Project Report: June 2025

Eco Restoration of Aravali Creek 4

Location:Sector55,56, 57, Gurugram

Reporting Period: Progress up to April 2025

Aravalli Creek Restoration Project: A Comprehensive Report

Introduction

TheAravalli Creek-4Restoration Project is a pioneering urban ecological initiative focused on revitalizing a 3.5 km stretch of neglected creek in Sector 56, Gurugram. Once a vital stormwater runoff and groundwater recharge zone, this creek has suffered from decades of urban encroachment, pollution, and infrastructure neglect — transforming it into a sewage-laden channel.

This project aims to reverse that damage by transforming the area into a self-sustaining urban forest trail and green mobility corridor, integrating principles of stormwater management, biodiversity restoration, circular economy, and public engagement. By reimagining this linear green space, the project not only seeks to restore ecological balance but also enhance quality of life for surrounding communities. It represents a model for how cities can reclaim natural assets to build climate-resilient, livable, and inclusive urban ecosystems.

Project Overview: Aravalli Creek 4

The Aravalli Creek 4 project focuses on the ecological restoration of a 3.5 km long linear creek, spanning approximately 55 acres, located in Sector 56, Gurugram. This creek originates at the base of the Aravalli ridge at Ghata and extends up to the Rajesh Pilot Marg / Golf Course Extension Road. Historically, this area functioned as a crucial storm water runoff zone, facilitating groundwater recharge for the surrounding villages.

Site History and Current Conditions

Historically, the creek was an integral part of the local water retention system. However, with increasing urbanization, the creek has undergone significant degradation. It is now intersected by two major roads and at least five internal sector roads, leading to concretization and encroachment that have disrupted its natural ecological network.

Consequently, the creek 4 water and sewage channel. Key issues identified include:

Pollution: The creek is heavily polluted with grey water and untreated sewage due to leakages from municipal sewer and water supply pipes. This has led to a significant decline in water quality and poses environmental and health risks.

Solid Waste Dumping: Large sections of the creek area are used as solid waste dumping grounds, further exacerbating pollution and creating unsanitary conditions. Open defecation is also prevalent in certain areas.

Encroachment and Lack of Maintenance: Municipal parks within the creek area are being incrementally encroached upon, and the overall area remains neglected, unkempt, and underutilized, despite its potential as a forested trail.

Site History

Current Conditions

Site History

Current Conditions

- Designed water channels to direct road runoff into the drain, reducing water stagnation and preventing erosion.
- Used permeable materials like stone pitching to allow gradual water absorption and filtration.

Apron construction at the drain outlet to prevent erosion at the outfall area

Soil Erosion: The lack of proper management and vegetation has led to significant soil erosion along the creek banks.

Poor Accessibility and Pathways: Pathways are often undefined or non-existent, and there are no dedicated cycle tracks, limiting public access and recreational use.

Project Objectives

The Aravalli Creek 4 project aims to address these challenges through a multi-faceted approach, focusing on three primary objectives:

1. **Waste Water & Storm Water Management:**

- Urban flood mitigation.
- Groundwater recharge.
- Restoration of the derelict open grey water/sewage laden creek.

2. **Ecological Improvement:**

- Establishing an urban forest trail.
- Community-led plantation of native species.
- Restoring local biodiversity.
- Promoting the reuse of waste materials.
- Implementing low structural footprint solutions.

3. **Public Space & Urban Mobility Trail:**

- Creating an alternate and self-sustaining urban mobility corridor for walking and cycling.
- Fostering community social interaction.
- Providing environmental education opportunities.
- Developing passive recreation spaces for the community.

Way Forward

The project outlines several key strategies for the restoration:

- **Native Species Plantation:** Planting native flora of the Aravalli range to restore ecological balance.
- **Renewable Energy:** Utilizing renewable energy methods for lighting solutions.
- **Contextual Design:** Carefully considering existing land uses, accessibility, mobility, and the creek's sectional profile at various locations.
- **Waste Utilization:** Wherever possible, using Construction & Demolition (C&D) waste from landfills and construction sites in Gurugram for earth-fill operations and other infrastructural works to conserve resources and reduce project costs.
- **Solid Waste Management:** Creating a robust solid waste management system with compost pits for biodegradable waste and on-site generation of plant manure. Fencing and barricading will be implemented to prevent future waste dumping.
- **Rainwater Harvesting:** Establishing a comprehensive Rainwater Harvesting System with appropriate technologies, recharge pits, and subsurface piping.

- **Creek Cleaning and Diversion:** Cleaning the areas along the creek banks and installing mesh at tunnels to block entry points, preventing solid waste and sewage flow into the creek. Sewage will be redirected to treatment plants.

  This project represents a significant effort to transform a degraded urban space into a thriving ecological corridor, promoting environmental sustainability and enhancing community well-being.

Digging a recharge Pit & Insert a pipe


BEFORE
AFTER


BEFORE


AFTER

Key benefits of effective stormwater drainage include:

- **Flood Prevention:** By channeling water away, storm drains prevent localized flooding, which can cause significant damage to property and infrastructure, disrupt transportation, and pose risks to human life.

- **Pollution Control:** Stormwater runoff often carries pollutants such as debris, chemicals, oil, grease, pesticides, and sediment from urban surfaces. While storm drains themselves do not filter these contaminants, a well-managed system can direct this polluted runoff to treatment facilities or designated areas where it can be managed to minimize environmental harm.

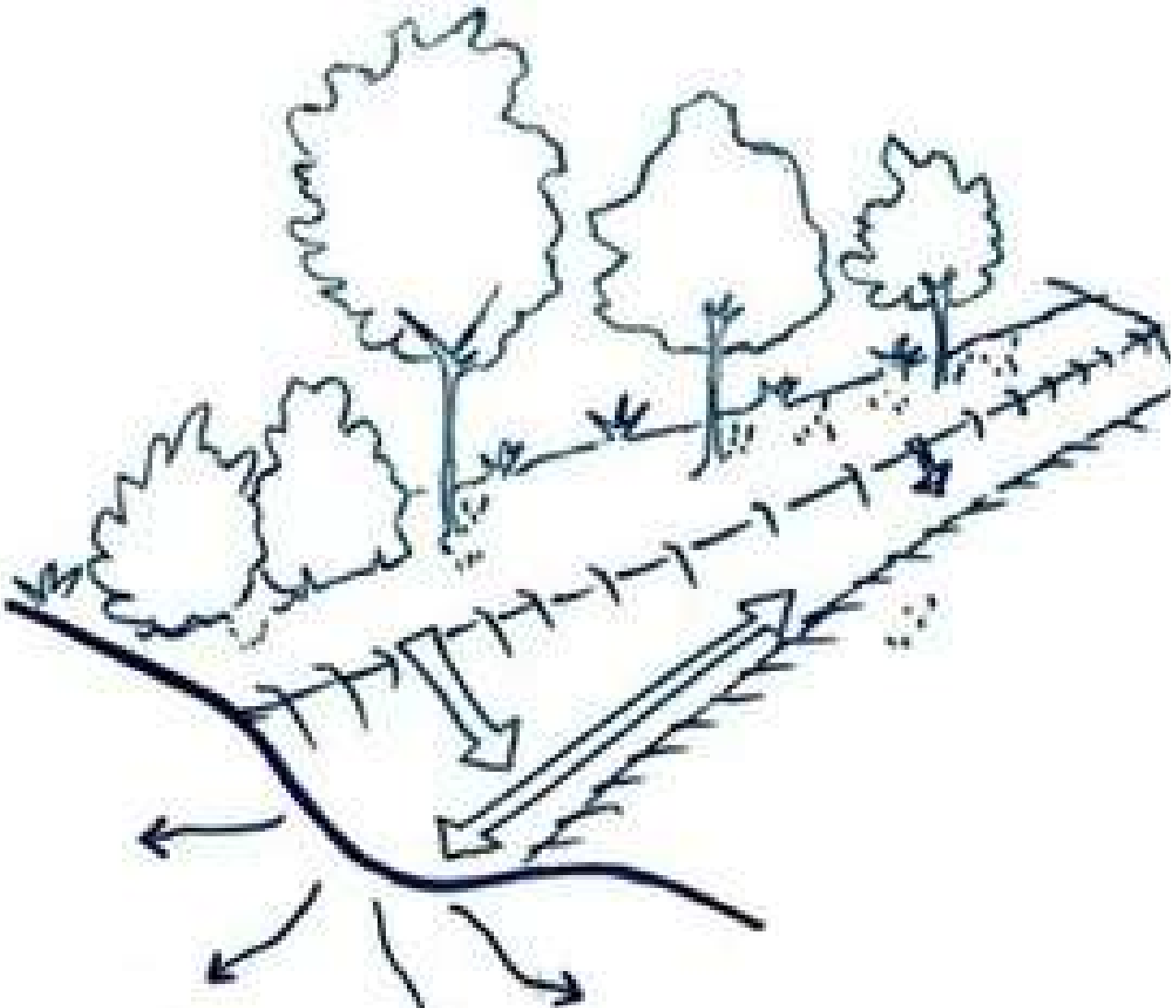
- **Erosion Control:** Uncontrolled stormwater flow can lead to severe soil erosion,especially in areas with exposed soil. Storm drains help to manage the flow velocity, thereby reducing erosion of land and stream banks

- **Protection of Water Quality:** By preventing pollutants from directly entering natural water bodies, stormwater management contributes to the improved quality of rivers, lakes, and coastal waters, safeguarding aquatic ecosystems and drinking water sources.

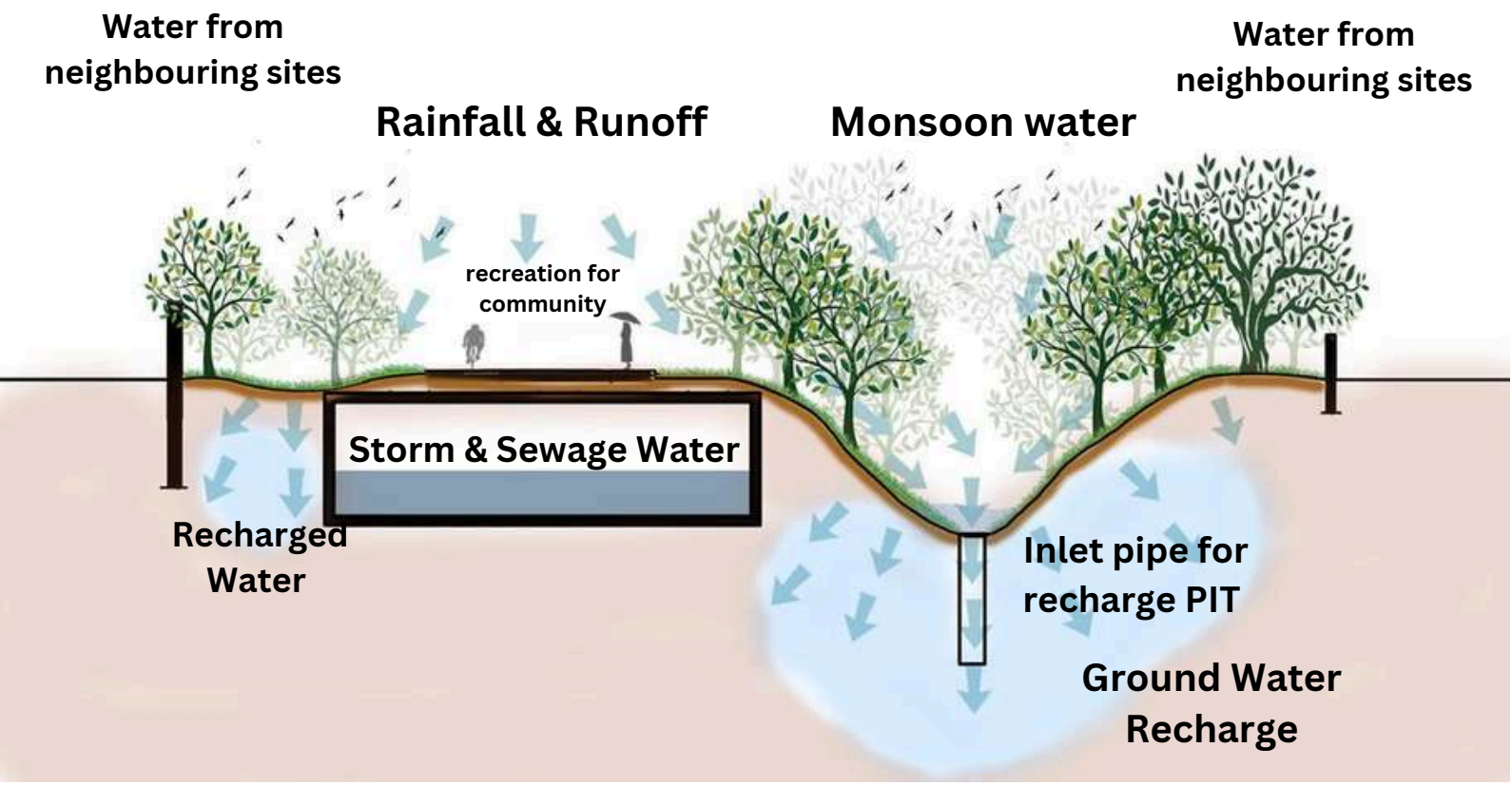
- **Groundwater Recharge:** In systems designed for it, stormwater can be directed to permeableareas or infiltration systems, allowingittoslowlyseep into the ground and replenish groundwater reserves. This is particularly important in regions facing water scarcity.


Stormwater Drain


Freshwater Line



After: Designed Solution



Natural vs. Concretized Drains

There is a significant difference between natural and concretized (or traditional) stormwater drains, with natural systems offering numerous advantages in terms of environmental sustainability and long-term effectiveness.

Concretized Drains: These are typically rigid, engineered structures made of concrete or other impermeable materials. They are designed for rapid conveyance of water, often channeling it directly into larger water bodies. While effective at quickly moving water, they come with several drawbacks:

Limited Infiltration: Concrete surfaces prevent water from percolating intothe ground,reducing ground water recharge and exacerbating run-off volume.

Increased Flow Velocity: The smooth, hard surfaces of concretized drains can leadtohigherwater velocities,increasing theerosivepowerof the waterdownstream and potentially damaging natural habitats.

Lack of Ecological Function: They offer no ecological benefits, failing to support biodiversity or natural water purification processes.

Natural Drainage Systems (Green Infrastructure): These systems, often referred to as green infrastructure, mimic natural hydrological sediment, requiring regular and often costly mechanical cleaning.

Maintenance Challenges: Concretized drains can accumulate debris and processes. They utilize elements like vegetated swales, permeable pavements, rain gardens, and restored natural channels. Their advantages include:

Enhanced Groundwater Recharge: Permeable surfaces and vegetated areas allow stormwater to infiltrate the soil, replenishing groundwater and reducing the strain on municipal water supplies.

Improved Water Quality: Vegetation and soil act as natural filters, removing pollutants from stormwater through processes like filtration, absorption, and biological uptake. This significantly improves the quality of water before it reaches natural water bodies.

Reduced Runoff Volume and Peak Flows: By promoting infiltration and temporary storage, natural systems reduce the overall volume of runoff and attenuate peak flows, thereby lessening the burden on drainage infrastructure and reducing flood risk.

Habitat Creation and Biodiversity: Vegetated drainage systems provide valuable habitats for local flora and fauna, contributing to urban biodiversity and ecological health.

Aesthetic and Amenity Benefits: Green infrastructure enhances the aesthetic appeal of urban landscapes, creating green spaces that can improve community well-being and provide recreational opportunities.

Cost-Effectiveness: While initial costs can vary, natural drainage systems often prove more cost-effective in the long run due to reduced maintenance needs and the multiple co-benefits they provide (e.g., improved air quality, reduced urban heat island effect).

In the context of the Aravalli Creek, transitioning from a concretized, sewage-laden channel to a more natural, vegetated creek aligns with best practices in sustainable stormwater management, offering significant environmental and community benefits.

Project Impacts

CLIMATE RESILIENCY
Groundwater Recharge
Recycling and Reuse of Waste Native Plantation
Biodiversity Habitat
Urban Forest

ACCESS FOR ALL
Open Space Access for Community
Diverse User Groups
Universal Accessibility
Livelihoods Safe mobility corridor

Reduction in Pollution
Recreation and Play Areas
Community Spaces
Walking, Jogging, Cycling Trails

HEALTH AND WELLBEING

Most civil work on box drain
Zero Discharge Site
Nature Based Solutions
Low Maintenance

SUSTAINABILITY

The Impact of Sewage Mixing with Stormwater

The mixing of sewage with stormwater is a critical environmental and public health issue, often occurring in areas with combined sewer systems or due to illicit connections and overflowing infrastructure. This contamination has severe consequences:

Before

After

Water Pollution: Untreated sewage introduces a high load of pathogens (bacteria, viruses, parasites), nutrients (nitrogen, phosphorus), and organic matter into stormwater. When this mixture enters natural water bodies, it leads to severe water pollution, making the water unsafe for human contact, recreation, and consumption.

Eutrophication: The excess nutrients from sewage can cause eutrophication in receiving waters, leading to algal blooms. These blooms deplete oxygen levels in the water, creating dead zone that harm aquatic life.

Public Health Risks: Exposure to sewage-contaminated water can cause a range of illnesses, including gastrointestinal diseases, skin infections, and respiratory problems. This poses a direct threat to public health, especially for those who come into contact with affected water bodies.

Ecological Damage: The introduction of pollutants from sewage can devastate aquatic ecosystems, leading to fish kills, loss of biodiversity, and disruption of food webs. The altered water chemistry and reduced oxygen levels make it difficult for many species to survive.

Odour and Aesthetic Nuisance: Sewage-laden stormwater creates foul odours and an unsightly appearance, diminishing the aesthetic value of natural landscapes and urban areas. Addressing the issue of sewage mixing with stormwater, as highlighted in the Aravalli Creek - 4 project, is paramount for environmental recovery and public well-being. This often involves repairing leaking sewer lines, preventing illicit connections, and, in some cases, separating combined sewer systems.

The Role of Channels and the Larger Water Picture

Channels in stormwater management serve as conduits to convey runoff from impervious surfaces to treatment areas or receiving water bodies. They are a fundamental component of drainage systems, designed to manage the flow and velocity of stormwater. While traditionally engineered channels might be concretized for rapid conveyance, the trend is towards more natural, vegetated channels (like swales) that offer additional benefits such as filtration and erosion control.

The destination of stormwater in urban areas is critical to understanding the larger water picture. In many urban environments, stormwater is collected by drainage systems and discharged directly into local rivers, lakes, or the ocean.

This rapid discharge, especially from impervious surfaces, significantly alters the natural water cycle.

The Urban Water Cycle: In a natural environment, rainfall infiltrates the ground, replenishes groundwater, and slowly makes its way to streams and rivers. In urban areas, however, extensive impervious surfaces prevent this natural infiltration. Instead, a large percentage of rainfall becomes runoff, which is quickly channeled away. This leads to:

Reduced Groundwater Recharge: Less water infiltrates the ground, leading to declining groundwater levels.

Increased Peak Flows and Flooding: Rapid runoff overwhelms natural and engineered drainage systems, leading to more frequent and severe flooding.

Pollutant Loading: Stormwater picks up pollutants from urban surfaces and carries them directly into water bodies, degrading water quality.

Altered Stream Hydrology: Increased and rapid flows erode streams banks,widen channels, and disrupt aqatic habitats

Effective stormwater management, particularly through green infrastructure and the restoration of natural channels like the Aravalli Creek, aims to restore a more natural urban water cycle. By promoting infiltration, filtration, and slower conveyance, these practices help to replenish groundwater, reduce flood risk, improve water quality, and support healthy ecosystems. This holistic approach recognizes that stormwater is not merely a waste product to be disposed of, but a valuable resource that can be managed to benefit both the environment and urban communities.

WE ARE PRESERVING EACH DROP OF WATER

Zero Discharge Site

No Flooding, yet designed to withstand excessive water

60-90% ground water recharged, rest evaporates or is absorbed by plants

My Role as a Student in this Project

As a student undertaking this project, my primary motivation was to delve into the complexities of urban ecological restoration and understand the practical application of sustainable development principles. The Aravalli Creek project, in particular, presented a compelling case study of how human activities can severely degrade natural systems, but also how concerted efforts can lead to their revival. My involvement allowed me to explore critical environmental challenges such as water pollution, waste management, and habitat degradation, and to appreciate the multidisciplinary approaches required to address them.

This project was not merely an academic exercise; it was an opportunity to understand the tangible impact of environmental degradation on local communities and ecosystems. The transformation of a once-vital creek into a sewage-laden drain highlighted the urgent need for effective urban planning and responsible resource management. By researching best practices in stormwater management and analyzing the proposed solutions for the Aravalli Creek, I gained a deeper understanding of how ecological principles can be integrated into urban infrastructure development.

Furthermore, the project emphasized the importance of community involvement and a holistic approach to environmental challenges. The idea of converting a neglected space into an urban forest trail and a public mobility corridor resonated strongly, demonstration how ecological restoration.

simultaneously enhance biodiversity, improve public health, and foster community engagement. This experience has reinforced my commitment to contributing to sustainable solutions for urban environments, recognizing that the health of our natural systems is intrinsically linked to the well-being of our communities.

Holding the Water: Conservation and Reuse

The concept of "holding the water" is central to sustainable stormwater management and water conservation, especially in urbanized areas where rapid runoff is prevalent. Instead of quickly channeling stormwater away, the goal is to retain it within the landscape, allowing for natural processes to occur, such as infiltration and evapotranspiration. This approach is crucial for several reasons:

Groundwater Replenishment: By holding water on-site or in distributed systems, it has more time to infiltrate the soil, recharging underground aquifers. This is vital for maintaining groundwater levels, which are often depleted in urban areas due to increased impervious surfaces and high water demand.

Reduced Flood Risk: Retaining stormwater reduces the volume and entering drainage systems, thereby mitigating the risk flooding and reducing the burden on conventional infrastructure.

Water Quality Improvement: When water is held and allowed to slowly nfiltrate through soil and vegetation, natural filtration processes remove pollutants, improving the quality of both surface and groundwater.

Support for Green Spaces: Held water can sustain urban green spaces, reducing the need for irrigation and promoting healthier ecosystems within the city.

Potential for Reuse: Retained stormwater can be collected and treated for various non-potable uses, such as irrigation, toilet flushing, or industrial processes, thereby reducing the demand on potable water supplies.

Check Dams

Check dams are small, often temporary, barriers constructed across a drainage ditch, swale, or channel to reduce the velocity of concentrated stormwater flow. They are a simple yet effective method for "holding the water" and promoting infiltration. Typically made from natural materials like rocks, logs, or even compacted earth, or sometimes from more permanent structures like concrete, check dams serve several key functions:

Velocity Reduction: By creating small pools behind them, check dams slow down the flow of water, reducing its erosive power and preventing channel degradation.

Sediment Trapping: The reduced velocity allows suspended sediments to settle out, improving water clarity and preventing sediment from accumulating downstream or in larger water bodies.

Infiltration Enhancement: The impounded water behind check dams has more time to infiltrate into the ground, contributing to groundwater recharge.

Pollutant Removal: As water is slowed and infiltrates, some pollutants can be filtered out by the soil and vegetation.

Erosion Control: They help stabilize the channel bed and banks, preventing gully formation and further erosion.

Check Dam

We have constructed a check dam to slow down rainwater flow in the creek. An added benefit is its location near the STP, allowing the treatment plant to utilize the stored water.

In the context of the Aravalli Creek restoration, strategic placement of check dams could be highly beneficial in managing stormwater flow, promoting infiltration, and aiding in the natural purification of water within the creek system.

Circular Economy and Waste Utilization

The concept of a circular economy is a systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the traditional linear

model of 'take-make-dispose,' a circular economy aims to keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.

In the context of the Aravalli Creek restoration project, the principles of a circular economy are evident in the proposed "reuse of waste" and the utilization of Construction & Demolition (C&D) waste. This approach offers significant benefits:

Resource Conservation: By using C&D waste for earth-fill operations and other infrastructural works, the project reduces the demand for virgin materials, conserving natural resources.

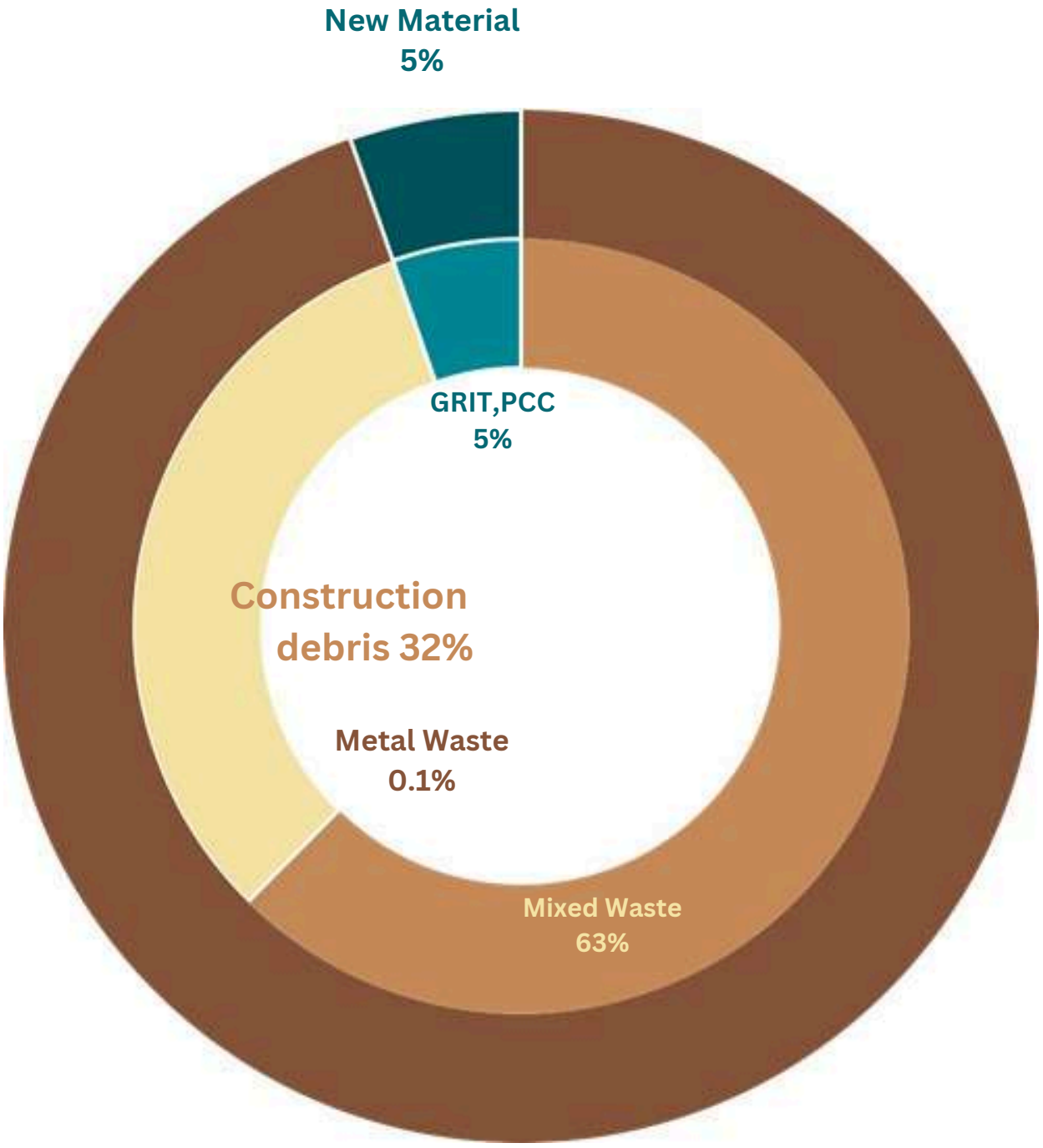
Waste Reduction: Diverting C&D waste from landfills reduces the overall volume of waste generated, lessening the environmental burden associated with waste disposal.

C**ost Savings:** Utilizing readily available waste materials can significantly reduce project costs, making restoration efforts more economically viable.

Environmental Benefits: Proper reuse of waste materials can prevent pollution associated with their disposal and reduce the energy consumption and emissions linked to producing new materials.

Innovation and Local Economy: Embracing circular economy principles can foster innovation in waste management and create opportunities for local businesses involved in waste processing and material recovery.

Materials Used



Waste Material Used
95%

The Aravalli Creek project's commitment to using C&D waste exemplifies a practical application of circular economy principles, transforming what would otherwise be a waste product into a valuable resource for ecological restoration. This not only contributes to the project's sustainability but also sets a precedent for future urban development initiatives.

Waste Reuse

Pathways

Breaking the wall and building culvert with the malba waste.

Seating Area created from the existing wall and the waste material available at the site

Entrance gates are constructed using malba, beautifully designed with pavements and a signage panel, creating an attractive and informative entry point .

Conclusion

The Aravalli Creek restoration project is a critical endeavor that addresses multifaceted environmental challenges in an urban setting. By focusing on ecological restoration, sustainable stormwater management, and community engagement, the project aims to transform a degraded natural asset into a vibrant urban forest trail. The integration of best practices, such as promoting natural drainage systems, mitigating sewage contamination, and embracing circular economy principles through waste utilization, underscores a holistic and forward-thinking approach to urban development. This report highlights the urgent need for such initiatives to restore ecological balance, enhance public well- being, and foster a more sustainable urban future.


Galaxy S20 FE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ThankYou