



INTERNATIONAL WATER RESOURCES ASSOCIATION'S  
1<sup>st</sup> ISLANDS WATER CONGRESS  
FAROE ISLANDS - SEPTEMBER 4-6, 2024

# NATURE-BASED WASTEWATER MANAGEMENT : A REGIONAL APPROACH CARIBSAN



**Interreg**  
Caraïbes  
Fonds européen de développement régional



HIELARD Gaëlle

Martinique Water Office

Thursday 5 September 2024



Martinica is,  
 a Caribbean  
 basin,  
 a French  
 overseas island  
 on the  
 Americas.



- Population : **349 925** (2024)
- Geography : 1128km<sup>2</sup>, Fort-De-France, Moutain Pelée (volcano / UNESCO world heritage site)
- Climatic & natural characteristics : tropical zone, earthquake, storms, rainfall, biodiversity, etc...

# CARIBSAN : from research in Martinica & Guadeloupe

EXPERIMENTATION Successful in Martinica & Guadeloupe

- ATTENTIVE **research project** (5 years / consortium of researchers & actors)
- **Wastewater treatment using wetlands developed and adapted to tropical conditions**
- Search for ideal local plant  
Technics adapted to the tropical and island context
- Testing the full-scale technique



Watch the video  
With Michéla ADIN,  
The Office of water of Martinique  
ODE 's Manager





## CARIBSAN : the Martinica's experiment

Currently,

- Routine operation of several treatment units (collective treatment plants of 600 to 2000 population equivalent)
- Some experiments on autonomous sanitation : remains to be developed
- Under test : industrial effluents experiment on JM rum distillery



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# Planted filters in Martinica

## Lotissement les Bords de l'Etang (2020)

Location: Saint-Joseph  
Capacity: 544 EH  
Effluent type: Domestic



Watch the video  
With Pascal MOLLE,  
the CARIBSAN Searcher, expert  
on water traitement with  
wetland for INRAE



CARIBSAN

# CARIBSAN : Treatment wetland technologies

a technical guide  
→ website CARIBSAN

An engineered wetland system designed to harness natural process for the purpose of improving water quality

Under tropical climate

Technically and operationally simple, but involving complex interactions between **Water**, **Soil**, **Plants**, **Micro-organisms**, and the atmosphere.



CARIBSAN





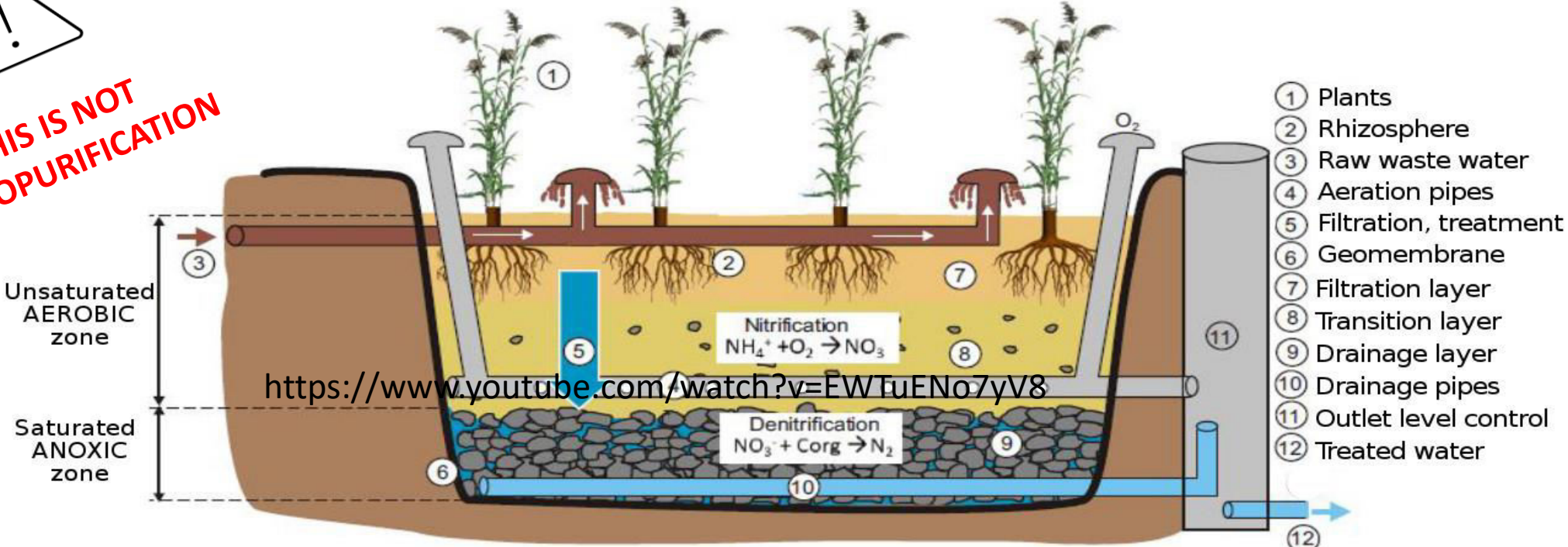
# CARIBSAN : Nature-based technology



**THIS IS NOT  
PHYTOPURIFICATION**



CARIBSAN



- ① Plants
- ② Rhizosphere
- ③ Raw waste water
- ④ Aeration pipes
- ⑤ Filtration, treatment
- ⑥ Geomembrane
- ⑦ Filtration layer
- ⑧ Transition layer
- ⑨ Drainage layer
- ⑩ Drainage pipes
- ⑪ Outlet level control
- ⑫ Treated water

planted filter station built with unsaturated/saturated vertical flow  
 → 0.8 m<sup>2</sup>/per EqHab



gravel

**filter layer: 40 cm 2/4 mm**  
**layer: 15 cm 11/22 mm gravel, aeration pipes (0.25 lm/m<sup>2</sup>)**  
**layer: 40 – 60 cm 20/40 mm**



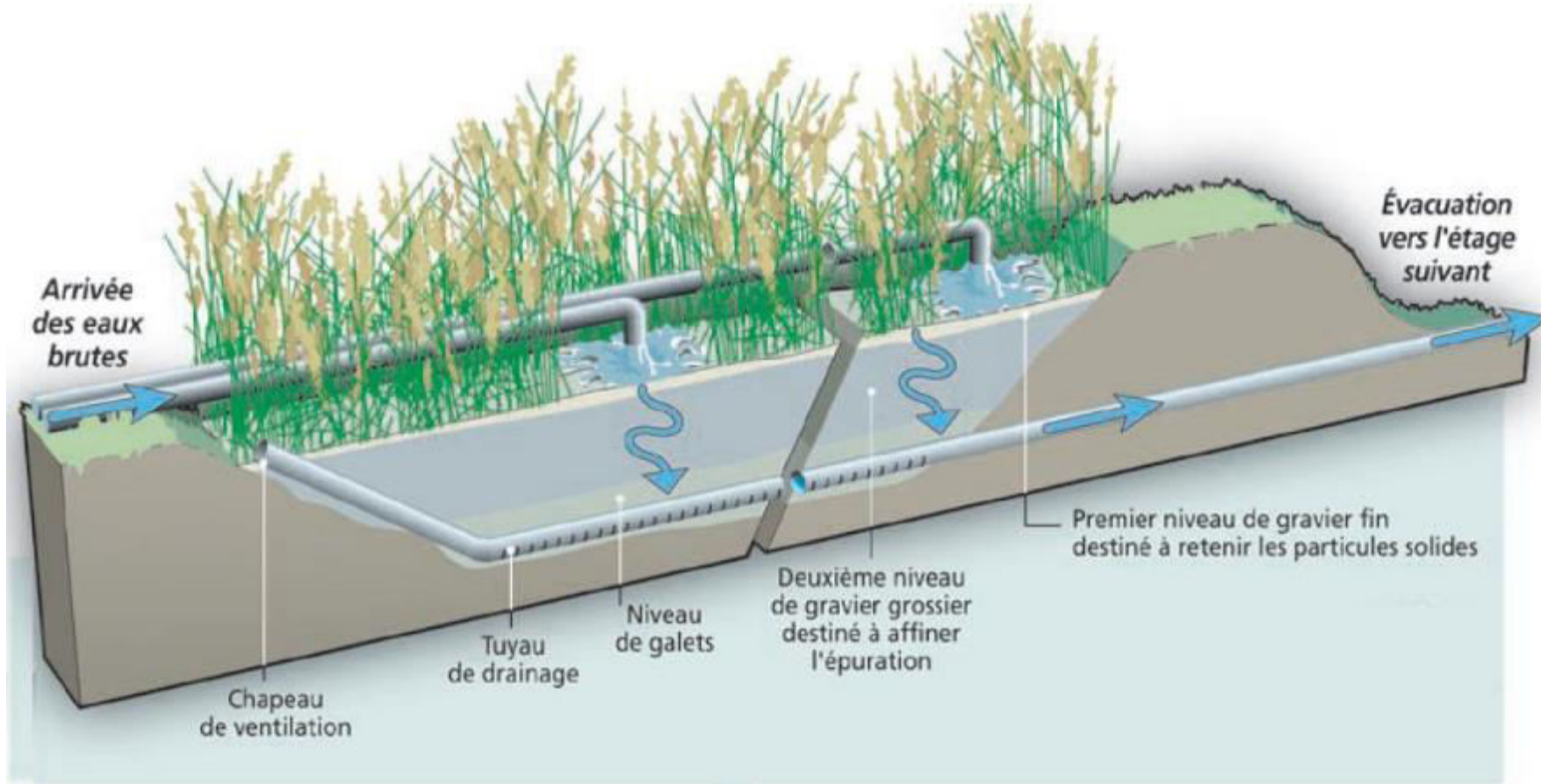
# Planted filters



CARIBSAN

[Watch the video](#)

Une zone humide artificielle ?



the PLANT  
A mechanical role  $\neq$  phytodepuration

### Nutrient export

**20 à 200 gN/m<sup>2</sup>/an**  $\longrightarrow$

**– 3 à 15 gP/m<sup>2</sup>/an**  $\longrightarrow$

Discharge of 1 inhabitant  
10 gN/jour  
2 gP/jour





# Which species ?



Heliconia psitacorum  
*oiseau du paradis*



Brachiaria decumbens



Cyperus involucratus



Costus speciosus



Cyperus Alternifolius



1st FLOOR : gravels and sand



2nd floor - bacterial bed





## Taupinière



# PLANTED FILTERS FOR TREATMENT OF WASTE WATER

## ADVANTAGES

**Robustness**

**Ecological**

**Climate Resilience**

**Modularity (+ modules)**

**Simple maintenance and operation**

**Economical operation**

**Efficient :**

High pollution treatment rate (> 95%)

**Esthetic** (field of flowers / Biodiversity)

Integrates the landscape → **High social acceptability**



CARIBSAN

## CARIBSAN : a shared Caribbean context

- Natural resources: biodiversity conservation, sensitive ecosystems, etc.
- Economic activities : tourism, fishing, etc.
- Urbanization of coastal areas
- Health problems

- Lack of infrastructure
- Inappropriate means
- Topography (mountains, lagoon, etc.)
- Earthquakes, storms (increased by climate change)

DEFECTIVE  
SANITATION

Issues

Natural  
constraints



Watch the video  
With Ignatius JEAN  
CARIBSAN Technical  
coordinator for CAWASA,

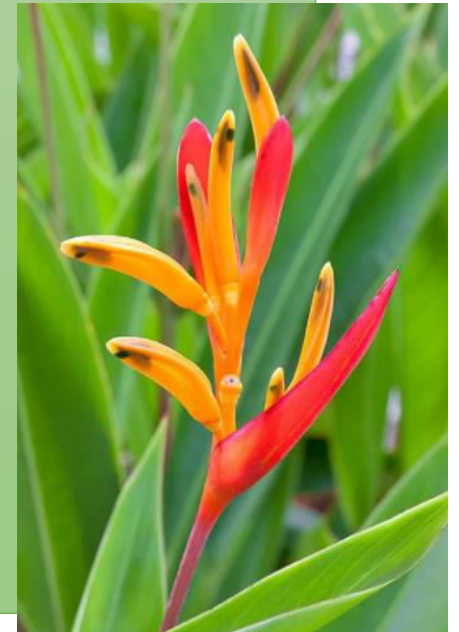




## CARIBSAN : an ambition

### **A cooperation project that offers a SOLUTION**

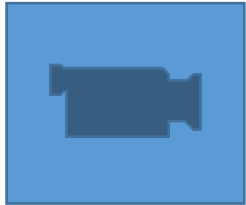
- **Nature-based**
- **Already tested and approved (in Martinique and Guadeloupe)**
- **Suitable for island tropical territories**
- **Rustic and innovative at the same time**
- **Less expensive for smaller communities**
- **Resilient to natural hazards (climate-resilient)**



CARIBSAN

# CARIBSAN : Reducing the impact of wastewater

## An environmental and health emergency in the Caribbean



Water stakeholders from  
Cuba, Dominica, St Lucia, Guadeloupe  
Martinique unite and create CARIBSAN.

Watch the video  
with  
Magnus WILLIAMS,  
the dominican  
CARIBSAN manager





## CARIBSAN : OBJECTIVE

- **Promote constructed wetlands for wastewater treatment**
- **Disseminate knowledge on this technique**
- **COOPERATE in Caribbean**

### 3 goals

- **studies** for the identification of implantation sites and plant species
- **training** of Caribbean sanitation actors on planted filters
- **dissemination** of results in the Caribbean



### **INTERREG Programme (European Union)**

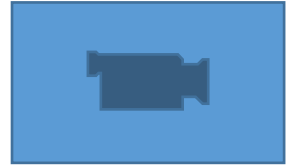
- **Axis 5** : Natural and Cultural Environment
- **Objective 7** : Protect and enhance the Caribbean natural heritage through the implementation of joint strategies and tools



**United Nations Development Programme  
Sustainable Development Goal 6 "Clean water and sanitation for all" by  
2030**



# CARIBSAN : A COMPLEX PROJECT



- Piloting : ODE Martinique
- 5 Caribbean territories
- 10 partners, 3 languages, 30 engineers

Watch the video  
With Amaury, the  
CARIBSAN Cuban  
manager



Partenaires techniques



Partenaires  
techniques  
et financiers



Partenaires  
financiers

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# CARIBSAN : the course

**JANUARY 2022 : MISSION / Technical team meetings to Dominica & St Lucia → proposed construction sites / Communication plan**



Watch the VIDEO  
With Bernard  
ETINOFFE,  
DOWASCO  
manager



CARIBSAN



# CARIBSAN : the course

## STEERING COMITEE #2 from St LUCIA / CAWASA

From CUBA,  
INRH



From St Lucia,  
WASCO

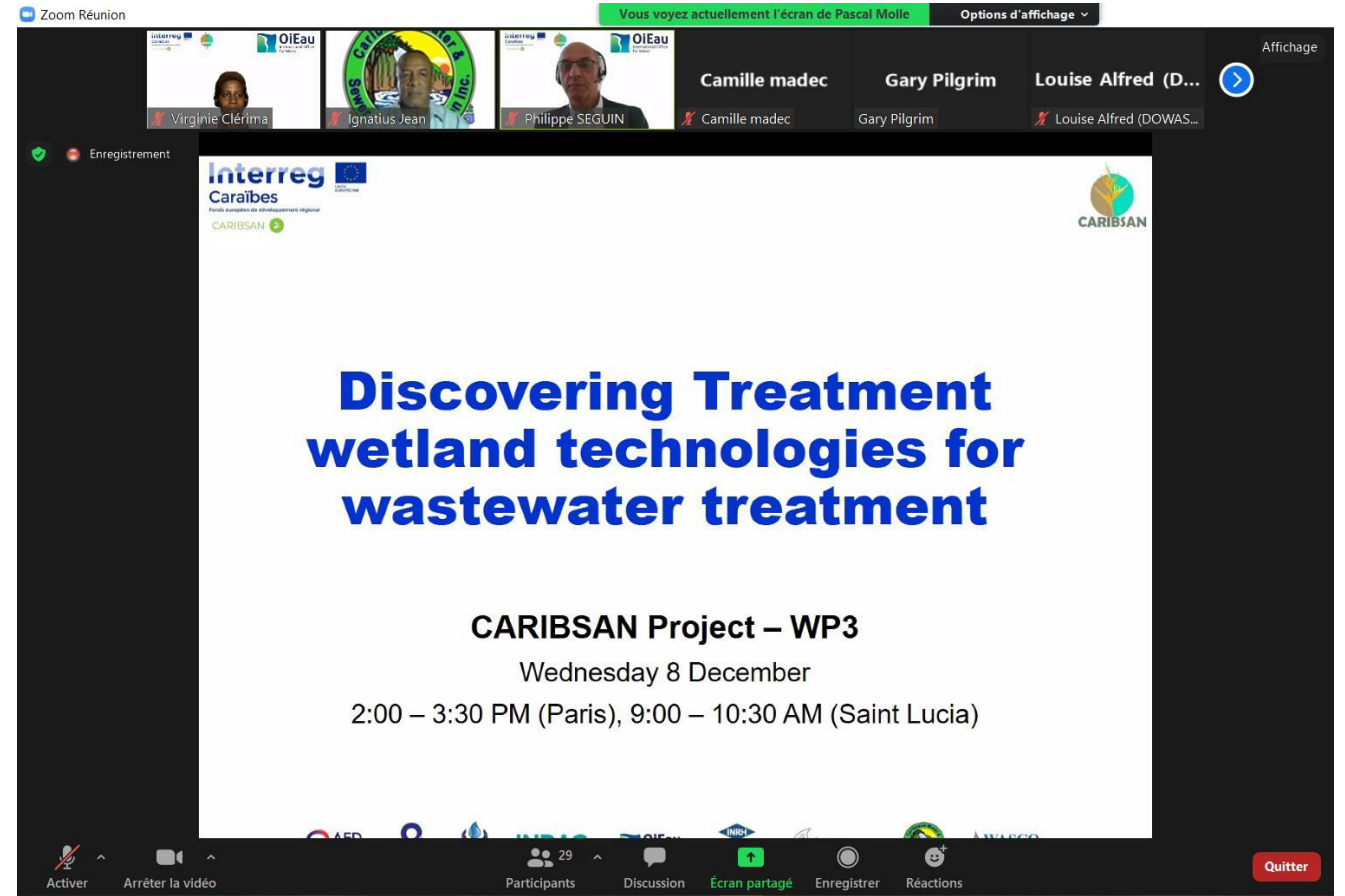


# CARIBSAN : training sessions WEBINAIRE by CAWASA

\* "Discovering treatment wetland technologies for wastewater treatment"

\* « construction of wetlands traitement plants » by COTRAM

> 50 participants : Antigua & Barbuda, Barbados, Dominica, France, Saint Lucia, Trinidad & Tobago + OECS + private companies



Zoom Réunion

Vous voyez actuellement l'écran de Pascal Molle

Options d'affichage

Affichage

Virginie Clérime

Ignatius Jean

Philippe SEGUIN

Camille madec

Gary Pilgrim

Louise Alfred (DOWAS...)

Enregistrement

Interreg Caraïbes

Projet financé par le Fonds européen régional de développement

CARIBSAN

## Discovering Treatment wetland technologies for wastewater treatment

**CARIBSAN Project – WP3**

Wednesday 8 December

2:00 – 3:30 PM (Paris), 9:00 – 10:30 AM (Saint Lucia)

Activer

Arrêter la vidéo

Participants

Discussion

Écran partagé

Enregistrer

Réactions

Quitter



# MAY 2022 : INSTITUTIONAL AND TECHNICAL MISSION in Cuba



# MAY 2022 : Training Cuban ingeneers



[Watch the VIDEO](#)



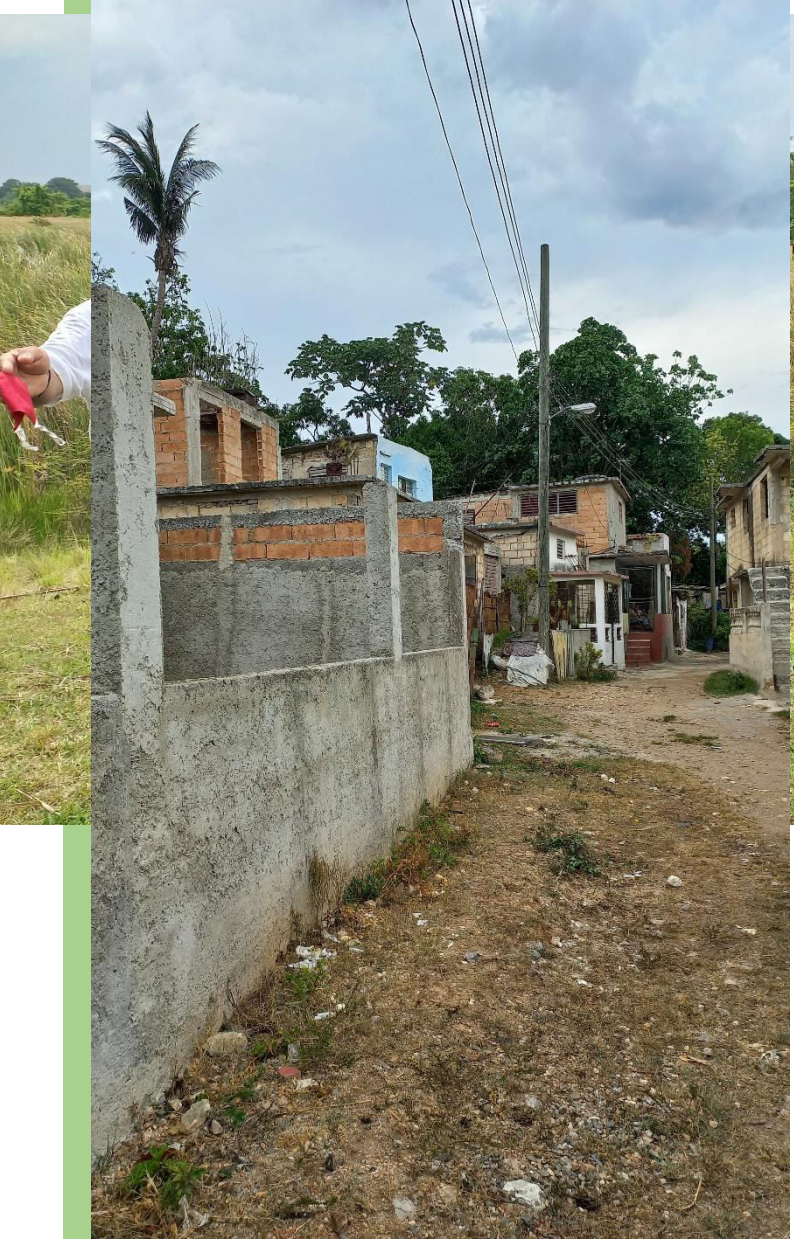
# MAY 2022 : Visit on site, Botanical garden

CARI





**MAY 2022 : visit on potential sites**





# MAY 2022 : Official signing of protocols in Havana





# CARIBSAN : the course

**JUNE 22 : English training week**

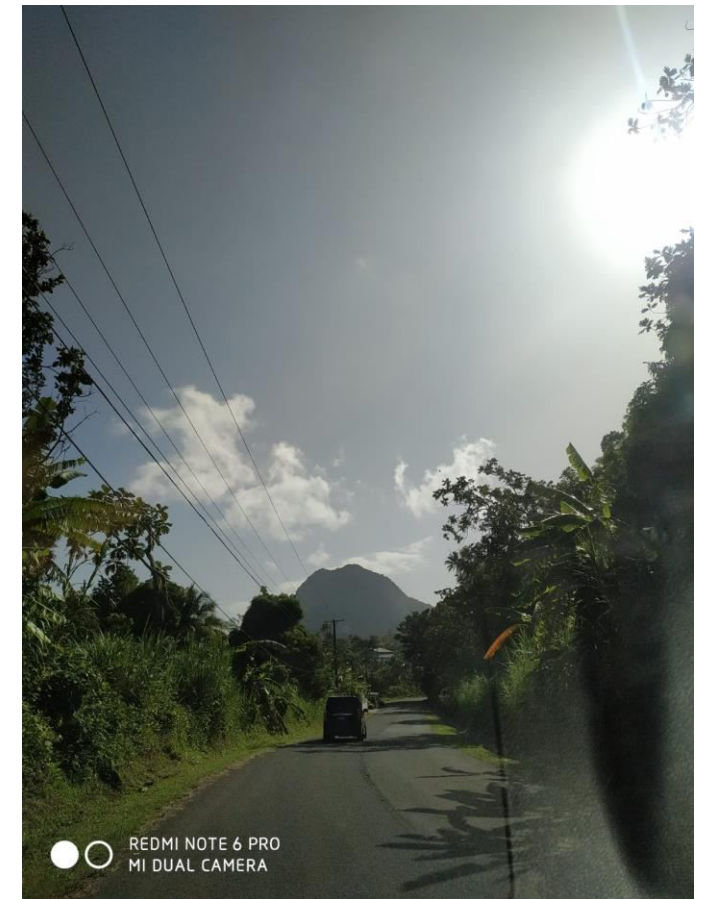


**Watch the VIDEO  
With Joseph  
PRONOST,  
CARIBSAN trainer  
for OIEAU**



# CARIBSAN : the course

**JULY 22 : technical visit in St Lucia / Choice of site for the construction of the plant**





# CARIBSAN : COMMUNICATION



- YouTube
- Accueil
- Explorer
- Shorts
- Abonnements
- Bibliothèque
- Historique
- Connectez-vous à YouTube pour cliquer sur "J'aime", ajouter un commentaire et vous abonner.
- SE CONNECTER
- EXPLORER
  - Musique
  - Sport
  - Jeux vidéo

Rechercher

ACCUEIL VIDÉOS PLAYLISTS CHAÎNES À PROPOS

<p>Interview de Bernard Ettinoffe, Directeur Général...</p> <p>2 vues · il y a 2 mois</p>	<p>Interview with Bernard Ettinoffe, General Director o...</p> <p>25 vues · il y a 2 mois</p>	<p>Entrevista a Bernard Ettinoffe, Director General...</p> <p>3 vues · il y a 2 mois</p>	<p>Interview d'Andrea Miranda López, Directrice...</p> <p>10 vues · il y a 2 mois</p>
<p>Entrevista a Andrea Miranda López, Directora de...</p> <p>7 vues · il y a 2 mois</p>	<p>Interview with Ignatius Jean, Executive Director at...</p> <p>2 vues · il y a 2 mois</p>	<p>Entrevista a Ignatius Jean, Director ejecutivo de la...</p> <p>5 vues · il y a 2 mois</p>	<p>Interview d'ignatius Jean, directeur de la CAWASA</p> <p>4 vues · il y a 2 mois</p>
<p>CARIBSAN: Cooperación caribeña para el tratamiento...</p> <p>27 vues · il y a 4 mois</p>	<p>Nature-Based Solution for Sanitation in Dominica</p> <p>47 vues · il y a 6 mois</p>	<p>Innovative method for wastewater treatment...</p> <p>74 vues · il y a 6 mois</p>	<p>Constructed wetlands for wastewater treatment :...</p> <p>355 vues · il y a 6 mois</p>

Facebook

**CARIBSAN**  
108 J'aime • 137 followers

J'aime déjà Message Rechercher

**CARIBSAN**  
le 23 septembre à 11:11

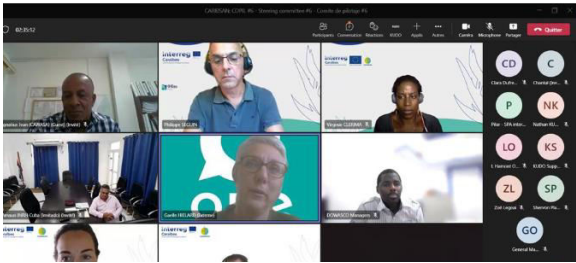
El sexto Comité Directivo de CARIBSAN tuvo lugar hoy. Gracias a todos por su participación!

6th steering committee meeting for #CARIBSAN today. Thank you all for your participation!

6ème comité de pilotage pour CARIBSAN aujourd'hui. Merci à tous pour votre participation!

ODE Ma... Voir plus

Voir la traduction

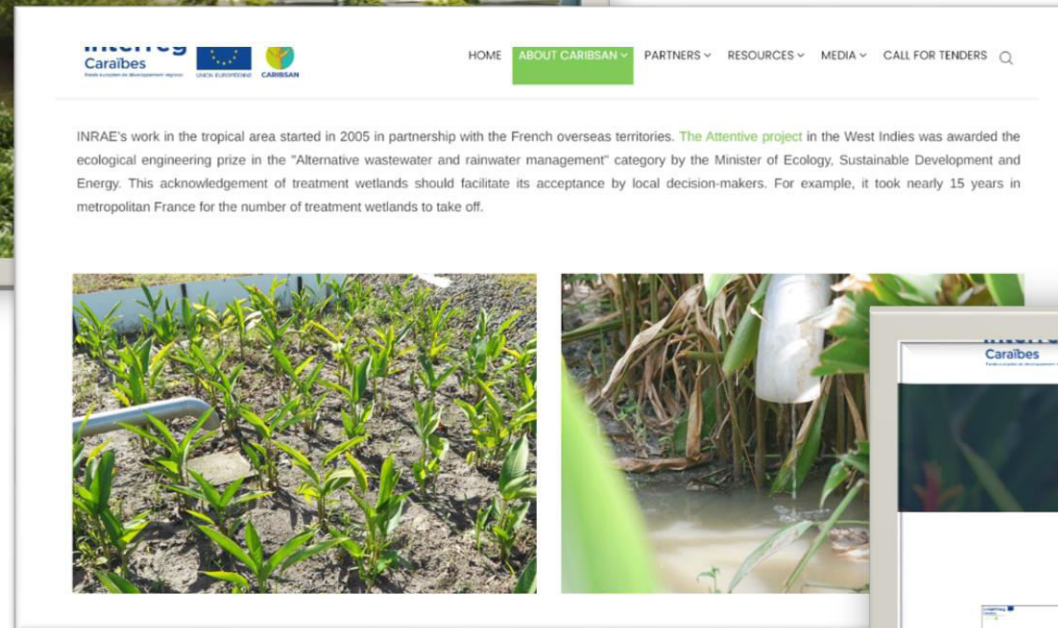




# CARIBSAN : A web site

[www.caribsan.eu](http://www.caribsan.eu)

Translated  
in French  
English  
Spanish





# CARIBSAN : interactive map

[www.caribsan.eu](http://www.caribsan.eu)

The screenshot displays the CARIBSAN interactive map interface. At the top, the logos for Interreg Caribbean (European Regional Development Fund), the European Union, and CARIBSAN are visible. The main title is "Constructed wetlands in the Caribbean". The map shows the Caribbean region with various countries and islands labeled, including The Bahamas, Cuba, Cayman Islands, Jamaica, República Dominicana, Anguilla, Antigua and Barbuda, Dominica, Saint Vincent and the Grenadines, Trinidad and Tobago, and Venezuela. A sidebar on the right contains a legend and a list of map layers. The legend shows "Constructed wetlands" with a green circle icon. The map layers list includes "OpenStreetMap" (100%), "Vue aérienne 2017 - ..." (Invisible) (100%), and "Google satellite" (Invisible) (100%). The bottom of the map shows a scale bar (~500 km) and coordinates (lat: 15.5698530, long: -66.2539677).

Interreg Caribbean  
European Regional Development Fund

EUROPEAN UNION

CARIBSAN

Constructed wetlands in the Caribbean

Thématiques

Légende

Thématiques

Constructed wetlands

Fonds de plan

OpenStreetMap 100%

Vue aérienne 2017 - ... (Invisible) 100%

Google satellite (Invisible) 100%

Échelle ~1/ 17333761

~500 km

lat : 15.5698530 long : -66.2539677

© les contributeurs d'OpenStreetMap | © Business Geografic - Ciril GROUP



CARIBSAN : You like ?  
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**CARIBSAN**

THANK YOU  
MERCI  
MUCHAS GRACIAS  
MÈSI ANPIL

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