ANCHOR

Advanced Noise Control strategies in HarbOuR

Webinar – Technical Workshop organizing by Municipality of Patras

MPA - Jaime Bustillo

MINISTERIO DE FOMENTO

Puerto de Melilla
Autoridad Portuaria de Melilla

ANCHOR LIFE Intermediate Meeting

PATRAS GR - March 30, 2021

Life

1. LOCATION

- EASTERN END OF THE STRAIT OF GIBRALTAR
- PUBLIC BODY OF MANAGING THE PORT OF MELILLA: PORT AUTORITY OF MELILLA
- SPANISH PORT SYSTEM: MADE UP OF A SET OF 46 PORTS MANAGED BY 28 PORT AUTHORITIES
- MINISTRY OF DEVELOPMENT THROUGH PUERTOS DEL ESTADO.

2. MAIN OBJECTIVES OF THE ACTION B3

- UPDATE GUIDE OF GOOD PRACTICES FOR THE MANAGEMENT AND REALIZATION OF PORT NOISE MAPS (Good Practice Guide on Port Area Noise Mapping and Management, NoMEPorts GPG).

- BY DEFINITION A PORT NOISE IMPACT ASSESSMENT (PNIA) METHODOLOGY

- FINAL OBJECTIVE: APLICATION METHODOLOGY TO THE EXPANSION PROYECT OF THE PORT OF MELILLA.

WORK FLOW PLAN

STEP 1: GEOGRAPHICAL DEFINITION AND LIMITS OF THE MODEL

STEP 2: CHARACTERIZATION OF NOISE SOURCES

STEP 3: REALIZATION OF NOISE MAPS

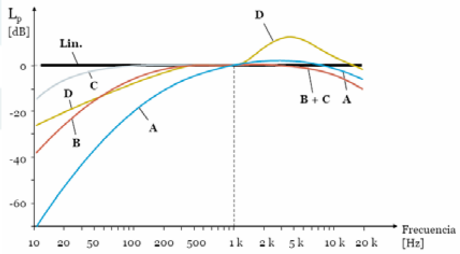
STEP 4: IMPACT ASSESSMENT

STEP 5: NOISE MANAGEMENT

3. STEP 1: GEOGRAPHICAL DEFINITION AND LIMITS OF THE MODEL

GEOGRAPHIC DEFINITION:

- TOPOGRAPHIC DEFINITION 3D.
- HEIGHT OF BUILDINGS.
- DEFINITION OF EXISTING OBSTACLES.
- GROUND ABSORPTION OBSTACLES.
- CONFIGURATION OF NOISE SOURCES.
- MAIN METEOROLOGICAL VARIABLES.
- LOCATION MAIN AFFECTED POPULATION.
- LOCATION MAIN SENSITIVE RECEPTORS.



Curvas de Ponderación Frecuencial

CONTOUR OF THE MODEL

GUIDE NoMEPorts: REACHING FOLLOWING LEVELS

Average daily level weighted day-late-night, long-term, with frequency weighting A	Lden	55 dBA
Equivalent daily level in night period, long-term, with frequency weighting A	Ln	50 dBA

HOWEVER, FRECUENCY WEIGHTING A IS ADAPTED TO HUMAN EAR SENSITIVE

LOW FRECUENCIES EFFECTCS CAN BE UNDERESTIMATED

PROPOSAL CONTOUR MODEL: CAN BE EXTENDED TO THE FOLOWWING ISOPHONIC CURVES

Equivalent daily level in night period, in the short term, with frequency weight C	LCeq,n	60 dBA
Equivalent daily level in day period, in the short term, with frequency weight C	LCeq,d	65 dBA

4. STEP 2: CHARACTERIZATION OF NOISE SOURCES

2 TYPES OF NOISE SOURCES

1) ACCORDING TO OPERATING REGIME.
(TRAFFIC NOISE, SOURCES VITH EMISION MODEL) → CAMPAING ACCORDING TO CALIBRATE MODELS

2) NOISE MESUREMENTS MADE ON SITE
(OPERATIONS SHIPS, CRANES, INDUSTRIES) → CAMPAING ACCORDING TO:

- DEFINITION OF THECNICAL CHARACTERISTICS
- DEFINITION OF PHYSICAL CHARACTERISTICS
-
- DEFINITION OF THE MODE OF OPERATION
- NOISE MESUREMENT

PARAMETERS IDENTIFICATION

- AVOID MEASUREMENT IN NOISE WIND SITUATION
- DISTINCTION BETWEEN BACKGROUND NOISE AND ACTIVITY NOISE

5. STEP 3: NOISE MAPS

NOISE MAP REALIZATION

- VALIDATION OF GEOMETRIC DEFINITION DATA OF MODEL
- DIGITAL TERRAIN MODEL (DTM)
- INCLUSION BUILDINGS AND STRUCTURES
- ALLOCATION OF THE RESIDENT POPULATION
- INCLUSION FACTORS MAY AFFECT TO NOISE PROPAGATION
- VALIDATION DATA FROM NOISE SOURCES
- INTEGRATION NOISE SOURCES IN THE MODEL

NOISE MODELING USING ALGORITHMS PROVIDED BY

- 2002/49 / EC
- 2015/996 / EC

ANALYSIS RESULTS

- HYPOTHESIS 1: CURRENT PORT
- HYPOTHESIS 2: EXPANDED PORT

HYPOTHESIS 3:

FINAL DESIGN EXPECTED TO OBTAIN AN OPTIMIZATION OF RESULTS AND IMPACT NOISE MINIMIZED ON RESIDENTIAL ZONES

6. STEP 4 AND 5: IMPACT ASSESSMENT AND NOISE MANAGEMENT

ASSESSMENT

- **DRAW UP GUIDELINE WITH KONW HOW LEARNED**
  (Guideline for a Common Port Noise Impact Assessment method, PNIA)

- **METHODOLOGY APPLIED IN EVALUATION NOISE IMPACT OF EXPANSION PORT**
- **OBJECTIVES: VIABILITY AND SUITABILITY**

NOISE MANAGEMENT: IDENTIFICATION MEASURES SPECIFIED IN AN ACTION PLAN.

- **ALTERNATIVES AND COST OF CORRECTIVES MEASURES**
- **ASSESSMENT EFFECTIVENESS OF CORRECTIVES MEASURES**
- **DEFINE OPTIMAL ALTERNATIVES**

PRESENTATION ACTION PLAN TO:

- **AGENTS NOISE EMITTERS**
- **RESIDENT POPULATION**
- **ANALYSIS OF RESULTS OF PUBLIC PARTICIPATION**

MPA Project Activities.

7. Application of the Port Noise Assessment method in a case study

7.1 Description of the real case study

The Port Impact Assessment suggested in this guideline has been tested in the Melilla Port Area, considering the current port layout. Melilla port is located in the homonymous autonomous city in North Africa, occupying a strategic location at the confluence of commercial maritime routes between the Mediterranean Sea and the Atlantic Ocean. With respect to its land location, the port is conditioned by its proximity to the city of Melilla centre and consists of two main functional areas, a commercial port and a marina; every year the port manages 850,000 passengers and up to 1 Mtonnes of goods.

The Melilla port area was the object of a noise mapping study performed by a private company, in 2017 [10], that realized an acoustical characterization of the port noise sources.

Noise limits were taken from the acoustic zoning plan of the acoustic zoning plan of the Municipality of Melilla (Figure 8).

7.2 Realization of noise simulations

Noise simulations were realized using the indication defined in chapter 5. Noise emission data were the ones used for the 2017 strategic noise maps. Figure 14 reported the noise sources characterized by this study. The data available for the characterization of the noise sources does not allow to group the sources in terms of their managing authority. The sources were grouped as performed in the 2017 strategic noise mapping study as reported in Figure 14:

A. TRAFICO: the group is made of the roads inside the port area and it is represented by green lines;
B. EMISOARES: the group is made by the linear noise sources and it is represented by orange lines;
C. BARCOES: the group is made by ship in docking. The permanence time in each docking was considered. It is represented by cyan areas the name of the docking is reported in the figure with a red text;
D. EMISUPERFICIALES: the group is made of all the other types of surface noise sources considered in the study. It is represented by purple areas. The name of each sources is reported with a black text. The "Ocio" area was created in order to take into account the effects of some leisure activities. The "Indusria" one allows to consider the noise emission of a cement plant.

Figure 15 reports the buildings where the sound pressure level was assessed on their façades through noise simulations.

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Figure 14: View of the study area.

Figure 15: Definition of the study area. Compared to Figure 14, here buildings where the sound pressure level was assessed through simulation in their façades are evidenced in grey.

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Figure 17: Critical areas and critical buildings.

7.4 Calculation of the Priority Index

Table 5 reports for each calculation point of each critical building the sound pressure level caused by each group of sources and the global one referred to the night period. The results referred to the other period were assessed, but they are not shown there since in these two periods the noise limits exceeds are lower than the night period. Moreover, the table specifies the critical area to which the critical buildings belong. The position of each critical building is reported in Figure 18

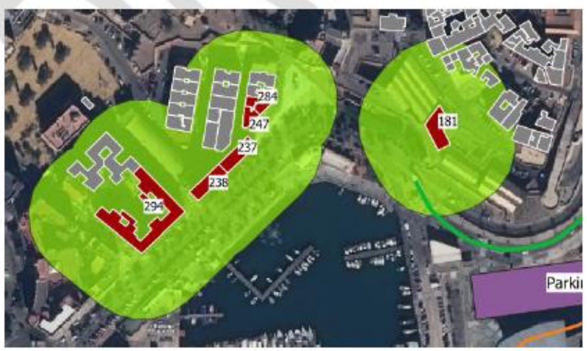

Figure 18: Identification of critical buildings

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The outcomes of the analysis were considered not completely sufficient to define the mitigation measures, consequently noise simulation were repeated considering separately the noise sources comprised in "BARCOES" group. The name of each noise source belonging to the "BARCOES" group is reported in Figure 19. The procedure executed to calculate the IP_x value for each critical area was repeated considering the new groups and the outcomes are reported in Table 8.

Figure 19: The red text indicates the name of all the sub-groups belonging to the "BARCOES" group

The ranking of the index of priority IP reported in Table 8 reports that the noise sources belonging to the sub-group "RIBERA I" are the more impacting ones.

The anti-noise actions aimed at reducing the noise immissions of "RIBERA I" in the critical areas "B" and "A" are respectively the first and the second more urgent measures. The contribution of the other sources is practically negligible.

The application on the case study evidenced that a sub-grouping procedure after a first stage analysis may be useful to have a clearer scenario of the noise exposure caused by the acoustic emission of all the noise sources in a port area. This procedure eases the identification of areas where anti-noise measures are more urgent in comparison to other one and addresses the authority in charge for noise mitigation plans and projects in the definition of a noise mitigation plan.

Table 8 : Detailed Calculation of the index of priority in the case study

Ranking	Group Name	Critical areas	IP_x
1	RIBERA I	B	96.1
2	RIBERA I	A	58.8
3	EMISUPERFICIALES	A	3.1
4	EMISUPERFICIALES	B	1.5
5	TRAFICO	A	1.0
6	EMISOARES	B	0.6
7	ESPIGON	B	0.4
8	TRAFICO	B	0.3

MPA Project Activities


Puertos del Estado

GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO

Revisión y Actualización del
Método de Evaluación de Inversiones Portuarias
(MEIPOR 2016)

(Versión preliminar para la evaluación de su aplicación práctica)

Mayo de 2016

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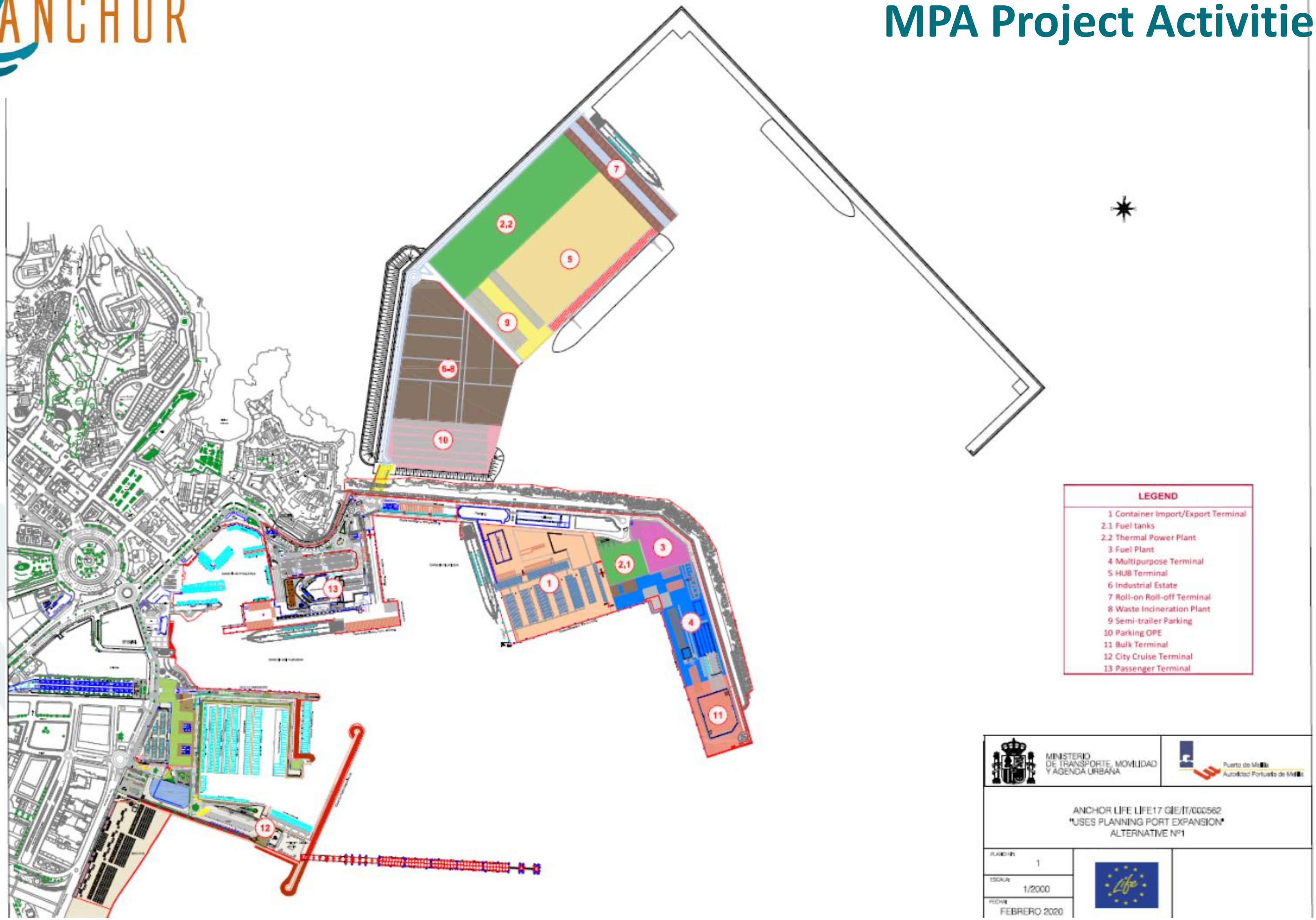

LEGEND

1 Container Import/Export Terminal
2.1 Fuel tanks
2.2 Thermal Power Plant
3 Fuel Plant
4 Multipurpose Terminal
5 HUB Terminal
6 Industrial Estate
7 Roll-on Roll-off Terminal
8 Waste Incineration Plant
9 Semi-trailer Parking
10 Parking OPE
11 Bulk Terminal
12 City Cruise Terminal
13 Passenger Terminal

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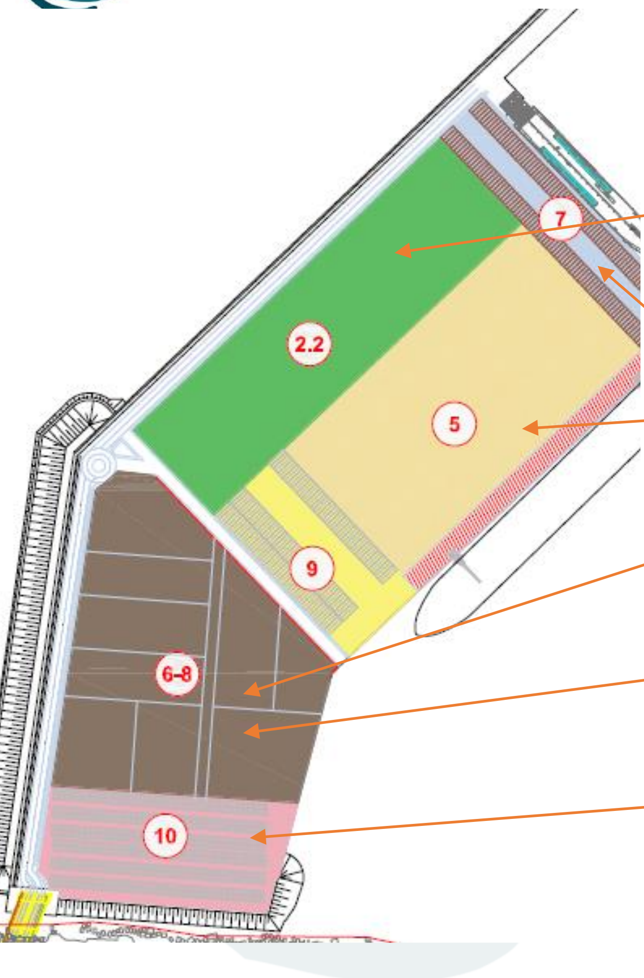

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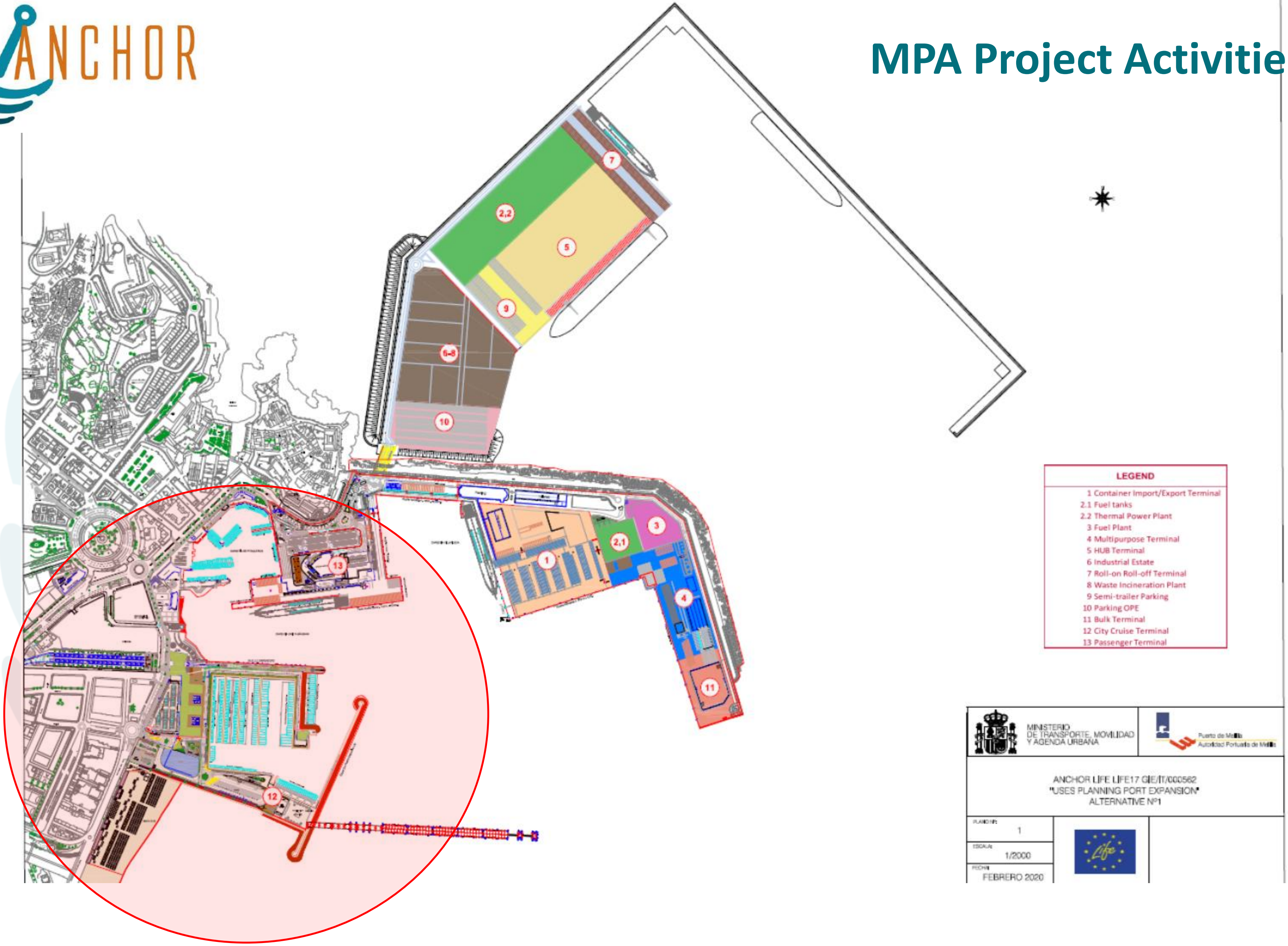

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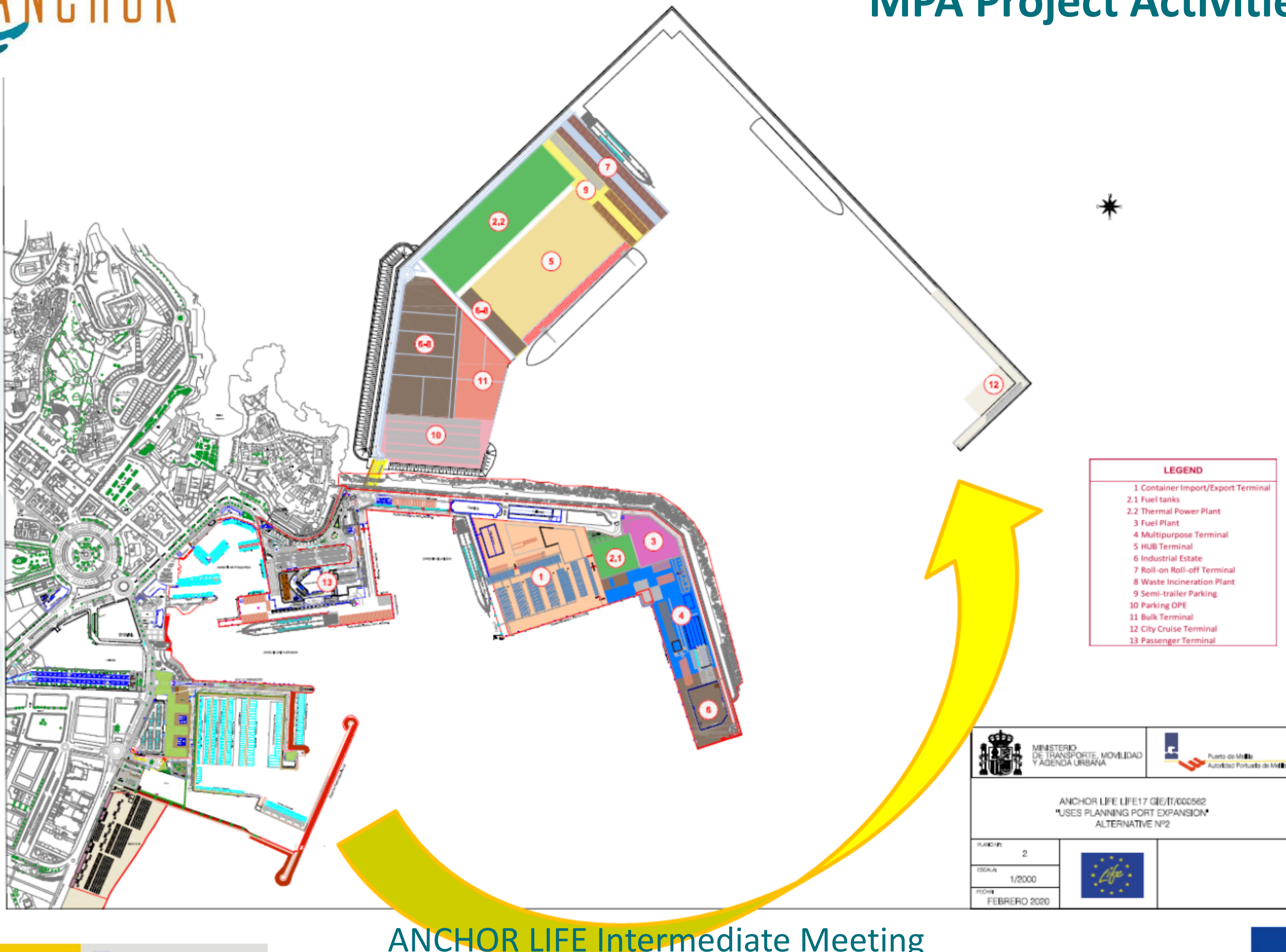

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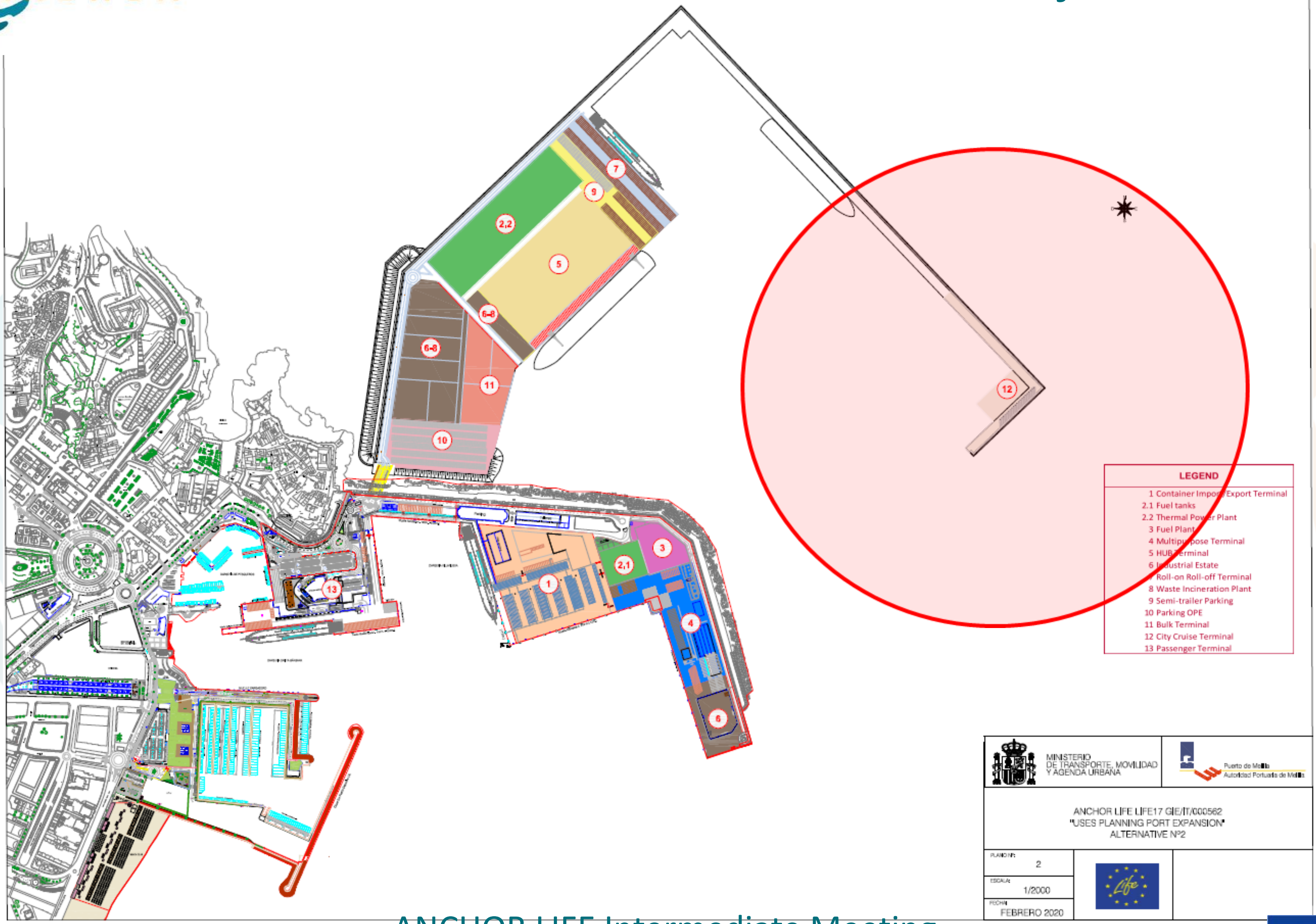

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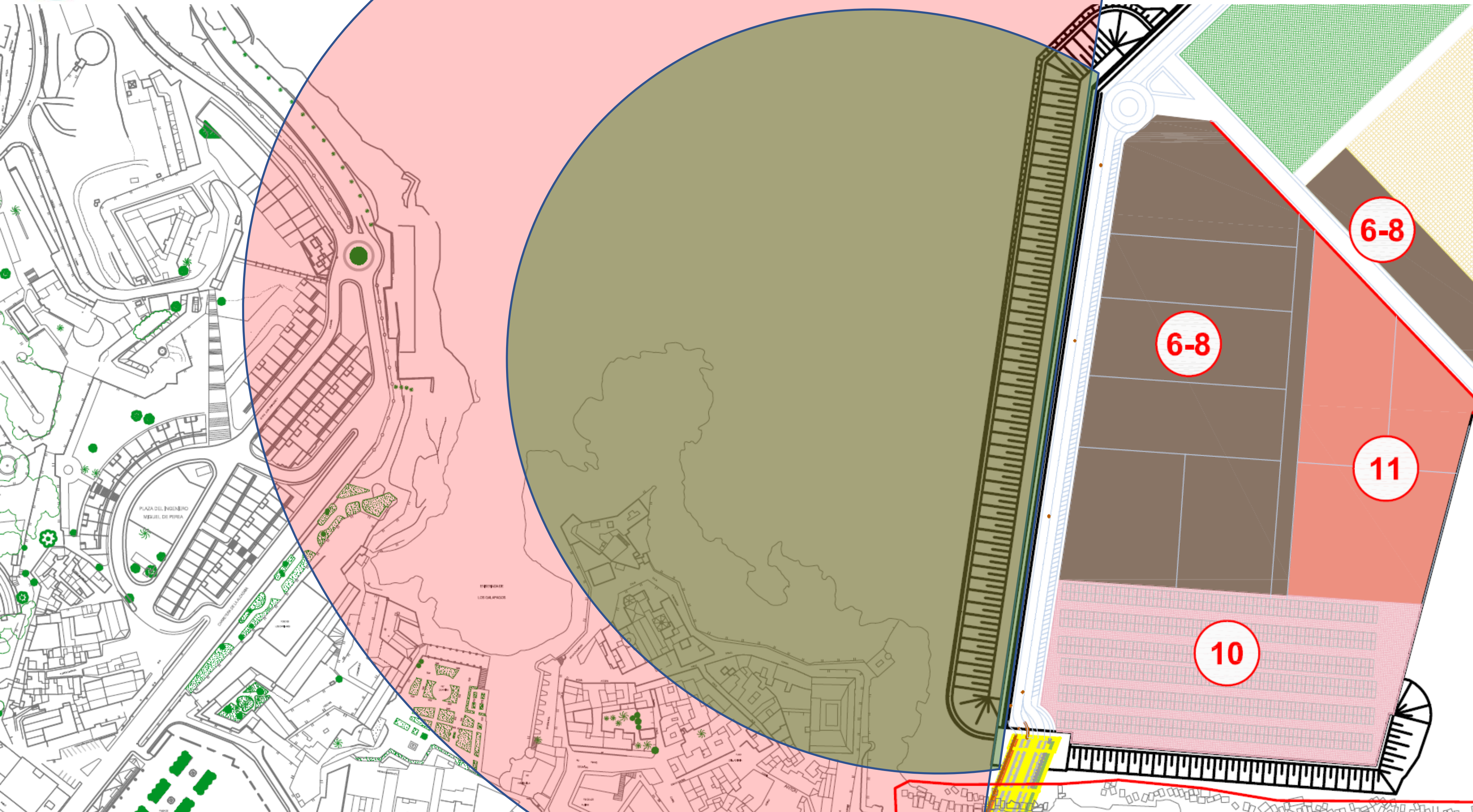

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MPA Project Activities.

1.- MELILLA CONTAINER TERMINAL (TCM)

1.1.- ESTIMATED TRAFFIC

Import /expo	Año 10	Año 20	Año 30	
Traffic WITHO	53.686	59.055	64.424	TEUs
Traffic WITH p	59.822	83.751	107.680	TEUs

Target year 30

TEUS PER VESSEL SERVED		
TEUs per vessel served maximum	1.496 TEUs/Ship	
TEUs per vessel attended minimum	237 TEUs/Ship	
TEUs per medium handled vessel	1.094 TEUs/Ship	(*)

TEUs attended at TCM 50% higher than the minimum number

Total TEUs served per vessel in the TCM 355,5 TEU/ship

we set an average value of 1,54 TEU/contenedor (*)

Total Average Containers served per vessel 231 containers

Number of vessels / year

Ships	Year 10	Year 20	Year 30
Without	152	167	182
With	169	236	303

1.2.- ESTIMATED CRANES

Crane performance, estimated based on the operations carried out between 2016 and 2019 in the Port of Melilla.

Annual performance per Crane maximum 37.165 Operations / year
Annual performance per Crane minimum 7.713 Operations / year
Annual performance per Crane average 17.196 Operations / year (**)

An average annual operating performance of 37.165 Operations / year

(*) Source: Cost chain study for container traffic; Puertos del Estado
(**) Source: Compiled by author from databases of the Melilla Port Authority

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Resulting a number of cranes needed from:

Cranes	Year 10	Year 20	Year 30
Without	0,94	1,03	1,13
With	1,05	1,46	1,88

Therefore, in the scenario without port expansion, a single crane is considered sufficient.
This is not the case in the scenario with port expansion, which would require a second crane from the year 20

Summary of machinery:

- A Panamax / Post-Panamax mobile crane with the following characteristics:
  - Maximum load capacity 124 t.
  - Maximum load with bulk 90 t.
  - Container Maximum Row Reach 16 Row
  - Engine power 750 Kw
  - Acoustic protector: Noise reduction: 50 %

- A Portainer crane type Panamax / Post - Panamax with the following characteristics:
  - Single lift capacity 40-50 t.
  - Container maximum row 16 Row

1.3.- GROUND HANDLING EQUIPMENT

Relationship between machine hour and crane hour: 2,2 (**)

A total of container handling equipment in the storage area is estimated for:

HANDLERS	Year 10	Year 20	Year 30
Without	2	2	3
With	3	4	4

- Front container handler
  - Single lift capacity 52 t.
  - Number of units 2 Ud.

- Reachstacker

Single lift capacity	46 t.
Number of units	2 Ud.

- Empty containers forklift

Single lift capacity	11 t.
Number of units	1 Ud.

1.4.- REEFER CONTAINER PLUGS

5 existing container terminals in Spain are analyzed, obtaining the following table:

TERMINALS	1	2	3	4	5	Average
TEUs/year	198.000	50.000	36.000	800.000	1.300.000	476.800
Reefers	1.226	330	16	486	486	509

An allocation of Reefers is estimated based on the traffic of one unit per 1000 TEUs per year.

Obtaining:

REEFERS	Year 10	Year 20	Year 30
Without	60	60	60
With	100	100	100

A simultaneity coefficient is estimated: 0,2 in situations Standard
0,3 in situations OPE

Depending on the estimated traffic, a continuous total simultaneity of:

REEFERS 24h	Year 10	Year 20	Year 30
Without	10	11	12
With	11	16	20

in situations Standard

REEFERS 24h	Year 10	Year 20	Year 30
Without	15	16	18
With	17	23	30

in situations OPE

1.5.- DEGREE OF OCCUPANCY (ϕ) OF THE DOCKING LINE S / ROM 2.0-11

Expected number of vessels (Nb) = γp . Nb1		
Number of berths (Na)	1	Berth
Average service time (ts)	10	Hours / operation
Time the terminal is open ($t_{año}$)	5.548	Hours / year
Daily opening hours	16	Hours / day
Climatic operability	95	%

Number of ships according to expected traffic Nb1 =

(Nb1)	Year 10	Year 20	Year 30
Without	152	167	182
With	169	236	303

Peak factor (γp) 1,2 S/ROM 2.0-11

Degree of occupancy (ϕ) = Nb . Ts / Na / $t_{año}$

(ϕ)	Year 10	Year 20	Year 30
Without	0,33	0,36	0,39
With	0,37	0,51	0,66

1.6.- DEPOSIT CAPACITY OF TERMINAL S / ROM 2.0-11

Maximum annual volume to be handled in the berth (Ct), TEUs/year:

Ct	Year 10	Year 20	Year 30	
Without	53.686	59.055	64.424	TEUs
With	59.822	83.751	107.680	TEUs

Future Vessel Capacity according to Future Demand Analysis. 750 TEUs

An average unit traffic (Cu) is adopted, that is, the average volume of loading and unloading in each scale, of 4
given the geographical uniqueness - significantly higher than that indicated in ROM 2.0-11 in initial or final sca
40%).

Average unit traffic (Cu) = 352,5 TEUs/ship

Number of vessels in the maximum month λmáx = Ct . γp / Cu /12
let γp = 1,2

λmáx	Year 10	Year 20	Year 30
Without	15	17	18
With	17	24	31

The storage capacity, according to ROM 2.0-11, is obtained by the following expression:

$C_{almacenamiento} = Ct \cdot \gamma p \cdot ((1-\rho)(2 \cdot t_{import} + 30/\lambda máx + 2) + \rho (2 \cdot t_{export} + 30/\lambda máx + 2)) / 356 / 2$

Being:
t_{import} = the time of permanence of the container in regime of entry in the terminal
t_{export} = the time of permanence of the container in exit regime of the terminal
ρ = ratio of outbound traffic with respect to the total facility

t_{import} =	10 days	S/ ROM 2.0-11
t_{export} =	5 days	S/ ROM 2.0-11

50% of the time spent in the terminal is adopted due to the reduced territorial scope, being values with the current time spent.

t_{import} =	5 days	S/ ROM 2.0-11
t_{export} =	2,5 days	S/ ROM 2.0-11
ρ =	50% Due to the reduced territorial scope and island effect.	

$C_{almacenamiento}$	Year 10	Year 20	Year 30	
Without	1.012	1.096	1.180	TEUs
With	1.108	1.482	1.855	TEUs

Average number of stacking heights $N_{alturas}$: 3 heights

Occupancy rate in storage areas I_{huella} = 235 batch / Ha
(perpendicular to the pier) S/ROM 2.0-1

$S_{almacenamiento}$ Area = $C_{almacenamiento}$ / $N_{alturas}$ / I_{huella}

$S_{almacenamiento}$	Year 10	Year 20	Year 30	
Without	1,4	1,6	1,7	Has
With	1,6	2,1	2,6	Has

Operating surface = Latraque * Ancho Zona Operación

Berth length =Lat = 230 m. Inside the terminal
Operation Zone Width = 30 m.

Operating surface = 0,69 Has

Transfer surface = 50% of the operating surface

Auxiliary Services Area = 20% of the storage surface S/ROM 2.0-11

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Total area of TCM (Has)

Total Area	Year 10	Year 20	Year 30	
Without	3,1	3,3	3,5	Has
With	3,4	4,3	5,2	Has

1.7.- FORECAST OF TRAFFIC GENERATED FOR THE TCM TERMINAL

It is done through the following mathematical expression:

$T = Ct \cdot \alpha \cdot \beta \cdot \tau \cdot (1-\delta) \cdot \sigma / 360 / W / \mu$

Being:

T = Expected traffic density (vehicles / hour).
Ct = Annual volume of goods handled in the facility under the import-export regime (t).
W = Average tonnage moved by a truck (t).
α = Part of the merchandise transported by road (expressed on a per unit basis)
β = Monthly variation index (peak month traffic / ordinary month traffic).
τ = Daily variation index (peak day traffic / ordinary day traffic).
δ = Passive vehicle index (passive vehicles / transport vehicles).
μ = Loaded vehicle index (loaded vehicles / transport vehicles).
σ = Hourly variation index (rush hour traffic / rush day traffic).

Adopting the following parameters according to ROM 2.0-11

W =	12,73 t. for containers	s/ Melilla Port Authority Anual Reports 2016-2019
W =	3 t. for general cargo	
α =	1 only road traffic	
β =	1 t. for containers	
β =	1,2 t. for general cargo	
τ =	1,5	
δ =	0,5	
μ =	0,5	
σ =	0,125	

Breaking down road traffic into fractional cargo and container, estimating 20%
of the general cargo load that is broken down in the terminal's auxiliary facilities.

Is obtained:

T1 = 4,09E-05 . Ct,contenedor
T2 = 2,08E-04 . Ct,general

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BAR DIAGRAM

Traffic is distributed in two annual types:

- Situation with Operation Paso del Estrecho: With a duration of 4 months: June, July, August and September

- Standard Situation: The rest of the year

1.1.- SHIP CALLS

The average number of vessels per month being those indicated in the following table,

SHIPS	Year 10	Year 20	Year 30
Without	12	13	15
With	14	19	25

Assumed λmáx, number of vessels in the maximum month, as a value in OPE Scenario

λmáx	Year 10	Year 20	Year 30
Without	15	17	18
With	17	24	31

And the following difference, with respect to the annual total, as a representative value of the Standard Scenario:

λdif	Year 10	Year 20	Year 30
Without	10	11	13
With	13	17	22

1.2.- CRANES

- Mobile crane of 124 t.

Operation during the call of the ship, in all scenarios

Grúa Móvil	Year 10	Year 20	Year 30
Without	1	1	1
With	1	1	1

- Portainer crane type Panamax / Post-Panamax of 40 t.

It would be necessary in Situation WITH expansion from the year 20

Grúa Pórtico	Year 10	Year 20	Year 30
Without	0	0	0

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1.3.- INLAND CONTAINER HANDLERS

- 52 t forklift.

A minimum of two units is established in all scenarios.
As traffic increases, it is necessary to increase working hours.

- Reachstacker 40 t.

Reachstacker	Year 10	Year 20	Year 30
Without	0	0	1
With	1	1	2

- Empty containers forklift 11 t.

1 unit is estimated in year 30 of in the scenario WITH expansion, once the terminal is consolidated

1.4.- REEFERS

The reefers obtained in Standard situation are:

REEFERS 24h	Year 10	Year 20	Year 30
Without	10	11	12
With	11	16	20

In OPE situation:

REEFERS 24h	Year 10	Year 20	Year 30
Without	15	16	18
With	17	23	30

Situación: MES ESTÁNDAR
Ampliación: NO

SIN ACTIVIDAD
CON ACTIVIDAD

Actividad		Horario	AÑO 10 Unidades	AÑO 20 Unidades	AÑO 30 Unidades
1 TERMINAL CONTENEDORES MELILLA (TCM)					
1.1	Escala Buque Cont Import/Export Escala 10 horas	M / T / N	Buques/Mes 10	Buques/Mes 11	Buques/Mes 13
1.2.1	Grúa 1: móvil de 124 t. Operación simultánea con buque	M / T / N			
1.2.1	Grúa 2: Pórtico tipo Panamax de 40 t. Operación simultánea con buque	M / T / N			
1.3.1	Elevadora Nº1 de 52 t.	M / T / N			
1.3.2	Elevadora Nº2 de 52 t.	M / T / N			
1.3.3	Reachstacker Nº1 de 40 t.	M / T / N			
1.3.4	Reachstacker Nº2 de 40 t.	M / T / N			
1.3.5	Elevadora Contenedores Vacíos de 11 t.	M / T / N			
1.4	Reefers	M / T / N	Unidades 10	Unidades 11	Unidades 12
1.5	Tráfico Vehículos Pesados (Entrada+Salida)	M / T / N	Vehic/hora 26	Vehic/hora 28	Vehic/hora 32

Situación: MES ESTÁNDAR
Ampliación: SI

SIN ACTIVIDAD
CON ACTIVIDAD

Actividad		Horario	AÑO 10 Unidades	AÑO 20 Unidades	AÑO 30 Unidades
1 TERMINAL CONTENEDORES MELILLA (TCM)					
1.1	Escala Buque Cont Import/Export Escala 12 horas	M / T / N	Buques/Mes 13	Buques/Mes 17	Buques/Mes 22
1.2.1	Grúa 1: móvil de 124 t. Operación simultánea con buque	M / T / N			
1.2.1	Grúa 2: Pórtico tipo Panamax de 40 t. Operación simultánea con buque	M / T / N			
1.3.1	Elevadora Nº1 de 52 t.	M / T / N			
1.3.2	Elevadora Nº2 de 52 t.	M / T / N			
1.3.3	Reachstacker Nº1 de 40 t.	M / T / N			
1.3.4	Reachstacker Nº2 de 40 t.	M / T / N			
1.3.5	Elevadora Contenedores Vacíos de 11 t.	M / T / N			
1.4	Reefers	M / T / N	Unidades 11	Unidades 16	Unidades 20
1.5	Tráfico Vehículos Pesados (Entrada+Salida)	M / T / N	Vehic/hora 30	Vehic/hora 41	Vehic/hora 53

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Situación: MES ESTÁNDAR
Ampliación: NO

SIN ACTIVIDAD (white) · CON ACTIVIDAD (lilac)

Actividad		Unidades	Horario	AÑO 10																													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1 TERMINAL CONTENEDORES MELILLA (TCM)																																	
1.1	Escala Buque Cont Import/Export	Buques/Mes	M	10			10			10			10			10			10			10			10			10			10		
	Escala 10 horas	10	T	10			10			10			10			10			10			10			10			10			10		
			N																														
1.2.1	Grúa 1: móvil de 124 t.		M	10			10			10			10			10			10			10			10			10			10		
	Operación simultánea con buque		T	10			10			10			10			10			10			10			10			10			10		
			N																														
1.2.1	Grúa 2: Pórtico tipo Panamax de 40 t.		M																														
	Operación simultánea con buque		T																														
			N																														
1.3.1	Elevadora Nº1 de 52 t.		M	10	8		10	8		10	8		10	8		10	8		10	8		10	8		10	8		10	8		10	8	
			T	10			10			10			10			10			10			10			10			10			10		
			N																														
1.3.2	Elevadora Nº2 de 52 t.		M	10			10			10			10			10			10			10			10			10			10		
			T	10			10			10			10			10			10			10			10			10			10		
			N																														
1.3.3	Reachstacker Nº1 de 40 t.		M																														
			T																														
			N																														
1.3.4	Reachstacker Nº2 de 40 t.		M																														
			T																														
			N																														
1.3.5	Elevadora Contenedores Vacíos de 11 t.		M																														
			T																														
			N																														
1.4	Reefers	Unidades	M	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		10	T	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
			N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1.5	Tráfico Vehículos Pesados (Entrada+Salida)	Vehíc/hora	M	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
		26	T	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
			N	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Takeaways

- Sound and Vibration Modelling and Port Planning (Both Works and Management) have a very productive potential if there is a Good interconnection.
- The economic impact of noise and reduction measures based on mitigation and / or management can be integrated into port works evaluation systems

Thank you for your attention

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