

**A review of soil and soft-scape material management as a sustainable
Intervention for the execution of landscape in residential projects of Pune.**

**Una revisión de la gestión de suelos y materiales de paisaje blando como una
estrategia sostenible intervención para la ejecución de paisaje en proyectos
residenciales de Pune.**

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ABSTRACT

Landscape is an integral part of today's urban residential projects. As far as Pune is concerned, it has seen a rapid rise in the number of residential projects over the last decade. In many of these residential projects, landscape development is done either by landscape architects or by architects. Overall, development takes place over two to three years and landscape development is done at the end of projects. Further investigation by interviews and field observations carried out during this research process pointed out many issues in the planning and execution stage of the project. Issues observed in the execution stage were mostly related to natural materials like soil, plants and water. These are precious resources for landscape projects and their loss is not measurable in terms of money. Also, they are difficult to replenish. Improper planning w.r.t. project timeline is also responsible for wastage of topsoil and plants. This identifies the need for management during the execution of landscape. Thus, this paper aims to review the need of Soil and soft scape material management-plan as a tool for sustainable, economic and season-wise scheduled landscape development in residential projects as per construction management principles.

Key words: Landscape, Material management, Execution, Sustainable, Soil, Water, Plant material.

RESUMEN

El paisaje es una parte integral de los proyectos residenciales urbanos de hoy. En lo que respecta a Pune, ha visto un rápido aumento en el número de proyectos residenciales durante la última década. En muchos de estos proyectos residenciales, el desarrollo del paisaje lo realizan arquitectos paisajistas o arquitectos. En general, el desarrollo se lleva a cabo durante dos o tres años y el desarrollo del paisaje se realiza al final de los proyectos. La investigación adicional mediante entrevistas y observaciones de campo realizadas durante este proceso de investigación señaló muchos problemas en la etapa de planificación y ejecución del proyecto. Los problemas observados en la etapa de ejecución estaban relacionados principalmente con materiales naturales como suelo, plantas y agua. Estos son recursos preciosos para proyectos de paisaje y su pérdida no se puede medir en términos de dinero. Además, son difíciles de reponer. Planificación inadecuada w.r.t. El cronograma del proyecto también es responsable del desperdicio de tierra vegetal y plantas. Esto identifica la necesidad de gestión durante la ejecución del paisaje. Por lo tanto, este documento tiene como objetivo revisar la necesidad de un plan de gestión de suelos y materiales blandos como una herramienta para el desarrollo del paisaje sostenible, económico y estacionalmente programado en proyectos residenciales según los principios de gestión de la construcción.

Palabras clave: Paisaje, Gestión de materiales, Ejecución, Sostenible, Suelo, Agua, Material vegetal.

INTRODUCTION

The scope of this paper includes two important natural materials of the landscape, viz, soil and plants. Natural soil takes 100 years for formation. It is a naturally available material on site, which is required during the entire execution of a landscape project as a medium for plant growth. This precious natural material can't be replenished and thus needs to be conserved. Trees and native plantations are part of the ecosystem of a particular site. Replacing these plant materials with another plant material, which is less sturdy, high on water demand like lawn and which is non-productive but aesthetical, is a trend observed in residential landscape projects. So, in order to maintain the ecological quality of a project, preservation of plant materials is a must. In addition to this, management of water to sustain the development of the landscape is also essential. In Pune, during four months of rain, enough water is easily available for landscape development. Pre-execution planning is required though to reach a certain stage before the start of rain. While planning, reducing the water demand and reuse of waste water is also the need of the hour. Especially in the maintenance stage of a project, its unavailability can increase the cost or can simply affect the entire landscape development done. This research is limited to only natural materials and their management as landscape construction and materials required for that are similar to those used for building construction. And the same team executes the landscape construction, thus the process of execution is quite streamlined. On the other hand, in many residential landscape projects there is no dedicated landscape execution team available. During the project phase of 3-4 years, the landscape takes place at the end of a project; it's often executed in a hurry and unsustainable way. Material procurement is unplanned. Thus, management is required for natural materials more than that of construction materials of landscape. Thus, this research paper aims to recommend strategies for conservation of topsoil and plant material in order to have sustainable landscape development.

MATERIAL AND METHODS

In order to study different project stages and execution of landscape, ten projects were chosen as case studies. All these projects were located within 18-25 km from Pune and they have a land area around 10-30 Acre. A Typical execution of residential landscape project occurs in 3 different Phases namely,

The below three phases are generally spread from the start to the end of a construction project. It's observed that linking of landscape and construction activities is not done. Execution of landscape as per availability of rain is neither worked out. Both of these are important interventions for sustainable landscape development.

Qualitative Analysis of project execution phase based on interviews:






Figure 1 Bar chart qualitative analysis of landscape execution phase, Source: Author

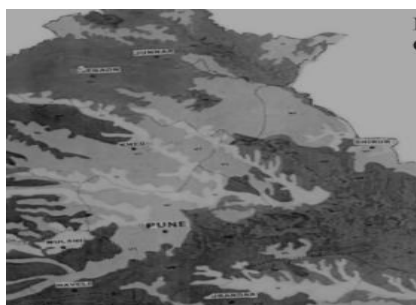
Based on interviews of landscape architects, Horticulturists, Project managers for 10 different projects following findings were observed.1 in some cases, appointment of a landscape architect was done after construction started. In eighty % of projects, Site inventory was missing. This caused damage to existing trees on site and

topsoil being transported to landfills. 2 Pre-execution planning and protection of landscape areas were not done in 70 % of projects, which resulted in soil pollution. This soil was later on replaced with procured soil .3 dedicated landscape execution teams were missing in 70% projects. This showed overall negligence towards landscape development.4Lack of landscape management observed in 80% of projects.

Table 1: Residential landscape project phases, Source: Author, Image 1, 2, 3, Source: Author

Sr. No.	Location in Master plan Different factors	Near site office	Boundary /Road Plantation	Landscape in open space
				
1	Design intent	Temporary aesthetical value To attract customers.	Shade/for compliance of Sanctioning norms	Active/passive landscape in a 10% area of the site.
2	Time of Execution	At the beginning of construction project	Along with construction project/After Completion of Construction	After completion of construction activity and during the finishing stage of the project.
3	Quality of soil required	1) The required quantity of soil is less. 2) Existing soil can be used.	1) Fertile soil is required. But generally on site soil, used. 2) Manure is used to increase fertility.	1) Existing top soil replaced with fertile imported soil. 2) Lawn requires large quantity of fertile soil.
4	Procurement of plants	Imported from nursery	Existing trees are cut down and replaced by trees procured from nurseries	Imported from nursery
5	Maintenance required for landscape	Needs to be maintained throughout project	Needs to be maintained forever.	It needs to be retained and maintained after completion of project

NEED AND IMPORTANCE OF SOIL MANAGEMENT:



Good quality soil
 Poor quality soil
 Very good quality soil

Image 4, soil map Source: Krishi.Maharashtra.gov.in Image 5 soil pollution Source: by Author

Since it's easily available on site, this soil is suitable for trees and shrubs, whereas for ground cover, lawns etc. Red fertile soil is required, which is procured from the Mulshi area. This highlights the need of Staking of soil for future use as well as adapting to suitable plant material as per available soil on site.

ADVANTAGES OF TOPSOIL PRESERVATION

Bapat (2020) mentioned that,

- 1) The quality of soil is the same throughout the site.
- 2) As per the known fertility status of soil plant material can be decided.
- 3) Natural drainage is promoted and unnecessary importation of soil can be stopped.
- 4) Cost of execution can be controlled.(Bapat 2020)

ISSUES W.R.T. SOIL DURING EXECUTION.

1 Lack of sustainable planning: Soil is the most important non-perishable material available on site. It is removed at the start of the project during excavation and sent to landfills due to ignorance. On the other landscape etc. Which will cause a negative environmental impact and residential landscapes will have to compromise on landscape areas, which is one of the important factors for selling a project?hand, when a project is about to complete and landscape work starts, fertile soil is procured and laid over again. Thus fertile soil suitable for crops is utilized for nonproductive lawn.

2 Gap in Demand and Supply Chain: Soil purchased at 20 % extra cost in rainy season.

3 Soil Pollution: When construction is going on, if the landscape area is not protected from vehicular movement and construction activities, the existing sub base gets polluted. Soil has to undergo excessive compaction. (Crown copyright, 2009)The Sometimes labor camps are set on site, in which plastic waste is mixed with soil.

4 Additional costs need to be paid for procuring soil at the end of the project.

If all this continues for the next few years, we may not have any fertile soil left for crops, landscape etc. Which will cause a negative environmental impact and residential landscapes will have to compromise on landscape areas, which is one of the important factors for selling a project?

NEED AND IMPORTANCE OF PLANT MATERIAL MANAGEMENT:

Any residential landscape further comprises three types of plant material i.e. trees, shrubs, lawns. The chart below gives a tentative idea of the percentage of plant material found in the 1-acre landscape area which is part of the 10 Acre site area. Ten Case studies of similar land area were selected for this research work, as number of such projects is high and ignorance towards landscape development is also high. (Bapat D (2020)

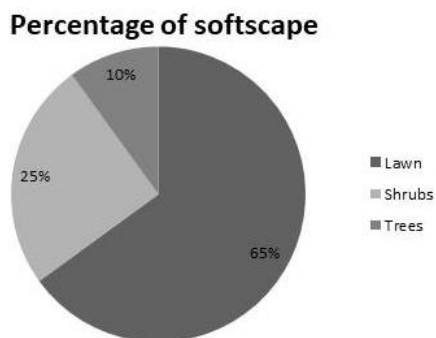


Fig2: Proportion of soft scape material in 1 Acre landscape, Source: Author

ISSUES OBSERVED WITH RESPECT TO PLANTS BASED ON FIELD OBSERVATIONS

1 Threat to Existing plants:

Existing trees on site are often removed from sites on the pretext of development, causing damage to the natural ecosystem. The root system of existing trees gets damaged during construction activity. Obsession of paved areas and increasing parking demand leaves very little uncovered space on site for trees to grow and water percolation to roots.

2 Excess cost due to unavailability of resources:

The choice of plants, shrubs and lawns is often based on an aesthetical approach rather than sustainable,. There is not enough space on site to set up a nursery. Thus, fully grown plants and a plant are procured just before plantation. This increases the cost by at least three times more than the actual cost. In the maintenance stage, the water demand is high due to a higher percentage of lawn. Extra costs if sub base (Soil is not preserved.)

In the analysis below, one particular type of lawn variety is considered to derive the base cost for development of a lawn in a one acre landscape area. Different factors like availability of sub base, water, delays etc. are considered to determine cost variance. Interesting findings from this chart conclude that, if

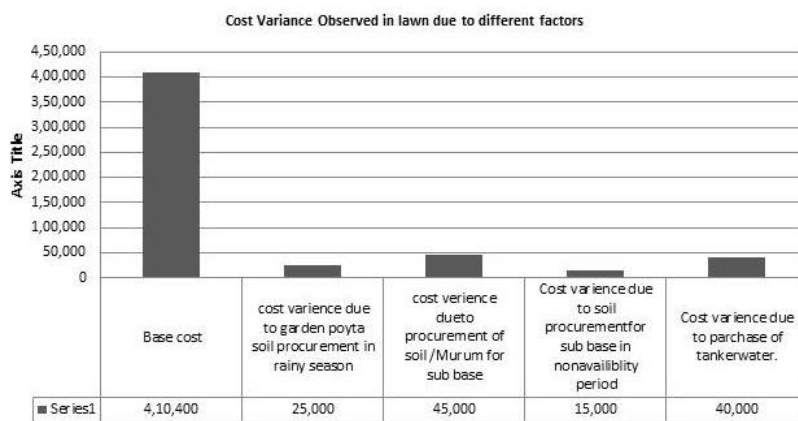


Fig 3: Cost variance for lawn due to different parameters. Based on interviews Source: Author

1 Soil sub base is unavailable. One has to spend 18% extra as compared to base cost. This cost can further go to 22% if demand is in the rainy season. 2 If water is unavailable during the plantation of lawns, the project cost can increase by 17% as compared to the original cost.

NEED FOR MANAGEMENT OF WATER:

In the last few years in Pune, water scarcity has been observed due to an increasing urban population and thus not sufficient water is available for the landscape. Tanker water is very costly. And thus, lawns which mostly occupy 60% of the landscape area and other plants are very difficult to maintain. On the other hand, in residential projects, waste water generation is very high and if this treated water can be utilized for landscaping purposes, it can reduce the water load.

Table 2: Water calculations for 1 acre landscape area requirement and availability of waste water (Based on SIBH system), Source: Author

Type of Softscape	Percentage of softscape/1 Acre	Landscape Water requirement in lit/Per month	Tanker Capacity(10,000 lit per tanker)	Waste Water Calculation	Equivalent capacity in terms of tanker
Lawn	60	4,42,558	50 Tankers required in summer months	For 750 Flats approx... 1120000	137 Tankers Treated water available as against requirement
Shrubs	30	42,900			
Trees	10	8,640			
		4,94,098			
		Five Lakh lit.	Cost =1.5 Lakh r	Eleven Lakh lit.	

The above table shows landscape water demand and the amount to be paid for water tankers in summer months. It also shows that if even 50% of waste water is treated it can easily fulfill the landscape water demand and extra water will be available for flushing.

ISSUES DUE TO NON PRODUCTIVE USAGE OF CONSTRUCTION TIMELINE:

Construction timeline is roughly up to 3 years, whereas the actual time for landscape execution is nearly half of that. In spite of that, trees are not grown on site. This timeline includes 2-3 rainy seasons, and still no attention is paid to making plantations before it rains. Instead of planting lawns by dibbling method, a carpet lawn method is used due to a shortage of time. This promotes only a few varieties of lawn which are non-sustainable.

RESULTS AND DISCUSSION

Residential landscape projects need to be planned, keeping in mind the least environmental impact.

A landscape consultant should be appointed at the start of a project and retained till the end of the project. Landscape consultants should be consulted regarding minute details of projects such as the design of compound walls. Any change in site levels or design should be immediately brought to the notice of a landscape consultant. Planning should be done in such a way to involve people by means of the development of edible landscapes. Overall, planning of a landscape plan should involve at least 70% native plants. Plant materials with less water requirement, sturdy and less maintenance should be preferred. Similarly, plantation design has to be done considering water demand at the operation stage. Soil stripping should be done at the start. Mixing of site soil and imported soil should be done carefully. While execution, proper coordination between consultants has to be maintained. Existing soil and plants should be retained and preserved during construction. All the construction activities and service installation should finish before the start of the plantation. Plantation should happen immediately after plants are obtained. Plantation work should be ideally done before it rains.

RECOMMENDATIONS FOR SOIL AND PLANT MATERIAL MANAGEMENT:

Four goals towards Sustainable Development: Planning-Preservation-Production-Procurement

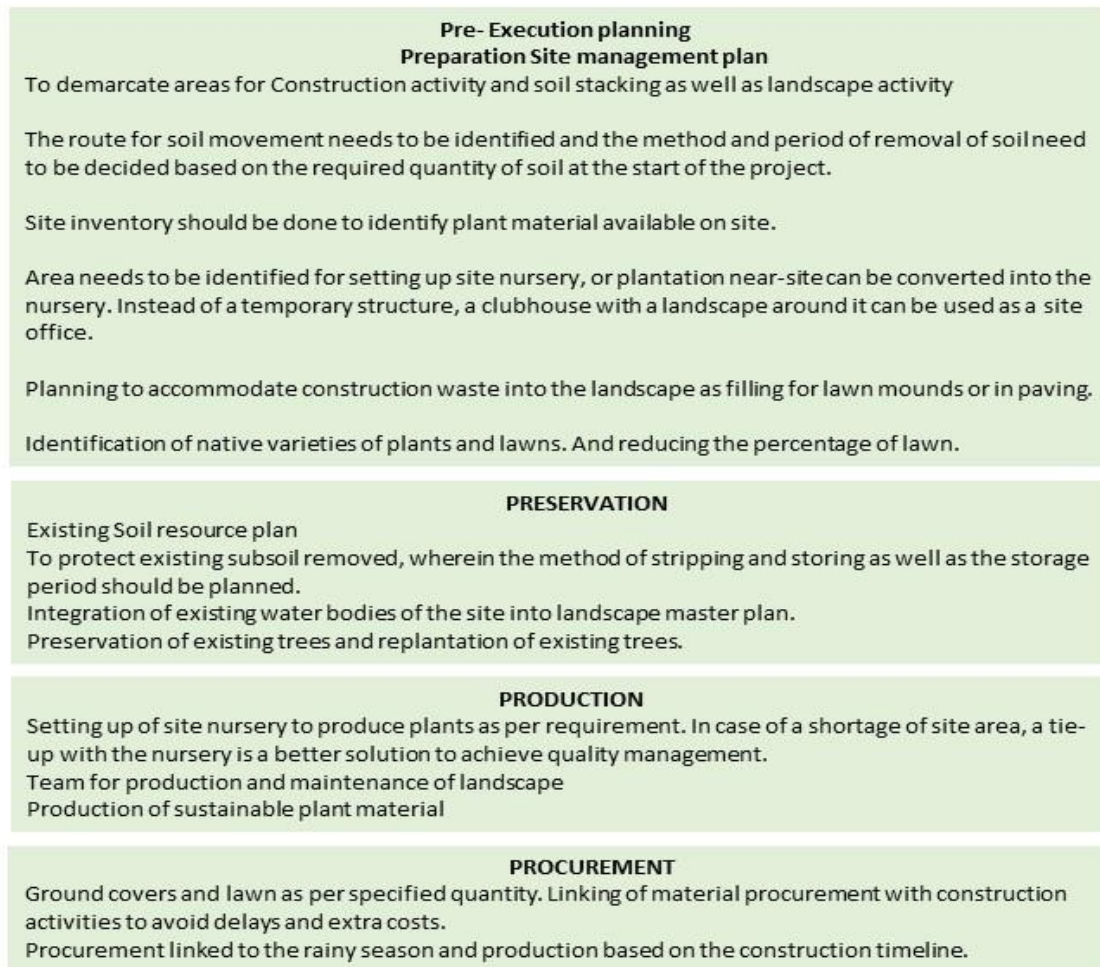


Fig 4 Recommendations for Sustainable goals, Source: Author

RECOMMENDATION FOR UTILIZATION OF WASTE WATER

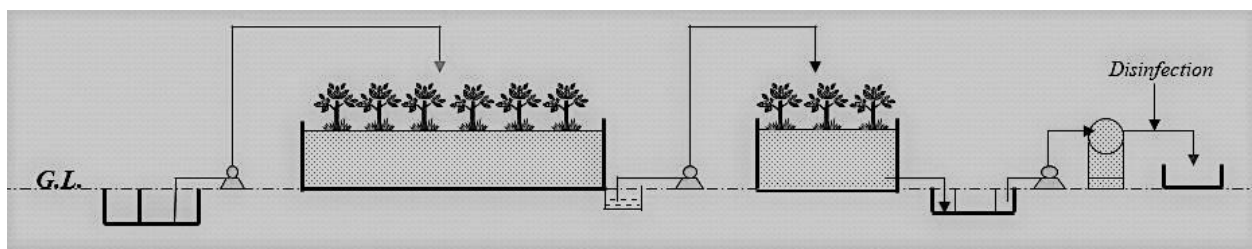


Image 6 SIBH system, Source: Navin Singh, SIBH System

Using Solid Immobilized Bio-Filter, almost three times more water required for the landscape can be generated. It requires much less space on site, and 90 % of the area of the treatment plant is active landscape in terms of canna shrubs. The payback period for this system is two years.

RECOMMENDATIONS FOR MATERIAL MANAGEMENT AND PROCUREMENT WITH RESPECT TO CONSTRUCTION
 TIMELINE:

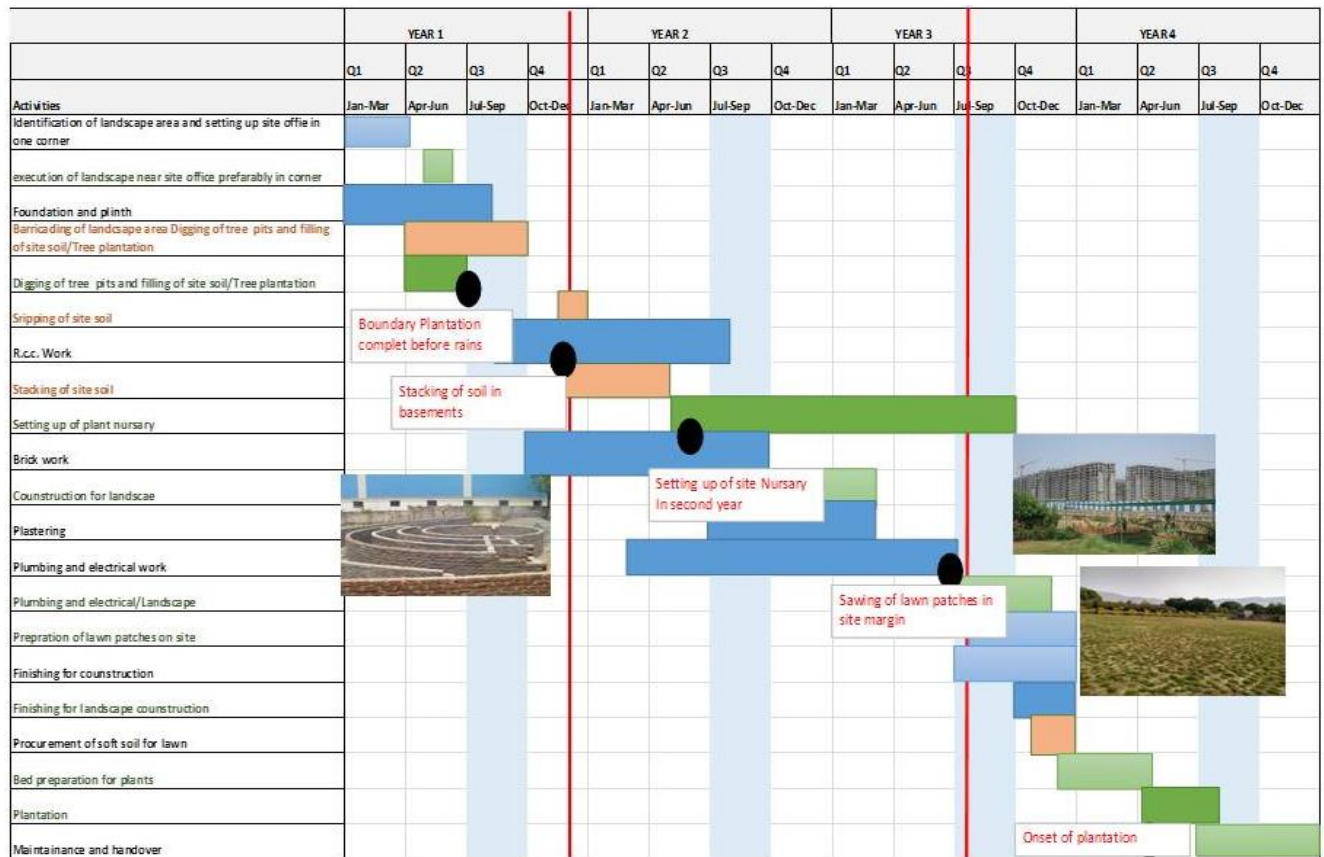


Fig 5: Linking of landscape activities, Source, Author- Demonstration Based on Case Study (Star City)

The above image shows how landscape material production and procurement can integrate into the construction timeline for sustainable development. It also shows planning as per availability of rain.

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