



**ST. MAARTEN**

STATEN VAN SINT MAARTEN

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Par. B hrg

Aan de Voorzitter der Staten  
Wilhelminastraat 1  
Alhier

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Onderwerp: ontwerp Landsverordening begroting 2016

**Philipsburg, 25 februari 2016**

- Bijlagen:
1. Nota naar aanleiding van het verslag
  2. Waste Characterization Study and Material Flow Projection
  3. EHIA of the Solid Waste management & SWMPF Sint Maarten
  4. Subsoil Investigation at Pond Island
  5. GEBE Capital-Investment Operating Programs
  6. General Subsidy Ordinance
  7. Critical Vacancies Ministry of General Affairs

Hierbij bieden wij u mede namens de Ministerraad de nota naar aanleiding van het verslag aan inzake het ontwerp van Landsverordening tot vaststelling van de Begroting van het Land Sint Maarten voor het dienstjaar 2016 (Landsverordening begroting 2016) met de bijbehorende bijlagen.

  
De Minister van Financiën

  
De Minister van Algemene Zaken

*c.i. Min Pros 25/2/16*

Gelieve bij beantwoording datum en nummer te vermelden en in elke brief slechts ÉÉN onderwerp

## Ministry of General Affairs

**MP Leona Marlin.**

What about those employees that fall through the system, where they do not show up to work, for months even years, but collect 100 percent of their salaries or show up and do nothing and burden the budget. How many of these situations do we still have?

Answer: These are not all reported on by the respective ministries. In the Ministry of General Affairs: 2 fte

What is being done in these situations?

Answer: We are implementing the law "Regeling vakantie en vrijstelling van dienst" which stipulates the periods within which actions can be taken.

E.g. after 2 yrs 10% salary cut/ after 3 yrs 20% salary cut/ herkeuring, monitor that civil servant goes to SZV, etc.

Why isn't the no work no pay being used? It is being used in several cases. The ministries are authorized to apply the policy?

Answer: Instead of us rewarding those specific type of civil servants, the government should ensure that HR Cycle Process is properly implemented and that the hard working civil servants are placed in their rightful scales. Some are walking around with besluits that do not correspond to their actual function. If this is the case, the civil servant has to properly object to the decree so that it can be resolved via the route that was put in place.

**MP Loyd Richardson**

Question no. 1

Although this is not a question for AZ, we would like the following to be added to the answer. The entire Government organization including all Civil Servants and the Ministers would not fit in the new administration building.

There are departments that certainly will not be moving to the building. (Baby Clinic, Fire department, Ambulance department, Student Support Services, certain departments of the Ministry of VROMI, TEAT).

Please also note that The Government Administration building can house 450 to 500 Civil Servants max.

What regulations are in place to minimize expenditure of Gov. owned vehicles?

Answer: Even though the majority of Government owned vehicles are older than 5 year, Facility Management started with preventive maintenance to these vehicles and is seeking replacement of those that by no means would be budgetwise to keep maintaining them.

**MP Cornelius de Weever**

Integrity chamber when will this be done?

Answer: Agreement with Minister Plasterk is that we will await the decision of the Constitutional court (around march 4, 2016).

Corporate gov. council – Please let me know where this is mentioned.

Answer. The budget of the CGC is not mentioned in the draft budget 2016, because in accordance with the law the expenses should be paid by government owned companies. The last years, Government has been given advances to the CGC, while that was not the intention of the law maker. Staring 2016, the Government owned companies have to cover the expenses as is mentioned in the law. In accordance with the law there should also be distribution key. The Ministry of Finance , since last year has send letter to the four biggest Government owned companies with the request for their contribution. At this moment a national decree containing general measures, is being drafted to formalize the distribution key, so the Government owned companies know exactly how much they need to contribute.

Status electoral reform, how much will it cost, how much reserved, where to find it in the budget?

Answer. The committee is working diligently and in accordance with their instructions, will hand in the report this week. The next step by the committee is to propose changes in the law to Governemnt. In accordance with their instructions these drafts needs to be presented around March 2016. These proposals, when approved by the council of ministers will be send to the relevant institutions for advice and finally to parliament for approval. The costs of changing the existing laws, or coming with new laws, is the same as in the case of any adjustment or new law.

Pag 60 religious institutions receiving money, Is there policy on this, who are entitled to it.

SMDF What budget is allotted to them?

Telephone issue. Is it changed or not? Can calls be made online?

Answer: not yet. The intention is for this to be functional in the new administration building.

Integrity chamber: what is position given the fact that this present gvt (except SWW) voted against, what is their position now?

Answer: will await the Constitutional Court

Rent is under AZ and sometimes it is not, is government centralizing or decentralizing, what is policy?

Answer: The policy is that it is centralized.

Question. How many of these cases do we still have,

Answer: We can only specify these cases if the persons in question actually object to their decree.

**MP Tamara Leonard**

Facilities

Q. How does the advice procedure in the ministries guarantee quality control and delivery of services in actuality? (Cars for example) who checks that we are purchasing ten cars for 10k each but have an invoice reflecting 110k suggesting one car fell through the cracks?

A. The general procedure concerning the advices is that the relevant department heads will draft the advice based on their expertise and the relevant information. The draft is signed by the department head and send to the Secretary General. The Secretary General is the last to make sure that the advices are in accordance with the procedures and the policy of Government, before sending it to the Minister to sign off, or for the handling in the Council of Ministers. If the case and advise needs to be handled in the Council of Ministers, it is the responsibility of the Secretary General of the Council of Ministers to verify if the advice is what is called "decision ready" (beslisrijp), which means that all the relevant information is attached, including financial and legal review where necessary, and that the Secretary general of that Ministry has signed the advice.

Concerning the same question relating to cars, in accordance with the Government vehicle policy 2013, the Secretary General and the department head signs a request for a vehicle. The department of Facility Services makes the advice according to the requested quotations.

Q. Of the 150 vehicles considered to be part of government fleet, please indicate how many vehicles belong to government? How many are actually in use, and how many are being rented?

A. A total of 10 vehicles are being leased by the Justice Ministry. From the 241 vehicles 231 belong to the Government and are in use. 10 vehicles are occasionally in the garage for maintenance & repairs. At the moment 4 vehicles are being rented.

Q. How many vehicles are we paying insurance for and what type of insurance(s) does the entire fleet consist of?

A. Government is paying insurance for 241 vehicles. There are two types of vehicle insurances 1. Comprehensive (all risk) and 2. Third party. Even though some Emergency vehicles are older than 5 years, all Emergency vehicles are insured comprehensive.

Q. Who carries out control of the wear and tear on government vehicles (e.g. tires, batteries, filters motors etc. for servicing etc.)?

A. In accordance with the Government vehicle policy, each Ministry has a civil servant appointed as coordinator, in charge of the vehicles of that specific Ministry. This coordinator needs to coordinate with the Government Fleet manager of Facility Management, who regulates the maintenance & repairs accordingly.

Q. How much is actually spent on vehicle repairs and service in general? Please break this down to ministries.

Answer: for the year 2015 the Government has spent Naf. 135.085,01 on repairs of vehicles.  
Min. TEZVT: 9.748,66 VSA: 6.403,05 Justice: 27.136,27 AZ: 50.208,90 VROMI: 9.020,20  
OCJS: 6.722,40 Finance: 1.264,32

Q. What is happening to the vehicles in the VROMI yard? Are these apart of the 150 as listed in the budget?

A. The Ministry of VROMI has a garage that does small maintenance and small repairs to Government vehicles. The yard is also used to store total loss damaged Government vehicles. Most of the vehicles in the VROMI yard are not there for service or repairs. Damaged vehicles will be put on auction. In order to curb the purchasing of vehicles, parts from the damaged vehicles are being used to repair other vehicles.

Q. Has the ministry considered implementing a tender for full maintenance (extensive) of all government owned vehicles?

A. Yes the possibility to outsource the maintenance of all Government vehicles is being looked into. At present the head of the department of Facility Services, is discussing the possibilities with several garages with regards to service level agreements for an extensive maintenance program.

Q. How is the need for new vehicles established?

A. The department Head & the Secretary General of the relevant Ministry determine the need for vehicles within their ministry or department. Then the advice is made up, and a request is made, if the budget allows it, for the approval of the Minister (of Finance).

Q. How does the ministry determine when to go from all risk to comprehensive or third party insurance?

A. In the Government vehicle policy it is established that all vehicles not older than 5 years, are comprehensive insured, as explained earlier, exception is made with the Emergency vehicles. Comprehensive insured means, all risk insured.

Q. How much money is spent on paper, ink, toners, and servicing of printers and copy Machines?  
On papers the Government spends Naf.67.792, 04, on ink / toners Government spends Naf.726.236, 36, for servicing of printers & copy machines Government spends Naf.21.540, 00

Q. Do we have any plans on going automated or paperless? If so when?

A. The Ministry of General Affairs is currently testing paperless workflows within the department of ICT and Facility Services, with the intention on going fully paperless. Further discussion is now ongoing for paperless workflows in other departments. The Ministry VSA already has a paperless stream for all advices directly to the Minister, as well as paperless operations within Social Services and Labor Affairs. There are many more examples of the paperless and automated systems, in fact the paperless and automated system is being implemented under the umbrella of the project called VGO (Versterken Gegevensbeheer Overheid).

Q. Has a study been made to determine what it will cost to going paperless and what we are paying now to see which make better financial sense?

A. Based on implementations made already, it will cost approximately 1-1.5 Million US\$ for the next 5 years to implement paperless and automated systems (including the VGO) completely. This amount is for the whole project, meaning that costs concerning the processes of all the ministries providing services, which will be automated, is included in the mentioned mount.

The organization could save up to 75% of the current cost of paper by utilizing digital forms and online services, which are used in some departments already so this should continue. And by implementing the voice over internet protocol (VOIP) on the current ICT infrastructure, the organization could realize a savings of between Naf 4 to 5 million on a yearly basis.

Q. What is the status of the telephone policy that was initiated by the previous PM?

A. The policy referred to, entails the use of the so called "top up" machines, which would have been installed in the administration building, and an allowance to be given to the ones entitled to a phone, so they can buy their own phone and pay for the expenses themselves. The decision was to be executed by the Ministry of Finance together with the Department of facility services of the Ministry of General Affairs. The parties have met, and it is being worked on. However, please realize that the exercise for this draft budget started in December 2015, after one month this government took office, and this budget was given priority.

Q. Is the ICT department properly staffed? How many civil servants are budgeted for the department and how many do we have right now? Is that amount sufficient to assist the entire government offices?

A. In the draft budget 2016, there are eleven (11) civil servants budgeted. While the formation calls for thirteen (13) civil servants. At this moment, the department has nine (9) civil servants. The fact that at the current moment not all the functions are filled, can be interpreted as the department being understaffed. Obviously there was a reason the formation was put on thirteen. The department head is requesting attention for the department, and in the course of the months to come, government for sure will address the situation, especially in the light of the moving of the ministries to the new building. Finally it must also be mentioned that some of the advices on personnel and investments, have been put on hold by the previous government. As the responsible minister for this department, I have requested the Secretary General to present to me based on the advices that were put on hold, and taking the current draft budget 2016, into consideration.

Q. In relation to the National Development Plan, how much is the total cost of the project?

A. The total allocated budget is US\$ 899,870. Cost per subproject are as follows:

1. National Development plan: US\$ 253,000.-
2. National database system: US\$ 118,000.-
3. Millennium Development Goals (MDG) report and a separate Millennium development goals Acceleration Framework (MAF) report on the topics of "poverty" and "environment" including 2 pilot projects US\$ 333,400.-
4. Administration/management: US\$ 94,870.-

Q. What is the timeline for completing this plan?

A. The time line is as follows.

1. The draft National Development Plan will be finished third quarter of 2016;
2. National Database is developed and launched in March 2016;
3. Millennium development goals report and a separate millennium development goals acceleration framework report April 2016;
4. The two Pilot projects will be implemented before the end of 2016;

Q. Now it is understood that the (NDP) is a United nation development Project (UNDP) however does it have any financial consequences for Government?

A. Yes.

As a follow up to my previous question if Gov't has indeed invested in this project, How much money has been spent so far on it?

Q. Including the committed costs US\$ 645,711. Breakdown is as follows:

1. NDP 40% spent of total US\$ 253,000.-.
2. National Data Base 100% = US\$ 118,000.-.
3. MDG/MAF/Pilot projects 100% = US\$ 333,400.-.

Q. How much of it was indeed contributed through UNDP program and how much has been invested in consultants from abroad for this project?

A. Consultant costs to date:

- NDP US\$ 80,000 and one United Nations Volunteer US\$ 40,000
- Millennium development goals Acceleration Framework (MAF) US\$ 45,000
- National Data Base US\$ 11,362

Q. What role will members of parliament play in this plan?

A. Like every action of Government, Government needs to answer to parliament. The UNDP is part of the Governing program. It is not a law which needs approval from parliament, but parliament has the authority to request government for an explanation of this project.

Q. Is it the intention of this project to eventually contribute to the financial affair of the country?

A. Yes. Strategic planning creates effective government by aligning country resources efficiently to create results and a tool to attract development financial assistance, if needed.

Q. While it was clearly stated by the PM that this is not yet off the ground I would like to make clear that my question concerns How much money has been invested in the integrity bureau project? As it pertains to training and activities?

A. The implementation of an integrity bureau was part of the project "integrity policy" of the IVB program (Institutional building and governance strengthening program). IVB was managed by USONA as part of the Dutch collaboration program with St. Maarten and as such the investments were done outside of government's budget. The Integrity policy project was approved in December 2010 by the council of ministers.

Total funding for the project was Naf. 800,000.00 of which Naf. 799,576.19 was actually spent.

The total investment done into the "Integrity bureau" component of the project was Naf 94.348,24.

The rest of the project funding was invested in:

Research (including vision meetings):	Naf 175.000,00
Training:	Naf 371.080,47
Communications/Awareness:	Naf 158.542,18

Furthermore, in discussions with the Kingdom council of ministers, after receiving the results of the various integrity investigations, in 2014, St Maarten changed the plan for an integrity bureau, to a more independent integrity chamber, in the form of a so called "zelfstandig bestuur orgaan" (ZBO institution, based on article 97 of the Constitution.

Q. Are we still spending any other monies on this project even while on hold?

A. Like mentioned in the previous answer, the project was adjusted to the more independent integrity chamber, and no more money is being spent since 2014 on that project.

Q. Were any consultants hired for the assessments and who or which ministry bore the burden of this cost?

A. HPS consulting, an St Maarten based consultant, was hired on USONA budget and in accordance with the USONA procedures for the assessments to the tune of Naf 65,000.00. This also included the vision workshop, including internal and external stakeholders resulting in a vision document, the integrity survey, quick scans in the various areas of integrity and the integrity assessment. It is out of this that the need for an integrity bureau was established.

Q. Does Gov't still have any outstanding where this project is concerned?

A. The USONA integrity project is finished and currently no follow up project has been started.

How much (crucial) open vacancies are there per ministry at this time?

A. See Excell Sheet attached.

Q. What is being done to fill these positions?

A. As long as there is budget, the position will be filled in accordance with the procedures for hiring.

Q. What is being done to promote internal growth for those qualified?

A. If qualified, internal candidates get preference when vacancies arise. Different departments have internal trajectories for individuals who wish to grow and have shown that they have the competencies to grow. P&O assists where necessary.

Q. Has consideration been kept, or has the ministry exhausted using the Brain Gain project to recruit (return) students/professional locals?

A. This is a project initiated by the Ministry of Education. However, all Ministries are available to hire professionals from St Maarten that come back to help develop the country. The ministry of general Affairs has hired one lawyer for the Department of legal Affairs through the Brain gain project, and had also three young students doing an internship (project) at the same department at the end of last year.

Q. As it pertains to the third party consultancies be it companies or individuals, how are the respective tasks/function that these consultancies have been hired to carry out reflected in the actual personnel organization of Government?

A. With the shortage of personnel within some of the departments such as legal affairs (JZW) and communication department (DCOMM), persons have been hired in to execute certain tasks that the department cannot accomplish on a day to day basis. Some departments have budgeted for such since it is customary to make use of staffing agencies during busy work periods to accommodate the heavy workload. Others have budgeted on the basis of past experiences.

Q. The numbers in personnel van der den are significant, and as such does not validate such actions as "internal" personnel stop". Can a breakdown of the consultancy firm listing be given as it pertains to the type of business these consultancies are? (eenmanzaak etc., n.v.)

A. Currently, there is only 2 persons that we have commitments with in the Ministry of general Affairs, namely:

(Department of Communication) Roddy Heyliger	Naf 65,000
(Quartermaster Integrity) Richard Begina	Naf 47,000 (varies based on work done)

All ministries have their own budgetpost "personeel van der den".



**MP Leona Marlin**

**Q. How much gvt paying out in the last 3 years in legal fees**

A. In 2013 government paid an amount of Naf. 815.928,- in legal fees.

In 2014 government paid an amount of Naf 1.953.784,- in legal fees. 171 court cases are still pending. So this amount can become higher.

In 2015 government paid an amount of Naf 36.000,- in legal fees. 140 court cases are still pending. So this amount can become higher.

In 2016 government has to pay Naf 1.350,- in legal fees.

**Q. What is the basis used to take matters to court and what basis is used to terminate court proceedings. Gvt lost a particular courtcase 3 times, will gvt pursue for the fourth time.**

A. Government does not take cases to court very often. Most of the time it is the other way around: Government is taken to court by civilians or business owners. That is not strange, for government takes decisions that can be appealed according to the law. That is part of the "rechtsstaat".

However, when a certain verdict or decision by a judge of the Court In First Instance is in conflict with the law or government policy, there is a reason for government to appeal such a decision. A case can be withdrawn if it is evident that the judge will not rule in favor of government or parties have reached a settlement.

The decision to appeal the court's decision or to withdraw a case depends very much on the facts and circumstances of the particular court case. In the end the decision is taken by the minister to appeal or withdraw a case.

Q. How many gvt cases are pending for 2016. How many cases have been lost thusfar 2014 – 2015. And how many won for this same period.

A. In 2014, 35 cases were won by government, 43 were lost. 171 court cases from 2014 are still pending.

In 2015, 13 cases were won by government, 16 were lost. 140 court cases from 2015 are still pending.

In 2016 5 were won by government thus far, 2 were lost, 20 court cases are pending.

Q. 4. Is it true that the fire dept has taken gvt to court

A. The Fire department did not take government to Court, yet. There is an letter from the legal representative of a few of the members of the Fire Department , requesting the government to provide answers to their previous questions to Government concerning their legal positions, like promotion etc. This letter was send to the Secretary General with the urgent request to provide a reaction.

Q. What is being done to curb the errors by the HR dept. There are lot of civil servants that are disgruntled, documents are being lost. What is being done on those situations. More details can be given if requested. It was also a concern since the last time.

A. See answer in round one of the questions.

Q. Kerntaken analyse: will this Minister take it up again. It was put aside by the former minister.

A. As stated in answering questions in the first round, after the first phase the project was stopped because of among other things the elections in 2014. After that there was no budget for this project. Like mentioned this government will go by priority lists. Therefore, a decisions to continue with this project, depends on the priority list of the Ministry.

Q . Will the civil registry dept fit into the new government building. What will happen to the machinery that is in place in the new building for passports for several years.

A. The civil registry will not move to the NAB, based on the intention to upgrade the current building of the Receiver's and the Civil Registry. The equipment for the passport operations will be maintained and used in the New Administration Building and arrangements will be made with the Civil Registry on the distribution of the passports via the Public Service Center operations.

8. Deplorable situation at the registry dept.: what happened to the plans for the expansion of the civil registry and the receivers office. Drawings were made by nieuwe werken, where are those drawings. A study was done on this expansion

A. Already verbally answered.

Q. Scanning documents in the archive, are there any plans to scan to save our history.

A. There is a project planned for scanning the historical documents in the archives. The company KARMAC was contacted as they have the necessary equipment and expertise. KARMAC would also provide whatever necessary training to local staff. This project was put hold due to budget constraints and lack of personnel in the Archive department. The archive department currently has only one staff member charged with the daily operation.

**MP Emmanuel**

Q. What is your thought on the gvt building, why did you make it a priority.

A. Already verbally answered.

Q. Can you give an account or the state affairs of the condition of the Census office, what plans do u have to remedy the situation.

A. Already verbally answered.

Q. Can you give an account what was done by the former gvt.: to the Census office, new building, persons not in the right. ..Anything.

A. Already verbally answered.

**MP R. Samuel**

Q. explain what contributions are being made, financial or any other way, to sxm by the Netherlands. If any financial contribution is in this budget by the Netherlands.

A. Already answered verbally

Q. There are some fees that we slowly calling Kingdom fees, kingdom taxes. SXM is definitely paying money to Holland. Can PM shed some light on this. How much money is being collected. Passports, leges etc.

Q. Telem: explain why is helpdesk of Telem in curacao, why cannot it be here. If it can be here, how fast can it be here.

A. Already answered verbally.

**MP F. Richardson**

Q. There was an incident with the vehicle of minjus, a deal was made that the former minister could keep / buy mr3. We were informed that the vehicle was sold. It needs clarity, how do u buy a gvt vehicle, can PM do this on his own, or does it have to go on open auction. Was there any documentation on the sale of MR3. If there is sale, than the vehicle should be given to the former minister and not be driven around.

A. Already answered verbally. The vehicle has not been sold.

Q. The new gvt administration building: when the finalization of the administration, how minaz tends to see how the works will be done in a speedily manner to make sure that the different ministries are able to move in into the new building. We need a plan of action.

A. Already answered verbally.

Question MP Leona Marlin first round.

Q. Linking of the administration?

A. The question concerns an update of the so called VGO – “Versterking Gegevensbeheer Overheid”, project.

This projects has started in 2011, with as objective to determine the base registries of information that Government use and to link all systems that government use together, and by doing that to ensure that all common information in the base registries are the same in all systems of government.

Next to that, the VGO would provide management information that was lacking in order for government to make proactive decisions.

Since the start in 2011, there has been many different developments for the respective Ministries, for example:

- 1) BLIS (Business License Information System) - TEZVT
- 2) SS37 (Labor and Social Services information System) – (Labor and Social Affairs)
- 3) LEX (Exam Scheduling System) - Education
- 4) Online Taxes – (Finance -Tax Administration)
- 5) Item requisition –
- 6) VOG –Certificate of Good Conduct – Public Service Center (see attached) (General Affairs)

**Developments in process includes:**

- 7) CRIS (Infrastructure Management Information System – Case Reporting Information System- VROMI)
- 8) SMART (School Management and reporting tool)- Education

- 9) Contract Management Information System –  
General Affairs
- 10) Council Information System -
- 11) Study Financing information System -
- 12) AIMS –Advice Management Information System-  
Entire Organization

Secretariat  
Education

**Pilots include**

Connectivity between systems from SZV-Tax Administration-Civil Registry-Chamber of Commerce.

VGO is an ongoing project that requires executive sponsorship, budget and other resources to be finalized within government. When finalized all systems within government will be automated and ultimately linked to each other.

## Ministry of Finance

MP LEONA MARLIN

FACTION: INDEPENDENT FACTION

ALL MINISTERS

1. Were the ministries able to accomplish any goals that were budgeted for in 2015. If yes, can parliament receive a detailed outline of such per ministry, so in essence, these are the ministries plans, this was accomplished and this was the cost. This is needed to make a better comparison on what is being budgeted for in 2016.

The plans of the various ministries during 2015 have not yet been reviewed and evaluated. Therefore they cannot yet be determined if the ministries in 2015 were able to accomplish their goals budgeted for 2015. A comparison with budget 2016 based on 2015 cannot be made at this time.

2. Can you please provide me with a policy priority list for 2016.

This will be done as soon as the governing program is completed.

3. Can I be provided with a list of potential risks associated with this budget due to lack of funds?

The income projected in the 2016 budget is realistic, and the expenses projected in the budget are fixed. The 2016 budget is in balance. If budget figures are adhered to in the execution of budget, there are no risks other than possible delays in execution of certain desirable programs which can only be executed if revenues are increased.

4. Can you please elucidate if this government has examined the possibility of shared service efforts due to the limited funds that are available (for example reduction of the number of systems, merging HR departments, sharing of personnel between different departments) How much will we save if we link the administration of Ministries?

Shared services could definitely produce savings and should be looked at seriously and carefully. The new administration building certainly presents an opportunity to exploit shared services efficiently.

MIN FIN

1. Can I be provided with a list of potential risks associated with this budget due to lack of funds?

Please refer to question 3.

The income projected in the 2016 budget is realistic, and the expenses projected in the budget are fixed. The 2016 budget is in balance. If budget figures are adhered to in the

execution of budget, there are no risks other than possible delays in execution of certain desirable programs which can only be executed if revenues are increased.

2. Can you please provide me with a status report on those policies and any other financial policies that is being drafted?
  - a. Dividend policy being drafted
  - b. Procure to pay policy- in trial stage.
  - c. Consultancy Guidelines- communicated throughout organization
  - d. Financial Management Policy being drafted by FBB
  - e. Subsidy Policy being drafted by FBB
  - f. General measures strengthening budget discipline (versterking budgetdiscipline)- FBB working on this
  - g. General measures for Tendering (Ibham opnebaar aanbesteding) presently in the working group.
  
3. Can you please elucidate what is the country's debt ceiling and how much have we lent thus far of that max.?
  - a. 5% of the average income of the collective sector (2010-2014) is NAF 31.912.000. At an average rate of 2.5%, which is the present interest rate we can borrow the debt ceiling is Naf 1.200.000.000 of which we have already borrowed NAF 508.671.000.
  
4. Can you please elucidate if the water reserves mentioned in the Income is a non-recurring or recurring revenue and how much was collected in 2015?
  - a. It is a recurring income that is totally dependent on profits generated from water the distribution arrangement government has with GEBE. The reserves present total some Naf. 39 million guilders build up over several years.
  
5. Can you please elucidate why 'overheidsbijdrage SZV' in Ministry of Health was not budgeted?
  - a. SZV is not in a position at this time to provide us with accurate numbers and this has been the case for numerous years. Until such time, Government has decided not to budget this amount.
  
6. Does government have a reserve policy (a policy that outlines a prudent level of financial resources that government will maintain to prevent service disruption in the event of unexpected revenue shortfall or unpredicted expenditures) or are there any plans to draft one in the near future?- FIN
  - a. The aim of government is to have three months of operational expenses in reserves. However, given the present financial constraints that is not the case. Government strives towards attaining this goal once the financial conditions have improved.
  
7. Does government have any reserves at the bank? If yes, what is the amount?
  - a. 20.1 million in reserves.

8. Can you please elaborate on what is being done to have a greater emphasis on long-term planning and forecasting in order to identify and anticipate budgetary challenges before they become unmanageable?
  - a. Maintain and monitor a realistic multi-annual budget;
  - b. Ensuring that policies remain within budget expenditures;
9. What policy has been changed in the Tax office to generate the extra income?
10. What are these initiatives?
11. What are the current and planned measures?
  - a. 9. 10. 11: Improving credibility of tax authorities by not issuing warnings and demands only, but effectively acting on warnings and demands issued.
  - b. Insisting on keeping payment arrangements as short as possible to collect outstandings.
  - c. Assigning members of collection teams to specific geographical areas.
  - d. Hiring more audit and collection agents when additional income can justify such hiring.
12. How will these measures affect the small businesses, of which SXM is made up?

These measures will not affect small businesses who are up to date with payment of their taxes.
13. How much of the 2015 Capital investment was used? And for what, please provide breakdown. Are there funds remaining? And, if so how much?

Because the 2015 budget was not approved by the CFT the government was prohibited from borrowing to execute any capital investments. Therefore no funds were borrowed and no funds remain from 2015.



14. Please provide a comparison from 2010 – 2015 of the Capital investment account by Ministry.

Kapitaaldienst uitgaven	2011	2012	2013	2014	2015	2016
Parlement en HC		32,000	553,000	254,100	318,695	635,795
Algemene Zaken	55,683,541	10,915,840	1,556,819	17,343,474	8,173,779	6,132,793
Financien		0	0	21,000,000	4,877,231	4,011,587
Justitie		0	721,900	34,137,281	19,922,350	12,799,339
Onderwijs	15,015,100	13,660,175	14,765,763	30,679,580	22,554,080	20,947,155
VSA	2,015,000	780,384	1,841,062	35,780,394	5,835,316	5,096,234
TEZVT	10,709,130	0	7,567,418	11,850,000	15,400,000	12,968,344
VROMI	40,213,000	40,213,000	45,400,583	66,513,000	33,950,000	14,993,346
Total						

15. If possibility to lend exists, where will those funds come from? From who, which government or entity will lend that money and at what interest rate?

a. The funds will be borrowed from the Dutch government and the interest rate will be approximately 2.5%

16. What steps have the minister taken to increase revenue? And what income generating measures are planned? There are a number of project that are being work on that will generate extra funds for government coffers;

- The Legislation process has been initiated to increase casino fees;
- Legislation process has been commenced to levy advertising signs/boards visible from the public boards.
- Draft legislation is being prepared to collect departure taxes from persons (mostly tourists) on trips to neighbouring islands from Sint Maarten.

17. What is the` status of the IVUV project? If still being worked on, has this project been taken up in the 2016 budget?

The IVUV project consists of several sections. Some of these have been approved and executed, such as the Ex-pat regeling, mobile phone policy has been approved, car-policy is being debated. Due to The remainder of the project is still being worked on.

18. How many losses to outright fraud, overpayment and payments to ineligible beneficiaries of government payments? . (FIN)

To my knowledge there are 0 losses due to outright fraud. If there are any overpayments, they were rectified. We have no knowledge to ineligible beneficiaries.

Clarification round:

19. How far back do the outstanding casino controller fees go? What are the amounts that have been written off and how far do they date back to ?

Casino fees and controller fees go back to 2001 in some cases. Total amount written off for casino controller fees Naf 896,648. Total amount of casino fees written off due to statute barred is Naf. 3.358.551.77.

20. Current value of new government admin building? Appraisal report?

See attached Appraisal Report.

21. Can the minister clarify if there is something new in the air that we can get this 60 million from NA boedelscheiding?

No there is nothing new in the air, other than in December 2014 the final report of the committee charged with bringing about a settlement was completed.

22. What is a sinking fund loan and bullet payment loan?

- a. A sinking loan is paid overtime and gradually reduces the amount of loan
- b. Bullet loan payment- is a loan that is paid in full on a specific date in time.

### MP Lloyd Richardson

#### Faction: UP Party

1. When do we see our self-paying off the debt from from APS and SZV while renting / leasing or how will this bld. then become ours? Will we build a new one or leave in the hands of the SZV and what will they then do with the bld.?  
The intention is that the building will be owned by SZV and leased to the government. The government has an option to buy back the building.
2. Provide break down how we intend to use the 30 million from the Kapitaal dienst.  
Once the priority list is approved by the CoM, parliament will be provided a copy.
3. Pg. 8: loans in Oct. 2015, 20 million due to beautification projects before 101010; is it really 6 or 7 projects? 2 figures were mentioned 20 million and 26 million, has this loan matured over the 5 years? Is this the same loan or another loan? **FIN**

*There were 7 projects.*

1. *Beautification phase 1*
2. *Beautification phase 2*
3. *Festival phase 1*
4. *Festival phase 2*

5. *ROB*
6. *St Peters infrastructure*
7. *Fish marked*

*In the elucidation of the budget 2016 an amount of 20 million is mentioned this is a typo. The figure should be 26 million. The budget book properly reflects 26 million.*

*There were 7 loans for these projects which have converted in 2011 to 1 loan and that loan beings due and payable in September 2016.*

4. What can be done to save money to recoup having to present a lean budget each year? **FIN**

- a) Have realistic budgets and stick to the budget
- b) Pay premiums to SZV and APS to avoid accumulating debt
- c) Adhere to the hiring/personnel stop measure as much as you can.
- d) Get boards of Government owned entities to function more efficiently
- e) Separate supervisory board and management to enable proper supervision.
- f) Hold management more accountable for operations and spending.
- g) Control on travel spending
- h) Do not overpay for goods and services.
- i) Reform T.O.T.

5. How is our liquidity situation?

*We have Naf 20.1 million in reserves.*

6. what can be done to safeguard a basic liquidity so that we don't have to borrow for this (late study loan payment) problem?

*Collect what is owed to government and exercise budgetary discipline.*

**MP Name: Cornelius de Weever**

**Faction: Independent**

1. What is government spending policy, is this constant?  
Government's policy is to exercise budget discipline, ie do not overspend and stick to the budget.
2. Will government increase taxes, deficit spending, consequences how do we get out of it?  
Government has no intention of increasing income taxes or profit taxes. Nor does government have any intention to embark on deficit spending. This would be against the law. Government policy is, first earn and then spend.
3. What fiscal actions government intends to take?  
Government intends to reform the tax system. A study has been executed to implement tax reform. The approval of the items in the study are being reviewed and attention will be given to the actual implementation of a new tax system aimed at growing the economy.
4. Does government have policies for a year plan **All Ministers**  
The governing program has not been completed. Once completed, this question can be addressed.
5. Does this budget contain the financial consequences of government policies intentions. **All Ministers**  
This will be addressed once the governing program has been completed.
6. Structural growth. How many laws have to change to increase income, please list them. **FIN**  
That depends on which decision is taken and which growth path is decided on. A list cannot be produced before the decision is taken.
7. Pag. 4. Which government properties are being sold, when will the 'vereffening' be completed. **FIN**  
The new government building will be sold as well as parcels C and D for the construction of a parking building. The process of settlement (division of assets) has been completed. The "verreffening" is expected to be settled in 2016
8. What does government intend to do on income expenditure/budgetary discipline **FIN**  
A monitoring committee consisting of controllers of all ministries, is being formed to review and monitor monthly all expenditure of each ministry. To this end the Council of Ministers has already resolved to have all controllers report directly to the minister of finance as far the monitoring of these expenditures are concerned.
9. Pag 10 retirement age gov . What is gov position on taking pension age to 65? Or is there a possibility of opting out between 62 – 65? **FIN + AZ**

This is presently being studied and in line with the instruction received by the kingdom council of ministers, pension reform has to be executed in 2016 to make the pension fund sustainable. VUT, early retirement option will also be looked at.

10. Schommelfunds funds, is this realistic (Page 11)? **FIN**

The schommelfunds "Swing Fund" has been implemented in Curacao quite effectively. The various funds at SZV, from time to time, swing between positive and negative positions. The intent with the 'schommelfunds' is to automatically supplement a fund that is negative with funds from another fund that are positive.

11. CFT conditions debt write off one of conditions, what is gov position on write off, will this happen yes or no **FIN**

I am in favor of looking at possible write offs as well as repatriation of funds that are held abroad with no questions asked, provided that the write offs and repatriated funds can be invested in a Development Bank for Sint Maarten. This has to be properly studied and prepared but my first reaction is that this could be a WIN/WIN for everyone, especially for the development of Sint Maarten.

12. Pag 13 effect on initiative In 2016 1 mln projected 2017 6 mln why decreasing in 2018 to 4 mln?

'Wet van verminderde meeropbrengst' (Law of diminishing returns).

13. What does government intend to do for staffing tax dept. Government position. **FIN**

The tax department needs attention, however we cannot spend what we don't have. We have to first earn and then spend.

14. Is online filing possible, what is status on this possibility? **FIN**

Online filing is currently available for the taxes and premiums that are due on a monthly basis namely: wage and turnover tax and avbz, aov/aww premiums.

15. When will Indirect taxes switch take place, what is the income projection? **FIN**

This is part of the tax reform plans which are being studied and will be implemented once study is completed. The intent is to move as much possible from direct taxes to indirect taxes. A closer look has to be taken at T.O.T. because it is the biggest obstacle to more economic growth and a major contributor to unemployment.

16. Pag 28 finance ministry; Turnover tax and transfer tax was budgeted less than previous years, why? **FIN**

The average turnover tax and transfer tax collected over the past three years augmented with an indexation of 1.5% results in less to project in 2016.

For instance, the amount budgeted for turnover tax and transfer tax was 115 million, however only 114 million was collected in 2015.

17. Why is there an increase in residence permits? Is this as a result of increased fees or an influx of more people than before **JUS/FIN**

In 2015 Naf 1.6 million was budgeted for residence permits. The realized figure in 2015 was 3 mln. The projected amount for 2016 is 2.8 mln.

18. OBNA 9.81 % confirm if it is 7.0% or not. **FIN**

The total sxm shares in the Ontwikkelings Bank Nederlandse Antillen (OBNA) is 7.08%. Based on the audit done by SOAB on the 2014 financial statements, it was identified that there is a discrepancy in the amount of 9.81% that is reported. This will be corrected in the 2015 financial statements and 2017 budget.

#### **MP Sarah Wescot Williams**

#### **Faction Democratic Party**

19. **Fin:** The Economic Growth for 2015 was projected at 1.4%. What was the Real growth?

The real growth was 0.3 % in 2015.

20. **Fin:** Harbour concession: only 1.8 milj. paid in 2014. Explain.

The explanation is that according to my information the harbor simply did not pay and efforts have to be undertaken to collect what is outstanding.

21. **Fin:** What is the Budget 2015 vs realization 2015? (Budget vs Actual?) Provisional numbers.

The revenue on a cash basis for 2015 is Naf 435 million, while Naf 445 million was budgeted. There was therefore a shortfall of Naf. 10 million. The expenses for 2015 are still being administrated and we expect to have an idea of this amount prior to the end of March.

We are not in a position to estimate the expenses at this time.

22. **Fin:** APS premium: The government wants to establish the premium officially and retroactively at 22%. What premium amount is taken up in the 2016 draft budget?

The APS premium in the draft budget 2016 is 22%.

23. **Fin:** Annual account SXM 2014. Are the 2014 Figures in the draft 2016 budget accurate? What is the status of the annual account 2014.

The figures used in the budget for the column of "vermoedelijke werkelijke uitgaven 2014" were derived from the Q3 – 2015 report and not from the final annual accounts of 2014.

The Annual accounts were approved by the CoM on September 8<sup>th</sup> and then sent on to SOAB and the General Audit Chamber. The final reports from these two institutions have been completed.

Currently the Dienst Comptabiliteit is working to have the annual accounts of 2012, 2013 and 2014 sent to Parliament for ratification (vaststelling). Currently we are in communication with JZW and the RvA to have these finalized by the end of Q1 2016.

24. **Fin.**Pls. Provide data regarding The "pensioenen en uitkeringen ex-gezagdragers"? See Nader Rapport, page 6.

	2015	2016
<b>Ministers</b>	<b>132,397.84</b>	<b>387,933.83</b>
<b>Parliament Members</b>	<b>1,666,856.46</b>	<b>566,000.00</b>
<b>Total Gross Pay</b>	<b>1,799,254.30</b>	<b>953,933.83</b>

25. **Fin:** Increase verblijfsvergunningen with 1.2 milj. Motivation?

In 2015 Naf 1.6 million was budgeted for residence permits. The realized figure in 2015 was 3 mln. The projected amount for 2016 is 2.8 mln.

26. **Fin:** Explain the drop in "loterijvergunningen".

The increase in 'loterijvergunningen' was based on an average income of three years including an indexation of 1.5% and also taking into consideration the realized figures of 2015 January to November. The realized figure of 2015 was 1.2 mln. The projected amount for 2016 is 1.6 mln.

27. **Fin:** Explain the status of the "Vereffening":

In December 2014 the final report from the committee charged with the division of assets was completed. It is expected that what is due to Sint Maarten will be settled in 2016.

28. **Fin:** Foundations/associations: how has the decision to postpone been formalized? Will an official notice be made?

The decision has not yet been formalized, the draft legislation is currently by JZW for legal vetting. Once this process has been formalized, it will be publicly announced.

29. **Fin:** GEBE water plant management and Claiming Shareholder Dividends from GEBE: have the financial positions of these 2 been verified and how is/are the claims of government being formalized?

GEBE committed to submit their financial statements by January 31, 2015, however to date these financials have not been presented government.

The shareholder is requiring GEBE to pay out to government in advance, dividends emanating from their reserves and their profits.

30. FIN: BTP: what is the estimate in the 2016 draft budget based on? (F. 3.118.000,--)

The projected income from BTP in the draft budget 2016 is based on information provided by BTP.

31. FIN: Concrete measures to improve liquidity: how (quick) will the boedelscheiding impasse be solved? Are there any agreements to deal with a partner contesting the estimates?

The process of settlement (division of assets) has been completed. The "verreffening" is expected to be settled in 2016.

**MP Tamara Leonard**

Sent by letter dated February 3- received February 5

1. A breakdown on the kapitaaldienst for each ministry as presented on page 17 of the budget 2016

The Prime Minister already answered this question yesterday in parliament.

2. A breakdown of all the consultants hired, both individually and/or per company for each ministry in its entirety. Please include the associated salaries or consultants fees and benefits.

See attachments.

3. Please provide financials as per the requirements of subsidizing for the Heineken regatta, SCDF, and all other entities receiving subsidy as present in the budget 2016.

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See attachments.

## **MP TAMARA LEONARD**

1. Can you give a step by step explanation on how you intend to increase tax compliance by at least 15%, and how much revenue will this generate for Government coffers?

Since I took office, 5 persons were added to the Tax Department. More staff is needed and will be added once revenues permit.

According to a study conducted, tax compliance in Sint Maarten runs 4% behind the rest of the region. If Government increases tax compliance, it could generate considerably more income.

2. Can the minister (possibly via the central bank) provide a breakdown or list depicting the difference in amounts between cash and card/ cheque payments deposited on banks?

The CBCS does not possess reliable data as yet about the use of the several payment methods segregated for Curacao and Sint Maarten. The Bank, in cooperation with the Worldbank and CEMLA (the Yellow Book project), is currently engaged in a project to correct this situation. The Bank aims to start publishing statistics on the payment systems in Curacao and Sint Maarten during the course of this year.

3. It was mentioned that some businesses use card machines registered outside of St. Maarten. What measures are considered by the Minister of Finance to ensure government receives tax revenues from this type of practice and how does the Minister plan to eliminate such practices? How does this effect the TOT payments made by such companies? Does the central bank have a role in monitoring such practices?

Based on the foreign currency legislation, cross border transactions have to be reported to the Central Bank of Curacao and Sint Maarten. To not report cross border transaction is punishable by law. The Central Bank has started an investigation into this practice; I have to await the outcome of this investigation before any effects on TOT payments can be measured.

4. Are there any policies that protect consumers from merchants adding additional fees to credit card purchases/ transactions?

The CBCS currently has no legal basis to promulgate policies for protecting consumers from merchants adding additional fees to credit card purchases/ transactions.

5. How much does government pay in rental fees for government subsidized organizations? Are there any measures in place to curb the subleasing, without the consent of Government, by these organizations?

To my knowledge, government does not pay rental fees for any organization. Government issues subsidy to certain organizations. These organizations use the subsidy to pay operational expenses, including rent.

6. In the explanatory notes it is stated that the working class has increased by some 9%, is this increase reflected in the amounts collected for social premiums as well as income taxes? Are there plans in place to ensure that this is reflected across the board?

A study would have to be done to see how the increase in working class would relate to the increase in income tax.

7. Reviewing the income of government, we can see that TOT has not been working for St. Maarten. Businesses have become creative at somewhat avoiding this tax. It cannot be that every time the Government needs money, it increases taxes on those who are compliant.

TOT is a threat for and disruptive to economic growth. It affects employment and it affects Sint Maarten's competitive position. It also contributes to tax evasion. When TOT was at 3% and was increased to 5%, it was expected that revenues would increase by 2%. This has not been the case.

The World Bank and the International Monetary Fund (IMF) have conducted a study on the effects of the TOT. The study recommends switching to an added value tax system. Ways and means of this change in tax system need to be studied including alternatives to compensate any losses incurred by eliminating TOT.

8. Last year I submitted a motion instructing the then Minister of Finance to start the process to switch to a sales tax or value added tax, which would cast a bigger net and everyone would contribute to the coffers of Government. It also stated to make a report on the feasibility of reducing or eliminating wage tax, giving our people more spending power. My questions are; Was anything done by the ministry concerning this motion? Does this minister consider switching from TOT to a sales or value added tax? Does the minister consider direct or indirect taxes to be more beneficial for the Government of St. Maarten as it pertains to revenue generating? Are there any increases or new taxes in the works that would affect the working class of this country?

Government intends to reform the tax system. A study has been executed to implement tax reform. The recommendations of the study are being reviewed and attention will be given to the actual implementation of a new tax system aimed at growing the economy.

9. In the response the minister indicated that the breakdown for the capital investments can only be available after the CoM approve the priority list. Will this list be approved before the voting for or against this budget? And if not is it the understanding we are expected to vote for a budget without knowing how the monies that we are committing the country to repay in loans will be spent? Same as with the 20 million being demanded of GeBe?

The details and specifics on capital expenditures have been provided in the 'nota van wijziging' presented to parliament.

10. How are the rates controlled for third party contracting because they are very high, also when there is stop on personnel hiring does it include these third party consulting?

Consultants charge a fee and based on that fee it is up to the discretion of the Government to hire the consultant. However, I am discouraging the hiring of consultants unless it is absolutely necessary. For example, one of the first steps I took after taking office was to intercept the "strategy for growth" project by a consultant that would cost an enormous amount. Consultancy services have to be reviewed and analyzed to determine if those services can be carried out by our Civil Servants.

11. The list provided of third party consulting including legal and other experts amounts to over 4.1 million a year, in two cases, being the case of the justice ministry as well as the ministry of VSA it is duly noted the amount of time given for the third party contract are listed as a

one-time function or that the contract ends at a specified date. However the majority of the case is itemized as a yearly amount.... Who are these companies' individuals? This alone equates more than the salaries of member parliament. While I understand that every ministry has a controller how is it that we do not have dated contracts?

Consultancy contracts do have a commencement and an end date. Contracts are reevaluated every year and have termination clauses. With regard to providing the names, I have been advised that this would be in contradiction of 'Europees verdrag inzake de rechten van de mens en de fundamentele vrijheden' (EVRM) and other privacy laws.

**MP LEONA MARLIN**

1. What policy has changed in tax office to generate extra income? And what are the initiatives? What are the current and planned measures? How will these measures affect the small business, of which Sint Maarten is made up?

The Government will review the 'Belastinghervorming', but already changed the legislation on the casinos, in the way the Receivers can collect the casino fees. Furthermore, the government is working on a legislation to levy a tax on advertising signs that are visible from the public road and legislation is being prepared to charge the departure fee to visit neighboring islands.

2. How was the NAf 12 million outstanding for casinos calculated?

The casino fees are a fixed amount set in the legislation. It is calculated by deducting the statute barred amount from the total presently outstanding.

3. Who are the consultants, in the light of transparency, who are these consultants, names, companies, which technical assistance, which lawyers etc? Can government provide this information in detail?

I received advice that releasing names will be in contradiction of the privacy laws and the EVRM.

4. Were the ministries able to accomplish any goals that were budgeted in 2015? What were the costs?

The plans of the various ministries during 2015 have not yet been reviewed and evaluated. Therefore, it cannot yet be determined if the ministries have accomplished their goals budgeted for 2015. A comparison with the 2016 budget based on the 2015 figures cannot be made at this time.

Every year by September the annual reports for the preceding year are finalized. As long as the annual reports are not completed, it cannot be assessed whether the ministries have realized the plans and goals of 2015.

5. Appraisal report: would like an explanation of the following;

Based on the agreement made with SZV- what will be the monthly payment on the government building when govt will be renting back?

The agreement is not a loan and, therefore, there are no monthly payments. Once the sale to SZV is done, government will pay rent at a fixed rate of 6% of the purchase price. This will amount to approximately NAf. 3 million a year versus the NAf 1.1 million the government is currently paying in rent per month (NAf.13.2 million per year).

6. What will be paid monthly outside the agreement government is having with APS and SZV- elucidate on the reduction with current rents-

If we assume that 80 - 90% of the departments move into the new building, we will pay NAf. 3 million and for the remaining 10% we will pay approximately NAf. 1,3 million a year. These savings can be used for other general expenditures.

7. As a former member of CFT and now Minister of Finance, how likely is it that the cft will approve or request amendments to the 2016 budget and what are the risks based on his experience? Will there be room in the budget for adjustments or is this how far we can go?

I expect Cft to be critical and I expect them to come with some suggestions. I do not expect the Cft to not approve the 2016 budget. The 2016 budget effectively addresses the issue that has been haunting Sint Maarten since 2010, which is projecting unrealistic income every year.

8. What measures have been taken with regards to indirect taxes?

The new government has been in place for 60 working days, thus no new measures have been taken regarding indirect taxes as yet. But I am a strong believer that we have to move from direct taxes to indirect taxes.

9. What measures are in place to ensure businesses are paying their fair share of taxes?

I think that we have to eliminate or reduce profit tax substantially, because profit tax requires an apparatus and human resources that we do not have. However, we have to find substitute income that does not hit the small man severely. At the same time the substitute income needs to be simple i.e., the amounts payable needs to be determined easily and should be collected also easily.

10. Are container taxes/fees being regulated?

This is not controlled by Government, but by the Harbor and can be found in the financial statements of the Harbor.

11. Can we agree to a monthly update on the execution of the budget to ensure that the budget is being executed as mentioned?

I am working on accomplishing this. Details of such are being work on and it is my intention to include parliament.

#### **MP CORNELIUS DE WEEVER**

1. When was the study started for tax reform?

A year and a half ago the tax reform study was commissioned.

2. What are the Laws that needed to be changed in order to realize the tax reform?

The laws that need to be changed to accommodate tax reform, depend on Government's decision on the direction they want to take subject to parliament's approval.

3. Has a monitoring committee been put in place? How effective is this?

The Council of Ministers approved a monitoring system in which controllers will respond directly to the Minister of Finance, who on his turn will respond to the Council of Ministers and consequently the Minister of Finance will inform Parliament of the developments regarding the monitoring of the budget.

4. Can Government inform if internal control department has been established and has that been staffed or is it the intention not have the department at all?

The internal control department is not functioning. There were two persons employed at that department, one employee is no longer working at that department and has been transferred to the Cabinet of the Minister.

5. TOT is the biggest obstacle to economic growth, is there information to back up this statement, can this be proven? Can Government provide facts and figures?

Refer to question 7 of MP Tamara Leonard.

#### **MP RUDOLPH SAMUEL**

1. Do the government owned companies have money in foreign banks, if so what is the benefit of this activity and why not put the money on the local banks?

I suspect they do, and it would only be beneficial to them if they receive interest on these foreign deposits and if these foreign deposits facilitate international transactions. However, if the sole reason for having foreign deposits is to not pay the 1 % foreign exchange fee, this is not beneficial for Sint Maarten. If the Government Owned Companies keep their funds on domestic accounts, this will help Sint Maarten with its liquidity and, hence, help us achieve lower interest rates. The latter is crucial for our competitiveness vis-à-vis other countries in the region.

2. Can government explain *through put fee*? What is this, where is it collected and how much did this bring to the island in the year 2012, 2013, 2014 and 2015?

I refer you to the financial statements of the Harbor Group of Companies. This information can be extracted from the financials.

3. Please explain the Tax Holiday, how does a company does qualify? Can a small or local company / entrepreneur also benefit/qualify?

Yes, local entrepreneurs can qualify for a 'Tax Holiday' if they meet the following criteria:

- Broaden economic base;
- Investment of Naf 250,000;
- Provide jobs to 5 born Sint Maarteners .

The tax holiday is only related to profit taxes. In this case, the profit tax will amount to 2%.

4. Explain what is a crib number? How does a person get a crib number? How many crib numbers do we have in sxm? Where they are registered- how many business related and person related? How many related to public sector and private sector?

A crib number is an identification number provided by the Inspectorate of Taxes that identifies you as a person.

In addition to the answers given: please see the table below.

Description	Number
# of Unique CRIB numbers attached to people	42746
# of Unique CRIB numbers attached to businesses	9572 (excluding Sole Props) 4546 Sole Propos
# of Unique CRIB numbers attached to public sector	1
# of Unique CRIB numbers attached to private sector	The remaining

5. Do persons pay any water rights tax? How is this collected? How much was collected in 2012-2013-2014-2015?

Water rights are included in the long lease. However, there has been an issue with the billing and collection of these taxes. When erfpacht is invoiced by the receivers, this item line is included in the total amount.

Overview of Erfpacht (NAf)

- a. 2012- 3,220,000
- b. 2013- 4,022,000
- c. 2014- 4,336,696
- d. 2015- 4,951,070

In addition to the answers given: The exact water rights amount should be requested at VROMI.

6. Concerning the reduction of salary compensation for Member of Parliament. Can government provide a breakdown of the gross salary if 19,000 NAF is earned as well as if gross 12,000 NAF is earned and what is the net salary for a Member of Parliament to take home?

Naf 12,000 gross- net pay 8,455.14  
Naf 19,000 gross- net pay 11,830.90

7. Can Government provide breakdown from 2012-2015 of the costs for the government owned companies of consultants and legal fees and travel expenses?



Please review government owned companies financial statements provided by government on to parliament on January 10, 2014 and December 29, 2014.

8. Are the government owned companies up to date with yearly financial statements?  
No. The government owned companies are not up to date with their financials.

**MP GEORGE PANTOPHLET**

1. What happened to the internal control department that was there before?

Previously, two persons were working at the department. However, one person has been transferred to the Cabinet of the Minister. Consequently, the department is not functioning accordingly due to a lack of human resources.

**MP CHRISTOPHER EMMANUEL**

1. Can the consequences of not having a balanced budget be explained?

According to the Kingdom Act on Financial Supervision, Sint Maarten is required to have a balanced current budget. If the country does not comply with this rule, the Kingdom Council of Ministers might issue a targeted instruction to the government of Sint Maarten. Until the terms of this instruction are not met, Sint Maarten will not be able to issue any new debt for necessary capital investments.

2. When was the last time Sint Maarten had a balanced budget?

From 2010 until 2014, we have relied on fictitious revenue generating ideas that were never materialized. We have built up deficits every year, which need to be compensated for in the coming years.

3. Why do we have a surplus in our Budget?

In addition to the answers given: To compensate from the deficits incurred as of 2010, this surplus will also be used for the settlement of the substantial payments arrears towards SZV and APS.

4. What does it mean to be given an instruction and why was government given an instruction?

The Kingdom Council has issued a mandatory order to Sint Maarten to tackle outstanding issues. If Government of Sint Maarten cannot comply with these instructions, a measure of higher supervision will come and execute the tasks that were ordered by the Kingdom Council. Furthermore, until the terms of this mandatory order are not met, Sint Maarten will not be able to issue any new debt for necessary capital investments.

5. Why was government given an instruction? Why didn't Cft approve budget 2015?

CFT was of the opinion that the measures that were projected to raise revenues in 2015 to balance the government's budget were unattainable and would not have resulted in extra revenues. Consequently, according to the CFT Sint Maarten would again record a deficit on its current budget.

6. When pensioners receive payment via WIB they have to pay fee, if they receive it via post office (SZV) without fee- can we remedy this situation?

This issue will be looked into.

#### **MP MAURICE LAKE**

1. On page 8 of the elucidation mentions that cft report of 2014 talks about poor financial management. What is being done to address this? And is it reflected in budget 2016?

In addition to the answers given: There is a plan of approach in place called financial management led by SOAB to tackle issues to improve financial management. There is also NAf 4 million budgeted in the capital expenditures of Finance, of which a part can be allocated for investments in the financial systems that the government can put into place to improve financial management.

2. Sale-back and lease agreement with SZV and APS- is it the same as a loan? Was the cft involved/informed and do they support government with this?

There is no lease back agreement to pay down debt. It is not a loan. The initial remarks of Cft of the draft budget 2016 confirms that the agreement reached with APS and SZV is palatable.

3. What income generating measures used from the budget amendment 2015 did this government cut and what was the expected income? Will this government come up with structured income generating measures?

No income generating measures were cut. The budget amendment did not pass; therefore those measures were not in place and could not be cut.

4. In budget 2016 is there a post for emergency/calamity

Yes, there is an item in the budget for emergencies and calamities.

#### **MP SILVO MATSER**

1. Is the minister looking into all the technical and interim positions that are filled by outsiders and place locals to fill these positions? How are we going to change this to have locals fill the positions as this will be lessor burden for government, getting our students back?

The question is whether we have the expertise and human resources available to do the job. The problem is that we have not created the expertise needed for this Island. I am supporting a project that will create a Law School on the Island. If successful, we will be able to produce within 5 – 6 years

an a certain amount of lawyers. A similar approach needs to be used to develop the skills and expertise needed for Sint Maarten to achieve higher economic growth.

2. How is Minister of Finance looking into a capital flight in SXM? Using expertise of local accountants while expertise are on the island, are we looking into preventing this from happening?

By hiring consultants from abroad, Sint Maarten is encouraging capital flight. Furthermore, the consultants will pay taxes to the governments of their home countries instead of to the government of Sint Maarten. Therefore, the government intends to reevaluate the consultant agreements in order to address this issue.

3. How can we make it attractive for new investors to come to the island? How can we come up with new incentives to generate good income for Sint Maarten?

In addition to the answers given: hopefully, when the tax reform is implemented, the new system will attract more foreign investments.

4. Is the Government looking into ways of incentive for local companies to employ more of our youngsters to get into the job market?

In addition to the answers given: we will take this into consideration by reviewing the tax reform system.

#### **MP TAMARA LEONARD**

1. With regards to the credit card transactions, is it legal/ or is this practice illegal? Are there penalty that can be given to them

All these penalties are arranged by bilateral contracts. There is a free competition in the economy. It is not something that is subject to fines or breach of existing laws.

#### **MP LEONA MARLIN**

1. List of names of consultants/ technical assistance

I received advice that releasing names will be in contradiction of the privacy laws and the EVRM.

#### **MP JANCHI LEONARD**

1. What do we do to assists pensioners?

Pensioners currently qualify for 70% of their last salary. Perhaps Government can develop some kind of methodology for pensioners to receive 70% of the minimum wage.

However, the feasibility of such an incentive needs to be assessed. The question that arises is whether everyone is willing to pay a higher contribution to assist pensioners.

## Ministry of Tourism, Economic Affairs, Traffic and Telecommunication

### MP Leona Marlin-Romeo

1. Can the Minister of TEZVT provide me with a list of economic development initiatives for 2016?

We are in a Catch-22 where limited financial resource necessary to invest in revenue generating projects and or regulatory bodies such as; (GCB / Consumer Protection / Competition Authority). The Ministry of TEZVT is currently in the process of completing the Economic Development Plan for St. Maarten. Once completed, the Economic Development Plan will outline key sectors for economic development and action plans for the development of these sectors. Along with the Economic Development Plan.

The Ministry will also be focusing on small business support via the implementation of the approved Small and Medium Enterprise (SME) Policy Framework. Small business support will include training and development for entrepreneurs and streamlining of processes to make it easier for entrepreneurs to be successful when doing business on St. Maarten.

#### Legislative Projects

- Competition Authority Legislation: To stimulate fair competition and consequently decreasing cost of living. Memorie van toelichting to be done by inhouse legal advisor.
- The Gaming control board : To regulate the overall gaming industry by establishing the Gaming control Board. Advice to be submitted to proceed with setting up the GCB.
- Legesverordening : with regards to the 2016 budget. To generate additional revenue of Naf1 8 million by adjusting economic tariffs in the legesverordening. The draft ordinance to be submitted to Parliament within 3 months April 2016
  - (additional revenue to be generated – 8 mil)
- Time share law : Introduction of consumer protection law for timeshare owners/ users
- Public Transportation Ordinance & LB Ham : To Professionalize the public transport sector and enhance control ( national ordinance and decree on transportation and national decree on taxi tariffs
- Ministerial decrees on maximum prices on petroleum products and bread, foodstuff. To regulate the legal the legal basis for maximum process for petroleum products and bread. To be adjusted based on the advice from the Council of advice.
- VRB – Economic licenses ordinance : To merge all existing economic activities in one ordinance This include vending, operational economic licenses, public transportation and business licenses
- Revision or annulment of the Tax holiday for hotels and ground development, depending out outcome of EDP

- Ministerial decree, now LB Ham to provide a legal base to enable administrative collection of Casino controllers fees
- Implementing of the national energy policy

2. When will the 12 Mil be collected from the Casinos?

This question is for Finance Minister. The decree was signed off by the Minister of TEATT and published in the publication sheet. It is being revised and put into and LB Ham – March 2016.

3. How long has the 12 Mil been outstanding?

Finance Minister has stated since 2007.

4. How did the casino's end up accumulating 12 million?

There was no legal basis to collect the outstanding fees : Article 2 of the National Decree containing general measures, the implementation of Articles 4 and 5 of the Ordinance gaming license duty hazard games (hereinafter: the execution country act) requires to be appointed for the purpose of control of casinos casino inspectors.

This Article stipulates that the labor and social security of the casino auditors should be paid by the casinos. For that purpose the Head of the Finance Department is a monthly assessment for the recovery to be sent to the recipient.

In the case between Atlantis casino and the Country, Atlantis sought a declaration that the receiver erroneously used the powers under the Ordinance regulating the collection of taxes, charges and fees. The claim by the casino owner was that the absence of legislation, where the rate of reimbursement for casino controllers is captured, the fee could not be collected. By judgment of the Court of First Instance of 16 January 2007, Atlantis in the equivalent. This could be shown that the recovery of fees for casino inspectors was only possible through civil law, in the absence of an administrative base for recovery by the Finance Department.

Gaming control board : With the introduction of the Gaming Control Board, the recovery of those fees will be further regulated. In anticipation of the introduction of the Gaming Control Board, the government considers it desirable that in the meantime, a legal basis for the administrative enforcement of the labor and social welfare inspectors of casinos established on the basis of the implementing decree. The present ministerial regulation will lead to a more efficient form of collecting said fees.

Article 4 of the implementing national decree gives the Minister of Tourism, Economic Affairs, Transport and Telecommunications, the power to adopt detailed rules for its implementation. Pursuant to this authority in this ministerial order yet determined the rate of the average wage and the average social services for a casino inspector.

5. Has Government, Minister of TEZVT prioritized these capital projects and was an economic impact study done? What projects, if any, have been identified as priority?

The St. Maarten Tourism Authority Building	ANG 4.5 Million
Repairs to Front St. and Back St.	ANG 2 Million
Beautification of Tourist Areas (rockwall)	ANG 2 Million
Taxi Parking Lot and Dispatch	ANG 0.5 Million
Movement of Vendors to "Vendor Mall"	ANG 0.2 Million

An economic impact study was not done as it was not necessary.

How much of the 2015 Capital investment was used? And for what, please provide breakdown. Are there funds remaining? And, if so how much?

See attached list from "Capital Investments 2015"

Please provide a comparison from 2010 – 2015 of the Capital investment account by Ministry.

2015 Capital Investment	ANG 1,715,618
2014 Remaining Capital	ANG 3,677,241
Total 2014 and 2015	ANG 5,392,859

#### Overall reduction TEZVT budget

6. How will we promote SXM? What is the plan of action?

Given the reduced 2016 budget and looking at the most effective pulling & pushing strategies, the following initiatives were identified to promote the destination:

- Through trade media Trip Advisor and Expedia.com " Save the summer program" A public/private initiative with the SHTA was launched. The advice has been drafted and be submitted pending the approval of the 2016 budget.
- A marketing program with Expedia and Trip Advisor is being finalized. We will be putting more emphasis on the use of Social media; such as Instagram, twitter, Facebook and other such tools. In light of the limited resources this form of marketing will allow us to maintain a large presence with limited investment.
- Through marketing firms North American, South American & Holland/Benelux Markets. The idea is to have all contracts in place during the 1st quarter of 2016. We have already completed the presentations of the Holland/Benelux market. The intention is that by the end of February, presentations will be given for both the South American market and the North American market to ascertain who/which company will represent SXM in the respective markets. Shortly thereafter, an advice will be sent for decision-making to commence the marketing in all of our major source markets.
- Through the use of Sales Representatives/Multi-Liners in the United States & Canada.
- Through agencies in Puerto Rico & Trinidad
- Cooperative marketing initiatives with key airline partners i.e. TUI, Sunwing, Air Canada, West Jet, Copa Airlines, Avianca (Colombian market)
- Attendance to key trade & consumer shows e.g. Annato South American market

7. Is there any intention to amend/revise the law that regulates casino fees?

There is legislation in place in the form of the "Regeling van de Minister van Toerisme, Economische Zaken, Verkeer en Telecommunicatie van de 16e December 2015, houdende nadere bepalingen betreffende de betaling van de loonkosten alsmede sociale voorzieningen van casinocontroleurs door de casino's". This legally sets the tariffs to be paid by casinos for the presence of casino controllers. The Legislation has been approved and published and has entered into force as of the 28th of January 2016

8. Can I get a status report on the gaming control board?

In November last year a presentation was given to the Council of Ministers on the implementation plan whereby permission was granted to commence consultations with relevant stakeholders in the gaming industry.

The legislation to needed to establish the Gaming Control Board has been completed and is now being reviewed by an independent lawyer. The Ministry is currently awaiting the results of said review to proceed further.

9. Pg 22 of budget - Bureau eigendom (BIE) SXM; not budgeted. Please explain.

As the Bureau of Intellectual Property is an income generating entity, via the collection of fees associated with copyright registration, the Bureau no longer requires ministerial funds and is now self-sufficient. Thus, the Bureau is not listed in the ministry's budget.

10. Pg 23 of budget - Personnel v. derden was decreased by 41.9%; please explain why. And how does this affect operations?

This limits the opportunity to hire external experts to support the ministry's efforts in achieving its mission. Furthermore as the ministry lacks specialized expertise such as legislative lawyers and topic specific technical experts, many of initiatives which would require such support will not be achieved this year.

Additionally as the ministry has multiple critical vacancies which will not be filled this further adds to the workload of civil servants within the departments.

11. Overige goederen decreased by 29%; how does this affect operations?

The budget post for market specific marketing are described in the budget heading '**Overige goederen**' which is reflected in the (almost \$ 1 million) cut this limits the marketing initiatives within the various markets.

12. Can I be provided with a list of risks associated with the budget cuts

Many of the critical vacancies that were not budgeted for were removed by the ministry of finance to balance the budget. As a result of the limited capacity within the department many project priorities and responsibilities are not able to be achieved. However in view of the income regenerating measures and funds to be collected the possibility exists that funds will be made available to finance some of the projects.

Significant reduction in the marketing budget (*almost \$ 1 million*) limits the marketing initiatives within the various markets. We risks losing our current market share in a very competitive tourism industry to our regional competitors.

13. Can the Minister explain ROI? (Return on Investment).

ROI is Return on Investment

23. Can the Minister provide clarification what is meant with “catch 22”?

Wikipedia defines A catch-22 is a paradoxical situation from which an individual cannot escape because of contradictory rules

An example would be:

To apply for a job, you need to have a few years of experience. But in order to gain experience, you need to get a job first.

We have limited financial resources and yet need to invest in revenue generating projects in order to stimulate economic growth.

24. How long has the ANG 12 million from the casino’s been outstanding? Minister TEZVT mentioned that it outstanding from 2007 while Minister FIN mentioned that the laws started from 1967 which is 47 years. When did these monies started expiring?

**Re-directed to Min. Finance**

25. What is ASYCUDA: explain further:

ASYCUDA is Automated System for Customs Data is a database system, used in most countries in our region to help manage & compile detailed data on the flow and value of imports & exports of goods. The TEATT ministry intends to have this system introduced on St. Maarten in 2016, which traders will be required to use via an online application, this will facilitate a quicker & more accurate system of establishing maximum prices but also assist with us producing trade statistics on specific items, trading partners and values of goods.

26. What is going on with the consumer protection agency and consumer authority? What is the status? What exactly is the Ministry working on?

**Clarity about Consumer Authority & Consumer Protection Agency:**

In 2011 a feasibility study carried out on St. Maarten by SEO Economisch Onderzoek from the Netherlands, this study was funded by the Social Economic Initiative (SEI). The draft policy was completed by SEO via funding by TEZVT. In 2014, the draft legislation was commission from the information gathered from the feasibility study and policy documents produced by SEO. In September 2014, feedback was received from the Department of Legal Affairs concerning the draft law and a consultant was hired based on these comments. As Legal Affairs was largely focused on the integrity legislation in 2015, there was a pause in the process. In mid-2015, the Memorie van Toelichting was produced by EVT.

As the draft legislation for the Competition Authority was partially completed in September 2015. The Ministry is currently working on finalizing an agreement with an independent consultant who specializes in this field to complete the legislation and implement the action plan which will include the Competition Authority’s structure and personnel. The use of a



specialized consultant as there are few entities with the knowledge, technical expertise and experience in this area. As the Ministry has a credit for work to be done, this credit will be used for this project as it has been identified as a priority. The entity being used has worked with the Ministry in the past and has provided a number of policy documents and feasibility studies.

27. Please provide us with an explanation for the School bus mobility plan.

**School bus Mobility Plan:**

The mobility plan is merely a project related to the formal organizing of the school bus system. It entails legal issues, Service Level Agreements and enhancing the control.

28. Explanation of what is being done for the safety of the life of school children on the school busses? What is meant with the positioning of the school bus? School bus Policy (**Safety Concern**):

The crossing of the road by school buses is not permissible under the traffic law. This however, is long standing practice by school bus drivers that is tolerated by law enforcement in the interest of the safety of the school children who need to cross the road. Where available, school buses should make use of bus stops, pull off the main road or make use of an assistant who will step out of the bus, give hand signals to stop traffic and assist school children in crossing the road. Further safety regulations will be addressed in the School bus Mobility Plan.

29. The harbor paid 1.8 million guilders? Mr. Mingo is absent, is he the only one that can answer this question?

In 2014 the Harbour was under the impression that it would be allowed to offset Govt contribution for the FCCA conference with the concession fee. This was done for the first 8 months of 2014. When the Govt indicated that it did not want the offset in such a manner payments were immediately resumed and an agreement was made with the receiver to pay off the withheld amounts ( 1 million on top of the regular concession per year until all paid)

30. Which legislations will the Central Bank be working on? Clarify which legislation is being worked on and who is assisting.

Presently, legislation is being worked on for the establishment of the Gaming Control Board. A draft has been produced and is being finalized with the assistance of the Central Bank.

Legislation is also being worked on for the establishment of the Competition Authority. The intention is to contract a specialized consultant to finalize the legislation and produce the necessary organizational documents.

31. Is the ANG 12 million for social premiums? Please explain.

Article 2 of the National Decree containing general measures, the implementation of Articles 4 and 5 of the Ordinance gaming license duty hazard games (hereinafter: the execution country act) requires to be appointed for the purpose of control of casinos casino inspectors. This Article stipulates that the labor and social security of the casino auditors should be paid by the casinos.

32. In 2007 there was a court case and the decision was that Government has no grounds to collect premiums from casino, so Minister saying from 2007 - 2015 nothing done?  
When I started; I was faced with this situation and as such signed a Ministerial Decree to regulate and resolve this issue. Ministerial decree was signed off by my person and published in the publication sheet; it is currently being revised and put into and LB Ham – March 2016.
33. No legislation for school bus mobility policy, crossing of schools busses, this is being tolerated? Explain what is meant with tolerated?  
The crossing of the road by school buses is not permissible under the traffic law. This however, is long standing practice by school bus drivers that is tolerated by law enforcement in the interest of the safety of the school children who need to cross the road. Where available, school buses should make use of bus stops, pull off the main road or make use of an assistant who will step out of the bus, give hand signals to stop traffic and assist school children in crossing the road. Further safety regulations will be addressed in the School Bus Mobility Plan.
34. Central bank will be working on the consumer protection and gaming control board (GCB) legislation? Please give a little more info on this? Give some more explanations as to the help is needed with these important legislations.  
Given the limited financial resources and the lack of legislative lawyers within the ministry we are utilizing the legal assistance offered by the Central Bank to aid in the drafting of some key legislation needed. Currently the Central Bank will aid in the drafting of Legislation for the GCB as well as that of Consumer protection.

**MP Tamara Leonard**

35. Minister FIN mentioned trade shows are not producing anything, Minister TEZVT states they are, how will this be settled to ensure both ministers report the same and that we are able to market Sint Maarten effectively?  
The consequence of not attending will result in loss of market share, notable exposure/awareness for the destination, (out of sight, out of mind), business opportunities with key industry partners i.e. Trip Advisor, Expedia, TUI, Copa Sunwing to name a few.
36. What formula was used to cut budgets? How did the decision come about to cut 10% across the board? Why not 5%? What formula was used?  
To be answered by Min. Finance
37. How did you determine how much subsidy should be cut when it's not regulated in the subsidy ordinance? How was the cut determined? How much is paid out? How do we come to the conclusion to take a cut in this ministry which is a ministry needed to promote the economy of the island?  
The budget was cut in order to achieve a balanced budget. This process was handled by the Finance Ministry. Hard decisions were forced to be made in order to be able to achieve a balanced budget, and though we did not want to make certain cuts, they were necessary and as such had to be made.  
With limited funds we are required to spend the money that is available very wisely - spending decisions are made based on the highest anticipated results.

38. Will the STA be set up in 2 months as mentioned by the Minister? Does this mean it is already in process and what kind of entity will this be?

The establishment of the STA is in the form of a Foundation, and it is already in process.

39. There was an increase in stay-over tourist 2013 and 2014, but not reflected in government revenue. What is being done to measure this?

At the moment the national accounts doesn't have tourism satellite accounts to accurately capture tourism revenue. As an indicator of tourism receipts we can use the tourism expenditure data.

- a. Stay-over per person daily expenditure, estimated at US\$91.00 in 2014.
- b. Cruise per person daily expenditure, estimated at US\$ 171 in 2014

40. Have we received cruise-line reports? What is the amount spent by the cruise tourists? Has there been an increase in amounts spent?

This information is available on the Tourism

There is a publication on the Tourism Exit Survey (TES) 2013 results and the results of 2014 is currently being worked on. This survey is a sample survey conducted inquiring about the visitor expenditure, travel activities, satisfaction and general demographic information. We will provide parliament with a copy of the publication. But it is also readily available on the department of statistics website for download.

A Preliminary result of 2014:

- Stay-over per person daily expenditure, estimated at US\$91.00 in 2014
- Cruise per person daily expenditure, estimated at US\$ 171 in 2014

41. What kind of entity will the STA be? Last it was to be a ZBO. Who are the stakeholders now?

The STA will presently be in the form of a foundation. The stakeholders will be government, the SHTA, the STA, the Harbor, the Airport.

42. How much money will be saved with the move to the Fire Station. What are the estimated costs to build and furnish. Will both the STA and the Tourist Office be stationed there?

This cannot be assessed at this point in time. The planning is in the infant stage at present.

The intention is for the Tourist Office to eventually be merged into the STA with both entities becoming one.

43. What are we doing to attract tourist in the slow season? What major shows do we have planned for the summer?

An expanded list and plan of approach can be provided to Parliament once the STA is functioning and the marketing representatives have been selected.

44. How many tourists do we attract from the Benelux and the South American Markets? Have we considered the Asian market?

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2014

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North America *(61.5%)	317,757
Europe *(22.7%)	106,848
Caribbean *(5.4%)	26,390
South America *(3.4%)	16,705
Rest of the World *(7.0%)	32,221
<b>Total</b>	<b>499,921</b>

Given our limited financial resources at present, we are forced to focus our effort on those markets that are already known.

45. With regard to the project regarding uncollected licenses. How many of those uncollected licenses were there? How many were never picked up and over what period of time? How much in revenue was lost when they were not picked up?

The department of Economic Licenses had a total over 2022 uncollected licenses approved between the year 2002 and Jan 1, 2015, which represented a total sum of Naf 1.56 Million in outstanding revenue.

Of the 2,022 licenses that were uncollected, a total of 77 licenses were picked up between June 26th - August 14th, 2015. Majority of the licenses collected were those approved in 2014, which substantiated the department's theory that the licenses issued years ago were no longer desired.

In terms of financials, the uncollected licenses project generated approximately: Naf 100,000 of the Naf 1.56 Million outstanding (less than 10%).

The project is ongoing in the fact that approved licenses are now only kept by the department for a period of 6 months, after which it will be discarded and interested applicants will have to submit their request as a new application and play all applicable processing fees anew.

46. Presently people deposit ANG 150 to when applying for a license. Is there the possibility to charge the ANG 1,500 upfront instead as a deposit when people apply for licenses? Given that they sometimes do not pay the balance as they do not pick up their licenses, after all the work is done. What was put in place to resolve this? Can the upfront payment be made non-refundable? Can they receive a report on that project?

This will be addressed in the "legesverordening".

47. Can the Minister elaborate on her statement that business licenses will be processed in 2 weeks?

I misspoke in answering that question. The processing time of an application is 4 weeks and then the approval process is 2 weeks. So in total is a 6 week process.

48. What are we doing to attaining CAT-1.

The Department of Civil Aviation and Shipping and Maritime in a continuous effort to achieve Cat 1 status has recently hired a flight operational inspector and is busy establishing a Personnel Licensing division which is essential to meet Cat 1 status. These two steps are critical in achieving Cat 1 status.

49. What is the status on the MET office and the Civil Aviation office?

The building to house the observers and forecasters of Meteo will be done by March. The Inflation building (the building for the weather balloon) has already been built and just the equipment need to be relocated. The building to house the administrative staff (Old Turtle Pier building) is almost ready just some small changes to the building.

50. Do we have to implement stricter control measures to control the telecommunication companies.

BTP is responsible for establishing their collection control measures. This will be discussed with BTP.

#### **MP S. Wescot**

51. Harbor concession: only 1.8 million paid in 2014. Explain.

Mr. Mingo is Currently out of the country, I will inquire once he has return.

52. What are the Projections for the cruise industry for 2016/2017?

The Smart model estimates that 2016 Cruise PAX arrivals will record a 2.4% increase 1,947,113

#### **MP C. de Weever**

53. State of the economy?

Given the financial challenges facing the government, we are called upon to still be positive and govern accordingly, despite these challenges, and take the requisite decisions to ensure the continued growth of our economy. To this end, we should reflect upon the developments over the last year in order to determine the course of action going forward in 2016.

Firstly, I will like to briefly highlight a number of key economic indicators which are as follows,

The economic performance of the economy 2015 based on analysis to date, shows a declining GDP growth when compared to the year 2014. Reasons substantiating this decline growth are:

- ✓ The decrease in performance of the hotel and restaurant sector, Retail and wholesale sector and the construction sector.
- ✓ Slower exports of goods and services for 2015 compared to 2014
- ✓ Decreased in Government investment by approximately ANG 36 million over the period compared to 2014
- ✓ Decreased in Tourism Receipts from both cruise and stay over arrivals due to the decreased arrivals

With regards to inflation, with the falling oil price on the global market; Inflation on St. Maarten experienced a decrease of 1.06 percentage points from rate of 1.9% in 2014 to a 0.3% in 2015. This declining trend is expected to continue into 2016.

The rate of unemployment remained stable at 9.2 %.

Conclusion:

Despite the challenges being faced, the Ministry will continue on its part to ensure a favorable economic climate by making key initiatives and decisions. Additionally with the positive growth of the United States economy combined with an assertive marketing program we will be well positioned to turn things around in our tourism product and subsequently our economy.

54. BTP concessions 2014 projected 7 million actuality only 2.1 million collected. 2015 it was 5 million and 2016 it is 3 million. Can we get real grasp on BTP figures and how that is explained?

Concession revenues for 2014 were projected at ANG 2,550,000.00 based on One (1) fixed landline operator, three (3) international operators and three (3) mobile Operators being concession holders in the local market. The statement made that the projected concession income was 7mln for 2014 is thus incorrect.

Concession revenues for 2015 were projected at ANG 3,000,000.00 based on One (1) fixed landline operator, three (3) international operators and four (4) mobile Operators being concession holders in the local market. The statement made that the projected concession income was 5 mln for 2015 is thus incorrect.

Concession revenues for 2016 were projected at ANG 3,350,000.00 based on One (1) fixed landline operator, three (4) international operators and four (4) mobile Operators being concession holders in the local market.

The budgeted decrease in 2016 income for BTP is due to the non-operational status of two mobile concessionaires. Mobile operators are the biggest consumers of spectrum. As long as these operators are not active in the market, there will be little to no increase in BTP's income as operators are constantly seeking for ways to be more efficient in their spectrum use for business operations.

55. Between Heineken Regatta and Carnival which one is producing a return on investment? How much?

Both entities are producing returns on investments, although the amounts are difficult to quantify.

56. Clarify which medium is used for promoting St. Maarten Expedia or Trip Advisor? Clarity on which search engines are to be used **Wikipedia or Trip advisor and Expedia?**

The Minister of Finance misspoke, the search engines used are Trip advisor and Expedia

57. Minister FIN mentioned trade shows are not producing anything, Minister TEZVT states they are, how will this be settled to ensure both ministers report the same and that we are able to market Sint Maarten effectively?

The consequence of not attending will result in loss of market share, notable exposure/awareness for the destination, (out of sight, out of mind), business opportunities with key industry partners i.e. Trip Advisor, Expedia, TUI, Copa Sunwing to name a few.

58. Provide clarity on how testing of school bus drivers will be done? What is the legal basis for the checks on the school buses?

The TEATT Ministry performs checks on the school busses, bus licenses, and driver's licenses. Testing of school bus driver's in terms of alcohol, etc. falls under the Justice Ministry as those matters are handled by police officers.

59. Is the person marketing St. Maarten via the trade shows?

The attendance of tradeshows is just one of the means of promoting the destination

60. Is the French side piggy banking on the Dutch side marketing efforts? Is there any joint collaboration with French side ref. promoting of the island?

This is a new question.

## Ministry of Housing, Spatial Development, Environment and Infrastructure

### MP Leona Marlin

1. Were the ministries able to accomplish any goals that were budgeted for in 2015. If yes, can parliament receive a detailed outline of such per ministry, so in essence, these are the ministries plans, this was accomplished and this was the cost

As for VROMI, there were no significant strategic goals accomplished as a result of lack of capital investment budget. The year 2015 can be categorized as mainly accomplishing a lot of going concern and operational activities as reflected in the budget. There were also various projects being executed, that were mostly funded from the 2014 capital investment budget. The projects included:

- the hard-surfacing of certain dirt road,
- the execution of the FOGA infrastructure plan,
- the installation of sewage connections in Middle Region
- recapping of the Link 1 phase 2.

2. Can you please provide me with a policy priority list for 2016

Within the current constraints of the 2016 draft budget the Ministry is intended to continue its policy priorities as set forward in the 2015-2018 Ministry plan. More specific Emphasis on:

- National Ordinance on Spatial Development Planning (Zoning)
- Update Building Ordinance and Decree
- Hindrance Ordinance
- Ordinance on Management of Solid Waste
- Ordinance on Management of Waste Water
- Ordinance on Management of Government Land (Long Lease  
Decision on future of solid waste management: Waste to Energy
- Sewage Management organization
- Prioritization sewage project Cole Bay with French Side
- Disaster management fund



- Invest in modernization data management: Geospatial Information System (GIS), Management of Addresses (BAG)
- Improvement of functioning Domain Affairs (organization, resources, policy and organization) to improve revenue source
- Together with the SMHDF Facilitate affordable housing and home ownership

Continue improving Ministry's performance in relation to services provided to the public, by frequent monitoring and reporting.

3. Can I be provided with a list of potential risks associated with this budget due to lack of funds?

There are a number of areas where the Ministry sees potential risks, which are due to budgetary constraints cannot be covered (in full). To name a few:

- Back log Roads maintenance
- Legal expenses
- Modernization of the organization
- Critical vacancies
- Infrastructure injuries and damage claims
- Climate change measures (shore protection, construction resilience etc.)
- Disaster Management Fund
- Land/location for new cemetery
- VROMI yard (and vehicle fleet maintenance)

Beautification neighborhoods (sidewalks, signage)

4. On the Capital budget, what projects, if any, have been identified as priority? What are the priorities (capital budget) per Ministry? Please give a breakdown

This will be in the area of the road network expansion, sewage network expansion, upgrading cemeteries. Furthermore the finalizing FOGA Housing project in cooperation with the SMHDF. Also continuing with District Improvement as well as living up to the Government's commitment with regards to external (EDF) funding.

5. Beheerstort Plaats (Landfill management) increased by 1.7 Mil;
  - a. How will these funds be used?
  - b. What plans are in place to control the continued growth of the landfill?
  - c. Have alternative measures been researched? And what is holding us back from implementing these measures? (Recycling plant)
  - d. When are we going green? Are there any Public Service Announcement being developed to make our population more conscious of garbage production.
  - e. Are there any investments in capital investments for Alternative Energy

- a. In 2015 the budget for the Landfill was under the assumption that the Waste to Energy (WtE) agreement would go into effect within 6 months. This did not

materialize as such, in the end this shortage was covered by postponing projects in other (budgeted) areas. The Budget in 2016 is sufficient to cover the Maintenance of the Landfill as per outcome of the applicable Tender.

- b. A survey is being conducted of the landfill site to assess the most efficient manner to continue landfilling and reducing the visual impact of the mound that is being created. The most effective manner to reduce the growth of the landfill is through the implementation of the plans for incineration of garbage. Sint Maarten is effectively out of space for more landfilling and while some recycling efforts are being employed, this depends largely on available market for the recycled materials, while the cost of transportation heavily constrains these efforts.
  - c. Alternative measures have been researched and the most effective solution for Sint Maarten is the realization of a waste to energy incineration facility. Recycling possibilities are constrained by available markets to ship materials to cost effectively, taking the market value of the recycled goods and the cost of transportation from Sint Maarten into account.
  - d. The waste to energy project is the best manner for Sint Maarten to go green. In this manner the garbage produced daily can be turned into fuel for energy. The facility will also include a more elaborate recycling station.
  - e. There are no capital investment reservations made for this, as this project will be executed from alternative funds from private investments
6. Monumenten beheer was not budget, Why? Please clarify. What is being done to maintain and protect our monuments?

Monuments care and management is a responsibility of the Ministry of OCJS or of the owners of the monuments. The VROMI budget includes reservations for subsidy to SIMARC, which is responsible in the area of archeology.

7. Overige onderhoud was increased by 18%; Please explain why

See Answer 5a

8. I'd like to get clarification as to who is the owner of the Gov't bldg.? This is in relation to the sale of the building. What is the current value?

This falls under the responsibility of MIN-FIN / MIN-AZ. At present the government building is owned by Government/country SXM. The building value is in the range of NAf 45M. Min AZ can provide a more accurate figure.

#### **MP C. De Weever**

1. Does government have policies for a year plan?

Question similar to 2<sup>nd</sup> question of MP L. Marlin:

Within the current constraints of the 2016 draft budget the Ministry is intended to continue its policy priorities as set forward in the 2015-2018 Ministry plan. More specific Emphasis on:

- National Ordinance on Spatial Development Planning (Zoning)
- Update Building Ordinance and Decree
- Hindrance Ordinance
- Ordinance on Management of Solid Waste
- Ordinance on Management of Waste Water
- Ordinance on Management of Government Land (Long Lease)
  - o Decision on future of solid waste management: Waste to Energy
- Sewage Management organization
- Prioritization sewage project Cole Bay with French Side
- Disaster management fund
- Invest in modernization data management: Geospatial Information System (GIS), Management of Addresses (BAG)
- Improvement of functioning Domain Affairs (organization, resources, policy and organization) to improve revenue source
- Together with the SMHDF Facilitate affordable housing and home ownership
- Continue improving Ministry's performance in relation to services provided to the public, by frequent monitoring and reporting.

2. Does this budget contain the financial consequences of government policies intentions  
As elucidated in the previous question, within the budgetary constraints (ceilings) the Ministry has the intention to continue with its policy priorities as set in its strategic plan. A synopsis of the potential risks associated with the lack of funds have been provided (Q&A 3 MP L. Marlin)

3. Pag 15 What effect on infrastructure what needs to happen?  
This question is not clear. This would need to be clarified by the MP.

4. Erfpacht canon, what is gov position, reevaluate who pays what and in which districts. Is zoning in place. Do those that have to pay more are they going to pay more

The Government is currently carrying out an assessment of the functioning of the Department of Domain Affairs, based on which we will also look into the current situation with the long lease canons, and assess where these may need to be reviewed. There is currently no zoning in place, with the exception of the plan for the Fort Amsterdam peninsula since 2001. Zoning will be a priority for this government.

5. Septic truck fee what happened that we need 250.000 ? Is it new contract, explain VROMI

This is income type was previously budgeted under the incorrect budget item (Keuring Elektriciteits installaties). It is therefore a mere budgetary correction of currently applicable VROMI Income. Sceptic fees are levied per sceptic truck by means of applicable bonds book.

6. Pag 17 Specify Vromi and education investments

Similar to Question of MP L. Marlin: This will be in the area of the road network expansion, sewage network expansion, upgrading cemeteries. Furthermore the finalizing FOGA Housing project in cooperation with the SMHDF. Also continuing with District Improvement as well as living up to the Government's commitment with regards to external (EDF) funding.

7. Pag 39 Transition landfill no figures by it. There has been a new contract signed, but does not see it reflected, where can I find it. VROMI

The amount here is shifted to 43439 – Overig Onderhoud in order to capture this budget in the category 'maintenance' (from category 'other'). For reporting purposes this gives a more clear picture of the Ministry's activity

8. Reconstruction and maintenance of cemetery no budget, where taken up in budget VROMI NAf. 150K is budgeted within Districts Maintenance (910 – Districten Onderhoud). Furthermore it is the intention to prioritize construction of burial vaults from the Capital expense budget, once applicable loan is approved.

**MP S. Wescott - Williams**

1. I miss the Nature Foundation in the subsidized institutions. Does not the Management of the Marine Park require such

This is budgeted within Cost center (kp) 9115 within the category Beheersovereenkomsten.

**MP C. De Weever**

1. Clarification on question 5 on the most effective way to reduce the landfill. Is it through incineration of garbage or WTE?

Incineration of garbage and WTE is one and the same. The garbage is incinerated and turned into fuel for energy.

2. Clarification on question 3 from MP De Weever. What consequence is there on the infrastructure of N.V. GEBE water distribution when money from the reserves goes to government?

N.V. GEBE did not present an investment plan to government to detail there investment for the coming years and the capital needed

#### **MP Leona Marlin**

1. Clarification on question 2, if zoning plans are a policy priority why is it not budgeted?

Zoning plans has limited financial consequences and provision is already taken up in the operational budget.

2. Clarification on question 3, beautification of neighborhoods. What does that entails as there are many neighborhoods that need beautification.

It is more in terms of upgrading neighborhoods with sidewalks signage etc. That are basic elements that should be in all neighborhoods.

#### **MP Leonard**

1. The maintenance of cemeteries is the Naf 150K per month and for which cemeteries?

The Naf 150K is per year and it includes the burial cost. It is for the 2 government owned cemeteries, which is Cul de Sac and Cay Bay.

At the moment it is included in the garbage contracts but will be part of the district maintenance in the new contracts.

#### **Leona Marlin**

Tips:

Related to the pumps and affected by the salt water pumps in the event of flooding. Pay keen attention the forecasts and pay period checks on the pumps in the event of weather to avoid flooding.

The corner by the late James Marlin is a dangerous corner as regards flooding.

Thank the MP for the tips and we will pay keen attention to the tips and try to do whatever is possible to ensure these concerns are properly addressed.

#### **MP Johan Leonard**

Underscores the sentiments of Leona Marlin.

Recommendation concerning the location of the Police Houses, to connect it to the Sundial Trench, to get the water to flow out with the trench at Sundial.

The concern of the MP is well noted and I also acknowledge that it is indeed a recurring problem. I will instruct the ministry to take keen note and to propose a solution to address this issue in a more sustainable and permanent manner.

**MP Tamara Leonard**

1. How does the ministry ensure or oversee that physically impaired can access buildings? What policies are in place for this, are there inspectors that deal with this, are there fines implemented, how is this handled in building permits? Based on the current legislation, there are no specific provisions to address access to building by the physically challenged. This is a concern that is recognized. The ministry is currently busy with the preparation of revisions to the building ordinance that will specifically address this concern. The draft ordinance is currently in review between the Ministry of VROMI and the Department of Legal Affairs. Until this is legally regulated, this is not something that can be enforced in private projects and buildings. However, prior to the completion of the legislation I intend to ensure that all Government projects or public building make provisions for ease of accessibility of physically challenged persons.
2. What measures has the ministry taken to ensure the following changes related to NV GEBE: will the fuel clause be eliminated? What kind of relief can be expected? Will this be reflected on the invoices of the consumers? At present there is no discussion ongoing with GEBE concerning the fuel clause. However it is the intention of the Government to address this matter with GEBE, in the event of production of electricity from other sources than fossil fuel. This discussion becomes relevant in the event of for example production of electricity from solar power as well as the waste to energy project, both points of energy source which are currently being discussed with GEBE. Currently there is also a discussion ongoing between the shareholder and the supervisory board of GEBE to make the relief for seniors, to give this a more permanent character. GEBE is expected to come with a proposal within soon on this. Based on the final outcome of the discussions with GEBE, we can expect that this will be reflected on the electricity invoices of the consumers.
3. What studies were used for the waste to energy project? Is there a copy available? This project for the waste to energy is one that has been ongoing for some years now. The recent initiative premises on various studies that were carried out, having to do with the assessment of the quantity of waste produced as well as the quality of the waste produced. There has also been a study carried out on the possible environmental and health impact such a facility. All these studies are available and if needed these can be provided to parliament for perusal.
4. Did the ministry use the study to determine the Terms Of Reference and who is the author of the study? Yes, the studies were used to determine the TOR. The name of the author of the study is not readily available and can be provided at a later time.
5. Was the author of the study paid? The studies used for the project were paid for, however these were paid for by a third party who was involved in a previous stage of the project. The third party has given the Government the permission to use the studies and the information gathered for the project. However the Government is still in discussion with the third party about the payment for the use of the information and materials as a result of these works carried out.

**MP Frans Richardson**

1. Can the minister inform parliament concerning the land that TESI NV has in long lease and has the long lease fees been paid for the land? Have they been paying? Based on investigations recently carried out by the Ministry of VROMI we can confirm that during the period 2002 – 2008 TESI did not comply with their obligations for payment of long lease fees. For this period they have furthermore made a claim to bar the Government from collecting these fees because of the period of 5 years having passed. The information about payment prior to this period is difficult to retrieve, but the very strong suspicion is there that also for this prior period no long lease fees have been paid by TESI. This concerns an amount of minimum NAf 73.000 per year. Since 2009, the only year that TESI paid on time based on an issued invoice was for the year 2012. Based on the recent request of TESI to obtain the area adjacent to their parcel in long lease, TESI recently went in October 2015 to make a payment arrangement for the payment of the outstanding years since 2009.
2. Has the land of the parking lot at Kim Sha been given away to the PdP group in long lease? The previous Government took a decision to issue the mentioned parcel to TESI in long lease, however the decree was flawed and I have declared that decree null and void and informed TESI accordingly.
3. Can the Minister inform parliament if a lien has been put by TESI on the land designated for parking? Yes recently TESI put a lien on the property in question, pending further litigation about the issuance of the land in long lease to the company.
4. What was the reason for the lien? The reason for the lien was because TESI feels that the land should be issued in long lease to that company, and to prevent the Government from transferring the land to another party.
5. About the landfill, what is the urgency that needs to be put to remedy the issue of the landfill? This is a very urgent matter, as the landfill from a visual point of view is getting way out of hand and is an eyesore in Philipsburg. In addition, and maybe more importantly, there are also various concerns from an environmental and health point of view, as reflected from the analyses of sludge samples done by the Nature Foundation in 2015.
6. How much money does the new bidding save Government? As pertains to the recent tender for the landfill management, there were no significant savings compared to the previous contracts. However as regards the bidding process for the collection of household waste, this process is not yet complete, but the expectation is that the savings can be significant for the budget of Sint Maarten. A specific number cannot be given at this point in time, as the process is not yet complete.
7. Person using govt land and not paying, what are the plans of the ministry to enforce or ensure that govt can collect lease fees/rent for persons using the land free of charge? It is my intention to conduct a complete inventory of government land that is being used without proper long lease title to it, and to ensure that where these lands can be issued to the person in effect illegally using the land, these lands are issued in long lease to them, so that the Government can collect the revenues for such use. In cases where the land cannot be issued in long lease for whatever reason, then it may be possible that Government will have to enforce the vacating of persons illegally using such properties.

8. What are plans of the ministry to collect monies for water rights where the water is being used but not paid for? As in line with the previous question, a preliminary assessment concerning illegal use of water parcels has been conducted. Based thereon the total additional amount that can be collected by the Government amounts to in excess of NAF 350.000 per year. It is the intention within soon to start a similar procedure as described in response to the previous question, to ensure that the Government is properly compensated for the use of the water parcels.
9. Cadaster, it's not sure if it falls under VROMI or FIN, but we noticed in the media at Caravanseria about court cases concerning long lease land being sold and now the notaries or cadaster has to pay the owners who owns those deeds. Can the minister inform parliament if the director or the board will be held liable for wrongdoing? Apparently there may be more cases to come. In answer to the question, I believe that we first need to ascertain if there was any issue of wrongdoing at hand. In such case, it is likely a matter for the public prosecutor. In the event of legitimate mistakes or errors being made, the case is that the Cadaster or Notary involved with the case would be held liable. Indeed the Government is in the end responsible and liable for the Cadaster. We have to await the outcome of the case, which is currently still in litigation, to address this matter appropriately and prudently as Government.
10. Can the Minister provide to parliament a copy of the investment plan of GEBE? The investment plan of GEBE can be provided before the end of the week.

**MP Rudolph Samuel**

1. The road through Dutch Quarter has been undergoing some upgrading, when will the road be completed? The Dutch Quarter road is planned as part of the European Development Funding project, which is to focus on sewage transport lines, based on which the road will undergo an upgrade. The project is subject to European tender regulations which take time. Based on the current planning we expect the project to start in November/December 2016. It is anticipated that the entire project could take as much as 2 years, but that the main Dutch Quarter road can be completed earlier, possibly towards the end of 2017.
2. Emergency Houses in DQ have no lights, the homes have been put there, can the minister find money in the budget for the paving of the roads? The capital budget of 2016 will include some reservations for hard-surfacing of dirt roads, and I will take the request of the MP into consideration, depending on the total availability of the budget.
3. Sucker Garden road near Cowboy, the road becomes very narrow; can the Minister indicate if the Department is aware of it, and are there any plans to improve this, and any plans to upgrade the rest of the Sucker Garden Road? The Ministry is aware of this situation and has plans for upgrading of the area. However, at this time we have to assess to what degree this particular need can be accommodated in the available capital budget.
4. Between SG Road and Arch Rd, many big truck and equipment use that corner, can it be widened? This is the same situation as regards the Sucker Garden Road mentioned in the previous question.



5. GEBE bought land in Hope Estate, how much land, when was it bought , how much was paid and with what intention? What are the plans? **GEBE did buy this land, however, as regards the specific plans for that property I will have to get back to the Parliament on this.**
6. Frontstreet and Backstreet and especially plastic rings along the palm trees and metal sticking out, can the minister find space in the priority list to do something about this? **This project is a high priority and it is the intention to execute the improvement of these 2 main roads in the main commercial district of Philipsburg as soon as possible, pending the approval of the capital budget.**
7. The minister has a unique position to have come from the Ministry, does the Ministry have any wishes for the department/ministry? **Since taking office I have approved a ministry plan for the coming years as a guide for the activities of the ministry. The plan includes 4 strategic objectives, being: 1) sustainable development through protection of our environment and natural resources, 2) to enhance the resilience of the Country, 3) to enhance the quality of life of the citizens and last but not least, 4) to improve the performance an organization of the ministry. These 4 strategic objectives entail many specific actions and project, which will lead to a stronger and more representative performance of the ministry, and thereby a more satisfied constituency.**

#### **MP Maurice Lake**

1. Frontstreet and Backstreet upgrading needs to be more handicapped friendly.
2. Underscores the concern of Leona Marlin about the pumps, concerning flooding.
3. Possibly we can landowner cooperation to create a roundabout at the Arch Road Suckergarden Road intersection.

## Ministry of Education, Culture, Youth and Sports

**MP Leona Marlin**

**Regering/All Ministers**

Were the ministries able to accomplish any goals that were budgeted for in 2015. If yes, can parliament receive a detailed outline of such per ministry, so in essence, these are the ministries plans, this was accomplished and this was the cost.

All submitted year reports 2015 of the various departments and divisions of MINOCJS will be sent within one week. These reports provide an overview of the accomplishments for 2015.

Can you please provide me with a policy priority list for 2016.

The priorities and activities of the Ministries are detailed in the OCJS year plans 2016. They are in a phase of completion and are expected to be signed off after the budget handling. The final year plans will therefore be sent shortly and around the 3<sup>rd</sup> week of February.

Can I be provided with a list of potential risks associated with this budget due to lack of funds?

Yes, please see attachment: this is hereby provided

Can you please elucidate if this government has examined the possibility of shared service efforts due to the limited funds that are available? (For example reduction of the number of systems, Merging HR departments, sharing of personnel between different departments.

NB: This will be answered by MINAZ

How much will we save if we link the administration of the Ministries?

This is a general question that applies to all Ministries. It is therefore more appropriate to have this question be answered by MINAZ and MINFIN.

**KAPITAAL DIENST (Capital Investment)**

What projects, if any, have been identified as priority?

The identified priority projects are:

Renovation Charles Leopold Bell Educational Care Centre

Complete 4 classrooms St. Maarten Vocational Training School

Finalize Interior Little League Ballpark

Critical Technical upgrade electrical and plumbing Public Schools

Solar panels for public schools

What are the priorities per Ministry? Please give a breakdown.

6	Ministry of OCJS		
	<i>Culture &amp; Arts :</i>		
	National Theatre for the Arts/Phase 1	Culture	1,500,000
	Preparation, Expansion John Larmonie Center	Culture	2.500,000
	<i>Sport Facilities Upgrade/Construction:</i>		
	Finalize Interior Little League	Sports	360,000
	Renovation Main Bleachers RISC Building	Sports	1,500,000
	<i>Education Facilities:</i>		
	Educational Care Center/Renovation CLB	Public Education	507,575
	Finalization St. Maarten Vocational Training School	Public Education	1,100,000
	SVOBE School-Renovation MPC phase 1/Sundial Phase 1	Education	2,000,000
	Critical Electrical and Cabling Upgrade Public Schools/Phase 1	Public Education	1,000,000
	Solar Panels on School/Air Conditioning in Schools/Phase 1	Public Education	1,000,000
	Construction Prins Willem Alexander School/Phase 1	Public Education	3,000,000
	<b>Total wish list OCJS</b>		<b>14,467,575</b>

School Bussing;What is the current policy?

Current policies are based on the following legislation:

Organisatiebesluit TEZVT art2d/14j.

Organisatiebesluit OCJS art 2g and 11q.

Landsverordening Leerplicht art 7.

The current policy on school bussing is that TEZVT is responsible for the transportation policy and ensuring that there is regular transportation for schoolchildren and periodical controls on the safety of school busses.

OCJS is responsible for promoting, establishing and maintaining optimum facilities for education, culture, youth and sport. By means of an LBham rules have to be put in place concerning the provision of food, clothing and school transportation.

The former Minister signed off in 2015 on a new policy for bussing which will detail how bussing expenses can and will be reduced and the measures taken to do so. It's from a pay per trip to a pay per child system which eliminates the government paying for empty buses which is currently being done.

Are measures in place to: reduce expenses?

In addition: TEZVT has 2 inspectors assigned to control and monitor said service. To ensure the proper routes are being run with the vehicle as stated.

Control and manage accuracy of invoices?

Once the invoices are provided from the Contractors, OCJS ensures that the correct route, route cost, size of bus listed and number of official bussing days are accurate to ensure that cost paid out are correct. This verification is performed manually at the Division of Inspection.

What is being done to ensure the safety of students on the school bus?

The Inspectors at TEZVT perform checks to ensure that the buses used are up to proper working standards (brakes, steering, seating etc).

The inspectors check to see if the operators are in drivable condition such as not under the influence of any narcotics or alcohol.

The bus operators are advised to ensure that the children are able to cross the street by putting the bus in a position as to impede traffic and allow for crossing.

The new policy as signed off by the former Minister will:

Add technology (Video Monitors) to monitor both students and drivers.

Have special conditions and licenses required to continue to provide bus transport services to students.

Have funds been allocated to ensure that the action plan of the policy can be implemented and executed?

NafL 4,250,000.00 is assigned to the bussing policy for 2016.

What is our return on investment with regards to funding education?

This question will be answered at a later moment. The answer to the question is being prepared by the respective section.

What guarantees/measures are in place to ensure that our schools perform on a high level?

Government ensures that there is adequate funding.

The Inspection Division OCJs monitors the quality of Education and reports on it in the State of Education Report.

There are Basic criteria in place to hire teaching staff.

There is teaching staff and their quality of teaching is being monitored by the Inspection Division OCJS.

Students leaving primary education are being assessed.

Extension of school hours.

What incentives are there to ensure that our local young people are groomed to become teachers and teach in the public schools instead of the private/ subsidized ones?

There are no incentives concluded as yet. It is DPE's intention to continue discussions with the president of USM and other relevant stakeholder(s) in 2016 to ensure maximum enrollment for local students. In addition, the Ministry is considering an awareness /promotion campaign for the teaching profession, but this can only be executed once sufficient funds can be allocated for this activity. Government is now also applying their secondary benefits more actively to the recruitment of teachers for public education. Furthermore we are looking for possibilities to develop a teacher assistant internship program to have local students participate in the public schools.

The word studying in the region is often used, can the minister provide me with what is considered the region, so in essence where exactly in the region our students are applying to further their studies?

**Definition of the region is as follows:**

St. Maarten

USA

Canada

Aruba, Curacao and Bonaire

Panama (FSU)

The other Caribbean Islands like:

Barbados

Puerto Rico

Trinidad

Jamaica

St.Lucia (MONROE)

Dominican Republic

Etc.

16. Personnel costs was increased by 24.8%; please explain why.

The personnel cost for the department of Culture was increased based on the fact that three new staff members (2 policy officers and 1 secretary) were hired in the fourth quarter of 2015 that is reflected in the budget of 2016 that wasn't the case in 2015.

The subsidies that falls under the Department of Culture are broken down as follows:

2015	2016		
Museum and Heritage Foundation	NAf. 103,500.00		103,500.00
0% increase			
Monument care/Fund	NAf. 125,000.00		112,500.00
-10% decrease			
John Larmonie Center	NAf. 50,000.00		45,000.00
-10% decrease			
Library		NAf.1,219,000.00	
1,097,100.00			
-10% decrease			

The reason the Museum and Heritage Foundation was not decreased the subsidy is going towards one FTE and all other personnel are volunteers and all of the required documents according to the general subsidy ordinance was submitted in a timely manner. In essence there is no increase in subsidies from the department of Culture and the decrease of subsidies for the other foundations are related to non-adherence to subsidy requirements and a shift of policy priorities.

Jeugd & Jongeren (Youth affairs) **Youth:** Subsidies & bijdragen increased by 222%; please provide a breakdown of these subsidies

During the 2015 Parliamentary debate a budget amendment was presented and adopted on the floor of parliament to re-establish subsidies in areas which were cut. These amounts however were not reflected on the budget and for this reason some areas may appear to have had an increase . The amounts currently reflect the adjustment of the subsidy area to reflect reality.

Exam: Budget increased by 39.2%; Please clarify.

The Budget has been increased due to the following reasons:

**Staffing:**

The Division of Examinations has 6 FTE's and has sought to fill the FTE of research assistant in 2016. This FTE has been listed as a critical function and approved as such in a decision of the

COM. This FTE has to be filled to be able to carry out and comply with the various tasks and responsibilities of the Division of Examinations as it pertains to the :

Screening of SBO examinations at both institutions- NIPA and the Justice academy. Art 28 LV SBO en educatie

The validation process of all courses on SBO level. ( art. 3 of the LV SBO en educatie

And the maintenance of the Central Registry of SBO courses as outlined in art 10 of the 'LVO SBO en Educatie'.

#### **Examinations:**

Implementation of the CAPE at the St. Maarten Academy in 2015- increase in examination cost. For 2015 all CXC –related examinations at both SDH and SMAC was total ANG 108.268 including Ang 14.000 for Cape ( it was not on the budget of 2015- Cape was approved in 2015 by the min of ECYS- ) In 2016 the cost for CXC Examinations are 122.380.- including Ang 15,285.60 for Cape.

**Establishment** of the Charlotte Brookson Academy and the MAC Secondary School- increase in examination cost- CCSLC examinations scheduled in May/ June of 2016. The amount for CCSLC examination at the MAC SEC School in 2016 is ANG 8000,-

**Payment** of the Examinations of Cambridge Dutch at the SDH & SM Academy ( previously paid for by the schools) + /- ANG 45.000.00

**Payment** of the IB Examinations (Were never paid for by Min ECYS) were paid for by the Parents & fundraising activities for 2016 ANG 53,972.00.

#### **Public Education**

Personnel costs were decreased by 10.9%; please explain.

8 Critical FTE vacancies for schoolteachers were not recruited/ replaced as these vacancies and FTE will be re-evaluated in 2016 based on a thorough needs assessment.

**What is being done about the increase of undocumented students in PubEd?**

As to the impact of the undocumented students in the public schools this so far has proven to be an issue that requires close cooperation between the Ministry ECYS and the Ministry of Justice. In order to alleviate unnecessary challenges for the students and the schools, research will be completed before the end of the school year about the distribution and the possibilities of transitional classes as well.

**How does the reduction in personnel costs compensate for the increase in enrolment?**

At this stage, the quality of education is secured. Data still has to be compiled and analyzed in order to complete a more effective personnel planning based on students enrollment, specific requirements and the size of operational schools.

**What plans are in place to curtail undocumented students from inflating our budget?**

On one hand it is governments responsibility to live up to every childs right to an education. On the other hand we can observe that the current Compulsory education legislation provides too much opportunity for easy enrollment of children that just land on SXM with a tourist visa. We

will continue to work in close cooperation with MINJUS to keep it at a minimum, align procedures and review possibilities to adapt the current compulsory education law.

**Will the compulsory education law be re-evaluated?**

The Department of Education is in the process of re-evaluating policies and ordinances.

The Ordinance on Compulsory Education is not on the Priority list for 2016, but eventually it will happen once other priorities are completed and implemented.

**The total budget Personnel v. derden for the entire Ministry was increased by 249%; please explain why.**

This is for the division of Public Education and amounts to Naf 129.912,-. This is meant for Substitute/Temporary teachers for the Public Schools.

**Has MINOCJS identified a difference in education quality between the public schools and the subsidized schools? If yes what is being done to tackle this problem?**

We do observe some differences in performance, but in order to make a fair comparison we need a fully established supervisory framework. In the framework differences in student population etc. need to be incorporated in order to compare the performance to established standards. The Inspectorate is working hard on establishing this and the Department of Education is in the process of drafting the Ordinance on the Inspection of Education, because it is a high priority for 2016. It is expected to discuss the standards on teaching quality, educational process, output, student care, internal quality monitoring, management, financial management and compliance with the Laws and regulations within the Ministry of ECYS and with the full educational field before the summer.

The next step then would be to monitor all schools according to this framework. This will result in more specific and objective data and in more specific advice on how to improve performance of schools.

**Can I be provided with a list of how many students passed for the different levels (havo/vwo/tkl/vsbo) of secondary schools per elementary school?**

Yes, and hereby provided.

**Can I be provided with a list of risks associated with the budget cuts.**

Yes, and hereby provided.

**MP L. Richardson**

**Heard that Loans for study fin. Funds were not in place on time for students, is this so?**

This relates solely to the Studying in the Region Project funded by the Dutch Government. However, the funds were deposited on time by the Dutch Government. The funds were previously dispersed by USONA. In the absence of USONA, the Government of St. Maarten had to put the proper procedures in place to ensure proper accountability. Unfortunately process suffered several delays resulting in students receiving their initial payment late



Now much is being redeemed form students who have completed studies and are now working, how much is being paid back yearly?

Year	Amount repaid in student loans
2013	4,835.81
2014	44,522.58
2015	12,802.82 (Collection efforts were stopped in 2015 by the former Prime minister)

How our liquidity situation and what can be done to safeguard a basic liquidity so that we don't have to borrow for this problem. FIN/OCJS

As long as the loans will remain outstanding, liquidity may be a concern. Once the repayment of study debts will increase, cash flow will improve allowing the fund to operate as a so called revolving fund. With the LVO Study financing it is anticipated that government (enforcement) policy will improve.

Ref. reduced subsidies; which institutions are effected?

Answer

SVOBE ANG	500.000
SKOS	500.000
NIPA	1.100.000

Reason:

The budget for the subsidized schools were reduced in anticipation of a budget amendment in the course of 2016 based on extra income as suggested by the Honorable Minister of Finance. If this will materialize extra funds would possibly have to be allocated to the Ministry OCJS to cover these high risk areas.

Is UJIMA involved in the 44201 budget post?

The UJIMA foundation is not funded by OCJS. It falls under the responsibility of VSA.

The Charlotte Brookson Academy (CBA) is an educational Institution which receives subsidy via Education. The Charlotte Brookson Academy was however supervised and managed by the UJIMA foundation during its inception in 2013.

#### **MP C. deWeever**

Does gov have policies for a year plan

Yes, the Ministries Year plans are in a finalizing stage and are expected to be agreed upon and sign off after the budget handling next week.

Does this budget contain the financial consequences of government policies intentions.

Yes the policy intentions have been adjusted to the available resources and budget 2016.

Page 17 Specify VROMI and education investments

6	Ministry of OCJS Capital Investments 2016		
	<i>Culture &amp; Arts :</i>		
	National Theatre for the Arts/Phase 1	Culture	1,500,000
	Preparation, Expansion John Larmonie Center	Culture	2,500,000
	<i>Sport Facilities Upgrade/Construction:</i>		
	Finalize Interior Little League	Sports	360,000
	Renovation Main Bleachers RISC Building	Sports	1,500,000
	<i>Education Facilities:</i>		
	Educational Care Center/Renovation CLB	Public Education	507,575
	Finalization St. Maarten Vocational Training School	Public Education	1,100,000
	SVOBE School-Renovation MPC phase 1/Sundial Phase 1	Education	2,000,000
	Critical Electrical and Cabling Upgrade Public Schools/Phase 1	Public Education	1,000,000
	Solar Panels on School/Air Conditioning in Schools/Phase 1	Public Education	1,000,000
	Construction Prins Willem Alexander School/Phase 1	Public Education	3,000,000
	<b>Total OCJS</b>		<b>14,467,575</b>

New school bus policy, please provide copy.

The new policy framework on school bussing that have been considered the preferred scenario can be summarized as follows:

The school bussing service is provided to and from school for all school children between 4 and 18 years old. The service will also include school activities (such as swimming and gym), in specific cases. No fees will be charged for the service.

#### Entitlement Regulations

All school children between 4 to 18 years are allowed to make use of the school bussing service to and from school.

Costs for extracurricular activities (sport days, etc.) are only covered for Public schools pending the introduction of a compensation scheme for Public schools.

Costs for extracurricular activities of the private and subsidized schools are the responsibility of the competent authority.

Costs for gym activities, requiring school bus transport, coordinated by the Ministry of Education will be covered.

#### Execution of the system

Private parties will be contracted after a public bidding to execute the service. The Public bidding will take place in close cooperation with the Ministry of TEZVT.

The Ministry of OCJS will contract parties based on their ability to deliver the conditions in the TOR (TERMS OF REFERENCE).

The Government of Sint Maarten will enter into the agreement with the private parties, based on a Service Level Agreement. The Ministry of OCJS will act on behalf of the Government of Sint Maarten.

Agreements (SLA's) are established with bus operators to secure reliability of safe school bussing; addressing requirements for buses, bus operators, monitors.

Monitoring of the proper execution and compliance with the SLA will be done by a government agency.

The Minister of OCJS will decide which government agency will be responsible, in as much as it is within the Minister's competence.

An electronic monitoring and a surveillance system is to be used to monitor and record the daily bus activities.

The budget will be fixed taking into account the number of students and payment per ride. School bussing is available between 6.30 am and 16.30 pm.

Every child using the school bussing system should be in possession of a bus pass, in order to make use of the school bussing service.

**Committee Flag day no budget? How to build nation without budget for flag day.**

The department of Culture has a line item in the budget that covers Intangible Cultural Heritage and this have been used to give credence to such areas as national symbols and also for the committee Fag Day.

**1.2 mln library any plans for e-libraries or combine/merge it with USM.**

Considering that both the Library and USM are private foundations subsidized by government we haven't seen a joint proposal recently by either parties to combine/merge a e-library.

**Pag. 8 Extra income? What extra income are you referring in Culture/youth and sports.**

There is no extra income in the department of Culture, Department of Youth and the department of Sport.

#### **Clarification Questions Round 1:**

**Cornelius de Weever**

**Faction: Independent**

Clarification questions:

Issues were raised about the hygiene of rest rooms in all schools. There was a report about the conditions, but I did not hear anything mentioned about it. Was this addressed in the improvements / capital investments?

Yes these priorities will be addressed and are captured under the capital investments post: "Critical Electrical and Cabling Upgrade", Nafl. 1.000.000,=

Bus drivers checked for narcotics/alcohol, how is this done and by whom?

Yes, these checks are part of the regular tasks of the inspectors/ controllers of TZVET as they also have these tasks for regular bus drivers. We have been informed that the controllers followed the BAVPOL and in that capacity are recognized with specific mandates. It usually starts with their general controls and observations on the busses and if there is a need further tests can be required.

Asked for adjusted school bus policy and would like to request it again.

The schoolbus policy framework as approved by the previous Minister will indeed be sent.

**Name: Lloyd Richardson:**

**Faction: UPP**

Meeting Central Committee, stated meeting adjourned and thereafter never finished. It was about study finance. I would like to have this clarified. What is spent on this post and what is the repayment. If this is to be a revolving fund, then this has to change. If ordinance doesn't exist ,this gets difficult. Clarification on this please?

Recent jurisprudence confirmed that the government is allowed to request repayment of the study loan based on existing legislation. Due to uncertainty and sometimes discontinuity as requested by previous Ministers, income has been lagging behind. We do hope that the recent jurisprudence as well as the new study finance legislation scheduled for decision making this year, assists to indeed increase income from repayment and that the fund can then gradually function as a revolving fund.

What is spent on this post?

Grants: Naf. 3.143.647,40

Loans: Naf. 4.196.915,09

Total: Naf. 7.340.562,49

What is the repayment?

Year	Amount repaid in student loans
2013	4,835.81
2014	44,522.58
2015	12,802.82

If this is to be a revolving fund, then this has to change.

The intention is transform the current process into a revolving fund in the next 5-10 years

If ordinance doesn't exist ,this gets difficult. Clarification on this please.

The legal basis for issuing study financing is:

Landsstudietoelagenregeling van 21 juli 2010, AB 2010 GT no. 1 en AB 2010 GT no. 30.  
In practice however since 1995, based on a letter from the then Governor of the Netherlands Antilles and the Prime Minister, the Government of St.Maarten was authorized to issue study financing based on the so-called Island Ordinance Study Financing and Implementation until a permanent solution was found.

The Court of First Instance has upheld decisions made by the Minister using this policy in the LAR cases:

117/2014, uitspraak: 4 februari 2015, nr. :20

58/2014, uitspraak: 4 februari 2015, nr. :19

12/2015, uitspraak: 16 november 2015

### **Tamara Leonard**

#### **Faction: UPP**

Agreement studying in the region, can we get a copy of such.

Yes, and this will be submitted.

### **F. Richardson**

#### **Faction: US**

Look into the possibility of the field in Belvedere. If we can transfer the field in the hands of Pony League. Field not being used, assistance to cut the grass is needed, to get it clean. They can use the field and take care of it.

Yes I will look into this matter

### **MP Name: R. Samuel**

#### **Faction: NA**

How many kids / children do we have in school? In category and type. (K1, primary, secondary, tertiary)(Attached and can be handed over)

- Primary : 4759
- Public schools: 1358 incl. 51 students from PWAS
- Hillside : 703
- SDA : 349
- SKOS : 1541
- MAC : 804

Secondary: 3297

- Charlotte Brookson : 128

- MAC High : 127
- St. Dom High : 346 incl. 38 IB
- MPC- Havo : 245
- MPC- VWO : 52
- MPC- TKL : 346
- MPC- PBL/PKL : 230
- Sundial : 322
- SMVTS : 224 incl. 90 LOE
- NIPA : 291
- SMAC : 224incl. 41 CAPE
- SMAC-PSVE : 545

How many studying worldwide?

Place Of Study Amount

ARUBA	12
BARBADOS	1
BONAIRE	1
CANADA	22
CURACAO	35
DOM.REPUBLIC	1
ENGLAND	5
Grand Cayman	1
HOLLAND	187
SCOTLAND	1
ST. THOMAS	1
ST. MAARTEN	55
ST.THOMAS	2
THAILAND	1
TRINIDAD	4

USA 128  
TOTAL 457

Every year scholarships being given, Government has a priority list. A job secured scholarship can be considered, part of it for students that 100% surety that we can give them a job on their return. Have student do job training and internships to ensure future placements. **Yes we will look into this as well**

Take look at the sports fields that are there, take a inventory. What needs upgrading. Basketball court next to Marie Lawrence School, lights are out and field needs upgrading.

**This will be considered into our detailed planning**

**MP Name: L. Marlin**

**Faction: Independent**

Are there any other schools offering in state tuition, if yes give list.

**Schools where In state Tuition is granted to St. Maarten students are:**

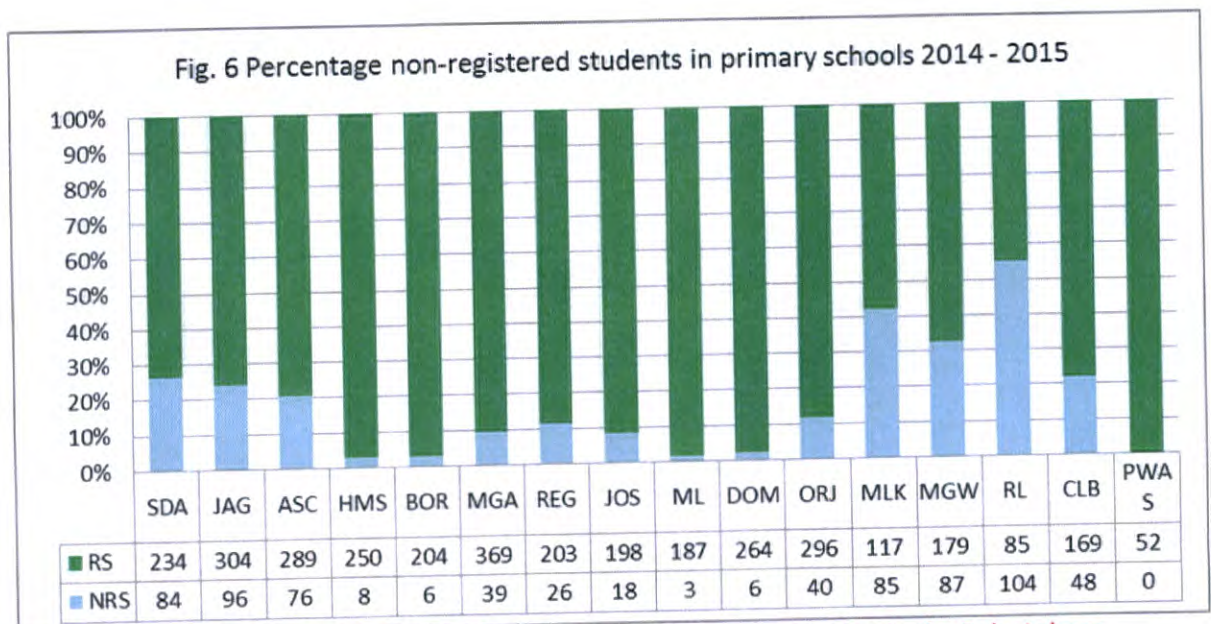
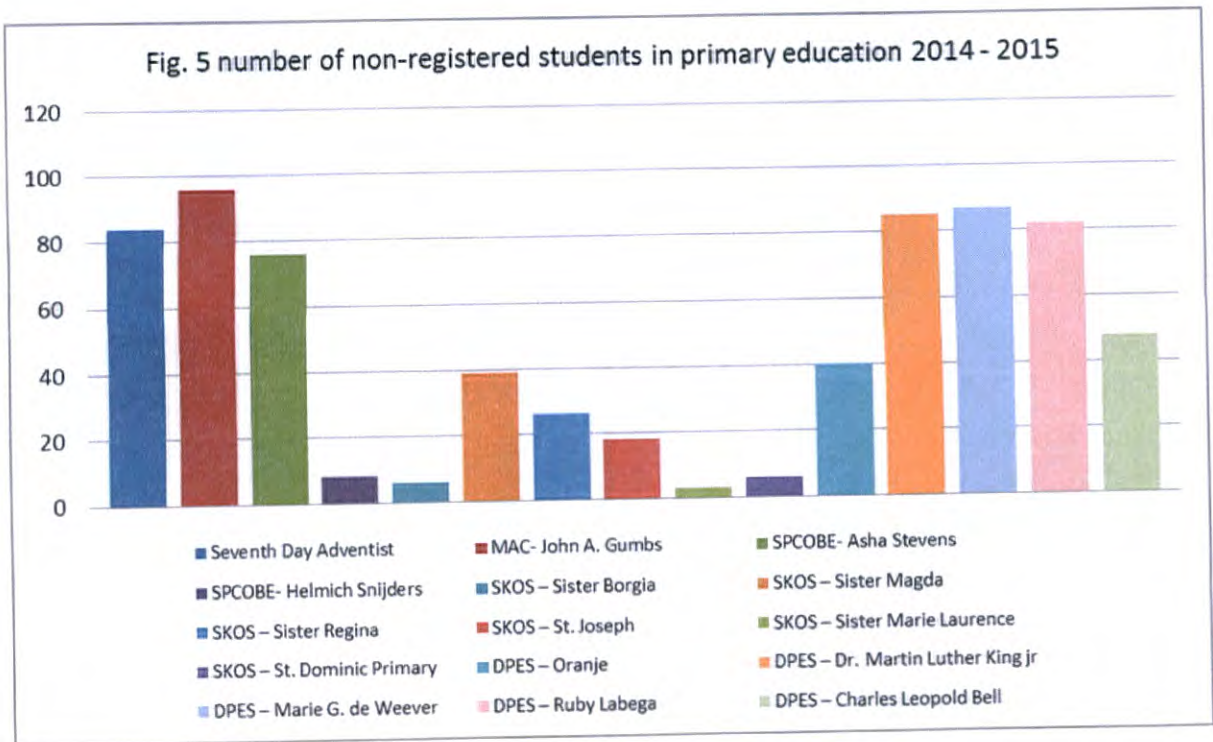
1. T.C.C
2. F.A.M.U
3. F.S.U. is granted via the school
4. Monroe: \$15.000 per 2 semesters scholarship from school
5. Pittsburgh Technical Institute: \$15.000 St. Maarten  
\$10.000 Scholarship
  
6. Johnson & Wales University: \$15.000 Government  
\$ 15.000 JW  
\$10.000 Student

**All the above mention Universities/ colleges has an MOU agreement with St. Maarten.**

Response of the interim min of ECYS, on undocumented students, pay keen attention to the amount of undocumented students coming into our schools. It is inflating the budget. It is a hindrance, to our legal children. Please find a solution. Minister does need to answer now but make it a priority.

The information below has been taken from the "Compulsory Education Report 2014-2015", which was presented to parliament in 2015. Detailed information pertaining the "non-registered" students and tables below can be found on pages 24 through 26 of above mentioned report.

Overall, there were 4784 primary school students registered for 2014-2015 academic year.



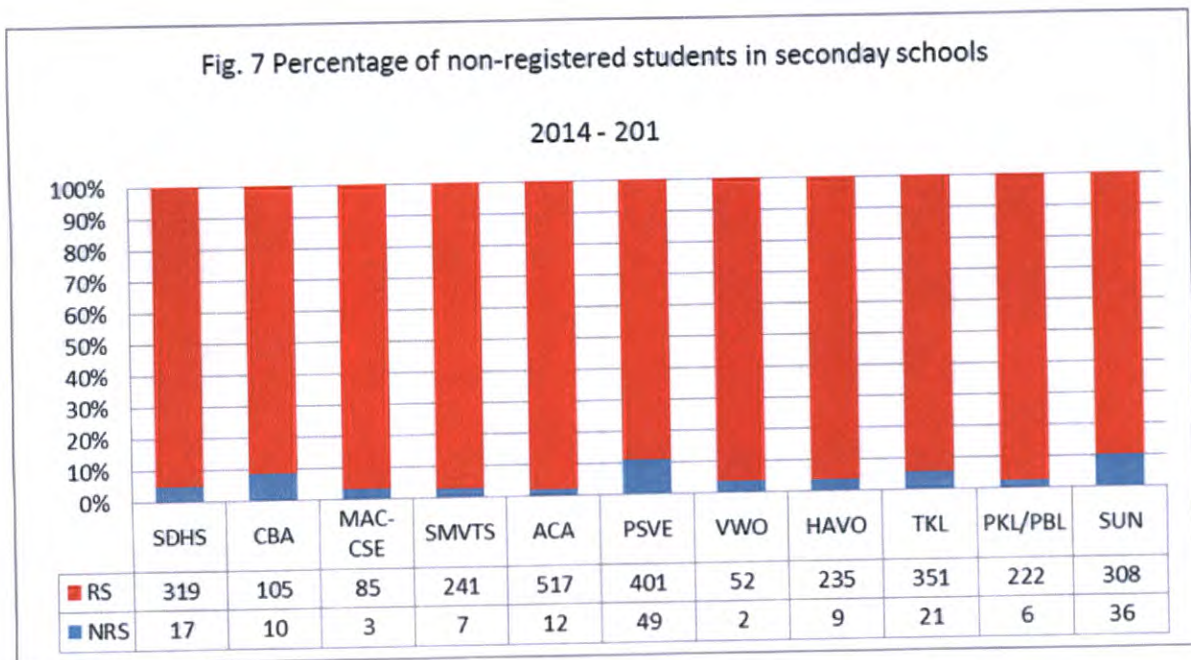
From the overview above it can be seen that in the government owned schools, the Ruby Labega (55%), Dr. Martin Luther King Jr. (42%) and the Marie Genevieve de Weever (33%) schools have the highest percentage of non-registered students.



However, when considering the actual number of non-registered students attending subsidized and government-owned schools, it must be noted that one cannot conclude that the majority of non-registered students attend Public Schools.

The schools with the highest number of non-registered students are Ruby Labega (104), John A. Gumbs Campus (96), Marie Genevieve de Weever (87) and the Seventh Day Adventist School (84).

Overall, there were 3008 secondary school students registered for the 2014-2015 academic year. The overall total of non-registered students represents 0.06% of the total number of students registered in secondary education based on the information provided by the schools.



The total number of non-registered students enrolled at secondary schools was significantly less than those enrolled in primary institutions. The highest numbers of non-registered students are in PSVE schools, namely the SXM Academy PSVE with 49 and Sundial School with 36 students.

The above mentioned data has been captured with the assistance of information provided by the school managers in an attempt to collect the data regarding students who are not registered at the Civil Registry. enrolled at their schools.

Although the individual schools provided a list of non-registered students, the Truancy Officers were not able to cross check the lists with that of the Civil Registry, due to a lack of man power. The Ministry of ECYS in collaboration with the ITC Department has embarked on a project to developed a School Management and Registration Tool. This School Management and Registration Tool, known as ( S.M.A.R.T) has been piloted as of 2015-2016 and will give all non- registered students a unique ID number which will enable the Truancy Officers to immediately cross check registrations with the Civil Registry's data to get a more accurate picture of the number of non- registered students.

Currently this project has been completed for 75% completed.

Got an answer for the compulsory education, please take a next look at this. Stop the influx of the new undocumented children. Classroom is overcrowded.

Define undocumented and illegals as it relates to children and provide statistics of such in our schools. Undocumented is defined as follows:

- Children come on vacation and stay
- Children that is born on St. Maarten from undocumented parents
- Children with expired documents
- Children with landing permit/

**MP Name: T. Leonard**

**Faction: Independent**

What is being done with the public schools being up to par with the subsidized schools.

The manner in which the subsidized schools and the public schools are measured will be synchronized in the coming years.

As emphasized in the first round we will first have to fully establish a supervisory framework in which various indicators can then be compared such as teaching quality, student care, financial management and budget, student population and overall performance to name a few.

This framework will help to compare systems fairly and ensure effective interventions for improvement. This framework indicates government intention to have similar and objective educational, support and financial systems in place and this will help for the right choices to support the further reorganisation and priorities as set in the year plans of DPE

Status of the brain gain project? Did the Minister consider using the project to fill vacancies, with the assistance of General Affairs.

Brain gain project is still ongoing and recently 4 SXM interns from NL completed their internship and return to NL to finish their studies, mostly Bachelor studies. The majority indicated their wish and ambition to return and Brain gain will continue to provide internship opportunities to have SXM students familiarize themselves with working environment on SXM. Brain Gain project assisted with 6 employments of young professionals as a positive outcome of Fred recruitment drive in May 2015: 1 in government and 5 in the private sector.

Was the project validated with measured success?

The project is not completed yet so the validation and evaluation report will only follow after completion of the project.

Students that do not meet all study financing criteria's and including not holding a Dutch passport, where these students can attain study financing? Can they be considered for studying in the region?

Yes, if they will comply with the other criteria as well.

Studying in Region has been utilized especially to assist specifically students who do not fit the criteria for regular study financing especially students who have lived here for years and have not finalized the process to become a Dutch citizens and meet the grades requirements , students then get the opportunity to find that process.

Post 10-10-10 are students not obligated to pay back the study loans?

No, that is incorrect, Study Financing was granted since 1942 under the National Ordinance 'Landsstudietoelage' and just recently in November 2015 , in a case of a student the judge ruled that government is entitled to collect the loan which was issued.

Shareholders Government owned companies can they assist with funding studies in the fields of those Government owned companies.

Government can set dividend policies but can't force government owned companies to set up scholarship funds. Government will determine how dividends received can best be put to use. As Minister my priority will be more scholarship funding for talent scholarships in sport and culture, arts etc.

**MP Name: M. Lake**

**Faction: Independent**

Give an update on the recognition of the USM. What is the issue?

Was there an increase in the subsidy of USM?

The Government of St. Maarten reserved an amount of NafL. 1,000,000 for USM in the budget of 2016.

In 2015 USM received a subsidy of NafL. 949,140. An amount of NafL. 850,000 was reserved in the 2015 budget.

The reserved amount for USM in the budget of 2016 has increased with NafL. 150,000 compared to 2015.

St Maarten does not have an ordinance on Higher Education as yet. The absence of clear regulations related to higher education therefor complicates a clear answer to the question to what extend USM legally meets the requirement of an Institute for Higher Education. Due to this situation the government of St Maarten primarily subsidizes USM on the basis of the Subsidy Ordinance. Expectations related to the subsidy are specified in the Ministerial Decree that supports their annual subsidy.

Monuments: what is status of the advice to subdivide the monuments.

(Monument at Atrium, close to Burger King, the old Simpson Bay bridge needs to be restored. Port de Pleasance is willing to work with Government.

Monument by the MAC School, in Ebenezer, by the high school need to restore).

The advice has been approved by the CoM and the department of culture has contacted the property owners seeking their consent and approval for the Cadastre to re-measure their property in order to pinpoint exactly what and where the monument on the property is. As soon we get consent in writing Cadastre can move forward. So far we have contacted the Vineyard building, a monument on the ocean front in Simson bay, Ebenezer monument, St. Peters Battery and government properties (Fort Willem, FOGA). These are the most urgent properties that have contacted government for re-measurement.

Update on the Ministry plans for upgrade on sports facilities.

The multi annual capital investment planning are hereby provided.

**MP Name: C. Emmanuel**

**Faction: NA**

Give the update on the situation of NIPA?

- a. Financial report of NIPA was received however this is not a full audited report and therefor SOAB will do an additional audit to review any specific risks.
- b. The board member for OCJS resigned and a new member will have to be selected and proposed according to the procedures outlined in AOI and the Corporate Government Council.

Ministry of Public Health, Social Development and Labor (VSA)

MP Leona Marlin

1. Were the ministries able to accomplish any goals that were budgeted for in 2015. If yes, can parliament receive a detailed outline of such per ministry, so in essence, these are the ministries plans, this was accomplished and this was the cost  
The final results and accomplished goals for the Ministry of VSA that were budgeted for 2015 are being finalized, including the actual financial figures. The Minister of Finance by national Ordinance (Comptabiliteitsverordening) will submit the report on achievements to Parliament. Highlights of major achievements for the Ministry in 2015 are for example:
  - The legislation to increase in age from 60 to 62 years was approved in Parliament.
  - The Public health law was approved in parliament.
  - Finalization phase of submitting the civil code including a labour chapter to Parliament.
  - Finalization phase of the registration for public health providers to Parliament.
  - Tripartite agreement and business case development for the expansion of the St. Maarten Medical Center in progress.
2. Can you please provide me with a policy priority list for 2016.  
This information is to be found on page 20 and 21 of the budget. But we will submit it in writing separately.
3. Can I be provided with a list of potential risks associated with this budget due to lack of funds?  
5 mln Government contribution to ZV (Sickness Insurance) funds for non-active employees
4. Can you please elucidate if the water reserves mentioned in the Income is a non-recurring or recurring revenue and how much was collected in 2015?

Five (5) mln was collected in 2015 and it is a non-recurring revenue

#### Risks & Bottlenecks

5. What plan of action is in place to reduce risks and circumvent the bottlenecks?

Most risks and bottlenecks have been identified within the health care sector. We have noticed a trend in the increase of health care costs but premiums have not increased. Therefore the Ministry is working on a health reform plan.

6. How many persons were unemployed in 2015 and what measures will be taken to decrease this amount in 2016?

The most recent official data is based on the last Labour Force Survey of 2013 which identifies the overall unemployment rate as 9.2%. In absolute numbers this is approximately 1,900 persons. In the report, results illustrate that persons with lower education are those that are less employed.

Activities carried out by the Ministry of VSA that contribute to ensuring that persons find employment range from the registering and matching of persons to appropriate jobs, to organizing empowerment programs, adult training programs, and establishing various partnerships with key stakeholders.

In collaboration with Ministry of Education and Economic affairs we focus more on aligning policies and activities to secure a more educated work force. (School to work survey / participation in workgroups with Economic Affairs / participation in strategic workgroups / Tripartite)

As it pertains to the unemployed registered at the Labor Affairs in 2015 approximately 279 are registered.

7. Can you please elucidate if sufficient funds have been put aside for the possible epidemic outbreak of Zika and what is the amount?

A total amount of Naf 50.000 is allocated on the budget for chemicals for fogging. On the capital investment there is also an amount of Naf. 101.000 allocated for outbreak prevention namely for 4 hand held foggers and equipment for SLA for Zika viral testing. If more funding is needed the Ministry will have to shift priorities to make funding available for this.

8. Burial insurance; Why was this not budgeted? Is there a structure/policy for states funerals for our fallen service men and women?

There is no Burial insurance but Burial assistance. For civil servants this is regulated in the LMA. When a civil servant passes, their spouse is entitled to the lump sum of 3 months' salaries (LMA art. 37).

Additionally, Government will contribute Naf. 4500,- towards the funeral expenses. These expenses are budgeted on VSA's budget under budget post 44212-7230 "Begrafeniskosten On-en Minvermogend".

Besides this we also have a portion on this budget post that relates to Burial assistance as mentioned in National Financial assistance Ordinance, where the eligibility of applicants to one-time financial assistance for funeral costs is stipulated.

9. Pg 17

- Social development was decreased by 31%
- Social Services was decreased by 27.5%
- Collective prevention services decreased by 18.4%

23. What programs are being cut?

24. How will these reductions affect the current programs?

25. Who will be affected by these reductions?

The budget cuts were based on the actuals of 2015 and as such guarantee the continuation of optimal services. VSA is looking at establishing collaboration with third parties in order to carry out the overall task for the wellbeing of the society. This has proven in the past to be a strategy for embedding certain policy areas in a structural manner.

However new projects will have to be reprioritized taking the country's financial situation into consideration.

10. What provisions are being made for our aging population? And are these taken up in the budget?

In addition to the existing activities, outreach programs and services being carried out by our executing agencies, care for the elderly who require a protective living environment has been included in the AVBZ. Additionally the Ministry completed the needed legislation to secure improved AOV pay-outs.

26.

11. What are the priorities per Ministry for capital Investments? Please give a breakdown.

- |  |               |
|--|---------------|
| • Health Information System                                | Naf 1,300,000 |
| • Investment Outbreak Prevention                           | Naf 101,000   |
| • 2 new Replacement Ambulances                             | Naf 500,000   |
| • Medical Investments (Upgrade for ICU and operating room) | Naf 1,983,000 |

12. How much of the 2015 Capital investment was used? And for what, please provide breakdown. Are there funds remaining? And, if so how much?

Nothing was used for 2015 because budget was never approved by CFT so we could not obtain the loan for capital investments.

13. Please provide a comparison from 2010 – 2015 of the Capital investment account by Ministry.

What was budgeted for VSA:

2010 No information available

2011 Naf 2.015.000

2012 Naf 780.384

2013 Naf 1.841.062

2014 Naf 35.780.384

2015 Naf 5.835.316

MP Lloyd Richardson

7. Q12: With regards to reduced subsidies; which institutions are effected?

The institutions will not be affected by the reduced subsidies as the cuts were made in line with 2015 allotted subsidies.

8. Q13: Is UJIMA involved in the 44201 budget post?

Yes. The subsidy extended to UJIMA is reflected in the budget post 'Residential Care' 44201 - 7280-70010

MP Cornelius de Weever

1. Q2: What is current unemployment rate - VSA

This was already answered in a question posed by MP Leona Marlin.

2. Q8: Does Government have policies for a year plan All Ministers

VSA has a draft 2016 year plan but is awaiting the approval of the 2016 budget to finalize this process.

3. Q10: Policy controls; New policy on sex workers, what are financial consequences for income vs before. What will SZV collect from this new policy or are they privately insured? How will the control be carried out and by whom, Implementation cost? VSA

Currently a new policy and procedure is being reviewed and therefore the financial consequences associated with this new policy procedure cannot be calculated..

4. Q11: Page 2. Article 5 SXM emergency foundation is mentioned. Why needed, how much will it cost, what is the projected income from it as well? VSA



The objective of the foundation is to promote a good relationship between the Ambulance Service of Sint Maarten and its citizens. To establish the foundation an amount of NAF. 1.335,- is needed. This foundation does not have the objective to generate income.

5. Q13: Min Public Health BBsZZ (Cost saving measure with regards to Social Security and Sickness Insurance) draft law, present please. It will be a cost saving measure. Where is it and can it be submitted?

This legislation which is intended to insure parts of the community who are currently not insured is currently being reassessed. The financial revisions and implementation impact has not yet been finalized.

6. Q16: Page 10 What is Government's position on increasing pension age to 65? Or is there a possibility of opting out between 62 – 65?

There is a plan to further increase the pension age to 65 however this will be worked out in the recommendations of the secondary pension feasibility study which is currently on-going. The option to opt out will be taken up in this.

7. Q17 Page 11 Schommelfonds is this realistic?

In case of shortfalls in one of the fund managed by SZV, a Schommel fund is an instrument that allows to temporary supplement these shortfalls from the reserves of another fund. As a short term solution it is realistic but it requires long term evaluations to ensure that the funds remain healthy.

8. Q19: Page 12 Why has there been a delay in addressing the tariff reform?

In 2015, the priority was placed on securing the availability of hospital care locally via the tripartite and business case, this resulted in a delay in the tariffs total health care reform project.

9. Page 20 Pilot project for elderly transportation? What is the status? Has it been evaluated, if yes, results please.

The pilot transportation project was finalized, and results of the project are being embedded into a social care policy that will serve as a basis for the needed legislation.

10. Q31: Mandatory pension can we receive a copy of the report of Actuary?

We have not yet received the final report. A first draft was developed and is being adjusted based on the comments of the ministry and the final draft is expected the beginning of March.

11. Q36: Page 28 Health: There is an increase in budgeted income from 30,000 -69,000 for Ambulance. What are the actual figures 2014 over the 1<sup>st</sup> - 4<sup>th</sup> quarter? Are the budgeted figures for 2016 realistic?

January - March 2014	Naf. 4.056,00
April - June 2014	Naf. 46.488,00
July - September 2014	Naf. 7.136,00
October - December 2014	Naf. 7.825,00
Total	Naf. 65.505,00 (as mentioned in the budget).

Yes they are realistic.

12. Q41: How many patients for MHF fall under AVBZ?

AVBZ Care Patients	Budget amount	Real amount
Day Care Faraja	20	20
Short Stay	3	3
Long Stay	3	2
Ambulant Care	20	20

13. Q42: How is the increase justified without the study being complete, how much with

the increase be, what are the consequences of increase?

It is the intention to implement a 3 phased approach with the SMMC tariffs.

1. indexation of current tariffs
2. application of budget advance as outlined in the recently completed tariff study
3. finalization of legislation establishing the new tariff structure.

14. Q50: Page 64 Council of Public Health, Registration Committee for Medication, and the Labor Tripartite: How are the board members being paid?

On quarterly bases the councils/committees hand in an overview of the amount of meetings held and they are paid accordingly.

15. Q58: Employment fund: Where is it. How will this be financed?

There is no Employment Fund as this in an exploratory stage.

16. Q61: Is subsidy for Mental Health Foundation enough?

Financing through subsidies has proven not to be sustainable. Therefore the Ministry is working on adjusting the current tariffs for mental health care, as a means of providing a more sustainable and controllable financing structure.

MP Sarah Wescot-Williams

1. Please elucidate the creation of a St. Maarten Government Emergency Medical Services Foundation.

This question was posed by MP de Weever and therefore already answered.

2. Unemployment amongst young men is reportedly at 28.2%. Pls. Provide overall unemployment figures and trends.

A copy of the Labor Force Survey Report from 2013 has been provided to Parliament. For the general public this report can also be found on the Statistic Department website.

3. Which "Steps to get to an National Health Insurance" are being undertaken? ( see page 21)

The NHI is part of the National Health Reform which focuses on 3 elements:

1. Legislative

Legislation is being prepared regarding

- the healthcare package, coverage and defining insured persons
- tariff adjustments
- securing provision of general hospital services

2. Quality:

- continuation of the introduction of a health information - and management system
- implementation of the newly established quality indicators for health care providers and institutions

3. Prevention

- prevention project being developed

4. What is the Status of the Health Information System? Is the system in operation?

Health information system project was delayed due to:

- The fact that stakeholder namely general practitioners wanted to see an increase in tariffs before the roll of the HIS as this required them to spend more hours on reporting digitally.
- Hospital care was identified as top priority, and as a result of limited resources, it was not possible to realize these two important projects simultaneously.

However, within this budget it has been taken up as a priority.

5. What is the policy on the Elderly (Ouderenbeleid). Is there one? (Page 21)

The elderly research is incorporated in the social care policy which is presently being drafted as the basis for social legislation for a wider range of social care services

6. Is the mandatory 2nd layer pension being worked on?

This answer has already been provided based on questions from MP de Weever.

7. When is the Increase in the pension age to 65 years being envisaged?

This answer has already been provided based on questions from MP de Weever.

8. It is stated that "Bottlenecks exist to the implementation of an NHI ( National Health Insurance). How then will the approach to a national health insurance be?

VSA drafted a plan of action for the phased implementation, which also address bottlenecks such as :

- defining the financial and economic consequences of a general health insurance
- sensitizing and securing that stakeholders are aware of their roles and responsibilities in the various phases

## Round 1 Central Committee Clarifications Q's & A's

### MP Cornelius de Weever

1. Figures for the Council of Public Health, Registration Committee for Medication, and the Labor Tripartite on 2016 budget are zero . Why are they zero?

In previous years these payments were budgeted under subsidies, however they are not subsidies. Therefore a shift was made and these amounts are budgeted under budget post 43501.

2. Recent tariff study can a copy be provided

This is still an internal document, and therefore cannot be provided at this time.

3. AVBZ for MHF - on the budget it is zero. How will AVBZ be able to cover this?

The AVBZ fund managed by SZV is considered a healthy fund and has sufficient money to cover costs of services. Therefore the decision was made 2 years ago for the Government contribution to be temporarily put on hold. This has been formalized in legislation.

4. Foundation for the Ambulance - can you elucidate the objective and what the activities are going to be?

This is intended to be a foundation to increase social interaction with the community. Similar to the Friends of the St. Maarten Island Government Fire Fighters Foundation which aims at improving cooperation for fires amongst the people of Sint Maarten.

### MP Leona Marlin

1. Elucidate further what is meant by 5 mln Government contribution to ZV (Sickness Insurance) funds for non-active employees

This reflects a contribution from Government to SZV for unemployed persons in the private sector, who were previously insured under the Sickness Insurance and are still entitled to insurance.

MP Tamara Leonard

1. Is there a separation where it concerns the physically and mentally challenge to help them to work? Is there a policy or are we planning to put together one that allows them to get back into work?

Yes a policy is being developed to get persons who are challenged and can work back into the work force.

There is an initiative by Sister Bastillia Center called the Guided Living Project where most of their clients were successfully placed in the Labor Market. The results of this initiative has been submitted to the Department of Social Development and is currently being used to aid with the development of the policy.

2. As it pertains to interim position for the SG, is there a length of time that this can continue, does the pay reflect that of the position itself?

An SG can act as long as the position is not filled. A person can receive an acting allowance.

3. As it pertains to unemployment insurance, where will we get the funds and has it been included in this budget?

Regarding unemployment insurance there is a feasibility study being conducted and therefore the financial implications are not reflected in this budget.

4. As it pertains to the companies inspected, in 2015 how many have been inspected in how many were shutdown, where are they located? As of 2016 how many have been inspected, how many were shut down and how where were they?

This will be presented in writing.

MP Leona Marlin

1. What if any investments has government made in the water company of GEBE NV?

From VSA budget there has been no investments in the water company.

MP Rudolph Samuel

1. Is there shortage of beds at the SMMC and if so how much are there and how much is the need?

It is a seasonal shortage, during high season there is a shortage of 10%. There are currently 66 beds and based on their existing specialties they need 82 beds.

2. How long is the request to upgrade or expansion of the ICU and Operating room been on the table?

This has been on the table since 2012. An inspection was held from Nov 2011 - April 2012, the first report came out in sept 2012 and the revised version was in Nov 2012 and from then it was clear what had to be done.

3. The equipment on the grounds by SMMC what is the situation with that? Did they move and if not when will they move and are there any costs related to that?

The equipment is gone. The Director of SMMC received a letter from Liccom stating that he owes \$125,000 for their investments made. They had to prepare the ground for placing the equipment there. This is mobilization and demobilization fee.

4. How long is the acting SG been in place?

Since the end of 2013.

#### MP Christopher Emmanuel

1. Commercial Sex Worker(CSW) policy is there one, is it a new policy, how is it being done as it pertains to the CSW being checked? Where do they go?

There is a CSW policy that was developed in 2014.

The CSWs are being checked by two GPs on a regular basis.

#### Round 2 Central Committee Clarifications Q's & A's

1. When recruiting for SG position, will the person holding the position currently they be the first candidate considered?

A recruitment process must be held first and if the current SG wishes to apply I believe she is doing a great job.

## Ministry of Justice

### **MP Tamara Leonard (in letter dated Feb 5, 2016)**

The amount collected in refundable residence permit fees, the number of persons that amount represents, and the number of persons who have requested their refund.

In 2015 and amount of NAF 2.731.685 was collected by the Immigration & Border Protection Service on permit fees. An amount of NAF 133.385 of fees was paid back because the residence permit was rejected. The total amount of applicants was 6141.

Residence Applications By Type										
Per Year	2011		2012		2013		2014		2015	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
First Time Applicants	1798	22%	2455	30%	3126	26%	2301	39%	2786	45%
Admitted By Law	438	5%	931	12%	594	5%	397	7%	493	8%
Extension of Temporary Permits	5911	72%	4595	57%	8417	69%	3038	51%	2746	45%
Permit Change	113	1%	109	1%	115	1%	173	3%	116	2%
Total	8260	100%	8090	100%	12252	100%	5909	100%	6141	100%

### **MP - Leona Marlin**

Were the ministries able to accomplish any goals that were budgeted for in 2015. If yes, can parliament receive a detailed outline of such per ministry, so in essence, these are the ministries plans (in 2015), this was accomplished and this was the cost.

This is needed to make a better comparison on what is being budgeted for in 2016.

Carried out policy priorities in 2015:

- Updating laws and regulations:
  - invoeringslandsverordening wetboek van strafrecht
  - regeling grensoverschrijdende geldtransporten
  - LBHAM cel vergelijking en geautomatiseerd vergelijken DNA profielen tussen landen en het Koninkrijk
  - Regeling van de minister van justitie van de 4<sup>de</sup> september 2015 tot intrekking regeling elektronisch toezicht
  - Verdrag politie samenwerking Sint Maarten/Saint Martin
- Introduction DECOS at the Department of Justice and major services

Performed studies

- SOAB investigation absenteeism
- SOAB research management information IGD
- KPMG organization establishment Department of Justice
- Final report Evaluation of Judicial Kingdom Laws

- Automation;



- Completion JIS application Court of Guardianship
- Completion JI (automation) application HVB

- Housing;
  - Completion Phase 2; kitchen HvB
  - Completion of Phase 3; offices hvB
  - Completion rebuilding Landsrecherche
  - Finishing fence Ms. Lalie Centre

Can you please provide me with a policy priority list for 2016.

Crime prevention:

- 1) execution of Camera Project – related policies
- 2) Establishment of Youth Community Service Policies for 1<sup>st</sup> time offenders
- 3) continue/finalize Plans of approach (Prison/Police)

Can I be provided with a list of potential risks associated with this budget due to lack of funds? Even though the Justice Ministry received increases, it will still be challenging to acquire all necessary software & hardware, vehicles, personnel, and training across the Ministry.

What projects, if any, have been identified as priority? What are the priorities per Ministry? Please give a breakdown

Soremar (purchasing of a building)
Camera Project
Gevangenis ingang en Hekwerk
Schietbaan
KPSM - Substation - St. Peters
MIN JUS - Automobiles
KPSM - Project (hardware and software)

Police Dept. personnel costs were increased by 2 Mil an extra 10%. Prison personnel costs were increased by 64.7%. Immigration increased by 17.7%; Landsrecherche increased by 58%; Will these increases remedy the short-staff situation?

No. The increase in salaries will be allocated to the following:

27. Filling of critical vacancies
28. Increase in salaries
29. Yearly increments
30. Retroactive payments
31. Salary adjustment for officers placed in the incorrect scale.
32. In addition, the personnel cost was under-budgeted in the previous years.

Has additional staff been hired to remedy the crime situation?

Yes. A number staff was hired in 2015, in addition a number of officers were sent abroad for extensive training. Unfortunately the ministry has been plagued with short staff since its inception at 10.10.10, partially due to budgetary constraints.

What is the cause of the short staff-situation?

The reason why most departments are short staffed is due to the fact:

- Ministry started with insufficient personnel at 10.10.10
- A Government-wide freeze on hiring new persons
- Insufficient fund to hire new persons

Does MINJUS have an approved formation? Can you please provide me with the formation document?

(There is an approved formation of the Staff Bureau and Judicial Affairs Department.) Justice came over from the Netherlands Antilles incomplete, because it was a new organization for Country Sint Maarten. The point of departure was that the necessary completion and structuring of the Ministry would take place based on the needs. At this point there are proposed changes to the legislation and various documents that have been drafted, pending finalization.

Can you please provide me with a list of how many persons were hired in 2015 and what was the total costs?

39 persons – 17 @ Police; 4 @ Immigration; 3 @ OM; 4 @ MOT; 3 @ HvB; 3 @ Miss Lalie Center; 1 @ Court of Guardianship; 2 @ Landsrecherche; 2 @ Directie Beleid.

This amount includes those that have been hired to replace personnel who went on pension and those who resigned. (total yearly cost approx. 2.489.679.)

Can you elucidate why overtime is also increasing?

There is the much talked about lack of personnel.

In addition there are a number of activities during the year (e.g. Carnival, Heineken Regatta, X-Mas season) that require additional police presence to ensure the safety of the public.

Also, the Dark Hours worked – the hours between 6pm and 6am - are included in the overtime figures, which gives an inaccurate indication of the amount of actual overtime worked.

The overall cost of the budget account “voeding” is decreased. Does this pertain to food expenditure at the Prison and if yes, what action plan has been put in place to reduce these costs? What is the current procedure for purchasing food at the prison?

Yes, it pertains to the purchasing of food for the inmates. The prison is presently working on a public bidding and we believe as a result of the bidding the cost will decrease.

The overall cost of the budget account “maaltijden” has also decreased. What action plan has been put in place to reduce these costs? How are these costs monitored?

The ministry is in the process of reviewing all the “maaltijden bons” and putting a new policy in place to lower the cost, bearing in mind that the “maaltijden bons” are tied into the overtime worked.

Burial insurance; Why was this not budgeted? Is there a structure/policy for state funerals for our fallen service men and women?

I believe you mean life insurance; yes I am busy preparing bidding for said insurance. There are provisions reserved for burial expenses in the general budget post to cover the cost of burials. (regulated in general terms in de Regeling vergoeding behandelings- en verplegingskosten overheidsdienaren art. 28: If the cause of death is work related, Govt will contribute a max. of Ang. 1000,- to the funeral costs)

Cursus & opleiding: budget reduced by 385k; how is the needed training going to be executed?

What plan of action is in place to keep our service men and women up to date with current trends and

Policies worldwide to avoid SXM falling victim to criminal plots? Can you please provide an overview of?

How this budget account was spent in 2015?

To accommodate the limited funds available for training and courses, the ministry is looking at alternative ways to lower the cost, for example instead of sending away 10-20 officers for training, we are looking into the possibility of having the courses and training done here on the Island, and also at combining efforts with Aruba, Curacao, BES, which in turn will lower the cost. In addition we will look at webinars as another alternative.

#### **MP Cornelius de Weever**

Does government have year plans per Ministry?

The Justice Services have year plans.

Does this budget contain the financial consequences of government policies intentions?

In the Toelichting op de Begroting.

New policy re commercial sex workers. Projected income?

There is a draft policy being worked on presently.

What is this Government's policy as it relates to prevention of crime and terrorism?

Regarding the Crime Prevention: The Police has a number of strategies that they have devised.

Regarding Terrorism: The Immigration & Border Protection Service have different sanction lists (EU and UN) that is used to control the borders. The IBP receives and provides regular alerts to its service partners along the migration chain on terrorism, of unwanted and signaled persons of interest.

Huge increase in income generated by residence permits. Will this be generated as result of increase in fees or an influx of more people than before?

Not because of influx of more people, but because of implementation of fees (that was begun in 2014). The total amount of applications for a residence permit has dropped in the years 2014, 2015 compared to the year 2012. The year 2013 is not compatible with 2014 and 2015 because in 2013

the handling of Brooks Tower permits took place. The amount of first time applications in 2015 has increased compared to the first time applications in 2012 and 2014.

Pag 11 How many children are actually in foster care and average cost per child?  
As of February 8<sup>th</sup> 2016:

Total 121 children with a protective measure.

33. 55 live at home under the guidance of a family Guardian (SJIB)
34. 3 live at home under guidance of Court of Guardianship Youth probation section
35. 2 live at Miss Lalie Center under Guidance of Court of Guardianship Youth Probation section
36. 47 live in a residential care (Children homes) setting
37. 14 live with foster families

Cost build up as follows:

38. Residential care @ nafl 500 per month per child
39. Foster Family @ nafl 250 per month per child
40. All (medical) bills that are not covered by insurance
41. Services of Court of Guardianship for the account of "landkas".
42. ½ of SJIB subsidy (=family guardianship department)

#### Faction Democratic Party

Provide an update on the operations of the FIU (MOT) in terms of its effectiveness.

It is not as effective as it could be. To improve, we are presently working on several pieces of legislation and also on connections with different data systems in order to enrich FIU's information.

What is the status of the Prison expansion project?

Phase 2 – offices – is completed; Phase 3 – kitchen is completed.

Phase 4 – additional cells, is being reviewed by me.

What is the status of the implementation of the Justice protocol, signed with the Kingdom/Netherlands government?

The Justice protocol can be divided in two:

- 1) The Intergity Chamber – which I kindly defer to the Minister of General Affairs
- 2) Strengthening of the justice Chain. During the last meeting with Minister Plasterk, we agreed to hold a Rount Table Conference in Holland to discuss the expectations on both sides (before June 2016)

Increase verblijfsvergunningen with 1.2 milj. Motivation?

The actual amount of permit fees collected in 2015 is 2.731.685,00; we expect this amount to increase with the collection of additional guarantor fees . Guarantor fees needs to be paid by shipping agents that execute visa required crew change. A conservative estimated crew change in a year by agents is 500 changes a 45 NAF a guarantor fee; this will generate an additional 225.000 Netherlands Antillean guilders a year.

## Questions Round 2: Minister JUS

### MP R. Samuel:

Funds for the camera system, is there sufficient to ensure that the outer part of Philipsburg can also get cameras at strategic positions.

The execution of the camera project has been split in 2. During the course of this year, approx. 2mln. Guilders will be spent on the Philipsburg area. During the course of next year (2017), the rest of the project will be executed, which would include some strategic locations.

Recommend that Min take a look at the camera system on the French side of the island.

Thank MP. Samuel for the recommendation.

### MP Johan Leonard:

Question to Fin but meant for Jus - How does the prison perform adequately under the current circumstances, how does MinJUS plan to go about this.

Have been hearing internationally and locally that SXM is a corrupt island, is there any indication that the casinos on SXM are they laundering money or involve in any illegal activity in any form or fashion? Provide hard proof. Provide this in writing (in black and white).

Explain how money laundering works: The different companies in Sxm have to provide MOT with information in case of unusual transactions. After analysing the info MOT reports to the OM; OM, after receiving the info determines whether to investigate. As far as I know there is no reports to the MinJus regarding investigations. Furthermore, the OM has independence to investigate and does not have to inform me of their individual investigations.

The different departments in the police force have complained, have he already consulted with the police union and the other unions that represents the police force, the other employees and immigration as there are issues that concerns these individuals ref. promotion and their living situation.

Since I took office, about 10 days ago, I have had 3 fruitful meetings with the Unions; I have signed 17 advises for Immigration staff, and one of my priorities is to address the existing HR issues.

Keep in mind the education facilities, how are we going to educate our police officers and that we get proper education facilities? How are we going to provide managers with academic training?

I have met with the Justice Academy to discuss their plans. Next, I have planned to hold a meeting with the Board of the Academy to finalize the educational plans. These plans will be for the entire Justice Ministry (which includes the Prison).

### MP Tamara Leonard:

Is the budget of 2016 as presented consisting of retroactive corrections of Police, customs and other officers?

Yes, as I mentioned yesterday, the funds would be allocated to retroactive corrections for the whole Ministry, once the funds are approved.

Is JOA been approved if not when?

No, it has not been approved. The rechtspositieregeling is still at the GOA. Once it is approved it has to go to the Council of Advice, so it is difficult to give an exact time of completion/approval.

Has the Benjamin family been awarded equal insurance as fire fighters as approved in MR?

I am told that an advice was written, but I do not know if it has already been paid.

What is the possibility of having officers trained in the same training as security officers ensuring a more BAVpol?

This is a good suggestion and I will take it into consideration.

What does the minister have planned to ensure sufficient police coverage through the entire period of carnival season?

In a recent meeting with the Chief of Police, he assured me that there would be enough coverage for both the Heineken Regatta and Carnival season.

**MP Leona Marlin:**

Request that overtime of police officers be prioritized and that complains be looked into and that police officers continues to take training in the field of security.

I agree with the recommendations of MP Marlin. In fact, these matters are on my priority list.

**MP Maurice Lake:**

Over time is 3 million for justice what were the actuals in 2015?

The actual was 2.6 mln Guilders.

How much is budgeted for training and development for the police force?

200.000,- Guilders

What is his action plan for the immigration officers at PJIA? When will they placed in the positons that they are trained for?

Yesterday I had a meeting with some Immigration officers and heard their side of the issues. Next week, after discussing the matter with the department head, I will make an appointment with them to inform them of my decision.

Final Report  
Rev. 01

## Waste Characterization Study and Material Flow Projection

Windward Roads B. V.

June 2009







Final Report  
Rev. 01

# Waste Characterization Study and Material Flow Projection

Windward Roads B. V.

June 2009





**St. Maarten**  
**Waste Characterization Study and Material Flow Projection**  
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# EXECUTIVE SUMMARY

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## Overview

Windward Roads B. V. (“WWR”), a subsidiary of the Dutch company Janssen de Jong, in partnership with Waste to Energy Sint Maarten B.V. (“the partnership”), has been tasked with the planning and development of a Waste to Energy (“WTE”) and Waste Recycling (“WR”) facility that is proposed to be built on the Dutch side of St. Maarten (“SXM”, or “the island”). As part of the planning initiative, the partnership retained R. W. Beck to perform a waste characterization study to develop estimates and projections of waste amounts and types that are currently being disposed at the Pond Island Landfill on the Dutch side of the island.

As part of this waste characterization study, the following were produced by R. W. Beck:

- Detailed Pond Island Landfill waste composition results with a statistical confidence interval of 90 percent, consistent with industry standards for sorted generators;
- An estimate of the energy content of materials available for disposal at the proposed WTE facility through laboratory analysis of moisture content coupled with existing data regarding the chemical composition of key waste categories;
- Projections (Base Case and high/low tourism scenarios) of future total disposal available for a WTE facility, based on recent scale house data and demographic projections for the island as developed by the Central Bureau of Statistics (“CBS”); and
- A material flow projection that combines the annual disposal estimate and the composition results to project the tonnage expected to be generated by material category.

The central results of this study are summarized herein. The remainder of this report provides more complete detail on each aspect of the analysis. The executive summary should not be used as a substitute for a complete review of this report, including all principle assumptions and considerations noted which define the limitations of the results.

## Results

### Waste Characterization

Table ES-1 below summarizes the average aggregated SXM waste stream.

## EXECUTIVE SUMMARY

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**Table ES-1  
Overall Waste Composition and Projected Weights for 2010**

Material Group	Material	Percent of Disposed Waste	Total Weight for 2010 (Mtons)
<b>Paper</b>		<b>9.6%</b>	<b>11,280</b>
	1 Newspaper	0.8%	969
	2 Corrugated Paper	3.9%	4,572
	3 High Grade/Magazine/Books	0.8%	983
	4 Other Paper	4.1%	4,756
<b>Plastics</b>		<b>6.9%</b>	<b>8,081</b>
	5 HDPE	0.3%	313
	6 PET	1.4%	1,589
	7 Plastic Film	2.8%	3,314
	8 Other Plastics	2.4%	2,866
<b>Glass</b>		<b>6.9%</b>	<b>8,104</b>
	9 Glass Containers	6.2%	7,247
	10 Other Glass	0.7%	857
<b>Metals</b>		<b>5.7%</b>	<b>6,635</b>
	11 Ferrous	4.6%	5,391
	12 Aluminum	0.7%	859
	13 Other Non-Ferrous	0.1%	106
	14 Other Metals	0.2%	279
<b>Organics</b>		<b>15.2%</b>	<b>17,804</b>
	15 Food Waste	7.0%	8,272
	16 Textiles	1.5%	1,738
	17 Tires	0.5%	644
	18 Rubber Products	0.0%	56
	19 Other Organics/Fines	6.0%	7,094
<b>Inorganics</b>		<b>0.2%</b>	<b>280</b>
	20 Miscellaneous Inorganics	0.2%	280
<b>Yard Waste</b>		<b>11.9%</b>	<b>14,010</b>
	21 Yard Waste	11.9%	14,010
<b>Construction</b>		<b>41.0%</b>	<b>48,186</b>
	22 Wood	19.6%	23,047
	23 Other C&D	21.4%	25,139
<b>HHW</b>		<b>0.7%</b>	<b>788</b>
	24 Batteries	0.0%	19
	25 Other HHW	0.7%	769



## EXECUTIVE SUMMARY

Material Group	Material	Percent of Disposed Waste	Total Weight for 2010 (Mtons)
Other Waste		1.9%	2,265
	26 Durables	1.9%	2,265
<b>TOTAL</b>		<b>100.0%</b>	<b>117,433</b>

The “Other C&D” category was comprised of materials used for construction or demolition that could not be clearly categorized in any other category. Materials assigned to this category included but were not limited to concrete blocks, tiles, gravel, drywall, dirt, rocks, asphalt, and fiberglass insulation.

The amount of waste from the Construction Waste category seems relatively high compared to other similar solid waste characterizations completed. From discussions with WWR and waste delivery drivers, there were two extraordinary circumstances that may have contributed to this outcome. They are:

1. Two buildings were being demolished during the time of the sorting events, and
2. An intersection was being demolished for the construction of a new roundabout.

Additionally, a large amount of wooden pallets were disposed. The pallets were categorized under the “Wood” material category in the “Construction” material group.

Detailed composition results by generator can be found in Appendix A of this report. More information about the construction waste samples can be found in Appendix D.

### High Heat Values

Table ES-2 details the estimated high heat values (“HHVs”) on a wet basis based on laboratory results of moisture content, ash content, and the chemical composition of each of the materials sorted.

**Table ES-2  
High Heating Values (Wet Basis)**

Material	High Heat Values (kcal/kg)
Newspaper	3,105
Corrugated Paper	3,885
High Grade/Magazines/Books	2,549
Other Paper	2,018
HDPE	7,854
PET	4,570

## EXECUTIVE SUMMARY

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<b>Material</b>	<b>High Heat Values (kcal/kg)</b>
Plastic Film	5,934
Other Plastics	6,786
Glass Containers	48
Other Glass	48
Ferrous	328
Aluminum	725
Other Non-Ferrous	455
Other Metals	392
Food Waste	2,494
Textiles	2,763
Tires	7,042
Rubber Products	6,914
Other Organics/Fines	2,256
Miscellaneous Inorganics	2,695
Yard Waste	1,550
Wood	3,959
Other C&D	1,830
Batteries	451
Other HHW	3,435
Durables	1,876
<b>Overall Waste Stream*</b>	<b>2,534</b>

\* Reflects a weighted average HHV.

The table shows the overall HHV for the projected waste stream in 2010 (as indicated by results from the study period) is 2,534 kilocalories per kilogram (“kcal/kg”). Typical industry practice in the United States considers Domestic Waste to have a HHV over 2,800 kcal/kg. It should be anticipated that the heating value of solid waste will fluctuate throughout the course of the year depending upon the amount of precipitation, variations in the composition of the incoming waste, and future changes in the waste stream.

### Projections and Material Flow

Figure ES-1 below summarizes the Base and high/low tourism disposal projections in metric tons (“Mtons”). The Base Case projections were developed by combining the estimated per-capita generation rate from the scale house observations with the population projection from the CBS. The alternative cases apply a historical volatility analysis of tourism data to the Base Case.

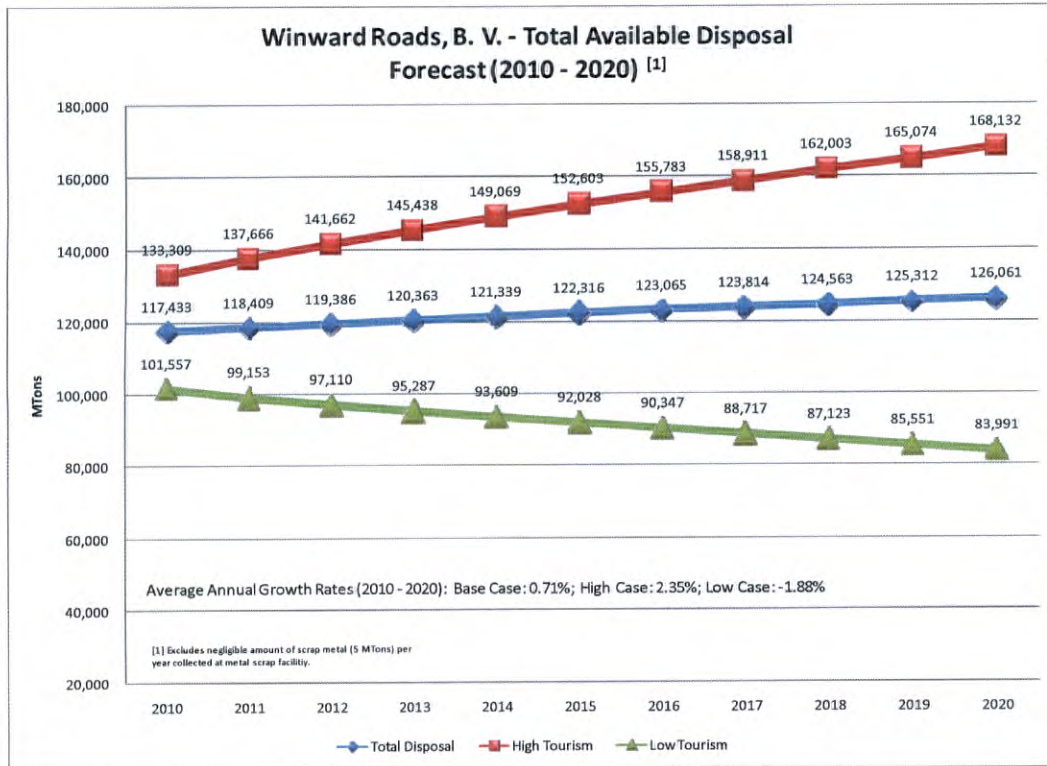


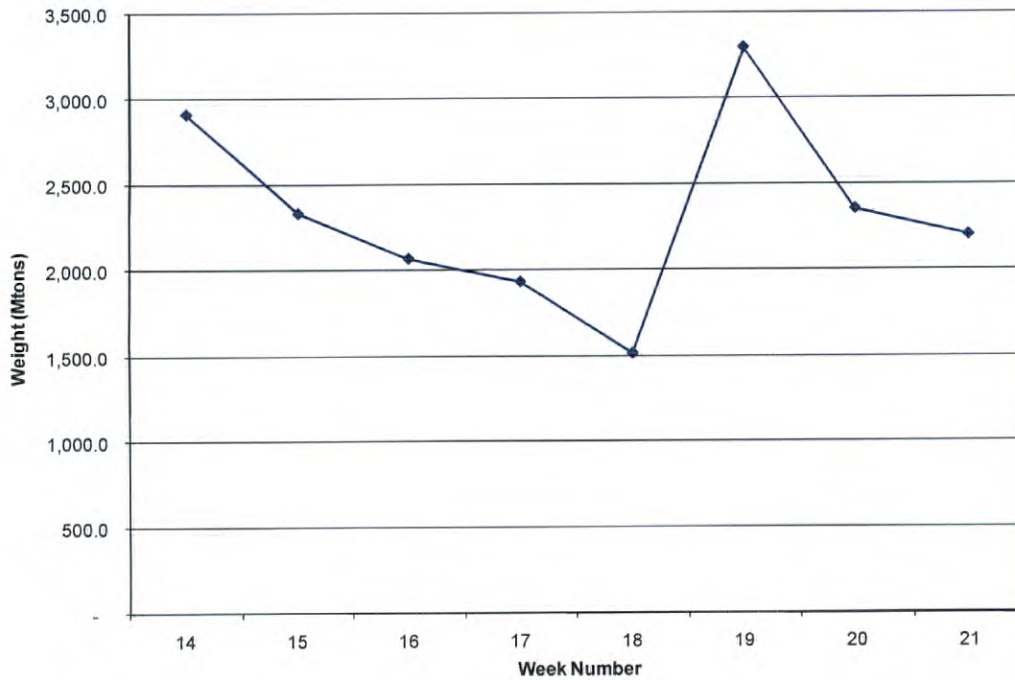
Figure ES-1: Forecast of Total Available Disposal

Disposal in the Base Case is expected to grow at an average annual rate of 0.7%, in alignment with the CBS population projection of 0.7% growth per year. The uncertainty in tourism generates a range of growth rates for disposal between 2.4% per year (high case) and a decline of 1.9% per year<sup>1</sup> (low case). Because of the fluctuations in the weekly amount of generation observed at the scale house (in particular construction waste), and the high volatility of available historical tourism data, the high/low cases represent increasingly large deviations from the Base Case. Figure ES-2 below summarizes weekly generation observed, which in some weeks reflects fluctuations in generation rates related to some known construction activity taking place during the sort as well as the Carnival.

<sup>1</sup> There is a significant amount of uncertainty surrounding actual tourist activity and the amount of construction debris that can be expected in a normal year, and such totals could be considerably lower than those reported.

## EXECUTIVE SUMMARY

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**Figure ES-2: Summary of Weekly Available Disposal**

Despite the large range around the Base Case, it is important to note that the high/low cases are intended to represent a 90% confidence interval for future available disposal, and that they can be interpreted as extreme cases (i.e., there is a 5% likelihood that available disposal will be either above the high case or below the low case, respectively).

The Base Case projection estimates that 117,433 Mtons will be available for disposal in 2010, increasing to 122,316 Mtons in 2015 and 126,061 Mtons by 2020.

Table ES-3 below summarizes the material flow projection for a high-level set of material categories, using the Base Case disposal projections. Please note the relatively high amount of construction materials, based on the composition results.

**Table ES-3  
High-Level Material Flow Projection (2010)**

Category	Mtons (2010)
Paper	11,280
Plastics	8,081
Glass	8,104
Metals	6,635
Organics	17,804
Inorganics	280
Yard Waste	14,010

## EXECUTIVE SUMMARY

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<b>Category</b>	<b>Mtons (2010)</b>
Construction	48,186
HHW	788
Other Waste	2,265
<b>Total</b>	<b>117,433</b>

Appendix B of this report provides a complete material flow projection through 2020 with a partitioning of the tonnage into all of the material categories sorted in the study.



# Section 1 OVERVIEW

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## Introduction

Windward Roads B. V. (“WWR”), a subsidiary of the Dutch company Janssen de Jong, in partnership with Waste to Energy Sint Maarten B.V. (“the partnership”), has been tasked with the planning and development of a Waste to Energy (“WTE”) and Waste Recycling (“WR”) facility that is proposed to be built on the Dutch side of St. Maarten (“SXM”, or “the island”). As part of the planning initiative, the partnership retained R. W. Beck to perform a waste characterization study to develop estimates and projections of waste amounts and types that are currently being disposed at the Pond Island Landfill on the Dutch side of the island.

## Project Objectives

The purpose of the Project was to gather information on the amount and type of waste being generated and disposed on the Dutch side of St. Maarten. This information will be used to evaluate the design and planning of a proposed WTE and WR facility.

The specific outputs required from this study were as follows:

- Detailed Pond Island Landfill waste composition results with a statistical confidence interval of 90 percent, consistent with industry standards for sorted generators;
- An estimate of the energy content of materials available for disposal at the proposed WTE facility through laboratory analysis of moisture content coupled with existing data regarding the chemical composition of key waste categories;
- Projections (Base Case and high/low tourism scenarios) of future total disposal available at the WTE facility, based on recent scale house data and demographic projections for the island as developed by the Central Bureau of Statistics (“CBS”); and
- A material flow projection that combines the annual disposal estimate and the composition results to project the tonnage expected to be generated by material category.

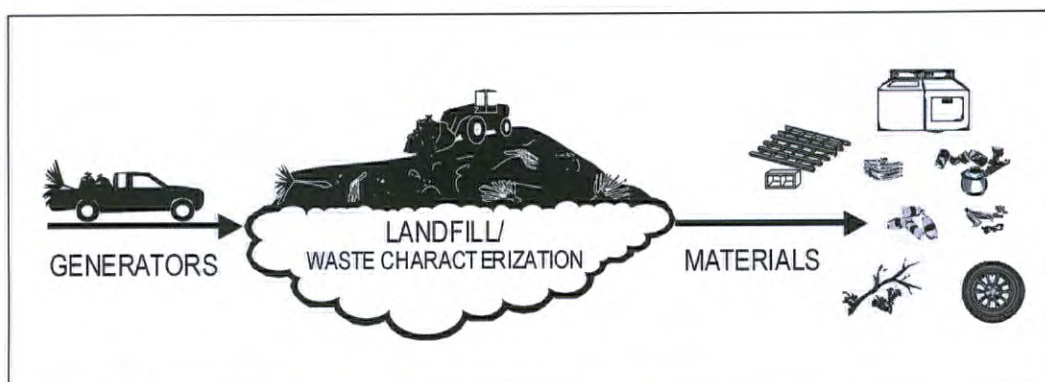
## Waste Categories

In characterizing a waste stream, it is necessary to first identify the sources of the waste (or generators). Then, a sample of the waste – representative of the sources and quantities – is analyzed to learn about its component parts (or materials).

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## Section 1

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**Figure 1-1: Depiction of High-level Waste Categories**

Ideally, generators produce waste which is brought to the landfill in dedicated loads (i.e., sources are not commingled on one truck). Waste from a particular generator is sampled and sorted into various material categories. The results of the sort are analyzed to produce a percent composition by material for each generator or in the aggregate.

Applying the percent composition to the estimated total quantities provides an estimate of the quantity of each material type disposed. These estimates then may be used to project waste available for a proposed solid waste facility, such as a waste-to-energy (“WTE”) facility. Using historical trends in the amount of waste disposed at a particular location or alternatively, scale house data on current incoming disposal; we can estimate the amount of waste that will be generated over a defined timeframe. The combination of these two key results (composition and projected total waste generation) results in an estimate of the amount of material available for disposal over time by waste category. This is the primary goal of this study. Additionally, these materials have inherent energy content (or caloric value) that can be estimated for the chemical composition of each waste category.

The categories of source generators used in this study are shown below. These categories were determined primarily as a function of how the new Pond Island Landfill scale house system allocates a specific load of waste to a generator class. Note that some waste categories (construction, yard waste, industrial, and stray) were audited visually (as opposed to physical sorting) based on the homogeneity of the sampled loads and the nature of the materials in the respective loads.

1. House Waste,
2. Commercial Waste,
3. Industrial Waste,
4. Yard Waste,
5. Stray Waste,
6. Construction Waste,
7. Bulky Domestic Waste,
8. Car Wrecks/Tires,



9. Cruise Ship Waste,
10. Airport Waste,
11. Hazardous Waste,
12. Medical Waste,
13. Institutional Waste,
14. Mixed Waste, and
15. Other Waste.

Based on prior studies conducted by R. W. Beck involving calculations of energy content, and available literature regarding chemical composition of materials, R. W. Beck developed a list of material categories for the study. The categories were designed to carefully balance the time and budgetary constraints of the project with the planning needs of the study in terms of energy content and material flow. The material categories used in this study are:

1. Newspaper,
2. Corrugated Paper,
3. High Grade/Magazine/Books,
4. Other Paper,
5. High-Density Polyethylene (HDPE),
6. Polyethylene Terephthalate (PET),
7. Plastic Film,
8. Other Plastics,
9. Glass Containers,
10. Other Glass,
11. Ferrous,
12. Aluminum,
13. Other Non-Ferrous,
14. Other Metals,
15. Food Waste,
16. Textiles,
17. Tires,
18. Rubber Products,
19. Other Organics/Fines,
20. Miscellaneous Inorganic,
21. Yard Waste,

## Section 1

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- 22. Wood,
- 23. Other C&D,
- 24. Batteries,
- 25. Other Household Hazardous Waste, and
- 26. Durables.

For this study, some generators align with material types which may cause some confusion. To understand the results provided in the report, it is important to remember the difference between a generator and a material. For example, the generator “Bulky Domestic Waste” indicates a truckload of solely large items from a house. The material category “Durables” also defines large household items. In this study, waste from the generator “Bulky Domestic Waste” is best classified in the material type “Durables”.

Similarly the “Car Wrecks/Tires” generator and the “Tires” material category align with each other. However, it is possible for tires to arrive at the landfill in a truck bringing garbage from a house. In this situation, the generator is “House Waste” but “Tires” are one material category found in that generator.

More specific definitions of the source generators and material categories can be found in Appendix C.

## Section 2 BACKGROUND

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SXM is one of the five Netherlands Antilles Caribbean islands. The Dutch area encompasses the southern half of the St. Maarten-Saint Martin Island. The island is the smallest land mass in the world to be shared by two different nations, with the French occupying the northern territory. The island has a combined land mass of 37 square miles, with St. Maarten occupying only one third of the total island, or about 16 square miles.

St. Maarten is highly dependent upon tourism to sustain its economy. Over 1.8 million tourists visited St. Maarten in 2006. With a cruise ship port located in the Great Bay area of St. Maarten, more than 75% of the tourists visiting the island come by way of cruise ship.

The Dutch side of the island contains an estimated 38,000 residents in 2009. Tourism adds an additional 40,000 temporary residents annually based on data provided by WWR. The cruise ship docking establishes an additional amount of people, estimated to be equivalent to 1.4 million people over the period of one year. Additionally, a number of inhabitants are purported to be living illegally on the island and are undocumented. The exact number of people living on the island illegally is undetermined. WWR estimates that the number of illegal residents may range from five to twenty thousand people.

The Dutch side of St. Maarten is host to one solid waste management facility, Pond Island Landfill. The landfill is quickly running out of capacity. One estimate, provided by the owner/manager of one of the largest hauling companies, is that roughly five percent of the waste disposed at Pond Island Landfill is actually generated on the French side of the island. It has been proposed that the French dumping in St. Maarten is caused by free use of the landfill on the Dutch side versus the French side where tip fees are charged. Yet, the Dutch haulers state that this may also be due to the proximity of the dump to the French collection routes, which would save the French haulers time and money to use the landfill. There is no evidence that has been made available to R. W. Beck that indicates this percentage may actually be higher than five percent.

There is a scrap metal facility across the road from the Pond Island Landfill that collects vehicle wrecks and other large pieces of scrap metal – one owner of the scrap metal facility estimates that 70 percent of the material they receive is vehicles. They process about 5,000 metric tons per year of ferrous metals and only 15 to 20 percent of what they process is non-ferrous metals (approximately 750 to 1,000 metric tons). About 1,000 metric tons of scrap metal is estimated to come from the French side of the island. Waste delivered to the scrap metal facility is not included in the characterization results of this report because it is diverted from disposal.

## Section 2

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Overall, the solid waste collection and hauling environment is unique and, at times, quite fluid.

## Section 3

# WASTE CHARACTERIZATION METHODOLOGY

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## Introduction

In characterizing a waste stream, it is necessary to identify the sources of the waste (or generators) and the amount of waste that exists. Then, a sample of the waste – representative of the sources and quantities – is analyzed to learn about the characteristics of its component parts. These characteristics can then be applied to the entire waste stream to address a range of waste management issues. This section of the report explains the methodologies used in characterizing the waste stream disposed at the Pond Island Landfill.

## Waste Disposal Trends

The quantity of waste disposed at the Pond Island Landfill was unknown at the inception of this project. At the beginning of March 2009, WWR installed a weigh bridge scale system at the entrance of the landfill so weights of trucks could be recorded as they entered and departed to determine the quantities of the waste disposed by vehicle and in total.

From April 14<sup>th</sup> through April 18<sup>th</sup>, R. W. Beck performed a gate survey during which an R. W. Beck staff member surveyed trucks as they entered and departed the landfill. The collection vehicle drivers were surveyed to determine the source of the waste hauled. The answers provided by the drivers were used: (1) to classify the load into a generator category, and (2) in an attempt to determine the amount of waste coming in from the French side of the island.

R. W. Beck was able to confirm that the sources of waste, for the most part, matched the generator categories recommended by WWR. A list of the generators may be found in Section 1 of this report and are defined in Appendix C.

During the R. W. Beck gate survey, a WWR employee was trained in identifying generator classes and discerning the source of truck loads. This individual, along with other WWR staff members, continued to record generators and waste quantities via survey after the R. W. Beck employee completed the gate survey. The waste quantity information used by R. W. Beck for the analysis included waste amounts for the April 14, 2009 through May 24, 2009 timeframe.

## Waste Characterization Field Events

### Planning

During the gate survey, it was noted that some generators produced waste that was very consistent throughout an entire truck-load (i.e., homogeneous) and others produced waste that was quite varied and was comprised of many different materials in any one truck-load (i.e., heterogeneous). For example, homogeneous loads included truck-loads containing only tires. Heterogeneous loads included waste from residences or commercial businesses. In addition, waste from certain generators, while not 100 percent homogeneous, was relatively homogeneous and comprised of large, heavy materials that do not lend themselves to easy manipulation by hand. Homogeneous loads do not need to be sorted, as their quantities by weight are recorded at the scale house. Homogeneous loads include loads from the “Bulky Domestic Waste”, “Car Wrecks/Tires”, “Hazardous Waste”, and “Other Waste” generators. These generators were classified in the material categories “Durables”, “Tires”, “Other HHW”, and “Other Organics” respectively. All other loads would need to be sampled to determine their component parts. It was determined, as is typical industry practice, that totally heterogeneous loads would be physically sorted for identified material types. The remaining loads would be sampled and the entire truck load visually assessed to determine its component parts. The methods used for physical and visual sorting are discussed later in this section.

Waste samples were taken during two, one-week sampling events, the first occurring April 22, 2009 through April 26, 2009 and the second occurring May 18, 2009 through May 22, 2009. Prior to each event, a sampling plan for taking a portion of the waste representative of all waste disposed was developed.

In order to representatively sample waste from a waste stream, it is imperative to know the quantities of waste disposed by each generator in order to develop a sampling plan indicating the amount of waste to sample from each generator. For this particular project, because the amount of data was limited prior to the first sort, the proportion of generators was evaluated at two distinct times, namely before the 1<sup>st</sup> sorting event and then again before the 2<sup>nd</sup> sorting event. This was to ensure that the maximum amount of data was used to develop the second event sampling plan, thereby ensuring that any statistical issues in the first sort – driven from data limitations – was addressed with a revised sampling plan in the second sort. The percent of total waste by generator is contrasted in Table 3-1 below.

**Table 3-1  
Comparison of Waste by Generator Prior to Both Sampling Events**

Generator	Weight Disposed 4/14/09 - 4/18/09	% of Generators Sampled	Weight Disposed 4/14/09 - 5/10/09	% of Generators Sampled
House waste	179,477	13%	821,726	10%
Commercial waste	185,188	13%	715,112	8%
Industrial waste	4,912	0%	14,247	0%

## WASTE CHARACTERIZATION METHODOLOGY

Generator	Weight Disposed 4/14/09 - 4/18/09	% of Generators Sampled	Weight Disposed 4/14/09 - 5/10/09	% of Generators Sampled
Yard waste	233,537	16%	636,995	8%
Stray garbage	4,477	0%	181,540	2%
Construction waste	795,905	56%	3,607,875	43%
Bulky domestic waste	3,977	NS	28,377	NS
Car wrecks/tires	5,440	NS	28,599	NS
Cruise ship waste	5,593	0%	9,472	0%
Airport Waste	5,543	0%	9,914	0%
Hazardous waste	6,686	0%	6,764	0%
Medical waste	0	0%	347	0%
Other waste	59,983	NS	193,909	NS
Mixed waste*	364,375	NS	2,462,844	29%
Institutional waste	0	0%	0	0%
Not categorized**	422	NS	422	NS
<b>Total</b>	<b>1,855,516</b>	<b>100%</b>	<b>8,718,143</b>	<b>100%</b>

\* Mixed waste was not sampled during the first sampling event because communications with the scale house were not established to identify such loads at that time.

\*\* Some trucks passed by the scale house without being categorized into any generator class. The amount that was not categorized makes up less than 1/10 th of one percent.

NS – No samples were taken from these generators because their loads were homogeneous in nature unless otherwise specified.

During the second sampling event, two changes included placards were used so the scale house staff could label trucks selected for analysis and mixed waste was sampled.

### Sampling and Sorting Team Positions and Responsibilities

The sampling and sorting team was made up of four R. W. Beck solid waste professionals, led by a supervisor or “Crew Chief.” The Crew Chief was responsible for working with the facility staff, and setting up the sort field site. Additionally, the Crew Chief kept track of the schedules, sampling plans, general sort logistics, and management of the sort crew.

### Sampling

Proper sampling requires that the origin and contents of each sampled truckload be verified prior to taking samples. During the first day of the field data collection, the Crew Chief provided the staff at the gate a list of the targeted material generators for that week’s sampling and sorting. Truckloads were selected using a stratified random sampling methodology to select incoming vehicles for sampling. This means that trucks were selected at random but in proportion to the number of loads from each specific hauler delivering waste to the facility. Since a method of communication was not set-up prior to the first sort event, trucks were randomly selected by the Crew Chief as they arrived at the tipping location close to the sorting area.

## Section 3

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When targeted trucks entered the facility, an R. W. Beck staff member conducted a brief interview with the driver to verify certain information about the contents of the truckload. Questions included:

- From what type of generator is the load: commercial, residential, all over the island (mixed)?
- Where did the material originate (specific geographic origin)?
- Were any out-of-the-ordinary items picked up on route?
- Is this a special load? (This question served to verify that material was picked up from the targeted generating sector).

The truck number and area the refuse originated from was recorded so that the tonnage of the load could be verified at a later time.

A designated area was established at the landfill to conduct the sorting. Trucks that were selected for sampling were directed to tip their loads in a location designated by facility personnel, ideally adjacent to the sort area. The Crew Chief or other R. W. Beck staff used a loader to randomly select a 200- to 250-pound sample to be staged next to the sorting area. The samples were placed on a plastic tarp, so that smaller particles, or “fines”, could be captured. The remaining (unsampled) waste was then disposed of in a normal manner.

Industry literature specifies a minimum sample size of 200 pounds, which is consistent with R. W. Beck’s past sorting experience. However, in any field sort, it is to be expected that occasionally samples will weigh less than the 200-pound target because of variation in the density of the waste. This discrepancy is more likely to occur with commercial loads that contain a significant fraction of corrugated boxes, foam packaging, or other light material. Conversely, some of the denser samples may be significantly heavier than 200 pounds.

## Sorting

All sorting was conducted in a designated area of the landfill, out of the way of ongoing facility operations. Sorting took place under a covered area for protection of the workers from heat and rain and to avoid any contamination of the samples by rain or wind.

Manual sorting was performed by a crew of four R. W. Beck solid waste professionals. All sorting personnel have been trained in the specific safety and technical requirements of this sorting protocol prior to performing the sort and have years of experience both managing and participating in sorts.

Once samples were staged for sorting, each sample was manually loaded onto a specially designed sorting table. Bagged waste was carried to the table, while loose waste was scooped and loaded into a 30-gallon container to be moved to the table top. Certain large or bulky items were carried to a scale for direct weighing.

At the sort table, which was covered by 1-inch mesh screening, solid waste was manually sorted into labeled bins or baskets. Bagged or boxed materials were opened



## WASTE CHARACTERIZATION METHODOLOGY

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and all waste was sorted into the 26 material categories identified in Section 1. Sorting continued until the screen top material reached a particle size of less than two inches. Material particles ranging from one-half to two inches (typically shredded paper, plastic caps and lids, etc.) were apportioned to the appropriate material category by the Crew Chief. When the inch screen was clear of material, the layer of fines beneath the screen was placed in a “fines” category. Special effort was made to separate all waste above the screen into the component material categories and remove or shake off to the appropriate category as much contamination (grit and moisture) as possible.

### Visual Audits

Due to the nature of Construction and Demolition debris (“C&D”) and Yard Waste (“YW”), it is industry standard to perform visual volumetric analysis (“visual audits”) of these types of waste. The size and weight of the material disposed in these loads prevent them from being physically sorted, though the homogeneity of the loads allow for them to be visually characterized. Some loads of stray waste and industrial waste presented the same challenge as is typical of C&D waste and thus were visually audited.

For each visual audit the field staff member asked the driver where the load was generated. The field observer recorded the type of truck, the type of waste being disposed, truck number, and the time and date of the truck’s arrival. After the load was dumped at the tipping area the observer measured the dimensions of the load to calculate the true cubic yardage of the load and took a picture of the load. The composition of the load was then noted. The observer recorded the percent by volume of each material in the load. These values were noted on the data collection form. This process was completed for all of the visual audits.

During the sampling and sorting there were a few issues that arose worth noting:

- While pulling samples from randomly selected loads it was not uncommon to have people gathered around the recently disposed load pulling out metals and other commonly recycled materials. After a few hours onsite an agreement was made that we would like to take the sample prior to residents pulling out items of interest.
- During the first week of sampling and sorting, R. W. Beck randomly selected incoming loads for analysis. R. W. Beck would note the generator, truck number and time of arrival. In a limited number of occurrences the generator type documented by R. W. Beck varied from that marked at the scale house. During the second season, R. W. Beck provided the scale house with bright orange placards that could be filled out and provided to the drivers notating the generator and that the load was selected for sampling. On several of the days the scale house attendant would come to the tipping face and point out the loads by type as they came in, eliminating the need for the placards.

Information about construction waste samples can be found in Appendix D.

## Analysis

Subsequent to the field work, all data was entered by an R. W. Beck staff member into a proprietary waste composition model. A staff member checked that the data in each form was correct and legible before it was entered into the model. Once the data was entered, it was reviewed by other staff members to ensure accuracy and validity of each entry. The model contains 48 queries that are designed to catch any data that seemed out of the ordinary, such as negative weights, duplicate entries, and bulk items not included. Composition results were created after each material weight was created. The composition results were reviewed by qualified staff members for accuracy and validity. While in the field, many visual audit loads were photographed. These images were downloaded and labeled appropriately.

Visual audit percentages by volume were entered into a database that uses the percentage by volume numbers recorded in the field, to compute cubic yards. To convert the percentage by volume data into cubic yards, the total cubic yardage of the load was divided by the volumetric percentages. A conversion sheet was then utilized to convert the cubic yardage numbers into pounds per material per sample. The conversion factor sheet consisted of a list of each material and the pound per cubic yard value associated with each material. The conversion factor sheet has been derived from multiple data points including various industry publications, as well as previous studies conducted by R. W. Beck. The conversion factors used in this analysis are shown in the following table.

**Table 3-2  
Density Factors by Material**

<b>Material</b>	<b>Density Factor (pounds/cubic yard)</b>
Newspaper	471
Corrugated Paper	105
High Grade/Magazine/Books	485
Other Paper	364
HDPE	27
PET	35
Plastic Film	24
Other Plastics	40
Glass Containers	693
Other Glass	1,000
Ferrous	566
Aluminum	64
Other Non-Ferrous	200
Other Metals	184
Food Waste	1,123

## WASTE CHARACTERIZATION METHODOLOGY

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<b>Material</b>	<b>Density Factor (pounds/cubic yard)</b>
Textiles	218
Tires	480
Rubber Products	480
Other Organics/Fines	1,046
Miscellaneous Inorganics	616
Yard Waste	363
Wood	278
Other C&D	1,140
Batteries	1,174
Other HHW	1,445
Durables	305

For each material set that was sampled and sorted, this report presents several statistical measures. These are described below:

**Sample Mean** – The sample mean composition is the average composition of each material category (or material group) for the samples included in a given result set. Because it is conceptually easy to understand, the sample mean values are often cited as a definitive estimate of the actual mean (i.e., the mean of the entire population). It is important to remember that the sample mean has associated uncertainty, described below.

**Confidence Intervals** – The lower and upper bounds of a confidence interval indicate the likelihood that the population mean (i.e., the actual composition of the entire waste stream) falls close to the sample mean (i.e., the samples analyzed in the study). The lower and upper bounds throughout this report have been calculated at a 90 percent level of confidence. In laymen's terms, this means we can be 90 percent confident that the true fraction of this material in the overall population falls between the lower and upper bound shown. For example, the sample mean composition of all paper in the St. Maarten samples was 10.0 percent. We can be 90 percent confident that the actual fraction of paper in the overall solid waste stream falls between 8.0 percent and 12.3 percent.

Complete results of the analysis of all sample data are shown in the remaining sections and appendices of this report.

As mentioned previously, several of the generator classes were not sampled and sorted due to the homogeneity of their loads. To account for these materials, annual weight estimates were produced for the waste that was sampled and sorted. Then, the weights of the generators not sampled were added to the appropriate material category and final percentages were calculated to estimate the breakdown of the entire disposed waste stream.

The results of the waste characterization analysis are presented in Section 4.

## Moisture, Ash, and High Heating Value Analysis

In addition to providing the characterization for the waste, grab samples (or laboratory testing units) were collected twice for laboratory testing. The first batch of samples was collected on Thursday during the first week of sorting. The second batch of samples was collected on Friday during the second week of sorting.

A grab sample or laboratory testing unit is a sub-sample of a presorted material. A randomly selected sample was chosen for moisture sampling. After the sample was fully sorted and weighed out, materials were taken from each of the material buckets. The laboratory testing unit was collected in two plastic bags, weighed, labeled, and placed in a cardboard box for shipment. Some of the material groups were found in the samples so infrequently that moisture samples were not taken during either sort event. Alternatively, an additional sample of a more prevalent material was taken instead.

These laboratory testing units were exported to an overseas laboratory, Woods End Laboratories, Inc. in Mt. Vernon, Maine, USA, where moisture and ash values of each relevant material-type were developed.

The moisture samples collected during the sort are sent to the lab for two tests determining moisture and ash content. In moisture determination, the contents of the refuse are sub-sampled into clean aluminum pans loosely filling the pan with all varieties of refuse in similar proportion to the whole. Where possible, items were cut into 2 inch square pieces. Very heavy samples were weighed to 1.0 g accuracy and lighter ones to 0.001 g. In ash determination, light weight dried samples were cut into pieces less than 1 square millimeter and weighed into crucibles with accuracy to 0.001 g. The heavy dried samples included glass and metal, which were ashed as 2 to 3 inch chunks and weights determined to 0.01 g. Due to the large differences in mass, density, and hardness, all mass measurements are estimates.

**Table 3-3**  
**Count of Laboratory Testing Units**

<b>Material</b>	<b>Count of Laboratory Testing Units</b>
Newspaper	3
Corrugated Paper	2
High Grade/Magazine/Books	2
Other Paper	4
HDPE	2
PET	3
Plastic Film	4
Other Plastics	2
Glass Containers	4
Other Glass	2

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<b>Material</b>	<b>Count of Laboratory Testing Units</b>
Ferrous	2
Aluminum	2
Other Non-Ferrous	0
Other Metals	1
Food Waste	4
Textiles	2
Tires	0
Rubber Products	1
Other Organics/Fines	4
Miscellaneous Inorganics	1
Yard Waste	3
Wood	2
Other C&D	1
Batteries	0
Other HHW	1
Durables	0
<b>Total</b>	<b>52</b>

R. W. Beck has performed other analyses to estimate the heating values of various refuse materials. This research has provided a listing of materials, their moisture values, their ash values, and their chemical makeup. The list of materials for which R. W. Beck has known values does not directly match the listing of materials used in this SXM analysis. Where a direct match does exist, the appropriate proxy values were used. In the event a direct match did not exist, the average of known values for similar materials was used as a proxy. The chemical component values were used, along with the moisture and ash results, to estimate heating values for the waste components and the waste stream as a whole.

The results of the moisture, ash, and high heating value analysis are discussed in Section 4.



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# WASTE CHARACTERIZATION RESULTS

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Our analysis to characterize the waste disposed at the Pond Island Landfill provides a comprehensive set of findings. Results include the following:

1. Estimates of the overall amount of waste disposed,
2. Estimates of the amounts disposed by generator,
3. Estimates of the amounts of waste sampled and sorted,
4. Estimates of the composition of waste sampled and sorted,
5. Estimates of the composition of the overall waste disposed,
6. Estimates of moisture and ash composition of materials in the waste, and
7. Estimates of heating values of materials in the waste and overall.

## Disposed Waste

Quantities of waste disposed at the Pond Island Landfill were recorded beginning on March 30, 2009. The table below shows the amounts disposed for each week of the year (Monday through Sunday) beginning on week 14 (March 30, 2009) and ending the last day of week 21 (May 24, 2009) for an eight week period.

**Table 4-1**  
**Waste Disposal Amounts**

Week No.	Weight (Mtons)
14	2,914.7
15	2,335.9
16	2,072.8
17	1,937.5
18	1,520.4
19	3,298.4
20	2,358.0
21	2,206.4
<b>Average</b>	<b>2,330.5</b>

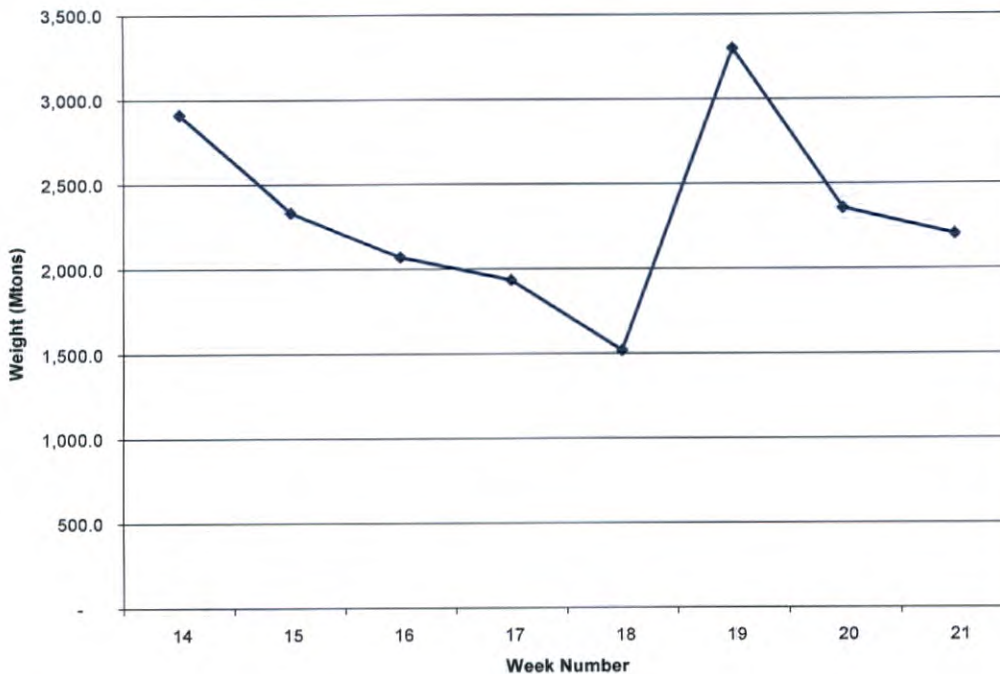
The following figure represents the disposed amounts as a line graph showing fluctuations among the weeks.

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**Figure 4-1: Waste Disposal Amounts**

The gate survey occurred during week 16. Sampling and sorting events occurred during weeks 17 and 21. The island celebration of Carnival took place in 2009 from April 16<sup>th</sup> through May 4<sup>th</sup>, with the peak of the festivities occurring during the last week which is the 18<sup>th</sup> week of the year (week 18). As reflected in the line graph above, the variation between weeks 18 and 19 was dramatic with disposal quantities more than doubling immediately following the completion of the Carnival. The first sampling and sorting event was purposely scheduled – in coordination with the partnership – to occur prior to week 18 due to the potential uniqueness of the waste flows caused by the peak of the celebration. Figure 4-1 reflects a weekly volatility in the waste stream of 16 percent during the period in which data was gathered.

## Waste Disposal by Generator

During the gate survey, an R. W. Beck staff person was able to view and assess truck-loads of waste originating from different sources (generators). At that time, the following definitions were developed for the categories of generators.

1. House waste: waste coming from a residence or residential area;
2. Commercial waste: waste coming from a place of business that sells goods or services directly to end-users like a store, restaurant, or office;
3. Industrial waste: waste coming from a place of business that mainly manufactures goods for sale to the commercial sector;



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4. Yard waste: waste produced through landscaping, tree trimming, or other garden replacement/maintenance activities;
5. Stray garbage: waste collected from areas not intended for waste disposal such as along the side of the road – includes litter and street sweepings;
6. Construction waste: waste produced by the demolition, construction, or remodeling/decorating of roads or buildings;
7. Bulky Domestic waste: waste coming from a residence or residential area that is too large to fit in a typical waste disposal receptacle – includes appliances (white goods), furniture, or other large household items;
8. Car wrecks/tires: waste comprised of whole or parts of vehicles (including tires) – generally, all such loads of waste were directed to transport any metal at a scrap metal facility across from the landfill and thus were not regularly seen and/or recorded unless they contained only tires;
9. Cruise ship waste: any waste brought to the landfill from a cruise ship;
10. Airport waste: any waste brought to the landfill from the airport;
11. Hazardous waste: any waste that is flammable, toxic, explosive, corrosive, poisonous, potentially infectious or the like – includes pesticides, explosives, paints, oils, glues, and adhesives;
12. Medical waste: any bio-hazardous waste produced as a by-product of medical services – includes blood, tissue, syringes (sharps);
13. Other waste: any waste that does not appropriately fit into any of the categories above – includes residual waste from septic trucks and disposal of used laundry water; and
14. Mixed waste: waste delivered to the landfill from a location that produces any combination of the categories above – an example is a community bin that contains waste from residences and commercial business.

The amounts of waste from each of these generators was recorded by scale house staff (and obtained by R. W. Beck) from March 30, 2009 through May 24, 2009. These weights are shown in the following table.

**Table 4-2  
Waste Disposal by Generator**

Generator	Weekly Disposal (Mtons)								Total
	Week 14*	Week 15*	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	
House Waste	172.8	1.1	196.8	157.1	285.0	182.9	81.2	62.8	1,139.6
Commercial Waste	73.1	6.1	194.8	278.5	171.5	70.4	112.0	159.8	1,066.2
Industrial Waste	229.9	1.4	5.4	3.2	4.7	1.4	7.8	5.2	259.1
Yard Waste	632.0	87.7	255.2	100.4	61.0	226.9	180.6	158.2	1,702.2
Stray Waste	104.8	26.0	5.7	7.9	8.9	160.2	0.5	5.7	319.9
Construction Waste	1,161.6	1,103.0	831.7	492.5	443.6	1,853.9	1,178.2	1,084.7	8,149.1
Bulky Waste	13.8	3.3	4.1	22.4	1.9	0.0	44.7	3.3	93.5

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Generator	Weekly Disposal (Mtons)								Total
	Week 14*	Week 15*	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	
Car Wrecks/Tires	1.0	11.2	5.4	14.0	6.6	2.6	16.1	5.8	62.8
Cruise Ship Waste	0.0	0.0	5.6	0.8	3.1	0.0	0.0	1.2	10.7
Airport Waste	0.0	0.0	8.0	0.0	1.9	0.0	0.0	0.0	9.9
Hazardous Waste	4.5	0.0	6.7	0.0	0.1	0.0	0.0	0.0	11.3
Medical Waste	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.3
Other Waste	135.1	46.1	60.0	84.9	48.9	0.1	74.1	35.5	484.6
Mixed Waste	365.4	1,049.8	493.0	775.5	483.2	799.9	662.8	684.2	5,313.7
Not Categorized**	20.7	0.0	0.4	0.0	0.0	0.0	0.0	0.0	21.1
<b>Total</b>	<b>2,928.7</b>	<b>2,350.9</b>	<b>2,088.8</b>	<b>1,954.5</b>	<b>1,538.4</b>	<b>3,317.4</b>	<b>2,378.0</b>	<b>2,227.4</b>	<b>18,644.0</b>

\* Training of scale house staff in identifying and categorizing generators did not occur until week 16.

\*\* Some trucks passed by the scale house without being categorized into any generator class. The amount that was not categorized makes up less than 1/10 th of one percent.

## Waste Sampled and Sorted

During the two one-week sampling and sorting events, a total of 131 samples were gathered and sorted from nine of the 14 generators. The distribution of the samples across these generators is shown in the following table.

**Table 4-3**  
**Distribution of Sampling Units across Generators**

Generator	Num of Sampling Units	% of Sampling Units
House Waste	14	10.7%
Commercial Waste	14	10.7%
Industrial Waste	5	3.8%
Yard Waste	11	8.4%
Stray Waste	2	1.5%
Construction Waste	51	38.9%
Cruise Ship Waste*	0	0.0%
Airport Waste	1	0.8%
Mixed Waste	33	25.2%
<b>Total</b>	<b>131</b>	<b>100.0%</b>

\* The sampling plan called for one sample of Cruise Ship waste during the second sorting event; however, no Cruise Ship waste entered the landfill during that time.

## Composition of Waste Sampled and Sorted

Together, the 131 samples comprise a statistically representative profile of the waste (from the sampled generators) disposed at the landfill at the time of the sampling and sorting events. The table below shows the composition of the materials sampled

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including a distribution of the total weight disposed by the sampled generators during the two one-week sampling events. Please note that this does not represent the composition of the overall waste stream. The waste composition by generator is provided in Appendix A.

**Table 4-4  
Composition of Waste Sampled and Sorted**

Material Group	Material	Weight (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>345.4</b>	<b>10.0%</b>	<b>8.0%</b>	<b>12.3%</b>
	1 Newspaper	29.7	0.9%	0.6%	1.1%
	2 Corrugated Paper	140.0	4.1%	3.2%	5.1%
	3 High Grade/Magazine/Books	30.1	0.9%	0.7%	1.1%
	4 Other Paper	145.6	4.2%	3.3%	5.3%
<b>Plastics</b>		<b>247.4</b>	<b>7.2%</b>	<b>5.7%</b>	<b>8.8%</b>
	5 HDPE	9.6	0.3%	0.2%	0.4%
	6 PET	48.6	1.4%	1.1%	1.8%
	7 Plastic Film	101.5	3.0%	2.3%	3.7%
	8 Other Plastics	87.7	2.6%	2.0%	3.2%
<b>Glass</b>		<b>248.1</b>	<b>7.2%</b>	<b>5.6%</b>	<b>9.0%</b>
	9 Glass Containers	221.9	6.5%	4.9%	8.2%
	10 Other Glass	26.2	0.8%	0.5%	1.0%
<b>Metals</b>		<b>203.1</b>	<b>5.9%</b>	<b>4.6%</b>	<b>7.4%</b>
	11 Ferrous	165.0	4.8%	3.6%	6.2%
	12 Aluminum	26.3	0.8%	0.6%	1.0%
	13 Other Non-Ferrous	3.3	0.1%	0.1%	0.1%
	14 Other Metals	8.5	0.2%	0.2%	0.3%
<b>Organics</b>		<b>411.8</b>	<b>12.0%</b>	<b>9.4%</b>	<b>14.8%</b>
	15 Food Waste	253.2	7.4%	5.6%	9.3%
	16 Textiles	53.2	1.5%	1.2%	2.0%
	17 Tires	2.0	0.1%	0.0%	0.1%
	18 Rubber Products	1.7	0.0%	0.0%	0.1%
	19 Other Organics/Fines	101.7	3.0%	2.3%	3.7%
<b>Inorganics</b>		<b>8.6</b>	<b>0.2%</b>	<b>0.2%</b>	<b>0.3%</b>
	20 Miscellaneous Inorganics	8.6	0.2%	0.2%	0.3%
<b>Yard Waste</b>		<b>428.9</b>	<b>12.5%</b>	<b>8.9%</b>	<b>16.6%</b>
	21 Yard Waste	428.9	12.5%	8.9%	16.6%
<b>Construction</b>		<b>1,475.2</b>	<b>42.9%</b>	<b>34.2%</b>	<b>51.8%</b>
	22 Wood	705.6	20.5%	15.4%	26.2%

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Material Group	Material	Weight (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
	23 Other C&D	769.6	22.4%	16.2%	29.2%
<b>HHW</b>		<b>23.9</b>	<b>0.7%</b>	<b>0.5%</b>	<b>0.9%</b>
	24 Batteries	0.6	0.0%	0.0%	0.0%
	25 Other HHW	23.4	0.7%	0.5%	0.9%
<b>Other Waste</b>		<b>44.1</b>	<b>1.3%</b>	<b>0.9%</b>	<b>1.8%</b>
	26 Durables	44.1	1.3%	0.9%	1.8%
<b>TOTAL</b>		<b>3,436.6</b>	<b>100.0%</b>		

The “Other C&D” category was comprised of materials used for construction or demolition that could not be clearly categorized in any other category. Materials assigned to this category included but were not limited to concrete blocks, tiles, gravel, drywall, dirt, rocks, asphalt, and fiberglass insulation.

## Overall Waste Composition

As noted, the results above only represent the waste stream from the generators that were sampled and sorted. It does not include amounts from generators from which loads are homogeneous in nature. The table below shows the composition (by weight) of the waste disposed by sampled and sorted generators, the weight of material from homogeneous loads (i.e., all waste disposed from generators not sampled and sorted), and the overall waste composition (by weight and percentage by material). All weights represent materials disposed during the two one-week sampling and sorting events. Information about construction samples can be found in Appendix D.

**Table 4-5**  
**Overall Waste Composition during Sampling and Sorting Events**

Material Group	Material	Sampled Generator Weight (Mtons)	Weight from Other Generators (Mtons)*	Total Weight (Mtons)	Percent of Disposed Waste
<b>Paper</b>		<b>345.4</b>		<b>345.4</b>	<b>9.6%</b>
	1 Newspaper	29.7		29.7	0.8%
	2 Corrugated Paper	140.0		140.0	3.9%
	3 High Grade/Magazine/Books	30.1		30.1	0.8%
	4 Other Paper	145.6		145.6	4.1%
<b>Plastics</b>		<b>247.4</b>		<b>247.4</b>	<b>6.9%</b>
	5 HDPE	9.6		9.6	0.3%

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Material Group	Material	Sampled Generator Weight (Mtons)	Weight from Other Generators (Mtons)*	Total Weight (Mtons)	Percent of Disposed Waste
	6 PET	48.6		48.6	1.4%
	7 Plastic Film	101.5		101.5	2.8%
	8 Other Plastics	87.7		87.7	2.4%
<b>Glass</b>		<b>248.1</b>		<b>248.1</b>	<b>6.9%</b>
	9 Glass Containers	221.9		221.9	6.2%
	10 Other Glass	26.2		26.2	0.7%
<b>Metals</b>		<b>203.1</b>		<b>203.1</b>	<b>5.7%</b>
	11 Ferrous	165.0		165.0	4.6%
	12 Aluminum	26.3		26.3	0.7%
	13 Other Non-Ferrous	3.3		3.3	0.1%
	14 Other Metals	8.5		8.5	0.2%
<b>Organics</b>		<b>411.8</b>		<b>545.1</b>	<b>15.2%</b>
	15 Food Waste	253.2		253.2	7.0%
	16 Textiles	53.2		53.2	1.5%
	17 Tires	2.0	17.8	19.7	0.5%
	18 Rubber Products	1.7		1.7	0.0%
	19 Other Organics/Fines	101.7	115.5	217.2	6.0%
<b>Inorganics</b>		<b>8.6</b>		<b>8.6</b>	<b>0.2%</b>
	20 Miscellaneous Inorganics	8.6		8.6	0.2%
<b>Yard Waste</b>		<b>428.9</b>		<b>428.9</b>	<b>11.9%</b>
	21 Yard Waste	428.9		428.9	11.9%
<b>Construction</b>		<b>1,475.2</b>		<b>1,475.2</b>	<b>41.0%</b>
	22 Wood	705.6		705.6	19.6%
	23 Other C&D	769.6		769.6	21.4%
<b>HHW</b>		<b>23.9</b>		<b>24.1</b>	<b>0.7%</b>
	24 Batteries	0.6		0.6	0.0%
	25 Other HHW	23.4	0.2	23.6	0.7%
<b>Other Waste</b>		<b>44.1</b>		<b>69.3</b>	<b>1.9%</b>
	26 Durables	44.1	25.2	69.3	1.9%
<b>TOTAL</b>		<b>3,436.6</b>		<b>3,595.3</b>	<b>100.0%</b>

\* The weight from generators with homogeneous loads includes 17.8 Mtons of tires from the "Car Wreck/Tires" generators, 115.5 Mtons of organic material from generators classified as "Other Wastes" (including water and residue from septic trucks), 0.2 Mtons of hazardous waste from the "Hazardous Waste" and "Medical Waste" generators, and 25.2 Mtons of waste from the "Bulky Domestic Waste" generators.

## Moisture and Ash Analysis

As discussed in Section 3, sub-samples of waste were packaged and sent to a laboratory where the moisture and ash components of the materials were estimated.

The results below show the moisture amounts found in the materials tested.

**Table 4-6  
Moisture Amounts by Material**

<b>Material</b>	<b>Solids</b>	<b>Moisture</b>
Newspaper	67%	33%
Corrugated Paper	90%	10%
High Grade/Magazine/Books	81%	19%
Other Paper	51%	49%
HDPE	98%	2%
PET	93%	7%
Plastic Film	70%	30%
Other Plastics	82%	18%
Glass Containers	98%	2%
Other Glass	94%	6%
Ferrous	94%	6%
Aluminum	95%	5%
Other Non-Ferrous	NT	NT
Other Metals	96%	4%
Food Waste	57%	43%
Textiles	59%	41%
Tires	NT	NT
Rubber Products	95%	5%
Other Organics/Fines	53%	47%
Miscellaneous Inorganics	90%	10%
Yard Waste	58%	42%
Wood	87%	13%
Other C&D	67%	33%
Batteries	NT	NT
Other HHW	85%	15%
Durables	NT	NT

NT – The samples selected for moisture and ash testing did not include these materials, thus, no testing was performed.

The results below show the ash amounts found in the dried materials tested.

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**Table 4-7  
Ash Amounts by Material**

Material	Ash	Volatile Solids
Newspaper	2%	98%
Corrugated Paper	4%	96%
High Grade/Magazine/Books	29%	71%
Other Paper	14%	86%
HDPE	23%	77%
PET	1%	99%
Plastic Film	19%	81%
Other Plastics	20%	80%
Glass Containers	99%	1%
Other Glass	93%	7%
Ferrous	92%	8%
Aluminum	83%	17%
Other Non-Ferrous	NT	NT
Other Metals	84%	16%
Food Waste	17%	83%
Textiles	10%	90%
Tires	NT	NT
Rubber Products	13%	87%
Other Organics/Fines	21%	79%
Miscellaneous Inorganics	45%	55%
Yard Waste	47%	53%
Wood	4%	96%
Other C&D	68%	32%
Batteries	NT	NT
Other HHW	2%	98%
Durables	NT	NT

NT – The samples selected for moisture and ash testing did not include these materials, thus, no testing was performed.

## High Heating Values

The moisture and ash values developed by the laboratory were combined with known chemical make-ups of various materials to estimate HHVs of the waste disposed at the Pond Island Landfill. The table below lists an estimate of the mass of material that can be expected in the disposed waste stream in 2010 based on the projected disposal quantities for 2010 and the associated HHV.

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**Table 4-8**  
**Estimated 2010 Mass and High Heating Values (Wet Basis)**

<b>Material</b>	<b>Weight in 2010 (Mtons)</b>	<b>High Heat Values (kcal/kg)</b>
Newspaper	969	3,105
Corrugated Paper	4,572	3,885
High Grade/Magazines/Books	983	2,549
Other Paper	4,756	2,018
HDPE	313	7,854
PET	1,589	4,570
Plastic Film	3,314	5,934
Other Plastics	2,866	6,786
Glass Containers	7,247	48
Other Glass	857	48
Ferrous	5,391	328
Aluminum	859	725
Other Non-Ferrous	106	455
Other Metals	279	392
Food Waste	8,272	2,494
Textiles	1,738	2,763
Tires	644	7,042
Rubber Products	56	6,914
Other Organics/Fines	7,094	2,256
Miscellaneous Inorganics	280	2,695
Yard Waste	14,010	1,550
Wood	23,047	3,959
Other C&D	25,139	1,830
Batteries	19	451
Other HHW	769	3,435
Durables	2,265	1,876
<b>OVERALL WASTE STREAM*</b>	<b>117,433</b>	<b>2,534</b>

\* Reflects a weighted average HHV.

The table shows the overall HHV for the projected waste stream in 2010 (as indicated by results from the study period) is 2,534 kcal/kg. As a reference point, typical industry practice in the United States considers Domestic Waste to have a HHV over 2,800 kcal/kg. It should be anticipated that the heating value of solid waste will fluctuate throughout the course of the year depending upon the amount of



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precipitation, variations in the composition of the incoming waste, and future changes in the waste stream.

### Waste Densities

Based on a literature review of common waste density factors and R. W. Beck past experience, the table below shows planning level estimates of density factors for the generator categories used in this study.

**Table 4-9**  
**Estimated Density Factors by Generator**

<b>Generator</b>	<b>Density Factor</b>
Residential, Uncompacted	158 kg/m <sup>3</sup>
Commercial	267 kg/m <sup>3</sup>
Industrial	267 kg/m <sup>3</sup>
Yard	208 kg/m <sup>3</sup>
Stray	213 kg/m <sup>3</sup>
Construction	
▪ Wood	165 kg/m <sup>3</sup>
▪ All Other C&D Materials	676 kg/m <sup>3</sup>
Bulky Domestic	86 kg/m <sup>3</sup>
Car Wrecks/Tires	131 kg/m <sup>3</sup>
Cruise Ship	213 kg/m <sup>3</sup>
Airport	213 kg/m <sup>3</sup>
Hazardous	640 kg/m <sup>3</sup>
Medical	80 kg/m <sup>3</sup>
Mixed	208 kg/m <sup>3</sup>

The overall waste entering the landfill (excluding that from the generator “Other Waste” which is mostly water), breaks down across the generators (on a planning level basis) as follows:

**Table 4-10**  
**Waste Breakdown by Generator**

<b>Generator</b>	<b>Percent of Total</b>
Residential Waste	6%
Commercial Waste	6%
Industrial Waste	1%

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Generator	Percent of Total
Yard Waste	9%
Stray Waste	2%
Construction Waste	
▪ Wood	16%
▪ All Other C&D Materials	29%
Bulky Domestic Waste	1%
Car Wrecks/Tires*	0%
Cruise Ship Waste*	0%
Airport Waste*	0%
Hazardous Waste*	0%
Medical Waste*	0%
Mixed Waste	29%

\* The amount of waste from these generators is more than 0 but makes up less than 1 percent (when rounded) of the entire waste stream

The resulting density (as a weighted average) is approximately 333 kg/m<sup>3</sup>.

The overall waste entering the landfill excluding that from the generator “Other Waste” (which is mostly water) and any wood from the “Construction Waste” generator breaks down across the generators as follows:

**Table 4-10**  
**Waste Breakdown by Generator Excluding Wood**

Generator	Percent of Total
Residential Waste	7%
Commercial Waste	7%
Industrial Waste	1%
Yard Waste	11%
Stray Waste	2%
Construction Waste	
▪ All Other C&D Materials	35%
Bulky Domestic Waste	1%
Car Wrecks/Tires*	0%
Cruise Ship Waste*	0%
Airport Waste*	0%
Hazardous Waste*	0%
Medical Waste*	0%

## WASTE CHARACTERIZATION RESULTS

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<b>Generator</b>	<b>Percent of Total</b>
Mixed Waste	35%

\*The amount of waste from these generators is more than 0 but makes up less than 1 percent (when rounded) of the entire waste stream

The resulting density excluding “Construction Waste” wood (as a weighted average) is approximately 370 kg/m<sup>3</sup>.

## Section 5

# FUTURE DISPOSAL SCENARIOS AND MATERIAL FLOW

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## Introduction

As a guide in planning for the amount of waste that will be available for throughput at the proposed WTE and WR facility, it is useful to estimate a range of future tonnage volumes expected to be generated on the Dutch side of the island. This projection can then be combined with the results of the waste characterization study to estimate how much of each material will be generated, assuming a constant composition through time. The value of such an analysis is highly dependent upon the availability of historical generation or disposal data that can shed light on the relationship between the island's economic activity and the quantity of waste disposed.

## Approach

### Base Case

No previous historical data on disposal at the Pond Island Landfill was available, as the facility has not had a scale house system in place until very recently. R. W. Beck had anticipated such a data shortfall prior to the project, and had devised various alternative methods for deriving disposal projections. The per-capita generation rate and associated annual extrapolation was selected as the method of choice given the available data. The series of steps below summarize our approach to development of Base Case projections:

1. During the week of the gate survey and all succeeding weeks leading up to report delivery, data gathered from the new landfill scale house system was provided to R. W. Beck. Each daily report summarizes the total incoming tonnage and allocates the waste into one of 14 categories. These reports were reviewed for completeness by R. W. Beck, and were used to determine an estimate of the average weekly incoming waste. These average weekly rates were then extrapolated to annual values to estimate total annual disposal for the current year. An examination of the generation trends on a weekly basis showed a somewhat declining generation rate which appeared to stabilize around week 19 as debris from construction work decreased. However, as evidenced by Figure 4-1, the total amount of weekly waste fluctuated somewhat even in the more stable period, driven by fluctuations in construction waste. Ultimately, after some review and feedback from WWR regarding the units in which the weights were recorded, which differed in some weeks, the entire data set was utilized to determine an extrapolated annual value.

## Section 5

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2. Using the most recent historical and projected population data from the Central Bureau of Statistics (“CBS”), a per-capita<sup>2</sup> generation rate for the island was developed by taking the extrapolated total annual tonnage at the facility and dividing it by the estimated population for the year 2009. R. W. Beck reviewed numerous potential data sets and various views regarding future growth as potentially useful drivers of the forecast. The CBS forecast was determined to be the most credible third-party projection of future demographic activity, and posited a “limits to growth” depiction of the future that appears to appropriately capture the long-term growth constraints on an island. Based on notes and feedback gathered on site, a 5% reduction to the total tonnage generated was applied to the facility totals to account for French side loads that made it to the landfill (either due to the closeness of Pond Island Landfill to French loads or so as to avoid French disposal tip fees). This adjustment was made for planning purposes, as the proposed facility should be designed to receive Dutch generated wastes.
3. The per-capita rate from Step 2 was applied to the future values of population as developed by the CBS to arrive at a future Base Case available waste for disposal. The CBS projection was reported in 5 year intervals, so a linear interpolation was performed to fill in the missing population years.

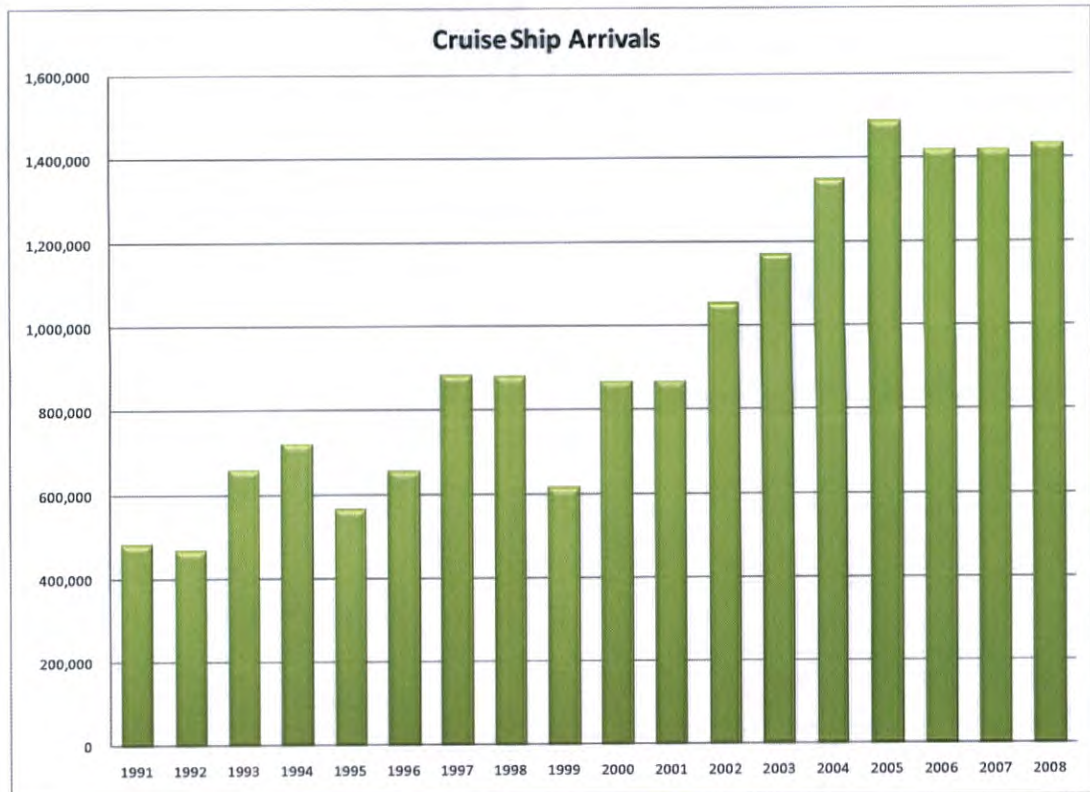
## Scenarios

Given that there was no historical data upon which to build relationships, the scope of the scenarios was limited. However, historical data on tourist activity was provided. The uncertainty surrounding the health of the tourism industry for the island can be a significant driver of uncertainty in waste generation. Figure 5-1 below summarizes reported tourists from cruise ship arrivals, which have increased significantly in recent years and have an annual volatility of about 19%.

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<sup>2</sup> The term “per-capita” is used loosely here, as the CBS population projection has been assumed to represent the entire island (both French and Dutch sides). Therefore, while the resulting ratio may not be accurate in terms of actual Dutch side per-capita generation, it is appropriate as a ratio to explain future generation, given a projection of population from a reliable source. The true on-site number of people on the island also includes individuals who may be residing on the island illegally, tourists who frequent the island, and cruise ship arrivals.

## FUTURE DISPOSAL SCENARIOS AND MATERIAL FLOW



**Figure 5-1: Historical SXM Tourists from Cruise Ship Arrivals**

Additionally, given the variation in weekly scale house data on generation resulting from construction activity, it is critical to the planning process to understand the range of potential futures for available disposal should construction activity on average be far lower than the rate sampled during this study.

In order to construct scenarios for a “high” and “low” tourism case, historical volatility analysis was conducted on the tourism data available. This variability was then applied to the Base Case projection, creating a bound around the Base Case. Because of the nature of the historical analysis and the highly volatile tourism counts through time, the projected range around the Base Case grows over time, and does so steadily given the limited nature and quality of the data. While the high and low cases represent a significant amount of uncertainty, they are a conservative estimation of the volatility that may be present in the future in terms of disposal.

### Material Flow

The process for deriving material flow is simply the allocation of the total disposal amount for the Base Case into its constituent parts by using the composition results presented in Section 4. Because a portion of the composition samples were processed using a visual audit, the appropriate density factors were applied to these samples and they were combined with the regularly sorted samples to arrive at an aggregated composition result. The total disposal forecast in each year was multiplied by the

## Section 5

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category composition results to arrive at a tonnage forecast by material grouping in each year, assuming a constant composition.

The Results subsection below details the Base, high, and low disposal projections, as well as the material flow projection.

### Principle Assumptions and Considerations

The results presented herein must be reviewed carefully given the following principle considerations and assumptions:

- The type of data typically required to produce a defensible forecast of the future was not available for this project. While the proxy method used represents the best available estimate of future disposal that can be produced given the data at hand, it is subject to uncertainty driven from the following:
  - The forecast is not based on historical relationships;
  - The scale house data-set utilized to generate per-capita disposal rates is based on a limited period of time, which may not completely account for seasonal issues;
  - The CBS forecast of population is subject to its own margin of error, and
  - Data on tourism visits was highly volatile for the period available.
- While R. W. Beck has taken care to exclude observations of daily generation that represented out of the ordinary activity related to construction and seasonal events (Carnival, etc.) the residual impact of such activity may have a minor impact on estimated generation rates.
- This analysis utilizes the composition results developed in the field. Please refer to other sections in this report for details on some caveats related to the field work, and the general limitations of the waste characterization process.
- While the projections of material flow are suitable for the purposes intended herein, it is important to note that the composition of waste utilized is a “snapshot” in time. Changes in the composition of waste in the future resulting from innovation, material obsolescence, regulatory activities, or other factors related to waste generation are not captured in this analysis.
- The projections have ignored a negligible amount of scrap metal (about 5 Mtons) delivered to the metal scrap facility on the island.

### Results

Table 5-1 below summarizes the Base Case and high and low tourism results for available disposal for the years 2010 to 2020.

## FUTURE DISPOSAL SCENARIOS AND MATERIAL FLOW

**Table 5-1**  
**Summary of Projected Available Disposal (2010 – 2020)**

Mtons				
Year	Projected Population <sup>[1]</sup>	Total Disposal <sup>[2]</sup>	High Tourism <sup>[3]</sup>	Low Tourism <sup>[4]</sup>
2010	38,843	117,433	133,309	101,557
2011	39,166	118,409	137,666	99,153
2012	39,489	119,386	141,662	97,110
2013	39,812	120,363	145,438	95,287
2014	40,135	121,339	149,069	93,609
2015	40,458	122,316	152,603	92,028
2016	40,706	123,065	155,783	90,347
2017	40,954	123,814	158,911	88,717
2018	41,201	124,563	162,003	87,123
2019	41,449	125,312	165,074	85,551
2020	41,697	126,061	168,132	83,991

Average Annual Growth Rates (2010 - 2020)			
0.7%	0.7%	2.3%	-1.9%

**Footnotes**

[1] Source: CBS Population Forecast (January 2006). Linear interpolation has been used to project intervening years, as the CBS projection data was available in increments of five years.

[2] Based on a per-capita generation rate derived from very recent scale-house data by day, extrapolated to a year. Future values of population projection drive the Base Case projection for total disposal.

[3] Projected amount of disposal as a percentage of the Base Case as a function of the uncertainty in tourist visits to SXM. Uncertainty in the projection grows over time.

[4] Symmetrical case to High Tourism, but with a pessimistic application of uncertainty in tourist visits.

As evidenced in Table 5-1, disposal is expected to grow at an average annual rate of 0.7%, in alignment with the CBS population projection of 0.7% growth per year, which as mentioned previously is assumed to consist of the entire island's resident population, and is being used solely as a ratio (and not as a benchmark for per-capita generation). The uncertainty in tourism generates a range of growth rates for disposal between 2.4% per year (high case) and a decline of 1.9% per year (low case).



## Section 5

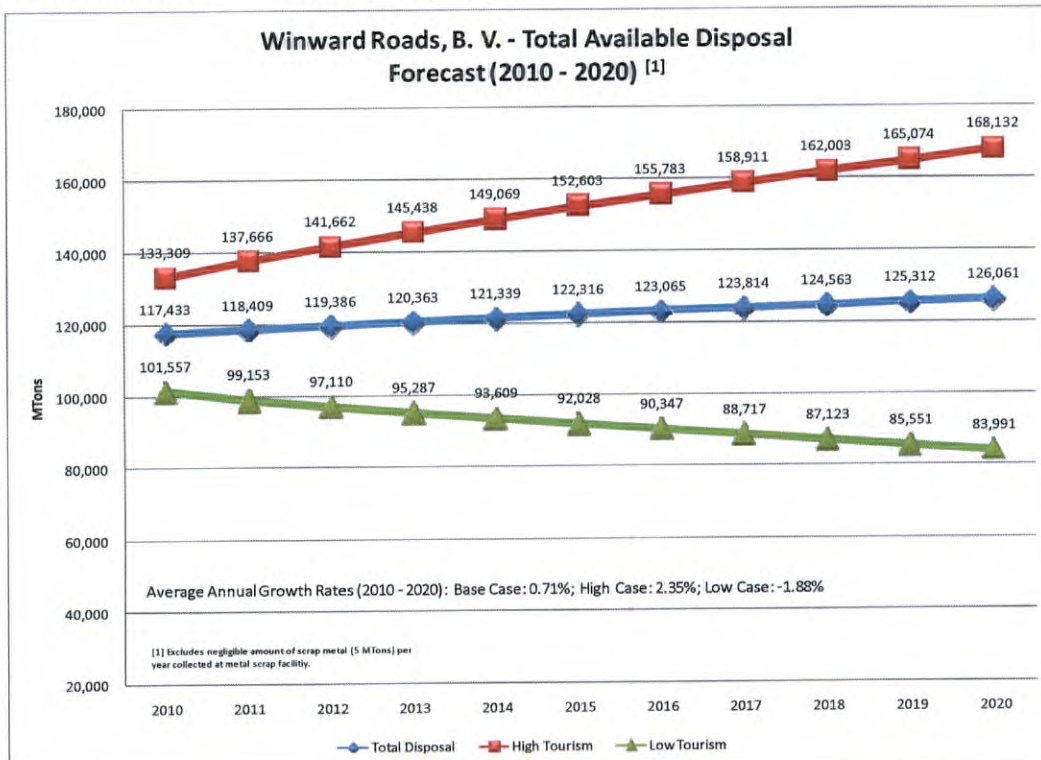
Despite the large range around the Base Case, it is important to note that the high/low cases are intended to represent a 90% confidence interval for future available disposal, and that they can be interpreted as extreme cases (i.e., there is a 5% likelihood that available disposal will be either above the high case or below the low case, respectively).

The Base Case projection estimates that 117,433 Mtons will be available for disposal in 2010, increasing to 122,316 Mtons in 2015 and 126,061 Mtons by 2020.

It is important to gain a tangible reference point to benchmark the resulting metric ton projection. The CBS estimates native island population to be around 40,000. The addition of about 40,000 tourists on the island at any one time, coupled with about 1.4 million tourists from cruise ship arrivals, who can be conjectured to spend some time on the island (around 1% of time spent on the island would still amount to the equivalent of about 14,000 natives), and possible illegal residents, could push the equivalent net island population to as much as 120,000.

This translates to about 0.98 Mtons or 1.08 US tons per person per year. The EPA estimates that US waste generation is on the order of about 0.87 – 1.0 tons per person per year, with higher rates for heavy tourist areas. As the US estimate pertains to Municipal Solid Waste (“MSW”), and excludes construction debris, it appears that the resulting generation rates are within the realm of reasonableness.

These same results are depicted graphically in Figure 5-2 below.



**Figure 5-2: Forecast of Total Available Disposal**

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## FUTURE DISPOSAL SCENARIOS AND MATERIAL FLOW

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Table 5-2 below summarizes the material flow projection for a high-level set of material categories, using the Base Case disposal projections. Notice the relatively high amount of construction materials, as based on the composition results.

**Table 5-2**  
**High-Level Material Flow Projection (2010)**

Category	Mtons (2010)
Paper	11,280
Plastics	8,081
Glass	8,104
Metals	6,635
Organics	17,804
Inorganics	280
Yard Waste	14,010
Construction	48,186
HHW	788
Other Waste	2,265
<b>Total</b>	<b>117,433</b>

Appendix B provides a complete material flow projection through 2020 with a partitioning of the tonnage into all of the material categories sorted in the study. The same results can be produced for the high and low tourism scenarios by applying the waste composition results (percentages) to the corresponding estimated available disposals (Mtons) shown in Figure 5-2.

### Summary

In summary, the Base Case projects available disposal to grow at 0.7% per year, with a 90% confidence interval around that growth of 2.4% per year and a decline of 1.9% per year, driven from volatility in tourism.

Gathering more information in the future, including more weekly scale house observations, fully investigating potential sources of growth on the island, and obtaining a revised Base Case CBS population projection as conditions warrant, may help decrease the uncertainty surrounding the range of potential available disposal in the future. As historical data on disposal quantities becomes available, the underlying relationship between the island's economy and available disposal can be investigated.



## Appendix A

# WASTE CHARACTERIZATION RESULTS BY GENERATOR

The tables in this appendix show the estimated annual weight projected for each of the sampled and sorted generators for the year 2010. Each table also shows the mean composition and the corresponding 90 percent confidence interval.

**Table A-1**  
**Waste Characterization Results - House Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>962.3</b>	<b>16.6%</b>	<b>14.0%</b>	<b>19.4%</b>
	1 Newspaper	91.1	1.6%	0.8%	2.5%
	2 Corrugated Paper	255.2	4.4%	3.0%	6.1%
	3 High Grade/Magazine/Books	94.3	1.6%	0.8%	2.8%
	4 Other Paper	521.7	9.0%	7.3%	10.8%
<b>Plastics</b>		<b>885.5</b>	<b>15.3%</b>	<b>12.7%</b>	<b>18.1%</b>
	5 HDPE	58.5	1.0%	0.7%	1.3%
	6 PET	131.5	2.3%	1.6%	3.1%
	7 Plastic Film	446.6	7.7%	6.5%	9.0%
	8 Other Plastics	249.0	4.3%	3.2%	5.6%
<b>Glass</b>		<b>943.0</b>	<b>16.3%</b>	<b>11.4%</b>	<b>21.9%</b>
	9 Glass Containers	894.7	15.4%	10.6%	21.0%
	10 Other Glass	48.3	0.8%	0.4%	1.5%
<b>Metals</b>		<b>321.6</b>	<b>5.5%</b>	<b>4.1%</b>	<b>7.2%</b>
	11 Other Ferrous	179.8	3.1%	1.9%	4.5%
	12 Aluminum	72.4	1.3%	1.0%	1.6%
	13 Other Non-Ferrous	35.2	0.6%	0.1%	1.4%
	14 Other Metals	34.1	0.6%	0.2%	1.1%
<b>Organics</b>		<b>1,681.7</b>	<b>29.0%</b>	<b>25.1%</b>	<b>33.1%</b>
	15 Food Waste	875.4	15.1%	12.3%	18.1%
	16 Textiles	335.2	5.8%	3.1%	9.3%
	17 Tires	0.0	0.0%	0.0%	0.0%
	18 Rubber Products	2.8	0.0%	0.0%	0.1%
	19 Other Organics/Fines	468.2	8.1%	6.6%	9.7%

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Inorganics</b>		<b>23.6</b>	<b>0.4%</b>	<b>0.1%</b>	<b>0.9%</b>
	20 Miscellaneous Inorganics	23.6	0.4%	0.1%	0.9%
<b>Yard Waste</b>		<b>473.0</b>	<b>8.2%</b>	<b>3.3%</b>	<b>15.0%</b>
	21 Yard Waste	473.0	8.2%	3.3%	15.0%
<b>Construction</b>		<b>340.4</b>	<b>5.9%</b>	<b>1.9%</b>	<b>11.8%</b>
	22 Wood	178.1	3.1%	0.7%	7.0%
	23 Other C&D	162.3	2.8%	0.7%	6.3%
<b>HHW</b>		<b>38.1</b>	<b>0.7%</b>	<b>0.2%</b>	<b>1.3%</b>
	24 Batteries	2.0	0.0%	0.0%	0.1%
	25 Other HHW	36.1	0.6%	0.2%	1.3%
<b>Other Waste</b>		<b>124.6</b>	<b>2.2%</b>	<b>0.4%</b>	<b>5.1%</b>
	26 Durables	124.6	2.2%	0.4%	5.1%
<b>TOTAL</b>		<b>5,793.8</b>	<b>100.0%</b>		

\* Results based on 14 samples.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-2**  
**Waste Characterization Results - Commercial Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>3,026.3</b>	<b>23.7%</b>	<b>15.9%</b>	<b>32.5%</b>
	1 Newspaper	130.8	1.0%	0.4%	1.9%
	2 Corrugated Paper	1,446.8	11.3%	6.6%	17.1%
	3 High Grade/Magazine/Books	257.3	2.0%	0.9%	3.6%
	4 Other Paper	1,191.4	9.3%	5.9%	13.4%
<b>Plastics</b>		<b>1,702.7</b>	<b>13.3%</b>	<b>9.2%</b>	<b>18.0%</b>
	5 HDPE	54.5	0.4%	0.2%	0.8%
	6 PET	235.4	1.8%	1.0%	2.9%
	7 Plastic Film	896.3	7.0%	4.3%	10.4%
	8 Other Plastics	516.5	4.0%	2.2%	6.4%
<b>Glass</b>		<b>1,268.9</b>	<b>9.9%</b>	<b>5.1%</b>	<b>16.1%</b>
	9 Glass Containers	1,093.2	8.6%	4.0%	14.6%
	10 Other Glass	175.7	1.4%	0.4%	2.9%
<b>Metals</b>		<b>1,104.6</b>	<b>8.6%</b>	<b>3.9%</b>	<b>15.1%</b>
	11 Other Ferrous	635.8	5.0%	1.4%	10.6%
	12 Aluminum	401.1	3.1%	1.1%	6.1%
	13 Other Non-Ferrous	8.1	0.1%	0.0%	0.1%
	14 Other Metals	59.7	0.5%	0.2%	0.9%
<b>Organics</b>		<b>3,214.2</b>	<b>25.1%</b>	<b>14.0%</b>	<b>38.3%</b>
	15 Food Waste	2,453.0	19.2%	8.8%	32.4%
	16 Textiles	217.3	1.7%	0.6%	3.4%
	17 Tires	0.0	0.0%	0.0%	0.0%
	18 Rubber Products	6.2	0.0%	0.0%	0.1%
	19 Other Organics/Fines	537.7	4.2%	2.1%	7.0%
<b>Inorganics</b>		<b>4.2</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.1%</b>
	20 Miscellaneous Inorganics	4.2	0.0%	0.0%	0.1%
<b>Yard Waste</b>		<b>506.6</b>	<b>4.0%</b>	<b>1.0%</b>	<b>8.9%</b>
	21 Yard Waste	506.6	4.0%	1.0%	8.9%
<b>Construction</b>		<b>1,552.6</b>	<b>12.1%</b>	<b>3.2%</b>	<b>25.7%</b>
	22 Wood	1,502.1	11.8%	2.9%	25.5%
	23 Other C&D	50.5	0.4%	0.1%	0.9%

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>HHW</b>		<b>102.4</b>	<b>0.8%</b>	<b>0.2%</b>	<b>1.8%</b>
	24 Batteries	0.5	0.0%	0.0%	0.0%
	25 Other HHW	101.8	0.8%	0.2%	1.8%
<b>Other Waste</b>		<b>298.6</b>	<b>2.3%</b>	<b>0.4%</b>	<b>6.0%</b>
	26 Durables	298.6	2.3%	0.4%	6.0%
<b>TOTAL</b>		<b>12,781.0</b>	<b>100.0%</b>		

\* Results based on 14 samples.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-3  
Waste Characterization Results - Industrial Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>19.6</b>	<b>9.1%</b>	<b>0.1%</b>	<b>29.7%</b>
	1 Newspaper	0.0	0.0%	0.0%	0.0%
	2 Corrugated Paper	13.9	6.4%	0.0%	25.8%
	3 High Grade/Magazine/Books	0.0	0.0%	0.0%	0.0%
	4 Other Paper	5.8	2.7%	0.0%	11.7%
<b>Plastics</b>		<b>1.7</b>	<b>0.8%</b>	<b>0.0%</b>	<b>2.5%</b>
	5 HDPE	0.0	0.0%	0.0%	0.0%
	6 PET	0.0	0.0%	0.0%	0.0%
	7 Plastic Film	0.2	0.1%	0.0%	0.4%
	8 Other Plastics	1.5	0.7%	0.0%	2.6%
<b>Glass</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	9 Glass Containers	0.0	0.0%	0.0%	0.0%
	10 Other Glass	0.0	0.0%	0.0%	0.0%
<b>Metals</b>		<b>26.6</b>	<b>12.3%</b>	<b>0.5%</b>	<b>50.0%</b>
	11 Other Ferrous	26.6	12.3%	0.5%	50.0%
	12 Aluminum	0.0	0.0%	0.0%	0.0%
	13 Other Non-Ferrous	0.0	0.0%	0.0%	0.0%
	14 Other Metals	0.0	0.0%	0.0%	0.0%
<b>Organics</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	15 Food Waste	0.0	0.0%	0.0%	0.0%
	16 Textiles	0.0	0.0%	0.0%	0.0%
	17 Tires	0.0	0.0%	0.0%	0.0%
	18 Rubber Products	0.0	0.0%	0.0%	0.0%
	19 Other Organics/Fines	0.0	0.0%	0.0%	0.0%
<b>Inorganics</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	20 Miscellaneous Inorganics	0.0	0.0%	0.0%	0.0%
<b>Yard Waste</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	21 Yard Waste	0.0	0.0%	0.0%	0.0%
<b>Construction</b>		<b>168.8</b>	<b>77.9%</b>	<b>42.5%</b>	<b>98.6%</b>
	22 Wood	168.8	77.9%	42.5%	98.6%
	23 Other C&D	0.0	0.0%	0.0%	0.0%



## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
HHW		0.0	0.0%	0.0%	0.0%
	24 Batteries	0.0	0.0%	0.0%	0.0%
	25 Other HHW	0.0	0.0%	0.0%	0.0%
Other Waste		0.0	0.0%	0.0%	0.0%
	26 Durables	0.0	0.0%	0.0%	0.0%
<b>TOTAL</b>		<b>216.7</b>	<b>100.0%</b>		

\* Results based on 5 samples.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-4**  
**Waste Characterization Results - Yard Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>99.0</b>	<b>1.4%</b>	<b>0.3%</b>	<b>3.2%</b>
	1 Newspaper	4.2	0.1%	0.0%	0.2%
	2 Corrugated Paper	83.0	1.1%	0.2%	2.8%
	3 High Grade/Magazine/Books	0.0	0.0%	0.0%	0.0%
	4 Other Paper	11.8	0.2%	0.0%	0.4%
<b>Plastics</b>		<b>52.0</b>	<b>0.7%</b>	<b>0.1%</b>	<b>1.7%</b>
	5 HDPE	0.5	0.0%	0.0%	0.0%
	6 PET	1.4	0.0%	0.0%	0.1%
	7 Plastic Film	35.9	0.5%	0.1%	1.3%
	8 Other Plastics	14.3	0.2%	0.0%	0.4%
<b>Glass</b>		<b>5.6</b>	<b>0.1%</b>	<b>0.0%</b>	<b>0.2%</b>
	9 Glass Containers	5.6	0.1%	0.0%	0.2%
	10 Other Glass	0.0	0.0%	0.0%	0.0%
<b>Metals</b>		<b>19.2</b>	<b>0.3%</b>	<b>0.0%</b>	<b>0.7%</b>
	11 Other Ferrous	5.1	0.1%	0.0%	0.2%
	12 Aluminum	2.3	0.0%	0.0%	0.1%
	13 Other Non-Ferrous	2.1	0.0%	0.0%	0.1%
	14 Other Metals	9.7	0.1%	0.0%	0.4%
<b>Organics</b>		<b>80.5</b>	<b>1.1%</b>	<b>0.2%</b>	<b>2.7%</b>
	15 Food Waste	12.5	0.2%	0.0%	0.5%
	16 Textiles	47.9	0.7%	0.1%	1.8%
	17 Tires	0.0	0.0%	0.0%	0.0%
	18 Rubber Products	9.9	0.1%	0.0%	0.4%
	19 Other Organics/Fines	10.2	0.1%	0.0%	0.4%
<b>Inorganics</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	20 Miscellaneous Inorganics	0.0	0.0%	0.0%	0.0%
<b>Yard Waste</b>		<b>6,368.8</b>	<b>87.6%</b>	<b>73.0%</b>	<b>97.0%</b>
	21 Yard Waste	6,368.8	87.6%	73.0%	97.0%
<b>Construction</b>		<b>640.0</b>	<b>8.8%</b>	<b>1.9%</b>	<b>20.1%</b>
	22 Wood	546.3	7.5%	1.3%	18.3%
	23 Other C&D	93.8	1.3%	0.1%	3.6%

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>HHW</b>		<b>6.5</b>	<b>0.1%</b>	<b>0.0%</b>	<b>0.3%</b>
	24 Batteries	0.0	0.0%	0.0%	0.0%
	25 Other HHW	6.5	0.1%	0.0%	0.3%
<b>Other Waste</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
	26 Durables	0.0	0.0%	0.0%	0.0%
<b>TOTAL</b>		<b>7,271.7</b>	<b>100.0%</b>		

\*Results based on 11 samples.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-5  
Waste Characterization Results - Stray Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)
<b>Paper</b>		<b>65.7</b>	<b>14.1%</b>
	1 Newspaper	3.6	0.8%
	2 Corrugated Paper	33.7	7.2%
	3 High Grade/Magazine/Books	3.7	0.8%
	4 Other Paper	24.8	5.3%
<b>Plastics</b>		<b>3.6</b>	<b>0.8%</b>
	5 HDPE	0.6	0.1%
	6 PET	0.5	0.1%
	7 Plastic Film	1.3	0.3%
	8 Other Plastics	1.2	0.3%
<b>Glass</b>		<b>7.2</b>	<b>1.5%</b>
	9 Glass Containers	0.0	0.0%
	10 Other Glass	7.2	1.5%
<b>Metals</b>		<b>73.2</b>	<b>15.7%</b>
	11 Other Ferrous	72.7	15.6%
	12 Aluminum	0.5	0.1%
	13 Other Non-Ferrous	0.0	0.0%
	14 Other Metals	0.0	0.0%
<b>Organics</b>		<b>60.9</b>	<b>13.0%</b>
	15 Food Waste	51.0	10.9%
	16 Textiles	9.9	2.1%
	17 Tires	0.0	0.0%
	18 Rubber Products	0.0	0.0%
	19 Other Organics/Fines	0.0	0.0%
<b>Inorganics</b>		<b>0.0</b>	<b>0.0%</b>
	20 Miscellaneous Inorganics	0.0	0.0%
<b>Yard Waste</b>		<b>160.7</b>	<b>34.4%</b>
	21 Yard Waste	160.7	34.4%
<b>Construction</b>		<b>29.8</b>	<b>6.4%</b>
	22 Wood	12.6	2.7%
	23 Other C&D	17.2	3.7%

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

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Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)
HHW		0.0	0.0%
	24 Batteries	0.0	0.0%
	25 Other HHW	0.0	0.0%
Other Waste		66.2	14.2%
	26 Durables	66.2	14.2%
<b>TOTAL</b>		<b>467.4</b>	<b>100.0%</b>

\*Results based on 2 samples which is an insufficient number for statistical inference.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-6**  
**Waste Characterization Results - Construction Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>316.7</b>	<b>0.7%</b>	<b>0.4%</b>	<b>1.0%</b>
	1 Newspaper	0.0	0.0%	0.0%	0.0%
	2 Corrugated Paper	174.6	0.4%	0.2%	0.6%
	3 High Grade/Magazine/Books	0.0	0.0%	0.0%	0.0%
	4 Other Paper	142.1	0.3%	0.2%	0.5%
<b>Plastics</b>		<b>87.0</b>	<b>0.2%</b>	<b>0.1%</b>	<b>0.3%</b>
	5 HDPE	0.0	0.0%	0.0%	0.0%
	6 PET	9.9	0.0%	0.0%	0.0%
	7 Plastic Film	44.4	0.1%	0.1%	0.1%
	8 Other Plastics	32.7	0.1%	0.0%	0.1%
<b>Glass</b>		<b>306.9</b>	<b>0.6%</b>	<b>0.3%</b>	<b>1.1%</b>
	9 Glass Containers	65.7	0.1%	0.1%	0.2%
	10 Other Glass	241.2	0.5%	0.2%	0.9%
<b>Metals</b>		<b>2,611.7</b>	<b>5.5%</b>	<b>3.2%</b>	<b>8.3%</b>
	11 Other Ferrous	2,529.0	5.3%	3.1%	8.2%
	12 Aluminum	44.9	0.1%	0.0%	0.2%
	13 Other Non-Ferrous	24.8	0.1%	0.0%	0.1%
	14 Other Metals	13.0	0.0%	0.0%	0.0%
<b>Organics</b>		<b>213.9</b>	<b>0.5%</b>	<b>0.2%</b>	<b>0.7%</b>
	15 Food Waste	0.0	0.0%	0.0%	0.0%
	16 Textiles	151.9	0.3%	0.2%	0.5%
	17 Tires	10.3	0.0%	0.0%	0.0%
	18 Rubber Products	8.9	0.0%	0.0%	0.0%
	19 Other Organics/Fines	42.9	0.1%	0.0%	0.2%
<b>Inorganics</b>		<b>94.9</b>	<b>0.2%</b>	<b>0.1%</b>	<b>0.3%</b>
	20 Miscellaneous Inorganics	94.9	0.2%	0.1%	0.3%
<b>Yard Waste</b>		<b>518.0</b>	<b>1.1%</b>	<b>0.6%</b>	<b>1.7%</b>
	21 Yard Waste	518.0	1.1%	0.6%	1.7%
<b>Construction</b>		<b>42,745.5</b>	<b>90.1%</b>	<b>86.1%</b>	<b>93.5%</b>
	22 Wood	17,232.7	36.3%	25.9%	47.4%
	23 Other C&D	25,512.8	53.8%	40.4%	66.9%

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
HHW		313.4	0.7%	0.3%	1.1%
	24 Batteries	0.0	0.0%	0.0%	0.0%
	25 Other HHW	313.4	0.7%	0.3%	1.1%
Other Waste		249.3	0.5%	0.3%	0.9%
	26 Durables	249.3	0.5%	0.3%	0.9%
<b>TOTAL</b>		<b>47,457.3</b>	<b>100.0%</b>		

\* Results based on 51 samples.

## WASTE CHARACTERIZATION RESULTS BY GENERATOR

**Table A-7**  
**Waste Characterization Results - Mixed Waste\***

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
<b>Paper</b>		<b>8,194.0</b>	<b>18.9%</b>	<b>15.6%</b>	<b>22.3%</b>
	1 Newspaper	954.8	2.2%	1.5%	3.0%
	2 Corrugated Paper	3,045.1	7.0%	5.1%	9.2%
	3 High Grade/Magazine/Books	803.8	1.9%	1.3%	2.5%
	4 Other Paper	3,390.4	7.8%	6.2%	9.6%
<b>Plastics</b>		<b>6,418.2</b>	<b>14.8%</b>	<b>12.6%</b>	<b>17.0%</b>
	5 HDPE	210.7	0.5%	0.4%	0.6%
	6 PET	1,515.6	3.5%	2.8%	4.2%
	7 Plastic Film	2,064.0	4.8%	3.9%	5.7%
	8 Other Plastics	2,627.9	6.0%	5.0%	7.2%
<b>Glass</b>		<b>6,726.2</b>	<b>15.5%</b>	<b>12.3%</b>	<b>18.9%</b>
	9 Glass Containers	6,198.9	14.3%	11.3%	17.6%
	10 Other Glass	527.3	1.2%	0.7%	1.9%
<b>Metals</b>		<b>2,597.6</b>	<b>6.0%</b>	<b>4.2%</b>	<b>8.1%</b>
	11 Other Ferrous	1,969.6	4.5%	2.9%	6.6%
	12 Aluminum	432.6	1.0%	0.8%	1.3%
	13 Other Non-Ferrous	0.7	0.0%	0.0%	0.0%
	14 Other Metals	194.7	0.4%	0.3%	0.7%
<b>Organics</b>		<b>9,524.4</b>	<b>21.9%</b>	<b>18.3%</b>	<b>25.8%</b>
	15 Food Waste	5,833.9	13.4%	10.9%	16.2%
	16 Textiles	923.2	2.1%	1.5%	2.8%
	17 Tires	83.8	0.2%	0.1%	0.4%
	18 Rubber Products	33.5	0.1%	0.0%	0.1%
	19 Other Organics/Fines	2,650.0	6.1%	4.8%	7.5%
<b>Inorganics</b>		<b>213.9</b>	<b>0.5%</b>	<b>0.2%</b>	<b>0.9%</b>
	20 Miscellaneous Inorganics	213.9	0.5%	0.2%	0.9%
<b>Yard Waste</b>		<b>4,967.7</b>	<b>11.4%</b>	<b>7.4%</b>	<b>16.2%</b>
	21 Yard Waste	4,967.7	11.4%	7.4%	16.2%
<b>Construction</b>		<b>3,665.4</b>	<b>8.4%</b>	<b>4.4%</b>	<b>13.6%</b>
	22 Wood	2,010.1	4.6%	2.4%	7.6%
	23 Other C&D	1,655.3	3.8%	1.6%	6.9%



## WASTE CHARACTERIZATION RESULTS BY GENERATOR

Material Group	Material	Weight Disposed in 2010 (Mtons)	Mean (%)	90 % Confidence Interval	
				Lower Bound	Upper Bound
HHW		476.1	1.1%	0.6%	1.7%
	24 Batteries	22.1	0.1%	0.0%	0.1%
	25 Other HHW	454.0	1.0%	0.6%	1.6%
Other Waste		661.4	1.5%	0.6%	2.8%
	26 Durables	661.4	1.5%	0.6%	2.8%
<b>TOTAL</b>		<b>43,445.1</b>	<b>100.0%</b>		

\* Results based on 33 samples.

## Appendix B COMPLETE MATERIAL FLOW PROJECTION THROUGH 2020

<u>Line No.</u>	<u>Material Category</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
1	<b>Paper</b>	11,280	11,374	11,468	11,562	11,656	11,749	11,821	11,893	11,965	12,037	12,109
2	Newspaper	969	977	985	993	1,001	1,009	1,015	1,022	1,028	1,034	1,040
3	Corrugated Paper	4,572	4,610	4,648	4,686	4,724	4,762	4,791	4,820	4,850	4,879	4,908
4	High Grade/Magazine/Books	983	992	1,000	1,008	1,016	1,024	1,030	1,037	1,043	1,049	1,056
5	Other Paper	4,756	4,796	4,835	4,875	4,914	4,954	4,984	5,015	5,045	5,075	5,106
6	<b>Plastics</b>	8,081	8,149	8,216	8,283	8,350	8,417	8,469	8,521	8,572	8,624	8,675
7	HDPE	313	316	318	321	324	326	328	330	332	334	336
8	PET	1,589	1,602	1,615	1,628	1,641	1,655	1,665	1,675	1,685	1,695	1,705
9	Plastic Film	3,314	3,342	3,369	3,397	3,424	3,452	3,473	3,494	3,515	3,536	3,558
10	Other Plastics	2,866	2,889	2,913	2,937	2,961	2,985	3,003	3,021	3,040	3,058	3,076
11	<b>Glass</b>	8,104	8,171	8,239	8,306	8,373	8,441	8,492	8,544	8,596	8,648	8,699
12	Glass Containers	7,247	7,307	7,368	7,428	7,488	7,548	7,595	7,641	7,687	7,733	7,779
13	Other Glass	857	864	871	878	885	892	898	903	909	914	920
14	<b>Metals</b>	6,635	6,690	6,745	6,801	6,856	6,911	6,953	6,996	7,038	7,080	7,123
15	Other Ferrous	5,391	5,435	5,480	5,525	5,570	5,615	5,649	5,684	5,718	5,752	5,787
16	Aluminum	859	866	873	881	888	895	900	906	911	917	922
17	Other Non-Ferrous	106	107	108	109	110	111	112	112	113	114	114
18	Other Metals	279	281	284	286	288	290	292	294	296	298	299

**COMPLETE MATERIAL FLOW PROJECTION THROUGH 2020**

<u>Line No.</u>	<u>Material Category</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
19	<b>Organics</b>	17,804	17,952	18,100	18,248	18,396	18,544	18,658	18,771	18,885	18,998	19,112
20	Food Waste	8,272	8,341	8,409	8,478	8,547	8,616	8,669	8,721	8,774	8,827	8,880
21	Textiles	1,738	1,752	1,767	1,781	1,795	1,810	1,821	1,832	1,843	1,854	1,865
22	Tires	644	650	655	661	666	671	675	680	684	688	692
23	Rubber Products	56	56	57	57	58	58	59	59	59	60	60
24	Other Organics/Fines	7,094	7,153	7,212	7,271	7,330	7,389	7,434	7,479	7,525	7,570	7,615
25	<b>Inorganics</b>	280	282	284	286	289	291	293	295	296	298	300
26	Miscellaneous Inorganics	280	282	284	286	289	291	293	295	296	298	300
27	<b>Yard Waste</b>	14,010	14,126	14,243	14,359	14,476	14,592	14,682	14,771	14,860	14,950	15,039
28	Yard Waste	14,010	14,126	14,243	14,359	14,476	14,592	14,682	14,771	14,860	14,950	15,039
29	<b>Construction</b>	48,186	48,586	48,987	49,388	49,789	50,189	50,497	50,804	51,111	51,419	51,726
30	Wood	23,047	23,239	23,430	23,622	23,814	24,005	24,152	24,299	24,446	24,593	24,740
31	Other C&D	25,139	25,348	25,557	25,766	25,975	26,184	26,344	26,505	26,665	26,826	26,986
32	<b>HHW</b>	788	795	801	808	814	821	826	831	836	841	846
33	Batteries	19	19	19	19	20	20	20	20	20	20	20
34	Other HHW	769	776	782	788	795	801	806	811	816	821	826
35	<b>Other Waste</b>	2,265	2,284	2,303	2,322	2,340	2,359	2,374	2,388	2,403	2,417	2,432
36	Durables	2,265	2,284	2,303	2,322	2,340	2,359	2,374	2,388	2,403	2,417	2,432
37	<b>Total Generation</b>	117,433	118,409	119,386	120,363	121,339	122,316	123,065	123,814	124,563	125,312	126,061

## Appendix C

# GENERATOR AND MATERIAL CATEGORY DEFINITIONS

The tables in this appendix show the definitions for both generator and material categories. Table C-1 shows the definitions of generators as used in this study.

**Table C-1**  
**Generator Definitions**

Generator	Definition
House waste	Waste coming from a residence or residential area
Commercial waste	Waste coming from a place of business that sells goods or services directly to end-users like a store, restaurant, or office
Industrial waste	Waste coming from a place of business that mainly manufactures goods for sale to the commercial sector
Yard waste	Waste produced through landscaping, tree trimming, or other garden replacement/maintenance activities
Stray waste	Waste collected from areas not intended for waste disposal such as along the side of the road – includes litter and street sweepings
Construction waste	Waste produced by the demolition, construction, or remodeling/decorating of roads or buildings
Bulky domestic waste	Waste coming from a residence or residential area that is too large to fit in a typical waste disposal receptacle – includes appliances (white goods), furniture, or other large household items
Car wrecks/tires	Waste comprised of whole or parts of cars including tires – generally, all such loads of waste were directed to dispose any metal at a scrap metal facility across from the landfill and thus were not regularly seen and/or recorded unless they contained only tires
Cruise ship waste	Any waste brought to the landfill from a cruise ship
Airport waste	Any waste brought to the landfill from the airport
Hazardous waste	Any waste that is flammable, toxic, explosive, corrosive, poisonous, potentially infectious or the like – includes pesticides, explosives, paints, oils, glues, and adhesives
Medical waste	Any bio-hazardous waste produced as a by-product of medical services – includes blood, tissue, syringes (sharps)
Other waste	Any waste that does not appropriately fit into any of the categories above – includes residual waste from septic trucks and disposal of used laundry water
Mixed waste	Waste delivered to the landfill from a location that produces any combination of the categories above – an example is a community bin that contains waste from residences and commercial business
Institutional waste	Waste delivered to the landfill from any organization dedicated to education, public service, culture or the like – includes waste from schools, prisons, hospitals (if not otherwise categorized as "medical waste")

## GENERATOR AND MATERIAL CATEGORY DEFINITIONS

Table C-2 shows the definitions of the material groups and materials, as used in this study. In some instances, examples are given to assist in describing a material. Not all possibilities of items categorized in a specific material category are provided.

**Table C-2**  
**Material Definitions**

Group	Material	Material Definition
Paper	1 Newspaper	Printed ground wood newsprint (Advertising "slicks"-glossy paper - if found mixed with newspaper; otherwise, ad slicks are included with High Grade/Magazine/Books.).
	2 Corrugated Paper	Old unwaxed/uncoated corrugated container boxes
	3 High Grade/Magazine/Books	White and lightly colored bond, rag, or stationary grade paper. This includes white or lightly colored sulfite/sulfate bond, copy papers, notebook paper, envelopes, Continuous-feed sulfite/sulfate computer printouts and forms of all types. Magazines and catalogs printed on glossy, coated paper stock. Low grade recyclable paper. Includes text books, other books and catalogs with ground wood paper; construction paper, junk mail, polycoated cartons and aseptic packages, blue prints, and glossy, coated paper.
	4 Other Paper	Low-grade non-recyclable paper. Includes tissue paper, napkins, paper towels, paper plates, paper food cartons, cigarette packages, waxed paper, wax or plastic coated corrugated boxes, coated FAX paper, and carbon paper, whether or not they are contaminated with fluids or food. Includes all other grades of paper if substantially contaminated with fluids or food waste.
Plastic	5 HDPE	Blow molded plastic bottles and jars (natural and pigmented) labeled #2 HDPE
	6 PET	Blow molded plastic bottles and jars labeled #1 PET
	7 Plastic Film	Any film plastic including garbage bags, retail bags, cereal bags, sheet plastic, shrink wrap, tarping, and other non-rigid plastic.
	8 Other Plastics	Includes other thermoformed or injection-molded rigid plastic not captured in the above categories. Includes tubs, trays and containers labeled #1, #2, #3, #4, #5, #6 and #7. Includes all non-container rigid plastics such as plastic pipe, electrical components, automotive components, toys, and foamed plastics.
Glass	9 Glass Containers	Recyclable beverage and food bottles and jars
	10 Other Glass	Pressed and blown glass products such as light bulbs, decorative items and fixtures, cooking ware, and flat or pressed glass products such as mirrors, windows, safety glass.

## GENERATOR AND MATERIAL CATEGORY DEFINITIONS

Table C-2  
Material Definitions

Group	Material	Material Definition
Metal	11 Other Ferrous	Ferrous and alloyed ferrous scrap metals from any source except intact white goods.
	12 Aluminum	Aluminum products and scrap that are 50% or more aluminum. Does not include aluminum appliances. May include nail files and other personal hygiene related and aluminum wire hangers. Also includes aluminum food containers, trays, foil, aluminum beverage cans (UBC), and bi-metal cans made mostly of aluminum.
	13 Other Non-Ferrous	Non-aluminum metals not derived from iron, to which a magnet will not adhere, and which are not significantly contaminated with other metals or materials.
	14 Other Metals	Any metal not captured by the above categories
Organics	15 Food Waste	Food wastes and scraps, including bone, rinds, etc. Excludes the weight of food containers, except when container weight is not appreciable compared to the food inside.
	16 Textiles	Fabric materials including natural and man-made textile materials made from cottons, wools, silks, nylon, rayon, polyesters, and other materials. This category includes clothing rags, curtains, and other fabric materials. Leather and leather goods are also included such as belts and wallets. Includes all shoes.
	17 Tires	Pneumatic tires from vehicles, including bicycles.
	18 Rubber Products	Finished products and scrap materials made of natural and synthetic rubber, such as bath mats, inner tubes, rubber hoses, foam rubber, tire pieces, latex gloves.
	19 Other Organics/Fines	Organic materials not otherwise categorized. Includes natural fibers, cork, hemp rope, wicker products, jute carpet backing, sawdust, hair and lint. Soap, bathroom products such as: bubble bath, body waste, shampoo, and conditioner. All particles capable of passing through a 1-inch screen if encountered loose, regardless of material type. Includes small pieces of paper, plastic, broken glass, metal, loose soil, food scraps, bottle caps, and grass clippings.
Inorganics	20 Miscellaneous Inorganics	Other inorganic materials not classified elsewhere.
Yard Waste	21 Yard Waste	Yard waste including grass clippings, leaves, garden trimmings, and brush up to 4 inches in diameter

## GENERATOR AND MATERIAL CATEGORY DEFINITIONS

Table C-2  
Material Definitions

Group	Material	Material Definition
C&D	22 Wood	Untreated, milled lumber commonly used in construction for framing and related uses. Pallets and wooden crates. Also includes lumber and wood products that have been painted or treated so as to render them difficult to compost. This includes painted and chemically treated lumber, plywood, strandboard, and particleboard.
	23 Other C&D	Construction debris that cannot be classified elsewhere and mixed fine building material scraps. Examples include, but are not limited to, wire, asphaltic roofing, bricks, rock, concrete, construction-related dirt, drywall, and fiberglass insulation.
HHW	24 Batteries	Lead-acid batteries used in automobiles, motorcycles, golf carts, alkaline batteries, and other household use batteries. It also includes small rechargeable batteries typically found in toys, appliances, and cellular telephones.
	25 Other HHW	Hazardous Waste not described in any of the above categories that can be potentially harmful if disposed of improperly, including household cleaners and chemicals, detergents, fire extinguishers, pesticides, and herbicides.
Other Waste	26 Durables	Discarded, enamel-coated major appliances, such as washing machines, clothes dryers, hot water heaters, stoves, refrigerators, and freezers. Also includes stainless steel washers, refrigerators, furniture and any other bulk item.

## Appendix D

### CONSTRUCTION WASTE SAMPLES

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The amount of construction waste disposed during this study was much more than expected during the planning phase. The materials list included categories common in construction and demolition (“C&D”) waste like cardboard, film and other plastics, ferrous and non-ferrous metals, wood, and large durable items. The “catch all” material category of “Other C&D” was included in the event materials were present that did not readily align with the other material categories.

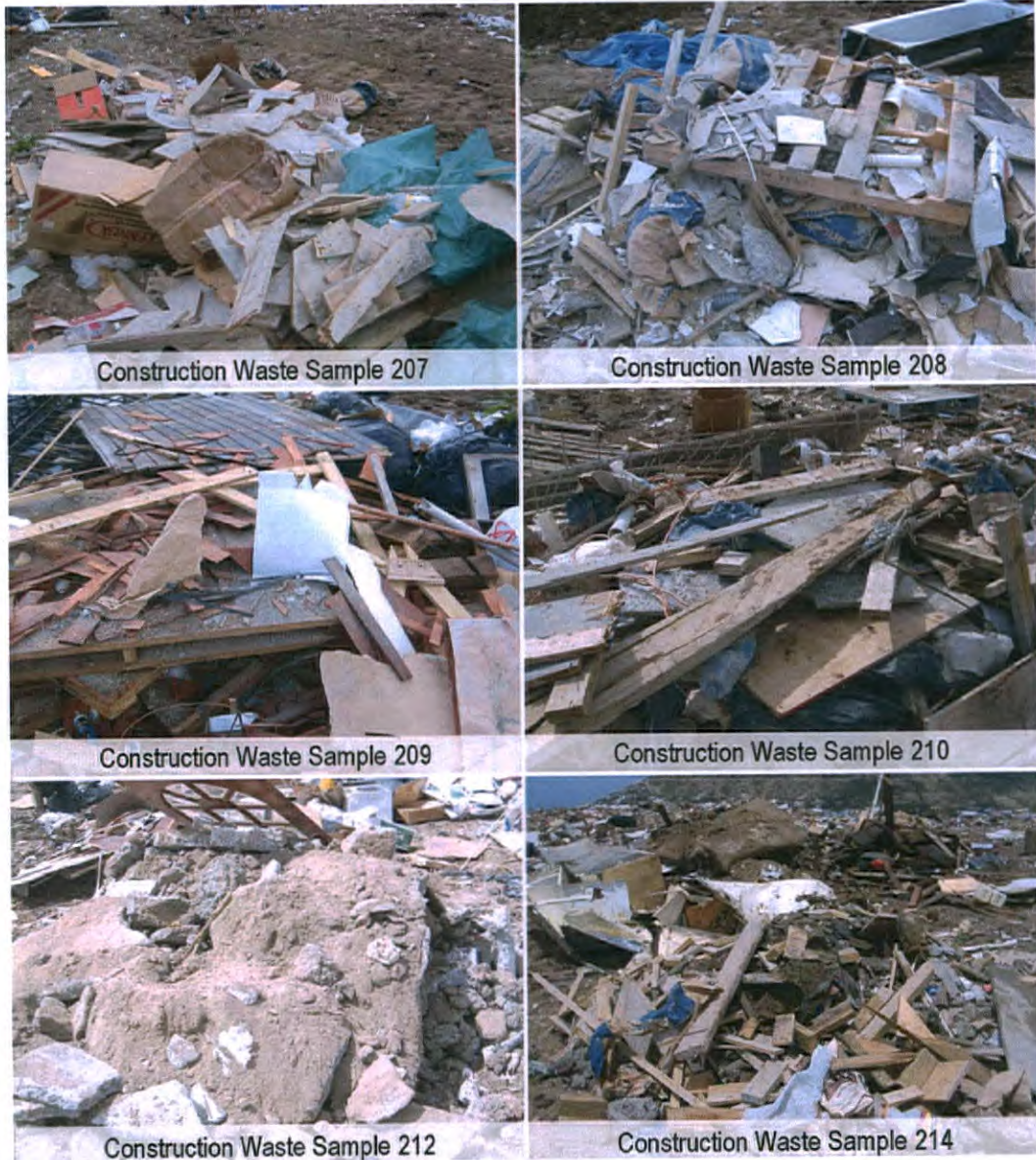
There was quite a lot of wood present in the samples. Additionally, road construction debris (and similar) was commonly seen. Items like bricks, rocks, dirt, fiberglass insulation, gypsum or dry wall were all assigned to the “Other C&D” material category.

The pictures on the following pages show some construction-generated waste loads that were sampled and visually sorted. Not all loads that were sampled were photographed.



## CONSTRUCTION WASTE SAMPLES

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**Figure D-1: Pictures of Construction Waste Samples**

## CONSTRUCTION WASTE SAMPLES

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**Figure D-1 (Continued): Pictures of Construction Waste Samples**

## CONSTRUCTION WASTE SAMPLES

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**Figure D-1 (Continued): Pictures of Construction Waste Samples**



## Environmental and Health Impact Assessment (EHIA) of the Solid Waste Management & Processing Facility (SWMPF) Sint Maarten

October 29, 2009  
Final Document





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1

**SUMMARY**

**Introduction**

The Government of the Island Territory of Sint Maarten launched a tender procedure for a new waste treatment facility on Sint Maarten. This new facility should be erected at Pond Island, Philipsburg, Sint Maarten. After evaluating the proposals, the Tender Board decided that Windward Roads B.V., proposing a batch process thermal gasification technology, had the most economically and environmentally advantageous proposal. Part of the tender procedure is the assessment of the environmental and health impacts of the project. The results of this assessment are presented in this report.

**Technology (Base Case)**

The facility (Solid Waste Management and Processing Facility, or SWMPF) is roughly divided in 2 plants: a gasification plant using a continuous Batch Oxidation System or cBOS™ ("cBOS") and a construction and demolition ("C&D") waste recycling plant. In the gasification plant mainly organic materials will be converted to energy. Flue gases are treated with a complete flue gas treatment system to reduce nitrogen oxides (NO<sub>x</sub>), acidic components, dust/particles, trace metals and other air toxics. Inorganic residues (ash) will be recycled or landfilled. The C&D recycling plant will treat mainly inorganic waste materials from construction activities and from the mining of the old landfill (10.000 tonnes per year).

The expected amount of waste to be treated by the SWMPF as a whole is 131.000 Mt per year. The plant will produce 60 GWh of energy with this waste (net production), thus preventing the emission of a significant amount of the Green House gas Carbon Dioxide (app. 70.000 tonnes per year). The total SWMPF residue is estimated to be 5% of the incoming waste flow.

**Stakeholder input**

Stakeholders that have been consulted bring forward a number of points of attention. These are summarized in Table 1.

Table 1. Summary of points of attention of local environmental NGO's

Organization	Contact person	Points of concern
SXM Pride Foundation	Jadira Veen Chris Tihanyi Rueben Thompson	<ul style="list-style-type: none"> <li>• Hazardous Waste separation and export (permits, professional inspection and reinforcement) point of concern</li> <li>• Awareness and outreach important</li> <li>• Monitoring and maintenance (e.g. filters) ensured for long term?</li> </ul>
EPIC	Rueben Thompson	<ul style="list-style-type: none"> <li>• Environmentally relevant alternatives should be included in EIA</li> <li>• Location alternatives should be included (Cay Bay?)</li> <li>• Serious attention to maintenance procedures (external auditing)</li> </ul>
SXM Heritage Foundation	Elsje Bosch	<ul style="list-style-type: none"> <li>• People of SXM and businesses will have to contribute (financially) to waste management</li> <li>• Need for good solution for ashes</li> <li>• Location not preferred, but few or no alternatives</li> <li>• Protection of people and wildlife in Salt Pond area</li> <li>• Collection in certain areas needs to be improved</li> <li>• Visual aspects point of concern, mangrove planting as compensating measure</li> <li>• Use dredged sand for waste dump covering</li> </ul>

### Scenarios and options

Compared to the Base Case a number of scenarios and options have been described:

- Nil-scenario (15 years of landfilling at current site, elevation to 20 meters)
- NO<sub>x</sub> reduction (by Selective catalytic Reduction, SCR)
- Improvement of (modeled) ambient air quality by a higher stack
- Reduction of the visual impact of the building

### Evaluation of scenarios and options

Table 2 shows a comparison of the environmental impact of the SWMPF and the Nil-scenario (legend: see below table).

Table 2: Relative environmental impact change of SWMPF compared to Nil scenario

Environmental concern	Relative impact	Explanation	
Landscape	↑	Significant impact of cBOS building in landscape, however impact is less than elevated waste dump (20 meters).	
Flora and fauna	↑	Less stray waste and debris is beneficial for breeding birds.	
Cultural heritage	↑	Nil scenario implies loss of attraction value for Salt Walk	
Water	Surface water	↑	Base case implies no further expansion of waste dump and inherent increase of leachate load on environment. Prevention of emissions from SWMPF by roofing all possibly polluted surfaces.
	Ground water	↑	Base case implies no further expansion of waste dump and inherent increase of percolate load to groundwater. Prevention of emissions to soil from SWMPF by paving of surfaces.
Air	NO <sub>2</sub>	↓	Introduction of a new source of NO <sub>2</sub> , however within limits of EU ambient air quality standards. Baseline establishment necessary.
	Dust	↑	Ending of waste dump fires. Very low impact of fine dust from SWMPF
	Air toxics	↑	Ending of waste dump fires and cable burning. No significant impact of trace metals, dioxins and from SWMPF.
	Odour	↑	Odour sources will be closer to receivers however, odour production will be drastically lower and lead to less hindrance downwind (Nisbeth Road).
Climate Change	↑	SWMPF leads to production of 60 GWh of electrical energy and CO <sub>2</sub> emission reduction of app. 70.000 tonnes/year.	
Noise	↓	Noise sources will be closer to receivers however within standards	
Soil	Litter	↑	Overflow of waste will be drastically lower than nil scenario
	Deposited toxics	±	Current situation with fires and cable burning unfavorable. Impact by SWMPF very low (air toxics adhered to particles, low calculated ambient air concentrations of PM, PM10 and PM 2,5 and heavy metals).
	Rodents	↑	Control of rodents
	Insects	↑	Control of insects
Public safety	Transport accidents	=	No significant change
	Incidents at site	±	Less fires, fires better controlled, however location closer to built environment

#### Legends (relative impacts of SWMPF compared to nil-scenario)

- ↑ Environmental impact improves
- = Environmental impact is unchanged
- ± Environmental impact is different, but of undetermined impact
- ↓ Environmental impact deteriorates

The conclusion can be drawn that the Base Case performs better than the Nil-scenario on all environmental aspects except for some air pollutants (mainly NO<sub>2</sub>) and noise. The NO<sub>2</sub> concentrations and the noise levels however are all well within (European and Antillean) standards.

SCR leads to a higher reduction of NO<sub>x</sub> emissions than the use of Selective Non Catalytic Reduction (SNCR, Base Case) but SNCR as a technique results in efficiency high enough to guarantee compliance with European emission standards.

A stack of 22 meters does not result in significantly better (modeled) ambient air quality values.

### Conclusions

The erection of the Solid Waste Management & Processing Facility (SWMPF) at Pond Island Sint Maarten will significantly improve the quality of waste treatment on Sint Maarten as well as most of the environmental aspects concerned.

The SWMPF can be expected to comply with all standards set forward for the relevant environmental compartments. The SWMPF also complies with Antillean standards at the level of complete waste management facilities.

For air emissions the stringent European emission standards of the Waste Incineration Directive have been used. For ambient air quality the European Union standards (limits and target values) for air quality have been used. For noise the Antillean standards have been used.

The emissions of the SWMPF will be treated with a DeNO<sub>x</sub> system (SNCR), a sodium bicarbonate dosing system (for acid components) and active carbon injection combined with removal by bag filters.

From existing and operational BOS technology -mainly the Iceland Husavik plant- it becomes clear that comparable plants comply with European (Waste Incineration Directive, WID) standards for the relevant components (e.g. NO<sub>x</sub>, dust, HCl) for the majority of time with limited abatement systems. It can therefore be assumed that the Sint Maarten plant equipped with a complete air emissions abatement system will comply with the EU (WID) standards.

Air quality modeling results should be interpreted with caution because there is no valid baseline information. However for critical parameters like NO<sub>2</sub> the baseline concentrations in comparable situations (Curaçao, busy road) are relative low, between 5 and 12 µg/m<sup>3</sup>.

From the air quality modeling and the subsequent health impact assessment the following conclusions can be drawn.

- EU limit and target values for ambient air quality are met even with an over estimation of particles, heavy metals and NO<sub>x</sub> with a factor of approximately 2,5.
- In general the area west of the plant is impacted, mostly above the Great Salt Pond and to limited extent in the neighbourhoods of Sentry Hill, Cay Hill and Fort Hill/Fort Willem, but peak levels are mostly found to the north and south in Lower Princess Quarter and Philipsburg.
- The anticipated contribution of air pollutants from the plant generally are between 1% and 40% of the EU-standard values for ambient air quality, except

for NO<sub>2</sub> (1 hour average) and Nickel (year average) which are at some receptor points at 51% and 100% of the EU standard values.

- The modeled value for NO<sub>2</sub> as a 1 hour average of 101,72 µg/3 (51% of maximum peak value) in Lower Princess Quarter is a single peak value observed only once in the 5 year modeling period. Average values are at 0,1 µg/3.
- Nickel values are at the European ambient air quality target value for 2012 (0,02 µg/m<sup>3</sup> as a year average) for a small part of west border of the Great Salt Pond (highest values). It has to be kept in mind that nickel emissions are over estimated with a factor of approximately 2,5.
- Monitoring of all emissions but especially nickel values should take place in at least the first 6 months of operation (see also paragraph 11.2). If Nickel emission values prove to be high, a battery recycling program could be considered.
- A higher stack (22 meters) leads to slightly lower ambient air concentrations of pollutants except for the 1 hour average values for NO<sub>2</sub> and SO<sub>2</sub>, which become slightly higher.
- The exposure of the population to air toxics such as Polycyclic Aromatic Hydrocarbons (PAH's), dioxins and furans and trace metals through air is expected to be very low. Uptake from locally produced food is also rather unlikely, but dioxin levels in near shore fish (bottom feeders) are of concern and warrant monitoring.

#### **Recommendations for Government**

The following recommendations are given for Government:

- Carry out a baseline study for air quality in the impact area of the SWMPF and for the baseline level of dioxin in fish.
- Take preparations such that an environmental permit of high quality can be ensured, which offers suitable standards and suitable articles for future enforcement.
- Take preparations such that Government Representatives will be well trained for their task to inspect the facility.
- Set up a collection system for batteries to be exported for recycling
- Stop the cable burning at the car wreck site.
- Establish an independent monitoring committee with at least 3 members.

#### **Recommendations for the SWMPF:**

The following recommendations are given for SWMPF management:

- Take responsibility for Internal Quality Control
- Take responsibility for application of Safety Standards
- Take responsibility for Certifications of Supervision (using ISO, EPA or OSHA)

## 2 INTRODUCTION

### 2.1 Rationale

For years the waste dump at Pond Island has been the official dumping place for nearly all waste streams produced in Sint Maarten. The explosive growth of the local population and the tourist industry has brought an increase in most of the waste streams (e.g. construction and demolition waste, household waste and commercial waste).

Since the remodelling of the waste dump in 1998 it has been known that the capacity of this dumpsite is limited. Only a few years are left for the dump to reach its maximum capacity at the current permitted height of 12 meters above sea level. Further horizontal expansion of the dump is only possible within the perimeter-dikes of Pond Island because of the necessity of maintaining a water body sufficiently large to buffer water masses from heavy rains and hurricanes.

The necessity to start with a sustainable solution for waste treatment has become very critical and urgent.

It is therefore that the Government of the Island Territory of Sint Maarten launched a tender procedure to treat the waste produced at Sint Maarten. The procedure started early February 2008 with an advertisement in the local newspapers, asking specialized companies to show their interest in participating in this tender. From the Expressions of Interest received, the Tender board invited several companies to submit a proposal for the design, build, finance, own, operate and transfer of a solid waste management processing facility (May, 29 2008). As stated in the invitation this facility should be located at Pond Island, Philipsburg, Sint Maarten.

The proposals were received at October 23, 2008. After evaluating all the proposals, the Tender Board decided that Windward Roads B.V., proposing a batch process thermal gasification technology, had the most economically and environmentally advantageous proposal.

Part of the tender procedure is the assessment of the environmental and health impacts of the aforementioned proposed technology (Environmental and Health Impact Assessment, EHIA). The results of this assessment are presented in this report.

### 2.2 Objective of the Environmental and Health Impact Assessment

The objective of this Environmental and Health Impact Assessment (EHIA) is to identify and assess potential environmental and health impacts associated with all aspects and components of the Waste to Energy Facility at Sint Maarten.

### 2.3 Scope of the EHIA

The choice of the technology was determined by the outcome of the Tender Procedure (see paragraph 2.2). Hence, the impact of the winning bid (Proposal Sint Maarten

DFBOOT Solid Waste Management Processing Facility, Alternative 2, October 23, 2008) will be studied. No technological alternatives such as waste incineration or pyrolysis have been investigated in this report.

The same is true with respect to the choice of the location for the gasification plant. No alternative for the location of the facility has been investigated because the location (Pond Island) was pointed out by the Tender Board.

The DFBOOT proposal provides the following waste treatment facilities:

- Thermal gasification for waste, including shredders for preprocessing of waste
- Construction and Demolition recycling plant (C&D plant) including stone crusher
- Bulky domestic waste collection and dismantling
- Car wrecks dismantling
- Hazardous waste handling

In this study we describe the abovementioned units of the SWMPF. According to the tender documents all proposals need to comply with the stringent standards of the European Union (see also in par. 4.4).

Elements which are not included in the scope of the EHIA are:

- Activities outside the site of the facility itself such as mining of the old waste dump (however access/egress roads are included);
- Land reclamation for project-site;
- The EHIA serves to assess the health and safety risks for the residents of Sint Maarten. Health and safety of the workforce during construction and operation are beyond the scope of an EHIA. The tender documents require a health and safety plan for the operational phase of the SWMPF, this document will be produced by the management of the SWMPF in a later phase.

The current environmental (baseline) situation has not been assessed and an environmental monitoring program is beyond the means of the EHIA, and therefore the baseline situation will be assessed on the basis of limited field work and literature. Currently a separate assessment of the baseline ambient air quality is being prepared by the ROB Department (see Annex 9)

### 3 PROJECT LOCATION AND BRIEF DESCRIPTION OF PROJECT

#### 3.1 Location

Figure 3.1 gives a plane view of the area in which the project is located with the current location of the waste dump of Sint Maarten (a) and the proposed location for the new waste treatment plant (project area, b), which is currently a water body within the perimeter dikes of Pond Island (west side of Pond Island).

Potential impacts primarily involve Pond Island and the built areas surrounding the Great Salt Pond, including the access/egress roads to and from the project site. With respect to air quality the area of potential impact may be larger. A definition of the impact area for air quality is given in paragraph 9.1.



Figure 3.1: Area surrounding project area

a: Current location of waste dump

b: Planned location for solid waste management facility

#### 3.2 Overall objectives

The objective of the Waste to Energy Plant is twofold. On the one hand the plant reduces the amount of waste to be landfilled by 95% by using a thermal treatment process. On the other hand the plant will produce approximately 60 GWh of electrical energy to the Sint Maarten public grid per year.

#### 3.3 Brief description of process

##### Gasification system

The gasification system will use an advanced thermal treatment process using proprietary batch-process thermal gasification technology, called the continuous Batch Oxidation System™ (cBOS™, further referred to as "cBOS"). In the process, variable

organic wastes will be converted to energy and other usable products without sorting or pre-processing the materials to be converted.

The following waste categories will be treated:

- House Waste
- Commercial Waste
- Industrial waste
- Yard Waste
- Stray Garbage
- Construction Waste
- Bulky Domestic Waste
- Car Wrecks / Tires
- Cruise Ship Waste
- Airport Waste
- Hazardous Waste from households and commercial sources (not industrial)<sup>1</sup>
- Medical Waste
- Other Waste (drybeds)
- Mixed Waste

Some of these wastes (e.g. hazardous wastes) will be stored in the facility and exported to countries with sufficient treatment capacity (in the sense of both quantity and quality).

In total three cBOS<sup>TM</sup> process trains will be realized. Each process train contains four Primary Gasification Chambers (PGC's) and one Secondary Combustion Chamber (SCC). Each PGC will have a processing capacity of approx 65 m<sup>3</sup>. Each PGC will process one batch per day (24 hr).

For higher plant efficiency, a large part of the waste will be preprocessed by shredders (2 units). The four PGC in each cBOS<sup>TM</sup> process train will have a combined daily volume capacity of 260 m<sup>3</sup>. The three trains together will thus have a combined daily processing capacity of approx 780 m<sup>3</sup> per day equal to 273,000 m<sup>3</sup> per year. By using shredders the density of the waste will increase before entering the PGC. Assuming a waste density of 400 kg/ m<sup>3</sup> the three trains can thus process 110,000 tonnes on a yearly base where only 98,000 tonnes will be delivered to the cBOS<sup>TM</sup>. The plant will be designed in such way that an extension with a fourth process train is possible. The gasification system includes individual emission control systems on each train with continuous emissions monitoring and instantaneous feedback for flue gas treatment.

#### **Construction and Demolition recycling system (C&D system)**

Some types of waste such as waste originated from construction and demolition, as well as the contents of the existing waste dump will be sorted by the C&D system first before separated waste components will enter the cBOS<sup>TM</sup>. The C&D process which is still under design will result in the production of sand, bricks, wood, ferrous, non ferrous, paper and cardboard, plastics and residue.

In the C&D plant also the bottom ash from the cBOS<sup>TM</sup> process will be treated to retrieve valuable recyclables like ferrous, non ferrous and glass.

---

<sup>1</sup> For hazardous wastes not accepted see table 6.1  
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The C&D plant will consist of the following elements: star screens, air separation, magnets, and manual sorting as the last stage of the recycling to retrieve the remaining recyclables.

The Gasification system and the C&D recycling system will be installed in 2 separate buildings. The cBOS building will be a 9,500 square meters building (height 15 meters), the C&D building will be an 1,800 square meters building (90 by 20 meters, height 12 meters).

#### Car wreck dismantling

Car wrecks will be stored and dismantled on the SWMPF. In the process all fluids will be removed and stored as hazardous waste for export. All synthetic materials will be removed and combined with other wastes for the cBOS. The steel bodies of the cars will be compacted and exported for recycling.

#### Hazardous waste storage

A hazardous waste storage facility will be erected at the site. Hazardous wastes that cannot be treated in the cBOS will be stored in the Hazmat Handling area. They will be removed from the site to treatment facilities elsewhere. Therefore, hazardous waste will be stored in acclimatized containers with sufficient containment for fluids. These containers will be transported / exported to authorized hazardous waste treatment facilities.

Equally, hazardous waste removed from waste treated in the cBOS or C&D plant will be stored at the Hazmat Area.

### 3.4 Gasification instead of incineration

The process by which the waste will be handled is gasification. There are a number of environmental advantages of gasification over incineration and a comparison of both technologies is given in Table 3.1.

Table 3.1 Brief general comparison of technologies: Gasification versus incineration

	Gasification	Incineration
Process temperature	Primary gasification: 200-800 °C Combustion of syn-gas 1100-1200 °C	> 850 °C
Emission levels and flue gas treatment	Secondary combustion. Flue gas treatment defined by waste type and legislation/standards	Defined by waste type and legislation/standards
Residue and Ash/Slag Handling	Slag is non-leachable, non-hazardous. Fine particulate matter recycled or processed	Bottom ash and fly ash collected, treated, and disposed as hazardous wastes.

Source: [http://www.netl.doe.gov/publications/others/techrpts/igcc\\_wp.pdf](http://www.netl.doe.gov/publications/others/techrpts/igcc_wp.pdf)

## 4 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

### 4.1 Overview governmental policies Sint maarten

The Governmental Policy concerning waste treatment is stated in the following documents:

- Request for Proposals, Solid Waste Management Processing Facility in Sint Maarten (2008);
- Previous DP Governing program 2007 – 2011 (2007)
- Social Economic Initiative (SEI) 2007-2010, Sint Maarten (2007)
- Evaluation of the Cooperation Program for Sustainable Economic Development 2004-2007, Netherlands Antilles, Chapter 4: Sint Maarten Government Report (NA-SED evaluation, Sint Maarten) (2007)
- Economic Diversification Study (2006)
- Feasibility study for a waste disposal management system for the Island of Sint Maarten/ Saint Martin (2005);
- Comprehensive Economic Development Plan (2004);
- Carrying capacity study (2004);
- Tourism Master Plan (2003);
- Development vision for Philipsburg and surroundings (2003)

#### **Request for Proposals, Solid Waste Management Processing Facility in Sint Maarten**

Since the remodelling of the waste dump in 1998 it has been known that the capacity of this dumpsite is limited. Only a few years are left for the dump to reach its maximum capacity. Further expansion of the dump (outside the dikes) is not possible in the light of maintaining a minimum water surface in the pond for its buffer function during heavy rains and hurricanes.

The need to start with a sustainable solution has become very critical and urgent.

The project for a waste treatment plant focuses on a long-term solution. The main goal of this project is to start the processing of waste in an environmentally safe and sound way. The Government wants to bring a sustainable and long-term solution for the waste problems of Sint Maarten by contracting a party to Design, finance, build, own, operate, and transfer a solid waste management processing facility at Pond Island.

Currently nearly all of the waste streams are being disposed of at the waste dump. The Government is looking for a minimum 95% reduction of the disposal of all the waste streams into the waste dump. In the current system trucks are neither being weighed nor registered.

#### **Previous DP Governing program 2007 – 2011 (2007)**

The previous Democratic Party Governing Program *Sint Maarten Governing Program 2007- 2011* describes the period in which the conception of Sint Maarten towards an autonomous country within the Kingdom of the Netherlands will be realized. The aim of the economic development policy within this program is to achieve a balanced and

managed economic growth, by taking the constraints of the island into consideration (i.e. size, resources, labour market, educational facilities, health and social services).

The Governmental Policy on Spatial and Environmental issues according to this program are:

- To manage economic development;
- To ensure adequate housing and mobility of the citizens;
- To improve the treatment of solid waste and sewage;
- To conserve nature.

This indicates the high priority on improving the treatment of solid waste.

### **Social Economic Initiative (SEI) 2007-2010, Sint Maarten**

In order to be able to develop an appropriate economic development policy, the government commissioned several studies, including the Carrying Capacity Study, the Tourism Master Plan (TTC, 2005) and the Economic Diversification Study (SQW, 2006). These studies provided a basis for a social-economic strategy, the Social Economic Initiative (SEI). The SEI provides a coherent program with measures aimed at improving the starting position of Sint Maarten as a new country within the Kingdom of the Netherlands; this program replaces the before mentioned *Comprehensive Economic Development Plan*.

Within the SEI program it is stated that "*The strong economic growth of Sint Maarten increasingly puts a pressure on the use of land and the road system. This results in insufficiently regulated use of land (open market policy), severe traffic congestion and problems with waste management, which, among other things, endangers the attractiveness of the island for tourists and residents alike. This will affect the economic, social and environmental sustainability of the island.*"

One of the proposed measures within SEI is to improve waste management and sewage treatment systems.

### **NA-SED evaluation, Sint Maarten**

This report, executed under contract of USONA, evaluates the implementation of the Comprehensive Economic Development Plan (CEDP) for 2004-2007. This plan was approved in 2004 by the Executive Council of the government of the island territory of Sint Maarten.

With respect to waste management the following remark from the Sint Maarten National Heritage Foundation is relevant: "*basic infrastructure issues such as water and waste management must be coordinated with regard for environmental issues*".

### **Economic Diversification Study**

The Economic Diversification Study does not have direct relevance to the policy on waste treatment. It describes the way to come to a more diverse economical system on Sint Maarten. The results of this study are used in the SEI plan (see paragraph 4.1.).

### **Feasibility study for a waste disposal management system for the Island of Sint Maarten/ Saint Martin (2005);**

In 2003 the governments of Sint Maarten (Dutch side) and Saint Martin (French side) decided to work together to find a long term solution for the waste problem.

In 2005 the Government of Sint Maarten, together with the Government of French Saint Martin, ordered for a Feasibility study for a waste disposal management system for the Island of Sint Maarten / Saint Martin (TNO, 2005). The main conclusions of this study are:

- There is a limitation to the time that capacity at the Land fill remains available for dumping. It is assumed that at the present volume of waste production, the location will reach capacity in a few years;
- Possible location at Dutch side is near GEBE (reclaimed from the sea);
- Waste to Energy plant is feasible, with only power generation (no desalination).

### **Comprehensive Economic Development Plan**

The economic development policy is stated in the *Comprehensive Economic Development Plan (2004 – 2007)*. This plan serves as a framework for joint funding by the Dutch and Sint Maarten governments of the socio-economic development of Sint Maarten. Within this plan the focus was laid on several projects to reinforce the basic infrastructure of St. Maarten, including the improvement of the Waste management systems.

### **Carrying capacity study**

Regarding waste management the Carrying capacity Study recommends the following:

- to develop a comprehensive waste management strategy consisting of:
  - Waste prevention (minimising production);
  - Maximising separation and recycling; and
  - Collecting and processing at minimal environmental and health costs.
- Establish a database on solid waste production and disposal, disaggregating by source sectors in such a way as to provide reliable data on the tourism sector.
- No longer accept solid waste from cruise ships for dumping anywhere on Sint Maarten, while ensuring regular monitoring of sewage treatment systems (MSDs) on board cruise ships and yachts.
- More rigorously monitor the quality and efficiency of private sewage treatment plants, including their effluents.
- Install adequate reception facilities for yachts - including sewage pump-up stations - in the marine area of the Simpson Bay Lagoon as a matter of urgency, complementing the privately built installations already present.
- For a tourist destination it is of utmost importance to curb the deterioration of the environment by way of environmental and spatial planning and concomitant legislation, such as on sewage and waste water treatment (cf. Eilandsverordening Afvalwater Sint Maarten, AB 2002, No. 5), solid waste disposal, and reef protection. Adequate spatial planning is needed also to protect land suitable for agriculture and horticulture from further being used for other purposes. Environmental and spatial legislation form part of the legal framework needed for safeguarding an orderly

development. The private sector should operate within the legal limitations given by government. Within these it may compete according to free market principles.

### **Tourism Master Plan**

*The Sint Maarten Tourism Master Plan* – TourMap, (TTC, 2005) highlights the diversity of the tourism sector and the extent to which external factors impact on its development, together with impacts of tourism on other aspects of life in Sint Maarten.

With respect to a sustained tourism development and the natural heritage and to provide a sustainable balance between economic growth and environmental enhancement the following remarks are stated in the plan:

- It is recommended that existing laws be more rigorously enforced especially in the areas of hillside policy, beach side policy, the nature and water ordinances and marine park legislation.
- New legislation is recommended to require independent Environmental and Social Impact Assessments to international standards before major developments are approved and to update the current building ordinance.
- Awareness of the importance of the environment to tourism growth would be raised by stakeholders working collaboratively to achieve Green Globe, Blue Flag and ISO awards and by the introduction of Environmental Education in the school curriculum.
- The implementation and effective enforcement of new marine park legislation will be an important tool in nature conservation.
- The development of a terrestrial park is proposed as this would provide increased habitat, flora and fauna protection and raise tourist and community awareness of the importance of protecting the natural environment.
- It is recommended that international treaties on species and habitat protection be ratified and adhered by Sint Maarten.
- Measures are proposed to minimize noise and visual intrusions into guests' experience at resort locations e.g. commercial hoardings and nightclub noise in the late evening.

Consultations undertaken during the process to come to the plan indicate the importance of the policy concerning the natural environment, physical planning, the built environment, and waste management. Waste & Sewage Management is among the actions in the Action plan and has to be executed on the short term.

### **Development Vision for Philipsburg and surroundings**

With respect to the Physical development policy a "Development Perspective for Philipsburg and the Greater Bay Area" (Almere TKA, 2003) has been prepared. This plan has been approved by the Island Council on October, 2003, as a basis for the area development plan.

Within this Development Perspective, the development of Pond Island was proposed as a business like modern and future-oriented area. Within this plan, the waste to energy plant was not foreseen on Pond Island. The plan also mentions the importance of The Great Salt Pond as a buffer reservoir for rainwater from surrounding areas (Hillsides). The current capacity is considered necessary to keep the flooding risks for Philipsburg

within acceptable limits. Further expansion of Pond Island (and the land fill) is therefore not desired.

#### **Environmental Health Policies**

To date no formal policies for environmental health are available for Sint Maarten or the Netherlands Antilles. Hygiene policies are in place for pest control and food quality (HACCP). In addition, VoMil has drafted a list of priority environmental issues for the Islands. 'Waste management' and 'air pollution from traffic' are among the priorities for Sint Maarten.

In The Netherlands the national government follows an integral approach for solving environmentally related health problems in the so-called 'National Approach environment and health'<sup>1</sup>. The Ministry of VROM coordinates the approach, which is directed towards:

- a. indoor environment;
- b. design and layout of the living environment;
- c. information supply about the local living environment;
- d. signaling and monitoring environmental and health problems.

Another relevant Dutch policy paper is the Action plan Youth, Environment and Health (VROM, 2006). The Action Plan aims to fulfill the commitment of The Netherlands to the targets of the European Children's Environment and Health Action Plan for Europe (CEHAPE), drafted by the World Health Organization (WHO). Targets of the Dutch action plan are:

- a. create conditions for more physical exercise;
- b. reduce exposure to air pollution;
- c. improve the knowledge on the quality of schools and kindergartens and of means for improvement;
- d. draw attention of school teachers and boards to indoor quality

#### **4.2 International Treaties and Conventions related to the environment**

The *Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean* is the only multilateral environment agreement. It is an instrument of the *Caribbean Environment Program (CEP)* of the *Regional Seas Programs of the United Nations Environment Program (UNEP)*. More information on the Cartagena convention can be found on [www.cep.unep.org/cartagena-convention](http://www.cep.unep.org/cartagena-convention). There are three protocols under the convention, which each address a specific area of environmental concern:

- the *Oil Spill Protocol*;  
Specifically addresses oil spills and is intended to strengthen national and regional preparedness and response capacity of the nations and territories in the Caribbean in case of oil spills.
- the *Specially Protected Areas and Wildlife (SPA/W) Protocol*;

<sup>1</sup> The approach is the result of an Action Plan Environment published in 2006, runs from 2008 – 2012 and is to be evaluated in 2010.

Serves as the main regional instrument for co-operation to protect biodiversity and has a special place in the international efforts of the national government of the Netherlands Antilles.

- the *Land Based Sources of Marine Pollution* (LBS) Protocol. (not yet in force).

The Kingdom of the Netherlands, and subsequently the Netherlands Antilles, is party to several international treaties and conventions on the subject nature preservation and landscape control.

The *Convention on Migratory Species* (CMS, or *Bonn Convention*, Trb 1981, 6) serves to protect migrating wild animals. Parties of this convention are aware of the fact that migrating animals will cross their borders and may make use of their territory for resting, breeding or foraging. More information on the Bonn convention can be found on [www.cms.int](http://www.cms.int).

The *Ramsar Convention* (Wetland convention, Trb. 1975, 84) serves to designate areas as protected wetlands. On Sint Maarten no area has yet been designated as Ramsar wetland. More information on the Ramsar convention can be found on [www.ramsar.org](http://www.ramsar.org).

The *Biodiversity Convention* (Tr. 1992, 164) serves three main goals: the conservation of biological diversity (or biodiversity); sustainable use of its components; and a fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity. More information on the biodiversity convention can be found on [www.cbd.int](http://www.cbd.int).

The *Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES* (Trb. 1975, 23). Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. More information on the Cites convention can be found on [www.cites.org](http://www.cites.org).

The Netherlands Antilles is also party to a number of global treaties addressing various environmental aspects.

The *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal* (*Basel Convention*), serves to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation. Information on the convention can be found on [www.basel.int](http://www.basel.int). Furthermore this convention gives a structured option, when the local waste management facilities are not sufficiently capable of handling a specific waste stream.

The transportation of hazardous waste towards other countries for final treatment of the hazardous waste, is only possible after a an agreement with the receiving country. At the moment only with the Netherlands such an agreement on transportation and acceptance of hazardous waste has been signed.

The *Montreal Protocol* or *CFC Protocol*, serves to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion.

The *London Dumping Convention* (Trb. 1973, 172) is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. It covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft, and platforms. More information can be found on [www.londonconvention.org](http://www.londonconvention.org).

The *Marine Pollution Protocol* (Marpol, Trb. 1975, 145) is designed to minimize pollution of the seas, including dumping, oil and exhaust pollution. Its stated object is: to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances. Parties should report about their reception facilities in the harbours. These reception facilities are part of the local waste management system.

The *Kyoto Protocol* is a protocol to the *United Nations Framework Convention on Climate Change* (UNFCCC). The protocol is intended to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. The Kyoto Protocol establishes legally binding commitments for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride). More information about the Kyoto protocol can be found on [www.unfccc.int](http://www.unfccc.int). The protocol has not yet been ratified by the Netherlands Antilles.

Kyoto includes defined "flexible mechanisms" such as Emissions Trading, the Clean Development Mechanism and Joint Implementation to allow industrialised economies to meet their greenhouse gas (GHG) emission limitations by purchasing GHG emission reductions credits from elsewhere, through financial exchanges in projects that reduce emissions in non-industrialised economies.

Gasification of waste is considered as contributing to reducing greenhouse gasses and is eligible for emission trading with "Carbon credits" under the Clean Development mechanism. This is only valid after ratification of the Kyoto protocol by the National Government. Only volunteer emission trading of carbon credits is an option at the moment.

#### 4.3 Legal framework on environment and physical planning

According to the Island Ordinance Netherlands Antilles (Eilanden Regeling Nederlandse Antillen, ERNA). Article 2 paragraph e sub 11, the protection of the environment and the preservation of nature, flora and fauna are the responsibility of the Island Territory of Sint Maarten.

In addition, the National Government can adopt framework Ordinances that instruct the Island Territories to adopt further regulations. The main reason for adopting these ordinances is to comply with international treaties.



## Legislation on environment and physical planning Sint Maarten

The *Sint Maarten Hindrance Ordinance* (Hinderverordening, AB 1964, no. 8) of 1964 serves as the foundation for the regulation of danger, damage and nuisance. The *Hindrance Ordinance* indicates the obligation to have a Nuisance permit to every economic activity that has an impact on the environment. It contains a general prohibition to establish, modify or extend "institutions" without a permit. The Ordinance itself does not further elaborate on the concept of "institutions".

The *Waste Discharge Ordinance* (Afvalstoffenverordening, AB 1993, 3) contains regulations for the collection of waste from households and companies. The Executive Council has the authority to adopt more detailed regulations but has not yet set additional rules. A draft of a new Ordinance on solid waste will be presented to the Island Council shortly (see further in this paragraph).

The *Waste Water Discharge Ordinance* (Afvalwaterverordening, AB 2002, no. 5) applies to households, businesses and institutions and has a potential for an integral approach of the wastewater problem. The ordinance also enforces the protection of the sewerage system, sewage plan and surface waters from dangerous substances. This Ordinance has not been further implemented yet. Implementation must occur by a separate decision of the Executive Council thereto.

The *General Police Ordinance* (Algemene Politiekeur, APK) prohibits pollution of the public road. According to VROM, the APK is being updated with regards to environmental issues.

The *Island Nature Ordinance* (2003, Eilandsverordening natuurbeheer en bescherming Sint Maarten). The Island Nature Ordinance regulates the protection of flora and fauna, the conservation of biodiversity, the management and conservation of habitats and ecosystems and the implementation of International Treaties on the island/local level. The ordinance provides for the protection of flora and fauna, and the management and conservation of habitats.

Protected flora and fauna species include all Sint Maarten's plant and animal species that are included in appendix I of the Bonn-convention, appendices I and II of the SPAW-protocol, appendix I of the CITES-treaty and appendices I and II of the Sea Turtle Treaty. Furthermore, by island decision, animal and plant species can be appointed as protected animal and plants species which are not included in one of the mentioned treaties.

The *Ordinance on Waste and Electricity* (draft, August 2009) provides a formal regulation for the collection and treatment of several types of waste. Liquid wastes which are not packaged are not included in the regulation. The regulation points out which wastes can be regarded as hazardous: flammable wastes, poisonous wastes, explosive or contagious wastes (examples: pesticides, explosives, paint products, oils, adhesives. By decree of the Executive Council, this list can be extended.

The Ordinance also provides a regulation for the generation and distribution of electrical energy from waste. The regulation introduces the concept of concessions for waste collection and waste treatment.

The Ordinance is expected to be in effect in 2009.

The *Ordinance Principles of Town and Physical Planning* (Eilandsverordening Ruimtelijke Ontwikkelingsplanning Sint Maarten, EROP) was adopted in December 1993 (AB 1993, no. 13). This Ordinance obliges the Executive Council to adopt a development/zoning plan for the areas of Sint Maarten. The Executive Council has not yet adopted a (draft) land-use/zoning plan. The ordinance does give criteria for judging building permit requests.

As laid down in the mentioned ordinance, the Island Government has the responsibility to prepare a policy to come to a sustainable land use for Sint Maarten. At present, the responsible department VROM is in the process of establishing a Global Land Use Plan, including zoning plans describing specific land uses of the various areas of the Island. This plan will enable the government to judge all future developments and to pro-actively treat requests for building permits. Awaiting the realization of the Global Land Use Plan, the Department VROM will judge requests with the criteria as stated in EROP.

In 2003 the Island Territory adopted an *Island Ordinance on the Preservation of the Environment*. This Ordinance establishes the procedure for the adoption of a nature plan and the designation of a nature park (i.e. the procedure only, not the actual adoption of a nature plan or designation of a nature park). In addition, the Ordinance defines the protected flora and fauna with a reference to the applicable international Treaties and prohibits – in short – any act that negatively affects such flora and fauna and/or its habitat.

#### **Legislation Netherlands Antilles related to the environment**

In 1998 the *National Ordinance on Principles of Nature Management and Preservation* (Landsverordening Grondslagen Natuurbeheer en bescherming, AB 1998, no. 49, as amended in 2001, PB 2001, 41) was adopted. The Ordinance obliges the (Executive Council of) Island Territories, to adopt a nature plan as well as to designate nature reserves. This ordinance serves mainly to implement the following international treaties:

- Cartagena Convention (Trb. 1983, 152)  
Protocols
  - Oil Spill
  - SPAW
  - LBS (not yet in force)
- CMS / Bonn Convention
- Ramsar Convention
- Biodiversity Convention
- CITES

The Concept *National Ordinance on Principles of Environmental Management* (Concept Landsverordening Grondslagen Milieubeheer) implements several treaties or binding decisions of international institutions with regard to environmental management. This ordinance has not yet been adopted, but is anticipated to be adopted before the end of 2009. The ordinance will serve to implement the following treaties such as:

- Cartagena Convention (Trb. 1983, 152)  
Protocols
  - Oil Spill
  - SPAW

- LBS (not yet in force)
- Treaty of Basel (Trb. 1990, 12)
- Treaty of Rotterdam (Trb. 1999,30),
- Treaty for the Protection of the Ozone-layer, the Treaty of Montreal (Trb. 1988, 11; 1989,11; 1990, 99 and 1991, 49),
- the United Nations Framework Conventions on Climate Change (Kyoto protocol) (Trb. 1992, 189; 1994, 187; 1996, 85).

The treaties that have not yet been ratified by the Netherlands Antilles (treaties of Basel, Rotterdam and Kyoto), will be ratified after adoption of this National Ordinance.

#### 4.4 Legal framework on Public Health

The main legal framework for Public Health is the International Health Regulations, that have recently been revised (WHO 2005) and entered into force on 15 June 2007. The International Health Regulations (IHR) are an international legal instrument that is binding for 194 countries across the globe, including all the Member States of the World Health Organization (WHO), among which the Kingdom of the Netherlands, and the Netherlands Antilles as part of the Kingdom.

The aim of the Regulations is to help the international community prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide. The Regulations are primarily oriented to infectious diseases, but can also apply to other public health emergencies such as chemical spills, leaks and dumping, or nuclear melt-downs. The International Health Regulations require countries to report certain disease outbreaks and public health events to the WHO. The IHR also require countries to strengthen their existing capacities for public health surveillance and response.

In The Netherlands only recently the Public Health Act has been drafted<sup>1</sup>, which enters into force in 2010. In the Public Health Act, local authorities are given the responsibility to promote the development and continuity of an internal cohesion within the Public Health Care (art 2.1), among which the Environmental Health Care (art. 2.2e) and Technical Hygiene Care (art.2.2f).

#### 4.5 Beneficiaries and parties involved

##### Written policies of Stakeholders

The following stakeholders have written policies concerning waste and waste treatment:

##### **Sint Maarten Hospitality and Trade Association (SHTA):** White Paper on Sustainability (2006)

The SHTA proposes to improve the environmental legislation and to sensitize the public, business and Government as a solution to the environmental problems Sint Maarten is facing. A program for waste reduction is one of their suggested programs for solving the waste problem.

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<sup>1</sup> The Act serves to implement the revised IHR and bring the regulations for infectious diseases under one umbrella. The Act Collective Prevention, Quarantine Act and Infectious Diseases Act are withdrawn and incorporated in this new Act.

**Joint Environmental organizations (letter to Executive Council June 2007, updated July 2009)**

Sint Maarten's Environmental, Natural and Cultural Heritage Conservation Foundations (the Sint Maarten National Heritage Foundation, Ocean Care, Sint Maarten Pride Foundation, The Nature Foundation and The Emilio Wilson Estate Foundation) have presented recommendations for the improvement of St. Maarten's environmental legislation and for the protection of the island's Natural and Cultural Heritage. The Foundations urge political parties to consider and incorporate these issues into their governing programs, in view of environmentally sustainable development, the protection of the island's Natural and Cultural Heritage and St Maarten's future status as a country within the Kingdom of the Netherlands.

To improve St. Maarten's environmental legislation, the Foundations give the following Recommendations (related to waste management or Pond Island):

1. Enforcement of, and adherence to existing policy and regulations: a.o. Waste Ordinance, Sewage Ordinance.
2. Development and implementation of regulations e.g. Pond Protection Ordinance, Ordinance on Zoning.
3. Improving and revising currently outdated legislation e.g. updating current building ordinance and hindrance ordinance
4. Require, through proper legislation, environmental and social impact assessments to be carried out by independent consultants when any major facility development is being considered.
5. Ratification of, and adherence to international treaties on species and habitat protection on the Island level.
6. Include environmental (natural heritage) education in school curriculum (on a local level).
7. Update Monument Ordinance to include legal and financial instruments.
8. Development, implementation and enforcement of a Wetland Protection Ordinance (for Ponds, Lagoons).
9. Seek funding, develop and implement plans and infrastructure for the regulation of solid waste (garbage) and the establishment of waste management facilities, recycling companies etc.
10. The objections and advice of stakeholders, environmental / heritage organizations and immediately affected residents must be taken into consideration during the planned permit request procedure and in the stipulations of granted planning permits.
11. Increase VROM department staff (a successful country status for Sint Maarten will require an increase in capable policy makers as many of Sint Maarten's environmental ordinances and policies are outdated).

## Interviews with Stakeholders

Within the framework of the preparation of this EHIA several environmental NGO's have been contacted to inquire about their opinion with respect to the planned solid waste management facility and their specific points of attention.

The results of these meetings are summarized in table 4.1.

Table 4.1. Summary of concerns local environmental NGO's

Organization	Contact person	Points of concern
SXM Pride Foundation	Jadira Veen Chris Tihanyi Rueben Thompson	<ul style="list-style-type: none"> <li>• Hazardous Waste separation and export (permits, professional inspection and reinforcement) point of concern</li> <li>• Awareness and outreach important</li> <li>• Monitoring and maintenance (e.g. filters) ensured for long term?</li> </ul>
EPIC	Rueben Thompson	<ul style="list-style-type: none"> <li>• Environmentally relevant alternatives should be included in EIA</li> <li>• Location alternatives should be included (Cay Bay?)</li> <li>• Serious attention to maintenance procedures (external auditing)</li> </ul>
SXM Heritage Foundation	Elsje Bosch	<ul style="list-style-type: none"> <li>• People of SXM and businesses will have to contribute (financially) to waste management</li> <li>• Need for good solution for ashes</li> <li>• Location not preferred, but few or no alternatives</li> <li>• Protection of people and wildlife in Salt Pond area</li> <li>• Collection in certain areas needs to be improved</li> <li>• Visual aspects point of concern, mangrove planting as compensating measure</li> <li>• Use dredged sand for waste dump covering</li> </ul>

## 4.6 Environmental standards and requirements

### General remarks

The Employer's Requirements (Volume 1 General specifications of May 21, 2008, sub 3.7.2) indicate that:

*"The local standards have priority over the European Union or ASTM standards, unless there are no local standards".*

However in the Information memorandum this subject has been amended as follows:

"The local standard has priority over the European (EU) standard, unless the specific EU standard is more stringent. In that case the EU standard has priority over the local standard. Invited companies are allowed to submit an alternative proposal, in addition to the obligatory proposal, whereby the EU-standard is replaced by the ASTM-standard. If an invited company is not able to submit the obligatory proposal because of their proposed solid waste management processing system not being able to comply with the EU-standards, the company is allowed to submit its proposal in which the EU-standard is replaced by the ASTM-standard. This must be clearly indicated in the proposal. Considering the aforementioned and the outcome of the evaluation process Government, at its sole discretion, may give preference to the proposal that complies with the EU-standards. For the local standards is referred to annex L.8 and relevant ordinances".

ASTM standards are voluntary international standards for industry = see also astm.org

### Air emissions

With respect to the preferred standards (preceeding paragraph) the Directive on the incineration of waste (Directive 2000/76/EC, WID) is relevant. These are also the standards the project developer wishes to adhere to.

Important articles within the WID are:

#### Flue gas emission

According to article 7 the plant shall be designed, equipped, built and operated in such a way that the emission limit values set out in the table 4.2 will not be exceeded in the exhaust gas.

Table 4.2: Air emission limit values (values in mg/m<sup>3</sup> at 273 K, 1 atm., 11% O<sub>2</sub>, dry gas)

Component	Sampling period	Value (mg/m <sup>3</sup> )
Total dust	A	10
Gaseous and vaporous organic substances, expressed as total organic carbon	A	10
Hydrogen chloride (HCl)	A	10
Hydrogen fluoride (HF)	A	1
Sulphur dioxide (SO <sub>2</sub> )	A	50
Nitrogen Monoxide (NO) and Nitrogen dioxide (NO <sub>2</sub> )	A	200
Cadmium (Cd)	B	0.05
Thallium (Tl)	B	0.05
Mercury (Hg)	B	0.05
Other heavy metals	B	0.5
Carbon Monoxide (CO)	A	50
Dioxins and furans	C	0.1 ng/ m <sup>3</sup>

- A) Daily average
- B) Average measured over a sample period between 0.5 and 8 hours
- C) Average measured over a sample period between 6 and 8 hours

#### Abnormal operating conditions

Malfunction of any process can occur incidentally. The Directive meets this possibility by allowing an uninterrupted emission level exceeding the maximum emission levels for a maximum period of 4 hours. The cumulative duration of operation of such conditions over one year shall be less than 60 hours.

#### Monitoring

According to article 11 continuous measurement of NO<sub>x</sub>, CO, dust, TOC (Total Organic Carbon), HCl, HF and SO<sub>2</sub> is needed. A full copy of the Directive is enclosed in Annex 5.

## Ambient air quality

For the purpose of the EHIA the project developer uses the European ambient air quality standards, which are the most stringent if compared to the Antillean ones and the ones from the US/EPA. Some of these standards will be in effect in Europe after 2010.

Table 4.3 shows the values for the various pollutants.

Table 4.3 EU Ambient Air Quality Standards  
(Source: [http://ec.europa.eu/environment/index\\_en.htm](http://ec.europa.eu/environment/index_en.htm))

Pollutant	Concentration	Averaging period	Limit or target value	Permitted exceedances per year
Fine particles (PM2.5)	25 µg/m <sup>3</sup>	1 year	Target (2010)	n/a
Sulphur Dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup>	1 hour	Limit (2005)	24
	125 µg/m <sup>3</sup>	24 hours	Limit (2005)	3
Nitrogen dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup>	1 hour	Limit (2010)	18
	40 µg/m <sup>3</sup>	1 year	Limit (2010)	n/a
PM10	50 µg/m <sup>3</sup>	24 hours	Limit (2005)	35
	40 µg/m <sup>3</sup>	1 year	Limit (2005)	n/a
Lead (BP)	0.5 µg/m <sup>3</sup>	1 year	Limit (2005)	n/a
Carbon monoxide (CO)	10 mg/m <sup>3</sup>	Maximum daily 8 hour mean	Limit (2005)	n/a
Benzene	5 µg/m <sup>3</sup>	1 year	Limit (2010)	n/a
Ozone	120 µg/m <sup>3</sup>	Maximum daily 8 hour mean	Target (2010)	25 days averaged over 3 years
Arsenic (As)	6 ng/m <sup>3</sup>	1 year	Target (2012)	n/a
Cadmium (Cd)	5 ng/m <sup>3</sup>	1 year	Target (2012)	n/a
Nickel (Ni)	20 ng/m <sup>3</sup>	1 year	Target (2012)	n/a
PAH's (*)	1 ng/m <sup>3</sup>	1 year	Target (2012)	n/a

(\*) Polycyclic Aromatic Hydrocarbons (expressed as concentration of Benzo(a)pyrene)

## Noise

For noise there are 2 different standards. One is given in the Employer's Requirements, Volume 1 General specifications of May 21, 2008, sub 3.4:

*Inside rooms, the sound pressure shall not exceed 80 dB(A). In case the sound pressure exceeds the limit of 80 dB(A), the Contractor should ensure the use of safety and protective precautions as required by Local Authorities and the Department of Public Works, section VROM. All necessary protective measures shall be in place when the Works become operational.*

*Machinery vibration shall not exceed the limits defined in BS7854-1 or equivalent (ISO 10816-1).*

In addition to the above noise restrictions, the sound pressure of the equipment incorporated into the Works shall not exceed 55 dB(A) at the perimeter of the site of the Solid Waste Management Facility at Pond Island.

The abovementioned limit of 55 dB(A) is in contradiction with the more specific standards of the National Environmental Department ("Local Standards (requirements and limits) air, noise, water, waste water and solid waste").

Table 4.4 Overview of national noise standards

Type of area	Day	Evening and night
Rural environment, low noise recreation, care institutions	45	40
Outside town, little traffic	50	45
Town and built area	55	50
Near main roads, in town with commercial functions	60	55
Centre of town with residential, office and commercial functions	65	60
Industrial area	70	65

### Water

With respect to construction of the SWMPF paragraph 5.7 of the Employer's Requirements is relevant (Volume 1 General specifications of May 21, 2008). It is stated that: *The Contractor shall take all reasonable measures to ensure its activities do not cause pollution of soil, groundwater sources or surface watercourses.*

With respect to the operation of the plant National water emission standards for water could be used, however, they are not applicable to industrial processes. The standards are defined for household waste water and sewage treatment.

The project is set up in such a way (see Chapter 6 and 9) that no emissions to water during the operational phase are expected.

### Waste

With respect to construction of the SWMPF the Employer's Requirements are important (Volume 1 General specifications of May 21, 2008) Paragraph 5.1 indicates that: *All the produced waste shall, in as far as the Employer does not want to keep it, be removed and transported to the waste dump.*

With respect to the operation the Document "Local Standards (requirements and limits) air, noise, water, waste water and solid waste" (Netherlands Antilles) gives relevant standards. General requirements for waste treatment facilities are:

- An obligation to carry out an EIA
- The granting of a Nuisance permit
- The presence of a waste separation facility
- The presence of a hazardous waste storage facility



- A ban on landfilling (except for ashes and residues from treatment)

### Health and safety

The Employer's Requirements (Volume 1 General specifications of May 21, 2008, paragraph 4.1) indicate that:

*The Contractor shall prepare a Health, Safety and Environmental Plan (the HSE Plan) and submit the HSE Plan to the Employer's Representative for his approval at least 14 days prior to the Commencement Date. The HSE Plan shall include, but not be limited to:*

- *Construction risk assessment and control measures;*
- *Organisation and management arrangements for implementing the plan;*
- *Appropriate specified safety requirements;*
- *Welfare arrangements for staff messing, first aid and sanitary arrangements;*
- *Ensuring that emissions, surface discharges and effluent from the Contractor's activities will not exceed EU or USEPA standards.*

## 5 WASTE CHARACTERISATION SINT MAARTEN

### 5.1 Waste categories

Based on prior studies conducted by R. W. Beck (2009) the total waste flow can be categorized, partly on the basis of origin as follows.

1. House Waste
2. Commercial Waste
3. Industrial Waste
4. Yard Waste
5. Stray Waste
6. Construction Waste
7. Bulky Domestic Waste
8. Car Wrecks/Tires
9. Cruise Ship Waste
10. Airport Waste
11. Hazardous Waste
12. Medical Waste
13. Institutional Waste
14. Mixed Waste
15. Other Waste.

### 5.2 Waste composition

As part of the planning initiative for the SWMPF, R. W. Beck performed a waste characterization study from April 14<sup>th</sup> to May 24<sup>th</sup> 2009 (R.W. Beck, 2009). The purpose of the study was to develop estimates and projections of waste amounts and types that are currently being disposed at the Pond Island Waste dump as well as the composition of the wastes.

A detailed waste composition with a statistical confidence interval of 90 percent, consistent with industry standards for sorted generators was generated. Table 5.1 below summarizes the average aggregated SXM waste stream.

Table 5.1: Overall Waste Composition

Material Group	Material	Percent of Disposed Waste
<b>Paper</b>		<b>9.6%</b>
	1 Newspaper	0.8%
	2 Corrugated Paper	3.9%
	3 High Grade/Magazine/Books	0.8%
	4 Other Paper	4.1%
<b>Plastics</b>		<b>6.9%</b>
	5 HDPE	0.3%
	6 PET	1.4%
	7 Plastic Film	2.8%
	8 Other Plastics	2.4%
<b>Glass</b>		<b>6.9%</b>
	9 Glass Containers	6.2%
	10 Other Glass	0.7%
<b>Metals</b>		<b>5.7%</b>
	11 Ferrous	4.6%
	12 Aluminum	0.7%
	13 Other Non-Ferrous	0.1%
	14 Other Metals	0.2%
<b>Organics</b>		<b>15.2%</b>
	15 Food Waste	7.0%
	16 Textiles	1.5%
	17 Tires	0.5%
	18 Rubber Products	0.0%
	19 Other Organics/Fines	6.0%
<b>Inorganics</b>		<b>0.2%</b>
	20 Miscellaneous Inorganics 0.2%	280
<b>Yard Waste</b>		<b>11.9%</b>
	21 Yard Waste	11.9%
<b>Construction</b>		<b>41.0%</b>
	22 Wood	19.6%
	23 Other C&D	21.4%
<b>HHW (*)</b>		<b>0.7%</b>
	24 Batteries	0.0%
	25 Other HHW	0.7%
<b>Other Waste</b>		<b>1.9%</b>
	26 Durables	1.9%
<b>TOTAL</b>		<b>100.0%</b>

(\*) Hazardous

### 5.3 Waste amounts

As the study by RW Beck was done in a very limited time frame, the waste amounts were further assessed by Windward Roads in the period of week 14 to week 34 of 2009. Below the main results of this assessment are given.

The average amount of waste brought to the facility is 2.517 Mt per week. This amount will be diverted as follows (see also figure 5.1):

- Waste directly to cBOS (category 1+2+3+4+5+9+10+13): 1441 Mt/week
- Construction and Demolition waste (category 6): 1007 Mt /week of which 40% passes to the sBOS
- Bulky waste, car wrecks, hazardous waste and medical waste (category 7+8+11+12): 36,5 Mt /week of which 50% passes to sBOS
- Mixed waste (category 14) : 34 Mt/week of which 74% passes to sBOS

In total  $1441+403+18+26=1.888$  Mt per week or 98.176 Mt per year will be treated by the sBOS.

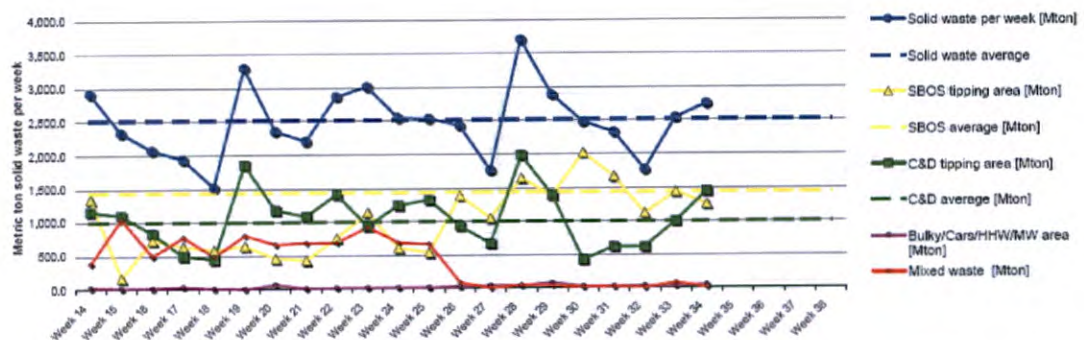


Figure 5.1 Waste flows per week registered during gate survey April/May 2009

The expected amount of waste per year is approximately 131.000 Mt ( $52 * 2.517 = 130.884$ ).

### 5.4 Energy content

An estimate of the energy content of materials available for disposal at the proposed waste treatment facility was established through laboratory analysis of moisture content coupled with existing data regarding the chemical composition of key waste categories (R.W. Beck 2009).

The total estimated high heat value ("HHVs") on a wet basis based on laboratory results of moisture content, ash content, and the chemical composition of each of the materials sorted is 2,534 kilocalories per kilogram ("kcal/kg"). For a complete Energy and mass balance we refer to Annex 2.

## 6 PROJECT DESCRIPTION (BASE CASE)

### 6.1 Site lay out

Figure 6.1 shows the site lay out of the waste processing facility. The facility includes the following units and departments (numbers indicated in figure 6.1):

Scale house (1)

Segregation platform (2a)  
Hazardous Materials storage (2b)  
Bulky Waste dismantling (2c)  
Car wreck dismantling (2d)  
Construction and Demolition unloading area (2e)  
cBOS unloading area including 2 shredders (2f)

Construction and Demolition (C&D) Plant including stone crusher (3)

cBOS process units including waste heat boilers, turbines and generators (4)  
Cooling fans (4a,b)

#### Facilities

Office (5a)  
Container storage (5b)  
Transformer (5c)  
Generator (5d)  
Fuel tanks (5e)

### 6.2 Logistics for main waste categories

#### All waste categories

Vehicles will be weighed at Site entrance by using the weigh-bridge at the scale house (1) and entries will be made to the Duty of Care paperwork. TARE weights held on the system or the unladen vehicle weight upon exit will be used to record the mass of waste deposited at the site.

#### Waste categories for cBOS (green line figure 6.1)

Household waste, commercial waste, ship- and airline waste, yard- and stray waste, cruise-waste, airport waste and some smaller quantities of (other) waste will be suitable for treatment in the cBOS with minor pre-treatment. Before treatment in the gasification chambers these waste categories will be unloaded on the tipping floor (2f, figure 6.1) where pre-selection takes place (a.o. removal of large parts or white goods). Subsequently the wastes will be shredded (2f, figure 6.1) to increase the low bulk density of the island waste and optimize the cBOS chamber volume use.

After gasification (see paragraph 6.4) the ashes will be removed from the PGC's. In a next step recyclables will be removed from the ashes (a.o. ferrous and non ferrous metals) and the residue will be stored in separate rooms (purple line fig. 6.1). The ash

residue possesses physical properties of construction mixtures such as concrete. The ash material has been tested extensively in a Toxicity Characteristic Leaching Procedure (TCLP) that subjects ash to acidic liquid, causing metals to leach from the material. Years of testing has proven the ash safe for disposal and reuse (see Annex 11).

The ash will be used as much as possible for the production of building materials (concrete and asphalt). If no suitable market for the materials can be found the material will be landfilled on Sint Maarten.

**Mixed waste for cBOS (red line figure 6.1)**

Some of the waste for the cBOS may be mixed with other wastes. In these cases the waste needs to be pre sorted more extensively, which takes place at the sorting area (no 2a figure 6.1). Large items may be transported to the C&D plant (fig. 6.1 , no 3) or the Dismantling area for bulky waste (fig. 6.1., no 2c).

**Construction and demolition waste for C&D plant (yellow line in fig. 6.1)**

The C&D plant (fig. 6.1 , no 3) is –better than the cBOS plant- capable of processing of inorganic materials: especially construction and demolition waste. Also waste mined from the old landfill will be processed. Recyclables and residues will be stored in a separate storage area (orange line figure 6.1). Organic residues which are not recyclable will be fed to the cBOS plant.

**Construction and demolition waste for C&D plant (blue line in fig. 6.1)**

Some of the waste for the C&D may be mixed with other wastes. In these cases the waste needs to be pre sorted more extensively, which takes place at the sorting area (no 2a figure 6.1). Large items may be transported to the Dismantling area for bulky wastes (fig. 6.1., no 2c).

**Bulky waste, car wrecks and tyres**

Bulky waste and car wrecks will be dismantled at the respective dismantling sites (2 c and d in fig 6.1). Tyres will be mixed with waste for cBOS, shredded and gasified.

**Hazardous wastes**

Hazardous wastes will either be gasified or stored and exported (see next paragraph). Storage will take place in the HAZMAT area (fig. 6.1., no 2b).



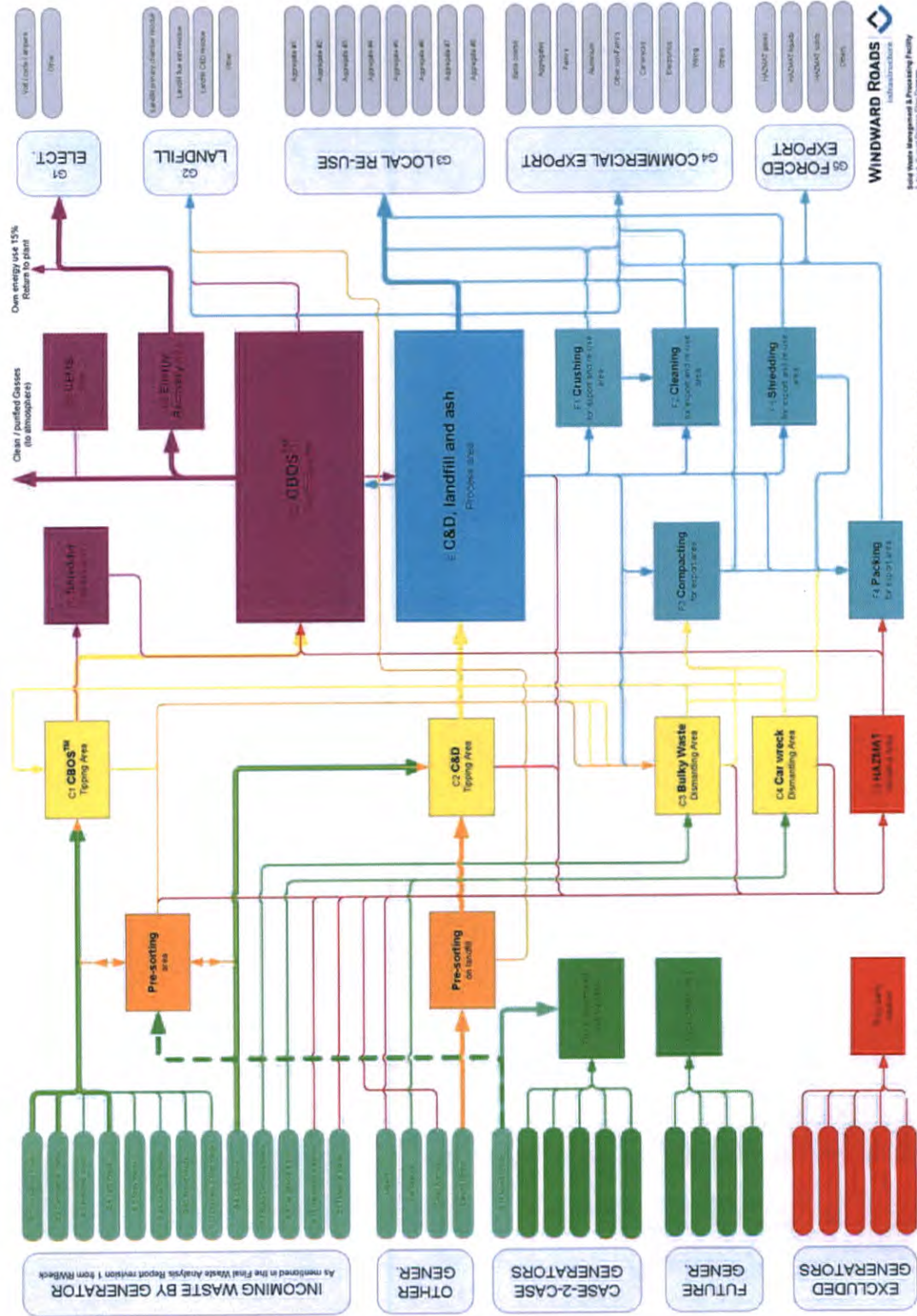


Figure 6.2 Preliminary waste flow diagram (see also Annex 13 for large printable version)



### 6.3 Acceptance procedures for the facility

#### 6.3.1 Acceptance

All waste categories described in paragraph 6.1 of this report can be accepted. However with respect to hazardous wastes, acceptance depends on the origin of the waste. The facility will only accept hazardous materials from households or comparable waste from commercial origin. Treatment and storage of hazardous waste from industrial activities is not included in the operational setup. For a complete list of substances not accepted see table 6.1 which is a preliminary estimation, still subject to negotiations with Government.

Table 6.1 Hazardous wastes that cannot be processed and are not accepted

Nr.	Type of hazardous waste
1	Sewer sludge of dry beds with off limit moisture contents
2	Hazardous wastes from factories, industries and laboratories including public utility companies and waste water processing plants.
3	Radioactive waste
4	Water, including waste water, laundry water, ballast water etc.
5	Sludge from sewers, drains, canals, ponds, ports and docks etc.
6	Explosives and fire works
7	Contained and uncontained liquids and gasses
8	Excessive quantities of waste caused by "Acts of God" other than Hurricane waste
9	Anti freeze

As far as possible hazardous waste is separated in waste that can be processed in the cBOS process units (as explained in paragraph 6.2) and the waste that needs to be exported for further processing.

The export, handling and end processing of the Hazardous Waste which cannot be processed in the cBOS system is an activity included in the operation. It will be carried out in accordance with the Basel Convention.

Waste from the reception facilities in the harbor (according to the Marine Pollution Protocol, Marpol, Trb. 1975, 145 (see paragraph 4.2) will also be accepted.

#### 6.3.2 Pre-acceptance procedures

A sample of the waste may be requested from the waste producer to facilitate an assessment of the suitability of the waste for disposal at the Facility if considered necessary by the technically competent manager. Wastes which result in excess of emission limit values or cause operational difficulties that lead to inadequate Facility performance will not be accepted at the Facility (see paragraph 6.3.1). The procedure for identification of such wastes will be developed following commissioning of the Facility hence will be based on operational experience.

### 6.3.3 Site-acceptance procedures

Should the waste load be rejected a record will be made of the incident in the Site Diary. Management will be informed and if necessary the material will be consigned off-site to a suitably licensed facility.

All vehicles delivering waste to the site shall be enclosed, sheeted or otherwise secured to prevent littering of waste in transit.

## 6.4 Description of cBOS procedures and process

### 6.4.1 Discharge of waste loads at platform

Following initial acceptance of the load by an administrator the vehicle will be directed to the specific waste category dedicated drop-off section. Visual inspections that only take place for mixed waste will be undertaken at this stage (sorting area, figure 6.1).

Collection vehicles for household waste can directly move on to the tipping floor. Here, the waste will be visually inspected as many times as possible before going in the cBOS, to avoid gas or pressurized cylinders or going the PGC's.

Any wastes unsuitable for the cBOS process such as large metallic or other non-combustible objects, large gas cylinders (larger than nominal 190g camping stove-type cylinders or similar), drummed wastes, packages of liquid waste greater than approximately 5 liters in volume, or other wastes that do not comply with the requirements will be removed from the unloaded waste and stored in the Hazmat area.

Air from the main building is used in the combustion process and will maintain negative pressure within the building hence emissions of odor will be minimized. The use of a batch process with 3 process streams each consisting of 4 gasifiers will result in combustion air being required on a continuous basis hence negative pressure will be maintained at all times.

Negative pressure can also be maintained when the facility is shut down when building air will be vented through the main stack to aid dispersion.

Approximately 75% of all incoming mixed wastes will be shredded before taken to the storage bays. The remainder will be taken directly to the storage bays, this will include hazardous wastes and animal wastes.

There is no provision of sorting facilities for recyclables at the cBOS installation prior to waste fuel storage. Waste received at the Facility will have been either bulk-segregated or sorted at the receiving - platform. Wastes unsuitable for processing through the gasifiers will be removed prior to waste storage or shredding.

### 6.4.2 Waste storage, handling and loading into gasifiers

The maximum total quantity of waste stored at the Facility will be 1,200 tonnes. Storage areas for waste are shown in figure 6.1. Waste will be stored in segregated bays according to waste type and calorific value. The maximum storage quantity and storage time for different waste categories is given in table 6.2 of 6.1

Table 6.2: Waste types, maximum storage quantities and storage times (for cBOS wastes)

Waste Type	Allowable quantity to be stored (tonnes)	Maximum Storage from day of reception
General Household, commercial, industrial and other waste	1200*	Various-4 day for general waste
Hazardous Waste	100	4 days
Animal Waste	20	1 day

\*Note: the total of all wastes stored at the site at any time will not exceed 900 tonnes.

Wastes will not be stored for a period longer than 4 days from the day of reception during the course of normal operations. Storage areas will be emptied and cleaned on a 2-weekly basis or as required to minimize the risk of anaerobic conditions and odors developing.

Appropriate fire fighting equipment will be made available in waste storage areas in accordance with the guidelines of the Fire Brigade. Locations of firefighting equipment and type will be agreed with the local Fire Officer upon completion of construction works.

In case dust control is required a mobile plant will be used to provide dust suppression using water. Any runoff generated from the dust sprays or from waste storage areas will be absorbed using sawdust and returned to waste storage for processing through the gasifiers.

The size of material from the waste sources will be variable. Any large or bulky items such as furniture will be broken up by shredding or loading equipment to facilitate loading into the gasifier chambers if necessary. Large waste items that are not combustible will be removed from the waste stream. Large items of dense waste, such as trees trunks, will be shredded or broken up on-site at the construction and demolition installation (C&D Plant) prior to being loaded into the gasifiers.

Storage areas will be flexible to accommodate changing waste inputs and to allow segregation of wastes with different calorific value and bulk density and allow their even distribution between the 12 individual gasifiers.

Wastes will be transported from storage areas by the tele-handler and loaded into the appropriate gasifier. Gasifiers are interlocked to ensure that they cannot be opened unless their temperature and status within the gasification process are suitable to allow waste to be loaded following de-ashing. The hydraulic top door will be opened to facilitate loading by the tele-handler.

The scheme below illustrates which type of internal vehicles will be used for internal waste transportation.

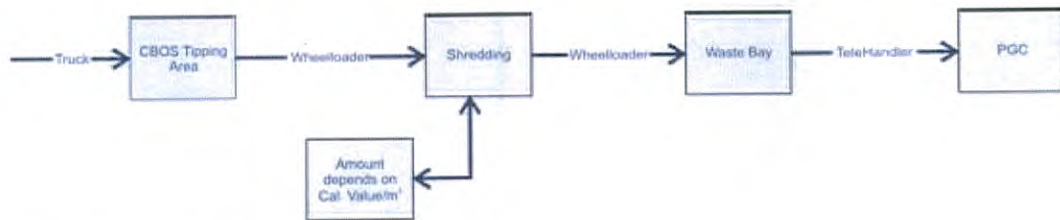


Figure 6.3 Internal transportation vehicles used

The shredded quantity is not dependant on the calorific value of the incoming waste. It is based on the quantity of waste coming into the facility. The low bulk density of the SXM waste is hereby increased and the volume of the chambers is optimized.

#### 6.4.3 Process of gasification

Each process stream comprises 4 primary gasifier units that supply Syngas to the downstream equipment dedicated for that process stream. Each primary gasifier unit operates on a sequential batch cycle. A simplified flow diagram of the facility is presented in Annex 3.

Waste is introduced into the primary chambers unsorted, as received or shredded. For most waste categories no preprocessing or preparation is necessary prior to loading into the chambers, however at the Sint Maarten facility a substantial part of the waste stream will be shredded due to the low bulk density of the waste. The loading method will be by a telescopic handler. After loading the waste into the primary chamber it is closed and sealed tight. A flame from an auxiliary burner is ignited and run for a short period of time. The burners run until the primary chamber temperature reaches about 200°C (392°F). Once this temperature is achieved, the burner in the primary chamber shuts off automatically. Instruments monitor and control the chamber temperature by controlling the air flow to the combustion bed. Under most conditions the burner in the primary chamber runs for less than 15 minutes each batch and has therefore very low fuel consumption.

The gasification procedure in the primary combustion chamber takes place under substoichiometric conditions (starved air). As the combustion bed is not disturbed or agitated during this process (such as if additional wastes were being introduced to the chamber), an environment for low emissions is created within the chamber. The combustion and waste volume reduction process progresses downward, from the top of the waste pile. The waste exposed near the top increases in temperature until it reaches its vaporization point, which occurs at relatively low temperatures. This combustible vapor is driven off to the already preheated secondary combustion chamber where it is mixed with additional air where it burns at higher temperature under violent turbulence.

As a result of this procedure the particulate and heavy metals emissions are minimized to the lowest possible level. Furthermore the low temperature environment within the primary chamber results in elimination of slagging of chamber walls, greatly reducing refractory wear and system maintenance.

The waste volume reduction process in the primary chamber occurs over a period of about 12 to 16 hours depending on waste type and system layout. This period includes 6-8 hours gasification and 6-8 hours burnout. More details are included in table 6.3 'Process stages'. Inorganic materials such as minerals, metals, aluminum, glass, copper wire, and cans never reach a gaseous state since the temperatures in the primary chambers are kept below their melting points. Hazardous heavy metal emissions to atmosphere are therefore kept to an absolute minimum. These unoxidized materials remaining in the chamber are sterilized and cleaned. They are thereby easily and safely separated from the ash for recycling. This separation will take place in the C&D plant.

By means of a telescopic handler the bottom ash is pushed out a low back door of each PGC, collected in a container and transported to the C&D plant for further treatment/separation.

The steps in the PGC gasification cycle are explained in table 6.3.

Table 6.3 PGC process stages

Stage	Typical duration (hours)
Filling of the gasification unit with waste (waste charging)	1
Ignition of the waste within the primary gasifier	0.5 (Initial stage of gasification)
Gasification of the waste 6-8	6-8
Residue carbon reduction (burnout)	6-8
Cool down of the ash	6.5 -10.5
De-ashing / off-line period	

The ash has passed the US EPA's TCLP test (toxicity characteristic leaching procedure) in test burns conducted by the Western Research Institute classifying the ash as "an inert substance, capable of being land filled or used as road bed."

Due to the starved air conditions in the primary chambers the combustion gasses are only partially oxidized when they pass to the secondary chamber to complete the combustion. At the point of entry additional air is introduced to the gasses resulting in very turbulent, high temperature combustion under excess air conditions. Full control of secondary combustion air and an auxiliary burner ensure that the required minimum temperature in the chamber is maintained throughout the process.

The burner running time, and therefore fuel usage, is dependent on the minimum temperature required by the local authorities. These requirements may vary between 850°C (1562°F)–1200°C (2192°F), depending on the application and location. For instance for most applications within the EU 850°C (1562°F) is the required minimum temperature, though 1100°C (2112°F) is required for full thermal breakdown of halogenated wastes. In North America 982°C (1800°F) is usually required. The secondary chambers in Sint Maarten will run at 1100°C (2112°F).

Residence time of the gasses at this high temperature is important for proper destruction of organic components. In the European Union a minimum residence time of two seconds is required in secondary combustion chambers for all wastes. The same usually applies to installations in North America, though in some isolated cases, codes may allow one second. The cBOS equipment can meet federal emissions regulations in the United States without any add on emission control devices. Therefore this technology can usually be operated without add on emission control devices in the US. However, without add on emission control device, this technology cannot 100% of the time achieve the current EU emission regulations. Therefore in the case of the Sint Maarten plant sodium bicarbonate will be used to capture acid components like HCl and SO<sub>2</sub> out of the flue gas. NO<sub>x</sub> will be captured through a De-NO<sub>x</sub> system utilizing urea via so called SNCR (Selective None Catalytic Reduction). See chapter 9 for more information.

The flue gas exiting the secondary combustion chamber will be cooled by a fire tube type waste heat boiler (one per stream). The waste heat boilers will produce super heated steam, which will be used to drive a steam turbine and generate electrical power. The exhaust vacuum steam from the turbine will be condensed and the condensate will be recycled back to the boiler, where it will be heated to regenerate the super heated steam. Cooled air supplied from an induced draught multi cell Air Handler will be used to condense the exhaust vacuum steam.

The cooled flue gas exiting each boiler (180 °C) will be directed into 'dry scrubbing' type flue gas cleaning plants. Each flue gas cleaning plant will be dedicated to a gasification stream and will comprise a reaction tower and a bag filter. Powdered carbon and sodium bicarbonate will be injected into the reaction tower to absorb pollutants (i.e. mercury, dioxins and acid gases) to ensure that the emission requirements of the Waste Incineration Directive (WID) are achieved. The waste solid residue generated by the gas cleaning (app. 2500 metric tones per year) will be collected, stored in bags and disposed off in the waste dump.

The flow of flue gas through each gasification stream will be induced by an induced draught (ID) fan (one per stream). This will maintain a negative pressure in the gasification chambers. The ID fan will pull the flue gas from the secondary combustion chamber through the boiler and the flue gas cleaning plant and will discharge the flue gas through individual flues located in a common multi flue stack (at 180 degrees C). Continuous Emissions Monitoring Systems (CEMS) will be installed on each flue. These will monitor the WID compliance of each individual gasification stream with respect to emissions.

## 6.5 Description of specific cBOS procedures and process

### 6.5.1 Hazardous waste

A range of solid hazardous wastes are considered acceptable for disposal at the facility. These are mainly the household type of hazardous wastes (see paragraph 6.3.1 for wastes not accepted).

#### *Pre-acceptance procedures*

To assess the suitability of the waste for disposal at the facility, information will be requested from the waste producer regarding the source of the waste, the quantity of waste, storage container, delivery details, the physical and chemical form of the waste and hazard codes, the typical particle size if available, the moisture content if available, the calorific value if available and the pre-treatment prior to acceptance at the site. Special handling and segregation requirements if required will also be requested from the waste producer. A sample of the waste may be requested from the waste producer to facilitate an assessment of the suitability of the waste for disposal at the Facility if considered necessary by the technically competent manager. As an example wastes with known high mercury content may not be considered suitable for processing at the facility.

Hazardous wastes will be recorded at the gate and directed to the HazMat area. Incoming hazardous wastes will be tagged and a destruction dates will be scheduled within 24 hours. This will allow storage requirements and impacts on the waste feedstock to be assessed.

#### *Acceptance procedures*

The administrator will inform the tele-handler operator within the main building that a hazardous waste load is incoming. A representative sample of hazardous waste loads will be taken by a suitably trained person. The sample will be labelled, referenced to the special waste consignment note, and kept for a minimum of 1 month after the waste has been processed through the facility.

#### *Waste storage, handling and loading into gasifiers*

The maximum quantity of hazardous waste stored at the Facility will be 100 tonnes. Dedicated storage areas for hazardous waste with clear warning signs will be provided. Hazardous wastes will be segregated where necessary in accordance with local health and safety regulation guidance.

Hazardous wastes will not be stored for a period longer than 4 days from the day of reception. Hazardous wastes that need to be exported will be stored for longer periods.

Any runoff generated from hazardous waste storage areas will be absorbed using sawdust and will be disposed of in the next available gasifier.

Selective loading of gasifiers with hazardous wastes will be undertaken to distribute such waste evenly between gasifiers. Based on the waste characterization study and hazardous waste quantities only specific gasifiers will be used for processing hazardous waste.

### 6.5.2 Animal waste and medical waste

#### *Acceptance procedures*

Animal wastes and medical wastes will be pre-booked when possible by a period of at least 24 hours to allow storage requirements and impacts on the waste feedstock to be assessed. Animal waste will have first priority to the gasifiers when pre-booking is not possible.

The administrator will inform the tele-handler operator within the main building that an animal waste load is incoming.

Odorous wastes will be pre-booked and their delivery and reception managed such that large volumes are only accepted with adequate notice and hence not stored at the facility.

#### *Discharge of waste loads*

Where animal waste and medical waste is delivered in wheeled containers they will be offloaded from vehicles and stored. Storage will take place at the HazMat area. These wastes will be taken immediately by site personnel to the tipping area and loaded to the first available PGC (waste including containers).

If a transporter or other client uses reusable containers, these empty containers will be closed and stored in a dedicated area for collection by the waste carrier. The containers will not be cleaned in the facility.

Animal wastes and medical wastes will be controlled wherever possible to allow direct discharge of suitable loads into gasifiers. Where this is not possible, dedicated storage areas for animal waste with clear warning signs will be provided. Storage areas will be engineered with a low bund to prevent any spread of liquid emanating from stored animal waste to the surrounding floor area.

#### *Waste storage, handling and loading into gasifiers*

The maximum quantity of animal waste and medical stored at the Facility will be 20 tonnes. This tonnage forms part of the 1,200 tonnes allowed for general non-hazardous waste.

Wastes will not be stored for a period longer than 1 day from the day of reception. Odorous wastes will be processed through the gasifiers as soon as possible. The use of refrigerated storage trailers may be adopted for particular waste streams should this be necessary.

Frequent building air changes through the negative pressure ventilation system as a result of the need for combustion air ensuring that any odors arising from specific waste streams will be passed through the treatment process prior to discharge through the main stack.

Storage areas will be emptied and disinfected on a weekly basis or more frequently if required to minimize the risk of anaerobic conditions and odors developing. Any runoff generated from disinfection or from waste storage areas will be absorbed using sawdust and disposed of in the next available gasifier.

Selective loading of gasifiers with animal wastes and medical wastes will be undertaken to distribute such waste evenly between gasifiers.

## **6.6 Description of C&D plant procedures and process**

The cBOS facility is not designed to process inorganic materials. Different types of waste entering the processing facility will however contain a high level of inorganic materials: especially construction and demolition waste. The amount is estimated at 52,000 ton/yr which includes 26,000 ton/yr wood & pallets (approximately 50% of C&D waste is wood, see paragraph 5.2 and 5.3).



Besides this the operator will start excavating the present waste dump with a volume of approximately 10,000 ton/yr. This cannot be processed in the cBOS directly given the expected high volume of inorganic materials. It has to be pre treated.

It is therefore that at the waste management and processing facility a Construction & Demolition recycling plant (C&D plant) will be realized. In this plant C&D waste and waste excavated from the waste dump will be sorted into fractions like:

- organic materials (wood, plastic, paper, etc.);
- ferro;
- non ferro;
- aggregate (sand, stones, bricks);
- light building material like plaster.

Besides the above mentioned waste streams the C&D plant has to be able to process the bottom ash of the cBOS. When waste is being processed in the cBOS, bottom ash remains containing recyclables like aggregate, glass, ferro and non ferro. The C&D plant will be designed in such way that it also can process the bottom ash of the cBOS with an approximate volume of 13,000 ton/yr.

The C&D plant will consist of several different types of sophisticated equipment like magnets, sieves, conveyor belts and also a sorting cabin for manual picking.

The C&D plant has not yet been designed. Figure 6.4 however presents a principle overview of such a plant. We would like to emphasize that this is just an example.

In general the process will be as follows: waste will be unloaded at the floor near the feeder of the system. A telehandler will feed the system. It can also remove parts that can not be dealt with in the C&D plant.

From the feeder the waste will be transported through a system of conveyor belts to the several different types of equipment such as magnets, sieves, etc.

The recyclables are collected at different places within the C&D plant and piled. A shovel will collect these from time to time and transport these recyclables to a storage area. At certain time intervals the recyclables will be transported from the storage area and leave the facility for its final destination (i.e. recycle industry)

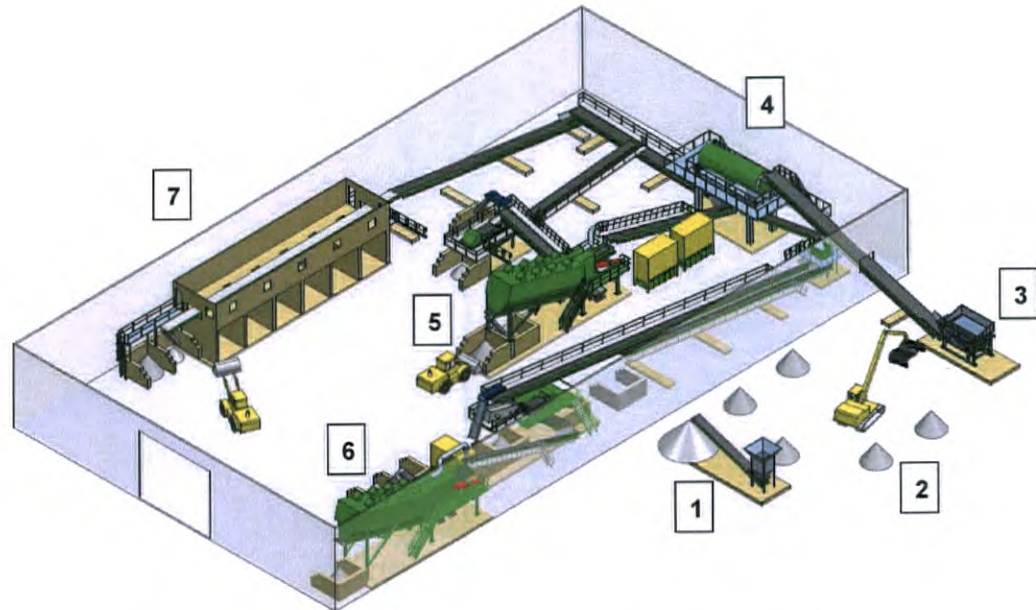


Figure 6.4: Preliminary lay out of the C&D waste separation plant (example)

The plant lay out presented above is tentative and only meant to present a possible design of a C&D plant. Such a plant could consist of (numbers referring to picture above).

1. bag cutter: cut large plastic bags full of waste before entering the system
2. unloading floor
3. feeder: a telescopic handler will lift the waste from the unloading floor into the feeder
4. sieve + magnets for splitting the main stream in several different fractions
5. sieve + magnets for sorting dedicated recyclable
6. sieve + magnets for sorting dedicated recyclable
7. sorting cabin. Manual sorting of the residue. Underneath the cabin are storage area's for several recyclables.

### Facilities

The C&D plant is in fact a large building which houses all the equipment. Inside this plant a sorting cabin will probably be erected depending on the outcome of the design study to be released in the near future.

Furthermore, a control room with all the electro technical equipment to control the process will be installed inside the building in such way that the controller has a good view over the plant.

The C&D plant will have a dust control system to avoid dust spreading in the air. It is to be expected that dust will be collected at several different spots inside the building and through a system of pipes transported to dust collector with probably big bags. These big bags with dust can easily be removed from the C&D plant and disposed of at the waste dump. Processing in the cBOS is not expected as the dust will mainly contain inorganic part.

Furthermore facilities for the operators will be arranged (office, locker room, etc).

## 6.7 Pest control

All waste with the potential to attract or generate vermin will be stored inside the main building. Strict storage time limits are applied for all wastes (4 days), with storage time of 1 day for wastes that have a high risk of attracting or generating vermin.

Some individual consignments of non-biodegradable wastes will, on occasion, be appropriately stored external to the main building, subject to them being 'secure' and having no potential to substantially degrade or attract vermin within the open such that would be detrimental to the environment.

All storage areas are cleaned regularly to prevent conditions favorable for vermin to proliferate. Waste water resulting from this process is collected in a concrete pit. After treatment (a.o. by means of sand filters) this water will be reused for cleaning purposes.

Should waste be accepted at the site that is already infested it will be processed as a priority. The waste producer will be contacted and the waste will not continue to be accepted without suitable pre-treatment to prevent a repeat of such an incident.

Waste storage areas will be inspected throughout the working day by site personnel, and formally once each working day by a suitably trained person. A record of formal inspections and any vermin noted will be made, along with corrective actions of required.

Insecticides and rodenticides will be used if necessary to eliminate or discourage vermin. A suitably qualified vermin control contractor will be appointed should specialist advice be required.

## 6.8 Consumables

Table 6.4 presents the amounts of consumables needed to operate the plant.

Table 6.4 Amounts of consumables (per hour or year)

Sint Maarten: Estimated Utility Consumption

Item	Consumer	Range per 60 TPD Stream
Electricity	Plant	0.3 MW
Gas / Oil	Gasification Trains auxiliary fuel for PGC Ignition, SCC constant temperature maintenance	20 - 82 liters per day
Sodium Bicarbonate	Flue Gas Treatment	0 to 120 kg per tonne of waste processed
Powder Activated Carbon	Flue Gas Treatment	0 to 170 kg per hour
Compressed Air	Bag-houses and plant instrumentation	2500 liters per hour
UREA	De-Nox	13-20 kg per hour
Chemicals	Water Treatment, plant cleaning	Subject to local conditions
Water	De-Nox	Up to 335 liters per hour
Water	Ash Wetting	2.5 m <sup>3</sup> per hour
Water	Emergency Shut Down	24 m <sup>3</sup> per hour
Water	Boiler make up	7000 m <sup>3</sup> per annum

Please note: All consumption figures are highly variable & site specific. Alternative plant process design or flue gas treatment can be adopted where local conditions make variable consumptions relatively expensive.

## 6.9 Mass balance of waste processing

The total mass balance of the SWMPF is as follows (quantities per year):

**Waste in:** 131.000 metric tonnes (52 \* 2.517 Mt).

**Processing:** treatment cBOS: 98.000 tonnes (for calculation, see paragraph 5.3)  
Inorganic residues from cBOS/C&D and other: 52.000 Mt (1007 Mt/week \* 52) of which 50-65% is recyclable and/or exported.

### Waste out:

The ultimate goal of the project is to reach a reduction of 95% of the disposal of all waste streams into the landfill. The expected ash residue from the cBOS is 4 – 5%, and the C&D plant will produce a minimum residue to be landfilled. Most products are either recyclable or will be used as waste-feed for the cBOS.

## 6.10 Main characteristics of base case

Table 6.5 summarizes the main characteristics of the plant.

Table 6.5 Main characteristics of SWMPF

Characteristic	Base Case
Waste treatment mT/yr	131.000 Mt
Number of trains cBOS	3
Process buildings	2
Waste separation facility	Yes
Hazardous waste storage facility	Yes
A ban on landfilling (except for ashes and residues from treatment)	Yes

It can be concluded from this chapter and paragraph 4.6 that the SWMPF is fully in compliance with the National standards for (new) waste treatment facilities<sup>1</sup>.

#### 6.11 Construction activities

It is estimated that the construction of the Facility will last approximately 2 years starting with filling and leveling of the plant area. After the filling and leveling the erection of the building will start.

Potential emissions to the air during construction works are dust and gaseous emissions. Dust emissions are caused preliminary by excavation works as well as from transport.

Odour emissions may also arise by use of machinery and painting works. Increased traffic during construction will cause a temporary noise pollution. However, since the area is a predominantly commercial area and since the construction phase is of limited time the impact is assessed as not significant. It is therefore that this impact is not further discussed in the report.

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<sup>1</sup> Under the assumption that the EHIA will be accorded and the Nuisance permit granted

## 7 BASELINE SITUATION

### 7.1 The waste dump

For years the waste dump at Pond Island has been the official dumping place for nearly all the waste streams produced in St. Maarten. The explosive growth of the local population and the tourist industry has brought an increase in most of the waste streams (e.g. construction and demolition -, household -, commercial waste). The disposal of garbage was going on with limited control and management. Due to hurricane Luis in 1995 the limited space led to a critical situation at the waste dump. Plans were designed for remodelling and reorganizing the dumpsite including a containment dyke around the waste dump area. These plans were executed in 1998.

After the completion of these works the management of the waste dump was outsourced to a private company. Ever since, the waste dump has been better-controlled and all entering trucks are being registered including the type and estimated volume of the waste.

The current waste treatment and -management implies a number of environmental threats:

- To day there is no suitable treatment for hazardous wastes. They are landfilled with all other wastes. Polluted leachate flows freely into the Great Salt Pond.
- Waste water is being dumped on the landfill
- Car tyres are being stored on the landfill causing problems with mosquitoes and fires on the landfill (see figure 7.1)
- Car wrecks are not stored on floors with sufficient fluid containment (see figure 7.2).

The highest level of the waste dump is approximately 12.00 meters + SMP. The finished parts of the waste dump are covered with a layer consisting of a mixture of sand and silt.



Figure 7.1 Car tyres on waste dump



Figure 7.2 Cars stored on open floor

## 7.2 The project site

Figures 7.3 and 7.4 show the project site. In the first picture one can see the dyke at some distance from the site. The part of the project site that is a water body at this moment will be filled with sea sand to realize a project site of sufficient area. Currently, the site is covered with stray waste and the actual dump site is approaching the project site at a rapid pace (figure 7.4).



Figure 7.3 Project site with dyke at some distance from the site.



Figure 7.4 Project site with active dump site at the background.

### 7.3 Air quality

The description of the baseline situation for air quality is a qualitative one. There is currently no information available on the air quality in the project area.

In the project area there are no major industries. There is traffic and there are residential areas. The contribution of these activities cannot be described in a quantitative way but existing information on ambient air quality from the Island of Curaçao may give an indication of what can be expected on Sint Maarten.

For Curaçao a study was carried out by TNO (TNO, 2007) in which air quality was monitored near a busy road (locations Goisco and Golf Course). During the measurements no influence from the refinery could be observed. For  $\text{NO}_x$  the background value appeared to be app. 6-12  $\mu\text{g}/\text{m}^3$  and for  $\text{PM}_{10}$  and  $\text{PM}_{2,5}$  the background values appeared to be 25  $\mu\text{g}/\text{m}^3$  and 11  $\mu\text{g}/\text{m}^3$  respectively (appendix C of TNO report).

With respect to Odor and dust it can be stated that the current way of waste deposition on the waste dump causes bad scents, dust emissions and smoke to be emitted to the atmosphere (also see figure 7.5).



Figure: 7.5 Emissions of smoke from an underground waste dump fire

Stench, rodents, mosquitoes and midges are among the regular nuisances for the population around the Salt Pond, as demonstrated in the St Maarten Health Study (Fuchs et al 2001, p. 89). The nuisances originate partly from the sewage water treatment plant and partly from the waste dump. Midges originate mostly from the sewage treatment plan (ROB Sint Maarten). According to an expert report the midges also originate from the wastewater from the waste dump (Letter from G. Seferina to mr. F. Meyers: Public Health Commissioner, Jan 16<sup>th</sup> 2006). The other nuisances are thought to result partly from the wastewater and partly from the waste dump.



### Soil/groundwater investigation

The planned location for the waste to energy plant is an embanked part of the salt pond at the south west side of Pond Island (see also chapter 6 and paragraph 7.1). It is planned to fill this embanked area with dredged sand from the new cruise terminal project at Great Bay. The dredging and filling of the embanked area are beyond the scope of this project.

### Recent research

The environmental situation for soil at the project area cannot yet be established, since the project area is not yet filled. The dredged sands from the harbour has been tested for oil and heavy metals. This gives a first indication of the quality of the soil at the future project site (samples taken from harbour Sint Maarten). The analyses results are shown below:

All heavy metals (As, Cd, Cu, Hg, Ni, Pb) are below detection limits except for:

- Chromium (Cr): 7,3 mg/kg (target value 100 mg/kg)<sup>1</sup>
- Zinc (Zn): 12 mg/kg (target value 140 mg/kg)

For oil all values are below detection limits.

The results indicate that there is no indication of heavy pollution of the dredged sands.

### Historical research

The environmental situation for soil, groundwater and surface water in the Great Salt Pond (wider area) has been studied by Civil Engineering Caribbean NV in cooperation with Witteveen & Bos (CEC, 1996). The study which was carried out with regard to pollutants related to the dump and resulted in the following findings:

- Pond Island: a slight pollution with zinc and a moderate pollution with copper was observed, both probably of natural background origin; on some places a moderate pollution with oil was observed, probably caused by spills of industrial activities;
- Ground water of Pond Island: on some places a strong pollution with oil was observed (above the intervention value), also a moderate pollution with PAC's , copper and zinc;
- Sediment of the Pond: on some places a slight to moderate pollution with copper was observed;
- Surface water of the Pond: a moderate pollution with copper and a moderate pollution of the groundwater with copper, zinc and oil was observed. Also a high load with nutrients from various sources, but this did not cause eutrophication.

It was concluded that that the pollution related to the dump posed no severe threat or risk to the environment and does not lead to the direct necessity of sanitation (removal) of the underground. No chemical waste was found on the land fill.

The results of this survey do not really give a relevant indication of the environmental situation today. The survey was conducted in 1996, so more than 13 years ago. Since

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<sup>1</sup> Circulaire streefwaarden en interventiewaarden bodemsanering

then significant changes have taken place in the situation around Pond Island and the Great Salt Pond:

- The Pond Island has been extended with an embankment at the western side, of which the greater part has yet been filled with waste;
- Many new developments have taken place around the Great Salt Pond including embankments, building of houses and industry. This all resulting in extra flushing of sewage and other wastes into the Pond;
- A sewage treatment plant at Madame Estate has been built to treat sewage from the shopping centre at Madame Estate. Influx of untreated sewage water into the Pond is caused by the sewage system of the FOGA housing project;
- The load of the public Philipsburg Sewage Treatment Plant has increased and regularly the plant is overloaded, resulting in an influx of untreated sewage water into the Pond;
- The Island of Sint Maarten has undergone a very strong economic development, resulting in an increase of waste production, probably also in the production of chemical waste (paint rests, batteries etc);

In the abovementioned report it was mentioned that the bottom of the Great Salt Pond can be seen at all places. Recent observations show greenish water in the Pond (see figure 7.6). Also a lot of waste and algae are visible around the shores of the Pond. (see figure 7.7).



Figure 7.6: Greenish surface water of the Great Salt Pond



Figure 7.7: Waste and algae at the shore of the Great Salt Pond

#### 7.4 Description of Flora and Fauna

The Great Salt Pond is the natural drainage basin for all the surrounding hillsides. The east side of the pond is bordered by a small mud flat area, which drops off quickly into deeper water. Immediately east of this border is a very busy paved public road, one of the main thoroughfares into Philipsburg (Suckergarden Road). The corners between the east shore and the north and south shores are small mudflat areas, thinly fringed in grass. The majority of the north, west, and south borders are rock wall remnants of the salt production era. Two other rock walls run north and south down the centre of the pond. The edges of the rock walls run into shallow water that quickly becomes deep.

Several studies have been conducted on the ecological values of the Great Salt Pond. In 1996, EcoVision carried out a study on the ponds of St. Maarten including Great the Salt Pond. Lievse (2009) states that the ecological observations made by EcoVision are still valid in general terms. Furthermore, Brown and Collier carried out surveys of the ponds focusing on birdlife in the successive years from 2001 – 2008, the reports of which (2001 and 2004-2008) can be found on the website of EPIC (Environmental Protection in the Caribbean).

Rojer (1997) carried out a biological inventory on St. Maarten, including both flora and fauna.

According to Brown and Collier, the immense size and connection to other ponds make the Great Salt Pond one of the most ecologically important ponds on St. Maarten. On the other hand, the complete removal of all vegetation, including mangroves surrounding the ponds, has left a major void in the ecosystem. Not only were the major natural filtration systems destroyed, but vital nesting and roosting habitat was lost for birds. Although vegetation is not abundant at all, some locations of the pond still serve as foraging grounds for considerable numbers of waterfowl (EcoVision, 1996). The studies by EcoVision (1996), Rojer (1997) and Brown and Collier (2001-2008) are described below in more detail:

### Vegetation

In the Biological Inventory of St. Maarten, Rojer (1997) states the following: "The salifia vegetation is found only at Great Salt Pond according to Stoffers (1956). In this vegetation Sea Purslane (*Sesuvium portulacastrum*), Wild Banana (*Batis maritima*) and *Salicornia ambigua* are found. However, Howard (1991) was unable to find this vegetation at the locations mentioned in the literature."

Detailed observations around the Salt Pond by EcoVision (1996) showed some scattered fringes of vegetation, consisting of Beach Morning Glory (*Ipomoea pes-caprae*), Sea Purslane (*Sesuvium portulacastrum*), Saltwort or Wild Banana (*Batis maritima*) small Acacia trees (*Acacia tortuosa*) and a few Seagrape trees (*Coccoloba uvifera*).

In the northeast section of the pond, between a residential area and a reclaimed area, a swamplike grass vegetation (Seashore rushgrass, *Sporobolus virginicus*) has developed parallel to the pond. The water in this part of the area originates from residences in the surrounding area and is probably fresh to brackish. This area of vegetation serves as foraging grounds for waterfowl.

Mangrove vegetation was not encountered. If ever existent, mangrove vegetation would probably have been removed during the 3 ages of salt exploitation, because tall vegetation was known to reduce evaporation significantly (Langemeyer, app. 1920).



Sea Purslane



Seagrape



Beach Morning glory

Figure 7.8: Examples of plant species found at the shore of the Great Salt Pond

### Birds

St. Maarten is classified as an important breeding area for seabirds. Several small rocky islands just off the shore provide an ideal habitat for breeding colonies.

Brown & Collier (2006) mention that 170 species of birds can be found on St. Maarten, of which 47 are resident and nesting birds, and 123 are migrants and non-nesting visitors.

The studies by EcoVision (1996) and Brown & Collier (2001-2008) show that the Great Salt Pond is used by more than 20 species of birds. Some of these species were encountered in large numbers, such as the Laughing Gull (*Larus atricilla*, more than 5000 in 2005), to which the Great Salt pond is a regionally significant stop-over site (2009, Nature Foundation). The Laughing Gull is not known to breed on Sint Maarten, large numbers congregate at the Salt Pond before breeding elsewhere (EPIC, pers. comm. 2009). Other observed species of gull include Ring-billed Gull (*Larus delawarensis*), Herring Gull (*Larus argentatus*), and Lesser Black-backed Gull (*Larus fuscus*). Large numbers of Black-winged Stilt (*Himantopus himantopus*) have also been observed, to which the shallow water in the southeast corner provides an excellent foraging habitat. White-cheeked Pintail (*Anas bahamensis*), Common Moorhen (*Gallinula chloropus*), American Coot (*Fulica Americana*) and Caribbean Coot have been documented to nest in the Great Salt Pond (Brown & Collier, 2006)



Greater Yellowlegs



Snowy egret



Blacknecked Stilt

Figure 7.9: Bird species found at the shores of the Great Salt Pond

Other frequently observed species are: Great Egret (*Egretta alba*), Snowy Egret (*Egretta thula*) and Cattle Egret (*Bubucus ibis*), Blue-winged Teal (*Anas discors*), Black-Bellied Plover (*Pluvialis squatarola*), Greater and Lesser Yellowlegs (*Tringa melanoleuca* and *T. flavipes*) and several species of Sandpiper (*Calidris spec.*). Herons were observed as well, including the Great Blue Heron (*Ardea Herodias*), Little Blue Heron (*Egretta caerulea*) and occasionally the Yellow Crowned Night Heron (*Nyctanassa violacea*). In 2006 a great number of swallow stayed at the Great Salt Pond, attracted by a food abundance in the form of a midges plague.

Many of these species use the rock walls as roosting habitat. The northeast swamplike section of the pond is used in particular by egrets as foraging grounds. The Snowy Egret nests on the island and uses e.g. the mangroves around the neighbouring Fresh Pond as nesting site. Waders such as Yellowlegs and Sandpipers can be observed in particular on the small mudflat areas.

#### Other fauna

The Great Salt Pond has limited fishery: some recreational fishing from small boats or from the banks, but there is neither commercial catch nor fish farming. Because of the pond water quality and bottom quality the consumption of fish from the Great Salt Pond is not recommended (EcoVision, 1996).

St. Maarten's ground lizard (*Ameiva pleei*) which appears to be common on the island, can also be found in and around the landfill and on the road through the Salt Pond (Rojer, 1997).

## 7.5 Nuisances

Table 7.1 shows the experience of nuisance in Sint Maarten as an average (first column) and the level experienced in the area that is considered to be the area impacted by the SWMPF (CBS zones 1, 3, 4 and 5 see paragraph 9.2).

It is noteworthy that the impacted area generally experiences less nuisances, except for air pollution and traffic.

Table 7.1 Distribution of nuisances on Sint Maarten.

<b>Nuisance</b>	<b>Average for Sint Maarten</b>	<b>Average for impacted area of SWMPF (see text)</b>
<i>Waste</i>	15.6	15.0
<i>Dust</i>	12.7	11.0
<i>Air pollution</i>	13.9	16.2
<i>Noise</i>	16.2	13.1
<i>Traffic</i>	6.2	6.5
<i>Plaques</i>	31.7	30.5
<i>Drug addicts</i>	5.9	5.4

## 7.6 Epidemiological investigation

Health impacts, if present, are related to air pollution and noise. Ambient air pollutants have been related to lung and heart diseases. In addition the carcinogenic load is of general concern<sup>1</sup>.

Vulnerable groups for environmental pollution are generally speaking the young, the old and the weak: a. youth is vulnerable because of immature defense mechanisms and high metabolic needs; b. the aged and groups with chronic disorders are vulnerable because of low reserve/buffering capacity and limited resilience. There is much overlap between the last two groups.

In relation to air pollution the development and aggravation of symptoms of asthma and other types of Chronic Obstructive Pulmonary Disease (COPD) among the youth are of most concern.

In relation to noise the learning ability of school children is of most concern.

The relevance of the abovementioned health impacts and vulnerabilities is as follows:

- The demographic pyramid of StM is rather peculiar, with a high proportion of persons in the economically active period (EAP: economically active population), and virtually no elderly. In view of the demography it is not surprising that the prevalence of cancer is rather low. In conclusion most concern goes to the youth with regard to vulnerable groups.
- The prevalence of asthma in StM is relatively high and of the allergic type: In the StM Health study a relatively low prevalence of asthmatic symptoms was found among the adult population. Asthma and other Chronic Obstructive Pulmonary Diseases (COPD) are most frequent among the youth, however. In agreement with this a much higher level of asthmatic symptoms was found in the Census 2001 among the youth (3.2%). The pediatrician at StM (dr. Offringa) confirmed this latest finding and stated to be alarmed by the high prevalence of COPD among the youth and by the relatively severe nature of the ailment at StM. The

<sup>1</sup> Disorders of the digestive tract are generally not related to environmental pollution, exc. for cancer, but this is related to food and eating habits. Dermatological ailments may be related to environmental pollution, but these ailments are so heavily influenced by psychological factors, that epidemiological findings are not informative of pollution aspects.

contribution of ambient air pollutants, most notably fine dust and nitrogen dioxide, is likely to be substantial and of concern for the public health.

- The prevalence of hypertension and heart diseases is very high in StM and the NA at large. This is mostly determined by eating habits and overweight, and also related to a high prevalence of diabetes. It is very unlikely that environmental pollutants, most notably noise and fine dust, contribute significantly to the disease load.
- The learning ability of school children is an issue of general concern in StM. The contribution of noise to the learning abilities is thought to be negligible or at least very limited. On the other hand, the situation should not be aggravated by adding noise pollution.

#### 7.7 Nuisance by insects and rodents

Mosquitoes are ubiquitous. The Great Salt Pond is one of many reservoirs on the Island. In a roundtrip around schools no gradient was found with the distance to the waste dump. For midges, however, a clear gradient was found, but this has been related to the waste water (see before).

Rodents are also present everywhere at Sint Maarten (but are not disease infested). The nuisance from rats has been investigated in the Sint Maarten Health Study. No relation with the dump site on Pond Island was suggested. More in general wastes are related to rodents (and stray dogs etc.), but this refers more to waste management and the collection system than to the waste dump as such. However, no field research was performed on the presence of rats in the nearby neighborhoods, so definitive conclusions cannot be drawn.

#### 7.8 Health situation at the site(s) and surrounding (sensitivity)

There is little descriptive information available of the public health situation at Sint Maarten. A roundtrip was made along schools and the pediatrician of Sint Maarten was interviewed by telephone. The population is too small to draw solid conclusions, but no indications have been found of a relationship between the waste dump with regular dust- and smoke emissions) and the incidence and prevalence of Chronic Obstructive Pulmonary Disease (COPD).

#### 7.9 Cultural assets, property and historical heritage

The Great Salt Pond has been used for Salt mining industry from around 1631 to 1940. Salt was collected from the Great Salt Pond and subsequently exported all over the world or locally used to conserve food. The rock walls still present in the Great Salt Pond are remnants of the salt mining period. Ruins of the Salt Factory, which was built in 1862, are located north of the Great Salt Pond.

Many Sint Maarteners are descendants of people who worked in the Great Salt Pond during and after slavery, a fact which makes the Pond an important aspect of the island's heritage.

The total area of Great Salt Pond has recently been identified and designated by the Executive Council of Sint Maarten as a monument. In doing so, government acknowledged the cultural/historical significance of the area.

A description of how this area could be utilized and appreciated was already given in 2007 by the archaeologist Jay Haviser, titled Salt Walk: "A wooden catwalk which crosses over the water along the western edge of the Great Salt Pond Pans, connecting the town to the proposed park area north. Along the catwalk, information signs about salt in Sint Maarten's history and nature, a central covered platform, and various signs also dedicated to individually named persons who worked the pans along the way. This creates a safe pedestrian walkway from town to the Melford Hazel Recreation Center, and highlights the salt pans as valuable monuments." The proposed Salt Walk is shown in the figure below.



Figure 7.10: Proposed Salt Walk



## 8 DEFINITION AND DESCRIPTION OF SCENARIOS AND OPTIONS

### 8.1 Nil Scenario

The 'Nil scenario' also referred to as the 'without scenario' is the scenario in which the Waste to Energy Facility will not be realized nor any alternative waste treatment. This scenario is in fact the continuation of the present situation.

For Sint Maarten the 'Nil scenario' means that the waste dump at Pond Island will continue its activities hence the waste of Sint Maarten will be landfilled at this site.

One may ask whether this is a realistic scenario. As it is stated by the Government of the Island Territory of Sint Maarten only a few years are left for the waste dump to reach its maximum capacity. Further expansion of the dump is not possible in light of maintaining a minimum water surface in the pond for its buffer function during heavy rains and hurricanes.

To visualise that the effects of continuation of the waste dump activities a photo impression is presented in figures 8.1 and 8.2. The second figure shows the waste dump after 15 years from now assuming an annual waste production of 130,000 Mtons to be landfilled (162.500 m<sup>3</sup> per year). Over time densifying of landfilled material takes place because of biological degradation of organic wastes (app. 20-40%, CUWVO, 1987).

For the visualization the following assumptions have been made:

- Total waste: 130.000 tonnes/year
- Degree of compacting max. 800 kg/m<sup>3</sup> (including earth cover)
- Volume of compacted waste 162.500 m<sup>3</sup>/year
- Densifying of material over time (30%)
- If calculated with equal surface of waste dump each year: elevation of level of waste dump will be 1 meter per year, or 15 jaar 15 meter
- However, slope of waste dump is 1 to 3 (vertical to horizontal) meaning that in 15 years app. 1/3 of surface is lost.
- Estimation app. 20 meters of elevation in 15 years.



Figure 8.1 Current situation



Figure 8.2 Situation after 15 years (estimated)

In this particular case the Government decided to take action and start a Tender Procedure and invite eligible companies to submit proposals to find a solution for the waste management situation at Sint Maarten.

## 8.2 Options for emission reduction and improved ambient air quality

Even though the facility has to comply with stringent EU standards, possibilities exist to reduce the emission to several environmental compartments. In this chapter these possibilities will be presented.

### Reduce relevant emissions (NO<sub>x</sub>) by SCR

The Sint Maarten plant will be equipped with SNCR (Selective Non Catalytic Reduction) for NO<sub>x</sub> -abatement. As an option SCR can be considered.

Compared to a SCR system a SNCR system is more vulnerable in case of batch systems due to fluctuations in the synthesis flow and variable composition of the incoming waste. For example: for mass burning installations a SNCR system is sufficient as this can be considered as a continuous process. For the facility in Sint Maarten this disadvantage of the SNCR has been counter attacked by means of two measures:

- 1 Incoming waste will be shredded to avoid too much variation of the waste composition to be fed in the primary gasification chambers;
- 2 Fluctuations in the synthesis flow are minimized because there is only one secondary combustion chamber for every four primary gasification chambers.

The main advantage of SCR is the abatement efficiency for NO<sub>x</sub>. This is higher than in case of SNCR. However and mostly based on the experience of the plant in Husavik, Iceland, it is proven that the SNCR system in the Sint Maarten plant assures compliance with the EU Directive.

One of the main disadvantages of SCR is the costs involved. Investment costs of SCR are several times higher than the costs related to the investment of a SNCR system.

Therefore the conclusion can be drawn that in case of the Sint Maarten facility the SNCR for NO<sub>x</sub> abatement is efficient enough and in compliance to the regulations.

#### **Stack height of 22 meters**

The impact of the flue gas emission can be reduced by increasing the height of the stacks. The height of the stack is 3m above the building, hence 18 meters above base level (base level is 1,5 meters). In this EHIA the impact of flue gas emissions are calculated using a stack of 22 meters above base level (23,5 meters).

### **8.3 Reduce the visual impact of the building**

At the facility several buildings will be realized. The biggest, with the largest footprint, will be the gasification plant. This plant will have a footprint of 9.500 m<sup>2</sup> with a height of 15 meters. Driving on the Pond Road the facility is always visible and it can be considered as a landmark.

Within the area of the Pond this building will be the biggest one. Its characteristics are shown in Chapter 9. To reduce the visual impact several measures can be taken, amongst others:

- Adapt the design. Instead of a standard warehouse lay out smaller building blocks could be integrated.
- Use outside colors which are in harmony with their surroundings.
- Introduction of a landscaped section on the south side of the project area.

## 9 ENVIRONMENTAL EFFECTS OF BASE CASE

### 9.1 Air emissions

#### 9.1.1 Sources of air emissions

Table 9.1 summarizes the main sources of air emissions. In this overview a distinction has been made between the regular emissions of operation according to design and emissions that can take place during partial system failure scenarios (defined in paragraph 9.10). During the system failure scenarios emissions take place through 3 different stacks (third line of table 9.1), either by a single stack or during more unlikely scenarios based on the system failure severity by two or more simultaneously.

Emissions of failure situations are described in paragraph 9.10.

Table 9.1: Overview of emission points

Source	Emission point	# of points or diffuse source	Type emission (dis)continuous	Characterization
cBOS	2 stacks (18m)	3 flue lines combined in 2 stacks	Continuous	Treated flue gases (a.o. NO <sub>x</sub> , SO <sub>2</sub> , particulate matter, heavy metals, acidic components and traces of halogenated hydro carbons) at 180 degrees C.
cBOS	3 emergency vents (16 m)	3 separate vents	Discontinuous (exceptional situations)	Untreated flue gases (NO <sub>x</sub> , SO <sub>2</sub> , particulate matter, heavy metals, acidic components and traces of halogenated hydro carbons at max. 1100 °C)
Building cBOS tipping zones	Doors	22 doors Main doors are Closing automatically	Discontinuous	Odour
C&D plant	Doors	10	Discontinuous	Particulate matter
Stone crusher	Machine	1	Discontinuous	Particulate matter

The cBOS technology is currently being operated in several parts of the world. The emissions of the Iceland (Husavik) system are best monitored and documented. These emissions comply with the European Emission standards (Waste Incineration Directive) even though the system is equipped with limited flue gas treatment (see Annex 6). As an example it can be mentioned that the NO<sub>x</sub> emissions in Husavik are well below 175 mg/m<sup>3</sup> (standard is 200 mg/m<sup>3</sup>) without any NO<sub>x</sub> treatment.

As the cBOS for Sint Maarten will be equipped with a full emission treatment, -control and -monitoring system (described in the next paragraph), the emissions will comply fully with the WID standards.

## 9.1.2 Abatement of cBOS emissions

### NO<sub>x</sub>

The plant at Sint Maarten has been designed for co-acceptance of hazardous waste and hence the design combustion temperature in the SCC is 1100°C compared to the 850°C at Husavik (Iceland). This will reduce the risk of formation of hazardous substances (dioxins, furanes etc.) while on the other hand stimulates the formation of NO<sub>x</sub>. Therefore NO<sub>x</sub> reducing measures have to be incorporated.

1. Flue Gas Recirculation
2. Urea Injection

#### *Flue Gas Recirculation*

Each secondary combustion chamber (SCC) will be equipped with a Flue Gas Recirculation Fan, which will recirculate approximately 15% of the total flue gas flow from the outlet of the waste heat boiler to the SCC air injection ring. Flue gas recirculation will reduce the oxygen content in the SCC and hence minimize the potential for (autogenous) NO<sub>x</sub> formation. During Emergency Venting no Flue Gas Recirculation shall be possible (see also process diagram of cBOS system, Annex 3).

#### *Urea Injection, SNCR (Selective Non Catalytic Reduction)*

To ensure compliance with WID, a De-NO<sub>x</sub> system utilizing urea will be installed on the SCC. Urea prills will be mixed with water in a proprietary De-NO<sub>x</sub> preparation package and the resulting urea solution will be pumped to the SCC and injected by two air atomized nozzles.

The dose rate of the urea solution to the SSC will be controlled by a PLC utilizing the NO<sub>x</sub> readings from the Continuous Emission Monitoring System (CEMS, for position in flue line see Annex 3).

### **Acid components (HCl and SO<sub>2</sub>)**

Like 2 other operational plants in Europe (Dargavel, Scotland and Husavik, Iceland) the Sint Maarten plant will use sodium bicarbonate to capture acid components, most notably HCl, HF and SO<sub>2</sub>. The dosing system at Sint Maarten will be an improvement on the Husavik design in that:

- The control of bicarbonate dosing (see also Annex 3) will use both the HCl and SO<sub>2</sub> measurements from the CEMS<sup>1</sup>.
- The dosing screw will not block at its maximum speed.

### **Heavy metals and other hazardous components**

Heavy metals and other hazardous components adsorbed to particulate matter, like dioxins and furans, will be taken from the flue gas stream by using powdered activated carbon injected into the gas stream prior to a bag filter. The flue gas cleaning system will be equipped with approximately 1300 filter bags (P84). These bag filters will remove entrained dust and used active carbon and will exceed the requirements of WID.

<sup>1</sup> The Waste Incineration Directive states that the continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded.

### Emissions from emergency vents

The existing gasification plant in Husavik/Iceland opened the emergency by-pass damper 5 times over the course of the one year. Three of these incidents were due to electrical blackout (the Husavik plant does not have its own electricity generation or backup system), the other were minor incidents such as worn thermocouples which were replaced in a matter of minutes and normal operation commenced after that.

In Sint Maarten there will be a power back-up system and dual thermocouples will be installed in the flue gas system.

As the emissions only take place in exceptional situations, they will not contribute to a significant change in the air quality as can be seen in the NO<sub>2</sub> 1 hour average values (see also paragraph 9.10). Therefore, these emissions will not be abated.

#### 9.1.3 Abatement of other emissions

The abatement of the emissions of the cBOS building (odours and dust) is described in Chapter 6, as well as the emissions of the stone crusher.

### C&D Plant

The most relevant emission of the C&D plant is dust. This can be characterized as coarse dust, which can form a nuisance but is not hazardous. Uncontrolled emission from dust to the outside of the building will be avoided by a dust collection system. The system collects dust at several different spots inside the plant. Each spot is situated close to/on top of the different machines installed in this building. Eventually all the dust is collected in big bags and disposed of at the waste dump.

## 9.2 Health criteria for impact assessment

The relevance of the SWMPF emissions and the need for impact assessment is discussed below in table 9.2:

Table 9.2 Relevance of the SWMPF emissions

Pollutant	Relevance in relation to other sources
Fine particles (PM2.5)	Dust may be divided into coarse dust from natural origin and respirable and fine dust from manmade origin. Coarse dust may be a nuisance, but is not a serious hazard to health. Respirable and fine dust on the other hand are hazardous. Traffic and transport is by far the largest contributor to fine and respirable dust. The stone grinders at Sucker garden mostly emit coarse dust, but may also contribute to limited extent to the levels of respirable dust. The SWMPF is a relatively modest contributor to respirable and fine dust. Further impact assessment of the contributions from the plant is not meaningful.
Respirable particles PM10	
Sulphur Dioxide (SO <sub>2</sub> )	Sulphur dioxide is mostly emitted from industrial sources using high sulphur fuels, most notably the water and electricity company at Cole Bay. The asphalt factory and the power plant (GEBE) are the only relevant emitters in the east part of the island. The contribution from the SWMPF remains far below standards. In addition fuel standards apply with unfavorable weather conditions ( Local standards, requirements and limits air noise, waste water, waste, table III). Impact assessment of the emissions is not meaningful.

Nitrogen dioxide (NO <sub>2</sub> )	Nitrogen oxides are formed with combustion processes, both (heterogeneously) from the nitrogen content of - in this case - the waste streams and (autogeneously) from the nitrogen in the air. Traffic and transport is probably the largest contributor to nitrogen oxides. The SWMPF is another substantial contributor. Impact assessment of the contributions from the plant is needed. In addition abatement measures should be considered for waste streams with high nitrogen content.
Carbon monoxide (CO)	Carbon monoxide is formed at incomplete combustion of organic material. Traffic and transport is by far the largest contributor to carbon monoxide. The SWMPF is a very modest contributor to carbon monoxide. Impact assessment of the contributions from the plant is not meaningful.
Benzene	Traffic and transport is by far the largest contributor to benzene. Gas stations may locally contribute substantially as well. The plant does not emit substantial amounts of benzene. Benzene may be emitted from ground water pollution underneath the land fill. Impact assessment for the residential areas is not meaningful.
Ozone	Ozone is a secondary pollutant that originates from photochemical smog comprised of hydrocarbons and nitrogen oxides. Traffic is the largest contributor to hydrocarbons and nitrogen oxides, but the SWMPF is another relevant source. However, formation of ozone takes time and takes place at larger distance from the source: at sea. Elevated ozone levels at the island from the plant are not expected. Impact assessment of the contributions from the SWMPF is not meaningful.
Lead (BP)	The sources of trace metals vary, as well as the relevant exposure routes. Direct exposures from the SWMPF through the air are thought to be minimal, as trace metals are bound to particulate matter. More in particular the levels of trace metals depend on the quality of the sorting process at the intake of wastes. Given the price of trace metals it generally pays to invest in the quality of the sorting (win-win situation).  Indirect exposures to trace metals from deposition to the surface and uptake in the food chain are also thought to be negligible compared to the general levels in food. For the sake of completeness a global assessment is presented of indirect exposures in general.
Arsenic (As)	
Cadmium (Cd)	
Nickel (Ni)	
PAH's (*)	PAH's are part of life. They are formed with thermal treatment of organic material. Emission levels are especially high with incomplete combustion, such as at barbecues. A dominant industrial source in the area is the asphalt factory. The crematorium at Sucker Garden may also contribute. The two stage combustion process of the plant provides for very effective and nearly complete combustion. The contribution from the plant is thought to be small. Impact assessment of the contributions from the plant is not meaningful.

In summary assessment is needed of the air pollution from NO<sub>2</sub> and to a lesser degree heavy metals. In addition indirect exposures are assessed for the sake of completeness.

### 9.3 Ambient air quality modelling

#### 9.3.1 General

As described in chapter 7 little or no information is available on the current air quality on Sint Maarten. Only from literature there is some information about the air quality on Curaçao at busy traffic points (NO<sub>x</sub> values 5-12 µg/m<sup>3</sup>, PM<sub>10</sub> and PM<sub>2,5</sub> values 25 and

11 µg/m<sup>3</sup> respectively). Therefore in this paragraph only the change in air quality is described as a result of the waste treatment facility. In doing so we made the assumption that the main contributor to a change in air quality is the continuous emission from the cBOS. It is assumed that the emissions of particulate matter from the C&D plant (including stone crusher) will be abated effectively and will result in only very local effects on the western part of Pond Island.

### 9.3.2 Air quality modeling methodology

The ambient air quality model used in this EHIA is AERMOD by Lakes Environmental Software. AERMOD is an U.S. EPA recommended model. The model uses two input data processors that are regulatory components of the AERMOD modeling system:

*AERMET* is a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts. For the air dispersion modeling 5 years of meteorological data of St. Maarten is used. It concerns meteorological data for the years 2004 – 2008. This data includes upper air and surface data.

*AERMAP* is a terrain data preprocessor that incorporates complex terrain using USGS Digital Elevation Data or SRTM (Shuttle Radar Terrain Model) data. SRTM is used in the dispersion modelling performed in this study.

*BPIP* uses algorithms to model the effects of building downwash on emissions from nearby or adjacent point sources. After the information of the buildings are put in AERMOD the U.S. EPA Building Input Profile Program (BPIP) can be run to obtain downwash calculation results.

To calculate the emission rates of the pollutants, first the gas flow (in Nm<sup>3</sup>/hour, dry gas, 11% O<sub>2</sub>) was calculated. This value was multiplied by the allowed emission levels (Waste Incineration Directive<sup>1</sup>) of all relevant pollutants resulting in a mass flow in g/s per pollutant. These values were entered in the air quality model. By using these air emission standards as real emissions (while in fact they will be lower), a worst case scenario is calculated. After entering the emission rate the gas flow parameters were entered (actual m<sup>3</sup>/hr, flow speed, diameter of stack, temperature etc.). For the modeling the 3 stacks were combined to 1 stack<sup>2</sup> where in reality 2 of them will be combined and one will be separate.

After the modeling process with AERMOD a comparison with the EU ambient air standards was carried out.

The abovementioned procedure leads to the following emission rates:

<sup>1</sup> Directive 2000-76-EC of the European Parliament and of the Council of 4 December 2004 on the incineration of waste.

<sup>2</sup> Similar stacks of which stack parameters do not differ by more than 20% and which are located no further apart than 100m may be modeled as one stack: Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised" (EPA -454/R-92-019, October 1992



Table 9.3 Emission rates at maximum allowed levels (3 combined flue lines)

Pollutant (Flue gas)	Emission rate (g/s)
Particulate matter*	0.29
PM <sub>2.5</sub>	0.20
PM <sub>10</sub>	0.22
CO	1.46
SO <sub>2</sub>	1.46
NO <sub>x</sub>	5.83
Cd	0.001
Ni	0.012
Pb	0.012

\* TSP

#### NO<sub>x</sub> and NO<sub>2</sub>

The percentage of NO<sub>2</sub> compared to total NO<sub>x</sub> in the combustion chamber will probably be around 5 - 8 %. This percentage will rise a little in the flue gas system (waste heat boiler - bag filter), resulting in app. 8 - 10% NO<sub>2</sub>. In our modeling we used 10% NO<sub>2</sub> as a "worst case" to avoid underestimation of NO<sub>2</sub> in the ambient air.

For the NO<sub>x</sub> emission –like all flue gas components- a worst case approach has been chosen. The NO<sub>x</sub> concentration in the Iceland system proved to be at app. 30% of the WID standard for the majority of time without any abatement (1 month trial). The NO<sub>x</sub> abatement system will be responsible for a significant reduction (removal rate 40-80% see also paragraph 10.2). If we assume the middle range of efficiency (60%), it can be concluded that the NO<sub>x</sub> emissions of the Sint Maarten SWMPF are over-estimated by approximately a factor 2.5 (real emissions/immissions 60% lower than modeled).

#### Total Dust, PM10 and PM 2.5 and heavy metals

The emission limit daily average value for dust as found in the Waste Incineration Directive is 10 mg/m<sup>3</sup>. In order to be able to model for PM10 and PM2.5 the following assumptions were made, based on the relevant literature (TNO, 2006; Vito, 2003). If TSP is 100%, then PM10 is 75% of TSP and PM2.5 is 93% of PM10, resulting in the following mass flows: PM10: 0.22 g/s, PM2.5: 0.20 g/s.

Dust emission data from Iceland (the BOS system in Husavik) show that the average dust emission was 4mg/Nm<sup>3</sup> during the trials and peaked at 14mg/Nm<sup>3</sup><sup>1</sup>. Hence the dust emissions were within the requirements of WID. The trial results demonstrate that the Sint Maarten facility will achieve WID with respect to dust emissions. The current approach -based on a dust emission at the WID standard of 10 mg/m<sup>3</sup>- leads to an over-estimation of dust emissions by a factor of 2.5 (real emissions/immissions 60% lower than modeled).

<sup>1</sup> Dust peaks occurred during periods in which temperatures fell below 850 degrees C. These situations will rarely occur on Sint Maarten where 4 PCG's feed the SCC.

This over estimation also takes place in modeling the heavy metals' air dispersion because of their strong tendency to adsorb to particles.

Table 9.4 summarizes other relevant input data for the air quality model.

Table 9.4 Input data for AERMOD

Number of sources (3 modeled as one) (*)	1
X coordinate (m)	494934.73
Y coordinate (m)	1993551.59
Release height (m) (**)	19.5
Gas exit temperature (K)	453.15
Stack inside diameter (m) (*)	1.39
Gas exit velocity (m/s)	25
Gas exit flow rate (m <sup>3</sup> /s)	37.937

\* the stack diameter is 0,80m for each of the 3 flue lines.  
In the model the 3 lines were modeled as one line with the same total area (m<sup>2</sup>).

\*\* stack height 18m, stack base 1.5m above sea level

AERMOD can account for the effect of buildings near the stack on concentrations of pollutants. This effect is typically referred to as Building Downwash. Usually there is no building downwash if:

- the stack is higher than 2.5 times the building height
- the stack is more than 5L away from the building (L=lesser of building height and projected building width)

In the modeling building downwash is calculated because the stack is 3 m higher than the building and the stack is relatively close to main building of the facility.

Two buildings were entered in AERMOD:

- cBOS building: height 15m, length 135m, width 65m
- C&D building: height (assumed) 10m, length 90m, width 20m

### 9.3.3 Results

#### a. Pollution levels

In Table 9.5 the output of the air quality modeling for the various pollutants is given. Table 9.5 consists of the pollutant, the averaging period, the ambient Air quality standard of the EU, the maximum value of the modeling observed in any public area, the permitted exceedances in 5 years (note that 5 years of meteorological data is used for the modeling), and the exceedance count for each run of 5 years.

Table 9.5 Output Ambient air quality modeling (base case)

Pollutant	Averaging period	Standard EU ( $\mu\text{g}/\text{m}^3$ )	Maximum (public area, $\mu\text{g}/\text{m}^3$ )	% of EU ambient air standard	Permitted exceedences (5y)	Exceedence counts (5y)
SO <sub>2</sub>	1h	350	66.57	19%	120	0
	24h	125	12.03	10%	15	0
NO <sub>2</sub>	1h	200	101.72	51%	90	0
	year (*)	40	9.32	23%	n.a	n.a
PM <sub>2.5</sub>	year	25	0.32	1%	n.a	0
PM <sub>10</sub>	24h	50	1.81	4%	175	0
	Year	40	0.35	1%	n.a	0
CO	8h	10000	36.09	0.4%	n.a	0
Cd	Year	0.005	0.002	40.0%	n.a	0
Ni	Year	0.02	0.02	100.0%	n.a	0
Pb	Year	0.5	0.02	4.0%	n.a	0

The modeling results indicate that the EU ambient air quality standard is never exceeded in any public area.

The modeled values show that for all pollutants except for NO<sub>2</sub> and Nickel the modeled maximum values are between 1% and 40% of the values of the EU standard.

The NO<sub>2</sub> 1 hour average maximum of 101.72  $\mu\text{g}/\text{m}^3$  (51%) is located in the area Lower Princess Quarter. It must be stressed however that this value is a single peak value, observed at some time during the 5 year modeling period. Further in this paragraph an evaluation is given of 3 receptor points which shows that also at this receptor point average values are very low.

In all residential areas the NO<sub>2</sub> year average is below 10  $\mu\text{g}/\text{m}^3$  (less than 25% of EU standard).

Modeled concentrations for NO<sub>x</sub> do not come close to the value of 400  $\mu\text{g}/\text{m}^3$  anywhere in the impact area ("alarm" value Netherlands not to be exceeded for more than 3 subsequent hours).

Nickel values are at the European ambient air quality standard (0,02  $\mu\text{g}/\text{m}^3$  as a year average) for a small part of west border of the Great Salt Pond. It has to be kept in mind that Nickel concentrations represent a strong overestimation by approximately a factor of 2,5 (see paragraph 9.3.2). Monitoring of the actual emissions and immissions (chapter 11) will point out whether additional measures will be necessary to further abate these emissions, however on the basis of the Iceland experiences this is very unlikely.

**b. Dispersion patterns**

Figures 9.1 and 9.2 show the modeled air quality for NO<sub>2</sub> (1 hour average and year average). Annex 8 shows the modeled air quality for all other parameters for their relevant averaging periods.

In order to get a better understanding of the health effects of the SWMPF in residential areas a further analysis for NO<sub>2</sub> has been carried out for 3 receptor points (see next paragraph). The effects of components with possible adverse effects on public health on the long term (heavy metals, dioxins, furanes) is discussed in paragraph 9.2.5.

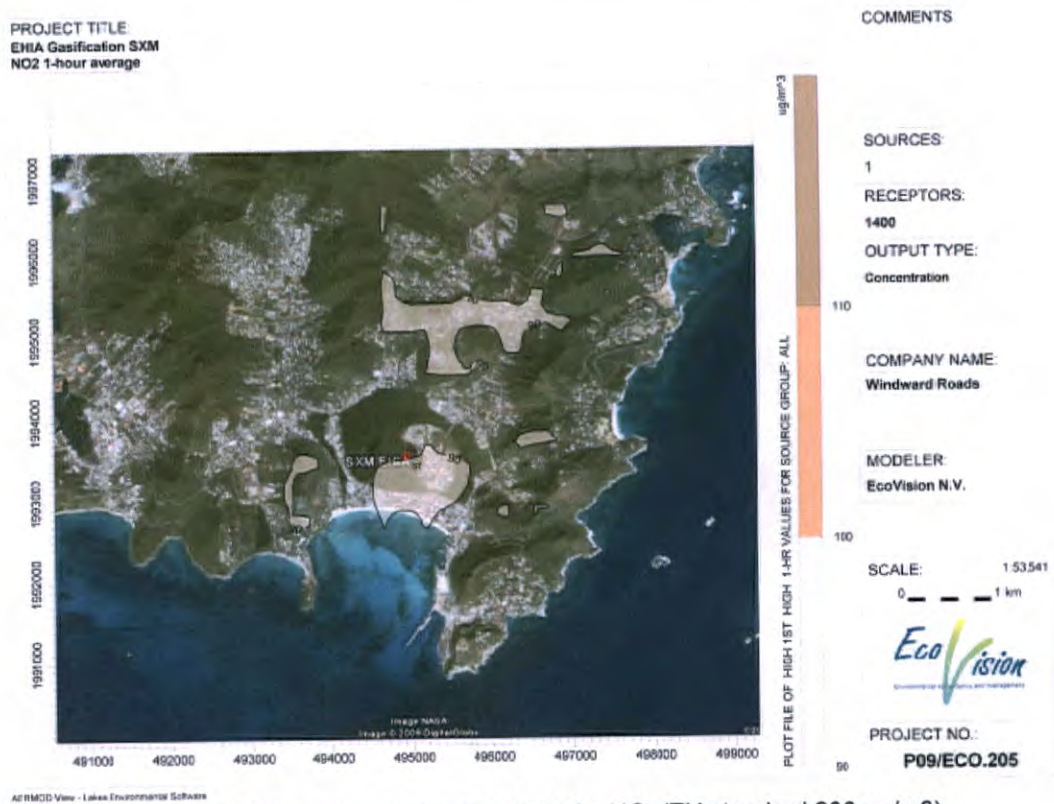
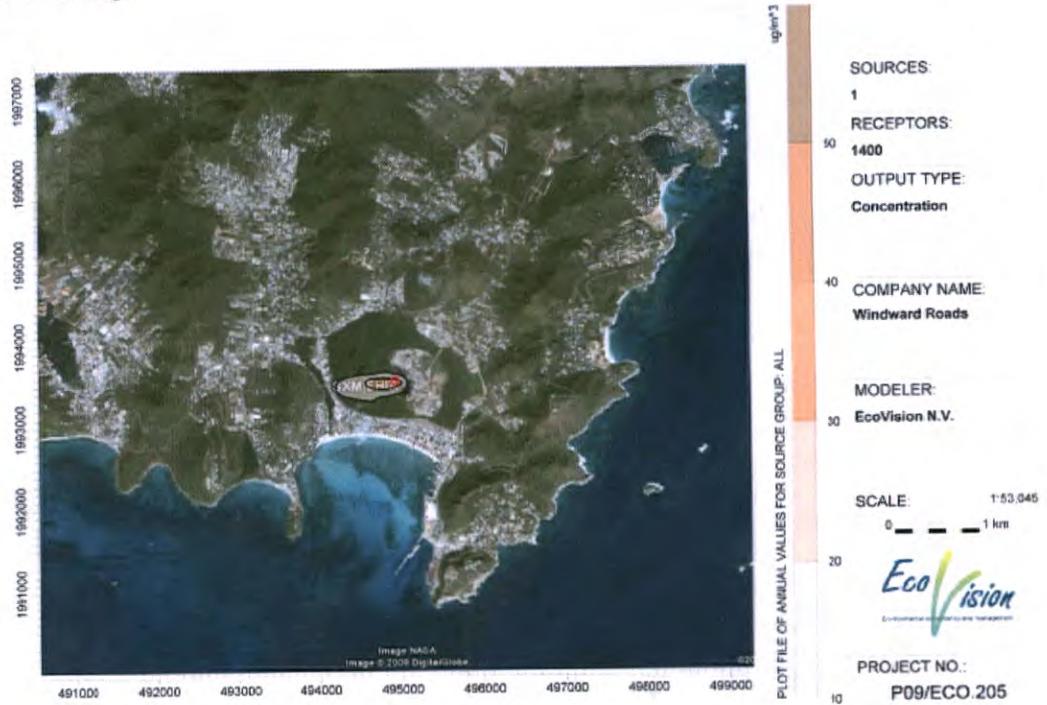


Figure 9.1: Modeled 1 hour average concentrations for NO<sub>2</sub> (EU standard 200 µg/m<sup>3</sup>)

PROJECT TITLE:  
EHIA Gasification SXM  
NO<sub>2</sub> Annual average

COMMENTS:

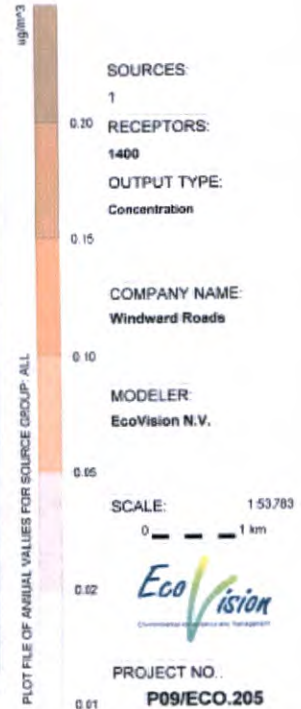


AERMOD View - Lakes Environmental Software

Figure 9.2 Modeled year average concentrations for NO<sub>2</sub> (EU standard 40 µg/m<sup>3</sup>)

PROJECT TITLE  
EHIA Geisification SXM  
Ni Annual average

COMMENTS:



AERMOD View - Lakes Environmental Services

Figure 9.3 Modeled year average concentrations for Ni (EU standard  $20 \text{ ng/m}^3 = 0.02 \text{ µg/m}^3$ )

In the modeling results of Nickel (Ni) the  $20 \text{ ng/m}^3$  contour reaches the west border of the Great Salt Pond, however in this area the values of  $20 \text{ ng}$  are not exceeded.

### c. Pollution profiles at selected receptor points

For a further ambient air quality modeling 3 points have been chosen (see also figure 9.4):

- Receptor 1: 1 Point in Central Philipsburg (downwind of facility)
- Receptor 2: 1 School in East Philipsburg
- Receptor 3: 1 Shack area in the Lower Princess Quarter neighborhood



Figure 9.4 Plane view of Receptor Point for detailed air quality modelling

Table 9.6 Calculated values of NO<sub>2</sub> (maximum in a period of 5 years, 1 hour average)

Receptor/Description	Receptor Coordinates (x,y)	Maximum value of NO <sub>2</sub> over a 5 year period (1-h average in µg/m <sup>3</sup> ) EU standard = 200 µg/m <sup>3</sup>	Average concentration on receptor point of NO <sub>2</sub> over 5 year period
Receptor1 Central Philipsburg	x 494929.04 y 1993013.96	89,69	0.26 µg/m <sup>3</sup>
Receptor2 School East Philipsburg	x 495349.81 y 1992747.89	90,11	0,03
Receptor3 Lower Princess Quarter	x 495643.31 y 1995339.25	101,71	0,1

Table 9.6 shows the maximum values of NO<sub>2</sub> on the receptor points over a 5 year period (1-h averages in µg/m<sup>3</sup>). As an example, in figures 9.5 to 9.7 the 1 hour average concentrations are plotted for 1 year (meteo data of 2008). It can be observed from these plots that at all 3 receptor points the calculated values are generally very low, that peaks are observed only a few times per year and that these peaks are brief events, not lasting any longer than several hours.



Figure 9.5: Receptor point 1: 1-h values for NO<sub>2</sub> for 1 year (meteo data 2008). Average value: 0.26 µg/m<sup>3</sup>, blue line indicating 80 µg/m<sup>3</sup>



Figure 9.6: Receptor point 2: 1-h values for NO<sub>2</sub> for 1 year (meteo data 2008). Average value: 0.03 µg/m<sup>3</sup>, blue line indicating 20 µg/m<sup>3</sup>

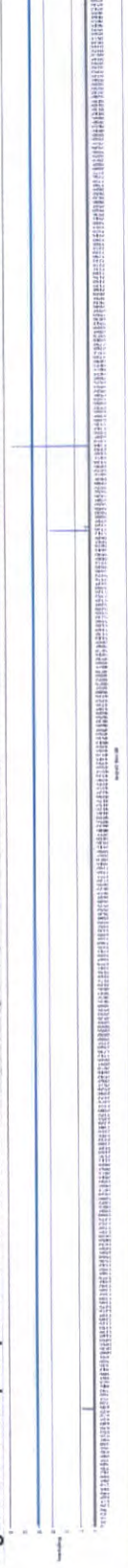


Figure 9.7: Receptor point 3: 1-h values for NO<sub>2</sub> for 1 year (meteo data 2008). Average value: 0.10 µg/m<sup>3</sup>, blue line indicating 80 µg/m<sup>3</sup>





#### d. Impacted area

For the interpretation of the results it is useful to know that:

- year averaged standard values are representative of the total exposures to the population.
- one hour averaged standard values are representative of the peak exposures to the population.

From the dispersion patterns it becomes clear that total exposures are related to the predominant weather conditions with wind directions from (globally) east to west. Highest air pollution levels are found immediately westward from the plant, mostly above the Great Salt Pond and to limited extent in Sentry Hill, Cay Hill (and the upper northern part of Fort Willem and Fort Hill). The impacted area for total exposures is therefore defined as Sentry Hill (CBS neighborhood #405), Cay Hill (CBS neighborhood #501) and Fort Hill/Fort Willem (CBS neighborhood #502).

From the dispersion patterns it becomes clear that peak exposures are related to unfavorable (stable) weather conditions with stagnant air. Dispersion is dominated by the geological profile and is predominantly in northern and southern direction with southern and northern wind directions respectively. Highest air pollution levels are found in Philipsburg and in the Lower Princess Quarter. These two zones (CBS zone #1 resp. #3) are defined as the impacted area for peak exposures.

#### 9.3.4 Particulate matter, heavy metals, dioxins and furans

The calculated levels of fine dust (PM-10 and PM-2.5) are very modest:  $\pm 10\%$  of the air quality standards. Trace metals and most of the dioxins and furans, which are emitted together with particulate matter, are therefore also expected to remain at modest levels.

The boiler design for the Sint Maarten facility (like in the facility in Dargavel Scotland) will minimize the time flue gas is in the temperature range of 450°C to 200°C and thus minimize the formation of dioxins and furans. This combined with the powdered activated carbon addition to the flue gas system is considered sufficient to ensure that Sint Maarten and Dargavel complies with WID with respect to Dioxin and Furan emissions.

The Sint Maarten and Dargavel facility are designed to accept waste that has similar heavy metal contamination as is found in MSW derived fuel. This design basis coupled with the powdered activated carbon addition to the flue gas system is considered sufficient to ensure that Sint Maarten and Dargavel comply with WID with respect to trace metal emissions.

#### 9.3.5 Conclusions air quality

The emissions of the SWMPF will be treated with a DeNOx system (SNCR), a sodium bicarbonate dosing system (for acid components) and active carbon injection combined with removal by bag filters.

The Husavik plant in Iceland complies with EU standards (Waste Incinerator Directive) for relevant components (e.g. NO<sub>x</sub>, dust and HCl) for the majority of time. This is true even given the fact that the Husavik gasification plant has no NO<sub>x</sub> abatement system and only a limited removal of acid components and limited active carbon injection. The Husavik emission control and abatement systems cannot be regarded as efficient as the ones on Sint Maarten. It can therefore be safely assumed that the Sint Maarten plant equipped with a complete air emissions abatement system will comply with the EU standards.

As a worst case approach for the air quality modelling, the emissions of the Sint Maarten SWMPF are modelled to be at 100% of the EU (WID) standards, which implies an over estimation for particles, heavy metals and NO<sub>x</sub> with a factor of approximately 2,5.

The following conclusions can be drawn:

- EU limit and target values for ambient air quality are met even with an over estimation of particles, heavy metals and NO<sub>x</sub> with a factor of approximately 2,5.
- Modeling results show that all EU-standard values for ambient air quality are met even with an over estimation of NO<sub>x</sub>, particles and heavy metals with a factor of approximately 2,5.
- In general the area west of the plant is impacted, mostly above the Great Salt Pond and to limited extent in the neighbourhoods of Sentry Hill, Cay Hill and Fort Hill/Fort Willem, but peak levels are mostly found to the north and south in Lower Princess Quarter and Philipsburg.
- The anticipated contribution of air pollutants from the plant generally are between 1% and 40% of the EU-standard values for ambient air quality, except for NO<sub>2</sub> (1 hour average) and Nickel (year average) which are at some receptor points at 51% and 100% of the EU standard values.
- The modeled value for NO<sub>2</sub> as a 1 hour average of 101,72 µg/3 (51% of maximum peak value) in Lower Princess Quarter is a single peak value observed only once in the 5 year modeling period. Average values are at 0,1 µg/3.
- Nickel values are at the European ambient air quality target value for 2012 (0,02 µg/m<sup>3</sup> as a year average) for a small part of west border of the Great Salt Pond (highest values). However it has to be kept in mind that Nickel, like all metals adsorbs strongly to particles and that over estimation takes place with a factor of approximately 2,5 <sup>1</sup>.

## 9.4 Health impacts of air pollution

### 9.4.1 Introduction

Health impacts may be assessed in several ways. Here the choice was made to focus on high risk situations, from high exposures and for vulnerable groups. An assessment

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<sup>1</sup> The fact that Nickel adsorbs to particles urges to a cautionary approach. Like all fine particles the compound can be inhaled and pass the respiratory defense mechanisms.

of the acceptability of exposures is not possible, since no baseline data are available about the air quality in general. Nevertheless, exposures from the plant are put in perspective by globally comparing the contributions to EU-standard values with the expected contributions from other sources.

#### 9.4.2 Vulnerabilities

Population groups may be vulnerable and at high risk because of high sensitivity and/or high exposures. Highly sensitive groups to air pollution are children, elderly and chronically ill people. For Sint Maarten the elderly are less relevant, as these generally leave the island. The age group of 65± has dropped to ±3% of the total population. There is one retirement home, but care and nursing centers for senior citizens are absent. Most attention is needed for the children, which by now form a substantial part of the population (CBS: ±30% under 20 yr in 2007).

According to Dutch regulations schools, child care and health care institutions must be regarded as vulnerable. The construction of such institutions is not allowed in areas with a potential for exceeding air quality standards. New occupancies by such institutions of existing facilities are not allowed in areas that do not conform to air quality standards. For Sint Maarten no conclusions can be drawn, as there is no insight in the baseline situation.

There is a substantial number of schools in the impacted areas, especially in Philipsburg and Lower Princess Quarter. However, schools are only partly representative for the exposures of children, since the schools are concentrated downtown in Philipsburg near the workplace of parents, rather than spread over the residential areas.

Hospitals are excluded in the Dutch regulation because they generally have an autonomous air conditioning system. For Sint Maarten, where only parts of the hospital have air conditioning, this is less valid, however the hospital is outside the impacted area.

Residential areas are excluded in the Netherlands because the standard is only intended to protect groups with high sensitivity. This may be valid for the Netherlands where people reside indoors for about 90% of the time, but it appears less relevant for Sint Maarten. Here the presence of air conditioning is indicative of the protection indoors. Households without air conditioning are considered to be at high risk because of high exposures. As a consequence most residential areas should be considered to be at high risk, since the average presence of air conditioning in Sint Maarten is 62%, with a variation between neighborhoods from 40 – 98% (Census 2001). In the impacted areas by the SWMPF 57% of households have air conditioning. Especially Mount William, Dutch Quarter and Sentry Hill are substandard (40-44%). Only Middle Region is substantially above average (73%).

### 9.4.3 Attributive risks

#### a. Nitrogen dioxide

The EU-standard values have been developed by the World Health Organization and are reported in the Air Quality Guidelines (AQG's). The standards, among which for NO<sub>2</sub>, are taken from the 2<sup>nd</sup> edition of the AQG's.

NO<sub>2</sub> may cause health effects on the lungs and airways. The health effects of acute exposures consist of irritation of the airways, reduced host defense against upper airways infection (URI) and bronchial hyper responsiveness of asthmatics. These effects have only been described in experimental studies with exposures far beyond the EU-standard values. In real life studies (epidemiological studies) with mixed exposures from traffic and transport (or indoor air) health effects were found at lower levels. Overall it is likely that acute exposures to NO<sub>2</sub> at EU-standard value contribute to the aggravation of asthma. Whether the standard level may be reached at Sint Maarten is unknown because the lack of baseline studies, but not likely, given the observations made in Curaçao (NO<sub>x</sub> values between 5 and 12 µg/m<sup>3</sup> near a busy road).

#### b. Air toxics and trace metals

Impacts on human health are directly via air and indirectly after deposition<sup>1</sup>: Arsenic, cadmium, nickel and certain Polycyclic Aromatic Hydrocarbons have carcinogenic properties for humans upon exposure via the air. Modeled values for nickel are at the European ambient air quality standard (0,02 µg/m<sup>3</sup> as a year average) for a small part of west border of the Great Salt Pond. It has to be kept in mind that the modeling results are based on an overestimation with a factor of approximately 2.5.

However, even when all emissions are in full compliance with the EU standards, caution must be given to heavy metals in the operational phase of the SWMPF. Separation and recycling of these - costly - metals is both profitable and important for the public health. In addition monitoring should take place in at least the first 6 months of operation (see also paragraph 11.2).

Arsenic, certain PAH's and dioxins have carcinogenic properties for humans upon exposure via ingestion. Exposures to these substances are highly dominated by the background levels in food and drinking water. Exposure via deposition and subsequent uptake in drinking water and food is negligible, at least for StM. An uncertain factor though is the concentrations of dioxins in fish: the concentrations may be low but the bioconcentration factor of dioxins in fish is very high (factor 100.000) ) and therefore of concern.

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<sup>1</sup> Directive 2004/107 of the European Parliament December, 15 2004

### c. Indirect exposures

Particle bound pollutants such as trace metals, PAH's, dioxins and furans may also give rise to indirect exposures from deposition and uptake in food and drinking water. This is especially important for toxicants that accumulate in the body such as lead, cadmium and dioxins/furans. Dioxins are discussed for illustration.

Below an overview is presented of the average daily intake in the US (NRC: EPA dioxin reassessment, summary 4/94, Vol 1, p. 37):

- Deposited material may be ingested to limited extent (50 – 200 mg/d) by young children during play outdoors by hand-mouth behavior. The average background concentration in the soil in the Netherlands is 2 – 5ng TEQ /kg d.w. This may thus result in a daily intake of 0,1 – 1 pg TEC p.d. which is negligible in comparison with the average intake from food of >100 pg/d.
- Uptake from drinking water is highly unlikely and is not further considered, since drinking water is generated from sea water.

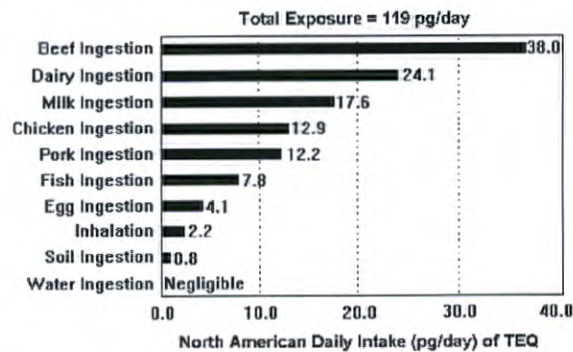


Figure 9.8 Dioxin exposure in the US, (Source: EPA dioxin reassessment, summary 4/94)

In Sint Maarten uptake from locally produced food is also rather unlikely. In the first place, there is - already for decades - very little agriculture and cattle breeding at the island (see next page: Rojer, A, Biological inventory of Sint Maarten, Carmabi 1997). In the second place the respirable and fine dust, which have the highest concentrations of pollutants (because it is a surface phenomenon), will deposit to considerable extent at sea. Dioxin in fish (especially bottom feeders) may be of some concern because of a bioconcentration factor of + 100,000, but cannot be estimated without measurement data.

Other local sources of dioxin emissions probably are of more concern on Sint Maarten, in particular the regular cable fires at the car wreck disposal site. Also the processing of medical wastes warrants re-evaluation. The incinerator of the hospital has been out of order for some time anyway, so it may be a good opportunity to make up a long term contract with the SWMPF.

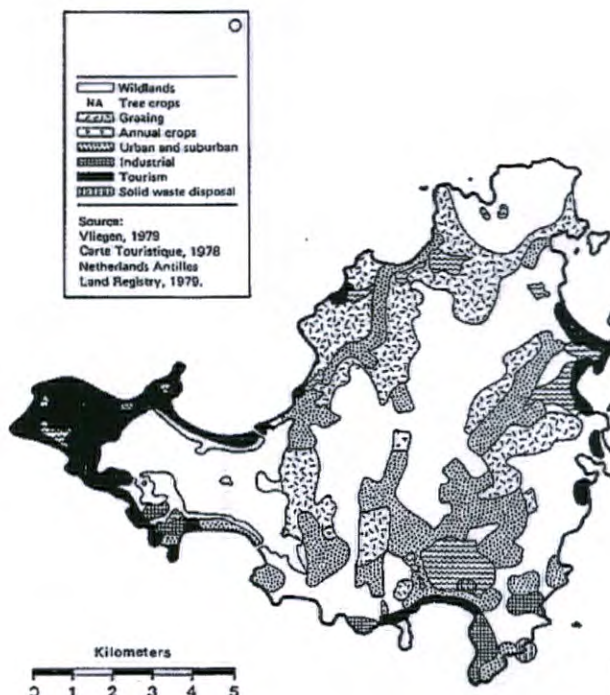


Figure 9.9 Overview of agricultural areas (Vliegen 1979, Netherlands Antilles Land Registry 1979)

#### 9.4.4 Conclusions health impacts of air pollution

The contributions from the SWMPF to air pollution are generally modest. The contribution of the SWMPF to  $\text{NO}_2$  levels is expected to be substantial and adds to a possibly burdened situation by traffic and transports. The contributions from the plant are well below the EU standards, even in a worst case estimate.

The exposure of the population to PAH's, dioxins and furans and trace metals through air is expected to be very low. Uptake from locally produced food is also rather unlikely. A substantial source of dioxin emissions to the air is the cable burning which takes place at the car wreck site on Pond Island. Overall dioxin levels in near shore fish (bottom feeders) may be of concern. It is advised to stop the cable burning. Furthermore it is advised to determine the baseline level of dioxins in fish and monitor for trends during the first years in which the plant is in operation.

Modeled values for nickel are at the European ambient air quality target value for 2012 ( $0,02 \mu\text{g}/\text{m}^3$  as a year average) for a small part of the west border of the Great Salt Pond, although these figures are based on an overestimation of the emissions by a factor approximately 2,5.

Monitoring of heavy metals (notably nickel) should take place in the first 6 months of operation (see also paragraph 11.2).



## 9.5 Climate

The SWMPF converts app. 100.000 tonnes of waste to energy. With this conversion CO<sub>2</sub> is produced and emitted in the flue gases, however the use of fossile fuels for the generation of electricity is prevented.

This results in the prevention of the emission of app. 70.000 tonnes of CO<sub>2</sub> per year. Also the SWMPF prevents the emission of gases much more hazardous for the atmosphere such as methane.

## 9.6 Nuisances and noise

### 9.6.1 Main sources of noise

#### **cBOS Building**

The main sources of noise of the cBOS building are:

- 3 gasification trains
- Shredders for incoming waste
- Telescopic handlers and other equipment in building

These sources lead to an indoor noise level of 80 dB(A)

Outside the cBOS building there are 2 other important sources of noise.

- 2 Stacks (with 3 flue lines)
- Coolers (air cooled, with fans) with a capacity of 18 MWth
- Several shovels and cranes (3 locations)

#### **C&D Building**

The main sources of noise of the C&D building are:

- The stone crusher
- Several screens
- Wood crusher
- Conveyor belts

## Traffic

Table 9.7 summarizes the expected number of trucks and vans during regular working days and Saturdays. For Sundays less traffic is anticipated.

Table 9.7: Anticipated transportation on a working day

Transportation vehicle	Total	Day (90%)	Evening (10%)	Night
Heavy truck	150	135	15	5
Van or pick-up	120	108	12	5
Total	270	243	27	10

### 9.6.2 Noise reducing measures

Several measures have been included in the project to reduce noise:

- Stone crusher partly indoors (3 walls and a roof)
- Coolers (air cooled system with fans) are between 2 buildings
- Closed doors (automatically shutting doors)

### 9.6.3 Building characteristics and assumptions for modelling

For the noise modeling (next paragraph) it is important to define the main characteristics of the buildings. These are presented in Annex 10 together with a number of assumptions used in the noise modeling.

### 9.6.4 Noise situation after realization of the project

The noise influence on the surrounding areas due to the operation of the waste to energy plant is calculated with the noise modelling programme Geonoise v5.41. The results of the noise modelling are given in figure 9.10.

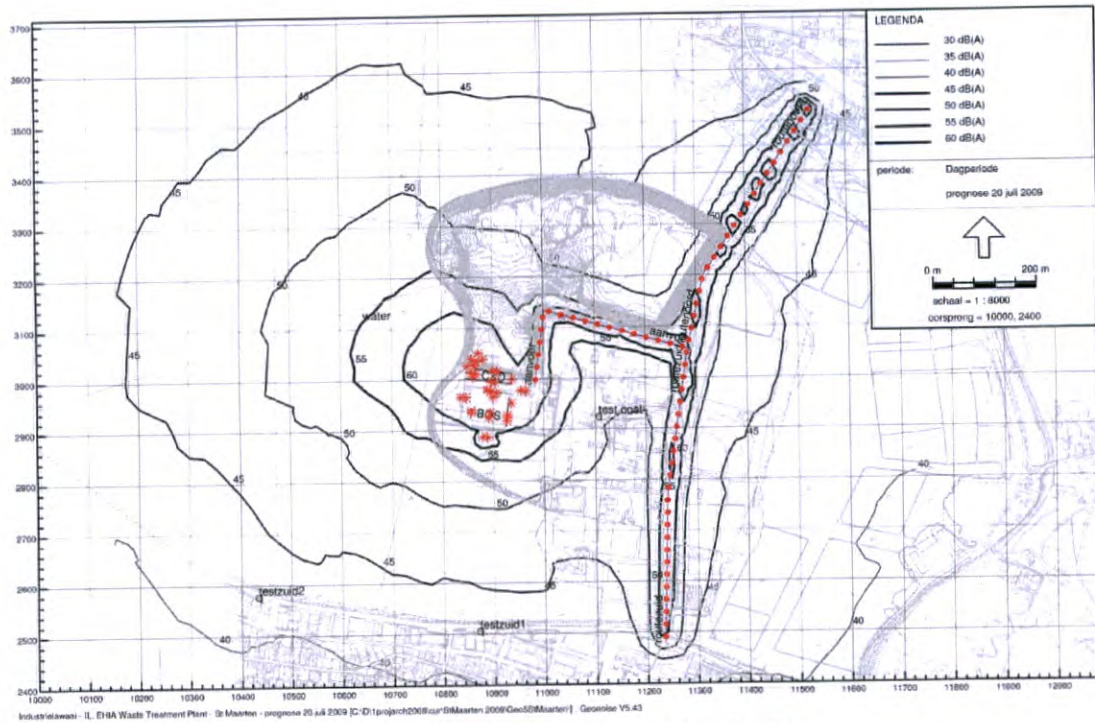


Figure 9.10: Results of noise modelling for all sources during day time

### 9.6.5 Compliance with noise standards

As indicated in paragraph 4.6 the allowed maximum noise impact depends on the use of the area. For Pond Island the area is classified as Industrial area, while Philipsburg is classified as city centre, with living and working functions. This results in the maximum allowed noise impacts as indicated in table 9.8.

Table 9.8: Maximum allowed noise impact for Pond Island and Philipsburg

Area	Classification	Maximum allowed noise impact [dB(A)]	
		Day	Night
Pond Island	Industrial area	70	65
Philipsburg	City centre, with living and working functions	65	60

The standard for noise is only applicable on noise sensitive objects. Noise sensitive objects are houses, schools, hospitals and such. The only noise sensitive object on Pond Island is the University of St. Maarten. The noise sensitive objects in Philipsburg are the houses, not the stores and offices.

The maximum noise impact caused by all sources from the waste to energy plant during day time on the buildings of the University of St Maarten is 55 dB(A) (see figure 9.10). The main contributor to this level is road-traffic by trucks. According to the standard the maximum allowed impact is 70 dB(A), indicating that the noise impact caused by the waste to energy facility is broadly within the limits of the standard. Even on any of the offices the noise impact due to the operation of the waste to energy plant during day time is below 55 dB(A).

The noise impact caused by all sources from the waste to energy plant during day time on the area of Philipsburg is below 45 dB(A), meaning the noise impact caused by the plant is broadly within the limits of the standard.

From the above it can be concluded that also in the night situation – with significantly lower noise emissions – there will be full compliance with the standards (no values above 65 dB(A) are expected).

The clause for noise in the Terms of Reference for the project which states that the noise impact on the perimeter of the plant area should be below 55 dB(A), is not fully met. At the south and southeast border of the waste facility the 55 dB(A) contour is 40-80 meters distance from the perimeter. At the north of the plant, at the land fill, and at the west of the plant, Great Salt Pond, where no sensitive objects are present, the 55 dB(A) contour is at 100-200 meters distance. However, as discussed in paragraph 4.6 the standard of 55 dB(A) standard “at the perimeter” is not in congruence with the standard of the Netherlands Antilles and is disregarded here.

#### 9.6.6 Final remarks

The calculated noise levels are levels based on a European meteo-correction (all wind directions equally represented). The situation on Sint Maarten is different with a higher representation of winds from eastward directions.

If the actual wind directions would be introduced in the noise model this would result in higher levels westward of the source (at 100 meters and more 2 to 4 dB(A) additional) while eastward of the source 1 - 10 dB(A) can be subtracted. This correction may result in lower noise levels at the office building of Pond Island and slightly higher values on the west border of Great Salt Pond. Also with these corrections noise will be within allowable values of the standards.

#### 9.7 Soil and water

All the activities related to the gasification process are taking place inside a warehouse with fluid resistant floors. Hence there is no impact to the soil.

As for the activities that do take place outside the building (e.g. transport of waste, transport of recyclables, storage of recyclables) the site is paved. There is no direct contact with the soil. Therefore also outside the gasification building there is no impact to the soil.

All activities related to the dismantling of cars, white goods and other materials that can contain oily and hazardous fluids will take place on a concrete or tarmac surface. Contamination of runoff water will be prevented by installing roofs above these floors. Runoff water will be unpolluted, however prior to discharging in the Pond treated the water will be treated in an oil/water separator.

Rainwater falling on roofs is not contaminated. Therefore it is collected and stored to be reused at the facility (e.g. to clean floors, equipment, but also in case of emergence to shut down the Primary Gasification Chamber, etc.)

## 9.8 Human risk from exposures through dermis, water and residuals

Man may be exposed to environmental factors through all three compartments: air, water and soil. The workforce may experience relatively high exposures, but these will be treated in a later phase of the plant design. The management of the SWMPF is responsible for the drafting of a Health and Safety Plan which is binding through the contract with Government.

In this report the exposures of the general population are discussed. For the general population exposures to air pollution are of most concern. These therefore have been treated separately in paragraph 9.3 en 9.4.

Exposures to water and residuals with toxicants are absent or at least very unlikely.

### a. Water

No wastewater is produced, and measures are taken at the reception hall to minimize leachate, so no risks from the plant are to be expected. On the other hand however, the Salt Pond and the groundwater are substantially polluted, which may pose health risks to the workforce and to fire brigade that has to use the lake as extinguishing pond.

The potential concern for bioaccumulation of toxicants in fish has been mentioned before (paragraph 9.4), but this refers to bottom feeders near the sea shore. It should be common knowledge that fish from the Great Salt Pond should not be eaten. Although the situation may improve over time with the ending of the landfill operation and the improvement of the sewage treatment system, it is still recommendable to properly inform people about the hazards of eating fish from this Pond or implement a ban on fishing there.

### b. Skin

Skin diseases from chemicals are restricted to the workforce and are not discussed further (see first section of this paragraph).

### c. Residuals

The residual bottom slag from the cBOS will be reused in construction works. The bag filter ashes will be landfilled in a controlled manner using big bags. The workforce may be exposed, but exposures to the general public should be minimal by taking the following into account:

- Regular inspections of the bag filters will limit leaks and overfilling
- Transport of bags takes place in closed vehicles
- Bottom slag is reused in construction materials, but this is allowed according to leaching tests

## 9.9 Nature, flora and fauna

According to Brown and Collier (2008) the main hazard to the entire Great Salt Pond is the build-up of debris in the pond. The sources of the debris are many and include household trash commonly dumped by the residents of St. Maarten, industrial waste deposited by local companies, and trash overflow from the Dutch waste facility (dump site). The waste dump is located on the Pond Island's northern edge. Pond Island has been filled from the south (Philipsburg) in northern and western direction. In recent years the waste dump developed from the north-east part to the west part of Pond Island. Pond Island is now covering almost a quarter of the pond's acreage. As the pond is constantly filled with waste from this source, important foraging, roosting and nesting habitat for birds is lost.

With the erection of the new SWMPF the active dump site will be closed. The overflow of trash will be halted which will be beneficial to the nesting and foraging birds.

Furthermore, when the new waste processing installation is in operation, it is expected that there will be no further filling in of the pond by the waste dump, preventing further loss of habitat for birds.

From several studies, including the yearly observations by EPIC, (Brown & Collier), it appears that Laughing Gull (*Larus atricilla*) are abundant in the Great Salt Pond, with numbers exceeding 5500 individuals. According to Birdlife International, the Great Salt Pond is an important bird area (IBA), significant for its population of Laughing Gull.

According to EPIC it is not likely that the population of Laughing Gulls would be growing significantly because of the dump, since they are only there to congregate before breeding. There is not a major Laughing Gull breeding population near St. Maarten, so it is not likely that the majority of these birds forage at the dump during the breeding season. Therefore, their population would most likely be dependent on food sources closer to their breeding grounds and the dump at the Great Salt Pond would not affect their nesting success (pers comm EPIC, September 2009).

The construction of the new SWMPF may have impact on bird life because of the noise produced during construction and the emission of dust. However the period of construction is limited hence the impact is limited and not taken into consideration. Short term effects by air pollutants ( $\text{NO}_x$  and  $\text{SO}_2$ ) on flora and fauna are considered to be minimal because maxima are not found in the more quiet parts of Great Salt Pond (see figure 9.2). Long term effects are not expected because of the relatively low ambient air values of trace metals, dioxins and furanes. It is expected that future deposition in the Pond is much lower than the current deposition (cable burning) and leaching of percolate.

Improvement of water quality may have positive effects on fish, birds and flora.

Ground lizard, which occurs in and around the landfill, may not be attracted anymore to this particular site.

## 9.10 Landscape

To assess the visual impact on the landscape two visualizations have been prepared. The viewpoints are both on the Walter Nisbeth Road: the eastward viewpoint 9.12 (nearby) and westward viewpoint, 9.13 (at greater distance).



Figure 9.11: Position of viewpoints



Figure 9.12: Visualization from nearby viewpoint Walter Nisbeth Road



Figure 9.13: Visualization from photo-point western part of Walter Nisbeth Road

From both viewpoints it can be observed that the future structure is a dominating structure in the area. However, the size of the building is such that it does not disturb the line of the hilltops in the background. Neither is the building the only large structure in the area. The satellite dish of Telem, the new Telem Building and the Waste Dump are also clearly visible structures from these viewpoints.

In the base case the option of using landscaping and introduction of mangrove species (paragraph 10.3) has been included.

#### 9.11 Cultural assets, property and historical heritage

As was described in paragraph 7.10, the Executive Council of the Island Territory of St. Maarten identified and designated the Great Salt Pond as a monument (BC# 1172-08). This area is not expected to be affected negatively by the proposed activities. Also the remains of rock walls and the ruins of the Salt Factory, respectively in other parts of the pond and north of the pond, are not expected to be affected negatively.

A positive effect may occur with respect to smell, which is expected to decrease. During construction, hindrance because of noise and dust may occur, which situation is temporary.



## 9.12 Emergencies and failure scenarios

### 9.12.1 Overview

An overview of potential scenarios at the gasification plant is presented below. The scenarios are limited to physical causes. Socioeconomic causes, such as payment delays and strikes, or security related issues such as sabotage, are beyond the scope of this report.

Scenarios are limited to the cBOS-plant because of their possible impact outside the project area. Hazards for the workforce, such as a person falling from a scaffolding, are not discussed.

Finally only location-specific scenarios are considered. Generic scenarios that have impact all over the island, such as the introduction of rats with Weil's disease are not treated.

Table 9.9 Overview of potential emergency scenarios at the gasification plant

Type of emergency	Scenario
Hurricane	The building has to be able to withstand a hurricane level 4, which is higher than the requirements for most current buildings. However the access road may become inaccessible (flooding and fallen trees) and bulky wastes from outdoor storage sites (car wrecks, refrigerators, furniture) may damage the building. An emergency response plan for hurricanes is called for.
Flooding	The Salt Pond serves as drainage basin for rainfall. The plant is built at an elevation of 1,5 meters above sealevel. Flooding of the access road is expected to occur on an exceptional basis. If this happens this may create logistical problems with the waste collection (see Irregularities in waste flow and treatment).
Fire in surroundings	Fires may occur at the outdoor storages of car wrecks, refrigerators and furniture. These are not expected to pose substantial hazards to the building (distance of the storage areas from the buildings is app. 30 meters), but may hinder and pose risks to the transports. The response is discussed further in this paragraph.
Transport accidents	Transport accidents may happen on the access road, with or without fire (fires happen in about 15% of car crashes), and with or without blocking the road (both ways). If undefined wastes are involved in the fire, the fire brigade may choose to let the fire burn. Transports may be blocked for several hours, but not for days. Specific measures do not seem necessary.
Irregularities in waste flow and treatment	Logistical problems may occur with the waste collection and/or in the treatment at the plant, e.g. because of a hurricane, epidemic, strike, malfunction of or damage to the plant. Consequences may be that: <ul style="list-style-type: none"> <li>a. waste collection stops which may result in growth of vermin, rats, stray dogs etc. in residential areas. An emergency landfill site will be created.</li> <li>b. waste storages at the plant may become overfilled and the maximum storage times may be exceeded. Additional hygienic measures are needed to control the situation. Specific attention in the emergency response plan is needed.</li> <li>c. gas formation may occur in temporary storages. Measures to prevent anaerobic conditions, regular controls and means for fire suppression are needed to keep the situation under control. Specific attention in the emergency response plan is</li> </ul>

	needed.
Collapse of walls or roof	During handling of wastes with trucks and shovels accidents may occur. Collapse of one beam should be possible without compromising the physical integrity of the building. Collapse of two or more beams at the same time is considered a 'freak' accident for which generally no measures are taken.
Fire or explosion at reception area	Spontaneous fires or dust explosions in the reception area may occur. A combination of measures is needed to create a safe situation: <ul style="list-style-type: none"> <li>- clear acceptance criteria with strict control and maintenance measures,</li> <li>- swift sorting by personnel with adequate personal protection equipment,</li> <li>- electrical equipment in accordance with ATEX-standards</li> <li>- enough distance to prevent damage to or involvement of the gasification units</li> <li>- adequate means for fire suppression.</li> </ul> These and such measures will be determined in a later phase in cooperation with the fire brigade.
Fire or loss of fuel supply	The fuel storage site or a fuel line may catch fire, or there may be leaks. Safety measures will be determined in a later phase in cooperation with the fire brigade. In addition it should be realized that loss of the fuel supply implies a total stop of the process. A reassessment of the robustness of the design may be warranted.

#### 9.12.2 Failure of the gasification process

A refractory lined emergency vent stack will be provided on the discharge of the Secondary Combustion Chamber (SCC). In normal operation, the emergency vent stack will be isolated by a hydraulically operated isolation valve and flue gas flow will be discharged from the SCC through the waste heat boiler and into the flue gas cleaning plant prior to being discharged to atmosphere via the main stack. The emergency vent may be open during the following periods:

- When the gasification stream is initially warmed on a cold start up (to prevent excessive condensation forming in the flue gas system). During this start up, waste ignition / gasification will be inhibited by the open limit switch on the emergency vent hydraulic valve;
- When the gasification stream is shutdown and no waste is being processed/gasified;
- During abnormal operation when there has been a failure of the downstream flue gas processing equipment or when there is the potential that downstream flue gas equipment will be damaged. The failure scenarios that will result in the opening of the emergency vent (including safeguards in place) are identified in the following table:

Table 9.10 Overview of process related failures

Failure	Safeguards
Full Power Failure	UPS system allows PLC and SCADA to operate so that plant monitoring can still be undertaken. Steam Turbine Generator can operate in island mode and supply own electrical power.  A standby emergency diesel generator is always heated and ready to start. This will supply the full plant load for 3 streams within 15 seconds and permit the plant to be restarted and emergency vent closed.
Failure of Induced Draught	A boxed spare fan will be available

Fan or Loss of Suction in the SCC	
Failure of the Flue Gas Cleaning Plant / CEMS Failure – Shutdown initiated manually by operator -	Frequent inspection of the bag filter discharge plenum for dust deposits. Spare Calibrated CEMS system Local storage of sodium bicarbonate at each stream that will permit safe shutdown if there is a failure of the bicarbonate storage silo and conveying system
Ultimate high flue gas exiting the SCC	An independent alarm will be provided at a lower flue gas temperature, which will provide the operator with time to manually intervene
Ultimate high flue gas entering the gas cleaning plant	The flue gas temperature will be monitored by an independent thermocouple. This will alarm and put the gasification stream into a 'Turndown Mode' where the gasification rate will be put to a minimum value. This will reduce the temperature and allow the plant to be shutdown safely / provide the operator with time to resolve the issues.
Ultimate low water in the boiler steam drum	The drum boiler water level will be monitored by an independent level probe. This will alarm and put the gasification stream into a 'Turndown mode' where the gasification rate will be put to a minimum value. This will reduce the water evaporation rate in the boiler and provide the operator with time to resolve the water level issues.
Loss of cooling water flow or high cooling water temperature	The cooling tower sump has sufficient capacity to allow gasification facility to be shutdown in the event of make up water failure.

During a fault scenario that requires the emergency vent to be opened, the following actions will occur.

1. The under air and over air fans in each Primary Gasification Chamber (PGC) will be stopped. This will substantially reduce the gas flow into the SCC.
2. The induced draught fan and flue gas recirculation fans will be stopped.
3. The emergency vent hydraulically actuated valve will be opened (and be confirmed by the valve limit switch).
4. The induced draught fan inlet valve will be closed (and be confirmed closed by the valve limit switch).
5. The gas oil ring main will remain operational / be restarted.
6. The SCC burners will remain operational / be re-started and these will be in automatic control ensuring that the flue gas discharge from the SCC is maintained above 1100 °C.

The opening of the Emergency vent will induce a small flow of air through the PGCs and into the SCC. Any synthesis gas from the PGCs will be combusted and discharged via the emergency vent.

If the fault can be quickly resolved, the gasification stream will be restarted and the emergency vent closed. If the fault cannot be resolved quickly, then the operator will shutdown the PGCs within the four hour WID requirement by either controlled quenching or completion of the gasification cycle.

#### Controlled Quench

Controlled quenching will be undertaken using the four water quench nozzles located in each PGC. The water supply will be manually connected to the quench nozzles and water will be admitted into the PGC at a controlled rate to stop gasification.

### 9.12.3 Modeling the impact of emergency venting on air quality

Unusual circumstances can result in a different emission pattern during short periods of time (Waste Incineration Directive 2000-76-EC: max. 4 hours with a maximum of 60 hours per year). Because the emissions will –if they take place- only last for such a short period, only effects on NO<sub>2</sub> are modeled.

The following assumptions have been made to calculate the effects of unusual situations:

- 6 times per year (4 hours per event)
- 3 sources (stacks, 16 meters) modelled as 1 (see also paragraph 9.2.2.
- The emission rate of NO<sub>x</sub> is 12.42 g/s and is based on the calculations used in the Dargavel EIA).

Table 9.11: Emission summary unusual circumstances

Source Coordinates (x,y):	494980.81, 1993545.48
Release Height (m)	17.5*
Gas Exit Temperature (K)	1423.15
Stack Inside Diameter (m)	2.25**
Gas Exit velocity (m/s)	31.8
Gas Exit Flow Rate (m <sup>3</sup> /s)	12.566

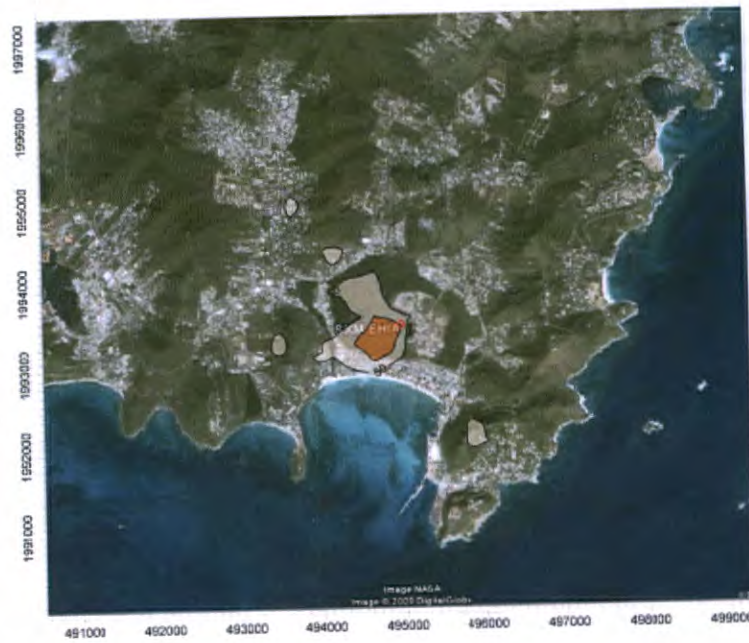
\*Stack height 16m plus stack base 1.5m

\*\*diameter was calculated in order to model 3 sources as one

Figure 9.14 shows the contour plots of the modelling of emergency venting. Emissions were modelled to take place every two months for 4 hours per event (alternating during night and day). The maximum concentration for NO<sub>2</sub> calculated as 1 hour average over a 5 year period was found to be 84,4 µg/m<sup>3</sup> (EU standard 200 µg/m<sup>3</sup>). The maximum is found to be in the West part of Philipsburg. The height of the maximum is lower than in a regular situation, probably due to plume rise as a result of the high temperature of the emission.

PROJECT TITLE  
EHIA Gasification SXM  
NO2 1 hour average: Emergency venting

COMMENTS



SOURCES:

1

RECEPTORS:

1400

OUTPUT TYPE:

Concentration

COMPANY NAME:

Windward Roads

MODELER:

EcoVision N.V.

SCALE: 1:53541

0 1 km



PROJECT NO.:

P09/ECO.205

ACERMOD Venu - Lakes Environmental Software

Figure 9.14: Impact of emergency venting on air quality

## 10 ANALYSIS OF SCENARIOS AND OPTIONS

### 10.1 Comparison of base case with Nil-scenario

Table 10.1 shows a comparison of the environmental impact of the SWMPF and the Nil-scenario (legend: see below table).

Table 10.1: Relative environmental impact change of SWMPF compared to Nil scenario

Environmental concern	Relative impact	Explanation	
Landscape	↑	Significant impact of cBOS building in landscape, however impact is less than elevated waste dump (20 meters).	
Flora and fauna	↑	Less stray waste and debris is beneficial for breeding birds.	
Cultural heritage	↑	Nil scenario implies loss of attraction value for Salt Walk	
Water	Surface water	↑	Base case implies no further expansion of waste dump and inherent increase of leachate load on environment. Prevention of emissions from SWMPF by roofing all possibly polluted surfaces.
	Ground water	↑	Base case implies no further expansion of waste dump and inherent increase of percolate load to groundwater. Prevention of emissions to soil from SWMPF by paving of surfaces.
Air	NO <sub>2</sub>	↓	Introduction of a new source of NO <sub>2</sub> , however within limits of EU ambient air quality standards. Baseline establishment necessary.
	Dust	↑	Ending of waste dump fires. Very low impact of fine dust from SWMPF
	Air toxics	↑	Ending of waste dump fires and cable burning. No significant impact of trace metals, dioxins and from SWMPF.
	Odour	↑	Odour sources will be closer to receivers however, odour production will be drastically lower and lead to less hindrance downwind (Nisbeth Road).
Climate Change	↑	SWMPF leads to production of 60 GWh of electrical energy and CO <sub>2</sub> emission reduction of app. 70.000 tonnes/year.	
Noise	↓	Noise sources will be closer to receivers however within standards	
Soil	Litter	↑	Overflow of waste will be drastically lower than nil scenario
	Deposited toxics	±	Current situation with fires and cable burning unfavorable. Impact by SWMPF very low (air toxics adhered to particles, low calculated ambient air concentrations of PM, PM10 and PM 2,5 and heavy metals).
	Rodents	↑	Control of rodents
	Insects	↑	Control of insects
Public safety	Transport accidents	=	No significant change
	Incidents at site	±	Less fires, fires better controlled, however location closer to built environment.

#### Legends (relative impacts of SWMPF compared to nil-scenario)

- ↑ Environmental impact improves
- = Environmental impact is unchanged
- ± Environmental impact is different, but of undetermined impact
- ↓ Environmental impact deteriorates

## 10.2 Options for emission reduction and improved ambient air quality

### SCR (NO<sub>x</sub> reduction)

An alternative for SNCR as a DeNO<sub>x</sub> system could be SCR (Selective Catalytic Reduction). The sensitivity of SCR to temperature changes is limited and controlled by the upstream flue gas treatment (e.g. by heat exchange). A layer of urea is formed on the catalytic surface in the SCR reactor which makes this technology less sensitive to incorrect dosing related to fluctuations in the flue gas flow. Besides, SCR will result in lower emissions of ammonia.

In Iceland (Husavik) NO<sub>x</sub> emissions are compliant with the EU (WID) emission standard for the majority of time without any NO<sub>x</sub> abatement. The degree to which NO<sub>x</sub> needs to be reduced is limited and SNCR is likely to realize values much lower than the EU emission standard for NO<sub>x</sub>. Although the SCR technology may have some advantages, these may not balance the significantly higher costs of the system.

### Stack height 22 meters (regular emissions)

As a comparison a stack height of 22 meters instead of 18 meters was modeled. The results show that the maximum concentration levels of the pollutants are slightly lower than the maximum values with an 18 meter stack (see table 10.3 for a detailed comparison). Exceptions are the 1 hour averages for SO<sub>2</sub> and NO<sub>2</sub> which show a slight increase of the maximum, which can be explained by the elevation of the locations where the maximum values are observed.

Because of this ambivalent result a higher stack might not be the most appropriate option to choose.

Table 10.3 Output Ambient air quality modeling with a 22 meter stack

Pollutant	Averaging period	Standard EU (µg/m <sup>3</sup> )	Maximum public area (22m stack)	% of EU standard (22m)	In-/decrease compared to 18 m	Maximum in residential area	Permitted exceedences (5y)	Exceedence counts (5y)
SO <sub>2</sub>	1h	350	69.57	20%	4.51%	No	120	0
	24h	125	38.98	31%	-11.27%	No	15	0
NO <sub>2</sub>	1h	200	102.91	51%	1.18%	No	90	0
	year (*)	40	26.75	67%	-6.73%	No	n.a	n.a
PM <sub>2.5</sub>	year	25	2.32	9%	-9.73%	No	n.a	0
PM <sub>10</sub>	24h	50	5.87	12%	-11.33%	No	175	0
	Year	40	2.55	6%	-9.89%	No	n.a	0
CO	8h	10000	48.98	0.5%	-13.06%	No	n.a	0
Cd	Year	0.005	0.005	100%	0.00%	No	n.a	0
Pb	Year	0.5	0.07	14%	0.00%	No	n.a	0

### 10.3 Reduce the visual impact of the building

The introduction of landscaping on the plant site may have a positive impact on the visual experience of the plant and its surroundings. This could be done also by introducing certain high growing mangrove species on the Pond Island perimeter dyke (e.g. red mangrove, *Rhizophora mangle*).

This measure has become a feature of the base case (see paragraph 9.10)

### 10.4 Mitigation measures

All mitigation measures have been described in the relevant paragraphs. Additional measures that could be taken are described below for the relevant compartments.

#### Air

Introduction of a program for separate collection of batteries, to prevent the gasification of batteries. A program like this would contribute to lowering the amounts of heavy metals (notably Ni and Cd) in the flue gases.

#### Noise

The use of noise reducing building materials instead of single steel sheet will likely reduce the noise levels in the surroundings of the SWMPF. This effect has not been quantified as yet.



## 11 MONITORING AND EVALUATION

### 11.1 Monitoring indicators for the facility

#### Noise

A verification measurement will be carried out in the first year of the operation.

#### Air emissions

Following Article 11 of the Directive 2000-76-EC of the European Parliament and of the council of 4 December 2000 on the incineration of waste, the following monitoring measurements for air emissions will be carried out at the SWMPF.

- Continuous measurement of NO<sub>x</sub>, CO, Total dust, TOC, HCl, HF, SO<sub>2</sub><sup>1</sup>
- Continuous measurement of process operation parameters (a.o temperature, oxygen concentration, pressure, water vapour content of the exhaust gas)
- At least two measurements per year of heavy metals, dioxins and furans
- The residence time as well as the minimum temperature and the oxygen content of the exhaust gases (single event)

Every year the noise and air emissions will be assessed by an independent company/consultant and compared with the requirements as set in the permits. The competent authority shall state the measurement requirements and the location of measurement and sampling points. Before the monitoring activities will start WWR will seek approval of the independent company/consultant by the competent authority. Details hereto will be elaborated in the permits.

The results of the investigation will be reported to the competent authority. If after two years (and two investigations) the results show that the facility complies with the permits, the frequency for future investigations can be set to once per two years.

The Government may establish an independent monitoring committee to coordinate and control the monitoring process. This committee will consist of at least 3 members:

- 1 member of Windward Roads
- 1 member of Government
- 1 NGO member

<sup>1</sup> Periodic measurements of HCl, HF and SO<sub>2</sub> instead of continuous measuring only if the emissions of those pollutants are under no circumstances be higher than the prescribed emission limit values.

## 12 CONCLUSIONS AND RECOMMENDATIONS

### 12.1 Conclusions

The erection of the Solid Waste Management & Processing Facility (SWMPF) at Pond Island Sint Maarten will significantly improve the quality of waste treatment on Sint Maarten as well as most of the environmental aspects concerned.

The SWMPF can be expected to comply with all standards set forward for the relevant environmental compartments. The SWMPF also complies with Antillean standards at the level of complete waste management facilities.

For air emissions the stringent European emission standards of the Waste Incineration Directive have been used. For ambient air quality the European Union standards (limits and target values) for air quality have been used. For noise the Antillean standards have been used.

The emissions of the SWMPF will be treated with a DeNO<sub>x</sub> system (SNCR), a sodium bicarbonate dosing system (for acid components) and active carbon injection combined with removal by bag filters.

From existing and operational BOS technology -mainly the Iceland Husavik plant- it becomes clear that comparable plants comply with European (Waste Incineration Directive, WID) standards for the relevant components (e.g. NO<sub>x</sub>, dust, HCl) for the majority of time with limited abatement systems. It can therefore be assumed that the Sint Maarten plant equipped with a complete air emissions abatement system will comply with the EU (WID) standards.

Air quality modeling results should be interpreted with caution because there is no valid baseline information. However for critical parameters like NO<sub>2</sub> the baseline concentrations in comparable situations (Curaçao, busy road) are relative low, between 5 and 12 µg/m<sup>3</sup>.

From the air quality modeling and the subsequent health impact assessment the following conclusions can be drawn.

- EU limit and target values for ambient air quality are met even with an over estimation of particles, heavy metals and NO<sub>x</sub> with a factor of approximately 2,5.
- In general the area west of the plant is impacted, mostly above the Great Salt Pond and to limited extent in the neighbourhoods of Sentry Hill, Cay Hill, and Fort Hill/Fort Willem, but peak levels are mostly found to the north and south in Lower Princess Quarter and Philipsburg.
- The anticipated contribution of air pollutants from the plant generally are between 1% and 40% of the EU-standard values for ambient air quality, except for NO<sub>2</sub> (1 hour average) and Nickel (year average) which are at some receptor points at 51% and 100% of the EU standard values.
- The modeled value for NO<sub>2</sub> as a 1 hour average of 101,72 µg/3 (51% of maximum peak value) in Lower Princess Quarter is a single peak value

observed only once in the 5 year modeling period. Average values are at 0,1 µg/3.

- Nickel values are at the European ambient air quality target value for 2012 (0,02 µg/m<sup>3</sup> as a year average) for a small part of west border of the Great Salt Pond (highest values). It has to be kept in mind that nickel emissions are over estimated with a factor of approximately 2,5.
- Monitoring of all emissions but especially nickel values should take place in at least the first 6 months of operation (see also paragraph 11.2). If Nickel emission values prove to be high, a battery recycling program could be considered.
- A higher stack (22 meters) leads to slightly lower ambient air concentrations of pollutants except for the 1 hour average values for NO<sub>2</sub> and SO<sub>2</sub>, which become slightly higher.
- The exposure of the population to air toxics such as Polycyclic Aromatic Hydrocarbons (PAH's), dioxins and furans and trace metals through air is expected to be very low. Uptake from locally produced food is also rather unlikely, but dioxin levels in near shore fish (bottom feeders) are of concern and warrant monitoring.

## 12.2 Recommendations

Recommendations have been formulated for Government and for the SWMPF:

For Government:

- Carry out a baseline study for air quality in the impact area of the SWMPF (see also letter of ROB Sint Maarten to the National Department of Public Health and Social Development/MINA, Annex 12) and for dioxin levels in near shore fish.
- Take preparations such that an environmental permit of high quality can be ensured, which offers suitable standards and suitable articles for future enforcement.
- Take preparations such that Government Representatives will be well trained for their task to inspect the facility.
- Set up a collection system for batteries to be exported for recycling
- Stop the cable burning at the car wreck site
- Establish an independent monitoring committee with at least 3 members.

For the SWMPF:

- Take responsibility for Internal Quality Control
- Take responsibility for application of Safety Standards
- Take responsibility for Certifications of Supervision (using ISO, EPA or OSHA)

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## Annexes

1. Waste analysis by R.W. Beck
2. Energy and Mass balance cBOS
3. Process Diagram cBOS
4. Analysis of quality of sediments for area leveling
5. Standards for Air Emissions European Union (waste treatment, Directive 2000/76/EC)
6. Emissions Husavik Iceland
7. Calculated flue gas volumes (Nm<sup>3</sup>/hour, dry gas, 11% O<sub>2</sub>)
8. Modeling results for ambient air quality
9. Correspondence with regard to baseline ambient air quality assessment
10. Overview of relevant sources and assumptions for noise calculations
11. Fact sheet ashes from gasification process
12. Letter of ROB Sint Maarten to the National Department of Public Health and Social Development/MINA regarding baseline study ambient air quality
13. Waste generators and processing of waste categories

**SUBSOIL INVESTIGATION**

**SOLID WASTE TREATMENT FACILITY**

**AT**

**POND ISLAND**

**PHILIPSBURG, SINT MAARTEN**

**Client: Windward Roads NV**

**Report: 210-008-614**

**Date: November 2010**

**G.T.S. N.V.**

**GEOTECHNICAL RELATED ENGINEERING AND CONSTRUCTION**

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#### **4. Investigation program**

A limited investigation program has been executed in April 2010 by the firm "Geotron". Copy of the report is included in annex 6 to this report. The investigations executed for this report consisted solely of Dynamic Cone Penetrometer soundings (exact characteristics of the testing equipment not specified), continued to refusal on the penetrometer.

As the report and limited investigation leaves several questions unanswered, it has been decided, in consultation with the principal, to extend the program as follows:

- Execution of 3 wash borings with execution of SPT testing (Standard Penetration Test) per 1.5 meter depth interval and collection of samples from the SPT split spoon sampler.
- After refusal on the SPT, continuation of the sounding by Dynamic Cone Penetrometer sounding DCPT (conus diameter 2 inch, drop hammer 140 lbs, drop height 30 inches), until refusal on the DCPT is encountered.
- Since one of the main questions remaining after the limited investigation by Geotron remains the consistency and thickness of the harder layer encountered at depths around 10.5- 12.00 meters (in other locations on Pond Island a harder layer is encountered at the same depths, but proves to have limited thickness and bearing capacity), it has been decided to continue the boring by destructive rotary drilling to the point where either softer layers are encountered again, or to the point where hard bedrock is encountered.
- Depending on what is encountered by the destructive rotary drilling, additional testing by SPT including sample collection, and eventually further Dynamic Cone Penetrometer testing are executed.
- Samples collected from SPT testing are classified and relevant samples are subjected to mechanical analysis (grain size distribution).

Test locations are indicated on fig 2 Boring location plan.

10.00- 11.00:	black fine to coarse sand
12.00- 18 meters	brown sands with silts and clays, and gravels: in variable degrees of hardness and compactness, in general very dense

## 6. Conclusions and recommendations

### a. Terrain and settlement

The terrain consists of very recent land reclamation in the Great Salt pond. The subsoil in the Pond consists of approximately 10 meters of very loose sands and silts.

Automatically questions arise about the potential for liquefaction of the subsoil and settlements over the longer term.

#### 1. Liquefaction

The potential for danger for liquefaction has been analyzed based on the specifications of the "Regles Parasismiques 1992- Norme NF 06-013- France), and based on the recommendations formulated in the article in annex 4: " Liquefaction resistance of soils: summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of Liquefaction Resistance of Soils"

The results of the analysis are summarized in annex 5.

It can be concluded that **in general the terrain is not susceptible to liquefaction risks**, except in isolated cases that concern layers of limited extend and at variable depths.

For all practical purposes the risk of liquefaction can be considered minimal.

#### 2. Settlement

The nature of the loose layers is such that one must count with considerable settlements of the recent fill layers over the coming years. Areas nearby which have been filled in a similar manner have shown settlement of the overall terrain in the order of 15 to 20 centimeters in the last 10 to 15 years. In those cases settlement is not completed yet, the areas continue to show signs of (light) further settlement.

After any campaign to compact/ densify the loose layers, SPT testing should be carried out to verify the degree of compaction achieved and to determine the modified soil parameters for further design purposes.

After proper compaction and densification of the subsoil, it will be possible to design buildings and other structures on mat foundations. Parameters for such can be determined after compaction of the subsoil has been achieved.

After completion of compaction, settlement will not be a further significant factor in the project.

It is our strong recommendation to consider densification of the terrain subsoil. A comparison should be made between the costs of densification and the additional costs required for deep foundations and the inconveniences and operational costs caused by settlement of the terrain in general.

We understand it might be clients intend to realize the project without proceeding with compaction. The consequences of this option and parameters to be used will be further handled below.

### **c. Design considerations without further densification of the subsoil**

When compaction/ densification of the subsoil is not considered, settlement of the terrain, and the (limited) bearing capacity of the recent fill layer become major factors in foundation design considerations. In this case one has to take into account that settlements of up to 15 to 20 centimeters can occur in the future (spread out overall several years, but also depending on loadings in each particular case)

#### *1. Major Buildings (C&D Building and CBOS Building)*

The project has two major buildings, with several thousands of square meters of surface.

The dimensions of these buildings are such that in case superficial foundations would be used for these, differential settlements over the area of the building will be such that major problems are guaranteed to develop.

The only practical foundation method for these structures will be a pile foundation (see later for further discussion of pile foundations).

## 6. Floors inside the major buildings

One will have to study carefully which floors inside the C&D and CBOS buildings can be allowed to show settlement over time, and which not.

Floors that cannot show settlement will have to be founded on piles.

- Floor in the office part of the building
- Others?

These floors should be placed on pile foundations.

Possibly other floors will not be sensitive to settlements and can be leveled off at a later stage when part of the settlements have taken place:

- Tipping and waste handling area?
- Others

The design of these floors has to take into account that they will settle completely differently than the movement of the building itself (on piles) and that settlements can be in the order of 15 to 20 cm over the next 10 to 15 years, depending on loads imposed on these floors.

One can consider either isolated concrete plates, which can be jacked up by grouting or can be lifted and placed back after leveling, or asphalt pavement with additional courses added as settlement progresses.

## 7. General infrastructure

The design of the infrastructure has to take into account that settlement will take place:

- Flexible pavements that can be adjusted as settlement progresses
- Drainage trenches with sufficient slope so that some settlement does not hamper water flow
- Detailing of connections of pavements and other site infrastructure to structures founded on piles has to take into account that a settlement difference will occur.
- Where cables or pipes are connected to structures (especially those founded on piles, but also other structures on mat foundations), provisions have to be taken that:
  - i. Flexible connections are included
  - ii. Sufficient slack is incorporated into cable layouts to allow for the settlement

ii. *Mat foundations*

Mat foundations with stiffening ribs should only be used for elements that are not settlement sensitive, and of maximum dimensions 12 meters.

Mats can be dimensioned with an allowable soil pressure of 0.75 kg/cm<sup>2</sup> and a modulus of sub grade reaction of 1.5 kg/cm<sup>3</sup>. The mats should be calculated for differential settlements of 0.5 cm per linear meter of mat dimension.



Project: 210-008-614- Solid Waste treatment facility  
Client: WWR  
Subject: Borehole records

**Boring 1**

0-12.45 m:	washboring + SPT: Sands/ silts
12.30-13.95:	DCPT: brown sand + clay/silts
0-14.00:	drilling + casing installation
14.00 – 15.00	drilling open hole: hard material: brown sand + clay/silts
15.00- 17.33	BW casing driven with 140 lbs hammer: relatively less dense material: brown sand + clay/silts
17.33- 17.78:	SPT testing: brown sand + clay/silts
17.78-18.45	DCPT
18.45- 20.00	Drilling open hole: very dense brown sands + clay

**Boring 2:**

0-10.95	washboring + SPT: Sands/ silts
10.95- 12.30:	DCPT brown sand + clay/silts
0-15.0	drilling + casing installation
15.00- 15.45	SPT Testing brown sands + Clay/silt and black silts/ grey sand
15.45-16.05:	DCPT
16.05-18.0	drilling open hole: very dense brown sands + clay

## **ANNEX 2: SPT and DCPT TESTING**



# G.T.S. N.V.

## Borehole Record Standard Penetration Test (SPT)

Test no : 1

Project : **Waste Treatment Facility**  
 Principal : **Windward Roads N.V.**  
 Surface Elev : 0 m      Borehole location : 1  
 Date Started : 06-10-2010      Borehole Type : WASH  
 Date Complete: 11-10-2010      Borehole Diameter : 63mm  
 Boring Foreman: EG      hammer weight/drop : 140lbs/30"  
 Inspector : EC      Casing : BW  
 Engineer : JVE      Sampler : Splitspoon

Depth (m)	Casing blows per 30cm	SAMPLE					Strata Change ELEV.	N-Value	SOIL DESCRIPTION	SAMPLE		
		No.	Depth (m)	Blows per 15cm						No.	Pen. (cm)	Rec. (cm)
				0-15	15-30	30-45						
9	27	1-S7	9-9.45	1	1	1	2	grey fine to coarse coral sand and silt	7	45	46	
	24											
	24											
	40											
	60											
10.5	65	1-S8	10.5-10.95	9	11	8	1 9	black fine to coarse sand, some silt	8	45	30	
	100											
	200											
	223											
	400											
12		1-S9	12-12.45	151	180	155	3 3 5	brown fine to coarse sand, some clay & silt	9	45	21	
13.5							0					
15	26						0					
	12											
	6											
	10											
	10											
16.5	100						0	brown fine to coarse sand, some clay & silt				
	397											
	500	1-S10	17.33-17.78	67	69	100					10	45
							1 6 9					
18							0					

Remarks: Groundwater = 0.87m

proportions used trace=0-10%, little= 10-20%, some=20-35%, and= 35-50%

SAMPLE TYPE	cohesionless density	cohesive consistency
C = Cored	0-4 very loose	0-2 very soft
W = Washed	4-10 loose	2-4 soft
SS = Split Spoon	10-30 compact	4-8 medium
UP = Undisturbed Pisto	30-50 dense	8-15 stiff
TP = Test Pit	50+ very dense	15-30 very stiff
UT = Undisturbed Thin		30+ hard

Job Number: 210-008-614

SUMMARY :  
 casing driven to : 12 m  
 sampler driven to : 12.45 m  
 total no. of samples : 9 #

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# G.T.S. N.V.

## Borehole Record Standard Penetration Test (SPT)

Test no : 2

Project : **Waste Treatment Facility**  
 Principal : **Windward Roads N.V.**  
 Surface Elev : 0 m      Borehole location : 2  
 Date Started : 30-09-2010      Borehole Type : WASH  
 Date Completed: 05-10-2010      Borehole Diameter : 63mm  
 Boring Foreman : EG      hammer weight/drop : 140lbs/30"  
 Inspector : EC      Casing : BW  
 Engineer : JVE      Sampler : Splitspoon

Depth (m)	Casing blows per 30cm	SAMPLE No.	Depth (m)	Blows per 15cm			Strata Change ELEV.	N-Value	SOIL DESCRIPTION	SAMPLE		
				0-15	15-30	30-45				No.	Pen. (cm)	Rec. (cm)
0	6	2-S1	0-0.45	1	1	4	5	fine to coarse cora sand, some silt, trace shell	1	45	22	
	9											
	20											
	52											
	36						2	fine to coarse cora sand, some silt, trace shell				
1.5	11	2-S2	1.5-1.95	23	12	10			2	45	16	
	24											
	20											
	16						2	grey clay, trace sand				
3	14	2-S3	3-3.45	2	1	1			2	45	45	
	11											
	23											
	57						2	grey fine to coarse coral sand and silt				
4.5	25	2-S4	4.5-4.95	4	1	1			2	45	46	
	13											
	12											
	14						2	grey fine to coarse coral sand and silt				
6	18	2-S5	6.0-6.45	3	1	1			2	45	35	
	20											
	19											
	19						2	grey fine to coarse coral sand and silt				
7.5	21	2-S6	7.5-7.95	4	1	1			2	45	24	
	16											
	16											
	16						2	grey fine to coarse coral sand and silt				
	21								2	45	39	
9	30	2-S7	9-9.45	1	1	1						

Remarks: Groundwater = 0.87m

proportions used trace=0-10%, little= 10-20%, some=20-35%, and= 35-50%

SAMPLE TYPE	cohesionless density	cohesive consistency
C = Cored	0-4 very loose	0-2 very soft
W = Washed	4-10 loose	2-4 soft
SS = Split Spoon	10-30 compact	4-8 medium
UP = Undisturbed Piston	30-50 dense	8-15 stiff
TP = Test Pit	50+ very dense	15-30 very stiff
UT = Undisturbed Thinwall		30+ hard

Job Number: 210-008-614

SUMMARY :  
 casing driven to : 10.5 m  
 sampler driven to : 10.95 m  
 total no. of samples : 8 #

website: [www.icesxm.com](http://www.icesxm.com)

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# G.T.S. N.V.

## Borehole Record

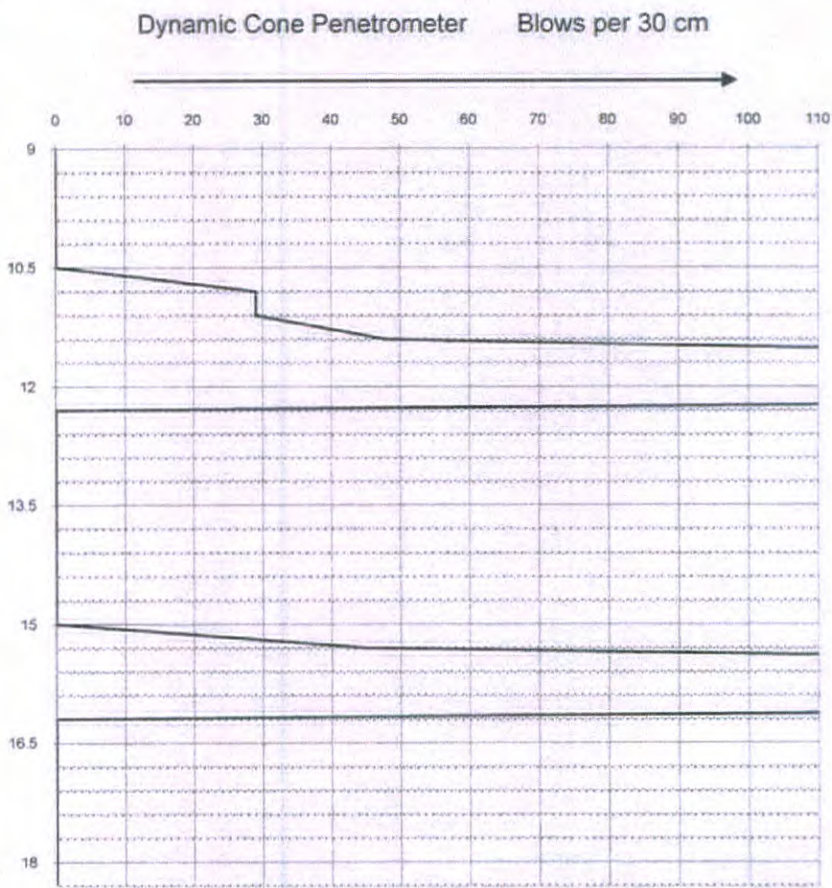
Dynamic Cone Penetrometer Test (CPT)

Page 1 of 1

Project: **Waste Treatment Facility**  
 Principal: **Windward Roads N.V.**  
 Test no: **2**  
 Date: **05/10/10** Hammer Weight/Drop: **140 LBS/30"**  
 Boring Foreman : **EG** Test Location: **2**  
 Inspector : **EC** Cone Size : **5 cm**  
 Engineer : **JVE**

JOB NO. : 210-008-614

Depth (m)	Blows Per 15cm
9	
10.5	13    16 12    17 21    27 57    153
12	150    350
13.5	
15	45 115    145 450
16.5	
18	



**REMARKS:**

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# G.T.S. N.V.

## Borehole Record

Standard Penetration Test (SPT)

Test no : 3

Project : **Waste Treatment Facility**  
 Principal : **Windward Roads N.V.**  
 Surface Elev : 0 m      Borehole location : 3  
 Date Started : 28-09-2010      Borehole Type : WASH  
 Date Completed: 31-09-2010      Borehole Diameter : 63mm  
 Boring Foreman EG      hammer weight/drop : 140lbs/30"  
 Inspector : EC      Casing : BW  
 Engineer : JVE      Sampler : Splitspoon

Depth (m)	Casing blows per 30cm	SAMPLE					Strata Change ELEV.	N-Value	SOIL DESCRIPTION	SAMPLE		
		No.	Depth (m)	Blows per 15cm						No.	Pen. (cm)	Rec. (cm)
				0-15	15-30	30-45						
9	37	3-S7	9-9.45	1	1	1		2	dark grey silt & clay & coral sand	7	45	20
	27											
	96											
	63											
	450											
10.5		3-S8	10.5-10.95	115	152	180		3	dark grey/ black fine to coarse sand	8	45	24
								2				
12								0				
13.5								0				
15								0				
	56											
16.5	113							2	brown fine sand and silt/clay			
	300							5				
	480	3-S9	17.4-17.85	27	80	179		9		9	45	33
18								0				

Remarks: Groundwater = 0.87m

proportions used trace=0-10%, little= 10-20%, some=20-35%, and= 35-50%

SAMPLE TYPE	cohesionless density	cohesive consistency
C = Cored	0-4 very loose	0-2 very soft
W = Washed	4-10 loose	2-4 soft
SS = Split Spoon	10-30 compact	4-8 medium
UP = Undisturbed Piston	30-50 dense	8-15 stiff
TP = Test Pit	50+ very dense	15-30 very stiff
UT = Undisturbed Thinwa		30+ hard

Job Number: 210-008-614

SUMMARY :  
 casing driven to : 10.5 m  
 sampler driven to : 10.95 m  
 total no. of samples : 8 #

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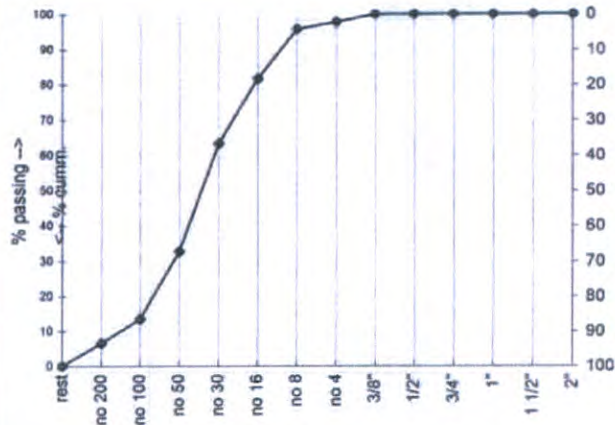
**ANNEX 3: LAB ANALYSIS**



**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 1-S3  
Initial Sample Weight: 0.1456 kg  
Date Received: 6-Oct-10  
Date Test: 14-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2" (50.80mm)	0.0	0.0	0	100		
1 1/2" (38.10mm)	0.0	0.0	0	100		
1" (25.40mm)	0.0	0.0	0	100		
3/4" (19.05mm)	0.0	0.0	0	100		
1/2" (12.70mm)	0.0	0.0	0	100		
3/8" (9.53mm)	0.0	0.0	0	100		
n° 4 (4.75mm)	3.3	2.3	2	98		Crushing value: %
n° 8 (2.36mm)	2.8	1.9	4	96		Sand Equivalent: %
n° 16 (1.190mm)	20.6	14.1	18	82		Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	26.6	18.3	37	63		Fin. Modulus: %
n° 50 (0.300mm)	44.7	30.7	67	33		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	27.9	19.2	86	14		Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	10.2	7.0	93	7		Moisture content: %
rest	9.5	6.5	100	0		% passing sieve No.200 6.5 %
total	145.6	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

Test by: Eugene Chance

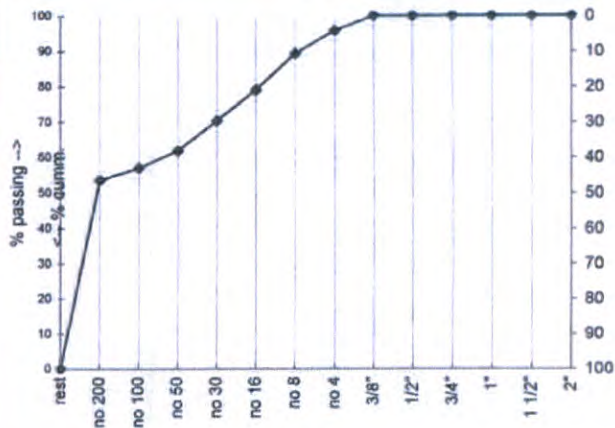
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**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 1-S7  
Initial Sample Weight: 0.2373 kg  
Date Received: 6-Oct-10  
Date Test: 14-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2"	0.0	0.0	0	100		
1 1/2"	0.0	0.0	0	100		
1"	0.0	0.0	0	100		
3/4"	0.0	0.0	0	100		
1/2"	0.0	0.0	0	100		
3/8"	0.0	0.0	0	100		
n° 4	10.0	4.2	4	96		
n° 8	15.3	6.4	11	89		
n° 16	24.4	10.3	21	79		
n° 30	20.7	8.7	30	70		
n° 50	20.1	8.5	38	62		
n° 100	11.6	4.9	43	57		
n° 200	8.2	3.5	46	54		
rest	127.0	53.5	100	0		
total	237.3	100	100	0		

Crushing value:	%
Sand Equivalent:	%
Specific Gravity:	kg/m <sup>3</sup>
Fin. Modulus:	%
Unit WT., dry rodded:	kg/m <sup>3</sup>
Unit WT.:	kg/m <sup>3</sup>
Moisture content:	%
% passing sieve No.200	53.5 %
Colour NaOH-test:	
Clay lump % by WT:	%
Chloride content:	%

Remark: None

Test by: Eugene Chance

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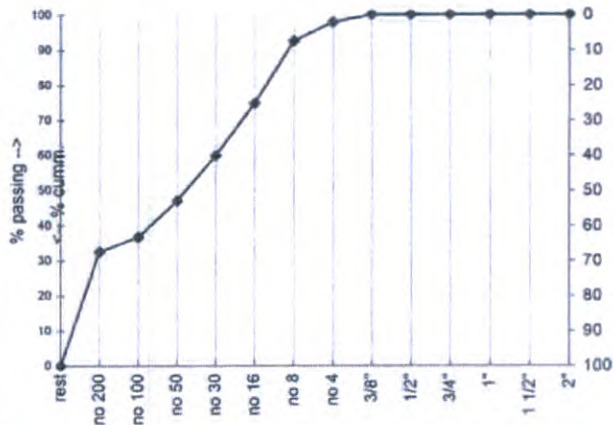


**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 1-S9

Initial Sample Weight: 0.3619 kg  
Date Received: 6-Oct-10  
Date Test: 14-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2"	0.0	0.0	0	100		
1 1/2"	0.0	0.0	0	100		
1"	0.0	0.0	0	100		
3/4"	0.0	0.0	0	100		
1/2"	0.0	0.0	0	100		
3/8"	0.0	0.0	0	100		
n° 4	7.9	2.2	2	98		Crushing value: %
n° 8	18.9	5.2	7	93		Sand Equivalent: %
n° 16	64.1	17.7	25	75		Specific Gravity: kg/m <sup>3</sup>
n° 30	54.4	15.0	40	60		Fin. Modulus: %
n° 50	46.4	12.8	53	47		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100	37.3	10.3	63	37		Unit WT.: kg/m <sup>3</sup>
n° 200	15.4	4.3	68	32		Moisture content: %
rest	117.5	32.5	100	0		% passing sieve No.200 32.5 %
total	361.9	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

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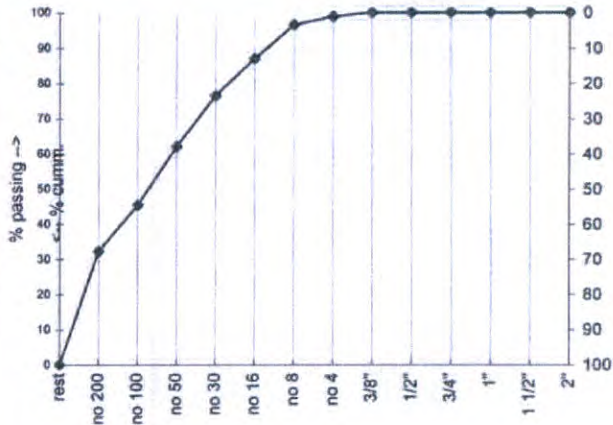




**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: **Windward Roads N.V.**  
Source: **Waste Treatment Facility**  
Sample No: **2-S2**  
  
Initial Sample Weight: **0.3026 kg**  
Date Received: **30-Sep-10**  
Date Test: **18-Oct-10**



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2"	0.0	0.0	0	100		
1 1/2"	0.0	0.0	0	100		
1"	0.0	0.0	0	100		
3/4"	0.0	0.0	0	100		
1/2"	0.0	0.0	0	100		
3/8"	0.0	0.0	0	100		
n° 4	3.4	1.1	1	99		Crushing value: %
n° 8	7.1	2.3	3	97		Sand Equivalent: %
n° 16	28.9	9.6	13	87		Specific Gravity: kg/m <sup>3</sup>
n° 30	31.7	10.5	23	77		Fin. Modulus: %
n° 50	43.5	14.4	38	62		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100	50.7	16.8	55	45		Unit WT.: kg/m <sup>3</sup>
n° 200	39.9	13.2	68	32		Moisture content: %
rest	97.4	32.2	100	0		% passing sieve No.200 32.2 %
total	302.6	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

Test by: Eugene Chance

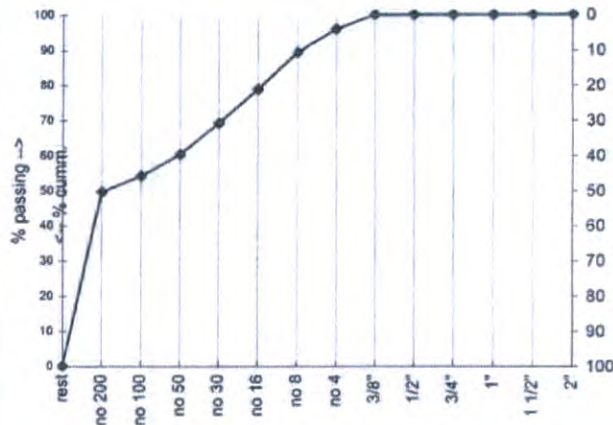
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**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 2-S5  
  
Initial Sample Weight: 0.206 kg  
Date Received: 30-Sep-10  
Date Test: 18-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2" (50.80mm)	0.0	0.0	0	100		
1 1/2" (38.10mm)	0.0	0.0	0	100		
1" (25.40mm)	0.0	0.0	0	100		
3/4" (19.05mm)	0.0	0.0	0	100		
1/2" (12.70mm)	0.0	0.0	0	100		
3/8" (9.53mm)	0.0	0.0	0	100		
n° 4 (4.75mm)	8.3	4.0	4	96		Crushing value: %
n° 8 (2.36mm)	13.6	6.6	11	89		Sand Equivalent: %
n° 16 (1.190mm)	21.8	10.6	21	79		Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	19.7	9.6	31	69		Fin. Modulus: %
n° 50 (0.300mm)	18.3	8.9	40	60		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	12.7	6.2	46	54		Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	9.3	4.5	50	50		Moisture content: %
rest	102.3	49.7	100	0		% passing sieve No.200 49.7 %
total	206.0	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

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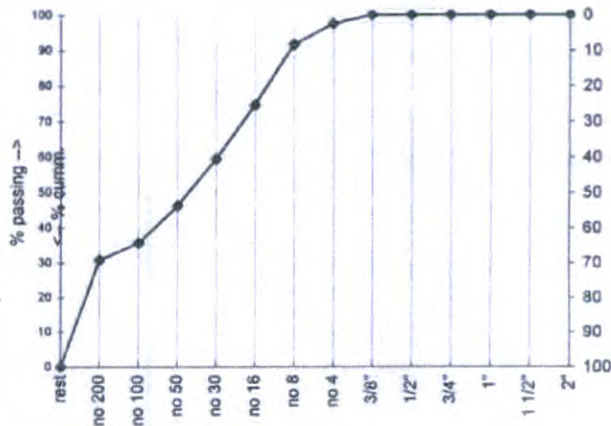


**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 2-S8

Initial Sample Weight: 0.3753 kg  
Date Received: 30-Sep-10  
Date Test: 18-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2" (50.80mm)	0.0	0.0	0	100		
1 1/2" (38.10mm)	0.0	0.0	0	100		
1" (25.40mm)	0.0	0.0	0	100		
3/4" (19.05mm)	0.0	0.0	0	100		
1/2" (12.70mm)	0.0	0.0	0	100		
3/8" (9.53mm)	0.0	0.0	0	100		
n° 4 (4.75mm)	9.3	2.5	2	98		Crushing value: %
n° 8 (2.36mm)	22.1	5.9	8	92		Sand Equivalent: %
n° 16 (1.190mm)	63.7	17.0	25	75		Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	57.2	15.2	41	59		Fin. Modulus: %
n° 50 (0.300mm)	49.8	13.3	54	46		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	39.7	10.6	64	36		Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	18.1	4.8	69	31		Moisture content: %
rest	115.4	30.7	100	0		% passing sieve No.200 30.7 %
total	375.3	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

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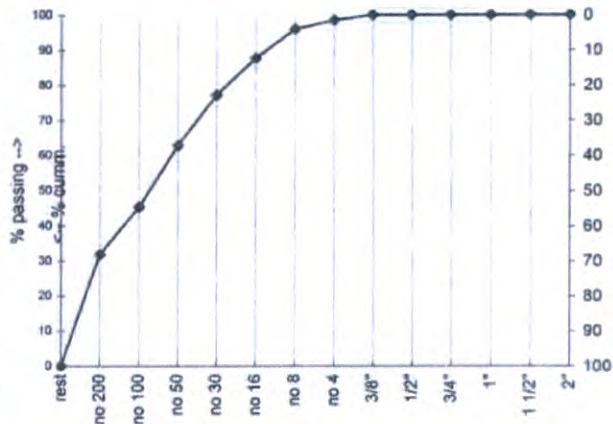


**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 3-S1

Initial Sample Weight: 0.2961 kg  
Date Received: 28-Sep-10  
Date Test: 21-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2" (50.80mm)	0.0	0.0	0	100		
1 1/2" (38.10mm)	0.0	0.0	0	100		
1" (25.40mm)	0.0	0.0	0	100		
3/4" (19.05mm)	0.0	0.0	0	100		
1/2" (12.70mm)	0.0	0.0	0	100		
3/8" (9.53mm)	0.0	0.0	0	100		
n° 4 (4.75mm)	4.3	1.5	1	99		Crushing value: %
n° 8 (2.36mm)	7.4	2.5	4	96		Sand Equivalent: %
n° 16 (1.190mm)	24.7	8.3	12	88		Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	31.1	10.5	23	77		Fin. Modulus: %
n° 50 (0.300mm)	42.8	14.5	37	63		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	51.7	17.5	55	45		Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	39.9	13.5	68	32		Moisture content: %
rest	94.2	31.8	100	0		% passing sieve No.200 31.8 %
total	296.1	100	100	0		Colour NaOH-test:

Remark: None

Test by: Eugene Chance

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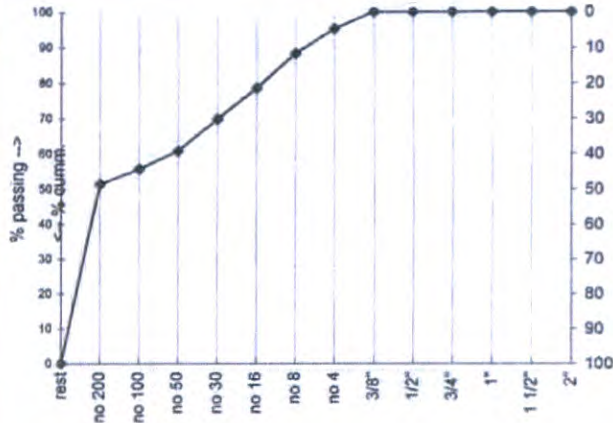


**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 3-S4

Initial Sample Weight: 0.2612 kg  
Date Received: 28-Sep-10  
Date Test: 21-Oct-10



Sieves	Retained			Passing	
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%	
2" (50.80mm)	0.0	0.0	0	100	
1 1/2" (38.10mm)	0.0	0.0	0	100	
1" (25.40mm)	0.0	0.0	0	100	
3/4" (19.05mm)	0.0	0.0	0	100	
1/2" (12.70mm)	0.0	0.0	0	100	
3/8" (9.53mm)	0.0	0.0	0	100	
n° 4 (4.75mm)	12.3	4.7	5	95	Crushing value: %
n° 8 (2.36mm)	18.4	7.0	12	88	Sand Equivalent: %
n° 16 (1.190mm)	25.3	9.7	21	79	Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	22.7	8.7	30	70	Fin. Modulus: %
n° 50 (0.300mm)	23.6	9.0	39	61	Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	13.4	5.1	44	56	Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	11.3	4.3	49	51	Moisture content: %
rest	134.2	51.4	100	0	% passing sieve No.200 51.4 %
total	261.2	100	100	0	Colour NaOH-test:
					Clay lump % by WT: %
					Chloride content: %

Remark: None

Test by: Eugene Chance

website: [www.icesxm.com](http://www.icesxm.com)  
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Tel. : +(599) - 542 2421 Fax : +(599) - 542 2597  
e-mail: [icesxm@sintmaarten.net](mailto:icesxm@sintmaarten.net)

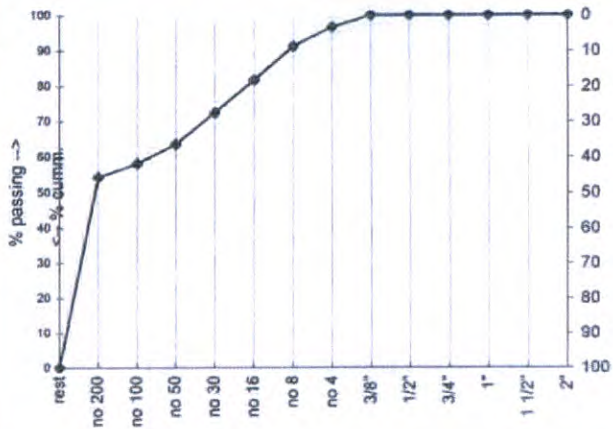


**Independent Consulting Engineers N.V.**  
Testing Service Department

**Sieve Analysis**  
ASTM

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 3-S7

Initial Sample Weight: 0.2435 kg  
Date Received: 28-Sep-10  
Date Test: 21-Oct-10



Sieves	Retained			Passing		
	Weight 10 <sup>-3</sup> kg	Ind. %	Cumm. %	%		
2" (50.80mm)	0.0	0.0	0	100		
1 1/2" (38.10mm)	0.0	0.0	0	100		
1" (25.40mm)	0.0	0.0	0	100		
3/4" (19.05mm)	0.0	0.0	0	100		
1/2" (12.70mm)	0.0	0.0	0	100		
3/8" (9.53mm)	0.0	0.0	0	100		
n° 4 (4.75mm)	8.2	3.4	3	97		Crushing value: %
n° 8 (2.36mm)	13.2	5.4	9	91		Sand Equivalent: %
n° 16 (1.190mm)	23.1	9.5	18	82		Specific Gravity: kg/m <sup>3</sup>
n° 30 (0.600mm)	22.7	9.3	28	72		Fin. Modulus: %
n° 50 (0.300mm)	21.6	8.9	36	64		Unit WT., dry rodded: kg/m <sup>3</sup>
n° 100 (0.150mm)	13.2	5.4	42	58		Unit WT.: kg/m <sup>3</sup>
n° 200 (0.075mm)	9.4	3.9	46	54		Moisture content: %
rest	132.1	54.3	100	0		% passing sieve No.200 54.3 %
total	243.5	100	100	0		Colour NaOH-test:
						Clay lump % by WT: %
						Chloride content: %

Remark: None

Test by: Eugene Chance

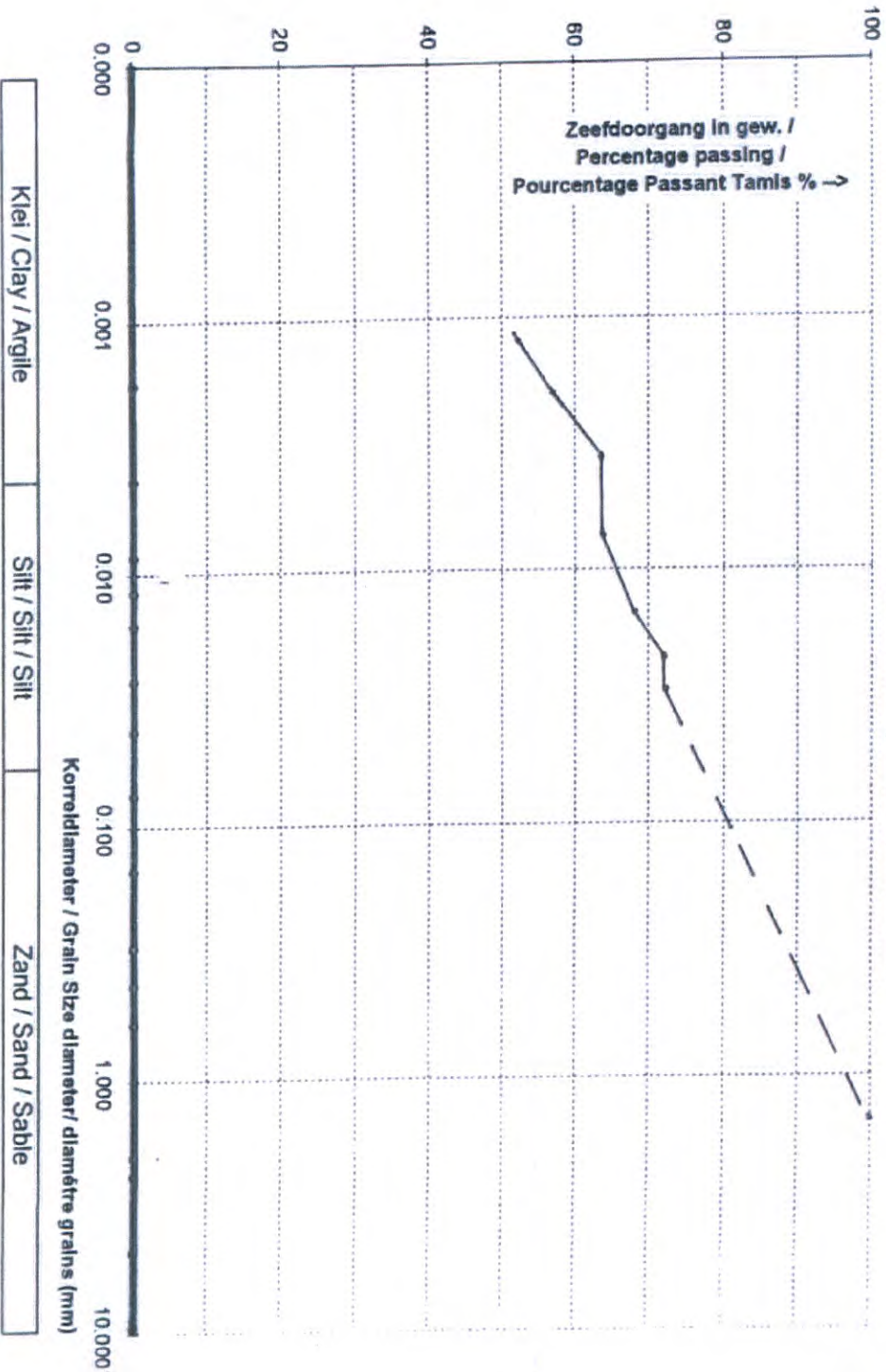
website: [www.icesxm.com](http://www.icesxm.com)  
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HYDROMETER TEST  
(Sédimentométrie)

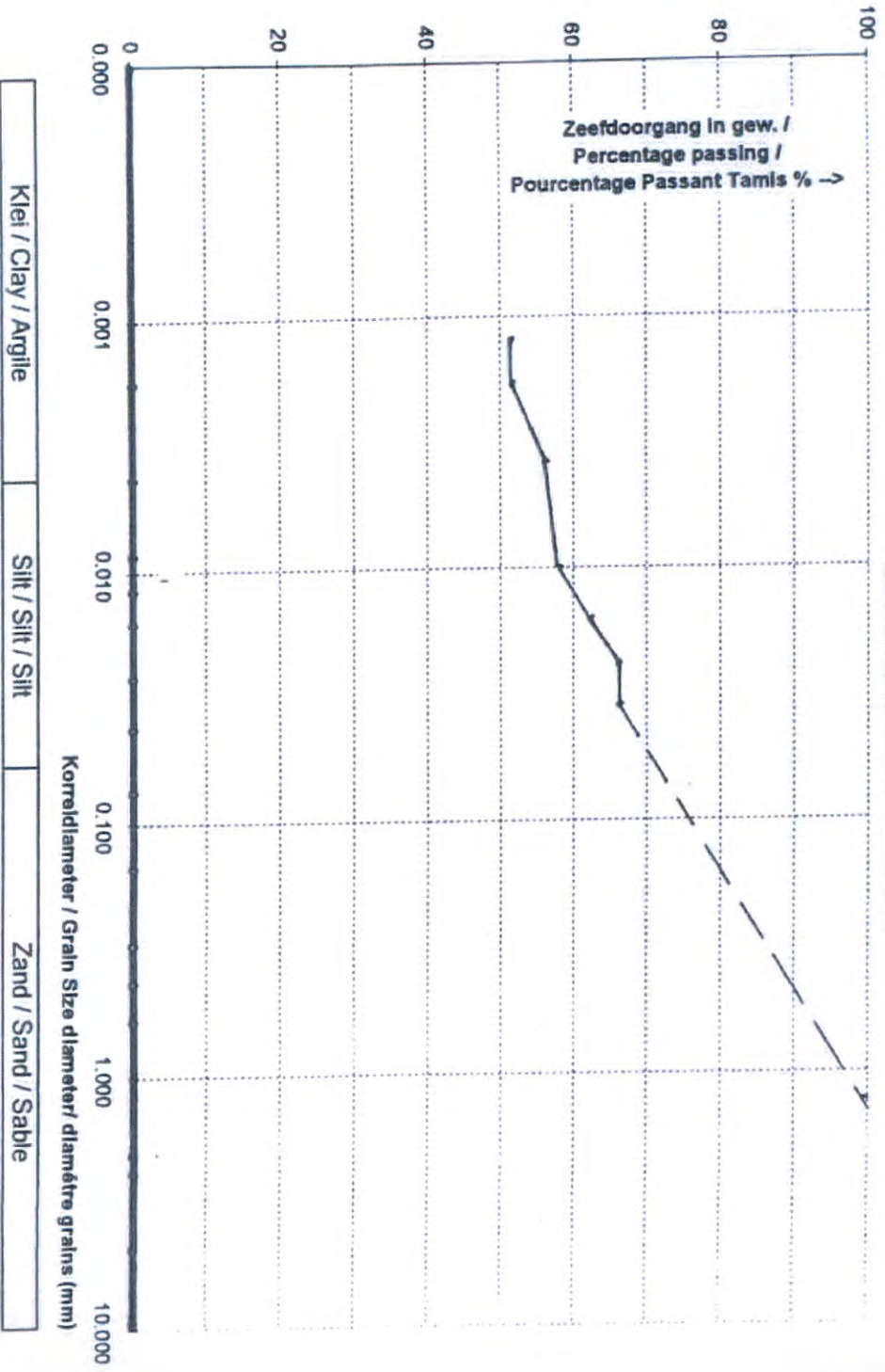
Sample: 1-S1





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**HYDROMETER TEST**  
(Sédimentométrie)  
Sample: 1-55



Klei / Clay / Argile      Silt / Silt / Silt      Zand / Sand / Sable

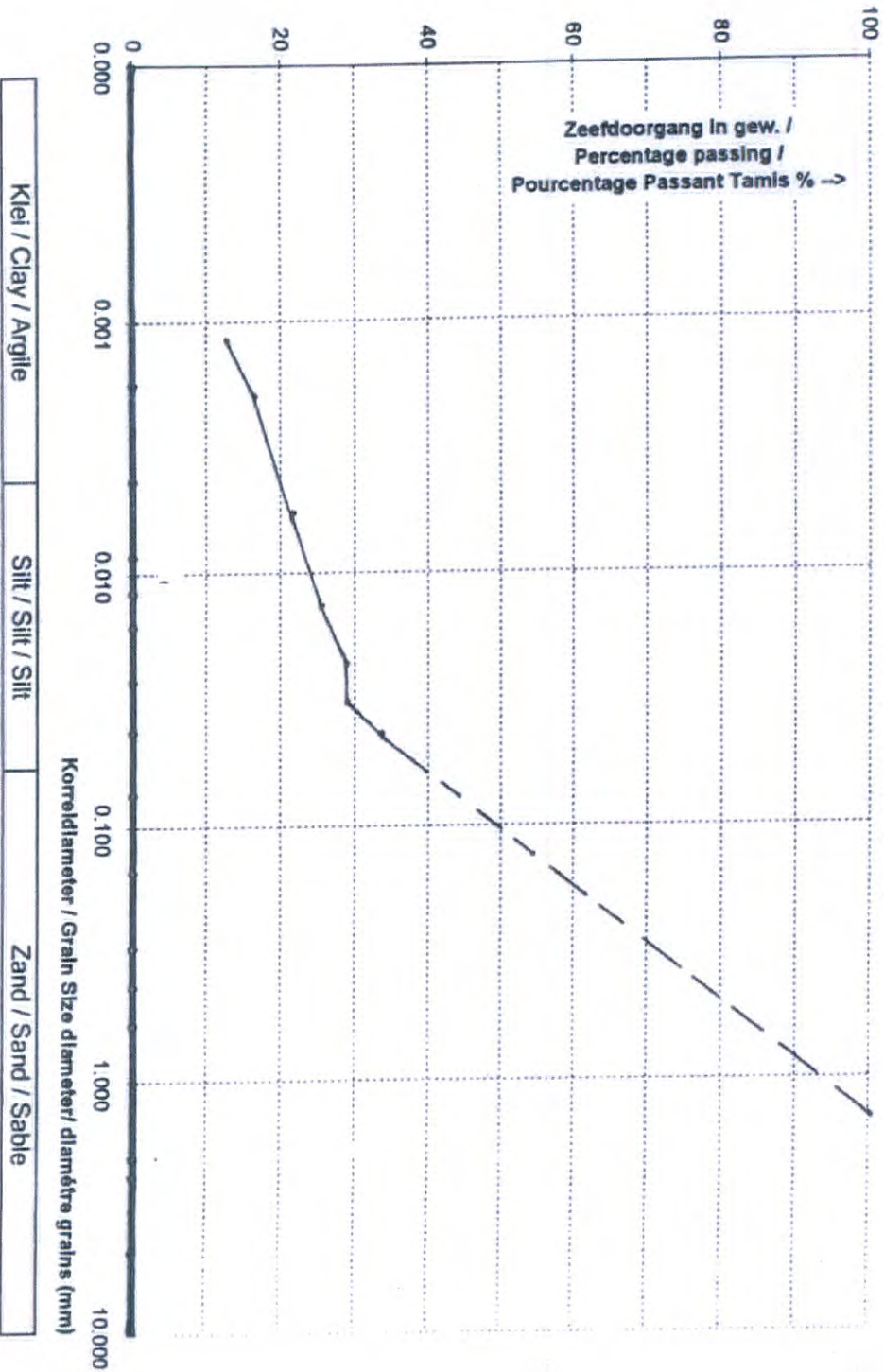




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HYDROMETER TEST  
(Sédimentométrie)

Sample: 1-S7



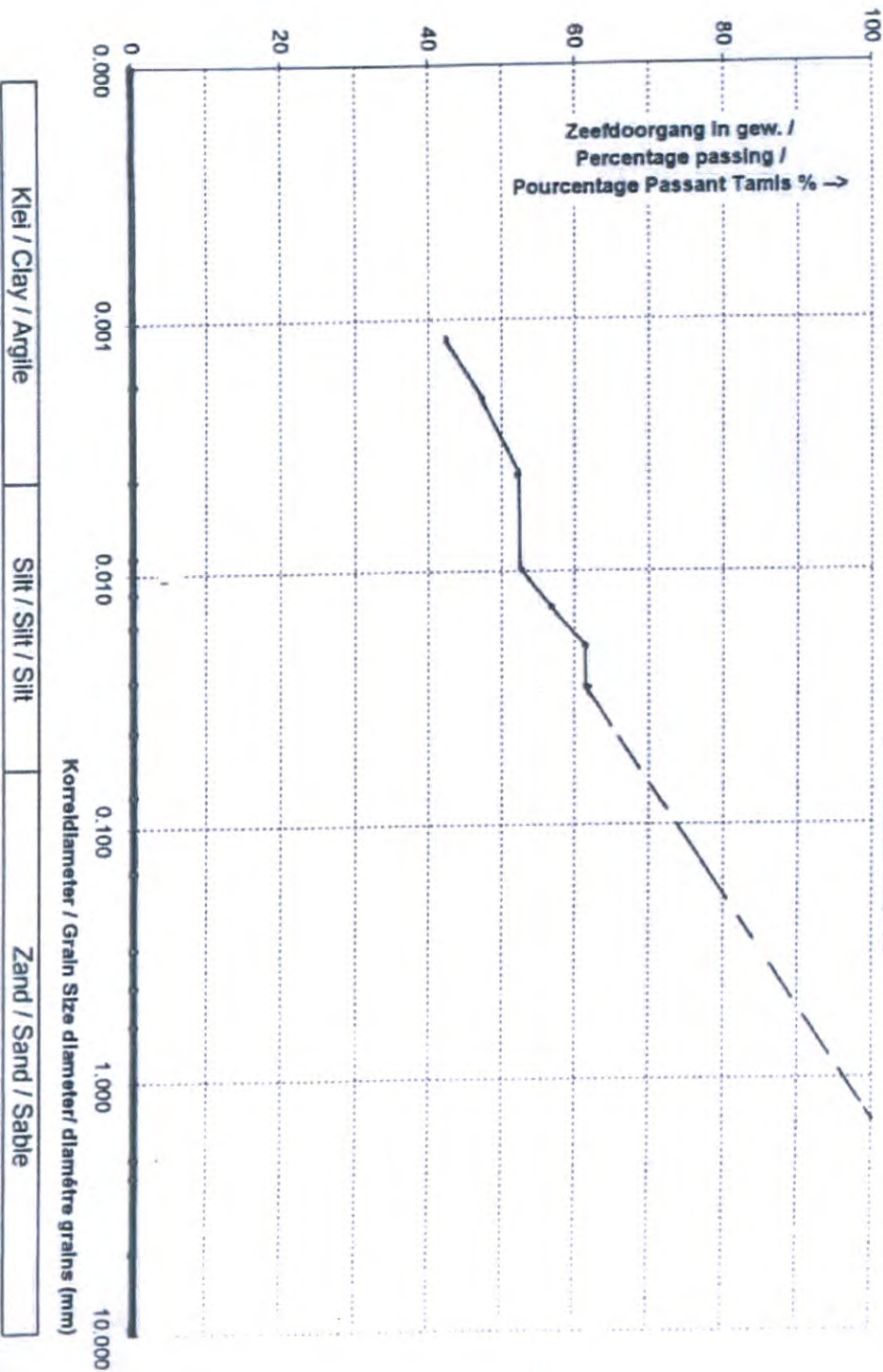




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HYDROMETER TEST  
(Sédimentométrie)

Sample: 1-510

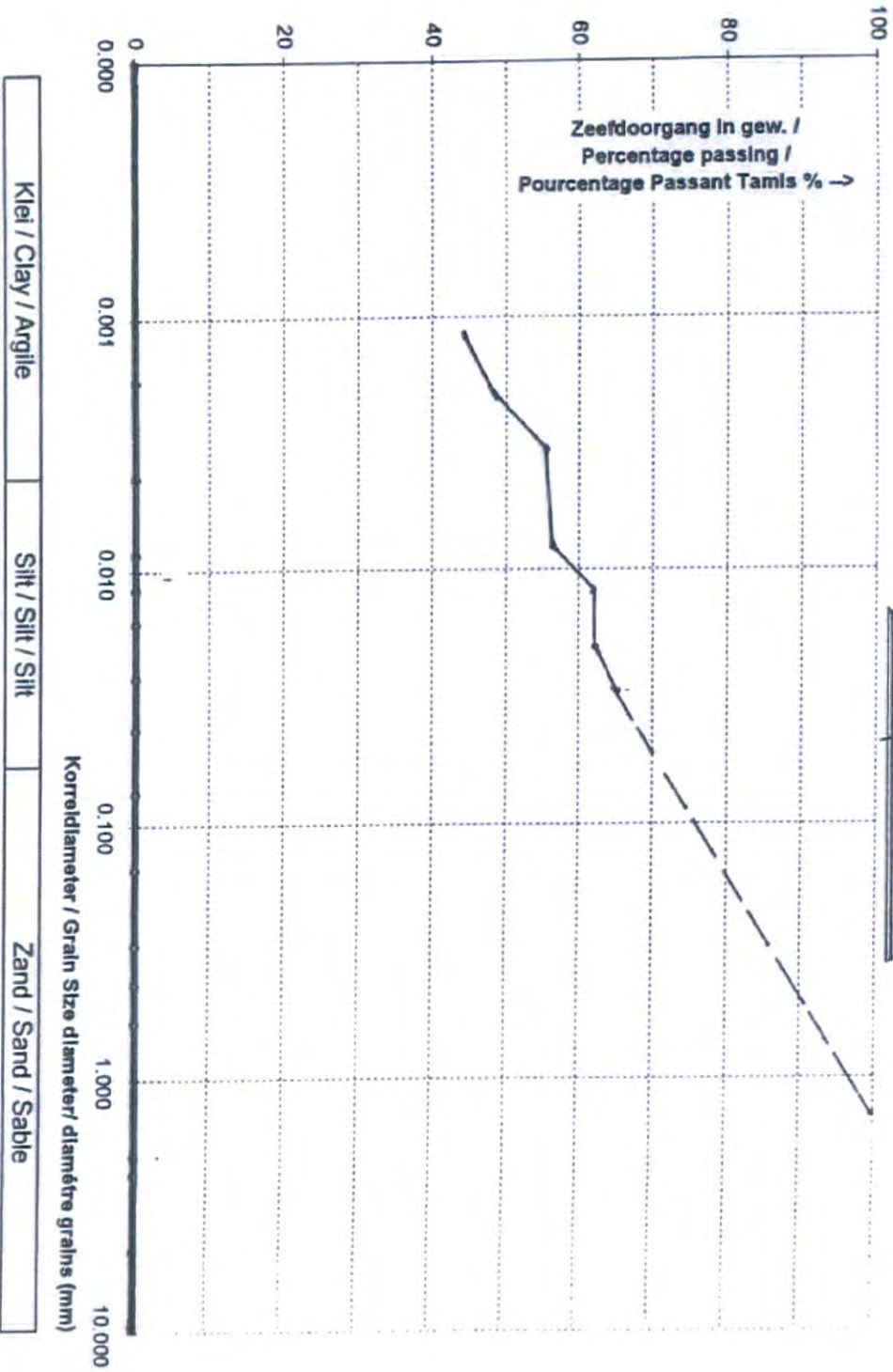




Independent Consulting Engineers N.V.  
Testing Service Department

**HYDROMETER TEST**  
**(Sédimentométrie)**

Sample: 2-S2

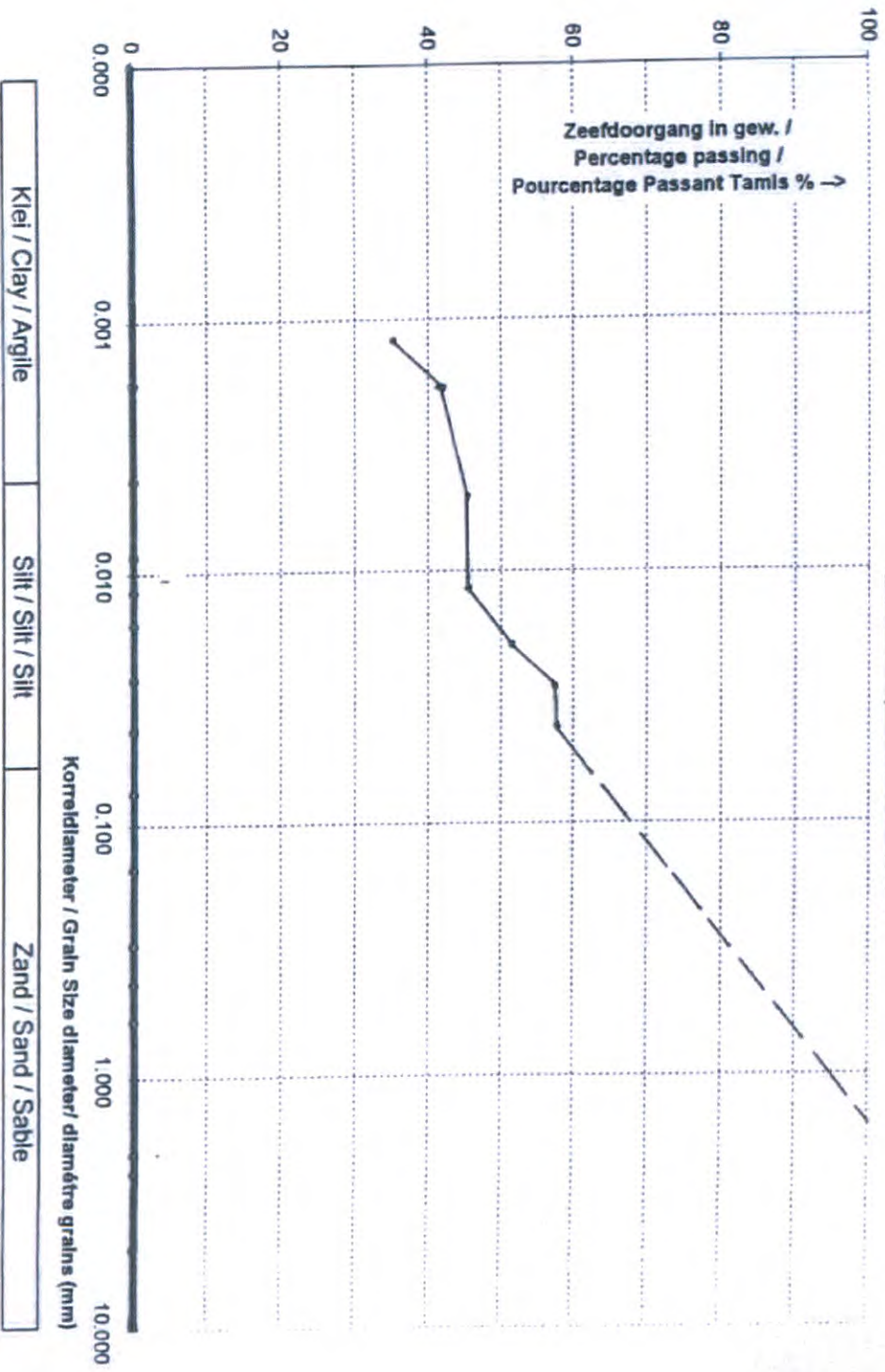


Klei / Clay / Argile	Silt / Silt / Silt	Zand / Sand / Sable
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Testing Service Department

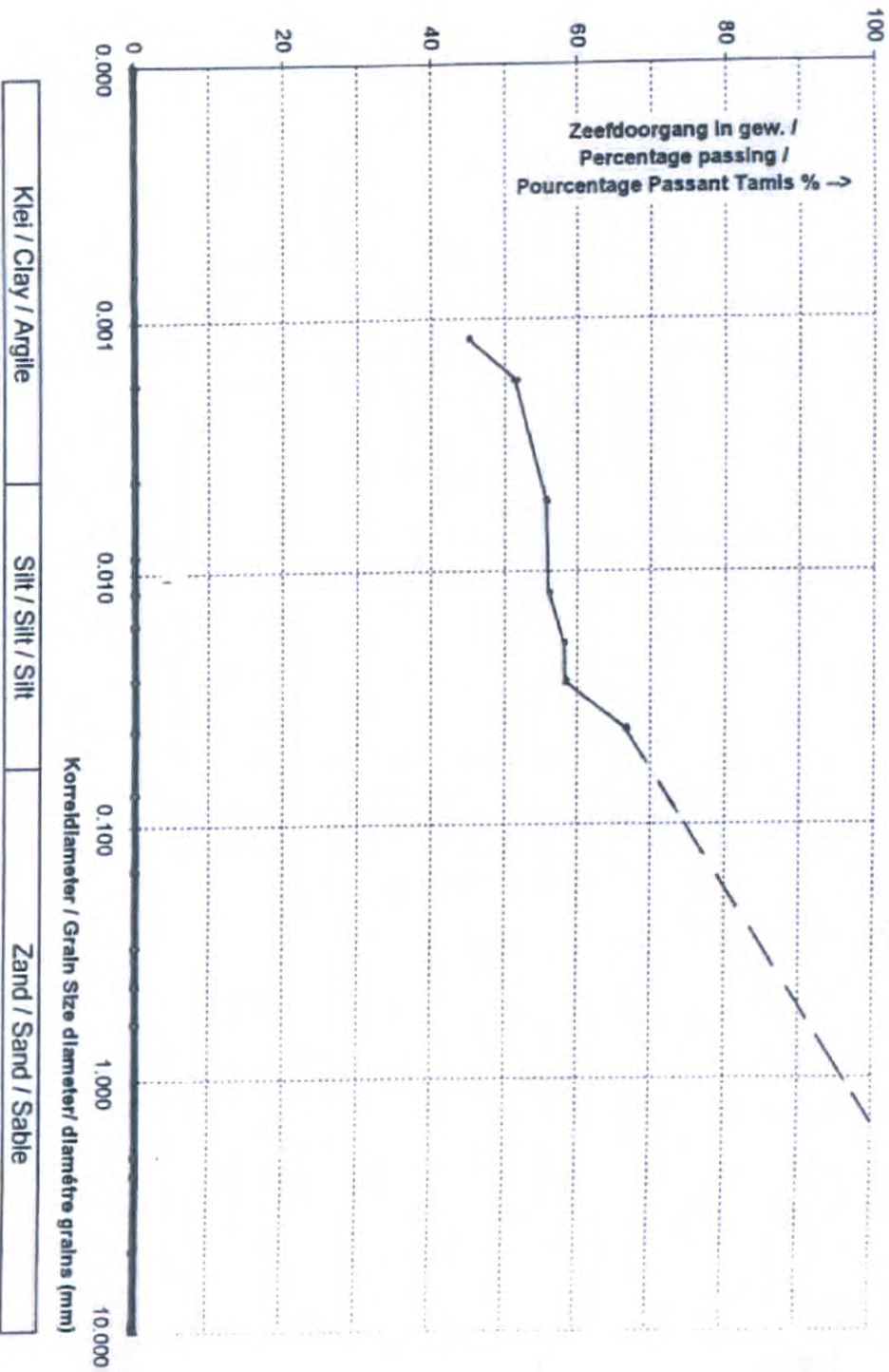
**HYDROMETER TEST**  
(Sédimentométrie)  
Sample: 2-53





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Testing Service Department

**HYDROMETER TEST**  
(Sédimentométrie)  
Sample: 2-SS



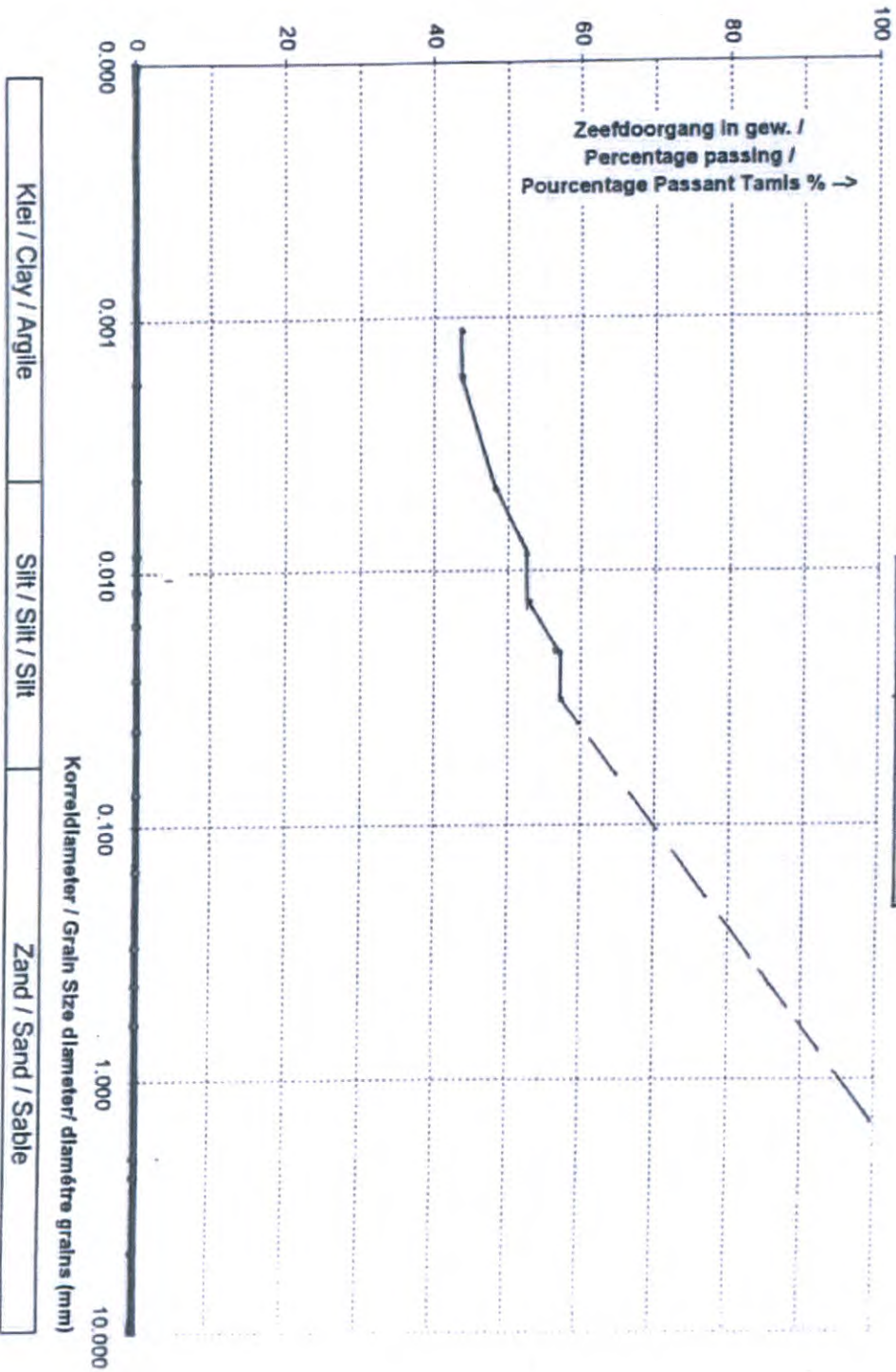
Klei / Clay / Argile      Silt / Silt / Silt      Zand / Sand / Sable



Independent Consulting Engineers N.V.  
Testing Service Department

**HYDROMETER TEST**  
**(Sédimentométrie)**

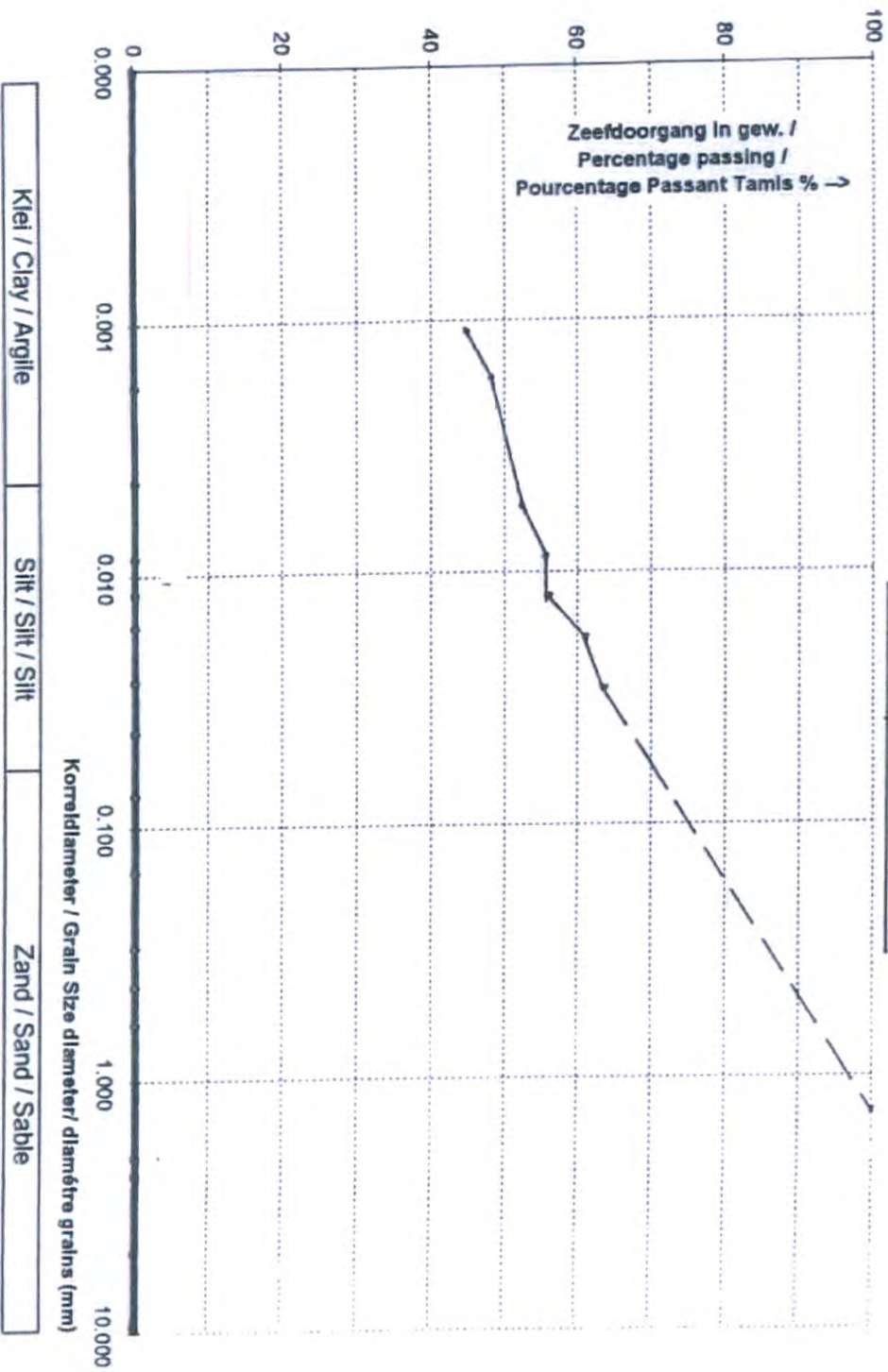
Sample: 2-S8





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Testing Service Department

**HYDROMETER TEST**  
(Sédimentométrie)  
Sample: 3-S1



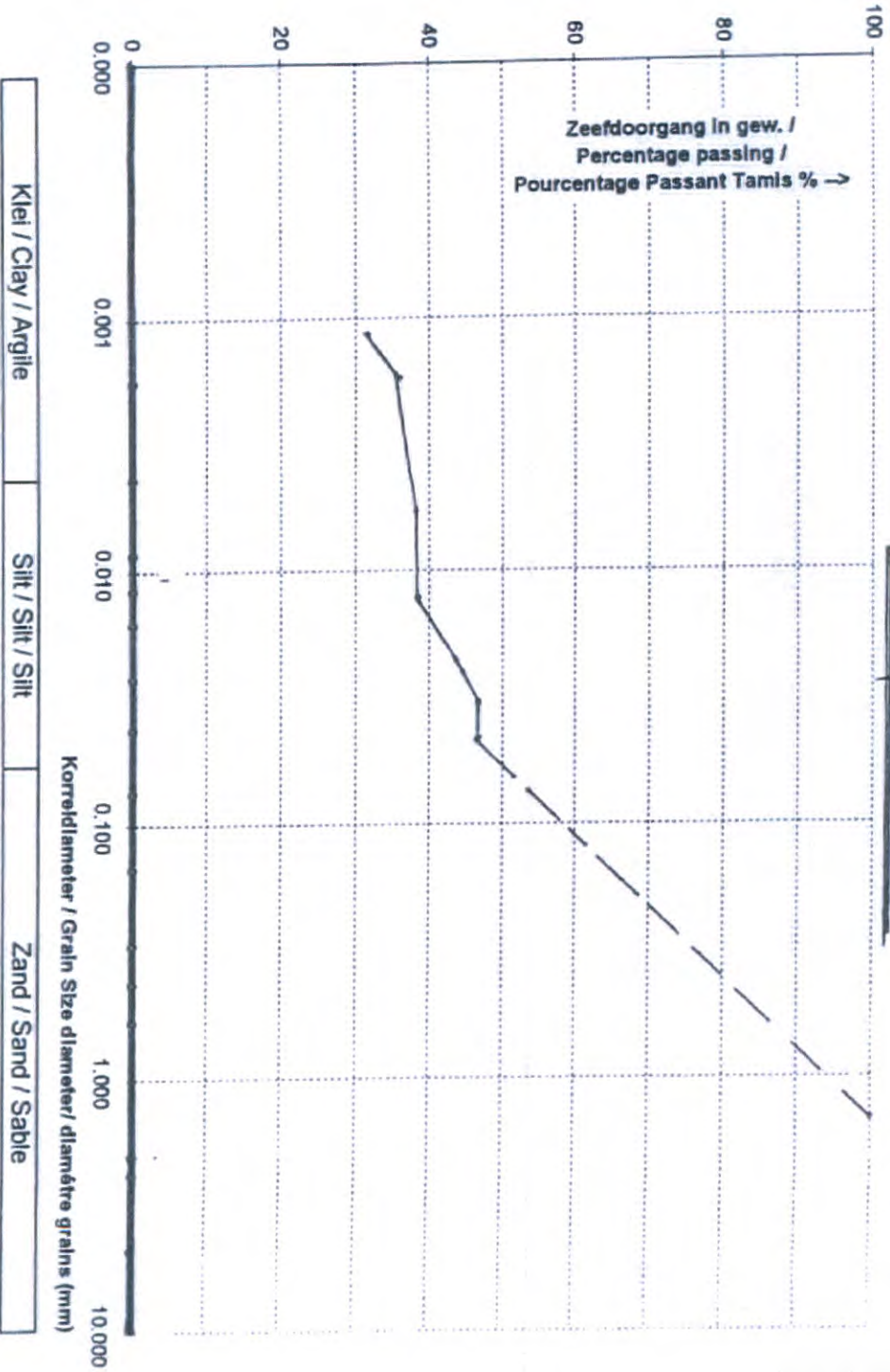




Independent Consulting Engineers N.V.  
Testing Service Department

HYDROMETER TEST  
(Sédimentométrie)

Sample: 3-S4



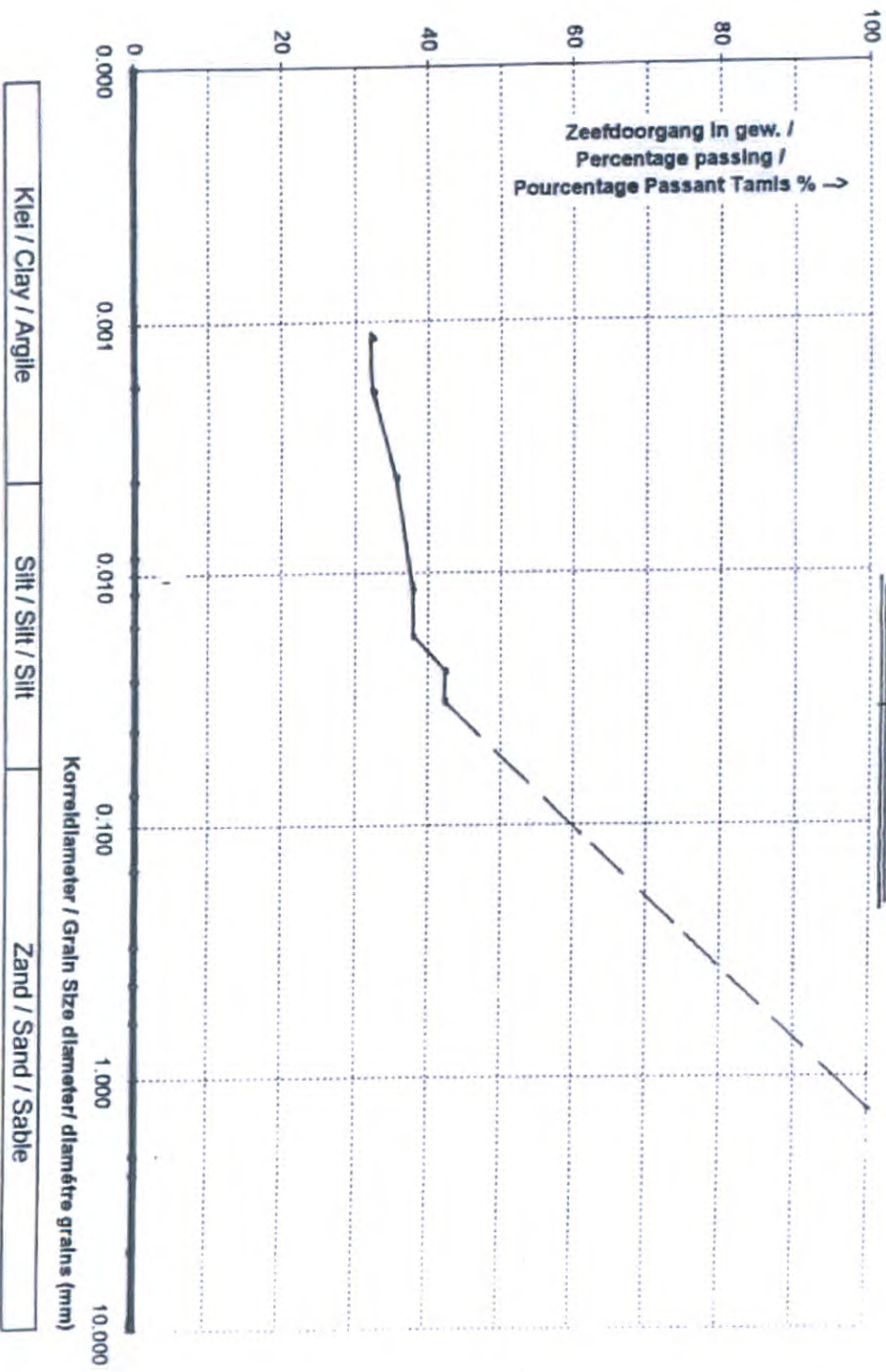
Klei / Clay / Argile      Silt / Silt / Silt      Zand / Sand / Sable



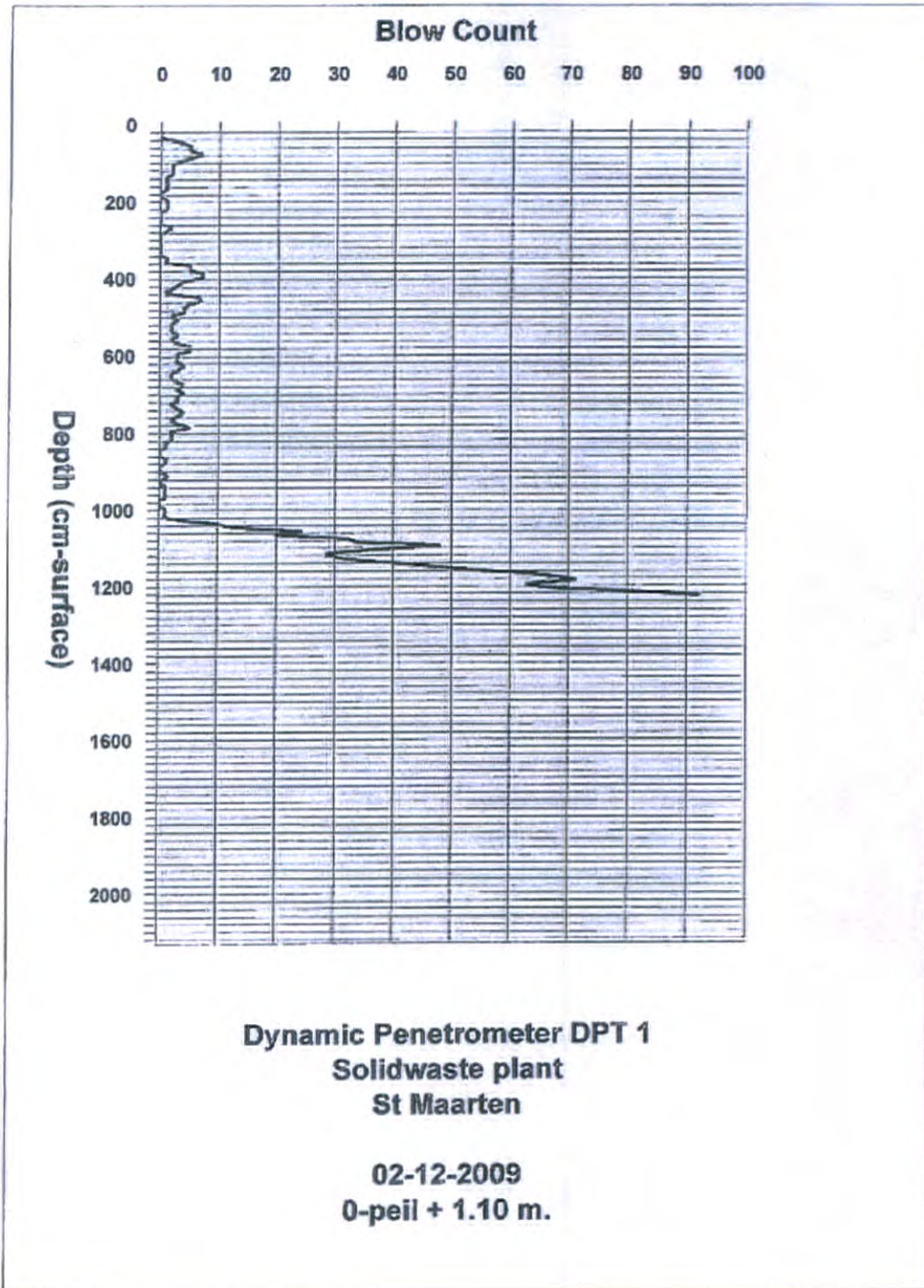
Independent Consulting Engineers N.V.  
Testing Service Department

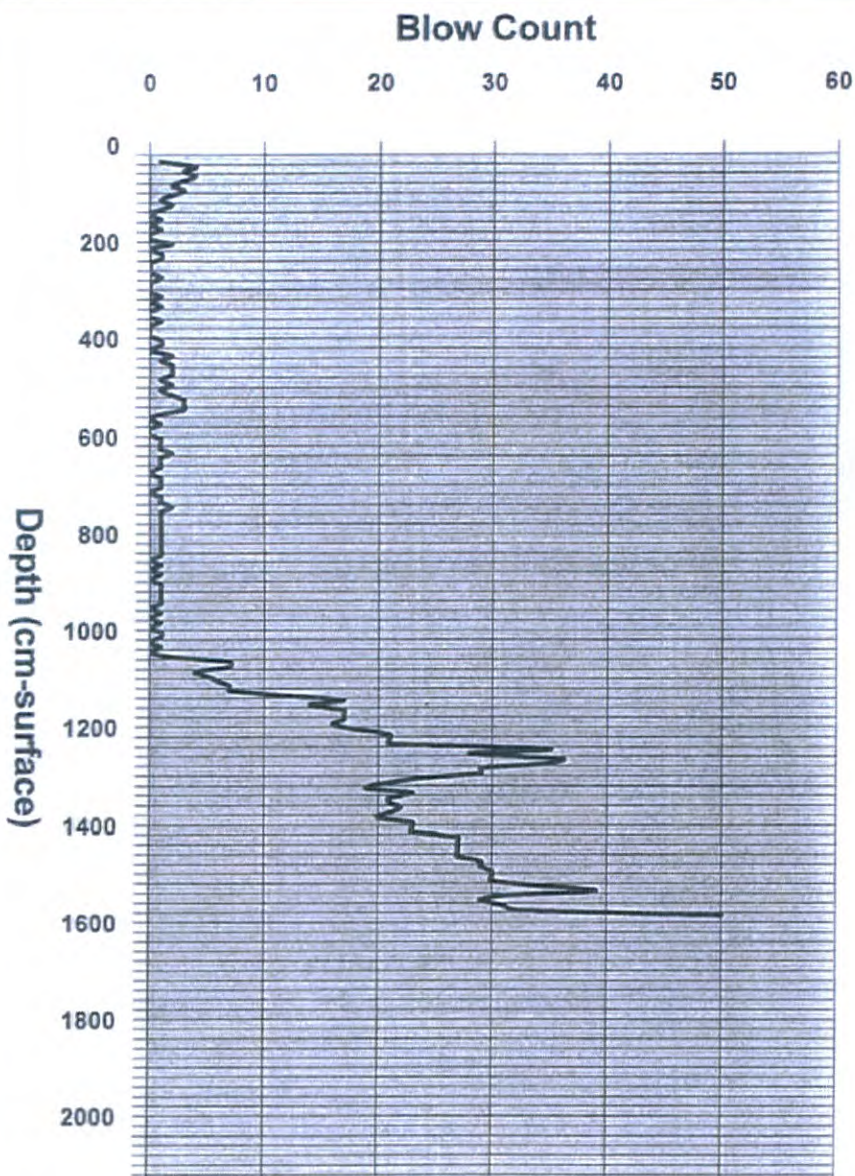
**HYDROMETER TEST**  
(Sédimentométrie)

Sample: 3-55



Klei / Clay / Argille      Silt / Silt / Silt      Zand / Sand / Sable





**Dynamic Penetrometer DPT 2  
Solidwaste plant  
St Maarten**

**03-02-2010  
0-peil + 1.10 m.**



**Pile foundation solid waste Sint Maarten Salt Pond**

**INDICATION**

**ROUGH ASSESSMENT**

**INDICATION**

The bearing capacity of a pile foundation (see table 1) is calculated according NEN 6743 with the following assumptions:

- Driven steel pipe piles with closed ended pile tip or driven cast in situ piles.
- A pile toe level of approximately 12.5 m – groundlevel = approx. 11.3 m – pond water level
- A  $\xi$ -factor of 0.77. This factor determines the representative value of the bearing capacity from the mean value of all soundings.
- A material factor  $\gamma_{m,b} = 1.25$ . This factor is one of the partial safety factors.
- Negative skin friction over the first 10 m pile shaft.

**Table 1. Calculation values for the maximum bearing capacity ( $F_{r,max;d}$ ) in compression.**

$F_{r,max;d}$ in kN per pile				
$\varnothing$ 200 mm	$\varnothing$ 250 mm	$\varnothing$ 300 mm	$\varnothing$ 350 mm	$\varnothing$ 400 mm
175	280	380	520	630

The following condition should be checked:

$$F_{s;d} + F_{s,nk;d} \leq F_{r,max;d} \quad \text{with:}$$

$F_{s;d}$  = design value of the structural load per pile (\*\*).

$F_{s,nk;d}$  = design value of the negative skin friction load per pile (load factor is included).

$F_{r,max;d}$  = design value of the maximum bearing capacity per pile.

(\*\*) A load factor (partial safety factor on the representative load) of 1.3 to 1.35 is typically used.

When the traditional design method, according to the ultimate bearing capacity / safety factor 2.0, is used; the net allowable bearing capacities are respectively 140 kN, 225 kN, 310 kN, 425 kN, 510 kN for piles  $\varnothing$  200 mm,  $\varnothing$  250 mm,  $\varnothing$  300 mm,  $\varnothing$  350 mm,  $\varnothing$  400 mm.

Driven steel piles with a closed ended tip or driven cast in situ piles are applicable.

A higher pile capacity can be achieved on a (somewhat) deeper driving depth. However a supplementary investigation with i) a boring, in order to get additional information about the ground stratum around the pile tip (e.g. the driveability) and to calculate the negative skin friction, and ii) additional (heavy) soundings are necessary for this more elaborated design. With a greater number of soundings the  $\xi$ -factor can be raised, resulting in a higher maximum pile base pressure.

**ANNEX 6: REPORT GEOTRON APRIL 2010**

#### 4. Analyses

Sample	Z	Water	Sr	D60	D10	D60/d10	D50	% fines	Dvo/D'vo	CSR	N	N60	N60 crit	Conclusi liquefact
<b>SPT1</b>		<b>0.85</b>												
S1	0		<<100								2	2		NL
S2	1.5		100	~S3	~S3	~S3	~S3	~S3	1.35	0.25	13	13	23	L
S3	3		100	.55	0.1	5.5	0.40	6.5	1.77	.33	5	5	27	L
S4	4.5		100	~S5	~S5	~S5	~S5	~S5	1.97	.36	2	2	19	NL
S5	6		100	0.55	0.001	<b>550</b>	0.3	41	2.08	.39	2	2	20	NL
S6	7.5		100	~S5	~S5	~S5	~S5	~S5	2.14	.40	2	2	20	NL
S7	9		100	0.1	0.001	100	0.05	53.5	2.22	.41	2	2	18	NL
S8	10.5		100	0.6	0.05	11	0.5	22.7	2.26	.42	19	<b>24</b>	21	NL
S9	12										335	<b>427</b>		NL
S10	17.5										169	<b>215</b>		NL
<b>SPT2</b>		<b>0.85</b>												
S1	0		<<100								5	5		NL
S2	1.5		100	0.30	0.01	<b>30</b>	0.20	32	1.35	0.25	22	<b>22</b>	17	NL
S3	3		100	0.3	0.001	<b>300</b>	0.075	51	1.77	.33	2	2	16	NL
S4	4.5		100	~S5	~S5	~S5	~S5	~S5	1.97	.36	2	2	16	NL
S5	6		100	0.3	0.001	<b>300</b>	0.075	50	2.08	.39	2	2	17	NL
S6	7.5		100	~S5	~S5	~S5	~S5	~S5	2.14	.40	2	2	17	NL
S7	9		100	0.6	0.05	11	0.4	23	2.22	.41	2	2	22	L
S8	10.5		100	0.6	0.001	<b>60</b>	0.35	31	2.26	.42	19	<b>24</b>	22	NL
S9	15										83	<b>106</b>		NL
<b>SPT3</b>		<b>0.85</b>												
S1	0		<<100	0.30	0.01	<b>30</b>	0.2	32			25	25		NL
S2	1.5		100	~S1	~S1	~S1	~S1	~S1	1.35	0.25	13	13	15	NL
S3	3		100	0.6	0.075	<b>8</b>	0.45	8	1.77	.33	5	5	26	L
S4	4.5		100	0.3	0.001	<b>300</b>	0.075	51	1.97	.36	6	6	17	NL
S5	6		100	0.45	0.01	<b>45</b>	0.3	41	2.08	.39	2	2	19	NL
S6	7.5		100	~S5	~S5	~S5	~S5	~S5	2.14	.40	2	2	19	NL
S7	9		100	0.15	0.001	<b>150</b>	0.075	54	2.22	.41	2	2	17	NL
S8	10.5		100								332	<b>423</b>		NL
S9	17.5										259	<b>330</b>		NL

Note: L = risk of liquefaction  
 NL = not susceptible to liquefaction

## ANNEX 5

### Subsoil investigation Waste Treatment Facility Pond Island- WWR: 210-008-614

#### Detail analysis liquefaction

##### 1. Starting points ( basis Regles PS 92- France)

- nominal acceleration : zone iii, work classe B:  $a_n = 3.5 \text{ m/ s}^2$
- terrain type S2 => acceleration 0.9  $a_n = 3.15 \text{ m/ s}^2$
- Unit weight soil:  $1650 \text{ kg/ m}^3$

##### 2. Formule CSR

- $0.65 ( a_n/g)( d_{vo}/d'_{vo}) r_d = \text{CSR}$
- $a_n/g = 0.32$
- $r_d \sim 0.9$

##### 3. Règles PS92:

- $S_r \sim 100 \%$
- $C_u = D_{60}/ D_{10} < 15$
- $0.05 \text{ mm} < D_{50} < 1.5 \text{ mm}$
- $d_v' < 0.3 \text{ Mpa}$



**ANNEX 5: LIQUEFACTION ANALYSIS**

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## NOTATION

The following symbols are used in this paper:

- $a, b$  = curve fitting parameters for use with  $V_s$  criteria for evaluating liquefaction resistance;
- $a_{max}$  = peak horizontal acceleration at ground surface;
- $C_b$  = correction factor for borehole diameter;
- $C_E$  = correction factor for hammer energy;
- $C_N$  = correction factor for overburden pressure applied to SPT;
- $C_Q$  = correction factor for overburden pressure applied to CPT;
- $C_R$  = correction factor for drilling rod length;
- $C_S$  = correction factor for split spoon sampler without liners;
- CRR<sub>7.5</sub> = cyclic resistance ratio for  $M_w = 7.5$  earthquakes;
- $d_c$  = diameter of CPT tip;
- $F$  = normalized friction ratio;

- $J$  = empirical correction from site conditions used in calculation of  $K_w$ ;
- $f$  = sleeve friction measured with CPT;
- $g$  = acceleration of gravity;
- $H$  = thickness of thin granular layer between softer sediment layers;
- $I$  = soil behavior type index for use with CPT liquefaction criteria;
- $K$  = correction factor for grain characteristics applied to CPT;
- $K_H$  = thin-layer correction factor for use with CPT;
- $K_w$  = correction factor for soil layers subjected to large static shear stresses;
- $K_v$  = correction factor for soil layers subjected to large static normal stresses;
- $M_L$  = local or Richter magnitude of earthquake;
- $M_s$  = surface-wave magnitude of earthquake;
- $M_w$  = moment magnitude of earthquake;
- $m_B$  = long period body-wave magnitude of earthquake;
- $m_b$  = short period body-wave magnitude of earthquake;
- $N_m$  = measured standard penetration resistance;
- $(N_1)_{60}$  = corrected standard penetration resistance;
- $(N_1)_{60cs}$  =  $(N_1)_{60}$  adjusted to equivalent clean-sand value;
- $n$  = exponent used in normalizing CPT resistance for overburden stress;
- $P_w$  = atmospheric pressure, approximately 100 kPa;
- $P_L$  = probability of liquefaction;
- $Q$  = normalized and dimensionless cone penetration resistance;
- $q_{c1N}$  = normalized cone penetration resistance;
- $(q_{c1N})_{cs}$  = normalized cone penetration resistance adjusted to equivalent clean-sand value;
- $r_d$  = stress reduction coefficient to account for flexibility in soil profile;
- $V_s$  = measured shear-wave velocity;
- $V_{s1}$  = overburden-stress corrected shear-wave velocity;
- $V_{s1}^*$  = limiting upper value of  $V_{s1}$  for liquefaction occurrences;
- $z$  = depth below ground surface (m);
- $\alpha, \beta$  = coefficients, that are functions of fines content, used to correct  $(N_1)_{60}$  to  $(N_1)_{60cs}$ ;
- $\sigma'_{vo}$  = effective overburden pressure;
- $\tau_{av}$  = average horizontal shear stress acting on soil layer during shaking generated by given earthquake; and
- $\tau_{st}$  = static shear stress acting on soil element due to gravitational forces.

University graduate students Steven Noble, Samuel Gilstrap, and Curt Peterson, assisted in organizing and conducting the workshops.

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the two orthogonal peak accelerations yields a larger estimate of  $a_{max}$ , is conservative, and is allowable. Vectorial accelerations are seldom calculated and should not be used. Peak vertical accelerations are generally much smaller than peak horizontal accelerations and are ignored for calculation of liquefaction resistance.

**Question:** Liquefaction usually develops at soil sites where ground motion amplification may occur and where sediment may soften, reducing motions as excess pore pressure develop. How should investigators account for these factors in estimating peak acceleration?

**Answer:** The recommended procedure is to calculate or estimate the  $a_{max}$  that would occur at the site in the absence of increased pore pressure or the onset of liquefaction. That peak acceleration incorporates the influence of site amplification, but neglects the influence of excess pore-water pressure.

**Question:** Should high-frequency spikes (periods  $<0.1$  s) in acceleration records be considered or ignored?

**Answer:** In general, short-duration, high-frequency acceleration spikes are too short in duration to generate significant instability or deformation of granular structures, and should be ignored. By using attenuation relationships for estimation of peak acceleration, as noted above, high-frequency spikes are essentially ignored because few high-frequency peaks are incorporated in databases from which attenuation relationships were derived. Similarly, ground response analyses programs such as SHAKE and DESRA generally attenuate or filter out high-frequency spikes, reducing their influence. Where amplification ratios are used, engineering judgment should be used to determine which bedrock acceleration is to be amplified.

## ENERGY-BASED CRITERIA AND PROBABILISTIC ANALYSES

The workshop considered two additional topics: (1) liquefaction resistance criteria based on seismic energy passing through a liquefiable layer (Kayen and Mitchell 1997; Youd et al. 1997), and probabilistic analyses of case history data (Liao et al. 1988; Youd and Noble 1997b). Although probabilistic or risk analyses have been made for some localities and critical facilities, the workshop participants concluded that probabilistic procedures are still under development and not sufficiently formulated for routine engineering practice. Similarly, new energy-based criteria need to be independently tested before recommendations can be made for general practice. The workshop participants recommend that research and development continue on both of these relatively new and potentially useful procedures.

## CONCLUSIONS

The participants in the NCEER workshop reviewed the state-of-the-art for evaluating liquefaction resistance and recommend several augmentations to that procedure. Specific recommendations, including procedures and equations, are listed in each section of this summary paper. Consensus conclusions from the workshop are:

1. Four field tests are recommended for routine evaluation of liquefaction resistance—the cone penetration test (CPT), the standard penetration test (SPT), shear-wave velocity ( $V_s$ ) measurements, and for gravelly sites the Becker penetration test (BPT). Criteria for each test were reviewed and revised to incorporate recent developments and to achieve consistency between resistances calculated from the various tests. Each test has its advantages and limitations (Table 1). The CPT provides the most detailed soil stratigraphy and robust field-data based liq-

uefaction resistance curves now available. CPT testing should always be accompanied by soil sampling for validation of soil type identification. The SPT has a longer record of application and provides disturbed soil samples from which fines content and other grain characteristics can be determined. Measured shear-wave velocities provide fundamental information on small-strain soil behavior that is useful beyond analyses of liquefaction resistance.  $V_s$  is also applicable at sites, such as landfills and gravelly sediments, where CPT and SPT soundings may not be possible or reliable. The BPT test is recommended only for gravelly sites and requires use of rough correlations between BPT and SPT, making the results less certain than other tests. Where possible, two or more test procedures should be applied to assure adequate definition of soil stratigraphy and a consistent evaluation of liquefaction resistance.

2. The magnitude scaling factors originally derived by Seed and Idriss (1982) are overly conservative for earthquakes with magnitudes  $<7.5$ . A range of scaling factors is recommended for engineering practice, the lower end of the range being the new MSF recommended by Idriss (column 3, Table 3), and the upper end of the range being the MSF suggested by Andrus and Stokoe (column 7, Table 3). These MSFs are defined by (25) and (26), respectively. For magnitudes  $>7.5$ , the new factors by Idriss (column 3, Table 3) should be used. These factors, which are more conservative than the original Seed and Idriss (1982) factors, should be applied.
3. The  $K_s$  factors suggested by Seed and Harder (1990) appear to be overly conservative for some soils and field conditions. The workshop participants recommend  $K_s$  values defined by the curves in Fig. 14 or (31). Because  $K_s$  values are usually applied to depths greater than those verified for the simplified procedure, special expertise is generally required for their application.
4. Procedures for evaluation of liquefaction resistance beneath sloping ground or embankments (slopes greater than about 6%) have not been developed to a level allowable for routine use. Special expertise is required for evaluation of liquefaction resistance beneath sloping ground.
5. Moment magnitude  $M_w$  should be used for liquefaction resistance calculations. Magnitude, as used in the simplified procedure, is a measure of the duration of strong ground shaking. The present magnitude criteria are conservative and should not be corrected for source mechanism, style of faulting, distance from the energy source, subsurface bedrock topography (basin effect), or tectonic region (eastern versus western U.S. earthquakes).
6. The peak acceleration  $a_{max}$  applied in the procedure is the peak horizontal acceleration that would occur at ground surface in the absence of pore pressure increases or liquefaction. Attenuation relationships compatible with soil conditions at a site should be applied in estimating  $a_{max}$ . Relationships based on the geometric mean of the peak horizontal accelerations are preferred, but use of relationships based on peak horizontal acceleration is allowable and conservative. Where site conditions are incompatible with existing attenuation relationships, site-specific response calculations, using programs such as SHAKE or DESRA, should be used. The least preferable technique is application of amplification factors.

## ACKNOWLEDGMENTS

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event. The influence of distance generally is of secondary importance within the range of distances to which damaging liquefaction effects commonly develop. Basin effects are not yet sufficiently predictable to be adequately accounted for in engineering practice. Thus the workshop participants recommend continued use of the generally conservative relationship between magnitude and duration that is embodied in the simplified procedure.

**Question:** An important difference between eastern U.S. earthquakes and western U.S. earthquakes is that eastern ground motions are generally richer in high-frequency energy and thus could generate more significant stress cycles and equivalently longer durations than western earthquakes of the same magnitude. Is a correction needed to account for higher frequencies of motions generated by eastern U.S. earthquakes?

**Answer:** The high-frequency motions of eastern earthquakes are generally limited to near-field rock sites. High-frequency motions attenuate or are damped out rather quickly as they propagate through soil layers. This filtering action reduces the high-frequency energy at soil sites and thus reduces differences in numbers of significant loading cycles. Because liquefaction occurs only within soil strata, duration differences on soil sites between eastern and western earthquakes are not likely to be great. Without more instrumentally recorded data from which differences in ground motion characteristics can be quantified, there is little basis for the development of additional correction factors for eastern localities.

Another difference between eastern and western U.S. earthquakes is that strong ground motions generally propagate to greater distances in the east than in the west. By applying present state-of-the-art procedures for estimating peak ground acceleration at eastern sites, differences in amplitudes of ground motions between western and eastern earthquakes are properly taken into account.

**Question:** Which magnitude scale should be used for selection of earthquake magnitudes for liquefaction resistance analyses?

**Answer:** Seismologists commonly calculate earthquake magnitudes using five different scales: (1) local or Richter magnitude  $M_L$ ; (2) surface-wave magnitude  $M_s$ ; (3) short-period body-wave magnitude  $m_b$ ; (4) long-period body-wave magnitude  $m_B$ ; and (5) moment magnitude  $M_w$ . Moment magnitude, the scale most commonly used for engineering applications, is the scale preferred for calculation of liquefaction resistance. As Fig. 16 shows, magnitudes from other scales may be substituted directly for  $M_w$  within the following limitations— $M_L < 6$ ,  $m_b < 7.5$ , and  $6 < M_s < 8 - m_b$ , a scale commonly used for eastern U.S. earthquakes, may be used for magnitudes between 5 and 6, provided  $m_b$  values are corrected to equivalent  $M_w$  values. The curves plotted in Fig. 16 may be used for this adjustment (Idriss 1985).

### Peak Acceleration

In the simplified procedure, peak horizontal acceleration  $a_{max}$  is used to characterize the intensity of ground shaking. To provide guidance for estimation of  $a_{max}$ , the workshop addressed the following questions.

**Question:** What procedures are preferred for estimating  $a_{max}$  at potentially liquefiable sites?

**Answer:** The following methods, in order of preference, may be used for estimating  $a_{max}$ :

1) The preferred method for estimating  $a_{max}$  is through empirical correlations of  $a_{max}$  with earthquake magnitude, distance from the seismic energy source, and local site conditions. Several correlations have been published for estimating  $a_{max}$  for sites on bedrock or stiff to moderately stiff soils. Preliminary attenuation relationships have also been developed for a limited range of soft soil sites (Idriss 1991). Selection of an at-

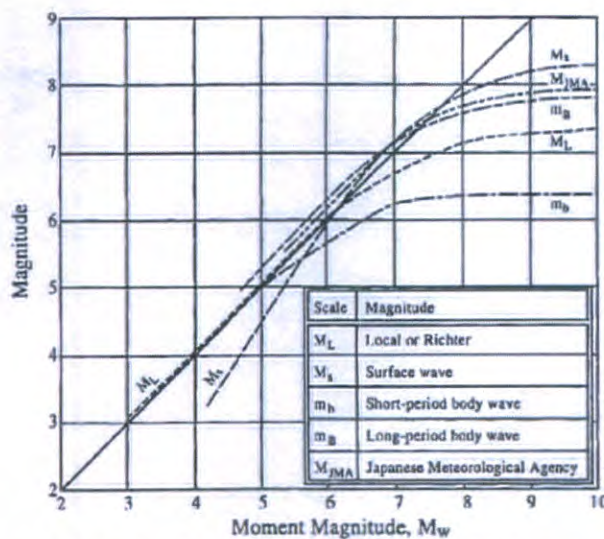


FIG. 16. Relationship between Moment  $M_w$  and Other Magnitude Scales (Reproduced from Heaton et al., Unpublished Report, 1982)

tenuation relationship should be based on such factors as region of the country, type of faulting, and site condition.

2) For soft sites and other soil profiles that are not compatible with available attenuation relationships,  $a_{max}$  may be estimated from local site response analyses. Computer programs such as SHAKE and DESRA may be used for these calculations (Schnabel et al. 1972; Finn et al. 1977). Input ground motions in the form of recorded accelerograms are preferable to synthetic records. Accelerograms derived from white noise should be avoided. A suite of plausible earthquake records should be used in the analysis, including as many as feasible from earthquakes with similar magnitudes, source distances, etc.

3) The third and least desirable method for estimating peak ground acceleration is through amplification ratios, such as those developed by Idriss (1990, 1991) and Seed et al. (1994). These factors use a multiplier or ratio by which bedrock outcrop motions are amplified to estimate surface motions at soil sites. Because amplification ratios are influenced by strain level, earthquake magnitude, and frequency content, caution and considerable engineering judgment are required in the application of these relationships.

**Question:** Which peak acceleration should be used: (1) the largest horizontal acceleration recorded on a three-component accelerogram; (2) the geometric mean (square root of the product) of the two maximum horizontal components; or (3) a vectorial combination of horizontal accelerations?

**Answer:** According to I. M. Idriss (oral discussion at NCEER workshop, 1996), where recorded motions were available, the larger of the two horizontal peak components of acceleration was used in the compilation of data used to derive the original simplified procedure. Where recorded values were not available, which was the circumstance for most sites, peak acceleration values were estimated from attenuation relationships based on the geometric mean of the two orthogonal peak horizontal accelerations. In nearly all instances where recorded motions were used, the peaks from the two horizontal records were approximately equal. Thus where a single peak was used, the peak and the geometric mean of the two peaks were about the same value. Based on this information, the workshop participants concurred that use of the geometric mean is consistent with the development of the procedure and is preferred for use in engineering practice. However, use of the larger of

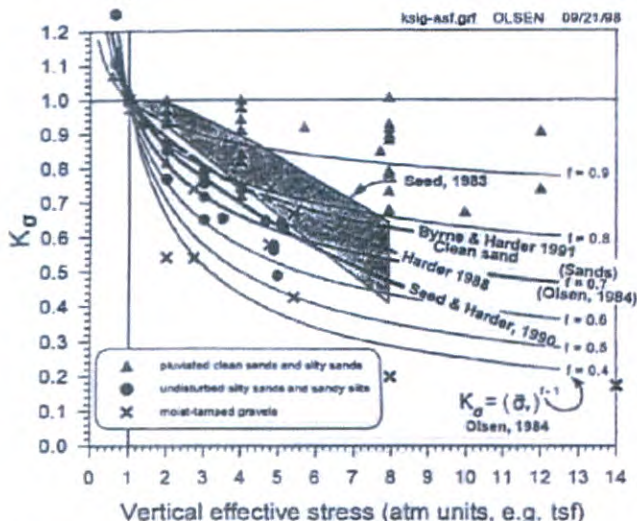


FIG. 14. Laboratory Data and Compiled  $K_{\alpha}$  Curves (Reproduced from Hynes and Olsen 1999)

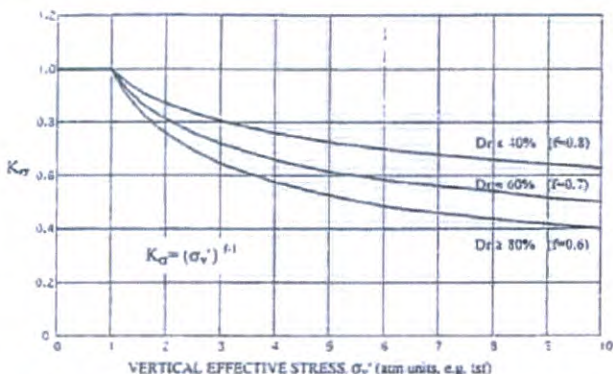


FIG. 15. Recommended Curves for Estimating  $K_{\alpha}$  for Engineering Practice

mates of  $K_{\alpha}$ , for use in engineering practice for both clean and silty sands, and for gravels. The workshop participants concurred with this recommendation.

#### $K_{\alpha}$ Correction Factor for Sloping Ground

The liquefaction resistance of dilative soils (moderately dense to dense granular materials under low confining stress) increases with increased static shear stress. Conversely, the liquefaction resistance of contractive soils (loose soils and moderately dense soils under high confining stress) decreases with increased static shear stresses. To incorporate the effect of static shear stresses on liquefaction resistance, Seed (1983) introduced a correction factor  $K_{\alpha}$ . To generate values for this factor, Seed normalized the static shear stress  $\tau_{st}$  acting on a plane with respect to the effective vertical stress  $\sigma'_{v0}$ , yielding a parameter  $\alpha$ , where

$$\alpha = \tau_{st} / \sigma'_{v0} \quad (32)$$

Cyclically loaded triaxial compression tests were then used to empirically determine values of the correction factor  $K_{\alpha}$  as a function of  $\alpha$ .

For the NCEER workshop, Harder and Boulanger (1997) reviewed past publications, test results, and analyses of  $K_{\alpha}$ . They noted that a wide range of  $K_{\alpha}$  values have been proposed,

indicating a lack of convergence and a need for continued research. The workshop participants agreed with this assessment. Although curves relating  $K_{\alpha}$  to  $\alpha$  have been published (Harder and Boulanger 1997), these curves should not be used by nonspecialists in geotechnical earthquake engineering or in routine engineering practice.

#### Influence of Age of Deposit

Several investigators have noted that liquefaction resistance of soils increases with age. For example, Seed (1979) observed significant increases in liquefaction resistance with aging of reconstituted sand specimens tested in the laboratory. Increases of as much as 25% in cyclic resistance ratio were noted between freshly constituted and 100-day-old specimens. Youd and Hoose (1977) and Youd and Perkins (1978) noted that liquefaction resistance increases markedly with geologic age. Sediments deposited within the past few thousand years are generally much more susceptible to liquefaction than older Holocene sediments; Pleistocene sediments are even more resistant; and pre-Pleistocene sediments are generally immune to liquefaction. Although qualitative time-dependent increases have been documented as noted above, few quantitative data have been collected. In addition, the factors causing increased liquefaction resistance with age are poorly understood. Consequently, verified correction factors for age have not been developed.

In the absence of quantitative correction factors, engineering judgment is required to estimate the liquefaction resistance of sediments more than a few thousand years old. For deeply buried sediments dated as more than a few thousand years old, some knowledgeable engineers have omitted application of the  $K_{\alpha}$  factor as partial compensation for the unquantified, but substantial increase of liquefaction resistance with age. For man-made structures, such as thick fills and embankment dams, aging effects are minimal, and corrections for age should not be applied in calculating liquefaction resistance.

#### SEISMIC FACTORS

Application of the simplified procedure for evaluating liquefaction resistance requires estimates of two ground motion parameters—earthquake magnitude and peak horizontal ground acceleration. These factors characterize duration and intensity of ground shaking, respectively. The workshop addressed the following questions with respect to selection of magnitude and peak acceleration values for liquefaction resistance analyses.

#### Earthquake Magnitude

Records from recent earthquakes, such as 1979 Imperial Valley, 1988 Armenia, 1989 Loma Prieta, 1994 Northridge, and 1995 Kobe, indicate that the relationship between duration and magnitude is rather uncertain and that factors other than magnitude also influence duration. For example, unilateral faulting, in which rupture begins at one end of the fault and propagates to the other, usually produces longer shaking duration for a given magnitude than bilateral faulting, in which slip begins near the midpoint on the fault and propagates in both directions simultaneously. Duration also generally increases with distance from the seismic energy source and may vary with tectonic province, site conditions, and bedrock topography (basin effects).

**Question:** Should correction factors be developed to adjust duration of shaking to account for the influence of earthquake source mechanism, fault rupture mode, distance from the energy source, basin effects, etc.?

**Answer:** Faulting characteristics and variations in shaking duration are difficult to predict in advance of an earthquake

was updated after publication of the NCEER proceedings (Youd and Idriss 1997):

$$\text{Logit}(P_L) = \ln(P_L/(1 - P_L)) = -7.0351 + 2.1738M_w - 0.2678(N_1)_{\text{cor}} + 3.0265 \ln CRR \quad (26)$$

where  $P_L$  = probability that liquefaction occurred;  $1 - P_L$  = probability that liquefaction did not occur; and  $(N_1)_{\text{cor}}$  = corrected equivalent clean-sand blow count. For magnitudes  $<7.5$ , Youd and Noble recommended direct application of this equation to calculate the CRR for a given probability of liquefaction. In lieu of direct application, Youd and Noble defined three sets of MSFs for use with the simplified procedure. These MSFs are for probabilities of liquefaction occurrence  $<20$ ,  $32$ , and  $50\%$ , respectively, and are defined by the following equations:

$$\text{Probability } P_L < 20\% \quad \text{MSF} = 10^{3.81}/M_w^{4.33} \text{ for } M_w < 7 \quad (27)$$

$$\text{Probability } P_L < 32\% \quad \text{MSF} = 10^{3.74}/M_w^{4.33} \text{ for } M_w < 7 \quad (28)$$

$$\text{Probability } P_L < 50\% \quad \text{MSF} = 10^{4.21}/M_w^{4.81} \text{ for } M_w < 7.75 \quad (29)$$

### New Recommendation by Idriss

I. M. Idriss (TRB 1999) proposed a new set of MSFs that are compatible with, and are only to be used with, the magnitude-dependent  $r_d$  that he also proposed. These new MSFs have lower values than the revised MSFs listed in Table 3, but slightly higher values than the original Seed and Idriss (1982) MSFs. Because the proposed  $r_d$  and associated MSFs have not been published and the factors have not been independently verified, the workshop participants chose not to recommend the new  $r_d$  or MSFs at this time.

### Recommendations for Engineering Practice

The workshop participants reviewed the MSFs listed in Table 3, and all but one (S. S. C. Liao) agree that the original factors were too conservative and that increased MSFs are warranted for engineering practice for magnitudes  $<7.5$ . Rather than recommending a single set of factors, the workshop participants suggest a range of MSFs from which the engineer is allowed to choose factors that are requisite with the acceptable risk for any given application. For magnitudes  $<7.5$ , the lower bound for the recommended range is the new MSF proposed by Idriss [column 3 in Table 3, or (23)]. The suggested upper bound is the MSF proposed by Andrus and Stokoe [column 7 in Table 3, or (26)]. The upper-bound values are consistent with MSFs suggested by Ambraseys (1988), Arango (1996), and Youd and Noble (1997a) for  $P_L < 20\%$ .

For magnitudes  $>7.5$ , the new factors recommended by Idriss [column 3 in Table 3; (25)] should be used for engineering practice. These new factors are smaller than the original Seed and Idriss (1982) factors, hence their application leads to increased calculated liquefaction hazard compared to the original factors. Because there are only a few well-documented liquefaction case histories for earthquakes with magnitudes  $>8$ , MSFs in that range are poorly constrained by field data. Thus the workshop participants agreed that the greater conservatism embodied in the revised MSF by Idriss (column 3, Table 3) should be recommended for engineering practice.

### CORRECTIONS FOR HIGH OVERBURDEN STRESSES, STATIC SHEAR STRESSES, AND AGE OF DEPOSIT

Correction factors  $K_v$  and  $K_s$  were developed by Seed (1983) to extrapolate the simplified procedure to larger overburden pressure and static shear stress conditions than those embodied in the case history data set from which the simplified

procedure was derived. As noted previously, the simplified procedure was developed and validated only for level to gently sloping sites (low static shear stress) and depths less than about 15 m (low overburden pressures). Thus applications using  $K_v$  and  $K_s$  are beyond routine practice and require specialized expertise. Because these factors were discussed at the workshop and some new information was developed, recommendations from those discussions are included here. These recommendations, however, apply mostly to liquefaction hazard analyses of embankment dams and other large structures. These factors are applied by extending (23) to include  $K_v$  and  $K_s$  as follows:

$$FS = (CRR_{7.5}/CSR) \cdot \text{MSF} \cdot K_v \cdot K_s \quad (30)$$

### $K_v$ Correction Factor

Cyclically loaded laboratory test data indicate that liquefaction resistance increases with increasing confining stress. The rate of increase, however, is nonlinear. To account for the non-linearity between CRR and effective overburden pressure, Seed (1983) introduced the correction factor  $K_v$  to extrapolate the simplified procedure to soil layers with overburden pressures  $>100$  kPa. Cyclically loaded, isotropically consolidated triaxial compression tests on sand specimens were used to measure CRR for high-stress conditions and develop  $K_v$  values. By taking the ratio of CRR for various confining pressures to the CRR determined for approximately 100 kPa (1 atm) Seed (1983) developed the original  $K_v$  correction curve. Other investigators have added data and suggested modifications to better define  $K_v$  for engineering practice. For example, Seed and Harder (1990) developed the clean-sand curve reproduced in Fig. 13. Hynes and Olsen (1999) compiled and analyzed an enlarged data set to provide guidance and formulate equations for selecting  $K_v$  values (Fig. 14). The equation they derived for calculating  $K_v$  is

$$K_v = (\sigma'_{vm}/P_a)^{f-1} \quad (31)$$

where  $\sigma'_{vm}$ , effective overburden pressure; and  $P_a$ , atmospheric pressure, are measured in the same units; and  $f$  is an exponent that is a function of site conditions, including relative density, stress history, aging, and overconsolidation ratio. The workshop participants considered the work of previous investigators and recommend the following values for  $f$  (Fig. 15). For relative densities between 40 and 60%,  $f = 0.7-0.8$ ; for relative densities between 60 and 80%,  $f = 0.6-0.7$ . Hynes and Olsen recommended these values as minimal or conservative esti-

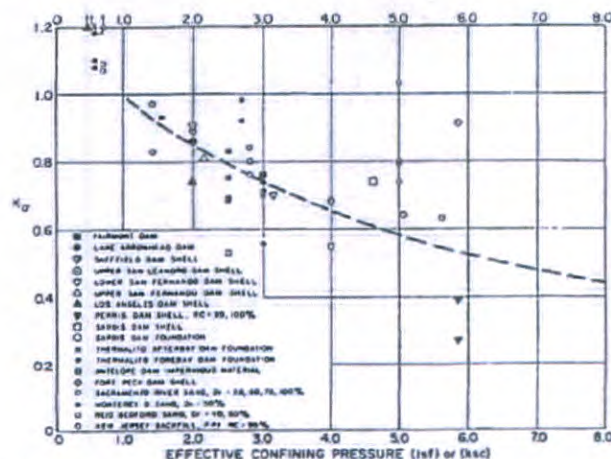


FIG. 13.  $K_v$ -Values Determined by Various Investigators (Reproduced from Seed and Harder 1990)

TABLE 3. Magnitude Scaling Factor Values Defined by Various Investigators (Youd and Noble 1997a)

Magnitude, $M$	Seed and Idriss (1982)		Ambraseys (1988)	Arango (1996)		Andrus and Stokoe (1997)	Youd and Noble (1997b)		
	Idriss	Idriss*		Distance based	Energy based		$P_L < 20\%$	$P_L < 32\%$	$P_L < 50\%$
5.5	1.43	2.20	2.86	3.00	2.20	2.8	2.86	3.42	4.44
6.0	1.32	1.76	2.20	2.00	1.65	2.1	1.93	2.35	2.92
6.5	1.19	1.44	1.69	1.60	1.40	1.6	1.34	1.66	1.99
7.0	1.08	1.19	1.30	1.25	1.10	1.25	1.00	1.20	1.39
7.5	1.00	1.00	1.00	1.00	1.00	1.00	—	—	1.00
8.0	0.94	0.84	0.67	0.75	0.85	0.8?	—	—	0.73?
8.5	0.89	0.72	0.44	—	—	0.65?	—	—	0.56?

Note: ? = Very uncertain values.

\*1995 Seed Memorial Lecture, University of California at Berkeley (I. M. Idriss, personal communication to T. L. Youd, 1997).

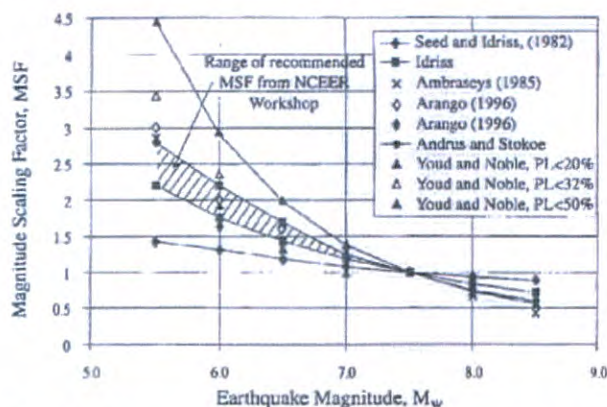


FIG. 12. Magnitude Scaling Factors Derived by Various Investigators (Reproduced from Youd and Noble 1997a)

in Fig. 12. The revised MSFs are defined by the following equation:

$$MSF = 10^{2.24} / M_w^{2.56} \quad (24)$$

The workshop participants recommend these revised scaling factors as a lower bound for MSF values.

The revised scaling factors are significantly higher than the original scaling factors for magnitudes <7.5 and somewhat lower than the original factors for magnitudes >7.5. Relative to the original scaling factors, the revised factors lead to a reduced calculated liquefaction hazard for magnitudes <7.5, but increase calculated hazard for magnitudes >7.5.

#### Ambraseys (1988) Scaling Factors

Field performance data collected since the 1970s for magnitudes <7.5 indicate that the original Seed and Idriss (1982) scaling factors are overly conservative. For example, Ambraseys (1988) analyzed liquefaction data compiled through the mid-1980s and plotted calculated cyclic stress ratios for sites that did or did not liquefy versus  $(N_1)_{60}$ . From these plots, Ambraseys developed empirical exponential equations that define CRR as a function of  $(N_1)_{60}$  and moment magnitude  $M_w$ . By holding the value of  $(N_1)_{60}$  constant in the equations and taking the ratio of CRR determined for various magnitudes of earthquakes to the CRR for magnitude 7.5 earthquakes, Ambraseys derived the magnitude scaling factors listed in column 4 of Table 3 and plotted in Fig. 12. For magnitudes <7.5, the MSFs suggested by Ambraseys are significantly larger than both the original factors developed by Seed and Idriss (column 2, Table 3) and the revised factors suggested by Idriss (column 3). Because they are based on observational data, these factors have validity for estimating liquefaction hazard; however, they have not been widely used in engineering practice.

For magnitudes >7.5, Ambraseys factors are significantly lower and much more conservative than the original (Seed and Idriss 1982) and Idriss's revised scaling factors. Because there are few data to constrain Ambraseys' scaling factors for magnitudes >7.5, they are not recommended for hazard evaluation for large earthquakes.

#### Arango (1996) Scaling Factors

Arango (1996) developed two sets of magnitude scaling factors. The first set (column 5, Table 3) is based on furthest observed liquefaction effects from the seismic energy source, the estimated average peak accelerations at those distant sites, and the seismic energy required to cause liquefaction. The second set (column 6, Table 3) was developed from energy concepts and the relationship derived by Seed and Idriss (1982) between numbers of significant stress cycles and earthquake magnitude. The MSFs listed in column 5 are similar in value (within about 10%) to the MSFs of Ambraseys (column 4), and the MSFs listed in column 6 are similar in value (within about 10%) to the revised MSFs proposed by Idriss (column 3).

#### Andrus and Stokoe (1997) Scaling Factors

From their studies of liquefaction resistance as a function of shear wave velocity  $V_s$ , Andrus and Stokoe (1997) drew bounding curves and developed (22) for calculating CRR from  $V_s$  for magnitude 7.5 earthquakes. These investigators drew similar bounding curves for sites where surface effects of liquefaction were or were not observed for earthquakes with magnitudes of 6, 6.5, and 7. The positions of the CRR curves were visually adjusted on each graph until a best-fit bound was obtained. Magnitude scaling factors were then estimated by taking the ratio of CRR for a given magnitude to the CRR for magnitude 7.5 earthquakes. These MSFs are quantified by the following equation:

$$MSF = (M_w / 7.5)^{-2.56} \quad (25)$$

MSFs for magnitudes <6 and >7.5 were extrapolated from this equation. The derived MSFs are listed in column 7 of Table 3, and plotted in Fig. 12. For magnitudes <7.5, the MSFs proposed by Andrus and Stokoe are rather close in value (within about 5%) to the MSFs proposed by Ambraseys. For magnitudes >7.5, the Andrus and Stokoe MSFs are slightly smaller than the revised MSFs proposed by Idriss.

#### Youd and Noble (1997a) Scaling Factors

Youd and Noble (1997a) used a probabilistic or logistic analysis to analyze case history data from sites where effects of liquefaction were or were not reported following past earthquakes. This analysis yielded the following equation, which



from BPT measurements. These plots indicate that although SPT blow counts can be roughly estimated from BPT measurements, there can be considerable uncertainty for calculating liquefaction resistance because the data scatter is greatest in the range of greatest importance [ $N$ -values of 0–30 blows/300 mm (ft)].

A major source of variation in BPT blow counts is deviations in hammer energy. Rather than measuring hammer energy directly, Harder and Seed (1986) monitored bounce-chamber pressures and found that uniform combustion conditions (e.g., full throttle with a supercharger) correlated rather well with variations in Becker blow count. From this information, Harder and Seed developed an energy correction procedure based on measured bounce-chamber pressure.

Direct measurement of transmitted hammer energy could provide a more theoretically rigorous correction for Becker hammer efficiency. Sy and Campanella (1994) and Sy et al. (1995) instrumented a small length of Becker casing with strain gauges and accelerometers to measure transferred energy. They analyzed the recorded data with a pile-driving analyzer to determine strain, force, acceleration, and velocity. The transferred energy was determined by time integration of force times velocity. They were able to verify many of the variations in hammer energy previously identified by Harder and Seed (1986), including effects of variable throttle settings and energy transmission efficiencies of various drill rigs. However, they were unable to reduce the amount of scatter and uncertainty in converting BPT blow counts to SPT blow counts. Because the Sy and Campanella procedure requires considerably more effort than monitoring of bounce-chamber pressure without producing greatly improved results, the workshop participants agreed that the bounce-chamber technique is adequate for routine practice.

Friction along the driven casing also influences penetration resistance. Harder and Seed (1986) did not directly evaluate the effect of casing friction; hence, the correlation in Fig. 10(b) intrinsically incorporates an unknown amount of casing friction. However, casing friction remains a concern for depths >30 m and for measurement of penetration resistance in soft soils underlying thick deposits of dense soil. Either of these circumstances could lead to greater casing friction than is intrinsically incorporated in the Harder and Seed correlation.

The following procedures are recommended for routine practice: (1) the BPT should be conducted with newer AP-1000 drill rigs equipped with supercharged diesel hammers to drive plugged 168-mm outside diameter casing; (2) bounce-chamber pressures should be monitored and adjustments made to measured BPT blow counts to account for variations in diesel hammer combustion efficiency—for most routine applications, correlations developed by Harder and Seed (1986) may be used for these adjustments; and (3) the influence of some casing friction is indirectly accounted for in the Harder and Seed BPT-SPT correlation. This correlation, however, has not been verified and should not be used for depths >30 m or for sites with thick dense deposits overlying loose sands or gravels. For these conditions, mudded boreholes may be needed to reduce casing friction, or specially developed local correlations or sophisticated wave-equation analyses may be applied to quantify frictional effects.

#### MAGNITUDE SCALING FACTORS (MSFs)

The clean-sand base or CRR curves in Figs. 2 (SPT), 4 (CPT), and 10 ( $V_{s1}$ ) apply only to magnitude 7.5 earthquakes. To adjust the clean-sand curves to magnitudes smaller or larger than 7.5, Seed and Idriss (1982) introduced correction factors termed "magnitude scaling factors (MSFs)." These factors are used to scale the CRR base curves upward or downward on CRR versus ( $N_1$ )<sub>60</sub>,  $q_{c1/30}$ , or  $V_{s1}$  plots. Conversely, magnitude

weighting factors, which are the inverse of magnitude scaling factors, may be applied to correct CSR for magnitude. Either correcting CRR via magnitude scaling factors, or correcting CSR via magnitude weighting factors, leads to the same final result. Because the original papers by Seed and Idriss were written in terms of magnitude scaling factors, the use of magnitude scaling factors is continued in this report.

To illustrate the influence of magnitude scaling factors on calculated hazard, the equation for factor of safety (FS) against liquefaction is written in terms of CRR, CSR, and MSF as follows:

$$FS = (CRR_{7.5}/CSR)MSF \quad (23)$$

where CSR = calculated cyclic stress ratio generated by the earthquake shaking; and  $CRR_{7.5}$  = cyclic resistance ratio for magnitude 7.5 earthquakes.  $CRR_{7.5}$  is determined from Fig. 2 or (4) for SPT data, Fig. 4 or (11) for CPT data, or Fig. 9 or (22) for  $V_{s1}$  data.

#### Seed and Idriss (1982) Scaling Factors

Because of the limited amount of field liquefaction data available in the 1970s, Seed and Idriss (1982) were unable to adequately constrain bounds between liquefaction and non-liquefaction regions on CRR plots for magnitudes other than 7.5. Consequently, they developed a set of MSF from average numbers of loading cycles for various earthquake magnitudes and laboratory test results. A representative curve developed by these investigators, showing the number of loading cycles required to generate liquefaction for a given CSR, is reproduced in Fig. 11. The average number of loading cycles for various magnitudes of earthquakes are also noted on the plot. The initial set of magnitude scaling factors was derived by dividing CSR values on the representative curve for the number of loading cycles corresponding to a given earthquake magnitude by the CSR for 15 loading cycles (equivalent to a magnitude 7.5 earthquake). These scaling factors are listed in column 2 of Table 3 and are plotted in Fig. 12. These MSFs have been routinely applied in engineering practice since their introduction in 1982.

#### Revised Idriss Scaling Factors

In preparing his H. B. Seed Memorial Lecture, I. M. Idriss reevaluated the data that he and the late Professor Seed used to calculate the original (1982) magnitude scaling factors. In so doing, Idriss replotted the data on a log-log plot and suggested that the data should plot as a straight line. He noted, however, that one outlying point had strongly influenced the original analysis, causing the original plot to be nonlinear and characterized by unduly low MSF values for magnitudes <7.5. Based on this reevaluation, Idriss defined a revised set of magnitude scaling factors listed in column 3 of Table 3 and plotted

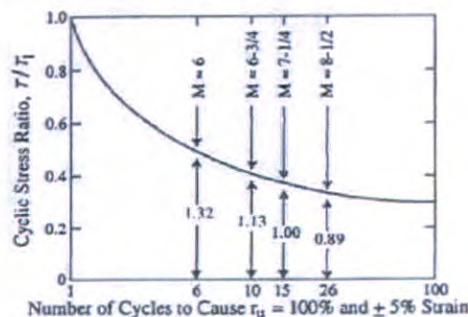


FIG. 11. Representative Relationship between CSR and Number of Cycles to Cause Liquefaction (Reproduced from Seed and Idriss 1982)

between  $V_{s1}$  and CSR for constant average cyclic shear strain suggested by R. Dobry (personal communication to R. D. Andrus, 1996). The second parenthetical term is a hyperbola with a small value at low  $V_{s1}$ , and a very large value as  $V_{s1}$  approaches  $V_{s1}^*$ , a constant limiting velocity for liquefaction of soils.

CRR versus  $V_{s1}$  curves recommended for engineering practice by Andrus and Stokoe (2000) for magnitude 7.5 earthquakes and uncemented Holocene-age soils with various fines contents are reproduced in Fig. 9. Also plotted and presented in Fig. 9 are points calculated from liquefaction case history information for magnitude 5.9–8.3 earthquakes. The three curves shown were determined through an iterative process of varying the values of  $a$  and  $b$  until nearly all the points indicative of liquefaction were bounded by the curves with the least number of nonliquefaction points plotted in the liquefaction region. The final values of  $a$  and  $b$  used to draw the curves were 0.022 and 2.8, respectively. Values of  $V_{s1}^*$  were assumed to vary linearly from 200 m/s for soils with fines content of 35% to 215 m/s for soils with fines content of 5% or less.

The recommended curves shown in Fig. 9 are dashed above CRR of 0.35 to indicate that field-performance data are limited in that range. Also, they do not extend much below 100 m/s, because there are no field data to support extending them to the origin. The calculated CRR is 0.033 for a  $V_{s1}$  of 100 m/s. This minimal CRR value is generally consistent with intercept CRR values assumed for the CPT and SPT procedures. Eq. (22) can be scaled to other magnitude values through use of magnitude scaling factors. These factors are discussed in a later section of this paper.

## BPT

Liquefaction resistance of nongravelly soils has been evaluated primarily through CPT and SPT, with occasional  $V_s$  measurements. CPT and SPT measurements, however, are not generally reliable in gravelly soils. Large gravel particles may interfere with the normal deformation of soil materials around the penetrometer and misleadingly increase penetration resistance. Several investigators have employed large-diameter

penetrometers to surmount these difficulties; the Becker penetration test (BPT) in particular has become one of the more effectively and widely used larger tools. The BPT was developed in Canada in the late 1950s and consists of a 168-mm diameter, 3-m-long double-walled casing driven into the ground with a double-acting diesel-driven pile hammer. The hammer impacts are applied at the top of the casing and penetration is continuous. The Becker penetration resistance is defined as the number of blows required to drive the casing through an increment of 300 mm.

The BPT has not been standardized, and several different types of equipment and procedures have been used. There are currently very few liquefaction sites from which BPT data have been obtained. Thus the BPT cannot be directly correlated with field behavior, but rather through estimating equivalent SPT  $N$ -values from BPT data and then applying evaluation procedures based on the SPT. This indirect method introduces substantial additional uncertainty into the calculated CRR.

To provide uniformity, Harder and Seed (1986) recommended newer AP-1000 drill rigs equipped with supercharged diesel hammers, 168-mm outside diameter casing, and a plugged bit. From several sites where both BPT and SPT tests were conducted in parallel soundings, Harder and Seed (1986) developed a preliminary correlation between Becker and standard penetration resistance [Fig. 10(a)]. Additional comparative data compiled since 1986 are plotted in Fig. 10(b). The original Harder and Seed correlation curve (solid line) is drawn in Fig. 10(b) along with dashed curves representing 20% over- and underpredictions of SPT blow counts. These plots indicate that SPT blow counts can be roughly estimated

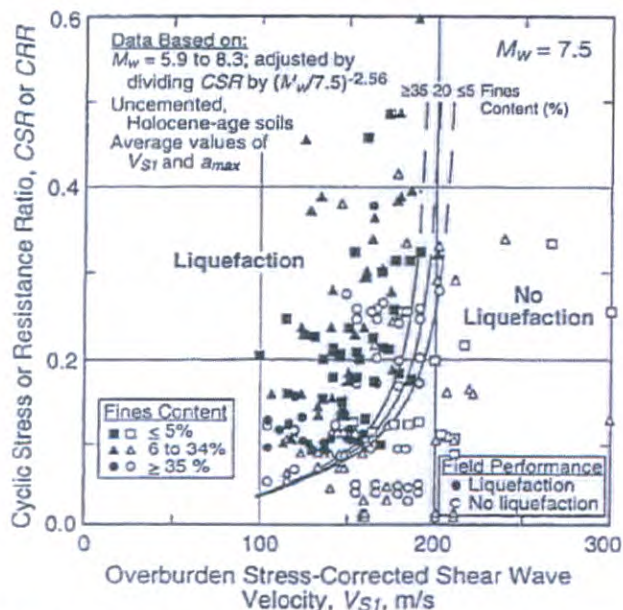


FIG. 9. Liquefaction Relationship Recommended for Clean, Uncemented Soils with Liquefaction Data from Compiled Case Histories (Reproduced from Andrus and Stokoe 2000)

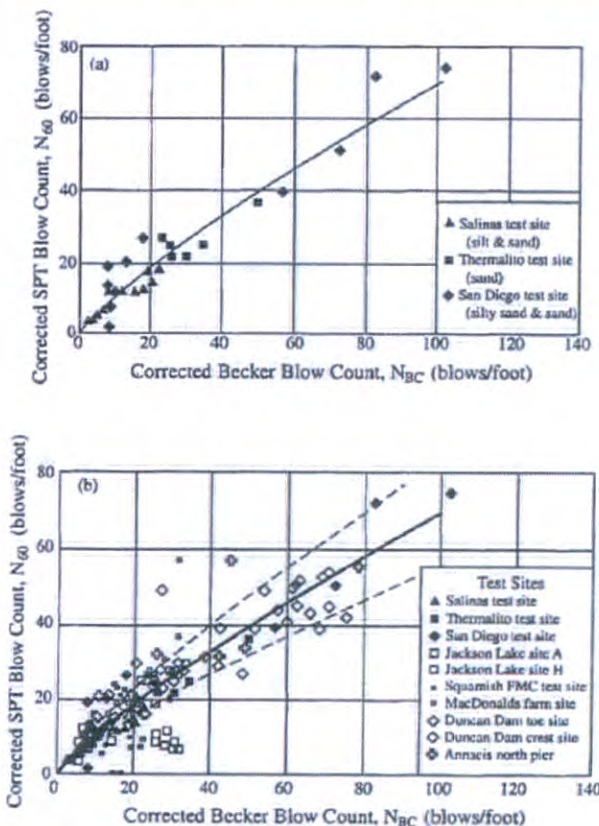
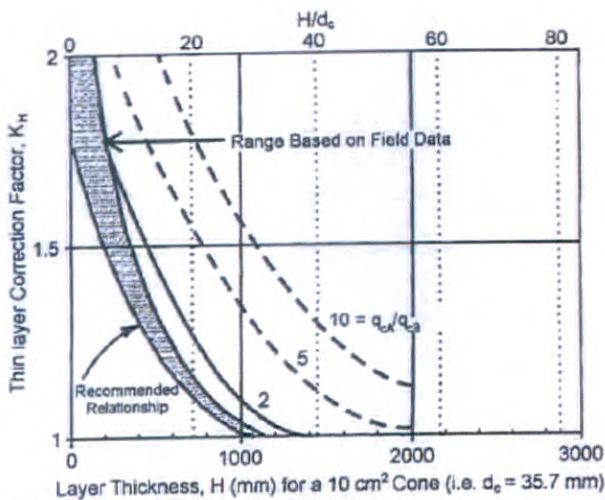
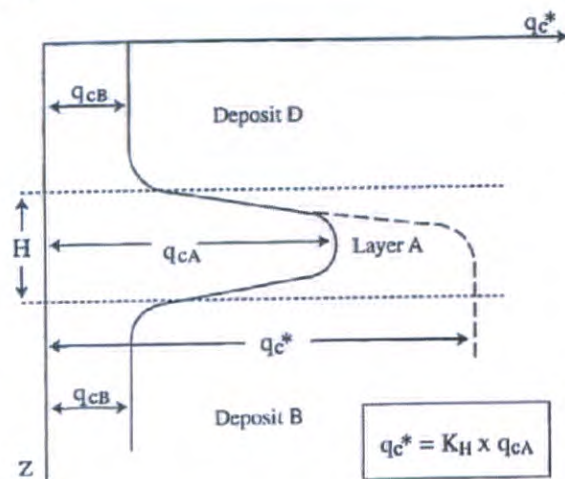


FIG. 10. Correlation between Corrected Becker Penetration Resistance  $N_{bc}$  and Corrected SPT Resistance  $N_{60}$ : (a) Harder and Seed (1986); (b) Data from Additional Sites (Reproduced from Harder 1997)



(a)



(b)

FIG. 7. Thin-Layer Correction Factor  $K_H$ , for Determination of Equivalent Thick-Layer CPT Resistance (Modified from Robertson and Fear 1995)

small-strain shear modulus is a parameter required in analytical procedures for estimating dynamic soil response and soil-structure interaction analyses.

Three concerns arise when using  $V_s$  for liquefaction-resistance evaluations: (1) seismic wave velocity measurements are made at small strains, whereas pore-water pressure buildup and the onset of liquefaction are medium- to high-strain phenomena; (2) seismic testing does not provide samples for classification of soils and identification of nonliquefiable soft clay-rich soils; and (3) thin, low  $V_s$  strata may not be detected if the measurement interval is too large. Therefore the preferred practice is to drill sufficient boreholes and conduct in situ tests to detect and delineate thin liquefiable strata, nonliquefiable clay-rich soils, and silty soils above the ground-water table that might become liquefiable should the water table rise. Other tests, such as the SPT or CPT, are needed to detect liquefiable weakly cemented soils that may have high  $V_s$  values.

#### $V_s$ Criteria for Evaluating Liquefaction Resistance

Following the traditional procedures for correcting penetration resistance to account for overburden stress,  $V_s$  is also cor-

rected to a reference overburden stress using the following equation (Sykora 1987; Kayen et al. 1992; Robertson et al. 1992):

$$V_{s1} = V_s \left( \frac{P_\sigma}{\sigma'_{v0}} \right)^{0.25} \quad (21)$$

where  $V_{s1}$  = overburden-stress corrected shear wave velocity;  $P_\sigma$  = atmospheric pressure approximated by 100 kPa (1 TSF); and  $\sigma'_{v0}$  = initial effective vertical stress in the same units as  $P_\sigma$ . Eq. (21) implicitly assumes a constant coefficient of earth pressure  $K'_0$ , which is approximately 0.5 for sites susceptible to liquefaction. Application of (21) also implicitly assumes that  $V_s$  is measured with both the directions of particle motion and wave propagation polarized along principal stress directions and that one of those directions is vertical (Stokoe et al. 1985).

Fig. 8 compares seven CRR- $V_{s1}$  curves. The "best fit" curve by Tokimatsu and Uchida (1990) was determined from laboratory cyclic triaxial test results for various sands with <10% fines and 15 cycles of loading. The more conservative "lower bound" curve for Tokimatsu and Uchida's laboratory test results is also shown as a lower bound for liquefaction occurrences. The bounding curve by Robertson et al. (1992) was developed using field performance data from sites in Imperial Valley, Calif., along with data from four other sites. The curves by Kayen et al. (1992) and Lodge (1994) are from sites that did and did not liquefy during the 1989 Loma Prieta earthquake. Andrus and Stokoe's (1997) curve was developed for uncemented, Holocene-age soils with 5% or less fines using field performance data from 20 earthquakes and over 50 measurement sites. Andrus and Stokoe (2000) revised this curve based on new information and an expanded database that includes 26 earthquakes and more than 70 measurement sites.

Andrus and Stokoe (1997) proposed the following relationship between CRR and  $V_{s1}$ :

$$\text{CRR} = a \left( \frac{V_{s1}}{100} \right)^2 + b \left( \frac{1}{V_{s1}^* - V_{s1}} - \frac{1}{V_{s1}^*} \right) \quad (22)$$

where  $V_{s1}^*$  = limiting upper value of  $V_{s1}$  for liquefaction occurrence; and  $a$  and  $b$  are curve fitting parameters. The first parenthetical term of (22) is based on a modified relationship

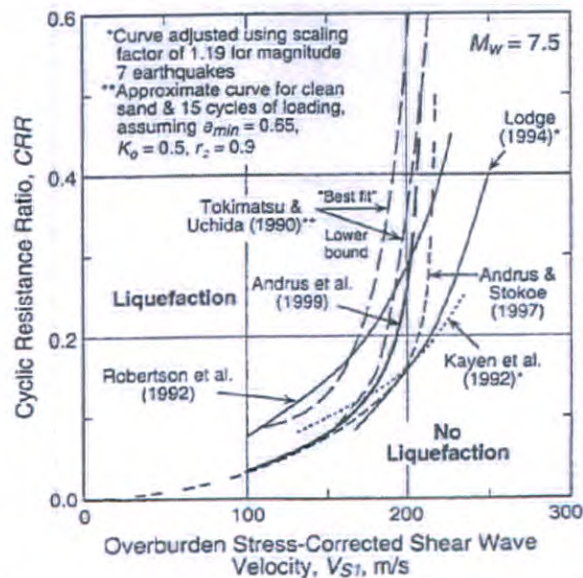


FIG. 8. Comparison of Seven Relationships between Liquefaction Resistance and Overburden Stress-Corrected Shear Wave Velocity for Granular Soils

>2.6, the soil is likely to be very silty and possibly plastic. In this instance,  $q_{c1N}$  should be recalculated from (12) using an intermediate exponent  $n$  of 0.7 in (13).  $I_c$  is then recalculated from (14) using the recalculated value for  $q_{c1N}$ . This intermediate  $I_c$  is then used to calculate liquefaction resistance. In this instance, a soil sample should be retrieved and tested to verify the soil type and whether the soil is liquefiable by other criteria, such as the Chinese criteria.

Because the relationship between  $I_c$  and soil type is approximate, the consensus of the workshop participants is that all soils with an  $I_c$  of 2.4 or greater should be sampled and tested to confirm the soil type and to test the liquefiability with other criteria. Also, soil layers characterized by an  $I_c > 2.6$ , but with a normalized friction ratio  $F < 1.0\%$  (region 1 of Fig. 5) may be very sensitive and should be sampled and tested. Although not technically liquefiable according to the Chinese criteria, such sensitive soils may suffer softening and strength loss during earthquake shaking.

#### Calculation of Clean-Sand Equivalent Normalized Cone Penetration Resistance ( $q_{c1N}$ )<sub>cs</sub>

The normalized penetration resistance ( $q_{c1N}$ ) for silty sands is corrected to an equivalent clean sand value ( $q_{c1N}$ )<sub>cs</sub>, by the following relationship:

$$(q_{c1N})_{cs} = K_c q_{c1N} \quad (18)$$

where  $K_c$ , the correction factor for grain characteristics, is defined by the following equation (Robertson and Wride 1998):

$$\text{for } I_c \leq 1.64 \quad K_c = 1.0 \quad (19a)$$

$$\text{for } I_c > 1.64 \quad K_c = -0.403I_c^4 + 5.581I_c^3 - 21.63I_c^2 + 33.75I_c - 17.88 \quad (19b)$$

The  $K_c$  curve defined by (19) is plotted in Fig. 6. For  $I_c > 2.6$ , the curve is shown as a dashed line, indicating that soils in this range of  $I_c$  are most likely too clay-rich or plastic to liquefy.

With an appropriate  $I_c$  and  $K_c$ , (11) and (19) can be used to calculate  $CRR_{7.5}$ . To adjust CRR to magnitudes other than 7.5, the calculated  $CRR_{7.5}$  is multiplied by an appropriate magnitude scaling factor. The same magnitude scaling factors are used with CPT data as with SPT data. Magnitude scaling factors are discussed in a later section of this report.

#### Olsen (1997) and Suzuki et al. (1995) Procedures

Olsen (1997), who pioneered many of the techniques for assessing liquefaction resistance from CPT soundings, sug-

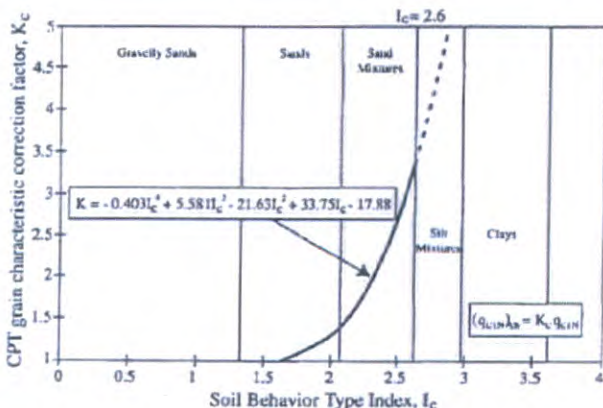


FIG. 6. Grain-Characteristic Correction Factor  $K_c$  for Determination of Clean-Sand Equivalent CPT Resistance (Reproduced from Robertson and Wride 1998)

gested a somewhat different procedure for calculating CRR from CPT data. Reasons for recommending the Robertson and Wride (1998) procedure over that of Olsen are the ease of application and the ease with which relationships can be quantified for computer-aided calculations. Results from Olsen's procedure, however, are consistent with results from the procedure proposed here for shallow (<15 m deep) sediment beneath level to gently sloping terrain. Olsen (1997) noted that almost any CPT normalization technique will give results consistent with his normalization procedure for soil layers in the 3–15 m depth range. For deeper layers, significant differences may develop between the two procedures. Those depths are also beyond the depth for which the simplified procedure has been verified. Hence any procedure based on the simplified procedure yields rather uncertain results at depths >15 m.

Suzuki et al. (1995) also developed criteria for evaluating CRR from CPT data. Those criteria are slightly more conservative than those of Robertson and Wride (1998) and were considered by the latter investigators in developing the criteria recommended herein.

#### Correction of Cone Penetration Resistance for Thin Soil Layers

Theoretical as well as laboratory studies indicate that CPT tip resistance is influenced by softer soil layers above or below the cone tip. As a result, measured CPT tip resistance is smaller in thin layers of granular soils sandwiched between softer layers than in thicker layers of the same granular soil. The amount of the reduction of penetration resistance in soft layers is a function of the thickness of the softer layer and the stiffness of the stiffer layers.

Using a simplified elastic solution, Vreugdenhil et al. (1994) developed a procedure for estimating the thick-layer equivalent cone penetration resistance of thin stiff layers lying within softer strata. The correction applies only to thin stiff layers embedded within thick soft layers. Because the corrections have a reasonable trend, but appear rather large, Robertson and Fear (1995) recommended conservative corrections from the  $q_{cs}/q_{cs} = 2$  curve sketched in Fig. 7.

Further analysis of field data by Gonzalo Castro and Peter Robertson for the NCEER workshop indicates that corrections based on the  $q_{cs}/q_{cs} = 2$  curve may still be too large and not adequately conservative. They suggested, and the workshop participants agreed, that the lower bound of the range of field data plotted by G. Castro in Fig. 7 provides more conservative  $K_H$  values that should be used until further field studies and analyses indicate that higher values are viable. The equation for the lower bound of the field curve is

$$K_H = 0.25[(H/d_c)/17 - 1.77]^2 + 1.0 \quad (20)$$

where  $H$  = thickness of the interbedded layer in mm;  $q_{cs}$  and  $q_{cs}$  = cone resistances of the stiff and soft layers, respectively; and  $d_c$  = diameter of the cone in mm (Fig. 7).

#### $V_s$

Andrus and Stokoe (1997, 2000) developed liquefaction resistance criteria from field measurements of shear wave velocity  $V_s$ . The use of  $V_s$  as a field index of liquefaction resistance is soundly based because both  $V_s$  and CRR are similarly, but not proportionally, influenced by void ratio, effective confining stresses, stress history, and geologic age. The advantages of using  $V_s$  include the following: (1)  $V_s$  measurements are possible in soils that are difficult to penetrate with CPT and SPT or to extract undisturbed samples, such as gravelly soils, and at sites where borings or soundings may not be permitted; (2)  $V_s$  is a basic mechanical property of soil materials, directly related to small-strain shear modulus; and (3) the

tios between the two clean-sand base curves, plotted in Figs. 4 and 2, respectively, range from 5 to 8—values that are slightly higher than those expected for clean sands. Shifting the CPT base curve to the right by 10 to 15% would increase those ratios to unusually high values ranging from 6 to 9. Second, base curves, such as those plotted in Figs. 2 and 4, were intended to be conservative, but not necessarily to encompass every data point on the plot. Thus the presence of a few points beyond the base curve should be allowable. Finally, several studies have confirmed that the CPT criteria in Fig. 4 are generally conservative. Robertson and Wride (1998) verified these criteria against SPT and other data from sites they investigated. Gilstrap and Youd (1998) compared calculated liquefaction resistances against field performance at 19 sites and concluded that the CPT criteria correctly predicted the occurrence or nonoccurrence of liquefaction with >85% reliability.

The clean-sand base curve in Fig. 4 may be approximated by the following equation (Robertson and Wride 1998):

$$\text{If } (q_{c1N})_{cs} < 50 \quad \text{CRR}_{7.5} = 0.833[(q_{c1N})_{cs}/1,000] + 0.05 \quad (11a)$$

$$\text{If } 50 \leq (q_{c1N})_{cs} < 160 \quad \text{CRR}_{7.5} = 93[(q_{c1N})_{cs}/1,000]^3 + 0.08 \quad (11b)$$

where  $(q_{c1N})_{cs}$  = clean-sand cone penetration resistance normalized to approximately 100 kPa (1 atm).

#### Normalization of Cone Penetration Resistance

The CPT procedure requires normalization of tip resistance using (12) and (13). This transformation yields normalized, dimensionless cone penetration resistance  $q_{c1N}$

$$q_{c1N} = C_Q(q_c/P_a) \quad (12)$$

where

$$C_Q = (P_a/\sigma'_{vo})^n \quad (13)$$

and where  $C_Q$  = normalizing factor for cone penetration resistance;  $P_a$  = 1 atm of pressure in the same units used for  $\sigma'_{vo}$ ;  $n$  = exponent that varies with soil type; and  $q_c$  = field cone penetration resistance measured at the tip. At shallow depths  $C_Q$  becomes large because of low overburden pressure; however, values >1.7 should not be applied. As noted in the following paragraphs, the value of the exponent  $n$  varies from 0.5 to 1.0, depending on the grain characteristics of the soil (Olsen 1997).

The CPT friction ratio (sleeve resistance  $f_s$  divided by cone tip resistance  $q_c$ ) generally increases with increasing fines content and soil plasticity, allowing rough estimates of soil type and fines content to be determined from CPT data. Robertson and Wride (1998) constructed the chart reproduced in Fig. 5 for estimation of soil type. The boundaries between soil types 2–7 can be approximated by concentric circles and can be used to account for effects of soil characteristics on  $q_{c1N}$  and CRR. The radius of these circles, termed the soil behavior type index  $I_c$ , is calculated from the following equation:

$$I_c = [(3.47 - \log Q)^2 + (1.22 + \log F)^2]^{0.5} \quad (14)$$

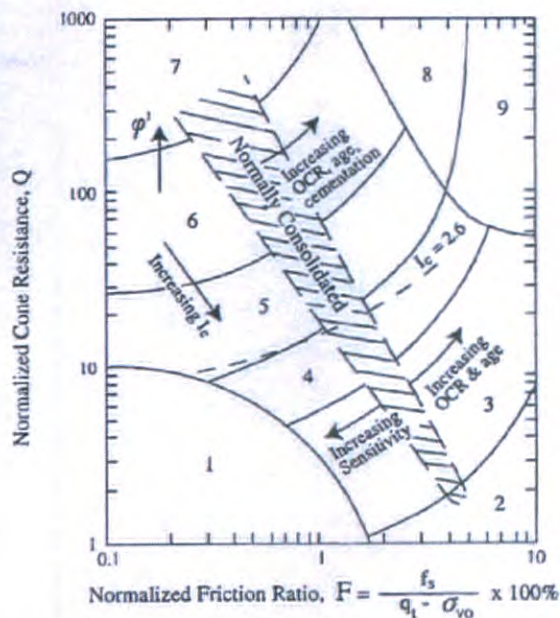
where

$$Q = [(q_c - \sigma_{vo})/P_a][(P_a/\sigma'_{vo})^n] \quad (15)$$

and

$$F = [f_s/(q_c - \sigma_{vo})] \times 100\% \quad (16)$$

The soil behavior chart in Fig. 5 was developed using an exponent  $n$  of 1.0, which is the appropriate value for clayey soil types. For clean sands, however, an exponent value of 0.5 is more appropriate, and a value intermediate between 0.5 and



- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand*  |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained*        |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |
- \*Heavily overconsolidated or cemented

FIG. 5. CPT-Based Soil Behavior-Type Chart Proposed by Robertson (1990)

1.0 would be appropriate for silts and sandy silts. Robertson and Wride recommended the following procedure for calculating the soil behavior type index  $I_c$ . The first step is to differentiate soil types characterized as clays from soil types characterized as sands and silts. This differentiation is performed by assuming an exponent  $n$  of 1.0 (characteristic of clays) and calculating the dimensionless CPT tip resistance  $Q$  from the following equation:

$$Q = [(q_c - \sigma_{vo})/P_a][(P_a/\sigma'_{vo})^1]^{1.0} = [(q_c - \sigma_{vo})/\sigma'_{vo}] \quad (17)$$

If the  $I_c$  calculated with an exponent of 1.0 is >2.6, the soil is classified as clayey and is considered too clay-rich to liquefy, and the analysis is complete. However, soil samples should be retrieved and tested to confirm the soil type and liquefaction resistance. Criteria such as the Chinese criteria might be applied to confirm that the soil is nonliquefiable. The so-called Chinese criteria, as defined by Seed and Idriss (1982), specify that liquefaction can only occur if all three of the following conditions are met:

1. The clay content (particles smaller than 5  $\mu$ ) is <15% by weight.
2. The liquid limit is <35%.
3. The natural moisture content is >0.9 times the liquid limit.

If the calculated  $I_c$  is <2.6, the soil is most likely granular in nature, and therefore  $C_Q$  and  $Q$  should be recalculated using an exponent  $n$  of 0.5.  $I_c$  should then be recalculated using (14). If the recalculated  $I_c$  is <2.6, the soil is classed as nonplastic and granular. This  $I_c$  is used to estimate liquefaction resistance, as noted in the next section. However, if the recalculated  $I_c$  is

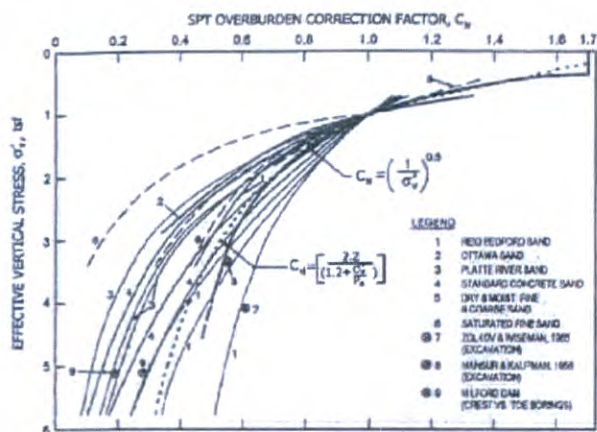


FIG. 3.  $C_c$  Curves for Various Sands Based on Field and Laboratory Test Data along with Suggested  $C_c$  Curve Determined from Eqs. (9) and (10) (Modified from Castro 1995)

pressures up to 300 kPa (3 tsf). For pressures >300 kPa (3 tsf), the uncertainty is so great that (9) should not be applied. At these high pressures, which are generally below the depth for which the simplified procedure has been verified,  $C_c$  should be estimated by other means.

Another important factor is the energy transferred from the falling hammer to the SPT sampler. An ER of 60% is generally accepted as the approximate average for U.S. testing practice and as a reference value for energy corrections. The ER delivered to the sampler depends on the type of hammer, anvil, lifting mechanism, and the method of hammer release. Approximate correction factors ( $C_E = ER/60$ ) to modify the SPT results to a 60% energy ratio for various types of hammers and anvils are listed in Table 2. Because of variations in drilling and testing equipment and differences in testing procedures, a rather wide range in the energy correction factor  $C_E$  has been observed as noted in the table. Even when procedures are carefully monitored to conform to established standards, such as ASTM D 1586-99, some variation in  $C_E$  may occur because of minor variations in testing procedures. Measured energies at a single site indicate that variations in energy ratio between blows or between tests in a single borehole typically vary by as much as 10%. The workshop participants recommend measurement of the hammer energy frequently at each site where the SPT is used. Where measurements cannot be made, careful observation and notation of the equipment and procedures are required to estimate a  $C_E$  value for use in liquefaction resistance calculations. Use of good-quality testing equipment and carefully controlled testing procedures conforming to ASTM D 1586-99 will generally yield more consistent energy ratios and  $C_E$  with values from the upper parts of the ranges listed in Table 2.

Skempton (1986) suggested and Robertson and Wride (1998) updated correction factors for rod lengths <10 m, borehole diameters outside the recommended interval (65–125 mm), and sampling tubes without liners. Range for these correction factors are listed in Table 2. For liquefaction resistance calculations and rod lengths <3 m, a  $C_R$  of 0.75 should be applied as was done by Seed et al. (1985) in formulating the simplified procedure. Although application of rod-length correction factors listed in Table 2 will give more precise  $(N_1)_{60}$  values, these corrections may be neglected for liquefaction resistance calculations for rod lengths between 3 and 10 m because rod-length corrections were not applied to SPT test data from these depths in compiling the original liquefaction case

history databases. Thus rod-length corrections are implicitly incorporated into the empirical SPT procedure.

A final change recommended by workshop participants is the use of revised magnitude scaling factors rather than the original Seed and Idriss (1982) factors to adjust CRR for earthquake magnitudes other than 7.5. Magnitude scaling factors are addressed later in this report.

## CPT

A primary advantage of the CPT is that a nearly continuous profile of penetration resistance is developed for stratigraphic interpretation. The CPT results are generally more consistent and repeatable than results from other penetration tests listed in Table 1. The continuous profile also allows a more detailed definition of soil layers than the other tools listed in the table. This stratigraphic capability makes the CPT particularly advantageous for developing liquefaction-resistance profiles. Interpretations based on the CPT, however, must be verified with a few well-placed boreholes preferably with standard penetration tests, to confirm soil types and further verify liquefaction-resistance interpretations.

Fig. 4 provides curves prepared by Robertson and Wride (1998) for direct determination of CRR for clean sands ( $FC \leq 5\%$ ) from CPT data. This figure was developed from CPT case history data compiled from several investigations, including those by Stark and Olson (1995) and Suzuki et al. (1995). The chart, valid for magnitude 7.5 earthquakes only, shows calculated cyclic resistance ratio plotted as a function of dimensionless, corrected, and normalized CPT resistance  $q_{c1N}$  from sites where surface effects of liquefaction were or were not observed following past earthquakes. The CRR curve conservatively separates regions of the plot with data indicative of liquefaction from regions indicative of nonliquefaction.

Based on a few misclassified case histories from the 1989 Loma Prieta earthquake, I. M. Idriss suggested that the clean sand curve in Fig. 4 should be shifted to the right by 10–15%. However, a majority of workshop participants supported a curve in its present position, for three reasons. First, a purpose of the workshop was to recommend criteria that yield roughly equivalent CRR for the field tests listed in Table 1. Shifting the base curve to the right makes the CPT criteria generally more conservative. For example, for  $(N_1)_{60} > 5$ ,  $q_{c1N}:(N_1)_{60}$  ra-

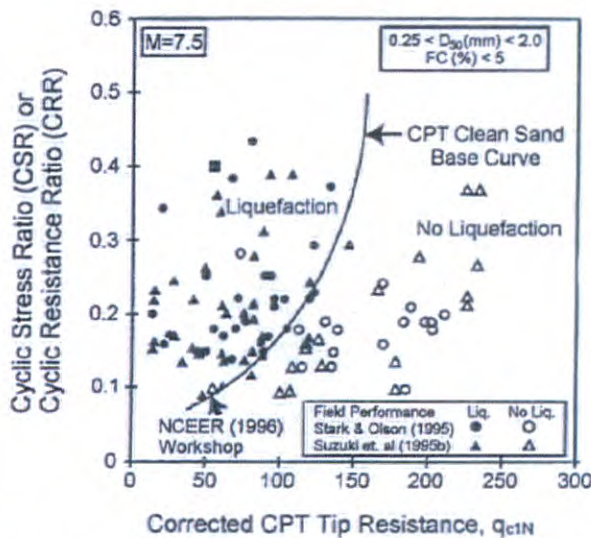


FIG. 4. Curve Recommended for Calculation of CRR from CPT Data along with Empirical Liquefaction Data from Compiled Case Histories (Reproduced from Robertson and Wride 1998)

tory of the clean-sand base curve at low  $(N_1)_{60}$  to a projected intercept of about 0.05 (Fig. 2). This adjustment reshapes the clean-sand base curve to achieve greater consistency with CRR curves developed for the CPT and shear-wave velocity procedures. Seed and Idriss (1982) projected the original curve through the origin, but there were few data to constrain the curve in the lower part of the plot. A better fit to the present empirical data is to bow the lower end of the base curve as indicated in Fig. 2.

At the University of Texas, A. F. Rauch (personal communication, 1998), approximated the clean-sand base curve plotted in Fig. 2 by the following equation:

$$CRR_{7.5} = \frac{1}{34 - (N_1)_{60}} + \frac{(N_1)_{60}}{135} + \frac{50}{[10 \cdot (N_1)_{60} + 45]^2} - \frac{1}{200} \quad (4)$$

This equation is valid for  $(N_1)_{60} < 30$ . For  $(N_1)_{60} \geq 30$ , clean granular soils are too dense to liquefy and are classed as non-liquefiable. This equation may be used in spreadsheets and other analytical techniques to approximate the clean-sand base curve for routine engineering calculations.

#### Influence of Fines Content

In the original development, Seed et al. (1985) noted an apparent increase of CRR with increased fines content. Whether this increase is caused by an increase of liquefaction resistance or a decrease of penetration resistance is not clear. Based on the empirical data available, Seed et al. developed CRR curves for various fines contents reproduced in Fig. 2. A revised correction for fines content was developed by workshop attendees to better fit the empirical database and to better support computations with spreadsheets and other electronic computational aids.

The workshop participants recommend (5) and (6) as approximate corrections for the influence of fines content (FC) on CRR. Other grain characteristics, such as soil plasticity, may affect liquefaction resistance as well as fines content, but widely accepted corrections for these factors have not been developed. Hence corrections based solely on fines content should be used with engineering judgment and caution. The following equations were developed by I. M. Idriss with the assistance of R. B. Seed for correction of  $(N_1)_{60}$  to an equivalent clean sand value,  $(N_1)_{60cs}$ :

$$(N_1)_{60cs} = \alpha + \beta(N_1)_{60} \quad (5)$$

where  $\alpha$  and  $\beta$  = coefficients determined from the following relationships:

$$\alpha = 0 \quad \text{for FC} \leq 5\% \quad (6a)$$

$$\alpha = \exp[1.76 - (190/FC^2)] \quad \text{for } 5\% < \text{FC} < 35\% \quad (6b)$$

$$\alpha = 5.0 \quad \text{for FC} \geq 35\% \quad (6c)$$

$$\beta = 1.0 \quad \text{for FC} \leq 5\% \quad (7a)$$

$$\beta = [0.99 + (FC^{1.5}/1,000)] \quad \text{for } 5\% < \text{FC} < 35\% \quad (7b)$$

$$\beta = 1.2 \quad \text{for FC} \geq 35\% \quad (7c)$$

These equations may be used for routine liquefaction resistance calculations. A back-calculated curve for a fines content of 35% is essentially congruent with the 35% curve plotted in Fig. 2. The back-calculated curve for a fines content of 15% plots to the right of the original 15% curve.

#### Other Corrections

Several factors in addition to fines content and grain characteristics influence SPT results, as noted in Table 2. Eq. (8) incorporates these corrections

TABLE 2. Corrections to SPT (Modified from Skempton 1986) as Listed by Robertson and Wride (1998)

Factor	Equipment variable	Term	Correction
Overburden pressure	—	$C_N$	$(P_o/\sigma'_{vo})^{0.5}$
Overburden pressure	—	$C_N$	$C_N \leq 1.7$
Energy ratio	Donut hammer	$C_E$	0.5–1.0
Energy ratio	Safety hammer	$C_E$	0.7–1.2
Energy ratio	Automatic-trip Donut-type hammer	$C_E$	0.8–1.3
Borehole diameter	65–115 mm	$C_B$	1.0
Borehole diameter	150 mm	$C_B$	1.05
Borehole diameter	200 mm	$C_B$	1.15
Rod length	<3 m	$C_R$	0.75
Rod length	3–4 m	$C_R$	0.8
Rod length	4–6 m	$C_R$	0.85
Rod length	6–10 m	$C_R$	0.95
Rod length	10–30 m	$C_R$	1.0
Sampling method	Standard sampler	$C_S$	1.0
Sampling method	Sampler without liners	$C_S$	1.1–1.3

$$(N_1)_{60} = N_m C_N C_E C_B C_R C_S \quad (8)$$

where  $N_m$  = measured standard penetration resistance;  $C_N$  = factor to normalize  $N_m$  to a common reference effective overburden stress;  $C_E$  = correction for hammer energy ratio (ER);  $C_B$  = correction factor for borehole diameter;  $C_R$  = correction factor for rod length; and  $C_S$  = correction for samplers with or without liners.

Because SPT  $N$ -values increase with increasing effective overburden stress, an overburden stress correction factor is applied (Seed and Idriss 1982). This factor is commonly calculated from the following equation (Liao and Whitman 1986a):

$$C_N = (P_o/\sigma'_{vo})^{0.5} \quad (9)$$

where  $C_N$  normalizes  $N_m$  to an effective overburden pressure  $\sigma'_{vo}$  of approximately 100 kPa (1 atm)  $P_o$ .  $C_N$  should not exceed a value of 1.7 [A maximum value of 2.0 was published in the National Center for Earthquake Engineering Research (NCEER) workshop proceedings (Youd and Idriss 1997), but later was reduced to 1.7 by consensus of the workshop participants] Kayen et al. (1992) suggested the following equation, which limits the maximum  $C_N$  value to 1.7, and in these writers' opinion, provides a better fit to the original curve specified by Seed and Idriss (1982):

$$C_N = 2.2/(1.2 + \sigma'_{vo}/P_o) \quad (10)$$

Either equation may be used for routine engineering applications.

The effective overburden pressure  $\sigma'_{vo}$  applied in (9) and (10) should be the overburden pressure at the time of drilling and testing. Although a higher ground-water level might be used for conservatism in the liquefaction resistance calculations, the  $C_N$  factor must be based on the stresses present at the time of the testing.

The  $C_N$  correction factor was derived from SPT performed in test bins with large sand specimens subjected to various confining pressures (Gibbs and Holtz 1957; Marcuson and Bieganousky 1997a,b). The results of several of these tests are reproduced in Fig. 3 in the form of  $C_N$  curves versus effective overburden stress (Castro 1995). These curves indicate considerable scatter of results with no apparent correlation of  $C_N$  with soil type or gradation. The curves from looser sands, however, lie in the lower part of the  $C_N$  range and are reasonably approximated by (9) and (10) for low effective overburden pressures [200 kPa (<2 tsf)]. The workshop participants endorsed the use of (9) for calculation of  $C_N$ , but acknowledged that for overburden pressures >200 kPa (2 tsf) the results are uncertain. Eq. (10) provides a better fit for overburden

flexibility and thus  $r_d$  at field sites, that  $r_d$  calculated from (2) are the mean of a wide range of possible  $r_{d0}$ , and that the range of  $r_d$  increases with depth (Golesorkhi 1989).

For ease of computation, T. F. Blake (personal communication, 1996) approximated the mean curve plotted in Fig. 1 by the following equation:

$$r_d = \frac{(1.000 - 0.4113z^{0.3} + 0.04052z + 0.001753z^{1.5})}{(1.000 - 0.4177z^{0.3} + 0.05729z - 0.006205z^{1.5} + 0.001210z^2)} \quad (3)$$

where  $z$  = depth beneath ground surface in meters. Eq. (3) yields essentially the same values for  $r_d$  as (2), but is easier to program and may be used in routine engineering practice.

I. M. Idriss [Transportation Research Board (TRB) (1999)] suggested a new procedure for determining magnitude-dependent values of  $r_d$ . Application of these  $r_d$  require use of a corresponding set of magnitude scaling factors that are compatible with the new  $r_d$ . Because these  $r_d$  were developed after the workshop and have not been independently evaluated by other experts, the workshop participants chose not to recommend the new factors at this time.

### EVALUATION OF LIQUEFACTION RESISTANCE (CRR)

A major focus of the workshop was on procedures for evaluating liquefaction resistance. A plausible method for evaluating CRR is to retrieve and test undisturbed soil specimens in the laboratory. Unfortunately, in situ stress states generally cannot be reestablished in the laboratory, and specimens of granular soils retrieved with typical drilling and sampling techniques are too disturbed to yield meaningful results. Only through specialized sampling techniques, such as ground freezing, can sufficiently undisturbed specimens be obtained. The cost of such procedures is generally prohibitive for all but the most critical projects. To avoid the difficulties associated with sampling and laboratory testing, field tests have become the state-of-practice for routine liquefaction investigations.

Several field tests have gained common usage for evaluation of liquefaction resistance, including the standard penetration test (SPT), the cone penetration test (CPT), shear-wave velocity measurements ( $V_s$ ), and the Becker penetration test (BPT). These tests were discussed at the workshop, along with associated criteria for evaluating liquefaction resistance. The participants made a conscientious attempt to correlate liquefaction resistance criteria from each of the various field tests to provide generally consistent results, no matter which test is applied. SPTs and CPTs are generally preferred because of the more extensive databases and past experience, but the other tests may be applied at sites underlain by gravelly sediment or where access by large equipment is limited. Primary advantages and disadvantages of each test are listed in Table 1.

### SPT

Criteria for evaluation of liquefaction resistance based on the SPT have been rather robust over the years. Those criteria are largely embodied in the CSR versus  $(N_1)_{60}$  plot reproduced

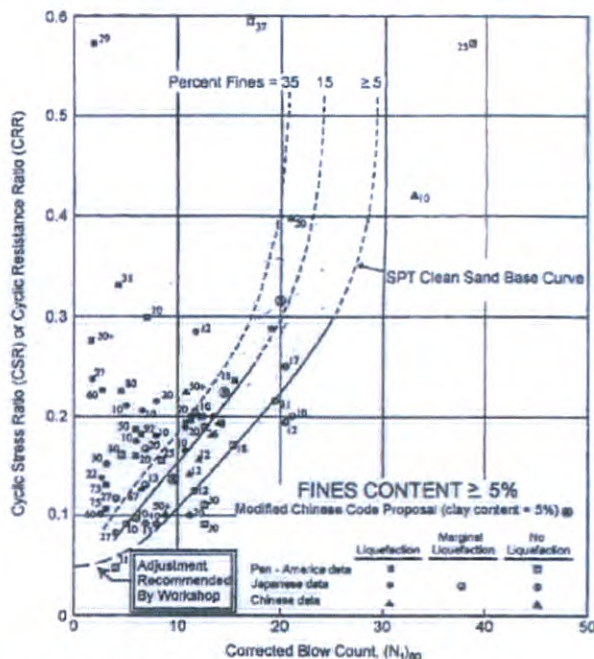


FIG. 2. SPT Clean-Sand Base Curve for Magnitude 7.5 Earthquakes with Data from Liquefaction Case Histories (Modified from Seed et al. 1985)

in Fig. 2.  $(N_1)_{60}$  is the SPT blow count normalized to an overburden pressure of approximately 100 kPa (1 ton/sq ft) and a hammer energy ratio or hammer efficiency of 60%. The normalization factors for these corrections are discussed in the section entitled Other Corrections. Fig. 2 is a graph of calculated CSR and corresponding  $(N_1)_{60}$  data from sites where liquefaction effects were or were not observed following past earthquakes with magnitudes of approximately 7.5. CRR curves on this graph were conservatively positioned to separate regions with data indicative of liquefaction from regions with data indicative of nonliquefaction. Curves were developed for granular soils with the fines contents of 5% or less, 15%, and 35% as shown on the plot. The CRR curve for fines contents <5% is the basic penetration criterion for the simplified procedure and is referred to hereafter as the "SPT clean-sand base curve." The CRR curves in Fig. 2 are valid only for magnitude 7.5 earthquakes. Scaling factors to adjust CRR curves to other magnitudes are addressed in a later section of this report.

### SPT Clean-Sand Base Curve

Several changes to the SPT criteria are recommended by the workshop participants. The first change is to curve the trajec-

TABLE 1. Comparison of Advantages and Disadvantages of Various Field Tests for Assessment of Liquefaction Resistance

Feature	Test Type			
	SPT	CPT	$V_s$	BPT
Past measurements at liquefaction sites	Abundant	Abundant	Limited	Sparse
Type of stress-strain behavior influencing test	Partially drained, large strain	Drained, large strain	Small strain	Partially drained, large strain
Quality control and repeatability	Poor to good	Very good	Good	Poor
Detection of variability of soil deposits	Good for closely spaced tests	Very good	Fair	Fair
Soil types in which test is recommended	Nongravel	Nongravel	All	Primarily gravel
Soil sample retrieved	Yes	No	No	No
Test measures index or engineering property	Index	Index	Engineering	Index



## INTRODUCTION

Over the past 25 years a methodology termed the "simplified procedure" has evolved as a standard of practice for evaluating the liquefaction resistance of soils. Following disastrous earthquakes in Alaska and in Niigata, Japan in 1964, Seed and Idriss (1971) developed and published the basic "simplified procedure." That procedure has been modified and improved periodically since that time, primarily through landmark papers by Seed (1979), Seed and Idriss (1982), and Seed et al. (1985). In 1985, Professor Robert V. Whitman convened a workshop on behalf of the National Research Council (NRC) in which 36 experts and observers thoroughly reviewed the state-of-knowledge and the state-of-the-art for assessing liquefaction hazard. That workshop produced a report (NRC 1985) that has become a widely used standard and reference for liquefaction hazard assessment. In January 1996, T. L. Youd and I. M. Idriss convened a workshop of 20 experts to update the simplified procedure and incorporate research findings from the previous decade. This paper summarizes recommendations from that workshop (Youd and Idriss 1997).

To keep the workshop focused, the scope of the workshop was limited to procedures for evaluating liquefaction resistance of soils under level to gently sloping ground. In this context, liquefaction refers to the phenomena of seismic generation of large pore-water pressures and consequent softening of granular soils. Important postliquefaction phenomena, such as residual shear strength, soil deformation, and ground failure, were beyond the scope of the workshop.

The simplified procedure was developed from empirical evaluations of field observations and field and laboratory test data. Field evidence of liquefaction generally consisted of surficial observations of sand boils, ground fissures, or lateral spreads. Data were collected mostly from sites on level to gently sloping terrain, underlain by Holocene alluvial or fluvial sediment at shallow depths (<15 m). The original procedure was verified for, and is applicable only to, these site conditions. Similar restrictions apply to the implementation of the updated procedures recommended in this report.

Liquefaction is defined as the transformation of a granular material from a solid to a liquefied state as a consequence of increased pore-water pressure and reduced effective stress (Marcuson 1978). Increased pore-water pressure is induced by the tendency of granular materials to compact when subjected to cyclic shear deformations. The change of state occurs most readily in loose to moderately dense granular soils with poor drainage, such as silty sands or sands and gravels capped by or containing seams of impermeable sediment. As liquefaction occurs, the soil stratum softens, allowing large cyclic deformations to occur. In loose materials, the softening is also accompanied by a loss of shear strength that may lead to large shear deformations or even flow failure under moderate to high shear stresses, such as beneath a foundation or sloping ground. In moderately dense to dense materials, liquefaction leads to transient softening and increased cyclic shear strains, but a tendency to dilate during shear inhibits major strength loss and large ground deformations. A condition of cyclic mobility or cyclic liquefaction may develop following liquefaction of moderately dense granular materials. Beneath gently sloping to flat ground, liquefaction may lead to ground oscillation or lateral spread as a consequence of either flow deformation or cyclic mobility. Loose soils also compact during liquefaction and reconsolidation, leading to ground settlement. Sand boils may also erupt as excess pore water pressures dissipate.

## CYCLIC STRESS RATIO (CSR) AND CYCLIC RESISTANCE RATIO (CRR)

Calculation, or estimation, of two variables is required for evaluation of liquefaction resistance of soils: (1) the seismic

demand on a soil layer, expressed in terms of CSR; and (2) the capacity of the soil to resist liquefaction, expressed in terms of CRR. The latter variable has been termed the cyclic stress ratio or the cyclic stress ratio required to generate liquefaction, and has been given different symbols by different writers. For example, Seed and Harder (1990) used the symbol  $CSR_L$ , Youd (1993) used the symbol  $CSRL$ , and Kramer (1996) used the symbol  $CSR_L$  to denote this ratio. To reduce confusion and to better distinguish induced cyclic shear stresses from mobilized liquefaction resistance, the capacity of a soil to resist liquefaction is termed the CRR in this report. This term is recommended for engineering practice.

## EVALUATION OF CSR

Seed and Idriss (1971) formulated the following equation for calculation of the cyclic stress ratio:

$$CSR = (\tau_{av}/\sigma'_{vo}) = 0.65(a_{max}/g)(\sigma_{vo}/\sigma'_{vo})r_d \quad (1)$$

where  $a_{max}$  = peak horizontal acceleration at the ground surface generated by the earthquake (discussed later);  $g$  = acceleration of gravity;  $\sigma_{vo}$  and  $\sigma'_{vo}$  are total and effective vertical overburden stresses, respectively; and  $r_d$  = stress reduction coefficient. The latter coefficient accounts for flexibility of the soil profile. The workshop participants recommend the following minor modification to the procedure for calculation of CSR.

For routine practice and noncritical projects, the following equations may be used to estimate average values of  $r_d$  (Liao and Whitman 1986b):

$$r_d = 1.0 - 0.00765z \quad \text{for } z \leq 9.15 \text{ m} \quad (2a)$$

$$r_d = 1.174 - 0.0267z \quad \text{for } 9.15 \text{ m} < z \leq 23 \text{ m} \quad (2b)$$

where  $z$  = depth below ground surface in meters. Some investigators have suggested additional equations for estimating  $r_d$  at greater depths (Robertson and Wride 1998), but evaluation of liquefaction at these greater depths is beyond the depths where the simplified procedure is verified and where routine applications should be applied. Mean values of  $r_d$  calculated from (2) are plotted in Fig. 1, along with the mean and range of values proposed by Seed and Idriss (1971). The workshop participants agreed that for convenience in programming spreadsheets and other electronic aids, and to be consistent with past practice,  $r_d$  values determined from (2) are suitable for use in routine engineering practice. The user should understand, however, that there is considerable variability in the

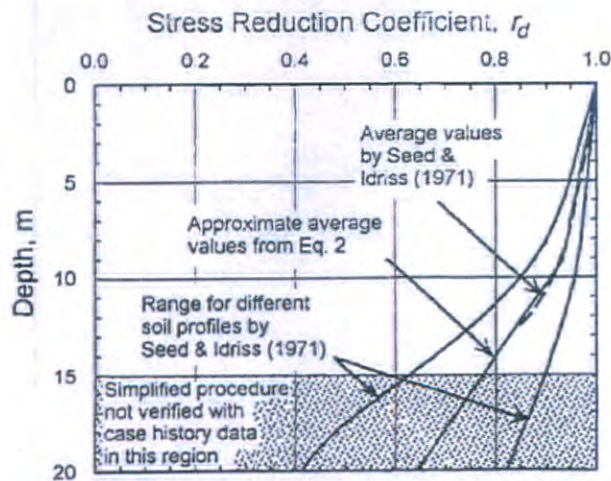


FIG. 1.  $r_d$  versus Depth Curves Developed by Seed and Idriss (1971) with Added Mean-Value Lines Plotted from Eq. (2)

## Preface

Evaluation of soil liquefaction resistance is an important aspect of geotechnical engineering practice. To update and enhance criteria that are routinely applied in practice, workshops were convened in 1996 and 1998 to gain consensus from 20 experts on updates and augmentations that should be made to standard procedures that have evolved over the past 30 years. At the outset, the goal was to develop this state-of-the-art summary of consensus recommendations. A commitment was also made to those who participated in the workshops that all would be listed as co-authors. Unfortunately, the previous publication of this summary paper (April 2001) listed only the co-chairs of the workshop, Profs. Youd and Idriss, as authors; the remaining workshop participants were acknowledged in a footnote. In order to correct this error and to fully acknowledge and credit those who significantly contributed to the work, this paper is being republished in its entirety, at the request of the journal's editors, with all the participants named as co-authors. All further reference to this paper should be to this republication. The previous publication should no longer be cited. Also, several minor errors are corrected in this republication.

### LIQUEFACTION RESISTANCE OF SOILS: SUMMARY REPORT FROM THE 1996 NCEER AND 1998 NCEER/NSF WORKSHOPS ON EVALUATION OF LIQUEFACTION RESISTANCE OF SOILS<sup>a</sup>

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**ABSTRACT:** Following disastrous earthquakes in Alaska and in Niigata, Japan in 1964, Professors H. B. Seed and I. M. Idriss developed and published a methodology termed the "simplified procedure" for evaluating liquefaction resistance of soils. This procedure has become a standard of practice throughout North America and much of the world. The methodology which is largely empirical, has evolved over years, primarily through summary papers by H. B. Seed and his colleagues. No general review or update of the procedure has occurred, however, since 1985, the time of the last major paper by Professor Seed and a report from a National Research Council workshop on liquefaction of soils. In 1996 a workshop sponsored by the National Center for Earthquake Engineering Research (NCEER) was convened by Professors T. L. Youd and I. M. Idriss with 20 experts to review developments over the previous 10 years. The purpose was to gain consensus on updates and augmentations to the simplified procedure. The following topics were reviewed and recommendations developed: (1) criteria based on standard penetration tests; (2) criteria based on cone penetration tests; (3) criteria based on shear-wave velocity measurements; (4) use of the Becker penetration test for gravelly soil; (4) magnitude scaling factors; (5) correction factors for overburden pressures and sloping ground; and (6) input values for earthquake magnitude and peak acceleration. Probabilistic and seismic energy analyses were reviewed but no recommendations were formulated.

<sup>a</sup>This Summary Report, originally published in April 2001, is being republished so that the contribution of all workshop participants as authors can be officially recognized. The original version listed only two authors, plus a list of 19 workshop participants. This was incorrect; all 21 individuals should have been identified as authors. ASCE deeply regrets the error.

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Note. Discussion open until March 1, 2002. To extend the closing date one month, a written request must be filed with the ASCE Manager of Journals. The manuscript for this paper was submitted for review and possible publication on January 18, 2000; revised November 14, 2000. This paper is part of the *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 127, No. 10, October, 2001. ©ASCE, ISSN 1090-0241/01/0010-0817-0833/\$8.00 + \$.50 per page. Paper No. 22223.

**ANNEX 4:**

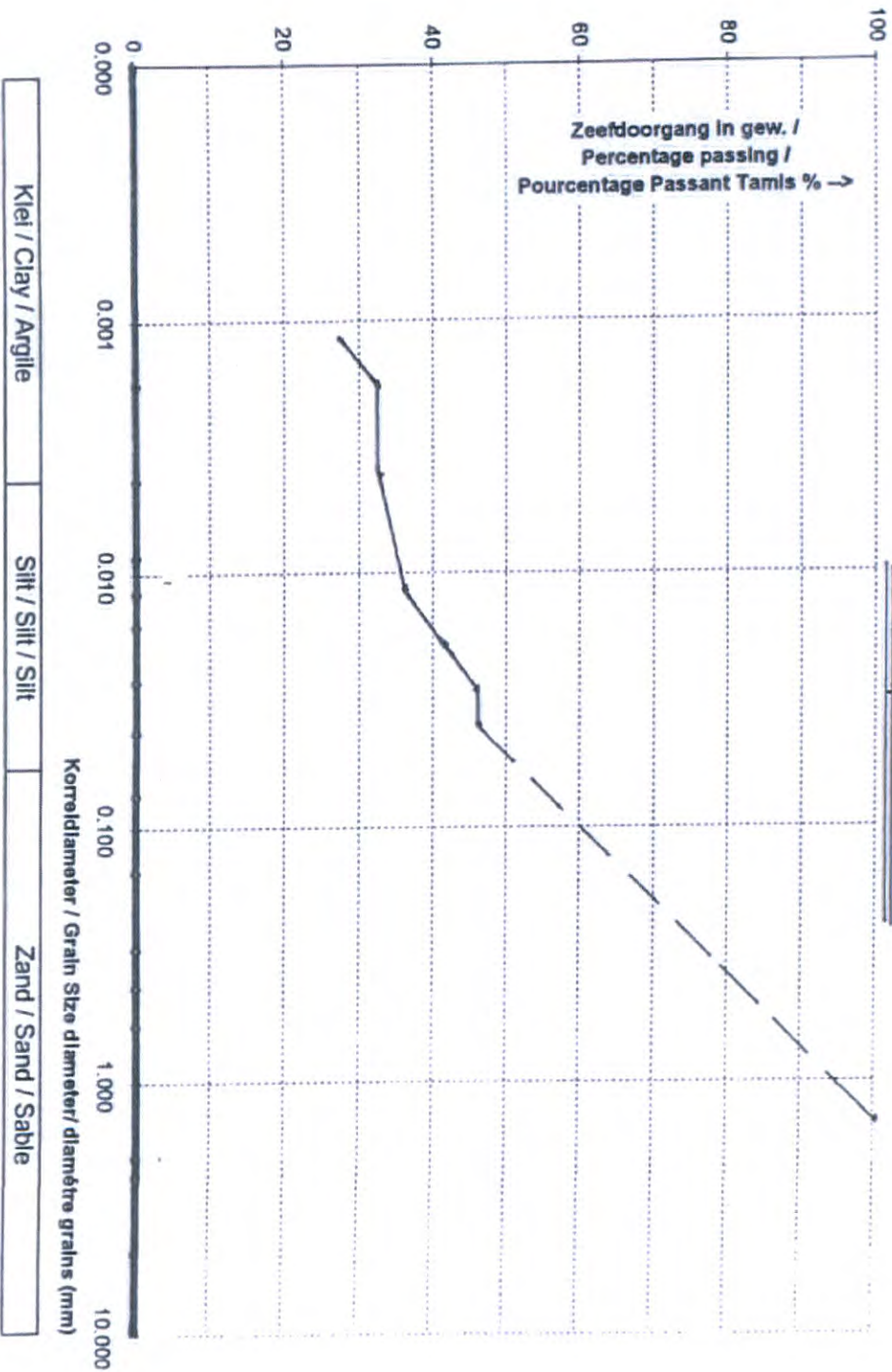
**“ Liquefaction resistance of soils: summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of Liquefaction Resistance of Soils”**



Independent Consulting Engineers N.V.  
Testing Service Department

**HYDROMETER TEST**  
(Sédimentométrie)

Sample : 3-58



Klei / Clay / Argille      Silt / Silt / Silt      Zand / Sand / Sable



Independent Consulting Engineers N.V.  
Testing Service Department

**Hydrometer Test**

ASTM D422-63

Client: Windward Roads N.V.  
Source: Waste Treatment Facility  
Sample No: 3-S8  
Material used for hydrometer test (W): 100 grams finer than 2mm  
Date Received: 31-Sept-10  
Date Test: 25-Oct-10  
Viscosity  $\eta$ : 0.01 gr/(cm s)  
Specific Gravity G: 1.981 gr/cm<sup>3</sup>  
Specific Gravity (relative density) G1: 1.000 gr/cm<sup>3</sup>  
Hydrometer type: 151H

Time of readings, T minutes	Hydrometer readings, R	Thermometer readings °C	Effective depth L cm	Results	
				D mm	P %
2	1.022	27	10.5	0.0405	44.4
5	1.022	27	10.5	0.0256	44.4
15	1.020	27	11.0	0.0151	40.4
30	1.018	27	11.5	0.0109	36.3
60	1.016	27	12.1	0.0079	32.3
250	1.016	27	12.1	0.0039	32.3
1440	1.014	27	12.6	0.0017	28.3

Sieve analysis of materials retained after washing and sieving on Sieve n° 200:

ASTM Sieves	mm	Weight grams	ind. %	cumm. %	passing %
N°: 10	2.000	0	0	0	100
30	0.600	15.2	15.2	15.2	84.8
40	0.425	21.5	21.5	36.7	63.3
50	0.300	19.4	19.4	56.1	43.9
100	0.150	15.4	15.4	71.5	28.5
200	0.075	17.2	17.2	88.7	11.3
rest		11.3	11.3	100.0	0
Total		100.0	100.0	100.0	0

Test by: Eugene Chance

website: [www.icesxm.com](http://www.icesxm.com)

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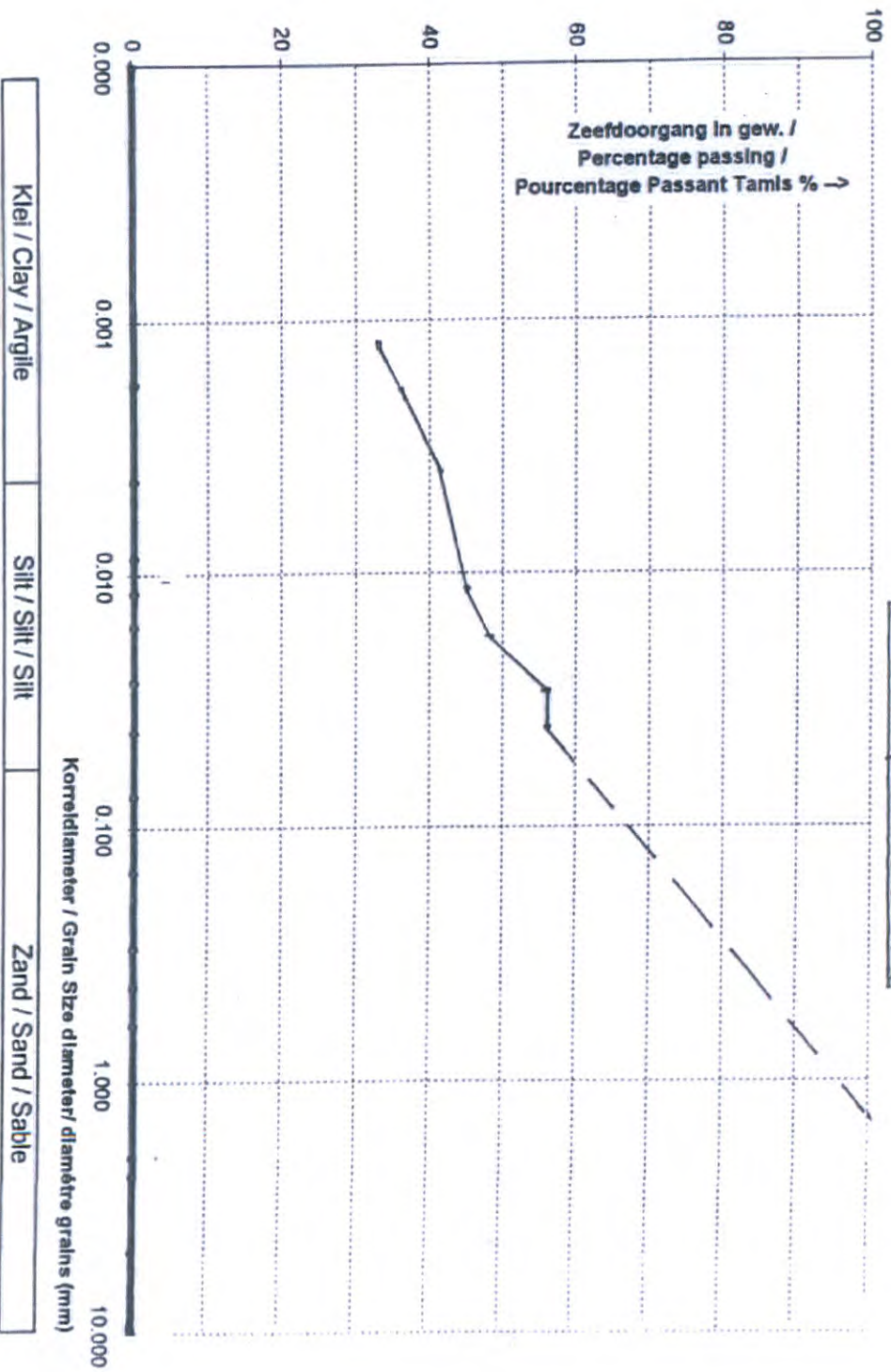
e-mail: [icesxm@sintmaarten.net](mailto:icesxm@sintmaarten.net)



Independent Consulting Engineers N.V.  
Testing Service Department

HYDROMETER TEST  
(Sédimentométrie)

Sample: 3-57



2016 CAPITAL - INVESTMENT OPERATING PROGRAMS/ PROJECTS FUNDS REQUESTS

PRODUCTS

SOURCE	Description	TOTAL	ELECTRICITY	WATER
<b>CORE BUSINESS</b>				
<b>PRODUCTION</b>				
	<b>ELECTRICITY</b>			
	Purchase Dual fuel Generator set # 20, 100 %	22,000,000.00	22,000,000.00	
	Upgrade Power Plant fire detection and protection system(pumps & tank)	750,000.00	750,000.00	
	Day Fuel storage facility "ONE CLEAN HFO TANK"	700,000.00	700,000.00	
	New HFO Separator 13, 3 m3/hr	210,000.00	210,000.00	
	Upgrade WOIS station building 1-3-4-5	500,000.00	500,000.00	
	Boiler water treatment plant	60,000.00	60,000.00	
	NEW 440 Transformer bld # 5	60,000.00	60,000.00	
	Tools & Equipment	80,000.00	80,000.00	
	<i>Sub-total</i>	<b>24,360,000.00</b>	<b>24,360,000.00</b>	
	25 % Installation 2 MW Plant of Solar panels (9,000K)	2,250,000.00	2,250,000.00	
	<i>Sub-total</i>	<b>0.00</b>		<b>0.00</b>
	<b>WATER</b>			
	Water Quality Laboratorium	0.00		0.00
	<i>Sub-total</i>	<b>0.00</b>		<b>0.00</b>
	<b>TOTAL PRODUCTION</b>	<b>26,610,000.00</b>	<b>26,610,000.00</b>	<b>0.00</b>
<b>DISTRIBUTION</b>				
	<b>ELECTRICITY</b>			
	<i>Carry Over Projects Budget years 2008 - 2015</i>			
	Misc. Projects Out standing - carry over 2008	402,716.00	402,716.00	
	Misc. Projects Out standing - carry over 2009	253,660.00	253,660.00	
	Misc. Projects Out standing - carry over 2010	396,285.00	396,285.00	
	Misc. Projects Out standing - carry over 2011	966,485.00	966,485.00	
	Misc. Projects Out standing - carry over 2012	165,535.00	165,535.00	
	Misc. Projects Out standing - carry over 2013	338,282.00	338,282.00	
	Misc. Projects Out standing - carry over 2014	1,056,172.00	1,056,172.00	
	Misc. Projects Out standing - carry over 2015	2,058,472.00	2,058,472.00	
	<i>Sub-total</i>	<b>5,637,607.00</b>	<b>5,637,607.00</b>	
	<i>2016 Planned Budget requests</i>			
	<b>- Placing of the Overhead cables underground</b>			
	St.Peters #2 ( Up to the UTS Cell cite and to the Roumous by the boarder)	800,000.00	800,000.00	
	St.Peters #3 (Marigot hill road to the South Reward water tank)	600,000.00	600,000.00	
	Mount William Hill ( road to small Pot Th and construction of 1 TH)	150,000.00	150,000.00	
	Dutch Quarter/ Garden of Eden	350,000.00	350,000.00	
	Pt. Blanche/ Merlin road	150,000.00	150,000.00	
	Cole Bay underground cabling project	400,000.00	400,000.00	
	Belvedere underground cabling project	250,000.00	250,000.00	
	High voltage Underground Cabling Ext.	500,000.00	500,000.00	
	Low voltage Underground Cabling Ext. (NRE)	1,000,000.00	1,000,000.00	
	Reloc.Trsf. Soskin Bld.-GEBE Pl.	50,000.00	50,000.00	
	Experiment Estate Hope estate	90,000.00	90,000.00	
	LT Saunders/Sunflower rd	100,000.00	100,000.00	
	LT upgrade Amaranthus rd Saunders	100,000.00	100,000.00	
	Mass meter sealing 2	200,000.00	200,000.00	
	Cables to French border	175,000.00	175,000.00	
	Mullet bay substation (2,700K)	500,000.00	500,000.00	
	Cupe Coy cables	450,000.00	450,000.00	
	Install 2 x(240) circuit Pond Island Sub to Pt.Blanche ( 2.7 Km)	2,000,000.00	2,000,000.00	
	<i>Sub-total</i>	<b>7,865,000.00</b>	<b>7,865,000.00</b>	
	<b>Streetlights</b>			
	Various Streetlights	800,000.00	800,000.00	
	<i>Sub-total</i>	<b>800,000.00</b>	<b>800,000.00</b>	

2016 CAPITAL - INVESTMENT OPERATING PROGRAMS/ PROJECTS FUNDS REQUESTS

PRODUCTS

SOURCE	Description	TOTAL	ELECTRICITY	WATER
	<b>Smart Grid program</b>			
	Dispatch/Customer service	100,000.00	100,000.00	
	System intergration AMI to SAP ( WA+EL+SCADA+GIS)	550,000.00	550,000.00	
	Replacement Electra Consumption meters	1,000,000.00	1,000,000.00	
	Electrical Grid + Water Loss management system	50,000.00	50,000.00	
	Fiber project Beacon Hill	1,500,000.00	1,500,000.00	
	<i>Sub-total</i>	<b>3,200,000.00</b>	<b>3,200,000.00</b>	
	<b>Monitoring of Electrical Grid</b>			
	Fiber Project- Instrumentation/data acausition of Substation houses	300,000.00	300,000.00	
	Fiber project- Instrumentation/data acausition of electrical work	50,000.00	50,000.00	
	SCADA - Micro	50,000.00	50,000.00	
	GIS System	700,000.00	700,000.00	
	<i>Sub-total</i>	<b>1,100,000.00</b>	<b>1,100,000.00</b>	
	<b>Equipment &amp; Tools</b>			
	Workshop Tools & Misc. Equipment	140,000.00	140,000.00	
	Drawing room equipment	60,000.00	60,000.00	
	<i>Sub-total</i>	<b>200,000.00</b>	<b>200,000.00</b>	<b>0.00</b>
	<b>TOTAL DISTRIBUTION - ELECTRICITY</b>	<b>18,802,607.00</b>	<b>18,802,607.00</b>	<b>0.00</b>
	<b>WATER</b>			
	<b>Carry Over Projects Budget years 2011 - 2015</b>			
	Misc. Projects Out standing - carry over 2011	148,400.00		148,400.00
	Misc. Projects Out standing - carry over 2012	1,319,478.00		1,319,478.00
	Misc. Projects Out standing - carry over 2013	312,945.00		312,945.00
	Misc. Projects Out standing - carry over 2014	3,378,607.00		3,378,607.00
	Misc. Projects Out standing - carry over 2015	2,005,217.00		2,005,217.00
	<i>Sub-total</i>	<b>7,164,647.00</b>		<b>7,164,647.00</b>
	<b>Non Revenue Water Loss program</b>			
	Instrumentation of primary + secondary lines	560,000.00		560,000.00
	Bulk Meter installation	340,000.00		340,000.00
	Upgrade water work (repetitive leaking lines)	500,000.00		500,000.00
	<i>Sub-total</i>	<b>1,400,000.00</b>		<b>1,400,000.00</b>
	<b>Filling Lines</b>			
	Replacement of filling line Point blanc	300,000.00		300,000.00
	St.Peters #3 (South Reward water tank to Concordia Tank)	600,000.00		600,000.00
	Mount William Hill ( road to small Pot Th)	150,000.00		150,000.00
	Dutch Quarter/ Garden of Eden	350,000.00		350,000.00
	Land & preparations new tank park Defiance	500,000.00		500,000.00
	Replacement of filling line Pelican tank	250,000.00		250,000.00
	<i>Sub-total</i>	<b>2,150,000.00</b>		<b>2,150,000.00</b>



2016		CAPITAL - INVESTMENT OPERATING PROGRAMS/ PROJECTS FUNDS REQUESTS		PRODUCTS	
SOURCE	Description	TOTAL	ELECTRICITY	WATER	
	<b>Water Main Grid</b>				
	Point Blanche 12" Main line	1,500,000.00		1,500,000.00	
	Cole Bay 8" mainline	750,000.00		750,000.00	
	Big Betsy Pump station	100,000.00		100,000.00	
	<b>Sub-total</b>	<b>2,350,000.00</b>		<b>2,350,000.00</b>	
	<b>Equipment &amp; Tools</b>				
	Instrumentation/data acquisition of pump houses	30,000.00		30,000.00	
	<b>Sub-total</b>	<b>30,000.00</b>		<b>30,000.00</b>	
	<b>TOTAL DISTRIBUTION - WATER</b>	<b>13,094,647.00</b>		<b>13,094,647.00</b>	
	<b>TOTAL DISTRIBUTION</b>	<b>31,897,254.00</b>	<b>18,802,607.00</b>	<b>13,094,647.00</b>	
<b>SERVICES</b>					
<b>ICT &amp; AUTOMATION</b>	Carry over SAP - Assessments & SAP - Upgrades	2,640,000.00	2,640,000.00		
	Misc. other Application upgrades	340,000.00	340,000.00		
	Misc. Equipment upgrades & replacements	590,000.00	590,000.00		
	<b>Sub-total ICT departmental</b>	<b>3,570,000.00</b>	<b>3,570,000.00</b>	<b>0.00</b>	
	PROD- ICT Replace and Upgrade Equipment (incl. CCTV) , Software & Licenses	60,000.00	60,000.00		
	DISTR- ICT Replace and Upgrade Equipment, Software & Licenses	580,000.00	580,000.00		
	CCS- ICT Replace/Upgrade Equip, Mass Billing - Printing & folding	60,000.00	60,000.00		
	FICO- ICT Replace and Upgrade Equipment, Software & Licenses	740,000.00	740,000.00		
	IAD- ICT Replace and Upgrade Equipment, Software & Licenses	130,000.00	130,000.00		
	HRM- ICT Replace and Upgrade Equipment, Software & Licenses	140,000.00	140,000.00		
	WQL- ICT Replace and Upgrade Equipment, Software	60,000.00	60,000.00		
	<b>Sub-total ICT Services</b>	<b>1,770,000.00</b>	<b>1,770,000.00</b>	<b>0.00</b>	
	<b>TOTAL ICT &amp; AUTOMATION</b>	<b>5,340,000.00</b>	<b>5,340,000.00</b>	<b>0.00</b>	
<b>GENERAL AFFAIRS</b>					
	<b>Vehicles</b>				
	Prod. 2x Vehicles (Mgr & Maint.)	110,000.00	110,000.00		
	Distr. 1x Van - Electra execution	65,000.00	65,000.00		
	Distr. 2x Suzuki Jeep - ETD planning	100,000.00	100,000.00		
	Distr. 1x pick-up - Bus. Impr.	50,000.00	50,000.00		
	Distr. 1x Suzuki Jeep - Metering Infrastructure	50,000.00	50,000.00		
	Distr. 2x Pick up - Metering Infrastructure	80,000.00	80,000.00		
	Distr. 2x Pick up - Water Execution	80,000.00		80,000.00	
	Gar. 1x Pick-up	50,000.00	50,000.00		
	Comm. 1x Nissan Jeep	50,000.00	50,000.00		
	<b>SubTotal TRANSPORT</b>	<b>635,000.00</b>	<b>555,000.00</b>	<b>80,000.00</b>	
	<b>Facilities</b>				
	20% v Hope est. Buildings; Housing all facilities (6030k) & WQLab (1115k)	1,430,000.00	1,430,000.00		
	Commercial dept.	480,000.00	480,000.00		
	Warehouse PP & Cable yard	145,000.00	145,000.00		
	EHS - dept.	47,000.00	47,000.00		
	HRM - dept.	10,000.00	10,000.00		
	WQL - dept.	10,000.00		10,000.00	
	Gar. Dept. Misc. Equipment & tools	50,000.00	50,000.00		
	<b>SubTotal FACILITIES</b>	<b>2,172,000.00</b>	<b>2,162,000.00</b>	<b>10,000.00</b>	
	<b>E. H. Safety &amp; Security</b>				
	Automated Fire Suppression system Substations Server rooms	160,000.00	160,000.00		
	<b>SubTotal E. H. SAFETY &amp; SECURITY</b>	<b>160,000.00</b>	<b>160,000.00</b>	<b>0.00</b>	
	<b>TOTAL GENERAL AFFAIRS</b>	<b>2,967,000.00</b>	<b>2,877,000.00</b>	<b>90,000.00</b>	
<b>GEN. MANAGEMENT</b>					
	Purchase Property H.G & Canneg. & Doncher	3,020,000.00	3,020,000.00		
	<b>TOTAL GEN. MANAGEMENT</b>	<b>3,020,000.00</b>	<b>3,020,000.00</b>	<b>0.00</b>	
<b>GRAND TOTAL</b>	<b>CAPITAL INVESTMENTS REQUESTS OPERATIONS GEBE NV 2016</b>	<b>69,834,254.00</b>	<b>56,649,607.00</b>	<b>13,184,647.00</b>	

NV Gebe

2016 CAPITAL - INVESTMENT OPERATING PROGRAMS/ PROJECTS FUNDS REQUESTS

PRODUCTS

SOURCE	Description	TOTAL	ELECTRICITY	WATER
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2016 SUMMARY

TOTAL CAPITAL INVESTMENT 2016 GEBE NV		Amounts in Ang
Total Production Investments Electricity co. Sxm		26,610,000.00
Total Distribution Investments Electricity co. Sxm		18,802,607.00
Total Distribution Investments Water co. Sxm		13,094,647.00
Total Transportation Investments Water co. Sxm		80,000.00
Total Transportation Investments Gebe NV - Sxm		555,000.00
Total MGNT & Gen. Admin. & Support Gebe NV Sxm		10,682,000.00
Total Gen. Admin. & Support Water ops Sxm		10,000.00
<b>Total Capital Investment GEBE NV</b>		<b>69,834,254.00</b>

## APPENDIX A

### GENERAL SUBSIDY ORDINANCE

Island Territory St. Maarten  
Netherlands Antilles

AB 1998                      Number 34

Official Publication of the Island Territory of St. Maarten

Island Ordinance of December 7<sup>th</sup>, 1998, containing general conditions for subsidies granted by the Government of the Island Territory of St. Maarten (General Subsidies' Ordinance)

Considering the Island Regulation of the Netherlands Antilles;

#### RESOLUTION:

Establish the following Island Ordinance, containing general conditions for subsidies granted by the Government of the Island Territory of St. Maarten:

#### Article 1

##### Definitions

In this ordinance the following definitions apply:

- a. island territory: the Island Territory of St. Maarten;
- b. sub-ordinance: an ordinance as referred to in article 3, section one;
- c. institution: a natural or legal entity, including an independent department of a legal entity, which will or has presented a request for subsidy, or which has been granted a subsidy;
- d. annual program: the written program of an institution, to be determined annually, indicating the activities planned for that year and the means for covering such;
- e. subsidy: financial support from the island territory, other than investments' contributions, loans, membership fees, for executing the activities indicated in the annual program;
- f. subsidy year: the calendar year;
- g. activities: anything geared towards the achievement of the objectives of the institution;
- h. annual report: a report of the institution concerning the execution of its annual program.

## Article 2

### Scope of Application

1. This ordinance applies to all petitions for subsidies to institutions deploying activities or planning to deploy activities pertaining to functions in the budget of the island territory.
2. The Island Council may determine that this ordinance also applies to other cases.

## Article 3

### Sub-ordinances and periodic evaluations

1. The Island Council may establish separate sub-ordinances pertaining to the requirements for institutions to be considered for subsidies, and also pertaining to the basis and way of calculating subsidies.
2. As far as such sub-ordinances deviates from this ordinance, the sub-ordinance prevails, however, article 6 may not be deviated from.
3. The Executive Council determines once every four years whether or not this ordinance or these sub-ordinances should be reviewed.
4. Section three does not apply to sub-ordinances or restricted duration.

## Article 4

### General requirements and other requirements

- 1. In order to be granted subsidies, institutions should meet the requirement established by this ordinance or sub-ordinances.**
- 2. In any the case the requirements as per section one include:**
  - a. the institution should sufficiently insure its movable and immovable goods against fire and other perils; and**
  - b. the institution is obliged to take a third-party insurance for its members, employees, volunteers, and participants.**

## Article 5

### Dispensations and other requirements

1. The Executive Council may grant an institution dispensation from the requirements of this ordinance or these sub-ordinances. No dispensations are granted for requirements resulting from the subsidy basis, or which pertain to the objectives for granting subsidies.
2. The Executive Council may issue additional requirements to institutions or replace the ones of this ordinance or these sub-ordinances.
3. Should section two of this ordinance be applied, then the Executive Council informs this to the Island Council.

Article 6  
Maximum Subsidy

An institution is only entitled to subsidies resulting from the amount approved by the island budget.

Article 7  
Prevention of concurrence of subsidies

Pertaining to similar activities of an institution only sub-ordinances apply.

Article 8  
Requirements pertaining to the institution

1. An institution should be a legal entity.
2. An institution, which wishes to be considered for annual subsidies, should be incorporated by notarial deed and registered at the public registry, recorded at the Chamber of Commerce and Trade.
3. Modifications of the statutes, organization or operation of the institution, or change of management of the institutions should immediately be notified in writing to the Executive Council.
4. Management of any institution should include those working at the institution as well as those utilizing its services, unless otherwise represented at the institutions.
5. The objectives or operation of any institution should not be contrary to the law or general interest.
6. Institutions are non-profit organizations.

Article 9  
Employees

Subject to the stipulations of article 14 section four, the number and positions of employees at any institution are determined by the Executive Council should subsidy explicitly be based upon the cost of personnel.

**Article 10**  
**Type of Subsidies**

**Subsidies granted annually or occasionally are based upon, personnel expenses, accommodation, administration, or expenses for activities, after partly or full deduction of the structural revenues of the institution.**

**Article 11**  
**Request for annual subsidy**

**The request for an annual subsidy must be submitted in writing to the Executive Council by March 1<sup>st</sup> of the year preceding that for which the subsidy is being requested.**

Article 12  
Requests for incidental subsidy

The request for incidental subsidy must be submitted in writing to the Executive Council at least two months before the commencement of the activity for which the subsidy is being requested.

Article 13  
Documents to submit together with the request for subsidy

1. At the time of submission of the request for an annual subsidy, the following documents must be submitted:
  - a. An annual program and a budget for the year in question;
  - b. An overview of the activities, which the institute has planned for the coming years and the amounts intended for personnel and material use, this in as far as these differ from the previous years;
  - c. The data necessary for the calculation of the amount of the subsidy and a list with the wishes connected to the above, with regard to the subsidy.
2. When submitting a request for incidental subsidy, the following documents must also be submitted:
  - a. A budget;
  - b. A list of the purpose and the sort of activities for which the subsidy is being requested and;
  - c. Data necessary for the calculation of the subsidy.
3. The institution must show to the satisfaction of the Executive Council that it fulfills the criteria to qualify for the subsidy.

Article 14  
Decision

1. The Executive Council decides within 2 months after receipt of the request for subsidy on that request, if, at least at the time, the island budget for the relevant year has been established.
2. In other cases the Executive Council will decide on the request for a subsidy within two months after the establishment of the relevant budget.
3. The Executive Council may, in cases depicted in sub 1 and 2, decide to extend the term for the awarding of subsidy, by two months, by motivated decision. It

informs the institution of its decision in writing, before the termination of the term mentioned in sub one.

4. The Executive Council may attach guidelines to granting of the subsidy.

#### Article 15

##### Advancement of the subsidy

1. As rule, the Executive Council will make the subsidy payable in the form of advance;
2. It decides the amount of the advance and the terms of payment. As rule, the advance is made payable up to a maximum of 90% of the amount of the subsidy granted. In cases of annual subsidies, the advance is made payable in 12 monthly terms, unless the institution can show that another payment schedule should be followed based on its liquidity budget. In such a case, the Executive Council may deviate from the rule of paying in installments.

#### Article 16

##### Reports in cases of annual subsidy

1. The institution which receives annual subsidy will submit to the Executive Council before March 1<sup>st</sup> of the year following that for which subsidy has been received, a report, based on the actual figures, outlining which activities were performed by the institution and up to what extent the purpose for which the subsidy was granted has been achieved.
2. **Before June 1<sup>st</sup> of the year following that for which subsidies were received, the institution concerned will submit to the Executive Council an annual report and an financial report.**
3. **The institutions with an annual subsidy of Naf. 25,000 or more, will also submit an unconditionally approved declaration from a certified public accountant or a registered accountant with regard to the conditions set by this federal ordinance or ordinances derived from it, or the guidelines attached to the subsidy.**

#### Article 17

##### Reports of incidental subsidy

The institution, which has been granted incidental subsidy, will submit to the Executive Council, within three months after the activity for which subsidy was received, a report based on figures, of said activity and the manner in which the subsidy was spent.

#### Article 18

##### Settlement

1. The Executive Council definitely establishes the subsidy within four months after receipt of the documentation meant in article 16, second paragraph or article 17.

2. The Executive Council may extend the term meant in the first paragraph with two months in a motivated decision.
3. If the institution did not or did not sufficiently realize its program or did not or not sufficiently follow the conditions set forth therein, the Executive Council may definitely establish the subsidy at a lower amount or it may retract the decision to grant the subsidy.
4. Article 22, second and fourth paragraph are applicable accordingly to the decision to decrease in the amount of an initially granted subsidy or to retract a decision to grant subsidy.
5. If the definitive subsidy differs from the amount of the advanced subsidy, the balance will be settled within a month after the definitive establishment of the amount of the subsidy.

#### Article 19

##### Own Capital and reserves

1. The Executive Council, when granting subsidy, decreases the amount of said subsidy by the amount of the institutions' own capital and its financial reserves, in as far as the sum of the own capital and the financial reserves amount to more than 25% of the operation expenses for the year relevant to the subsidy.
2. The Executive Council may allow the maximum mentioned in the first paragraph to be exceeded. It may attach guidelines and limitations to its decision.
3. The Island Council will be advised by the Executive Council of any decision as meant in paragraph 2.

#### Article 20

##### Information

1. The institution, which submitted the request or who is granted a subsidy will submit to the Executive Council or to the civil servant appointed by said Council, upon the first request, all information, which may be necessary for a responsible judgment of the request for subsidy or the activities carried out by the institution and purpose given to the subsidy.
2. The institution also cooperates with investigations started by or on behalf of the Executive Council, which are geared to obtaining information for the policy of the Island Government.
3. If necessary, the institution will provide access to the books and the administration at the place and in the manner requested and it will provide access for the Executive Council, or the civil servants appointed by said body, to all locations falling under its management, in as far as homes are concerned here, only in as far as the institution has the right to do such.

#### Article 21

##### Management and Administration



1. The administration of an institution must be organized and kept in such a manner that it reflects at all times a true and insightful picture of the activities, which were undertaken and of the financial situation of said institution.
2. All income and expenses of the institution must be acceptable and cash receipts must indicate the nature of the acquired goods and services.
3. The financial year of the institution is the same as a calendar year.
4. It is the responsibility of the institution to maintain a clearly structured administration of the data necessary for establishing whether or not the institution fulfills the criteria to which it is subjected and in order to calculate the subsidy.

#### Article 22

##### Termination of the subsidy

1. The Executive Council will retract a decision to subsidize if it is clear that:
  - a. The institution does not or does no longer fulfill the conditions by which, by virtue of this ordinance or the relevant by-laws, it would be eligible for subsidy, in as far as it was not exempted from said conditions;
  - b. The institution has knowingly, or otherwise, provided reproachable incorrect or incomplete information, which, had they been known at the time the request for subsidy was being considered, would have led to a rejection of the requested subsidy or a lower amount of subsidy;
  - c. The financial management or the administration of the institution does not comply with reasonable requirements and the institution neglects to rigorously follow the relevant guidelines given by or on behalf of the Executive Council.
  - d. The institution is terminated or if its purpose changes, or if the activities resulting from its purpose are reduced, unless it has received written permission to do so from the Executive Council.
2. Before the Executive Council decides to retract a subsidy, the institution will be granted the opportunity to be heard by or on behalf of the Executive Council.
3. A decision to grant subsidy becomes legally null and void as soon as the institution is put in a state of bankruptcy.
4. The Executive Council informs the institution by means of a registered letter of the retraction or expiration of a decision to grant subsidy.

#### Article 23

##### Duty to inform

The institution will inform the Executive Council immediately and in writing of any circumstance, which may lead to the retraction of the subsidy or which can lead to the expiration of the subsidy.

#### Article 24

### Consequences of the termination of the subsidy

1. If a decision to grant a subsidy in accordance with article 18, third paragraph or is retracted or has expired, then the institution, which received the subsidy or one or more cash advances on the subsidy, owes the Island Territory an amount to be determined by the Executive Council as compensation.
2. When calculating the amount of this subsidy, the total amount of the compensation received by the institution is considered as well as the amount with regard other income of the institution and eventual changes in the value of the separate assets since the time they were acquired.
3. The compensation will be paid within the time frame and in the manner indicated by the Executive Council.

### Article 25

#### Legal protection

1. The institution may submit a written protest by the Executive Council against a decision taken on the grounds of this ordinance or part thereof.
2. By decision is understood: a written decision of the Executive Council containing a legal action of public law, which is not of a general nature.
3. The refusal to make a decision is seen as being equal to taking a decision. When according to this ordinance or part-ordinance hereof, the time to take a decision has passed without a decision being made, then such is to be seen as a refusal to take a decision.
4. The written objection is submitted within six weeks after the date of the decision or of the given notice of said decision, or within 6 weeks of the date on which the decision is valid as a refusal or a rejection.
5. The Executive Council will decide on the written objection does not have a suspending action.

### Article 26

#### Transition stipulations

1. With regard to the definitive establishment and the settlement of the insular subsidies over the year 1998 and the preceding subsidy years articles 18,19, 20 and 22, first paragraph, beginning and sections b up to an including d, and the second section, and articles 23 up to and including article 25, are applicable.
2. In deviation of article 25, fourth paragraph, if it concerns a decision regarding a subject, for which guidelines are provided by this ordinance and which was made within the period of three months immediately preceding the validation date of this ordinance, a written objection may be lodged within six weeks after validation of this ordinance.
3. In deviation of article 11, the request for annual subsidy for the year 1999 must be submitted before May 1<sup>st</sup> of 1999.

Article 27  
Retraction

The Island Ordinance regulating the awarding of subsidies to institutions, established on May 26<sup>th</sup> 1995, is hereby retracted.

Article 28  
Validation

This island ordinance is valid from the date that it is publicly announced.

Article 29  
Referral

This ordinance will be referred to as: the general subsidy ordinance.

Thus, established in the meeting of December 7<sup>th</sup> 1998

The Secretary  
A.O. Muller

The Chairman  
M.S. Voges

This island ordinance was publicly announced on this 28<sup>th</sup> day of December 1998.  
The Lt. Governor: M.S. Voges

English Version Translator  
Cheryl Labega



Critical vacancy for Brandweer

<b>FUNCTIE</b>	<b>AANTAL VACATURES</b>	<b>AFDELING/DIENST</b>
Medewerker PPO	1	Brandweer
<b>Totaal</b>	<b>1 FTE</b>	

<b>Afdeling</b>	<b>Vacante fte</b>
<b>P&amp;O</b>	
Bedrijfsmaatschappelijk Werker	1 fte
Personelsadviseur	2 fte
Personeelsmedewerker	1 fte
<b>JZ&amp;W</b>	
Beleidsmedewerker	1 fte
Senior Wetgevingsjurist	1 fte

Stafbureau

	<b>Formatieplan</b>	<b>Schaal</b>
Beleidsadviseur	ja	13

Ministerie van Algemene Zaken: DIV

<b>Dienst</b>	<b>Kritieke vacature</b>	<b>Vacante fte</b>
<b>DIV</b>		
Applicatiebeheerder	1 fte	1 fte

