# A: Formalities

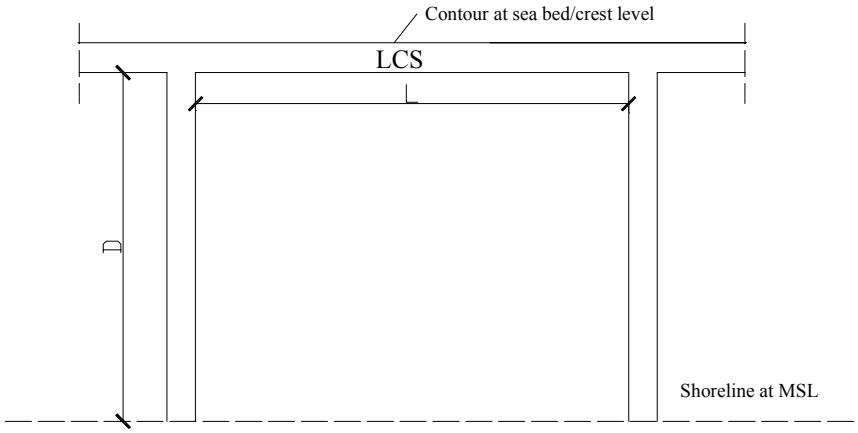
| | |
|---|---|
| Participant code and who to contact. | MOD UR3 |
| E-mail | |
| This date (today, mm:dd:yyyy) and revision number (A..Z). | 07;07;2001 |
| Location of LCS. | Pellestrina, Venice |
| Start date, length and/or end of works. Have there been any later changes? If so, when? | Start date 1992<br>End date 1997 |
| Design life - the minimum length of time the beach management scheme is designed to last. | |
| Which tools and regulations are used for the design formulae (mathematical models, model tests, engineering experience, standards, recommendations). | Mathematical models, model tests, engineering experiences |
| Who fund the work (e.g. Public Administration or private company)? | Ministry of Public Works |
| Costs. | |

# B: Geometry and construction materials

## B1 System layout (aerial view)

| | |
|---|---|
| Are shore attaching structures present (e.g. groins)? | ☒Yes ☐No |
| Are emerging head islands present? | ☐Yes ☒No |

The following sketch concerns only shore parallel LCS; if the layout is different you must insert another sketch and specify parameters like the ones suggested. If a picture is available please insert it too.




The typical layout is given at Sea Bed (index SB) and at Crest Level (index CL).

| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| D | Distance from shoreline | 290 | Meters |
| $L_{SB}$ | Length of LCS at sea bed | 500 | Meters |
| $L_{CL}$ | Length of LCS at crest level | 500 | Meters |
| $G_{SB}$ | Gap between LCS at sea bed | 0 | Meters |
| $G_{CL}$ | Gap between LCS at crest level | 0 | Meters |
| n | Number of LCS in system | 17 | cells |

| **Remarks** |
|---|
| All values are referred to the single cell |

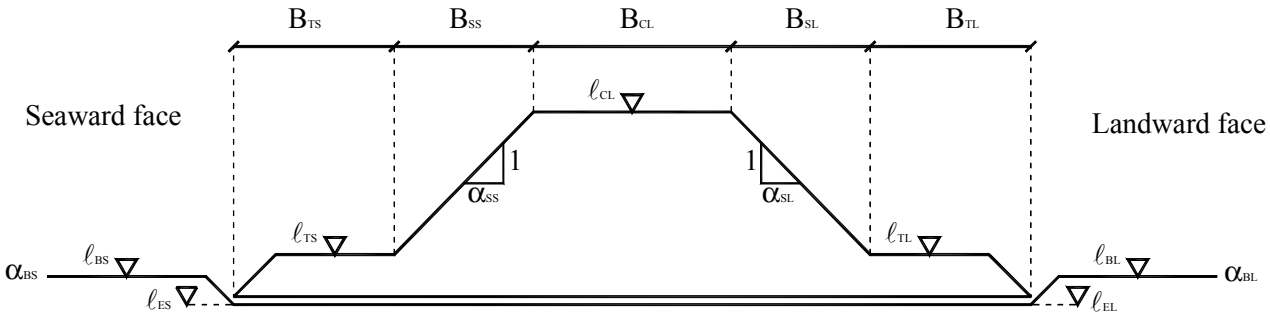
## B2 Bathymetry of sea bed and beach

Please insert a dimensioned sketch if possible.

| **Description of bathymetry when LCS were build** |
|---|
| |

## B3 Trunk cross section/contour geometry – outer profile

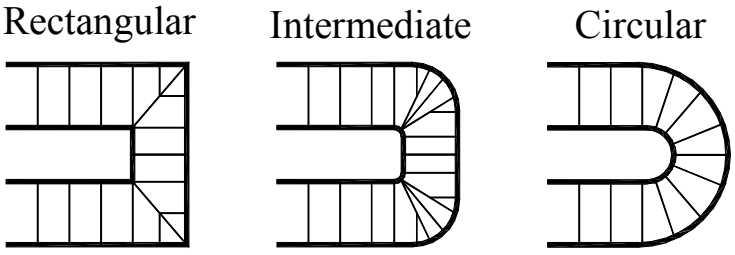
If shore attached structures perpendicular to shoreline are present, please insert a sketch with typical longitudinal section and typical selected cross sections. Specify parameters as the ones given below. If the layout does not fit the following sketch please insert another sketch.




| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| $\alpha_{BS}$ | Steepness of sea bed, seaward | | |
| $\alpha_{BL}$ | Steepness of sea bed, landward | | |
| $\alpha_{SS}$ | Steepness of slope, seaward | 2 | |
| $\alpha_{SL}$ | Steepness of slope, landward | 2.5 | |
| $\ell_{BS}$ | Level of sea bed at seaward toe | 4.00 | meters |
| $\ell_{ES}$ | Level of excavation, seaward | 0 | meters |
| $\ell_{TS}$ | Level of toe, seaward | 0 | meters |
| $\ell_{CL}$ | Level of crest | 1.50 | meters |
| $\ell_{BS}$ | Level of sea bed at landward toe | | meters |
| $\ell_{ES}$ | Level of excavation, landward | | meters |
| $\ell_{TS}$ | Level of toe, landward | 2.00 | meters |
| $B_{TS}$ | Width of toe, seaward | | meters |
| $B_{SS}$ | Width of slope, seaward | | meters |
| $B_{CL}$ | Width of crest | | meters |
| $B_{SL}$ | Width of slope, landward | | meters |
| $B_{TL}$ | Width of toe, landward | | meters |

**Remarks** (e.g. different layout along shoreline, other important parameters).

# B4 Round head contour geometry

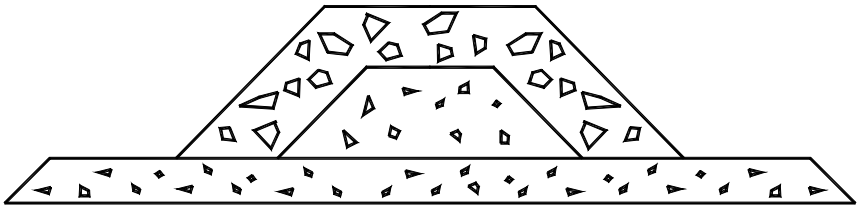



What is the shape of the round head?

| |
|---|
| ☐ Rectangular<br>☒ Intermediate<br>☐ Circular |

## B5 Description of layers

Please insert a dimensioned sketch with the typical cross-section composition.



For each layer, please provide the following information.

| Layer type e.g. ARMOUR LAYER CHARACTERISTICS | | | |
|---|---|---|---|
| **Parameter** | **Description** | **Fill in box** | **unit** |
| | Material (e.g. quartzite, concrete) | | |
| | Shape of blocks (e.g. quarry rock, sea stones, cubes) | | |
| $\rho_r$ | Mass density of material | | $kg/m^3$ |
| $D_{n50}$ | Nominal diameter | | meters |
| Gr | Grading of the material ($D_{85}/D_{15}$) | | |
| | Geotextile between layers? | ☐ Yes ☒ No | |

| |
|---|
| **Remarks** (e.g. details on geotextile) |

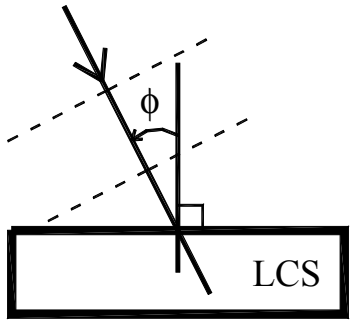
## B6 Construction method

| |
|---|
| How have the stones been placed?<br>☒ Dumped with barges<br>☐ Placed with barges<br>☐ Land based operation<br>☐ Other: |

| |
|---|
| Sequence of operation.<br>☒ Construction started upstream<br>☐ Construction started downstream |

# C: Local meteomarine conditions at the structure

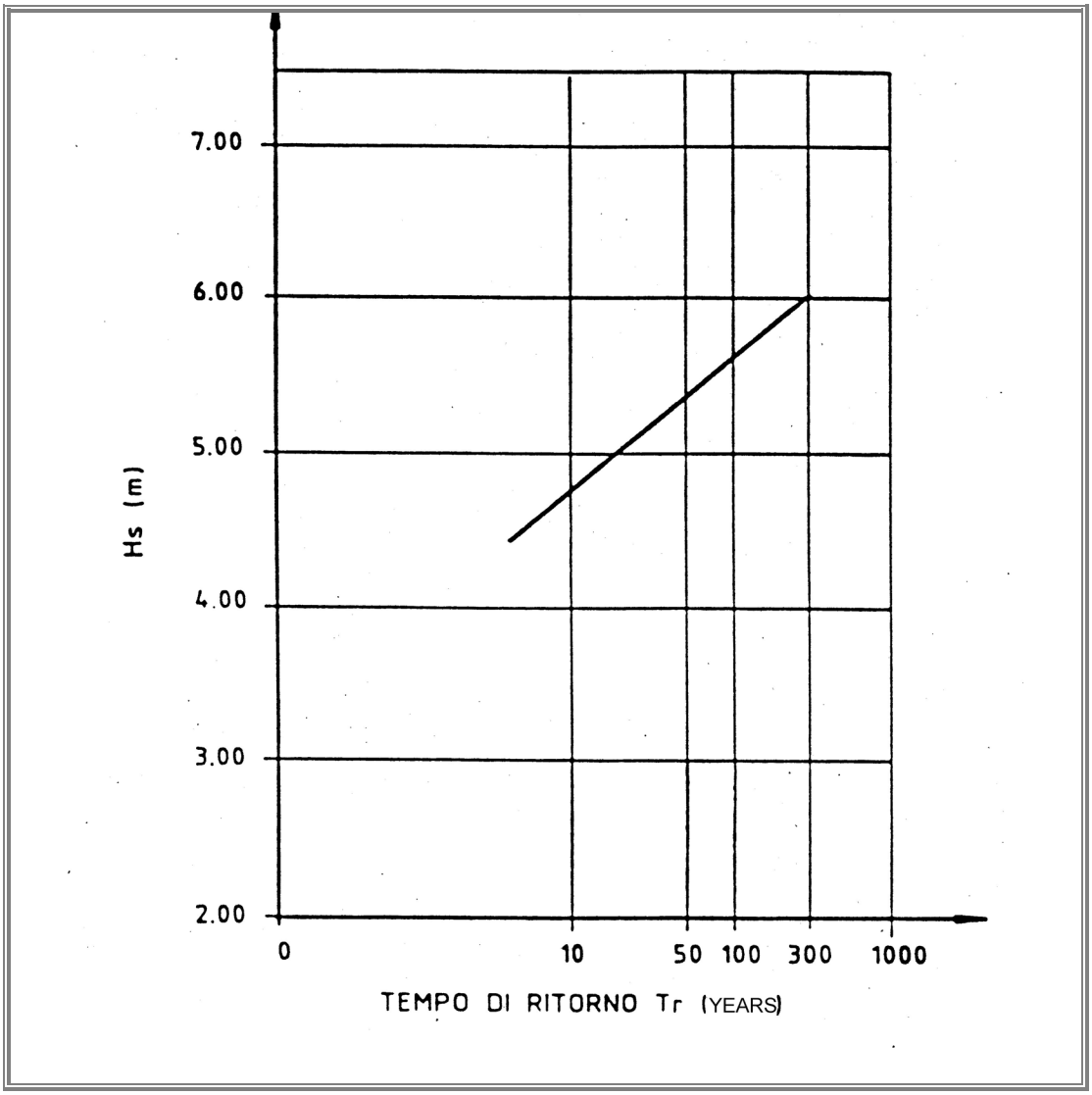
## C1 Waves




| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| $H_S$ | Design significant wave height | | meters |
| $T_P$ | Design peak period | | seconds |
| $\phi$ | Design wave incidence angle | | degree |

**Remarks:**
**Wave climate monthly requencies (at the CNR tower)**

| Month | 1<Hs<2 | 2<Hs<3 | Hs>3 | tot Hs>1 |
|---|---|---|---|---|
| JAN | 10.2 | 1.9 | 0.8 | 12.9 |
| FEB | 12.9 | 2.1 | 0.7 | 15.7 |
| MAR | 12.8 | 2.2 | 0.7 | 15.7 |
| APR | 10.9 | 1.8 | 0.4 | 13.1 |
| MAY | 9.6 | 1.1 | 0.1 | 10.7 |
| JUN | 6.2 | 0.1 | 0 | 6.3 |
| JUL | 3.4 | 0.1 | 0 | 3.4 |
| AGO | 5.9 | 0.3 | 0 | 6.2 |
| SEPT | 7.1 | 0.8 | 0.1 | 8.1 |
| OTT | 10 | 1.6 | 0.1 | 11.8 |
| NOV | 9.9 | 2.1 | 0.4 | 12.5 |
| DIC | 10.7 | 2.2 | 0.5 | 13.4 |




# C2 Water levels

| TIDAL WATER LEVEL VARIATIONS | | | |
|---|---|---|---|
| **Parameter** | **Description** | **Fill in box** | **Unit** |
| HAT | Highest astronomical tide level | 50 | Meters |
| MHWL | Mean tide high water level | | Meters |
| MWL | Mean water level | | Meters |
| MLWL | Mean tide low water level | | Meters |
| LAT | Lowest astronomical tide level | -50 | Meters |

| **Water level statistics:** |
|---|

| Return periods (years) | High tide level (cm) | Low tide level (cm) |
|---|---|---|
| 5 | 138 | -90 |
| 10 | 151 | -100 |
| 20 | 161 | -105 |
| 50 | 176 | -112 |
| 100 | 186 | -118 |

## C3 Current

**Tidal currents**

| **Description & statistics if available** |
|---|
| |

**Surge generated currents**

| **Description & statistics if available** (e.g. mean velocities as function of water depth/distance to shore line) |
|---|
| |

# D: Sea bed and beach characteristics, incl. sediment transport

| **Description of the coast** (e.g. bar type coast with gentle slope or plane coast with steep slope) |
|---|
| |

## D1 Natural sea bed material at surface

| **Parameter** | **Description of sea bed material** | Fill in box | unit |
|---|---|---|---|
| | Material (e.g. quartzite) | | |
| $\rho_r$ | Mass density of material | | $kg/m^3$ |
| $D_{n50}$ | Nominal diameter grain size | | meters |
| Gr | Grading of the material ($D_{85}/D_{15}$) | | |

| **Remarks** (provide grain distribution if available) |
|---|
| |

## D2 Natural beach material at surface

| **Parameter** | **Description of beach material** | **Fill in box** | **unit** |
|---|---|---|---|
| | Material (e.g. quartzite) | | |
| $\rho_r$ | Mass density of material | | $kg/m^3$ |
| $D_{n50}$ | Nominal diameter grain size | | meters |
| Gr | Grading of the material ($D_{85}/D_{15}$) | | |

| | |
|---|---|
| Natural supply? | ☐ Yes ☐ No |
| Supplied by beach nourishment? | ☐ Yes ☐ No |

| |
|---|
| **Remarks** (provide grain distribution if available) |

## D3 Artificial beach nourishment

| |
|---|
| **Description of nourishment** |

| Parameter | Description of artificial nourishment | Fill in box | unit |
|---|---|---|---|
| | Material (e.g. quartzite) | | |
| $\rho_r$ | Mass density of material | | $kg/m^3$ |
| $D_{n50}$ | Nominal diameter | | meters |
| Gr | Grading of the material ($D_{85}/D_{15}$) | | |

| |
|---|
| **Remarks** (provide grain distribution if available) |

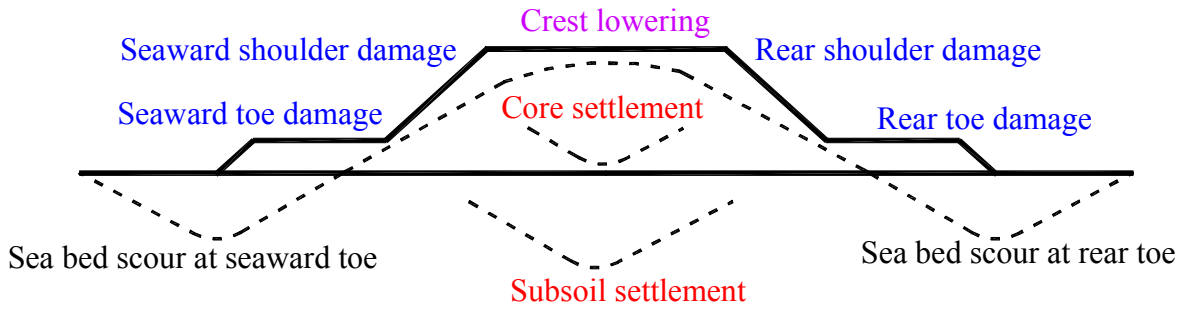
## D4 Sediment transport

| |
|---|
| **Description of the sediment transport** (e.g. direction and amount of transport, distribution over the coastal profile) |

| Parameter | Description of sediment | Fill in box | unit |
|---|---|---|---|
| | Material (e.g. quartzite) | | |
| $\rho_r$ | Mass density of material | | $kg/m^3$ |
| $D_{n50}$ | Nominal diameter | | meters |
| Gr | Grading of the material ($D_{85}/D_{15}$) | | |

# E: Structural performance

## E1 Definition of failure modes




Please insert a sketch with dimensions of LCS cross-section when it was build compared to the appearance now (like the figure of failure modes) if possible.

In the following please specify damages by failure mode (see figure of failure mode definition) and amount of damage. If you know the reason for the problems/failures (e.g. extreme wave climate/water level), please type it in the description boxes.

# E2 Materials

| | |
|---|---|
| Problems caused by deterioration? | ☐ Yes ☒ No |
| Problems caused by breakage? | ☐ Yes ☒ No |

| |
|---|
| **Description of the condition of the materials** |

# E3 Settlement of the structure

| |
|---|
| **Description of settlements of core/subsoil** (e.g. instabilities in foundation, internal erosion). Please specify settlement in meters. |

# E4 Local erosion of sea bed/scour

| |
|---|
| **Description of erosion/scour by roundheads** (please specify scour depth) |

| |
|---|
| **Description of erosion/scour by trunk** (please specify scour depth) |

# E5 Erosion and instability of slopes, shoulders, crest and toes

| **Stage of damage** |
|---|
| ☐ No or marginal damage |
| ☐ Moderate to severe damage |
| ☐ Failure |

| |
|---|
| **Description of displacements of structural material** (provide sketch if possible) |

## E6 Damage parameters

The definition of a displaced unit is, when a unit is displaced by more than $D_{n50}$.
Try to give an estimate of the following damage parameters relevant to armour.

| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| The relative number of displaced units | $D(\%) = \frac{n_d\,(\text{number of displaced units})}{\text{Total number of units}} \cdot 100$ | | % |
| The strip displacement | $N_{od} = \frac{n_d}{L / D_{n50}}$ , L is the length of LCS | | |

# F: Socio-economic aspects

What regime of property has the coast at this site?
Private ☐, Public full free access ☒, Public limited access ☐, Natural reserve ☐, Don't know ☐,
Other (please specify):

Who decided that an LCS should be built at that site?
Individual, acting for private purpose ☐
Individual, acting for public purpose (e.g. Natural park administrator) ☐
Local authority (e.g. city council) ☐
Regional authority (e.g. province level) ☐
National authority (e.g. ministry) ☒ **Ministero delle Infrastrutture e dei Trasporti – Magistrato alle Acque di Venezia**
Don't know ☐
Please give name of the authority whenever applicable:

What was the main motive for building the LCS?
Coast erosion ☒
Inducing or maintaining recreational activity ☐, please specify:
Environmental concern ☐, please specify:
Other ☐, please specify:
Don't know ☐

Was that LCS part of a larger coastal management plan?
Yes ☒, please specifyPellestrina beach protection is a part of a wide project aimed to protect the Venice Lagoon
No ☐, please specify:
Don't know ☐

Public opinion on that LCS:
Construction was accompanied by public protest ☐
The public did not react ☐
Public opinion asked for the LCS ☐
Local commerce asked for the LCS ☐
Don't know ☐
Other (please specify): At first the Pellestrina citizens refused the project as it modified the original layout of the littoral. After the serious storms which occurred they changed of mind

Description of the coast:
Urban ☐, Densely constructed ☐, Scarcely constructed ☒, No apparent construction ☐

Are there dunes? Yes ☐, No ☒
Has commercial activity changed significantly after construction of the LCS?
hotels construction: More hotels ☐, Less hotels ☐, Unaffected ☒, Don't know ☐
bars and similar construction: More ☐, Less ☐, Unaffected ☒, Don't know ☐
advertising for the area: More ☐, Less ☐, Unaffected ☐, Don't know ☒
other (specify): maybe in the future territorial planning some activities that involve the beach utilisation will be included

Visual impact of LCS not already described in Part B: Are there parts of the LCS visible under average conditions? Poles ☐, Cables ☐, Reefs ☐,
Others (please specify):

Water quality changes since LCS construction
Are there episodes of water turbidity since construction?
No ☒, Rare ☐, Often ☐, Permanent ☐
Were there episodes of water turbidity before construction?
No ☒, Rare ☐, Often ☐, Permanent ☐
Has water quality otherwise been affected (for example, more or less detritus accumulating)?
Please describe:

How would you qualify the following recreational activities at or around the LCS? (DK = Don't know)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fishing (recreational) | Intense ☐ | Moderate ☒ | Scarce ☐ | Absent ☐ | DK ☐ |
| Seafood collecting | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Wildlife watching | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Sunbathing and similar | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☐ |
| Scuba diving | Intense ☐ | Moderate ☒ | Scarce ☐ | Absent ☐ | DK ☐ |
| Sailing and similar | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Other (specify) | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☐ |

Could you describe those recreational activities before the LCS was built? (DK = Don't know)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fishing (recreational) | Intense ☐ | Moderate ☒ | Scarce ☐ | Absent ☐ | DK ☐ |
| Seafood collecting | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☐ |
| Wildlife watching | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Sunbathing and similar | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Scuba diving | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Sailing and similar | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☒ |
| Other (specify) | Intense ☐ | Moderate ☐ | Scarce ☐ | Absent ☐ | DK ☐ |

Has that LCS had an environmental impact assessment before being built? Yes ☐, No ☐, Don't know ☐
Could you give its references and location (specify)?

Has there been an economic study on that LCS,
before it was built? Yes ☐, No ☐, Don't know ☐, References:
after it was built? Yes ☐, No ☐, Don't know ☐, References:

# G: Ecological aspects

What are the dominant species on the structures? *Ulva rigida, Mytilus galloprovincialis*

What are the dominant species in the sediment and fish assemblages around the structures? piccoli pesci di scoglio, gobidi, piccole orate.

| |
|---|
| Were any environmental changes observed following the construction of the structure (e.g. increase of water turbidity, floating algal debris)? No |

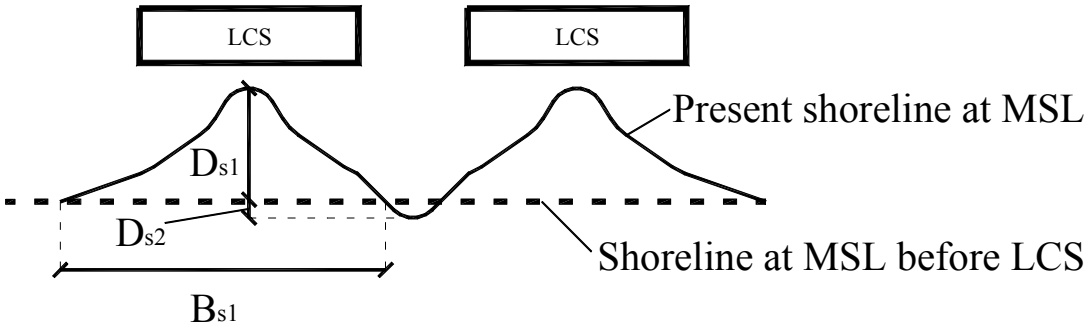
# H: Coastal protection performance

## H1 Bathymetry and beach evolution

| **Description of historical beach evolution before LCS was built (10-20 years).** |
|---|
| |

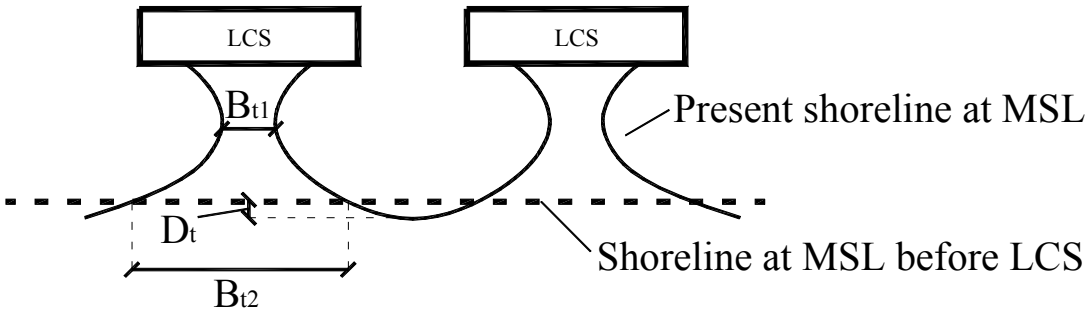
| **Description of beach evolution after LCS was built up to now.** |
|---|
| |

## H2 Salient formation




| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| $D_{s1}$ | Max distance between new and old shoreline, seaward | | meters |
| $D_{s2}$ | Max distance between new and old shoreline, landward | | meters |
| $B_{s1}$ | Width of salient at old MSL | | meters |

## H3 Tombolo formation




| Parameter | Description | Fill in box | unit |
|---|---|---|---|
| $D_t$ | Distance between new and old shoreline, landward | | meters |
| $B_{t1}$ | Minimal width of tombolo | | meters |
| $B_{t2}$ | Width of tombolo at old MSL | | meters |

## H4 Renourishment

| **Description of renourishment (add more fill)** (e.g. amount, how often) |
|---|

## H5 Down drift erosion

Please insert a sketch if relevant.

| **Description of down drift erosion** (morphological impact, e.g. down drift erosion length and maximal down drift shoreline retreat) |
|---|

# I: Problems in general

| **Description of other problems/impacts** |
|---|