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Reclamation and Restoration Plan Development

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Introduction

The site-specific data gathered throughout the life cycle of an upstream facility provides the basis for the integrated environmental management principles commonly applied for the reclamation of upstream facilities. The site-specific management often involves multi-disciplinary approaches that are carried out by qualified professionals. The rehabilitation of disturbed natural landscapes relies on planning and technology that consider ecological processes at numerous time and spatial scales.

Historical site-specific information for upstream facilities constructed after June 1, 2007 likely includes the Conservation and Reclamation Plan along with pre-disturbance assessment, construction and operation diagrams and progressive reclamation. As minimum disturbance has long been advocated for natural landscapes, the planning for the final reclamation would involve the rehabilitation of production facilities within a partially reclaimed wellsite area.

The development of a reclamation plan for old facilities uses the information gathered from the desktop review and ground reconnaissance. Although site-specific in nature, the reclamation plan will contain the framework for the re-establishment of drainage and vegetation. Basic reclamation plan components include:

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Equipment requirements

- Fill removal
 - Presence of graded access, pad, production teardrop will necessitate heavy equipment to remove and transport
 - Location(s) for disposal/use will usually be within the vicinity although associated borrow areas are often kept in place
 - Borrow pits are source of water used by wildlife and firefighting operations
 - Long access may feature more than one borrow pit
 - Fill may have been taken from high grounds/hills nearby
 - Cuts will be present along the forest floor
 - Amount of fill to re-contour and distance to move the mineral soil will determine type and size of equipment needed
 - Large excavator (300+)
 - D-8
 - Box trucks to effectively haul fill long distances to disposal/use areas
 - De-compaction equipment
 - Stripped sites will necessitate de-compaction of the surface horizon prior to subsoil redistribution
 - Bulldozer-pulled sub-soiler
 - Excavator-mounted sub-soiling grapple rake or chuck blade
 - Padded areas will require de-compaction once the mineral fill is removed
 - Soil volume to move and push
 - Stripped sites may have large sub and surface soil piles that will require loosening and distribution over the de-compacted area
 - Volume to loosen, distance to push soils and total area to re-contour will determine the size of the bulldozer and excavator needed to complete the reclamation work
 - Soil preparation
 - Highly compacted subsoil are commonly loosen with tractor-mounted rotospike or rotovator after distribution to reduce coarse fragment content
 - The reclaimed surface may also benefit from 1 or 2 passes of the soil preparation implement to mitigate potential compaction from contour reconstruction
 - A competent practitioner will monitor the results from the rotospike or rotovator implement to ensure that soils are not pulverized in the surface preparation process
 - Woody debris and slash distribution
 - Woody debris is often associated with upstream facilities constructed on forested lands

- Use of organic debris in final surface preparation may entail the use of another excavator implement to move and distribute if significant debris volume is present
- Re-vegetation strategies
 - Site-specific requirements will dictate equipment and supplies needs
 - Specialised equipment to harvest biological resources essential to the rehabilitation of ecosystem function
 - Specialised equipment to build propagation beds for endemic plant species
 - Access may limit the use of motorised equipment such as quad and quad-mounted implements

Access

- Distance to move equipment and biological resources, if required
 - Mobilisation logistics
 - Ground travel versus air travel
 - Mode of transportation will be based on the size of the equipment needed to complete the reclamation work
 - Use of heavy equipment requires access mapping to identify water crossings and other ecological sensitive features along the access to the facility
 - Small soil volume pushing and re-contouring may be achieved with heli-portable equipment when biological resources are present within proximity
 - Personnel
 - Long-term reclamation work necessitates planning for personnel accommodation
 - Daily access to and from site
 - Distance to accommodation

Seasonal Timing

- Remote sites or proximity to ecologically sensitive landscapes
 - Winter access
 - Ground transport
 - Site access may be restricted to winter roads and frozen seismic lines in muskeg areas
 - Site within active fields may be accessible via graded roads
 - May require road use agreement
 - Movement of heavy equipment may be restricted by road bans
 - Site within inactive/low producing fields may be partly accessed through graded roads

- May have to be reached by walking heavy equipment through seismic lines accessible only in winter if short distance and no water crossings. ASRD and right-of-ways (RoW's) licensee approvals will be required for any use of non LOC access.
 - Use of heavy equipment may necessitate snow clearing if site is remote and within inactive field/area
 - May be able to walk heavy equipment short distance if water crossings are not present along the access
 - Cost allocations are made to account for snow filling when water crossings are present along access to facility
 - Winter reclamation usually requires heavy equipment to decompact, move and work frozen soils
 - Daily travel to and from sites
 - Summer/fall access
 - Ground transport
 - Feasible when graded access still in place
 - Sites located within producing fields may be partially accessible via graded roads
 - May be able to walk heavy equipment under dry conditions
 - Smaller scale disturbance may be reclaimed with heli-portable equipment
 - Limited soil pushing and re-contouring capabilities
 - May be cost efficient in comparison to opening ground access in winter
 - Smaller equipment results in minimum disturbance of desirable site and/or vegetation features

Re-vegetation strategies

- Construction dates will be considered prior to re-vegetation plan formulation
 - Sites constructed before April 30, 1994 until June 1, 2007 and abandoned prior to June 1, 2007 -both downhole and surface- are not required to comply with the 2010 Criteria vegetation parameters
 - If these upstream facilities were abandoned after June 1, 2007, they need to comply with the vegetation parameters
 - Sites constructed after June 1, 2007 are required to comply with all parameters outlined by the 2010 Criteria
- Agreements with FMA holders
 - Timber damage assessment funds may be used to reforest upstream facilities within FMA's, depending on working relationships
 - Site preparation is often needed prior to tree planting

- FMA holders employ silviculture forester(s) who specialise in tree stand establishment
 - Vast local knowledge is available through FMA holders
 - Seed zones
 - Ecological features
 - Macro and micro-scale components
 - Access
 - Soil preparation
 - Tree planting
- Vegetation establishment plan
 - Geographic location of disturbance and surrounding vegetation type indicates the target species for vegetation establishment
 - Compatible layers
 - Herbaceous: non-allelopathic species, endemic as opposed to agronomic species utilisation
 - Woody: tree species with compatible genetic component
- Seasonal Timing
 - Species-specific requirements
 - Planting window for softwood species
 - Harvesting of local propagules or live cuttings
 - Propagation techniques using dormant cuttings
 - Access
 - Equipment, personnel and supplies

Depending on the scope of work, the reclamation plan may involve several disciplines. The delivery of reclamation outcomes is usually the responsibility of the coordinating professional. This individual has to recognize the need for professional input when required. The key strategy in the implementation and completion of the reclamation plan is to ensure that there are no site deficiencies likely to arise from rehabilitation work. This include BMP's that mitigate subsidence often seen when sites are reclaimed in the winter.

Details on reclamation plan development can be found in the [Plan Development body of knowledge](#)