BOTANIC GARDENS & PARKS AUTHORITY

KINGS PARK AND BOTANIC GARDEN • BOLD PARK

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Wayne Ennor
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Dear Wayne

EXECUTIVE SUMMARY

We are pleased to provide you with the attached Executive Summary of the research being undertaken by our scientists for the "Restoration Research Plan Sinosteel Midwest Corporation Limited: Koolanooka, Blue Hills and Weld Range exploration lines" project.

Yours sincerely

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EXECUTIVE SUMMARY
September 2014

"Restoration Research Plan Sinosteel Midwest Corporation Limited: Koolanooka, Blue Hills and Weld Range exploration lines"

A demonstrated framework

Restoration is faced with many challenges in Biodiverse ecosystems and includes temporal and spatial resource issues. Because of this, restoration practices informed by scientific programs have proven to be successful in achieving the highest quality restoration in Western Australia. For example the research by Botanic Gardens and Parks Authority (BGPA) with Rocla Quarry Products has established a framework to deliver biodiverse restoration of Banksia woodland and is a prime example of what can be achieved. Research and technology development across a diverse spectrum including an analysis of reconstructed soil profiles; soil seed bank stripping, storage and return; direct seeding technology; aerosol smoke application, and; strategic greenstock planting, now allows Rocla to return one of the highest levels of species and plant replacement per unit area (100 plants/5m^2) in the resources sector. This framework and the principles within it are not specific to Banksia woodland restoration and can be applied more generally to mining projects requiring restoration.

It is with this approach that restoration is currently being undertaken at Sinosteel Midwest Corporation Limited's (SMC) operations (both at Koolanooka and Blue Hills). After three years, significant advancement has occurred and although some challenges still exist it is thought these will be readily overcome provided the framework is followed.

Advantages of small scale operations

The most significant issue with mine site restoration is how to achieve biodiverse outcomes across large areas. This is the issue that is currently facing miners in the Pilbara region of Western Australia (EPA report reference here) that are currently facing square kilometre (10,000 ha's) scale restoration deficits. Large scale restoration requires a large amount of restoration resource (predominantly topsoil and seed), which is predominantly limited across operations. For smaller scale operations (hectare scale) the collection and storage of valuable restoration resources is manageable, as demonstrated by leading mine site restoration practitioners Alcoa and Rocla Quarry Products.

Upon completion of mining at SMC a total of 103 ha at Koolanooka and 107 ha at Blue Hills Mungada East and West have been identified as requiring restoration. This total of ~200 ha's is staged to occur over 7 years resulting in approximately 20-30 ha of restoration to be undertaken annually (a similar scale to the successful restoration operations above).

Advantages of short-timeframe operations

Operations that have short time frames between disturbance and restoration have many advantages over those with long time-frames. This predominantly relates to restoration resource availability, specifically topsoil. In many systems topsoil provides ~85% of the floral biodiversity, provided it is handled appropriately. Direct return of topsoil from cleared to restored sites results in biodiverse outcomes being optimised. Any significant storage of topsoil may result in degradation of the resource and therefore other supplementary restoration practices (sowing seed and planting greenstock) must be undertaken to ensure biodiversity targets are reached.

The short-timeframes of operations at booth Koolanooka (3 years) and Blue Hills (2 years) has allowed direct return of topsoil in some restoration areas as well as and where required topsoil has been stored for a minimal time before use in restoration. This is likely to maximise this resource across SMC's operations. Where topsoil has been stored research is being undertaken to quantify the impact of this practice and to understand the scale of supplementary restoration required to achieve targets.

Smaller scale operations provide additional opportunities to more intensely manage restoration. For example SMC understood the risk of variable and drying environments on restoration success and therefore invested in developing the state's first restoration controlled environment facility. This allowed various rainfall scenarios to be applied to restoration best practice to understand implication for biodiversity outcomes. Outcomes highlighted that by applying mean annual rainfall to sites increased seedling emergence 6-fold compared to the below average ambient conditions received over the past two years. If the application of mean rainfall in the first year establishes an appropriate trajectory for restoration then SMC will undertake investigate supplementary irrigation to provide suitable establishment niches for plants.

Well defined and achievable targets

The focus of all restoration programs is on achieving well defined targets which form the basis of robust completion criteria. SMC along with Kings Park have defined restoration targets as guided by the EPA (70% target). The outcomes of this analysis have resulted in the following targets: Koolanooka – target of 59 species to be restored to the TEC offset area with a mean species richness of ~29 species/quadrat (20 m x 20 m plot; Blue Hills target of 59 species to be restored with a mean species richness of 15 at Mungada East and 17 at Mungada West (per 20m x 20m quadrat). Plant density data is incomplete with plant density information only available for most perennial species at Koolanooka. Vegetation surveys will need to be undertaken at Blue Hills to establish plant density targets for restoration.

Significant progress towards restoration success

The following dot points highlight the progress to date in achieving restoration success at SMC's operations.

- Overcoming a topsoil deficit – With topsoil being at a premium research at SMC sites has highlighted that topsoil can be mixed with rock to cover a larger area as the addition of rock to topsoil (topsoil + rock) had no negative impact on emergence. However, the addition of rock should be made with care as it could

significantly increase runoff rates on slopes as it decreased infiltration rates in rainfall simulation experiments.

- Success in germination solutions - Kings Park has tested 61 species for seed quality and germination. Of these only 3 have germination issues that are unresolved.
- Plant growth medium solutions - Cross ripping has been demonstrated to improve soil properties at SMC operations. In heavily compacted areas ripping increases water infiltration relative to non-ripping treatments. Ripping is necessary even with the addition of topsoil. Selection of substrates is critical with seedling emergence from broadcast seed being significantly lower in "fines – substrate" than topsoil and topsoil + rock substrates.

Challenges ahead

- Seed collections are limited – to date Kings Park has only tested 22 species from the TEC offset target species list (34 collected in total) and 21 species from Blue Hills. In addition the quantity of seed collected is likely to be insufficient for most species for restoring species at required plant densities. Therefore only 13 species have had adequate numbers of seed for field trials (testing specific restoration substrate requirements) by Kings Park. SMC is undertaking a significant and more focussed seed collection program to ensure sufficient seed is available for restoration programs in 2015/16 at all sites. To improve seed availability it is recommended to test the effectiveness of seed farming by using irrigation to improve seed production of vegetation in undisturbed vegetation and/or irrigation of rehabilitation sites.
- Due to difficulty in acquiring adequate seed for some species and/or difficulties in germination, Kings Park has identified species to be tested for suitability for greenstock propagated from seed and/or cuttings. Field trials are planned in 2015 at the Koolanooka TEC offset area to test the suitability of greenstock as a method of vegetation restoration.
- As above SMC have highlighted that low winter rainfall has resulted in very low seedling emergence from seed sown in field trials. The requirement to ensure water is not limiting in the first years of establishment may need to be addressed by SMC operations with supplementary irrigation.

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