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on marine aquaculture
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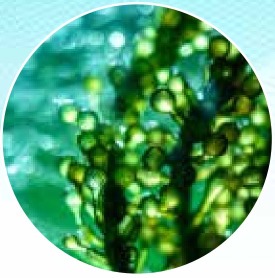


METHODOLOGICAL GUIDE

Set up an onshore aquaculture site with sea water supply

I have a marine aquaculture project, I need to equip my site (land or building) with sea water pumping

I am a technician from a local authority, I have a site to equip with seawater pumping or a project to support

KEY ELEMENTS TO BE ANALYSED

Made by
INVESTIR EN FINISTÈRE
REUSSIR VOTRE IMPLANTATION

In partnership with
Technopole
Quimper-Cornouaille

EDITO

Finistère is the leading maritime department in mainland France with 1,391 km of coastline with a variety of features: cliffs, rias, abers (estuaries) and numerous ports. Marine aquaculture has been present here for a long time, particularly shellfish farming centered on the breeding of mussels and oysters.

Today, this activity faces various challenges (coveted coastline, scarcity of resources, water quality, etc.) but also with new prospects (mastery of new techniques, development of biotech-nologies, interest in algaculture, etc.). The sea is a resource that cannot be relocated, and Finistère has a real interest in maintaining and developing aquaculture activities.

In Finistère, marine aquaculture covers two geographical realities which, depending on the project, may be complementary or independent: sea- based concessions and land-based sites supplied with sea water. For offshore aquaculture activities that require onshore structures, the choice of site is decisive (often in the immediate vicinity of production). The criteria for site selection are usually considered in a feasibility study, which is the first step in the implementation of an aquaculture project.

The location of the aquaculture premises must take into account the distance from the coastline for both the raw seawater supply and the wastewater discharge. The pressure of land use on the seashore and the occupation of harbours may lead the project developer to look for a more distant site. However, depending on the activity, areas that are more than one kilometer away are generally considered to be outside the scope of the study for technical and economic reasons. However, depending on the activity, areas more than 2500m from the coast and at an altitude of more than 40m are generally considered to be outside the scope of the study for technical and economic reasons.

Aquaculture remains a primary production sector overall (comparable to agriculture): the supply of quality sea water is at the heart of the aquaculture production system. In his search for a site, the project owner must be able to be confident of a regular, high-quality water supply, the possibility of carrying out controls and sanitary monitoring, of being able to intervene in an emergency in the event of a failure, of being able to

In its search for a site, the project owner must be able to be confident of a regular, high-quality water supply, the possibility of carrying out checks and health monitoring, of being able to intervene in an emergency in the event of failure, and of carrying out adequate maintenance of pumping units and pipes.

It is because these activities have particular characteristics and constitute a development potential for Finistère, that Investir en Finistère, with the support of the Technopole of Quimper Cornouaille, decided to produce this methodological guide.

HOW THEN, TO LAUNCH A PROJECT ?

The first step is to study the site: to produce, you need a physical space. This guide indicates the steps and key indicators to check when equipping a site. It is intended for:

- *Entrepreneurs who are embarking on an onshore aquaculture project requiring seawater pumping, whether linked to an off-shore concession or on their own.*
- *Technicians from public organizations and communities who are supporting a project on their territory or who wish to equip a site.*

In 2018, after two years of work with a group of partners, Investir en Finistère drew up an atlas of existing sites, accessible online at www.accesmerenfinistere.fr, and a list of potential sites. This non-exhaustive and non-exclusive list evolves regularly.

It is available from : Aurore Coppens, a.coppens@investir29.fr, 02 98 33 97 73.

You can also contact the professional federations, communities of communes or port managers directly.

CONTENTS

1 APPROACH AN AQUACULTURE PROJECT AS A BUSINESS PROJECT

"I have a marine culture project on a land-based site requiring seawater pumping. »

An aquaculture project is above all a business creation project that mobilizes multiple skills: technical, administrative, managerial and scientific. It is necessary to take stock of all of these items in order to benefit from an initial audit and to associate the complementary/missing skills as we go along. Furthermore, aquaculture remains a primary production sector, comparable to agriculture, with low profit margins, sometimes high investments in proportion to turnover, and reasonable operating costs. It is therefore necessary to weigh the ratios carefully in order to build a viable economic model.

1.1 The steps of a project

STEP 1
I formalize my project

I write a summary specification (10/15 lines) to explain my project:

- Level of progress and steps already taken
- Activity and production envisaged (species, tonnage, etc.)
- Possible partners, budget
- Site requirements (surface area, water flow rate, etc.)

STEP 2
I focus on technical aspects

I check the technical criteria inherent in my project (see technical part of the guide).

I contextualize my project: points to be skimmed over and/or redhibitory points.

All of the criteria must be addressed from the outset in order to carry out a sufficiently exhaustive analysis to avoid any points that could prove to be prohibitive later on. For example, regarding water quality, which is a key factor, when data is not available, a summer measurement campaign may be necessary. Tolerance thresholds must be studied on a case-by-case basis, depending on the species, the nature of the project, and the financing capacities for filtration systems.

> **It is therefore necessary to examine and analyse all the criteria to have this global vision.** It is also necessary to identify those that can be acted upon and those that cannot be changed.

STEP 3
I carry out a feasibility study

The site survey is the first step in a technical and economic feasibility study of an aquaculture project, which includes:

- Site study
- Definition of zootechnical criteria in line with the selected site
- Production planning
- Definition of technical criteria, preliminary design of technical production facilities
- Sketch plan
- Definition and description of investments
- Economic and financial forecasting: depreciation, operating costs, sales forecasts, definition of stocks, provisional profit and loss account, project costs, financial requirements, cash flow plan, internal rate of return.

The average time for setting up an aquaculture project is two to three years*, from the initial idea to the start of production, and it is not uncommon to have to add one or two more years.*

A feasibility study usually takes between 2 and 6 months *depending on the complexity of the project when the data is available.*

An ICPE study (Classified Installations for Environmental Study) can take 2 years, an impact study 18 months.

It is possible to be accompanied by a professional structure and/or the support structures for business creation.

1.2 Some useful contacts

- Comité Régional de la Conchyliculture Bretagne Sud - huitres-de-bretagne.com
- Comité Régional de la Conchyliculture Bretagne Nord - crcbn.com
- Syndicat de la Truite d'Élevage de Bretagne - aquaculteurs-de-bretagne.fr
- Syndicat Professionnel des Récoltants d'Algues de Rive de Bretagne - srparb.assoconnect.com
- Chambre Syndicale des Algues et des Végétaux Marins - chambre-syndicale-algues.org
- Technopole Quimper-Cornouaille - tech-quimper.bzh
- Technopôle Brest-Iroise - tech-brest-iroise.fr
- Agrocampus Ouest, site de Beg Meil - agrocampus-ouest.fr

2 SOME RATIOS AND DATA BY TYPE OF AQUACULTURE

The term marine aquaculture covers very different project realities, particularly in terms of land-sea interface and regulations. Depending on the species, the function of the site (purify, store, produce), the surface area, the flow rates and technical constraints can vary greatly. Thus, a fish farmer who needs purification ponds of a few m³ will not be subject to the same technical or regulatory constraints as a seaweed or fish farming project that will cover several hundred/thousand m².

The figures and ratios below give orders of magnitude by type of aquaculture, which always need to be put into context.

II.1 THE SHELLFISH AQUACULTURE

II.1.1 THE LAND-SEA INTERFACE AT THE HEART OF THE ACTIVITY

In the case of shellfish farming,the land-based facilities are linked. They are an extension of the sea farming activity. This is known as the land-sea interface.

In Finistère, the onshore sites are in most cases purification and/or storage facilities in ponds supplied with sea water. Therefore, it is not strictly speaking land-based cultivation as it may be for other activities. There is no use of inputs, the water flow is often less than 30 m³/h, which results in less regulation than other types of aquaculture.

Shellfish farming functional unit diagram

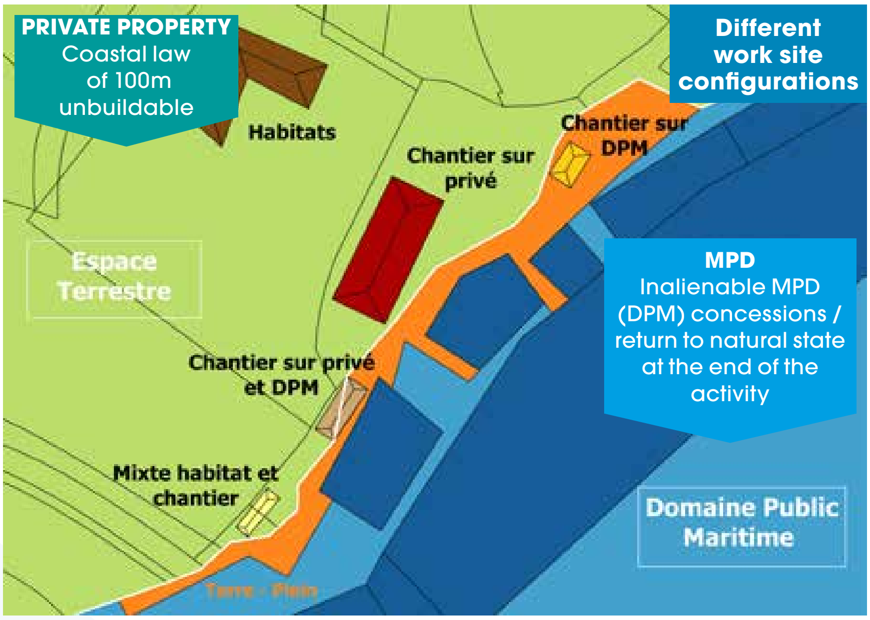


Photo credit: CRC Bretagne Sud

II.1.2 EXAMPLES OF RATIOS

It is difficult to establish standard configurations: the activities carried out by the shellfish farming enterprise necessarily condition their land area requirements. Indeed, different factors influence the land area required for production, such as:

- the position in the production stage: does the company do the whole cycle (from catching to marketing)? Or only part of it: catching, hatchery, pre-growth, growth?
- the marketing method.
- the water quality: a shellfish farmer who farms at sea in zone A may have a large tonnage and little need on land since he will not need to purify, whereas a farm at sea in zone B will require more important purification means on land.
- the type of building: covered or uncovered ponds.
- the species cultivated: oysters, mussels, other shellfish, etc.

6 activities are presented below in Table 1 as examples. They are based on real cases and are orders of magnitude. The installations and their surface areas must always be put into context.

Small shellfish hatchery

Industrial shellfish hatchery

Oyster grow-out

Mussel grow-out

Open circuit shellfish purification

Recirculating shellfish purification

Table 1: Shellfish production systems, some examples of ratios based on real cases

	TYPES OF PRODUCTION SYSTEMS					
Shellfish aquaculture	**Small shellfish hatchery**	**Industrial shellfish hatchery**	**Grow-up of flat oysters and hollow oysters Onshore requirements**	**Mussel grow-out Onshore requirements**	**Open circuit shellfish purification**	**Purification of shellfish in recirculation**
Expected production (/year)	200 million µ spat	1 billion µ spat	300-700t	100-1000t	-	-
Floor area (m²)	1500	1200-1300	300-700	220-750	200-250	200-250
Land area (m²)	2200-2400	1800-2100	450-4200	300-1200	300-400	300-400
Ratio Land area / Floor area	1,5-1,6	1,5-1,6	1,5-6	1,4-1,6	1,5-1,6	1,5-1,6
Storage capacity - purification	-	-	0-700t/year	Included	32t/day	15t/day
Continuous seawater requirement (m³/h)	25	50	0-25	-	13-15	2,5-3
One-time seawater requirements (m³/h)	50	60	100	-	-	-
Maximum discharge rate of the aquaculture process (m³/h)	80	120	120	20	20	20

source IDEE Aquaculture

COMMENTS ON THE 6 TYPES OF PRODUCTION SYSTEMS

1. Small shellfish hatchery

A shellfish hatchery is said to be "small" when production does not exceed 200 million spat per year. For a production of 200 million, the building surface is estimated at 1,500 m^2 and the land surface at 2,200 - 2,400 m^2. The seawater requirement is on average 25 m^3/h continuously. From time to time, particularly for filling the tanks before the start of a new production cycle, these requirements may be doubled. The sizing of the discharge pipes must take into account the continuous flow rate + the flow rate for emptying the ponds. This emptying flow is considered to be approximately equivalent to the filling flow (point flow).

2. Industrial shellfish hatchery

The industrial shellfish hatchery uses the latest technology for intensive quality production. For a production of one billion spat per year, the building surface area is estimated at 1,200-1,300 m^2, i.e. a smaller surface area than the small shellfish hatchery for a production capacity 5 times higher. The seawater requirements are 50 m3/hr continuously + 60 m^3/hr occasionally, i.e. a maximum discharge rate of 120 m^3/hr.

Furthermore, the needs for flat oyster spats vary considerably depending on the companies. However, we can take the following example:

- Hatchery discharge of 100,000 1-mm-spat. 5-2 to the nursery
- Exit from the nursery 6mm-8mm after sorting: 80%, i.e. 80,000 individuals to pre-growth
- Exit from pre-growth after 80% survival, i.e. 64,000 individuals to grow-out
- Grow-out with 40% survival, i.e. 25,600 individuals or approximately 2 tonnes.

3. Oyster grow-out - Onshore requirements to be correlated with offshore concessions

Oyster grow-out operations have varying land area requirements. These requirements depend on many factors such as the type of production, the share of trade, storage and purification capacities, storage time, and the way of working.

As an example, here is the case of a company that has an annual production of 300t of hollow oysters, its onshore facilities are

- Production floor: 250-300 m^2
- Shipping, packaging, cold storage: 60-100 m^2
- Purification (11t capacity): 140-150 m^2

Onshore requirements in terms of the surface area of offshore concessions vary greatly from one company to another, depending on production techniques, production areas, purification requirements and the seasonality of sales. However, the building surface requirements are 300 to 700 m^2 for a production of 300 to 700 tonnes per year. For these productions, the land area varies from 450 to 4,200 m^2. The seawater requirements are also very variable; the flow rates range from 0 to 25 m^3/h continuously, up to 100 m^3/h occasionally, and a discharge capacity of up to 120 m^3/h. To make the link with the surface area at sea, a great variability of production can be observed; to take an example, we can consider a productivity of 10 tonnes/ha/year in a concession and a concession area of 10ha.

4. Mussel grow-out – Onshore requirements

In mussel farming, 3 main activities can be distinguished in terms of their needs on land:

- Grow-out: a large part of the work is carried out directly on the boats, especially for the sea-based lines. Land requirements are low, and are reduced to access to the sea, a storage area for equipment, mussels in bags or raw ropes in a cold room before shipping;
- Storage - purification: mussel farmers can store or purify their products and trade product. These activities vary greatly from one producer to another or from one geographical area to another: in this case, the additional land areas are those mentioned in the categories. In this case, the additional land areas are those mentioned in the "shellfish purification" categories in Figure 1;
- Trade - process: the surface requirements are greater than those for purification; the process of pallets of raw mussels received from other destinations consists of cold storage for less than 24 hours, storage in water for more than 24 hours, vacuum-packing in trays or other before sale to wholesalers.

For the purposes of this study, only the grow-out activity is considered: for a production at sea of 100 to 1,000 tonnes per year, the floor space requirements are estimated at 220-750 m2, the land requirements at 300 to 1,200 m2, without pumping sea water and the aquaculture water discharge requirements only for cleaning operations.

5-6. Shellfish purification

Purification can be done:

- in an open circuit: water is pumped, treated, used to purify and store and then discharged
- or in a recirculated circuit: the water is pumped, treated, used to purify and store and then reused without being rejected, there is a renewal of water but minimal compared to the open circuit

In shellfish purification as in production, the methods and criteria vary greatly from one company to another.

In open circuit, for a building of 200 to 250 m^2 (300 to 400 m^2 land), the purification capacity is 32 tonnes per day. The continuous seawater requirements are 13 to 15 m^3/h and the discharge requirements for emptying can be sized by considering a maximum flow rate of 20 m^3/h.

In recirculation, for the same 200-250 m^2 building, the seawater requirement is reduced to 2.5-3m^3/h due to the recirculation systems treating the water, but the purification capacity increases to 15 tonnes per day. Some installations using innovative and more efficient technologies can treat 40 tonnes per day in a 250-300 m^2 building with a new water flow rate of less than 1m^3/hr in routine use, and a higher flow rate for refilling the tanks after a cleaning drain.

II.2 LAND-BASED CULTURE IN PONDS

Another major category of marine aquaculture is the development of land-based cultures in ponds such as: seaweed farming, fish farming, shrimp farming... These culture activities that use inputs and/or flow rates that can be higher than 30 m³/h are subject to stricter regulations on discharges and possibly to other regulations (such as classified installations).

II.2.1 SEAWEED FARMING

The production of macroalgae on land is a recent aquaculture activity, often conducted in co-culture. We can consider 3 types of production systems which are detailed in table 2 according to their seawater requirements:

Recirculated system

Semi-closed system

Open system

These are general datas, without citing specific species, and are intended to define areas on land.

Table 2: Macroalgal production systems in land-based ponds

	TYPES OF PRODUCTION SYSTEM		
Macroalgal production in land-based ponds	**Open**	**Semi-closed**	**Recirculation**
Expected production (wet tonnes/ha/year)	300-700	300-700	600-700
Ratio land area / floor area	1,5-1,6	1,5-1,6	1,5-1,6
Ratio floor area / pond area	1,5-3	1,5-2	1,5-1,7
Ratio Pond volume / Pond area	0,6-0,7	0,6-0,9	0,9-1
Percentage of water renewal in ponds / day	250-300	50-100	5-6
Flow rate (m³/day/1000m² of ponds)	1,500-2,100	300-900	45-60
Peak flow (m³/h/1000m² of ponds)	75-87	75-112	10

	TYPES OF PRODUCTION SYSTEM		
Example: unit of 5000m2 ponds	**Open**	**Semi-closed**	**Recirculation**
Expected production (wet tonnes/year)	150-350	150-350	300-350
Floor area (m²)	7,500-15,000	7,500-10,000	7,500-8,500
Land area (m²)	11,200-24,000	11,200-16,000	11,200-13,500
Ratio land area / floor area	1,5-1,6	1,5-1,6	1,5-1,6
Flow rate (m³/day)	7,500-10,500	1,500-4,500	225-300
Peak flow (m³/h)	375-435	375-560	50
Maximum discharge rate of the aquaculture process (m³/h)	435	560	50

Recommendation: under no circumstances may these data be used in the context of a technical-economic feasibility study or a market study, which are not the subject of this study.

COMMENTS ON THE 3 PRODUCTION SYSTEMS FOR MACROALGAE IN LAND-BASED PONDS

1. Seaweed farming: Open-loop production

The production of macroalgae on land was first developed in an open circuit, either alone or using the waste from another aquaculture production, for example ulva production from a fish hatchery. The production systems vary greatly, but generally speaking, for an annual production of 150 to 350 wet tonnes per year and a pond surface area of 5,000 m^2, a floor area of 7,500 to 15,000 m^2 and a land area of 11,200 to 24,000 m^2. In open circuit, producers generally work with a water renewal rate of 250 to 300% per day, i.e. a peak flow rate of 375 to 435 m^3/h, which must be taken into account for the sizing of the supply channels or pipes. The maximum flow of discharges is based on the maximum flow of new water, i.e. 435 m^3/h.

2. Production in a semi-closed circuit

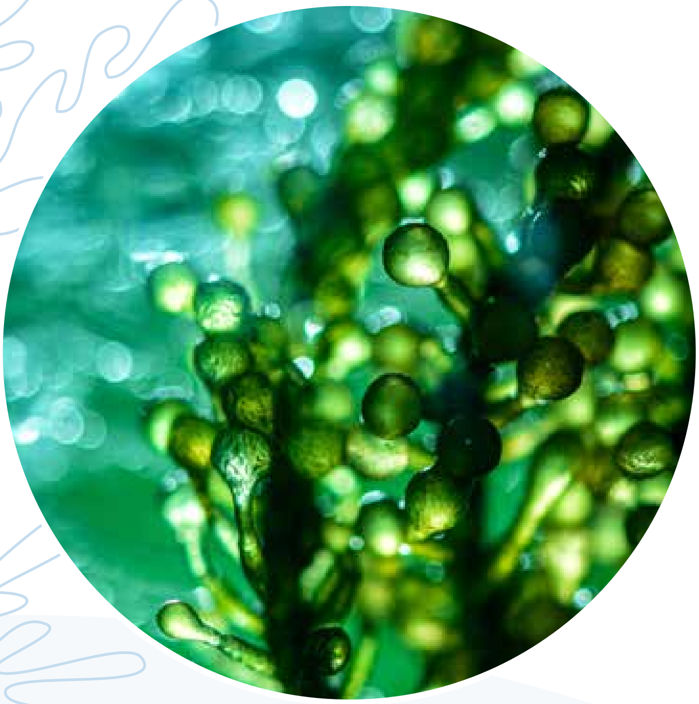
In a semi-closed circuit, treatment installations allow part of the water to be recirculated in order to reduce the need for new water on a routine basis. The renewal rate of the ponds is thus reduced to 50-100%/day (250-300%/day in open circuit). For an annual production of 150-350 wet tonnes, the floor or land area requirements remain the same as for open circuit production.

3. Seaweed farming: recirculation production

Recirculating macro-algae production is a recent activity that requires a high level of know-how and technology. Depending on the species, the experimental needs remain important. The objective is to achieve a very low freshwater requirement of up to 5-6% of tank turnover per day. For a unit with 5,000 m^2 of ponds, an annual production of 300-350 wet tonnes and a peak flow rate of 50 m^3/h is expected, in a building with the same surface area as in an open or semi-closed circuit.

When macro-algae production is carried out at sea, for species authorized in Finistère, the onshore requirements are limited to:

- A small hatchery of a few square meters or a few dozen square meters;
- An unloading dock, a reception, preparation and dispatch area of a few dozen square meters to 200-300 m^2.



II.2.2 FISH FARM

For fish farming, we consider 6 types of systems in Table 3.

Small experimental plateform

Multi-species experimental plateform

Sea bass and sea bream hatchery

Turbot type hatchery

Pre-growth (PG) sea bass or lean type

Recirculating production system salmon and 3kg trout type

Table 3 : fish production systems

	TYPES OF SYSTEM					
Fish farm	**Small experimental platform**	**Multi- species experimental platform**	**Sea bass and sea bream type hatchery**	**Turbot type hatchery**	**Recirculating sea bass or lean PG**	**Salmon and 3 kg-trout in recirculation grow-out**
Expected production (/year)	Research	Research	50 million alevins	3 million alevins	10 million alevins 10g	800-1,000t
Floor Surface (m²)	420-450	1,100-1,200	12,000	7,500-8,000	1,000-1,100	7,000-8,000
Land Surface(m²)	630-720	1,600-2,000	18,000-19,000	11,000-13,000	1,500-1,800	10,500-13,000
Ratio Land surface / Floor surfac	1,5-1,6	1,5-1,6	1,5-1,6	1,5-1,6	1,5-1,6	1,5-1,6
Seawater requirement (m³/h)	5	100-130	250-300	250-300	60	100-150
Sizing the discharge rate of the aquaculture process without buffer tank	A 10m³/h backwash for 10min + purging and emptying of tanks	130m³/h in 2 sequential backwashes of 65m³/h then purging and emptying of tanks in sequentially in one day: 130+65=195 m³/h rounded up to 200	4 sequential backwashes of 75m³/h + 25m³/h margin	4 sequential backwashes of 75m³/h + 25m³/h margin	2 sequential backwashs + purges +emptying	Fluidised bed treatment + purges + vidanges
Maximum discharge requirement of the aquaculture process without buffer tank (m³/h)	10	200	400	400	100	250
To be considered when dimensioning the volume of a buffer tank	A 10m³/h backwash for 10min + purging and emptying of tanks	2 backwashs of 65m³/h for 10min (22m³/day) + purges + emptying the tanks (28m³/day)=50m³	4 backwashs of 75m³/h for 10min (50m³/day) + purges + emptying the tanks (100m³/day)	4 7 backwashs of 5m³/h for 10min (50m³/day) + purges + emptying the tanks (100m³/day)	2 backwashs (50m³/day) + emptying one tank (50m³/day)	Fluidised bed treatment + purges + emptying one tank de 250m³

COMMENTS ON THE 6 FISH PRODUCTION SYSTEMS

1. Small experimental platform

A small experimental aquaculture platform is a small building of less than 500 m² with a low seawater requirement of around 5 m³/h, the purpose of which is to carry out experiments on a particular species. The maximum discharge requirement of the aquaculture process for the sizing of the pipes is 10 m³/h for a direct discharge after treatment, without a buffer tank.

2. Multi-species experimental platform

The multi-species experimental platform has more circuits and aquaculture equipment, in a building of 1,100 to 1,200 m² (land area 1,600 to 2,000 m²). The seawater requirements are much higher, at 100 to 130 m³/h. The maximum discharge requirement for the aquaculture process is estimated at 200 m³/h.

3. Sea bass and sea bream type hatchery

To achieve economic profitability, industrial marine fish hatcheries need to produce a relatively large quantity of fry. In sea bass and sea bream, for a production of 50 million alevins per year, the building and land areas are respectively 12,000 m² and 18,000-19,000 m². The seawater requirements are 250-300 m³/h and the discharge pipe for the aquaculture process water must be designed for a flow rate of 400 m³/h.

4. Turbot type hatchery

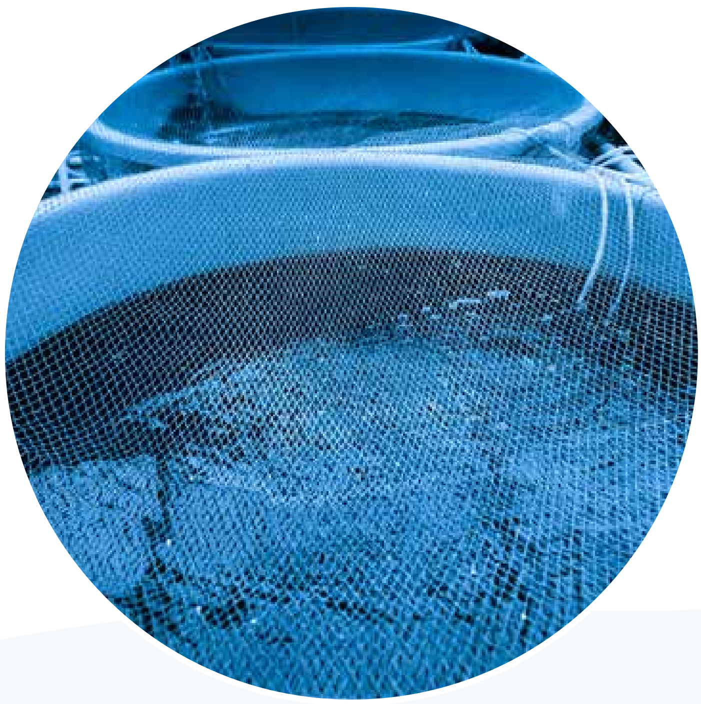
As an example of another type of industrial marine fish hatchery, let's take the turbot hatchery, with an identical seawater requirement: annual production of 3 million alevins, building and land areas of 7,500-8,000 m² and 11,000-13,000 m² respectively.

5. Recirculating sea bass or lean PG

To grow 10 million 10g sea bass and lean fish per year, the building area requirement is 1,000 to 1,100 m², the land requirement is 1,500 to 1,800 m², the seawater requirement is 60m³/h, and the discharge requirement for aquaculture process water is 100 m³/h.

6. Salmon and 3kg-trout in recirculation grow-out

To produce 800 to 1,000 tonnes of salmon or large trout of 3kg per year, the building surface requirements are 7,000 to 8,000 m², the land requirements are 10,500 to 13,000 m², and the seawater requirements are 100 to 150 m³/h depending on the conventional technologies, and possibly less with innovative technologies. The discharge requirement for aquaculture process water is 250 m³/h.



II.3 BIOTECHNOLOGY AND COSMETICS

Biotechnology and cosmetics activities can be very diverse, but generally the seawater flow requirements are low (table 4).

For hydraulic reasons, we consider flows of 2 to 12 m³/h.

The needs can be continuous or punctual, with the possibility of building a tower tank to facilitate gravity distribution.

Table 4: biotechnology and cosmetics

	REQUIREMENTS			
Biotechnology / Cosmetics	Minimum (continuous flow)	Minimum (punctual flow)	Maximum (continuous flow)	Maximum (punctual flow)
Continuous flow (m³/h)	2	_	12	_
Punctual flow (m³/h)	_	2	_	12
Maximum process discharge rate (m³/h)	10	10	23	23

3 HOW TO ANALYSE THE TECHNICAL ENVIRONMENT OF A SITE?

When analyzing a site, there are three main categories of elements to be taken into account. Two elements are considered unchangeable because it is often impossible to act on them:

- **water quality,**
- **the technical elements for laying the water supply and/or discharge pipes (nature of the soil, relief, etc.).**

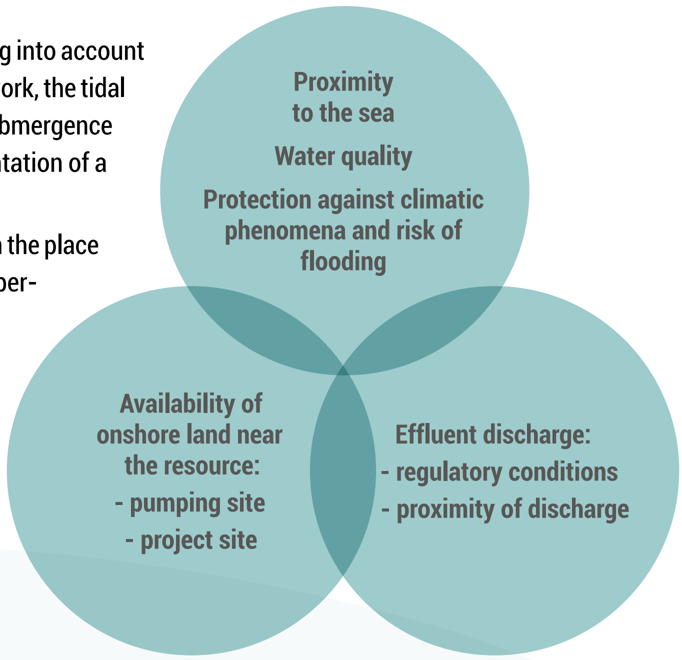
The third category consists of the regulatory analysis, it is sometimes possible to change or modify the elements (Local Urban Plan for example).

The location of the aquaculture premises must take into account the distance from the coastline for both the raw seawater supply and the wastewater discharge.

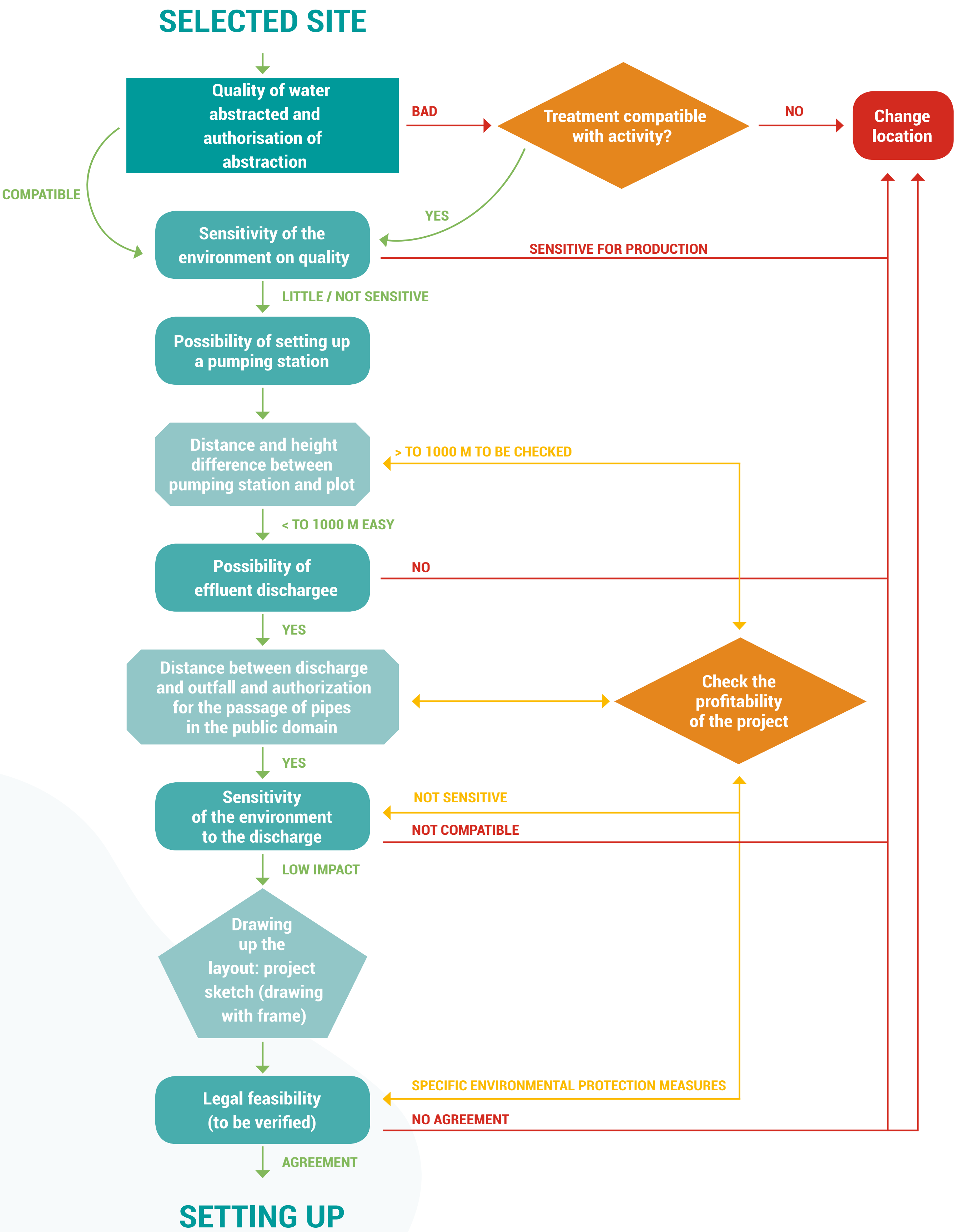
In order to verify the suitability of an aquaculture site, the profitability of the project with regard to the supply of raw seawater and the discharge of treated water must be examined.

The following must be checked:

1) The possibility of siting a seawater pumping system taking into account the constraints of raw water quality, the regulatory framework, the tidal range, the available land, the protection against marine submergence and climatic phenomena (see flowchart for the implementation of a pumping station).
2) The possibility of laying seawater discharge pipes between the place of abstraction and the site of installation and obtaining permission to lay private pipes in public domain.
3) The way the raw sewage is to be treated.
4) Acceptability of the receiving environment with regard to environmental constraints or authorization for discharge to a treatment plant.



The flowchart below helps to guide the project actors in their search for the most suitable site for the project owner.



III.1 WATER QUALITY
(RAW SEAWATER SUPPLY)

Seawater quality is a central issue in a site survey for an aquaculture project. Complete water analyses should be carried out during the first phases of the site study, in accordance with the nature of the project and the species being farmed or cultivated.

Firstly, the shellfish farming classification of the area and whether there are any sources of pollution in the vicinity of the pumping point should be examined.

Beyond this first fundamental step, the water quality parameters generally studied before a site search for the creation of an aquaculture project are listed in the following table. Depending on the water quality, investments will have to be made to pre-treat or treat the water according to the characteristics of the project.

Table 5: water quality parameters

WATER QUALITY PARAMETERS TO BE ANALYSED BEFORE SETTING UP AN AQUACULTURE ACTIVITY			
Temperature	°C	Total coliforms	ufc/g
pH	-	Enterococci	ufc/g
Salanity	‰	Escherichia coli	ufc/g
O2	mg/l	COD	mg/l
Conductivity	ms/cm	BOD5	mg/l
Turbidity	ntu	Arsenic	mg/kg
Redox	mV	Cadmium	mg/kg
Marine flora	ufc/ml	Copper	mg/kg
Vibrionaceae flora	ufc/ml	Mercury	mg/kg
Overall nitrogen	mg/l	Lead	mg/kg
Organic and ammoniacal nitrogen	mg/l	Other heavy metals depending on the context	
Total Organic Carbon	mg/l	Organochlorine pesticides	
TSS	mg/l	Organophosphates pesticides	mg/kg
Nitrates	mg/l	Polyaromatic hydrocarbons (HPA or HAP)	
Nitrites	mg/l	Polychlorinated biphenyls (sum of 6NDLUpp)	ng/g
Total phosphorus	mg/l		

In certain specific hydrogeological cases, seawater drilling is possible and may be the subject of a specific study to determine the water quality and flow rates available.

In general, in addition to water analyses, **all of the following points are analyzed during a site study for the implementation of an aquaculture project:**

Table 6: general criteria for analyzing the site in relation to the proposed activity

- General catchment pond data: geology, hydrography, hydrogeology, drinking water production
- Location and discharge of wastewater treatment plants
- Agricultural activities and discharges
- Other outfalls
- Bathing water quality
- Phycotoxins and closing periods
  - Ecological status of water bodies, SDAGE (Water Development and Management Master Plan), other environmental conditions
- Classified installations
- Aquaculture activities
- Marinas and anchorages
- Pumping conditions compatible with good project ergonomics
- Receiving environments of discharges
  - Nature of the soil
  - Topography of the land
  - Logistical facilities
  - Risk of flooding, submersion
  - Compatibility with peripheral activities
  - Sanitary isolation
  - Bathymetry, meteorology, currentology, tides
  - Nearby economic activities
  - Electricity and drinking water networks
  - Sensitivity of the environment to natural elements, risks of bad weather, rising sea levels
  - Presence of existing seawater extraction works.

In addition to water quality, for a selected site, the following issues must be addressed:

- sea water abstraction and its technical limits,
- discharge of industrial wastewater into the natural environment,

in order to carry out an aquaculture activity.

III.2. PUMPING

III.2.1 RAW SEAWATER SUPPLY: SELECTION OF A PUMPING SITE AND STUDY OF THE FEASIBILITY OF CONNECTION FOR WATER COLLECTING

III.2.1.1 In the case of an existing pumping station

- Verify the existence of a pumping system and the technical feasibility of connection from the existing network.
- Analyze the potential of the existing works, with regard to current operation and future operation hypotheses (on the basis of expres sed and presumed needs).
- Propose scenarios based on the different connection hypotheses.
- Identify the legal and contractual conditions for connection and treatment of discharges.
- Obtaining authorization to draw water (laying of pipes, impact on the surrounding environment, etc.).

Site reconnaissance

Diagnosis of the existing system

- Water pumping
- Water supply point
- Wharf works (civil engineering condition)
- Wastewater treatment plant and effluent discharge point
- Other works

The layout

Most likely scenario

- Topography
- Characteristics (high point, low point, crossing of existing structures)
- Identification of the industrial wastewater discharge point
- Other structures

The scenarios

Based on available/ envisaged capacity

- Typology and characteristics of the possible pumping (flow rate, pressure, geometric and manometric height, continuity of supply...)
- Civil engineering and hydraulic works (impacted/to be modified/to be planned)
- Budget estimates

III.2.1.2 In the case of a pumping station to be created

Raw seawater abstraction must take into account:

- the possibility of installing a pumping station on the shoreline according to the techniques available,
- the tidal range on site (up to 9 m on the Finistère coasts),
- the availability of the resource: 24 hours a day or on the tide,
- the morphology of the coast (sand, rock, dunes, land use, tides, etc.),
- protection against the risk of marine submersion of electrical and electronic systems,
- protection against climatic hazards (swells, storms, etc.),
- the distance from the place of use,
- the conditions for authorizing extraction (laying of pipes on the coast, beach, rock, impact on the surrounding environment, etc.).

IN ALL CASES IT WILL BE NECESSARY TO:

- **Verify the conditions of implementation with regard to the DPM (Public Maritime Domain), town planning rules, and the rules of the environmental code, see the Legal Feasibility section on p.29.**
- **Propose an overall economic approach to estimate the estimated investment and operating costs and the impact on the price per cubic meter of sea water.**

III.2.2 GENERAL INFORMATION ON SEAWATER PUMPING INSTALLATIONS

Seawater pumping techniques (Source: M. J. SELTZ).
BOUGIS J. (2013). Revue des aspects maritimes du dessalement d'eau de mer. Revue Paralia, Vol. 6, pp 1.1–1.13

A pumping installation consists of four components:

- The pumping unit, comprising the pump itself and the motor that drives it,
- The pumping station, housing the pumping unit(s), as well as various ancillary equipment such as a control cabinet, transformer or emergency generator,
- The water supply point,
- The delivery or discharge pipe.

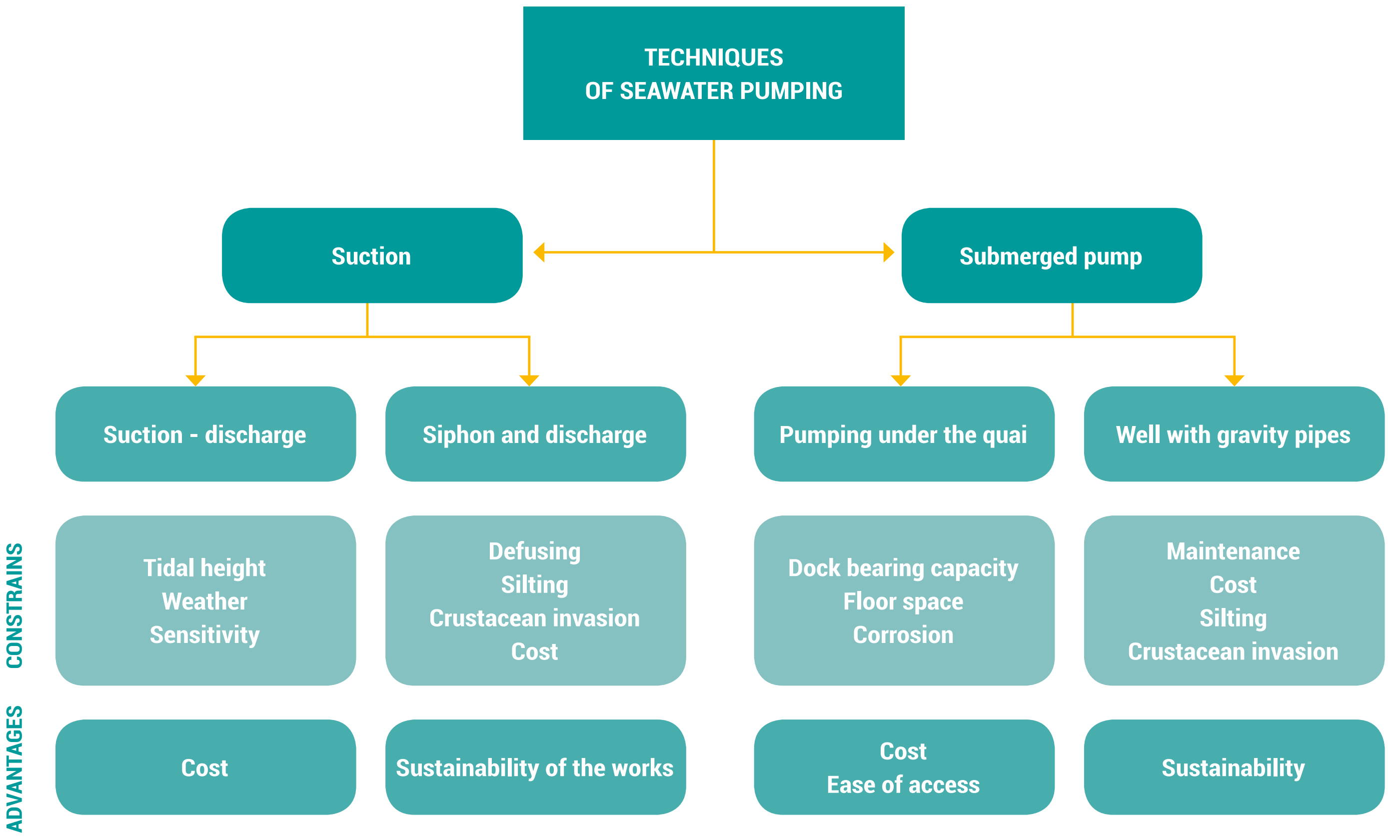
The project owner must check the adequacy between its need for sea water (flow rate) and the distance from the resource. The "distance" aspect includes:

- The depth at which he wishes to pump the seawater;
- The sensitivity of the extraction point to swell, storm, ease of access for maintenance;
- The morphology of the coastline: beach, cliff, quay in a port, slipway, jetty;
- The location of the company's site: distance from the pumping site, length of water transfer (discharge) and passage constraints (bends, valves, cleaning points).

Through the following elements, it is proposed to:

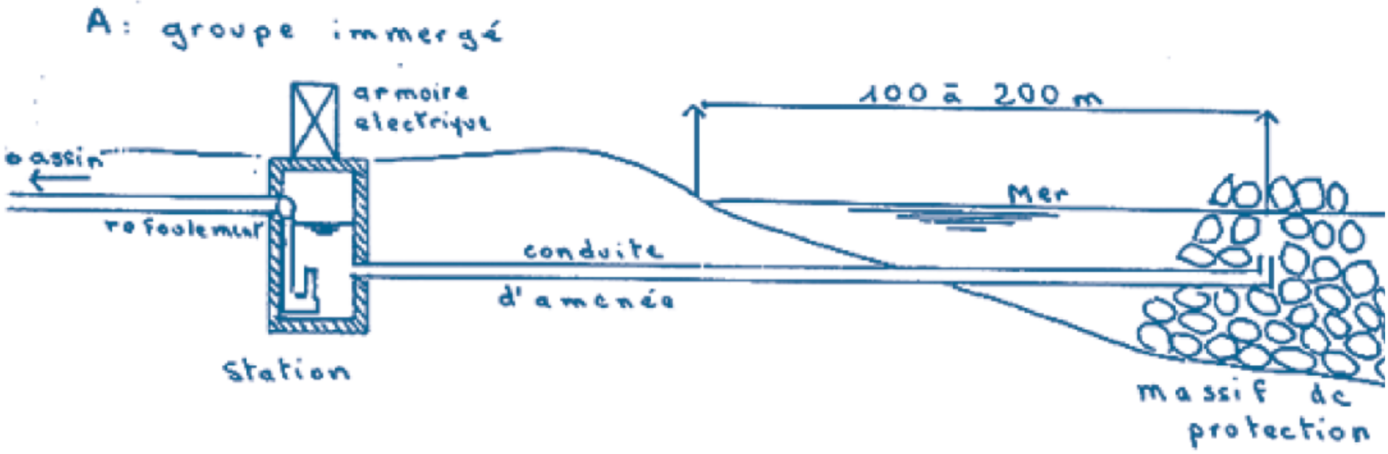
1) to show the advantages and constraints of the two seawater pumping techniques used in Finistère,
2) provide a table showing the relationship between the distance of the project developer's premises from the coastline and the pumping power required.

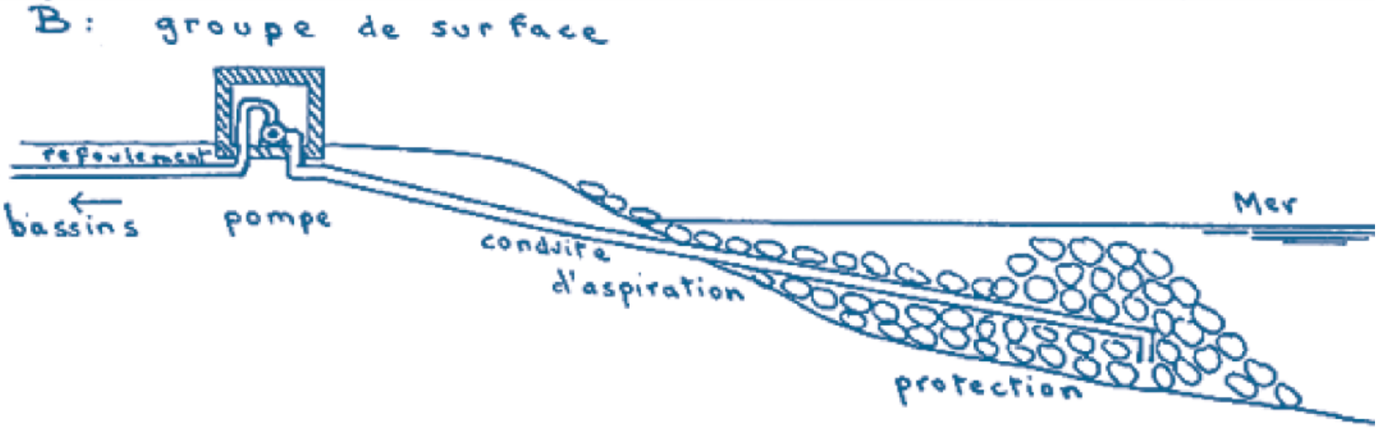
Choice of pumping technique



III.2.3 Types of seawater collection

In the working hypothesis, we have considered pumping from a submerged well or by suction on the quay.





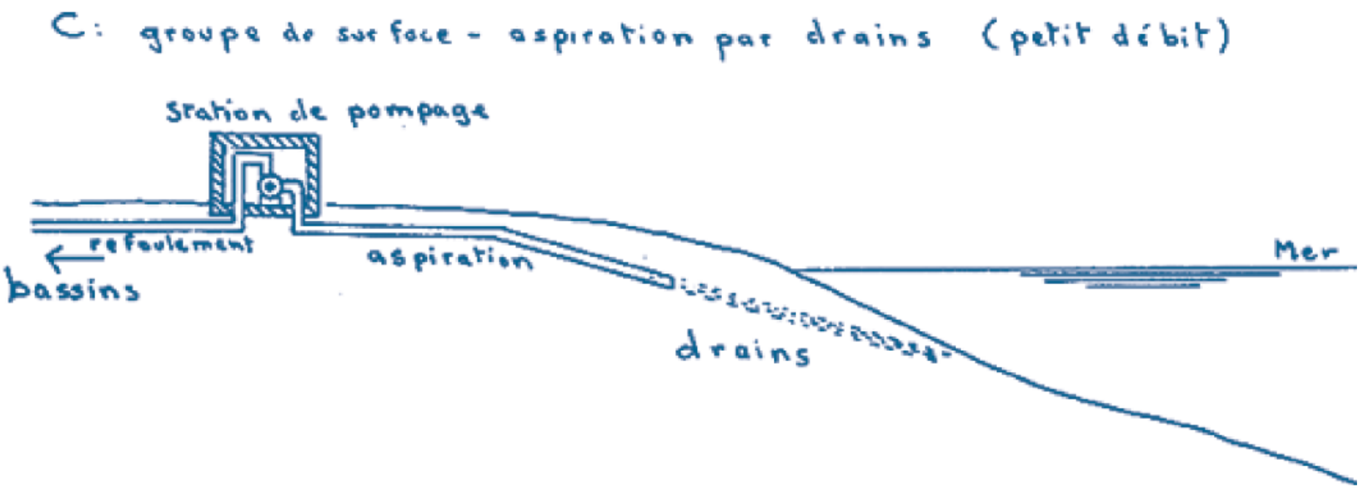
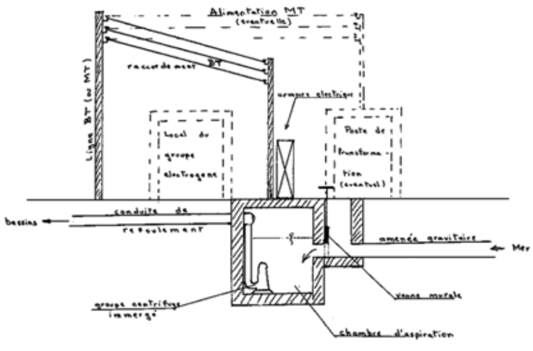
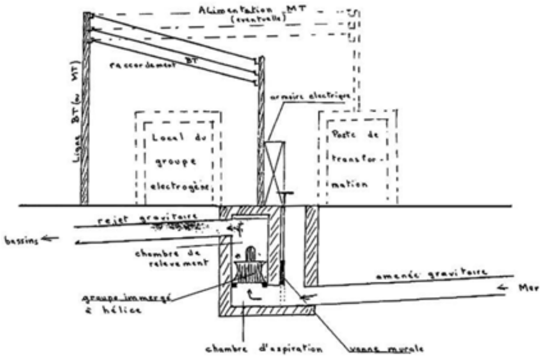
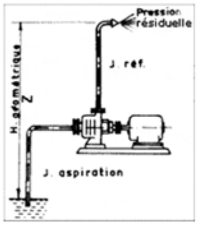
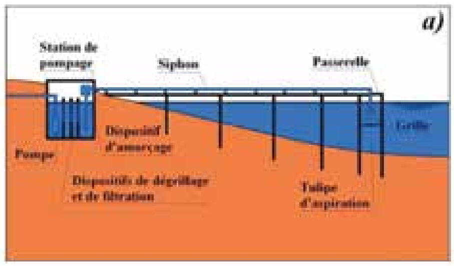


Table 7: Advantages and disadvantages of seawater pumping techniques

<table>
<tr><th>TECHNIQUE</th><th>SUBMERGED WELL PUMPING</th><th>SUCTION PUMPING</th></tr>
<tr><td></td><td>




</td><td>




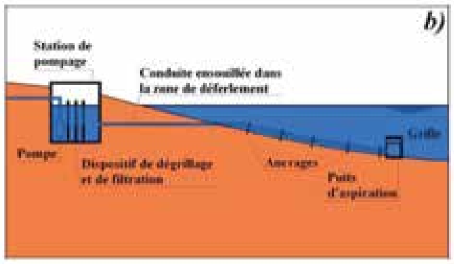


Figure 2 : Prise sur estacade

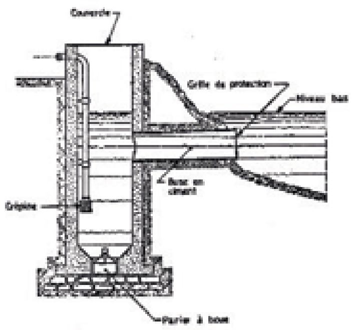

Figure 3 : Prise en berge maçonnée


Figure 4 : Prise en berge par l'intermédiaire d'un puisard.
</td></tr>
<tr><td>Protection against climatic phenomena (swell, storm, marine submersion)</td><td>- Not very sensitive
- Far from the coast
- Requires a well and a gravity supply pipe (to be dug into the rock or protected from navigation, risk of scouring if laid on a beach)</td><td>- High sensitivity and exposure as the pump unit must be close to the sampling site
- Suction lines must be protected</td></tr>
</table>

TECHNIQUE	SUBMERGED WELL PUMPING	SUCTION PUMPING
Power supply	Power supply must be above the high-water mark + protection against breaking waves	
Siltation / silting	High risk	Almost no risk
Risk of clogging (mussels, etc.)	Maintenance to remove shells in the well and in the supply line Min 1 pipe. 2 pipes for safety.	Frequent maintenance of the strainer
Technical limit	No risk Water supply pipe to be laid in the rock and/or on the beach and at a depth that is always submerged Drilling	Limited to -5 to -7 m in relation to the altitude of the motors (maximum suction height 7 m, + height to avoid cavitation due to the creation of a suction cone for large flows)
Risks related to corrosion	High: submerged pump system	Low except for strainers and valves
Use	No need for frequent diving	Maintenance of the strainer by diver on demand
Valves and impellers	Stainless steel duplex	Stainless steel duplex
Reliability	Not very sensitive to weather conditions, robust, risk of clogging of the supply line (sand) depending on the design and layout	Very sensitive to weather conditions. "Easy" suction line replacement. Very regular strainer maintenance.
Investment cost	Higher for the construction of the water supply line	Lower than the well technique
Maintenance cost	To be evaluated	To be evaluated

III.2.4 Pumping power required in kW between the points of collection and delivery

The following table is intended to provide a quick overview of the feasibility of an aquaculture project according to the par ameters flow rate/seaward distance.

The colours correspond to the required electrical power:

Green: from 0 < P < 10 kW **Yellow**: from 10 < P < 20 kW **Red**: P>20 kW (more energy-consuming)

Depending on the type of activity, energy consumption can represent a significant part of the production cost (impact on the price of pumped seawater). The distance from the coastline and the flow rate required have a direct impact on the profitability of a project.

Table 8: Power consumption ratio flow/distance

Diamètre nominale (Commercial) de canalisation PEHD PN 16 en mm			32	40	50	63	75	90	110	125	140	160	180	200	225	250	280	315	355	400	450	500	560	630	710
Pertes de charge linéaire en m/km à V=1 m/s			0.06	0.038	0.028	0.022	0.02	0.017	0.016	0.009	0.008	0.007	0.0055	0.005	0.0043	0.0038	0.0035	0.0029	0.0052	0.0022	0.018	0.017	0.016	0.013	0.0012
HMT en m	Presssion en bar	Débit en m3/h	2	3	5	7	10	15	23	30	37	48	61	75	96	119	149	188	239	303	381	475	594	752	954
5	0.5	Puissance en kW	0.05	0.1	0.1	0.2	0.2	0.3	0.5	0.7	0.8	1.1	1.4	1.7	2.2	2.7	3.4	4.3	5.4	6.9	8.7	10.8	13.5	17.1	21.7
10	1		0.1	0.1	0.2	0.3	0.5	0.7	1.0	1.4	1.7	2.2	2.8	3.4	4.4	5.4	6.8	8.6	10.9	13.8	17.4	21.6	27.1	34.3	43.5
15	1.5		0.1	0.2	0.3	0.5	0.7	1.0	1.6	2.1	2.5	3.3	4.2	5.1	6.6	8.1	10.2	12.8	16.3	20.7	26.0	32.5	40.6	51.4	65.2
20	2		0.2	0.3	0.5	0.6	0.9	1.4	2.1	2.7	3.4	4.4	5.6	6.8	8.7	10.8	13.6	17.1	21.8	27.6	34.7	43.3	54.1	68.5	86.9
30	3		0.3	0.4	0.7	1.0	1.4	2.1	3.1	4.1	5.1	6.6	8.3	10.3	13.1	16.3	20.4	25.7	32.7	41.4	52.1	64.9	81.2	102.8	130.4
35	3.5		0.3	0.5	0.8	1.1	1.6	2.4	3.7	4.8	5.9	7.7	9.7	12.0	15.3	19.0	23.8	30.0	38.1	48.3	60.8	75.8	94.7	119.9	152.1
40	4		0.4	0.5	0.9	1.3	1.8	2.7	4.2	5.5	6.7	8.7	11.1	13.7	17.5	21.7	27.2	34.3	43.6	55.2	69.4	86.6	108.3	137.1	173.9
45	4.5		0.4	0.6	1.0	1.4	2.1	3.1	4.7	6.2	7.6	9.8	12.5	15.4	19.7	24.4	30.6	38.5	49.0	62.1	78.1	97.4	121.8	154.2	195.6
50	5		0.5	0.7	1.1	1.6	2.3	3.4	5.2	6.8	8.4	10.9	13.9	17.1	21.9	27.1	33.9	42.8	54.4	69.0	86.8	108.2	135.3	171.3	217.3
55	5.5		0.5	0.8	1.3	1.8	2.5	3.8	5.8	7.5	9.3	12.0	15.3	18.8	24.1	29.8	37.3	47.1	59.9	75.9	95.5	119.0	148.9	188.5	239.1
60	6		0.5	0.8	1.4	1.9	2.7	4.1	6.3	8.2	10.1	13.1	16.7	20.5	26.2	32.5	40.7	51.4	65.3	82.8	104.2	129.9	162.4	205.6	260.8

III.2.5 The supply of water: transfert

Depending on the distance between the pumping point and the point of use, the needs to secure the water supply will have to be sized differently.

0 < D < 500 meters

500 < D < 1000 m

1000 < D < 2500m

Distance pumping / use energy consumption

2 PARALLEL PIPES:
1 pipe operating
1 pipe at rest (anaerobic)
Access devices for cleaning every 200m

3 PARALLEL PIPES:
1 pipe operating
1 pipe at rest (anaerobic)
1 pipe for safety
Access devices for cleaning every 200m

Maintenance of pipes and permanent availability (development of shellfish in the pipe)

Passage of private pipes in the public domain requiring authorisation and registration (notification of Intent of work commencement)
Adding 2 to 3 pipes > Checking the size of the underground

Position of the pipes

III.3. WASTEWATER DISCHARGE

An analysis should be made of where industrial wastewater can be discharged in relation to the activity on the site:

→ to a wastewater treatment plant

OR

→ in the natural environment directly

→ with

OR

→ without treatment

The evaluation of the parameters will take into account:

- volumes and pollution(s) (innovative technology, bio, micro-algae...),
- the residual capacity (flow/pollution) of the WWTP (wastewater treatment plant), including the prospects for urban and industrial developments
- the acceptability of the receiving environment and the level of treatment to be obtained if discharges cannot be made to an existing treatment plant.

Diagram of the constraints to be taken into account according to the envisaged receiving environment

WASTEWATER DISCHARGE

CAN THE WWTP ACCEPT CHLORINATED WATER AND DOES THE COMMUNITY ACCEPT THIS WASTERWATER ?

NO → SEA / RIVER

YES → COMMUNAL WASTEWATER SYSTEM

DISCHARGE OUTFALL	SEA	RIVER	COMMUNAL WASTEWATER SYSTEM
Treatment	By the industrialist	By the industrialist	Pre-treatment (if any) imposed according to sanitation regulations, attention to volume, flow rate, chloride content and volume. Cost imposed by the community
Acceptability of the receiving environment	DISCHARGE STANDARDS TO BE MET		
	• Quality, dilution, coastal protection • Limit the impact on aquaculture activities located in the dilution cone • Protection against exploited invasive species	• Quality, flow rate time/second • Chloride dilution (seawater) • Tidal discharge • Limit the impact on aquaculture activities located in the dilution cone • Protection against exploited invasive species	• Constraints on discharge volumes and flows • Chloride dilution (seawater) • Tidal discharge • Limit the impact on aquaculture activities located in the dilution cone • Protection against exploited invasive species

CONSTRAINTS RELATED TO THE DISCHARGE OF INDUSTRIAL WASTEWATER / FOCUS ON WWTP

If a public wastewater system network serves the plot, the industrialist should check with the manager of the wastewater treatment plant (WWTP) whether he agrees to connect water loaded with chlorides. The addition of chlorides (brought in by sea water or brackish solutions) is detrimental to the microfauna (bacteria) responsible for treating water pollution in a WWTP.

[...The presence of high concentrations of salt in the network (seawater intrusion) rapidly modifies the osmotic pressure in the bacteria and leads to cell destruction by plasmolysis...]. Source: Biological malfunctions in wastewater treatment plants / FNDAE technical document n°33.

If the WWTP is not designed to treat this type of effluent (organic load, flow rate and chloride content) it is unlikely that effluent from aquaculture activities can be accepted in a municipal WWTP. Before anything else, the WWTP manager should be consulted and a feasibility study carried out.

Example of a solution implemented on a new facility: subject to a technical study, a buffer tank with a weekly storage capacity (volume and duration to be determined according to the water temperature and the chloride load) could be introduced upstream of a treatment plant. The role of this tank would be to avoid sudden changes in chloride concentration by smoothing its content. A major constraint of this technique is the creation of a large storage volume with the risk of developing odours and corrosive gas (H2S).

This will require a study on the existing treatment of the wastewater treatment plant. Local authorities will have to study the coherence between the type of existing treatment, the additional volume to be treated and the incoming loads (rate of chlorides, BOD5, COD, nitrogen, phosphorus, TSS, temperature, pH). Significant and costly adaptations of the WWTP may be necessary: a complete review of the water and sludge treatment processes. The WWTP manager could also impose a pre-treatment of the effluents on the industrialist.

If a connection to the municipal network is not possible, the industrialist will have to treat his wastewater on his site according to the discharge standards imposed by the legislation in force, depending on the acceptability of the natural environment.

It should be noted that sanitary wastewater (toilets, showers, etc.) can be connected to the municipal wastewater system or to a non-collective wastewater system.

III.4 ASSESSING COSTS

Estimating the cost of connection is essential to assist in the evaluation of sites.

Some general notions which can be used as indicators but which remain to be contextualized on a precise site as the types of pumps, materials used, length of pipe or nature of the ground (types of foundation and supports), slope, study of existing quay structures or dykes and adaptations of the project to the constraints of the works (rocks to be broken, work at tide or underwater)... can make the prices vary in one way or the other. Pumping station prices vary according to flow rates and will be estimated according to the scenarios selected.

It is therefore only an indicative estimate based on equipment assumptions and ratios calculated according to:

- the distance between the potential site and the location of the water intake,
- an estimate of the necessary flow rate calculated from the available surface area of the potential site.

Some indications of costs

◗ Cost of the pipe

- 150-200 € EXCL/ml onshore pipe < DN 200 mn (pumping or discharge)
- 1700 € EXCL/ml offshore (pumping)

◗ Cost of the pump depending on the pumping rate

- 70 000 € EXCL for 20 m³/h pumping (if surface < 0.5 ha)
- 140 000 € EXCL for 40 m³/h pumping (if 0.5 ha < surface < 1 ha)
- 300 000 € EXCL for 100 m³/h pumping
- + 270 000 € EXCL per 100 m³/h (assuming 100 m³/h per ha)

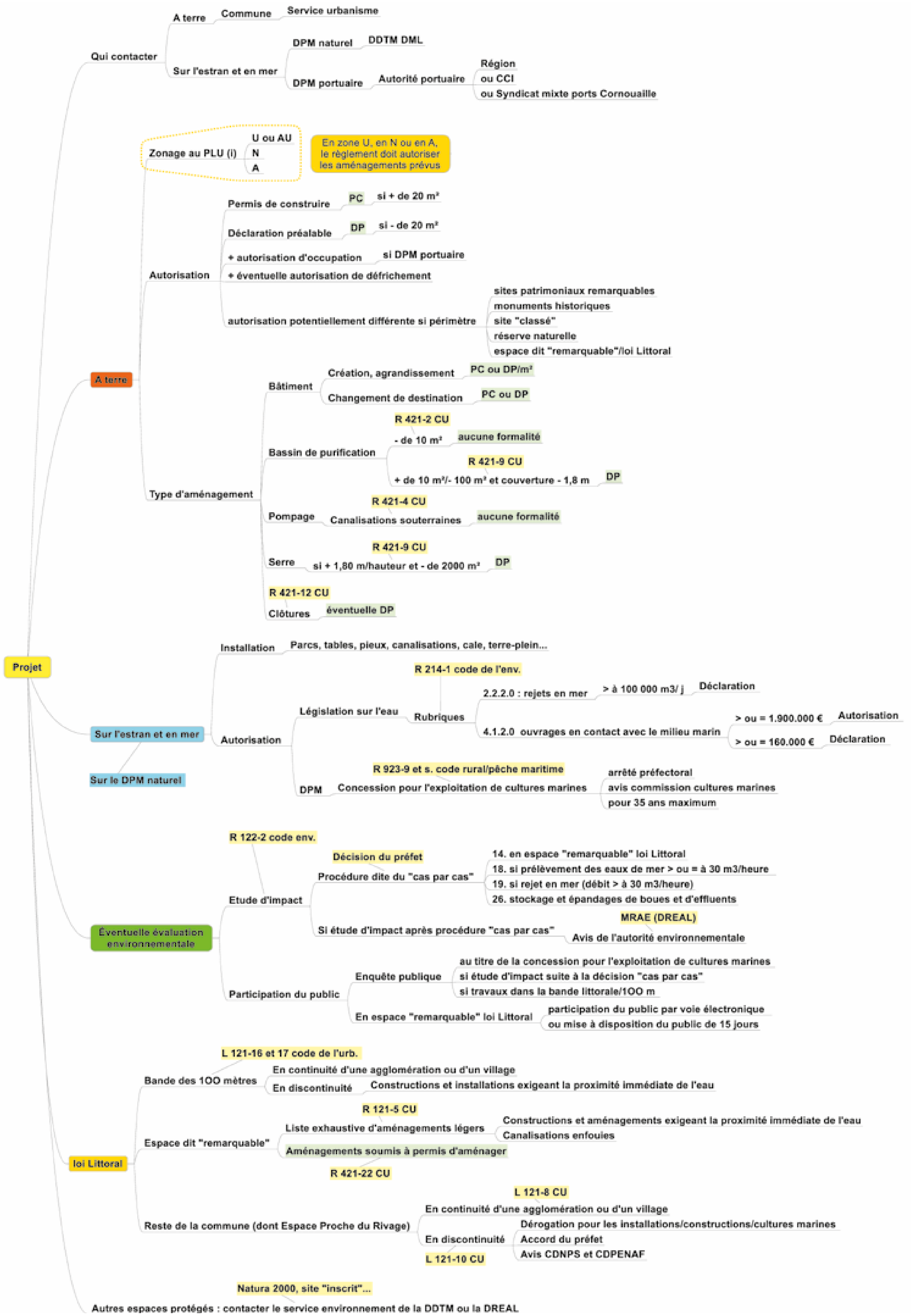
Effluent treatment costs should also be included, if necessary.

III.5 LEGAL FEASIBILITY

Legal feasibility of my project: what procedures am I likely to be subject to?

Important: the tree structure is not exhaustive but illustrates the different texts and regulations to which a project may be subject. The procedures should be contextualised according to the characteristics and dimensions of the installation (other possible legislation such as ICPE - French site classification system for environmental protection).

For example, a shellfish farming project that purifies in ponds by pumping sea water at a low flow rate without discharge will not be subject to the same authorisations as a project involving several hectares of crops in ponds with inputs and discharges and a significant flow rate.


Projet
Qui contacter
A terre
Commune
Service urbanisme
Sur l'estran et en mer
DPM naturel
DDTM DML
DPM portuaire
Autorité portuaire
Région
ou CCI
ou Syndicat mixte ports Cornouaille
A terre
Zonage au PLU (i)
U ou AU
N
A
En zone U, en N ou en A, le règlement doit autoriser les aménagements prévus
Autorisation
Permis de construire
PC
si + de 20 m²
Déclaration préalable
DP
si - de 20 m²
+ autorisation d'occupation
si DPM portuaire
+ éventuelle autorisation de défrichement
autorisation potentiellement différente si périmètre
sites patrimoniaux remarquables
monuments historiques
site "classé"
réserve naturelle
espace dit "remarquable"/loi Littoral
Type d'aménagement
Bâtiment
Création, agrandissement
PC ou DP/m²
Changement de destination
PC ou DP
Bassin de purification
R 421-2 CU
- de 10 m²
aucune formalité
R 421-9 CU
+ de 10 m²/- 100 m² et couverture - 1,8 m
DP
Pompage
R 421-4 CU
Canalisations souterraines
aucune formalité
Serre
R 421-9 CU
si + 1,80 m/hauteur et - de 2000 m²
DP
R 421-12 CU
Clôtures
éventuelle DP
Sur l'estran et en mer
Sur le DPM naturel
Installation
Parcs, tables, pieux, canalisations, cale, terre-plein...
Autorisation
Législation sur l'eau
R 214-1 code de l'env.
Rubriques
2.2.2.0 : rejets en mer
> à 100 000 m3/ j
Déclaration
4.1.2.0 ouvrages en contact avec le milieu marin
> ou = 1.900.000 €
Autorisation
> ou = 160.000 €
Déclaration
DPM
R 923-9 et s. code rural/pêche maritime
Concession pour l'exploitation de cultures marines
arrêté préfectoral
avis commission cultures marines
pour 35 ans maximum
Éventuelle évaluation environnementale
Etude d'impact
R 122-2 code env.
Décision du préfet
Procédure dite du "cas par cas"
14. en espace "remarquable" loi Littoral
18. si prélèvement des eaux de mer > ou = à 30 m3/heure
19. si rejet en mer (débit > à 30 m3/heure)
26. stockage et épandages de boues et d'effluents
MRAE (DREAL)
Si étude d'impact après procédure "cas par cas"
Avis de l'autorité environnementale
Participation du public
Enquête publique
au titre de la concession pour l'exploitation de cultures marines
si étude d'impact suite à la décision "cas par cas"
si travaux dans la bande littorale/100 m
En espace "remarquable" loi Littoral
participation du public par voie électronique
ou mise à disposition du public de 15 jours
loi Littoral
Bande des 100 mètres
L 121-16 et 17 code de l'urb.
En continuité d'une agglomération ou d'un village
En discontinuité
Constructions et installations exigeant la proximité immédiate de l'eau
Espace dit "remarquable"
R 121-5 CU
Liste exhaustive d'aménagements légers
Constructions et aménagements exigeant la proximité immédiate de l'eau
Canalisations enfouies
Aménagements soumis à permis d'aménager
R 421-22 CU
Reste de la commune (dont Espace Proche du Rivage)
L 121-8 CU
En continuité d'une agglomération ou d'un village
En discontinuité
Dérogation pour les installations/constructions/cultures marines
Accord du préfet
Avis CDNPS et CDPENAF
L 121-10 CU
Natura 2000, site "inscrit"...
Autres espaces protégés : contacter le service environnement de la DDTM ou la DREAL

4

SITE ANALYSIS GRIDS

We propose you hereafter the grids/tables with all the parameters to look at. These grids are available on request, contact Investir en Finistère. We can also provide 2 examples (1 harbour, 1 bare land) for more details on the sources used to fill the tables.

CONTEXT OF THE COMPANY PLANNING TO SET UP ON THE SITE
Products
Production objectives
Economic and social context, employment area
Technical and biological state of the art
Reasons for the pre-selection of the site by the project developer
Distance between the land and the production site at sea
Ease of access by sea

REGULATORY CONTEXT
Consideration by the project developer of elements related to Inter-communal cooperative organisations
Environmental impact assessment: context
Other regulatory aspects: Local Urban Plan, etc.

GENERAL HYDROLOGICAL CONDITIONS
Geographical location of the land
Watershed
Water bodies
Description of the offshore production site
Description of the infrastructures at sea and on land
Tide: amplitudes and heights
Salinity: average, variations, minimum, maximum
Seawater temperatures: annual, monthly, minimum, maximum

WEATHER CONDITIONS
Meteorological risks, flooding, submersion
Temperature
Winds
Sunshine
Rainfall
Rainfall and watershed
Waves

WATER QUALITY
Water analysis at critical points
Positioning and discharges from wastewater treatment plants
Agricultural activities and discharges
Other outfalls
Bathing water quality
Phycotoxins and closure periods
Ecological status of water bodies, SDAGE (master plan for improvement and water management), other environmental conditions
Classified installations in the vicinity
Nearby aquaculture activities
Marinas and anchorage areas

SEAWATER PUMPING AND DISCHARGE: FEASABILITY
Type of bottom
Benthic fauna and flora
Oceanographic study of the site: currentology, bathymetry, swell, etc.
Water quality analyses at critical points
Eutrophication
Green algae
Proposal for the positioning of pipes, pumping wells
Option to connect to an existing sea water intake

NETS
Existing electricity supply
Existing drinking water supply
Existing connection to the sewage treatment network
Mobile coverage
Internet network
Proximity to road: time and distance

PHYSICAL CHARACTERISTICS OF THE LAND
Access to the sea: quay, harbour, launching, etc.
Topography of the site
Geology
Soil analysis, constructability
Boundary marking plan

HYDROGEOLOGY
Descriptions of hydrogeological conditions
Freshwater drilling
Groundwater
Seawater drilling

ECOLOGY
Sensitive areas
Fauna - Flora
Environment, habitats, ecosystems, biodiversity
Positioning of the project in relation to the environmental impact assessment
Sustainable aquaculture

ECONOMIC ENVIRONMENT
Habitat
Stormwater networks
Wastewater systems, WWTPs
Discharges from WWTPs
Non collective sanitation: current situation
Agricultural activities
Agricultural activities and watershed
Industrial activities
Surrounding aquaculture production, sanitary isolation

POWER
Waste heat
Geothermal energy
Renewable energy

SOCIAL ACCEPTABILITY
Knowledge of the project by local residents, associations, institutions, etc.
Identification of risks of non-acceptability and reasons

PRODUCTION
Quality
Production structures
Technical facilities
Production planning
Suitability of site / production objectives
Workforce

SUMMARY OF REQUIREMENTS
Expected annual production
Offshore production area
Floor area (m2)
Land area (m2)
Ratio of land area to floor area
Storage capacity - Purification
Continuous seawater requirement (m3/h)
Occasional seawater requirement (m3/h)
Maximum flow rate of aquaculture process discharge (m3/h)

PREREQUISITES		Intercommunal cooperative organisation / Local authorities			
WASTEWATER		LOCAL OFFICIALS	TECHNICIAN	PROJECT MANAGER	EXPERT OR MANDATED
Effluent discharge					
Environmental acceptability of industrial wastewater discharge	Check the regulations in force and, if necessary, prepare the regulatory file under the environmental code concerning the acceptability of discharges into the natural environment			R	R
What will be the destination of the industrial effluent discharge (sea, communal or port-owned rainwater network discharging into the sea, communal wastewater network)?	Specify the outlet for raw, treated or pre-treated industrial wastewater		R	R	R
Check the acceptability standards of the natural environment and provide for industrial water treatment if necessary to reduce pollution.	Check the discharge standards and contact the water police to find out the discharge levels and acceptability of the receiving environment for the parameters (macropollutants: TSS, WFD, BOD, N, P, pH, T°, Cl-, and possibly see micropollutants). If necessary, call in a technical consultancy firm	I	R	R	R
Indicate the chemical parameters of your discharges if known	Do you know the concentrations of your industrial discharges? Consult a process consultancy firm if necessary			R	R
Do you plan to treat the industrial water before discharge to reduce pollution? If yes, indicate the standards for each parameter after treatment (the values must not exceed the environmental acceptability standards)	Define the type of treatment for non-domestic wastewater (industrial wastewater) and domestic wastewater (black water)			R	R
Can the production have an influence on the local ecosystem? (invasive species)	What impact can your activity have on the natural environment: in normal operation, in the event of an incident or accident?	A	AD	R	R
If so, what are the means to eliminate this risk?	Define protection measures	A	AD	R	R
What impact can your activity have on existing activities?	In the event of a discharge, would there be a risk of pollution of the pumping system located downstream or near your establishment?	I	I	R	R
Extract from SHOM (Naval Hydrographic and Oceanographic Service chart)	Identify and locate known existing activities on a map		R	R	R
1) If discharge into the sea is possible: - specify the distance to the various existing water abstractions around your location - check the compatibility of your activity with the existing withdrawals around your discharge point		A	AD	R	R
2) If discharge to the stormwater system, specify the distance to existing water abstractions around your stormwater discharge point	Identify neighbouring users who may be impacted or impact you		AD	R	R
3) If the discharge is planned to the municipal wastewater system, check with the wastewater treatment plant manager to ensure that the effluent is compatible with the treatment facility (WWTP). Most treatment plants will not accept water with a high chloride load (seawater).		A	AD	R	R
Verification of the acceptability of chloride-laden effluents (seawater) by the treatment plant	Check with the operator or manager of the existing treatment plant whether it can accept and treat your industrial effluent		AD	A	R
Source of information	Data on the type of existing treatment and its saturation level can be found at: http://www.services.eaufrance.fr/donnees/service	AD	R	R	R
Chloride-free industrial wastewater discharge					
Average hourly flow rate (m3/h) of chloride-laden wastewater discharge	Estimate or have an engineering firm estimate your peak wastewater discharge in cubic metres per hour. These data can be used to establish a discharge agreement.			R	R
Average daily flow rate (m3/d) of chloride-laden wastewater discharge	Estimate or have an engineering firm estimate your peak wastewater discharge in cubic metres per hour. These data can be used to establish a discharge agreement.			R	R
Other industrial wastewater (not chloride-laden) that can be discharged into a municipal wastewater system	Estimate or have an engineering firm estimate your peak wastewater discharge in cubic metres per hour. These data can be used to establish a discharge agreement.	A	AD	R	R
What treatment have you planned?	Define the wastewater treatment envisaged. This will have a financial impact depending on the level of treatment required to comply with discharge standards in relation to the pollution of the natural environment that you will generate with your new activity.			R	R
Verification of acceptability of non-chloride laden water by the treatment plant	Contact the operator of the wastewater treatment plant	A	AD	R	R
SEAWATER WITHDRAWAL					
Existing Infrastructure	**Diagnosis and research of project inputs**				
Is there a seawater pumping station(s) on site?	Survey of existing pumping facilities: this allows you to locate uses, users and possibly share the investment in a common pumping facility	AD	AD	R	AD
What is the flow rate of the existing pumping station?	Find out about the capacities of existing facilities in order to compare them with your seawater needs	R	R	I	I
Is this pumping station shared with other users?	Check the possible impacts on your shared operating mode if you choose to do so	R	R	I	I
Who owns the works?	Identify the manager and owner of the pumping station	R	R	I	I
Brief description of the existing work	The location and capacity allow you to check the compatibility of existing facilities with your production needs and constraints	R	R	I	AD
Can the existing installation meet your needs?	Take stock of previous research to conclude and continue	I	I	R	AD
Number of existing suction pipes	For safety reasons, it is advisable to provide two pipes to ensure continuity of water supply in the event of problems with clogging of the pipe or suction strainer.	A	R	I	I
Number of suction lines required (to ensure safety of supply against risk of clogging)?	Determine the desired level of safety			R	AD
Number of pumps in the existing installation	As for the pipes, the number of pumps installed in parallel or alternating/backup allows you to check the continuity of service in the event of maintenance of one of the pumps		R	I	AD
Power of the existing installation	ENEDIS pricing and power of the installation	I	R	I	R
Minimum and maximum flow rate of the existing installation	Knowledge of the installed equipment	I	R	I	AD
State of the electrical installation	Allows verification of the reliability or obsolescence of the installation	I	R	I	AD

Electrical supply to the station (security?)	Presence of a back-up or loop in case of power failure	I	R	I	AD
On/off or frequency variation starting?	Check the operating mode and frequency range for varying pump flow		R	I	AD
Distribution pipe					
- Number of pipes	After the pumping unit, what are the existing infrastructures and the expected possible flow rate?	A	R	I	I
- Nature of the material used		A	R	I	I
- Diameter		A	R	I	I
- Pumping depth in metres	A suction pump will have an operating limit that is sensitive to the tidal level and its installation height. Above 7 to 8 m, the pumping station should either be buried or use submersible pumps (see table in ITEM 1)	A	R	I	I
- Length of discharge (in m)	Determine pressure drops and pump capacity (suction)	A	R	I	I
Position of existing pipes	Identify risks of damage to suction pipes: - weather related - exposure of the pipe to swell - damage by dredging - draught of vessels at low tide - fishing area - shock when a vessel berths. Locate the distribution pipes in order to know their position in order to facilitate any subsequent interventions or to avoid damage to the works during construction.	A	R	I	I
PUMPING: INFRASTRUCTURES TO BE CREATED					
Possible techniques					
Is there space to locate a pumping station according to technical criteria (HMT, NPSH) as close to the shore as possible	Carry out or have carried out by a technical design office a technical feasibility study for pumping sea water	I	I	A	R
Position of the pumping station and risk from weather, sheltered or swell exposed area	Identify the risks for the structures created according to the chosen location	AD	AD	A	R
Is the structure supporting the pumping station (quay, breakwater, quayside...) able to accommodate it (carry out a soil study, bearing capacity, foundations)	Study the bearing capacity of the soil with regard to the works to be created: plan to carry out soil surveys and a civil engineering study to check the bearing capacity of a quay, a soil, the existing foundations, etc.	I	R	R	R
Is there a risk of damage to the submerged pipes (dredging, shallow draught, etc.)	Identify risks of damage to suction pipes: - weather related - exposure of the pipe to swell - damage by dredging - draught of vessels at low tide - fishing area - shock when a vessel berths. Locate the distribution pipes in order to know their position in order to facilitate any subsequent interventions or to avoid damage to the works during construction.	AD	AD	R	R
Raw seawater requirement					
Minimum and maximum flow rate (m3/h)	Define the hourly raw seawater requirements of the project developer's process			R	AD
Water supply time (24 h/d, 10 h/d, 6 h/d...)	Operating mode (tide dependant or 24 hours a day)			R	AD
Daily volume (m3/d)	- Define the daily raw seawater requirements of the project developer's process - Check the need for storage			R	AD
Treated seawater requirement (yes/no)	**Are you going to treat the seawater collected?**				
Minimum and maximum flow rate	Definition of the raw seawater requirements			R	AD
Water requirement (24 h/24, 10, 6...)				R	AD
Daily volume (m3/d)				R	AD
Daily pumping time				R	AD
Altimeter of the landfill (TN) in mNGF of the seawater pumping site	Data required for pump sizing: include a topographical or bathymetric survey			R	AD
Channel (estimated depth in m)				R	AD
Distance between the extraction point (suction strainer) and the pumping point (dimensions in m NGF and head loss in m), linear suction pipe	Determine the linear pressure drops that impact the choice of pump type and the power required			R	AD
Preliminary studies	Once the project is advanced and regulatory constraints are identified, the project can proceed to create the necessary pumping infrastructure. A 1st step will be to carry out a feasibility study				
- on the pumping station	Project management study, topographic, bathymetric and geotechnical study			A	R
- on the suction/discharge pipe				A	R
Sampling pipe					
Offshore piping (suction or gravity)	Locate the sampling point according to the quality of the resource. A water quality analysis campaign must be carried out to verify water quality fluctuations			A	R
Distribution pipe					
- Discharge line (in m) = Distance between pumping point (pumps) et delivery point in m	Data needed to size and estimate the investment cost of the project			A	R
- Number of pipes				A	R
- Nature of the material				A	R
- Diameter				A	R
- Pumping depth in m				A	R
- Type				A	R
- Discharge line (in m)				A	R
Type of pumping station					
Pumping wells with submersible pumps and drilling line	See table of pump capacities according to the HMT (Total manometric head). Data needed to size and estimate the investment cost of the project			A	R
Suction pump on platform or ground (technical limit at approximately 8 m of suction)				A	R
Type of project envisaged				A	R
Type of pump based on technical data				A	R
Maximum power of the pumps to be provided (see ITEM 1 table of pump power according to HMT, DN pipeline and flow)				A	R
Is public domain work required (road side, crossing))	Work on the MPD and municipal roads requires authorization -> see regulatory section	A	AD	A	R

PROJECT INPUT DATA TO BE FILLED IN

FOR ANY INFORMATION

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The European Interreg Atlantic project Acces2Sea aims to support the aquaculture sector by collaborating on the issues and challenges of marine aquaculture. It brings together 9 partners (Spain, Portugal, Ireland, United Kingdom and France) and is coordinated by the CEEI Bahia de Cadiz.

The development of aquaculture is considered strategic by the European Union, which has made it one of the objectives of blue growth. At national, regional and local levels, there is also a desire to support and develop this sector. However, few new sites are created, as companies face various difficulties in setting up. The problems encountered are shared by our partners and are the subject of lines of work: spatial planning, societal acceptability, economic models.

It is within the framework of this project that this methodological guide **"Setting up an onshore aquaculture site with seawater service"** was created.

It is the result of collaborative work with the following actors:

It is based on work carried out under the coordination of:

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