The Jumeirah Project: first combination of beach dewatering system and sand nourishment.
Dubai coastline
Conditions at site

Wave roses for Jumeirah (Mangor 2007)
Conditions at site

### Table 1: Wave Conditions

<table>
<thead>
<tr>
<th>Return Period (yrs)</th>
<th>Extreme Wave Conditions</th>
<th></th>
<th>Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nearshore</td>
<td>Wave Height, $H_s$ (m)</td>
<td>Wave Height, $H_s$ (m)</td>
</tr>
<tr>
<td>1</td>
<td>3.45</td>
<td>3.50</td>
<td>6.50</td>
</tr>
<tr>
<td>10</td>
<td>4.00</td>
<td>4.35</td>
<td>7.10</td>
</tr>
<tr>
<td>50</td>
<td>4.15</td>
<td>4.95</td>
<td>7.50</td>
</tr>
<tr>
<td>100</td>
<td>4.15</td>
<td>5.10</td>
<td>7.60</td>
</tr>
</tbody>
</table>

### Table 2: Tide Levels

<table>
<thead>
<tr>
<th>Tidal Elevation (mDMD)</th>
<th>HAT</th>
<th>MHW</th>
<th>MSL</th>
<th>MLW</th>
<th>LAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+2.20</td>
<td>+1.62</td>
<td>+1.13</td>
<td>+0.66</td>
<td>+0.00</td>
</tr>
</tbody>
</table>

### Table 3: Water Levels

<table>
<thead>
<tr>
<th>Return Period</th>
<th>Still Water Level (mDMD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.40</td>
</tr>
<tr>
<td>10</td>
<td>2.72</td>
</tr>
<tr>
<td>30</td>
<td>2.87</td>
</tr>
<tr>
<td>50</td>
<td>2.94</td>
</tr>
<tr>
<td>100</td>
<td>3.03</td>
</tr>
</tbody>
</table>
Figure 6: Close-up of waves for Jumeirah area. Wave conditions at model boundary: $H_s = 2.25 \text{ m,}$ $T_p = 8.5 \text{ s}$ and $MWD = 295^\circ \text{ N}$
O.D.S influence
(Mangor 2007)
Erosion at site

- placed (too) steep profile
- fast retreat of placed beach crest
- fast redistribution of sand by the waves
- profile smoothed out by the waves = design profile
Erosion at site
Looking for a sustainable solution

Hard engineering

Soft engineering

2 M US$ every 2 years. approx. 80000m³
Principle of beach dewatering

- Facilitate deposit of sediments
- Make sand more cohesive
- Absorb part of the energy of the wave
- Reduce water runoff toward the sea
Principle
About Beach Dewatering

- discovered in 1983 by DGI (GEO) in Hirshtals (H.Vesterby)

- **1984 - 1999**: implementations by DGI/GEO
  - Denmark, Sweden, Germany
  - Florida, USA
  - Italy, Spain
  - Malaysia, Japan...

- **1999 – 2004**: 3 pilot projects in France

- Since 2006: 5 new implementations
The System

- Evacuation pipe
- Pumping station
- Collector pipe
- Drains
Sables d’Olonne (France)

November 2001 – Before implementation

November 2002 – After implementation
Quend Plage
(France)

Mach 2008 – Before implementation

Mach 2009 – After implementation
project: ecoplage® + nourishment
Beach reclamation

- +10m platform from BL
- D50~ 0.30mm
- Beach slope 1/10-12
- Approx 60000m³
Dewatering system design

After nourishment, 10 Year Return High Water. Pressure above drain ~1.5 m. Inflow 0.9 m$^3$/h/m
Works: Aug-Oct 2011
Monitoring

Nov 2011 – May 2012

May 2012 – Nov 2012

Nov 2012 – May 2013

May 2013 – Nov 2013
**Monitoring**

**Sand displacement volume calculations**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (m³)</td>
<td>-32047</td>
<td>1245</td>
<td>-11146</td>
<td>8846</td>
</tr>
</tbody>
</table>
Before / After

June 2011

Burj Al Arab

Erosion - Cliffs from 0.5 to 1m

June 2013

Épi sud

Recovery of natural profile
Stable sedimentary cell
Beach tends to stability

Before: 40 000m³/yr min

the first year (Nov 2011—Nov 2012: - 30 000m³) despite the rebalancing after nourishment.

2nd year, beach almost stable (-2300m³)

Tombolo is a sufficient stock (~15 000m³/y)

No need for nourishment yet

No external input for next nourishment

Monitoring survey yet another 2 years...

A cost effective method ! ?

+ water for waterway oxygenation
Production of highly filtered sea water

Fresh water

Heat and cold

Swimming pool

Shellfish or fish farm basins

Oxygenation of marinas / ponds / lagoons
Filtered seawater
Hot Fresh water
discharge
Thank you for attention!

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