BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

SOUTHERN BENCH AT CHENNAI

ORIGINAL APPLICATION NO. 104 OF 2020

RAJESH GHANTAYATH

... APPLICANT

VERSUS

UNION OF INDIA AND 7 ORS.

... RESPONDENTS

INDEX TO THE LIST OF DOCUMENTS

Place: CHENNAI

DATE: 11.01.2024

T. Hemalatha

COUNSEL FOR RESPONDENT No.8

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MEMO FILED BY RESPONDENT NO.8

This respondent is filing herewith relevant material relating to Landfill Remediation/Capping which may be of assistance to this Hon'ble Tribunal while disposing of the above application.

Dated at Chennai this 11th day of January 2024

T. Hemalatha

Counsel for Respondent No.8

NIUA | C3 Climate Centre for Cities

Ministry of Housing and Urban Affairs
Government of India

Counter MEASURE FOR PLASTIC FREE RIVERS

Scientific Landfill Remediation

TRAINING MANUAL

ClimateSmart Cities Assessment Framework

Waste Management

3

Scientific Landfill Remediation

Open dumping sites are concerning as they have environmental, health, and livelihood risks. Most landfill sites are dumping grounds that were once low-lying areas that were filled with waste, hence the name "land-fill." These dumping grounds create severe ground water pollution, methane gas emissions, fire dangers, and vermin, which is the polar opposite of a scientific landfill site. To address this, it is critical to reclaim these areas in order to construct new scientific landfills for the disposal of inerts and residual solid waste, as well as to extend the life of existing landfills (a process known as 'landfill capacity extension'). In addition, legacy garbage buried in dumpsites must be handled and recycled for profit-generating purposes.

Scientific Remediation is a process in which contaminants are removed or neutralized scientifically so that they cannot cause further harm to the environment.

On-site clean-up is a tried-and-true strategy for reducing environmental concerns from abandoned landfills and eventually reclaiming the area for public use.

Remediation of Scientific Landfill

Landfills pose a number of risks due to their poor design and indiscriminate waste disposal. One of the most serious concern is the release of methane gas as a result of garbage accumulation. Methane is the most common cause of landfill fires, which result in rubbish burning and severe air pollution. Landfills also represent significant health risks since they are a repository for viruses and bacteria that cause cardiovascular and respiratory ailments.

Threats possessed by Landfills:

- Uncontrolled Fires
- Methane Emission
- Cardiovascular and Lung Disease

In non-scientific words, remediation is the process of covering existing landfill cells with dirt and potentially a membrane to lessen the risk of fires, leachate, storm water runoff, vermin, windblown dust, and other undesired impurities.

On-site clean-up is a tried-and-true strategy for reducing environmental concerns from abandoned landfills and eventually reclaiming the area for public use. Another plus is that any new waste management facility would include adequately lined landfill cells and, ideally, the option to include features like sorting, recycling, and even waste-to-energy technology if its installation is financially feasible and its long-term operation is viable.

There are various remediation guidelines in place around the world, like,
The Environmental Protection Agency (EPA) Region 9 has the most comprehensive list of Preliminary Remediation Goals (PRGs) in the United States. There is a set of European standards that is commonly referred to as the Dutch standards. Although most of Europe's industrialised nations have their own standards, the European Union (EU) is gradually heading toward Europe-wide standards. The majority of remediation standards in Canada are defined by individual provinces, however the Canadian Council of Ministers of the Environment provides federal advice in the form of the Canadian Environmental Quality Guidelines and the Canada-Wide Standards| 3.2 Petroleum Hydrocarbons in Soil: A Canada-Wide Standard.

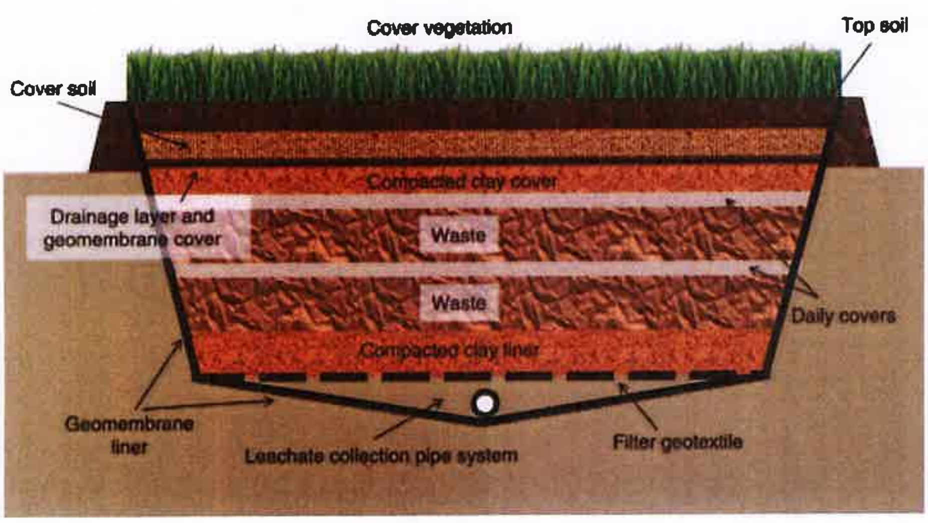
Guidelines to adopt landfill remediation in India

All existing and old landfills will be inspected and boreholes will be drilled for (i) recovery of leachate samples from the base of the landfill, (ii) recovery of subsoil samples beneath the base of the landfill for evaluation of permeability and soil properties and (iii) recovery of waste samples for waste characterisation. A minimum of 3 boreholes will be drilled with atleast one borehole for each acre of landfill area. The quality of leachate samples will be compared with (a) the ground water quality in existing borewells 2 km away from the landfill and (b) the Central Pollution Control Board (CPCB) norms for limits of contaminants in leachate. If the leachate quality and the permeability of the subsoil strata is observed to be satisfactory, the existing landfill can continue to operate with bi-annual monitoring of leachate quality in the drilled boreholes. (f) If the leachate quality is observed to be of poor quality with respect to the local ground water quality or with respect to the CPCB norms, steps will be taken to close the existing landfill site and remedial measures adopted. (http://cpheeo.gov.in/upload/uploadfiles/files/chap17(1).pdf)

Post Closure MSW rules 2016

1. The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely:-'
   i. Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;
   ii. Monitoring leachate collection system in accordance with the requirement;
   iii. Monitoring of ground water in and around landfill;
   iv. Maintaining and operating the landfill gas collection system to meet the standards.
2. Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous emission and leachate quality analysis complies with the specified standards and the soil stability is ensured.

Fig 3.1 Typical section of a remediated landfill



Overview of Remediation waste

To safeguard human health and the environment, remediation waste is regulated. The specifications are determined by the pollutants found in the trash. As a result, you must be able to classify your remediation waste in order to comply with the standards that apply during garbage removal and disposal.

Remediation waste is a type of trash that is formed during the remediation process and typically consists of polluted soil, water, or demolition debris. Hazardous and/or non-hazardous waste can be found in remediation waste. Before generating any remediation trash, you must classify the waste as hazardous or non-hazardous and devise a management, treatment, or disposal strategy. The clean-up waste must be addressed immediately after it has been generated.

Important waste characterization concepts include the following:

- Point of Generation.
- Listed vs. Characteristic waste.
- "Contained-in" Policy for Contaminated Environmental Media.
- "Area of Contamination" Policy.
- Requirements for treatment.
- Land Disposal Restrictions

Waste characterization should be an integral part of site-wide project management:

- Tempting to focus on clean-up and worry about characterization later.
- Allows Law of Unintended Consequences to kick in.
- Opportunities to minimize disposal cost can be missed.
- Timing of "Contained-in" determinations.
- Contaminated soil management and staging.
- In-situ treatment vs. ex-situ.
- Can result in a need for unexpected approvals/permits, causing delays and cost overruns.

Remediation technologies

1. Bioremediation (Excavation/landfill mining)
2. Landfill capping
3. Landfill surcharging
4. Soil vapor extraction and air sparging
5. Co-treatment of landfill leachate
    i. Landfill leachate with sewage in a wastewater treatment plant
    ii. Bioreactor landfills

Landfill capping:

In this method, the dumpsite is initially levelled, covered with soil by providing the surface drainage system, leachate management and gas collection systems and then capped. By doing these the landfill site is converted into a green space having an environmental monitoring systems as well. This is used in absence of viable reclamation options where bioremediation becomes highly expensive, high levels of contamination or unpredictable material that would come out of the legacy dumpsite. Capping a landfill involves three layers: an upper vegetative (top soil) layer, a drainage layer and a low permeability layer comprised of a synthetic material overlaying two feet of compacted clay. Capping has a 50-100 years of lifetime, although the cap's performance depends on the site's environmental conditions. Caps can crack and erode as a result of changes in air temperatures and precipitation, as well as if the region is prone to subsidence and earthquakes. To prevent frost, the top must be thick enough to accommodate vegetative roots and burrowing animals.

Fig 3.2: Landfill remediation technology

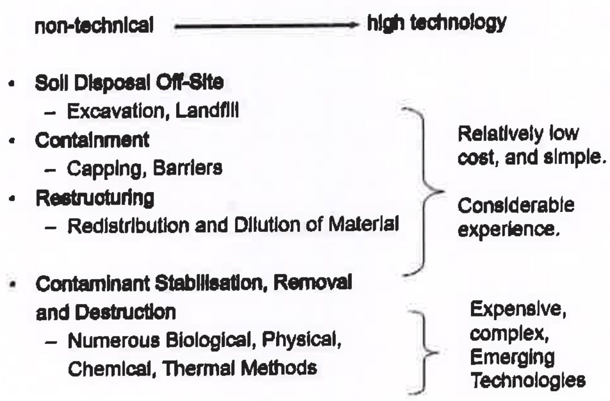


Fig 3.3: Partial land reclamation and capping project in Nashik[1]

Before After

[1]Source: Swachh Bharat Mission – Advisory on Land reclamation

Landfill Surcharging:

Surcharging is the process of putting additional weight on the landfill. Usually this is done with soil stockpiles (clean soil so that it can be reused). The heavier the stockpile and the longer it stays in-place, resulting in noticeable settlements. The settlement can also be improved by placing the green/wood waste operation on top of the landfill. Surcharging usually carried out when a landfill reaches its final elevation levels.

Soil vapor extraction and air sparging:

In-situ remediation procedure such as Soil vapor extraction (SVE) and air sparging are used to remove vapors from polluted soil and plume, respectively. These procedures, SVE and air sparging are used in site parallely. This removes solvents, fuels and volatile organic compounds readily. The procedure involves with the construction of two types of wells around the landfill, (i.e.) extraction wells and air injection wells. The vacuum is created in the extraction well to draw the vapors to the surface, while an air injection well pumps air into the ground. The injected air promotes the growth of aerobic bacteria which aid in the microbial decomposition. The evaporation of the compounds is enhanced if the injected air is heated. SVE and air sparging are both safe, although full remediation can take years, depending on the amount and depth of the pollution, the type of soil, and the chemical concentrations in the soil and groundwater. These solutions, on the other hand, are faster than relying solely on natural processes.

Co-treatment:

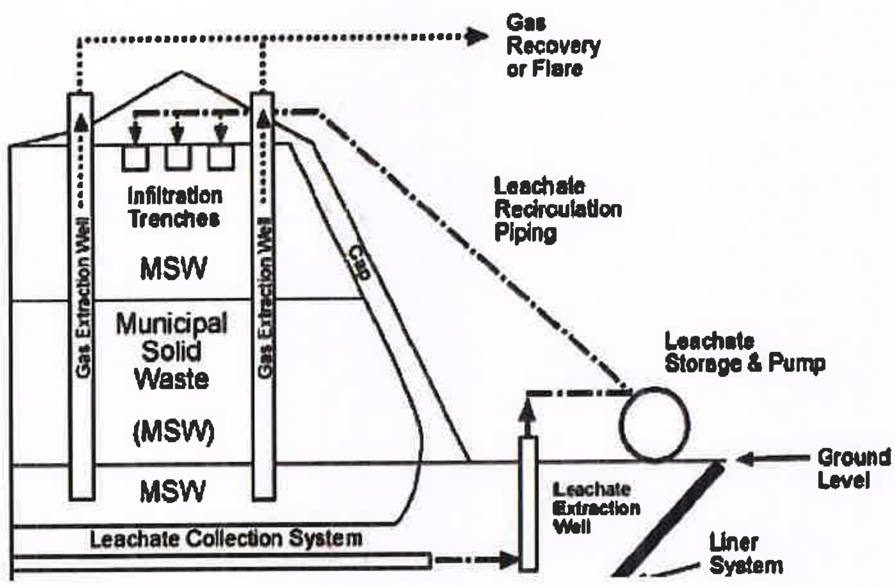
A. Landfill leachate with sewage in a wastewater treatment plant

In this the leachate is usually discharged to a wastewater treatment plant. Pre-treatment is done before discharging to a wastewater treatment plant, or treatment onsite followed by discharge to a nearby stream are all options for leachate management. The most typical approach is to connect to a local sewer line. The majority of municipal wastewater treatment plants employ aerobic biological treatment (e.g., the activated sludge process), which is created specifically to target biodegradable organic matter and suspended solids in sewage. As a result, refractory organics and emergent contaminants may be inadequately removed from leachate. Although a lot of big sewage can dilute the persistent pollutants in leachate, it's important to remember that these pollutants aren't really removed or eradicated. Furthermore, harmful compounds in leachate (such as ammonia and heavy metals) might disrupt microbial activity and cause atypical wastewater treatment plant operation. Additionally, sewer lines may be inaccessible, have insufficient capacity, or be prohibited for certain reasons for connection to nearby treatment plants.

B. Bioreactor landfills

In a bioreactor landfill, the microbial activity is purposely increased by cycling of leachate back into filled cells. Leachate recirculation provides moisture and/or oxygen to encourage microbial breakdown of solid wastes while also reducing the amount of leachate required for treatment. To reclaim landfill space, a bioreactor landfill can be either aerobic or anaerobic. Anaerobic bioreactor landfills just inject leachate, whereas aerobic bioreactor landfills pump both air and leachate into the garbage. In comparison to anaerobic bioreactor landfills, the aerobic bioreactor enhances microbial digestion rates, resulting in faster waste settlement. Anaerobic bioreactor landfills, on the other hand, produce more methane gas. As a result, it's a good option for energy recovery initiatives.

Fig 3.4: Schematic of a bioreactor landfill using leachate recirculation[2]



[2]Bendere, R., Šmigins, R. & Teibe, I., 2012. *WASTE PRE-TREATMENT METHOD – STARTING STATEMENTS, MAINTENANCE, FINAL RECOVERY AND LANDFILLING. Linnaeus ECO-TECH 2012, Issue November 26-28, 2012.*

Fig 3.5: Approaches to Landfill Remediation

Quantity of the waste to be remedied on the basis of area and surveys

↓

Reaching the Lowest Ground Level

↓

Garbage Layer Ranking

↓

Coarse Material and Garbage are screening

↓

Valuable Land recovered by Bio-Remediation

↓

C&D Waste- sent to C&D Processing Facility

↓

Recovered Soil is used for refilling Grounds

↓

Post Screening, useful waste is sent to further processing (recycle/ selling) and C&D waste may be used for filling low-lying areas

↓

Respective machinery and tools deployment

↓

Regular Monitoring

Site characterization and Preparation

There are 10 steps to for site preparation and characterization, mentioned below:

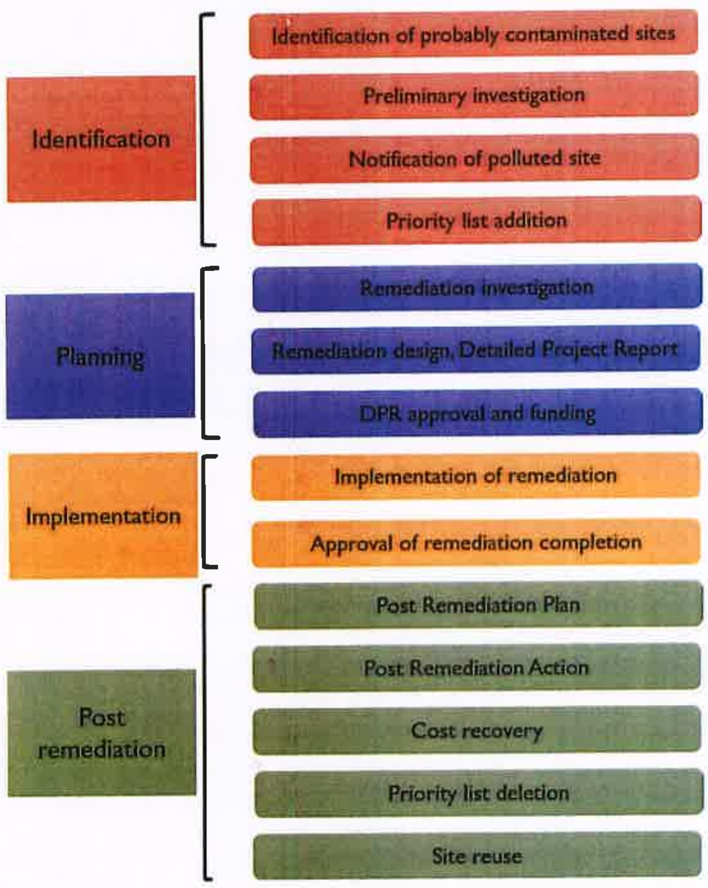
- Quality of groundwater
- Surrounding Land
- Local Landscape
- Operational Timeline
- Waste Disposal Type
- Disposal Procedure
- Depth and Volume of Waste
- Site Location
- Local Geology
- Depth of Ground & Surface Water, and nearby water channels.

The first step in the landfill repair procedure is to assess the contamination. Environmental Site Assessment is frequently the first step in the process. The evaluation technique and type of sample and chemical analysis to be performed will be guided by the site's use and the materials placed there. Even though the current land use appears to be harmless, surrounding sites held by the same corporation or nearby sites that have been reclaimed, levelled, or filled are frequently contaminated. Off-site pollution of surrounding locations, frequently caused by decades of emissions to soil, groundwater, and air, is also vital to address. Before and after any repair, the ceiling dust, topsoil, surface water, and groundwater of surrounding properties should all be evaluated.

The final criteria is that the environmental impact, social acceptance, and transportation and remediation costs are to considered.

Remediation principles and process

Fig 3.6: Fourteen Steps remediation process



Models for Implementing Dumpsite Remediation (Swachh Bharat Mission – Urban, Advisory on Landfill Reclamation) are

Execution Methods

- 100% Reclamation: Design Finance Own and Operate and Transfer with near-zero residues. All work must be carried out in compliance with SWM Rules 2016 and CPCB Guidelines for the disposal of legacy waste 2019. (Tamil Nadu Model)- Maximum processing cost & no operating costs
- 100% Capping (Minimum operating/ processing cost) e.g. Gorai Dumpsite in Mumbai
- 60-70% Reclamation, rest with inert capping - Part Capping, (Nashik Model, EPC)- Processing & Operating cost lying between the first two models

Working Models

- 100% work to outsourced to selected private contractor • 100% by ULB with rented equipment and manpower
- Part by private operator (processing only) and rest by ULB (utilization, transportation and disposal)

The reference scope and qualification criteria for each model mentioned above is elaborated in the annexure for general understanding and reference.

Leachate and Gas

Landfill gas (LFG) is a natural byproduct of the decomposition of organic material in landfills. LFG is composed of roughly 50 percent methane (the primary component of natural gas), 50 percent carbon dioxide (CO^2) and a small amount of non-methane organic compounds.

Collecting and Treating Landfill Gas:

Landfill gas can be caught, processed, and used as a renewable energy resource instead of escaping into the atmosphere. Landfill Gas is used to eliminate odours and other risks associated with Landfill Gas emissions, as well as to prevent methane from migrating into the atmosphere and contributing to local smog and global climate change. Landfill Gas energy projects also produce revenue and career opportunities in the community and beyond.

Fig 3.7:Landfill collection system[3]

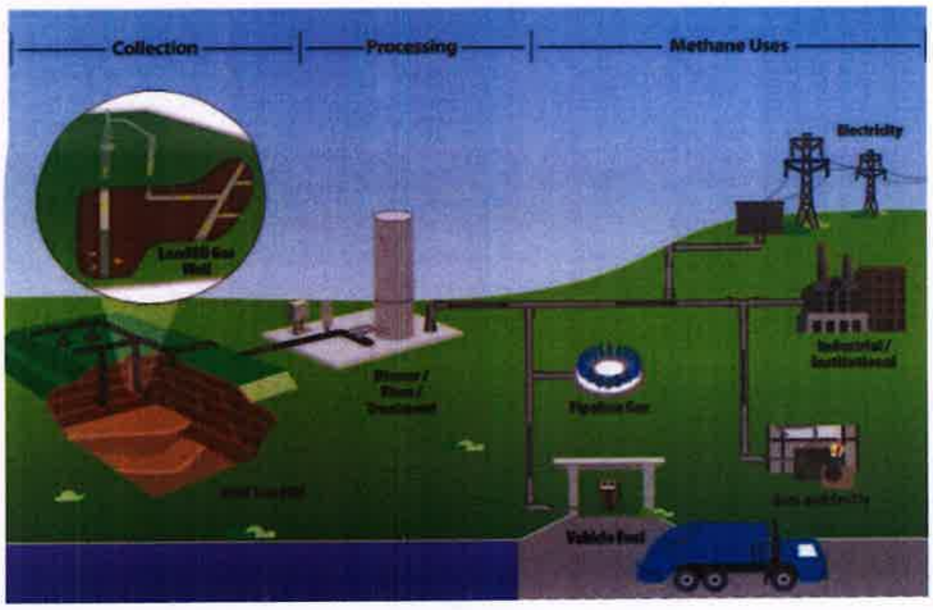
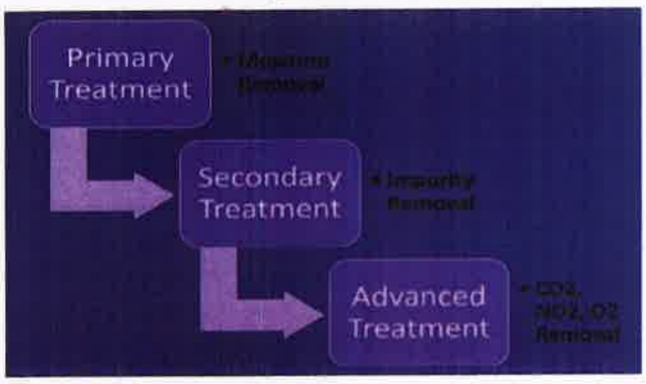
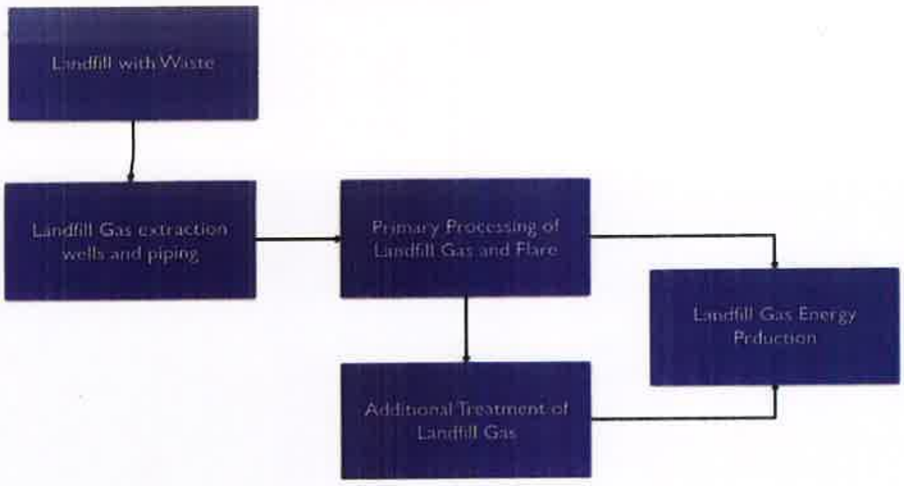


Fig 3.8: Three stages of landfill gas treatment



[3](USEPA), U. S. E. P. A., n.d. EPA. [Online] Available at: https://www.epa.gov/lmop/basic-information-about-landfill-gas

Fig 3.9: Flowchart of a Basic LFG Collection and Processing System



Closure of Remediation Landfill:

- Compacting of land for Waste
- Before the waste processing, the waste shall be sent to the sanitary landfill.
- Before monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading.
- Final cover shall be designed to minimize infiltration and erosion after completion of landfill.
- The final cover shall have a barrier soil layer comprising of 60 cm of clay with proper drainage layer of 15cm on top of it vegetative layer of 45 cm to support natural plant growth and to minimize erosion.

The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following

- Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;
- Monitoring leachate collection system in accordance with the requirement;
- Monitoring of ground water in and around landfill;
- Maintaining and operating the landfill gas collection system to meet the standards.

Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous emission and leachate quality analysis complies with the specified standards and the soil stability is ensured.

Fig 3.10: Benefits and challenges of remediation

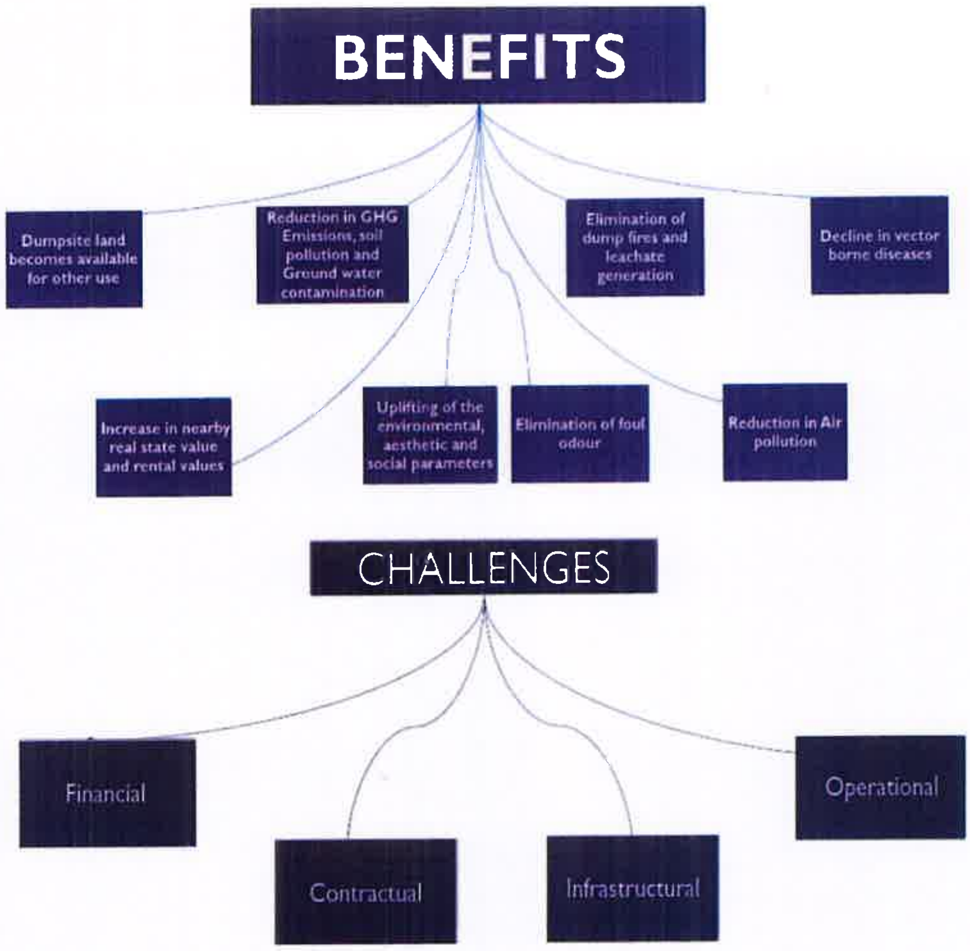
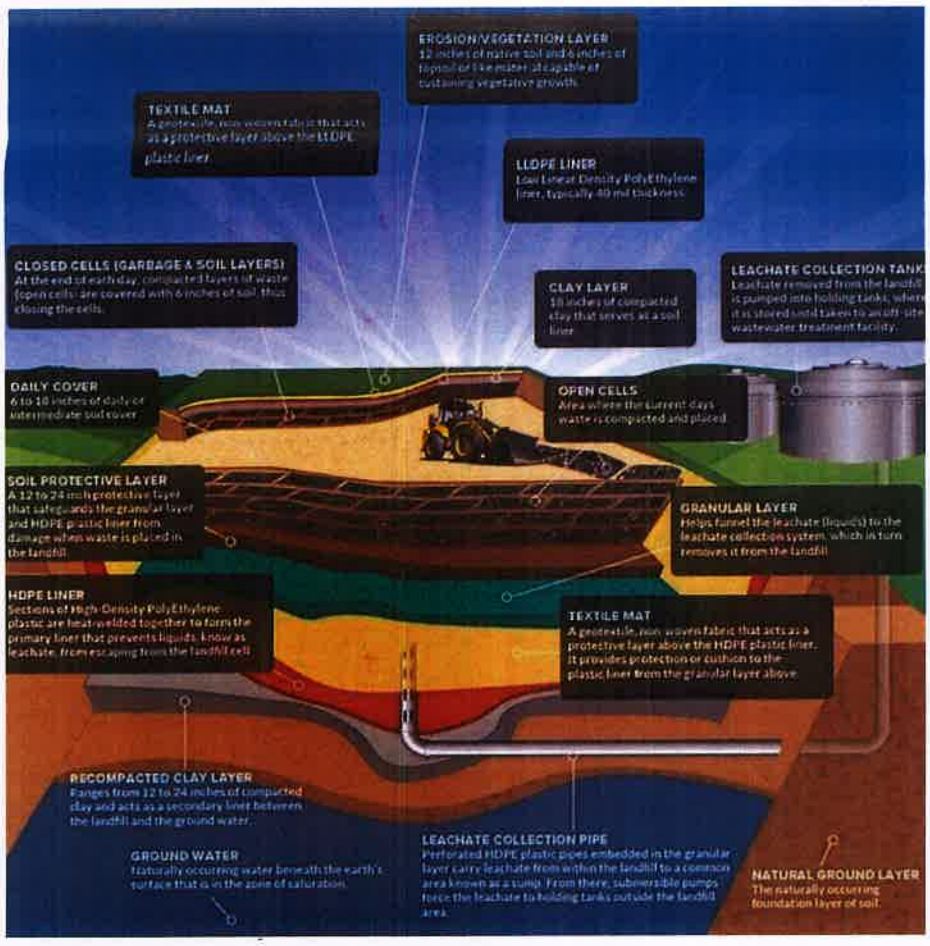


Fig 3.11: Landfill Closure[4]



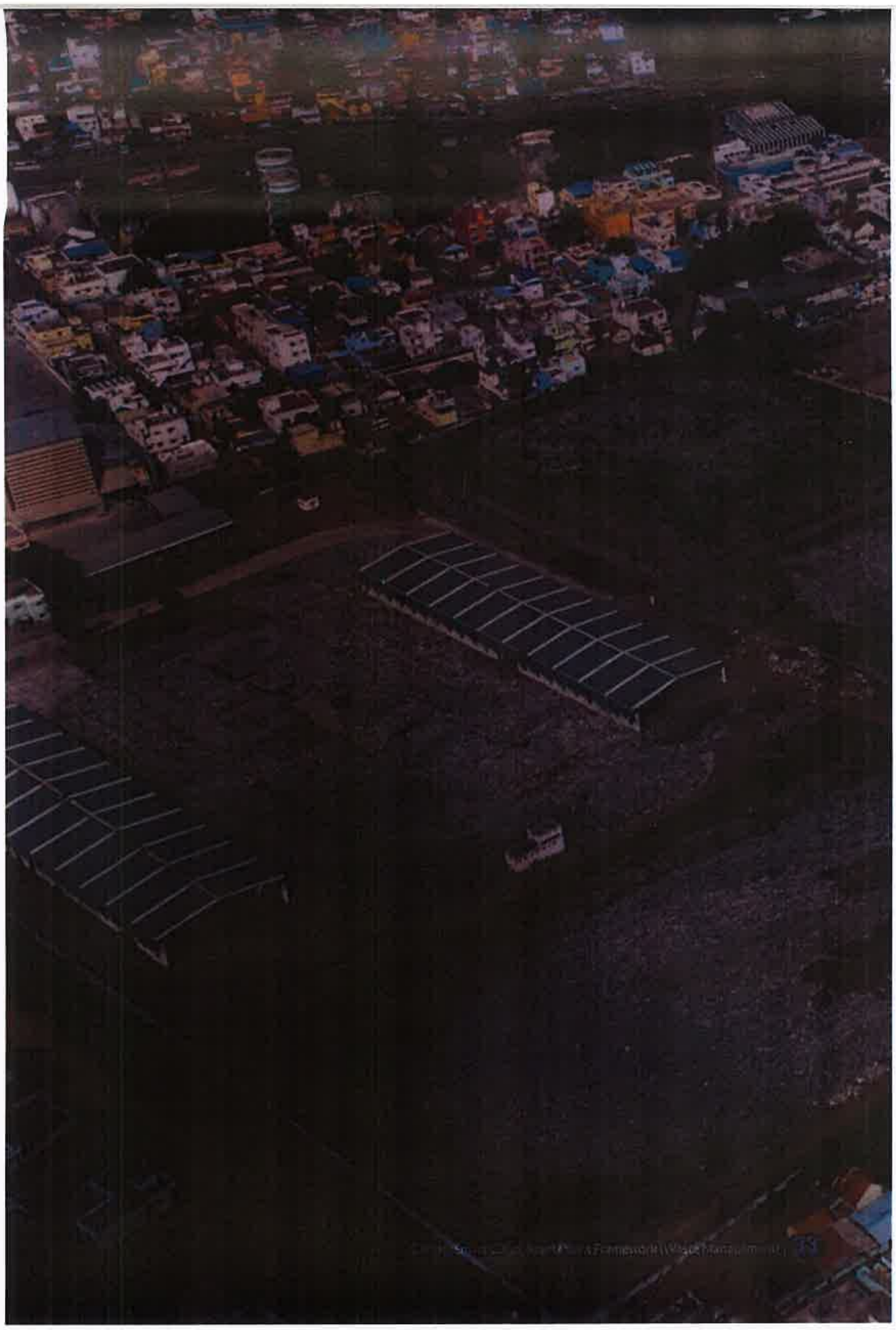
[4]Anon., n.d. *Plastic Smart Cities is an initiative by WWF - World Wide Fund For Nature.* [Online] Available at: https://plasticsmartcities.org/products/sanitary-landfilling [Accessed 2021]

Action Plan

States and Union territories are required to prepare action plans for cities and towns based on the population and waste generation. Steps/action need to be taken could be indicated in a phased manner. An

Fig 3.12: Indicative action plan based on city population

MSW Generation (T/day)	[illegible]	[illegible]	[illegible]
Authorization	Should apply for authorization and seek from SPCBs/PCCs		SPCBs/PCCs to prioritize based on State/ UT- specific requirement
Collection of Waste	Comply with Schedule- II of the Rules and comply within six months		
Segregation of waste	Launch mass awareness programme		
Storage of Waste [illegible]	Set up waste storage facilities which would be combination of conventional as well as mechanized system		Set up conventional bin system and maintaining them in hygienic manner
Transportation of waste	• Vehicles used for transportation of waste. • Storage facilities should synchronize with transportation system. • Strict compliance with Schedule-II to be ensured		• Vehicles of smaller size and easy to maintain be used
Processing of waste Schedule II & IV	• Adopt combination of waste processing technologies, as single technology may not take care of such quantities of waste. • Processing plants should be set up as per Schedule-I		• Considering technical capabilities of local bodies and garbage quantities upto 100 t/d, aerobic process could be feasible solution with better segregation, bio-gas plants can be set up.
Disposal of waste (Schedule-III)	• Rejects of waste processing plants to be disposed off as per Schedule-III of the Rules. • In case of mixed waste, landfilling may be continued following specifications laid down in Schedule III of the Rules.		• Simpler-easy to operate landfills be preferred



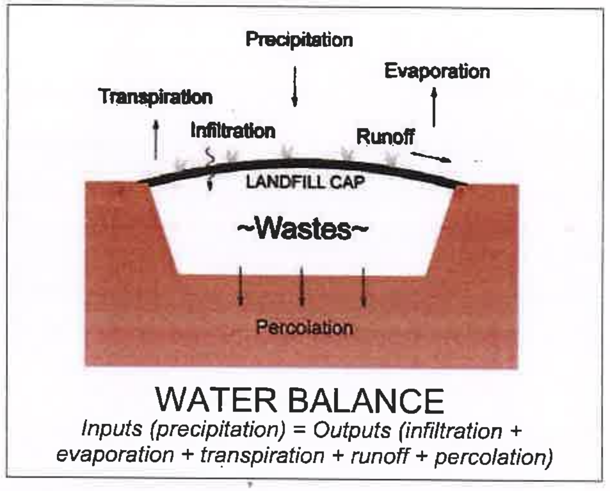
AN INNOVATIVE APPROACH TO LANDFILL CAPPING

BACKGROUND

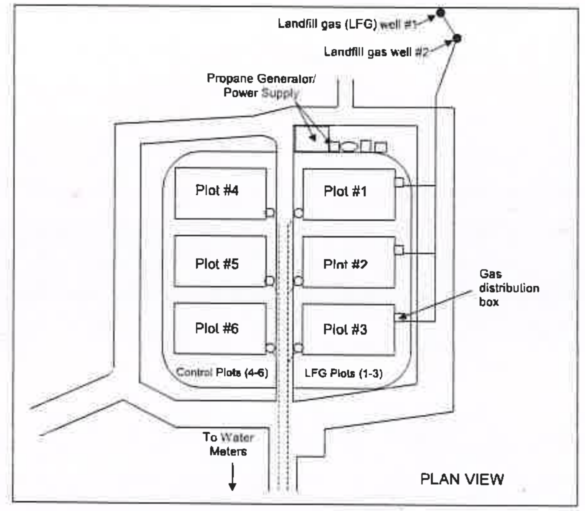
When landfills reach their capacity, they are typically covered (i.e., "capped") with layers of impermeable clay or plastic. ARS is investigating an innovative method to cap landfills using a combination of plants and compost to prevent precipitation from entering landfill wastes and forming undesirable leachates. The combination of bioreactive compost, which retains water and provides nutrients for vegetative growth, and vegetation selected for its ability to produce extensive systems that utilize water, achieves the same result of preventing precipitation from entering underlying waters. This 3 year study is designed to demonstrate the effectiveness of a vegetative cap. In addition to potential cost savings, the benefits of using vegetation and compost to cap landfills include:

- Minimizes the use of limited resources, such as geo-fabric and clay, while optimizing the use of sustainable resources, such as vegetation and compost.
- Does not require the use of elaborate equipment, maintenance, and monitoring, thereby reducing energy and maintenance costs.
- Increases the potential use of the property for parks or other beneficial uses.
- Enhances natural habitat and ecological environment.

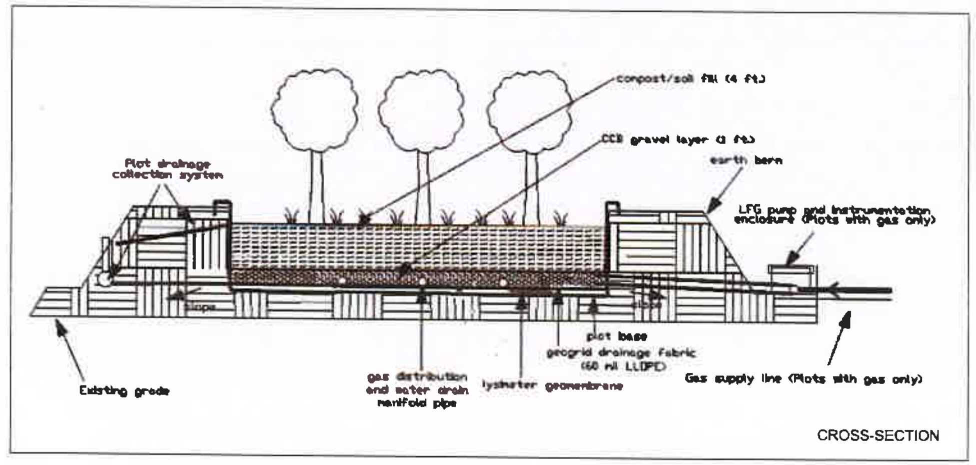
An additional benefit that is being studied is the use of soil microorganisms to sequester methane and carbon dioxide present in the landfill, thereby reducing emissions of these powerful greenhouse gases.



Landfill capping systems reduce the quantity of water moving into and through underlying wastes. Water movement through the organic waste matrix creates leachate, and can result in contamination of ground water and surface water. The effectiveness of a cap design is based on the classical water balance equation based on the principle of conservation of mass:



Six study plots have been established to simulate a vegetative cap using vegetation (i.e., trees and understory), and varying compost/mulch soil mixtures. Plots are identical in all respects, except for the composition of the compost/mulch substrate, and vegetation. The pilot system will measure the volume of infiltrating precipitation that does not run off or evaporate, or is not captured by soil or transpiration. Landfill gas is piped into the plots to evaluate the extent of carbon sequestration occuring within the plots.



Each study plot consists of a gas distribution plenum (sandy-gravel) covered with a bioreactive layer of landfill cover soil mixed with compost. Lysimeters installed in each study plot are designed to capture infiltrating precipitation. Infiltrating precipitation is conveyed to water meters to measure volumes over time. A sub-base gravel mixture has been spread to form the base of each research plot. Landfill gas distribution piping is embedded into the base mixture.

Compost/soil mixtures have been selected based on laboratory studies that indicate optimum water-holding capacities. Vegetation has been selected for test plots based on their characteristics to maximize water usage. Each bioreaclor prototype contains hybrid poplar trees and other mixed tree and plant species.

ars Agricultural Research Service

A Citizen's Guide to Capping

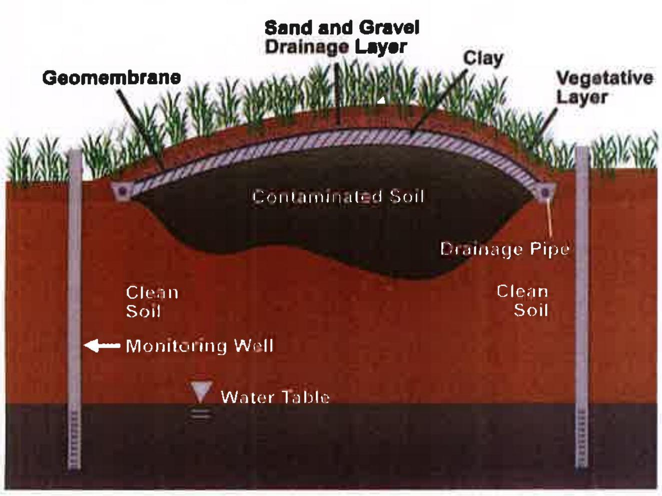
What Is Capping?

Capping involves placing a cover over contaminated material such as landfill waste or contaminated soil. Such covers are called "caps." Caps do not destroy or remove contaminants. Instead, they isolate them and keep them in place to avoid the spread of contamination. Caps prevent people and wildlife from coming in contact with contaminants.

How Does It Work?

A cap isolates and prevents the spread of contamination in several ways. For example, it can:

- Stop rain and snowmelt from seeping through the material and carrying contaminants to the groundwater.
- Keep storm water runoff from carrying contaminated material offsite or into lakes and streams.
- Prevent wind from blowing contaminated material offsite.
- Control releases of gas from wastes containing or producing "volatile" chemicals (those that evaporate).
- Keep people and wildlife from coming into contact with the hazardous material and tracking contaminants offsite.



Example of a cover with several layers.

The cap design selected for a site will depend on several factors, including the types and concentrations of contaminants present, the size of the site, the amount of rainfall the area receives, and the future use of the property. Construction of a cap can be as simple as placing a single layer of a material over lightly contaminated soil to placing several layers of different materials to isolate more highly contaminated wastes. For example, an asphalt cap might be selected to cover low levels of soil contamination on a property whose future reuse requires a parking lot. A cap for a hazardous waste landfill, however, might require several layers, including a vegetative layer, drainage layer, geomembrane, and clay layer. The following are some of the options for caps:

- **Asphalt or concrete:** A layer of these materials can serve as a parking lot or building slab foundation.
- **Vegetative layer:** A top layer of soil planted with grass or other vegetation can help prevent soil erosion and make the area look more natural and attractive. An evapotranspiration or "ET" cover is a vegetative cap in which the plants and underlying soil keep rain and snowmelt from soaking down into the contaminated area. (For more information, please see *A Citizen's Guide to Evapotranspiration Covers* [EPA 542-F-12-006.)
- **Drainage layer:** A layer of sand and gravel, often containing rows of slotted pipes, is built to collect and drain any water that makes it through the top layers of a cap.
- **Geomembrane:** A sheet of strong plastic-like material is used to prevent downward drainage of water and upward escape of gases.
- **Clay:** A layer of compacted clay also can help prevent the downward drainage of water.

Some landfill covers, such as those for municipal landfills, may also include collection and venting systems for methane and other gases that could build up underground.

How Long Will It Take?

Building a cap can take a few days up to several months. Construction may take longer when:

- The contaminated area is large.
- The design of the cap is thick or complex.
- Supplies of clean topsoil, clay, or other cap materials are not available locally.

Caps can be effective for many years when they are properly maintained. They are maintained for as long as the contaminated materials remain in place.

Is Capping Safe?

When properly built and maintained, a cap can safely keep contaminated material in place. A cap will continue to isolate contamination as long as it does not erode or develop cracks or holes that allow water to reach the contaminated material. Regular inspections are made to make sure that the weather, plant roots, and human activity have not damaged the cap and that plants on vegetative caps are still growing. Also, groundwater monitoring wells are placed around the capped area and sampled to help determine if leaks occur.

How Might It Affect Me?

Residents and businesses close to a site may see increased truck traffic as cap materials are brought to the site. Construction of the cap may involve bulldozers, backhoes, and other noisy equipment, and some soil may need to be excavated for use in the cap. Dust from excavation and construction can be controlled by spraying water or covering stockpiled materials with tarps.

Why Use Capping?

Capping is the traditional method for isolating landfill wastes and contaminants. It sometimes is used to address large volumes of soil or waste with low-levels of contamination. Caps made of asphalt or concrete, or even a layer of soil planted with grass, can allow some sites to be reused. Caps have been selected for use at many Superfund sites across the country.

Spring grasses grow on the cap of a hazardous waste landfill.

Example

Capping is one of several methods being used to protect people and the environment from contamination at the Roebling Steel Superfund site in New Jersey. Drums and other wastes were removed from one 5-acre area of the site. Two areas of soil that remained contained metals and other contaminants from steel manufacturing. In 2005, this soil was covered with two types of caps: asphalt and clean soil planted with grass. The purpose of these caps was to avoid the spread of contaminants and to prevent people from coming into contact with contaminated soil.

The caps also were designed with the future use of the site in mind. A station for New Jersey's light rail system was constructed on the property, and the asphalt cap serves as its parking lot. The grassy landscaping surrounds the remainder of the property. A plan is in place for the long-term maintenance and monitoring of the caps to ensure that they remain protective. Future excavation through the soil cap is not permitted.

For More Information

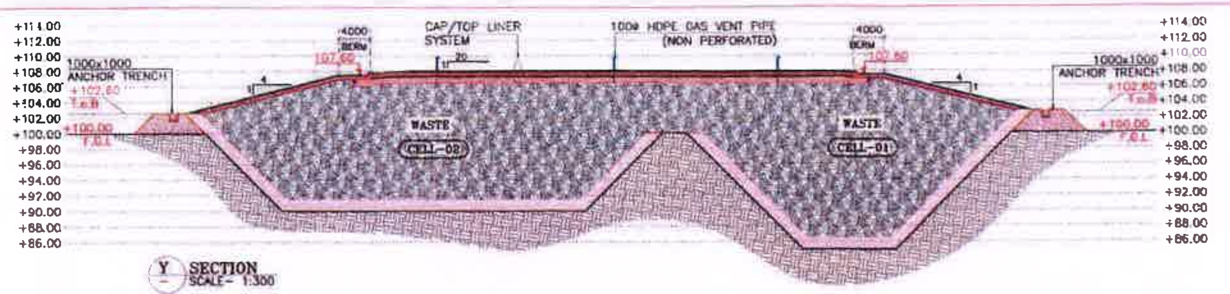
For more information about this and other technologies in the Citizen's Guide Series, visit:

www.cluin.org/remediation
www.cluin.org/products/citguide

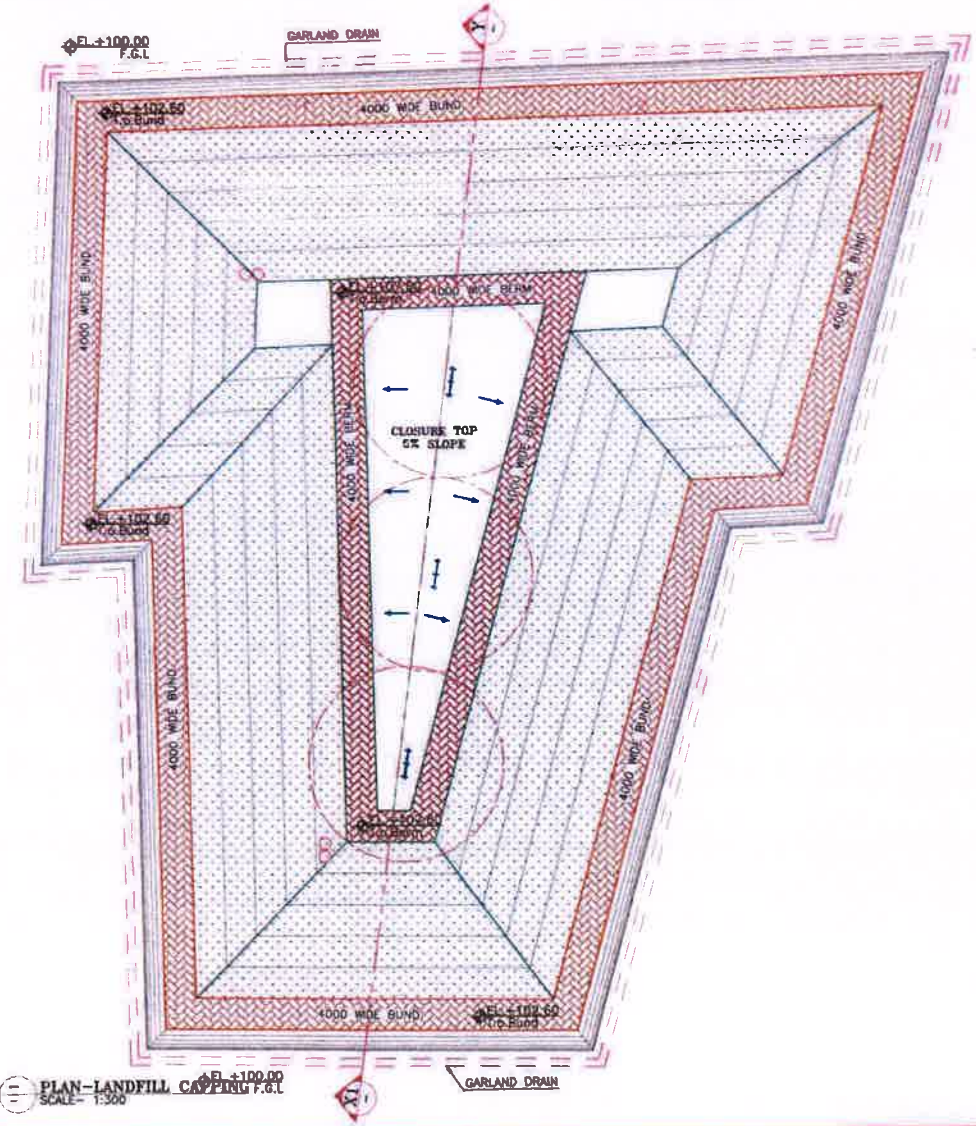
United States Environmental Protection Agency

Office of Solid Waste and Emergency Response (5102G)

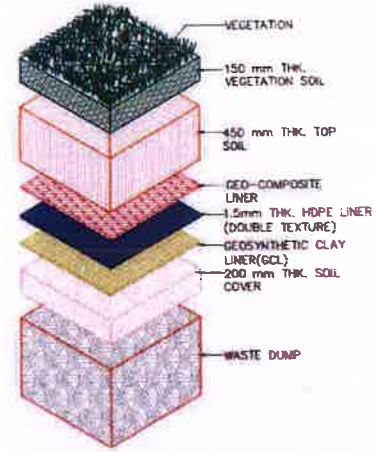
EPA 542-F-12-004
September 2012
www.epa.gov/superfund/sites
www.cluin.org



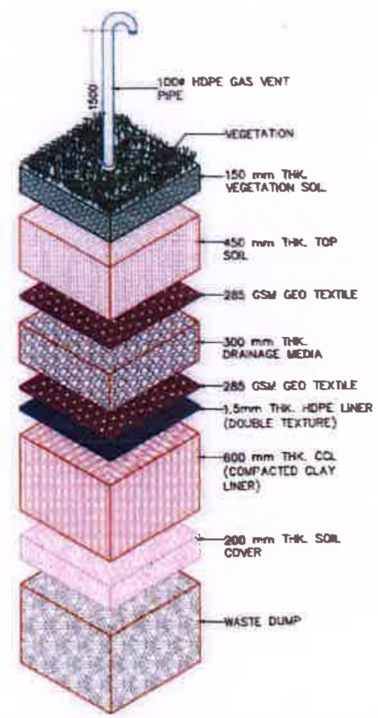
Y SECTION
SCALE- 1:300



PLAN-LANDFILL CAPPING
SCALE- 1:300



DUMP CAPPING COVER SYSTEM (TYP.)
SCALE- NTS AT (SLOPE 4:1)



DUMP CAPPING COVER SYSTEM (TYP.)
SCALE- NTS AT CLOSER TOP (SLOPE 20:1)

NOTES:

1. FGL TENTATIVELY ASSUMED AS +100.00.
2. ALL DIMENSIONS IN MILLIMETERS, LEVELS & COORDINATES IN METERS UNLESS OTHERWISE STATED.
3. DO NOT SCALE DRAWING. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
4. THIS DRAWING SHOWS GENERAL ARRANGEMENT ONLY; REFER STRUCTURAL DRAWING FOR ALL RCC WORKS.
5. STRUCTURE ORIENTATION SHOULD CONFIRM TO THE LAYOUT PLAN.
6. ANY DISCREPANCIES NOTED SHALL BE BROUGHT TO THE NOTICE OF THE ARCHITECT PRIOR TO EXECUTION.
7. ROAD WIDTH SHOWN ARE INCLUSIVE OF BERMS & STORM WATER DRAINS SHALL BE EXECUTED AS PER SITE GRADING.
8. THE ARRANGEMENTS, DIMENSIONS, LEVELS & ANGLES OF THE VARIOUS ITEMS/BUILDINGS/PIPELINES SHOWN IN THIS DRAWING ARE INDICATIVE ONLY. THESE SHALL BE SUBSTANTIATED AT THE TIME OF EXECUTION AS PER SITE CONDITIONS.
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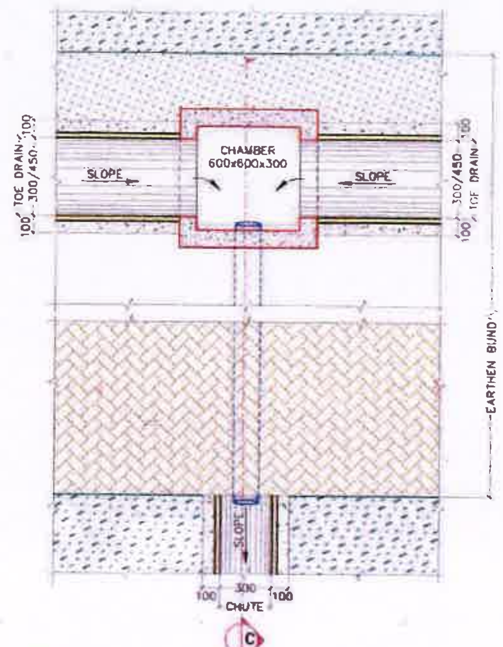
SYMBOLS / ABBREVIATIONS :

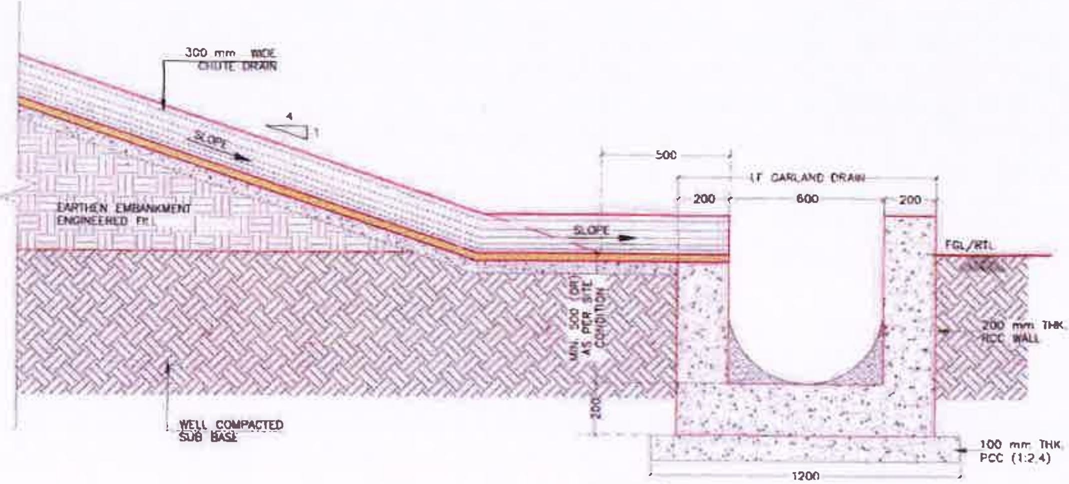
1. ℄ : CENTER LINE
2. m : METER
3. sqm : SQUARE METER
4. rmt : RUNNING METER
5. RCC : REINFORCED CEMENT CONCRETE
6. MoC : MATERIAL OF CONSTRUCTION
7. RTL : ROAD TOP LEVEL
8. FFL : FLOOR FINISH LEVEL
9. NGL : NATURAL GROUND LEVEL
10. T.o.B : TOP OF BUND

THIS DRAWING IS TENTATIVE AND IS MEANT FOR REFERENCE PURPOSE ONLY.

CLIENT: MOTHER EARTH ENVIRON TECH PRIVATE LIMITED (MEEPL) BENGALURU, KARNATAKA.	CONSULTANT: PS ENGINEERING CONSULTANTS HYDERABAD, TELANGANA psec.ts@gmail.com Mobile: 98497 15400, 80089 42055	PROJECT: COMMON HAZARDOUS WASTE TREATMENT STORAGE DISPOSAL FACILITY IN 4 ACRE LAND AT KIADB HAROHALLI INDUSTRIAL AREA PHASE II, KANAKAPURA TALUK, RAMANAGARA DISTRICT, KARNATAKA	TITLE: SCIENTIFIC LANDFILL CLOSURE CAPPING (TOP) PLAN, SECTION & TYP. SECTION	REV. 0	SHEET A1	
			SCALE: NTS / DWG. NO.: MEEPL/PSEC/1008/SLF_CAP/100	DATE: 09.01.2021		REV. / DATE / DESCRIPTION / CHD. BY



2 PLAN-CHAMBER & CHUTE CONNECTIVITY AT BERM
SCALE- 1:15



NOTE: 500 WIDE OPENING TO BE PROVIDED @ EVERY 3.0 M C/C. ON FACILITY SIDE TO ALLOW WATER IN SIDE THE DRAIN

SECTIONAL DETAIL OF CHUTE & GARLAND DRAIN CONNECTIVITY
SCALE- 1:5

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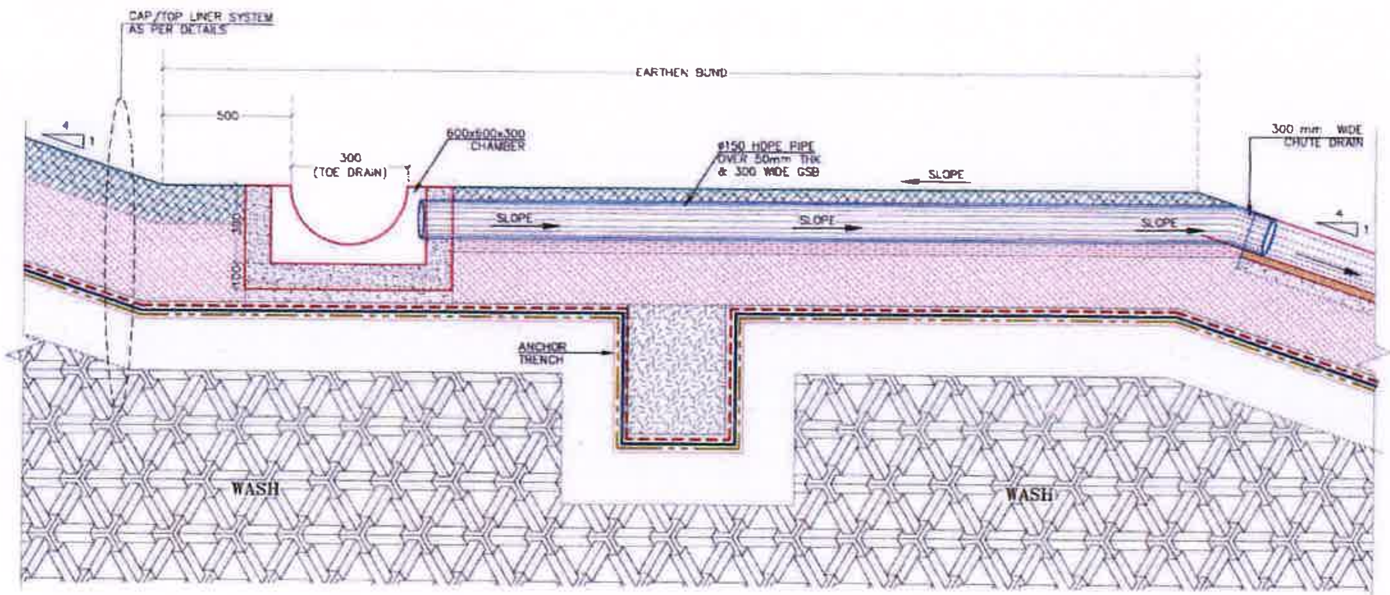
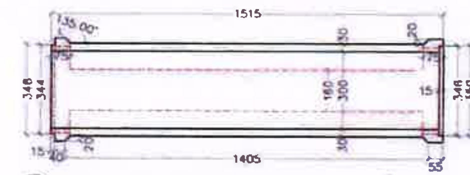
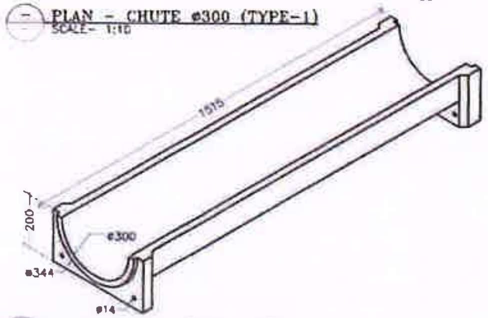
10. ToB : TOP OF BUND
11. BoP : BOTTOM OF PIPE
12. HDPE : HIGH DENSITY POLYETHYLENE
13. CCL : COMPACTED CLAY LINER
14. GCL : GEO-SYNTHETIC CLAY LINER



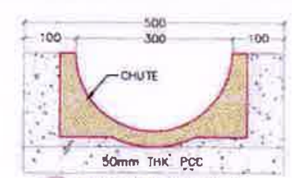
C SECTIONAL DETAIL OF CHAMBER & CHUTE CONNECTIVITY AT BERM
SCALE- 1:5



PLAN - CHUTE ø300 (TYPE-1)
SCALE- 1:10



VIEW - CHUTE ø300 (TYPE-1)
SCALE- 1:5

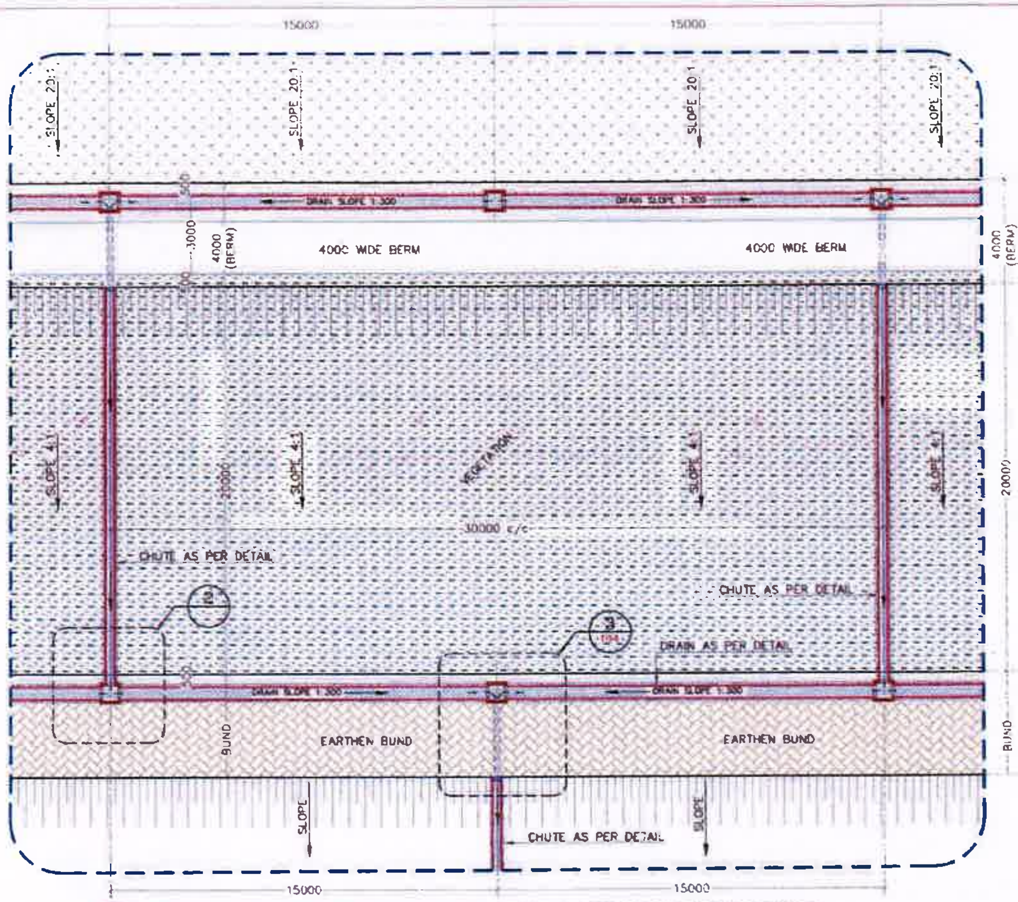


C/S TOE DRAIN-1
SCALE- 1:5

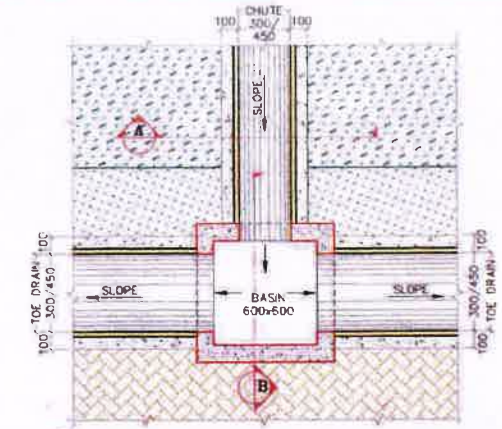
THIS DRAWING IS TENTATIVE AND IS MEANT FOR REFERENCE PURPOSE ONLY.

CLIENT:	CONSULTANT:	PROJECT:	TITLE:	REV.	SHEET
MOTHER EARTH ENVIRON TECH PRIVATE LIMITED (MEEPL) BENGALURU, KARNATAKA.	PS ENGINEERING CONSULTANTS HYDERABAD, TELANGANA psec.ts@gmail.com Mobile: 98497 15400, 80089 42056	COMMON HAZARDOUS WASTE TREATMENT STORAGE DISPOSAL FACILITY IN 4 ACER LAND AT KIADB HAROHALLI INDUSTRIAL AREA PHASE II, KANAKAPURA TALUK, RAMANAGARA DISTRICT, KARNATAKA	SCIENTIFIC LANDFILL CLOSURE TOE/CHUTE DRAINS, DISSIPATION BASIN DETAILS	0	A1
SCALE: NTS	DRG NO: MEEPL/PSEC/1008/SLF_CAP/104			DATE: 08.01.2021	

REV.	DATE	DESCRIPTION	CHD BY



PARTIAL PLAN – TOE DRAIN SLOPE AT BERMS & CONNECTIVITY WITH CHUTS
SCALE- 1:100



1 PLAN-TOE DRAIN, CHUTE & DISSIPATION BASIN CONNECTIVITY
SCALE- 1:15

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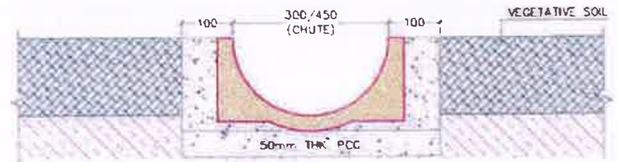
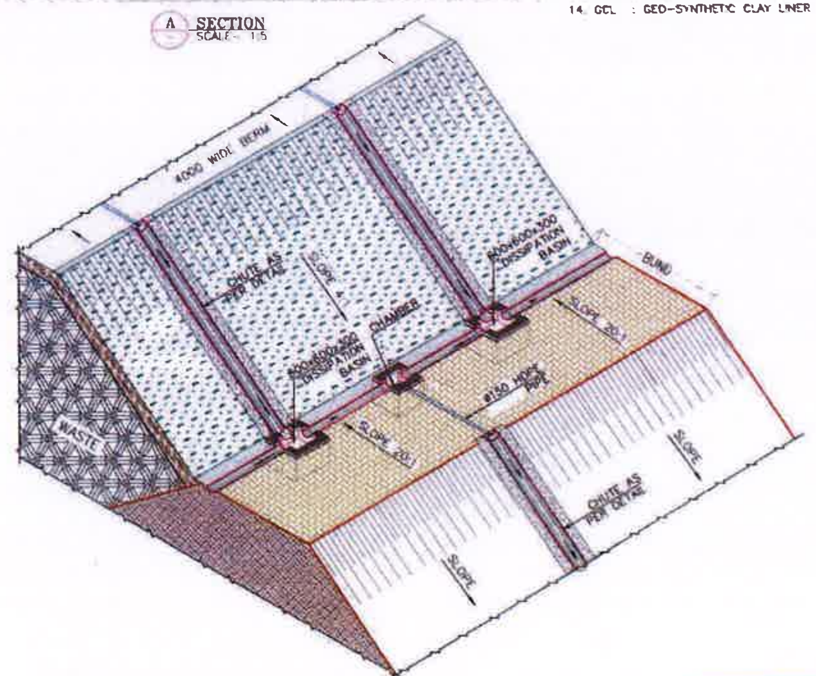
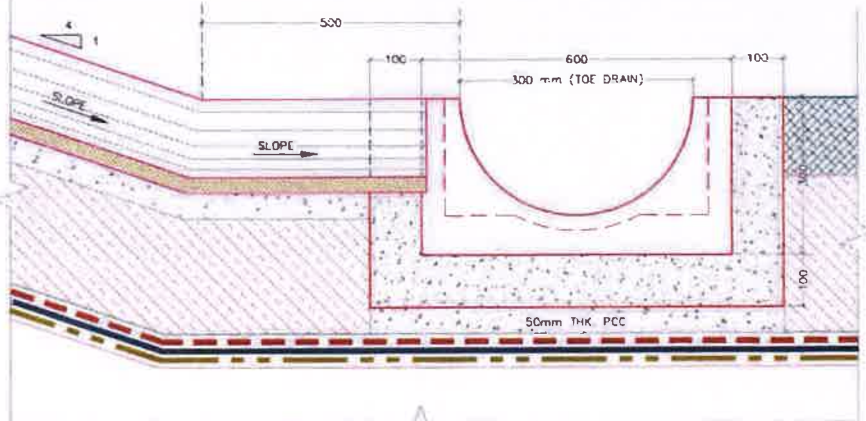


A SECTION
SCALE- 1:5



ISOMETRIC VIEW-CHUTE & BASIN
SCALE- NTS



B SECTION
SCALE- 1:5

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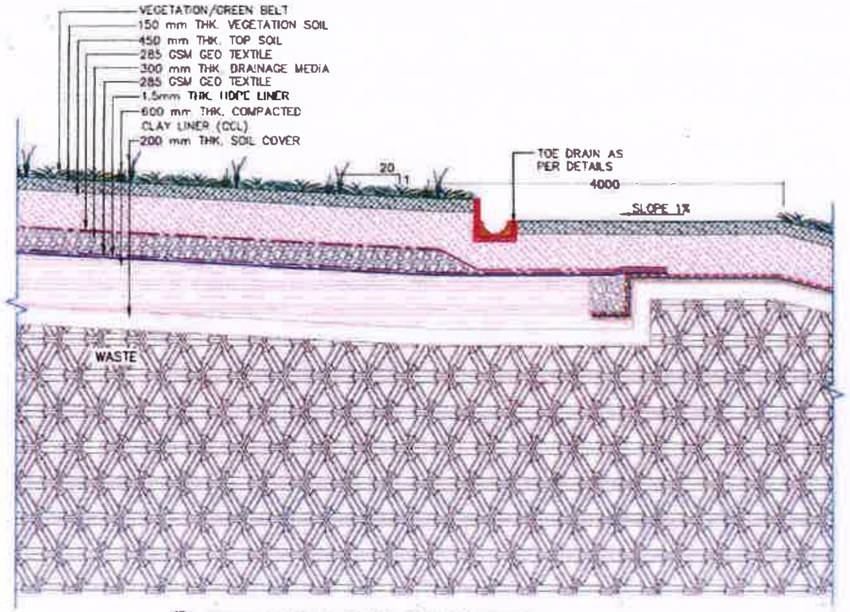
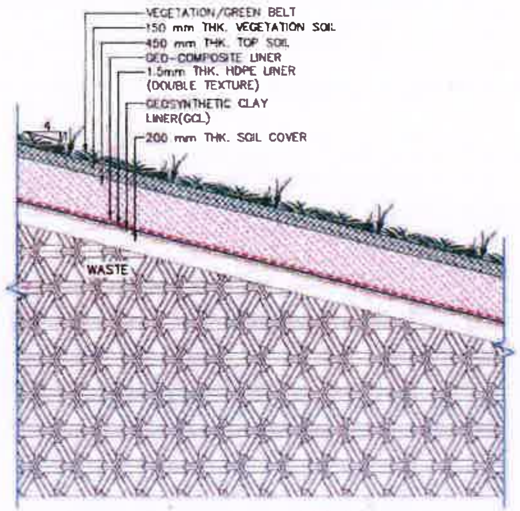
			SCALE: NTS / DRG. NO.: MEEPL/PSEC/1008/SLF_CAP/103	DATE: 09.01.2021	

REV.	DATE	DESCRIPTION	CHD BY

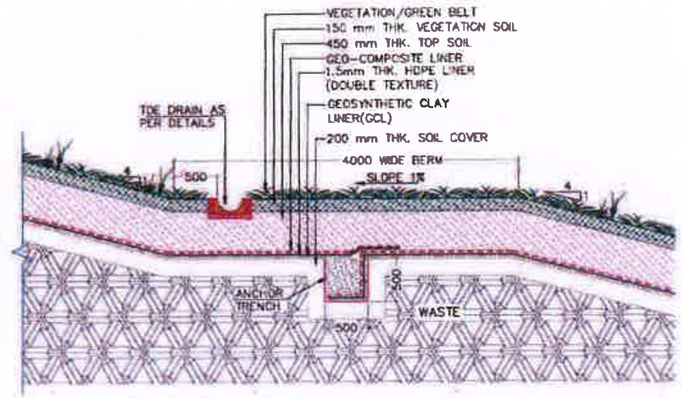
4



DUMP CAPPING COVER SYSTEM (TYP.) AT CLOSER TOP (SLOPE 20:1)
SCALE- 1:30



DUMP CAPPING COVER SYSTEM (TYP.) AT SLOPE (4:1)
SCALE- 1:30



DUMP CAPPING COVER SYSTEM (TYP.) AT BERM
SCALE- 1:30

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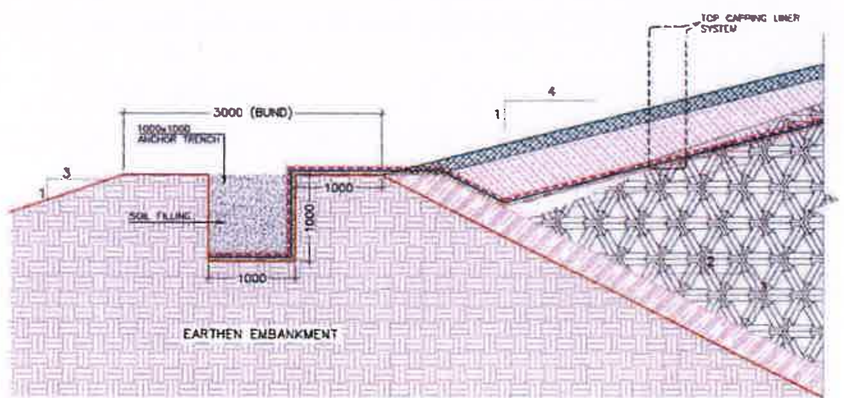
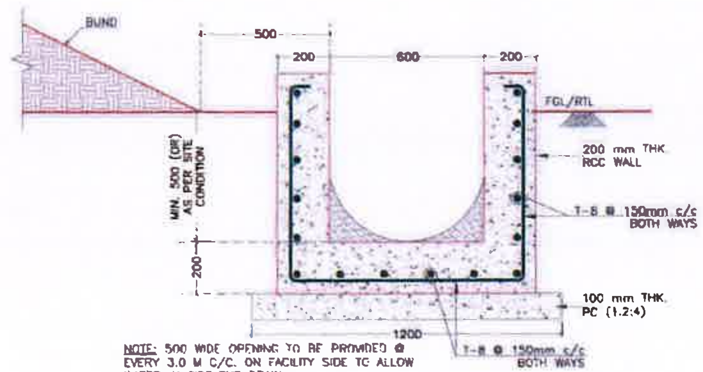


ANCHOR TRENCH & ANCHORING DETAIL (TYP.)
SCALE- 1:30



NOTE: 500 WIDE OPENING TO BE PROVIDED @ EVERY 3.0 M C/C. ON FACILITY SIDE TO ALLOW WATER IN SIDE THE DRAIN

GARLAND DRAIN REINFORCEMENT DETAILS
SCALE- 1:10

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8. HDPE : HIGH DENSITY POLYETHYLENE
9. CCL : COMPACTED CLAY LINER
10. GCL : GEO-SYNTHETIC CLAY LINER

LEGEND :

REF NO.	NOTATION	DESCRIPTION
1		VEGETATION SOIL
2		DRAINAGE MEDIA
3		COMPACTED CLAY LINER
4		LOW PERMEABILITY SOIL
5		285 GSM GEO-TEXTILE
6		1.5mm THK. HDPE LINER (DOUBLE TEXTURED)
7		GEO COMPOSITE LINER
8		GEO SYNTHETIC CLAY LINER

CLIENT:	CONSULTANT:	PROJECT:	TITLE:	REV.	SHEET
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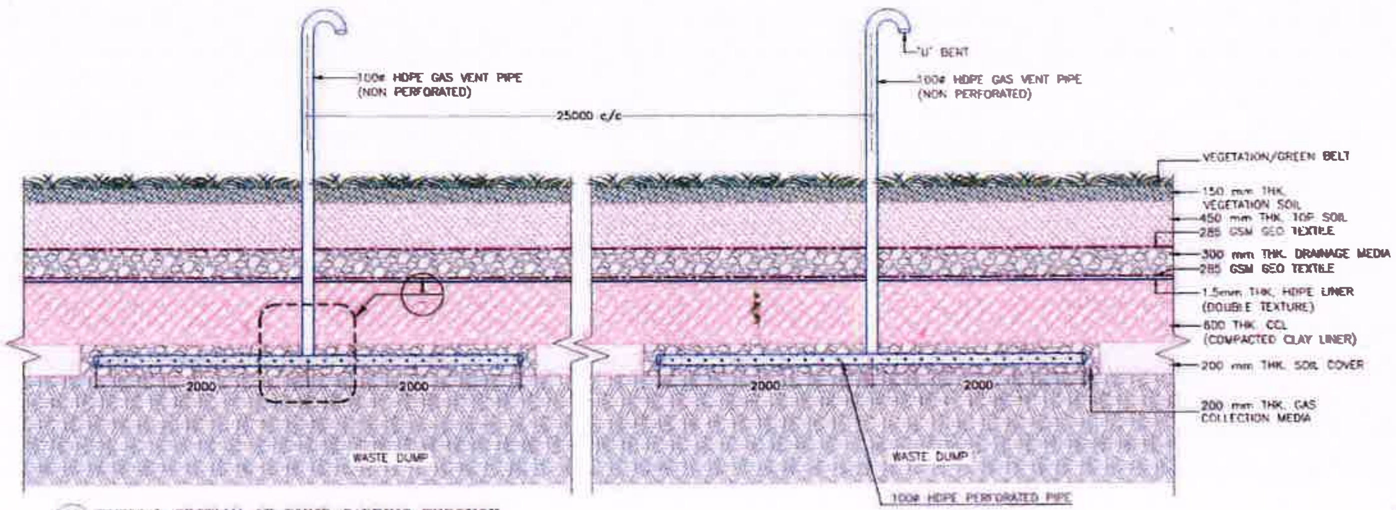
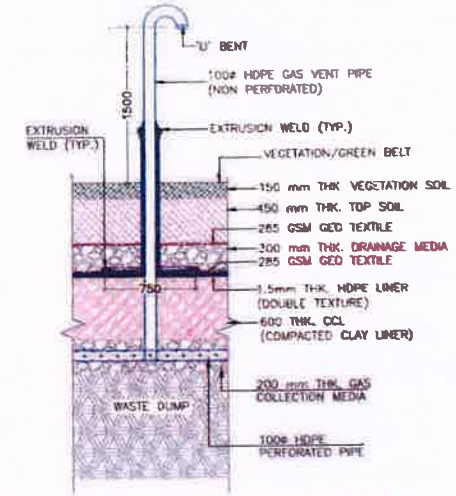
			SCALE: NTS / DRG NO.: MEEPL/PSEC/1008/SLF_CAP/101	DATE: 09.01.2021	

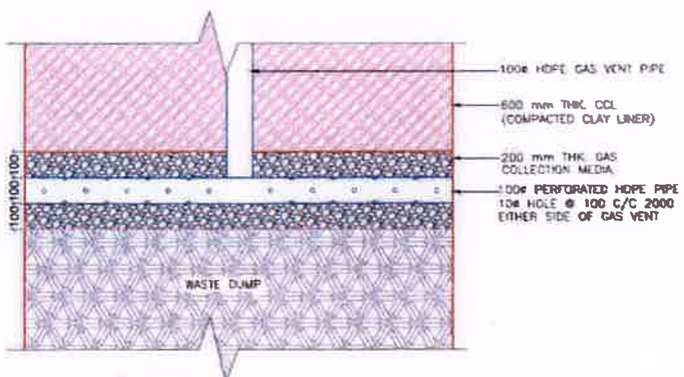
REV.	DATE	DESCRIPTION	CHD BY



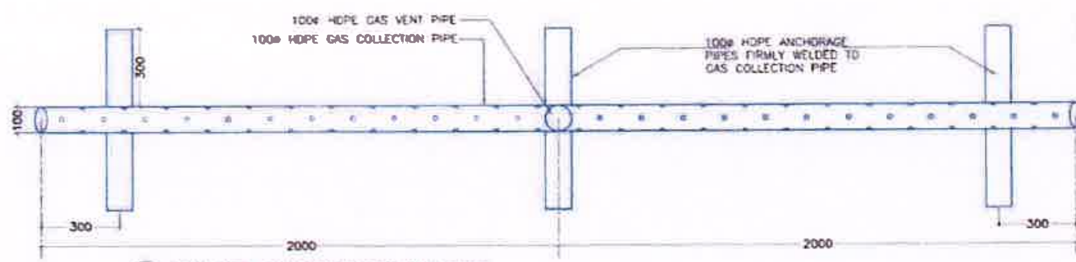
TYPICAL SECTION OF DUMP CAPPING THROUGH GAS COLLECTION PIPE
SCALE- 1:25



DETAIL OF STANDARD HDPE PIPE BOOT (TYP.)
SCALE- 1:25



1 DETAIL
SCALE- 1:10



TOP VIEW OF PERFORATED GAS PIPE
SCALE- 1:10

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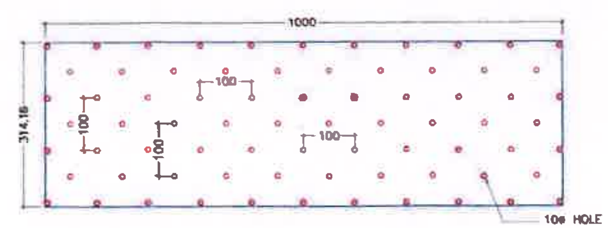

DETAIL OF PERFORATION IN 100ø HDPE PIPE
SCALE- 1:5

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			SCALE: NTS — DWG NO: MEEPL/PSEC/1008/SLF_CAP/102	DATE: 09.01.2021	

REV.	DATE	DESCRIPTION	CHD BY

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
SOUTHERN BENCH AT CHENNAI

ORIGINAL APPLICATION NO. 104 OF 2020

RAJESH GHANTAYATH
... APPLICANT

VERSUS

UNION OF INDIA AND 7 ORS.
... RESPONDENTS

MEMO ALONG WITH ANNEXURES FILED ON BEHALF OF THE 8TH RESPONDENT

T.HEMALATHA, R.RAJMOHAN & S.DEEPIKA

COUNSEL FOR RESPONDENT NO.8