

# Criteria and indicator framework for oil sands mine reclamation

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## Abstract

*The Government of Alberta has recently approved the recommendation from the Cumulative Environmental Management Association (CEMA) that reclamation certification in the oil sands region of northern Alberta be supported by a criteria and indicators framework. To support development of the framework, use and implementation approaches of reclamation criteria and indicators within four jurisdictions across North America were examined and analysed, synthesising common elements, differences and adaptive capability.*

*Results show that outcome-based criteria encourage innovations in reclamation techniques. Also, the use of criteria and indicators to inform reclamation certification decisions provides a higher level of credibility for decision makers, improves fairness between operators and increases certainty for the operator. Criteria and indicators remove the ambiguity between the operator and the regulator's interpretation of mine approval conditions that mandate specific reclamation outcomes, by establishing clear performance criteria, indicators and measurement methods.*

*In developing a framework, options must be considered for the setting of reclamation goals and objectives, the selection of criteria and indicators and for implementation approaches. Challenges need to be overcome by ensuring cooperation between the operator and regulator in determining how criteria and indicators will be used in the jurisdiction's legislative and regulatory environment.*

*Building adaptive management into the framework is important. New technologies and reclamation techniques will require the criteria and indicators to be refined over time. Changes to policy and/or regulation will require the rules defining the use of criteria and indicators to be updated, especially where they inform reclamation certification decisions.*

## 1 Introduction

A criteria and indicator framework is being developed by the Cumulative Environmental Management Association's (CEMA) Reclamation Working Group (RWG), including the concept for its use within the Alberta regulatory system. The criteria and indicator framework is intended to be used in support of decisions for oil sands mine reclamation certification readiness. The project goal is to recommend a populated framework and the rules for its use to the Alberta government by November 2012.

Approximately 640 square kilometres of 4,800 square kilometres of mineable oil sands area has been disturbed by oil sands mining as of December 2010, of which approximately 68 square kilometres is reclaimed (not certified) or is undergoing active reclamation (Alberta Government, 2011). Oil sands mines operate in close proximity to each other and share a common reclamation goal prescribed by government. A common reclamation certification criteria and indicator framework, developed in a collaborative manner between the operators, regulator and stakeholders will enable tracking and reporting of reclamation progress in a consistent manner.

### 1.1 Challenges

The challenges of implementing a criteria and indicator framework are primarily associated with development of processes and procedures that will work within a jurisdiction's regulatory environment. Some challenges related to Alberta are:

- Oil sands mine approvals are updated every ten years and the timing of renewals is staggered among the mines; implementing reclamation criteria through approval conditions increases the difficulty of establishing common criteria between the mines.

- The Government of Alberta (GOA) presently does not have a specific list or single document defining reclamation standards; however there are common oil sands mine approval clauses specifying numerical standards that must be met.
- Reclamation plans represent the means by which operators submit reclamation criteria, indicators and measurement methods for approval by the regulator. The performance criteria may or may not be similar between the mines, where the approval conditions or prescribed guideline documents do not specify thresholds, measures or methods.

These challenges are being addressed where possible within the development of the criteria and indicator framework and the concept for its use.

## 1.2 Opportunities

Alberta oil sands mines share a common reclamation goal established by government and implemented consistently through the mine approval.

Each operator independently defines reclamation objectives within their respective reclamation plan, which is submitted to government for approval. The criteria and indicator framework can benefit operators by:

- Defining common reclamation objectives for the goal.
- Establishing common reclamation criteria.
- Developing common indicators, measures, measurement methods and thresholds.

Duplicate effort by the operators on the development of reclamation objectives, criteria and indicators, where they are not stated in the mine approval conditions or prescribed guideline documents, can be significantly reduced. By establishing reclamation certification objectives and criteria in the framework, the operators can dedicate more of their effort on reclamation planning focused on design, techniques and technology to achieve the criteria.

The concept for criteria and indicator use can enhance the current regulatory approach by:

- Removing ambiguity from the interpretation of approval condition requirements.
- Improving upon fair treatment between operators.
- Creating a transparent process for the assessment of mine reclamation certification readiness.

Outcome based mine approval conditions, for example those requiring integration of reclaimed landforms, natural appearance, or self-sustainably are generally clear in intent, but not in how success will be measured. Taken to the extreme, these conditions may never be met. The framework will define the criteria and indicators linked to achieving these conditions, thereby establishing the performance measure, removing the ambiguity, debate and interpretation differences that abound. Fairness between operators is achieved because the performance metrics, defined by the criteria and indicators, are applied to all of the operators in a consistent manner.

## 2 Methodology

Qualitative research methods were used for the development of the criteria and indicator framework. Information from literature reviews, policy analysis, policy implementation means, processes for developing objectives and criteria, and decision processes for the use of reclamation criteria, was collected and synthesised.

In December 2009, the RWG produced a draft framework, described in the report *A Framework for Reclamation Certification Criteria and Indicators for Mineable Oil Sands* (Poscente, 2009). The report was approved by the CEMA board of directors and submitted to the Alberta government, along with recommendations related to the acceptance and further development of a criteria and indicator framework. The Alberta government replied in March 2010 stating, “*Alberta Environment agrees that the establishment of a framework for the development of reclamation certification criteria and indicators has benefits to stakeholders, Government and oil sands mine operators. Not only will such a framework provide*

*transparency to the process of assessment of reclamation outcomes at the time of certification, it will provide fair an equal treatment to all oil sands mine operators, and it will support assurance that long-term reclamation outcomes are being realized.”*

In March 2010 the Aquatic Sub-group (ASG) commissioned a report titled, *Process Assessment of Wetland Reclamation Criteria and Indicator Frameworks for Surface Mines* (Poscente, 2011) to examine processes in use by other jurisdictions for reclamation goal, objective and criteria development, including the means by which criteria and indicators are implemented within the respective regulatory environment. Literature reviews, mine reclamation site visits and interviews with regulators and operators were conducted. The focus of the project was on wetland reclamation, however the findings are being considered in the current RWG project to develop the *Framework for Reclamation Certification Criteria and Indicators for Mineable Oil Sands – Production of Content and Guidance for Use*.

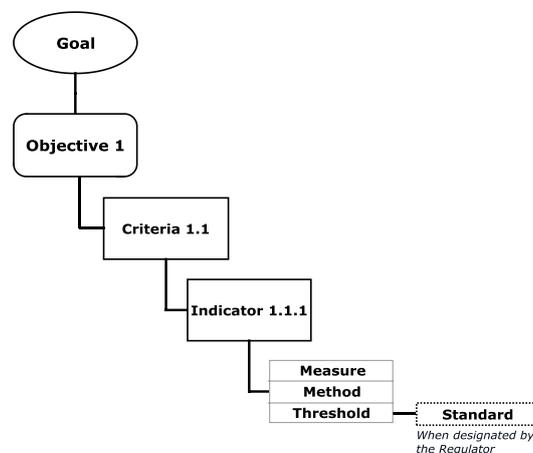
### 3 Results

#### 3.1 Criteria and indicator framework

The criteria and indicator framework was adapted from the Canadian Council of Forest Ministers (CCFM, 2011) criteria and indicator framework for managing Canada's progress in sustainable forest management. The CCFM framework was used as a foundation because:

- Previous CEMA recommendations suggested the CCFM approach (Welham and Robinson, 2006).
- The CCFM framework is a tested and proven process, implemented in 1995, updated in 2003 (demonstrating continuous improvement process) and having several published progress reports (tracked, documented and reported results).

The criteria and indicator framework (Figure 1) developed for the oil sands mines are based on a goal–objective–criteria–indicator hierarchy, with each indicator having a defined measure, method and threshold.



**Figure 1 Criteria and indicator framework for oil sands mine reclamation**

Definitions were adapted by the RWG during the development of *A Framework for Reclamation Certification and Indicators for Mineable Oil Sands* (Poscente, 2009) from those used for the CCFM framework:

- *Goal*: The final result or outcome toward which effort is directed.
- *Objective*: A purpose toward which a reclamation effort is directed.
- *Criteria*: (plural) A category of conditions or processes by which the achievement of a reclamation objective is assessed. A criterion (singular) is characterised by one or more related indicators which are used to determine success or to assess change over time.

- *Indicator*: An attribute which can be measured or described and used to evaluate if a criterion has been met.
- *Measure*: A qualitative or quantitative aspect of an indicator; a variable which can be measured (quantified) or described (qualitatively) and demonstrates either a trend in an indicator or whether or not a specific standard was met.
- *Method*: A description of a way, technique, process or procedure for attaining a measure.
- *Threshold*: The quantitative point which triggers an action or effect.
- *Standard*: A definite rule established by authority. Environmental standards often take the form of prescribed numerical values that must be met.

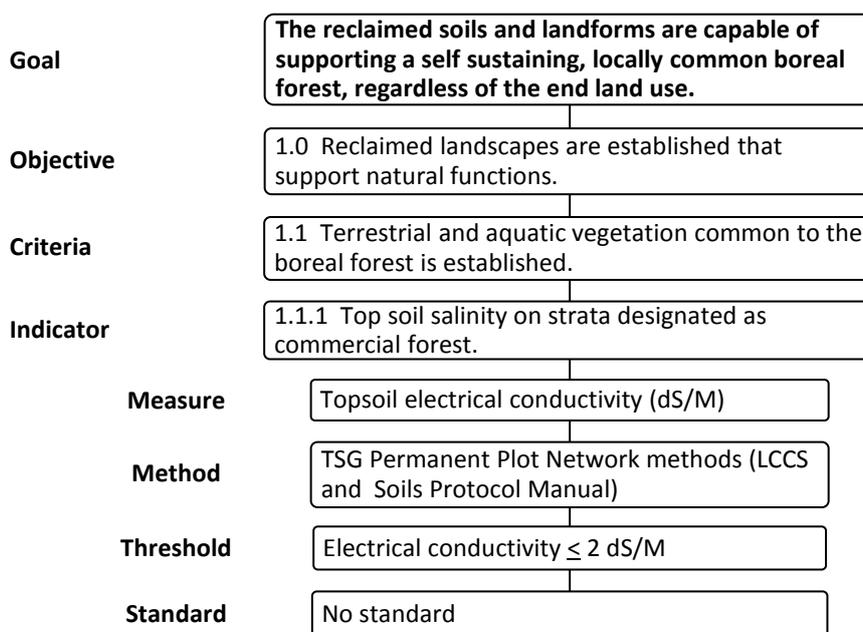
The regulator will not designate the threshold as a regulatory standard for each indicator. When a threshold designated as a standard cannot be achieved, the operator must obtain formal authorisation from the regulator for alternate approaches to be employed. When a threshold not designated as a standard cannot be achieved, the operator and regulator will collaborate on appropriate adaptive management responses, which often will be predetermined within the mine reclamation plan.

A common reclamation goal is prescribed by the Alberta government to all oil sands mines through the mine approval:

*“The approval holder shall reclaim the land so that the reclaimed soils and landforms are capable of supporting a self-sustaining, locally common boreal forest, regardless of the end land use”  
(Environmental Protection and Enhancement Act mine approval, Part 6, condition 6.1.6)*

The purpose of the framework is to establish common reclamation objectives, criteria and indicators applicable to all of the oil sands mines to support achievement of the goal. There may be additional reclamation goals established on a mine specific basis associated with an approved alternate end land use. In such cases it is the operator's responsibility to define the reclamation objectives, criteria and indicators for the alternate goal within their reclamation plan, for review and approval by the regulator.

Figure 2 represents an example of the framework using a criterion for the establishment of a commercial forest stand, which is a requirement on all Alberta oil sands mines.



**Figure 2 Example of a fully populated criterion and indicator with no designated standard**

### 3.2 Processes for implementation of criteria and indicators

The study of criteria and indicator implementation conducted by the ASG considered processes for deriving reclamation goals and objectives, processes to derive reclamation criteria, the management framework for implementing criteria (including the criteria used and monitoring requirements), and the adaptive management approaches employed (Poscente, 2011). Also considered was the impact of wetland conservation policy on surface mine reclamation in jurisdictions where it was in effect. A summary follows of the primary considerations resulting from the study and how they may influence the criteria and indicator framework being developed for the oil sands mines and the concept for its use.

#### 3.2.1 *Deriving reclamation goals, objectives and criteria*

In the four jurisdictions studied, land owners determined the end land use, except where wetland conservation policy required created wetlands to be a feature on the reclaimed site. On public land, returning the land capability to support naturally occurring and locally common ecotypes was a common reclamation theme. Multi-stakeholder input into reclamation goals, objectives and criteria occurred in three of the four case studies. Operators expressed difficulty in obtaining stakeholder input into reclamation goals, objectives and criteria early in the planning process and often had to manage stakeholder concerns after the reclamation work had commenced.

Oil sands mine development in Alberta is occurring on public land. The reclamation goal is prescribed by the regulator (the provincial Government). The regulator represents the land owner interest by defining the end land use, on behalf of the citizens of Alberta. Development of the reclamation objectives and criteria is being conducted in CEMA, a multi-stakeholder organisation with forty-four member organisations (CEMA, 2011). Benefits of this approach are that the CEMA stakeholders will have the opportunity to review, input and help develop the reclamation objectives and criteria. The operators will not have to engage stakeholders individually on development of the common objectives and criteria. Operators will continue to engage stakeholders through their reclamation planning process to identify and address site specific concerns.

#### 3.2.2 *Management framework for implementing criteria*

The jurisdictions studied did not have mine reclamation criteria established by regulation, other than very broad requirements, for example public safety or minimal off-site environmental impact. The reclamation plan was the primary tool for the operator to define the reclamation criteria and monitoring programme. Upon regulatory approval of the reclamation plan, the criteria are expected to be met, unless formal variances or plan amendments are approved. The exception was in jurisdictions having wetland conservation policy mandating compensation wetlands. In these cases there was a common suite of wetland criteria and monitoring requirements, established through regulation, and applied to all operators.

For the oil sands mines, an option is to develop the reclamation certification criteria and indicator framework as a stand-alone document, applied to all of the oil sands mines through a clause in the mine approval. Advantages to this approach include:

- Transparency – the public and stakeholders can be informed of the reclamation requirements without having to acquire and read through many planning documents from multiple mines.
- Fairness – the performance of all operators is based on the same criteria.
- Equality – all operators are treated equally by the regulator, even if there are multiple inspectors and technical reviewers.
- Certainty – operators know the thresholds to strive for at the time the work is being performed and can document that the work met the threshold in effect at the time the work was completed.

#### 3.2.3 *Adaptive management approaches*

Jurisdictions that require criteria to be defined within the reclamation plan, and incorporate routine evaluation schedules to update reclamation plans, tend to have the most adaptive and responsive performance criteria. In some cases updates to reclamation plans are done as frequently as every two or three years. Jurisdictions prescribing reclamation criteria through mine approval conditions can be somewhat adaptive

depending on whether there is a regular review period. Infrequent (e.g. 10 years) review periods of mine approvals are common, but may not be robust enough to stay current with policy changes, research findings or technological advancements. Jurisdictions with reclamation criteria prescribed by regulation were found to be the least adaptive in terms of continuous improvement and adaptation of criteria. The reason cited by regulators in interviews was because of the arduous process involved with regulatory changes.

An option for consideration in the oil sands criteria and indicator framework will be the inclusion of a sunset clause for review and update to reclamation objectives, criteria and indicators. Review periods of every 5 years would ensure that the framework reflects new research results and that criteria and indicators developed and approved since the last update are populated in the updated version.

### **3.2.4 Wetland conservation policy**

Wetland compensation policy can have a significant impact on surface mine reclamation. Locating and securing land for wetland compensation is a critical challenge, especially when the compensation wetlands must be constructed prior to, or concurrent with the mine disturbance. In such cases jurisdictions must have wetland banking policies or compensation payment options in place so operators can proceed with their development. Integrating wetland compensation into the reclamation plans is a practical approach; however the application of wetland compensation ratios can have a negative impact on desired end land uses. For example, on mines with small footprints, wetland reclamation at ratios of up to 3:1 created wetland to pre-disturbance wetland area can conflict with planned end land uses, especially on private land.

Currently Alberta has no wetland policy in effect for forested public land (green zone), on which the oil sands mines occupy. Oil sands mines are required to develop a wetland reclamation plan, inclusive of performance criteria and a monitoring programme, as an approval condition. The criteria and indicator framework being developed will include criteria and indicators for assessing wetland reclamation. The framework will not establish area based criteria for wetland reclamation. Each operator will continue to propose the type and area of wetland creation in their reclamation plan.

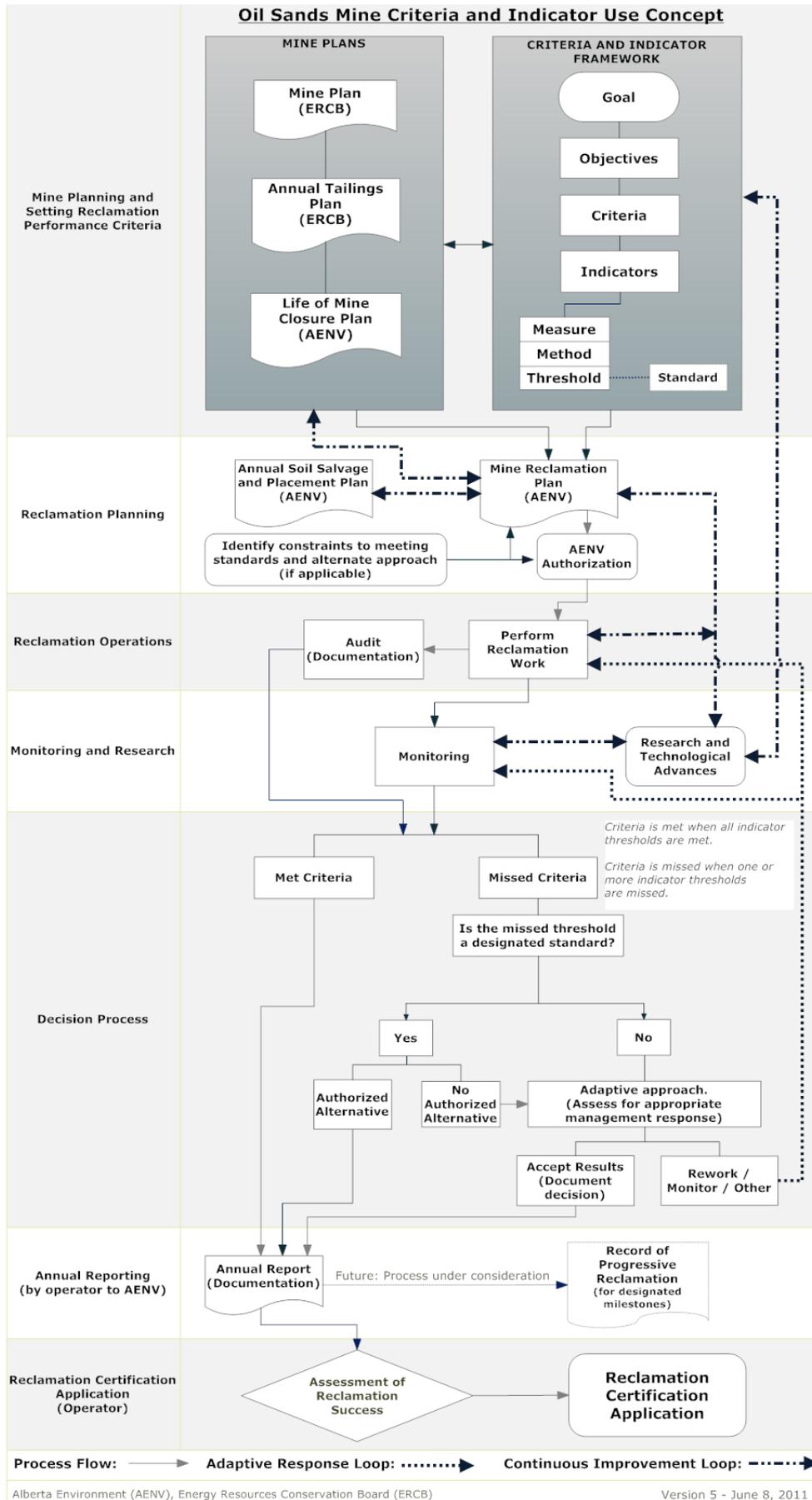
## **3.3 Concept for use**

The concept for the use of the criteria and indicator framework (Figure 3) is under early stages of development and will be subject to changes. Information in this section is presented as an example only, to demonstrate the how the work conducted by the ASG on process assessment of wetland reclamation criteria and indicator frameworks for surface mines was incorporated into the draft framework. The work conducted by the Australian Centre for Minerals Extension and Research on developing completion criteria for native ecosystem reconstruction (Nichols, 2005) was also a strong influence, especially for considering methods by which to implement adaptive management responses when thresholds are not achieved.

The concept for use has seven stages, each having distinct process elements and process flows:

1. Mine Planning and Reclamation Performance Criteria.
2. Reclamation Planning.
3. Reclamation Operations.
4. Monitoring and Research.
5. Decision Process.
6. Annual Reporting.
7. Reclamation Certification Application.

The framework has two adaptation loops. One is an adaptive management response, used when inspection or monitoring reveals that an indicator has not been met, or is not on a favourable trend. The second is a continuous improvement loop, which supports regular updates to the framework, mine plans, reclamation plans and research and development programmes, so they all remain current and valid.



**Figure 3 Draft criteria and indicator use concept for the oil sands mines**

A key concept is the alignment between the mine plans and the criteria and indicator framework, and their relationship to the reclamation plan. The intent is that the reclamation plan brings the higher level plan concepts into reality by detailing the spatial distribution and area of planned ecotypes and describes the sequencing, methods and technologies that will be used to achieve the reclamation criteria.

## 4 Conclusions

Best practices for applying reclamation criteria are not all directly transferable between jurisdictions. Local legislation, policy and regulation nuances often determine the approaches that can be used and the management system constraints that may be encountered.

Key considerations for developing a criteria and indicator management system for reclamation include:

- Adaptation:
  - An adaptive approach to continuously improve upon established reclamation objectives, criteria and indicators within a management framework is critical. New technologies, reclamation techniques and policy changes will require updating and improvement of the framework on a regular basis.
- Rules:
  - Criteria and indicators are used to inform decisions on the readiness of a site for reclamation certification. Rules and procedures are essential to describe how criteria and indicators will be used for this purpose. Rules are especially important to differentiate the response required for missing a threshold versus standard. For example, a standard must be met unless an authorisation is obtained granting an alternate approach. Not achieving a threshold will require collaboration between the operator and regulator and sound professional judgement to decide upon a management response. Such processes will need to be established.
- Approval conditions:
  - The ambiguity of some approval conditions and the interpretation differences that arise between the regular and the operator can be mitigated by applying criteria and indicators. This is especially so for mine approval conditions that mandate reclamation outcomes, such as self-sustainability, but have no defined measures, methods or thresholds to define success.

Using criteria and indicators to inform reclamation certification decisions increases the credibility and defensibility of the reclamation certification decision. Equality between operators is improved because they all must comply with the same criteria towards achieving a common reclamation goal. Operational certainty increases for the operators, by clearly defining reclamation certification requirements.

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