SintMaarten TRUST FUND

FEASIBILITY STUDY

Alternative Analysis Report (2025)

Overview

This report is a feasibility-stage alternatives analysis that addresses Municipal Solid Waste Disposal Sites (MSWDS) on Pond Island—specifically the long-standing Solid Waste Disposal Site (SWDS) and the post Irma Disposal Site (IDS). Prepared for the National Recovery Program Bureau (NRPB) by Witteveen+Bos and TAUW (dated March 20, 2025), it forms a core input for deciding how to stabilize, improve, and transition away from an open-dump regime that has created significant environmental, health, and safety risks.

The context is the post Hurricane Irma recovery ("Building Back Better") under the Emergency Debris Management Project (EDMP). The MSWDS, which has evolved as an uncontrolled dump over decades, now presents acute risks: geotechnical instability of steep, overtopped waste slopes threatening collapse; uncontrolled leachate discharge into the adjacent Great Salt Pond (GSP); fire and gas hazards; and visual and odour nuisances that undermine a tourism dependent economy. At the same time, Sint Maarten faces severe land constraints, high import costs for materials, and limited institutional capacity—factors that complicate large civil works and long-term operations.

This analysis frames a decisive choice for the island's waste pathway over the coming decade or more. It compares technically robust, realistic alternatives that would (a) reduce near-term EHS risks through reprofiling and control measures, (b) create sufficient disposal capacity for a bridging period, and (c) enable a transition to a modern integrated solid waste management system. In doing so, it clarifies tradeoffs between lifespan, cost, risk, and feasibility that NRPB and government counterparts must weigh now, before capacity constraints trigger an emergency.

Objectives and Audiences

The report's purpose is to define, compare, and rank feasible development pathways for the MSWDS so that NRPB can select a single alternative for Concept Design, a full Feasibility Study, and subsequent procurement. The alternatives are constructed on a uniform Environmental, Health, and Safety (EHS) Engineering Concept to ensure that comparisons are apples-to-apples across geotechnical stability, leachate and gas control, stormwater management, and operational enhancements.

The implicit objective is to secure a viable bridge from today's open dump situation to a future, more sustainable waste system. The report aims to identify the option that best balances urgent risk mitigation with the provision of sufficient operational life to plan, finance, and deliver a waste diversification strategy (reduction, recycling, composting, and alternative treatment) and eventual offsite disposal/treatment solutions. The alternative ultimately selected should be technically credible, socioeconomically acceptable, and implementable within Sint Maarten's constraints.

This report is intended primarily for the National Recovery Program Bureau (NRPB) and the World Bank–administered Trust Fund team, who will select a preferred alternative to advance into Concept Design, Feasibility, and procurement within financing and schedule constraints. Secondary audiences include the Government of Sint Maarten, especially VROMI and entities establishing a Waste Authority and fee systems; prospective contractors and service providers in civil works, operations, and waste processing, who need clarity on the technical concept and phasing; and civil society and community stakeholders, who require guidance on risk reduction, site aesthetics, operational impacts, and progress toward improved environmental outcomes.

Findings

The analysis is organized around a consistent engineering baseline and a comparative evaluation framework. It sets out three siting concepts—no horizontal expansion, horizontal expansion into a defined "Resettlement Area," and horizontal expansion into the "VROMI Yard"—and evaluates each with two vertical crest scenarios for the IDS (10 m and 25 m). A uniform EHS engineering package is then applied to each alternative.

Definition of Alternatives and Capacities/Lifespans

The alternatives differ primarily in geometry and therefore capacity and life-span. All include common closure and control elements to address current environmental risks.

Existing Boundary (no horizontal expansion)

- Base case (IDS crest 10 m): Approximately 70,000 m^3 remaining capacity; reaches end of life by mid-2025.
- Sensitivity (IDS crest 25 m): Approximately 360,000 m^3; life extended to the end of 2027.

Horizontal Extension at the Resettlement Area (approx. 3.3 ha southward)

- Base case (IDS crest 10 m): Approximately 900,000 m^3; capacity until mid-2033.
- Sensitivity (IDS crest 25 m): Approximately 1,190,000 m^3; capacity to end-2035 and potentially beyond 2040 if waste diversification is implemented effectively.

Horizontal Extension at the VROMI Yard (approx. 3.6 ha southward)

- Base case (IDS crest 10 m): Approximately 319,000 m^3; capacity until mid-2027.
- Sensitivity (IDS crest 25 m): Approximately 609,000 m^3; capacity to end-2030.

The lifespan results are pivotal: only the Resettlement Area extension yields a decade plus horizon that provides enough time to plan and roll out a new waste system. The existing boundary option creates a near term cliff, while the VROMI Yard delivers only a short to medium bridge that may not justify its complexity and cost in view of the limited added service years.

Uniform EHS Engineering Concept

All alternatives incorporate a standard set of engineering solutions emphasizing robust, low maintenance systems suited to an island context where materials and expertise are expensive and often slow to mobilize.

- Slope stabilization and final contours: Existing steep, unstable slopes are reprofilied to a 1:3 ratio with 5metre berms at 5metre vertical intervals. A geocell-reinforced cover layer is used to achieve target stability (Safety Factor > 1.1 per EuroCode 7). This approach avoids a large ringdike footprint extending into the Great Salt Pond, reducing complexity and environmental encroachment.
- Leachate control and treatment: For existing waste masses, a low permeability final cover reduces infiltration. Stakeholders prefer a synthetic barrier for the final cover to minimize leachate formation. New extension cells (in the Resettlement Area or VROMI Yard) include a composite base liner system and a drainage network to collect leachate. Collected leachate is treated via a helophyte system, selected for its low energy, resilient performance under local conditions and minimal O&M demands compared with more complex biological or physicochemical systems.
- Landfill gas management: For small volumes, a passive extraction with biofiltration is proposed. For larger waste masses, an active gas collection network using a dense grid of small flexible wells, with flaring for destruction, is recommended. Given data uncertainties, gas-to-energy is not evaluated.
- Stormwater and surface water management: Surface water diversion, slope drainage, and separation of clean stormwater from leachate influenced runoff reduce erosion and infiltration. Measures are tailored to control overland flow while avoiding additional flood risk to the Great Salt Pond.
- Operational improvements: A reconfigured operations area (new office and sanitary facilities, storage, waste inspection floor) and relocation of the weighbridge within a defined set-back improve safety and operational control. These measures professionalize site management and enable enforcement (e.g., waste inspection and fee collection).

Comparative Feasibility Analysis

For technical feasibility, the existing boundary option scores “Good” for robustness because it avoids the added complexity of new cells and associated leachate treatment systems, while extensions score “Moderate,” and all options score “Poor” for material accessibility because most materials must be imported. Socio economic feasibility ranks the existing boundary highest on procurement simplicity and visual outcomes but notes poor alignment with the June 2028 completion target, while extensions add capacity yet extend operations beyond 2028. For health, safety, and environmental feasibility, the existing boundary performs “Very Good,” whereas extensions face longer term emissions and site-specific constraints.

Cost Estimates and Cost Drivers

The report provides AACE Class 5 estimates—appropriate for concept level comparisons with wide accuracy ranges. Two cost bases are provided: (1) itemized direct costs (recommended for ranking) and (2) total investment including indirects and contingencies.

- Total investment (indicative):
    - Existing Boundary (IDS 25 m): ≈ $69.4 million
    - Resettlement Area (IDS 25 m): ≈ $78.6 million
    - VROMI Yard (IDS 25 m): ≈ $81.5 million
- Itemized direct costs (for ranking):

- Existing Boundary (IDS 25 m): ≈ $34.9 million
- Resettlement Area (IDS 25 m): ≈ $39.5 million
- VROMI Yard (IDS 25 m): ≈ $41.0 million

The principal differentiator is that the Resettlement Area extension—while roughly 13% higher in direct costs than the existing boundary option—delivers substantially greater capacity and service life. Import dependencies (soil, sand, gravel, geosynthetics) drive costs across all alternatives; logistics and mobilization are recurring cost risks.

Waste Generation and Lifespan Implications
Lifespan calculations derive from geometric capacity and forecasted waste disposal rates. Although the forecast is indicative rather than precise, the relative differences are decisive:

- Existing boundary quickly reaches capacity (mid-2025 to end-2027), leaving the island with a disposal gap unless a new site is already ready—an unlikely scenario.
- VROMI Yard offers a mid-range bridge (mid-2027 to end-2030), probably too brief to justify the investment given the timeline for planning and financing new solutions.
- Resettlement Area offers a decade plus bridge (mid2033 to end2035 and possibly beyond 2040 with waste diversion), allowing time for policy, institutional, and infrastructure transitions.

Notable Design Choices and Examples

- Cover system selection reflects stakeholder preference for synthetic barriers on final cover, trading increased material cost for better infiltration control.
- The helophyte system is chosen over mechanically intensive options based on resilience and low O&M demands in a small island context—an example of tailoring technology to capacity.
- A dense grid of small diameter, flexible gas wells is selected to balance effectiveness with ease of installation and maintenance in heterogeneous waste.

Lessons Learned

Long-term neglect of waste disposal standards creates liabilities far more expensive to remediate than to prevent, making a clear legal and regulatory regime essential, alongside economic instruments such as a gate fee and a dedicated Waste Authority to ensure financial sustainability and enforcement. Operationally, in small, import dependent economies, simpler, passive or semi passive systems are more reliable, alternatives should allow stepwise implementation, and land scarcity requires high land use efficiency and careful site layout near sensitive water bodies like the Great Salt Pond. Institutionally, infrastructure alone is insufficient, as public education, source separation, recycling incentives, market development, and funded in house and contracted O&M capacity are necessary to sustain long-term performance.

Implications for Stakeholders and Suggested Actions

Government of Sint Maarten (VROMI): The government must choose between a short-term closure that creates a near term capacity crisis or an extension that maintains disposal continuity while the long-term system is developed. Institutional reforms are as important as civil works:

- Establish a Waste Authority with clear mandates for operations, tariffs, compliance, and reporting.
- Use a gate-fee system or equivalent financing to support O&M, enforcement, and reinvestment.
- Reserve and secure land for the preferred extension and for future treatment/disposal facilities, integrating flood risk and environmental management for the Great Salt Pond.

NRPB and development partners: Given the Trust Fund's 2028 deadline, a phasing strategy is advisable.

- Near term: Implement slope stabilization, cover installation, leachate minimization, and gas control to reduce EHS risks and improve operations.
- Concurrently: Advance the design and financing of the chosen extension (likely the Resettlement Area) to secure bridging capacity beyond the Trust Fund horizon, potentially leveraging additional financing or public–private partnerships.

Private sector: The proposed pathway opens opportunities in construction (earthworks, liners, drainage), operations (weighbridge, inspection, leachate system upkeep), and downstream waste markets (recycling, composting, construction and demolition waste processing). However, operators of existing scrap and crushing activities must adapt to site reconfiguration and potential relocation.

Civil society and the public: The public will experience continued landfill operations—and associated nuisances—if an extension is chosen, but also gains reduced risk of fire, slope failure, and water contamination, and a more orderly site with progressive re-vegetation. Engagement and education will be critical to support waste reduction and segregation programs that lengthen the landfill's life and reduce environmental impacts.

Recommendations

Short term (0–2 years)

- Implement the uniform EHS engineering package: reprofile slopes, install cover layers to reduce infiltration, deploy LFG control, and separate stormwater from leachate affected flows.
- Reorganize operations: relocate the weighbridge; establish inspection platforms; construct basic office and sanitary facilities; demarcate set-backs and internal circulation.
- Launch institutional reforms: enact enabling regulations for a gate-fee; begin establishing a Waste Authority with operational oversight and financial governance.
- Initiate a practical waste diversification program: pilot source separation, scale C&D waste processing, and support private recycling where feasible.

Medium term (2–7+ years)

- Based on the analysis, the Resettlement Area extension is the only option that delivers a 10+ year life-span. Advance Concept and Feasibility studies into procurement and construction.
- Install and commission the helophyte leachate treatment system for new cells; continue progressive closure of legacy areas.
- Expand waste diversion measures to reduce disposal tonnage and extend life (organics management, dry recyclables capture, policy incentives).

Long term (7–15 years)

- Plan and secure financing for a next-generation treatment/disposal solution off the Pond Island site (e.g., transfer and treatment facilities), ensuring climate resilience and circularity principles.
- Strengthen end markets for recovered materials, embed extended producer responsibility where practical, and align with regional trade and standards.
- Maintain regulatory and financial frameworks to ensure continuous compliance, performance monitoring, and reserve funds for closure/aftercare.

Risks, Limitations, and Assumptions

Risks include a capacity shortfall, where selecting a short-life option without a ready successor could create an emergency with nowhere for waste to go; cost and schedule overruns, driven by import dependencies for materials and equipment that expose the project to price spikes, shipping delays, and supply chain disruptions; and O&M performance risks, since failure to fund and staff operations can degrade system performance, causing issues such as leachate overtopping, cover damage, or blocked drains, undermining environmental protection. Limitations include that cost estimates are Class 5 and intended for comparison only, waste generation forecasts are indicative, and ecological assessments are outside the report's scope. Assumptions are that land access is secured, certain fill materials can be sourced locally, and institutional reforms can be implemented alongside engineering measures to ensure sustainability.

Conclusion

This report reframes Sint Maarten's waste challenge from "fix the dump" to a strategic choice among engineered, costed pathways with distinct time horizons and implications. It shows that minimal interventions within the existing boundary cannot provide an adequate bridge and risk a near-term disposal crisis, while moderate extensions at the VROMI Yard offer limited breathing room relative to their added complexity and cost. A larger extension at the Resettlement Area, though more expensive upfront, buys critical time—potentially a decade or more—to implement waste diversification and long term solutions, underscoring that time is the scarcest asset. The conclusion emphasizes there is no low-cost workaround for under investment, and success requires robust engineering, institutional and financial reforms, and a shift toward reducing, reusing, and recycling waste.

Methodology

The report uses a structured comparative alternatives analysis. A uniform EHS Engineering Concept—covering slope stability, cover and liner systems, leachate and gas management, stormwater control, and operational upgrades—is specified and applied consistently to each siting/height alternative. Alternatives are then evaluated through a multi-criteria analysis across technical robustness, socio-economic feasibility (including procurement and timeline sensitivities), and HSE performance.

The analysis draws on prior technical inputs and site investigations, including:

- Environmental field study data for leachate and receiving water quality.
- Geotechnical and geomorphological surveys, including soil borings and lab testing for stability parameters.
- Methane generation modeling aligned with recognized guidelines.
- A waste generation, composition, and disposal note providing forecast parameters.
- A topographical survey (August 2024) to quantify existing volumes and geometry.

Analytical methods combined geotechnical, operational, and financial assessments. Geotechnical stability was evaluated using 3D modeling in line with EuroCode 7, with safety factors and reinforcement strategies such as geocells. Capacity and lifespan were estimated by dividing net airspace by projected disposal tonnages, including sensitivity analyses around IDS crest heights. Concept-stage costing followed AACE Class 5 practices, using a Bill of Quantities for direct costs and standard percentages for indirects, contingencies, and allowances. Technology screening prioritized operational resilience and lifecycle suitability for a small island context.