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## An unconventional re-vegetation plan for remediation of an Orphan Base Metal Mine in Ontario

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The Kam Kotia mine site is a large and technically challenging site, with difficult growing conditions, a short growing season and limited commercial availability of appropriate plant species. The site presents many challenges to plant establishment, growth and reproduction. These include desiccating winds, extremely acidic soils (~2.5 pH), elevated levels of plant bioavailable metals in the growing medium (i.e. subsoils), lack of soil, short growing season and infertile sub-soils.

It was inadvisable to attempt to re-vegetate the entire site in a single season; as it would not result in a long-term sustainable vegetation cover. Subdividing each area of the site into smaller re-vegetation units is proposed in order to make re-vegetation financially and logistically feasible, resulting in:

- Minimal risk of failure due to extreme weather events by distributing re-vegetation actions over multiple growing seasons.
- Incremental annual gains in terms of the overall vegetated area.
- Documentation of re-vegetation actions taken and results achieved.
- Greater re-vegetation efficiency through refinement of re-vegetation timing and techniques.

By taking an incremental approach, small trial test plots will reduce the risk associated with large scale re-vegetation techniques, which have not been successful at Kam Kotia. This approach allows for re-vegetation successes to be amplified once they have demonstrated their efficacy.

The achievement of a long term sustainable vegetation cover at the Kam Kotia mine site will depend on proper site preparation, high quality plant materials, correct timing of seeding, planting, monitoring and incremental actions. Custom collection of seed and plant materials from native species at and surrounding the mine site is a vital component of re-vegetation efforts. Some of the most suitable species for re-vegetation are not commercially available and thus must be collected.

Re-vegetation at Kam Kotia will take place over 5-10 years as funds become available to pay for reclamation activities. The activities required to achieve a sustainable vegetation cover will be undertaken incrementally over a period of several years. The proposed approach has been designed with this concept in mind. Expectations for site re-vegetation must take into consideration the extent and severity of site-specific factors, which currently limit or prevent plant establishment, growth and reproduction. The climate at Kam Kotia presents unique challenges to re-vegetation as it has a very short growing season with only 89 frost free days per year and long cold winters. The native perennial plants growing at Kam Kotia are characterized as being very slow growing for the first few years of their life.

Money invested into site characterization, site preparation, native plant materials and long term monitoring will provide greater long-term success with minimal increased upfront costs. Native species are preferred for the following reasons:

- They are slow to establish but they get stronger with time and permit infill of other native species.
- Non-native agronomic mixes typically start strong and either fade out or become so invasive that they prevent infiltration of native plants.

Some native species observed to be colonizing the site are commercially available as seed. A concurrent study has been undertaken to identify beneficial mycorrhizal fungi to assist plant growth for the remediation of the site.

