

Stations d'épuration des eaux usées en Tunisie :

*Evaluation de la biodiversité selon la norme de
performance 6*



Résumé

L'ONAS a engagé des consultants en conseil spécialisés sur les transactions, pour permettre la délégation de l'exploitation et de l'entretien d'un certain nombre d'actifs au secteur privé. L'ONAS a désigné la Société financière internationale (SFI) pour superviser les conseillers en matière de transactions.

Les études entreprises pour soutenir le processus d'appel d'offres ont mis en évidence le fait que certains des sites et/ou des émissaires sont situés dans, ou à proximité, des sites Ramsar, des zones importantes pour la conservation des oiseaux (ZICO) ou des zones clés pour la biodiversité (KBA). Ce rapport répond aux termes de référence de la SFI consistant à évaluer la biodiversité dans les zones de rejet/réutilisation des effluents afin d'obtenir des valeurs indicatives sur la qualité de l'eau des effluents, pour chacune des 15 stations d'épuration des eaux usées, conformément à la norme de performance 6 (PS 6) de la SFI, Conservation de la biodiversité et gestion durable des ressources naturelles vivantes.

Quels sites des STEP sont qualifiés d'habitat essentiel ?

Cinq des quinze sites STEP (les sites eux-mêmes et/ou leurs émissaires) sont documentés comme étant à moins d'un kilomètre d'un habitat critique (HC) : Djerba Aghir, Djerba Ajim, El Hamma, Kerkennah, et Sfax Sud. Cette constatation est fondée sur l'application de la note d'orientation PS6 mise à jour le 15 novembre 2018, qui renforce les seuils pour le critère 3 : le critère PS6 de la SFI, traitant du nombre d'individus d'espèces en rassemblement. De nombreux sites ZICO et Ramsar, proches des stations d'épuration, ont été désignés en grande partie en raison de la présence de plus de 1 % de la population biogéographique ou d'autres volatiles répondant à la définition de "population" d'oiseaux d'eau. Les orientations actualisées limitent l'application du critère 3 aux seuls sites comptant plus de 1 % de la population mondiale, un seuil beaucoup plus difficile à atteindre. Il peut y avoir jusqu'à dix fois plus de différence entre une population biogéographique et une population mondiale dans la zone concernée.

Trois sites, Djerba Aghir, El Hamma et Zarsis, peuvent également être qualifiés d'habitat critique selon le critère 1 (relatif à la présence d'espèces en danger et en danger critique d'extinction) et le critère 2 (relatif à la présence d'espèces dont l'aire de répartition est limitée) mais nécessiteraient des recherches supplémentaires dans le cadre des EIES¹ des sites pour le déterminer. Ces recherches supplémentaires sont recommandées pour El Hamma (avec trois espèces potentiellement préoccupantes) mais ne sont pas recommandées pour Djerba Aghir et Zarsis en raison de la difficulté à confirmer la présence et le nombre de la seule espèce de poisson concernée.

Le domaine d'analyse est-il approprié ?

¹ Etude des Incidences environnementales et sociales

Ce rapport a appliqué les critères d'habitat critique spécifiquement à la zone immédiate autour de la station d'épuration et de rejet (dans un rayon de 1 km environ) et dans les zones de conservation clés déjà identifiées près des sites (principalement les ZICO et les sites Ramsar). Toutefois, il convient de souligner que lors de la réalisation d'une évaluation complète de l'habitat critique (EHC), il est conseillé d'identifier une "zone d'analyse écologiquement appropriée" détaillée, qui peut parfois se situer au niveau du paysage terrestre ou marin et s'étendre au-delà de la zone d'influence du projet. Il est possible que, si le golfe de Gabès était évalué dans son ensemble, les seuils du critère 1 pourraient être atteints pour toute une série d'espèces marines à large répartition. Nous avons identifié les sites de STEP qui se déversent directement dans le golfe de Gabès, dans des zones qui ne sont actuellement pas identifiées comme HC, mais qui pourraient mériter une réévaluation, si le golfe de Gabès dans son ensemble était considéré comme un habitat critique (Tableau 6).

La ZICO et le site Ramsar de Chott El Djerid, situés à proximité, constituent une unité physiographique distincte ayant des fonctions écosystémiques communes et sont de la même taille que tout le golfe de Gabès. Dans le golfe, cependant, les systèmes Ramsar, ZICO et KBA ont évalué séparément des zones relativement petites et aucune tentative n'a été faite pour évaluer le golfe dans son ensemble.

Il est donc nécessaire que, dans le cadre de l'évaluation des impacts cumulatifs (EIC) du golfe de Gabès spécifiée dans les documents accompagnant les termes de référence, une EHC plus complète soit entreprise pour le golfe.

Les normes actuelles relatives aux effluents sont-elles appropriées pour tous les sites ?

L'étude environnementale supplémentaire détermine quelle norme d'effluent devrait être appliquée aux 15 stations d'épuration, tandis que la présente étude examine, de plus près, l'adéquation de la norme proposée pour les sites adjacents aux éléments sensibles, notamment ceux de la biodiversité. Certaines recommandations ont été formulées pour aider à respecter ces normes dans des cas spécifiques. Quatre sites, pour lesquels un travail supplémentaire sur la biodiversité pourrait être effectué dans le cadre des EIES détaillées (Tableau 6), ont été identifiés. Le site d'El Hamma, où trois espèces des Critères 1 ou 2 semblent être présentes, est préoccupant et l'état actuel du Sebkha Chott Fjej, pour ce qui concerne l'utilisation des oiseaux d'eau, doit être évalué plus en détail.

Les auteurs de ce rapport souscrivent à la plupart des conclusions de l'Étude Environnementale Supplémentaire. Ils reconnaissent que les améliorations apportées aux stations d'épuration amélioreront généralement la qualité des effluents, en particulier pour les paramètres dits traditionnels des STEP municipales (par exemple, DCO, DBO, MES, N, P). Il s'agit d'une hypothèse de base dans cette analyse et elle est considérée comme un aspect positif pour la biodiversité. L'application des différentes mesures améliorera les conditions environnementales et les auteurs du rapport ne pensent pas qu'il soit nécessaire d'appliquer aux sites des normes supplémentaires par rapport à ce qui est proposé.

Qu'en est-il des métaux lourds ?

Il semble aux auteurs de ce rapport que les contrats de partenariat public-privé (PPP) ne prendront en compte que les normes "traditionnelles" de type STEP municipales (DCO, DBO, TSS par exemple). D'autres paramètres, tels que les métaux lourds, spécifiés dans l'ancienne et la nouvelle norme tunisienne sur les effluents, sont considérés comme ne faisant pas partie des exigences contractuelles du PPP. Il n'existe pas de données sur la qualité actuelle de l'eau des milieux récepteurs, et les analyses chimiques des métaux lourds des effluents ont tendance à être sporadiques. Il n'est donc pas possible, dans le cadre de cette étude, d'aller beaucoup plus loin. Étant donné qu'entre 8 et 10 sites (selon les limites géographiques du Golfe) se déversent dans le Golfe de Gabès, il pourrait être utile de réaliser une évaluation des impacts cumulatifs pour la totalité du Golfe.

Une importance particulière doit être donnée aux métaux lourds au regard de l'élimination des boues. Il n'existe malheureusement pas suffisamment de données pour évaluer les impacts potentiels des différents sites d'élimination sur la biodiversité ou les services écosystémiques. Il conviendrait d'aborder cette question dans les EIES.

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List of Acronyms and Abbreviations

AFFI - Arab Financing Facility for Infrastructure

CIA – cumulative impact assessment

CR – IUCN status code for a species labeled as “Critically Endangered”

DD - IUCN status code for a species labeled as “Data Deficient”

EIA – environmental impact assessment

EN – IUCN status code for a species labeled as “Endangered”

ESIA - environmental and social impact assessment

IBA – Important Bird Area (Important Bird and Biodiversity Area)

IBAT – International Biodiversity Assessment Tool

IFC – International Finance Corporation

IUCN – International Union for the Conservation of Nature

KBA – Key Biodiversity Area

LC – IUCN status code for a species labeled as “Vulnerable”

NT – IUCN status code for a species labeled as “Least Concern”

ONAS – Tunisian *Office National de l'Assainissement* (National Sanitation Office)

PPIAF - Public Private Infrastructure Advisory Facility

PS – Performance standard (IFC)

PS6 – Performance standard 6 of the IFC dealing with biodiversity

STEP – Station d'épuration des eaux usées

VU – IUCN status code for a species labeled as “Vulnerable”

WWTP – Waste water treatment plant

1 Introduction

1.1 Purpose of report

The World Bank is providing technical assistance to the Tunisian National Sanitation Office (*Office National de l'Assainissement*, ONAS) to increase private sector participation in the sector. Funding from the Public Private Infrastructure Advisory Facility (PPIAF) and Arab Financing Facility for Infrastructure (AFFI) helped ONAS hire transaction advisory consultants to structure the first concession contract enabling the delegation of the operation and maintenance of these assets to the private sector. ONAS subsequently appointed the International Finance Corporation (IFC) to supervise the transaction advisors. The pre-qualification has now been successfully concluded, and draft bidding documents and contracts are being finalized.

The PPP contracts will comprise: (i) the delegation of Operation and Maintenance, (ii) the delegation of initial upgrade works (improved treatment), (iii) the delegation of large rehabilitation works, as well as (iv) the delegation of annual major maintenance and renewal works. The assets that will be subject of the PPP contracts include 15 existing wastewater treatment plants (“WWTPs”) that are geographically situated in two regional groups: Tunis Sud (14 WWTPs) and Tunis Nord (1 WWTP). The project aims to improve treatment in these existing WWTPs to achieve a positive impact on the receiving environment, however taking into account its assimilative capacity and most sensitive end-use.

To support the bidding process, a number of valuable supporting studies have been completed, see Section 1.2. The findings from these studies highlighted the fact that some of the sites and/or outfalls are located in or nearby Ramsar and/or Key Biodiversity Areas (KBAs). It was decided that a more thorough biodiversity assessment compliant with IFC Performance Standard 6 (PS 6) (Biodiversity Conservation and Sustainable Management of Living Natural Resources) was needed, to further inform the risk assessment for the bidding process.

This report responds to a Terms of Reference to provide a more detailed Biodiversity Assessment for each of 15 Wastewater Treatment Plants, and to provide input into a Terms of Reference for the biodiversity component of an Environmental and Social Impact Assessments that will be conducted for each WWTP by the future winning bidder.

The objectives of the study were:

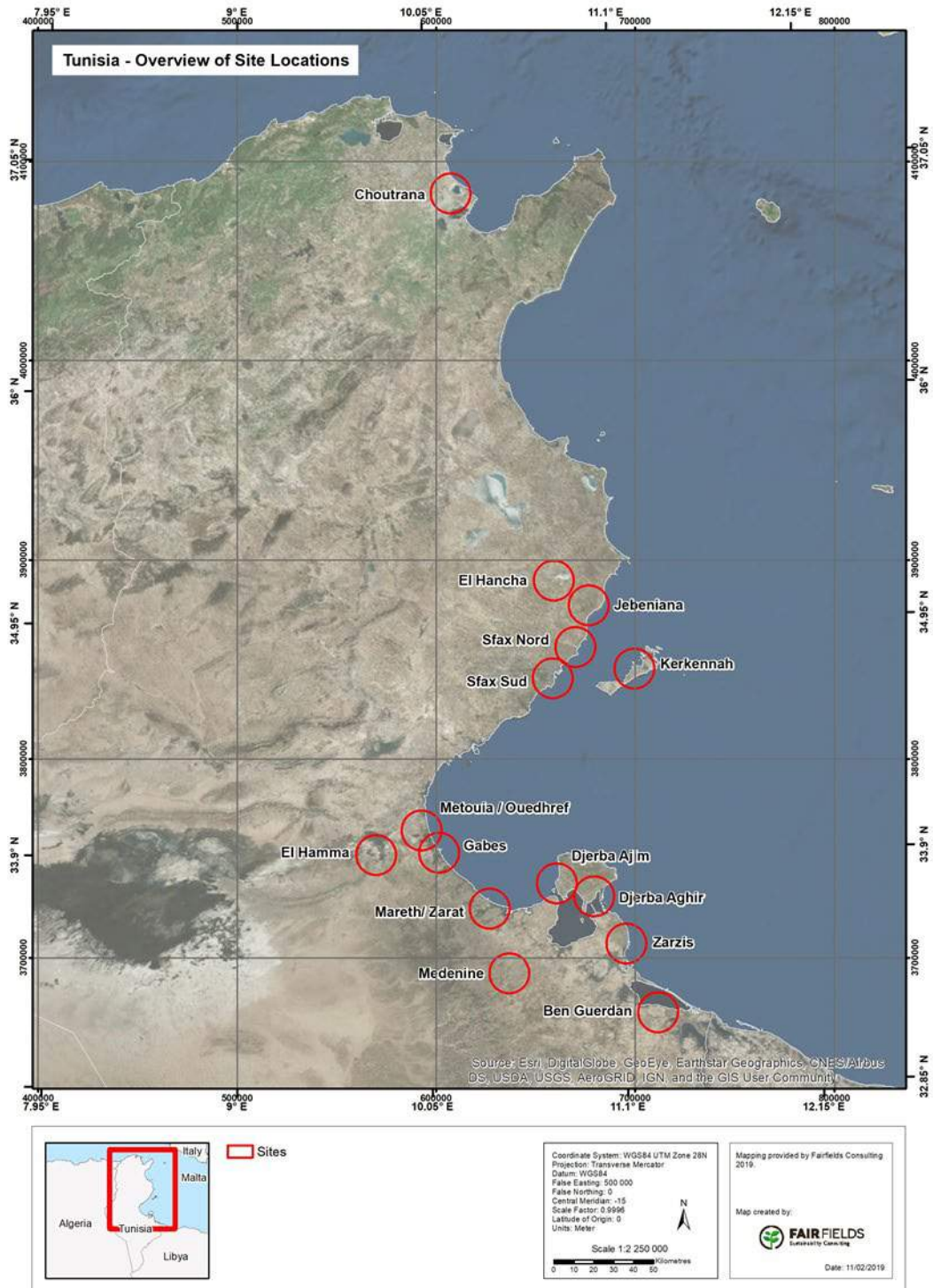
- (1) to characterize the habitat type in the area around each effluent discharge point/irrigation perimeter according to PS6 definitions as *Modified* and/or *Natural* habitat;
- (2) to confirm the proximity and/or overlap of the outfalls/irrigation perimeter areas with proposed or existing protected and internationally recognized areas;
- (3) to undertake a rapid Critical Habitat (“CH”) Screening;

(4) Based on the likely presence of CH triggers and/or location of outfalls/irrigation perimeter inside or in the proximity of legally protected or internationally recognized areas, provide recommendations for adequate standards/mitigation measures;

(5) to provide recommendations and prepare ToRs for additional data collection and additional studies to be undertaken for the future ESIA to comply with PS6;

(6) to engage with key stakeholders, to fill information gaps and understand the areas of analysis in terms of potential occurrence of biodiversity values.

Map 1 Overall map showing location of facilities



1.2 Structure of the report

The report is broken up into two volumes but should be read together.

Volume I is a summary of the analysis and conclusions. It includes an Executive Summary with a summary of the report's findings. Section 1 provides information on the terms of reference for the report, some background information and key findings from existing documents. The introduction is

followed in Section 2 with information on relevant standards such as IFC PS 6. Section 3 assesses which biodiversity features might trigger Critical Habitat at the WWTPs. Section 4 presents discussion of key issues and Section 5 summarizes the key findings for each WWTP separately. The references are added in Section 6.

Volume II (this volume) includes the detailed analyses for each of the 15 WWTPs and a series of appendices with the data that have been used.

In addition there are two stand-alone terms of reference: (1) for Biodiversity component of the WWTP-specific ESIA, and (2) for a Cumulative Impact Assessment (CIA) and critical Habitat Assessment (CHA) for the Gulf of Gabès .

1.3 Key findings from existing studies

A number of studies have been completed to support the bidding process. These include: the *Rapport de Due Diligence*, January 2015; an additional note (*Document de Travail: Considérations sur les objectifs de traitement N et P*), November 2016; and a Supplementary Environmental and Social Assessment (*Etude Environnementale Supplémentaire*) May 2018 draft version and January 2019 final version.

In addition, subject to a specific request, Artelia (one of the transaction advisory consultants) provided background data on effluent analyses from 2014 to 2016 (February 13th and 25th 2019). Finally on March 4th, the final version of the *Etude Environnementale Supplémentaire* (dated January 2019) was made available.

The initial version of this biodiversity assessment report had relied heavily on the data provided in the May 2018 version of *Etude Environnementale Supplémentaire*. Information from the effluent analysis data and the updated *Etude Environnementale Supplémentaire* considerably changed the biodiversity analysis.

1.4 Other information consulted

In addition to the documents highlighted above, additional data was gathered from other published reports and online information. This included the Integrated Biodiversity Assessment Tool (IBAT), Ramsar files, Important Bird Area (IBA) files, International Union for Conservation of Nature (IUCN) species status reports and journal articles and reports (some 600 consulted to date). The list of key references is provided in the reference section.

Additional data came from queries and exchanges with knowledgeable individuals and organizations, notably staff of Artelia, one of the transaction advisory consultants.

1.5 Study limitations

This report is a desktop-based study and did not include site visits. No current aerial or satellite images for the WWTP sites were provided, except for those low-resolution images in the *Etude*

Environnementale Supplémentaire report. Consequently, the analysis of the habitats around the sites was based on GoogleEarth images that date from 2014 to 2018. In addition, the data used to designate the IBA or Ramsar sites are not very recent. Much of the other published information from Tunisia, particularly in relation to wintering birds is out of date and the status of these sites may have changed in the intervening period. Lastly data on the water quality in the receiving bodies were not available.

1.6 Notes

The WWTPs are presented in the following section in alphabetical order, as they were in Volume 1.

The effluent data summaries from the *Etude Environnementale Supplémentaire* are not dated are assumed to be an average from the 2014-2016 data.

Chemical parameters in the tables from the *Etude Environnementale Supplémentaire* and when referring to the Tunisian standards are given with French acronyms but English acronyms are given when discussing the parameters in the text: DBO5 = BOD5; DCO=COD; MES=TSS).

Mention of national or local designations such as hunting reserves and National Wetlands came from the IBA and Ramsar site evaluations or the *Etude Environnementale Supplémentaire*. The presence of these nationally and locally designated sites would not in and of themselves trigger CH, nor would they qualify as internationally recognized protected area as per PS6 unless they were also recognized as a specific KBA or within an IBA or Ramsar site.

2 Detailed Assessment of the WWTPs

2.1 Ben Guerdan

2.1.1 *General description of the site*

Ben Guerdan is a new WWTP under construction. The planned hydraulic capacity is 7,500 m³/d. There is no information on the current effluent levels and potential exceedances.

The area around the proposed WWTP site is likely to be mainly Natural Habitat. The discharge is planned somewhere (no specific location determined yet) into Sebkhna Mnikhra, also in Natural Habitat. There is no data available to suggest that this area is likely to be CH.

2.1.2 *Protected areas or designated sites of international importance*

The location of the WWTP is inland and the closest IBA and Ramsar sites are the Bibane sites some 10-20 km to the north. These sites do not have confirmed CH. There is a large sebkhet complex to the east and north, Sebkhet Adhibate, but there are no data available to suggest that this area is likely to have CH.

2.1.2.1 *IBA/KBA sites*

See Section 2.15.2.1 for a discussion of the Bibane IBA site north of the WWTP site.

2.1.2.2 *Ramsar sites*

See Section 2.15.2.2 for a discussion of the Bahiret El Bibane Ramsar site north of the WWTP site.

2.1.2.3 *Other designations*

None known

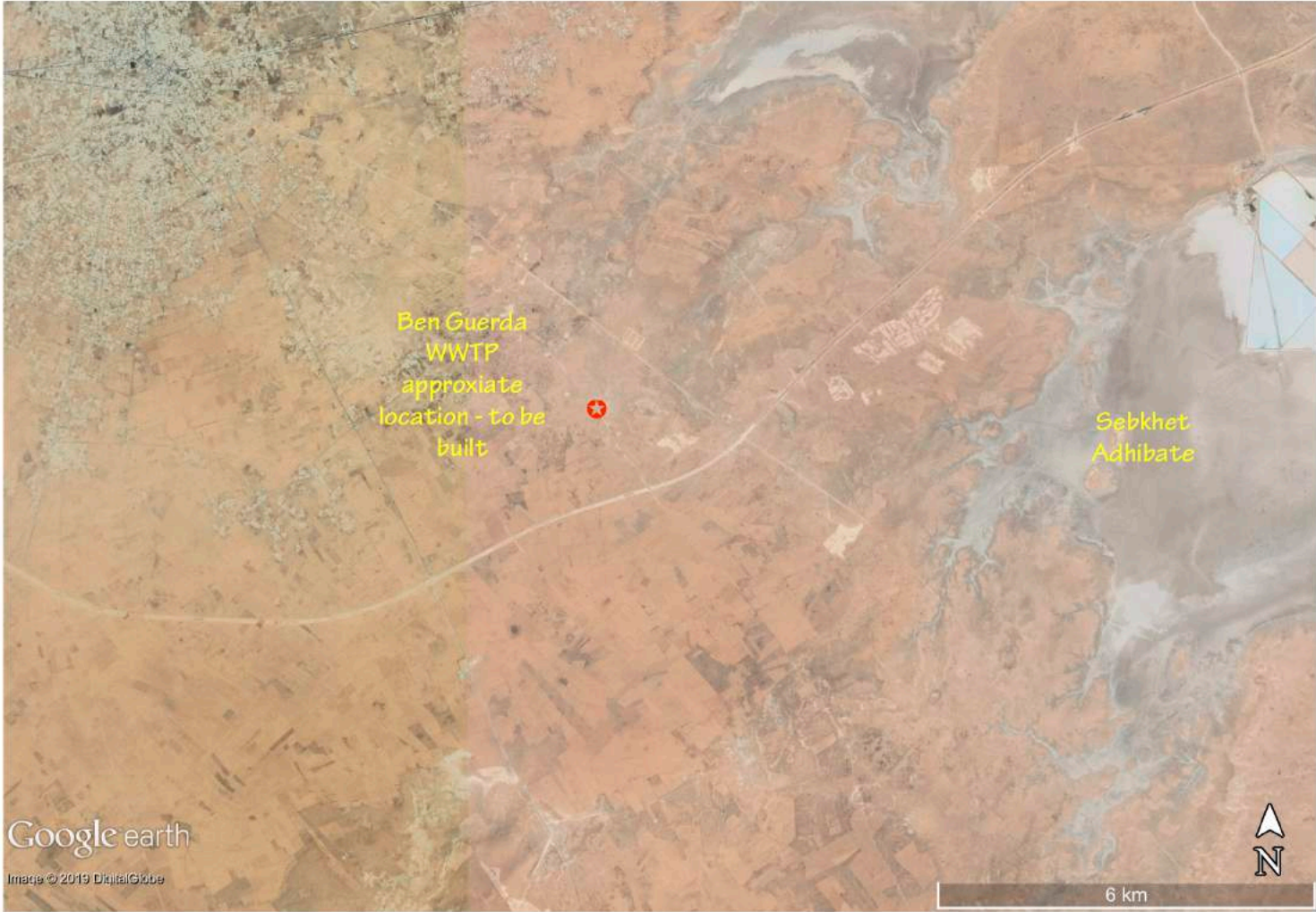
2.1.3 *Other information on biodiversity values in the area*

None

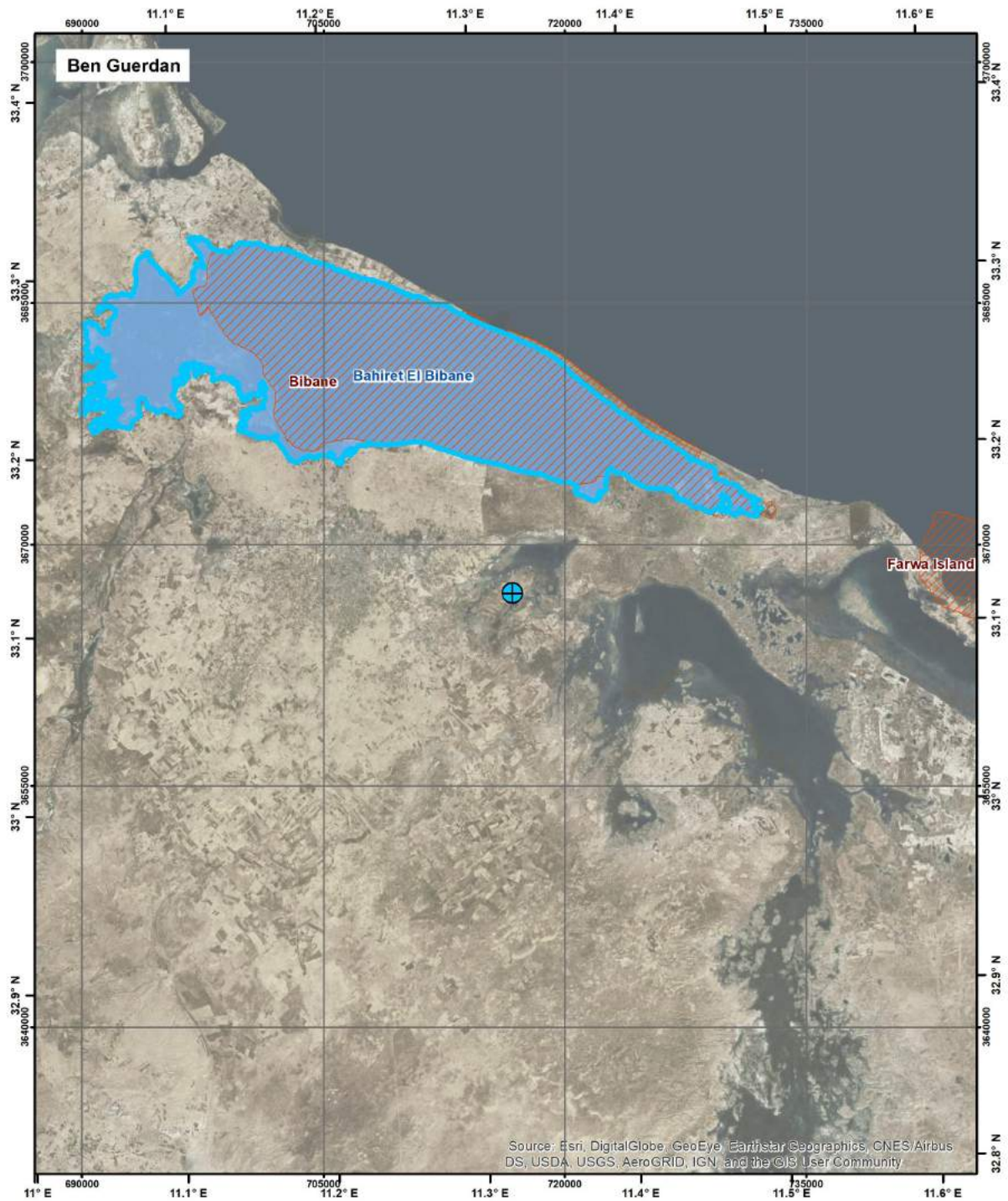
2.1.4 *Critical Habitat*

None known or expected. See above.

Map 2 Ben Guerdan regional setting



Map 3 Ben Guerdan protected areas or designated sites of international importance



	<ul style="list-style-type: none"> Waste Water Treatment Plant Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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2.1.5 *Ecosystem services*

None known

2.1.6 *Receiving environment*

The receiving environment is described in Section 2.2.15 of the *Etude Environnementale Supplémentaire*. No data are available for water quality in the receiving environment.

2.1.7 *Current effluent quality*

Obviously, the *Etude Environnementale Supplémentaire* does not give actual effluent values for this site but it is supposed to meet the new standard for the “traditional” municipal parameters.

2.1.8 *Use of effluent for irrigation*

None known

2.1.9 *Disposal of sludge*

No data.

2.1.10 *Recommendations regarding the adequacy of standards for this site*

The new Tunisian standard appears adequate if all parameters are considered applicable. In this case, since we have no current effluent data, it should be required specifically that the site meet all Tunisian standards not just the traditional municipal ones. This should be possible by ensuring that this new site functions correctly and does not accept industrial waste.

2.1.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None except that it is expected that the ESIA will be able to generate reasonable predicted effluent levels and that these will meet the Tunisian standards.

2.2 Choutrana

2.2.1 *General description of the site*

The Choutrana site is a special case. It is the only site in Northern Tunisia and it and Sfax Sud are the only two large WWTPs in the set being assessed. Both have hydraulic capacities of 40,000 m³/d or more, considerably large than many of the other WWTPs that just reach a few thousand m³/d.

The WWTP was built in 2007 and discharges to the marine realm.

The Choutrana WWTP now has a new discharge point some 6 km out at sea and 20 m deep. This is a significant improvement that will reduce impact on the coastal zone.

There is a Ramsar site to the north (Lagune de Ghar el Melh et Delta de la Mejerda) that comes close to the part of the coast where the discharge pipe leaves land.

There is also a KBA about 1 km to the north of the WWTP (Sebkha Ariana).

2.2.2 *Protected areas or designated sites of international importance*

Close to the WWTP and outfall is the Sebkheth Ariana KBA, designated for the presence of significant populations of globally threatened species and other bird species at certain times in their lifecycle or seasonal migration. However there are no available data on numbers or species. It is not an IBA site and there is no information on the IBAT report about the basis for the designation

There is a Ramsar site to the north of the new outfall: Lagune de Ghar el Melh et Delta de la Mejerda.

The habitat within 1 km of the WWTP is Modified Habitat, with the Natural Habitat of the Sebkheth Ariana KBA just beyond 1 km. The outfall being at sea is surrounded by 100% Natural Habitat.

2.2.2.1 *KBA sites*

The only KBA site close to the WWTP and outfall is the Sebkheth Ariana KBA, designated for the presence of significant populations of globally threatened species and other bird species at certain times in their lifecycle or seasonal migration. However there are no available data on numbers or species.

There are no IBA sites close enough to be of concern.

Map 4 Choutrana regional setting



Map 5 Choutrana WWTP and outfall



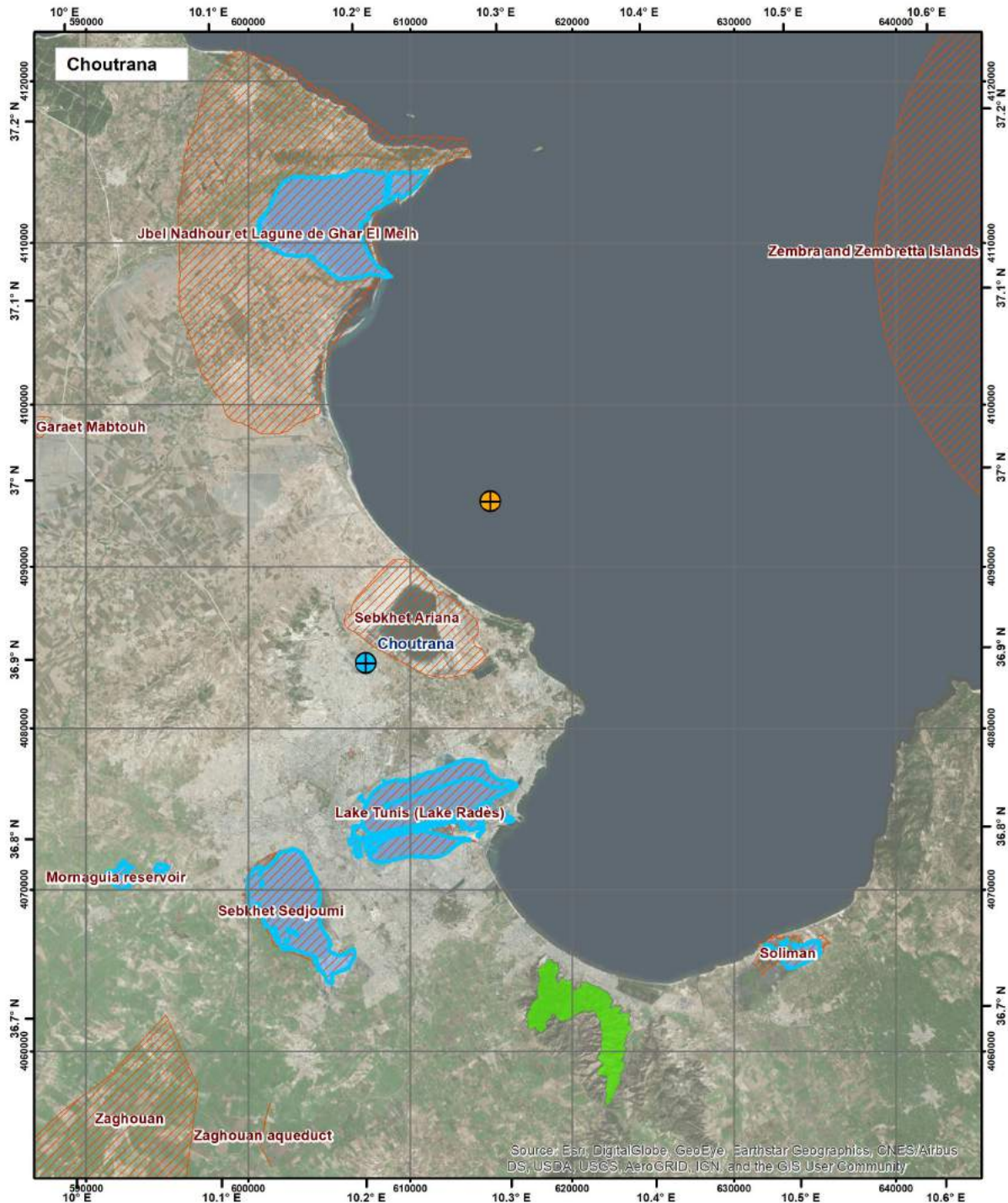
Map 6 Choutrana WWTP



Map 7 Choutrana outfall

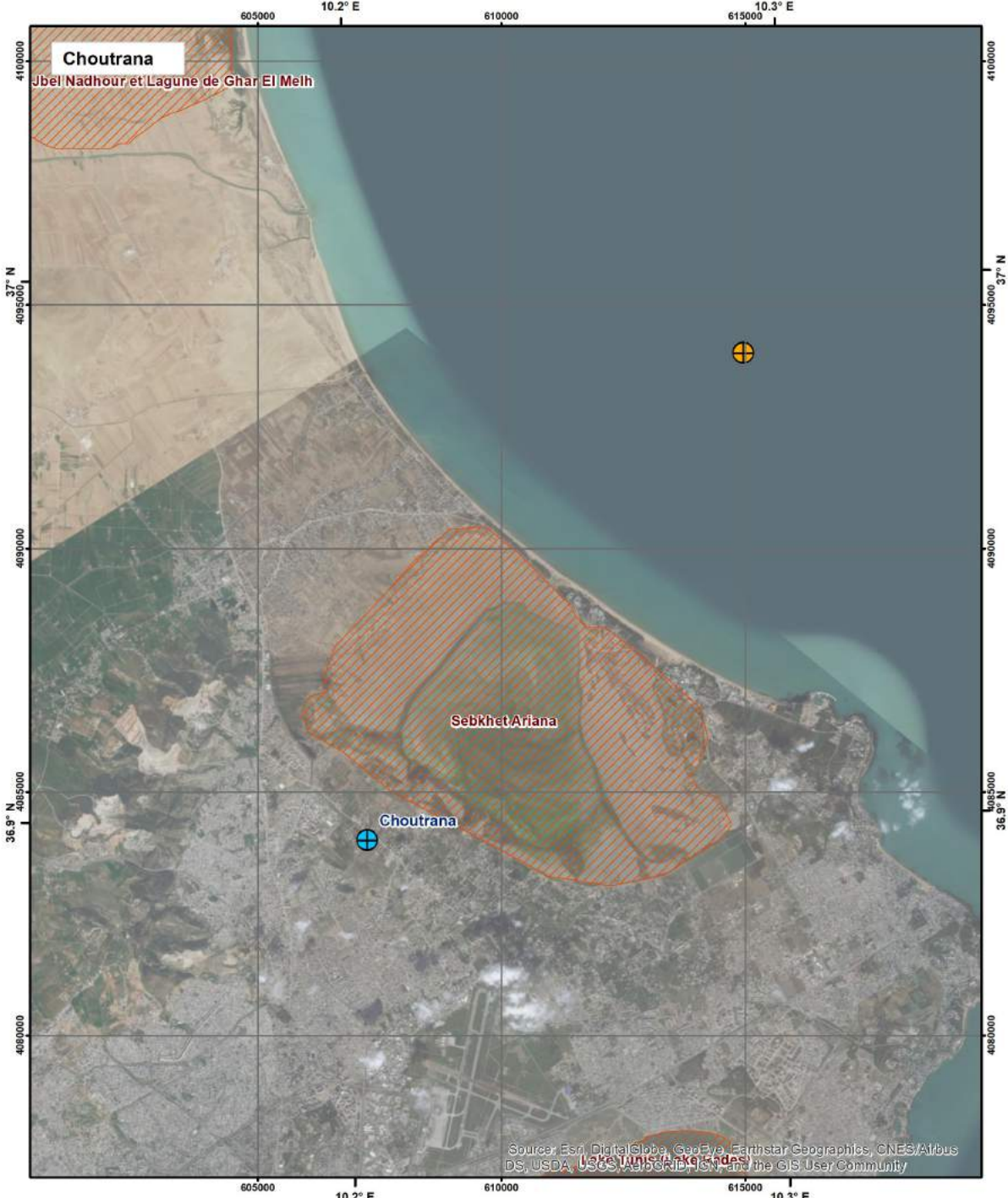


Map 8 Choutrana protected areas or designated sites of international importance



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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Map 9 Choutrana protected areas or designated sites of international importance (detailed view)

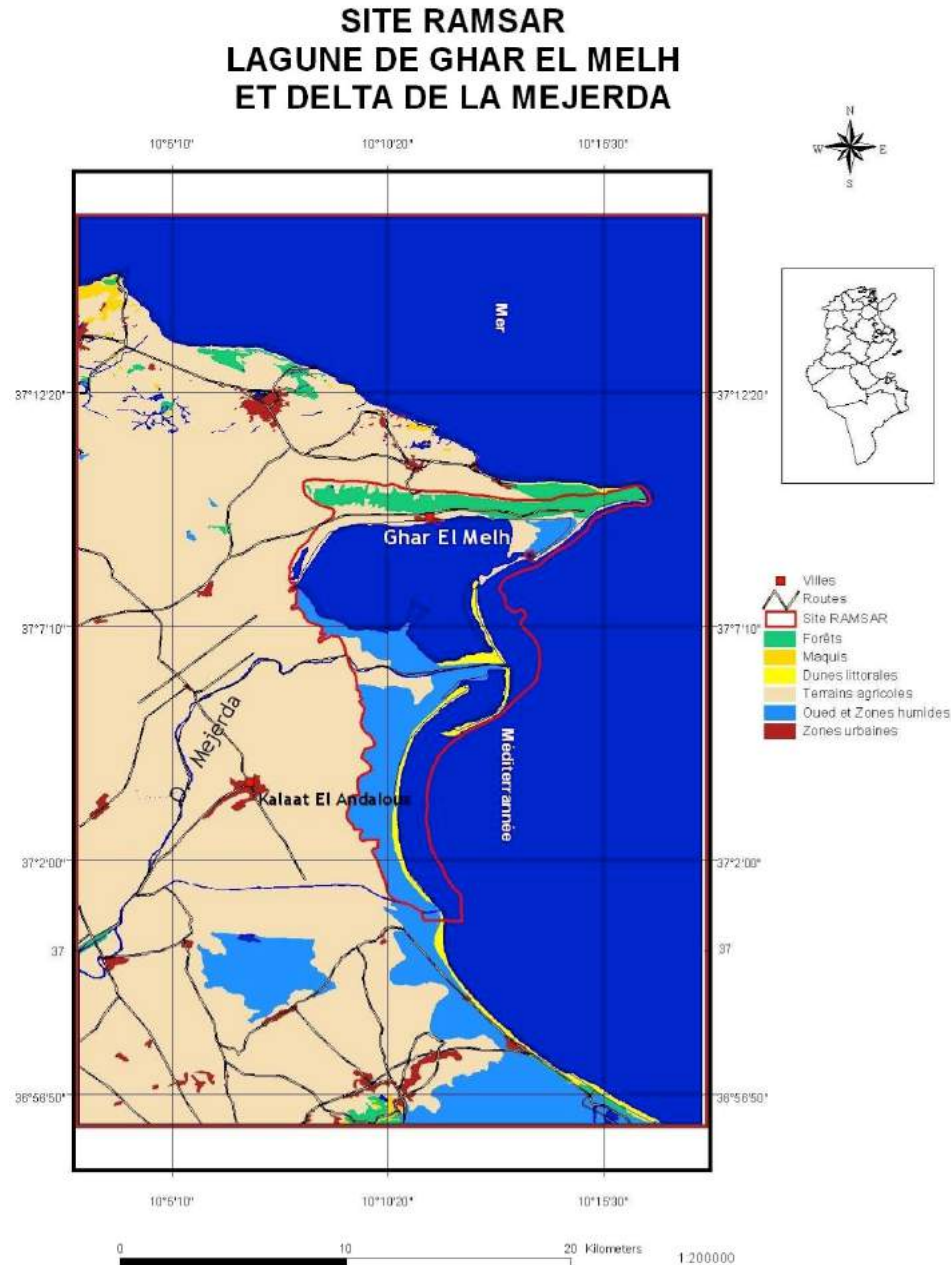


	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9998 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:100 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
	Outfall		
	Key Biodiversity Area		

2.2.2.2 Ramsar sites

The Lagune de Ghar el Melh et Delta de la Mejerda Ramsar site is located to the north of the outfall. The site configuration on Map 8 is based on the IBAT file and it does not conform to the outline given on the Ramsar website (Map 10)

Map 10 Lagune de Ghar el Melh et Delta de la Mejerda site (from Ramsar website)



The Ramsar mapping suggests that the Ramsar site extends considerably further south, to about within 2.5 to 3 km of the point where the outfall leaves the land to head out to sea.

The Ramsar website describes the area as: “An ancient sea bay now almost totally laden with sediments, this complex and dynamic wetland includes the delta of the most important river in the north of the country, a lagoon rich in fish species, and several secondary lagoons and floodplains. During the past 50 years the site has seen many changes, from water diversion for human uses to the building of a series of barrages to reduce the risk of floods. Migratory fish use the site for feeding, especially during the winter period before reaching the sea. Artisanal fishing is practised by the local population.” (<https://rsis.ramsar.org/fr/ris/1706>)

The Jbel Nadhour et Lagune de Ghar El Melh Ramsar site was designated in 2007 on the basis of meeting Criteria 1, 3, 4, 6 and 8 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 1 deals with representative wetlands and the site includes a good example of a delta of a large river plus the lagoon is a good example of a Mediterranean lagoon connected to the sea.

Criterion 3 deals with supporting populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site has a good diversity of benthic species (84) including 47 molluscs and 19 crustaceans. Some 45 species of fish have been identified from the site.

Criterion 4 deals with supporting plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site is important for a large number of wintering waterbirds. Key species include surface ducks such as *Anas penelope*, *A. crecca*, *A. acuta* and *A. clypeata*. It is also a breeding area for species such as *Himantopus himantopus*, *Charadrius alexandrinus*, and *Glareola pratincola*.

Criterion 6 deals with a site that regularly supports 1% of the individuals in a population of one species or subspecies of a species. The site has 200 breeding Collared Pratincoles *Glareola pratincola*. This easily meets the biogeographic population threshold but it does not meet the global population threshold.

Criterion 8 deals with sites that are an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. The lagoon is an important wintering area for fish.

2.2.2.3 Other designations

Sekhbet Ariana is listed as a Wetland of National Importance. Wetlands of National Importance noted in this report are wetlands that do not meet the Ramsar criteria but are noted as important at the national level.

The IBAT map (Map 8 and Map 9) also indicates a KBA south of their limits of the Ramsar site.

2.2.3 Other information on biodiversity values in the area

The WWTP site and the old outfall are within range of the endangered and restricted range Blanc's Fringe-toed Lizard *Acanthodactylus blanci*. However, there is no indication of its presence near the

WTTP or the old outfall. Work on creating the new outfall has been completed and no other work outside the WWTP seems likely.

2.2.4 *Critical Habitat*

No Critical Habitat has been identified.

2.2.5 *Ecosystem services*

There is some artisanal fishing along the coast. There is also some bathing north and south of the old discharge point on the shore.

2.2.6 *Receiving environment*

The receiving environment is described in Section 2.2.1 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.2.7 *Current effluent quality*

The Choutrana WWTP is intended for domestic wastewater treatment alone and does not accept industrial wastes.

Current values for the effluent are shown below

Table 1 Choutrana current effluent quality from the *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
CHOUTRANA 2	DBO5 mg/l	26	24,33	29
	DCO mg/l	86	81	89,25
	MES mg/l	27	25	24

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent on average meeting the current standard for BOD5, COD and TSS.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There are small (less than twice the current standard) exceedances for fecal coliforms and fecal streptococcus in 2015 (but not 2014 and 2016). There are some striking absences in the data, notably a total lack of measurements from 2014-16 for mercury, aluminum and manganese, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals. The sheer volume of the effluent from Chatrouna, an order of magnitude above that of other WWTPs considered, is a concern.

An EIA was conducted in 2013 regarding the Choutrana outfall, leading to the construction of a 6 km pipe at sea to help mitigate impacts. Modeling indicated that the bathing beaches near the old outfall would meet the Tunisian NT09 standard for bathing.

2.2.8 *Use of effluent for irrigation*

The re-use of the effluent for agricultural purposes is an important part of the planning for Choutrana WWTP, although it is not considered possible to use 100% of the effluent for this purpose. Thus the new outfall 6 km out in the sea will continue to play a significant role into the future.

Disinfection of all effluent is required, however the effluent from Choutrana will be mixed with the effluent from another nearby WWTP, Charguia. Charguia does not currently have disinfection and this will have to be added to the system in order for the combined effluent to meet the disinfection requirement.

The combined effluent from the two WWTPs are stored in a common retention pond and a disinfection system will be set up at the exit to the retention pond. Part of the effluent will go directly for irrigation purposes as the distribution system is set up and another part will go to the Bourj Touil irrigated perimeter (3,200 ha plus a 417 ha extension zone) (see Map 11). The Bourj Touil irrigated perimeter was subject to an ESIA in 2016 that seemed to ensure that adequate measures were to be placed to meet environmental concerns.

The irrigated area includes cereal, fodder and tree crops.

2.2.9 *Disposal of sludge*

According to the May 2018 *Etude Environnementale Supplémentaire*:

“Pour la STEP de Choutrana, les boues, ayant une siccité de 18%, sont transportées par camion vers les étangs de boues appartenant à l’ONAS distant de 1,5 km du site de Choutrana. Cette solution pour l’élimination des boues présente des impacts sur l’environnement et un risque sanitaire non négligeables car le site n’a pas été conçu de façon à garantir un stockage étanche dans les règles de l’art des boues. Toutefois, l’ONAS a prévu de remplacer cette solution d’élimination des boues sur le moyen et le long terme par un futur site de mono-enfouissement des boues. ”

This indicates that this temporary and not satisfactory approach will be replaced by a more suitable and environmentally sound long-term storage facility.

Map 11 The Choutrana irrigation system (from the *Etude Environnementale Supplémentaire*)



2.2.10 Recommendations regarding the adequacy of standards for this site

The new Tunisian standard appears adequate if all parameters are considered applicable. In this particular case, the non-application of many of the parameters does not appear to be a major issue as the 2014-16 effluent levels do not appear to demonstrate a problem.

2.2.11 Specific additions to terms of reference for the ESIA for this WWTP

None

2.3 Djerba Aghir

2.3.1 *General description of the site*

Djerba Aghir is a medium sized WWTP (about 15,000 m³/d hydraulic capacity) built in 2001 and located on the eastern side of Djerba Island. The island is the largest island of North Africa, located in the Gulf of Gabès. It is on Tentative List of UNESCO World Heritage Sites (for largely cultural reasons).

The area within 1 km of the WWTP is mainly Modified Habitat (largely agricultural) but includes some of the adjacent waters and therefore has at least 20% as Critical Habitat. The outfall is near the shore and therefore is roughly 50% Modified Habitat and roughly 50% Critical Habitat.

The waters of the lagoon are somewhat enclosed and pollution from various sources is a problem.

2.3.2 *Protected areas or designated sites of international importance*

The WWTP is not itself in an IBA or Ramsar site.

The outfall is located in the Bordj Kastil IBA and KBA in shallow water. The site can on occasion host over 1% of the global population of Eurasian spoonbill *Platalea leucorodia*. Other bird species present in large numbers, but not meeting the 1% global threshold are *Larus michahellis*, *Sterna caspia* and numerous waders. *Larus michahellis*, *Sterna hirundo* and *S. albifrons* breed at the site. The vegetation of the site is a mixture of sand-loving species such as *Ammophila arenaria*, *Eryngium maritimum* and *Euphorbia paralias* and halophytes including *Arthrocnemum*, *Salicornia* and *Atriplex* species.

The outfall is within the Djerba Bin El Ouedian Ramsar site and near the Boughrara IBA site.

Map 12 Djerba Aghir regional setting



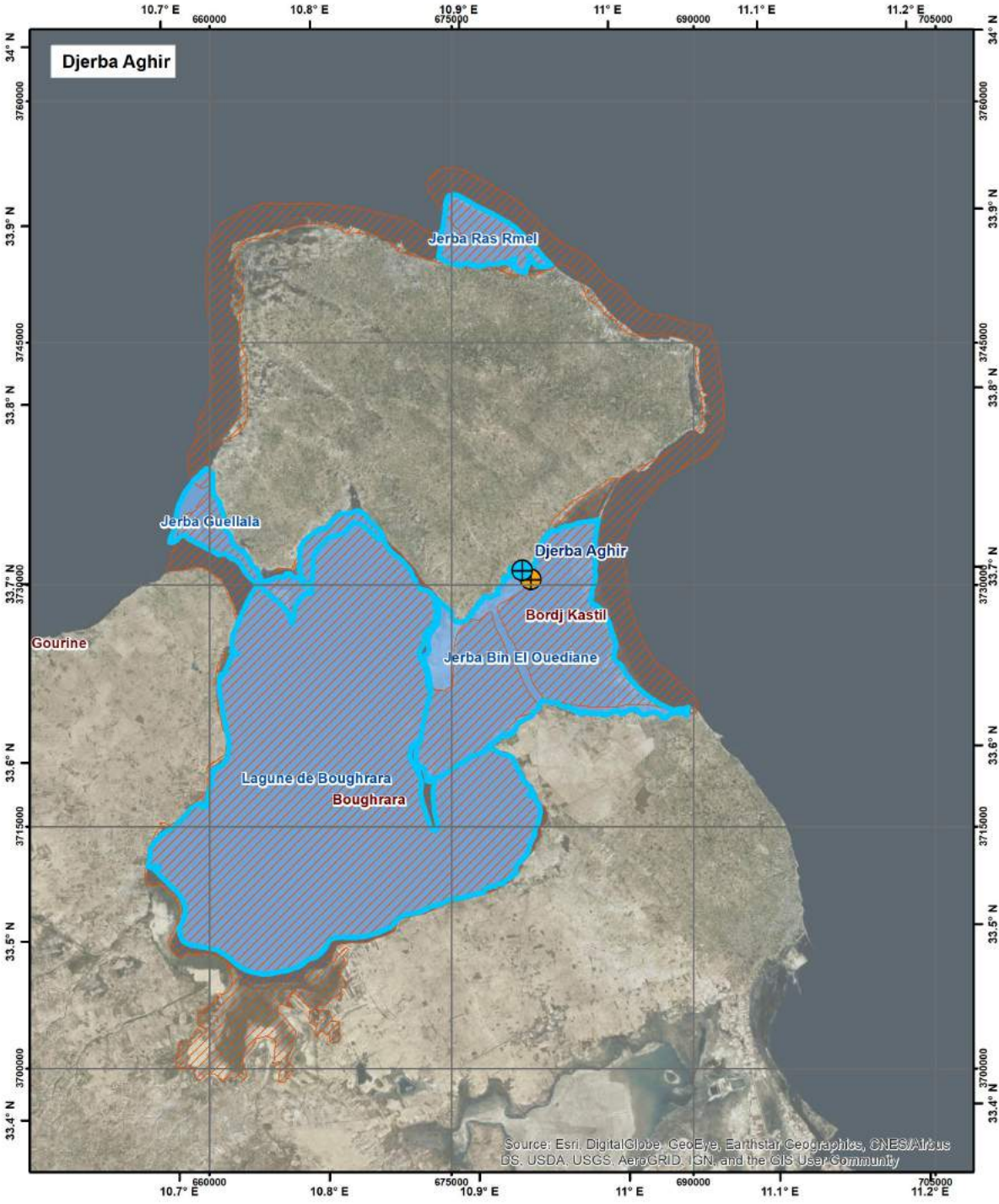
Map 13 Djerba Aghir WWTP and outfall



Map 14 Djerba Aghir WWTP and outfall (detailed view)



Map 15 Djerba Aghir protected areas or designated sites of international importance



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- Waste Water Treatment Plant
- Outfall
- Ramsar Wetland
- Key Biodiversity Area
- National Park
- Bird Reserve
- Faunal Reserve
- Nature Reserve
- Wetland Zone of National Importance

Coordinate System: WGS84 UTM Zone 32N
 Projection: Transverse Mercator
 Datum: WGS84
 False Easting: 500 000
 False Northing: 0
 Central Meridian: 9.0
 Scale Factor: 0.9996
 Latitude of Origin: 0
 Units: Meter

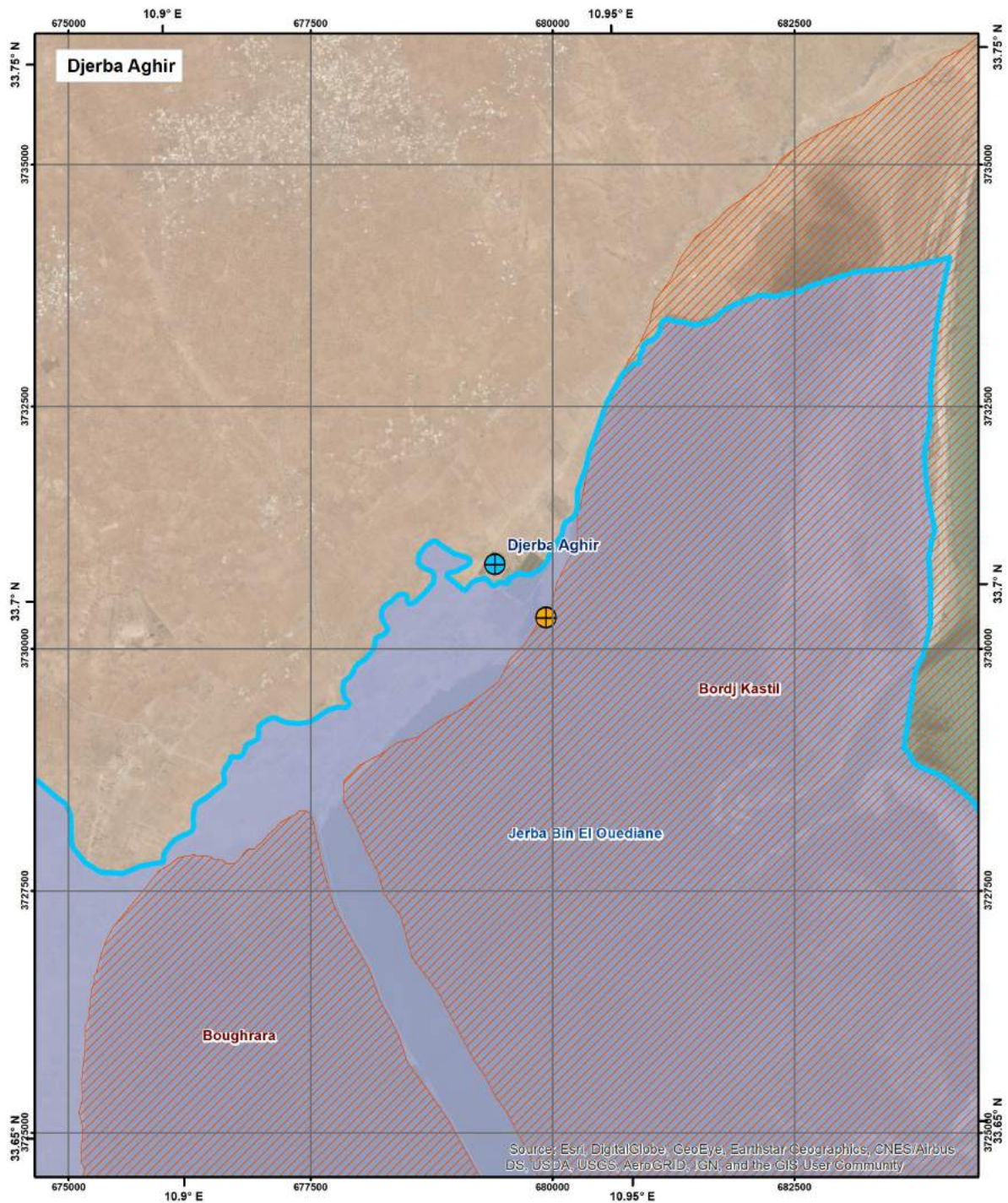
Scale 1: 300 000

Protected Area information from: BAT 2018.
 Mapping provided by: Fairfield's Consulting 2018.

Map created by:
 FAIRFIELDS CONSULTING

Date: 18/03/2019

Map 16 Djerba Aghir protected areas or designated sites of international importance



	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:50 000</p>	<p>Protected Area Information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by: FAIR FIELDS Sustainability Consulting</p> <p>Date: 18/03/2019</p>
	Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance		

2.3.2.1 IBA sites

The Boughrara IBA site is described in Section 2.4.2.1.

The Bordj Kastil IBA, designated in 2001, covers much of the coastline of Djerba Island (Map 17). According to the IBA site report:

Map 17 Bordj Kastil IBA site (taken from IBA website)



The triggers for IBA designation are A4i as given below:

Table 2 Bordj Kastil IBA triggers (as per IBA site report)

IBA Criteria
Year of most recent IBA criteria assessment: 2001

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	500-3,000 individuals	A4i
Eurasian Spoonbill <i>Platalea leucorodia</i> (http://datazone.birdlife.org/species/factsheet/22697565)	LC	winter	-	150-500 Individuals	A4i

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which in place at that time.

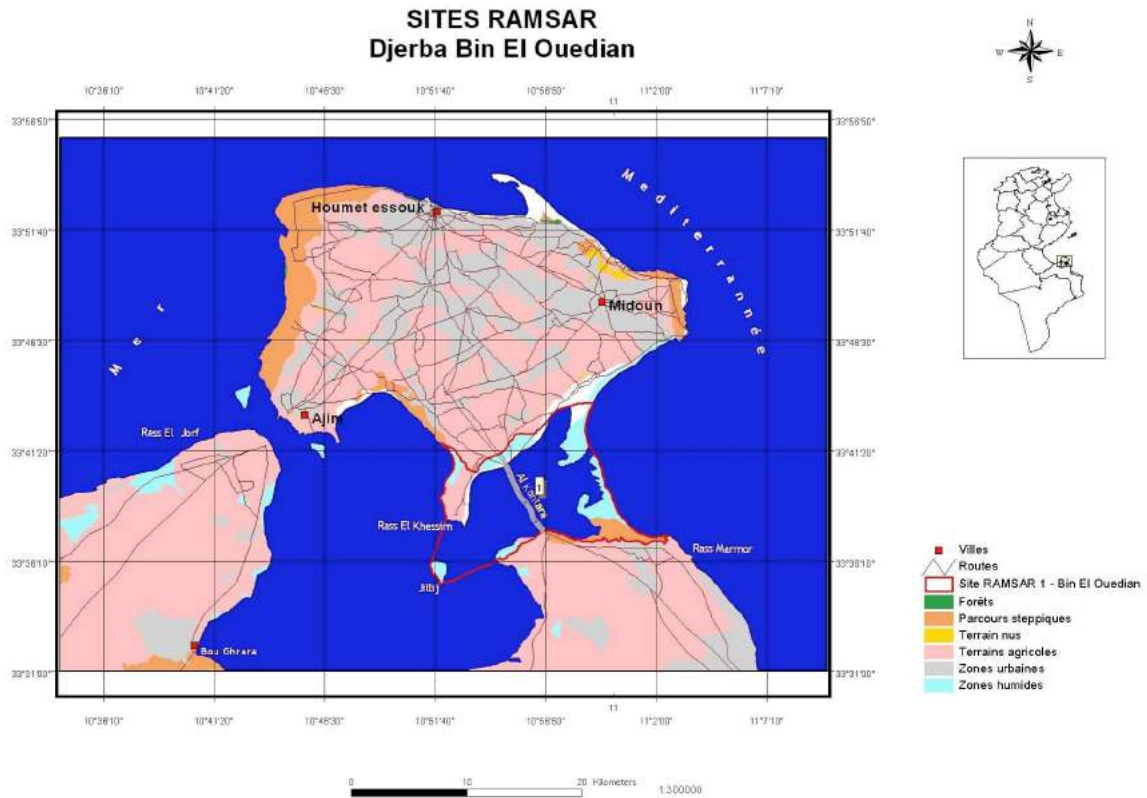
In addition, a 2009 monitoring assessment mentions populations of 668 Common Crane (*Grus grus*) and 701 Eurasian Spoonbill (*Platalea leucorodia*).

None of the above population estimates meet IFC Criterion 3 thresholds except for the 2009 Eurasian Spoonbill estimate.

2.3.2.2 Ramsar sites

The outfall is within the Jerba Bin El Quedian Ramsar site. The IBAT map of the site (Map 15) and the Ramsar map from the Ramsar website (Map 18) match fairly closely, if not perfectly.

Map 18 Jerba Bin El Quedian Ramsar site (from Ramsar website)



The Jerba Bin El Quedian Ramsar designation (2007) was based on meeting criteria 1, 3, 4, 6 and 8 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 1 deals with wetlands that contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region. The site met the criterion because of the tidal amplitude in the wetlands, a rare phenomena in the Mediterranean.

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. As for Criterion 1, the site met this criterion because of the tidal amplitude that allows the development of a variety of habitats otherwise uncommon in the area.

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The mud flats are an important feeding ground for a variety of birds in the winter and during migration.

Criterion 6 deals with wetlands that regularly support 1% of the individuals in a population of one species or subspecies of waterbird. Species exceeding the 1% biogeographic threshold are Greater

Flamingo *Phoenicopterus roseus* (500 to 3000) and Eurasian Spoonbill *Platalea leucorodia* (150 to 500). Neither of these meet the 1% global threshold.

Criterion 8 deals with wetlands that are an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

The 2007 Ramsar evaluation presents other data on the site:

“... Pour le flamant rose, il s’agit surtout d’hivernants venus des colonies nicheuses au nord de la Méditerranée. Les spatules blanches nichent dans des colonies en Europe centrale (et surtout le long du Danube), et viennent hiverner surtout dans les zones soumises à la marée du Golfe de Gabes ; les effectifs qui hivernent à Djerba (de l’ordre de 500 individus, sur une population estimée à 11.700) se réunissent la nuit dans un dortoir au Ras Rmel et se répandent au cours de la journée tout autour de l’île pour chercher leur alimentation, notamment dans la zone de Bin El Ouediane. Les vasières du site abritent, en hiver et aux passages de printemps et d’automne, une belle variété de limicoles. Les laridés, et notamment la sterne caspienne *Sterna caspia*, hivernent aussi en grand nombre. Les îlots Kilaat et Jilij, peu prospectées jusqu’à présent, fournissent des lieux sûrs de nidification à une gamme d’espèces et notamment à l’aigrette garzette, au chevalier gambette et aux sternes pierre-garin et naine.

... il s’agit notamment d’oiseaux d’eau migrateurs, qui y trouvent un lieu d’alimentation en hiver, stade critique, sur les vasières (et en particulier la spatule blanche *Platalea leucorodia*, différentes espèces de goéland *Larus* sp., la sterne caspienne *Sterna caspia* et plusieurs espèces de limicoles) ; d’autres espèces de limicoles y trouvent un point d’arrêt essentiel aux cours de leurs migrations entre l’Afrique et l’Europe (bécasseaux, chevaliers) ; enfin, certaines espèces (parmi elles l’aigrette garzette *Egretta garzetta*, le chevalier gambette *Tringa totanus*, le goéland leucopnée *Larus michahellis*, et les sternes pierre-garin *Sterna hirundo* et naine *S. albifrons*) y trouvent un lieu de nidification en été.”

To the south of the Jerba Bin El Quedian Ramsar site is the Golfe of Boughrara Ramsar site. The IBAT data suggests that the two sites touch (Map 15 and Map 16) but the Ramsar website map shows a much smaller Golfe of Boughrara site (Map 19).

The Golfe de Boughrara Ramsar designation (2010) was based on meeting criteria 1, 2, 3, 4, 5, 6 and 8 (see Section 3.5 for the explanation of the Ramsar criteria).

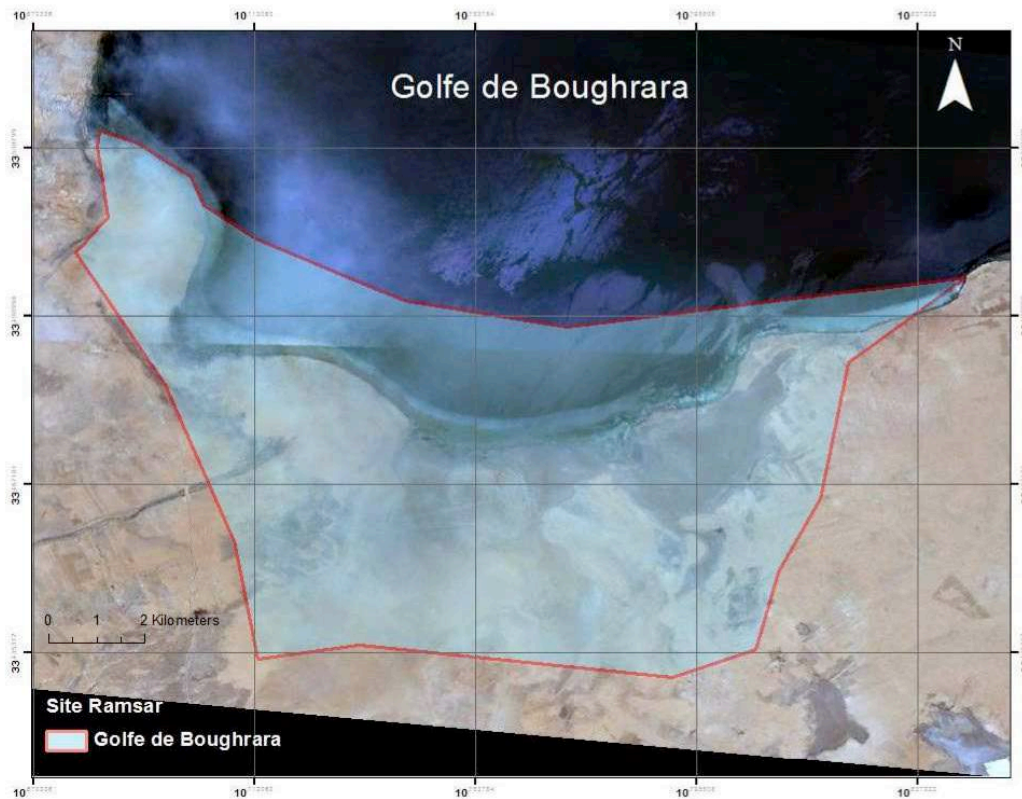
Criterion 1 deals with wetlands that contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region. The site includes a rare coastal lagoon as well as sebkhas important for ecological balance.

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The northern part of the Boughrara lagoon has important *Poseida* beds that provide habitats for various species.

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. As above, the northern part of the Boughrara lagoon has important *Posidonia* beds that provide habitats for various species.

Criterion 5 deals with wetlands that regularly support 20,000 or more waterbirds. The so-called Boughrara Sea regularly hosts more than 20,000 waterbirds during winter. In January 2008 the total was 31,182 and 21,723 in January 2009. Key species present include Great Cormorant *Phalacrocorax carbo*, Yellow-legged Gull *Larus michahellis*, Great White Egret *Ardea alba*, Little Stint *Calidris minuta* and many others.

Map 19 Golfe of Boughrara Ramsar site (from Ramsar website)



Criterion 6 deals with wetlands that regularly support 1% of the individuals in a population of one species or subspecies of waterbird. Species exceeding the 1% biogeographic threshold include: Greater Flamingo *Phoenicopterus roseus* (3000 to 5000); Slender-billed Gull *Larus genei* (200 to 600); Eurasian Spoonbill *Platalea leucorodia* (200 to 600); and Kentish Plover *Charadrius alexandrinus* (1000 to 2000). The Greater Flamingo and Eurasian Spoonbill numbers are close to the 1% global population threshold but don't quite reach it.

Criterion 8 deals with wetlands that are an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. A number of fish species spawn and serves as nurseries for fish species.

2.3.2.3 Other designations

The Bin El Ouedian lagoon was selected as one of the 20 sensitive sites in Tunisia to be managed by the Tunisian Ministry of the Environment.

2.3.3 Other information on biodiversity values in the area

None known

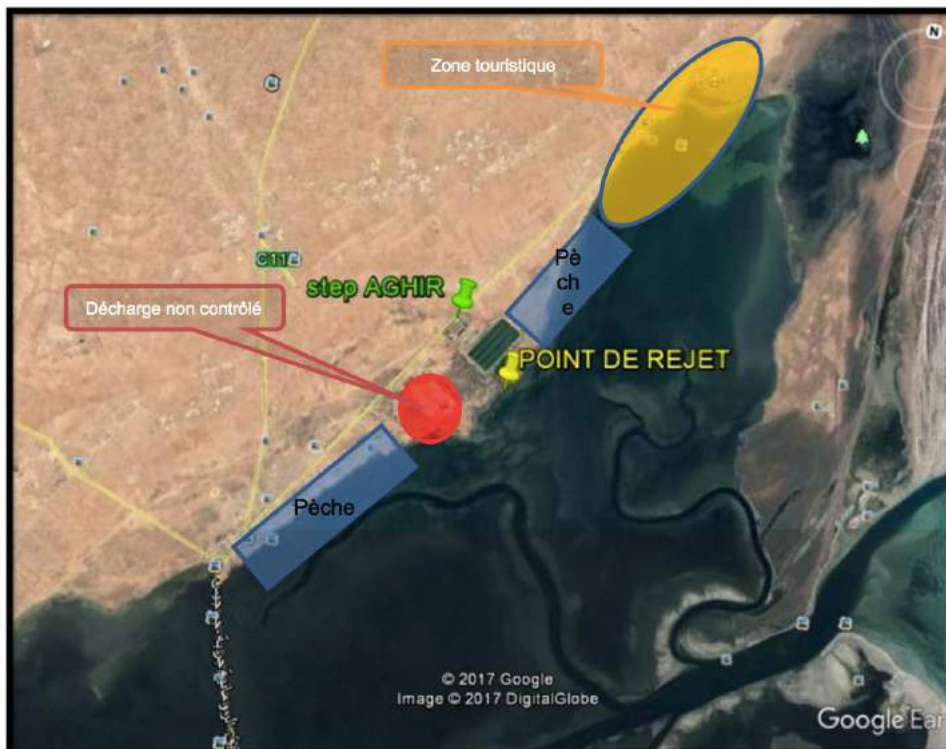
2.3.4 *Critical Habitat*

The only definite criterion for designating CH close to the WWTP is Criterion 3 for Eurasian Spoonbill and this is a marginal case, as mention of exceeding the 1% global population threshold was found only once in published counts. Also, there is the possible consideration of the entire Gulf of Gabès as possible CH.

2.3.5 *Ecosystem services*

The *Etude Environnementale Supplémentaire* identifies several resource uses: artisanal fishing in shallow waters, harvesting of seafood for local restaurants, aquaculture and tourism.

Map 20 Djerba Aghir resource use (*Etude Environnementale Supplémentaire*)



2.3.6 *Receiving environment*

The receiving environment is described in Section 2.2.8 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

The *Etude Environnementale Supplémentaire* considers the area around the outfall as of potential concern given the lack of water movement and other sources of pollution leading to eutrophication.

2.3.7 Current effluent quality

There is supposedly no industrial waste input.

Current values for the effluent are shown below:

Table 3 Djerba Aghir current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	15,6	23,6	26,5
	DCO mg/l	73	84	84,5
	MES mg/l	17	20,5	25,5

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent meeting the current standard for BOD5, COD and TSS.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There are small (less than twice the current standard) to significant exceedances for fecal coliforms and fecal streptococcus. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for lead, nickel and chrome, so some caution is warranted. We conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metal exceedances but that the enclosed lagoon area and possible discharge to the Gulf of Gabès mean more evaluation is needed.

2.3.8 Use of effluent for irrigation

Approximately 15% of the effluent goes to irrigate 51 ha of tree and fodder crops.

2.3.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.3.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès, depending on the definition of the Gulf. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.3.11 *Specific additions to terms of reference for the ESIA for this WWTP*

The conclusion in the *Etude Environnementale Supplémentaire* suggests concern on the part of the authors:

“Pour la STEP de Djerba Aghir, étant donné la sensibilité du milieu souffrant déjà de phénomènes d'eutrophisation résultant d'un cumul de facteurs naturels et anthropiques, le rejet d'EUT avec des valeurs seuils supérieurs aux normes de rejets dans le DPM amplifiera les problèmes environnementaux du milieu récepteur notamment pour les teneurs en azote global. Les menaces du site et des espèces qui le caractérisent semblent être plus accentuées. Selon les analyses des trois dernières années, plusieurs paramètres rejetés dépassent les seuils fixés par la nouvelle Norme^[1]_{SEP}.”

Afin de minimiser l'impact de la STEP sur l'environnement du milieu récepteur, il convient de traiter jusqu'à 30 mg/l d'azote tout en réutilisant le maximum des volumes d'EUT dans l'agriculture et ce en développant d'avantage le périmètre irrigué à proximité de la STEP (actuellement de 50 ha) et en négociant des tarifs de reprise acceptables par les agriculteurs.”

The effluent data suggests that the WWTP actually has a somewhat better total nitrogen effluent record than many other sites, however given the enclosed nature of the discharge area, requiring that the site meets the total nitrogen standard is obviously required.

The authors of the *Etude Environnementale Supplémentaire* suggest some approaches to reduce eutrophication in the enclosed lagoon environment. We think that the proposed reduction of pollutants contributing to eutrophication in the lagoon by an increase in irrigation water reuse must be carefully re-assessed in the WWTP specific ESIA to ensure that such an approach can yield the results anticipated.

The *Etude Environnementale Supplémentaire* (page 56) indicates that additional biodiversity work will be required in the site-specific ESIA.

The site is also of concern in terms of its impact on the Gulf of Gabès and the CIA will inform the adequacy of the Tunisian standards in dealing with this site.

2.4 Djerba Ajim

2.4.1 *General description of the site*

The Djerba Ajim is a small WWTP (1,950 m³/d hydraulic capacity) built in 2016 and located on the western side of Djerba Island. The island is the largest island of North Africa, located in the Gulf of Gabès. It is on Tentative List of UNESCO World Heritage Sites (for largely cultural reasons). Tourism, fishery, agriculture, are the main activities. Tourism development has had negative impacts on the coastal wetlands and their associated services.

The area within 1 km of the WWTP is partly Modified Habitat (largely residential and agricultural), partly Natural Habitat but includes some of the adjacent shoreline and therefore has at least 10% as Critical Habitat. The outfall is near the shore and therefore is roughly 50% Modified Habitat/Natural Habitat and roughly 50% Critical Habitat within 1km.

The site empties directly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

2.4.2 *Protected areas or designated sites of international importance*

The WWTP is not itself in a KBA, IBA or Ramsar site. The habitat next to the WWTP looks like a sebkha (i.e. a smooth flat saline plain in sometimes occupied after rain by a shallow lake) so it is likely to be a mix of Natural Habitat and Modified Habitat.

The outfall is located in the Bordj Kastil IBA and KBA in shallow water. The site can on occasion host over 1% of the global population of Eurasian spoonbill *Platalea leucorodia*. Other bird species present in large numbers, but not meeting the 1% global threshold are *Larus michahellis*, *Sterna caspia* and numerous waders. *Larus michahellis*, *Sterna hirundo* and *S. albifrons* breed at the site. The vegetation of the site is a mixture of sand-loving species such as *Ammophila arenaria*, *Eryngium maritimum* and *Euphorbia paralias* and halophytes including *Arthrocnemum*, *Salicornia* and *Atriplex* species.

The discharge site is just outside the Djerba Guellala Ramsar site and the Boughrara IBA site. The flora and fauna are characteristic of arid zones and include among others the pink flamingo *Phoenicopterus roseus* and the Eurasian spoonbill *Platalea leucorodia*, which use the site during their migrations between Africa and Europe.

Map 21 Djerba Ajim regional setting



Map 22 Djerba Ajim WWTP and outfall



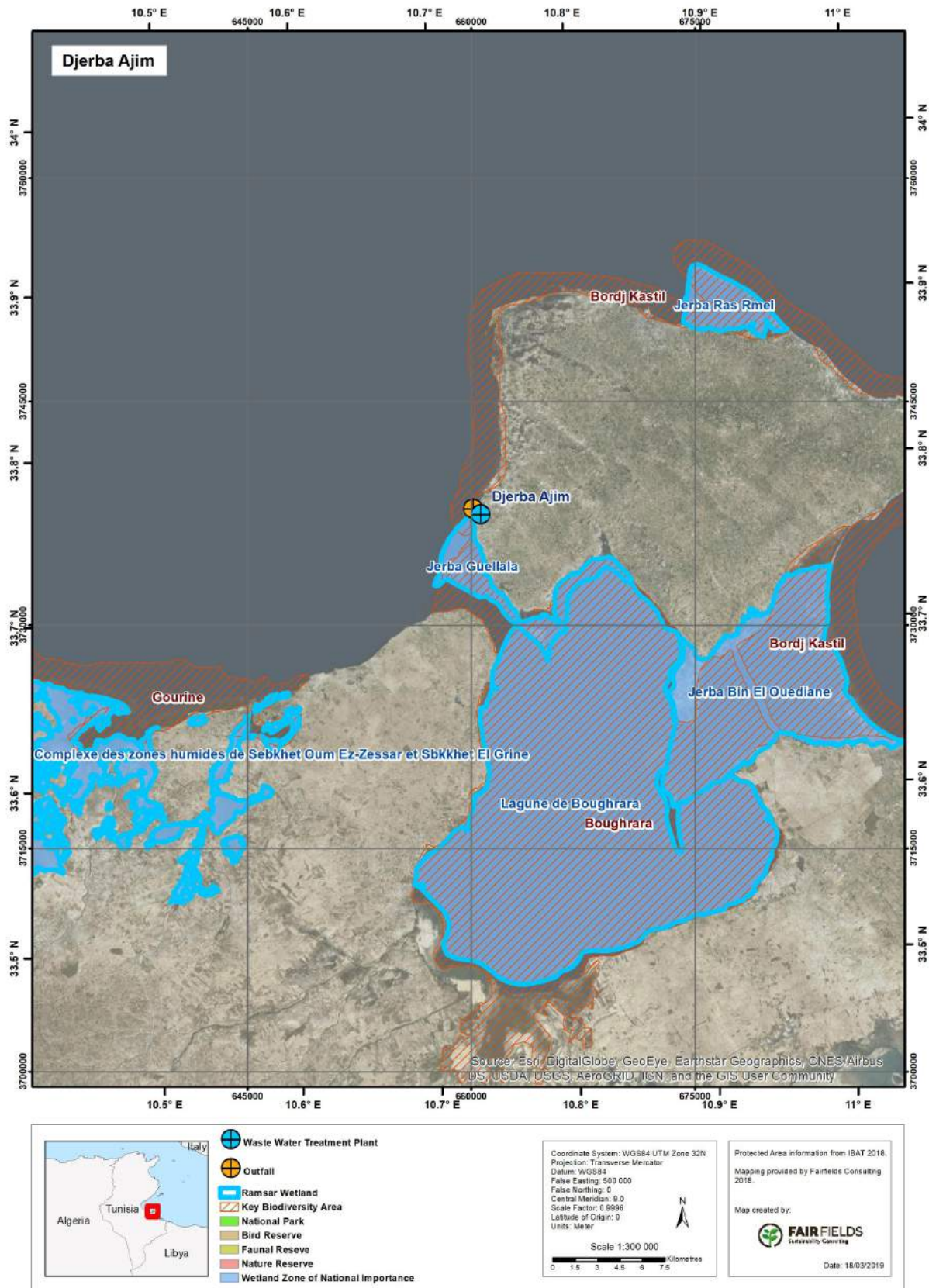
Map 23 Djerba Ajim WWTP



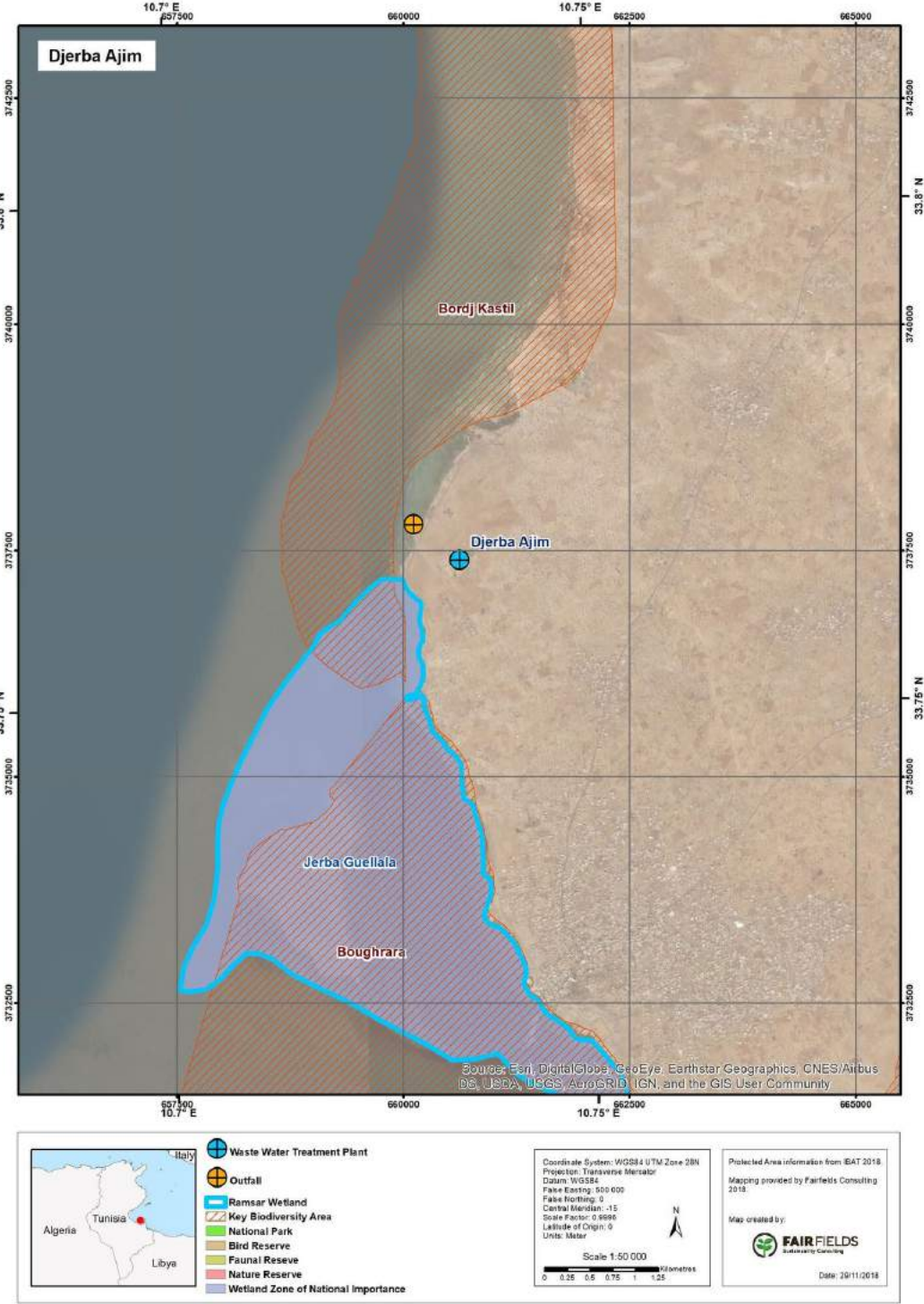
Map 24 Djerba Ajim outfall



Map 25 Djerba Ajim protected areas or designated sites of international importance



Map 26 Djerba Ajim protected areas or designated sites of international importance (detailed view)

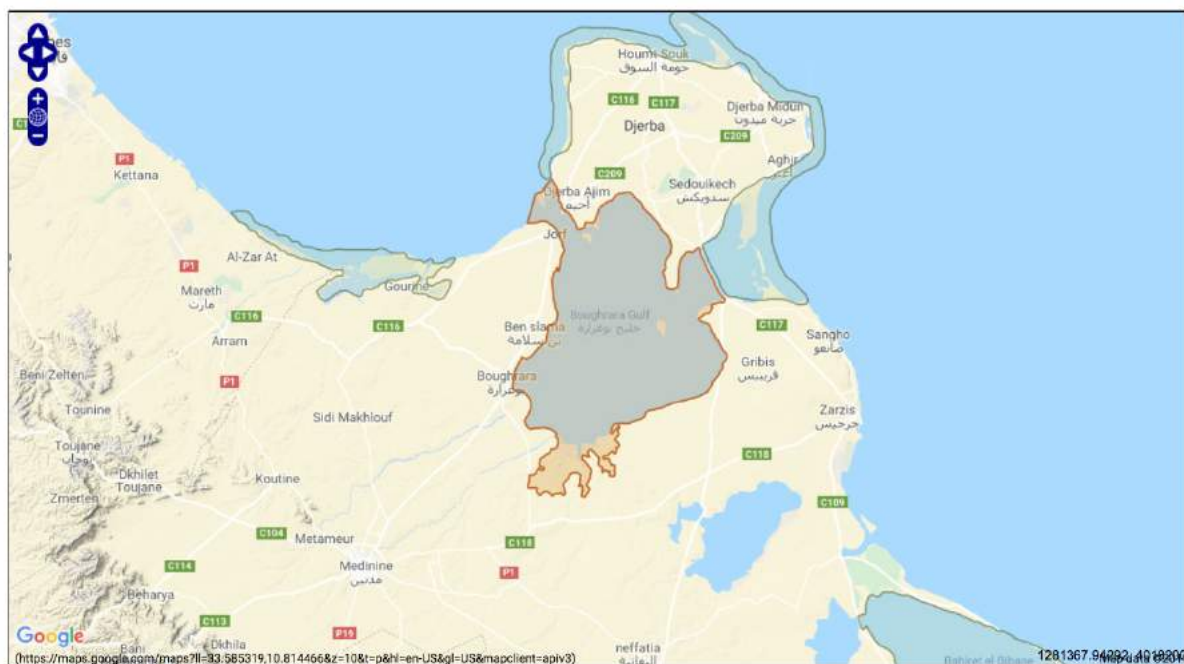


2.4.2.1 IBA sites

The Bordj Kastil IBA site is described in Section 2.3.2.1.

The Boughrara IBA site, designated in 2001, is south of the WWTP (Map 27).

Map 27 Boughrara IBA site (from the IBA website)



The IBA triggers for the site are A4i ad A4iii.

Table 4 Boughrara IBA site triggers

IBA Criteria

Year of most recent IBA criteria assessment: 2001

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	3,000-5,000 Individuals	A4i
Eurasian Spoonbill <i>Platalea leucorodia</i> (http://datazone.birdlife.org/species/factsheet/22697555)	LC	winter	-	200-600 individuals	A4i
Great White Egret <i>Ardea alba</i> (http://datazone.birdlife.org/species/factsheet/22697043)	LC	winter	-	100-300 individuals	A4i
Great Cormorant <i>Phalacrocorax carbo</i> (http://datazone.birdlife.org/species/factsheet/22696792)	LC	winter	-	2,500-5,000 Individuals	A4i
<i>Charadrius alexandrinus</i> (http://datazone.birdlife.org/species/factsheet/22693818)	NR	winter	-	1,000-2,000 individuals	A4i
Little Stint <i>Calidris minuta</i> (http://datazone.birdlife.org/species/factsheet/22693379)	LC	winter	-	1,500-4,500 individuals	A4i
<i>Larus cachinnans</i> (http://datazone.birdlife.org/species/factsheet/22694365)	NR	winter	-	1,000-5,000 Individuals	A4i
Slender-billed Gull <i>Larus genei</i> (http://datazone.birdlife.org/species/factsheet/22694428)	LC	winter	-	4,000 individuals	A4i
A4ii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	winter	-	20,000 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which is in place at that time.

(Note: *Larus cachinnans* should now be *Larus michahellis*)

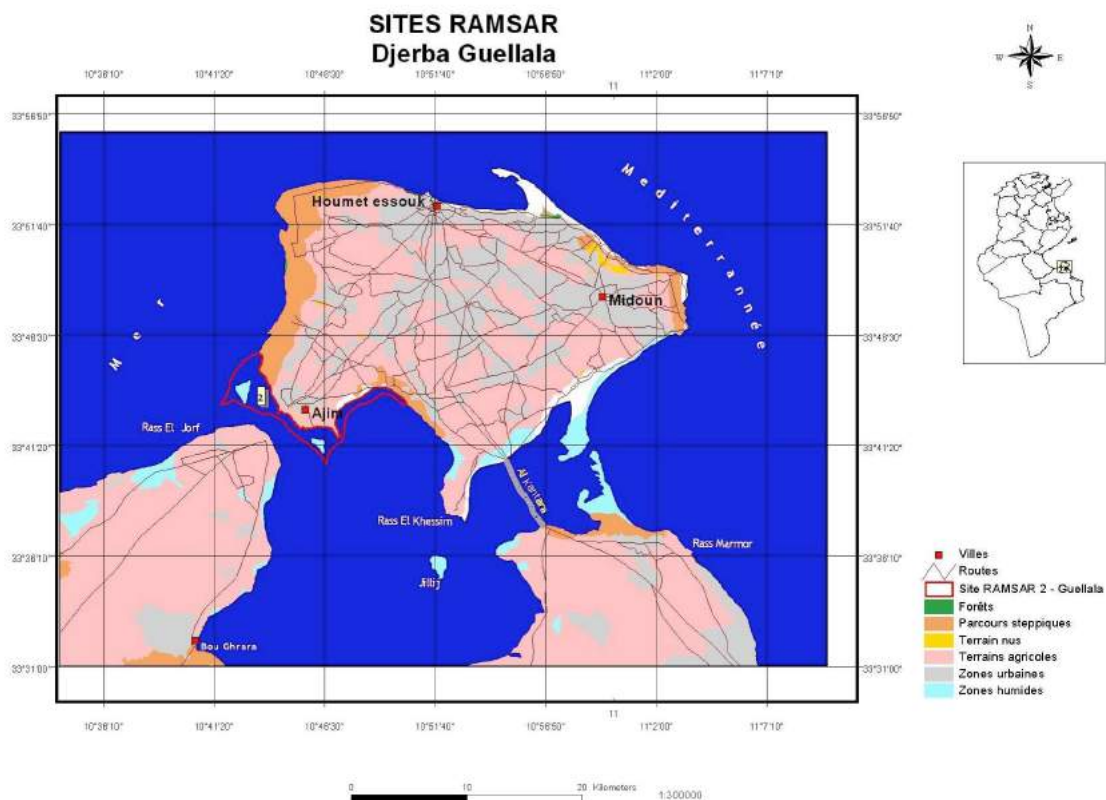
The 2009 monitoring analysis gave the following results: Greater Flamingo 5232; Eurasian Spoonbill 432; Great Cormorant 532; Kentish Plover 116; Little Stint 1300; Sander-billed Gull 3118; overall waterbirds 21,723.

The only species that appears to be meeting the IFC Criterion 3 threshold is the Slender-billed Gull.

2.4.2.2 Ramsar sites

The outfall is near the Djerba Guellala Ramsar site (Map 28). The outline of the site on the IBAT map (Map 26) is similar to the Ramsar map.

Map 28 Djerba Guellala Ramsar site (from Ramsar website)



The Djerba Guellala Ramsar designation (2007) was based on meeting criteria 1, 3, and 4 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 1 deals with wetlands that contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region. The site met the criterion because of the tidal amplitude in the wetlands, a rare phenomena in the Mediterranean.

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. As for Criterion 1, the site

met this criterion because of the tidal amplitude that allows the development of a variety of habitats otherwise uncommon in the area. The flora of the small islands includes some relict forest species.

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The mud flats are an important feeding ground for a variety of birds in the winter and during migration. Two of the small islands are nesting sites for some waders and terns.

2.4.2.3 Other designations

None known.

2.4.3 Other information on biodiversity values in the area

None known.

2.4.4 Critical Habitat

The coastal area can be considered CH based on the over 1% of global population for Eurasian Spoonbill and Slender-billed Gull,

The site empties directly into the Gulf of Gabès. Thus the possible consideration of the entire Gulf of Gabès as possible CH is pertinent.

2.4.5 Ecosystem services

Djerba Island as a whole is an important tourism area and the local fisheries help support the tourist restaurant businesses. There is a known shore-based fishing area near the discharge point and shellfish are collected locally. (Map 29)

Map 29 Djerba Ajim WWTP resource use (from *Etude Environnementale Supplémentaire*)



2.4.6 *Receiving environment*

The receiving environment is described in Section 2.2.7 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.4.7 *Current effluent quality*

The site currently receives none of its waste from industrial sites.

There are no current data on effluent quality because the WWTP has just recently been built.

2.4.8 *Use of effluent for irrigation*

None

2.4.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.4.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover).

We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.4.11 *Specific additions to terms of reference for the ESIA for this WWTP*

The lack of effluent data must be remedied during the site-specific ESIA. Special concern will have to be directed towards the fishing and bathing that occur nearby.

The site is of concern in terms of its impact on the Gulf of Gabès and it is assumed that a CIA will be carried out that will inform the site-specific ESIA.

2.5 El Hamma

2.5.1 *General description of the site*

The WWTP and outfall is located inland from the Gulf of Gabès (30 km) and on the southern edge of the Chott Djerid (aka Chott El Djerid or El Jerid) and Sebkha Chott Fjej complex. The Chott Djerid is the largest endorheic basin in North Africa and covers approximately 5,000 km².

The complex is largely groundwater fed and is dry for much of the year with salt crusts precipitating out. In winter when there has been a lot of rain, the area may be largely flooded. Overexploitation of the Complex Terminal Aquifer between 1970 and 2000 has contributed to the loss of the artesian conditions and decline in groundwater. Seasonal surface water flows and return flow from irrigation contributes to the formation of a perched local aquifer. Dilution of this discharge for most of the year is probably very small. According to the *Etude Environnementale Supplémentaire* the majority of the discharge will evaporate or infiltrate into the perched aquifer, but this remains to be proved.

The WWTP was built in 2004 and has a hydraulic capacity of 4,060 m³/d.

2.5.2 *Protected areas or designated sites of international importance*

The WWTP is not in a KBA or Ramsar site, although it is just over 1 km from a KBA based on the IBA Chott Djerid site. The habitat next to the WWTP a mix of Natural Habitat and Modified Habitat (50% Natural and 50% Modified within a 1 km radius). It is located on the edge of a small community and much of the area is in agricultural use.

The outfall is located on the edge of the Chott Djerid Key Biodiversity Area (KBA) and Chott Djerid IBA site and the Chott El Jerid Ramsar site is present further west. It is surrounded by 100% Natural Habitat.

The relationship of the Chott Djerid IBA/KBA site to the WWTP and outfall is shown on the following maps.

Map 30 El Hamma regional map



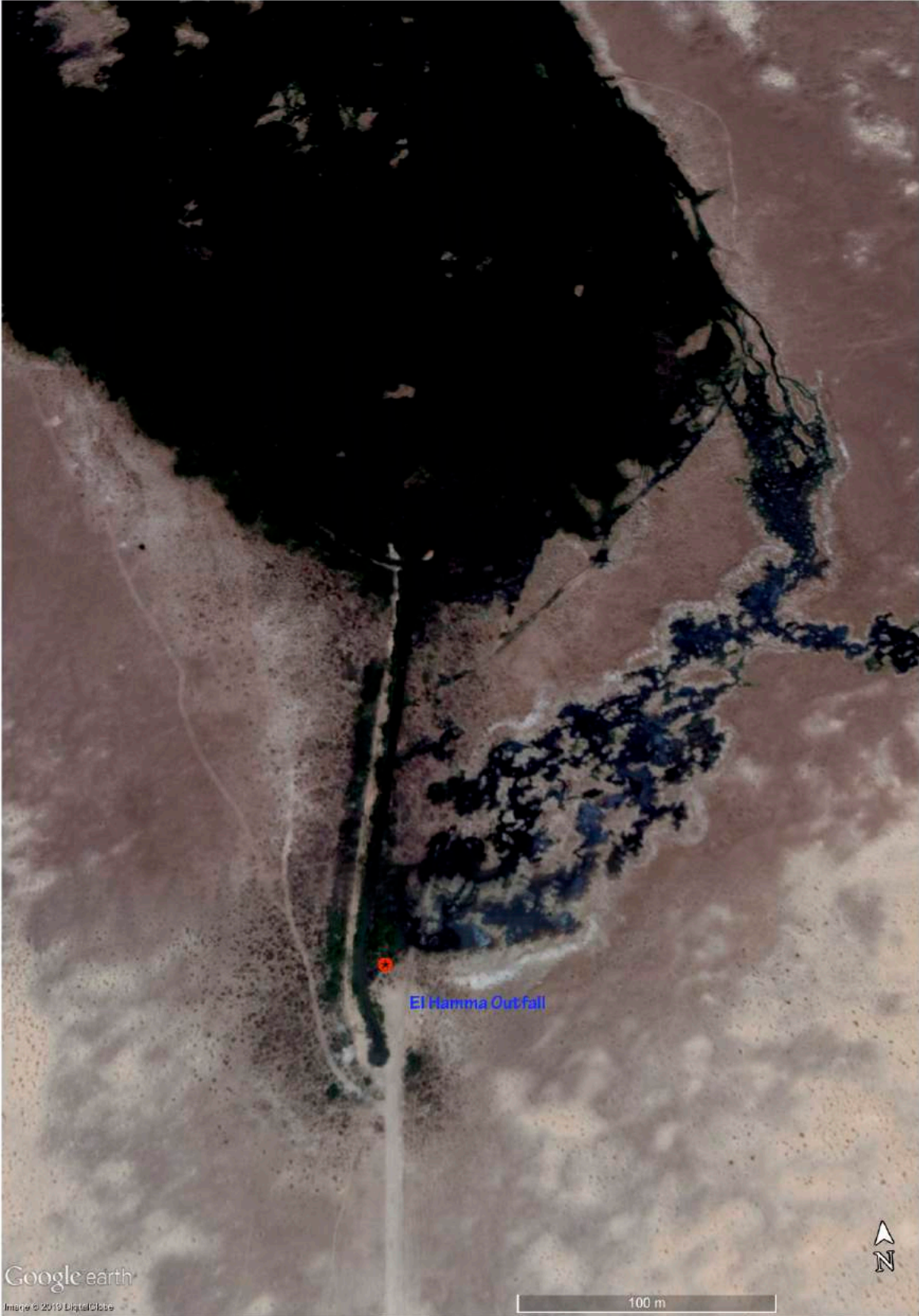
Map 31 El Hamma area around the WWTP and outfall



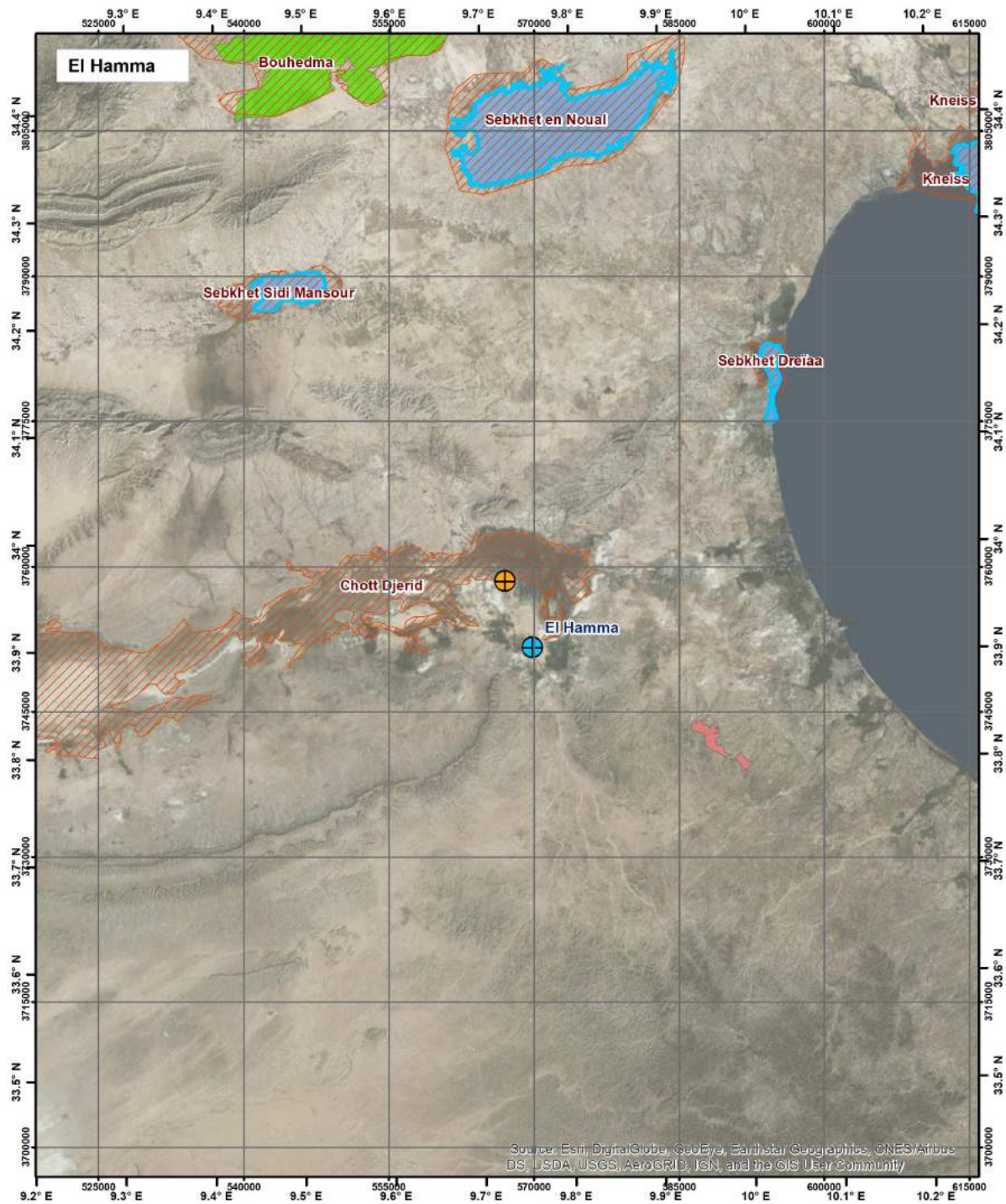
Map 32 El Hamma WWTP



Map 33 El Hamma outfall

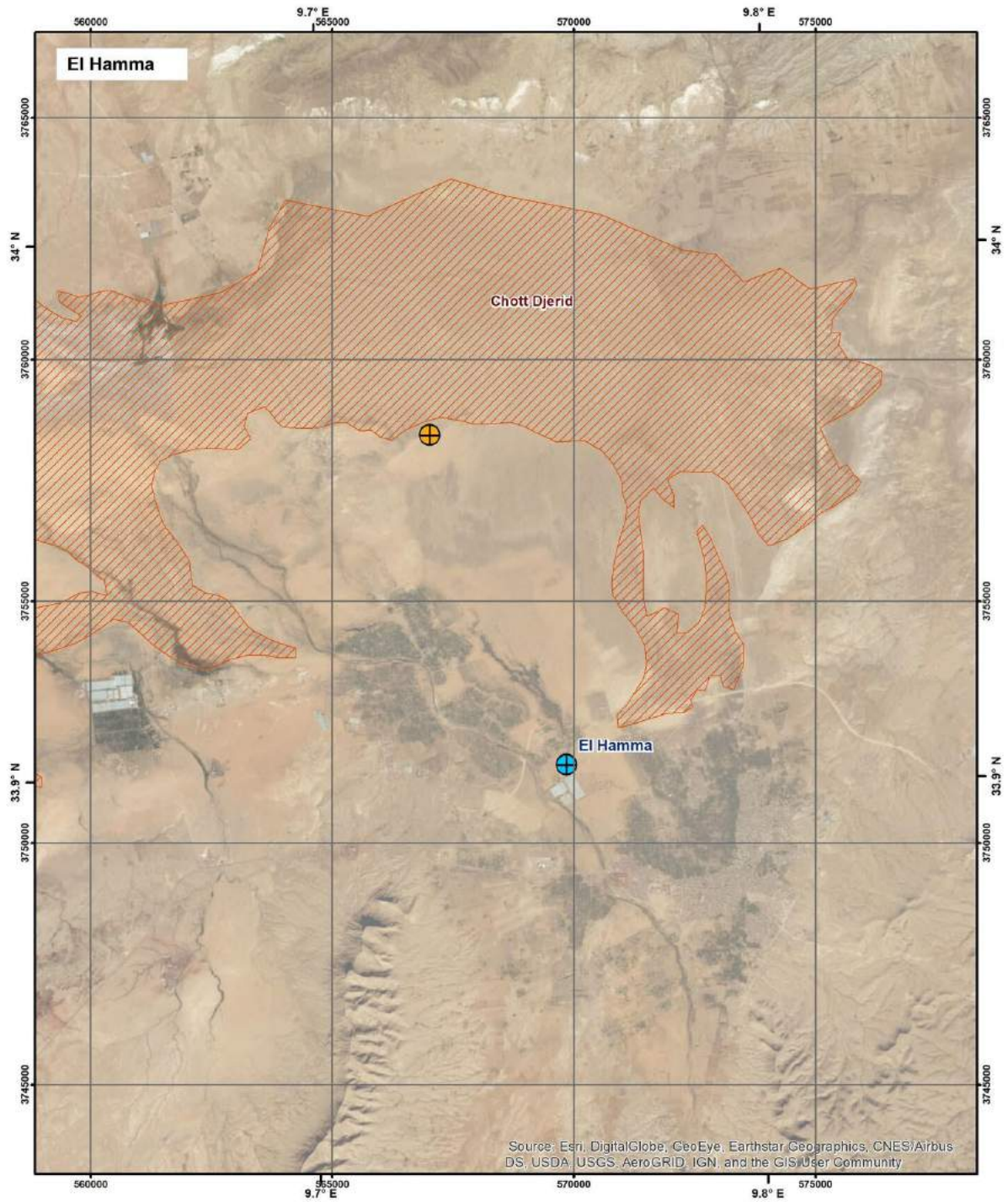


Map 34 General relationship of the Chott Djerid IBA site and the WTPP and outfall



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:500 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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Map 35 Detailed view of the Chott Djerid IBA/KBA site and the WTP and outfall



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Key Biodiversity Area 	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9990 Latitude of Origin: 0 Units: Meter</p> <p style="text-align: center;">N ↑</p> <p style="text-align: center;">Scale 1:100 000</p> <p style="text-align: center;">0 0.5 1 1.5 2 2.5 Kilometres</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p> FAIR FIELDS Sustainability Consulting</p> <p style="text-align: right;">Date: 20/11/2018</p>
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2.5.2.1 IBA sites

The IBA site was designated in 2001 based on meeting the following IBA criteria: A1, A3, A4i, and A4iii (2010) (Table 5). See Section 3.4 for a full explanation of the criteria.

Criterion A1 deals with globally threatened species and the Marbled Teal *Marmaronetta angustirostris* (VU) is the one species noted. This would not trigger IFC PS6 Criterion 1.

Criterion A3 deals with biome restricted species and there are a number present. These would not trigger IFC PS6 Criterion 2.

Criterion A4i deals with congregatory species whose numbers on-site exceed one of the 1% definitions. In this case the two species involved are Marbled Teal *Marmaronetta angustirostris* and Greater Flamingo *Phoenicopterus roseus*. With numbers observed up to 2010 of 332 to 4,000 and 3,000 to 15,000 individuals these levels can clearly at times exceed the global 1% levels.

Criterion A4iii deals with the total number of congregatory birds present and the 20,000 individuals' threshold is met. These would not trigger IFC PS6 Criterion 3.

Additional comments from the 2010 IBA report:

“Chott Djerid ... gives its name to the whole region. In very wet winters it resembles an inland sea, though water depth never exceeds 1 m; in most years it is a huge area of wet salt, unvegetated because of the high salinity. Also included in the IBA is the ste surrounding the Chott.”

“Most of the inhospitable salt-wastes of the Djerid are unattractive to birds, and wintering waterbirds only occur during very wet winters. Djerid is probably the only regular breeding site in Tunisia for *Phoenicopterus ruber*, but the breeding areas are so inaccessible that they have not recently been visited. The shores of Chott Djerid are important areas for many species of the steppe–desert ecotone.”

Table 5 Chott Djerid IBA criteria met

Year of most recent IBA criteria assessment: 2010

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Marbled Teal <i>Marmaronetta angustirostris</i> (http://datazone.birdlife.org/species/factsheet/22680339)	VJ	non-breeding	1991-2009	332-4,000 individuals	A1, A4
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	3,000-15,000 individuals	A4i
Spotted Sandgrouse <i>Pterocles senegallus</i> (http://datazone.birdlife.org/species/factsheet/22692994)	LC	resident	1999	present	A3
Greater Hoopoe-lark <i>Alaemon alaudipes</i> (http://datazone.birdlife.org/species/factsheet/22717262)	LC	resident	1999	present	A3
Desert Lark <i>Ammomanes deserti</i> (http://datazone.birdlife.org/species/factsheet/22717254)	LC	resident	1999	present	A3
Dupont's Lark <i>Chersophilus duponti</i> (http://datazone.birdlife.org/species/factsheet/22717380)	NT	resident	1999	present	A3
Temminck's Lark <i>Eremophila bilopha</i> (http://datazone.birdlife.org/species/factsheet/22717438)	LC	resident	1999	present	A3
Streaked Scrub-warbler <i>Scotocerca inquieta</i> (http://datazone.birdlife.org/species/factsheet/22713547)	LC	resident	1999	present	A3
<i>Sylvia cantillans</i> (http://datazone.birdlife.org/species/factsheet/22716967)	NR	passage	1999	present	A3
Sardinian Warbler <i>Sylvia melanocephala</i> (http://datazone.birdlife.org/species/factsheet/22716959)	LC	passage	1999	present	A3
Tristram's Warbler <i>Sylvia deserticola</i> (http://datazone.birdlife.org/species/factsheet/22716980)	LC	winter	1999	present	A3
Spotless Starling <i>Sturnus unicolor</i> (http://datazone.birdlife.org/species/factsheet/22710893)	LC	resident	1999	present	A3
Black-eared Wheatear <i>Oenanthe hispanica</i> (http://datazone.birdlife.org/species/factsheet/22710302)	LC	breeding	1999	present	A3
Buff-rumped Wheatear <i>Oenanthe moesta</i> (http://datazone.birdlife.org/species/factsheet/22710299)	LC	resident	1999	present	A3
Black Wheatear <i>Oenanthe leucura</i> (http://datazone.birdlife.org/species/factsheet/22710259)	LC	resident	1999	present	A3
A4iii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	unknown	-	20,000 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered then at the time of assessment, the current IUCN Red List category may vary from that which is in place at that time.

Map 36 Chott Djerid IBA site (from IBA website)



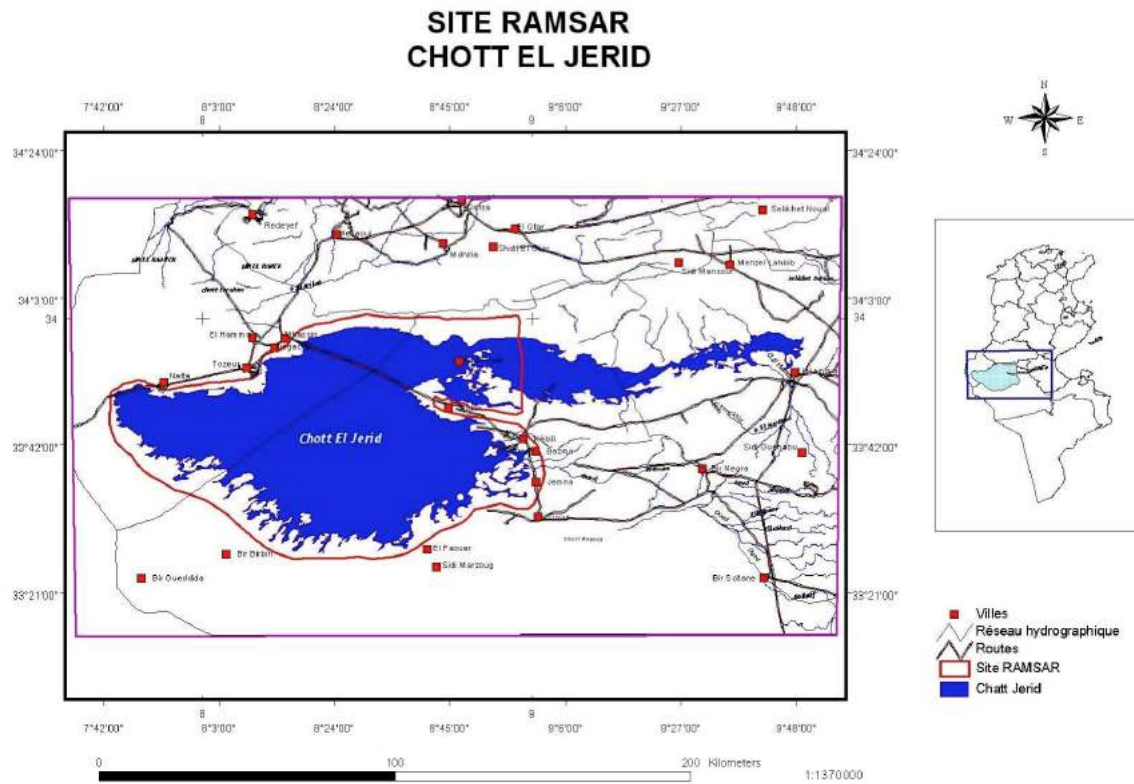
2.5.2.2 Ramsar site

There is also a Chott El Jerid Ramsar site evaluated in 2007. Unlike the IBA site the Ramsar site does not include the Sebkhha Chott Fjej complex and hence is at some distance (80km) from the WWTP. However the data for the site is still useful in understanding the overall complex. The IBAT (Map 37) and Ramsar website (Map 38) maps of the Ramsar site are not the same.

Map 37 IBAT map of Chott El Jerid Ramsar site



Map 38 Map of Chott El Jerid Ramsar site as per Ramsar website (2019)



The Ramsar designation was based on meeting criteria 1, 3, and 4 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 1 deals with representative wetlands and the Chott Djerid is seen as a good representation of the large salt depressions that line the edge of the steppe and desert areas in North Africa. It is by far the largest of these depressions and is important in terms of maintaining the groundwater that feeds the oases fringing the chott.

Criterion 3 deals with supporting populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site has 9 of the 16 bird species typical of the Mediterranean-North African biome and 4 of the 13 bird species typical of the Sindo-Saharan biome.

Criterion 4 deals with supporting plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site is important for a large number of waterbirds during nesting and migration. Key species include the Greater Flamingo *Phoenicopterus roseus*, shelducks *Tadorna* spp, the Black-winged Stilt *Himantopus himantopus* and the Slender-billed Gull *Larus genei*.

Additional comments from the Ramsar 2007 report:

“Le Chott El Jerid est une vaste dépression salée, située entre la chaîne de montagnes du Cherb au nord et le désert au sud, et reliée à l’est au Chott Fejaj ; c’est la plus vaste du chapelet de dépressions entre la steppe et le désert, caractéristique du nord saharien. La région du Jerid (c’est-à-dire « la région du palmier ») comprend toute la zone de Tozeur au nord du Chott. La zone humide elle-même est difficile d’accès, traversée par une seule route qui s’étend sur à peu près quatre-vingts kilomètres entre Tozeur au nord-ouest et la région de Kebili (appelée « Nefzaoua ») au sud-est. Il est fort dangereux de s’écarter de cette route pendant la traversée du Chott car la surface est peu stable, et l’histoire raconte de nombreux incidents au cours desquelles des troupeaux de chameaux, des caravanes, si ce n’est des armées entières, sont disparus sous les boues instables. Autrefois, elle abritait un lac de grande étendue. Aujourd’hui elle est rarement en eau, et son principal intérêt est plutôt hydrologique, géologique et géomorphologique, à cause des nappes d’eau fossile souterraines qui nourrissent les oasis autour du site, et également de la possibilité de gisements de valeur économique, notamment de pétrole.

La limite septentrionale du site est marquée par la crête de la chaîne de montagnes qui représente la ligne de partage des eaux ; cette ligne des crêtes constituait autrefois la limite méridionale de l’empire romain. Au pied de cette chaîne et en bordure septentrionale du Chott, se trouve l’oasis de Dghoumes dont le Parc national, compris dans le site Ramsar, abrite une faune et flore steppiques. Au sud du Chott se trouve le Sahara. C’est un paysage lunaire qui a toujours exercé une fascination sur les hommes (exploité d’ailleurs pour le tournage de films comme « La Guerre des Etoiles » et « Le Patient Anglais ») et qui abrite une faune et une flore typique des zones présahariennes.”

Other data from the Ramsar report for the site is presented in Section 3.7.

2.5.2.3 Other designations

The Chott Djerid and Chott Fjej (complex) was put on the WHS Tentative List in 2009. Described as a “Relict landscape”. Its value lies in the combination of a series of oases and endorheic lakes. The site has not yet been designated

2.5.3 Other information on biodiversity values in the area

There are two fish and one crustacean species of concern that are potentially present near the WWTP or outfall.

2.5.3.1 Haplochromis desfontainii

The hypothetical range for the Endangered *Haplochromis desfontainii* includes the WWTP and outfall. The species was first identified from the Chott Djerid area and was only found at five nearby sites.

There is little information available on this species and it may be extinct. The only recent data for this species is summarized in the IUCN data sheet for the species (Schraml, E. 2010. *Haplochromis desfontainii*. The IUCN Red List of Threatened Species 2010: e.T60841A12417481). Other useful data are in van der Zee, J. & Vonk, R. (1991): Fischexpeditionen in den Mahgreb. Die Aqu. u. Terr. Z. (DATZ) 44 (4): 255–257 and Schraml, E. Die Blaulippenmaulbruter *Haplochromis desfontainii*. DCG-Informationen 38 (11): 241–250

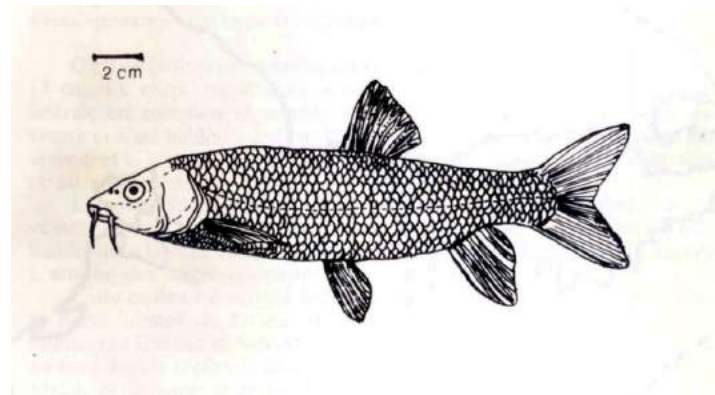
The habitat includes freshwater springs, irrigated lands and canals and ditches. It has been found in waters as warm as 60 degrees C. Habitat disturbance and water use seem to be the cause for the reduction in numbers of this species.

2.5.3.2 *Luciobarbus antinorii*

This is another somewhat mysterious species but if anything it is even more unusual.

It was first described by Boulenger in 1911 as *Barbus antinorii*. It had been found in the artesian waters that the French were then beginning to exploit in North Africa. The original finding was from the Nefzaoua oasis in the Chott Djerid area.

Figure 1 *Barbus antinorii* in Boulenger (1911)



There appears to be a 1935 specimen in the Natural Museum in Paris (85-33-111-102) from Ain Tawara near Fatnassa en Nefzaoua but it is not clear if this is Boulenger's original specimen relabelled or a new one described by Callot. Kraiem (1983) in his work on freshwater fish of Tunisia mentions having looked for this species but not finding it. No other specimen was found until 1989 when Doadrio and Kraiem (see Kraihem 1998) collected 14 specimens from Fatnassa en Nefzaoua, very close to the first sample locality.

Doadrio (1990) recommend the name change from *Barbus antinorii* to *Luciobarbus antinorii*.

Kraihem's (1998) description of the status of this species' habitat is one of the only ones available:

« Au cours de nos nombreuses prospections dans le sud tunisien, cette espèce n'a pu être capturée qu'une seule fois, lors de l'expédition que nous avons organisée en novembre 1989,

avec la collaboration de l'équipe du Dr. DOADRIO du Muséum des Sciences Naturelles de Madrid. En effet, au cours de cette campagne, de nombreuses recherches ont été effectuées dans différents points d'eau de l'oasis de Nefzaoua, sur les bords est du Chott-el-Jérid, où l'espèce a été signalée pour la première fois par BOULENGER (1911) lors qu'il a décrit les échantillons déposés au Muséum de Gênes, puis par CALLOT (in : ALMACA, 1971).

Cette espèce a été alors retrouvée dans un puits situé dans l'oasis de Bechri à Fatnassa (Fig. 4), où la température de l'eau était de 23 °C. Ici, *B. antinorii* existe en sympatrie avec d'autres poissons : *Hemichromis bimaculatus*, *Haplochromis desfontainesi* et *Gambusia affinis*. Cependant, il ne représente qu'une très faible proportion ; en effet, sur de nombreux coups de filet réalisés en plongée pendant deux jours, seulement une dizaine d'individus ont pu être capturés. Depuis, ce poisson n'a pu être retrouvé malgré les nombreuses prospections effectuées jusqu'à l'automne 1997, dans la même région.

Les différentes espèces de poissons récoltées dans ce puits pourraient se trouver normalement dans ces eaux souterraines ; leur apparition dans les eaux superficielles serait due à la force des appels d'eau qui se produisent lors des sondages des puits, quand le forage arrive à la nappe artésienne. Ces sondages qui s'effectuaient depuis longtemps pour l'alimentation en eau des oasis, auraient fortement contribué à l'assèchement des ruisseaux de communication souterrains entre les différentes nappes ; ce qui traduit la rareté de l'espèce et sa menace par l'extinction.

Une attention urgente, de la part des biologistes et des autorités compétentes en matière de protection et de conservation du patrimoine naturel, doit être accordée à cette espèce avant son extinction totale et irréversible. Des pêches répétées de sauvetage de l'espèce pourraient être envisagées et des tentatives d'élevage et de repeuplement seraient à prévoir. »

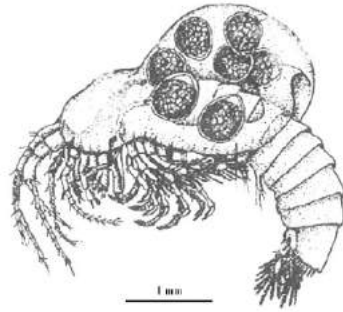
Further searches by Kraihem (1998) till 1997 proved negative. In 2010 and 2011 Joerg Freyhof also searched for this species and did not find any (<http://joerg-freyhof.de/fieldwork>)

The IUCN evaluation is: Crivelli, A.J. 2018. *Luciobarbus antinorii* (amended version of 2006 assessment). The IUCN Red List of Threatened Species 2018: e.T60731A136080951.). This species is officially listed as DD by IUCN, however given the very limited numbers, if it is extant it would doubtlessly be listed as CR. Also given the very limited range it has been found in, it must also be considered a restricted range species.

2.5.3.3 *Thermosbaena mirabilis*

Thermosbaena mirabilis is a small crustacean first described by Mondo in 1924 from the El Hamma hot springs, its only apparent habitat. It is the only species within the family Thermosbaenidae and grouped with three other families in the order Thermosbaenacea.

Figure 2 *Thermosbaena mirabilis* from Barker (1962)



The Thermosbaenacea live in thermal springs in fresh water, brackish water and anchialine habitats. They all have a troglobitic lifestyle, lack visual pigments and are therefore blind. It is assumed that the extant taxa are derived from ancestors that lived in open marine habitats.

Burgis and Symoens (1987) report:

“A special threat hangs over the hot springs of EJ. Hamma, type locality and sole site of *Thermosbaena mirabilis*. Of the three springs that harbor it, el Baama was blocked in 1950 and Ain sidi Abd Khadr was being rebuilt in 1976. The main site, the ancient public baths of Ain el Bordj, were under restoration in 1983. No specimens have been reported in the literature since 1976. In that year, *Thennosbaena* had become rare at Ain el Bordj, a consequence of the periodic disinfection of the springs. Another factor is the use of detergents in the baths, which flocculate with organic debris and block the cracks in the underwater walls that are the habitat of *Thermosbaena*. »

There are few other data on this species: Monod, 1924 (original description); Barker, 1959; Barker, 1962; Zilch, 1972; Por, 2014.

The species has not been assessed by IUCN (as of January 30 2019) but being limited to one set of hot springs and under some threat it would be likely that it would be considered CR and certainly of restricted range.

It is likely that there are other subterranean species of potential biological species that may be present.

2.5.3.4 Data from Burgis and Symoens (1987)

Besides the birds described later, there are few descriptions of the rest of the biota present. Burgis and Symoens (1987) present one of the few syntheses of the biota of the complex:

“Biota of the Chotts

The Chotts are poor in plant and animal life. Of the species one might expect in such an environment, *Dunaliella* has not been cited and even *Artemia* sp. does not appear to be common. Occasionally, brine pools develop a deep purple colour, indicative of purple bacteria. The ciliate *Fabrea salina*, sometimes peaks in great numbers. Aggregates of *Phormidium corium*

(cyanobacteria) were found under salt crusts by Serpette (1947). The saline spring El Kensof (20 m), inside the Chott, is richer in cyanobacteria: *Aphanotbece microscopa*, *Spirulina meneghiniana*, *S. subsahara* occur here. Two water beetles, *Ochtbebius salinator* and *Paracymus maximus* also occur. Similarly, a spring exists inside Chott el Fedjedj (Ain Trarfi, 25 m). With less than 6 g.l⁻¹ of total dissolved salts, it is comparable to the springs that abound around the Chotts, and it has a similar fauna. The Cladoceran *Daphnia magna* occurs here, beside several species of Hydrobiid snails (Seurat 1938).

Biota of the Oueds, Seguias and springs

A most diverse fauna and flora is found in the string of springs and oases that surround the Chott area, in the Region of El Hamma (de Gabes), Kebili, Tozeur-Nefta and in the so-called "mountain" oases north of Chott el Gharsa, in the Djebel en Nagueb. Thermal springs abound around El Hamma, with water temperatures as high as 51°C. Those at El Hamma itself are quite famous and three among them contain the Pancarid crustacean *Thermosbaena mirabilis*. Their outflow is characterised by massive developments of filamentous cyanobacteria and associated diatoms (Monod 1940; Dumont 1978), that may extend for some distance into the seguias of the surrounding oases. As the water cools, filamentous green algae, Characeae and, in the more mineralised springs, *Enteromorpha* develop. *Ruppia* spp., *Zannichellia palustris* and *Scirpus littoralis* are found in the wider sections of nearly stagnant water, and *Typha*-meadows form locally where swampy sections occur. Among the strands of periphytic algae and macrophytes, a microfauna develops, reduced to nematodes and amoebae in the hot springs. In cooler water, numerous gammarid amphipods, cyclopoid and harpacticoid copepods, and chydorid Cladocera appear, together with snails (Hydrobiids, *Melanoides tuberculata*, several species of *Bulinus*), a *Pisidium*-species and shrimps (*Palaemonetes* spp.) on damp shores, terrestrial amphipods (*Orchestia* spp.) and Isopods, the most interesting among which is *Saharolana seurati* (spring of Ras el Ma near Kebili), abound. Wells in the area have yielded phreatic Asselids: *P. coxalis africanus* and *P. bragadicus*. The dominant groundwater animal, however is *Gammarus rhipidiophorus*. Insects are represented by numerous dragonfly species (Dumont 1977), Hemiptera, and Coleoptera. The saline water beetle *Potamonectes cerysi* is particularly widespread (Pesce et al. 1981). Among Ephemeroptera, *Cloeon dipterum* is most common.

No vertebrates venture into the Chotts themselves, but four fish species are native to the fringing oases: the cyprinid *Barbus antinorii*, the Cyprinodont *Aphanius fasciatus* and the cichlids *Heaichromis bimaculatus* and *Haplocbromis desfontainesi* (for which Tozeur is the type locality). *Rana ridibunda perezi* and *Bufo viridis* represent the Anura, while *Mauremys caspica leprosa* has been found in the Oued Gabes and probably occurs in the Chott area as well. Some species of fish have been introduced to the area. »

2.5.4 Critical Habitat

The area that the outfall drains to is presumably within Critical Habitat given that two species of wintering waterbirds at least have met the 1% of the world population threshold. It is argued in the

Etude Environnementale Supplémentaire that this part of the Chott Djerid IBA site no longer meets the IBA criteria if it no longer floods. However, this is an assumption only at this stage and cannot be readily confirmed. Using the precautionary principle it seems warranted to assume that it continues to have Critical Habitat status.

The two fish species considered under Section 2.5.3 have the potential to trigger Critical Habitat designation but their status is very uncertain and it is possible that both are now extinct. They will require field checking in the vicinity of the WTP and outfall.

The crustacean in the hot springs poses a particular problem. It would certainly seem that anything that could contaminate the subterranean waters of El Hamma, besides being of concern for the continued use of the spa, would be of biological concern. How the notion of CH might be applied to underground water is not clearly spelled out in the 2018 Guidance Note for PS6.

2.5.5 *Ecosystem services*

The key activity near El Hamma that relies on ecosystem services, beyond agriculture of course, are the hammams. There are currently some eight hammams relying on the warm underground waters of the area (see <http://www.hydrotherapie.tn/portail-de-lhydrotherapie/hydrotherapie/le-saviez-vous/article/article/el-hamma-de-gabes/> for example).

The only other important use of ecosystem services in the area seems to some tourism activities. Occasionally tourist buses take the one road going through the Chott Djerid and the area is recommended to tourists seeking a different experience (see <http://escapade-tunisie.com/lacs-de-selles-enigmatiques-chotts-du-sud-tunisien/> for example).

The hypersaline conditions in the Chott Djerid are not conducive to fishing or bathing. Some hunting of waterbirds presumably takes place but it is not discussed in the sources found.

2.5.6 *Receiving environment*

The receiving environment is described in Section 2.2.2 of the *Etude Environnementale Supplémentaire*. There are no quantitative data on the receiving waters. The *Etude Environnementale Supplémentaire* report assumes that the effluent released will move down into the upper perched groundwater layer or evaporate rather than move down into the Chott complex. It should be noted that evaporation, while reducing the water volume, will not improve the quality of the remaining effluent, which will tend to become more concentrated.

2.5.7 *Current effluent quality*

The El Hamma WTP receives about 2% of its total waste water from “industrial” sources. For this WTP that means the local spa and hammam, a noted tourist attraction. There are several local hot springs and the area has been known for its waters for a long time.

Current effluent values for the three main criteria do not meet the old or new standard with values typically four times above the standard values.

Table 6 El Hamma current effluent values from the *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-août	Septembre-décembre
EL HAMMA	DBO5 mg/l	91,2	170	54,5
	DCO mg/l	277	407	156,7
	MES mg/l	81,2	110,6	56

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

It is clear that the El Hamma site currently does not come close to meeting the Tunisian standard for BOD5, COD and TSS, with effluent values three to five times over the standard.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. However, there is a significant cyanide exceedance in 2014 (but not 2015 or 2015). There are also significant exceedances for fecal coliforms and fecal streptococcus for all three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for chrome, nickle, cadmium and cobalt so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.5.8 *Use of effluent for irrigation*

Roughly 10% of the effluent is treated and used for irrigation. The irrigated lands cover 50 ha in the Oued Echerka irrigation perimeter. The crops are olive trees, pomegrenates, and fodder.

2.5.9 *Disposal of sludge*

The sludge from the WWTP is shipped to the Gabes landfill site. The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.5.10 *Recommendations regarding the adequacy of standards for this site*

Full implementation of either the old or new standards would likely be adequate. However, this is one of the sites with significant exceedance of both old and new standards. The uncertainty lies with the course of the effluent in the Sebkhia Chott Fjej.

The assertions in the *Etude Environnementale Supplémentaire* report that the effluent will not impact waterbirds is perhaps optimistic and is based solely on the Ramsar site configuration, ignoring the IBA/KBA configuration. We have not seen the data that enables the report to conclude definitely that the Sebkhia Chott Fjej has no birds and that the effluent could improve the bird habitat there:

“- le point de rejet d’El Hamma est très loin de la zone d’hibernation et de nidification des oiseaux et les EUT n’atteignent plus les limites de ces sites. En effet, les facteurs abiotiques de la région (Température, Ensoleillement, Humidité) ainsi que les facteurs géomorphologiques ne laissent plus la possibilité aux EUT d’atteindre les eaux de la zone humide quand ils existent.

Cela nous permet de dire que les EUT de la STEP d’El Hamma ne peuvent plus avoir un impact sur l’avifaune de Chott EL Jerid (Critères 3 et 4).

- la sebkhia de Chott El Fejej est lac sec qui n’abrite pas d’oiseaux et ne constitue pas un milieu favorable pour leur installation. Dans ce contexte, nous pouvons dire alors que le rejet des EUT peut être un facteur favorable pour l’installation des oiseaux dans cette zone suite à son alimentation et recharge par les eaux de la STEP.”

The adequacy of the Tunisian standards will have to be re-assessed in light of the results of field work for this site and the conducting of a complete CHA that includes the complete Chott El Jerid area of interest will be required.

2.5.11 *Specific additions to terms of reference for the ESIA for this WWTP*

The situation in terms of the outfall location is not clear from a biological perspective and the winning bidder will have to undertake the following studies:

- Clarification and documentation of the assumption regarding the drying up of the Sebkhia Chott Fjej.
- Conduct field surveys checking Sebkhia Chott Fjej water levels and bird use. All field surveys must be conducted by competent ornithologists at key times of year;

- Verify the presence or absence of *Haplochromis desfontainii* in canals and ditches near the WWTP and outfall, *Luciobarbus antinorii* in deep wells, and *Thermosbaena mirabilis* in hot springs. Field surveys are to be done by competent specialists;
- Conduct a complete CHA for the Chott El Jerid area of interest as a whole.
- On the basis of the above data gathered and additional data obtained as part of the ESIA reevaluate the adequacy of the standards to be put in place at this facility.

2.6 El Hancha

2.6.1 *General description of the site*

El Hancha is a very small WWTP (700 m³/d hydraulic capacity) inland site built in 2005. There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance.

The WWTP is in an agricultural area with only about 20% Natural Habitat within 1 km. The outfall is within the Sebkhah El Jem north of the WWTP with a majority of Natural Habitat around it..

2.6.2 *Protected areas or designated sites of international importance*

2.6.2.1 *IBA/KBA sites*

None close by.

2.6.2.2 *Ramsar sites*

None close by.

2.6.2.3 *Other designations*

None known

2.6.3 *Other information on biodiversity values in the area*

The *Etude Environnementale Supplémentaire* suggests that the Sebkhah El Jem may be important for the Endangered White-headed Duck *Oxyura leucocephala* and Vulnerable Marbled Teal *Marmaronetta angustirostris*.

The *Etude Environnementale Supplémentaire* report states (no reference included):

“Le milieu de rejet présente un intérêt écologique étant donné qu'il représente un site d'hivernage pour les oiseaux aquatiques qui fréquentent les zones humides. Les espèces les plus abondantes sont : le flamant *Phoenicopterus ruber* et le tadorne de belon *Tadornata dorna [sic]*, la grue cendrée *Grus grus*, le grèbe huppé *Podiceps nigricollis*, le fuligule milouin *Aythya ferina*, et l'érismature à tête blanche *Oxyura leucocephala*. »

The report also gives another list of possible birds, but these are from a Ramsar site some 30 km away.

Map 39 El Hancha regional setting



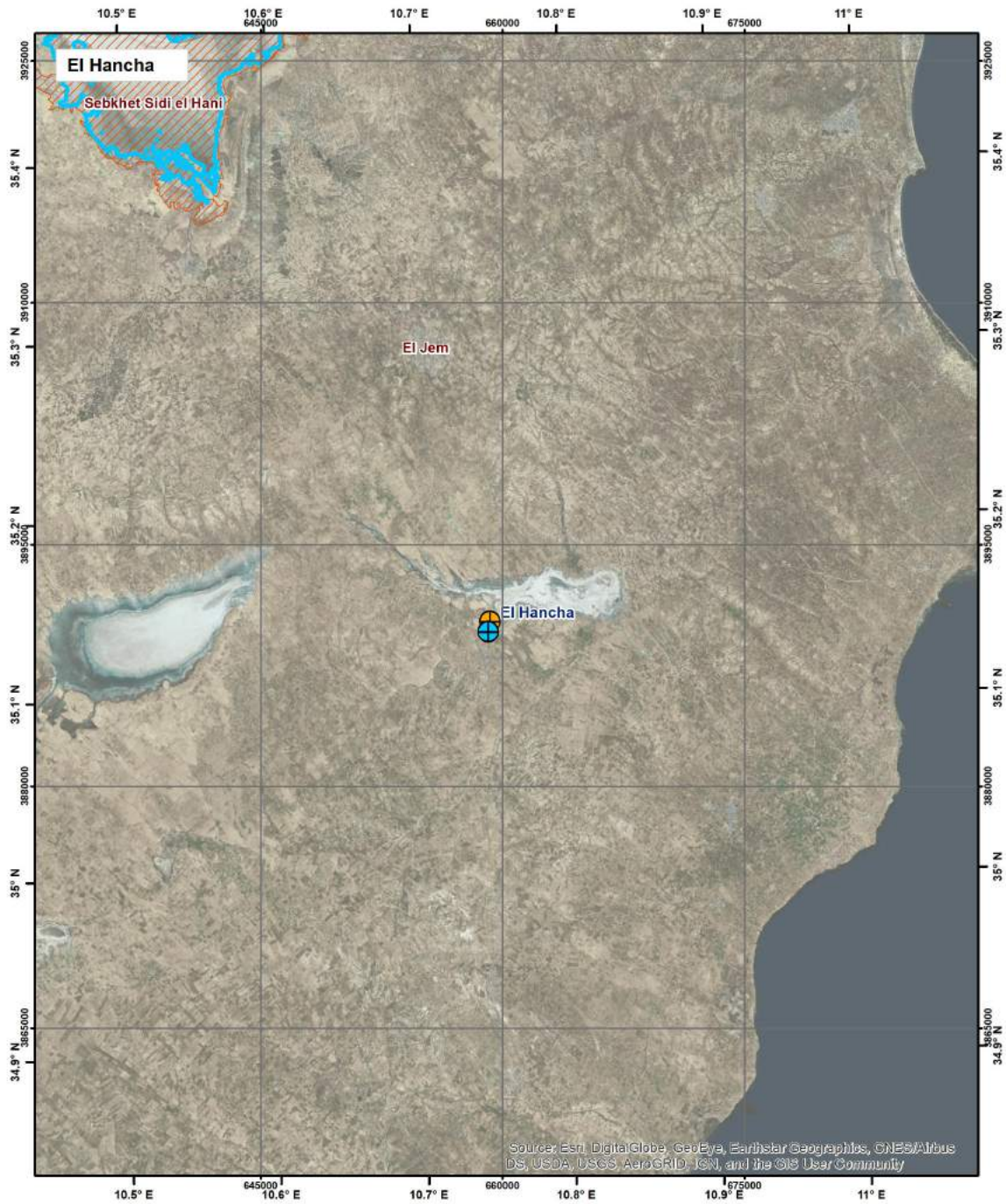
Map 40 El Hancha WWTP and outfall



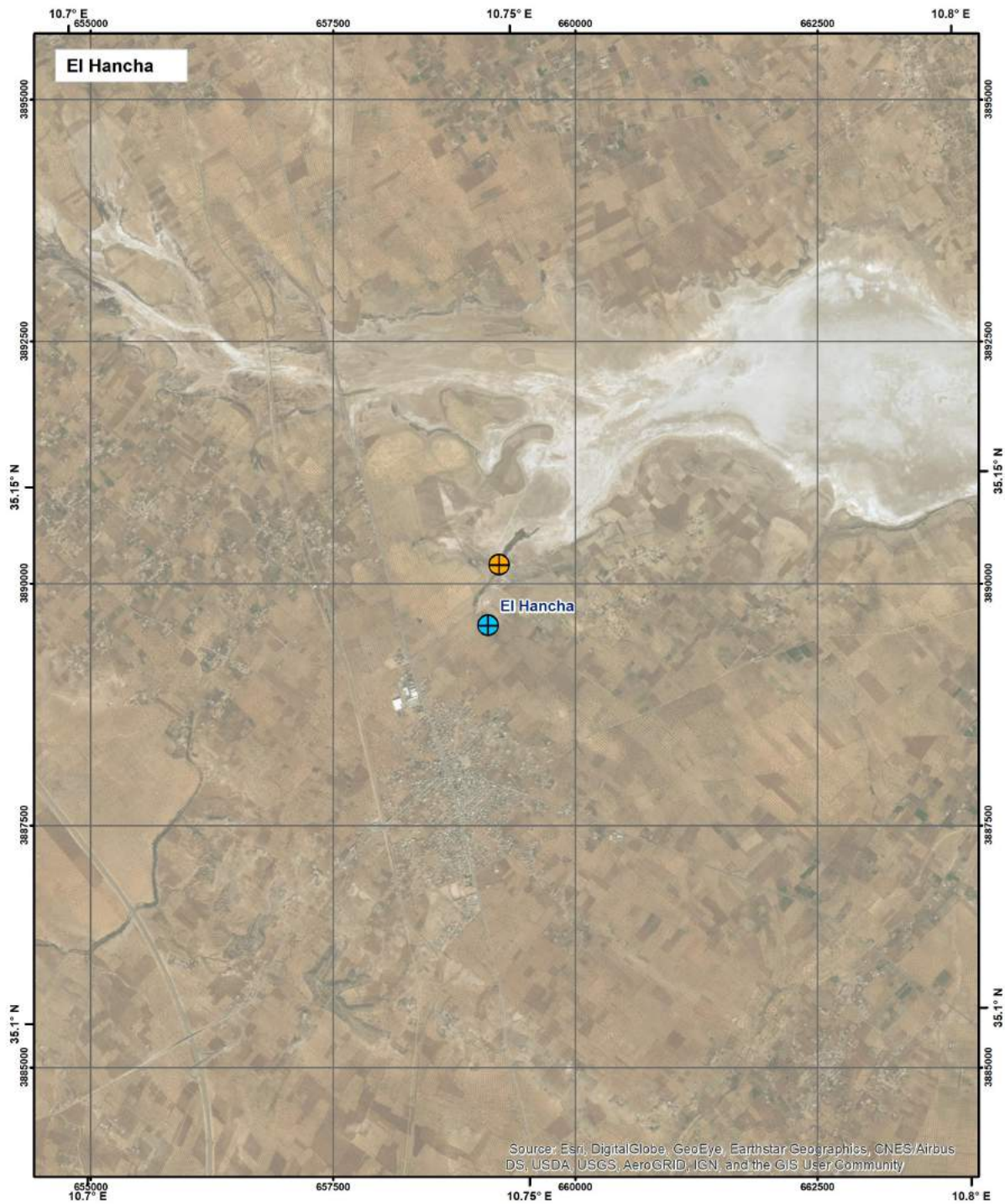
Map 41 El Hancha WWTP and outfall (detailed view)



Map 42 El Hancha protected and internationally designated areas



Map 43 El Hancha protected and internationally designated areas (detailed view)



	<p> Waste Water Treatment Plant Outfall </p>	<p> Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9998 Latitude of Origin: 0 Units: Meter </p> <p> </p> <p> Scale 1:50 000 </p>	<p> Protected Area information from IBAT 2018. Mapping provided by Fairfield's Consulting 2018. </p> <p> Map created by: </p> <p> Date: 18/03/2019 </p>
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2.6.4 *Critical Habitat*

The only possibility of CH nearby seems to be related to bird use of the Sebkhah El Jem. This needs to be checked out during the site specific ESIA for the El Hancha WWTP. However, the chances of the numbers of the White-headed Duck approaching 0.5% of the global population (the threshold for Criterion 1 in the updated PS6 GN) in the Sebkhah El Jem appear very slim. Similarly the likelihood of reaching the 1% of the global population for other species, also appear slight.

2.6.5 *Ecosystem services*

None identified.

2.6.6 *Quality of receiving environment*

The receiving environment is described in Section 2.2.3 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.6.7 *Current effluent quality*

About 5% to 7% of industrial wastes are accepted.

Current values for the effluent are shown below:

Table 7 El Hancha current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-août	Septembre-décembre
HANCHA SFAX	DBO5 mg/l	24,6	18,66	16,75
	DCO mg/l	82,2	62	51,75
	MES mg/l	26,2	17,33	14,75

For comparison with the comparable current and likely future standards :

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent meeting the current standard for BOD5, COD and TSS.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There are significant exceedances for fecal coliforms and fecal streptococcus in 2016 (but not 2014 and 2015). There is also a small exceedance for zinc in 2014. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for lead, copper and cobalt, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.6.8 *Use of effluent for irrigation*

Under 10% used in nearby olive and forage crops (50 ha).

2.6.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.6.10 *Recommendations regarding the adequacy of standards for this site*

The new Tunisian standard appears adequate if all parameters are considered applicable and subject to the work described below.

2.6.11 *Specific additions to terms of reference for the ESIA for this WWTP*

The situation in terms of the outfall location is not clear from a biological perspective and the winning bidder will have to undertake the following studies:

- Clarification and documentation of the use of Sebkhia El Jem by waterbirds, in particular White-headed Duck.
- Re-assessment of the site and the adequacy of the standard if CH is found.

2.7 Gabès

2.7.1 *General description of the site*

Gabès is a medium sized WWTP (17,000 m³/d hydraulic capacity) site built in 1995 that discharges directly into the Gulf of Gabès. There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance.

Within 1 km of the WWTP the habitat is primarily Modified Habitat (actually primarily industrial and residential) but because it is close to the shore about 30% is in Natural Habitat. The outfall is slightly closer to the shore and has a somewhat higher percentage of Natural Habitat (40%).

The *Etude Environnementale Supplémentaire* does not identify any sensitive area close by and states “Les milieux récepteurs des STEP de Sfax Nord, Gabès, Jebeniana, Zarzis ville et Métouia ne représentent pas des zones sensibles. Ainsi, les limites préconisées par la nouvelle Norme pour les rejets en DPM ou en DPH peuvent être appliquées aux rejets de ces STEP sans modification.”

2.7.2 *Protected areas or designated sites of international importance*

There are no protected areas or designated sites of international importance close enough to be of concern.

2.7.2.1 *IBA/KBA sites*

None close by.

2.7.2.2 *Ramsar sites*

None close by.

2.7.2.3 *Other designations*

None.

2.7.3 *Other information on biodiversity values in the area*

The site empties directly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

See Section 2.7.6.

2.7.4 *Critical Habitat*

None currently identifiable, except for the possible consideration of the entire Gulf of Gabès as potential CH.

Map 44 Gabes regional setting



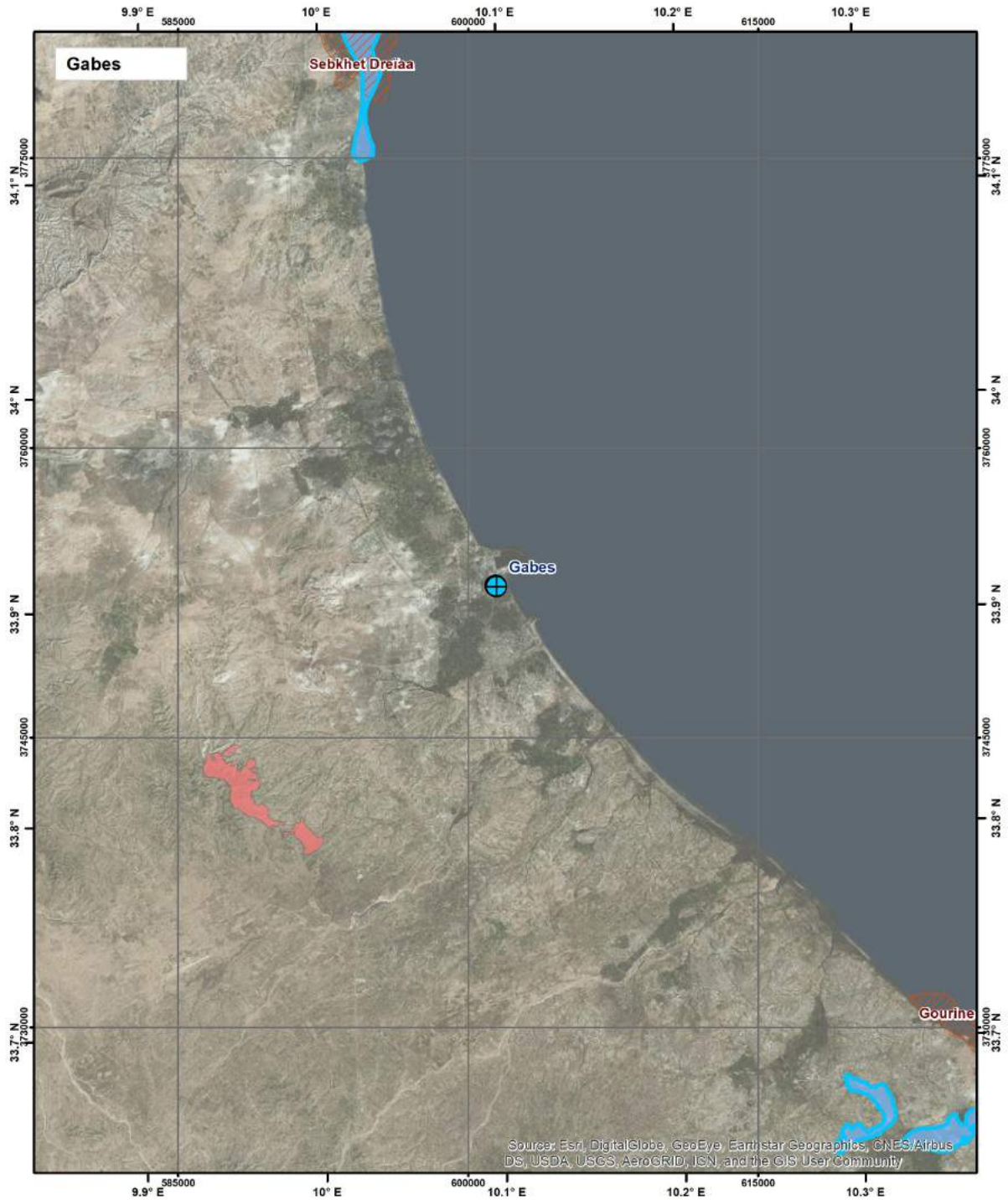
Map 45 Gabes Wastewater Treatment Plant and Outfall



Map 46 Gabes WWTP



Map 47 Gabes protected areas or designated sites of international importance



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p> <p>0 1 2 3 4 5 kilometres</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p> FAIRFIELDS Sustainable Consulting</p> <p>Date: 18/03/2019</p>
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2.7.5 Ecosystem services

Some fishing occurs but no bathing. The main uses in the vicinity of the outfall are industrial and marine transport.

2.7.6 Receiving environment

The receiving environment is described in Section 2.2.3 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

The *Etude Environnementale Supplémentaire* quotes the work by Drira (2009) that puts the area into some perspective in terms of the overall pollution in the Gabes area, leading to the survival primarily of species that can handle the eutrophic conditions.

2.7.7 Current effluent quality

The site accepts 5% of its waste from industrial sources.

Current values for the effluent are shown below:

Table 8 Gabes current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
GABES	DBO5 mg/l	118,8	170	54,4
	DCO mg/l	359,5	407,33	154,25
	MES mg/l	145	210	66,5

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently not producing effluent meeting the current standard for BOD5, COD and TSS, with values three to five times over the standards.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There is only one significant heavy metal exceedance based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There is a significant exceedance in 2014 for cyanide and a small exceedance for mercury in 2015. There is one gap in the data, a total lack of measurements from 2014-16 for nickel, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metal exceedances. There are significant exceedances for fecal coliforms and fecal streptococcus for all three years.

There are also significant impacts to the local water quality from local industries, notably the Groupe Chimique Tunisien (GCT).

2.7.8 *Use of effluent for irrigation*

Approximately 25% of the effluent is used to irrigate 200-300 ha of olive trees, pomegranates and fodder crops in the Eddissa irrigated perimeter. Given the current effluent quality, the use of the effluent for irrigation could have environmental and social impacts, which should be specifically assessed in the site-specific ESIA.

2.7.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.7.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually, without having an overall assessment of impacts of all other WWTPs (and ideally other polluters) discharging in the Gulf of Gabès. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.7.11 *Specific additions to terms of reference for the ESIA for this WWTP*

Given the current effluent quality, the use of the effluent for irrigation could have environmental and social impacts, which should be specifically assessed in the site-specific ESIA. Also subject to the Gulf of Gabès CIA.

2.8 Jebeniana

2.8.1 *General description of the site*

Jebeniana is a very small WWTP (1312 m³/d hydraulic capacity) inland site built in 2007.

The WWTP is in an agricultural area with 100% Modified Habitat Natural Habitat within 1 km. The outfall is within the Gulf of Gabès southwest of the WWTP (50% Modified Habitat, 50% Natural Habitat).

2.8.2 *Protected areas or designated sites of international importance*

There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance.

2.8.2.1 IBA/KBA sites

None nearby

2.8.2.2 Ramsar sites

None nearby

2.8.2.3 Other designations

None known

2.8.3 *Other information on biodiversity values in the area*

None

Map 48 Jebeniana regional setting



Map 49 Jebeniana WWTP setting



Map 50 Jebeniana WWTP



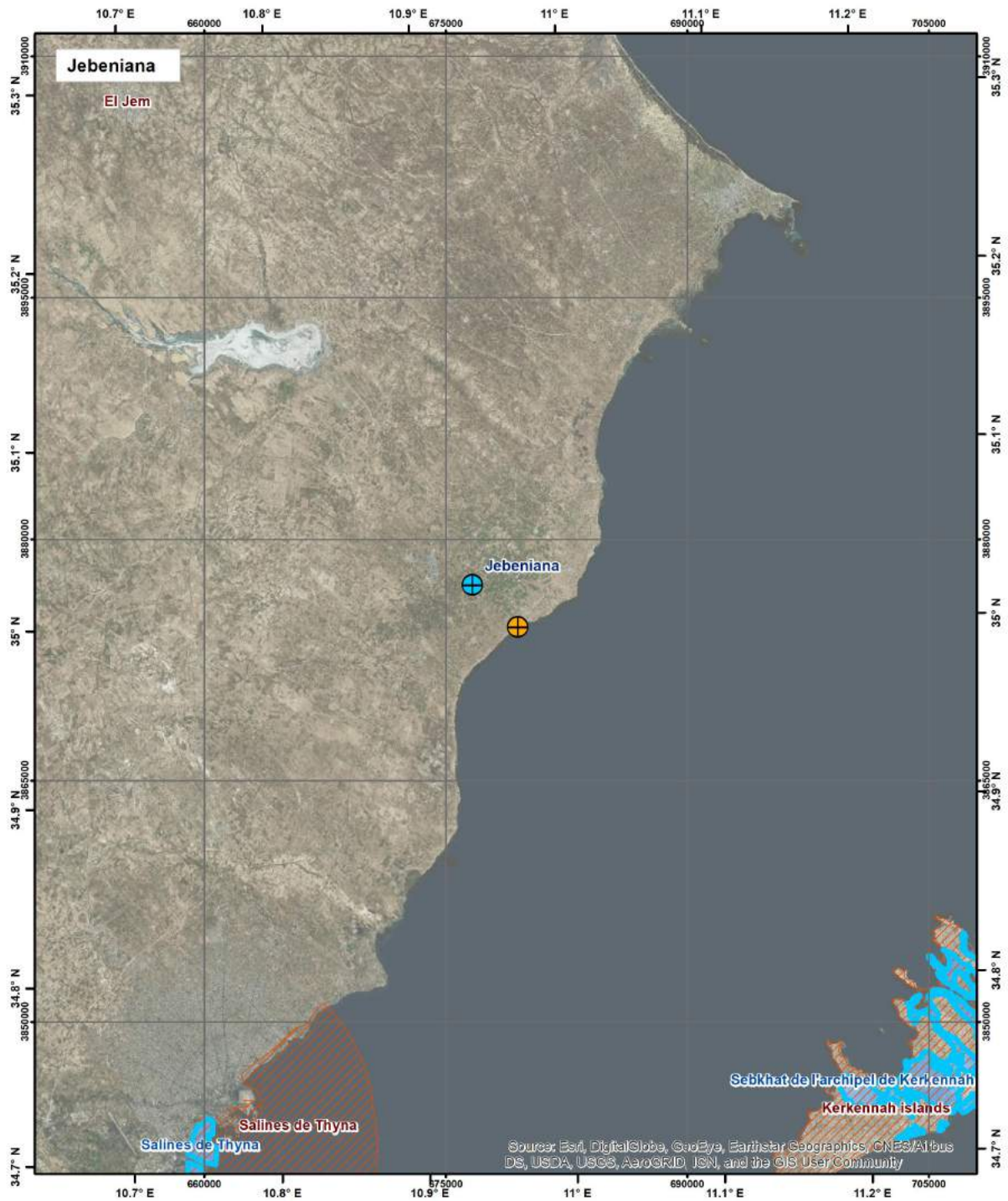
Map 51 Jebeniana outfall setting



Map 52 Jebeniana outfall



Map 53 Jebeniana protected areas or designated sites of international importance



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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2.8.4 *Critical Habitat*

None currently identifiable, except for the possible consideration of the entire Gulf of Gabès as possible CH.

2.8.5 *Ecosystem services*

The discharge is in an industrial and commercial area. No resource uses identified. There is a fishing harbor nearby.

2.8.6 *Receiving environment*

The receiving environment is described in Section 2.2.11 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.8.7 *Current effluent quality*

The site currently receives 6% of its waste from industrial sites.

Current values for the effluent are shown below:

Table 9 *Jebeniana current effluent quality from Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	25	26	20
	DCO mg/l	85,4	84	63,5
	MES mg/l	25,4	26,33	36,75

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent close to the current standard for BOD5, COD and TSS. The wrong name in the above table is presumably simply a labeling error in the *Etude Environnementale Supplémentaire*.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There is a small mercury exceedance in 2015 for mercury. There are variable exceedances for fecal coliforms and fecal streptococcus in all three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for cobalt, copper, lead nickel and zinc, so caution is warranted, however, we conclude based on the evidence available that the WWTP is probably not a major problem in terms of heavy metals.

2.8.8 *Use of effluent for irrigation*

Approximately 10% of the effluent is used for irrigating around 50 ha of olive trees and fodder crops.

2.8.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.8.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.8.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage, except for the Gulf of Gabès CIA.

2.9 Kerkennah

2.9.1 *General description of the site*

The Kerkennah WWTP is on Kerkennah Island. The islands form an archipelago, 20 km east of the town of Sfax, in the tidal Gulf of Gabès. Kerkennah is a small WWTP (2700 m³/d hydraulic capacity) WWTP built in 2007.

The WWTP itself is in an arid area with poor vegetation cover. The outfall is into shallow marine waters. An 800-metre-long pipe was put in place to minimize pollution. However, the discharge is into shallow near shore water.

The WWTP is in Natural Habitat. There appears to be some habitat on the east within 1 km that might qualify as Critical Habitat as it could be used by the Eurasian Spoonbill. The outfall is out 800 m in the Gulf of Gabès and surrounded by 100% Natural Habitat.

2.9.2 *Protected areas or designated sites of international importance*

The entire island complex is considered an IBA and there is a Ramsar site about 5 km to the east. The islands do occasionally have Eurasian Spoonbill populations that meet the 1% global threshold.

Most of the islands are surrounded by at least 5km of shallows with significant seagrass beds, *Cymodocea nodosa* and *Posidonia oceanica* (exact locations unknown but mainly on the northeast). There appears to be a possible Marine Protected Area close to the discharge point.

Map 54 Kerkennah Islands



Map 55 Kerkennah WWTP and outfall



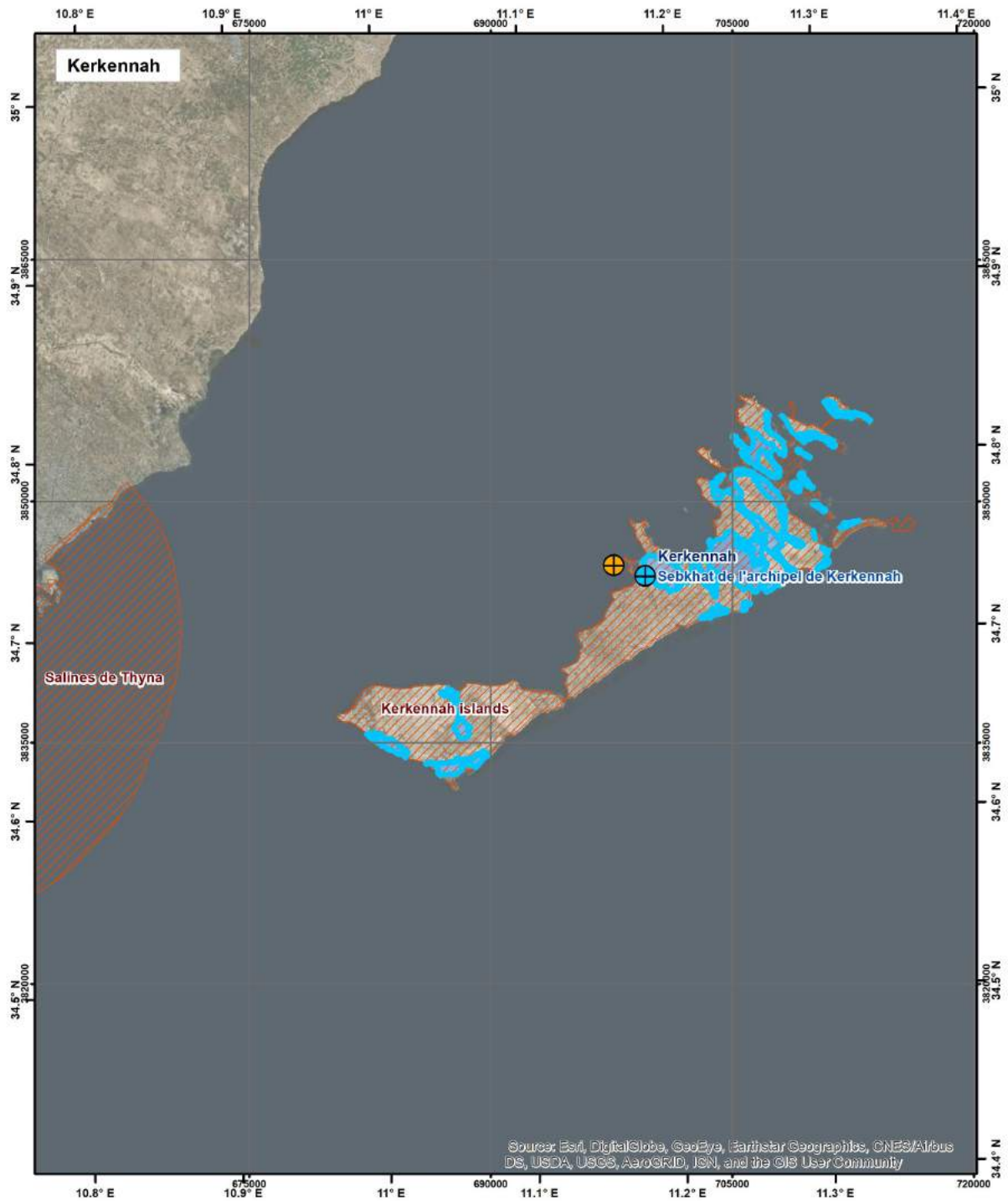
Map 56 Kerkennah WWTP



Map 57 Kerkennah outfall

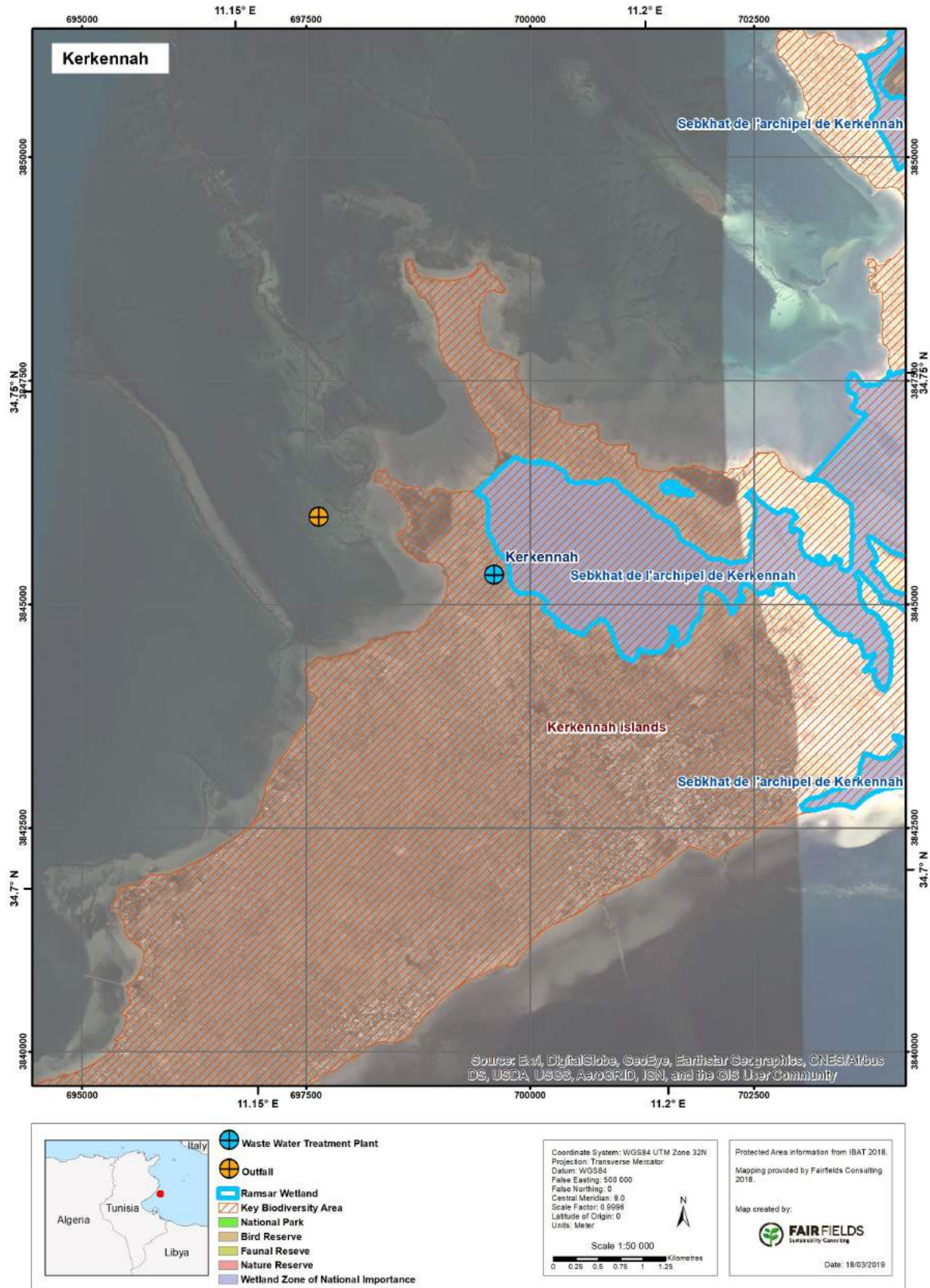


Map 58 Kerkennah protected areas or designated sites of international importance



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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Map 59 Kerkennah protected areas or designated sites of international importance (detailed view)



2.9.2.1 IBA site

The whole of the Kerkennah archipelago is an IBA (Map 60) as it is important wintering area for *Phalacrocorax carbo* and gulls and terns, including *Larus genei*, *Larus fuscus*, *Larus michahellis*, *Sterna caspia* and *Sterna sandvicensis*. Species that breed on the islands include *Falco tinnunculus*, *Cursorius cursor*, *Merops apiaster* and *Lanius excubitor*. In addition, the islands are an important stop-over site each spring and autumn for hundreds of thousands of migrant passerines.

The Kerkennah Islands IBA site was designated in 2001 based on meeting the following IBA criteria: A3 and A4i (2001). See Section 3.4 for a full explanation of the criteria.

Criterion A3 deals with supporting populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site has 6 of the 16 bird species typical of the Mediterranean-North African biome. This would not trigger IFC PS 6 CH.

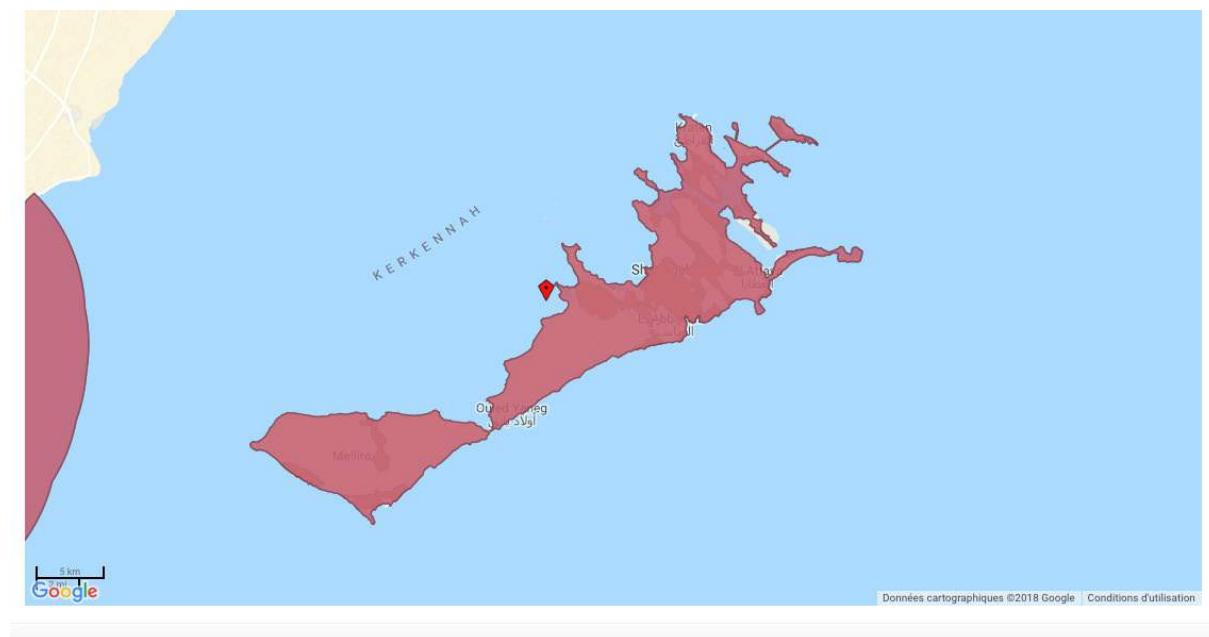
Criterion A4i deals with congregatory species whose numbers on-site exceed one of the 1% definitions. In this case the three species involved are Greater Flamingo *Phoenicopterus roseus* (400-1,500), Great Cormorant *Phalacrocorax carbo* (1,000-10,000) and Eurasian Spoonbill *Platalea leucorodia* (400-800). Of these, only the Eurasian Spoonbill sometimes reaches the 1% of the global population and would trigger PS 6 Criterion 3. Monitoring in 2009 did not identify any numbers that would meet the IFC threshold.

Table 10 Kerkennah IBA criteria met

Populations of IBA trigger species						
Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered	
Barbary Partridge <i>Alectoris barbara</i>	LC	resident	1999	present	A3	
Greater Flamingo <i>Phoenicopterus roseus</i>	LC	winter	-	400-1,500 individuals	A4i	
Eurasian Spoonbill <i>Platalea leucorodia</i>	LC	winter	-	400-800 individuals	A4i	
Great Cormorant <i>Phalacrocorax carbo</i>	LC	winter	-	1,000-10,000 individuals	A4i	
Sardinian Warbler <i>Sylvia melanocephala</i>	LC	resident	1999	present	A3	
Spectacled Warbler <i>Sylvia conspicillata</i>	LC	resident	1999	present	A3	
Spotless Starling <i>Sturnus unicolor</i>	LC	resident	1999	present	A3	
Moussier's Redstart <i>Phoenicurus moussieri</i>	LC	resident	1999	present	A3	
Black-eared Wheatear <i>Oenanthe hispanica</i>	LC	breeding	1999	present	A3	

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which was in place at that time.

Map 60 Kerkennah Islands IBA/KBA



2.9.2.2 Ramsar site

Sebkhât de l'archipel de Kerkennah is a Ramsar site according to Ramsar Criteria 1, 3, 4, and 6 (See Section 3.5 for definitions of the Ramsar criteria). The site was designated in 2010.

Criterion 1 deals with representative wetlands and the Kerkennah archipelago is considered unique in its biogeographic region because nearly 1/3 of the surface area consists of sebkhâs. These sebkhâs attract many aquatic birds during migration and in winter such as Eurasian Spoonbill *Platalea leucorodia*, Grey Heron *Ardea cinerea*, Yellow-legged Gull *Larus michahellis*, waders and terns.

Criterion 3 deals with supporting populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site has remarkable *Posidonia* beds as a result of the complex shape of the islands and the large tidal amplitude.

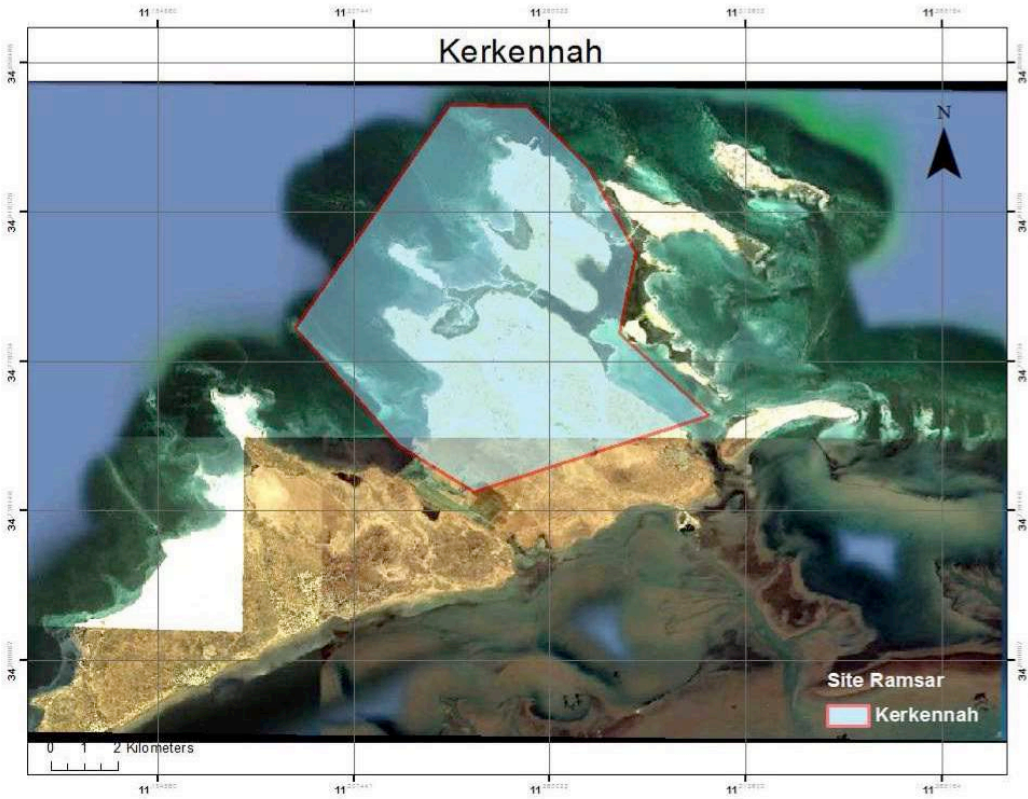
Criterion 4 deals with supporting plant and/or animal species at a critical stage in their life cycles, or providing refuge during adverse conditions. The site is important for the *Posidonia* beds that are crucial for young fish. The islands are also an important site for migrating and wintering aquatic birds.

Criterion 6 deals with regularly supporting 1% or more of the individuals in a population of one species or subspecies of waterbird. Numbers cited are 176 for Eurasian Spoonbill (January 2009) and 1981 Slender-billed Gull *Larus genei* (January 2009). Note that although these species numbers cited undoubtedly meet the biogeographic population threshold, neither meet the 1% global threshold used by IFC in PS6 .

The maps on the Ramsar site (Map 61) do not match those from IBAT (Map 62). Neither maps show overlaps between the Ramsar site and the WWTP or outfall locations.

Other data on the Ramsar site are included in Section 3.8 that is an excerpt from the Ramsar site listing.

Map 61 Kerkennah Ramsar site (as per Ramsar map)



Map 62 Kerkennah Ramsar site (as per IBAT data)



2.9.2.3 Other designations

None identified

2.9.3 Other information on biodiversity values in the area

2.9.3.1 Seagrass beds

The seagrass beds of the Kerkennah archipelago are considered exceptional :

« Le paysage marin de Kerkennah marqué par la présence d'un immense herbier de Posidonies affleurant à la surface des eaux lors des marées basses, est à juste titre, considéré comme l'un des plus remarquables de toute la Méditerranée. Les études faites sur la flore benthique ont permis de mettre en évidence l'importance écologique des hauts-fonds entourant l'archipel. Des observations de la configuration de la végétation marine a permis de mettre en évidence :

- l'aspect " tigré " de l'herbier de Posidonie ainsi que sa très large extension, notamment dans la partie nord est de l'archipel. [SEP]
- l'importance de la pelouse de Cymodocées avec une surface couverte de plus de 1000 km². [SEP]
- le fait qu'il n'y a pas, en dehors des grands cordons de posidonie, de peuplements strictement uni spécifiques et, qu'en réalité, on a, en de nombreux points, une mosaïque d'espèces végétales dont la répartition est mouvante au fil des années mettant en évidence la biodiversité de la zone en question. » [SEP] (Ramsar, 2010)

2.9.3.2 Marine animals

A number of threatened sea turtles are present in the area including the Green Turtle *Chelonia mydas* (EN) and Leatherback (VU). The Loggerhead Turtle (VU) is known to nest on the islands as well. The noble pen shell *Pinna nobilis* (protected under EU Directive) is present and the Fin Whale (EN) has been spotted offshore.

These species, and likely others, contribute to the importance of the waters around the Kerkennah Islands. Individually they would not trigger CH because of their status and/or the large ranges.

2.9.3.3 *Dipodillus zakariai*

The Kerkennah island gerbil (*Gerbillus zakarai* or *Dipodillus zakariai*) has been previously identified as a species of gerbil restricted to the Kerkennah Islands. It was discovered by Cockrum in 1976 (Cockrum et al 1976) and described as a new species in view of morphological differences. As such it would undoubtedly be considered a CH trigger under PS Criterion 2. However, its recognition as a separate species is not uniformly agreed upon.

In the IUCN species status reports it is listed as part of the *Gerbillus simoni* species, a species of LC status found from Morocco to Egypt (Granjon, L. 2016. *Gerbillus simoni* [errata version published in 2017]. The IUCN Red List of Threatened Species 2016: e.T9149A115518404.). As stated in Kingdon et al (2013):

“The status of *zakariai* is uncertain: considered as a synonym of *G. simoni* by Musser & Carleton (1993), but elevated to a species (*Dipodillus zakariai*) by Musser & Carleton (2005); *zakariai* is an insular taxon recorded only from the Kerkennah Is. (opposite the coastal city of Sfax, Tunisia) and related to *G. simoni* on the mainland. »

The combination of the two species into one is supported by Chetoui et al (2005, 2007) and Bouarakia et al (2018).

In the light of the recent DNA analyses it would appear that the Kerkennah gerbil is indeed part of the *Gerbillus simoni* complex and hence would not trigger Criterion 2. It could possibly be labeled a separate subspecies, such as *Gerbillus simoni zakariai* (as used on the IBA site listing).

2.9.4 *Critical Habitat*

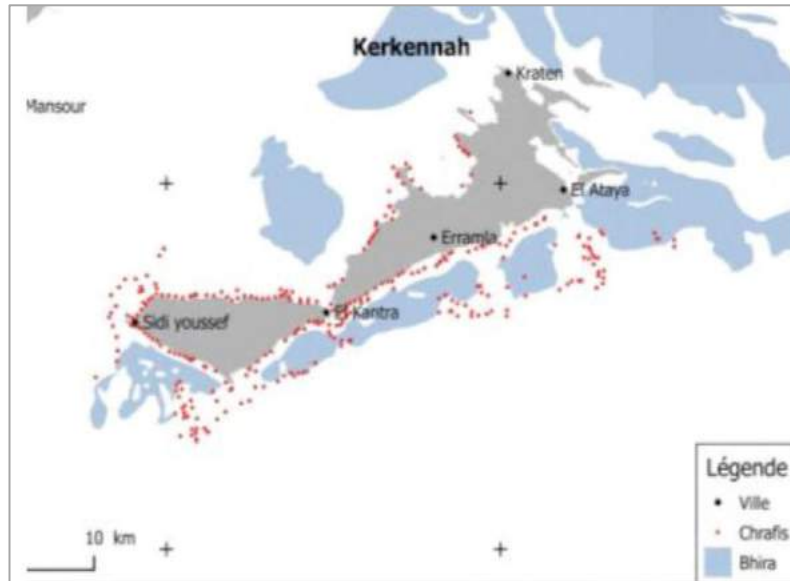
The only IFC PS6 Criterion definitely triggered is Criterion 3 for Eurasian Spoonbill but it appears that the threshold may not be met regularly.

Also note the potential consideration of the entire Gulf of Gabès as possible CH.

2.9.5 *Ecosystem services*

Traditional artisanal fishing using a technique called Charfiya or Charfia is undertaken here as well as non-traditional fishing (Map 63). Octopus are fished near the discharge area. The closest bathing spot is about 4km from the discharge point.

Map 63 Fishing areas around the Kerkennah Islands



2.9.6 Receiving environment

The receiving environment is described in Section 2.2.12 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

The *Etude Environnementale Supplémentaire* cites mixed concerns about the site:

“... la description du milieu récepteur a mis en évidence sa faible bathymétrie. L'émissaire mis en place pour le rejet des EUT de la STEP de 800 m de long ne permet pas d'assurer une dilution importante des EUT dans l'eau de mer. Toutefois, la dynamique des courants superficiels dont la circulation se fait de l'ouest vers l'est, c'est-à-dire de la côte vers le large assure une bonne dispersion des polluants rejetés dans les EUT et leur non-retour à la côte.”

2.9.7 Current effluent quality

The site currently receives none of its waste from industrial sites.

Current values for the effluent are shown below:

Table 11 Kerkennah current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	27,8	27,66	23
	DCO mg/l	94,4	224,33	148,5
	MES mg/l	30,4	30	29,75

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent meeting the current standard for BOD5 and TSS but is exceeding COD levels. The wrong location name in the above table likely is simply a labeling error in the *Etude Environnementale Supplémentaire*.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no heavy metal exceedances based on the data available from 2014, 2015 and 2016. There are variable exceedances for fecal coliforms and fecal streptococcus in all three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for cadmium, cobalt and lead, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.9.8 *Use of effluent for irrigation*

No

2.9.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.9.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent

inputs will be conducted prior to the site-specific ESIAS (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.9.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage except for: the Gulf of Gabès CIA and the efficiency of the outlet to dilute the effluents based on the bathymetry of the coastal receiving environment.

2.10 Mareth/Zarat

2.10.1 *General description of the site*

Mareth is a small WWTP (2860 m³/d hydraulic capacity) site built in 2007. The discharge is into a oued and then 3.5 km to the Gulf of Gabès. There is an IBA site (Gourine) at the point of discharge into the Gulf and a Ramsar site (Sebkhet Oum Ez-Zessar et Sebkhet El Grine) roughly 5 km to the east. Neither of these sites meet the IFC Criterion 3 threshold for Critical Habitat.

The WWTP and outfall are in a mixed agricultural and natural area with roughly 70% Modified Habitat and 30% Natural Habitat within 1 km.

The site empties indirectly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

2.10.2 *Protected areas or designated sites of international importance*

There is an IBA site (Gourine) at the point of discharge into the Gulf and a Ramsar site (Sebkhet Oum Ez-Zessar et Sebkhet El Grine) roughly 5 km to the east.

Map 64 Mareth/Zarat regional setting



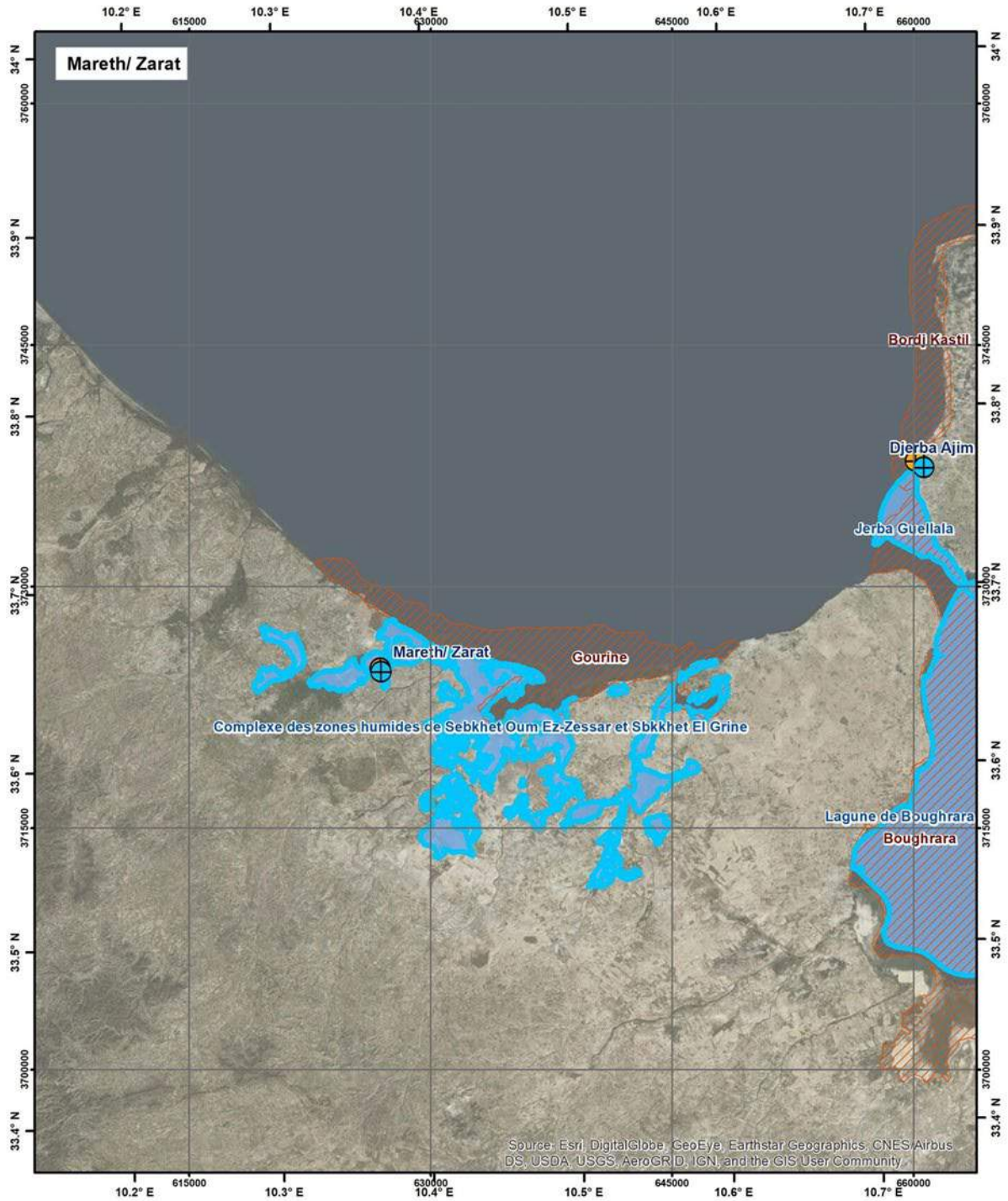
Map 65 Mareth/Zarat WWTP and outfall



Map 66 Mareth/Zarat WWTP and oufall (detailed view)



Map 67 Mareth/Zarat protected areas or designated sites of international importance

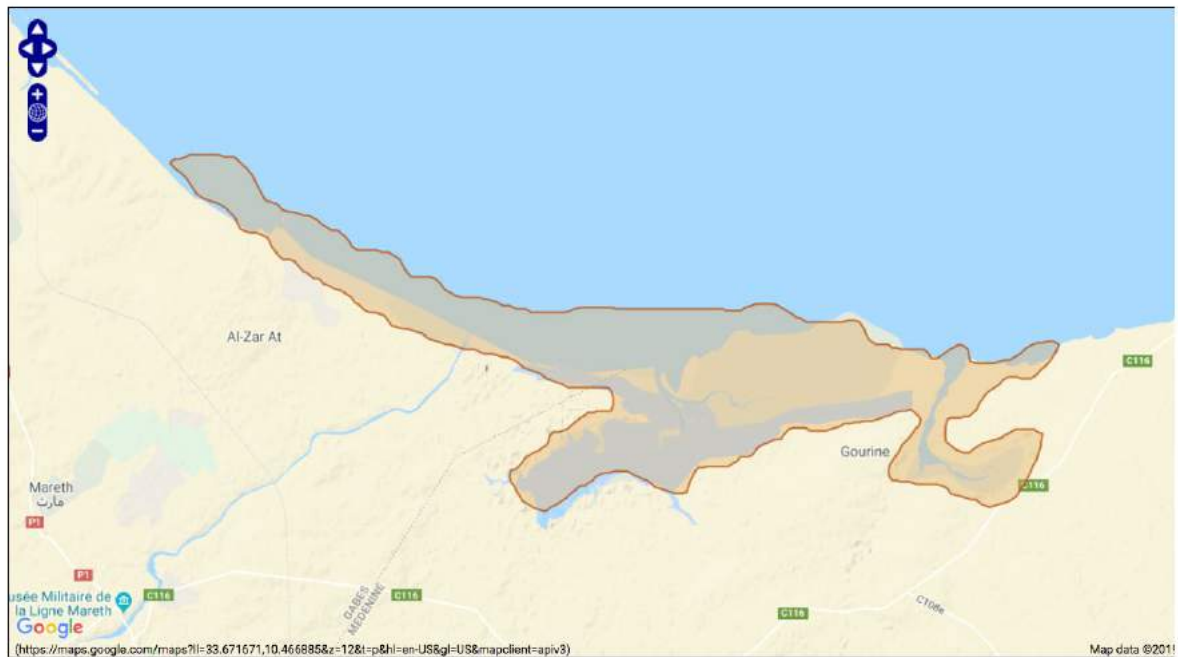


	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield Consulting 2018.</p> <p>Map created by: FAIR FIELDS Sustainability Consulting Date: 29/11/2018</p>
	Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance		

2.10.2.1 IBA sites

The Gourine IBA site, designated in 2010, is east of the WWTP (Map 68). It extends along the coastline to where the river that the WWTP discharges to empties. The IBAT map (Map 67) does not conform to the IBA map.

Map 68 Gourine IBA site (from the IBA website)



The IBA triggers were A4i and A4iii.

Table 12 Gourine IBA site trigger points (from the IBA site report)

IBA Criteria
Year of most recent IBA criteria assessment: 2010
Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	1992-2009	120-4,000 individuals	A4i
Eurasian Spoonbill <i>Platalea leucorodia</i> (http://datazone.birdlife.org/species/factsheet/22697555)	LC	winter	1992-2009	9-800 individuals	A4i
Great Cormorant <i>Phalacrocorax carbo</i> (http://datazone.birdlife.org/species/factsheet/22696792)	LC	winter	-	10,000-12,000 individuals	A4i
<i>Larus cachinnans</i> (http://datazone.birdlife.org/species/factsheet/22694365)	NR	winter	-	2,000-8,000 individuals	A4i
A4iii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	winter	-	20,000 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which was in place at that time.

None of these estimates meet IFC Criterion 3 thresholds.

2.10.2.2 Ramsar sites

Mareth is west of the Sebkheth Oum Ez-Zessar et Sebkheth El Grine Ramsar site. As with many of the other Ramsar site configurations, the data from IBAT (Map 67) is very different from the data from the Ramsar site (Map 69).

Map 69 Sebkheth Oum Ez-Zessar et Sebkheth El Grine Ramsar site (taken from Ramsar website)



The Sebkheth Oum Ez-Zessar et Sebkheth El Grine Ramsar site was designated in 2013 and encompasses a series of coastal sebkhas and estuarine oueds, made more dynamic because of the tidal amplitude of the Gulf of Gabès.

The site met the following Ramsar criteria (see Section 3.5 for the explanation of the Ramsar criteria):

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site was designated because of the role it plays during wintering and reproduction for fish (*Chelon labrosus*, *Liza saliens*, *Aphanius fasciatus*, ...) and birds (*Limosa limosa*, *Numenius arquata*, *Phalacrocorax carbo*, *Ardea alba*, *Ardea cinerea*, *Platalea leucorodia*, ...).

Criterion 6 deals with wetlands that regularly support 1% of the individuals in a population of one species or subspecies of waterbird. The site is known to support over 1% of the biogeographic population of Eurasian Spoonbill (*Platalea leucorodia*) with 360 individuals in 2012 (3% of the biogeographic population), and Greater Flamingo (*Phoenicopterus roseus*) with 2,200 individuals. These numbers however do not reach the 1% of the global population threshold.

2.10.2.3 *Other designations*

None identified.

2.10.3 *Other information on biodiversity values in the area*

None.

2.10.4 *Critical Habitat*

None identified. The site empties directly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

2.10.5 *Ecosystem services*

None identified. Presumably fishing occurs along the coastline.

2.10.6 *Receiving environment*

The receiving environment is described in Section 2.2.4 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

A key issue for this site is whether effluent from the discharge reaches the coast. The *Etude Environnementale Supplémentaire* concludes:

“Les EUT de la STEP de Mareth sont rejetées dans l’Oued Elouday dont l’embouchure est située à 3.5 km d’où un trajet suffisamment long pour permettre leur infiltration vers la nappe phréatique de Gabès Sud et la recharger surtout que l’Oued est à sec durant une longue période de l’année (330 jours/an). L’évaporation est un phénomène très important à mentionner vu son rôle dans l’élimination d’une grande partie de ces EUT. Dans ce cas, les effluents ne peuvent pas constituer une menace pour la zone Classée Ramsar et ZICO vu qu’ils n’atteignent pas les eaux marines. Dans le cas extrême, là où les EUT peuvent atteindre les eaux marines, notamment pendant les périodes de crue, le volume important des eaux de l’oued va favoriser leur dilution et par conséquent minimiser leur impact tout en sachant que la station ne reçoit pas des eaux industrielles.”

The assumption that evaporation in the oued reduces the impact of the effluent remains to be proved and this should be a key topic to be studied in the site-specific ESIA. Evaporation of the water in the effluent will lead to a concentrate of the substances of concern in the oued and therefore in the groundwater and/or the Gulf of Gabès. Evaporation is certainly an effective waste water treatment method but only when the evaporation occurs in a closed system and the residual effluent with high concentrations of various pollutants is retained and treated further.

2.10.7 *Current effluent quality*

No documented industrial input.

Current values for the effluent are shown below:

Table 13 Mareth current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	18,8	23	20
	DCO mg/l	70,4	85	54
	MES mg/l	21	19	18

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent meeting the current standard for BOD5, COD and TSS. The table is copied from the Mareth section in the *Etude Environnementale Supplémentaire*, however it is labeled as for Djerba Aghir. It appears simply to be a labeling error and the data are correct.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There is one significant heavy metal exceedance based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There is a significant exceedance for cyanide in 2014 (but not 2015 or 2016). There are significant exceedances for fecal coliforms and fecal streptococcus in all three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for lead and copper, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metal exceedances.

For heavy metals, we are not convinced, given the comparatively short distance, that these might not reach the coast during periods of flooding, and this needs to be considered further in the site-specific ESIA.

2.10.8 *Use of effluent for irrigation*

None.

2.10.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.10.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent could end up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.10.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage except for the Gulf of Gabès CIA and further consideration of the course of the effluent in the oued.

2.11 Medenine

2.11.1 *General description of the site*

Medenine is a medium WWTP (8870 m³/d hydraulic capacity) inland site built in 2000. The discharge is into the Oued Gueblaoui (or Giblawi) and then 25 km to the Boughrara Lagoon.

The WWTP and outfall are in a mixed agricultural and natural area with roughly 80% Modified Habitat and 20% Natural Habitat within 1 km.

2.11.2 *Protected areas or designated sites of international importance*

There is an IBA site (Boughrara) and a Ramsar site (Golfe de Boughrara) in the Boughrara Lagoon some 25 km away. The IBA site appears to meet the IFC Criterion 3 threshold for Critical Habitat for Slender-billed Gull.

There is no indication of Critical Habitat close to the WWTP.

2.11.2.1 *IBA/KBA sites*

None close by

2.11.2.2 *Ramsar sites*

None close by

2.11.2.3 *Other designations*

None

2.11.3 *Other information on biodiversity values in the area*

None

Map 70 Medenine regional setting



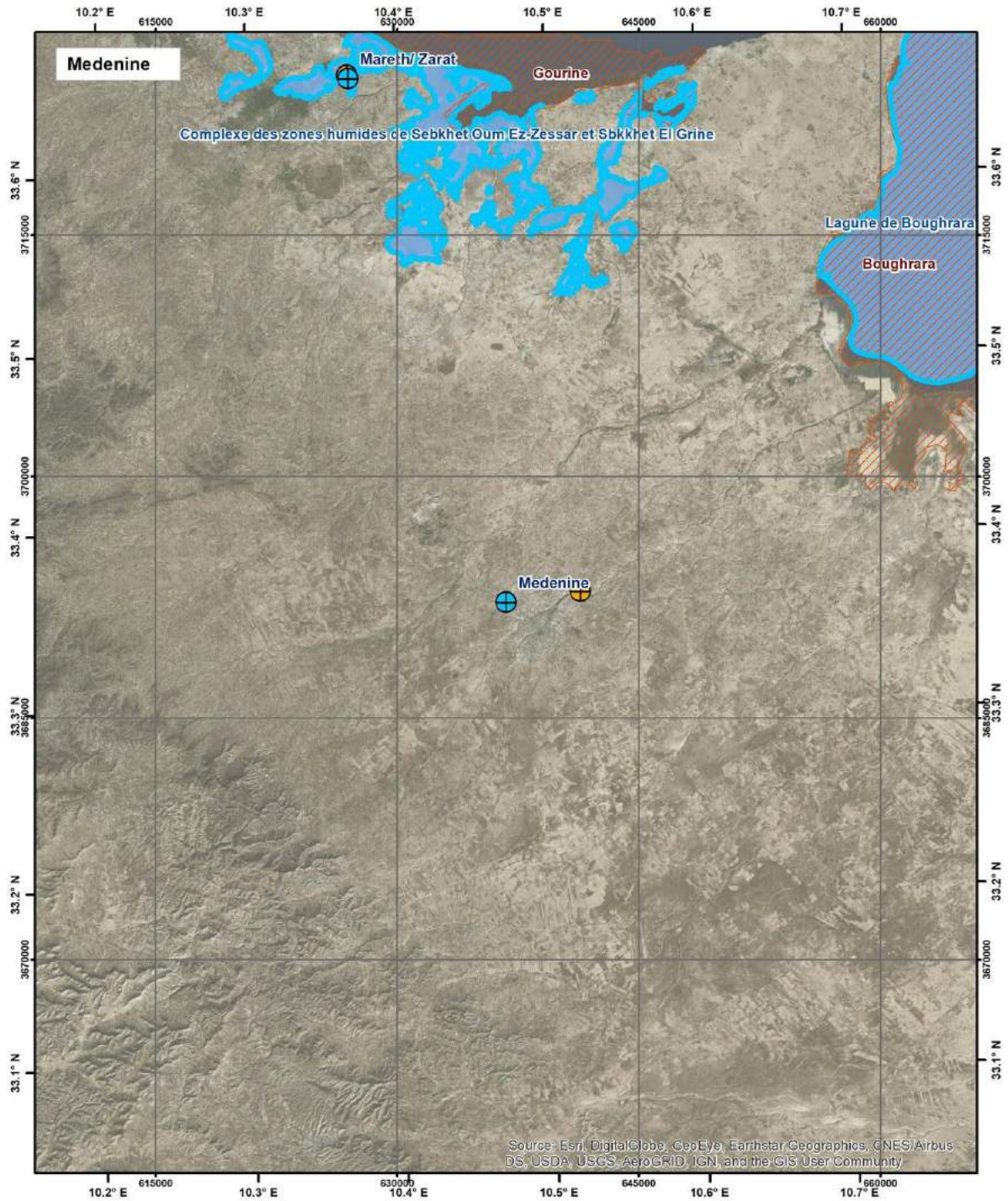
Map 71 Medenine WWTP and outfall



Map 72 Medenine WWTP and outfall



Map 73 Medenine protected areas or designated sites of international importance



	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by:</p> <p>Date: 29/11/2018</p>
	Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance		

2.11.4 *Critical Habitat*

No basis for any close by.

2.11.5 *Ecosystem services*

None documented

2.11.6 *Receiving environment*

The receiving environment is described in Section 2.2.9 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving environment. A key issue for this site is whether effluent from the discharge reaches the coast. The *Etude Environnementale Supplémentaire* concludes:

“Les EUT de la STEP de Medenine sont rejetées au niveau d’Oued Gueblaoui et sont en conformité avec les normes en vigueur. Le point de rejet est situé presque à 25 km de l’embouchure de l’Oued dans la lagune de Boughrara. Ce long trajet est suffisant pour permettre l’infiltration d’une partie des EUT et l’évaporation d’une autre partie avant l’arrivée à la lagune tout en sachant que les conditions climatiques de la région sont en faveur de ces phénomènes. En effet, la zone de la STEP est caractérisée par un climat saharien à faible précipitation (240 jour sans pluies) avec des températures élevées (35 à 40 °). Ces facteurs abiotiques sont des facteurs limitant qui influencent directement les EUT et les empêchent d’arriver à la lagune de Boughrara et menacer, par conséquent, la biodiversité de l’écosystème.”

These conclusions appear reasonable, especially given the 25 km to the Boughrara Lagoon.

2.11.7 *Current effluent quality*

The site currently receives none of its waste from industrial sites. The current values for the effluent are shown below:

Table 14 Medenine current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Medenine	DBO5 mg/l	24,8	29	16
	DCO mg/l	78	80	62
	MES mg/l	23	23	16

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent on average meeting the current standard for BOD5, COD and TSS. However, it should be noted that there has been a progressive increase in the levels in the period 2014-2016.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant exceedances based on the data available from 2014, 2015 and 2016, defined as a single exceedance over two times the current standard. There is a small exceedance for mercury in 2014 not repeated in 2015 or 2016. There are variable exceedances for fecal coliforms and fecal streptococcus in the three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for cobalt, copper, and lead, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.11.8 *Use of effluent for irrigation*

Approximately 10% of the effluent is used for irrigating 30 ha of tree crops and fodder.

2.11.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.11.10 *Recommendations regarding the adequacy of standards for this site*

The new Tunisian standard appears adequate if all parameters are considered applicable.

2.11.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None

2.11.12 *On-going checks with results to be added to main text*

None

2.12 Metouia/Ouethref

2.12.1 *General description of the site*

Metouia is a small WWTP (2860 m³/d hydraulic capacity) site built in 2007. The discharge is into Oued Melah and then 4 km to the Gulf of Gabès.

The WWTP and outfall are in a mixed agricultural and natural area with roughly 80% Modified Habitat and 20% Natural Habitat within 1 km.

The site empties indirectly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

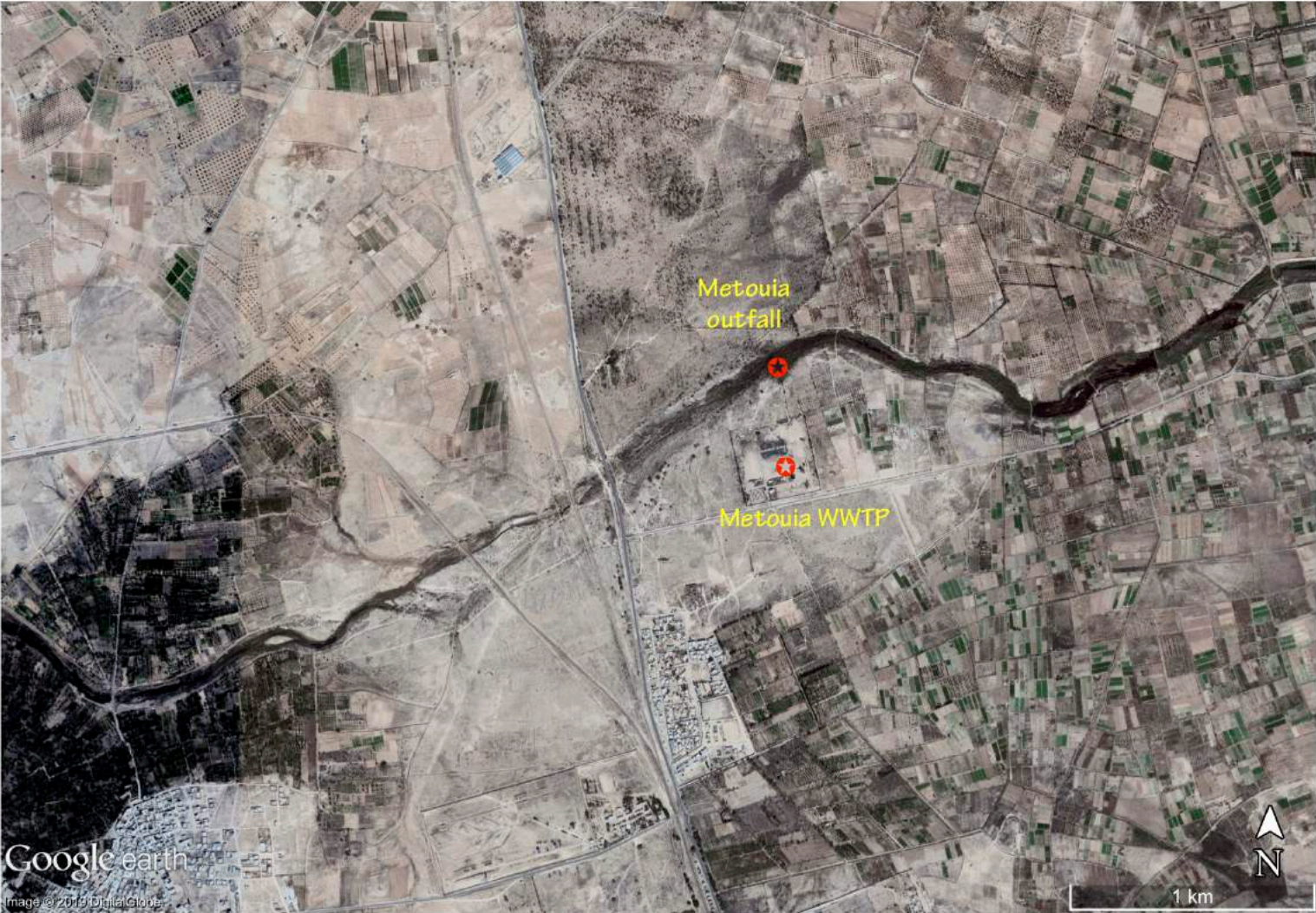
2.12.2 *Protected areas or designated sites of international importance*

There is a Ramsar site (Chott el Guetayate et Sebkhet Dhreia et Oueds Akarit, Rekhama et Meleh) at the point of discharge into the Gulf.

Map 74 Metouia/Ouethref regional setting



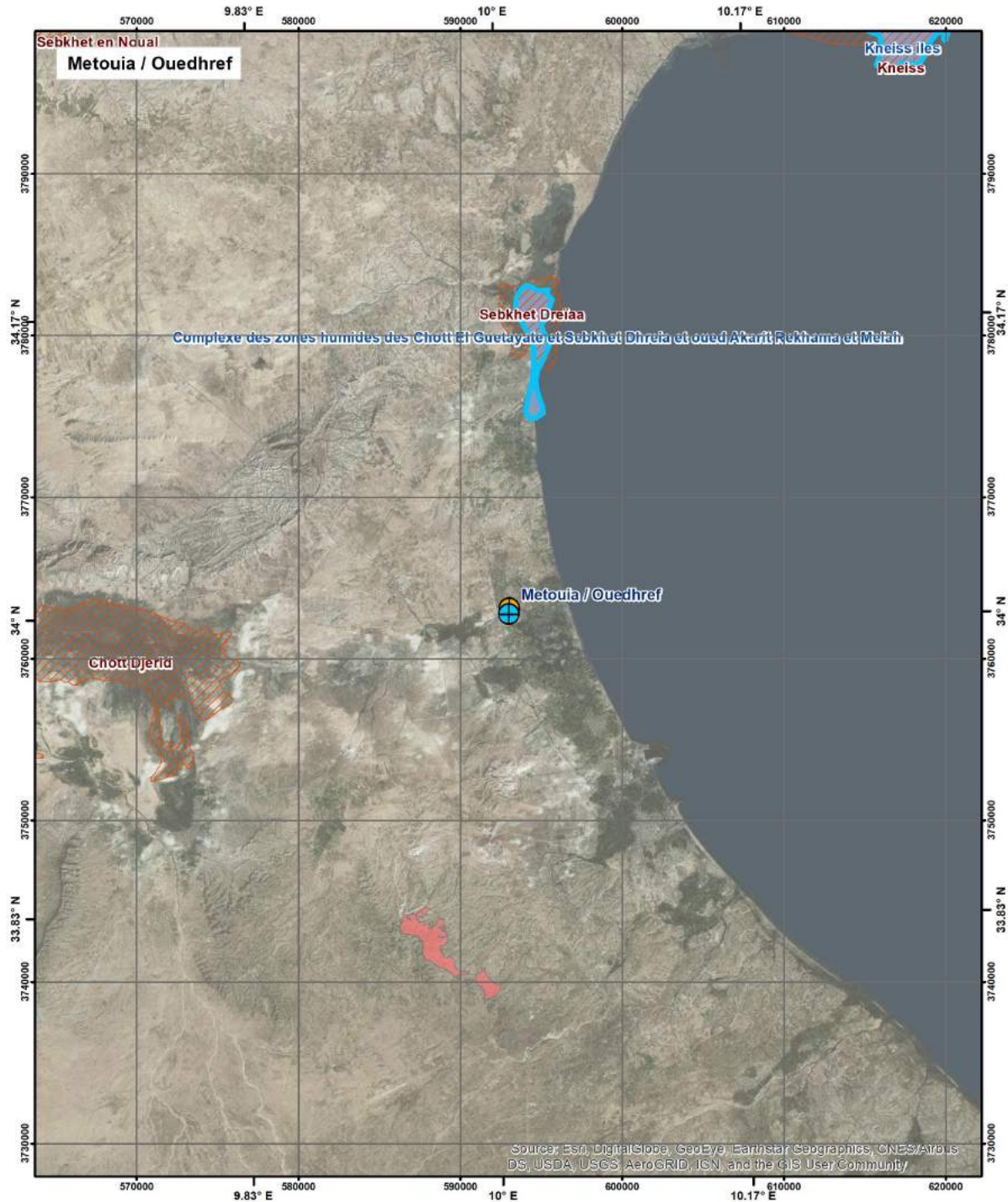
Map 75 Metouia/Ouethref WWTP and outfall



Map 76 Metouia/Ouethref WWTP and outfall (detailed view)



Map 77 Metouia / Ouedhref protected areas or designated sites of international importance

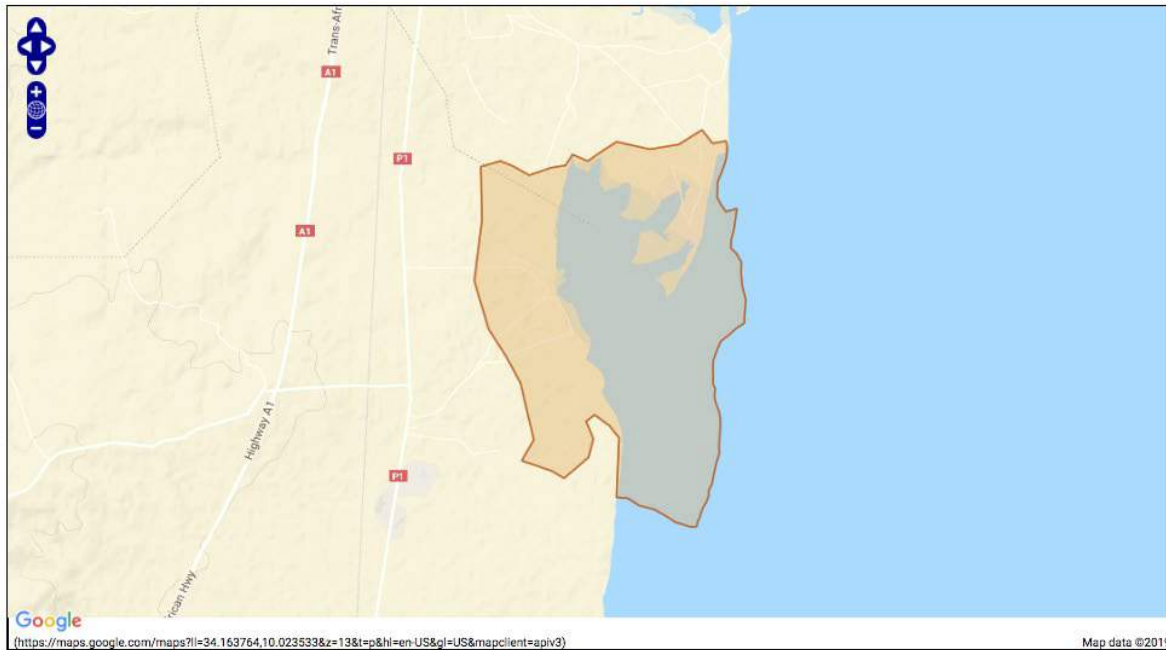


	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9998 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:50 000 0 1.5 3 4.5 6 7.5 Kilometres</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfields Consulting 2018.</p> <p>Map created by: Date: 18/03/2019</p>
	Metouia / Ouedhref Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance		

2.12.2.1 IBA sites

The Sebkheth Dreïaa IBA site, designated in 2001, is located north of the Metouia WWTP (Map 78).

Map 78 Sebkheth Dreïaa IBA site (from IBA website)



The site was designated based on meeting the A4i trigger.

Table 15 Sebkheth Dreïaa IBA site (from the IBA site report)

IBA Criteria

Year of most recent IBA criteria assessment: 2001

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
<i>Charadrius alexandrinus</i> (http://datazone.birdlife.org/species/factsheet/22693818)	NR	winter	-	700-1,000 individuals	A4i
Grey Plover <i>Pluvialis squatarola</i> (http://datazone.birdlife.org/species/factsheet/22693749)	LC	winter	-	1,500-2,000 individuals	A4i

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which in place at that time.

The 2009 monitoring gave the following results: Eurasian Spoonbill 120; Eurasian Curlew (*Numenius arquata*) 818; Dunlin (*Calidris alpina*) 20,000.

None of the above estimates trigger IFC's Criterion 3.

2.12.2.2 Ramsar sites

The Chott el Guetayate et Sebkhet Dhreia et Oueds Akarit, Rekhama et Meleh Ramsar site is located to the north of the Metouia WWTP (Map 79). Once again the IBAT Ramsar site configuration (Map 77) does not match the Ramsar website map. In the Ramsar website map the Ramsar site extends south the mouth of the river that the Metouia WWTP discharges to.

The Ramsar 2012 designation was based on meeting criteria 3, 4, and 7 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site is important for a wide variety of animals including birds (*Anas clypeata*; *Anas penelope*; *Anas crecca*; *Platalea leucorodea*; *Calidris alpina*; *Numenius arquata* NT; *Anas acuta*), fish (*Anguilla anguilla* CR; *Aphanius fasciatus*; *Gambusia affinis holbrooki*; *Mugil cephalus*; *Liza saliens*; *Liza ramada*) and molluscs (*Ruditapes decussatus*).

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site is important for various species of birds, fish and molluscs at key stages.

Criterion 7 deals with wetlands that support a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity. The site is important for various species of birds, fish and molluscs at key stages.

2.12.2.3 Other designations

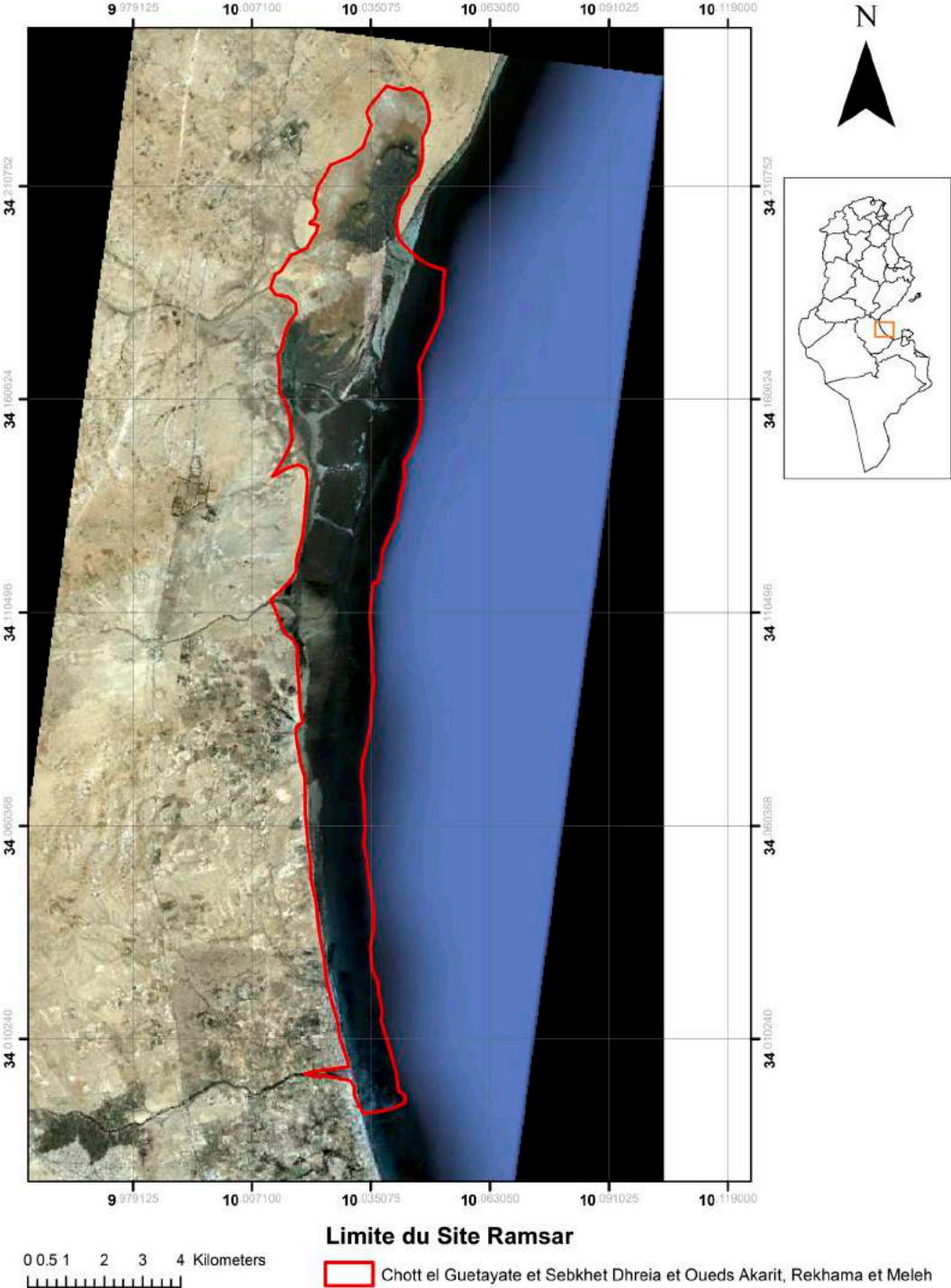
None identified.

2.12.3 Other information on biodiversity values in the area

Presence of the European Eel (*Anguilla anguilla*) considered Critically Endangered.

Map 79 Chott el Guetayate et Sebkheth Dhreia et Oueds Akarit, Rekhama et Meleh Ramsar site (taken from Ramsar site)

Chott el Guetayate et Sebkheth Dhreia et Oueds Akarit, Rekhama et Meleh



2.12.4 *Critical Habitat*

None currently identifiable, except for the possible consideration of the entire Gulf of Gabès as possible CH.

The presence of the European Eel (*Anguilla anguilla*) considered Critically Endangered is significant but is not likely to meet IFC Criterion 1 thresholds because of its wide range.

2.12.5 *Ecosystem services*

The mollusc (*Ruditapes decussatus*) is the subject of an important local fishery.

Some bathing occurs along the coastline close to where the Oued empties into the Gulf of Gabès.

2.12.6 *Receiving environment*

The receiving environment is described in Section 2.2.62 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.12.7 *Current effluent quality*

The site currently receives 5% of its waste from industrial sites.

Current values for the effluent are shown below:

Table 16 Metouia / Ouedhref current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	28,2	24,5	26
	DCO mg/l	89,4	80,33	66,75
	MES mg/l	22	23	21

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent meeting the current standard for BOD5, COD and TSS. The wrong name on the table appears to be just a labelling error in the *Etude Environnementale Supplémentaire*.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There were significant heavy metal exceedances, defined as single exceedances over two times the current standard, for lead and cadmium in 2014 (but no measurements in 2015 or 2016 for cadmium and no exceedance in 2015 for lead). There was also a small exceedance for cyanide in 2014. There are significant exceedances for fecal coliforms and fecal streptococcus in all three years. The lead and cadmium results are worrisome, in view of the limited followup.

2.12.8 *Use of effluent for irrigation*

None.

2.12.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.12.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.12.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage except for the Gulf of Gabès CIA and consideration in the site specific ESIA of the potential for effluent reaching the sea and the Ramsar site.

2.13 Sfax Nord

2.13.1 *General description of the site*

The Sfax Nord WWTP is a medium WWTP (17,900 m³/d hydraulic capacity) site built in 2004. It is located on the Gulf of Gabès, north of the town of Sfax. The outfall is via a 4km long pipe that goes out roughly 1 km into the Gulf.

The WWTP is in an agricultural area and there is 100% Modified Habitat within 1 km. The outfall is just over 1 km in the Gulf and is therefore 100% Natural Habitat within 1 km.

2.13.2 *Protected areas or designated sites of international importance*

2.13.2.1 *IBA/KBA sites*

None close by

2.13.2.2 *Ramsar sites*

None close by

2.13.2.3 *Other designations*

None close by

2.13.3 *Other information on biodiversity values in the area*

None

Map 80 Sfax Nord regional setting



Map 81 Sfax Nord WWTP and outfall



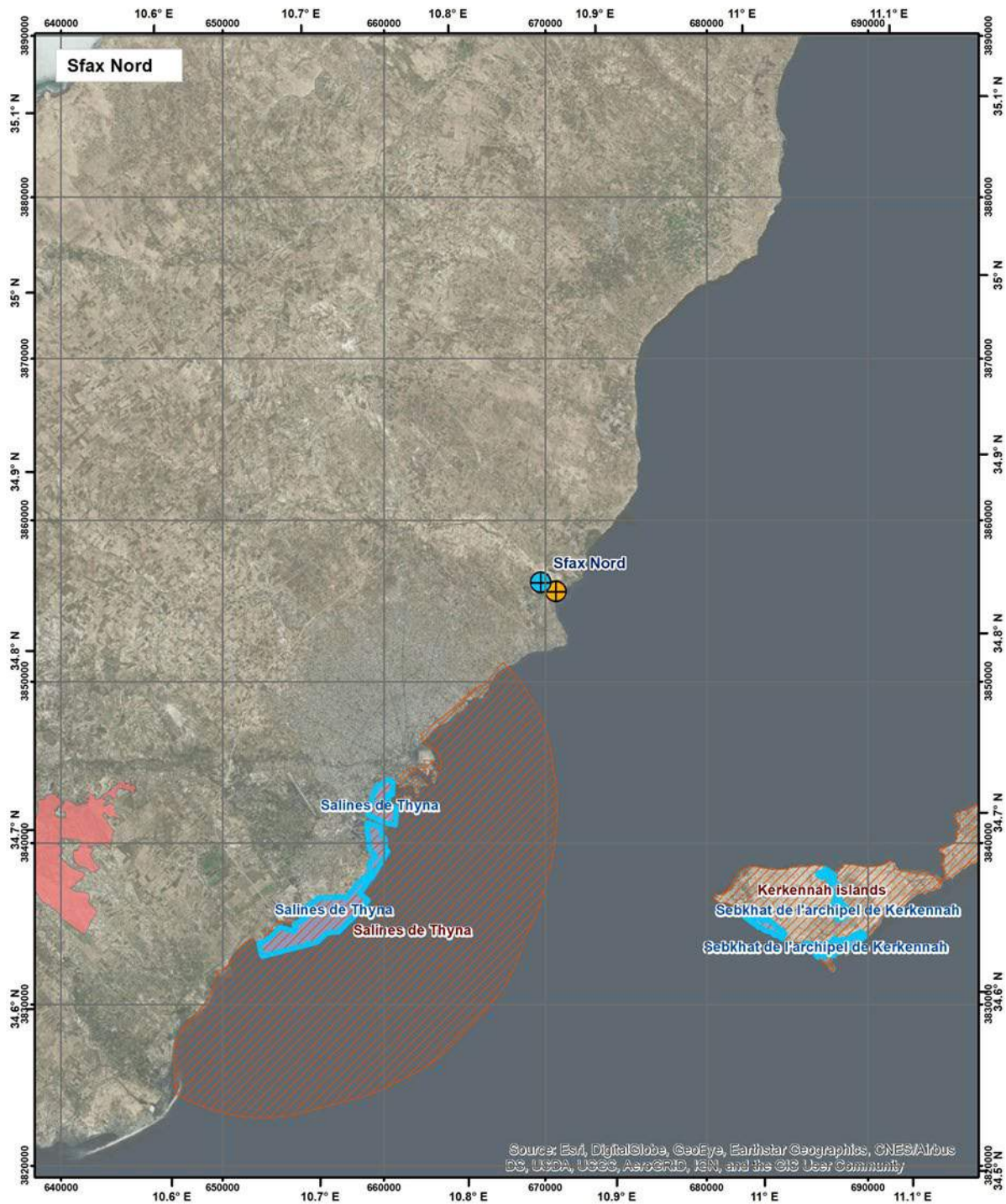
Map 82 Sfax Nord WWTP



Map 83 Sfax Nord outfall



Map 84 Sfax Nord outfall and internationally designated areas



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 32N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: 9.0 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield Consulting 2018.</p> <p>Map created by:</p> <p>Date: 18/03/2019</p>
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2.13.4 *Critical Habitat*

None currently identifiable, except for the possible consideration of the entire Gulf of Gabès as possible CH.

2.13.5 *Ecosystem services*

There is fishing near the discharge point and bathing within 2 km.

2.13.6 *Receiving environment*

The receiving environment is described in Section 2.2.13 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

2.13.7 *Current effluent quality*

The site currently receives 1% of its waste from industrial sites.

Current values for the effluent are shown below:

Table 17 Sfax Nord current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	25.4	19	44.5
	DCO mg/l	88.2	209	72.66
	MES mg/l	31	18	66

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing quite variable effluent often exceeding the current standard for BOD5, COD and TSS. The table in the *Etude Environnementale Supplémentaire* is for Sfax Nord but the label on the table says it is for Djerba Aghir, likely just mislabeling. Sfax Nord has some small exceedances, typically the data show compliance with the standard.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There is one significant heavy metal exceedance based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard, in 2015 for mercury. However, this value could be due to a unit error in the original spreadsheet. There are significant exceedances for fecal coliforms and fecal streptococcus in all three years. There are some striking absences in the data, notably a total lack of measurements from 2014-16 for cobalt, copper, lead and nickel, so some caution is warranted, however, we conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.13.8 *Use of effluent for irrigation*

No

2.13.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.13.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.13.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage except for the Gulf of Gabès CIA.

2.14 Sfax Sud

2.14.1 *General description of the site*

The Sfax Sud WWTP is the largest WWTP being considered (49,500 m³/d hydraulic capacity) site. It is located on the Gulf of Gabès, on the southern edge of the town of Sfax. The outfall is about 300m east of the WWTP directly into a channel between the town and the Salines de Thyna. The Salines de Thyna include commercially exploited and managed salt pans and are included in the Salines de Thyna IBA and Ramsar sites.

The WWTP is located in Modified Habitat (industrial) and within 1 km it is mainly Modified Habitat (60%) but with a substantial part that is Critical Habitat (Natural Habitat) (40%). The outfall is roughly 50/50 within 1 km.

2.14.2 *Protected areas or designated sites of international importance*

The key site near the WWTP is the Salines de Thyna IBA/KBA and Ramsar sites. The salt pans are a representative example of a rare type of wetland in the Mediterranean as they are subject to a considerable tide. The succession of shallow pools, of varying depth and salinity, provide prime habitat for water birds.

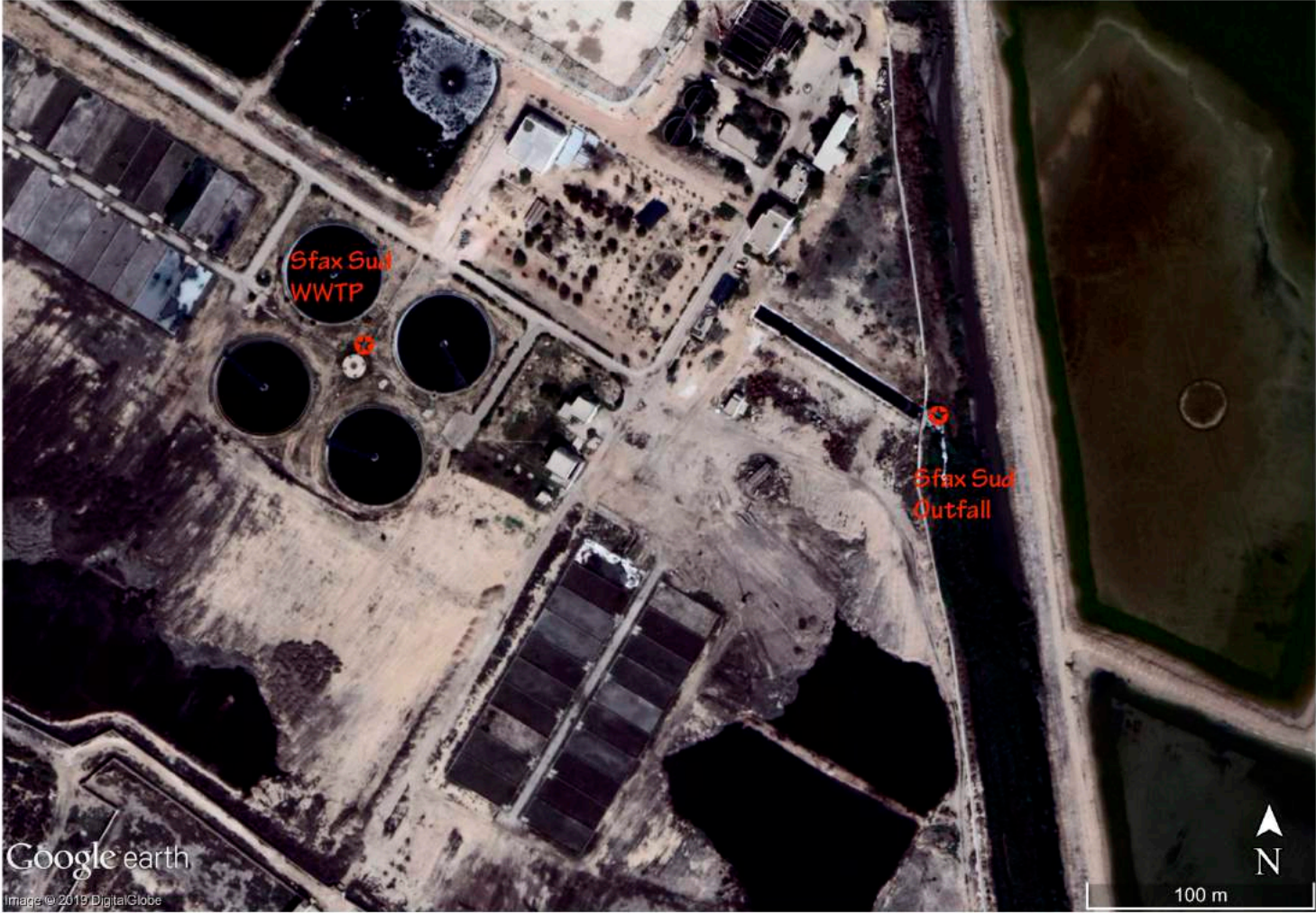
Map 85 Sfax Sud regional setting



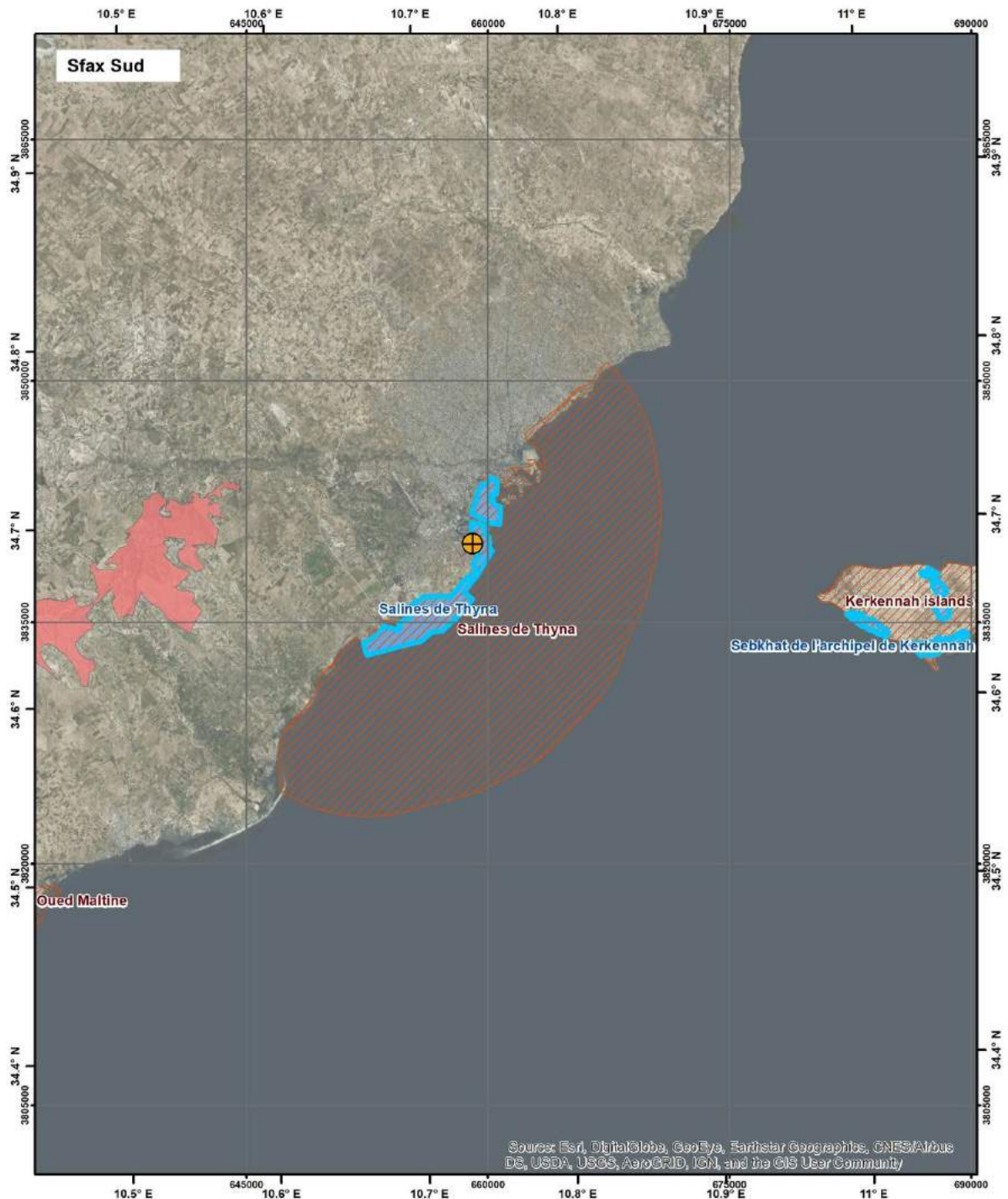
Map 86 Sfax Sud WWTP and outfall



Map 87 Sfax Sud WWTP and outfall



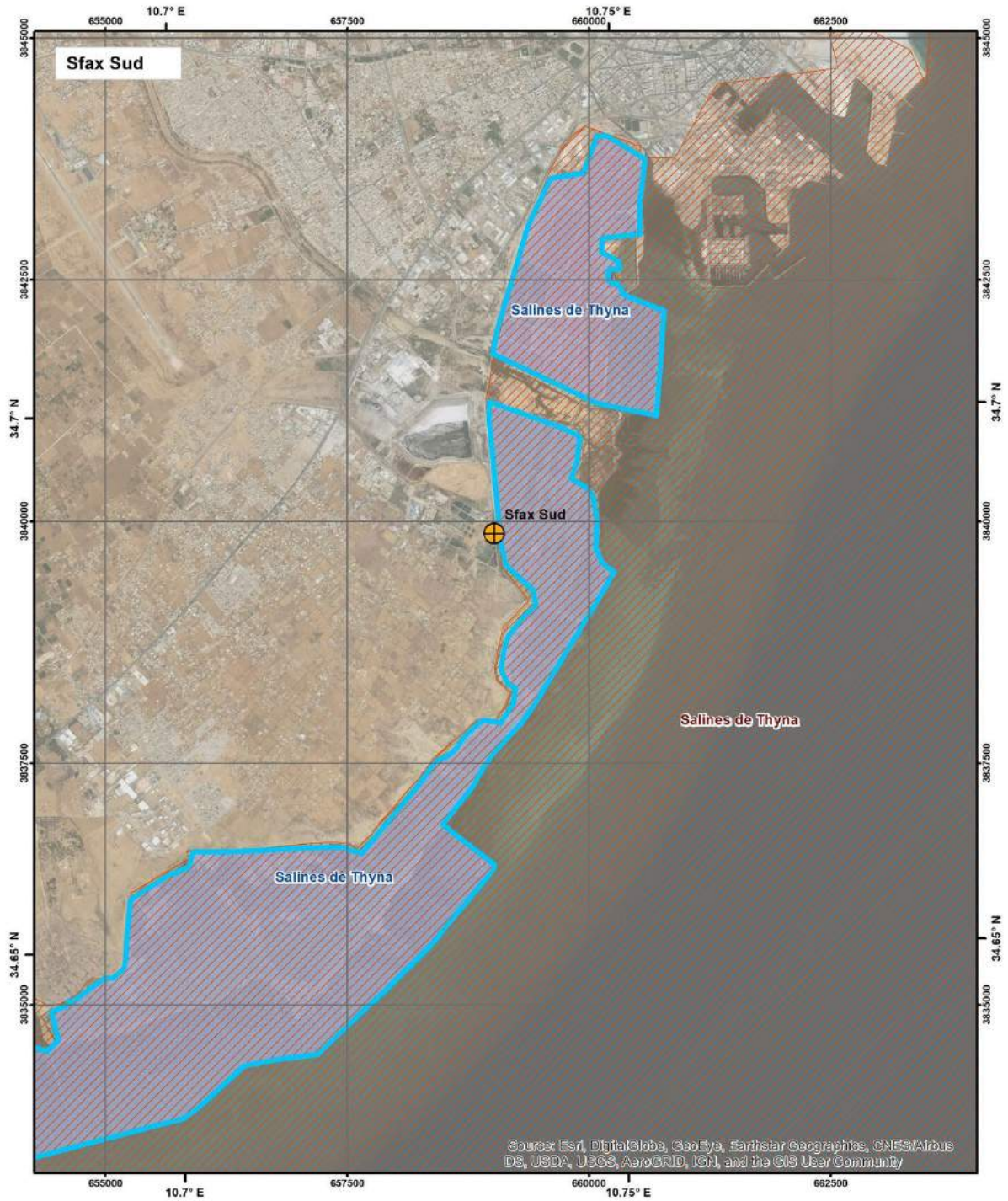
Map 88 Sfax Sud protected areas or designated sites of international importance



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

	Waste Water Treatment Plant	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:300 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield's Consulting 2018.</p> <p>Map created by: FAIR FIELDS Sustainability Consulting</p> <p>Date: 29/11/2018</p>
	Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance		

**Map 89 Sfax Sud protected areas or designated sites of international importance
(detailed view)**



	<ul style="list-style-type: none"> Waste Water Treatment Plant Outfall Ramsar Wetland Key Biodiversity Area National Park Bird Reserve Faunal Reserve Nature Reserve Wetland Zone of National Importance 	<p>Coordinate System: WGS84 UTM Zone 28N Projection: Transverse Mercator Datum: WGS84 False Easting: 500 000 False Northing: 0 Central Meridian: -15 Scale Factor: 0.9996 Latitude of Origin: 0 Units: Meter</p> <p>Scale 1:50 000</p>	<p>Protected Area information from IBAT 2018. Mapping provided by Fairfield's Consulting 2018.</p> <p>Map created by:</p> <p>Date: 29/11/2018</p>
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2.14.2.1 IBA sites

The WWTP is within the Salines de Thyna IBA site (Map 90), designated in 2012.

Map 90 Salines de Thyna IBA site (from the IBA website)



The site met the A4i and A4iii triggers:

Table 18 Salines de Thyna IBA site triggers

IBA Criteria

Year of most recent IBA criteria assessment: 2012

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Black-necked Grebe <i>Podiceps nigricollis</i> (http://datazone.birdlife.org/species/factsheet/22696810)	LC	winter	-	600-2,500 individuals	A4i
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	750-7,000 individuals	A4i
Eurasian Spoonbill <i>Platalea leucorodia</i> (http://datazone.birdlife.org/species/factsheet/22697555)	LC	winter	-	200-600 individuals	A4i
Pied Avocet <i>Recurvirostra avosetta</i> (http://datazone.birdlife.org/species/factsheet/22693712)	LC	breeding	-	1,000 individuals	A4i
Pied Avocet <i>Recurvirostra avosetta</i> (http://datazone.birdlife.org/species/factsheet/22693712)	LC	winter	-	1,000-2,000 individuals	A4i
Curlew Sandpiper <i>Calidris ferruginea</i> (http://datazone.birdlife.org/species/factsheet/22693431)	NT	winter	-	2,000-5,500 individuals	A4i
Little Stint <i>Calidris minuta</i> (http://datazone.birdlife.org/species/factsheet/22693379)	LC	winter	-	2,500-5,500 individuals	A4i
Slender-billed Gull <i>Larus genei</i> (http://datazone.birdlife.org/species/factsheet/22694428)	LC	breeding	-	1,400 individuals	A4i
Slender-billed Gull <i>Larus genei</i> (http://datazone.birdlife.org/species/factsheet/22694428)	LC	winter	-	1,400-3,000 individuals	A4i
Sandwich Tern <i>Thalasseus sandvicensis</i> (http://datazone.birdlife.org/species/factsheet/22694591)	LC	winter	-	400-3,500 individuals	A4i
A4iii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	winter	-	20,000 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered then at the time of assessment, the current IUCN Red List category may vary from that which in place at that time.

Table 19 Salines de Thyna IBA site 2009 monitoring results

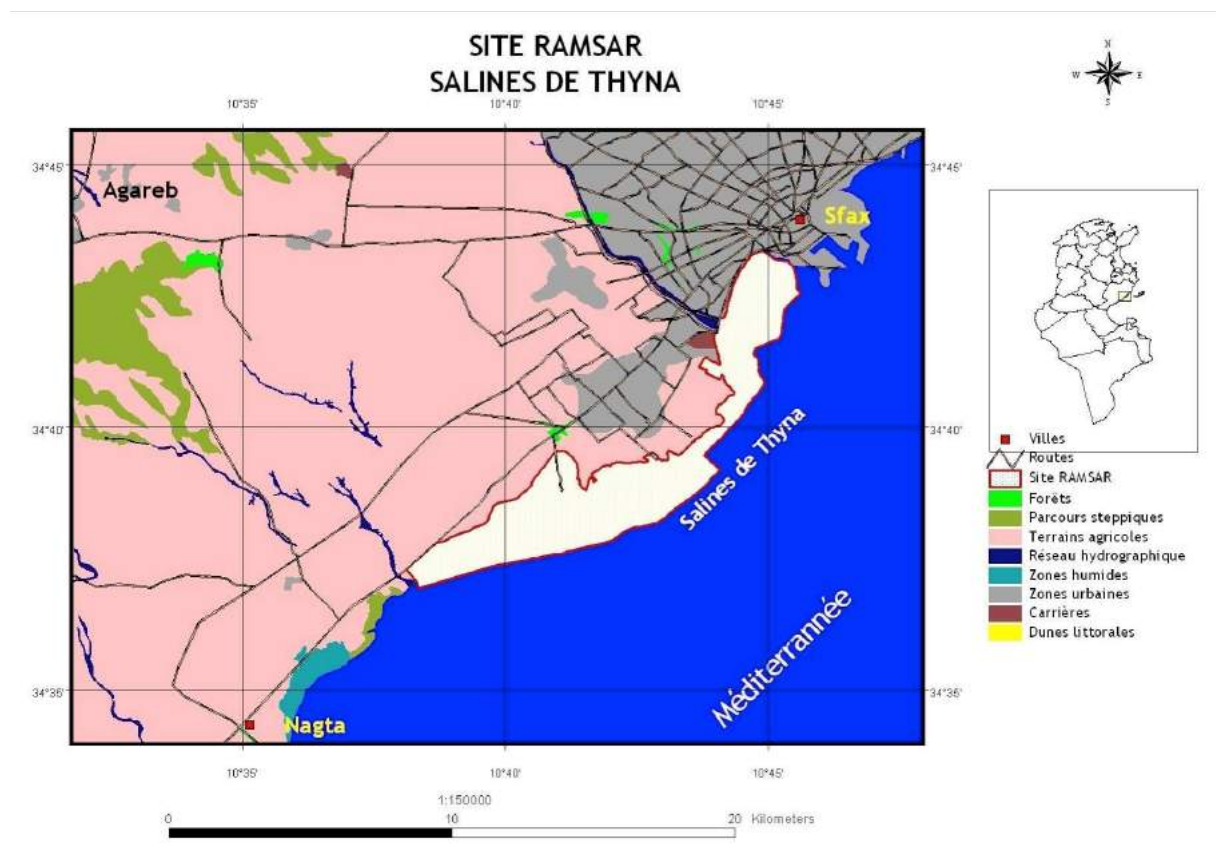
Condition of key/trigger populations (state)						
Scientific	Common	TargetPop	ActualPop	Units	Remaining	Result
<i>Oxyura leucocephala</i>	White-headed Duck	1	9	individuals	100	favourable
<i>Tadorna tadorna</i>	Common Shelduck	750	1277	individuals	100	favourable
<i>Marmaronetta angustirostris</i>	Marbled Teal	1	14	individuals	100	favourable
<i>Marmaronetta angustirostris</i>	Marbled Teal	1	3	breeding pairs	100	favourable
<i>Podiceps nigricollis</i>	Black-necked Grebe	2200	240	individuals	11	very unfavourable
<i>Phoenicopterus roseus</i>	Greater Flamingo	1325	8106	individuals	100	favourable
<i>Platalea leucorodia</i>	Eurasian Spoonbill	120	93	individuals	78	near favourable
<i>Egretta garzetta</i>	Little Egret	100	120	breeding pairs	100	favourable
<i>Recurvirostra avosetta</i>	Pied Avocet	1000	1446	individuals	100	favourable
<i>Himantopus himantopus</i>	Black-winged Stilt	770	1390	individuals	100	favourable
<i>Charadrius alexandrinus</i>	Kentish Plover	660	1619	individuals	100	favourable
<i>Glareola pratincola</i>	Collared Pratincole	190	54	breeding pairs	29	very unfavourable
<i>Sterna nilotica</i>		70	100	breeding pairs	100	favourable
<i>Larus genei</i>	Slender-billed Gull	1400	5290	individuals	100	favourable
<i>Larus genei</i>	Slender-billed Gull	700	3350	breeding pairs	100	favourable
<i>Sterna albifrons</i>	Little Tern	80	160	individuals	100	favourable
<i>Sterna hirundo</i>	Common Tern	250	500	breeding pairs	100	favourable
Species group - waterbirds	A4iii	20000	35210	individuals	100	favourable

The Greater Flamingo and Slender-billed gull numbers easily met the IFC Criterion 3 thresholds and the Eurasian Spoonbill threshold was nearly met. The Endangered White-headed Duck was present during the 2009 monitoring with a population of 9. The Vulnerable Marbled Teal breeds here.

2.14.2.2 Ramsar sites

The Saline de Thyna Ramsar site was designated in 2007. The IBAT configuration of the site (Map 89) conforms fairly well to the Ramsar website configuration (Map 91).

Map 91 Saline de Thyna Ramsar site (taken from Ramsar website)



The site was designated based on the following Ramsar criteria (See Section 3.5 for definitions of the Ramsar criteria):

Criterion 1 deals with wetlands that contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region. The site includes shallow marine waters subject to high tidal amplitude and salt pans.

Criterion 2 deals with wetlands that support vulnerable, endangered, or critically endangered species or threatened ecological communities. The site has been the location for a number of comparatively

recent sightings of the Critically Endangered, and possibly Extinct, Slender-billed Curlew (*Numenius tenuirostris*). The last sighting may have been as late as 1992 (Fishpool and Evans 2001). The Vulnerable Marbled Teal (*Marmaronetta angustirostris*) nests in small numbers (1-3 couples) in the Oued El Maou.

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The Kneiss Islands and the Salines de Thyna are considered the two most important sites in the Gulf of Gabès for waterbirds, especially waders, providing feeding and resting areas. The Gulf of Gabès is considered the most important site in the Medieterranean for waders.

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site provides a critical link for migrating birds between sub-Saharan Africa and Arctic nesting areas. Many birds also nest there.

Criterion 5 deals with wetlands that regularly support 20,000 or more waterbirds. Waterbird numbers are thought to regularly exceed this number at practically any season.

Criterion 6 deals with wetlands that regularly support 1% of the individuals in a population of one species or subspecies of waterbird. Species exceeding the 1% Ramsar definition include: Greater Flamingo (*Phoenicopterus roseus*) 750-7,000; Eurasian Spoonbill (*Platalea leucorodia*) 200-600; Pied Avocet (*Recurvirostra avosetta*) 1,000-2,000; Little Stint (*Calidris minuta*) 2,000-5,500; Sandwich Tern (*Sterna sandvicensis*) 400-3,500. These are high numbers and some are close to the 1% global thresholds but only the Greater Flamingo actually occasionally exceeds the global threshold. (Note: the breeding Slender-billed Gull (*Larus gene*) population of 4,000 couples, although not cited by Ramsar re Criterion 6 for this site, actually meets the 1% global threshold.)

Criterion 8 deals with wetlands that are an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. The shallow marine waters are important for a number of fish, crustacean and mollusc species at key stages in their life cycle.

2.14.2.3 Other designations

None identified.

2.14.3 Other information on biodiversity values in the area

The mudflats are fully submerged at high tide and dry for several hundred metres at low tide *Posidonia* seagrass beds are present which are considered a “threatened habitat” by IUCN (VU).

Besides the aspects already discussed above the Ramsar site report presents other useful data :

« Les salines sont une formation artificielle, série de bassins d'évaporation, séparés des terres et de la mer avoisinantes par des digues en pierre ou en boue. L'eau de mer entre dans les bassins au sud, et devient progressivement plus salée au fur et à mesure qu'elle s'approche des bassins de récolte de sel, à très forte salinité, au nord de la saline. La salinité varie entre 36

grammes/litre à l'entrée à 200-300 gr/l dans les bassins de récolte. Les bassins moins salés au centre et au sud du site fournissent des lieux d'alimentation et de repos aux oiseaux d'eau.

...

Les niveaux d'eau varient, non seulement selon la manipulation des niveaux par les saliniers, mais aussi d'après la force et la direction du vent. Ces conditions sont idéales pour l'alimentation des oiseaux d'eau, ainsi que pour la nidification en lieu sûr (sur les îlots) en période de reproduction. Les bassins servent également de reposoirs au moment de la marée haute. Dans ces conditions, toutes sortes d'oiseaux d'eau peuvent s'y observer : cormorans, hérons et aigrettes, ibis et spatules, anatidés, mais surtout limicoles, mouettes, goélands et sternes. Le crustacé *Artemia* est la base de l'alimentation de plusieurs espèces, notamment des flamants.

Les zones marines aussi sont importantes pour l'alimentation des oiseaux d'eau dans les vases et les sables à marée basse, et également pour la pêche. Dans ces zones marines, la végétation (typique du Golfe de Gabès) est dominée par *Posidonia oceanica*. ...

A Thyna, comme dans les principaux sites du Golfe de Gabès soumis à la marée (et notamment les îles Kneiss et Djerba), on rencontre des populations d'oiseaux d'eau inféodées aux conditions de la marée (surtout des limicoles) et qui ne se trouvent donc guère ailleurs en Méditerranée, ou du moins pas dans des concentrations aussi importantes.”

2.14.4 *Critical Habitat*

The WWTP itself is in Modified Habitat and is unlikely to qualify as CH.

The outfall discharges to CH for Criterion 3 (Greater Flamingo and Slender-billed Gull). It is unlikely to qualify as Criterion 1 as the Slender-billed Curlew appears to have disappeared and the White-headed Duck is present in numbers too small to trigger CH. However other highly threatened species whose nurseries are in seagrass beds in the bay include the Endangered common guitarfish *Rhinobatos rhinobatos* and blackchin guitarfish *Rhinobatos cemiculus*. The Green Turtle *Chelonia mydas* is also present, but like the marine fish, very unlikely to trigger CH.

The site empties directly into the Gulf of Gabès. This raises all of the concerns related to a broader consideration of the Gulf of Gabès as possible CH and the need for a cumulative assessment.

2.14.5 *Ecosystem services*

There is a fishing harbor nearby.

The salt pans are a good example of a complex system that depends on the natural environment and also helps to maintain important biodiversity elements. As the *Etude Environnementale Supplémentaire* states there are important ecosystem services related to the salt pans: groundwater recharge, flood control, protection against coastal erosion, salt production, and seafood production.

2.14.6 Receiving environment

The receiving environment is described in Section 2.2.14 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

The Ramsar site report outlines some of current issues related to the urban and industrial pollution from the town of Sfax and the SIAPE factory. The SIAPE factory releases substances such as fluoride, cadmium and mercury.

2.14.7 Current effluent quality

The site currently receives up to 25% of its waste from industrial sites.

Current values for the effluent are shown below:

Table 20 Sfax Sud current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-aout	Septembre-décembre
Djerba Aghir	DBO5 mg/l	58	90	53.25
	DCO mg/l	227	209	228.33
	MES mg/l	141.4	151.33	142.33

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent typically exceeding the current standard for BOD5, COD and TSS. The table from the *Etude Environnementale Supplémentaire* is for Sfax Sud but the label on the table says it is for Djerba Aghir. Looking at the raw data, it appears that the numbers are likely correct and this is just a labelling error.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no significant heavy metal exceedances based on the data available from 2014, 2015 and 2016, defined as single exceedances over two times the current standard. There are some small exceedances for cyanide, nickel and chrome. There are variable exceedances for fecal coliforms and fecal streptococcus. The only complete absence of data is a total lack of measurements from 2014-16 for cadmium.

The Draft May 2018 version of the *Etude Environnementale Supplémentaire* recognized the problems of the Sfax Sud effluent:

“La STEP de Sfax Sud fournit une qualité médiocre des EUT avec un dépassement pour les Chlorures, DCO, DBO5, MES, NtK, Pt, Sulfates, Al + Fe, Cyanures, Plomb, Mercure, Coliformes fécaux, Streptocoques fécaux, Salmonelles selon la Norme en vigueur et un dépassement des valeurs seuils de la DCO, DBO5, MES, NtK, Pt, Pt, Cyanures, AL + Fe, Plomb, Zinc, Chrome hexavalent, Mercure, Coliformes fécaux, Streptocoques fécaux, Salmonelles lorsqu’on se base sur la nouvelle Norme. Après réalisation des travaux initiaux et complémentaires, la STEP de Sfax Sud, tout comme les autres STEP du périmètre de la concession, respectera les valeurs seuils concernant la DCO, la DBO5, les MES, le NtK, le Pt et les paramètres biologiques. Toutefois, ces travaux n’agiront pas sur la réduction de la concentration en métaux lourds et autres polluants chimiques et organiques. Une partie de ces polluants a pour origine les EU domestiques mais les plus fortes concentrations sont dû aux rejets industriels ne respectant pas la Norme en vigueur pour les rejets en RPA. Etant donné que plus de 20% des rejets bruts traités au niveau de la station sont d’origine industrielle, il serait primordial de renforcer les contrôles des ouvrages de prétraitement des unités industrielles et de la qualité de leurs rejets.”

The assumption is that the work to be done at the WWTP will bring the effluent up to the standard, but only for the traditional municipal sewage water parameters, not for heavy metals and other parameters.

In this case, it becomes appropriate to consider that issue more carefully in the ESIA. Although the exceedances are fairly small, the total volume of effluent is an order of magnitude larger in volume compared to the other WWTPs emptying in the Gulf of Gabès. Thus the issue whether the standard is sufficient must be explored more fully and within the context of a CIA.

Not only is the effluent output possibly the most significant in quantity of any of the sites being considered, it is also next to one of the most significant natural areas, easily meeting the IFC Critical Habitat definition.

2.14.8 *Use of effluent for irrigation*

From 25% to 30% of the effluent is used to irrigate 537 ha of olive trees and fodder crops.

2.14.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.14.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès and potentially the most significant one. We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.14.11 *Specific additions to terms of reference for the ESIA for this WWTP*

We see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. The ESIA for this site needs to do some thorough fieldwork and analysis for the nearby sensitive sites.

The site is also of concern in terms of its impact on the Gulf of Gabès and the CIA will be needed to inform decisions regarding this site.

2.15 **Zarsis ville**

2.15.1 *General description of the site*

The Zarsis Ville WWTP is a small WWTP (1,335 m³/d hydraulic capacity) site built in 1992. It is located on the Mediterranean, just east of Djerba Island. The outfall is on the shore about 1 km southeast of the WWTP.

The WWTP is in mixed residential / industrial area and there is 100% Modified Habitat within 1 km. The outfall is on the shore and is therefore 50% Natural Habitat and 50% Modified Habitat within 1 km.

2.15.2 *Protected areas or designated sites of international importance*

There are no designated IBA or Ramsar sites close by. The closest sites are over 10 km away.

Map 92 Zarsis ville regional setting



Map 93 Zarsis ville WWTP and outfall



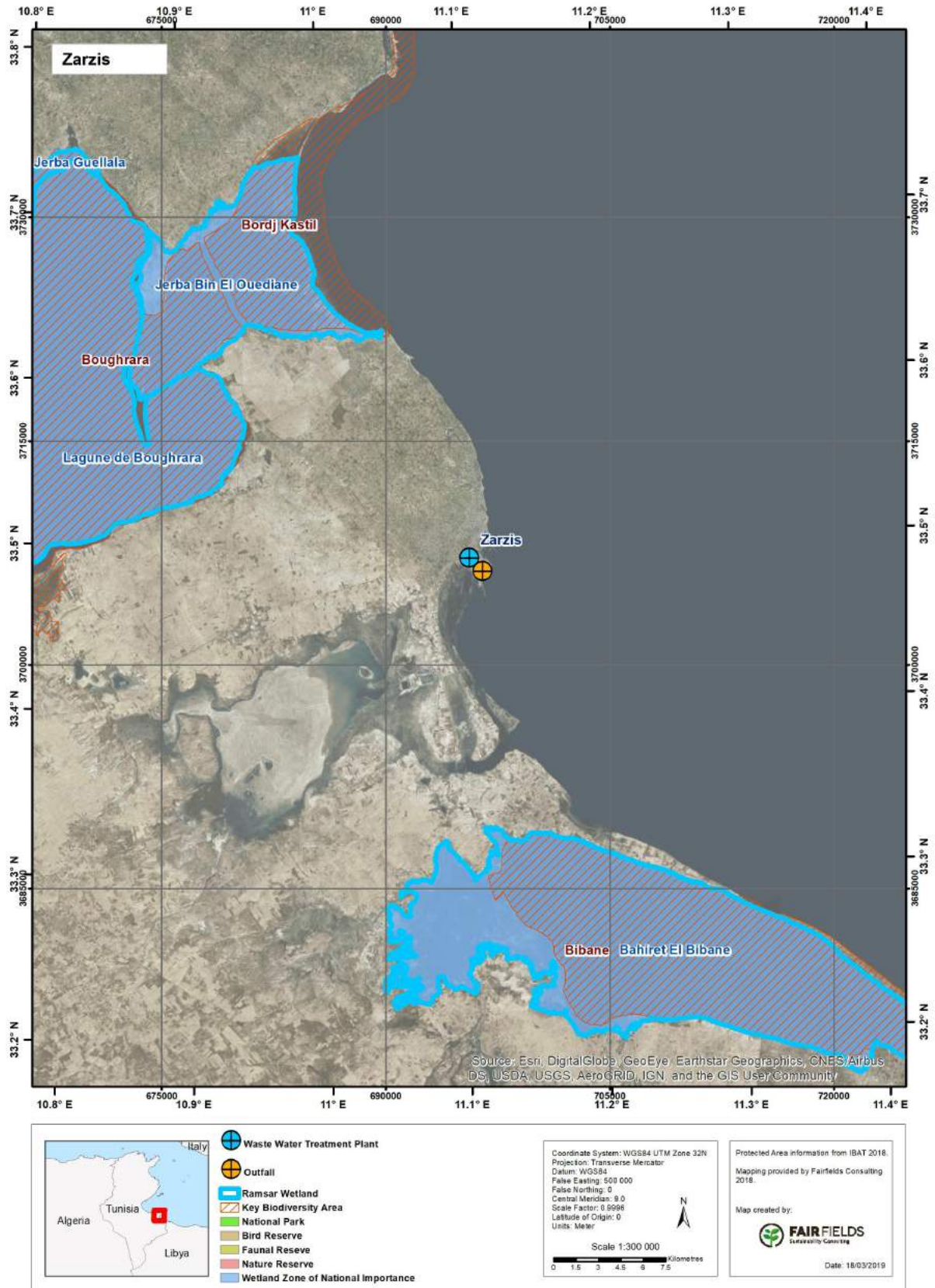
Map 94 Zarsis ville WWTP



Map 95 Zarsis ville outfall



Map 96 Zarsis ville protected areas or designated sites of international importance



2.15.2.1 IBA sites

To the south is the Bibane IBA site, designated in 2001.

Map 97 Bibane IBA site (from IBA website)



The triggers for the site are given below:

Table 21 Birbane IBA triggers (from IBA site report)

IBA Criteria

Year of most recent IBA criteria assessment: 2001

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	1,000-3,000 individuals	A4i
Great Cormorant <i>Phalacrocorax carbo</i> (http://datazone.birdlife.org/species/factsheet/22696792)	LC	winter	-	3,000-10,000 individuals	A4i
A4iii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	winter	-	20,000 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered them at the time of assessment, the current IUCN Red List category may vary from that which is in place at that time.

The 2009 monitoring assessment gave the following numbers : Greater Flamingo 258 ; Great Cormorant 3727; all waterbirds 7290.

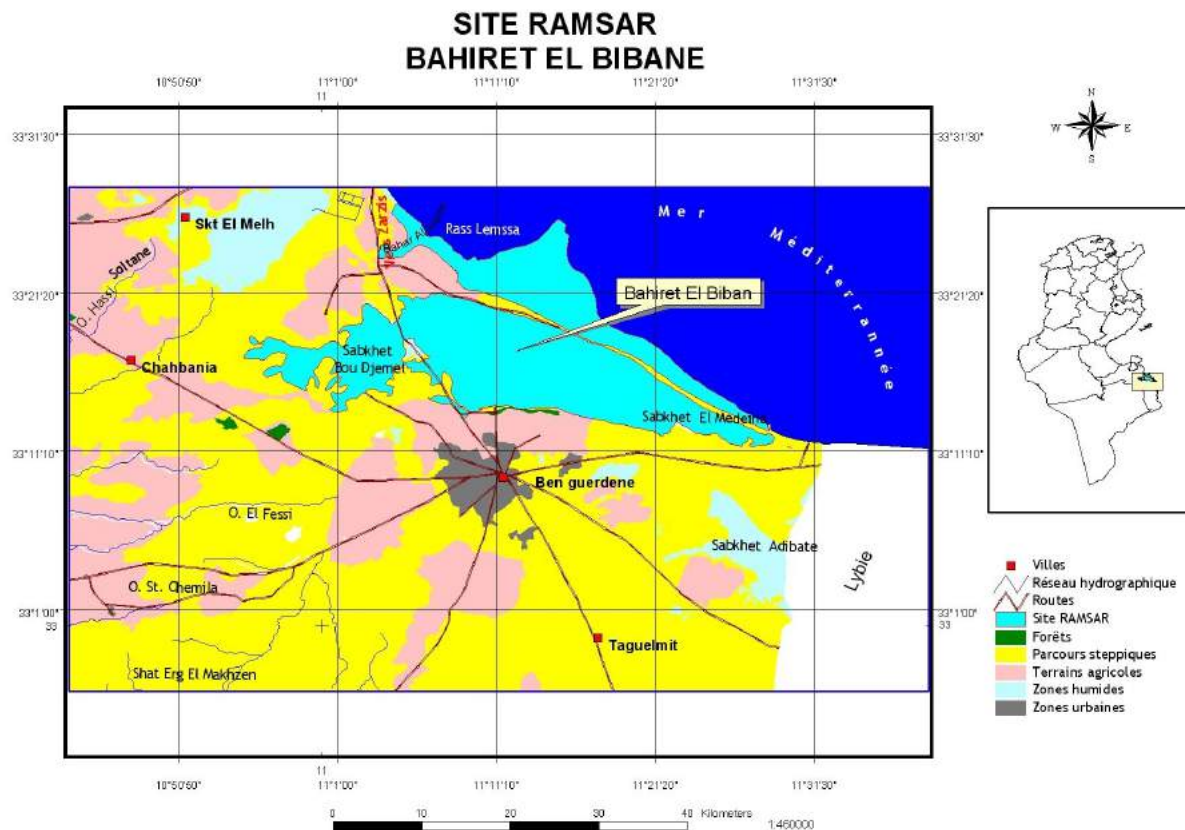
The above estimates do not trigger IFC Criterion 3 for Critical Habitat.

2.15.2.2 Ramsar sites

The WWTP site has Ramsar sites to the north and south. To the north it is the complex of Ramsar sites surrounding Djerba Island, in particular the Jerba Bin El Quediane Ramsar site (discussed in Section 2.3.2.2).

To the south is the Bahret El Bibane Ramsar site discussed here.

Map 98 Map of the Bahret El Bibane Ramsar site (from the Ramsar website)



It should be noted that the site outline in the Ramsar map (Map 98) is different from the site as depicted in the IBAT data (Map 96). The data from Ramsar is based on the 2016 update of the original 2007 Ramsar assessment so it is the most up to date version.

The Bahret El Bibane Ramsar designation was based on meeting criteria 1, 2, 3, 4, 5, 6 and 8 (see Section 3.5 for the explanation of the Ramsar criteria).

Criterion 1 deals with wetlands that contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region. This site was selected because it is an example of a lagoon system and is in comparatively good condition compared to other sites. In addition it is subject to a considerable tidal amplitude.

Criterion 2 deals with wetlands that support vulnerable, endangered, or critically endangered species or threatened ecological communities. The site was where the largest recent (1979) concentrations of the CR and possibly now extinct Slender-Billed Curlew in Tunisia were seen.

Criterion 3 deals with wetlands that support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region. The site has a good range of species found in areas of high tidal amplitude.

Criterion 4 deals with wetlands that support plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The site is important for young fish and for wintering and migrating waterbirds.

Criterion 5 deals with wetlands that regularly support 20,000 or more waterbirds. The total number of wintering birds regularly exceeds 20,000 and reach to 35,000 (2009).

Criterion 6 deals with wetlands that regularly support 1% of the individuals in a population of one species or subspecies of waterbird. This is the case of the Great Cormorant *Phalacrocorax carbo* whose numbers vary between 3.000 and 10.000 individuals and the Greater Flamingo *Phoenicopterus roseus* whose numbers vary between 1.000 to 3.000 individuals. These numbers are sufficient to meet the 1% threshold for a biogeographic population but do not meet the 1% global threshold.

Criterion 8 deals with wetlands that are an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. The site is important both for its coastal zone and the lagoon itself that harbour some 60 fish species.

The site evaluation gives further data on the site and although the Ramsar site is some distance from the WWTP, it gives a good description of the coastal area:

“La lagune de Bahiret el Bibane est une lagune rattachée à la mer par un étroit chenal et dotée d’une très grande diversité biologique; la végétation immergée est caractérisée par un herbier particulièrement riche de *Cymodocea nodosa* et de la phanérogame *Posidonia oceanica*; aux abords de la lagune on trouve une végétation halophile. Les lits marins subtidiaux en pleine mer sont d’une grande importance pour les poissons. Les deux sebkhet sont particulièrement importantes pour les oiseaux d’eau et notamment les flamants et les limicoles ; le lieu-dit El Mekhada, chenal par lequel la Sebkhet Bou Djemal est reliée à la lagune, est particulièrement propice. Les marais tidaux autour de Bahar Alouane, découverts à marée basse, sont également un lieu recherché pour l’alimentation par les limicoles. Enfin, les îlots rocheux offrent des lieux de nidification à différentes espèces d’oiseaux, notamment les sternes.

Le site est un lieu d’hivernage important pour les oiseaux d’eau cités à la section 12. C’est également une étape migratoire pour de nombreux limicoles (dont le courlis corlieu *Numenius phaeopus*) et sternes (dont *S. nilotica*). Parmi les oiseaux nicheurs on peut citer le goéland leucophaea *Larus michahellis*, la sterne pierre-garin *Sterna hirundo*, la sterne naine *S. albifrons*; la sterne caspienne y nichait autrefois, un des rares sites où sa nidification a été prouvée en Tunisie. » Ramsar site evaluation 2007)

“Parmi les oiseaux d’eau hivernants on peut citer : le canard siffleur *Anas penelope*, le canard pilet *A. acuta*, le canard souchet *A. clypeata*, la grue cendrée *Grus grus*, le courlis cendré

Numenius arquata, plusieurs espèces de goéland (*Larus melanocephalus*, *L. minutus*, *L. ridibundus* et *L. genei*), et la sterne caspienne *Sterna caspia*.” (Ransar site evaluation 2016).

2.15.2.3 Other designations

Réserve de Chasse Bhiret El Bibane

2.15.3 Other information on biodiversity values in the area

Pomatoschistus tortonesei, Tortonese’s goby (EN), is a marine fish with a range restricted to a few areas along the coast of Tunisia, adjacent Libya and Sicily. There is a small disjunct population east of Djerba Island and along to coast to Zarsis and although not flagged in the IBAT report, Zarsis WWTP is also a potential concern. The species is “a demersal species that is restricted to lagoons, brackish to slightly hypersaline, in shallows on sand near seagrass meadows, particularly *Zostera* seagrass beds. It feeds on small crustaceans and gastropods.” (Herler et al 2014).

It is unclear whether there might be a sufficient population within this restricted zone (Map 99) to meet the Criterion 1 threshold.

Map 99 Tortonese’s goby’s range near Zarsis WWTP (IUCN website)



2.15.4 *Critical Habitat*

None close to the WWTP, except for the possible consideration of the entire Gulf of Gabès as possible CH or if the impacted population of Tortonese's goby is large enough to qualify for Criterion 1.

2.15.5 *Ecosystem services*

The Bahiret El Bibane lagoon is considered as an extremely productive site in terms of fishing:

“C'est probablement le site le plus productif en termes de pêche de tout le pays. Les captures à l'intérieur de la lagune ont atteint 203 tonnes en 2000, et plus de 280 tonnes en 2001 et 2003, dans la zone contrôlée par la Direction Générale de la Pêche et de l'Aquaculture. Ces chiffres ne comprennent pas les captures effectuées par des pêcheurs privés en mer entre Jdaria (à la pointe de Solb el-Gharbi) et Ras Lemsa ; pêches réputées rapporter une tonne par jour. » (Ramsar site evaluation, 2007 version)

2.15.6 *Receiving environment*

The receiving environment is described in Section 2.2.10 of the *Etude Environnementale Supplémentaire*. According to the *Etude Environnementale Supplémentaire* there are no quantitative data on the receiving waters.

A primary concern is within the overall issue of the Gulf of Gabès and the need to evaluate impacts to the Gulf holistically and cumulatively (if indeed this site can be considered as within the Gulf).

The *Etude Environnementale Supplémentaire* provides some additional description of the receiving environment:

“Le milieu récepteur est caractérisé par : ...

- Le système naturel marin a subi des agressions d'origine aussi bien anthropique que naturelle, entraînant la détérioration de la biodiversité et la perte d'environ 90 % du couvert végétal ; [1] [SÉP]
- La bionomie benthique dans la zone du milieu récepteur se caractérise actuellement par la dominance d'invertébrés bio-indicateurs de vases instables chargées de matière organique à l'instar du Bivalve *Aloidisgibba*. Les populations benthiques remarquables sont essentiellement la Palourde *Ruditapesdecus satus* et Pinctaradiata (Bivalves), l'oursin *Paracentrotus lividus* (Echinoderme), les Eponges *Spongia officinalis* et *Hippospongia communis*.”

2.15.7 *Current effluent quality*

The site currently receives none of its waste from industrial sites.

Current values for the effluent are shown below:

Table 22 Zarzis current effluent quality from *Etude Environnementale Supplémentaire*

STEP	PRAMETRES	La qualité moyenne des eaux déversées en fonction des saisons		
		Janvier-mai	Juin-août	Septembre-décembre
ZARZIS VILLE	DBO5 mg/l	20	33	33
	DCO mg/l	92	115	98
	MES mg/l	35	41	27

For comparison with the comparable current and likely future standards:

- DBO5: below 30mg/l (new standard from 30 to 50 according to throughput)
- DCO: below 90mg/l (new standard from 120 to 160 according to throughput)
- MES: below 30mg/l (new standard from 30 to 50 according to throughput)

The data in the above table indicate that this WWTP is currently producing effluent very close to the current standard for BOD5, COD and TSS.

Exceedance data for other parameters are presented in Annexe 2 of the final *Etude Environnementale Supplémentaire* report and Annexe 1 of Volume I of this report. The data in Annexe 1 are based on an analysis of the Excel spreadsheets provided by Artelia and Annexe 2 of the final *Etude Environnementale Supplémentaire* report.

There are no heavy metal exceedances based on the data available from 2014, 2015 and 2016, There are small (less than twice the current standard) exceedances for fecal coliforms and fecal streptococcus in 2015 (but not 2014 and 2016). The data is fairly complete for heavy metals, with a total lack of measurements from 2014-16 only for lead. We conclude based on the evidence available that the WWTP is not a major problem in terms of heavy metals.

2.15.8 *Use of effluent for irrigation*

None

2.15.9 *Disposal of sludge*

The data on sludge disposal does not allow a detailed appraisal of the potential issues.

2.15.10 *Recommendations regarding the adequacy of standards for this site*

This is one of the WWTPs whose effluent ends up in the Gulf of Gabès (depending on the exact definition of the Gulf). We do not think that it is reasonable to conduct separate impact analyses of the impact to the Gulf by each WWTP individually. We have therefore assumed that a Cumulative Impact Analysis of the entire Gulf and all the effluent inputs will be conducted prior to the site-specific ESIA (see terms of reference under separate cover). We think that final conclusions about the

adequacy of the current or new municipal WWTP standards to protect the Gulf must depend on the results of that study.

2.15.11 *Specific additions to terms of reference for the ESIA for this WWTP*

None at this stage. The site is of concern in terms its impact on the Gulf of Gabès (if the site can indeed be considered within the definition of the Gulf of Gabès).

3 Appendices

3.1 Effluent standards

Table 23 Tunisian effluent standards

Parameter	Standard NT 106.02		"New Tunisian standard"			Standard NT 106.03
	Marine	Freshwater	Marine	Freshwater		Irrigation water
COD (mgO ₂ /L)	90	90	125 ; 160 si flux journalier maximal < 15kg/j	125 ; 160 si flux journalier maximal < 15kg/j		90
BOD ₅ (mgO ₂ /L)	30	30	30 ; 40 si flux journalier maximal < 15 kg/j ; 50 si lagunage et flux journalier maximal < 15 kg/	30 ; 40 si flux journalier maximal < 15 kg/j ; 50 si lagunage et flux journalier maximal < 15 kg/j		30
TSS (mg/L)	30	30	30 ; 40 si flux journalier maximal < 15 kg/j ; 50 si lagunage et flux journalier maximal < 15 kg/j	30 ; 40 si flux journalier maximal < 15 kg/j ; 50 si lagunage et flux journalier maximal < 15 kg/j		30
NTK (mg/L)	30	1	30	5		
Phosphore total (mg/L)	0,4	0,05	2	2		
Nitrate (mg/L)	90	50	90	50		
Nitrite (mg/L)	5	0,5	5	0,5		
Coliformes fécaux (NPP/100 ml)	2000	2000	2000	2000		
	1000	1000	1000	1000		

Parameter	Standard NT 106.02		"New Tunisian standard"			Standard NT 106.03
	Marine	Freshwater	Marine	Freshwater		Irrigation water
Streptocoques fécaux (NPP/100 ml)						
Salmonelles (NPP/100 ml)	Absence	Absence	Absence	Absence		
Vibrions cholériques (NPP/100 ml)	Absence	Absence	Absence	Absence		
Œufs de Nématodes intestinaux (Moyenne arithmétique)	Néant	Néant	<1/1000 ml	<1/1000 ml		<1/1000 ml
Température mesurée au moment du prélèvement (°C)	35	25	35	25		
pH	6,5 < pH < 8,5	6,5 < pH < 8,5	6,5 < pH < 8,5	6,5 < pH < 8,5		6,5 < pH < 8,5
Matières décantables (ml/l après 2 heures)	0,3	0,3	0,3	0,3		
Chlorures (mg/L)	Néant	600	Néant	700		2000
Conductivité (µS/cm)	Néant	Néant	Néant	5000		7000
Chlore actif : Cl ₂ (mg/L)	0,05	0,05	0,6	0,6		
Bioxyde de chlore: ClO ₂ (mg/L)	0,05	0,05	0,2	0,2		
Brome actif (mg/L)	0,1	0,05	0,2	0,2		
Sulfate (mg/L)	1000	600	1000	600		

Parameter	Standard NT 106.02		"New Tunisian standard"			Standard NT 106.03
	Marine	Freshwater	Marine	Freshwater		Irrigation water
Magnésium (mg/L)	2000	200	2000	300		
Calcium (mg/L)	Néant 500	500	Néant	500		
Potassium (mg/L)	1000 50	50	1000	50		
Sodium (mg/L)	Néant 300	300	Néant	700		
Fer + Al (mg/L)	Néant	Néant	5	5		5
Sulfures (mg/L)	2	0.1	2	1		
Fluorures dissous (mg/L)	5	3	3	3		3
Indice de Phénols (mg/L)	0,05 (en mer)	0.002	0,5	0,5		
Graisse et huiles saponifiables (mg/L)	20	10	10	10		
Hydrocarbures aliphatiques totaux (mg/L)	10	2	10	2		
Détergent ammoniques du type alkyl-benzène sulfanate (mg/L)	2	0.05	2	1		
Aluminium (mg/L)	5	5	Néant	Néant		
Solvants chlorés (mg/L)	0,05	0	Néant	Néant		

Parameter	Standard NT 106.02		"New Tunisian standard"			Standard NT 106.03
	Marine	Freshwater	Marine	Freshwater		Irrigation water
Bore (mg/L)	20	2	20	2,4		3
Cuivre (mg/L)	1,5	0.5	2	2		
Etain (mg/L)	2	2	2	2		
Manganèse (mg/L)	1	0.5	1	1		0.5
Zinc (mg/L)	10	5	5	5		5
Cobalt (mg/L)	0,5	0.1	0,5	0,5		0.1
Baryum (mg/L)	10	0.5	10	0,7		
Argent (mg/L)	0,1	0,05	0,1	0,1		
Arsenic (mg/L)	0,1	0,05	0,1	0,1		0.1
Cadmium (mg/L)	0,005	0,005	0,01	0,01		0.01
Cyanure (mg/L)	0,05	0,05	0,1	0,1		
Chrome hexavalent (mg/L)	0,5	0,01	0,1	0,05		0.1
Chrome trivalent (mg/L)	2	0,5	0,5	0,5		
Antimoine (mg/L)	0,1	0,1	0,1	0,1		
Nickel (mg/L)	2	0,2	1	0,2		0.2
Sélénium (mg/L)	0,5	0,05	0,5	0,05		0.05

Parameter	Standard NT 106.02		"New Tunisian standard"			Standard NT 106.03
	Marine	Freshwater	Marine	Freshwater		Irrigation water
Mercure (mg/L)	0,001	0,001	0,005	0,005		0.001
Plomb (mg/L)	0,5	0,5	0,5	0,1		1
Titane (mg/L)	0,001	0,001	1	1		
Composés organiques halogénés (AOX) (mg/L)	Néant	Néant	1	1		

3.2 CR and EN species with theoretical range within 50 km of WWTPs

Table 24 CR and EN species with theoretical range within 50 km of WWTPs

Type	Species	Status	WWTPs															Total
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebena na	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud	Zarsis Ville	
Marine plant																		0
Terrestrial Plant	<i>Convolvulus durandoi</i> Liseron de Durandoi	NT		√														1
	<i>Epilobium numidicum</i> Epilope de Numidie	CR		√														1
	<i>Pilularia minuta</i> Dwarf pillwort	EN		√														1
	<i>Rhynchospora modesti-lucennoi</i>	EN		√														1
	<i>Rumex algeriensis</i> Renouée d'Algérie	EN		√														1
	<i>Rumex tunetanus</i>	CR		√														1

Type	Species	Status	WWTPs														Total		
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebenia na	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud		Zarsis Ville	
	Patience de Tunisie																		
	<i>Serapias stenopetala</i> Sérapias à Pétales Étroits	CR		√															1
Marine invertebrate	<i>Cladocora caespitosa</i> Mediterranean pillow coral	EN	√	√	√	√				√	√	√	√		√	√	√		11
Terrestrial invertebrate	<i>Calopteryx exul</i> Glittering demoiselle	EN		√															1
	<i>Neomarius gandolphii</i>	EN		√															1
	<i>Thorectes puncticollis</i>	EN	√	√	√	√	√	√	√	√	√	√		√	√	√	√		14
Marine fish	<i>Anguilla anguilla</i> European eel	CR		√					√										2
	<i>Epinephelus marginatus</i> Dusky grouper	EN	√	√	√	√					√	√	√		√	√	√		10

Type	Species	Status	WWTPs														Total	
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebena na	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud		Zarsis Ville
	<i>Glaucostegus cemiculus</i> Blackchin guitarfish	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Leucoraja circularis</i> Sandy skate	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Leucoraja melitensis</i> Maltese skate	CR		√	√				√	√	√	√		√	√	√		9
	<i>Mobula mobular</i> Giant devil ray	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Pomatoschistus tortonesei</i> Tortonese's goby	EN	√	√	√												(Not included in IBAT report but should be)	3
	<i>Raja radula</i> Rough skate	EN	√	√	√	√			√	√	√	√		√	√	√		11

Type	Species	Status	WWTPs														Total	
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebenia na	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud		Zarsis Ville
	<i>Raja undulata</i> Undulate skate	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Rhinobatos rhinobatos</i> Common guitarfish	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Rostroraja alba</i> White skate	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Sphyrna lewini</i> Scalloped hammerhead	EN		√														1
	<i>Sphyrna mokarran</i> Great hammerhead	EN	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Squatina aculeata</i> Sawback angelshark	CR	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Squatina oculata</i> Smoothback angelshark	CR	√	√	√	√			√	√	√	√		√	√	√		11
	<i>Thunnus thynnus</i>		√	√	√	√			√	√	√	√		√	√			10

Type	Species	Status	WWTPs														Total	
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebeniana	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud		Zarsis Ville
	Atlantic bluefin tuna																	
Freshwater fish	<i>Haplochromis desfontainii</i>	EN	√				√		√			√						4
	<i>Luciobarbus antinorii</i>	DD but range restricted if not extinct					√											1
	<i>Pseudophoxinus punicus</i>	EN		√														
Marine reptile	<i>Chelonia mydas</i>	EN	√	√	√	√			√	√	√	√		√	√	√		11
	Green turtle																	
	<i>Eretmochelys imbricata</i>	CR	√	√	√	√			√	√	√	√		√	√	√		11
	Hawksbill turtle																	
Terrestrial reptile	<i>Acanthodactylus blanci</i> Blanc's fringe-toed lizard	EN		√														1
Bird	<i>Falco cherrug</i>	EN	√	√	√		√		√	√		√	√	√	√	√	√	12
	Saker falcon																	
	<i>Geronticus eremita</i>			√			√	√	√	√		√		√	√	√		9

Type	Species	Status	WWTPs														Total	
			Ben Guerdan	Choutrana	Djerba Aghir	Djerba Ajim	El Hammam	El Hancha	Gabès	Jebenia na	Kerke nnah	Marz eth/ Zarat	Medenine	Metouia / Ouethref	Sfax Nord	Sfax Sud		Zarsis Ville
	Northern bald ibis	CR (2018 status EN)																
	<i>Neophron percnopterus</i> Egyptian vulture	EN	√	√	√	√	√	√	√	√	√	√		√	√	√	√	14
	<i>Numenius tenuirostris</i> Slender-billed curlew	CR	√	√	√	√	√	√	√	√	√	√			√	√		12
	<i>Oxyura leucocephala</i> White-headed duck	EN		√			√	√	√	√		√		√	√	√		9
	<i>Puffinus mauretanicus</i> Balearic shearwater	EN	√	√	√	√			√	√	√	√		√	√	√		11
Marine mammal	<i>Balaenoptera physalus</i> Fin whale	EN	√	√	√	√			√	√	√	√		√	√	√		11
Terrestrial mammal																		0
Total			23	38	23	20	8	6	24	24	21	25	1	23	24	23	3	285

3.3 WWTP characteristics

Table 25 General characteristics of the WWTPs

(This table summarizes key data assembled early on as part of the analysis. See Table 6 in Volume 1 for a final evaluation of the presence of Natural/Critical Habitat and need for further assessment)

Name	Hydraulic Capacity (m ³ /d)	Biological Capacity (BOD ₅ /d)	Date of construction	Outfall	Classification of outfall	Industrial wastes accepted	Use of Effluent for Irrigation	Possible Critical Habitat	Other Habitat of Potential Concern
Ben Guerdan	7500	540	2019	Sebkha Menikha 2 km NW of WWTP	Freshwater	2%	No		
Choutrana	40000	20000	2007	El Khalij Canal then in sea	Marine	2%	To be progressively applied to 20%. Area 32417 ha. Cereal, fodder and tree crops.		Sebkha Ariana
Djerba Aghir	15730	3325	2001	Directly in sea via Boughrara lagoon	Marine	No	15%. 51 ha. Tree and fodder crops.	Bordj Kastil Ramsar (Djerba Guellala - Djerba Bin El Ouidan, Boughrara Lagoon)	Gulf of Gabes

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Date of construction	Outfall	Classification of outfall	Industrial wastes accepted	Use of Effluent for Irrigation	Possible Critical Habitat	Other Habitat of Potential Concern
Djerba Ajim	1950	900	2016	Directly in sea 100m out via 600m buried pipe, new outfall further out planned	Marine	No	No	Bordj Kastil Ramsar	Gulf of Gabes
El Hamma	4060	2030	2004	Sebkha chott Fejj via 7 km buried pipe	Freshwater	2%	10% used in 50 ha in Oued Echerka. Olive trees, pomegrenates, fodder.	Chott Djerid Ramsar - IBA	
El Hancha	700	300	2005	Sebkha El Jem	Freshwater	7%	Under 10% used in nearby olive and forage crops (50 ha) but data conflicts		Sebkha El Jem no designation but birds of concern. Dry about 320 days a year.
Gabes	17260	9050	1995	Directly in sea	Marine	5%	25%. 200-300 ha. Olive trees, pomegrenates and fodder		Gulf of Gabes

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Date of construction	Outfall	Classification of outfall	Industrial wastes accepted	Use of Effluent for Irrigation	Possible Critical Habitat	Other Habitat of Potential Concern
Jebeniana	1312	600	2007	Directly in sea via 4 km long buried pipe and 100m into sea	Marine	6%	10%. 10 ha. Olive trees and fodder.		Gulf of Gabes
Kerkennah	2700	950	2007	Directly in sea via 800 pipe out into sea	Marine	No	No	Kerkennah Island IBA	Gulf of Gabes
Marzeth/Zarat	2860	633	2007	3.5 km in Oued Elouday then in sea	Freshwater	No	No	Sebkhet Oum Ez-Zessar and Sebkhet El Grine Ramsar - IBA	Gulf of Gabes
Medenine	8870	3500	2000	Oued Gubiaoul (Giblawi) towards the Boughrara Lagoon	Freshwater	No	10%. 30 ha. Tree crops and fodder.	Boughrara lagoon Ramsar - IBA	
Metouia / Ouethref	2700	1735	2007	4 km in Oued Melah then in sea	Freshwater	5%	No		Gulf of Gabes
Sfax Nord	17900	8800	2004	Directly in sea via a 4km long pipe in the sea.	Marine	1%	No		Gulf of Gabes

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Date of construction	Outfall	Classification of outfall	Industrial wastes accepted	Use of Effluent for Irrigation	Possible Critical Habitat	Other Habitat of Potential Concern
Sfax Sud	49500	21600	2006	Directly in sea via 1.5 km channel	Marine	25%	25% to 30%. 537 ha. Olive trees and fodder.	Saline de Thyna Ramsar - IBA	Gulf of Gabes
Zarzis Ville	1335	800	1992	Directly in sea via 1 km buried pipe	Marine	No	No		

Table 26 Effluent characteristics of the WWTPs

(See Annexe 1 of Volume 1 for heavy metal exceedances.)

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Summer Effluent Flow			Contractual limitation			Comments
			Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	
Ben Guerdan	7500	540	Plant being built	Plant being built	Plant being built	30	90	30	Being constructed hence no coordinates for outfall
Choutrana	40000	20000	24.33	81	25	30	90	30	Supposedly only represents 5% of load in Gulf of Tunis

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Summer Effluent Flow			Contractual limitation			Comments
			Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	
Djerba Aghir	15730	3325	23.6	84	20.5	30	90	30	Outfall 500m from WWTP
Djerba Ajim	1950	900	Still being tested. No data.	Still being tested. No data.	Still being tested. No data.	30	90	30	Outfall 650m from WWTP.
El Hamma	4060	2030	170	407	110.6	30	90	30	Apparently very little of the water reaches the FW system, most evaporates or percolates down.
El Hancha	700	300	18.66	62	17.33	30	90	30	Potential birds of concern at outfall. Oxyura leucocephala of most concern. Others only on basis of percent of pop which will likely not be met in this small water body. Assumed that lots of water lost by evaporation and percolation.
Gabes	17260	9050	170	407.33	210	30	90	30	Right next to GCT. Assume that the WWTP only represents 10% of the local input.
Jebeniana	1312	600	26	84	26.33	30	90	30	

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Summer Effluent Flow			Contractual limitation			Comments
			Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	
Kerkennah	2700	950	27.66	224.33	30	30	90	30	Only local source of effluent into receiving body
Marzeth/Zarat	2860	633	23	85	19	30	90	30	Ground permeable and the waters of the Oued don't reach the sea. The Oued doesn't receive any other pollutants.
Medenine	8870	3500	29	80	23	30	90	30	Outfall at edge of WWTP. Oued dry most of time, water will percolate down.
Metouia / Ouethref	2700	1735	24.5	80.33	23	30	90	30	Slaughter houses account for most of waste waters to receiving body. WWTP accounts for only 5%.
Sfax Nord	17900	8800	19	209	18	30	90	30	
Sfax Sud	49500	21600	90	209	151.33	30	90	30	In industrial zone next to phosphate plant. Contamination by mercury, lead, cadmium and radioactive elements occurs in both surface and ground water..

Name	Hydraulic Capacity (m3/d)	Biological Capacity (BOD5/d)	Summer Effluent Flow			Contractual limitation			Comments
			Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	Effluent BOD5 mg/l	Effluent COD mg/l	Effluent TES mg/l	
Zarzis Ville	1335	800	33	115	41	30	90	30	In the midst of diverse industrial activities that release effluents.

3.4 IBA Criteria

3.4.1 IBA global criteria

From the IBA website: <http://datazone.birdlife.org/site/ibacritglob>

A1. Globally threatened species

Criterion: The site is known or thought regularly to hold significant numbers of a globally threatened species.

Notes: The site qualifies if it is known, estimated or thought to hold a population of a species categorized by the IUCN Red List as Critically Endangered, Endangered or Vulnerable. In general, the regular presence of a Critical or Endangered species, irrespective of population size, at a site may be sufficient for a site to qualify as an IBA. For Vulnerable species, the presence of more than threshold numbers at a site is necessary to trigger selection.

A2. Restricted-range species

Criterion: The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area (SA).

Notes: This category is for species of Endemic Bird Areas (EBAs). EBAs are defined as places where two or more species of restricted range, i.e. with world distributions of less than 50,000 km², occur together. More than 70% of such species are also globally threatened. Also included here are species of Secondary Areas. A Secondary Area (SA) supports one or more restricted-range species, but does not qualify as an EBA because less than two species are entirely confined to it. Typical SAs include single restricted-range species which do not overlap in distribution with any other such species, and places where there are widely disjunct records of one or more restricted-range species, which are clearly geographically separate from any of the EBAs.

A3. Biome-restricted species

Criterion: The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.

Notes: This category applies to groups of species with largely shared distributions which occur mostly or wholly within all or part of a particular biome and are, therefore, of global importance. As with EBAs, it is necessary that a network of sites be chosen to protect adequately all species confined to each biome and, as necessary, in each range state in which the biome occurs. The 'significant component' term in the Criterion is intended to avoid selecting sites solely on the presence of one or more biome-restricted species that are common and adaptable within the EBA and, therefore, occur at other chosen sites. Additional sites may, however, be chosen for the presence of one or a few species which would, e.g. for reasons of particular habitat requirements, be otherwise under-represented.

A4. Congregations

Criterion: The site is known or thought to hold congregations of $\geq 1\%$ of the global population of one or more species on a regular or predictable basis.

Notes: This criterion can be applied to seasonal (breeding, wintering or migratory) congregations of any waterbird, seabird or terrestrial bird species. Sites can qualify whether thresholds are exceeded simultaneously or cumulatively, within a limited period. In this way, the criterion covers situations where a rapid turnover of birds takes place (including, for example, for migratory landbirds).

3.4.2 *IBA European criteria*

From the IBA website: <http://datazone.birdlife.org/site/ibacriteuro>

At the European (=regional) level, three criteria have been applied to identify IBAs for congregatory species of birds, species of conservation concern in Europe and species that are largely restricted to Europe. A further six IBA criteria were developed exclusively for use within the European Union (=sub-regional criteria) to identify sites that comply with the requirements of Special Protection Areas (SPAs) designated under the Wild Birds Directive.

B: European IBA criteria

B1. Congregations

- i. The site is known or thought to hold $\geq 1\%$ of a flyway or other distinct population of a waterbird species.
- ii. The site is known or thought to hold $\geq 1\%$ of a distinct population of a seabird species.
- iii. The site is known or thought to hold $\geq 1\%$ of a flyway or other distinct population of other congregatory species.
- iv. The site is a 'bottleneck' site where over 5,000 storks, or over 3,000 raptors or cranes regularly pass on spring or autumn migration.

B2. Species with an unfavourable conservation status in Europe

The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe (SPEC1/2/3) and for which the site-protection approach is thought to be appropriate.

B3. Species with a favourable conservation status in Europe

The site is one of the 'n' most important in the country for a species with a favourable conservation status in Europe but concentrated in Europe (Non-SPEC^E [previously, SPEC4]) and for which the site-protection approach is thought to be appropriate.

C: European Union

C1. Species of global conservation concern

The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.

C2. Concentrations of a species threatened at the European Union level

The site is known to regularly hold at least 1% of a flyway population or of the EU population of a species threatened at the EU level (listed on Annex I and referred to in Article 4.1 of the EC Birds Directive).

C3. Congregations of migratory species not threatened at the EU level

The site is known to regularly hold at least 1% of a flyway population of a migratory species not considered threatened at the EU level (as referred to in Article 4.2 of the EC Birds Directive) (not listed on Annex I).

C4. Congregatory – large congregations

The site is known to regularly hold at least 20,000 migratory waterbirds and/or 10,000 pairs of migratory seabirds of one or more species.

C5. Congregatory – bottleneck sites

The site is a 'bottleneck' site where at least 5,000 storks (Ciconiidae) and/or at least 3,000 raptors (Accipitriformes and Falconiformes) and/or 3,000 cranes (Gruidae) regularly pass on spring or autumn migration.

C6. Species threatened at the European Union level

The site is one of the five most important in the European region (NUTS region) in question for a species or subspecies considered threatened in the European Union (i.e. listed in Annex I of the EC Birds Directive).

Notes: The "n" in criteria B2 and B3 indicates the maximum number of sites that can be identified in any given country and is proportional to the minimum size of the national population relative to the minimum estimate of the total European population. The country should hold a least 1% of the European population and each site should hold at least 1% of the national population.

3.4.3 IBA Middle Eastern criteria

From the IBA website: <http://datazone.birdlife.org/site/ibacritme>

The following regional IBA criteria have been applied in the Middle East:

B: Important Bird and Biodiversity Areas - Middle Eastern importance

B1: Regionally important congregations

The site may qualify on any one of the three criteria listed below:

- i. The site is known or thought to hold \geq 1% of a flyway or other distinct population of a waterbird species.
- ii. The site is known or thought to hold \geq 1% of a distinct population of a seabird species.

iv. The site is a 'bottleneck' site where over 5,000 storks, or over 3,000 raptors or cranes regularly pass on spring or autumn migration.

B2: Species with an unfavourable conservation status in the Middle East

The site is one of the five most important sites in the country/territory for a species with an unfavourable conservation status in the Middle East (threatened or declining throughout all or part of their range in the region) and for which the site-protection approach is thought to be appropriate.

B3: Species with a favourable conservation status but concentrated in the Middle East

The site is one of the five most important sites in the country/territory for a species with a favourable conservation status in the Middle East but with its global range concentrated in the Middle East, and for which the site-protection approach is thought to be appropriate.

3.5 Ramsar Criteria

From the Ramsar website: http://archive.ramsar.org/cda/en/ramsar-about-faqs-what-are-criteria/main/ramsar/1-36-37%5E7726_4000_0__

The Criteria for Identifying Wetlands of International Importance as adopted by the 4th, 6th, and 7th Meetings of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971) to guide implementation of Article 2.1 on designation of Ramsar sites

Group A of the Criteria. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B of the Criteria. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Specific criteria based on other taxa

Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

3.6 Data for the Kneiss IBA and Ramsar sites

Extract from the Iles Keiss Ramsar report :

“Les Iles Kneiss et leurs zones intertidales forment le noyau central de la zone marine du Golfe de Gabès soumise à la marée. En effet, ce golfe, qui s'étend sur une longueur de 200 kilomètres entre Sfax et la frontière libyenne, est une des très rares zones en Méditerranée où l'effet de la marée est importante (variation de niveau entre marée haute et marée basse de deux mètres) ; l'unique autre zone en Méditerranée où la marée est d'une amplitude comparable est située en Haut Adriatique (Lagune de Venise). Les Iles Kneiss forment un groupe de quatre îlots qui émergent de la mer à marée haute, mais qui sont entourés de vastes vasières à marée basse. La zone marine est dotée d'une riche végétation marine (composée notamment d'herbiers de *Cymodocea nodosa*) qui supporte des populations très riches de poissons et de coquillages, notamment la palourde. Mais le principal intérêt biologique de la zone réside dans les énormes effectifs d'oiseaux d'eau, en particulier les limicoles, (chiffres maximaux dépassant 300.000 individus) qui y séjournent pendant différentes périodes de l'année. C'est sans doute la zone la plus importante de toute la Méditerranée pour les limicoles (comparable aux grands estuaires de l'Atlantique oriental), ce qui explique pourquoi une série de missions ornithologiques visite le site depuis les années 1980 pour faire des recensements et des campagnes de baguage...

La présence de la tortue de mer *Caretta caretta*, espèce en danger, est signalée dans les eaux peu profondes par les pêcheurs.

En ce qui concerne le Critère 4, le site de Kneiss le remplit pleinement, en fournissant à une gamme d'oiseaux d'eau une espace vitale à différents stades critiques de leur cycle de vie ; il

présente une étape essentielle pour de nombreuses espèces de limicoles au cours de leur migrations entre l'Afrique sous saharienne et la zone arctique de nidification ; il fournit des lieux de nidification à plusieurs espèces d'oiseaux d'eau, en particulier l'aigrette garzette *Egretta garzetta* (plus de 100 couples), le chevalier gambette *Tringa totanus*, le goéland railleur *Larus genei* (2.000 couples), le goéland leucophée *L. michahellis* (2.000 couples), les sternes naine *Sterna albifrons*, pierre-garin *S. hirundo* et hansel *S. nilotica* (quelques couples de chacune des trois espèces) ; enfin il abrite pendant l'hiver, période de grand stress pour les oiseaux d'eau migrateurs, des effectifs importants (des dizaines de milliers dans le cas des limicoles) de plusieurs espèces, notamment la spatule blanche *Platalea leucorodia* le flamant rose *Phoenicopterus (ruber) roseus*, les limicoles et les goélants. Sur l'île principale on note la présence d'une graminée pérenne *Cenchrus ciliaris*, devenue rare dans les steppes continentales, qui a trouvé un refuge sur l'île.

Le site remplit facilement le Critère 5, qui indique qu'une zone humide est d'importance internationale si elle abrite, habituellement, un minimum de 20.000 oiseaux d'eau. Les effectifs de limicoles qui se reposent à marée haute sur l'île après s'être nourris sur les vasières avoisinantes, dépassent - et largement - le seuil minimum en hiver, au printemps et en automne, et il convient de souligner qu'il s'agit à chaque saison d'espèces et d'individus différents. Fishpool & Evans (2001) indiquent que les effectifs d'oiseaux d'eau présents ont atteint 330.000 individus; le site étant difficile d'accès et très étendu, les recensements complets se font généralement au cours de campagnes spéciales organisées tous les quatre ou cinq ans (van Dijk *et al*, 1986 ; van der Have *et al*, 1997). Les observations ponctuelles récentes confirment que des effectifs de cet ordre continuent à fréquenter le site.

Les conditions du Critère 6 (le fait d'abriter habituellement 1% des individus d'une population biogéographique d'une/des espèce(s) ou sous-espèce d'oiseau d'eau) sont remplies par un catalogue incroyable d'espèces, surtout des limicoles, qui illustre bien le valeur du site au niveau méditerranéen et international : la spatule blanche *Platalea leucorodia* (200 à 1.000 individus hivernants ; seuil 120) ; le flamant rose *Phoenicopterus (ruber) roseus* (600 à 7.000 individus en hiver ; seuil 1.000) ; l'huîtrier pie *Haematopus ostralegus* (10.000 à 20.000 individus en hiver; seuil 10.200); le pluvier argenté *Pluvialis squatarola* (1.000 à 32.500 (!) hivernants; seuil 2.500); le grand gravelot *Charadrius hiaticula* (3.000 à 10.000 hivernants ; seuil 730) ; le gravelot à collier interrompu *Ch. alexandrinus* (5.000 à 10.000 hivernants, quelques nicheurs ; seuil 660) ; la barge à queue noire *Limosa limosa* (2.000 à 7.000 hivernants ; seuil 1.700) ; la barge rousse *Limosa lapponica* (2.000 à 5.000 hivernants ; seuil 1.200) ; le courlis cendré *Numenius arquata* (800 à 6.000 hivernants ; seuil 4.200) ; *Tringa totanus* (40.000 hivernants, quelques nicheurs aussi ; seuil 2.500) ; le tourne-pierre à collier *Arenaria interpres* (600 à 4.000 hivernants ; seuil 1,000) ; le bécasseau minute *Calidris minuta* (5.000 à 8.000 en hiver ou en période de passage ; seuil 2.000) ; le bécasseau cocorli *C. ferruginea* (3.000 à 9.625 en hiver ou en période de migration ; seuil 7.400) ; le bécasseau variable *C. alpina* (125.000 hivernants ; seuil 13.300) ; le goéland leucophée *Larus michahellis* (600 à 8.000 hivernants, population nicheuse en expansion ; seuil 7.000) ; le goéland railleur *L. genei* (1.000 à 2.500 hivernants, effectifs nicheurs en hausse récente ; seuil 1.800) ; la sterne hansel *Sterna nilotica* (250 à 400 individus en période de

reproduction ; seuil 130) ; et enfin la sterne caugek *Sterna sandvicensis* (1.000 à 3.000 hivernants ; seuil 1.700). Les chiffres ci-dessus sont cités par Fishpool & Evans (2001), et se basent sur les données de van Dijk *et al* (1986) et van der Have *et al* (1997) ; ils sont repris ici pour illustrer la richesse du site..

Triggers from the Kneiss IBA site report :

IBA Criteria

Year of most recent IBA criteria assessment: 2001

Populations of IBA trigger species

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greater Flamingo <i>Phoenicopterus roseus</i> (http://datazone.birdlife.org/species/factsheet/22697360)	LC	winter	-	600-7,000 individuals	A4i
Red-necked Nightjar <i>Caprimulgus ruficollis</i> (http://datazone.birdlife.org/species/factsheet/22689875)	LC	breeding	1999	present	A3
Eurasian Spoonbill <i>Platalea leucorodia</i> (http://datazone.birdlife.org/species/factsheet/22697555)	LC	winter	-	200-1,000 individuals	A4i
<i>Haematopus ostralegus</i> (http://datazone.birdlife.org/species/factsheet/22693613)	NR	winter	-	10,000-20,000 individuals	A4i
<i>Charadrius alexandrinus</i> (http://datazone.birdlife.org/species/factsheet/22693818)	NR	winter	-	5,000-10,000 individuals	A4i
Grey Plover <i>Pluvialis squatarola</i> (http://datazone.birdlife.org/species/factsheet/22693749)	LC	winter	-	1,000-32,500 individuals	A4i
Common Ringed Plover <i>Charadrius hiaticula</i> (http://datazone.birdlife.org/species/factsheet/22693759)	LC	winter	-	3,000-10,000 individuals	A4i
Eurasian Curlew <i>Numenius arquata</i> (http://datazone.birdlife.org/species/factsheet/22693190)	NT	winter	-	800-6,000 individuals	A4i
Bar-tailed Godwit <i>Limosa lapponica</i> (http://datazone.birdlife.org/species/factsheet/22693158)	NT	winter	-	2,000-5,000 individuals	A4i
Black-tailed Godwit <i>Limosa limosa</i> (http://datazone.birdlife.org/species/factsheet/22693150)	NT	winter	-	2,000-7,000 individuals	A4i
Ruddy Turnstone <i>Arenaria interpres</i> (http://datazone.birdlife.org/species/factsheet/22693336)	LC	winter	-	600-4,000 individuals	A4i
Curlew Sandpiper <i>Calidris ferruginea</i> (http://datazone.birdlife.org/species/factsheet/22693431)	NT	winter	-	3,000-9,625 individuals	A4i
Dunlin <i>Calidris alpina</i> (http://datazone.birdlife.org/species/factsheet/22693427)	LC	winter	-	125,000 individuals	A4i
Little Stint <i>Calidris minuta</i> (http://datazone.birdlife.org/species/factsheet/22693379)	LC	winter	-	5,000-8,000 individuals	A4i
Common Redshank <i>Tringa totanus</i> (http://datazone.birdlife.org/species/factsheet/22693211)	LC	winter	-	40,000 individuals	A4i
<i>Larus cachinnans</i> (http://datazone.birdlife.org/species/factsheet/22694365)	NR	winter	-	600-8,000 individuals	A4i
<i>Sterna nilotica</i> (http://datazone.birdlife.org/species/factsheet/22694505)	NR	breeding	-	250-400 breeding pairs	A4i
Slender-billed Gull <i>Larus genei</i> (http://datazone.birdlife.org/species/factsheet/22694428)	LC	winter	-	1,000-2,500 individuals	A4i
Sandwich Tern <i>Thalasseus sandvicensis</i> (http://datazone.birdlife.org/species/factsheet/22694591)	LC	winter	-	1,000-3,000 individuals	A4i
Temminck's Lark <i>Eremophila bilopha</i> (http://datazone.birdlife.org/species/factsheet/22717438)	LC	resident	1999	present	A3
Sardinian Warbler <i>Sylvia melanocephala</i> (http://datazone.birdlife.org/species/factsheet/22716959)	LC	resident	1999	present	A3

Spectacled Warbler <i>Sylvia conspicillata</i> (http://datazone.birdlife.org/species/factsheet/22716976)	LC	resident	1999	present	A3
Spotless Starling <i>Sturnus unicolor</i> (http://datazone.birdlife.org/species/factsheet/22710893)	LC	resident	1999	present	A3
Black-eared Wheatear <i>Oenanthe hispanica</i> (http://datazone.birdlife.org/species/factsheet/22710302)	LC	breeding	1999	present	A3
Buff-rumped Wheatear <i>Oenanthe moesta</i> (http://datazone.birdlife.org/species/factsheet/22710299)	LC	resident	1999	present	A3
Black Wheatear <i>Oenanthe leucura</i> (http://datazone.birdlife.org/species/factsheet/22710259)	LC	resident	1999	present	A3
A4iii Species group - waterbirds (http://datazone.birdlife.org/species/factsheet/0)	n/a	winter	-	100,000-499,999 individuals	A4iii

Note: This table presents the IBA criteria triggered and the species that triggered then at the time of assessment, the current IUCN Red List category may vary from that which in place at that time.

Condition of key/trigger populations (state)						
Scientific	Common	TargetPop	ActualPop	Units	Remaining	Result
<i>Phoenicopterus roseus</i>	Greater Flamingo	1325	3968	individuals	100	favourable
<i>Platalea leucorodia</i>	Eurasian Spoonbill	120	185	individuals	100	favourable
<i>Charadrius alexandrinus</i>		660	3168	individuals	100	favourable
<i>Pluvialis squatarola</i>	Grey Plover	2500	3690	individuals	100	favourable
<i>Charadrius hiaticula</i>	Common Ringed Plover	730	99	individuals	14	very unfavourable
<i>Numenius arquata</i>	Eurasian Curlew	8500	2950	individuals	35	very unfavourable
<i>Limosa lapponica</i>	Bar-tailed Godwit	1200	251	individuals	21	very unfavourable
<i>Arenaria interpres</i>	Ruddy Turnstone	1500	368	individuals	25	very unfavourable
<i>Calidris ferruginea</i>	Curlew Sandpiper	10000	4580	individuals	46	unfavourable
<i>Calidris alpina</i>	Dunlin	13300	50800	individuals	100	favourable
<i>Calidris minuta</i>	Little Stint	2000	18200	individuals	100	favourable
<i>Tringa totanus</i>	Common Redshank	2500	11600	individuals	100	favourable
<i>Larus genei</i>	Slender-billed Gull	1700	982	individuals	58	unfavourable

3.7 Additional data from the Chott El Jerid Ramsar site report

14. Caractéristiques physiques du site:

Décrire, le cas échéant, la géologie, la géomorphologie; les origines - naturelles ou artificielles; l'hydrologie; le type de sol; la qualité de l'eau; la profondeur et la permanence de l'eau; les fluctuations du niveau de l'eau; les variations dues aux marées; la zone en aval; le climat général; etc.

Grande cuvette naturelle, limitée au nord par la chaîne de montagnes du Cherb (altitude moyenne 370m), et par la plaine au pied de ces montagnes, zone de réception des alluvions, des colluvions et des eaux de ruissellement ; au sud se perd dans les dunes sahariennes.

Géologie du chott : sédiments argileux, couverts par des croûtes de sel et de gypse. Le chott occupe la cuvette d'un synclinal asymétrique. La moitié nord date du Crétacé, et la moitié sud du Précambrien.

Le chott a connu, il y a 100.000 ou 200.000 ans avant l'ère présente, des périodes plus humides, au cours desquelles il s'est transformé en lac permanent, grâce surtout aux sources. Par endroits le fond du lac a été recouvert par une tranche d'eau de 25 m de profondeur (Ben Ouezdou, 1998). Des traces

de vie aquatique ont été découvertes sur les bordures actuelles des chotts, sous la forme de coquilles à l'état fossile, dominées par les *Cadmium*. On a cru à un moment donné que le lac fut relié, pendant la période Quaternaire, à la mer, au sud de la ville de Gabes ; cependant, la présence d'un seuil entre le Golfe de Gabes et les Chotts El Jerid et Fejaj constitue un obstacle à la pénétration de l'eau marine, d'autant plus que les deux chotts sont situés à une altitude de 15 mètres au-dessus de la mer.

Les changements climatiques ont par la suite favorisé l'évaporation, ce qui a créé les conditions actuelles; les prélèvements effectués par l'évaporation à l'heure actuelle sont sept fois plus importants que le volume d'eau apporté par la pluie. En général, il y a peu d'eau à la surface ; il s'agit plutôt d'une couche humide hypersalée ; cependant, au cours des années de forte pluviométrie dans le sud, la surface peut être inondée.

Dans le sous-sol par contre, deux nappes profondes, enfouies dans les couches géologiques à des profondeurs de 600 et de 2500 mètres, constituent d'importants gisements d'eau, considérés comme l'unique potentiel hydrologique de la région.

Climat de type aride avec une saison estivale chaude et sèche, pendant laquelle les températures moyennes varient entre 25° et 40°C, et une période hivernale pendant laquelle les températures moyennes varient entre 10° et 24°C ; les valeurs absolues varient entre -3° et +50°C. La différence de température est très sensible entre été et hiver, et encore plus entre jour et nuit, surtout en hiver. La pluviométrie moyenne annuelle se situe entre 75 et 100 mm, mais les valeurs réelles varient énormément d'une année à l'autre. L'évaporation est très intense, surtout en été. Les vents de sable sont fréquents, surtout au printemps. Le sirocco ou chéhili est un vent chaud et sec estival d'origine saharienne qui souffle pendant 55 jours par an et peut faire augmenter les températures d'une dizaine de degrés.

Du point de vue bioclimatique, le Parc national de Dghoumes appartient à l'étage bioclimatique aride inférieur à saharien supérieur.

16. Valeurs hydrologiques:

Décrire les fonctions et valeurs de la zone humide du point de vue de la recharge de l'eau souterraine, de la maîtrise des crues, du captage des sédiments, de la stabilisation des rives; etc.

Le Chott El Jerid joue un rôle essentiel dans le régime hydrologique de toute la région avoisinante. En effet les oasis de Degache, de Tozeur, de Nefza, ainsi que le groupe d'oasis du Nefzaoua, sont nourris par les eaux des nappes artésiennes souterraines. Cette alimentation en eau se faisait autrefois naturellement à travers des sources artésiennes ; aujourd'hui elle se fait par sondage.

Pendant les rares hivers humides (comme par exemple celui de 1990/1991), la surface du Chott peut être recouverte par une mince lame d'eau.

17. Types de zones humides

a) présence:

NB : La « sebkha » ou « sebkhet » est une appellation très fréquente en langue arabe des zones humides en Afrique du Nord. Il s'agit normalement d'un bassin, généralement endoréique (c'est-à-dire fermé et sans issue), qui reçoit l'eau de crue ou de ruissellement du bassin versant où il est situé ; les

eaux sont plus profondes en hiver, mais ont tendance à s'évaporer en été, de sorte que le sol devient très salé, parfois recouverte d'une couche de sel ; les sebkhet en zone désertique peuvent rester à sec pendant de longues années. (Quelquefois, généralement dans le cas de lacs de très grandes dimensions, on utilise également le mot arabe « chott » pour désigner des zones humides de ce type). En général donc il convient de les classer comme type **R** du système Ramsar, ou comme **Ss** dans le cas de zones de taille plus petite ; rares sont les sebkhet permanentes qui pourraient être classées comme **Q** dans le système Ramsar. Parfois on utilise l'appellation « sebkhet » pour des zones côtières qui sont plutôt des lagunes, ayant un contact direct avec la mer ; à ce moment-la, la

classification **J** semble opportun. En arabe tunisien, on distingue entre « sebkhet » qui est un bassin salé et incultivable, et « garaet » qui est un bassin à eau douce dont les terres, une fois les eaux baissées, peuvent être cultivées ; une garaet sera normalement à classer comme **P** (ou pour de petites mares **Tp**) selon le système Ramsar.

Dans le cas du Chott El Jerid, il s'agit bel et bien d'une dépression endoréique, qui porte le nom de chott plutôt que de sebkhet et répond donc au type Ramsar **R**.

Zones humides continentales^[L]_[SEP]**N** : Rivières/cours d'eau/ruisseaux saisonniers/intermittents/irréguliers.

R : Lacs salés et étendues/saumâtres/alcalins saisonniers/intermittents.

b) dominance:

La vaste majorité du site (plus de 95%) correspond au type « **R** » ; certaines zones en bordure, formées par le lit mineur des cours d'eau qui arrivent au lac, sont du type « **N** ».

18. Caractéristiques écologiques générales:

La plus grande partie du site est occupée par la zone de boues et d'eaux peu profondes du Chott. Celle-ci est hyper salée et ne supporte pratiquement pas de végétation.

Le pourtour nord (y compris le Parc National de Dghoumes) est une zone steppique sèche (appelé en arabe « hmadha »), caractérisée par une végétation halophile, qui a sa flore et sa faune naturelles caractéristiques, exploitée par le pâturage des chameaux et à un degré moindre, des moutons et des chèvres.

La zone au sud du chott comprend des dunes sableuses.

19. Flore remarquable:

Dans les zones de glaciis limoneux en bordure nord non salée du Chott il se trouvait autrefois une steppe d'*Acacia raddiana*, disparue depuis plusieurs décennies. Actuellement cette zone abrite une végétation dominée par la périploque *Periploca laevigata*, le rhus *Rhus tripartitum* et le retam *Retama retam*. Les plantes halophiles essentielles du « hmadha », plus près du Chott, sont les salicornes *Salicornia arabica*, *Halocnemum*, *Arthrocnemum indicum*, l'atriplex *Atriplex* sp. et la souida *Suaeda*.

20. Faune remarquable:

La nidification du flamant rose en période humide était déjà constatée aux années 1940 par Doumergue, et on a noté 3.800 couples au printemps de 1991. Des effectifs importants de flamants, dépassant de loin le seuil d'1%, peuvent s'observer les hivers humides (parfois plus de 20.000 individus

: 17.000 individus en hiver 1990/91, Johnson in WIWO, 1993). On y observe également des oiseaux d'eau spécialisés, inféodés aux zones semi arides, comme le tadorne casarca *Tadorna ferruginea*. Parmi les fourmis il faut citer *Cataglyphis halophila* ; parmi les crustacés *Artemia*.

La faune du Parc de Dghoumes, non loin du Chott, comprend les mammifères suivants : le mouflon à manchettes *Ammotragus lervia*, le lièvre *Lepus capensis pallidor*, le chat sauvage *Felix silvestris libyca*, le chacal *Canis aureus*, le renard des sables *Vulpes zerda* et le porc-épic *Hystrix cristata*. Parmi les oiseaux on peut citer les espèces steppiques suivantes, typiques du biome Sindo-Saharien : le ganga tacheté *Pterocles senegallus* ; le sirli du désert *Alaemon alaudipes* ; l'ammomane isabelline *Ammomanes deserti* ; et le dromoique du Sahara *Scotocerca inquieta*, ainsi que différentes espèces de traquet *Oenanthe* sp. On note parmi les reptiles la présence de la vipère à queue noire, de la vipère des pyramides, du varan du désert et du fouette-queue.

La présence du flamant rose en périodes de nidification et d'hivernage, les effectifs totaux d'oiseaux d'eau, ainsi que la présence de neuf sur seize espèces du biome Méditerranée - Afrique du Nord et de quatre sur treize espèces du biome Sindo-Saharien, a valu au site d'être classé par BirdLife International comme Zone Importante pour la Conservation des Oiseaux (ZICO/IBA), site TN 035 (Fishpool & Evans 2001).

21. Valeurs sociales et culturelles:

Des sites préhistoriques existent dans la région de Kebili. A l'entrée de presque chaque gorge au nord du Chott, on trouve des escargotières d'âge capsien (8.000 ans) ou néolithique (5.000 ans). Les noms des villes témoignent souvent de leurs origines romaines : Tozeur (Thusuros) ; Nefta (Nepte). Le long des montagnes au nord du Chott on trouve des traces du *Limes*, muraille en pierre conçue par les romains comme ligne défensive fortifiée contre les tribus berbères du sud.

Actuellement, les oasis des régions du Jerid et du Nefzaoua ont une culture et une ambiance propres, basées d'une part sur la production « à trois niveaux » dans les oasis (dattes, arbres fruitiers à l'ombre des palmiers, et cultures maraîchères au sol) et d'autre part sur les activités en bordure du désert (élevage du chameau).

Dans le Chott lui-même on pratique près de la route transversale la production de sel. Il y a eu par le passé de nombreuses recherches de pétrole, jusqu'à présent sans succès. Le pourtour du Chott, notamment en bordure nord, est exploité pour le pâturage du bétail. Une mise en défens intégrale est pratiquée au Parc de Dghoumes.

22. Régime foncier/propriété:

a) dans le site Ramsar:

En plus grande partie domaine de l'état: le Chott lui-même fait partie du Domaine Public Hydraulique ; les terrains limitrophes relèvent partiellement du domaine de l'état (par exemple le Parc de Dghoumes) et partiellement de la propriété privée.

b) dans la région voisine:

Les terrains de parcours et les zones de culture des oasis appartiennent en général à des propriétaires privés.

23. Occupation actuelle des sols (y compris l'eau):

a) dans le site Ramsar:

Peu d'activités dans le Chott lui-même, vu les conditions climatiques et hydrologiques (trop peu d'eau, de qualité trop salée). Exploitation de sel dans certains lieux près de la route ; recherches, à un rythme actuellement très peu intensif, de pétrole et d'autres gisements d'intérêt économique.

Pâturage aux abords septentrionaux du Chott et, les bonnes années, dans les dunes au sud.

b) dans la région voisine /le bassin versant:

Pâturage, cultures dans les oasis, tourisme de désert axé sur les villes, avec nuits sous la tente et promenade (généralement de très courte durée !) à chameau.

24. Facteurs (passés, présents ou potentiels) défavorables affectant les caractéristiques écologiques du site, notamment les changements dans l'utilisation des sols (y compris l'eau) et les projets de développement:

a) dans le site Ramsar:

Aléas du climat. Surpâturage sur les bords du Chott, provoquant une perte du couvert végétal et une érosion accrue.

b) dans la région voisine:

Difficulté des conditions naturelles dans une zone à climat très dur, malgré l'expansion du tourisme de désert. Evolution des mœurs et abandon du nomadisme, ce qui tend à favoriser la perte du couvert végétal et l'érosion.

25. Mesures de conservation en vigueur:

Une zone de 8.000 hectares à Dghoumes jouit du statut de Parc national. Ailleurs il n'y a pas de mesures de protection législative particulières, encore que l'appartenance au Domaine Public Hydraulique permette un certain contrôle des activités dans la sebkhet. Certains secteurs du site (en particulier le Parc national de Dghoumes) sont mentionnés chaque année, sur l'Arrêté du Ministre de l'Agriculture relatif à l'organisation de la chasse, comme zone où la chasse est interdite, mais cette mention ne donne pas de protection des habitats.

Les CRDA (Commissariats régionaux de Développement Agricole) de Tozeur et de Kebili entreprennent différentes mesures pour promouvoir la Conservation des Eaux et de Sols (construction de digues et de retenues d'eau) aux alentours du Chott.

26. Mesures de conservation proposées mais pas encore appliquées:

Le classement comme site Ramsar est conçu comme un premier pas dans l'élaboration de nouvelles mesures de conservation (établissement d'une protection juridique, élaboration d'un plan de gestion).

3.8 Additional data from the Kerkennah Ramsar site report

20. Caractéristiques écologiques générales :

Le paysage marin de Kerkennah marqué par la présence d'un immense herbier de Posidonies affleurant à la surface des eaux lors des marées basses, est à juste titre, considéré comme l'un des plus

remarquables de toute la Méditerranée. Les études faites sur la flore benthique ont permis de mettre en évidence l'importance écologique des hauts-fonds entourant l'archipel. Des observations de la configuration de la végétation marine a permis de mettre en évidence :

- l'aspect " tigré " de l'herbier de Posidonie ainsi que sa très large extension, notamment dans la partie nord est de l'archipel.
- l'importance de la pelouse de Cymodocées avec une surface couverte de plus de 1000 km².
- le fait qu'il n'y a pas, en dehors des grands cordons de posidonie, de peuplements strictement uni spécifiques et, qu'en réalité, on a, en de nombreux points, une mosaïque d'espèces végétales dont la répartition est mouvante au fil des années mettant en évidence la biodiversité de la zone en question. La faune benthique reste, en dehors des espèces malacologiques, très mal connue. L'essentiel de la biomasse benthique des hauts fonds est représenté par deux espèces : le bivalve bioindicateur du bon état de l'herbier, *Pinna nobilis* et par le bivalve *Pinctada radiata* qui se fixe en très grand nombre sur toutes sortes de substrat dur et, notamment, sur les palmes des pêcheries fixes.

21. Flore remarquable :

La flore marine remarquable se caractérise par l'abondance d'herbiers de phanérogame marines de *Cymodocea nodosa* et *posidonia oceanica* mélangées à des algues vertes *Caulerpa prolifera* qui devient l'espèce dominante du couvert végétal dans certains secteurs. Ces herbiers se développent sur des fonds qui n'ont pas une mobilité suffisante pour l'amortissement de la houle et la fixation du substratum sédimentaire.

Au nord de l'île Chergui, les structures de Posidonies constituent d'immenses cordons de plusieurs km de long. La disposition de ces cordons indique une étroite dépendance vis-à-vis des courants de marée. Les feuilles longues de 15 à 30 cm pour les Cymodocées et de 30 à 80 cm pour les posidonies jouent un rôle essentiel dans le mouvement et la rétention des sédiments (perches naturelles).

Les Cymodocées prédominent de 3 à 5 m de profondeur et occupent la plus grande surface du fond marin du platier. Au delà et jusqu'à 30 m de profondeur, ils sont associés aux posidonies rencontrées généralement au sommet des bancs sableux. Quand à la flore terrestre, elle se caractérise surtout par une forte diversité génétique des palmiers dattiers uniques dans leur genre.

22. Faune remarquable :

La faune marine des hauts fonds est représentée par des éponges : *Spongia officinalis*, *Petrosia ficiformis* et *Hippospongia communis* , des mollusques bivalves *Pinna nobilis*, *Pinctada radiata*, fixées sur les rhizomes de posidonies, les tortues de mer : tortue caouanne *Caretta caretta*, la tortue luth *Dermochelys coriacea* et la tortue verte *Chelonia mydas*, des gastéropodes *Conus mediterraneus*, *Cerithium vulgatum* et des échinodermes *Holothuria tubulosa* et *Paracentrotus lividus*.

D'un point de vue ornithologique, l'archipel abrite plusieurs espèces remarquables d'oiseaux d'eau comme :

- le flamant rose *Phoenicopterus roseus*, [L] [SEP]
- le grand cormorant *Phalacrocorax carbo* (1000 à 10000 présent pendant l'hiver), [L] [SEP]
- l' Etourneau unicolore *Sturnus unicolor* [L] [SEP]
- Le rougequeue de moussier *Phoenicurus moussieri* et [L] [SEP]
- la fauvette melanocephale *Sylvia melanocephala*. [L] [SEP]

Le site, du fait de l'importance des zones côtières, a permis le développement de la pêche côtière qui constitue la principale activité des habitants de la région depuis des siècles. Les barques côtières actives représentent 61 % de l'effectif total des barques côtières actives du gouvernorat de Sfax. La majeure partie de la flottille active de Kerkennah se concentre dans Mellita, l'Atataya et Kraten.

La population maritime totale dans les îles Kerkennah est de 7166 pêcheurs en 2003. D'après la DGPA, cette population est en accroissement progressif depuis l'année 2000 et jusqu'à maintenant. La production en produits de pêche côtière des îles Kerkennah représente environ 29% du total débarqué du gouvernorat de Sfax. Ce qui montre l'importance du site dans le secteur de la pêche côtière.

Il est important de signaler qu'à l'archipel de Kerkennah, une technique de pêche originale et traditionnelle est utilisée et transmise de père en fils. C'est les Charfias. C'est un système de capture des poissons où ces derniers sont piégés. Ces structures sont conçues en feuilles de palmiers en forme V ou en forme de flèche. L'alignement de ces feuilles forme un chemin que les poissons suivent jusqu'aux chambres de capture (ou Drinas) qui sont des sortes de cages où les poissons sont piégés dans un seul sens. A l'archipel, on compte plus de 400 Charfias.

La zone avoisinante (Sfax et le golfe de Gabes en général) est caractérisée par une forte activité industrielle. Elle abrite la plus grande industrie de phosphate, ainsi que d'autres industries (chimiques, textiles, tanneries, alimentaire, métallurgique...). Ce qui a des impacts nocifs sur toute la région. Ces impacts sont déjà présents dans tout le golfe de Gabes se manifestant par des nuisances pour les peuplements benthiques et ichtyologiques. Ce qui rend des mesures de conservation appuyé par des textes législatifs urgentes.

Oui, le plan de gestion des îles Kerkennah dans le cadre du projet de protection des ressources marines et côtières du Golfe de Gabes mis en place par l'Institut National des Sciences et Technologies de la Mer (INSTM) [L] [SEP] Décrire toute autre pratique de gestion actuelle :

Le largage en mer des récifs artificiels (blocs de ciment de 200 kg à 1000 kg), avec l'appui du Programme des Nations Unis pour le Développement PNUD et le Fond Mondial de l'Environnement FEM, pour la première fois en Tunisie, comme un engagement en faveur de l'environnement et de la biodiversité, afin de dissuader les braconniers, et permettre la reproduction des espèces marines menacées.

Les îles Kerkennah sont classées comme réserve naturelle [L] [SEP] Le site est classé comme Aire Importance pour la conservation des oiseaux d'eau ('Important Bird Area') par l'association mondiale 'Bird life International' ou Association des Amis des Oiseaux (AAO) depuis 2001 (référence du site TN026).

La partie Nord Est du site fait l'objet de création d'une Aire Marine Protégée (AMP) depuis 2001.^[1] Afin de préserver au mieux le site en question, une étude de décharge contrôlée des déchets de l'archipel a été menée en 2009 par l'Agence Nationale de Gestion des déchets (ANGed) (sous la tutelle du ministère de l'environnement et du développement durable) pour assurer une décharge contrôlée des déchets tout en prenant compte des mesures de santé, de protection de l'environnement, du développement durable ainsi que de l'évolution économique du pays.