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REM vis-à-vis Conventional Methods

The original research leading to the development of Riley Encased Methodology® (REM) was first published in 1995. The principles of the methodology remain the foundation of mangrove.org® coastal mangrove reforestation programs; however, the processes, technology, tools, specifications and procedures are under continuous process improvement. REM introduced an innovative approach that set a new paradigm vis-à-vis conventional methods.

Conventional approaches fall into 3 distinct Classes:

Class 1: Direct planting methods, such as transplanting, container and cluster planting, etc.
Class 2: Use of wave breaks, planters or other physical barriers.
Class 3: Modification of the topography and hydrology by changing land contours and surface features through excavation to allow mangroves to naturally regenerate or be planted by Class 1 approaches.

All conventional Classes attempt mangrove planting within the natural biological limits of the plant's physiology. These limits prevent conventional approaches from successfully addressing many critical applications, particularly along high-energy shorelines, areas where anthropogenic influences have modified the topography/hydrology and habitats degraded or destroyed by development or inclement weather events.

Processes and procedures of the methodology enable successful mangrove reforestation, even in extreme environmental settings, through the principles of Isolation and Adaptation. REM isolates propagules into a controlled environment that is favorable to their long-term development. REM Adaptation is defined as induced changes in morphology or structure that habituate the mangrove to a non-native environment or aberrant hydrology establishing reproductively mature trees where natural regeneration cannot occur and conventional planting methods are dysfunctional or ineffective.

REM is a cost effective solution in sustainable practice and on-site mitigation of the environmental impacts that results from coastal urbanization and overexploitation. In areas where littoral vegetation has been replaced with bulkhead, seawall or revetment, the methodology has been utilized to successfully create habitat and restore ecological function. The applications of REM in shoreline stabilization and erosion control are well established.

Development Life Cycle

The process of invention or innovation can be characterized by referring to a development life cycle. We characterize the development life cycle process as going through seven specific phases:

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1) Research
2) Conceptual Design
3) Proof-of-Concept
4) Field Trials
5) Implementation
6) Feedback
7) Design/Technology Update

Riley Encased Methodology® is currently maturing within this cycle and is in-process at phases five through seven (Implementation - Feedback - Update of the Design/Technology). Subsequent to the early phases encompassing Research, Conceptual Design, Proof-Of-Concept and Field Trials, multiple stages of the cycle may be active at any given time.

Our work in Continuous Process Improvement is a proactive effort to discover and amend deficiency in the methodology, thus ensuring positive long-term outcomes in a wide range of applications. This has been accomplished by using an incremental improvement strategy, which has resulted in numerous fundamental or breakthrough discoveries over time.

Functional and Non-functional Requirements

The future development of Riley Encased Methodology® and the integrated technology is controlled by both functional and non-functional requirements.

Functional requirements are observable tasks or processes that must be performed by the system or technology being developed. For example, a functional requirement of REM is for the encasement device to be a temporary structure that can be removed from the environment at the conclusion of a self-regulated adaptation process without damage to the tree.

Non-functional requirements are qualitative standards that the system or technology under development must comply with, but which are typically neither quantitative nor apparent from observation. An example of a non-functional requirement is an encasement device designed to be efficiently manufactured.

It is important to note that both types of requirements always exist in technological development projects regardless of the approach or methods implemented. Any “methodology” should provide theoretical justifications for the approach and help identify, document, and realize the derived requirements.

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Chronology

The current principles of Riley Encased Methodology® were first published in 1999; however, the Proof-Of-Concept phase was based on technology that has been made obsolete by ensuing innovation. The 1999 publication summarized empirical evidence and documented field trials implemented with encasements made from standard ASTM-2241 PVC, which due to subsequent redesign have been superseded. However, the principles of the methodology as defined by REM 1999 remain constant in all reforestation applications and the foundation for current process improvement.

In 2003, efforts began to focus on an encasement device that would fundamentally change the tools of the methodology. Updates to the methodology incorporated in REM 2005 included a major advancement in engineering and manufacturing of a cylindrical encasement device. Manufacture of the new device enabled control of critical properties and specifications including material formulation, pigmentation, opacity, etc. Through continuous process improvement the original encasement was reengineered to optimize and significantly accelerate plant development in conjunction with the self-regulated adaptation process. Concurrently, new mathematical functions were derived from empirical evidence in order to analyze and model site hydrology.

As a result of continuous process improvement, further design innovations in REM 2007 enabled the entire encasement to be removed from the environment at completion of the adaptation process without damage to the tree. Specialized elements of the redesign made the device a temporary structure and eliminated any potential future impact of the encasement on the surrounding ecosystem.

The current state-of-the-technology, as specified by REM 2010 methodology, includes processes pioneered in phototropism/thigmotropism/stereotropism that promote plant development and facilitate the adaptation process. Hydrology and elevations are optimized in the current release based on a proprietary integral function applied in quantitative analysis of tidal harmonics (sinusoidal components, amplitudes and frequencies). This integral function is valid for diurnal, semi-diurnal and mixed as-well-as mega tidal environments.

Our dedication to R&D, continuous process improvement and technological innovation will ensure that mangrove.org® maintains a leading-edge position in coastal reforestation and sustainable development technology. (Patents 8,181,386 & 8,333,032)

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