Lessons learned in managed realignment design along the Scheldt Estuary (Belgium)

Van Braeckel Alexander, Mertens Wim & Van den Bergh Erika
Restoration projects

updated Sigmaplan

Planned
- 989ha Managed Realignments
- 759ha FCA-CRT
Restoration sites

North Sea

GB

Scheldt

NL

B

F

2004

2006

Paardeschor

Lillo

Antwerp

Noordkasteel

Ketenisse

Heusden

Paddebeek

Gent

2002

2004

2006

2012

www.inbo.be
Types of managed realignment

3 different types applied:

- **Removal of defences:**
  - Ketenisse: 30ha - 2003
  - Lillo west: 5ha - 2012

- **Breach of defences:**
  - Paardeschor: 12ha – 2004
  - Lillo east: 11ha - 2011
  - Heusden: 13 ha – 2006 (fresh water zone)

- **Realignments of defences:**
  - Noordkasteel: 2.4 ha (2015 – still in progress)
  - Paddebeek: 1.6 ha – 2003 (fresh water zone)
**Design of the site**

- **Removal of defences:**
  - Ketenisse
  - Lillo West

- **Breach of defences:**
  - Paardeschor
  - Lillo East

- **Realignment of defences:**
  - Noordkasteel: 2.5ha (2015 in progress)

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**Local physical characteristics**

- Tidal amplitude (MLWS – MHWS): 6.6m
- Brackish: 4-7‰
- Fetch direction: to South-western winds
Design issues of MR

- initial elevation
  - elevation in tidal frame of the site
  - elevation of removed dike
- slope of the area
  - choice of the slope
- shape of the area
- breach dimension/shape
- creek precursors
Initial elevation

Realigned January 2003

Initial elevation (m - MHW)

Breeched April 2004

Realigned January 2003

Breeched Sept 2012
Breach dimension

Breach width (%) | Breach width/area

<table>
<thead>
<tr>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
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<tbody>
<tr>
<td>DO</td>
<td>KPBd</td>
<td>KPB</td>
<td>KPA</td>
<td>KPAe</td>
<td>LPB</td>
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</tbody>
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Breach width/area (m/ha)

State of the Art
Breach shape

DO  KP  LP

B  A  B  A

mean height to MHW

transectnr

30  20  10

50  25  12

20  15  10

transectnr

2.5  5.0  7.5  10.0

State of the art
Physical response

- Sedimentation/erosion rate
- Topographical heterogeneity
- Creek density
- Creek network complexity
Sedimentation rate
Topographic heterogeneity

black: T0  red: T10 or T1:

![Diagram showing topographic heterogeneity with transect numbers (DO, LPB, LPA) and coefficient of variance of elevation.](image)
Creek density & network complexity

DO KP LP

d e

DO KP LP

creak density (m/ha)

creak density per 1st order creek (m/ha)

T1 T10

order

1 2 3 4

11.6 4.2 4.1 7.0 10.4 4.9 2.8
Lessons learned

- Initial elevation:
  - Lower sites < -0.5m - MHW
    - high sedimentation/erosion rates in the initial period
    - higher creek network density & complexity in new sediment layer
- Slope and breach width/shape
  - Not to steep (<2.5%)
  - Flat slope and breach shape
    - Higher creek density but lower creek complexity
  - Dike removal ↔ breach (Lillo site: LPB ↔ LPA)
    - Difference in initial situation
      - Initial creek density (T1) slightly higher at dike removal site
      - Initial topographic heterogeneity (T1) higher at breached site
      - Tidal mudflat adjacent to dike removal site (LPB) more erosion
    - Future differences?
Thanks for your attention!

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