation that are not being done and that is a big failing on Alberta's part
	  - They just continue to approve these projects. Approve, approve, approve
	  - There is poor motivation or requirement for companies to actually reclaim a lot of these linear disturbances
	  - Standards are lacking when it comes to the requirements to reclaim
	- **Does the Government clearly communicate the limitations for progressive reclamation?**
	  - Has not hear Government discuss this entirely at all. If it is mentioned, it is minimal
	  - The public and First Nations have to push way too hard to get even small reclamation projects by companies underway
	- **Who decides if progressive reclamation is important?**
	  - Alberta and Canada really drop the ball when it comes to protecting public

	interest in (reclamation) - Things are just forgotten by industry way too often

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Limited progressive reclamation is occurring**
	  - I've never been on a tour of a progressive reclamation site, so to me, I haven't personally seen the evidence of it
	- **Some useful progressive reclamation is occurring**
	  - It's good and some innovative stuff is happening
	  - Caribou planning and cutline reclamation
	  - Fragmented landscape is changing wildlife interactions, and progressive reclamation on cutlines is important
	- **Uncertainty of outcomes**
	  - I guess I am hopeful that it will work, but I am not going to bet the farm on it
	- **Does the Government clearly communicate the limitations for progressive reclamation?**
	  - No. Part of the narrative spun by the Government is that this will all be okay after reclamation, when in reality, no one knows because so little land will be reclaimed until well after the majority of voters are long passed

Respondent 5
 	
- Public researcher
	- **Limited Progressive reclamation occurring**
	  - My general impression is that progressive reclamation is generally not being done
	  - The general preference is to allow natural processes to take over
	  - If areas are still in use, there is hesitation to engage in reclamation because they still have some use for the site that they could otherwise reclaim
	  - Many projects are in relatively early development, so little to no reclamation has occurred
	- **Passive reclamation first, then progressive reclamation**
	  - Progressive reclamation is deferred first to see if natural revegetation, natural reclamation occurs
	  - Progressive reclamation is being referred to as something proponents will only do following a certain period of time if natural revegetation (passive reclamation) hasn't delivered the results the proponent and regulator were looking for
	- **Uncertainty of outcomes**
	  - We have very little basis upon which to rest any case that this can in fact be reclaimed in any kind of meaningful manner
	  - We are in the relatively early phase of some of these developments. Not all of them. Suncor and Syncrude have been around since the 60s, so they've had 40 years, 50 years of operating history and still have very little o show in terms of fully reclaimed sites
	- **Does the Government clearly communicate the limitations for progressive reclamation?**
	  - No, probably not. In large part because the Government does not usually get into these details with the public. The message is that reclamation will proceed per the normal course

Respondent 6
 	
- Aboriginal consultant
	- **Limited Progressive Reclamation is occurring**
	  - It's still kind of new. The proof isn't there yet
	- **Progressive reclamation as mitigation/offset**
	  - Reclamation is often used as a mitigative tool by industry when they're going through the regulatory process to offset any effects from disturbing the land
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - Yes and no. Companies do the PR/advertising regarding positively promoting things like reclamation, and water recycling in broad general statements that do not provide reality of the details. Alberta provides more about the process on their website (Alberta Environment & Parks), but again, the devil in the details is not shared, so people are left with a rosy view of what is being done, but not the problematic, long-term issues.

Respondent 7 - Environmental NGO	- **Some useful progressive reclamation is occurring** - I want to give credit where credit is due. Suncor is trying. They're trying to pursue wetland reclamation with their Pond 1 site and they are throwing a lot of attention to that particular area

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Some progressive reclamation is occurring**
	  - Oil sands mines are required to track reclamation progress in their annual reports, which are publically available. I don't think there are any practical reasons why a mine cannot reclaim mined-out areas while still actively mining other locations within their footprint
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - Reclamation reports are publically available in companies annual reports

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Limited Progressive Reclamation occurring**
	  - If you look at, on an annual basis, how much land is disturbed and how much is actually reclaimed, and seeing the difference...they have good intentions to do progressive reclamation but they can't do it because of they way they do the mines
	  - If you look at Suncor base mine, the have something like seven tailings ponds on their mine lease. Four are part of a water recycling system. By doing that, they've reduced how much water they take from the Athabasca river. The have probably about 6000 hectares of tailings ponds that are going to be there until the next century and there is no opportunity for progressive reclamation
	  - In theory, progressive reclamation is a very good concept, but in reality, the opportunities for it are really limited and I don't think that anybody honestly communicates that very well
	  - Under the new AER Directive 085, mine operators have submitted their tailings management plans as required. Only one mine demonstrated significant shifts in achieving progressive reclamation over mine life
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - I think the Government wants the public to think the mines are all doing progressive reclamation, that it's all fine and it's all progressively reclaimed, but in reality they can't actually do much

Respondent 10
 	
- Public researcher
	- **Some useful progressive reclamation is occurring**
	  - A lot of active reclamation is happening on basically the earthen dams that are holding back tailings ponds. They reclaim the side of that, and that is where we do research
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - I think there is information available to the public through Government websites, but I do not know how extensive it is

Respondent 11
 	
- Environmental Consultant
	- **Uncertainty of outcomes**
	  - The Alberta Government themselves don't realize the scope of the need for reclamation that has been reached over the past 2-3 decades.
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - It would be very difficult to accurately communicate a message when all the facts aren't known

Respondent 12
 	
- University professor
- Former oil company employee
	- **Limited Progressive Reclamation occurring**
	  - It has the potential to make reclamation more effective and efficient, but hasn't really been tested because progressive mining is only used at small places
	  - If you went to the north mine at Syncrude, it is hundreds of hectares in size now. None of it has had progressive reclamation
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - No, I believe currently there is not a public communication process available to Alberta Government or the regulator to discuss items such as reclamation plans which are under regulatory approval

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Progressive reclamation is occurring**
	  - Progressive reclamation is definitely happening. There is nobody out there that is mining without doing something to assist reclamation
	  - Progressive reclamation is much more succinct in how it is being used
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - The previous provincial Government was not very forthcoming regarding the oil sands. Their policy was to keep mum unless pushed, and they were perhaps somewhat cryptic in their responses
	  - I am not sure there has ever been an honest and open debate regarding progressive reclamation/active reclamation such that the public would understand the process and therefore comprehend the limitations

Respondent 14 - Public Researcher	**Applicable responses not provided**

Respondent 15
 	
- Alberta Government employee
	- **Progressive reclamation is occurring in tailings**
	  - Tailings management framework regulates tailings reclamation by requiring all fluid tailings to be managed to a ready-to-reclaim state by ten years after mine-life
	  - This should speed up tailings reclamation
	- **Limited Progressive Reclamation occurring**
	  - Nature of oil sands mining. There is a need for storage and treatment space, so reclamation is often backloaded
	- **Does the Government clearly communication the limitations for progressive reclamation?**
	  - The Government decently communicates this to the public, when asked
	  - The Government is always looking for ways to expedite reclamation

Respondent 16
 	
- Métis Consultant
- Former CEMA
	- **Progressive reclamation is company specific**
	  - Some companies go above and beyond and reclaim seismic lines, although I haven't seen very many of them up here
	  - Usually companies do it if it's in exchange for something else, like "if we do this, will you do something for us?' or something like that
	- **Limited Progressive Reclamation occurring**
	  - For the most part, especially in the in situ side [progressive reclamation is happening]. Not so much on the mining side. It's reclamation by change
	- **Passive reclamation first**
	  - It's reclamation by chance. You might get a good crop of seed that was in the soil and it might come up pretty quick, or it might be sloped the wrong way, get very little sunlight and be a square in the forest. I've seen both, some that start to green up after five years, and some that are still square and pretty brown after twenty [years]

Table B.3.3: Challenges limiting progressive reclamation

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Active mining prohibits prog. rec.**
	  - You end up with landscapes outside of the pit operations. You need to conduct work in those areas for extended periods of time, right from the start through several years in, before you can consider reclamation in those areas
	- **Companies are unwilling to quickly reclaim 'unused' sites**
	  - Call it the mining philosophy. You don't really want to give up any land. There has always been, historically, resistance from a mining perspective to make a disturbed area green, so that you still have the option to use it down the road
	  - It is a paradigm that we need to work through with operational people
	  - They want to keep areas useable as opposed to reclaiming them as quickly as possible
	- **Reclaiming to the Standards of the Day is a challenge**

	- Agreements made in approvals are based on the Standards of the Day - If a company does all that was required in the original approval, but reclaim 30 years later to those standards and apply for a rec. certification, the Government says 'wait, these are not the standards we have today. This isn't what we would expect to see or how it goes.' That is a big challenge for us. - We know that things are different today, so we make recommendations to the regulator. Even though we may have an area covered under an older approval, let's not apply current standards until the ground is actually disturbed - **Industry manages their own reclamation** - Making recommendations to hold off on new standards until ground is disturbed - Deferring reclamation on inactive sites
Respondent 2 - Environmental NGO	- **No proof of reclamation success** - No company has met tailings reclamation standards under Directive 74 - It's fair to say that the oil sands industry track record on reclamation is horrendous - **Distrust/Uncertainty** - Very low confidence that we're going to see suitable reclamation regardless of end trajectories
Respondent 3 - First Nations Consultant	- **Distrust/Uncertainty** - There is a lot of uncertainty around [reclamation occurring and desired trajectories]. Just unknowns or potential risks so people have a lot of hesitation, especially those that are really connected with the land and are regular land users and rely on it still. - **Limited proof of reclamation success** - Right now there is really not a lot of reclamation that has gone on in the oil sands. It's still largely in development - **Companies are unwilling to reclaim land** - The big difference is companies might absolutely say 'we're going to go into this area soon, so it doesn't make sense to reclaim it,' and maybe that is the case, but if we're talking about a lot of seismic and cutlines and those areas on a lease that are not going to be used, there is a ton of linear disturbance that is probably never going to see development on that footprint - **Industry has too few restraints/Power imbalance** - If you look at the whole regulatory system, how approvals happen, how reclamation is dictated, everything is put on industry, essentially to make sure that all of these regulations are followed - Government does not have the capacity in place to monitor all the activity going on up here - A lot of accountability is put on the industry to make sure [regulation enforcement/monitoring] happens. When there is an economic downturn, environmental departments are the ones that get the cut - **Economy > Environment/Cost hinders prog. rec.** - If it's not tied to production, there are minimum requirements that companies have to meet and they'll make sure they meet those to the best of their abilities, but if they can cut things from the environmental department that aren't tied to production, they're going to do that
Respondent 4 - Aboriginal Consultant - CEMA	- **No prescribed reclamation timelines/Companies are unwilling to reclaim land** - The other piece of reclamation that doesn't get taken into account or thought about is the expanding timelines of reclamation. [Companies with new approvals/expansions] have no plans to develop in the near future, so they have to keep upgrading the land, so the land sits in transition...it could be another 20 years before 'conditions are right' to begin mining - The land sits, all cut up, half built and the original reclamation plans are pushed back 20 years because conditions were not there to develop [mines] in the first place - **Companies are unwilling to reclaim land** - You leave land sitting in this transition zone; it is neither reclaimed or built

	- **Companies have too few restraints/Limited regulation enforcement** - I think that has been a big mistake by the Government, by allowing companies to hold onto these leases, well treat them like they own the land, but not requiring them to start developing right now and therefore moving the reclamation much further down the road

Respondent 5
 	
- Public researcher
	- **Limited proof of prog. rec**
	  - With the oil sands mines, at least the big ones, we're still in the relatively early days
	  - In situ has been around for a bit longer, and their footprint is smaller. It is not as permanent.
	- **Financial liability if progressive reclamation is not accomplished**
	  - If we start transitioning to a low carbon economy...at some point, we may see operator's walking away, maybe even filing bankruptcy. Then Albertans will be on the hook for deal with these scarred landscapes, depending on how much effort [companies] are willing to put into them

Respondent 6 - Aboriginal consultant	- **Limited discussion of progressive reclamation challenges** - Companies do Public Relations/advertising regarding positively promoting things like reclamation and water recycling in broad, general statements that do not drive reality of the details

Respondent 7
 	
- Environmental NGO
	- **Uncertainty of outcomes**
	  - I'm not very optimistic based on the things I was reading back in the day, and I think that speaks to the need to slow down the pace and scale of development
	  - That speaks to the need to resolve some of these outstanding issues, like what are we going to do with those tailings ponds? What are we going to do with the vast amount of material that is created by mining?

Respondent 8 - Alberta Government employee - Upstream oil/gas	- **Complexity of reclaiming sites** - Issues with the complexity of hydrology, soil salinity/profiles, drainage and other natural processes are difficult to recreate accurately

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Limited prog. rec coordination between company leases**
	  - The industry knows a lot about their own project, but they don't know a lot about other projects. They won't necessarily know what company is operating next door to them
	  - It is a really complicated process to define any kind of closure coordination protocol because of the legal aspects of liability, mainly wastewater release.
	- **Limited regulations and/or enforcement**
	  - There is currently no policy around how to do the water release
	- **Approval conditions are different between leases**
	  - Approvals change. They are pretty different. Total's Joslyn mine approval was one that was issued before Fort Hills, and that was very different too
	- **Active mining prevents prog. rec.**
	  - CNRL's Horizon mine started in 2006 or so, and in 2015 they reclaimed about 170 hectares of land or something like that, and they've disturbed 7000 hectares of land. Those numbers aren't exactly accurate...but it is about that. They are never going to be able to reclaim 7000 hectares of land in one year until they are finished operations because the need to use the facilities that are creating the disturbance. They are using the pits, they are using the tailings ponds

Respondent 10 - Public researcher	- **No proof of prog. rec. using depressed soils** - Progressive reclamation is good in a way. However it has some flaws as well. One of them, the biggest one In their progressive reclamation, they use freshly salvaged material. They go into an unmined area and salvage the topsoil and some coarse woody debris. Some of that material they use

	right away and some of that material they stockpile for use at the end of the mine lifecycle for reclamation - The problem is that in the future, during that 50 year period of reclamation, they're going to have to use almost exclusively stockpiles material to reclaim the ecosystems, to reclaim surface soils and ecosystems because they'll no longer have an advancing mine front from which to derive fresh salvage material - Current research is based on freshly salvaged material. Future stockpiles will have essentially depressed soils; the function will be drastically reduced - **Uncertainty of outcomes** - The future reclamation environment is going to have to rely on a material from which we have no information. We have no research.
Respondent 11 - Environmental Consultant	- **No prescribed timelines for prog. rec.** - There needs to be prescribed timelines around reclamation. That is probably the biggest folly of the regulator right now
Respondent 12 - University professor - Former oil company employee	- **Active mine prevents prog rec** - One of the challenges is making reclamation work and continuing to operate the mine and the upgrader - Scheduling reclamation during active mining presents challenges - **Companies are unwilling to reclaim sites** - Anyone can see that the number of hectares reclaimed versus the number disturbed is pretty low - It is difficult to reclaim large tracts of land and operate a mine without re-disturbing it
Respondent 13 - Environmental Consultant - Botanist	- **Cost hinders prog. rec.** - There are techniques that have been used in the past that aren't used in the oil sands because it's considered too expensive - There are lots of things we know that we could do that we don't, and I think it comes down to the money. The financial part of it for the most part, and paying the shareholders - **Economy > Environment**
Respondent 14 - Public Researcher	**No applicable response provided**
Respondent 15 - Alberta Government employee	- **Active mining prevents prog. rec.** - A lot of the infrastructure on sites needs to be active until after mining: tailings area, plant sites and all that stuff. So, by nature, oil sands reclamation is back loaded
Respondent 16 - Métis Consultant - Former CEMA	- **No proof of reclamation outcomes** - We haven't really seen, or have a good idea of what the final reclamation landscape is going to look like here and we're waiting to see how we can plan out - **Limited progressive reclamation coordination between leases** - Right now, everyone submits their plans on a lease-by-lease basis - Government is trying to look at it regionally. I doubt that anybody in the stakeholders have seen it, but I'm sure there are consultants and industry working on it right now - **Industry has too few restraints/Regulations are not strongly enforced** - Industry has done some things they've improved on, but it still comes down to whether or not they are going to be volunteered to do it, or be told to do it, or as an approval condition or not - There is no desire to put more restrictions on a company, especially not in a time where the economics are not very tempting - You're trying to encourage whatever investment you can, not scare them out the door

	- **Distrust/Uncertainty**
	  - It was only five months ago, Brad Wall (Saskatchewan Premier) was saying 'hey, federal government, can you give us money so we can put our oil workers back to work cleaning up abandoned wells?'
	  - Well, isn't that supposed to be part of the process anyway? That's a small way to say, 'is that what the future is going to look like?' It's really worrisome, a live example where a Premier is begging for cash to clean up what should have been a corporate responsibility in the first place

Table B.3.4: Suggestions to improve progressive reclamation

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Improvement comes from examining previous results**
	  - You look at some of the earlier requirements and you take more recent requirements and you see the evolution of the expectations and requirements from the regulator on what they need to do and how they need to do it
	- **Examine what worked and what didn't work (Adaptive management)**
	  - The Alberta Research Council put together a compendium of reclamation activities and improvements over many years, 30 year cycles. You can see significant changes in reclamation practice and science as part of an adaptive management approach to what worked and what didn't work

Respondent 2
 	
- Environmental NGO
	- **Strengthen and enforce regulations/Hold companies accountable**
	  - If companies believe they are committed to progressive reclamation, they have to be held accountable for that
	- **Future approvals must be based conditionally on performance indicators**
	  - Future disturbance needs to be conditional on adequate performance on reclamation
	  - There has been no company and the Regulator has never been willing to link these two together

Respondent 3
 	
- First Nations Consultant
	- **Strengthen and enforce regulations**
	  - One thing the community would really like to see, and would really like to see it enforced and required is progressive reclamation
	  - It is important that the Government continues to update regulations, continues to be aggressive in requiring companies to reclaim as-soon-as-possible and actively (progressively)
	- **Improvement comes from examining previous results**
	  - There is a lot more responsibility now required by companies, but communities are tired of seeing disturbances being made and just left to come back naturally
	- **Power imbalance**
	  - When you are talking about linear disturbance and caribou ranges, it seems the Government is almost willing to do anything but deny an energy project approval to help reduce impacts on caribou.
	  - The Government is going to extreme measures because the option to say no to an energy project doesn't really exist in Alberta. The whole system is catered to making sure that energy projects can be approved

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Strengthen and enforce regulations/Hold companies accountable**
	  - Industry has to do a better job of showing us where these reclamations are happening and prove to us they are happening
	- **Improve communication between stakeholders**
	  - Industry and communities need to do a better job communicating
	- **Improve Aboriginal/community participation**
	  - While I think some companies are better at it than others, where [does] the community fits in?

Respondent 5 - Public researcher	- **Mandate progressive reclamation timelines/Strengthen regulations** - All of this is really complicated and it all costs money, but that is what needs to start happening and it needs to start happening now, or I think, as these projects become less profitable, there will be even less incentive, or at least more resistance from these proponents

	- **Increase financial liability securities/Strengthen regulations**
	  - Have money set aside and actually have reclamation done by a third party
	- **Third party reclamation**
	  - Have reclamation be done by an independent, third party
	  - A third party not tied to Government, that has its own objectives, that has a contract with the Government and it has to deliver
	- **Improve communication between stakeholders**
	  - As part of [the third party reclamation] the Province needs to be very clear on what are the deliverables and what does success look like
	- **Power imbalance**
	  - So long as it is left in the hands of proponents, there are too many disincentives to engage in rigorous and appropriate reclamation work early, as early as would be good from a scientific perspective or an ecological perspective

Respondent 6
 	
- Aboriginal consultant
	- **Improve stakeholder communication**
	  - Reclamation, [and] everything else, needs to be done Government to Government
	- **Improve community participation**
	  - You aren't going to have successful outcomes if you don't have 50-50 involvement. That needs to be Government, it needs to be ecologists, it needs to be other scientists, it needs to be Indigenous people, it needs to be everybody having a say about how they want to see reclamation to come out
	- **Strengthen Aboriginal roles/participation**
	  - When I say nation to nation, Canadians need to acquiesce to a higher level of authority. You have pre-landowners, or pre-residents, with the Indigenous populations and they need the land to be able to produce and give back and have that relationship they've had
	  - Honouring treaties
	- **Strengthen and enforce regulations**
	  - Canadian Constitution
	  - Treaty Rights

Respondent 7
 	
- Environmental NGO
	- **Government needs to incorporate new reclamation thinking/metrics**
	  - I think picking outcomes that aren't utilitarian focused, that aren't based on forestry metrics
	  - Outcomes should be based on natural values or First Nations land use or ecological integrity
	- **Strengthen Aboriginal Roles/participation**
	  - Outcomes should be based on natural values or First Nations land use or ecological integrity

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Improvement comes from examining previous results**
	  - Government can encourage research
	  - Encourage companies to continue reclaiming areas as they mine so that outcomes can be positive
	- **Include Adaptive Management in Progressive Reclamation**
	  - Encourage research, experimentation and risk taking with reclamation

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Improve communication between stakeholders**
	  - Everyone should be more honest about progressive reclamation being deferred. It would be clearer to everyone what is actually going on in reclamation
	- **Strengthen Aboriginal roles/participation**
	  - Reclamation planning needs to be in the context of reclaiming land to provide capability for Aboriginal land users, to reclaim towards how they used the land previously
	  - More collaborative reclamation planning to better integrate certain land uses across multiple leases
	- **Strengthen and enforce regulations**
	  - Regulate more lease-wide reclamation planning and integration
	  - The Government only recently, in 2015, released an AER Directive suggesting that in situ operators need to do lease-wide reclamation. Previously they only had to do a reclamation plan pre-disturbance

	- It needs to go one step further and use regional reclamation planning to re-establish traditional end-land uses

Respondent 10
 	
- Public researcher
	- **Government needs to incorporate new reclamation thinking/metrics**
	  - The Government should promote adaptive management research
	  - The people working in the Government or for the industry right now, are still deeply rooted in that sort of historic dogma
	  - They do reclamation of the past, still rooted in agriculture and forestry

Respondent 11
 	
- Environmental Consultant
	- **Strengthen financial liability security**
	  - Historically, the Government has never dealt with the volume they are now seeing
	  - Mine Financial Security is underfunded and understaffed
	- **Improvement comes from examining previous results**
	  - Make sure reclamation techniques are not inhibiting any precursors to successful vegetation re-establishment
	- **Mandate reclamation timelines**
	  - Reclamation should be planned from the start. That's how you create, in a human timeline, ELC, from upfront planning

Respondent 12
 	
- University professor
- Former oil company employee
	- **Third Party reclamation**
	  - I don't think the Government is ready for this. I don't think they are focused on this. Having then AER as the agency responsible for reclamation in the Province is wrong. I don't think they have the capacity and professional backing to effectively do this job. I don't think they have the wherewithal or the will to deal with it either. That's a mistake
	- **Strengthen and enforce regulations/More research to improve standards**
	  - Fundamentally, the Government of Alberta has to change the way it regulations reclamation of oil sands mines. We have to change that has not been something that has been discussed here yet.
	  - When the Government is pushed on ELC or end land use, we'll see the change. That will happen when someone works out the numbers and it will become readily apparent

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Improvement comes from examining previous results**
	  - Each time an approval comes up, more and more is added as we know more
	- **Strengthen approval process**
	  - The approval process is interesting. They aren't governed by a set of rules, so much as by guidelines. Each time an approval comes up, more and more is added as we know more
	- **Strengthen and enforce regulations**
	  - We need to be a little bit more strict in terms of what we're requiring [from companies]
	- **Encourage practical reclamation practices**
	  - If the Government makes it difficult for companies, they will pull back and stop doing some of the more progressive things

Respondent 14 - Public Researcher	**No application response provided**

Respondent 15
 	
- Alberta Government employee
	- **Improvement comes from examining previous results**
	  - The Government wants industry to reclaim as progressively as possible and reasonable and we're always looking at ways to expedite reclamation on sites
	- **Strengthening regulations**
	  - The Tailings Management Framework was released last year and should help to expedite reclamation on oil sands mines because the framework really pushed expedited treatment of tailings

Respondent 16 - Métis	- **Strengthen financial liability security** - When Alberta is still making money on oil, the ones that are going through reclamation are probably going to be supported a little better than

Consultant - Former CEMA	the last one, two, three or four projects when the pockets get pretty thin

Appendix B.4: Adaptive management (AM) themes and concepts

Table B.4.1: Adaptive management definitions and perspectives

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Changing perspectives on ELC standards**
	  - The current Alberta Land Management Act and the new system that the Government is proposing for establishing thresholds and action limits under the Regional Planning Process recognizes that there's more to [reclamation planning] than just dirt and trees
	- **Adaptive Management is applying learning**
	  - For me, adaptive management is really looking at what worked, and even sometimes what hasn't worked. We know this worked well, then let's try to enhance that a bit more, or this didn't work at all and there doesn't seem to be any way to save this particular practice or refine it in a way that justifies any further work
	  - Adaptive management really comes in around the research and applying that
	- **Adaptive management is active**
	  - There is no golden egg or magic pixie dust we can spread on the landscape
	  - Physically we need to go out and work, to understand the processes
	- **Adaptive management is researching**
	  - Part of the research activities and the research programs we're involved in really look at changing the way we do reclamation and how these small, incremental, subtle changes may result in more effective and efficient reclamation along the way
	- **Adaptive management has cycles**
	  - Applying research, that to me, is what an adaptive management piece is. Cycling back and making sure you can provide the best outcome, based on experience that we've garnered along the way

Respondent 2
 	
- Environmental NGO
	- **Adaptive management is a buzzword/Abused term**
	  - It's a very abused term
	  - Industry perspective seems to be that 'we can do whatever we want and we can change our approach. We can just keep trying things hopefully something will stick'
	- **Adaptive management should include the precautionary principle**
	  - Industry perspective (as mentioned above) is the opposite of the precautionary principle
	  - Adaptive management would be that you don't do anything until you have confidence, then you approve one or two mines. Once you've demonstrated [environmental/reclamation] performance, approve more.
	- **Adaptive management is unclearly applied/Recklessly used**
	  - All these mines are being approved concurrently with no clear path to dealing with the challenging issues of incorporating tailings into reclaimed landscapes or the issue of end pit lakes or things like that
	  - I think reckless would be the way I describe the way oil sands has been rolling out across the landscape, not adaptive management

Respondent 3
 	
- First Nations Consultant
	- **Adaptive management is a buzzword**
	  - You hear it thrown around quite a bit. You sometimes wonder if people really know what it is or if it's a catchphrase or a buzzword
	  - I think adaptive management is a nice buzzword to just say 'we're being responsive and not just sitting idly'
	- **Adaptive management is unclearly defined**
	  - You sometimes wonder if people really know what it is or if it's a catchphrase
	- **Adaptive management is active**
	  - Taking into account, say environmental change and you've got to manage that to reclamation. You're adaptive to how you're actually doing that reclamation. It's not just sitting by

	- Being responsive, not sitting idly by
	- **Contingency planning/Adapting to new situations**
	  - Not just sitting there doing the same thing if your circumstances are changing
	  - Being responsive

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Contingency planning/Adapting to new situations/Adapting to less financial resources**
	  - Learning how to manage with less money. Trying to do similar projects...I think it's better put in that sense, adapting to the financial constraints these organizations are forced to exist under
	- **Adaptive Management is a buzzword**
	  - (Referring to how interview described hearing other respondents state that adaptive management was a buzz word) As you say, that's the buzzword
	  - 'Oh, we don't need to worry about developing new plans. We're going to use adaptive management. We'll see how it goes…'
	- **Adaptive management is unclearly defined**
	  - I think it is just used by particularly companies and Government as a way to not have to stand by plans that they've developed because it becomes too hard
	- **Adaptive management requires stakeholder participation**
	  - CEMA was the policy organization to provide some direction using our multi-stakeholder status to really include all the voices of a number of people and move [adaptive management] forward

Respondent 5
 	
- Public researcher
	- **Adaptive management is uncertainty management**
	  - This is an issue that is uncertain, wrought with uncertainty in terms of how this is actually going to work. I've always been interested in the manner in which uncertainty is being managed, going forward, by Government especially, but including by industry
	  - Oil sands mines and reclamation issues present a very interesting case study for how regulators deal with uncertainties and with uncertain environmental effects and how they deal with those uncertainties with respect to the public, what they say to the public and how transparent and accountable they are about the risks they are taking
	- **Adaptive management has a 6 Step Framework/Cycle**
	  - Generally speaking, it is associated with a six step cycle of
	  - Defining the problem
	  - Designing a plan
	  - Implementing the plan
	  - Monitoring
	  - Evaluating results
	  - Adjusting decisions based on results (cycling back)
	  - Even that cycle is much more involved in each step
	- **Adaptive management is applying learnings**
	  - Adjusting decisions based on results
	- **Adaptive management is researching**
	  - Designing plan, monitoring and evaluating results
	- **Adaptive management is active**
	  - Adjusting decisions based on results
	- **Adaptive management is rigorous and resource intensive**
	  - It is a rigorous process. It is time consuming and resource intensive

Respondent 6
 	
- Aboriginal consultant
	- **Contingency planning/Adapting to new situations**
	  - Using the most current and best practices in reclamation is touted and adaptive management is part-and-parcel to that because as they're going through in their reclamation planning, adaptive management means there is supposed to be a robust way to have a plan and then respond where things can be better, where things aren't working
	  - Adapting as they go
	- **Passive adaptive management**
	  - Adapting as they go
	- **Adaptive management require stakeholder participation**
	  - Including stakeholders and rights holders in what they want to see done better or done along the planned reclamation path

Respondent 7
 	
- Environmental NGO
	- **Adaptive management is applying learning**
	  - Updating reclamation practices as you learn more about various technologies and practices from around the world
	  - Take those learnings (from conferences) and apply them to their own mine site
	- **Adaptive management requires stakeholder participation**
	  - I'd like to see an agreement that is approved and signed off by local First Nations, one they are happy with

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Adaptive management is applying learning**
	  - Learn from experiences
	  - Learn more to improve the reclamation process
	- **Adaptive management is cyclic**
	  - An ongoing process to learn more about how to improve the reclamation process
	- **Adaptive management is researching**
	  - Monitoring, experimenting and learning from experiences
	- **Adaptive management is experimenting**
	  - Experimenting on sites to aid the learning process
	- **Adaptive management is active**
	  - Reclamation trajectories should be determined at the start and all work should try to make trajectories that allow reclaimed sites to move, mostly on their own, towards a functionally similar ecosystem

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Mitigation/Contingency planning**
	  - What Alberta calls adaptive management is not adaptive management. It is more like response to crisis, and that's it
	- **Adaptive management is unclearly defined in Alberta**
	  - What operators and the Government of Alberta call adaptive management is not adaptive management in the true sense. Alberta does not use adaptive management
	- **Adaptive management is unclearly applied in Alberta**
	  - If you look at the EIA that a company does, they say they are going to do adaptive management, and nobody does that step, you know, the six steps that are part of adaptive management
	  - Everyone says they are doing adaptive management, but no one is actually doing it
	- **Adaptive management involves a 6 Step Frameworks**
	  - Monitoring
	  - Validate assumptions
	  - Adjust reclamation plan
	- **Adaptive management is active**
	  - Changing practices to achieve expected outcomes
	- **Adaptive management is applying learning**
	  - Using monitoring data to validate assumptions and changes practices that are not correctly producing expected outcomes
	- **Adaptive management is researching**
	  - Monitoring to collect data and validating outcomes

Respondent 10
 	
- Public researcher
	- **Adaptive management is applying learning**
	  - If you do something and it didn't work, you try and fix the problem as it is happening
	- **Adaptive management is active**
	  - Changing your prescription in the middle of reclamation
	- **Adaptive management is adapting to new situations**
	  - It should be a warning. It should be an indication that maybe the type of soil profile you're building is not the right thing to do

Respondent 11 - Environmental Consultant	**No applicable response provided**
Respondent 12	- **Mitigation/Contingency planning/Adapting to new situations** - What it means is a management plan is in place so that if the original or

- University professor - Former oil company employee	initial environmental management plan doesn't work out or isn't as successful, an adaptive management plan can be implemented to mitigate the environmental effects - A plan is in place before so when there is a requirement to address the hypothetical problem, we can use an adaptive management plan - **Industry uses passive adaptive management as contingency planning in real world** - There is a plan made up for that. That is not what adaptive management is
Respondent 13 - Environmental Consultant - Botanist	- **Contingency planning/Adapting to new situations** - In my mind, is that planning and development of reclamation is being done to try and adapt to the conditions that are there at the time, with some sort of look back to what was there before. One has to adapt to new conditions - **Adaptive management is unclearly defined** - Adaptive management is one of those terms that I think gets bandied about, but I know think that anybody has a true sense of what it is - **Adaptive management is applying learning** - As we go, we change our processes and methodologies to adapt to new learnings as we progress - It is using the learnings as you go
Respondent 14 - Public Researcher	- **Industry uses passive adaptive management as contingency planning/adapting to new situations** - Adaptive management means give us our license, we will monitor and fix things. That is not what adaptive management is at all. That is what industry says it is - **Adaptive management is applying learnings** - Choose and apply learned management practices - **Adaptive management has cycles** - You have a situation, you experiment purposefully with different types of management and see how they work - **Adaptive management is researching** - Purposefully experimenting to see how they work and choosing which management practice to use based on how well they are working - **Adaptive management uses experiments** - Purposefully experimenting to see how they work and choosing which management practice to use based on how well they are working - **Active vs Passive adaptive management** - Passive: monitoring and if a management plan works, we keep using it. If it doesn't work, we change it - Active: Purposefully experiment, apply learnings, choose best management practices
Respondent 15 - Alberta Government employee	- **Adaptive management is progressive reclamation** - Adaptive management is just another word for progressive reclamation. Not deferring all reclamation to the end
Respondent 16 - Métis Consultant - Former CEMA	- **Adaptive management is unclearly/unevenly applied** - This one is a bit hit or miss - Looking at tenure scales and certainly the last ten years, you've seen a lot of adaptive management and CEMA was a driver - **Adaptive management requires stakeholder participation** - CEMA was a big adaptive management driver because it brought together stakeholders with a common understanding in order to get people in and around concepts - When I was in one community, we looked at the controversy around end pit lakes and guidelines for them. The community will not sign off on end pit lakes as a final reclamation tool, but that doesn't mean they are not interested and if they are going to have to deal with end pit lakes, those lakes are going to be as functional and safe as possible

Table B.4.2: How adaptive management is perceived as occurring

Respondent	Concepts

Respondent 1
 	
- Biologist
- Oil company reclamation practitioner
	- **Unclear how adaptive management is used in practice**
	  - It is hard to say if [companies] are using adaptive management
	  - The entire [reclamation] research application and process is adaptive management, or some form of it. There may be particular research programs that have a component of adaptive management in them
	  - There are plenty of reclamation sites where there are research activities underway on all the oil sands sites
	- **Adaptive management is necessary to enhance reclamation**
	  - From my perspective, it's really to understand the [ecological] processes that are going on. Let's understand which are critical for reclamation, let's look to understand how we can enhance those [processes] where we need to and how we can kickstart or generate them where we need them
	  - It could be fed back into the practice on the ground to make more efficient and better reclamation
	- **COSIA performs adaptive management research (mostly adaptive management technology)**
	  - Agencies like COSIA really focus on developing these kinds of technologies, sharing that research and technologies through technology transfer programs and then changing the sites we have and the activities we are involved with
	- **Information sharing is occurring/Recommendations for adaptive management practices are created**
	  - A lot of that work [from COSIA] is shared through agencies like CEMA
	  - A pile of work has been done, pulling together research synthesis and documentation to say 'this is how we should do some of these things'
	  - The end pit lake guidance document was one of those things
	- **Oil companies pursue active adaptive management**
	  - Oil companies pursue active adaptive management
	  - COSIA provides grants and internal funding from companies, millions of dollars are provided to researchers, academic institutes and research agencies
	  - Gone are the days of passive adaptive management where we sit by and hope that what was done works

Respondent 2
 	
- Environmental NGO
	- **Cost hinders adaptive management**
	  - Companies follow the lowest cost option. There is no incentive actively pursue different approaches
	  - Poor reclamation performance has little consequence in terms of financial penalties or production curtailment, so there is little reason to invest more than necessary

Respondent 3
 	
- First Nations Consultant
	- **Companies pursue mostly passive but some active adaptive management**
	  - It depends on the company and may vary from project to project if the company is large
	  - I mostly believe it is passive with some active reclamation taking place
	- **Cost hinders adaptive management**
	  - What seems largely apparent is that when the price of oil drops, less active reclamation work seems to take place because of controlling costs. This should worry Albertans especially if we are expecting oil prices to be lower for longer
	- **Adaptive management is industry led/Companies choose their AM methods/Varying community participation**
	  - Some companies will involve the community, going out and looking at sites over the course of a few years and seeing how things are happening. There are companies that will involve a community in that and try to take community input. There are definitely efforts being made to include communities in reclamation activities
	  - I would say in a lot of cases the community is not really involved in what is going on. You may have a select segment more involved than others.
	  - The community is involved to some extent from a reclamation standpoint, and they'll often be asked for feedback but it's not an active role in a lot of cases. It's a consultation type role where they are brought in once in awhile to have a look. Maybe there is a photo-op and they give some feedback

	- There is that kind of thing which happens from time to time [to really provide some design input in , for ex. A wetland, the types of plants and what kinds of plants they would like to see], which I think is good, but from an AM point of view, I think that's a really tough one to say [how involved communities really are]

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Cost hinders adaptive management**
	  - I think oil companies pursue the area of least resistance and cost. That is especially true for reclamation because reclamation and reclamation technology is a pure cost and does not bring value to the company. This is why they are constantly pressuring the Government of Alberta to relax reclamation requirements
	- **Adaptive management is industry led/Unclear how they apply AM**
	  - they are constantly pressuring the Government of Alberta to relax reclamation requirements. For example, Tailings Management Framework Directive 074 was ignored
	  - Whatever resourced the Government may have pushed towards CEMA are now being pushed towards COSI. It's all the oil sands companies that are partnered together
	  - They are sharing technologies across the board, but the industry has made the argument repeatedly, 'don't worry Government of Alberta, we'll share our findings with you to plan your reclamation documents' which has left a lot of Aboriginal groups and NGOs saying 'What the hell is going on?'
	- **Limited stakeholder participation in adaptive management**
	  - COSIA is sharing technologies across the board, but the industry has made the argument repeatedly, 'don't worry Government of Alberta, we'll share our findings with you to plan your reclamation documents' which has left a lot of Aboriginal groups and NGOs saying 'What the hell is going on?'
	  - As a result, COSIA is just sitting there and the status quo has continued to the chagrin of many community advocates

Respondent 5
 	
- Public researcher
	- **Companies pursue mostly passive but some active adaptive management**
	  - Learning is always the goal, but it take a bit of a back-seat in passive AM because there is not the deliberate experimentation of multiple, different approaches
	  - It's definitely the passive version for the most part, although proponent do occasionally refer to the active form and call for it's implementation in the context of future plans
	  - None of the real experimental nature of AM is, as best as I can tell, coming out at the end of the pipe
	- **Cost hinders adaptive management**
	  - The reason [active adaptive management is not as common] is that passive AM is a lot cheaper to do
	- **Adaptive management is industry led**
	  - Passive AM is cheaper to do
	- **Adaptive management is used as contingency planning**
	  - AM is being reduced to ad hoc kind of contingency planning
	  - There is little attention paid by proponents to experimental design, and it is often conflated with compliance monitoring or what come refer to as performance monitoring
	- **Adaptive management requires stakeholder participation**
	  - First Nations are certainly aware of the issues and problems with AM. They've made the comment that AM appears to be a general promise to do something if something comes up
	  - First Nations are definitely aware of the issue. I think they are clearly aware, they've formed the view that this is generally not a good deal
	  - They are interveners
	  - The extent to which they are participants in development and reclamation, is a matter of capacity
	  - The extent to which they are involved and are demanding more, I couldn't say for sure, but my sense is these are definitely ongoing conversations

Respondent 6 - Aboriginal consultant	- **Companies pursue active and passive adaptive management** - Several larger companies with mining projects have recently been through the regulatory process and have, or are waiting for project approval, are pursuing active adaptive management policies for reclamation, whereas

	five years ago they were not - Depending on the company and operation (SAGD) may or may not have that level of real commitment - **Adaptive management may be unevenly applied** - Level of AM commitment depends on the company and their approval - **Adaptive management requires stakeholder participation** - Closure, Conservation and Reclamation planning since has been more inclusive of Aboriginal involvement and feedback on end land use - The inherent problem is that Aboriginal folks involved now, who hold land and use traditional knowledge are not able to practice land use or transfer place-based knowledge of that area to future generations - **Aboriginal communities must be involved in the adaptive management process** - Aboriginal involvement in determining criteria they require to achieve similar habitat and useful end land use is going to diminish over time - When policy makers and regulators sell their story, their land use framework, all that stuff as being fulfilled and concerned about every Albertan, that's not actually what they mean because their own policy advisors aren't writing from every Albertans' perspective. They're writing from a western science perspective. It doesn't involve an Aboriginal perspective - People don't realize that the Indigenous populations are completely necessary for our ecological diversity to continue
Respondent 7 - Environmental NGO	- **Adaptive management requires stakeholder participation** - There's been workshops on the topic where they've brought stakeholders together and what AM means and how it can be improved - I know it's a focus point. It's worth exploring
Respondent 8 - Alberta Government employee - Upstream oil/gas	- **Companies pursue active adaptive management** - I don't work actively with oil sands reclamation, but my impression is that companies are doing a lot of research and trying various techniques to determine what will have the most success - I think they are practicing active adaptive management - The last 10 years has seen a lot of active research on sites undergoing reclamation - **Adaptive management is industry led** - Companies are doing research
Respondent 9 - Ecologist - Aboriginal Consultant - Formerly CEMA	- **Companies pursue passive adaptive management** - Potentially passive adaptive management but not even that really - It is more of a response to a situation than a formal AM framework - Nobody is doing it [6 step AM framework] - **Adaptive management is industry led/Unclear how it is implemented** - Only one company has submitted an application with a real AM process and that is Teck in their Frontier project, updated in 2015, but nobody else does that - **Adaptive management is poorly implemented** - Even in the LARP, there is all this stuff about land use planning that is going to adaptively manage cumulative effects, but there is nothing measuring the practice to know that the planning is achieving the outcomes defined in LARP
Respondent 10 - Public researcher	- **Adaptive management is occurring** - They're doing adaptive management in the sense that every year they try to figure out what is working well and to try to do something better - **Cost hinders active adaptive management experiments** - Gateway Hill is a great experimental unit, because you don't need industrial permission to burn it. I don't believe it is a resilient site, and I'm concerned it shouldn't have been certified because it can't meet their approval requirements - It's risky in a sense [to conduct a prescribed burn experiment on the site because] now it is public property, so then the taxpayers would have to fix it - My concern is that industrial partners may choose not to use [their scientific research] findings when they are perceived to cost more money - **Adaptive management is industry led**

	- Government has required industry partners to contribute to scientific research. The research is aimed at improving reclamation practices - My concern is that industrial partners may choose not to use the findings when they are perceived to cost more money - **Companies pursue both active and passive adaptive management** - They are practicing active adaptive management, but maybe a little of both - Government has required industrial partners to contribute to scientific research
Respondent 11 - Environmental Consultant	- **Companies pursue both active and passive adaptive management** - I would have to say that they would employ both active and passive adaptive management strategies - **Cost dictates which form of adaptive management companies pursue** - Not being intimately familiar with man oil sands companies it would be hard for me to comment. Perhaps companies that are larger with better funding would be able to focus on active [adaptive management], with other smaller, less funded companies using a more passive approach
Respondent 12 - University professor - Former oil company employee	- **Adaptive management is industry led/Unclear exactly how industry applies adaptive management** - Adaptive management is the responsibility of the proponents, or companies. It is not the responsibility of the government - So, adaptive management plans aren't always even necessarily a part of the [mine] approval for the company - **Companies pursue passive adaptive management** - Oil companies use passive adaptive management - **Adaptive management is not legally required** - There is no regulatory requirement nor legal driver to use active adaptive management in Alberta
Respondent 13 - Environmental Consultant - Botanist	- **Companies pursue both active and passive adaptive management** - There is a strong tendency towards active adaptive management in specific areas of reclamation. It is obvious in the multitude of research projects that companies are involved with - However, I do believe that there is much more that could be done and some of the passive adaptive management would be formalized to obtain much more empirical data that could be feb into the feedback loop more rapidly - **Adaptive management is occurring** - I have seen us adapting to new information. New knowledge as well
Respondent 14 - Public Researcher	- **Companies pursue both active and passive adaptive management** - We made usual requirements or conditions that previous oil sands mines licenses had required, we continue to pour millions into learning better about how to do things. We accepted the principle that you might not get to that point [of learning]. The key point is that you have to think of that at the beginning - If you don't have any management that you can use, you are acting on faith or saying 'I'm willing to accept in principle that this won't work'
Respondent 15 - Alberta Government employee	- **Companies pursue active adaptive management** - Oil sands companies actively pursue ways to improve reclamation techniques - It is in the company's' best interests to reclaim successfully , as disturbed land needs to be returned to the Crown, and I doubt that the Government of Alberta would be willing to accept lands back with poor reclamation outcomes - Many reclaimed sites are still relatively young, so we need to continue monitoring the performance on those sites to make sure they are getting to their targeted ecological end land use. If they are not, the operators can intervene as need be - **Participation in adaptive management research is occurring** - Companies work with university researchers and consultants to conduct research that helps improve their reclamation practices and outcomes, and commit significant resources to do so - **Aboriginal participation in adaptive management reclamation planning is**

	occurring - First Nations expressed, in their engagement, the desire to hunt and harvest berries on reclaimed lands, so we integrated that into our new thinking and the new landscape planning - So, it's adapted based on the feedback received through engagement with stakeholders - **Adaptive management has created improved standards** - Reclamation practices have improved over the years. Nowadays, we're focused on emulating more of the natural boreal forest characteristics in the post-closure landscape. The drivers are different nowadays
Respondent 16 - Métis Consultant - Former CEMA	- **Cost affects adaptive management** - What drives the process of adaptive management is as long as it doesn't drive up the cost and it doesn't affect production, that seems to be the only adaptive management that occurs - **No honest discussion about how adaptive management should be applied** - As soon as you want to put restrictions on development or potentially sterilize the resource, or leave it in the ground, or phase the production in someway, it is almost a non-starter to the discussion with industry - You really can't have a full discussion on adaptive management. Sorry. - **Companies pursue active adaptive management only in technology** - On the technology side [adaptive management is] completely different. The technology advances that have occurred are completely different and I think industry has done a good job on that side - Industry probably hasn't been given their du for the amount of time and investment [in technologies to improve reclamation]. The amount of time and money and smart people put behind these issues is phenomenal, in the billion range, per year - **Adaptive management is industry led** - It's a shame they choose to do it in a private form instead of with their stakeholder friends like they used to - Now, they kind of purchase science projects: they buy out universities and do some pet projects with Ph.D.'s and if they yield results that can provide adaptive management tools - But, the ones we don't see are probably the [research projects] that don't work out so well. That's the unfortunate thing with the COSIA model is that it's hidden from the public - We haven't really seen [much adaptive management in reclamation]. We've got one certified reclamation site and that was based on reclamation standards in the 1908s. We'll need to wait 30 years and see if they are comparative to 2015/2016 standards - **Stakeholder participation is limited in adaptive management** - Government officials participate, key researchers can participate, but stakeholders and the public are shut out - Some [stakeholder] ideas have been incorporated, some of them haven't. - (Referring to company making a calving island in the middle of an end pit lake) That's one example of where you can listen to people and say 'this is our experience, what do your wildlife people day? It seems doable, it probably doesn't cost a lot of money. It is just a design change especially four years out on a project. Can we do it? Yeah, let's incorporate that change' - There are a whole pole of those that I am sure you could capture if you had broad conversations with the community and understood what their desires were

Table B.4.3: Challenges limiting adaptive management

Respondent	Concepts
Respondent 1 - Biologist - Oil company	- **Difficulty facing technology transfers/research application** - **Information sharing is limited** - AM really comes in around the research and applying that. That said though, I'm not sure we, as a society, really do a good job getting around

reclamation practitioner	technology transfers - A lot of research happens in academia and sometimes there is a disconnect between how you operationalize that piece

Respondent 2
 	
- Environmental NGO
	- **Industry structure makes Alberta financially vulnerable**
	  - Oil sands companies appear to be big multinationals, but then you actually look at how they are structured and the oil sands operation has been set up as a limited company with no linkage to its parent companies. I think the bigger issue is that we're going to be left with huge liability and these companies are going to disappear
	- **Distrust**
	  - Without any sort of public information on the sort of demonstrated performance of sites with tailings, I would hope there is some potential there, but there are some big questions marks [with tailings management] that haven't been addressed

Respondent 3
 	
- First Nations Consultant
	- **Limited stakeholder participation**
	  - There is a lot of requirements that the Government puts on industry to come and consult with First Nations on energy projects in each First Nation's traditional territory. Some small, ancillary projects or components of larger projects, Alberta doesn't deem those as requiring consultation, maybe just notification and sometimes not even that, and of course that becomes a bone of contention depending on what it is because there may be reasons why the First Nation wants to be aware of it and consulted on it
	  - Having a tiered system doesn't necessarily work in a lot of cases
	  - Community-based monitoring is really important from an understanding point of view to make sure community members know what is happening, but also for transparency and accountability
	- **Distrust**
	  - Things are obviously better than they used to be for reclamation standards, but there is still a lot of concern that communities have because there is often a lot of trust issues and value system differences
	  - It comes up all the time that community members find it really important to have a neutral third party participate, to have communities participating in monitoring
	  - Community-based monitoring is really important from an understanding point of view to make sure community members know what is happening, but also for transparency and accountability
	- **Power Imbalance**
	  - The values system is different. The Government looks at things like 'is this project in the public interest?'
	  - The way the Government looks at public interest is tax dollars and jobs. An economic definition of public interest
	  - **Economy > Environment**
	  - The reality is, if you're a community member, you're the one who lives in the area. Not a Calgary or Edmonton based executive or camp worker. Who is going to be up here using the land over the long term? It's First Nations
	  - You have the opportunity to talk about the number of species and biodiversity. DEpending on how it's measured, but it really depends on how it is measured and who is measuring it
	  - **Who decides AM practices for reclamation?**
	- **AM needs third party involved**
	  - It comes up all the time that community members find it really important to have a neutral third party participate, to have communities participating in monitoring
	- **Aboriginal involvement is necessary in AM**
	  - Community-based monitoring is really important from an understanding point of view to make sure community members know what is happening, but also for transparency and accountability
	- **Industry-led AM regulations are weakly enforced**
	  - The whole regulatory system, how approvals happen, how reclamation is dictated, everything is put on industry essentially, to make sure all these regulations are followed
	  - The Government doesn't have the capacity in place to monitor all of the activity that is going on up here right now

	- There is a lot of accountability that is put on industry to make sure [regulations are followed]
	- **Cost hinders AM**
	  - When you talk about an economic downturn, then environmental departments are the ones that get the cut
	  - Minimum requirements will be met, but if they can cut things from the environmental departments that aren't tied to production, they're going to do that

Respondent 4
 	
- Aboriginal Consultant
- CEMA
	- **Difficult to properly incorporate Aboriginal perspectives into AM planning/Aboriginal participation limited**
	  - Another challenge was the [CEMA] committees themselves. Let's say the reclamation committee, it was full of scientist-type folks, without having a real understanding about how traditional knowledge could be incorporated. What ended up happening, even if they had budget lines every year, because they didn;t know how to do it and there wasn't enough community representatives on that level, and the representatives at the advisory committee didn't know hot to articulate traditional knowledge, it was never incorporated. Budget lines were wasted.
	  - There are no guiding documents saying how to [incorporate traditional knowledge into reclamation] or how it should happen
	- **Power Imbalance**
	  - The Government has brought everything in house [after ceasing CEMA funding]. The Government has since gotten rid of AMIRA and brought everything in-house without a real explanation of how traditional knowledge is going to be incorporated. While there is hope, it is a bit guarded
	  - One of my big concerns as everything gets internalized and the decisions are made in Edmonton or Calgary, the local people are going to fall out of the loop
	- **Limited stakeholder participation**
	  - The concern is, where are the opportunities for local stakeholders to really participate?
	  - The Government has been less clear about what that process is going to be and so community members, they are still trying to participate, but the ways for them to participate are less clear
	- **Uncertain how AM processes will work/allow stakeholder access**
	  - The Government has been less clear about what that process is going to be and so community members, they are still trying to participate, but the ways for them to participate are less clear
	- **Distrust**
	  - When communities aren't involved in developing, whether it's policy or monitoring, they're not involved in the design and implementation, there is an inherent level of distrust built into it. So, when your only engagement is a "consultation" and say the Government comes and says 'what do you think of this?' the community gives their feedback and that's it
	  - It creates a very adversarial process and it creates a process that isn't very conducive to building trust in the region

Respondent 5
 	
- Public researcher
	- **Cost hinders AM**
	  - [AM experiments are] expensive. It's difficult and expensive
	- **Uncertainty is not being managed/AM is not a guarantee of success**
	  - What we have is a little bit, unfortunately, of a bait switch. There are these uncertainties around reclamation, around surface water management, around groundwater and the effects of these massive, unprecedented projects of these oil sands mines and their impacts
	  - It's getting better, but back in 2005 AM was basically a blanket strategy or routine strategy that you can apply to every problem and it will make environmental management better. But, because it would require so much rigor and effort, the flipside is that it doesn't end up getting done at all
	  - The issue of course, is that AM is not a guarantee or warranty that you're going to figure out how to deal with something. What you may learn over time is that you overshot the mark, or that there is no way to manage a particular issue and none of that comes across
	- **Industry-led AM regulations are not enforced**
	  - There is no additional pressure on proponents to deliver on some of these

	[approval] commitments they make with respect to AM - **Uncertainty/Distrust of AM implementation** - There is all kinds of scrutiny on proponents at the application state, at the project approval when they are applying for permits and submitting their environmental impact statements. There is zero transparency at the regulatory state, just to say the terms that are actually incorporated into their approvals and zero respect to their reporting requirements

Respondent 6
 	
- Aboriginal consultant
	- **Industry-led AM regulations are not standardized**
	  - The difficulty for Aboriginal folks, regulatory wise, is that these things like the reclamation plan and adaptive management plans, for the most part, are not set in stone
	  - They are not complete when the project is going under the approval process and the approval is generally given without having a hard, firm, final plan of reclamation
	- **Uncertain implementation of AM and outcomes**
	  - It's all unproven and it's all 'here is our best guess for what's going to happen. Here is the AM strategy we have as we got to deal with uncertainty.' Essentially, it's an uncertain process
	- **Power Imbalance**
	  - The Government can't wait 80 years to make a decision on if [the AM plan of a company] is going to work or not because the proponent wants to start developing now

Respondent 7 - Environmental NGO	**No applicable response provided**
Respondent 8 - Alberta Government employee - Upstream oil/gas	- **Novel ecosystems require active adaptive management intervention** - Novel ecosystems are an interim. Sites should not appear wholly novel. Sites are reclaimed with a trajectory in mind and monitoring and minimal intervention should allow systems to develop towards natural paths and desired end goals

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Limited stakeholder participation/Government reduced stakeholder involvement**
	  - In 2015 the Alberta Government made the decision that participation in CEMA by industry partners was voluntary, and basically CEMA decided to shut down because they no longer had funding. Industry wasn't required to pay for [a multistakeholder forum on oil sands development]
	- **Power imbalance/Uncertainty**
	  - With the closure of CEMA, there is less opportunity to have an equitable input into policy development because the governance structure of CEMA was such that every member had equal say to the degree that the member organization could participate
	  - From Aboriginal community perspectives, it wasn't a very good decision the NDP government made in shutting down CEMA because now there is no multistakeholder organization to tasked with the responsibility of creating reclamation guidance documents. Nobody knows who is going to manage them and the over that work
	  - For the most part, most mining companies only engage First Nations. They don't engage the Métis communities because there is no Métis consultation policy in Alberta. The Métis have even less involvement in this kind of thing than First Nations do
	- **Approval regulations/conditions are not enforced/Over promising**
	  - All the conditions that formally indicated that [one oil company approval renewal] their approval was based on their expectation t do this work at CEMA or a similar kind of organization has been removed from that approval
	- **Government fails to enforce AM**
	  - The Government has never said 'let's have a multistakeholder organization that is going to create an AM framework.' They've never done that. They should but they've never done it

	- Companies take on the consultation responsibilities from the Crown, so different companies will do different engagement with Aboriginal communities. For the most part, most mining companies only engage First Nations. They don't engage the Métis communities because there is no Métis consultation policy in Alberta

Respondent 10
 	
- Public researcher
	- **Regulation around AM research is present, but incorrectly applied**
	  - In the approval system for the oil sands, oil companies have to pay a percentage of their annual revenues towards research, but the way they do it right now is through COSIA (the Canadian Oil Sands Research Alliance).
	  - COSIA board members, or the scientific advisory panel and board members that sit on COSIA are made up of industrial reclamation specialists. I think that is the wrong groups of people to be on board
	- **Industry-led AM is wrong approach/Limited stakeholder participation in AM process**
	  - The board the decides where to put the money, industrial money, are industrial personnel, and maybe some Government personnel, but there is absolutely no academic or non-partisan scientific personnel and I think that is a mistake
	  - The Government should be promoting this kind of research
	- **Cost hinders AM/No experimental nature in reclamation AM**
	  - No industrial partner wants to spend a couple million dollars on reclaiming a site to then just burn it to see if it's a success or failure
	- **AM is needed because we lack data/helps improve reclamation standards and safety**
	  - If you're looking at medical professionals, they are constantly updating their knowledge
	  - I think [oil sands reclamation] is high risk, but it's not a human health risk. I think [there's] just sort of a belief that [reclamation is] working. A belief that this [current reclamation] system works and this system is simple to understand.

Respondent 11 - Environmental Consultant	**No applicable response provided**

Respondent 12
 	
- University professor
- Former oil company employee
	- **Moving AM theory into practice is difficult**
	  - Although well defined in theory, in practice there needs to be a prior plan in place that is adaptive before a decision is made to go from the current environmental plan
	- **Adaptive Management plans are not made before management decisions are implemented**
	  - In the real work, when something goes wrong, then a plan is made up for that
	  - That is not what adaptive management is

Respondent 13
 	
- Environmental Consultant
- Botanist
	- **Information sharing is limited**
	  - Under CONRAD, information was shared annually at a symposium
	  - That has now gone by the wayside and a lot of the work is being done under the auspices of COSIA
	  - The works isn't shared in the same way at the scientific level. The work is shared more at a managerial and upper echelon level
	- **Research might not be applied**
	  - I think that the benefits of sharing information at the scientific level or at the scientist's level and those who are actually doing reclamation is going to be much more positive
	  - I think we can move forward faster by doing that and I don't see that happening

Respondent 14 - Public Researcher	- **Passive adaptive management is impractical because you cannot adapt management in timely manner** - [Provides analogy of dam leak and 20 minutes before the dam breaks] So, adaptive management in that particular style is ineffective because you

	can't adapt the management in time, so you need an early warning indicator; an observation that industry people usually ignore
	- **Adaptive management plans are not made before management decisions are implemented**
	  - If bad things happen, management will be changed, but will you learn in time to be able to do that? Can you afford to do that?
	  - Adaptive management means that you have a plan that can get you information in time to be able to adapt the management to something that you commit to doing

Respondent 15 - Alberta Government employee	- **Active adaptive management is mostly used in tailings management** - The Tailings Management Framework should help expedite treatment of tailings on sites. If we can increase the rate of tailings treatment sites can be more readily reclaimed

Respondent 16
- Métis Consultant
- Former CEMA
	- **Industry chooses their own adaptive management/Unregulated or weakly regulated**
	  - If you look at some of the AER's decisions of late, you'll see that they will do what the companies agree to. It's a very incestuous relationship between companies and the Government on what they're going to do
	  - The company says 'that's just a really inconvenient approval condition. How about you, Regulator, take it out?' [The Regulator says] 'Okay, let's do that. Let's do something different, let's try something else'
	- **Stakeholder distrust/uncertainty in companies and AM processes**
	  - All conditions [in approvals] are between the Government, who has little trust in the company, or the communities raise really tough or hard questions to the company so accountability can be met
	  - All kinds of promises were made at the [CNRL Horizon Mine approval] hearing and behind closed doors and in agreements that the company would operate in a certain way. Fast-forward ten years later when it comes time to get their tenure renewal and all those [conditions] are now optional
	  - Do what you want, but at least do it in consultation with the people who are raising concerns in the first place and that hasn't happened
	  - [Approvals are] not transparent at all. I'd say it is very argumentative and probably even adversarial in some ways depending on the company and the nature you [go into it with]
	- **Limited stakeholder participation in AM process**
	  - Do what you want, but at least do it in consultation with the people who are raising concerns in the first place and that hasn't happened
	  - What's the next ten years going to bring when all the rest of [the company's' approval renewals] come up? It's continually changing
	- **No standardization of AM in mine approvals**
	  - All kinds of promises were made at the [CNRL Horizon Mine approval] hearing and behind closed doors and in agreements that the company would operate in a certain way. Fast-forward ten years later when it comes time to get their tenure renewal and all those [conditions] are now optional
	  - What's the next ten years going to bring when all the rest of [the company's' approval renewals] come up? It's continually changing

Table B.4.4: Suggestions to improve adaptive management

Respondent	Concepts

Respondent 1
- Biologist
- Oil company reclamation practitioner
	- **Apply New Standards and Recommendations as you go**
	  - We know things are different [in reclamation standards] today, so one of the things, if we were to make recommendations to the Regulator, even though we may have an area that is under an old approval, let's not apply the standards until the ground is actually disturbed
	  - If you disturb 2-3 thousand of 10,000 hectares in a 10 year approval term, apply standards only to those pieces and move the standards forward as as the other areas get disturbed and as we learn more
	- **Better define AM to inform all stakeholders what AM should be**
	  - I think there is a disconnect between academia and the general public on

	what AM is. From a science-informed basis instead of a politically informed basis - We talk with scientists, they think about AM and adjustment and changes, going back and correcting as you go, whereas I think the general public, thinking about AM, it's more along the lines of 'if it ain't broke, don't fix it - It really comes just from more of a base understanding that [different stakeholders] may have and their definitions of what [AM] means that probably needs to be better aligned
Respondent 2 - Environmental NGO	- **Balance Power** - [We] need a big discussion about this and [we] need some honesty. I think there is a need to certainly give a fair amount of priority to the needs of local communities who are going to have to deal with these [reclamation] issues for 100 years. I would appreciate more honesty about the challenges [of reclamation] - **Improve, strengthen and enforce regulations** - Of the top, the first one is accountability and binding reclamation performance standards. If operations don't meet those performance standards, they shouldn't be allowed to expand - More transparency and better reporting on actual reclamation outcomes - Strictly enforce the new Tailings Management Framework - Require companies to put forward more lands for reclamation certification - **Encourage stakeholder participation and process transparency** - More transparency and better reporting on actual reclamation outcomes - A frank and honest assessment of which reclamation trajectories are feasible and achievable and which ones, based on our track record, 40 years have not been successful and are too expensive and are not achieving the outcomes [stakeholders] want
Respondent 3 - First Nations Consultant	- **Passive reclamation and AM is unacceptable/Regulate progressive reclamation and active AM** - Community members are tired of seeing disturbances made and left to come back naturally. It's important to see that the Government continues to update regulation, continues to be aggressive in requiring companies to reclamation as soon as possible and actively - **Balance Power** - One of the big problems is if you look at who has the responsibility to First Nations and Aboriginal people, who signed treaties and things like that, it's the Government that has that obligation. They just delegate that to industry - It's a good example of the fox-in-the-hen-house: one of the requirements that communities accepted those projects on the basis of was that CEMA existed and it was a multistakeholder table for Aboriginal communities to go to and work on policy issues and environmental issues. When That gets taken away, that was one of the conditions that communities decided to accept these projects on - Government has a one-track mind when it comes to development. In terms of Alberta, that is the economy of Alberta: oil and gas, the energy industry. - **Strengthen regulations and enforce Aboriginal Constitutional and Treaty Rights** - Government really shirks its responsibility when it comes to consulting community members and making sure the community's interests are recognized and protected
Respondent 4 - Aboriginal Consultant - CEMA	- **Improve stakeholder participation** - Was it likely is that some issues like the environmental are going to get shorted, while other issues like the economic or social-cultural get better outcomes for the community as a result? - Actually involving stakeholders, meaningfully involving stakeholders in the conversation through an organization like CEMA - **Encourage Aboriginal perspectives in AM and reclamation planning** - Relating or involving community members, more from a visioning perspective, to understand what they want to see in the future - Developing a 'homeland' goal for reclamation - LARP doesn't aid regional planning with community voices front and center very well - **Strengthen regional AM and reclamation planning**

	- Do a better job of land use planning on a broader scale and not just on a project-by-project salce. Even though the LARP aims to do that, a recent review of it says it doesn't do it very well. It doesn't do it with community voices being front and center

Respondent 5
 	
- Public researcher
	- **Active AM is necessary and must be used immediately to prove reclamation can work**
	  - The reality is that to be able to demonstrate that you have developed or devised a method, reclamation or restoration technologies or approaches that will create some kind of functioning aquatic ecosystem and surround landscape, those need to be built right now because you need at least 10-15 years of base monitoring data to figure out what is going on
	- **AM needed to develop confidence in reclamation techniques/practices**
	  - It takes 5-10 years of data just to say anything with any kind of confidence in terms of what the effects are and what is working and what's not working
	- **Strengthen financial security/AM needs to happen to prevent reclamation liability**
	  - All [active AM] is really complicated and costs a lot of money, but that is what needs to start happening and it needs to start happening now. As these projects become less profitable, there will be even less incentive or more resistance from proponents
	  - The Province needs to start requiring security for reclamation at the outset of these projects. There needs to be money set aside and enough money
	- **Independent Third Party**
	  - Reclamation should be done by a third party, and independent third party not tied to [Government or industry] that has it's own objectives and a contract with the Province and it has to deliver
	  - As long as it's left in the hands of the proponents, there are too many disincentives to engage in rigorous and appropriate reclamation work early - as early as would be good from a scientific perspective or an ecological perspective [which differ] in their view from an operational perspective
	- **Clarify reclamation standards and success criteria**
	  - The province needs to be very clear on what are the deliverables and what does success look like, and have reclamation separated (Third Party contract)

Respondent 6
 	
- Aboriginal consultant
	- **Balance Power**
	  - Reclamation, [and] everything else needs to be done Government to Government, so to speak. That is delegated to industry in so many ways. You aren't going to have a successful outcome if you don't have 50-50 involvement
	- **Encourage stakeholder participation in AM planning**
	  - You aren't going to have a successful outcome if you don't have 50-50 involvement. That needs to be Government, it needs to be ecologists, other scientists, Indigenous people. It needs to be everybody having a say about how they want to see reclamation come out
	- **Strengthen regulations and enforce Aboriginal Constitutional and Treaty Rights**
	  - There is a legal imperative on all the Provinces, on the federal government as the Crown to fulfill the Constitution Section 35 and make sure they maintain the ability and the opportunity of those rights to be practiced, because if you can't practice those rights than they have nothing
	  - If the Government doesn't maintain those rights to ensure there is opportunity then they've reneged on the Treaties [and] the Constitution means nothing

Respondent 7
 	
- Environmental NGO
	- **Balance Power**
	  - I'm going to accept that with every type of economic development, there are going to be trade-offs and some level of compromise. I think it's knowing what the balance is or what level of compromise is going to be talked about
	  - Is there an agreed upon vision as to how the Regional Municipality of Wood Buffalo will look in 100 years? I think this would help determine what level of trade-offs are socially and environmentally acceptable
	  - Picking outcomes [of reclamation] that aren't utilitarian focused, but more

	based on natural values of First Nations land uses, or ecological integrity of the region - **Encourage stakeholder participation in AM planning** - Is there an agreed upon vision as to how the Regional Municipality of Wood Buffalo will look in 100 years? I think this would help determine what level of trade-offs are socially and environmentally acceptable

Respondent 8
 	
- Alberta Government employee
- Upstream oil/gas
	- **Apply learning, continually research to improve standards**
	  - There is still much to learn about reclaiming such large sites. The level of disturbance in the oil sands mines is unprecedented, but it offers unique opportunities for learning
	  - The Government should support ongoing research in these areas
	  - Reclamation must be willing to learn from mistakes when they are made and change approaches in the future
	- **Active adaptive management experiments/risk-taking are necessary to manage uncertainty**
	  - It is important to allow risk-taking in sites. These are learning opportunities that will improve our scientific understanding of how reclamation can be improved
	  - There is uncertainty, but if the Government encourages research, experimentation and risk-taking, as well as encouraging companies to continue progressive reclamation, the outcomes can be positive

Respondent 9
 	
- Ecologist
- Aboriginal Consultant
- Formerly CEMA
	- **Establish regional reclamation planning and implementation**
	  - There needs to be more of a regional reclamation planning initiative, where, especially in the context of re-establishing capability to support exercise of Constitutional rights by Aboriginal people
	  - Right now there is no planning effort at all to think about that kind of stuff (re-establishing wildlife habitat, corridors across leases). All reclamation planning is done at the stand level
	- **Strengthen Aboriginal participation in AM reclamation planning**
	  - Scaling up planning requirements is something that needs to be done, and it needs to be done in a way that Aboriginal people are a part of the process. That they are at the table with the planners, writing the plan and doing it to recreate conditions for Aboriginal land use. That is not being done in any way by any company and they really need to do it better.
	  - The Aboriginal people [should] actually define and write the guidelines for how they want the companies to include them in the process

Respondent 10
 	
- Public researcher
	- **Apply learning, continually research to improve standards**
	  - I would like to see [the Government] commit more funding to research and have some mechanism in place where they can take contemporary research and put it into practice more quickly, but that is a bit challenging
	  - Everything I do is evidence-based. Right now, I am trying to produce evidence, I am trying to produce scientific evidence to change theory and to change practice
	- **Improve measurement standards and regulations around AM and reclamation**
	  - The approval system is good, but it doesn't really touch on how to measure these things, how to measure ecosystem function
	  - The Industrial partners and the Government keep saying 'we need easy indicators of success. Pass/fail, yes/no,' and I don't think that's true.I think we need complicated indicators

Respondent 11
 	
- Environmental Consultant
	- **Regulate timelines for reclamation**
	  - There needs to be prescribed timelines around reclamation. Today, there isn't any so a site could sit unreclaimed for eternity, I guess, or until someone acts or intervenes
	  - Whether it's five years, seven years, ten years, there needs to be something in place so [reclamation actions] are done in a timely manner. The longer it's left, the harder it is to do

Respondent 12
 	
- University professor
	- **Increase Government involvement in AM and reclamation**
	  - What the Government of Alberta needs to do is become more involved in the land reclamation process
	  - I don't think the Government is ready for this. I don't think the

- Former oil company employee	Government is focused on this
	- **Improve standards and regulations around AM and reclamation**
	  - Fundamentally the Government of AB has to change the way it regulations reclamation of oil sands mine sites. We have to change and that has not been something that has been discussed [in the Province] yet
	- **Independent third party is needed**
	  - I think having the AER as the agency responsible for reclamation in the Province is wrong. I don't think they have the capacity and professional backing to effectively do this job
	  - I think that's a mistake. The AER comes into questions when we talk about oil sands because it has been foisted on them by the Conservative government as a way to demonstrate that they were effective in their regulations
	- **Improve effectiveness of Aboriginal stakeholder participation**
	  - The processes are there for them, they are being effective in inputting to these reclamation plans as well as they can
	  - The availability of the process is there, but the effectiveness of the process is not
	- **Reduce industry strength/Improve standards and regulations/Balance Power**
	  - As a proponent, it was my job and I can say that there is fundamentally too much power in the system given to the proponent

Respondent 13
- Environmental Consultant
- Botanist
	- **Improve standards and regulations around AM and reclamation**
	  - Many times, research is done and then it is shelved because it is proprietary and it doesn't sort of fit with [industry's] idea of what should be done
	  - There are financial constraints put on reclamation because it doesn't pay shareholders
	  - The Government needs to improve the standards of reclamation and that's truly based on policy needs to follow the science and to a certain extent, the art of reclamation
	  - There have been huge developments and leaps forward. I think the Government could be faster and more responsive, more quickly to what's there and the science coming out of [AM research]
	- **Balance power**
	  - Shareholders don't live in the community. For the most part, they don't have any idea what's happening up there.
	  - I think what we really need to have is the Government look at what's available and say 'your approval depends on this'

Respondent 14
- Public Researcher
	- **Independent third party is needed**
	  - It relates to how fair and impartial and independent the AER is. When the AER weighs evidence, I'm not entirely convinced that they weigh it as fairly as they should
	  - Independent panels, like the Federal Government tends to use might be a better way of doing that. It is fundamentally a difference in view, and there are pros and cons [to each method of reviewing]

Respondent 15
- Alberta Government employee
	- **Apply learning, continually improve standards**
	  - We look at what is actually working, what research trails are actually looking like
	  - The Government of Alberta would develop new policy and direction to help operations with their reclamation planning, looking at what the current situation looks like and developing policy needed or just working with the industry and regulator on improving regulations or reclamation on sites, so practices fit the description
	- **Improve and continue participating with stakeholders**
	  - I think we need to be continually speaking with various stakeholders so we understand their needs for a post-closure landscape. We need to make sure we know what stakeholders want so we know what the back-end [of reclamation] looks like, what the outcomes are that they want

Respondent 16
- Métis Consultant
- Former
	- **Encourage and incorporate stakeholder participation/ideas**
	  - If the Government really wanted to get everybody on board, work with the communities and incorporate their suggestions
	  - Some companies have started to do this and some haven't
	- **Standardize AM processes and stakeholder participation**

CEMA	- There is no formal process and the Government isn't that involved - It's really a company coming in and talking to the community - Obviously it's a partnership role that none of the First Nations or Métis groups have enough opportunity to achieve. Right now, it's 'tell us what you want' and the [companies] get to pick what they can do and not do what they can't do. - **Balance power** - I think the only thing that is going to make a difference on the trajectory side is how much, I'll use the word power, that communities can achieve, either by the regulatory process, the exertion of rights or through research and reducing costs [of reclamation]

Appendix C

Interview and Follow-up Questions for Respondents

Figure C.1: Interview Guide Questions for personal and telephone interviews

1) What is your connection to the oil sands?
2) Why is reclamation of post-mining sites in the oil sands important to you?
3) What does Equivalent Land Capability mean to you?
4) Why do you think the Alberta Government uses the term Equivalent Land Capability for oil sands reclamation?
5) What is your desired outcome for reclamation in post-mining sites? Why?
6) What does active reclamation, adaptive management and sustainable development mean in the context of oil sands reclamation? Are you familiar with these terms? Why or why not?
7) Does reclamation return mined land to a previous ecological state? Why or why not?
8) In your opinion, does reclamation create equivalent land capability? Why or why not?
9) If reclamation cannot return sites to a previous ecological state, can you accept an altered or novel ecosystem as an outcome? Why or why not?
10) How can the Alberta Government improve reclamation to ensure better outcomes for stakeholders?

Figure C.2: Follow-up questions via e-mail, including e-mail message to respondent

Respondent,

Thank you for taking your time to speak with me as part of my Master's thesis research. Through the initial research, some additional research areas emerged that will be important for my final thesis. I would kindly ask you to respond to this brief document to provide additional information to the research project. This will be the last information that I require to complete my research.

By completing and sending this document to me, Clayton Gouin, you agree to have your comments used in my final thesis. All responses will be securely stored and used for the sole purpose of my final Master's thesis at the Norwegian University of Life Sciences (NMBU). No responses will be shared with any other individual, organization or research project. Should you wish to remain anonymous to your responses, please select that option on the next page.

Instructions

- Please write down your responses to each question you choose to answer on the next page.
- Use plain font, Times New Roman, size 12 font.
- Responses between 1-3 paragraphs will suffice per question.
- Please write your response immediately below the question you are answering.
- Once completed, please upload as either as a Word (.doc or .docx) or PDF (.pdf) document and e-mail to clayton.gouin@nmbu.no

Again, I would like to thank you for your time and contribution to my research. I sincerely appreciate your insight and your time.

Clayton Gouin
Master of International Environmental Studies (M-IES), 2017

NMBU

Questions

1) Do you wish to have your responses used anonymously? (Write Yes or No)

2) Do you think the Alberta Government communicates clearly and honestly enough with the Albertan (and/or Canadian) public that opportunities for companies to progressively/actively reclaim areas are limited while mines are in operation? Why or why not?

3) Adaptive management is described in two ways: active adaptive management, where management practices purposefully pursue learning and reducing uncertainty through management interventions or experiments, and passive adaptive management, where management practices focus on resource objectives, with learning or reducing uncertainty being an unintended consequence of a management practice.

4) a) Do you believe that the oil sands companies pursue 'active' or 'passive' adaptive management policies for oil sands reclamation? Why do you think this?

4) b) Are you familiar with the term 'ecological resilience/resiliency?' Yes or no. If yes, please describe your understanding of ecological resilience.

5) Do you think that reclaimed sites in the oil sands will be resilient ecosystems, able to tolerate natural disturbances (fire, floods, drought, etc.) and return to or retain their ecological functions? Why or why not?

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