The Republic of Tunisia
Office National de l’Assainissement (ONAS)

PREPARATORY SURVEY
ON
THE RURAL CITIES SEWAGE AND WATER ENVIRONMENT IMPROVEMENT PROJECT
IN
THE REPUBLIC OF TUNISIA

Final Report

(Annex)

February 2012

Japan International Cooperation Agency (JICA)

INGEROSEC Corporation
HIDROPROJECTO, Engenharia e Gestao, S.A

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SEWAGE NETWORKS AND PUMPING STATIONS

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Interventions List

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BIZERTE	Bizerte	Biz	Ancienne Ville Bizerte	RS	Rh	1	BIZ-Biz-RS-Rh-1
BIZERTE	Bizerte	Biz	Cité Fahat Hachad	RS	Rh	2	BIZ-Biz-RS-Rh-2
BIZERTE	Bizerte	Biz	Cité Othman Allouche	RS	Rh	3	BIZ-Biz-RS-Rh-3
BIZERTE	Bizerte	Biz	Av. Hassen Nouri	RS	Rh	4	BIZ-Biz-RS-Rh-4
BIZERTE	Bizerte	Biz	Cité Centre Ville	RS	Rh	6	BIZ-Biz-RS-Rh-6
BIZERTE	Bizerte	Biz	Cité Hachad	RS	Rh	7	BIZ-Biz-RS-Rh-7
BIZERTE	Bizerte	Biz	Cité Ben Ismail	RS	Ex	1	BIZ-Biz-RS-Ex-1
BIZERTE	Zarzouna	Zar	SP RZ1 Oued Romine	SP	Rh	1	BIZ-Zar-SP-Rh-1
BIZERTE	Zarzouna	Zar	SP RZ2	SP	Rh	2	BIZ-Zar-SP-Rh-2
BIZERTE	Zarzouna	Zar	SP RZ3 Marche du Gros	SP	Rh	3	BIZ-Zar-SP-Rh-3
BIZERTE	Bizerte	Biz	SP Ben Ismail	SP	Ex	1	BIZ-Biz-SP-Ex-1
BIZERTE	Zarzouna	Zar	Cité Zaghouane	RS	Rh	1	BIZ-Zar-RS-Rh-1
BIZERTE	Tinja	Tin	Cité Ikbale e Cité Fatah	RS	Rh	1	BIZ-Tin-RS-Rh-1
BIZERTE	Tinja	Tin	Route Bizerte - Tinja	RS	Rh	2	BIZ-Tin-RS-Rh-2
BIZERTE	Tinja	Tin	Cité Guingla	RS	Ex	1	BIZ-Tin-RS-Ex-1
BIZERTE	Tinja	Tin	Cité Farhatia	RS	Ex	2	BIZ-Tin-RS-Ex-2
BIZERTE	Tinja	Tin	Rue Gandi	RS	Ex	3	BIZ-Tin-RS-Ex-3
BIZERTE	Tinja	Tin	SP SPROLS	SP	Rh	1	BIZ-Tin-SP-Rh-1
BIZERTE	Tinja	Tin	SP Guingla	SP	Ex	1	BIZ-Tin-SP-Ex-1
BIZERTE	Tinja	Tin	SP Farhatia	SP	Ex	2	BIZ-Tin-SP-Ex-2
BIZERTE	Menzel Bourguiba	Men	Centre Ville de Menzel Bourguiba	RS	Rh	1	BIZ-Men-RS-Rh-1
BIZERTE	Menzel Bourguiba	Men	Rue Destour	RS	Rh	2	BIZ-Men-RS-Rh-2
BIZERTE	Menzel Bourguiba	Men	Cité Ben Alaya	RS	Ex	1	BIZ-Men-RS-Ex-1
BIZERTE	Menzel Bourguiba	Men	Cité Sidi Yahia	RS	Ex	2	BIZ-Men-RS-Ex-2
BIZERTE	Menzel Bourguiba	Men	SP Ben Alaya	SP	Ex	1	BIZ-Men-SP-Ex-1
BIZERTE	Raf Raf	Raf	Raf Raf Plage	RS	Rh	1	BIZ-Raf-RS-Rh-1
BIZERTE	Raf Raf	Raf	SP Raf Raf Plage 1	SP	Ex	1	BIZ-Raf-SP-Ex-1
BIZERTE	Raf Raf	Raf	SP Raf Raf Plage 2	SP	Ex	2	BIZ-Raf-SP-Ex-2
BIZERTE	Menzel Jamil	Jam	Av. 7 Novembre	RS	Rh	1	BIZ-Jam-RS-Rh-1
BIZERTE	Menzel Jamil	Jam	Cité Habib Bourguiba	RS	Rh	2	BIZ-Jam-RS-Rh-2
BIZERTE	Menzel Jamil	Jam	SRJ 1	SP	Rh	1	BIZ-Jam-SP-Rh-1
BIZERTE	Menzel Jamil	Jam	SP Bir Rmal	SP	Rh	2	BIZ-Jam-SP-Rh-2
BIZERTE	Menzel Abderahmen	Abd	Av. Habib Bourguiba	RS	Rh	1	BIZ-Abd-RS-Rh-1
BIZERTE	Menzel Abderahmen	Abd	SPRA 2	SP	Rh	1	BIZ-Abd-SP-Rh-1
BIZERTE	El Alia	Ali	El Alia	RS	Rh	1	BIZ-Ali-RS-Rh-1
BIZERTE	Mateur	Mat	SP Hachad	SP	Rh	1	BIZ-Mat-SP-Rh-1
BIZERTE	Mateur	Mat	SP Sadaka	SP	Rh	2	BIZ-Mat-SP-Rh-2
ZAGHOUAN	El fahs	Fah	Cité Erriadh	RS	Rh	1	ZAG-Fah-RS-Rh-1
ZAGHOUAN	El fahs	Fah	Cité Essaada 1	RS	Rh	2	ZAG-Fah-RS-Rh-2
ZAGHOUAN	El fahs	Fah	Cité Essaada 2	RS	Rh	3	ZAG-Fah-RS-Rh-3
ZAGHOUAN	El fahs	Fah	Cité el Amel	RS	Rh	4	ZAG-Fah-RS-Rh-4
ZAGHOUAN	El fahs	Fah	Cité el Ennour	RS	Rh	5	ZAG-Fah-RS-Rh-5
ZAGHOUAN	El fahs	Fah	Cité el Essalam	RS	Rh	6	ZAG-Fah-RS-Rh-6
ZAGHOUAN	El fahs	Fah	Av. Liberté	RS	Rh	7	ZAG-Fah-RS-Rh-7
ZAGHOUAN	El fahs	Fah	Route Kairouan	RS	Rh	8	ZAG-Fah-RS-Rh-8
ZAGHOUAN	Zaghouan	Zag	Cité les Ninfes	RS	Rh	1	ZAG-Zag-RS-Rh-1
ZAGHOUAN	Zaghouan	Zag	Cité Lycee	RS	Rh	2	ZAG-Zag-RS-Rh-2
ZAGHOUAN	Zaghouan	Zag	Cité l'Independence	RS	Rh	3	ZAG-Zag-RS-Rh-3
ZAGHOUAN	Zaghouan	Zag	Cité Nessrine	RS	Rh	4	ZAG-Zag-RS-Rh-4
ZAGHOUAN	Zaghouan	Zag	Medina	RS	Rh	5	ZAG-Zag-RS-Rh-5
ZAGHOUAN	Zaghouan	Zag	Cité Bassatine	RS	Rh	6	ZAG-Zag-RS-Rh-6
ZAGHOUAN	Zaghouan	Zag	Route Essouani	RS	Rh	7	ZAG-Zag-RS-Rh-7
ZAGHOUAN	Zaghouan	Zag	Cité Borj	RS	Ex	1	ZAG-Zag-RS-Ex-1
ZAGHOUAN	Zaghouan	Zag	Cité Hanaya	RS	Ex	2	ZAG-Zag-RS-Ex-2

Table II.1.1
Interventions List

Governorate	Town	Town Code	Site	Network / Pumping Station	Rehabili-tation / Extension	Interventio n Number	Intervention Code
ZAGHOUAN	Zaghouan	Zag	Cité Bouhjar	RS	Ex	3	ZAG-Zag-RS-Ex-3
ZAGHOUAN	Zaghouan	Zag	Cité Administrative	RS	Ex	4	ZAG-Zag-RS-Ex-4
ZAGHOUAN	Zaghouan	Zag	SP Essouani	SP	Ex	1	ZAG-Zag-SP-Ex-1
ZAGHOUAN	Zaghouan	Zag	SP Bouhjar	SP	Ex	2	ZAG-Zag-SP-Ex-2
ZAGHOUAN	Zaghouan	Zag	SP Hanaya	SP	Ex	3	ZAG-Zag-SP-Ex-3
ZAGHOUAN	Hammam Zriba	Ham	Cité Lycee	RS	Rh	1	ZAG-Ham-RS-Rh-1
ZAGHOUAN	Hammam Zriba	Ham	Cité Dispensaire	RS	Rh	2	ZAG-Ham-RS-Rh-2
ZAGHOUAN	Hammam Zriba	Ham	Cité 20 Mars	RS	Rh	3	ZAG-Ham-RS-Rh-3
ZAGHOUAN	Hammam Zriba	Ham	Cité el Hammam	RS	Rh	4	ZAG-Ham-RS-Rh-4
ZAGHOUAN	Hammam Zriba	Ham	Cité 18 Janvier	RS	Rh	5	ZAG-Ham-RS-Rh-5
ZAGHOUAN	Hammam Zriba	Ham	Cité el Hounda	RS	Rh	6	ZAG-Ham-RS-Rh-6
ZAGHOUAN	Hammam Zriba	Ham	Cité El Ahd / Cité El Jadid 1	RS	Rh	7	ZAG-Ham-RS-Rh-7
ZAGHOUAN	Hammam Zriba	Ham	Cité El Ahd / Cité El Jadid 2	RS	Rh	8	ZAG-Ham-RS-Rh-8
ZAGHOUAN	Hammam Zriba	Ham	Cité Essalem	RS	Rh	9	ZAG-Ham-RS-Rh-9
ZAGHOUAN	Hammam Zriba	Ham	Cité AFH	RS	Rh	10	ZAG-Ham-RS-Rh-10
ZAGHOUAN	Hammam Zriba	Ham	Hammam Zriba (Distance from SPA water network)	RS	Ex	1	ZAG-Ham-RS-Ex-1
ZAGHOUAN	Hammam Zriba	Ham	SP Hammam	SP	Ex	1	ZAG-Ham-SP-Ex-1
BEJA	Béja	Bej	Cité Sabbalet el Araneb	RS	Ex	1	BEJ-Bej-RS-Ex-1
BEJA	Béja	Bej	Cité Sidi Khalaf	RS	Ex	2	BEJ-Bej-RS-Ex-2
BEJA	Béja	Bej	Cité Mzara	RS	Rh	1	BEJ-Bej-RS-Rh-1
BEJA	Béja	Bej	Cité Sidifradj + cité Eddahbia	RS	Rh	2	BEJ-Bej-RS-Rh-2
BEJA	Béja	Bej	Cité Nozha	RS	Rh	3	BEJ-Bej-RS-Rh-3
BEJA	Béja	Bej	Cité Ain el Goula	RS	Rh	4	BEJ-Bej-RS-Rh-4
BEJA	Béja	Bej	Cité el Medina	RS	Rh	5	BEJ-Bej-RS-Rh-5
BEJA	Maagoula	Maa	Cité Erriadh	RS	Rh	1	BEJ-Maa-RS-Rh-1
BEJA	Maagoula	Maa	SP Erriadh	SP	Ex	1	BEJ-Maa-SP-Ex-1
BEJA	Medjez El Bab	Med	Cité el Bahi	RS	Rh	1	BEJ-Med-RS-Rh-1
BEJA	Medjez El Bab	Med	Cité des professeurs	RS	Rh	2	BEJ-Med-RS-Rh-2
BEJA	Medjez El Bab	Med	Cité Erriadh	RS	Rh	3	BEJ-Med-RS-Rh-3
BEJA	Medjez El Bab	Med	Cité El Hana	RS	Rh	4	BEJ-Med-RS-Rh-4
BEJA	Medjez El Bab	Med	Cité Sidi Raies	RS	Rh	5	BEJ-Med-RS-Rh-5
BEJA	Medjez El Bab	Med	Cité Nattoucha	RS	Rh	6	BEJ-Med-RS-Rh-6
BEJA	Medjez El Bab	Med	Cité Touaben	RS	Rh	7	BEJ-Med-RS-Rh-7
BEJA	Medjez El Bab	Med	SP5	SP	Rh	1	BEJ-Med-SP-Rh-1
BEJA	Nefza	Nef	Cité Souassis	RS	Ex	1	BEJ-Nef-RS-Ex-1
BEJA	Nefza	Nef	Av. Republique	RS	Ex	10	BEJ-Nef-RS-Ex-10
BEJA	Nefza	Nef	Cité Erriadh	RS	Ex	2	BEJ-Nef-RS-Ex-2
BEJA	Nefza	Nef	Cité Sidi Saad	RS	Ex	3	BEJ-Nef-RS-Ex-3
BEJA	Nefza	Nef	Cité Farhat Hachad	RS	Ex	4	BEJ-Nef-RS-Ex-4
BEJA	Nefza	Nef	Cité Belle Vue	RS	Ex	5	BEJ-Nef-RS-Ex-5
BEJA	Nefza	Nef	Cité Ouroud 2	RS	Ex	6	BEJ-Nef-RS-Ex-6
BEJA	Nefza	Nef	Cité Ouroud 3	RS	Ex	7	BEJ-Nef-RS-Ex-7
BEJA	Nefza	Nef	Cité Elbaraka	RS	Ex	8	BEJ-Nef-RS-Ex-8
BEJA	Nefza	Nef	Cité Ezzouhour	RS	Ex	9	BEJ-Nef-RS-Ex-9
BEJA	Nefza	Nef	Rue Erriadh	RS	Rh	1	BEJ-Nef-RS-Rh-1
BEJA	Nefza	Nef	Cité Essaada	RS	Rh	2	BEJ-Nef-RS-Rh-2
BEJA	Nefza	Nef	SP Farhat Hachad	SP	Ex	1	BEJ-Nef-SP-Ex-1
BEJA	Nefza	Nef	SP Sidi Saad	SP	Ex	2	BEJ-Nef-SP-Ex-2
BEJA	Teboursouk	Teb	Cité Oued Essaha	RS	Ex	1	BEJ-Teb-RS-Ex-1
BEJA	Teboursouk	Teb	Cité Ain Mrad 1	RS	Ex	2	BEJ-Teb-RS-Ex-2
BEJA	Teboursouk	Teb	Teboursouk Medina	RS	Rh	1	BEJ-Teb-RS-Rh-1
BEJA	Teboursouk	Teb	Cité El Karma + Cité Avicenne + Cité Ennassim + Cité El Menchia + Cité Ezzayatine1 + Cité Ezzayatine2 (various urban zones)	RS	Rh	2	BEJ-Teb-RS-Rh-2
BEJA	Teboursouk	Teb	SP Oued Essaha	SP	Ex	3	BEJ-Teb-SP-Ex-3

Table II.1.1
Interventions List

Governorate	Town	Town Code	Site	Network / Pumping Station	Rehabili-tation / Extension	Intervention Number	Intervention Code
BEJA	Testour	Tes	Cité Gharnata	RS	Ex	1	BEJ-Tes-RS-Ex-1
BEJA	Testour	Tes	Cité Bassatine2 + Cité 20 Mars	RS	Ex	2	BEJ-Tes-RS-Ex-2
BEJA	Testour	Tes	Testour Medina	RS	Rh	1	BEJ-Tes-RS-Rh-1
BEJA	Testour	Tes	SP Bassatine2	SP	Ex	1	BEJ-Tes-SP-Ex-1
SILIANA	Bouarada	Bou	Cité Ibn Kaldoun	RS	Rh	1	SIL-Bou-RS-Rh-1
SILIANA	Bouarada	Bou	Cité el Mallassine	RS	Rh	2	SIL-Bou-RS-Rh-2
SILIANA	Bouarada	Bou	Cité Bassatines	RS	Rh	3	SIL-Bou-RS-Rh-3
SILIANA	Bouarada	Bou	Cité Zayatine Ouest	RS	Rh	4	SIL-Bou-RS-Rh-4
SILIANA	Bouarada	Bou	SP Ibn Kaldoun	SP	Ex	1	SIL-Bou-SP-Ex-1
SILIANA	Siliana	Sil	Cité Essabah	RS	Rh	1	SIL-Sil-RS-Rh-1
SILIANA	Siliana	Sil	Cité Taieb Mhiri	RS	Rh	2	SIL-Sil-RS-Rh-2
SILIANA	Siliana	Sil	Centre Ville de Siliana	RS	Rh	3	SIL-Sil-RS-Rh-3
SILIANA	Siliana	Sil	Cité Ennozha	RS	Rh	4	SIL-Sil-RS-Rh-4
SILIANA	Krib	Kri	Krib	RS	Ex	1	SIL-Kri-RS-Ex-1
JENDOUBA	Fernana	Fer	Fernana	RS	Rh	1	JEN-Fer-RS-Rh-1
JENDOUBA	Fernana	Fer	Cité El Fjouj	RS	Ex	1	JEN-Fer-RS-Ex-1
JENDOUBA	Fernana	Fer	SP El Fjouj	SP	Ex	1	JEN-Fer-SP-Ex-1
JENDOUBA	Ghardimaou	Gha	Ghardimaou	RS	Rh	1	JEN-Gha-RS-Rh-1
JENDOUBA	Ghardimaou	Gha	Cité Sidi Abbes	RS	Ex	1	JEN-Gha-RS-Ex-1
JENDOUBA	Ghardimaou	Gha	Cité Erraja	RS	Ex	2	JEN-Gha-RS-Ex-2
JENDOUBA	Ghardimaou	Gha	SP Sidi Abbes	SP	Ex	1	JEN-Gha-SP-Ex-1
JENDOUBA	Jendouba	Jen	Ville de Jendouba	RS	Rh	1	JEN-Jen-RS-Rh-1
JENDOUBA	Jendouba	Jen	Essaidia III	RS	Ex	1	JEN-Jen-RS-Ex-1
JENDOUBA	Jendouba	Jen	Cité Militaire	RS	Rh	2	JEN-Jen-RS-Rh-2
JENDOUBA	Jendouba	Jen	Cité Ennour	RS	Rh	3	JEN-Jen-RS-Rh-3
JENDOUBA	Jendouba	Jen	SP Ettataouer	SP	Rh	1	JEN-Jen-SP-Rh-1
JENDOUBA	Jendouba	Jen	SP 3	SP	Rh	2	JEN-Jen-SP-Rh-2
JENDOUBA	Jendouba	Jen	SP 4	SP	Rh	3	JEN-Jen-SP-Rh-3
JENDOUBA	Jendouba	Jen	SP Timiria	SP	Rh	4	JEN-Jen-SP-Rh-4
JENDOUBA	Jendouba	Jen	SP Essaidia III	SP	Ex	1	JEN-Jen-SP-Ex-1
JENDOUBA	Tabarka	Tab	Ville de Tabarka	RS	Rh	1	JEN-Tab-RS-Rh-1
JENDOUBA	Tabarka	Tab	Cité Houemdia	RS	Ex	1	JEN-Tab-RS-Ex-1
JENDOUBA	Tabarka	Tab	Cité Malloula	RS	Ex	2	JEN-Tab-RS-Ex-2
JENDOUBA	Tabarka	Tab	Cité Ain Mazouz	RS	Ex	3	JEN-Tab-RS-Ex-3
JENDOUBA	Tabarka	Tab	SP Morjane	SP	Rh	1	JEN-Tab-SP-Rh-1
JENDOUBA	Tabarka	Tab	SP Malloula1	SP	Ex	1	JEN-Tab-SP-Ex-1
JENDOUBA	Tabarka	Tab	SP Malloula2	SP	Ex	2	JEN-Tab-SP-Ex-2
JENDOUBA	Bousselem	Bss	Cité Ennour	RS	Ex	1	JEN-Bss-RS-Ex-1
JENDOUBA	Bousselem	Bss	SP Cité Ennour	SP	Ex	1	JEN-Bss-SP-Ex-1
KEF	Dahmani	Dah	Centre Ville de Dahmani / Cité Ben Amar	RS	Rh	3	KEF-Dah-RS-Rh-3
KEF	Dahmani	Dah	Cité Ennasr	RS	Ex	1	KEF-Dah-RS-Ex-1
KEF	Dahmani	Dah	SP 2	SP	Rh	1	KEF-Dah-SP-Rh-1
KEF	Kef	Kef	GP 5D	RS	Rh	1	KEF-Kef-RS-Rh-1
KEF	Kef	Kef	Avenue Hédi Cheker	RS	Rh	2	KEF-Kef-RS-Rh-2
KEF	Kef	Kef	Cité Chrichi	RS	Rh	3	KEF-Kef-RS-Rh-3
KEF	Kef	Kef	Cité Liberté	RS	Rh	4	KEF-Kef-RS-Rh-4
KEF	Kef	Kef	Cité Eddir	RS	Rh	5	KEF-Kef-RS-Rh-5
KEF	Kef	Kef	Cité Taieb M'hiri	RS	Rh	6	KEF-Kef-RS-Rh-6
KEF	Kef	Kef	Cité El Hana	RS	Rh	7	KEF-Kef-RS-Rh-7
KEF	Kef	Kef	Cité Eddir	RS	Ex	1	KEF-Kef-RS-Ex-1
KEF	Kef	Kef	SP 9 Avril	SP	Rh	1	KEF-Kef-SP-Rh-1
KEF	Kef	Kef	SP 3 Août	SP	Rh	2	KEF-Kef-SP-Rh-2
KEF	Kef	Kef	SP Eddir	SP	Ex	1	KEF-Kef-SP-Ex-1
KEF	Tajerouine	Taj	Cité Taieb Mhiri	RS	Rh	1	KEF-Taj-RS-Rh-1

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Interventions List

Governorate	Town	Town Code	Site	Network / Pumping Station	Rehabili-tation / Extension	Interventio n Number	Intervention Code
KEF	Tajerouine	Taj	Cité el Ain	RS	Rh	2	KEF-Taj-RS-Rh-2
KEF	Tajerouine	Taj	Cité Bourguiba	RS	Rh	3	KEF-Taj-RS-Rh-3
KEF	Tajerouine	Taj	Cité Rahba	RS	Ex	1	KEF-Taj-RS-Ex-1
KEF	Tajerouine	Taj	Cité Chebbi	RS	Ex	2	KEF-Taj-RS-Ex-2
KEF	Tajerouine	Taj	Cité 2 Mars	RS	Ex	3	KEF-Taj-RS-Ex-3
KEF	Tajerouine	Taj	SP Essanoubar	SP	Rh	1	KEF-Taj-SP-Rh-1
KEF	Tajerouine		SP Cité Chebbi	SP	Ex	1	KEF-Taj-SP-Ex-1
SFAX	Chihia	Chi	Chihia Tr 1	RS	Ex	1	SFA-Chi-RS-Ex-1
SFAX	Chihia	Chi	Chihia Tr 2	RS	Ex	2	SFA-Chi-RS-Ex-2
SFAX	Chihia	Chi	Chihia Tr 3	RS	Ex	3	SFA-Chi-RS-Ex-3
SFAX	Chihia	Chi	Route Teniour	RS	Rh	1	SFA-Chi-RS-Rh-1
SFAX	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 1	RS	Ex	1	SFA-Sae-RS-Ex-1
SFAX	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 2	RS	Ex	2	SFA-Sae-RS-Ex-2
SFAX	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 3	RS	Ex	3	SFA-Sae-RS-Ex-3
SFAX	Sakiet Ezzit	Sae	Route de Tunis GP 1	RS	Rh	1	SFA-Sae-RS-Rh-1
SFAX	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 1	RS	Ex	1	SFA-Sak-RS-Ex-1
SFAX	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 2	RS	Ex	2	SFA-Sak-RS-Ex-2
SFAX	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 3	RS	Ex	3	SFA-Sak-RS-Ex-3
SFAX	Sakiet Eddaier	Sak	Route de Mahdia MC 82	RS	Rh	1	SFA-Sak-RS-Rh-1
SFAX	El Ain	Ain	El Ain Tr 1	RS	Ex	1	SFA-Ain-RS-Ex-1
SFAX	El Ain	Ain	El Ain Tr 2	RS	Ex	2	SFA-Ain-RS-Ex-2
SFAX	El Ain	Ain	El Ain Tr 3	RS	Ex	3	SFA-Ain-RS-Ex-3
SFAX	El Ain	Ain	El Ain Tr 4	RS	Ex	4	SFA-Ain-RS-Ex-4
SFAX	Gremda	Gre	Gremda Tr 1	RS	Ex	1	SFA-Gre-RS-Ex-1
SFAX	Gremda	Gre	Gremda Tr 2	RS	Ex	2	SFA-Gre-RS-Ex-2
SFAX	Gremda	Gre	Gremda Tr 3	RS	Ex	3	SFA-Gre-RS-Ex-3
SFAX	Gremda	Gre	Gremda Tr 4	RS	Ex	4	SFA-Gre-RS-Ex-4
SFAX	Gremda	Gre	Gremda Tr 5	RS	Ex	5	SFA-Gre-RS-Ex-5
SFAX	Sfax Sud	Sfs	Zone Industrielle Sidi Salem	RS	Ex	1	SFA-Sfs-RS-Ex-1
SFAX	Sfax Sud	Sfs	Route Soukra Oued Chabounni 1	RS	Ex	2	SFA-Sfs-RS-Ex-2
SFAX	Sfax Sud	Sfs	Route Soukra Oued Chabounni 2	RS	Ex	3	SFA-Sfs-RS-Ex-3
SFAX	Sfax Sud	Sfs	Birjerbi	RS	Rh	1	SFA-Sfs-RS-Rh-1
SFAX	Sfax Sud	Sfs	Cité M'harza	RS	Rh	2	SFA-Sfs-RS-Rh-2
SFAX	Sfax Sud	Sfs	Cité Barnous	RS	Rh	3	SFA-Sfs-RS-Rh-3
SFAX	Sfax Sud	Sfs	Cité Essourour	RS	Rh	4	SFA-Sfs-RS-Rh-4
SFAX	Sfax Sud	Sfs	Cité Ellouz / Cité Bouret Avali / Cité Mouroj	RS	Rh	5	SFA-Sfs-RS-Rh-5
SFAX	Sfax Sud	Sfs	SP Zone Industrielle Sidi Salem	SP	Ex	1	SFA-Sfs-SP-Ex-1
SFAX	Sfax Ville	Sfv	Zone Route Kaied - M'hamed - Gremda	RS	Ex	1	SFA-Sfv-RS-Ex-1
SFAX	Sfax Ville	Sfv	Zone Route Lafrane - El Ain	RS	Ex	2	SFA-Sfv-RS-Ex-2
SFAX	Sfax Ville	Sfv	Zone Route Teniour - Tunis	RS	Ex	3	SFA-Sfv-RS-Ex-3
SFAX	Sfax Ville	Sfv	Zone Route Gremda - La Frane	RS	Ex	4	SFA-Sfv-RS-Ex-4
SFAX	Sfax Ville	Sfv	Cité Habbena / Cité Sidi Mansour	RS	Ex	5	SFA-Sfv-RS-Ex-5
SFAX	Sfax Ville	Sfv	Cité peripheries Canal DHU	RS	Ex	6	SFA-Sfv-RS-Ex-6
SFAX	Sfax Ville	Sfv	Zone Route Teniour - Kaied M'hamed	RS	Ex	7	SFA-Sfv-RS-Ex-7
SFAX	Sfax Ville	Sfv	Cité Saline	RS	Rh	1	SFA-Sfv-RS-Rh-1
SFAX	Sfax Ville	Sfv	Sfax Centre Ville	RS	Rh	2	SFA-Sfv-RS-Rh-2
SFAX	Sfax Ville	Sfv	Arrondissement Medina	RS	Rh	3	SFA-Sfv-RS-Rh-3
SFAX	Sfax Ville	Sfv	Cité Rbat Nord	RS	Rh	4	SFA-Sfv-RS-Rh-4
SFAX	Sfax Ville	Sfv	Cité El Boustane	RS	Rh	5	SFA-Sfv-RS-Rh-5
SFAX	Sfax Ville	Sfv	Route Habbena	RS	Rh	6	SFA-Sfv-RS-Rh-6
SFAX	Sfax Ville	Sfv	SP Sidi Mansour Plage	SP	EX	1	SFA-Sfv-SP-Ex-1
SFAX	Sfax Ville	Sfv	SP 2 Habbena	SP	Rh	1	SFA-Sfv-SP-Rh-1
SFAX	Sfax Ville	Sfv	SP Kasset Chabane	SP	Rh	2	SFA-Sfv-SP-Rh-2
SFAX	Tyna	Tyn	Tyna Tr 1	RS	Ex	1	SFA-Tyn-RS-Ex-1

Table II.1.1
Interventions List

Governorate	Town	Town Code	Site	Network / Pumping Station	Rehabili-tation / Extension	Interventio n Number	Intervention Code
SFAX	Tyna	Tyn	Tyna Tr 2	RS	Ex	2	SFA-Tyn-RS-Ex-2
SFAX	Tyna	Tyn	SP Tyna	SP	Ex	1	SFA-Tyn-SP-Ex-1
SFAX	Agareb	Aga	Agareb	RS	Ex	1	SFA-Aga-RS-Ex-1
SFAX	Agareb	Aga	Zone Industrielle	RS	Ex	2	SFA-Aga-RS-Ex-2
SFAX	Agareb	Aga	SP Zone Industrielle	SP	Ex	1	SFA-Aga-SP-Ex-1
SFAX	Hencha	Hen	Hencha Tr 1	RS	Ex	1	SFA-Hen-RS-Ex-1
SFAX	Hencha	Hen	Hencha Tr 2	RS	Ex	2	SFA-Hen-RS-Ex-2
SFAX	Jebeniana	Jeb	Jebeniana Tr 1	RS	Ex	1	SFA-Jeb-RS-Ex-1
SFAX	Jebeniana	Jeb	Jebeniana Tr 2	RS	Ex	2	SFA-Jeb-RS-Ex-2
SFAX	Mahres	Mah	Mahres Tr 1	RS	Ex	1	SFA-Mah-RS-Ex-1
SFAX	Mahres	Mah	Mahres Tr 2	RS	Ex	2	SFA-Mah-RS-Ex-2
SFAX	Mahres	Mah	SP Mahres Tr 2	SP	Ex	1	SFA-Mah-SP-Ex-1
SFAX	Mahres	Mah	GP 1	RS	Rh	1	SFA-Mah-RS-Rh-1
SFAX	Mahres	Mah	SP Port de Peche	SP	Rh	1	SFA-Mah-SP-Rh-1
KASSERINE	Kasserine	Kas	conduite vers STEP 1	RS	Rh	1	KAS-Kas-RS-Rh-1
KASSERINE	Kasserine	Kas	conduite vers STEP 2	RS	Rh	2	KAS-Kas-RS-Rh-2
KASSERINE	Kasserine	Kas	Centre Ville de Kasserine	RS	Rh	3	KAS-Kas-RS-Rh-3
KASSERINE	Kasserine	Kas	Collecteur de Ceinture	RS	Rh	4	KAS-Kas-RS-Rh-4
KASSERINE	Kasserine	Kas	Collecteur de AV. Bejaoui	RS	Rh	5	KAS-Kas-RS-Rh-5
KASSERINE	Kasserine	Kas	Collecteur de Ain el Gaied	RS	Rh	7	KAS-Kas-RS-Rh-7
KASSERINE	Kasserine	Kas	Cité Saad Eddine	RS	Rh	8	KAS-Kas-RS-Rh-8
KASSERINE	Kasserine	Kas	Cité el Bassatine 1	RS	Rh	9	KAS-Kas-RS-Rh-9
KASSERINE	Kasserine	Kas	Cité el Bassatine 2	RS	Rh	10	KAS-Kas-RS-Rh-10
KASSERINE	Kasserine	Kas	Cité el Bassatine 3	RS	Rh	11	KAS-Kas-RS-Rh-11
KASSERINE	Kasserine	Kas	Cité Nouvelle Medina	RS	Ex	1	KAS-Kas-RS-Ex-1
KASSERINE	Kasserine	Kas	Cité Essalem	RS	Ex	3	KAS-Kas-RS-Ex-3
KASSERINE	Kasserine	Kas	Cité el Feth 3	RS	Ex	4	KAS-Kas-RS-Ex-4
KASSERINE	Kasserine	Kas	Cité Loutissement rahmouni	RS	Ex	5	KAS-Kas-RS-Ex-5
KASSERINE	Kasserine	Kas	Cité Bnanna	RS	Ex	6	KAS-Kas-RS-Ex-6
KASSERINE	Sbeitla	Sbe	Collecteur Oued Sbeitla	RS	Rh	1	KAS-Sbe-RS-Rh-1
KASSERINE	Sbeitla	Sbe	Centre Ville de Sbeitla	RS	Rh	2	KAS-Sbe-RS-Rh-2
KASSERINE	Sbeitla	Sbe	Cité Loutissement el Feth	RS	Rh	3	KAS-Sbe-RS-Rh-3
KASSERINE	Sbeitla	Sbe	Cité Essourour Est / Cité Essourour Ouest	RS	Rh	4	KAS-Sbe-RS-Rh-4
KASSERINE	Sbeitla	Sbe	Cité Zayatine	RS	Ex	1	KAS-Sbe-RS-Ex-1
KASSERINE	Sbeitla	Sbe	Cité el Khadhra	RS	Ex	2	KAS-Sbe-RS-Ex-2
KASSERINE	Thala	Tel	Cité Tela	RS	Ex	1	KAS-Tel-RS-Ex-1
KASSERINE	Thala	Tel	SP1 - Cité SNIT	SP	Ex	1	KAS-Tel-SP-Ex-1
KASSERINE	Thala	Tel	SP 2 - Ain Ahmed	SP	Ex	2	KAS-Tel-SP-Ex-2
KASSERINE	Feriana	Fei	Feriana	RS	Ex	1	KAS-Fei-RS-Ex-1
KASSERINE	Feriana	Fei	SP1 - EL Amen	SP	Ex	1	KAS-Fei-SP-Ex-1
KASSERINE	Feriana	Fei	SP2 - El Bassatine	SP	Ex	2	KAS-Fei-SP-Ex-2
SIDI BOUZID	Sidi Bouzid	Sid	Cité Ennour Ouest	RS	Rh	1	SID-Sid-RS-Rh-1
SIDI BOUZID	Sidi Bouzid	Sid	Av. Maghreb Arabe	RS	Rh	2	SID-Sid-RS-Rh-2
SIDI BOUZID	Sidi Bouzid	Sid	Cité des Professeurs	RS	Rh	3	SID-Sid-RS-Rh-3
SIDI BOUZID	Sidi Bouzid	Sid	Cité Ali Belhouane	RS	Rh	4	SID-Sid-RS-Rh-4
SIDI BOUZID	Sidi Bouzid	Sid	Cité Elworroud 1	RS	Rh	5	SID-Sid-RS-Rh-5
SIDI BOUZID	Sidi Bouzid	Sid	Cité Hôspital Régional	RS	Rh	7	SID-Sid-RS-Rh-7
SIDI BOUZID	Sidi Bouzid	Sid	Cité Derrière Usine de Tomate	RS	Rh	8	SID-Sid-RS-Rh-8
SIDI BOUZID	Sidi Bouzid	Sid	Racc. Protection civile	RS	Rh	9	SID-Sid-RS-Rh-9
SIDI BOUZID	Sidi Bouzid	Sid	Rue Hammam Ibn el Aghlab	RS	Rh	10	SID-Sid-RS-Rh-10
SIDI BOUZID	Sidi Bouzid	Sid	Cité Ouled Belhedi	RS	Ex	1	SID-Sid-RS-Ex-1
SIDI BOUZID	Sidi Bouzid	Sid	Cité Elfrayjia	RS	Ex	2	SID-Sid-RS-Ex-2
SIDI BOUZID	Sidi Bouzid	Sid	Cité Ouled Chelbbi	RS	Ex	3	SID-Sid-RS-Ex-3
SIDI BOUZID	Sidi Bouzid	Sid	Cité Ennour Ouest	RS	Ex	4	SID-Sid-RS-Ex-4

Table II.1.1
Interventions List

Governorate	Town	Town Code	Site	Network / Pumping Station	Rehabili-tation / Extension	Intervention Number	Intervention Code
SIDI BOUZID	Sidi Bouzid	Sid	Cité Chrifa	RS	Ex	5	SID-Sid-RS-Ex-5
SIDI BOUZID	Sidi Bouzid	Sid	Cité Jammaa Sayah	RS	Ex	6	SID-Sid-RS-Ex-6
SIDI BOUZID	Sidi Bouzid		SP Cité Ennour Ouest	SP	Ex	1	SID-Sid-SP-Ex-1
KEBILI	Kebili	Keb	Kebili (Centre Ville)	RS	Rh	1	KEB-Keb-RS-Rh-1
KEBILI	Kebili	Keb	Kebili (Nezla) / Kebili (Ville)	RS	Ex	1	KEB-Keb-RS-Ex-1
KEBILI	Kebili	Keb	SR2	SP	Rh	1	KEB-Keb-SP-Rh-1
KEBILI	Kebili	Keb	SR1	SP	Rh	2	KEB-Keb-SP-Rh-2
KEBILI	Kebili	Keb	SP Nezla	SP	Ex	1	KEB-Keb-SP-Ex-1
KEBILI	Kebili nord	Ken	Cité Rabta	RS	Ex	1	KEB-Ken-RS-Ex-1
KEBILI	Kebili nord	Ken	Cité Tombar	RS	Ex	2	KEB-Ken-RS-Ex-2
KEBILI	Kebili nord	Ken	Cité Jdida Mansoura	RS	Ex	3	KEB-Ken-RS-Ex-3
KEBILI	Kebili nord	Ken	Cité Guetya	RS	Ex	4	KEB-Ken-RS-Ex-4
KEBILI	Kebili nord	Ken	SP Rabta	SP	Ex	1	KEB-Ken-SP-Ex-1
KEBILI	Kebili nord	Ken	SP Tombar	SP	Ex	2	KEB-Ken-SP-Ex-2
KEBILI	Kebili nord	Ken	SP Jdida	SP	Ex	3	KEB-Ken-SP-Ex-3
KEBILI	Kebili nord	Ken	SP Guetya	SP	Ex	4	KEB-Ken-SP-Ex-4
KEBILI	Kebili sud	Kes	Cité Bazma	RS	Ex	1	KEB-Kes-RS-Ex-1
KEBILI	Kebili sud	Kes	Cité Rahmat	RS	Ex	2	KEB-Kes-RS-Ex-2
KEBILI	Kebili sud	Kes	SP Bazma / Rahmat	SP	Ex	1	KEB-Kes-SP-Ex-1
KEBILI	Kebili sud	Kes	SP Rahmat	SP	Ex	2	KEB-Kes-SP-Ex-2
KEBILI	Douz	Dou	Douz	RS	Rh	1	KEB-Dou-RS-Rh-1
KEBILI	Douz	Dou	O M Zarzour / Gharbia	RS	Ex	1	KEB-Dou-RS-Ex-1
KEBILI	Douz	Dou	SP Gharbia	SP	Ex	1	KEB-Dou-SP-Ex-1
KEBILI	Douz sud	Dos	Cité Zeafrane	RS	Ex	1	KEB-Dos-RS-Ex-1
KEBILI	Douz sud	Dos	SP Zeafrane	SP	Ex	1	KEB-Dos-SP-Ex-1
KEBILI	El Golaa	Gol	Cité El Golaa	RS	Ex	1	KEB-Gol-RS-Ex-1
KEBILI	Souk Lahad	Sou	Ville de Souk Lahad	RS	Ex	1	KEB-Sou-RS-Ex-1
KEBILI	Souk Lahad	Sou	SP 1	SP	Ex	1	KEB-Sou-SP-Ex-1
KEBILI	Souk Lahad	Sou	SP 2	SP	Ex	2	KEB-Sou-SP-Ex-2
KEBILI	Souk Lahad	Sou	SP 3	SP	Ex	3	KEB-Sou-SP-Ex-3
KEBILI	Souk Lahad	Sou	SP 4	SP	Ex	4	KEB-Sou-SP-Ex-4
KEBILI	Souk Lahad	Sou	SP 5	SP	Ex	5	KEB-Sou-SP-Ex-5
KEBILI	Jemna	Jem	Jemna	RS	Ex	1	KEB-Jem-RS-Ex-1
KEBILI	Jemna	Jem	SP Jemna 3	SP	Ex	1	KEB-Jem-SP-Ex-1

Table II.1.2
Per-capita water consumption by town (2009)

Governorate	Gouvernorat Code	Town	Town code	Percapita water consumption (L/hab)
BIZERTE	BIZ	Bizerte	Biz	120
BIZERTE	BIZ	Zarzouna	Zar	110
BIZERTE	BIZ	Tinja	Tin	85
BIZERTE	BIZ	Menzel Bourguiba	Men	100
BIZERTE	BIZ	Metline	Met	85
BIZERTE	BIZ	Raf Raf	Raf	160
BIZERTE	BIZ	Menzel Jamil	Jam	80
BIZERTE	BIZ	Menzel Abderahmen	Abd	80
BIZERTE	BIZ	Alia	Ali	85
BIZERTE	BIZ	Mateur	Mat	80
BIZERTE	BIZ	Sajnane	Saj	60
ZAGHOUAN	ZAG	El fahs	Fah	85
ZAGHOUAN	ZAG	Zaghouan	Zag	108
ZAGHOUAN	ZAG	Hammam Zriba	Ham	107
SIDI BOUZID	SID	Sidi Bouzid	Sid	77
BEJA	BEJ	Beja	Bej	110
BEJA	BEJ	Maagoula	Maa	85
BEJA	BEJ	Medjez El Bab	Med	120
BEJA	BEJ	Nefza	Nef	85
BEJA	BEJ	Teboursouk	Teb	85
BEJA	BEJ	Testour	Tes	85
SILIANA	SIL	Bouarada	Bou	80
SILIANA	SIL	Siliana	Sil	100
SILIANA	SIL	Krib	Kri	75
JENDOUBA	JEN	Fernana	Fer	64
JENDOUBA	JEN	Ghardimaou	Gha	65
JENDOUBA	JEN	Jendouba	Jen	110
JENDOUBA	JEN	Tabarka	Tab	110
JENDOUBA	JEN	Bousselem	Bss	64
KEF	KEF	Dahmani	Dah	78
KEF	KEF	Kef	Kef	84
KEF	KEF	Tajerouine	Taj	78
SFAX	SFA	Agareb	Aga	85
SFAX	SFA	Jebeniana	Jeb	88
SFAX	SFA	Sfax Sud	Sfs	104
SFAX	SFA	Sfax Ville	Sfv	104
SFAX	SFA	Mahres	Mah	88
SFAX	SFA	Sakiet Eddaier	Sak	98
SFAX	SFA	Sakiet Ezzit	Sae	98
SFAX	SFA	Chihia	Chi	95
SFAX	SFA	El Ain	Ain	95
SFAX	SFA	Gremda	Gre	93
SFAX	SFA	Tyna	Tyn	93
SFAX	SFA	Hencha	Hen	87
KASSERINE	KAS	Thala	Tel	75
KASSERINE	KAS	Feriana	Fei	75
KASSERINE	KAS	Kasserine	Kas	75
KASSERINE	KAS	Sbeitla	Sbe	75
KEBILI	KEB	Kebili	Keb	65
KEBILI	KEB	Kebili nord	Ken	65
KEBILI	KEB	Kebili sud	Kes	65
KEBILI	KEB	Douz	Dou	72
KEBILI	KEB	Douz sud	Dos	72
KEBILI	KEB	El Golaa	Gol	50
KEBILI	KEB	Souk Lahad	Sou	54
KEBILI	KEB	Jemna	Jem	49

Table II.1.3
Geology, water level and soil salinity
Source: "Geological conditions questionnaire / July 2011" answered by ONAS

Governorate	Town	Soil Geology (up to 2 m depth)		Water level depth (m)	Soil salinity (yes/no)
		% normal	% rock		
BIZERTE	Bizerte	95	5	1.5	yes
BIZERTE	Zarzouna	100	0	1.5	yes
BIZERTE	Tinja	100	0	1.5	yes
BIZERTE	Menzel Bourguiba	95	5	2.0	no
BIZERTE	Metline	70	30	3.5	no
BIZERTE	Raf Raf	90	10	3.0	no
BIZERTE	Menzel Jamil	95	5	2.0	no
BIZERTE	Menzel Abderahmen	95	5	2.0	no
BIZERTE	Alia	85	15	3.5	no
BIZERTE	Mateur	95	5	2.5	no
BIZERTE	Sajnane	85	15	2.5	no
ZAGHOUAN	El Fahs	50	50	8.0	no
ZAGHOUAN	Zaghouan	100	0	10.0	no
ZAGHOUAN	Hammam Zriba	25	75	15.0	no
BEJA	Béja	60	40	5.0	no
BEJA	Maagoula	90	10	7.0	no
BEJA	Medjez El Bab	80	20	10.0	no
BEJA	Nefza	90	10	2.5	yes
BEJA	Teboursouk	30	70	15.0	no
BEJA	Testour	90	10	15.0	no
SILIANA	Bouarada	100	0	nd/na	no
SILIANA	Gaafour	100	0	nd/na	no
SILIANA	Siliana	100	0	nd/na	no
SILIANA	Krib	80	20	nd/na	no
JENDOUBA	Fernana	70	30	15.0	no
JENDOUBA	Ghardimaou	80	20	12.0	no
JENDOUBA	Jendouba	95	5	6.0	no
JENDOUBA	Tabarka	60	40	3.0	no
JENDOUBA	Bousselem	95	5	6.0	no
KEF	Dahmani	80	20	18.0	no
KEF	Kef	60	40	30.0	no
KEF	Tajerouine	90	10	70.0	yes
SFAX	Agareb	90	10	nd/na	no
SFAX	Jebeniana	60	40	nd/na	no
SFAX	Mahres	90	10	nd/na	no
SFAX	Sakiet Eddaier	90	10	nd/na	no
SFAX	Sakiet Ezzit	90	10	nd/na	no
SFAX	Chihia	90	10	nd/na	no
SFAX	Sfax	90	10	nd/na	no
SFAX	El Ain	90	10	nd/na	no
SFAX	Gremda	90	10	nd/na	no
SFAX	Tyna	90	10	nd/na	no
SFAX	Hencha	90	10	nd/na	no
KASSERINE	Kasserine	100	0	nd/na	no
KASSERINE	Sbeitla	100	0	nd/na	no
KASSERINE	Tela	20	80	nd/na	no
KASSERINE	Feriana	100	0	nd/na	no
SIDI BOUZID	Sidi Bouzid	100	0	3.0	yes
KEBILI	Kebili	100	0	4.0	yes
KEBILI	Kebili nord	100	0	2.0	yes
KEBILI	Kebili sud	100	0	70.0	yes
KEBILI	Douz	100	0	3.0	yes
KEBILI	Douz sud	100	0	2.0	yes
KEBILI	El Golaa	100	0	3.0	yes
KEBILI	Souk Lahad	80	20	6.0	no
KEBILI	Jemna	100	0	2.0	yes

Table II.1.4 - Pumping Stations Extension (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
KASSERINE	KAS	Feriana	Fei	SP1 - El Amen	SP	Ex	1	KAS-Fei-SP-Ex-1
KASSERINE	KAS	Ferina	Fei	SP2 - El Bassatine	SP	Ex	2	KAS-Fei-SP-Ex-2
KASSERINE	KAS	Thala	Tel	SP 1 - Cité SNIT	SP	Ex	1	KAS-Tel-SP-Ex-1
KASSERINE	KAS	Thala	Tel	SP2 - Ain Ahmed	SP	Ex	2	KAS-Tel-SP-Ex-2
BEJA	BEJ	Maagoula	Maa	SP Erriadh	SP	Ex	1	BEJ-Maa-SP-Ex-1
BEJA	BEJ	Nefza	Nef	SP Sidi Saad	SP	Ex	2	BEJ-Nef-SP-Ex-2
BEJA	BEJ	Nefza	Nef	SP Farhat Hachad	SP	Ex	1	BEJ-Nef-SP-Ex-1
BEJA	BEJ	Teboursouk	Teb	SP Oued Essaha	SP	Ex	3	BEJ-Teb-SP-Ex-3
BEJA	BEJ	Testour	Tes	SP Bassatine 2	SP	Ex	1	BEJ-Tes-SP-Ex-1
SILIANA	SIL	Bouarada	Bou	SP Ibn Kaldoun	SP	Ex	1	SIL-Bou-SP-Ex-1
KEF	KEF	Kef	Kef	SP Eddir	SP	Ex	1	KEF-Kef-SP-Ex-1
KEF	KEF	Tajerouine	Taj	SP Cité Chebbi	SP	Ex	1	KEF-Taj-SP-Ex-1
SFAX	SFA	Sfax Sud	Sfs	SP Zone Industrielle Sidi Salem	SP	Ex	1	SFA-Sfs-SP-Ex-1
SFAX	SFA	Sfax Ville	Sfv	SP Sidi Mansour Plage	SP	Ex	1	SFA-Sfv-SP-Ex-1
SFAX	SFA	Agareb	Aga	SP Zone Industrielle	SP	Ex	1	SFA-Aga-SP-Ex-1
SFAX	SFA	Mahres	Mah	SP Mahres Tr 1 (Cité El Hana)	SP	Ex	1	SFA-Mah-SP-Ex-1
SFAX	SFA	Tyna	Tyn	SP Tyna	SP	Ex	1	SFA-Tyn-SP-Ex-1
SFAX	SFA	Sfax Ville	Sfv	Cité Saline	RS	Rh	1	SFA-Sfv-RS-Rh-1
JENDOUBA	JEN	Ghardimaou	Gha	SP Sidi Abbes	SP	Ex	1	JEN-Gha-SP-Ex-1
JENDOUBA	JEN	Jendouba	Jen	SP cité Essaidia III	SP	Ex	1	JEN-Jen-SP-Ex-1
JENDOUBA	JEN	Tabarka	Tab	SP Malloula1	SP	Ex	1	JEN-Tab-SP-Ex-1
JENDOUBA	JEN	Tabarka	Tab	SP Malloula2	SP	Ex	2	JEN-Tab-SP-Ex-2
JENDOUBA	JEN	Bousselem	Bss	SP cité Ennour	SP	Ex	1	JEN-Bss-SP-Ex-1
JENDOUBA	JEN	Fernana	Fer	SP cité el Fjouj	SP	Ex	1	JEN-Fer-SP-Ex-1
KEBILI	KEB	Kebili	Keb	SP Nezla	SP	Ex	1	KEB-Keb-SP-Ex-1
KEBILI	KEB	Kebili nord	Ken	SP Rabta	SP	Ex	1	KEB-Ken-SP-Ex-1
KEBILI	KEB	Kebili nord	Ken	SP Tombar	SP	Ex	2	KEB-Ken-SP-Ex-2
KEBILI	KEB	Kebili nord	Ken	SP Jdida	SP	Ex	3	KEB-Ken-SP-Ex-3
KEBILI	KEB	Kebili nord	Ken	SP Guetya	SP	Ex	4	KEB-Ken-SP-Ex-4
KEBILI	KEB	Kebili sud	Kes	SP Bazma / Rahmat	SP	Ex	1	KEB-Kes-SP-Ex-1
KEBILI	KEB	Kebili sud	Kes	SP Rahmat	SP	Ex	2	KEB-Kes-SP-Ex-2
KEBILI	KEB	Douz	Dou	SP Gharbia	SP	Ex	1	KEB-Dou-SP-Ex-1

Table II.1.4 - Pumping Stations Extension (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
KEBILI	KEB	Douz sud	Dos	SPZeafrane	SP	Ex	1	KEB-Dos-SP-Ex-1
KEBILI	KEB	Souk Lahad	Sou	SP 1	SP	Ex	1	KEB-Sou-SP-Ex-1
KEBILI	KEB	Souk Lahad	Sou	SP 2	SP	Ex	2	KEB-Sou-SP-Ex-2
KEBILI	KEB	Souk Lahad	Sou	SP 3	SP	Ex	3	KEB-Sou-SP-Ex-3
KEBILI	KEB	Souk Lahad	Sou	SP 4	SP	Ex	4	KEB-Sou-SP-Ex-4
KEBILI	KEB	Souk Lahad	Sou	SP 5	SP	Ex	5	KEB-Sou-SP-Ex-5
KEBILI	KEB	Jemna	Jem	SP Jemna 3	SP	Ex	1	KEB-Jem-SP-Ex-1
BIZERTE	BIZ	Bizerte	Biz	SP Ben Ismail	SP	Ex	1	BIZ-Biz-SP-Ex-1
BIZERTE	BIZ	Menzel Bourguiba	Men	SP Ben Alaya	SP	Ex	1	BIZ-Men-SP-Ex-1
BIZERTE	BIZ	Raf Raf	Raf	SP Raf Raf Plage 1	SP	Ex	1	BIZ-Raf-SP-Ex-1
BIZERTE	BIZ	Raf Raf	Raf	SP Raf Raf Plage 2	SP	Ex	2	BIZ-Raf-SP-Ex-2
BIZERTE	BIZ	Tinja	Tin	SP Guingla	SP	Ex	1	BIZ-Tin-SP-Ex-1
BIZERTE	BIZ	Tinja	Tin	SP Farhatia	SP	Ex	2	BIZ-Tin-SP-Ex-2
BIZERTE	BIZ	Menzel Jamil	Jam	SP Bir Rmal	SP	Rh	2	BIZ-Jam-SP-Rh-2
SIDI BOUZID	SID	Sidi Bouzid	Sid	SP Cité Ennour Ouest	SP	Ex	1	SID-Sid-SP-Ex-1
ZAGHOUAN	ZAG	Zaghouan	Zag	SP Essouani	SP	Ex	1	ZAG-Zag-SP-Ex-1
ZAGHOUAN	ZAG	Zaghouan	Zag	SP Bouhjar	SP	Ex	2	ZAG-Zag-SP-Ex-2
ZAGHOUAN	ZAG	Hammam Zriba	Ham	SP Hammam	SP	Ex	1	ZAG-Ham-SP-Ex-1
ZAGHOUAN	ZAG	Zaghouan	Zag	SP Hanaya	SP	Ex	3	ZAG-Zag-SP-Ex-3

Note:

ZAG-Ham-SP-Ex-1	The intervention cost includes pre-traitement works
BIZ-Jam-SP-Rh-2	The intervention consists in the construction of a new pumping station on lower land 300m away. Consequently, even this intervention is classified as Rh, it will be considered as Ex in terms of cost estimation and works.

Table II.1.4 - Pumping Stations Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain
-	(hab)	(L/hab/day)	(L/hab/day)	(hab)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
KAS-Fei-SP-Ex-1	800	75	60	800	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	5.0
KAS-Fei-SP-Ex-2	1,000	75	60	1,000	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.3	5.0
KAS-Tel-SP-Ex-1	375	75	60	375	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.8	0.0	0.0	0.1	5.0
KAS-Tel-SP-Ex-2	375	75	60	375	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.8	0.0	0.0	0.1	5.0
BEJ-Maa-SP-Ex-1	300	85	68	300	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.7	0.0	0.0	0.1	5.0
BEJ-Nef-SP-Ex-2	25	85	68	25	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	5.0
BEJ-Nef-SP-Ex-1	125	85	68	125	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.3	0.0	0.0	0.0	5.0
BEJ-Teb-SP-Ex-3	300	85	68	300	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.7	0.0	0.0	0.1	5.0
BEJ-Tes-SP-Ex-1	38	85	68	38	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	5.0
SIL-Bou-SP-Ex-1	1,100	80	64	1,100	0.8	0.0	0.0	3.00	2.00	2.00	70%	2.4	0.0	0.0	0.6	5.0
KEF-Kef-SP-Ex-1	1,000	84	67	1,000	0.8	0.1	0.0	3.00	2.00	2.00	50%	2.3	0.1	0.1	0.4	5.0
KEF-Taj-SP-Ex-1	225	78	62	225	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.5	0.0	0.0	0.1	5.0
SFA-Sfs-SP-Ex-1	2,000	104	83	2,000	1.9	0.0	0.0	3.00	2.00	2.00	50%	5.8	0.0	0.0	1.0	6.7
SFA-Sfv-SP-Ex-1	1,036	104	83	1,036	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	5.0
SFA-Aga-SP-Ex-1	3,000	85	68	3,000	2.4	0.0	0.0	3.00	2.00	2.00	50%	7.1	0.0	0.0	1.2	8.3
SFA-Mah-SP-Ex-1	410	88	70	410	0.3	0.0	0.0	3.00	2.00	2.00	50%	1.0	0.0	0.0	0.2	5.0
SFA-Tyn-SP-Ex-1	925	93	74	925	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	5.0
SFA-Sfv-RS-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JEN-Gha-SP-Ex-1	458	65	52	458	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	5.0
JEN-Jen-SP-Ex-1	1,077	110	88	1,077	1.1	0.0	0.0	3.00	2.00	2.00	40%	3.3	0.0	0.0	0.4	5.0
JEN-Tab-SP-Ex-1	314	110	88	314	0.3	0.0	0.0	3.00	2.00	2.00	40%	1.0	0.0	0.0	0.1	5.0
JEN-Tab-SP-Ex-2	314	110	88	314	0.3	0.0	0.0	3.00	2.00	2.00	40%	1.0	0.0	0.0	0.1	5.0
JEN-Bss-SP-Ex-1	724	64	51	724	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.3	0.0	0.0	0.2	5.0
JEN-Fer-SP-Ex-1	425	64	51	425	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	5.0
KEB-Keb-SP-Ex-1	850	65	52	850	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.5	0.0	0.0	0.3	5.0
KEB-Ken-SP-Ex-1	3,000	65	52	3,000	1.8	0.0	0.0	3.00	2.00	2.00	50%	5.4	0.0	0.0	0.9	6.3
KEB-Ken-SP-Ex-2	5,550	65	52	5,550	3.3	0.0	0.0	2.87	2.00	2.00	50%	9.6	0.0	0.0	1.7	11.2
KEB-Ken-SP-Ex-3	600	65	52	600	0.4	0.0	0.0	3.00	2.00	2.00	50%	1.1	0.0	0.0	0.2	5.0
KEB-Ken-SP-Ex-4	2,530	65	52	2,530	1.5	0.0	0.0	3.00	2.00	2.00	50%	4.6	0.0	0.0	0.8	5.3
KEB-Kes-SP-Ex-1	5,000	65	52	5,000	3.0	0.0	0.0	2.94	2.00	2.00	50%	8.9	0.0	0.0	1.5	10.4
KEB-Kes-SP-Ex-2	1,350	65	52	1,350	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	5.0
KEB-Dou-SP-Ex-1	500	72	58	500	0.3	0.0	0.0	3.00	2.00	2.00	50%	1.0	0.0	0.0	0.2	5.0
KEB-Dos-SP-Ex-1	3,000	72	58	3,000	2.0	0.0	0.0	3.00	2.00	2.00	50%	6.0	0.0	0.0	1.0	7.0
KEB-Sou-SP-Ex-1	1,915	54	43	1,915	1.0	0.0	0.0	3.00	2.00	2.00	50%	2.9	0.0	0.0	0.5	5.0
KEB-Sou-SP-Ex-2	7,500	54	43	7,500	3.8	0.0	0.0	2.79	2.00	2.00	50%	10.5	0.0	0.0	1.9	12.3
KEB-Sou-SP-Ex-3	6,100	54	43	6,100	3.1	0.0	0.0	2.93	2.00	2.00	50%	8.9	0.0	0.0	1.5	10.5
KEB-Sou-SP-Ex-4	620	54	43	620	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.9	0.0	0.0	0.2	5.0
KEB-Sou-SP-Ex-5	2,600	54	43	2,600	1.3	0.0	0.0	3.00	2.00	2.00	50%	3.9	0.0	0.0	0.7	5.0

Table II.1.4 - Pumping Stations Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain
-	(hab)	(L/hab/day)	(L/hab/day)	(hab)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
KEB-Jem-SP-Ex-1	4,000	49	39	4,000	1.8	0.0	0.0	3.00	2.00	2.00	50%	5.4	0.0	0.0	0.9	6.4
BIZ-Biz-SP-Ex-1	2,500	120	96	2,500	2.8	0.0	0.0	3.00	2.00	2.00	50%	8.3	0.0	0.0	1.4	9.7
BIZ-Men-SP-Ex-1	600	100	80	600	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	5.0
BIZ-Raf-SP-Ex-1	5,000	160	128	5,000	7.4	0.0	0.0	2.42	2.00	2.00	50%	17.9	0.0	0.0	3.7	21.6
BIZ-Raf-SP-Ex-2	4,000	160	128	4,000	5.9	0.0	0.0	2.53	2.00	2.00	50%	15.0	0.0	0.0	3.0	17.9
BIZ-Tin-SP-Ex-1	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
BIZ-Tin-SP-Ex-2	8,000	85	68	8,000	6.3	0.0	0.0	2.50	2.00	2.00	50%	15.7	0.0	0.0	3.1	18.9
BIZ-Jam-SP-Rh-2	5,000	80	64	5,000	3.7	5.0	0.0	2.80	2.00	2.00	50%	10.4	10.0	0.0	1.9	22.2
SID-Sid-SP-Ex-1	330	77	62	330	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.7	0.0	0.0	0.1	5.0
ZAG-Zag-SP-Ex-1	600	108	86	600	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.8	0.0	0.0	0.3	5.0
ZAG-Zag-SP-Ex-2	50	108	86	50	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	5.0
ZAG-Ham-SP-Ex-1	1	107	86	1	0.0	0.0	15.0	3.00	2.00	2.00	50%	0.0	0.0	30.0	0.0	30.0
ZAG-Zag-SP-Ex-3	200	108	86	200	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.6	0.0	0.0	0.1	5.0

Table II.1.4 - Pumping Stations Extension (3/3)
Sizing and cost estimation - 2029

Intervention code	Pumping station type	Proportion of road pavement	Proportion of rocky soil	Total capacity	Total Head	Total power	Rising main length	Rising main Diameter	Standard rising main DN	Rising main velocity	Civil work cost	Equip-ment cost	Rising main cost	Total cost	Operation & maintenance cost (rising main)	Operation & maintenance cost (PS civil works)	Operation & maintenance cost (PS Equipment)	Electrical power cost	# Pumping Stations	Rising main lenght
-	-	(%)	(%)	(L/s)	(m)	(Kw)	(m)	D = 0,9 Q0.45	(mm)	(m/s)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	-	(m)
KAS-Fei-SP-Ex-1	SP1B	0%	10%	10.0	5	1.1	1340	83	125	1.0	57,500	57,500	123,280	238,280	3,698	863	2,875	50	1	1,340
KAS-Fei-SP-Ex-2	SP1B	100%	10%	10.0	5	1.1	443	83	125	1.0	57,500	57,500	58,587	173,587	1,758	863	2,875	62	1	443
KAS-Tel-SP-Ex-1	SP1B	100%	80%	10.0	5	1.1	424	83	125	1.0	57,500	57,500	73,140	188,140	2,194	863	2,875	23	1	424
KAS-Tel-SP-Ex-2	SP1B	100%	80%	10.0	5	1.1	241	83	125	1.0	57,500	57,500	41,573	156,573	1,247	863	2,875	23	1	241
BEJ-Maa-SP-Ex-1	SP1B	0%	10%	10.0	4	1.1	8	83	125	1.0	57,500	57,500	736	115,736	22	863	2,875	17	1	8
BEJ-Nef-SP-Ex-2	SP1A	0%	10%	10.0	15	3.0	218	83	125	1.0	46,000	46,000	20,056	112,056	602	690	2,300	5	1	218
BEJ-Nef-SP-Ex-1	SP1A	0%	10%	10.0	8	2.2	3	83	125	1.0	46,000	46,000	276	92,276	8	690	2,300	14	1	3
BEJ-Teb-SP-Ex-3	SP1A	0%	70%	10.0	12	3.0	571	83	125	1.0	46,000	46,000	72,232	164,232	2,167	690	2,300	51	1	571
BEJ-Tes-SP-Ex-1	SP1A	0%	10%	10.0	7	1.5	38	83	125	1.0	46,000	46,000	3,496	95,496	105	690	2,300	4	1	38
SIL-Bou-SP-Ex-1	SP1A	0%	0%	10.0	5	1.1	5	83	125	1.0	46,000	46,000	431	92,431	13	690	2,300	73	1	5
KEF-Kef-SP-Ex-1	SP1B	100%	40%	10.0	10	2.2	210	83	125	1.0	57,500	57,500	31,395	146,395	942	863	2,875	159	1	210
KEF-Taj-SP-Ex-1	SP1B	0%	10%	10.0	15	3.0	570	83	125	1.0	57,500	57,500	52,440	167,440	1,573	863	2,875	44	1	570
SFA-Sfs-SP-Ex-1	SP1B	80%	0%	10.0	5	1.1	66.0	95	125	1.0	57,500	57,500	7,818	122,818	235	863	2,875	172	1	66
SFA-Sfv-SP-Ex-1	SP1A	100%	0%	10.0	2	1.1	430.0	83	125	1.0	46,000	46,000	54,395	146,395	1,632	690	2,300	36	1	430
SFA-Aga-SP-Ex-1	SP1B	75%	10%	10.0	2	1.1	50.0	104	125	1.0	57,500	57,500	6,109	121,109	183	863	2,875	84	1	50
SFA-Mah-SP-Ex-1	SP1B	75%	10%	10.0	12	3.0	475.0	83	125	1.0	57,500	57,500	58,039	173,039	1,741	863	2,875	72	1	475
SFA-Tyn-SP-Ex-1	SP1B	100%	10%	10.0	2	1.1	207.0	83	125	1.0	57,500	57,500	27,376	142,376	821	863	2,875	28	1	207
SFA-Sfv-RS-Rh-1	-	90%	10%	-	-	-	4123.0	-	1,000	-	0	0	4,625,284	4,625,284	138,759	0	0	0	0	4,123
JEN-Gha-SP-Ex-1	SP1B	0%	20%	10.0	10	2.2	580	83	125	1.0	57,500	57,500	56,695	171,695	1,701	863	2,875	49	1	580
JEN-Jen-SP-Ex-1	SP1B	0%	5%	10.0	5	1.1	466	83	125	1.0	57,500	57,500	41,532	156,532	1,246	863	2,875	98	1	466
JEN-Tab-SP-Ex-1	SP1B	100%	40%	10.0	63	15.0	670	83	125	1.0	57,500	57,500	100,165	215,165	3,005	863	2,875	360	1	670
JEN-Tab-SP-Ex-2	SP1B	100%	40%	10.0	63	15.0	1123	83	125	1.0	57,500	57,500	167,889	282,889	5,037	863	2,875	360	1	1,123
JEN-Bss-SP-Ex-1	SP1B	50%	5%	10.0	7	1.5	1030	83	125	1.0	57,500	57,500	112,528	227,528	3,376	863	2,875	54	1	1,030
JEN-Fer-SP-Ex-1	SP1B	5%	30%	10.0	12	3.0	785	83	125	1.0	57,500	57,500	82,827	197,827	2,485	863	2,875	54	1	785
KEB-Keb-SP-Ex-1	SP1B	20%	0%	10.0	12	3.0	810	83	125	1.0	57,500	57,500	76,383	191,383	2,291	863	2,875	110	1	810
KEB-Ken-SP-Ex-1	SP1B	100%	0%	10.0	14	3.0	1260	92	125	1.0	57,500	57,500	159,390	274,390	4,782	863	2,875	452	1	1,260
KEB-Ken-SP-Ex-2	SP2B	100%	0%	11.2	10	3.0	835	120	125	1.1	52,127	78,191	105,628	235,946	3,169	782	3,910	597	1	835
KEB-Ken-SP-Ex-3	SP1B	0%	0%	10.0	5	1.1	390	83	125	1.0	57,500	57,500	33,638	148,638	1,009	863	2,875	32	1	390
KEB-Ken-SP-Ex-4	SP1B	100%	0%	10.0	55	11.0	4290	85	125	1.0	57,500	57,500	542,685	657,685	16,281	863	2,875	1,497	1	4,290
KEB-Kes-SP-Ex-1	SP2B	100%	0%	10.4	17	4.0	920	115	125	1.0	49,395	74,092	116,380	239,867	3,491	741	3,705	915	1	920
KEB-Kes-SP-Ex-2	SP1B	40%	0%	10.0	13	3.0	760	83	125	1.0	57,500	57,500	77,786	192,786	2,334	863	2,875	189	1	760
KEB-Dou-SP-Ex-1	SP1B	0%	0%	10.0	2	1.1	175	83	125	1.0	57,500	57,500	15,094	130,094	453	863	2,875	12	1	175
KEB-Dos-SP-Ex-1	SP1B	0%	0%	10.0	20	4.0	4710	97	125	1.0	57,500	57,500	406,238	521,238	12,187	863	2,875	715	1	4,710
KEB-Sou-SP-Ex-1	SP1B	90%	20%	10.0	25	5.5	550	83	125	1.0	57,500	57,500	73,686	188,686	2,211	863	2,875	428	1	550
KEB-Sou-SP-Ex-2	SP2B	90%	20%	12.3	9	2.2	450	125	125	1.2	55,362	83,042	60,289	198,693	1,809	830	4,152	570	1	450
KEB-Sou-SP-Ex-3	SP2B	90%	20%	10.5	14	3.0	495	116	125	1.0	49,738	74,606	66,318	190,662	1,990	746	3,730	764	1	495
KEB-Sou-SP-Ex-4	SP1B	90%	20%	10.0	5	1.1	200	83	125	1.0	57,500	57,500	26,795	141,795	804	863	2,875	29	1	200
KEB-Sou-SP-Ex-5	SP1B	90%	20%	10.0	19	4.0	795	83	125	1.0	57,500	57,500	106,510	221,510	3,195	863	2,875	442	1	795
KEB-Jem-SP-Ex-1	SP2B	100%	0%	10.0	55	11.0	11230	92	125	1.0	35,951	53,926	1,420,595	1,510,472	42,618	539	2,696	1,785	1	11,230
BIZ-Biz-SP-Ex-1	SP1B	100%	5%	10.0	20	4.0	600	112	125	1.0	57,500	57,500	77,625	192,625	2,329	863	2,875	993	1	600

Table II.1.4 - Pumping Stations Extension (3/3)
Sizing and cost estimation - 2029

Intervention code	Pumping station type	Proportion of road pavement	Proportion of rocky soil	Total capacity	Total Head	Total power	Rising main length	Rising main Diameter	Standard rising main DN	Rising main velocity	Civil work cost	Equip-ment cost	Rising main cost	Total cost	Operation & maintenance cost (rising main)	Operation & maintenance cost (PS civil works)	Operation & maintenance cost (PS Equipment)	Electrical power cost	# Pumping Stations	Rising main lenght
-	-	(%)	(%)	(L/s)	(m)	(Kw)	(m)	D = 0,9 Q0.45	(mm)	(m/s)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	-	(m)
BIZ-Men-SP-Ex-1	SP2B	100%	5%	10.0	30	7.5	600	83	125	1.0	30,772	46,158	77,625	154,555	2,329	462	2,308	298	1	600
BIZ-Raf-SP-Ex-1	SP2B	100%	10%	21.6	15	7.5	100	160	200	0.8	79,702	119,553	15,525	214,780	466	1,196	5,978	1,987	1	100
BIZ-Raf-SP-Ex-2	SP2B	100%	10%	17.9	15	5.5	150	147	160	1.0	70,595	105,892	21,563	198,050	647	1,059	5,295	1,589	1	150
BIZ-Tin-SP-Ex-1	SP2B	100%	5%	10.0	15	3.0	100	87	125	1.0	32,775	49,162	12,938	94,874	388	492	2,458	422	1	100
BIZ-Tin-SP-Ex-2	SP2B	100%	5%	18.9	25	11.0	300	151	160	1.1	72,948	109,422	42,263	224,632	1,268	1,094	5,471	2,815	1	300
BIZ-Jam-SP-Rh-2	SP2B	100%	5%	22.2	25	11.0	940	162	200	0.8	81,132	121,698	143,233	346,063	4,297	1,217	6,085	3,891	1	940
SID-Sid-SP-Ex-1	SP1B	0%	0%	10.0	5	1.1	433	83	125	1.0	57,500	57,500	37,346	152,346	1,120	863	2,875	21	1	433
ZAG-Zag-SP-Ex-1	SP2B	100%	0%	10.0	15	3.0	400	83	125	1.0	30,772	46,158	50,600	127,530	1,518	462	2,308	161	1	400
ZAG-Zag-SP-Ex-2	SP1A	100%	0%	10.0	10	2.2	80	83	125	1.0	46,000	46,000	10,120	102,120	304	690	2,300	9	1	80
ZAG-Ham-SP-Ex-1	SP2B	40%	75%	30.0	20	15.0	2100	186	200	1.1	98,625	447,938	353,798	900,360	10,614	1,479	22,397	5,365	1	2,100
ZAG-Zag-SP-Ex-3	SP1B	100%	0%	10.0	15	3.0	80	83	125	1.0	57,500	57,500	10,120	125,120	304	863	2,875	54	1	80

Table II.1.5 - Pumping Stations Rehabilitation (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
BEJA	BEJ	Medjez El Bab	Med	SP5	SP	Rh	1	BEJ-Med-SP-Rh-1
KEF	KEF	Dahmani	Dah	SP 2	SP	Rh	1	KEF-Dah-SP-Rh-1
KEF	KEF	Kef	Kef	SP 9 Avril	SP	Rh	1	KEF-Kef-SP-Rh-1
KEF	KEF	Kef	Kef	SP 3 Août	SP	Rh	2	KEF-Kef-SP-Rh-2
KEF	KEF	Tajerouine	Taj	SP Essanoubar	SP	Rh	1	KEF-Taj-SP-Rh-1
SFAX	SFA	Sfax Ville	Sfv	SP 2 Habbena	SP	Rh	1	SFA-Sfv-SP-Rh-1
SFAX	SFA	Sfax Ville	Sfv	SP Kasset Chabena	SP	Rh	2	SFA-Sfv-SP-Rh-2
SFAX	SFA	Mahres	Mah	SP Port de Peche	SP	Rh	1	SFA-Mah-SP-Rh-1
SFAX	SFA	Sakiet Ezzit	Sae	Route de Tunis GP 1	RS	Rh	1	SFA-Sae-RS-Rh-1
SFAX	SFA	Sfax Ville	Sfv	Cité Saline	RS	Rh	1	SFA-Sfv-RS-Rh-1
JENDOUBA	JEN	Jendouba	Jen	SP Ettataouer	SP	Rh	1	JEN-Jen-SP-Rh-1
JENDOUBA	JEN	Jendouba	Jen	SP 3	SP	Rh	2	JEN-Jen-SP-Rh-2
JENDOUBA	JEN	Jendouba	Jen	SP 4	SP	Rh	3	JEN-Jen-SP-Rh-3
JENDOUBA	JEN	Jendouba	Jen	SP Timiria	SP	Rh	4	JEN-Jen-SP-Rh-4
JENDOUBA	JEN	Tabarka	Tab	SP Morjane	SP	Rh	1	JEN-Tab-SP-Rh-1
KEBILI	KEB	Kebili	Keb	SR2	SP	Rh	1	KEB-Keb-SP-Rh-1
KEBILI	KEB	Kebili	Keb	SR1	SP	Rh	2	KEB-Keb-SP-Rh-2
BIZERTE	BIZ	Menzel Abderahmen	Abd	SPRA 2	SP	Rh	1	BIZ-Abd-SP-Rh-1
BIZERTE	BIZ	Zarzouna	Zar	SP RZ1 Oued Romine	SP	Rh	1	BIZ-Zar-SP-Rh-1
BIZERTE	BIZ	Zarzouna	Zar	SP RZ2	SP	Rh	2	BIZ-Zar-SP-Rh-2
BIZERTE	BIZ	Zarzouna	Zar	SP RZ3 Marche du Gros	SP	Rh	3	BIZ-Zar-SP-Rh-3
BIZERTE	BIZ	Menzel Jamil	Jam	SRJ 1	SP	Rh	1	BIZ-Jam-SP-Rh-1
BIZERTE	BIZ	Mateur	Mat	SP Hachad	SP	Rh	1	BIZ-Mat-SP-Rh-1
BIZERTE	BIZ	Mateur	Mat	SP Sadaka	SP	Rh	2	BIZ-Mat-SP-Rh-2
BIZERTE	BIZ	Tinja	Tin	SP Sprols	SP	Rh	1	BIZ-Tin-SP-Rh-1
SIDI BOUZID	SID	Sidi Bouzid	Sid	Av. Maghreb Arabe	RS	Rh	2	SID-Sid-RS-Rh-2
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Hôspital Régional	RS	Rh	7	SID-Sid-RS-Rh-7

Note:

BIZ-Jam-SP-Rh-2 The intervention consists in the construction of a new pumping station on lower land 300m away.
Consequently, even this intervention is classified as Rh, it will be considered as Ex in terms of cost estimation and works.

Table II.1.5 - Pumping Stations Rehabilitation (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain
-	(hab)	(L/hab/day)	(L/hab/day)	(hab)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
BEJ-Med-SP-Rh-1	5,000	120	96	5,000	5.6	0.0	0.0	2.56	2.00	2.00	40%	14.2	0.0	0.0	2.2	16.4
KEF-Dah-SP-Rh-1	1,000	78	62	1,000	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.2	0.0	0.0	0.4	5.0
KEF-Kef-SP-Rh-1	3,000	84	67	3,000	2.3	0.2	0.2	3.00	2.00	2.00	50%	7.0	0.4	0.3	1.2	8.9
KEF-Kef-SP-Rh-2	10,000	84	67	10,000	7.8	0.7	0.5	2.40	2.00	2.00	50%	18.6	1.4	1.0	3.9	24.9
KEF-Taj-SP-Rh-1	400	78	62	400	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.9	0.0	0.0	0.1	5.0
SFA-Sfv-SP-Rh-1	10,000	104	83	10,000	9.6	0.0	0.0	2.31	2.00	2.00	100%	22.2	0.0	10.0	9.6	41.8
SFA-Sfv-SP-Rh-2	10,000	104	83	10,000	9.6	0.0	0.0	2.31	2.00	2.00	100%	22.2	0.0	10.0	9.6	41.8
SFA-Mah-SP-Rh-1	1	-	-	1	0.0	5.0	0.0	0.00	2.00	0.00	-	0.0	10.0	0.0	0.0	10.0
SFA-Sae-RS-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SFA-Sfv-RS-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JEN-Jen-SP-Rh-1	20,000	110	88	20,000	20.4	0.0	0.0	2.05	2.00	0.00	40%	41.8	0.0	0.0	8.1	50.0
JEN-Jen-SP-Rh-2	5,000	110	88	5,000	5.1	0.0	0.0	2.61	2.00	0.00	40%	13.3	0.0	0.0	2.0	15.3
JEN-Jen-SP-Rh-3	30,000	110	88	30,000	30.6	0.0	0.0	1.95	2.00	0.00	40%	59.7	0.0	0.0	12.2	71.9
JEN-Jen-SP-Rh-4	200	110	88	200	0.2	0.0	0.0	3.00	2.00	0.00	40%	0.6	0.0	0.0	0.1	5.0
JEN-Tab-SP-Rh-1	2,000	110	88	2,000	2.0	0.0	0.0	3.00	2.00	0.00	40%	6.1	0.0	0.0	0.8	6.9
KEB-Keb-SP-Rh-1	4,000	65	52	4,000	2.4	0.0	0.0	3.00	2.00	0.00	50%	7.2	0.0	10.0	1.2	18.4
KEB-Keb-SP-Rh-2	7,500	65	52	7,500	4.5	0.0	0.0	2.68	2.00	0.00	50%	12.1	0.0	0.0	2.3	14.3
BIZ-Abd-SP-Rh-1	18,700	80	64	18,700	13.9	25.0	0.0	2.17	2.00	0.00	40%	30.1	50.0	1.0	5.5	86.6
BIZ-Zar-SP-Rh-1	18,700	110	88	18,700	19.0	25.0	0.0	2.07	2.00	0.00	40%	39.5	50.0	2.0	7.6	99.1
BIZ-Zar-SP-Rh-2	70,000	110	88	70,000	71.3	0.0	0.0	1.80	2.00	0.00	40%	128.1	0.0	3.0	28.5	159.6
BIZ-Zar-SP-Rh-3	30,000	110	88	30,000	30.6	12.0	0.0	1.95	2.00	0.00	40%	59.7	24.0	4.0	12.2	99.9
BIZ-Jam-SP-Rh-1	30,000	80	64	30,000	22.2	10.0	0.0	2.03	2.00	0.00	40%	45.1	20.0	5.0	8.9	79.0
BIZ-Mat-SP-Rh-1	15,000	80	64	15,000	11.1	10.0	0.0	2.25	2.00	0.00	40%	25.0	20.0	6.0	4.4	55.4
BIZ-Mat-SP-Rh-2	12,000	80	64	12,000	8.9	2.5	0.0	2.34	2.00	0.00	40%	20.8	5.0	7.0	3.6	36.3
BIZ-Tin-SP-Rh-1	12,000	85	68	12,000	9.4	0.0	0.0	2.31	2.00	0.00	40%	21.8	0.0	8.0	3.8	33.6
SID-Sid-RS-Rh-2	3,900	77	62	3,900	2.8	0.0	0.0	3.00	2.00	0.00	50%	8.3	0.0	0.0	1.4	9.7
SID-Sid-RS-Rh-7	1,000	77	62	1,000	0.7	0.0	0.0	3.00	2.00	0.00	50%	2.1	0.0	0.0	0.4	5.0

Table II.1.5 - Pumping Stations Rehabilitation (3/3)
Sizing and cost estimation - 2029

Intervention code	Pumping station type	Proportion of road pavement	Proportion of rocky soil	Total capacity	Total Head	Total power	Rising main length	Rising main Diameter	Standard rising main DN	Rising main velocity	Civil works rehabilitation %	Equip. rehabilitation %	Rising main rehabilitation %	Civil work cost	Equipment cost	Rising main cost	Total cost	Operation & maintenance cost (rising main)	Operation & maintenance cost (PS civil works)	Operation & maintenance cost (PS Equipment)	Electrical power cost	# Pumping Stations	Rising main lenght
-	-	(%)	(%)	(L/s)	(m)	(Kw)	(m)	D = 0,9 Q0.45	(mm)	(m/s)	(%)	(%)	(%)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	-	(m)
BEJ-Med-SP-Rh-1	SP1B	0%	20%	16.4	12	4.0	120	142	160	1.0	10%	50%	100%	5,750	28,750	15,732	50,232	342	750	2,500	1,192	1	120
KEF-Dah-SP-Rh-1	SP1B	100%	20%	10.0	20	4.0	170	83	125	0.5	0%	25%	0%	0	14,375	0	14,375	612	750	2,500	258	1	0
KEF-Kef-SP-Rh-1	SP1B	100%	80%	10.0	5	1.1	530	107	125	0.8	50%	100%	100%	28,750	57,500	109,710	195,960	2,385	750	2,500	240	1	530
KEF-Kef-SP-Rh-2	SP2A	100%	80%	24.9	5	3.0	250	171	200	0.9	50%	100%	100%	30,694	92,082	58,650	181,427	1,275	801	4,004	803	1	250
KEF-Taj-SP-Rh-1	SP1B	100%	10%	10.0	15	3.0	700	83	125	0.5	10%	0%	0%	5,750	0	0	5,750	2,415	750	2,500	77	1	0
SFA-Sfv-SP-Rh-1	SP2B	0%	10%	41.8	5	5.5	2	216	250	1.0	100%	100%	100%	122,407	183,610	331	306,349	7	1,597	7,983	861	1	2
SFA-Sfv-SP-Rh-2	SP2A	100%	0%	41.8	7	7.5	200	216	250	1.0	30%	100%	100%	25,784	128,918	41,400	196,102	900	1,121	5,605	1,205	1	200
SFA-Mah-SP-Rh-1	SP1B	20%	10%	10.0	8	2.2	386	113	125	1.0	40%	60%	100%	23,000	34,500	46,343	103,843	1,007	750	2,500	715	1	386
SFA-Sae-RS-Rh-1	-	100%	10%	-	-	-	150	-	200	-	0%	0%	100%	0	0	27,945	27,945	608	0	0	0	0	150
SFA-Sfv-RS-Rh-1	-	90%	0%	-	-	-	827	-	1,000	-	0%	0%	100%	0	0	1,107,593	1,107,593	24,078	0	0	0	0	827
JEN-Jen-SP-Rh-1	SP2A	100%	5%	50.0	5	5.5	380	234	250	1.2	80%	100%	100%	77,195	144,741	79,971	301,907	1,739	1,259	6,293	1,821	1	380
JEN-Jen-SP-Rh-2	SP2A	100%	5%	15.3	10	4.0	143	137	160	0.9	80%	100%	100%	35,785	67,098	24,174	127,057	526	583	2,917	911	1	143
JEN-Jen-SP-Rh-3	SP2B	100%	5%	71.9	10	15.0	10	275	315	1.1	100%	100%	100%	174,021	261,031	2,519	437,570	55	2,270	11,349	5,464	1	10
JEN-Jen-SP-Rh-4	SP1B	0%	5%	10.0	5	1.1	100	83	125	0.5	50%	50%	100%	28,750	28,750	10,695	68,195	233	750	2,500	18	1	100
JEN-Tab-SP-Rh-1	SP1B	100%	40%	10.0	6	1.5	744	96	125	0.7	0%	50%	100%	0	28,750	133,474	162,224	2,902	750	2,500	219	1	744
KEB-Keb-SP-Rh-1	SP2B	100%	0%	18.4	16	7.5	750	149	160	1.1	90%	100%	100%	64,654	107,757	124,200	296,611	2,700	937	4,685	689	1	750
KEB-Keb-SP-Rh-2	SP2B	100%	0%	14.3	10	3.0	1,760	133	160	0.8	90%	100%	0%	54,930	91,550	0	146,480	6,336	796	3,980	807	1	0
BIZ-Abd-SP-Rh-1	SP2B	100%	5%	86.6	55	110.0	1,000	299	315	1.3	50%	100%	100%	98,233	294,699	251,850	644,782	5,475	2,563	12,813	38,209	1	1000
BIZ-Zar-SP-Rh-1	SP2B	100%	5%	99.1	20	45.0	200	318	400	0.9	25%	100%	0%	53,605	321,633	0	375,238	1,395	2,797	13,984	15,752	1	0
BIZ-Zar-SP-Rh-2	SP2B	100%	5%	159.6	15	55.0	600	394	400	1.5	25%	75%	0%	73,061	328,776	0	401,838	4,185	3,812	19,059	19,123	1	0
BIZ-Zar-SP-Rh-3	SP2B	100%	5%	99.9	10	22.0	600	319	400	0.9	25%	75%	0%	53,878	242,451	0	296,329	4,185	2,811	14,055	7,609	1	0
BIZ-Jam-SP-Rh-1	SP2B	100%	5%	79.0	52	90.0	2,700	287	315	1.2	50%	100%	100%	92,529	277,588	679,995	1,050,112	14,783	2,414	12,069	29,960	1	2700
BIZ-Mat-SP-Rh-1	SP2B	100%	5%	55.4	40	45.0	2,200	245	250	1.3	25%	100%	100%	36,751	220,508	462,990	720,250	10,065	1,917	9,587	15,099	1	2200
BIZ-Mat-SP-Rh-2	SP2B	100%	5%	36.3	10	7.5	350	203	250	0.9	25%	25%	0%	27,928	41,892	0	69,819	1,601	1,457	7,285	2,036	1	0
BIZ-Tin-SP-Rh-1	SP2B	100%	0%	33.6	25	18.5	890	196	200	1.3	50%	100%	100%	53,106	159,319	159,666	372,091	3,471	1,385	6,927	4,222	1	890
SID-Sid-RS-Rh-2	SP1B	100%	0%	10.0	5	1.1	192	112	125	0.9	0%	0%	100%	0	0	29,146	29,146	634	750	2,500	249	0	192
SID-Sid-RS-Rh-7	SP1B	100%	0%	10.0	5	1.1	716	83	125	0.5	0%	0%	100%	0	0	108,689	108,689	2,363	750	2,500	64	0	716

Table II.1.6 - Networks Extension (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
KASSERINE	KAS	Feriana	Fei	Feriana	RS	Ex	1	KAS-Fei-RS-Ex-1
KASSERINE	KAS	Kasserine	Kas	Cité Nouvelle Medina	RS	Ex	1	KAS-Kas-RS-Ex-1
KASSERINE	KAS	Kasserine	Kas	Cité Essalem	RS	Ex	3	KAS-Kas-RS-Ex-3
KASSERINE	KAS	Kasserine	Kas	Cité el Feth 3	RS	Ex	4	KAS-Kas-RS-Ex-4
KASSERINE	KAS	Kasserine	Kas	Cité Loutissement rahmouni	RS	Ex	5	KAS-Kas-RS-Ex-5
KASSERINE	KAS	Kasserine	Kas	Cité Bnanna	RS	Ex	6	KAS-Kas-RS-Ex-6
KASSERINE	KAS	Sbeitla	Sbe	Cité Zayatine	RS	Ex	1	KAS-Sbe-RS-Ex-1
KASSERINE	KAS	Sbeitla	Sbe	Cité el Khadhra	RS	Ex	2	KAS-Sbe-RS-Ex-2
KASSERINE	KAS	Thala	Tel	Cité Tela	RS	Ex	1	KAS-Tel-RS-Ex-1
BEJA	BEJ	Medjez El Bab	Med	SP 5	SP	Rh	1	BEJ-Med-SP-Rh-1
BEJA	BEJ	Nefza	Nef	Cité Souassis	RS	Ex	1	BEJ-Nef-RS-Ex-1
BEJA	BEJ	Nefza	Nef	Cité Erriadh	RS	Ex	2	BEJ-Nef-RS-Ex-2
BEJA	BEJ	Nefza	Nef	Cité Sidi Saad	RS	Ex	3	BEJ-Nef-RS-Ex-3
BEJA	BEJ	Nefza	Nef	Cité Farhat Hachad	RS	Ex	4	BEJ-Nef-RS-Ex-4
BEJA	BEJ	Nefza	Nef	Cité Belle Vue	RS	Ex	5	BEJ-Nef-RS-Ex-5
BEJA	BEJ	Nefza	Nef	Cité Ouroud 2	RS	Ex	6	BEJ-Nef-RS-Ex-6
BEJA	BEJ	Nefza	Nef	Cité Ouroud 3	RS	Ex	7	BEJ-Nef-RS-Ex-7
BEJA	BEJ	Nefza	Nef	Cité Elbaraka	RS	Ex	8	BEJ-Nef-RS-Ex-8
BEJA	BEJ	Nefza	Nef	Cité Ezzouhour	RS	Ex	9	BEJ-Nef-RS-Ex-9
BEJA	BEJ	Nefza	Nef	Av. Republique	RS	Ex	10	BEJ-Nef-RS-Ex-10
BEJA	BEJ	Béja	Bej	Cité Sabbalet el Araneb	RS	Ex	1	BEJ-Bej-RS-Ex-1
BEJA	BEJ	Béja	Bej	Cité Sidi Khalaf	RS	Ex	2	BEJ-Bej-RS-Ex-2
BEJA	BEJ	Teboursouk	Teb	Cité Oued Essaha	RS	Ex	1	BEJ-Teb-RS-Ex-1
BEJA	BEJ	Teboursouk	Teb	Cité Ain Mrad 1	RS	Ex	2	BEJ-Teb-RS-Ex-2
BEJA	BEJ	Testour	Tes	Cité Gharnata (Cité Simpar Grenada)	RS	Ex	1	BEJ-Tes-RS-Ex-1
BEJA	BEJ	Testour	Tes	Cité Bassatine 2	RS	Ex	2	BEJ-Tes-RS-Ex-2
SILIANA	SIL	Krib	Kri	Krib	RS	Ex	1	SIL-Kri-RS-Ex-1
KEF	KEF	Dahmani	Dah	Cité Ennasr	RS	Ex	1	KEF-Dah-RS-Ex-1
KEF	KEF	Kef	Kef	Cité Chrichi	RS	Rh	3	KEF-Kef-RS-Rh-3
KEF	KEF	Kef	Kef	Cité Eddir	RS	Ex	1	KEF-Kef-RS-Ex-1
KEF	KEF	Tajerouine	Taj	Cité Rahba	RS	Ex	1	KEF-Taj-RS-Ex-1
KEF	KEF	Tajerouine	Taj	Cité Chebbi	RS	Ex	2	KEF-Taj-RS-Ex-2
KEF	KEF	Tajerouine	Taj	Cité 2 Mars	RS	Ex	3	KEF-Taj-RS-Ex-3
SFAX	SFA	Chihia	Chi	Chihia Tr 1	RS	Ex	1	SFA-Chi-RS-Ex-1
SFAX	SFA	Chihia	Chi	Chihia Tr 2	RS	Ex	2	SFA-Chi-RS-Ex-2
SFAX	SFA	Chihia	Chi	Chihia Tr 3	RS	Ex	3	SFA-Chi-RS-Ex-3
SFAX	SFA	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 1	RS	Ex	1	SFA-Sae-RS-Ex-1
SFAX	SFA	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 2	RS	Ex	2	SFA-Sae-RS-Ex-2
SFAX	SFA	Sakiet Ezzit	Sae	Sakiet Ezzit Tr 3	RS	Ex	3	SFA-Sae-RS-Ex-3
SFAX	SFA	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 1	RS	Ex	1	SFA-Sak-RS-Ex-1
SFAX	SFA	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 2	RS	Ex	2	SFA-Sak-RS-Ex-2
SFAX	SFA	Sakiet Eddaier	Sak	Sakiet Eddaier Tr 3	RS	Ex	3	SFA-Sak-RS-Ex-3
SFAX	SFA	El Ain	Ain	El Ain Tr 1	RS	Ex	1	SFA-Ain-RS-Ex-1
SFAX	SFA	El Ain	Ain	El Ain Tr 2	RS	Ex	2	SFA-Ain-RS-Ex-2
SFAX	SFA	El Ain	Ain	El Ain Tr 3	RS	Ex	3	SFA-Ain-RS-Ex-3
SFAX	SFA	El Ain	Ain	El Ain Tr 4	RS	Ex	4	SFA-Ain-RS-Ex-4
SFAX	SFA	Gremda	Gre	Gremda Tr 1	RS	Ex	1	SFA-Gre-RS-Ex-1
SFAX	SFA	Gremda	Gre	Gremda Tr 2	RS	Ex	2	SFA-Gre-RS-Ex-2
SFAX	SFA	Gremda	Gre	Gremda Tr 3	RS	Ex	3	SFA-Gre-RS-Ex-3
SFAX	SFA	Gremda	Gre	Gremda Tr 4	RS	Ex	4	SFA-Gre-RS-Ex-4
SFAX	SFA	Gremda	Gre	Gremda Tr 5	RS	Ex	5	SFA-Gre-RS-Ex-5
SFAX	SFA	Sfax Sud	Sfs	Zone Industrielle Sidi Salem	RS	Ex	1	SFA-Sfs-RS-Ex-1
SFAX	SFA	Sfax Sud	Sfs	Route Soukra Oued Chabounni 1	RS	Ex	2	SFA-Sfs-RS-Ex-2
SFAX	SFA	Sfax Sud	Sfs	Route Soukra Oued Chabounni 2	RS	Ex	3	SFA-Sfs-RS-Ex-3
SFAX	SFA	Sfax Ville	Sfv	Zone Rte Kaied - M'hamed - Gremda	RS	Ex	1	SFA-Sfv-RS-Ex-1
SFAX	SFA	Sfax Ville	Sfv	Zone Route Lafrane - El Ain	RS	Ex	2	SFA-Sfv-RS-Ex-2
SFAX	SFA	Sfax Ville	Sfv	Zone Route Teniour - Tunis	RS	Ex	3	SFA-Sfv-RS-Ex-3
SFAX	SFA	Sfax Ville	Sfv	Zone Route Gremda - La Frane	RS	Ex	4	SFA-Sfv-RS-Ex-4
SFAX	SFA	Sfax Ville	Sfv	Cité Habbena / Cité Sidi Mansour	RS	Ex	5	SFA-Sfv-RS-Ex-5
SFAX	SFA	Sfax Ville	Sfv	Cité peripheries Canal DHU	RS	Ex	6	SFA-Sfv-RS-Ex-6
SFAX	SFA	Sfax Ville	Sfv	Zone Route Teniour - Kaied M'hamed	RS	Ex	7	SFA-Sfv-RS-Ex-7
SFAX	SFA	Tyna	Tyn	Tyna Tr 1	RS	Ex	1	SFA-Tyn-RS-Ex-1
SFAX	SFA	Tyna	Tyn	Tyna Tr 2	RS	Ex	2	SFA-Tyn-RS-Ex-2
SFAX	SFA	Agareb	Aga	Agareb	RS	Ex	1	SFA-Aga-RS-Ex-1
SFAX	SFA	Agareb	Aga	Zone Industrielle	RS	Ex	2	SFA-Aga-RS-Ex-2
SFAX	SFA	Hencha	Hen	Hencha Tr 1	RS	Ex	1	SFA-Hen-RS-Ex-1
SFAX	SFA	Hencha	Hen	Hencha Tr 2	RS	Ex	2	SFA-Hen-RS-Ex-2
SFAX	SFA	Jebeniana	Jeb	Jebeniana Tr 1	RS	Ex	1	SFA-Jeb-RS-Ex-1
SFAX	SFA	Jebeniana	Jeb	Jebeniana Tr 2	RS	Ex	2	SFA-Jeb-RS-Ex-2
SFAX	SFA	Mahres	Mah	Mahres Tr 1	RS	Ex	1	SFA-Mah-RS-Ex-1

Table II.1.6 - Networks Extension (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
SFAX	SFA	Mahres	Mah	Mahres Tr 2	RS	Ex	2	SFA-Mah-RS-Ex-2
SFAX	SFA	Sfax Sud	Sfv	Birjerbi	RS	Rh	1	SFA-Sfs-RS-Rh-1
SFAX	SFA	Sfax Sud	Sfs	Cité M'harza	RS	Rh	2	SFA-Sfs-RS-Rh-2
SFAX	SFA	Sfax Sud	Sfs	Cité Ellouz / Cité Bouret Avali / Cité Mouroj	RS	Rh	5	SFA-Sfs-RS-Rh-5
SFAX	SFA	Sfax Ville	Sfv	Cité Saline	RS	Rh	1	SFA-Sfv-RS-Rh-1
JENDOUBA	JEN	Fernana	Fer	Cité el Fjouj	RS	Ex	1	JEN-Fer-RS-Ex-1
JENDOUBA	JEN	Ghardimaou	Gha	Cité Sidi Abbes	RS	Ex	1	JEN-Gha-RS-Ex-1
JENDOUBA	JEN	Ghardimaou	Gha	Cité Erraja	RS	Ex	2	JEN-Gha-RS-Ex-2
JENDOUBA	JEN	Jendouba	Jen	Cité Essaidia III	RS	Ex	1	JEN-Jen-RS-Ex-1
JENDOUBA	JEN	Tabarka	Tab	Cité Houemdia	RS	Ex	1	JEN-Tab-RS-Ex-1
JENDOUBA	JEN	Tabarka	Tab	Cité Malloula	RS	Ex	2	JEN-Tab-RS-Ex-2
JENDOUBA	JEN	Tabarka	Tab	Cité Ain Mazouz	RS	Ex	3	JEN-Tab-RS-Ex-3
JENDOUBA	JEN	Bousselem	Bss	Cité Ennour	RS	Ex	1	JEN-Bss-RS-Ex-1
JENDOUBA	JEN	Tabarka	Tab	SP Malloula2	SP	Ex	2	JEN-Tab-SP-Ex-2
JENDOUBA	JEN	Fernana	Fer	Fernana	RS	Rh	1	JEN-Fer-RS-Rh-1
JENDOUBA	JEN	Jendouba	Jen	SP Ettataouer	SP	Rh	1	JEN-Jen-SP-Rh-1
KEBILI	KEB	Kebili	Keb	Kebili (Nezla)/Kebili (Ville)	RS	Ex	1	KEB-Keb-RS-Ex-1
KEBILI	KEB	Kebili nord	Ken	Cité Rabta	RS	Ex	1	KEB-Ken-RS-Ex-1
KEBILI	KEB	Kebili nord	Ken	Cité Tombar	RS	Ex	2	KEB-Ken-RS-Ex-2
KEBILI	KEB	Kebili nord	Ken	Cité Jdida Mansoura	RS	Ex	3	KEB-Ken-RS-Ex-3
KEBILI	KEB	Kebili nord	Ken	Cité Guetya	RS	Ex	4	KEB-Ken-RS-Ex-4
KEBILI	KEB	Kebili sud	Kes	Cité Bazma	RS	Ex	1	KEB-Kes-RS-Ex-1
KEBILI	KEB	Kebili sud	Kes	Cité Rahmat	RS	Ex	2	KEB-Kes-RS-Ex-2
KEBILI	KEB	Douz	Dou	O M Zarzour / Gharbia	RS	Ex	1	KEB-Dou-RS-Ex-1
KEBILI	KEB	Douz sud	Dos	Cité Zeafrane	RS	Ex	1	KEB-Dos-RS-Ex-1
KEBILI	KEB	El Golaa	Gol	Cité El Golaa	RS	Ex	1	KEB-Gol-RS-Ex-1
KEBILI	KEB	Souk Lahad	Sou	Ville de Souk Lahad	RS	Ex	1	KEB-Sou-RS-Ex-1
KEBILI	KEB	Jemna	Jem	Jemna	RS	Ex	1	KEB-Jem-RS-Ex-1
KEBILI	KEB	Kebili nord	Ken	SP Tombar	SP	Ex	2	KEB-Ken-SP-Ex-2
KEBILI	KEB	Kebili nord	Ken	SP Guetya	SP	Ex	4	KEB-Ken-SP-Ex-4
KEBILI	KEB	Kebili sud	Kes	SP Bazma / Rahmat	SP	Ex	1	KEB-Kes-SP-Ex-1
KEBILI	KEB	Kebili sud	Kes	SP Rahmat	SP	Ex	2	KEB-Kes-SP-Ex-2
KEBILI	KEB	Douz sud	Dos	SPZeafrane	SP	Ex	1	KEB-Dos-SP-Ex-1
KEBILI	KEB	Jemna	Jem	SP Jemna 3	SP	Ex	1	KEB-Jem-SP-Ex-1
BIZERTE	BIZ	Bizerte	Biz	Cité Ben Ismail	RS	Ex	1	BIZ-Biz-RS-Ex-1
BIZERTE	BIZ	Menzel Bourguiba	Men	Cité Ben Alaya	RS	Ex	1	BIZ-Men-RS-Ex-1
BIZERTE	BIZ	Menzel Bourguiba	Men	Cité Sidi Yahia	RS	Ex	2	BIZ-Men-RS-Ex-2
BIZERTE	BIZ	Tinja	Tin	Cité Guingla	RS	Ex	1	BIZ-Tin-RS-Ex-1
BIZERTE	BIZ	Tinja	Tin	Cité Farhatia	RS	Ex	2	BIZ-Tin-RS-Ex-2
BIZERTE	BIZ	Tinja	Tin	Rue Gandi	RS	Ex	3	BIZ-Tin-RS-Ex-3
BIZERTE	BIZ	Bizerte	Biz	Ancienne Ville Bizerte	RS	Rh	1	BIZ-Biz-RS-Rh-1
BIZERTE	BIZ	Bizerte	Biz	Cité Fahat Hachad	RS	Rh	2	BIZ-Biz-RS-Rh-2
BIZERTE	BIZ	Mateur	Mat	SP Hachad	SP	Rh	1	BIZ-Mat-SP-Rh-1
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Ouled Belhedi	RS	Ex	1	SID-Sid-RS-Ex-1
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Elfrayjia	RS	Ex	2	SID-Sid-RS-Ex-2
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Ouled Chelbbi	RS	Ex	3	SID-Sid-RS-Ex-3
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Ennour Ouest	RS	Ex	4	SID-Sid-RS-Ex-4
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Chrifa	RS	Ex	5	SID-Sid-RS-Ex-5
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Jammaa Sayah	RS	Ex	6	SID-Sid-RS-Ex-6
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Hammam Zriba (Distance from SPA water network)	RS	Ex	1	ZAG-Ham-RS-Ex-1
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Borj	RS	Ex	1	ZAG-Zag-RS-Ex-1
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Hanaya	RS	Ex	2	ZAG-Zag-RS-Ex-2
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Bouhjar	RS	Ex	3	ZAG-Zag-RS-Ex-3
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Administrative	RS	Ex	4	ZAG-Zag-RS-Ex-4
ZAGHOUAN	ZAG	El Fahs	Zag	Av. Liberté	RS	Rh	7	ZAG-Fah-RS-Rh-7
ZAGHOUAN	ZAG	El Fahs	Zag	Route Kairouan	RS	Rh	8	ZAG-Fah-RS-Rh-8

Table II.1.6 - Networks Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
KAS-Fei-RS-Ex-1	4,950	75	60	4,950	3.4	0.0	0.0	2.85	2.00	2.00	50%	9.8	0.0	0.0	1.7	11.5
KAS-Kas-RS-Ex-1	1,000	75	60	1,000	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.3	2.4
KAS-Kas-RS-Ex-3	1,000	75	60	1,000	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.3	2.4
KAS-Kas-RS-Ex-4	1,250	75	60	1,250	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.6	0.0	0.0	0.4	3.0
KAS-Kas-RS-Ex-5	900	75	60	900	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.9	0.0	0.0	0.3	2.2
KAS-Kas-RS-Ex-6	750	75	60	750	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.6	0.0	0.0	0.3	1.8
KAS-Sbe-RS-Ex-1	75	75	60	75	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	0.2
KAS-Sbe-RS-Ex-2	950	75	60	950	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.0	0.0	0.0	0.3	2.3
KAS-Tel-RS-Ex-1	5,950	75	60	5,950	4.1	0.0	0.0	2.73	2.00	2.00	50%	11.3	0.0	0.0	2.1	13.3
BEJ-Med-SP-Rh-1	5,000	-	-	-	-	0.0	0.0	-	-	-	-	-	-	-	-	16.5
BEJ-Nef-RS-Ex-1	125	85	68	125	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.3	0.0	0.0	0.0	0.3
BEJ-Nef-RS-Ex-2	50	85	68	50	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	0.1
BEJ-Nef-RS-Ex-3	25	85	68	25	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	0.1
BEJ-Nef-RS-Ex-4	125	85	68	125	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.3	0.0	0.0	0.0	0.3
BEJ-Nef-RS-Ex-5	450	85	68	450	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.1	0.0	0.0	0.1	1.2
BEJ-Nef-RS-Ex-6	25	85	68	25	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	0.1
BEJ-Nef-RS-Ex-7	90	85	68	90	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.2	0.0	0.0	0.0	0.2
BEJ-Nef-RS-Ex-8	200	85	68	200	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.5	0.0	0.0	0.1	0.5
BEJ-Nef-RS-Ex-9	15	85	68	15	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.0	0.0	0.0	0.0	0.0
BEJ-Nef-RS-Ex-10	135	85	68	135	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.3	0.0	0.0	0.0	0.4
BEJ-Bej-RS-Ex-1	210	110	88	210	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.6	0.0	0.0	0.1	0.7
BEJ-Bej-RS-Ex-2	350	110	88	350	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.1	0.0	0.0	0.1	1.2
BEJ-Teb-RS-Ex-1	300	85	68	300	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.7	0.0	0.0	0.1	0.8
BEJ-Teb-RS-Ex-2	92	85	68	92	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.2	0.0	0.0	0.0	0.2
BEJ-Tes-RS-Ex-1	240	85	68	240	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.6	0.0	0.0	0.1	0.6
BEJ-Tes-RS-Ex-2	38	85	68	38	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	0.1
SIL-Kri-RS-Ex-1	8,000	75	60	8,000	5.6	0.0	0.0	2.56	2.00	2.00	70%	14.2	0.0	0.0	3.9	18.1
KEF-Dah-RS-Ex-1	125	78	62	125	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.3	0.0	0.0	0.0	0.3
KEF-Kef-RS-Rh-3	2,300	84	67	2,300	1.8	0.2	0.1	3.00	2.00	2.00	50%	5.4	0.3	0.2	0.9	6.8
KEF-Kef-RS-Ex-1	1,000	84	67	1,000	0.8	0.1	0.0	3.00	2.00	2.00	50%	2.3	0.1	0.1	0.4	2.9
KEF-Taj-RS-Ex-1	100	78	62	100	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	0.3
KEF-Taj-RS-Ex-2	225	78	62	225	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.5	0.0	0.0	0.1	0.6
KEF-Taj-RS-Ex-3	300	78	62	300	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.7	0.0	0.0	0.1	0.8
SFA-Chi-RS-Ex-1	2,108	95	76	2,108	1.9	0.0	0.0	3.00	2.00	2.00	50%	5.6	0.0	0.0	0.9	6.5
SFA-Chi-RS-Ex-2	1,045	95	76	1,045	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.8	0.0	0.0	0.5	3.2
SFA-Chi-RS-Ex-3	810	95	76	810	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.4	2.5
SFA-Sae-RS-Ex-1	658	98	78	658	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.8	0.0	0.0	0.3	2.1

Table II.1.6 - Networks Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
SFA-Sae-RS-Ex-2	950	98	78	950	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.6	0.0	0.0	0.4	3.0
SFA-Sae-RS-Ex-3	4,416	98	78	4,416	4.0	0.0	0.0	2.75	2.00	2.00	50%	11.0	0.0	0.0	2.0	13.0
SFA-Sak-RS-Ex-1	10,780	98	78	10,780	9.8	0.0	0.0	2.30	2.00	2.00	50%	22.5	0.0	0.0	4.9	27.4
SFA-Sak-RS-Ex-2	13,380	98	78	13,380	12.1	0.0	0.0	2.22	2.00	2.00	50%	26.9	0.0	0.0	6.1	33.0
SFA-Sak-RS-Ex-3	5,405	98	78	5,405	4.9	0.0	0.0	2.63	2.00	2.00	50%	12.9	0.0	0.0	2.5	15.3
SFA-Ain-RS-Ex-1	755	95	76	755	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.0	0.0	0.0	0.3	2.3
SFA-Ain-RS-Ex-2	2,290	95	76	2,290	2.0	0.0	0.0	3.00	2.00	2.00	50%	6.0	0.0	0.0	1.0	7.1
SFA-Ain-RS-Ex-3	3,595	95	76	3,595	3.2	0.0	0.0	2.91	2.00	2.00	50%	9.2	0.0	0.0	1.6	10.8
SFA-Ain-RS-Ex-4	4,040	95	76	4,040	3.6	0.0	0.0	2.83	2.00	2.00	50%	10.0	0.0	0.0	1.8	11.8
SFA-Gre-RS-Ex-1	2,805	93	74	2,805	2.4	0.0	0.0	3.00	2.00	2.00	50%	7.2	0.0	0.0	1.2	8.5
SFA-Gre-RS-Ex-2	5,040	93	74	5,040	4.3	0.0	0.0	2.70	2.00	2.00	50%	11.7	0.0	0.0	2.2	13.9
SFA-Gre-RS-Ex-3	5,205	93	74	5,205	4.5	0.0	0.0	2.68	2.00	2.00	50%	12.0	0.0	0.0	2.2	14.3
SFA-Gre-RS-Ex-4	4,340	93	74	4,340	3.7	0.0	0.0	2.79	2.00	2.00	50%	10.4	0.0	0.0	1.9	12.3
SFA-Gre-RS-Ex-5	3,315	93	74	3,315	2.9	0.0	0.0	2.98	2.00	2.00	50%	8.5	0.0	0.0	1.4	9.9
SFA-Sfs-RS-Ex-1	2,000	104	83	2,000	1.9	0.0	0.0	3.00	2.00	2.00	50%	5.8	0.0	0.0	1.0	6.7
SFA-Sfs-RS-Ex-2	1,030	104	83	1,030	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
SFA-Sfs-RS-Ex-3	810	104	83	810	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.3	0.0	0.0	0.4	2.7
SFA-Sfv-RS-Ex-1	1,050	104	83	1,050	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
SFA-Sfv-RS-Ex-2	600	104	83	600	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	2.0
SFA-Sfv-RS-Ex-3	2,250	104	83	2,250	2.2	0.0	0.0	3.00	2.00	2.00	50%	6.5	0.0	0.0	1.1	7.6
SFA-Sfv-RS-Ex-4	1,075	104	83	1,075	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.1	0.0	0.0	0.5	3.6
SFA-Sfv-RS-Ex-5	10,965	104	83	10,965	10.6	0.0	0.0	2.27	2.00	2.00	50%	24.0	0.0	0.0	5.3	29.2
SFA-Sfv-RS-Ex-6	1,400	104	83	1,400	1.3	0.0	0.0	3.00	2.00	2.00	50%	4.0	0.0	0.0	0.7	4.7
SFA-Sfv-RS-Ex-7	325	104	83	325	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.9	0.0	0.0	0.2	1.1
SFA-Tyn-RS-Ex-1	390	93	74	390	0.3	0.0	0.0	3.00	2.00	2.00	50%	1.0	0.0	0.0	0.2	1.2
SFA-Tyn-RS-Ex-2	3,830	93	74	3,830	3.3	0.0	0.0	2.88	2.00	2.00	50%	9.5	0.0	0.0	1.6	11.1
SFA-Aga-RS-Ex-1	1,500	85	68	1,500	1.2	0.0	0.0	3.00	2.00	2.00	50%	3.5	0.0	0.0	0.6	4.1
SFA-Aga-RS-Ex-2	1,500	85	68	1,500	1.2	0.0	0.0	3.00	2.00	2.00	50%	3.5	0.0	0.0	0.6	4.1
SFA-Hen-RS-Ex-1	1,750	87	70	1,750	1.4	0.0	0.0	3.00	2.00	2.00	50%	4.2	0.0	0.0	0.7	4.9
SFA-Hen-RS-Ex-2	1,100	87	70	1,100	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.7	0.0	0.0	0.4	3.1
SFA-Jeb-RS-Ex-1	1,000	88	70	1,000	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	2.9
SFA-Jeb-RS-Ex-2	1,350	88	70	1,350	1.1	0.0	0.0	3.00	2.00	2.00	50%	3.3	0.0	0.0	0.6	3.9
SFA-Mah-RS-Ex-1	10,825	88	70	10,825	8.8	0.0	0.0	2.34	2.00	2.00	50%	20.7	0.0	0.0	4.4	25.1
SFA-Mah-RS-Ex-2	2,750	88	70	2,750	2.2	0.0	0.0	3.00	2.00	2.00	50%	6.7	0.0	0.0	1.1	7.8
SFA-Sfs-RS-Rh-1	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0
SFA-Sfs-RS-Rh-2	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0
SFA-Sfs-RS-Rh-5	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0

Table II.1.6 - Networks Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
SFA-Sfv-RS-Rh-1	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0
JEN-Fer-RS-Ex-1	425	64	51	425	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
JEN-Gha-RS-Ex-1	458	65	52	458	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
JEN-Gha-RS-Ex-2	548	65	52	548	0.3	0.0	0.0	3.00	2.00	2.00	40%	1.0	0.0	0.0	0.1	1.1
JEN-Jen-RS-Ex-1	1,077	110	88	1,077	1.1	0.0	0.0	3.00	2.00	2.00	40%	3.3	0.0	0.0	0.4	3.7
JEN-Tab-RS-Ex-1	800	110	88	800	0.8	0.0	0.0	3.00	2.00	2.00	40%	2.4	0.0	0.0	0.3	2.8
JEN-Tab-RS-Ex-2	263	110	88	263	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
JEN-Tab-RS-Ex-3	821	110	88	821	0.8	0.0	0.0	3.00	2.00	2.00	40%	2.5	0.0	0.0	0.3	2.8
JEN-Bss-RS-Ex-1	724	64	51	724	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.3	0.0	0.0	0.2	1.5
JEN-Tab-SP-Ex-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JEN-Fer-RS-Rh-1	681	64	51	681	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.2	0.0	0.0	0.2	1.4
JEN-Jen-SP-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
KEB-Keb-RS-Ex-1	1,000	65	52	1,000	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.8	0.0	0.0	0.3	2.1
KEB-Ken-RS-Ex-1	3,000	65	52	3,000	1.8	0.0	0.0	3.00	2.00	2.00	50%	5.4	0.0	0.0	0.9	6.3
KEB-Ken-RS-Ex-2	5,550	65	52	5,550	3.3	0.0	0.0	2.87	2.00	2.00	50%	9.6	0.0	0.0	1.7	11.2
KEB-Ken-RS-Ex-3	3,000	65	52	3,000	1.8	0.0	0.0	3.00	2.00	2.00	50%	5.4	0.0	0.0	0.9	6.3
KEB-Ken-RS-Ex-4	2,530	65	52	2,530	1.5	0.0	0.0	3.00	2.00	2.00	50%	4.6	0.0	0.0	0.8	5.3
KEB-Kes-RS-Ex-1	3,650	65	52	3,650	2.2	0.0	0.0	3.00	2.00	2.00	50%	6.6	0.0	0.0	1.1	7.7
KEB-Kes-RS-Ex-2	1,350	65	52	1,350	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	2.8
KEB-Dou-RS-Ex-1	2,000	72	58	2,000	1.3	0.0	0.0	3.00	2.00	2.00	50%	4.0	0.0	0.0	0.7	4.7
KEB-Dos-RS-Ex-1	3,000	72	58	3,000	2.0	0.0	0.0	3.00	2.00	2.00	50%	6.0	0.0	0.0	1.0	7.0
KEB-Gol-RS-Ex-1	750	50	40	750	0.3	0.0	0.0	3.00	2.00	2.00	50%	1.0	0.0	0.0	0.2	1.2
KEB-Sou-RS-Ex-1	15,000	54	43	15,000	7.5	0.0	0.0	2.41	2.00	2.00	50%	18.1	0.0	0.0	3.8	21.8
KEB-Jem-RS-Ex-1	3,500	49	39	3,500	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.8	0.0	0.0	0.8	5.6
KEB-Ken-SP-Ex-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEB-Ken-SP-Ex-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEB-Kes-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEB-Kes-SP-Ex-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEB-Dos-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEB-Jem-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIZ-Biz-RS-Ex-1	2,500	120	96	2,500	2.8	0.0	0.0	3.00	2.00	2.00	50%	8.3	0.0	0.0	1.4	9.7
BIZ-Men-RS-Ex-1	600	100	80	600	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	1.9
BIZ-Men-RS-Ex-2	400	100	80	400	0.4	0.0	0.0	3.00	2.00	2.00	50%	1.1	0.0	0.0	0.2	1.3
BIZ-Tin-RS-Ex-1	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
BIZ-Tin-RS-Ex-2	1,500	85	68	1,500	1.2	0.0	0.0	3.00	2.00	2.00	50%	3.5	0.0	0.0	0.6	4.1
BIZ-Tin-RS-Ex-3	600	85	68	600	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.4	0.0	0.0	0.2	1.7
BIZ-Biz-RS-Rh-1	15,000	120	96	15,000	16.7	0.0	0.0	2.11	2.00	2.00	50%	35.2	0.0	0.0	8.3	43.5

Table II.1.6 - Networks Extension (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
BIZ-Biz-RS-Rh-2	1,500	120	96	1,500	1.7	0.0	0.0	3.00	2.00	2.00	50%	5.0	0.0	0.0	0.8	5.8
BIZ-Mat-SP-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SID-Sid-RS-Ex-1	800	77	62	800	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	2.0
SID-Sid-RS-Ex-2	1,400	77	62	1,400	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
SID-Sid-RS-Ex-3	900	77	62	900	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.9	0.0	0.0	0.3	2.2
SID-Sid-RS-Ex-4	330	77	62	330	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.7	0.0	0.0	0.1	0.8
SID-Sid-RS-Ex-5	1,100	77	62	1,100	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	2.7
SID-Sid-RS-Ex-6	800	77	62	800	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	2.0
ZAG-Ham-RS-Ex-1	1	107	86	1	0.0	0.0	10.0	3.00	2.00	2.00	50%	0.0	0.0	20.0	0.0	20.0
ZAG-Zag-RS-Ex-1	150	108	86	150	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.5	0.0	0.0	0.1	0.5
ZAG-Zag-RS-Ex-2	200	108	86	200	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.6	0.0	0.0	0.1	0.7
ZAG-Zag-RS-Ex-3	50	108	86	50	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	0.2
ZAG-Zag-RS-Ex-4	75	108	86	75	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	0.3
ZAG-Fah-RS-Rh-7	4,000	108	86	4,000	4.0	0.0	0.0	2.75	2.00	2.00	50%	11.0	0.0	0.0	2.0	13.0
ZAG-Fah-RS-Rh-8	700	108	86	700	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.4	2.5

Table II.1.6 - Networks Extension (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
KAS-Fei-RS-Ex-1	PVC	90	250	0.3%	235	32	35%	91%	97	0.7	1.5	20,735	444	0	0	0	0	0	0	990	50%	10%	Non	2,229,013	52,170	0	0	0	0	0	0	396,000	3,078,760	92,363	21,179
KAS-Kas-RS-Ex-1	PVC	90	250	0.3%	235	32	7%	58%	42	0.4	0.8	2,586	0	0	0	0	0	0	0	200	10%	0%	Non	228,861	0	0	0	0	0	0	0	80,000	355,190	10,656	2,586
KAS-Kas-RS-Ex-3	PVC	90	250	0.3%	235	32	7%	58%	42	0.4	0.8	3,352	0	0	0	0	0	0	0	450	0%	0%	Non	284,920	0	0	0	0	0	0	0	180,000	534,658	16,040	3,352
KAS-Kas-RS-Ex-4	PVC	90	250	0.3%	235	32	9%	62%	47	0.5	0.8	2,583	0	0	0	0	0	0	0	90	0%	0%	Non	219,555	0	0	0	0	0	0	0	36,000	293,888	8,817	2,583
KAS-Kas-RS-Ex-5	PVC	90	250	0.3%	235	32	7%	56%	40	0.4	0.7	2,723	0	0	0	0	0	0	0	90	0%	0%	Non	231,455	0	0	0	0	0	0	0	36,000	307,573	9,227	2,723
KAS-Kas-RS-Ex-6	PVC	90	250	0.3%	235	32	6%	54%	38	0.4	0.7	2,005	0	0	0	0	0	0	0	150	0%	0%	Non	170,425	0	0	0	0	0	0	0	60,000	264,989	7,950	2,005
KAS-Sbe-RS-Ex-1	PVC	90	250	0.3%	235	32	1%	26%	12	0.2	0.2	300	0	0	0	0	0	0	0	15	0%	0%	Non	25,500	0	0	0	0	0	0	0	6,000	36,225	1,087	300
KAS-Sbe-RS-Ex-2	PVC	90	250	0.3%	235	32	7%	58%	42	0.4	0.8	1,960	0	0	0	0	0	0	0	190	0%	0%	Non	166,600	0	0	0	0	0	0	0	76,000	278,990	8,370	1,960
KAS-Tel-RS-Ex-1	PVC	90	250	0.3%	235	32	41%	94%	104	0.7	1.6	12,000	0	0	0	0	0	0	0	1,190	50%	80%	Non	1,710,000	0	0	0	0	0	0	0	476,000	2,513,900	75,417	12,000
BEJ-Med-SP-Rh-1	PVC	90	315	0.5%	297	78	21%	79%	92	0.9	2.6	0	651	0	0	0	0	0	0	0	0%	20%	Non	0	68,355	0	0	0	0	0	0	0	78,608	2,358	651
BEJ-Nef-RS-Ex-1	PVC	90	250	0.5%	235	42	1%	29%	14	0.3	0.4	247	0	0	0	0	0	0	0	25	0%	10%	Oui	22,230	0	0	0	0	0	0	0	10,000	37,065	1,112	247
BEJ-Nef-RS-Ex-2	PVC	90	250	0.5%	235	42	0%	22%	9	0.2	0.3	376	0	0	0	0	0	0	0	10	0%	10%	Oui	33,840	0	0	0	0	0	0	0	4,000	43,516	1,305	376
BEJ-Nef-RS-Ex-3	PVC	90	250	0.5%	235	42	0%	14%	5	0.1	0.2	352	0	0	0	0	0	0	0	5	0%	10%	Oui	31,680	0	0	0	0	0	0	0	2,000	38,732	1,162	352
BEJ-Nef-RS-Ex-4	PVC	90	250	0.5%	235	42	1%	29%	14	0.3	0.4	583	0	0	0	0	0	0	0	20	100%	10%	Oui	72,875	0	0	0	0	0	0	0	8,000	93,006	2,790	583
BEJ-Nef-RS-Ex-5	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	1,010	0	0	0	0	0	0	0	90	100%	10%	Oui	126,250	0	0	0	0	0	0	0	36,000	186,588	5,598	1,010
BEJ-Nef-RS-Ex-6	PVC	90	250	0.5%	235	42	0%	14%	5	0.1	0.2	225	0	0	0	0	0	0	0	5	100%	10%	Oui	28,125	0	0	0	0	0	0	0	2,000	34,644	1,039	225
BEJ-Nef-RS-Ex-7	PVC	90	250	0.5%	235	42	1%	26%	12	0.2	0.4	375	0	0	0	0	0	0	0	18	0%	10%	Oui	33,750	0	0	0	0	0	0	0	7,200	47,093	1,413	375
BEJ-Nef-RS-Ex-8	PVC	90	250	0.5%	235	42	1%	32%	16	0.3	0.5	377	0	0	0	0	0	0	0	40	100%	10%	Oui	47,125	0	0	0	0	0	0	0	16,000	72,594	2,178	377
BEJ-Nef-RS-Ex-9	PVC	90	250	0.5%	235	42	0%	14%	5	0.1	0.2	265	0	0	0	0	0	0	0	3	0%	10%	Oui	23,850	0	0	0	0	0	0	0	1,200	28,808	864	265
BEJ-Nef-RS-Ex-10	PVC	90	250	0.5%	235	42	1%	29%	14	0.3	0.4	265	0	0	0	0	0	0	0	27	0%	10%	Oui	23,850	0	0	0	0	0	0	0	10,800	39,848	1,195	265
BEJ-Bej-RS-Ex-1	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	43	0	0	0	0	0	0	0	10	0%	40%	Non	4,515	0	0	0	0	0	0	0	4,000	9,792	294	43
BEJ-Bej-RS-Ex-2	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	975	0	0	0	0	0	0	0	93	0%	40%	Non	102,375	0	0	0	0	0	0	0	37,200	160,511	4,815	975
BEJ-Teb-RS-Ex-1	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	538	0	0	0	0	0	0	0	50	0%	70%	Non	64,560	0	0	0	0	0	0	0	20,000	97,244	2,917	538
BEJ-Teb-RS-Ex-2	PVC	90	250	0.5%	235	42	1%	26%	12	0.2	0.4	236	0	0	0	0	0	0	0	24	100%	70%	Non	36,580	0	0	0	0	0	0	0	9,600	53,107	1,593	236
BEJ-Tes-RS-Ex-1	PVC	90	250	0.5%	235	42	2%	35%	19	0.3	0.6	628	0	0	0	0	0	0	0	63	100%	10%	Non	78,500	0	0	0	0	0	0	0	25,200	119,255	3,578	628
BEJ-Tes-RS-Ex-2	PVC	90	250	0.5%	235	42	0%	18%	7	0.2	0.2	62	0	0	0	0	0	0	0	10	0%	10%	Non	5,580	0	0	0	0	0	0	0	4,000	11,017	331	62
SIL-Kri-RS-Ex-1	PVC	90	250	0.5%	235	42	43%	95%	106	0.9	2.7	3,198	0	0	0	0	0	0	0	30	80%	20%	Non	393,354	0	0	0	0	0	0	0	12,000	466,157	13,985	3,198
KEF-Dah-RS-Ex-1	PVC	90	250	0.5%	235	42	1%	29%	14	0.3	0.4	230	0	0	0	0	0	0	0	25	70%	20%	Non	27,485	0	0	0	0	0	0	0	10,000	43,108	1,293	230
KEF-Kef-RS-Rh-3	PVC	90	250	0.5%	235	42	16%	73%	64	0.7	1.8	1,060	0	0	0	0	0	0	0	0	100%	40%	Non	148,400	0	0	0	0	0	0	0	0	170,660	5,120	1,060
KEF-Kef-RS-Ex-1	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	2,290	0	0	0	0	0	0	0	139	100%	40%	Non	320,600	0	0	0	0	0	0	0	55,600	432,630	12,979	2,290
KEF-Taj-RS-Ex-1	PVC	90	250	0.5%	235	42	1%	26%	12	0.2	0.4	250	0	0	0	0	0	0	0	25	0%	10%	Oui	22,500	0	0	0	0	0	0	0	10,000	37,375	1,121	250
KEF-Taj-RS-Ex-2	PVC	90	250	0.5%	235	42	1%	35%	19	0.3	0.6	330	0	0	0	0	0	0	0	33	0%	10%	Oui	29,700	0	0	0	0	0	0	0	13,200	49,335	1,480	330
KEF-Taj-RS-Ex-3	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	820	0	0	0	0	0	0	0	82	0%	10%	Oui	73,800	0	0	0	0	0	0	0	32,800	122,590	3,678	820
SFA-Chi-RS-Ex-1	PVC	90	250	0.3%	235	32	20%	78%	71	0.6	1.2	10,330	0	0	0	0	0	0	0	422	30%	10%	Non	1,038,165	0	0	0	0	0	0	0	168,600	1,387,780	41,633	10,330
SFA-Chi-RS-Ex-2	PVC	90	250	0.3%	235	32	10%	63%	49	0.5	0.9	4,180	0	0	0	0	0	0	0	209	30%	10%	Non	420,090	0	0	0	0	0	0	0	83,600	579,244	17,377	4,180
SFA-Chi-RS-Ex-3	PVC	90	250	0.3%	235	32	8%	58%	42	0.4	0.8	4,640	0	0	0	0	0	0	0	162	30%	10%	Non	466,320	0	0	0	0	0	0	0	64,800	610,788	18,324	4,640
SFA-Sae-RS-Ex-1	PVC	90	250	0.3%	235	32	6%	56%	40	0.4	0.7	2,630	0	0	0	0	0	0	0	132	30%	10%	Non	264,315	0	0	0	0	0	0	0	52,600	364,452	10,934	2,630
SFA-Sae-RS-Ex-2	PVC	90	250	0.3%	235	32	9%	62%	47	0.5	0.8	3,800	0	0	0	0	0	0	0	190	30%	10%	Non	381,900	0	0	0	0	0	0	0	76,000	526,585	15,798	3,800
SFA-Sae-RS-Ex-3	PVC	90	250	0.3%	235	32	40%	94%	104	0.7	1.6	17,665	0	0	0	0	0	0	0	883	30%	10%	Non	1,775,333	0	0	0	0	0	0	0	353,300	2,447,927	73,438	17,665
SFA-Sak-RS-Ex-1	PVC	90	250	0.3%	235	32	84%	112%	165	0.8	2.1	43,210	0	0	0	0	0	0	0	2,156	30%	10%	Non	4,342,605	0	0	0	0	0	0	0	862,400	5,985,756	179,573	43,210
SFA-Sak-RS-Ex-2	PVC	90	250	0.3%	235	32	102%	114%	195	0.8	2.1	55,330	0	0	2,600	0	0	0	0	2,677	30%	10%	Non	5,560,665	0	0	473,200	0	0	0	0	1,070,800	8,170,365	245,111	57,930
SFA-Sak-RS-Ex-3	PVC	90	250	0.3%	235	32	47%	98%	113	0.7	1.7	21,620	0	0	0	0	0	0	0	1,081	30%	10%	Non	2,172,810	0	0	0	0	0	0	0	432,400	2,995,992	89,880	21,620
SFA-Ain-RS-Ex-1	PVC	90	250	0.3%	235	32	7%	58%	42	0.4	0.8	5,210	0	0	0	0	0	0	0	160	50%	10%	Non	560,075	0	0	0	0	0	0	0	64,000	717,686	21,531	5,210
SFA-Ain-RS-Ex-2	PVC	90	250	0.3%	235	32	22%	79%	73	0.6	1.2	9,150	0	0	0	0	0	0	0	460	50%	10%	Non	983,625	0	0	0	0	0	0	0	184,000	1,342,769	40,283	9,150
SFA-Ain-RS-Ex-3	PVC	90	250	0.3%	235	32	33%	89%	92	0.7	1.5	14,380	0	0	0	0	0	0	0	720	50%	10%	Non	1,545,850	0	0	0	0	0	0	0	288,000	2,108,928	63,268	14,380

Table II.1.6 - Networks Extension (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
SFA-Ain-RS-Ex-4	PVC	90	250	0.3%	235	32	36%	91%	97	0.7	1.5	16,150	0	0	0	0	0	0	0	810	50%	10%	Non	1,736,125	0	0	0	0	0	0	0	324,000	2,369,144	71,074	16,150
SFA-Gre-RS-Ex-1	PVC	90	250	0.3%	235	32	26%	83%	80	0.6	1.3	11,220	0	0	0	0	0	0	0	561	50%	10%	Non	1,206,150	0	0	0	0	0	0	0	224,400	1,645,133	49,354	11,220
SFA-Gre-RS-Ex-2	PVC	90	250	0.3%	235	32	43%	95%	106	0.7	1.6	20,160	0	0	0	0	0	0	0	1,008	50%	10%	Non	2,167,200	0	0	0	0	0	0	0	403,200	2,955,960	88,679	20,160
SFA-Gre-RS-Ex-3	PVC	90	250	0.3%	235	32	44%	96%	108	0.7	1.6	20,810	0	0	0	0	0	0	0	1,041	50%	10%	Non	2,237,075	0	0	0	0	0	0	0	416,400	3,051,496	91,545	20,810
SFA-Gre-RS-Ex-4	PVC	90	250	0.3%	235	32	38%	92%	99	0.7	1.5	20,832	0	0	0	0	0	0	0	868	50%	10%	Non	2,239,440	0	0	0	0	0	0	0	347,200	2,974,636	89,239	20,832
SFA-Gre-RS-Ex-5	PVC	90	250	0.3%	235	32	31%	87%	87	0.6	1.4	13,250	0	0	0	0	0	0	0	663	50%	10%	Non	1,424,375	0	0	0	0	0	0	0	265,200	1,943,011	58,290	13,250
SFA-Sfs-RS-Ex-1	PVC	90	250	0.3%	235	32	21%	78%	71	0.6	1.2	7,550	0	0	0	0	0	0	0	200	100%	0%	Non	906,000	0	0	0	0	0	0	0	80,000	1,133,900	34,017	7,550
SFA-Sfs-RS-Ex-2	PVC	90	250	0.3%	235	32	11%	65%	52	0.5	0.9	4,110	0	0	0	0	0	0	0	206	100%	0%	Non	493,200	0	0	0	0	0	0	0	82,400	661,940	19,858	4,110
SFA-Sfs-RS-Ex-3	PVC	90	250	0.3%	235	32	8%	60%	45	0.4	0.8	230	0	0	0	0	0	0	0	12	50%	0%	Non	23,575	0	0	0	0	0	0	0	4,800	32,631	979	230
SFA-Sfv-RS-Ex-1	PVC	90	250	0.3%	235	32	11%	65%	52	0.5	0.9	3,490	0	0	0	0	0	0	0	210	80%	10%	Non	411,820	0	0	0	0	0	0	0	84,000	570,193	17,106	3,490
SFA-Sfv-RS-Ex-2	PVC	90	250	0.3%	235	32	6%	54%	38	0.4	0.7	1,970	0	0	0	0	0	0	0	120	80%	10%	Non	232,460	0	0	0	0	0	0	0	48,000	322,529	9,676	1,970
SFA-Sfv-RS-Ex-3	PVC	90	250	0.3%	235	32	23%	80%	75	0.6	1.2	7,470	0	0	0	0	0	0	0	450	80%	10%	Non	881,460	0	0	0	0	0	0	0	180,000	1,220,679	36,620	7,470
SFA-Sfv-RS-Ex-4	PVC	90	250	0.3%	235	32	11%	65%	52	0.5	0.9	3,570	0	0	0	0	0	0	0	215	80%	10%	Non	421,260	0	0	0	0	0	0	0	86,000	583,349	17,500	3,570
SFA-Sfv-RS-Ex-5	PVC	90	250	0.3%	235	32	90%	113%	174	0.8	2.1	43,840	0	0	0	0	0	0	0	2,193	80%	10%	Non	5,173,120	0	0	0	0	0	0	0	877,200	6,957,868	208,736	43,840
SFA-Sfv-RS-Ex-6	PVC	90	250	0.3%	235	32	15%	70%	59	0.5	1.0	4,610	0	0	0	0	0	0	0	280	80%	10%	Non	543,980	0	0	0	0	0	0	0	112,000	754,377	22,631	4,610
SFA-Sfv-RS-Ex-7	PVC	90	250	0.3%	235	32	3%	45%	28	0.3	0.5	1,060	0	0	0	0	0	0	0	65	80%	10%	Non	125,080	0	0	0	0	0	0	0	26,000	173,742	5,212	1,060
SFA-Tyn-RS-Ex-1	PVC	90	250	0.3%	235	32	4%	47%	31	0.4	0.6	1,560	0	0	0	0	0	0	0	78	80%	10%	Non	184,080	0	0	0	0	0	0	0	31,200	247,572	7,427	1,560
SFA-Tyn-RS-Ex-2	PVC	90	250	0.3%	235	32	34%	90%	94	0.7	1.5	17,660	0	0	0	0	0	0	0	766	80%	10%	Non	2,083,880	0	0	0	0	0	0	0	306,400	2,748,822	82,465	17,660
SFA-Aga-RS-Ex-1	PVC	90	250	0.3%	235	32	13%	68%	56	0.5	1.0	5,960	0	0	0	0	0	0	0	300	80%	10%	Non	703,280	0	0	0	0	0	0	0	120,000	946,772	28,403	5,960
SFA-Aga-RS-Ex-2	PVC	90	250	0.3%	235	32	13%	68%	56	0.5	1.0	2,085	0	0	0	0	0	0	0	30	100%	10%	Non	260,625	0	0	0	0	0	0	0	12,000	313,519	9,406	2,085
SFA-Hen-RS-Ex-1	PVC	90	250	0.3%	235	32	15%	72%	61	0.5	1.0	7,500	0	0	0	0	0	0	0	350	90%	10%	Non	911,250	0	0	0	0	0	0	0	140,000	1,208,938	36,268	7,500
SFA-Hen-RS-Ex-2	PVC	90	250	0.3%	235	32	10%	62%	47	0.5	0.8	4,500	0	0	0	0	0	0	0	220	90%	10%	Non	546,750	0	0	0	0	0	0	0	88,000	729,963	21,899	4,500
SFA-Jeb-RS-Ex-1	PVC	90	250	0.3%	235	32	9%	62%	47	0.5	0.8	4,300	0	0	0	0	0	0	0	200	90%	40%	Non	586,950	0	0	0	0	0	0	0	80,000	766,993	23,010	4,300
SFA-Jeb-RS-Ex-2	PVC	90	250	0.3%	235	32	12%	67%	54	0.5	0.9	5,700	0	0	0	0	0	0	0	270	90%	40%	Non	778,050	0	0	0	0	0	0	0	108,000	1,018,958	30,569	5,700
SFA-Mah-RS-Ex-1	PVC	90	250	0.3%	235	32	77%	110%	153	0.8	2.0	7,300	0	0	0	0	0	0	0	365	100%	10%	Non	912,500	0	0	0	0	0	0	0	146,000	1,217,275	36,518	7,300
SFA-Mah-RS-Ex-2	PVC	90	250	0.3%	235	32	24%	82%	78	0.6	1.3	10,940	0	0	0	0	0	0	0	547	100%	10%	Non	1,367,500	0	0	0	0	0	0	0	218,800	1,824,245	54,727	10,940
SFA-Sfs-RS-Rh-1	-	-	-	-	-	-	-	-	-	-	-	4,005	0	0	0	0	0	0	0	421	80%	10%	Non	472,590	0	0	0	0	0	0	0	168,400	737,139	22,114	4,005
SFA-Sfs-RS-Rh-2	-	-	-	-	-	-	-	-	-	-	-	5,320	0	0	0	0	0	0	0	535	80%	10%	Non	627,760	0	0	0	0	0	0	0	214,000	968,024	29,041	5,320
SFA-Sfs-RS-Rh-5	-	-	-	-	-	-	-	-	-	-	-	1,060	0	0	0	0	0	0	0	106	80%	10%	Non	125,080	0	0	0	0	0	0	0	42,400	192,602	5,778	1,060
SFA-Sfv-RS-Rh-1	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	1,565	0	0	90%	0%	Non	0	0	0	0	0	0	869,358	0	0	999,761	29,993	1,565
JEN-Fer-RS-Ex-1	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	2,351	0	0	0	0	0	0	0	118	5%	30%	Non	239,214	0	0	0	0	0	0	0	47,200	329,376	9,881	2,351
JEN-Gha-RS-Ex-1	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	2,533	0	0	0	0	0	0	0	127	10%	20%	Non	249,501	0	0	0	0	0	0	0	50,800	345,346	10,360	2,533
JEN-Gha-RS-Ex-2	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	1,074	444	0	0	0	0	0	0	152	10%	20%	Non	105,789	48,174	0	0	0	0	0	0	60,800	246,977	7,409	1,518
JEN-Jen-RS-Ex-1	PVC	90	250	0.5%	235	42	9%	62%	47	0.6	1.4	2,990	0	0	0	0	0	0	0	299	0%	5%	Non	261,625	0	0	0	0	0	0	0	119,600	438,409	13,152	2,990
JEN-Tab-RS-Ex-1	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	4,833	0	0	0	0	0	0	0	162	0%	40%	Non	507,465	0	0	0	0	0	0	0	64,800	658,105	19,743	4,833
JEN-Tab-RS-Ex-2	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	4,750	0	0	0	0	0	0	0	73	0%	40%	Non	498,750	0	0	0	0	0	0	0	29,200	607,143	18,214	4,750
JEN-Tab-RS-Ex-3	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	4,555	0	0	0	0	0	0	0	228	0%	40%	Non	478,275	0	0	0	0	0	0	0	91,200	654,896	19,647	4,555
JEN-Bss-RS-Ex-1	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	2,376	627	0	0	0	0	0	0	201	0%	5%	Non	207,900	61,133	0	0	0	0	0	0	80,400	401,847	12,055	3,003
JEN-Tab-SP-Ex-2	PVC	90	250	2.0%	235	84	-	-	-	-	-	2,870	0	0	0	0	0	0	0		100%	40%	Non	401,800	0	0	0	0	0	0	0	0	462,070	13,862	2,870
JEN-Fer-RS-Rh-1	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	1,883	0	0	0	0	0	0	0	189	100%	30%	Non	254,205	0	0	0	0	0	0	0	75,600	379,276	11,378	1,883
JEN-Jen-SP-Rh-1	PVC	90	400	0.5%	-	-	-	-	-	-	-	0	0	1,660	0	0	0	0	0		100%	5%	Non	0	0	269,750	0	0	0	0	0	0	310,213	9,306	1,660
KEB-Keb-RS-Ex-1	PVC	90	400	0.5%	377	147	1%	35%	30	0.5	0.9	1,700	0	0	0	0	0	0	0	200	40%	0%	Oui	168,300	0	0	0	0	0	0	0	80,000	285,545	8,566	1,700
KEB-Ken-RS-Ex-1	PVC	90	400	0.5%	377	147	4%	50%	53	0.7	1.6	8,900	0	0	0	0	0	0	0	600	70%	0%	Oui	974,550	0	0	0	0	0	0	0	240,000	1,396,733	41,902	8,900
KEB-Ken-RS-Ex-2	PVC	90	400	0.5%	377	147	8%	58%	68	0.8	2.0	10,673	0	0	0	0	0	0	0	1,108	70%	0%	Oui	1,168,694	0	0	0	0	0	0	0	443,200	1,853,678	55,610	10,673
KEB-Ken-RS-Ex-3	PVC	90	400	0.5%	377	147	4%	50%	53	0.7	1.6	6,000	0	0	0	0	0	0	0	600	90%	0%	Oui	699,000	0	0	0	0	0	0	0	240,000	1,079,850	32,396	6,000

Table II.1.6 - Networks Extension (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
KEB-Ken-RS-Ex-4	PVC	90	400	0.5%	377	147	4%	47%	49	0.6	1.5	5,050	0	0	0	0	0	0	0	505	75%	0%	Oui	561,813	0	0	0	0	0	0	0	202,000	878,384	26,352	5,050
KEB-Kes-RS-Ex-1	PVC	90	400	0.5%	377	147	5%	52%	56	0.7	1.7	12,150	0	0	0	0	0	0	0	730	85%	0%	Oui	1,394,213	0	0	0	0	0	0	0	292,000	1,939,144	58,174	12,150
KEB-Kes-RS-Ex-2	PVC	90	400	0.5%	377	147	2%	38%	34	0.5	1.1	5,130	0	0	0	0	0	0	0	270	85%	0%	Oui	588,668	0	0	0	0	0	0	0	108,000	801,168	24,035	5,130
KEB-Dou-RS-Ex-1	PVC	90	400	0.5%	377	147	3%	45%	45	0.6	1.4	5,648	0	0	0	0	0	0	0	500	75%	0%	Oui	628,340	0	0	0	0	0	0	0	200,000	952,591	28,578	5,648
KEB-Dos-RS-Ex-1	PVC	90	400	0.5%	377	147	5%	50%	53	0.7	1.6	12,449	0	0	0	0	0	0	0	600	40%	0%	Oui	1,232,451	0	0	0	0	0	0	0	240,000	1,693,319	50,800	12,449
KEB-Gol-RS-Ex-1	PVC	90	400	0.5%	377	147	1%	29%	23	0.4	0.7	3,065	0	0	0	0	0	0	0	150	15%	0%	Oui	276,616	0	0	0	0	0	0	0	60,000	387,109	11,613	3,065
KEB-Sou-RS-Ex-1	PVC	90	400	0.5%	377	147	15%	72%	98	0.9	2.8	29,710	2,790	0	0	0	0	0	0	3,000	90%	20%	Non	3,758,315	380,835	0	0	0	0	0	0	1,200,000	6,140,023	184,201	32,500
KEB-Jem-RS-Ex-1	PVC	90	400	0.5%	377	147	4%	47%	49	0.6	1.5	11,200	0	0	0	0	0	0	0	700	80%	0%	Oui	1,265,600	0	0	0	0	0	0	0	280,000	1,777,440	53,323	11,200
KEB-Ken-SP-Ex-2	-	-	-	-	-	-	-	-	-	-	-	0	1,545	0	0	0	0	0	0	0	100%	0%	Oui	0	200,850	0	0	0	0	0	0	0	230,978	6,929	1,545
KEB-Ken-SP-Ex-4	-	-	-	-	-	-	-	-	-	-	-	425	0	0	0	0	0	0	0	0	100%	0%	Oui	51,000	0	0	0	0	0	0	0	0	58,650	1,760	425
KEB-Kes-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	285	0	0	0	0	0	0	0	0	100%	0%	Oui	34,200	0	0	0	0	0	0	0	0	39,330	1,180	285
KEB-Kes-SP-Ex-2	-	-	-	-	-	-	-	-	-	-	-	3,700	0	0	0	0	0	0	0	0	40%	0%	Oui	366,300	0	0	0	0	0	0	0	0	421,245	12,637	3,700
KEB-Dos-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	160	0	0	0	0	0	0	0	0	0%	0%	Oui	13,600	0	0	0	0	0	0	0	0	15,640	469	160
KEB-Jem-SP-Ex-1	-	-	-	-	-	-	-	-	-	-	-	420	0	0	0	0	0	0	0	0	100%	0%	Oui	50,400	0	0	0	0	0	0	0	0	57,960	1,739	420
BIZ-Biz-RS-Ex-1	PVC	90	250	0.5%	235	42	23%	80%	75	0.8	2.1	5,200	0	0	0	0	0	0	0	520	100%	5%	Oui	637,000	0	0	0	0	0	0	0	208,000	971,750	29,153	5,200
BIZ-Men-RS-Ex-1	PVC	90	250	0.5%	235	42	5%	50%	33	0.5	1.0	1,200	0	0	0	0	0	0	0	80	100%	5%	Non	147,000	0	0	0	0	0	0	0	32,000	205,850	6,176	1,200
BIZ-Men-RS-Ex-2	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	900	0	0	0	0	0	0	0	60	50%	5%	Non	94,500	0	0	0	0	0	0	0	24,000	136,275	4,088	900
BIZ-Tin-RS-Ex-1	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	2,150	0	0	0	0	0	0	0	145	100%	0%	Oui	258,000	0	0	0	0	0	0	0	58,000	363,400	10,902	2,150
BIZ-Tin-RS-Ex-2	PVC	90	250	0.5%	235	42	10%	63%	49	0.6	1.5	1,500	400	0	0	0	0	0	0	130	50%	0%	Oui	153,750	45,000	0	0	0	0	0	0	52,000	288,363	8,651	1,900
BIZ-Tin-RS-Ex-3	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	1,300	0	0	0	0	0	0	0	90	100%	0%	Oui	156,000	0	0	0	0	0	0	0	36,000	220,800	6,624	1,300
BIZ-Biz-RS-Rh-1	PVC	90	400	0.5%	377	147	30%	87%	139	1.1	3.7	90	0	0	0	0	0	0	0	20	100%	5%	Non	11,025	0	0	0	0	0	0	0	8,000	21,879	656	90
BIZ-Biz-RS-Rh-2	PVC	90	315	0.5%	297	78	8%	58%	53	0.6	1.6	800	790	0	0	0	0	0	0	160	100%	5%	Non	98,000	104,675	0	0	0	0	0	0	64,000	306,676	9,200	1,590
BIZ-Mat-SP-Rh-1	-	-	-	-	-	-	-	-	-	-	-	0	0	0	400	0	0	0	0	0	0%	5%	Non	0	0	0	67,000	0	0	0	0	0	77,050	2,312	400
SID-Sid-RS-Ex-1	PVC	90	250	0.5%	235	42	5%	50%	33	0.5	1.0	1,678	0	0	0	0	0	0	0	89	0%	0%	Oui	142,655	0	0	0	0	0	0	0	35,600	204,993	6,150	1,678
SID-Sid-RS-Ex-2	PVC	90	250	0.5%	235	42	8%	60%	45	0.6	1.3	1,989	0	0	0	0	0	0	0	156	0%	0%	Oui	169,065	0	0	0	0	0	0	0	62,400	266,185	7,986	1,989
SID-Sid-RS-Ex-3	PVC	90	250	0.5%	235	42	5%	52%	35	0.5	1.1	3,500	0	0	0	0	0	0	0	100	0%	0%	Oui	297,492	0	0	0	0	0	0	0	40,000	388,115	11,643	3,500
SID-Sid-RS-Ex-4	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	866	0	0	0	0	0	0	0	87	0%	0%	Oui	73,601	0	0	0	0	0	0	0	34,800	124,661	3,740	866
SID-Sid-RS-Ex-5	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	499	0	0	0	0	0	0	0	50	50%	0%	Oui	51,148	0	0	0	0	0	0	0	20,000	81,820	2,455	499
SID-Sid-RS-Ex-6	PVC	90	250	0.5%	235	42	5%	50%	33	0.5	1.0	1,299	0	0	0	0	0	0	0	130	50%	0%	Oui	133,148	0	0	0	0	0	0	0	52,000	212,920	6,388	1,299
ZAG-Ham-RS-Ex-1	PVC	90	315	0.5%	297	78	26%	83%	101	0.9	2.7	0	150	0	0	0	0	0	0	0	40%	75%	Non	0	21,975	0	0	0	0	0	0	0	25,271	758	150
ZAG-Zag-RS-Ex-1	PVC	90	250	0.5%	235	42	1%	32%	16	0.3	0.5	1,350	0	0	0	175	0	0	0	70	100%	0%	Non	162,000	0	0	0	54,250	0	0	0	28,000	280,888	8,427	1,525
ZAG-Zag-RS-Ex-2	PVC	90	250	0.5%	235	42	2%	35%	19	0.3	0.6	1,550	0	0	0	0	0	0	0	80	100%	0%	Non	186,000	0	0	0	0	0	0	0	32,000	250,700	7,521	1,550
ZAG-Zag-RS-Ex-3	PVC	90	250	0.5%	235	42	0%	22%	9	0.2	0.3	80	0	0	0	0	0	0	0	10	100%	0%	Non	9,600	0	0	0	0	0	0	0	4,000	15,640	469	80
ZAG-Zag-RS-Ex-4	PVC	90	250	0.5%	235	42	1%	26%	12	0.2	0.4	310	0	0	0	0	0	0	0	20	100%	0%	Non	37,200	0	0	0	0	0	0	0	8,000	51,980	1,559	310
ZAG-Fah-RS-Rh-7	PVC	90	250	0.5%	235	42	31%	88%	89	0.8	2.4	0	400	0	0	0	0	0	0	20	100%	0%	Non	0	52,000	0	0	0	0	0	0	8,000	69,000	2,070	400
ZAG-Fah-RS-Rh-8	PVC	90	250	0.5%	235	42	6%	54%	38	0.5	1.1	200	0	0	0	0	0	0	0	10	100%	0%	Non	24,000	0	0	0	0	0	0	0	4,000	32,200	966	200

Table II.1.7 - Networks Rehabilitation (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
KASSERINE	KAS	Kasserine	Kas	conduite vers STEP 1	RS	Rh	1	KAS-Kas-RS-Rh-1
KASSERINE	KAS	Kasserine	Kas	conduite vers STEP 2	RS	Rh	2	KAS-Kas-RS-Rh-2
KASSERINE	KAS	Kasserine	Kas	Centre Ville de Kasserine	RS	Rh	3	KAS-Kas-RS-Rh-3
KASSERINE	KAS	Kasserine	Kas	Collecteur de Ceinture	RS	Rh	4	KAS-Kas-RS-Rh-4
KASSERINE	KAS	Kasserine	Kas	Collecteur de AV. Bejaoui	RS	Rh	5	KAS-Kas-RS-Rh-5
KASSERINE	KAS	Kasserine	Kas	Collecteur de Ain el Gaied	RS	Rh	7	KAS-Kas-RS-Rh-7
KASSERINE	KAS	Kasserine	Kas	Cité Saad Eddine	RS	Rh	8	KAS-Kas-RS-Rh-8
KASSERINE	KAS	Kasserine	Kas	Cité el Bassatine 1	RS	Rh	9	KAS-Kas-RS-Rh-9
KASSERINE	KAS	Kasserine	Kas	Cité el Bassatine 2	RS	Rh	10	KAS-Kas-RS-Rh-10
KASSERINE	KAS	Kasserine	Kas	Cité el Bassatine 3	RS	Rh	11	KAS-Kas-RS-Rh-11
KASSERINE	KAS	Sbeitla	Sbe	Collecteur Oued Sbeitla	RS	Rh	1	KAS-Sbe-RS-Rh-1
KASSERINE	KAS	Sbeitla	Sbe	Centre Ville de Sbeitla	RS	Rh	2	KAS-Sbe-RS-Rh-2
KASSERINE	KAS	Sbeitla	Sbe	Cité Loutissement el Feth	RS	Rh	3	KAS-Sbe-RS-Rh-3
KASSERINE	KAS	Sbeitla	Sbe	Cité Essourour Ouest	RS	Rh	4	KAS-Sbe-RS-Rh-4
BEJA	BEJ	Béja	Bej	Cité Mzara	RS	Rh	1	BEJ-Bej-RS-Rh-1
BEJA	BEJ	Béja	Bej	Cité Sidifradj + cité Eddahbia	RS	Rh	2	BEJ-Bej-RS-Rh-2
BEJA	BEJ	Béja	Bej	Cité Nozha	RS	Rh	3	BEJ-Bej-RS-Rh-3
BEJA	BEJ	Béja	Bej	Cité Ain el Goula	RS	Rh	4	BEJ-Bej-RS-Rh-4
BEJA	BEJ	Béja	Bej	Cité el Medina	RS	Rh	5	BEJ-Bej-RS-Rh-5
BEJA	BEJ	Maagoula	Maa	Cité Erriadh	RS	Rh	1	BEJ-Maa-RS-Rh-1
BEJA	BEJ	Medjez El Bab	Med	Cité el Bahi	RS	Rh	1	BEJ-Med-RS-Rh-1
BEJA	BEJ	Medjez El Bab	Med	Cité des professeurs	RS	Rh	2	BEJ-Med-RS-Rh-2
BEJA	BEJ	Medjez El Bab	Med	Cité Erriadh	RS	Rh	3	BEJ-Med-RS-Rh-3
BEJA	BEJ	Medjez El Bab	Med	Cité El Hana	RS	Rh	4	BEJ-Med-RS-Rh-4
BEJA	BEJ	Medjez El Bab	Med	Cité Sidi Raies	RS	Rh	5	BEJ-Med-RS-Rh-5
BEJA	BEJ	Medjez El Bab	Med	Cité Nattoucha	RS	Rh	6	BEJ-Med-RS-Rh-6
BEJA	BEJ	Medjez El Bab	Med	Cité Touaben	RS	Rh	7	BEJ-Med-RS-Rh-7
BEJA	BEJ	Nefza	Nef	Cité Erriadh	RS	Rh	1	BEJ-Nef-RS-Rh-1
BEJA	BEJ	Nefza	Nef	Cité Essaada	RS	Rh	2	BEJ-Nef-RS-Rh-2
BEJA	BEJ	Teboursouk	Teb	Teboursouk Medina	RS	Rh	1	BEJ-Teb-RS-Rh-1
BEJA	BEJ	Teboursouk	Teb	Cité El Karma + Cité Avicenne + Cité Ennassim + Cité El Menchia + Cité Ezzayatine1 + Cité Ezzayatine2 (Various urban zones)	RS	Rh	2	BEJ-Teb-RS-Rh-2
BEJA	BEJ	Teboursouk	Teb	Cité Ain Mrad 1	RS	Ex	2	BEJ-Teb-RS-Ex-2
BEJA	BEJ	Testour	Tes	Testour Medina	RS	Rh	1	BEJ-Tes-RS-Rh-1
BEJA	BEJ	Testour	Tes	Cité Gharnata (Cité Simpar Grenada)	RS	Ex	1	BEJ-Tes-RS-Ex-1
BEJA	BEJ	Testour	Tes	Cité Bassatine 2	RS	Ex	2	BEJ-Tes-RS-Ex-2
SILIANA	SIL	Bouarada	Bou	Cité Ibn Kaldoun	RS	Rh	1	SIL-Bou-RS-Rh-1
SILIANA	SIL	Bouarada	Bou	Cité el Mallassine	RS	Rh	2	SIL-Bou-RS-Rh-2
SILIANA	SIL	Bouarada	Bou	Cité Bassatines	RS	Rh	3	SIL-Bou-RS-Rh-3
SILIANA	SIL	Bouarada	Bou	Cité Zayatine Ouest	RS	Rh	4	SIL-Bou-RS-Rh-4
SILIANA	SIL	Siliana	Sil	Cité Essabah	RS	Rh	1	SIL-Sil-RS-Rh-1
SILIANA	SIL	Siliana	Sil	Cité Taieb Mhiri + Bassatines	RS	Rh	2	SIL-Sil-RS-Rh-2
SILIANA	SIL	Siliana	Sil	Centre Ville de Siliana	RS	Rh	3	SIL-Sil-RS-Rh-3
SILIANA	SIL	Siliana	Sil	Cité Ennozha	RS	Rh	4	SIL-Sil-RS-Rh-4
SILIANA	SIL	Krib	Kri	Krib	RS	Ex	1	SIL-Kri-RS-Ex-1
KEF	KEF	Dahmani	Dah	Centre Ville de Dahmani / Cité Ben Amar	RS	Rh	3	KEF-Dah-RS-Rh-3
KEF	KEF	Kef	Kef	GP 5D	RS	Rh	1	KEF-Kef-RS-Rh-1
KEF	KEF	Kef	Kef	Avenue Hédi Cheker	RS	Rh	2	KEF-Kef-RS-Rh-2
KEF	KEF	Kef	Kef	Cité Chrichi	RS	Rh	3	KEF-Kef-RS-Rh-3
KEF	KEF	Kef	Kef	Cité Liberté	RS	Rh	4	KEF-Kef-RS-Rh-4
KEF	KEF	Kef	Kef	Cité Eddir	RS	Rh	5	KEF-Kef-RS-Rh-5
KEF	KEF	Kef	Kef	Cité Taieb M'hiri	RS	Rh	6	KEF-Kef-RS-Rh-6
KEF	KEF	Kef	Kef	Cité El Hana	RS	Rh	7	KEF-Kef-RS-Rh-7
KEF	KEF	Tajerouine	Taj	Cité Taieb Mhiri	RS	Rh	1	KEF-Taj-RS-Rh-1
KEF	KEF	Tajerouine	Taj	Cité el Ain	RS	Rh	2	KEF-Taj-RS-Rh-2
KEF	KEF	Tajerouine	Taj	Cité Bourguiba	RS	Rh	3	KEF-Taj-RS-Rh-3
SFAX	SFA	Chihia	Chi	Route Teniour	RS	Rh	1	SFA-Chi-RS-Rh-1
SFAX	SFA	Sakiet Ezzit	Sae	Route de Tunis GP 1	RS	Rh	1	SFA-Sae-RS-Rh-1
SFAX	SFA	Sakiet Eddaier	Sak	Route de Mahdia MC 82	RS	Rh	1	SFA-Sak-RS-Rh-1
SFAX	SFA	Sfax Sud	Sfs	Birjerbi	RS	Rh	1	SFA-Sfs-RS-Rh-1
SFAX	SFA	Sfax Sud	Sfs	Cité M'harza	RS	Rh	2	SFA-Sfs-RS-Rh-2
SFAX	SFA	Sfax Sud	Sfs	Cité Barnous (Ellouz)	RS	Rh	3	SFA-Sfs-RS-Rh-3
SFAX	SFA	Sfax Sud	Sfs	Cité Essourour	RS	Rh	4	SFA-Sfs-RS-Rh-4
SFAX	SFA	Sfax Sud	Sfs	Cité Ellouz / Cité Bouret Avali / Cité Mouroj	RS	Rh	5	SFA-Sfs-RS-Rh-5
SFAX	SFA	Sfax Ville	Sfv	Cité Saline	RS	Rh	1	SFA-Sfv-RS-Rh-1
SFAX	SFA	Sfax Ville	Sfv	Sfax Centre Ville	RS	Rh	2	SFA-Sfv-RS-Rh-2
SFAX	SFA	Sfax Ville	Sfv	Arrondissement Medina	RS	Rh	3	SFA-Sfv-RS-Rh-3

Table II.1.7 - Networks Rehabilitation (1/3)
Location and interventions encoding

Governorate	Governorate Code	Town	Town code	Site	Network / Pumping Station	Rehabilitation / Extension	Intervention number	Intervention code
SFAX	SFA	Sfax Ville	Sfv	Cité Rbat Nord	RS	Rh	4	SFA-Sfv-RS-Rh-4
SFAX	SFA	Sfax Ville	Sfv	Cité El Boustane	RS	Rh	5	SFA-Sfv-RS-Rh-5
SFAX	SFA	Sfax Ville	Sfv	Route Habbena	RS	Rh	6	SFA-Sfv-RS-Rh-6
SFAX	SFA	Mahres	Mah	GP 1	RS	Rh	1	SFA-Mah-RS-Rh-1
SFAX	SFA	Sfax Sud	Sfs	Route Soukra Oued Chabounni 2	RS	EX	3	SFA-SFS-RS-Ex-3
SFAX	SFA	Mahres	Mah	Mahres Tr 1	RS	EX	1	SFA-Mah-RS-Ex-1
JENDOUBA	JEN	Fernana	Fer	Fernana	RS	Rh	1	JEN-Fer-RS-Rh-1
JENDOUBA	JEN	Ghardimaou	Gha	Ghardimaou	RS	Rh	1	JEN-Gha-RS-Rh-1
JENDOUBA	JEN	Jendouba	Jen	Ville de Jendouba	RS	Rh	1	JEN-Jen-RS-Rh-1
JENDOUBA	JEN	Jendouba	Jen	Cité Militaire	RS	Rh	2	JEN-Jen-RS-Rh-2
JENDOUBA	JEN	Jendouba	Jen	Cité Ennour	RS	Rh	3	JEN-Jen-RS-Rh-3
JENDOUBA	JEN	Tabarka	Tab	Ville de Tabarka	RS	Rh	1	JEN-Tab-RS-Rh-1
JENDOUBA	JEN	Jendouba	Jen	SP 4	SP	Rh	3	JEN-Jen-SP-Rh-3
JENDOUBA	JEN	Jendouba	Jen	SP 3	SP	Rh	2	JEN-Jen-SP-Rh-2
KEBILI	KEB	Kebili	Keb	Kebili (Centre Ville)	RS	Rh	1	KEB-Keb-RS-Rh-1
KEBILI	KEB	Douz	Dou	Douz	RS	Rh	1	KEB-Dou-RS-Rh-1
BIZERTE	BIZ	Menzel Abderahmen	Abd	Av. Habib Bourguiba	RS	Rh	1	BIZ-Abd-RS-Rh-1
BIZERTE	BIZ	El Alia	Ali	El Alia	RS	Rh	1	BIZ-Ali-RS-Rh-1
BIZERTE	BIZ	Bizerte	Biz	Ancienne Ville Bizerte	RS	Rh	1	BIZ-Biz-RS-Rh-1
BIZERTE	BIZ	Bizerte	Biz	Cité Fahat Hachad	RS	Rh	2	BIZ-Biz-RS-Rh-2
BIZERTE	BIZ	Bizerte	Biz	Cité Othman Allouche	RS	Rh	3	BIZ-Biz-RS-Rh-3
BIZERTE	BIZ	Bizerte	Biz	Av. Hassen Nouri	RS	Rh	4	BIZ-Biz-RS-Rh-4
BIZERTE	BIZ	Bizerte	Biz	Cité Centre Ville	RS	Rh	6	BIZ-Biz-RS-Rh-6
BIZERTE	BIZ	Bizerte	Biz	Cité Hachad	RS	Rh	7	BIZ-Biz-RS-Rh-7
BIZERTE	BIZ	Menzel Jamil	Jam	Av. 7 Novembre	RS	Rh	1	BIZ-Jam-RS-Rh-1
BIZERTE	BIZ	Menzel Jamil	Jam	Cité Habib Bourguiba	RS	Rh	2	BIZ-Jam-RS-Rh-2
BIZERTE	BIZ	Menzel Bourguiba	Men	Centre Ville de Menzel Bourguiba	RS	Rh	1	BIZ-Men-RS-Rh-1
BIZERTE	BIZ	Menzel Bourguiba	Men	Rue Destour	RS	Rh	2	BIZ-Men-RS-Rh-2
BIZERTE	BIZ	Raf Raf	Raf	Raf Raf Plage	RS	Rh	1	BIZ-Raf-RS-Rh-1
BIZERTE	BIZ	Tinja	Tin	Cité Ikbale e Cité Fatah	RS	Rh	1	BIZ-Tin-RS-Rh-1
BIZERTE	BIZ	Tinja	Tin	Route Bizerte-Tinja	RS	Rh	2	BIZ-Tin-RS-Rh-2
BIZERTE	BIZ	Zarzouna	Zar	Cité Zaghouane	RS	Rh	1	BIZ-Zar-RS-Rh-1
BIZERTE	BIZ	Bizerte	Biz	SP RZ3 Marche du Gros	SP	Rh	3	BIZ-Zar-SP-Rh-3
BIZERTE	BIZ	Mateur	Mat	SP Hachad	SP	Rh	1	BIZ-Mat-SP-Rh-1
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Ennour Ouest	RS	Rh	1	SID-Sid-RS-Rh-1
SIDI BOUZID	SID	Sidi Bouzid	Sid	Av. Maghreb Arabe	RS	Rh	2	SID-Sid-RS-Rh-2
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité des Professeurs	RS	Rh	3	SID-Sid-RS-Rh-3
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Ali Belhouane	RS	Rh	4	SID-Sid-RS-Rh-4
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Elworroud 1	RS	Rh	5	SID-Sid-RS-Rh-5
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Hôspital Régional	RS	Rh	7	SID-Sid-RS-Rh-7
SIDI BOUZID	SID	Sidi Bouzid	Sid	Cité Derrière Usine de Tomate	RS	Rh	8	SID-Sid-RS-Rh-8
SIDI BOUZID	SID	Sidi Bouzid	Sid	Racc. Protection civile	RS	Rh	9	SID-Sid-RS-Rh-9
SIDI BOUZID	SID	Sidi Bouzid	Sid	Rue Hammam Ibn el Aghlab	RS	Rh	10	SID-Sid-RS-Rh-10
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité les Ninfes	RS	Rh	1	ZAG-Zag-RS-Rh-1
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Lycee	RS	Rh	2	ZAG-Zag-RS-Rh-2
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité l'Independence	RS	Rh	3	ZAG-Zag-RS-Rh-3
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Nessrine	RS	Rh	4	ZAG-Zag-RS-Rh-4
ZAGHOUAN	ZAG	Zaghouan	Zag	Medina	RS	Rh	5	ZAG-Zag-RS-Rh-5
ZAGHOUAN	ZAG	Zaghouan	Zag	Cité Bassatine	RS	Rh	6	ZAG-Zag-RS-Rh-6
ZAGHOUAN	ZAG	Zaghouan	Zag	Route Essouani	RS	Rh	7	ZAG-Zag-RS-Rh-7
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité Lycee	RS	Rh	1	ZAG-Ham-RS-Rh-1
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité Dispensaire	RS	Rh	2	ZAG-Ham-RS-Rh-2
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité 20 Mars	RS	Rh	3	ZAG-Ham-RS-Rh-3
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité el Hammam	RS	Rh	4	ZAG-Ham-RS-Rh-4
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité 18 Janvier	RS	Rh	5	ZAG-Ham-RS-Rh-5
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité el Hounda	RS	Rh	6	ZAG-Ham-RS-Rh-6
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité El Ahd / Cité El Jadid 1	RS	Rh	7	ZAG-Ham-RS-Rh-7
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité El Ahd / Cité El Jadid 2	RS	Rh	8	ZAG-Ham-RS-Rh-8
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité Essalem	RS	Rh	9	ZAG-Ham-RS-Rh-9
ZAGHOUAN	ZAG	Hammam Zriba	Ham	Cité AFH	RS	Rh	10	ZAG-Ham-RS-Rh-10
ZAGHOUAN	ZAG	El Fahs	Fah	Cité Erriadh	RS	Rh	1	ZAG-Fah-RS-Rh-1
ZAGHOUAN	ZAG	El Fahs	Fah	Cité Essaada 1	RS	Rh	2	ZAG-Fah-RS-Rh-2
ZAGHOUAN	ZAG	El Fahs	Fah	Cité Essaada 2	RS	Rh	3	ZAG-Fah-RS-Rh-3
ZAGHOUAN	ZAG	El Fahs	Fah	Cité el Amel	RS	Rh	4	ZAG-Fah-RS-Rh-4
ZAGHOUAN	ZAG	El Fahs	Fah	Cité Ennour	RS	Rh	5	ZAG-Fah-RS-Rh-5
ZAGHOUAN	ZAG	El Fahs	Fah	Cité Essalam	RS	Rh	6	ZAG-Fah-RS-Rh-6
ZAGHOUAN	ZAG	El Fahs	Fah	Av. Liberté	RS	Rh	7	ZAG-Fah-RS-Rh-7
ZAGHOUAN	ZAG	El Fahs	Fah	Route Kairouan	RS	Rh	8	ZAG-Fah-RS-Rh-8

Table II.1.7 - Networks Rehabilitation (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
KAS-Kas-RS-Rh-1	41,106	75	60	64,660	44.9	0.0	0.0	1.87	2.00	2.00	50%	84.1	0.0	0.0	22.5	106.6
KAS-Kas-RS-Rh-2	6,000	75	60	6,000	4.2	0.0	0.0	2.72	2.00	2.00	50%	11.4	0.0	0.0	2.1	13.4
KAS-Kas-RS-Rh-3	750	75	60	750	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.6	0.0	0.0	0.3	1.8
KAS-Kas-RS-Rh-4	23,000	75	60	23,000	16.0	0.0	0.0	2.13	2.00	2.00	50%	33.9	0.0	0.0	8.0	41.9
KAS-Kas-RS-Rh-5	6,000	75	60	6,000	4.2	0.0	0.0	2.72	2.00	2.00	50%	11.4	0.0	0.0	2.1	13.4
KAS-Kas-RS-Rh-7	30,000	75	60	30,000	20.8	0.0	0.0	2.05	2.00	2.00	50%	42.7	0.0	0.0	10.4	53.1
KAS-Kas-RS-Rh-8	1,000	75	60	1,000	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.3	2.4
KAS-Kas-RS-Rh-9	2,000	75	60	2,000	1.4	0.0	0.0	3.00	2.00	2.00	50%	4.2	0.0	0.0	0.7	4.9
KAS-Kas-RS-Rh-10	2,500	75	60	2,500	1.7	0.0	0.0	3.00	2.00	2.00	50%	5.2	0.0	0.0	0.9	6.1
KAS-Kas-RS-Rh-11	2,500	75	60	2,500	1.7	0.0	0.0	3.00	2.00	2.00	50%	5.2	0.0	0.0	0.9	6.1
KAS-Sbe-RS-Rh-1	1,250	75	60	1,250	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.6	0.0	0.0	0.4	3.0
KAS-Sbe-RS-Rh-2	750	75	60	750	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.6	0.0	0.0	0.3	1.8
KAS-Sbe-RS-Rh-3	1,250	75	60	1,250	0.9	0.0	0.0	3.00	2.00	2.00	50%	2.6	0.0	0.0	0.4	3.0
KAS-Sbe-RS-Rh-4	650	75	60	650	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.4	0.0	0.0	0.2	1.6
BEJ-Bej-RS-Rh-1	3,447	110	88	3,447	3.5	0.0	0.0	2.83	2.00	2.00	40%	10.0	0.0	0.0	1.4	11.4
BEJ-Bej-RS-Rh-2	3,425	110	88	3,425	3.5	0.0	0.0	2.84	2.00	2.00	40%	9.9	0.0	0.0	1.4	11.3
BEJ-Bej-RS-Rh-3	3,227	110	88	3,227	3.3	0.0	0.0	2.88	2.00	2.00	40%	9.5	0.0	0.0	1.3	10.8
BEJ-Bej-RS-Rh-4	920	110	88	920	0.9	0.0	0.0	3.00	2.00	2.00	40%	2.8	0.0	0.0	0.4	3.2
BEJ-Bej-RS-Rh-5	1,300	110	88	1,300	1.3	0.0	0.0	3.00	2.00	2.00	40%	4.0	0.0	0.0	0.5	4.5
BEJ-Maa-RS-Rh-1	300	85	68	300	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.7	0.0	0.0	0.1	0.8
BEJ-Med-RS-Rh-1	350	120	96	350	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.2	0.0	0.0	0.2	1.3
BEJ-Med-RS-Rh-2	250	120	96	250	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
BEJ-Med-RS-Rh-3	750	120	96	750	0.8	0.0	0.0	3.00	2.00	2.00	40%	2.5	0.0	0.0	0.3	2.8
BEJ-Med-RS-Rh-4	250	120	96	250	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
BEJ-Med-RS-Rh-5	500	120	96	500	0.6	0.0	0.0	3.00	2.00	2.00	40%	1.7	0.0	0.0	0.2	1.9
BEJ-Med-RS-Rh-6	200	120	96	200	0.2	0.0	0.0	3.00	2.00	2.00	40%	0.7	0.0	0.0	0.1	0.8
BEJ-Med-RS-Rh-7	350	120	96	350	0.4	0.0	0.0	3.00	2.00	2.00	40%	1.2	0.0	0.0	0.2	1.3
BEJ-Nef-RS-Rh-1	50	85	68	50	0.0	0.0	0.0	3.00	2.00	2.00	40%	0.1	0.0	0.0	0.0	0.1
BEJ-Nef-RS-Rh-2	75	85	68	75	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.2	0.0	0.0	0.0	0.2
BEJ-Teb-RS-Rh-1	1,500	85	68	1,500	1.2	0.0	0.0	3.00	2.00	2.00	40%	3.5	0.0	0.0	0.5	4.0
BEJ-Teb-RS-Rh-2	3,405	85	68	3,405	2.7	0.0	0.0	3.00	2.00	2.00	40%	8.0	0.0	0.0	1.1	9.1
BEJ-Teb-RS-Ex-2	783	85	68	783	0.6	0.0	0.0	3.00	2.00	2.00	40%	1.8	0.0	0.0	0.2	2.1
BEJ-Tes-RS-Rh-1	1,072	85	68	1,072	0.8	0.0	0.0	3.00	2.00	2.00	40%	2.5	0.0	0.0	0.3	2.9
BEJ-Tes-RS-Ex-1	183	85	68	183	0.1	0.0	0.0	3.00	2.00	2.00	40%	0.4	0.0	0.0	0.1	0.5
BEJ-Tes-RS-Ex-2	426	85	68	426	0.3	0.0	0.0	3.00	2.00	2.00	40%	1.0	0.0	0.0	0.1	1.1
SIL-Bou-RS-Rh-1	1,100	80	64	1,100	0.8	0.0	0.0	3.00	2.00	2.00	70%	2.4	0.0	0.0	0.6	3.0
SIL-Bou-RS-Rh-2	308	80	64	308	0.2	0.0	0.0	3.00	2.00	2.00	70%	0.7	0.0	0.0	0.2	0.8

Table II.1.7 - Networks Rehabilitation (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
SIL-Bou-RS-Rh-3	567	80	64	567	0.4	0.0	0.0	3.00	2.00	2.00	70%	1.3	0.0	0.0	0.3	1.6
SIL-Bou-RS-Rh-4	594	80	64	594	0.4	0.0	0.0	3.00	2.00	2.00	70%	1.3	0.0	0.0	0.3	1.6
SIL-Sil-RS-Rh-1	317	100	80	317	0.3	0.0	0.0	3.00	2.00	2.00	70%	0.9	0.0	0.0	0.2	1.1
SIL-Sil-RS-Rh-2	1,330	100	80	1,330	1.2	0.0	0.0	3.00	2.00	2.00	70%	3.7	0.0	0.0	0.9	4.6
SIL-Sil-RS-Rh-3	780	100	80	780	0.7	0.0	0.0	3.00	2.00	2.00	70%	2.2	0.0	0.0	0.5	2.7
SIL-Sil-RS-Rh-4	346	100	80	346	0.3	0.0	0.0	3.00	2.00	2.00	70%	1.0	0.0	0.0	0.2	1.2
SIL-Kri-RS-Ex-1	8,000	75	60	8,000	5.6	0.0	0.0	2.56	2.00	2.00	70%	14.2	0.0	0.0	3.9	18.1
KEF-Dah-RS-Rh-3	3,515	78	62	3,515	2.5	0.0	0.0	3.00	2.00	2.00	50%	7.6	0.0	0.0	1.3	8.9
KEF-Kef-RS-Rh-1	45,191	84	67	45,191	35.1	3.0	2.0	1.92	2.00	2.00	50%	67.5	6.0	4.1	17.6	95.3
KEF-Kef-RS-Rh-2	300	84	67	300	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.7	0.0	0.0	0.1	0.8
KEF-Kef-RS-Rh-3	2,300	84	67	2,300	1.8	0.2	0.1	3.00	2.00	2.00	50%	5.4	0.3	0.2	0.9	6.8
KEF-Kef-RS-Rh-4	600	84	67	600	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.4	0.0	0.0	0.2	1.6
KEF-Kef-RS-Rh-5	1,000	84	67	1,000	0.8	0.1	0.0	3.00	2.00	2.00	50%	2.3	0.1	0.1	0.4	2.9
KEF-Kef-RS-Rh-6	2,400	84	67	2,400	1.9	0.2	0.1	3.00	2.00	2.00	50%	5.6	0.3	0.2	0.9	7.1
KEF-Kef-RS-Rh-7	600	84	67	600	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.4	0.0	0.0	0.2	1.6
KEF-Taj-RS-Rh-1	1,500	78	62	1,500	1.1	0.0	0.0	3.00	2.00	2.00	50%	3.3	0.0	0.0	0.5	3.8
KEF-Taj-RS-Rh-2	950	78	62	950	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.1	0.0	0.0	0.3	2.4
KEF-Taj-RS-Rh-3	2,750	78	62	2,750	2.0	0.0	0.0	3.00	2.00	2.00	50%	6.0	0.0	0.0	1.0	7.0
SFA-Chi-RS-Rh-1	10,491	95	76	10,491	9.2	0.0	0.0	2.32	2.00	2.00	50%	21.4	0.0	0.0	4.6	26.1
SFA-Sae-RS-Rh-1	13,819	98	78	13,819	12.5	0.0	0.0	2.21	2.00	2.00	50%	27.7	0.0	0.0	6.3	33.9
SFA-Sak-RS-Rh-1	53,396	98	78	53,396	48.5	0.0	0.0	1.86	2.00	2.00	50%	90.1	0.0	0.0	24.2	114.3
SFA-Sfs-RS-Rh-1	2,375	104	83	2,375	2.3	0.0	0.0	3.00	2.00	2.00	50%	6.9	0.0	0.0	1.1	8.0
SFA-Sfs-RS-Rh-2	3,175	104	83	3,175	3.1	0.0	0.0	2.93	2.00	2.00	50%	9.0	0.0	0.0	1.5	10.5
SFA-Sfs-RS-Rh-3	1,625	104	83	1,625	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
SFA-Sfs-RS-Rh-4	1,025	104	83	1,025	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
SFA-Sfs-RS-Rh-5	2,480	104	83	2,480	2.4	0.0	0.0	3.00	2.00	2.00	50%	7.2	0.0	0.0	1.2	8.4
SFA-Sfv-RS-Rh-1	240,000	104	83	240,000	231.1	0.0	0.0	1.66	2.00	2.00	50%	384.7	0.0	0.0	115.6	500.2
SFA-Sfv-RS-Rh-2	5,000	104	83	5,000	4.8	0.0	0.0	2.64	2.00	2.00	50%	12.7	0.0	0.0	2.4	15.1
SFA-Sfv-RS-Rh-3	4,000	104	83	4,000	3.9	0.0	0.0	2.77	2.00	2.00	50%	10.7	0.0	0.0	1.9	12.6
SFA-Sfv-RS-Rh-4	20,000	104	83	20,000	19.3	0.0	0.0	2.07	2.00	2.00	50%	39.9	0.0	0.0	9.6	49.5
SFA-Sfv-RS-Rh-5	11,150	104	83	11,150	10.7	0.0	0.0	2.26	2.00	2.00	50%	24.3	0.0	0.0	5.4	29.7
SFA-Sfv-RS-Rh-6	8,100	104	83	8,100	7.8	0.0	0.0	2.40	2.00	2.00	50%	18.7	0.0	0.0	3.9	22.6
SFA-Mah-RS-Rh-1	7,500	88	70	7,500	6.1	0.0	0.0	2.51	2.00	2.00	50%	15.3	0.0	0.0	3.1	18.4
SFA-SFS-RS-Ex-3	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0
SFA-Mah-RS-Ex-1	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.0
JEN-Fer-RS-Rh-1	461	64	51	461	0.3	0.0	0.0	3.00	2.00	2.00	40%	0.8	0.0	0.0	0.1	0.9
JEN-Gha-RS-Rh-1	1,466	65	52	1,466	0.9	0.0	0.0	3.00	2.00	2.00	40%	2.6	0.0	0.0	0.4	3.0

Table II.1.7 - Networks Rehabilitation (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
JEN-Jen-RS-Rh-1	1,379	110	88	1,379	1.4	0.0	0.0	3.00	2.00	2.00	40%	4.2	0.0	0.0	0.6	4.8
JEN-Jen-RS-Rh-2	1,912	110	88	1,912	1.9	0.0	0.0	3.00	2.00	2.00	40%	5.8	0.0	0.0	0.8	6.6
JEN-Jen-RS-Rh-3	3,154	110	88	3,154	3.2	0.0	0.0	2.89	2.00	2.00	40%	9.3	0.0	0.0	1.3	10.6
JEN-Tab-RS-Rh-1	4,110	110	88	4,110	4.2	0.0	0.0	2.72	2.00	2.00	40%	11.4	0.0	0.0	1.7	13.1
JEN-Jen-SP-Rh-3	30,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71.9
JEN-Jen-SP-Rh-2	5,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.3
KEB-Keb-RS-Rh-1	4,000	65	52	4,000	2.4	0.0	0.0	3.00	2.00	2.00	50%	7.2	0.0	0.0	1.2	8.4
KEB-Dou-RS-Rh-1	25,000	72	58	25,000	16.7	0.0	0.0	2.11	2.00	2.00	50%	35.2	0.0	0.0	8.3	43.5
BIZ-Abd-RS-Rh-1	3,500	80	64	3,500	2.6	0.0	0.0	3.00	2.00	2.00	50%	7.8	0.0	0.0	1.3	9.1
BIZ-Ali-RS-Rh-1	3,500	85	68	3,500	2.8	0.0	0.0	3.00	2.00	2.00	50%	8.3	0.0	0.0	1.4	9.6
BIZ-Biz-RS-Rh-1	15,000	120	96	15,000	16.7	0.0	0.0	2.11	2.00	2.00	50%	35.2	0.0	0.0	8.3	43.5
BIZ-Biz-RS-Rh-2	1,500	120	96	1,500	1.7	0.0	0.0	3.00	2.00	2.00	50%	5.0	0.0	0.0	0.8	5.8
BIZ-Biz-RS-Rh-3	10,000	120	96	10,000	11.1	0.0	0.0	2.25	2.00	2.00	50%	25.0	0.0	0.0	5.6	30.6
BIZ-Biz-RS-Rh-4	1,000	120	96	1,000	1.1	0.0	0.0	3.00	2.00	2.00	50%	3.3	0.0	0.0	0.6	3.9
BIZ-Biz-RS-Rh-6	1,000	120	96	1,000	1.1	0.0	0.0	3.00	2.00	2.00	50%	3.3	0.0	0.0	0.6	3.9
BIZ-Biz-RS-Rh-7	6,000	120	96	6,000	6.7	0.0	0.0	2.47	2.00	2.00	50%	16.5	0.0	0.0	3.3	19.8
BIZ-Jam-RS-Rh-1	3,500	80	64	3,500	2.6	0.0	0.0	3.00	2.00	2.00	50%	7.8	0.0	0.0	1.3	9.1
BIZ-Jam-RS-Rh-2	3,500	80	64	3,500	2.6	0.0	0.0	3.00	2.00	2.00	50%	7.8	0.0	0.0	1.3	9.1
BIZ-Men-RS-Rh-1	15,500	100	80	15,500	14.4	0.0	0.0	2.16	2.00	2.00	50%	31.0	0.0	0.0	7.2	38.2
BIZ-Men-RS-Rh-2	25,000	100	80	25,000	23.1	0.0	0.0	2.02	2.00	2.00	50%	46.8	0.0	0.0	11.6	58.3
BIZ-Raf-RS-Rh-1	5,000	160	128	5,000	7.4	0.0	0.0	2.42	2.00	2.00	50%	17.9	0.0	0.0	3.7	21.6
BIZ-Tin-RS-Rh-1	8,000	85	68	8,000	6.3	0.0	0.0	2.50	2.00	2.00	50%	15.7	0.0	0.0	3.1	18.9
BIZ-Tin-RS-Rh-2	10,000	85	68	10,000	7.9	0.0	0.0	2.39	2.00	2.00	50%	18.8	0.0	0.0	3.9	22.8
BIZ-Zar-RS-Rh-1	20,000	110	88	20,000	20.4	0.0	0.0	2.05	2.00	2.00	50%	41.8	0.0	0.0	10.2	52.0
BIZ-Zar-SP-Rh-3	25,000	120	96	25,000	27.8	0.0	0.0	1.97	2.00	2.00	50%	54.8	0.0	0.0	13.9	68.7
BIZ-Mat-SP-Rh-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SID-Sid-RS-Rh-1	2,000	77	62	2,000	1.4	0.0	0.0	3.00	2.00	2.00	50%	4.3	0.0	0.0	0.7	5.0
SID-Sid-RS-Rh-2	3,900	77	62	3,900	2.8	0.0	0.0	3.00	2.00	2.00	50%	8.3	0.0	0.0	1.4	9.7
SID-Sid-RS-Rh-3	940	77	62	940	0.7	0.0	0.0	3.00	2.00	2.00	50%	2.0	0.0	0.0	0.3	2.3
SID-Sid-RS-Rh-4	12,000	77	62	12,000	8.6	0.0	0.0	2.35	2.00	2.00	50%	20.1	0.0	0.0	4.3	24.4
SID-Sid-RS-Rh-5	2,200	77	62	2,200	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
SID-Sid-RS-Rh-7	4,100	77	62	4,100	2.9	0.0	0.0	2.96	2.00	2.00	50%	8.7	0.0	0.0	1.5	10.1
SID-Sid-RS-Rh-8	500	77	62	500	0.4	4.8	0.0	3.00	2.00	2.00	50%	1.1	9.5	0.0	0.2	10.8
SID-Sid-RS-Rh-9	20,000	77	62	20,000	14.3	0.0	0.0	2.16	2.00	2.00	50%	30.8	0.0	0.0	7.1	38.0
SID-Sid-RS-Rh-10	100	77	62	100	0.1	0.0	0.0	3.00	2.00	2.00	50%	0.2	0.0	0.0	0.0	0.2
ZAG-Zag-RS-Rh-1	1,300	108	86	1,300	1.3	0.0	0.0	3.00	2.00	2.00	50%	3.9	0.0	0.0	0.7	4.6
ZAG-Zag-RS-Rh-2	400	108	86	400	0.4	0.0	0.0	3.00	2.00	2.00	50%	1.2	0.0	0.0	0.2	1.4

Table II.1.7 - Networks Rehabilitation (2/3)
Flow calculation - 2029

Intervention code	Served population (2010)	Percapita water consumption	Percapita water discharge	Population 2029	Mean daily flow of domestic wastewater	Mean daily flow from industrial source	Mean daily flow from tourist source	Domestic peak factor	Industrial peak factor	Tourist peak factor	Infiltration	Maximum flow from domestic source	Maximum flow from industrial source	Maximum flow from touristic source	Infiltration flow	Total flow to drain - q
-	(hab)	(L/hab./day)	(L/hab./day)	(hab.)	(L/s)	(L/s)	(L/s)	-	-	-	(%)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
ZAG-Zag-RS-Rh-3	200	108	86	200	0.2	0.0	0.0	3.00	2.00	2.00	50%	0.6	0.0	0.0	0.1	0.7
ZAG-Zag-RS-Rh-4	300	108	86	300	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.9	0.0	0.0	0.2	1.1
ZAG-Zag-RS-Rh-5	800	108	86	800	0.8	0.0	0.0	3.00	2.00	2.00	50%	2.4	0.0	0.0	0.4	2.8
ZAG-Zag-RS-Rh-6	2,000	108	86	2,000	2.0	0.0	0.0	3.00	2.00	2.00	50%	6.0	0.0	0.0	1.0	7.0
ZAG-Zag-RS-Rh-7	8,000	108	86	8,000	8.0	0.0	0.0	2.38	2.00	2.00	50%	19.1	0.0	0.0	4.0	23.1
ZAG-Ham-RS-Rh-1	1,300	107	86	1,300	1.3	0.0	0.0	3.00	2.00	2.00	50%	3.9	0.0	0.0	0.6	4.5
ZAG-Ham-RS-Rh-2	400	107	86	400	0.4	0.0	0.0	3.00	2.00	2.00	50%	1.2	0.0	0.0	0.2	1.4
ZAG-Ham-RS-Rh-3	1,500	107	86	1,500	1.5	0.0	0.0	3.00	2.00	2.00	50%	4.5	0.0	0.0	0.7	5.2
ZAG-Ham-RS-Rh-4	1,000	107	86	1,000	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
ZAG-Ham-RS-Rh-5	2,000	107	86	2,000	2.0	0.0	0.0	3.00	2.00	2.00	50%	5.9	0.0	0.0	1.0	6.9
ZAG-Ham-RS-Rh-6	1,000	107	86	1,000	1.0	0.0	0.0	3.00	2.00	2.00	50%	3.0	0.0	0.0	0.5	3.5
ZAG-Ham-RS-Rh-7	1,200	107	86	1,200	1.2	0.0	0.0	3.00	2.00	2.00	50%	3.6	0.0	0.0	0.6	4.2
ZAG-Ham-RS-Rh-8	500	107	86	500	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.5	0.0	0.0	0.2	1.7
ZAG-Ham-RS-Rh-9	300	107	86	300	0.3	0.0	0.0	3.00	2.00	2.00	50%	0.9	0.0	0.0	0.1	1.0
ZAG-Ham-RS-Rh-10	1,500	107	86	1,500	1.5	0.0	0.0	3.00	2.00	2.00	50%	4.5	0.0	0.0	0.7	5.2
ZAG-Fah-RS-Rh-1	600	85	68	600	0.5	0.0	0.0	3.00	2.00	2.00	50%	1.4	0.0	0.0	0.2	1.7
ZAG-Fah-RS-Rh-2	5,000	85	68	5,000	3.9	0.0	0.0	2.76	2.00	2.00	50%	10.9	0.0	0.0	2.0	12.8
ZAG-Fah-RS-Rh-3	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
ZAG-Fah-RS-Rh-4	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
ZAG-Fah-RS-Rh-5	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
ZAG-Fah-RS-Rh-6	2,000	85	68	2,000	1.6	0.0	0.0	3.00	2.00	2.00	50%	4.7	0.0	0.0	0.8	5.5
ZAG-Fah-RS-Rh-7	4,000	85	68	4,000	3.1	0.0	0.0	2.91	2.00	2.00	50%	9.2	0.0	0.0	1.6	10.7
ZAG-Fah-RS-Rh-8	700	85	68	700	0.6	0.0	0.0	3.00	2.00	2.00	50%	1.7	0.0	0.0	0.3	1.9

Table II.1.7 - Networks Rehabilitation (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
KAS-Kas-RS-Rh-1	Beton rev	90	630	0.5%	600	508	21%	79%	186	1.4	5.2	0	0	0	0	1,450	2,460	0	0	0	100%	0%	Non	0	0	0	0	539,400	1,328,400	0	0	0	2,147,970	53,699	3,910
KAS-Kas-RS-Rh-2	PVC	90	250	0.5%	235	42	32%	88%	89	0.8	2.4	1,450	0	0	0	0	0	0	0	20	100%	0%	Non	208,800	0	0	0	0	0	0	0	9,600	251,160	6,279	1,450
KAS-Kas-RS-Rh-3	PVC	90	250	0.5%	235	42	4%	50%	33	0.5	1.0	1,336	664	0	0	0	0	0	0	150	100%	0%	Non	192,384	103,584	0	0	0	0	0	0	72,000	423,163	10,579	2,000
KAS-Kas-RS-Rh-4	PVC	90	400	0.5%	377	147	29%	86%	136	1.1	3.6	0	0	2,122	0	0	0	0	0	100	100%	0%	Non	0	0	407,424	0	0	0	0	0	48,000	523,738	13,093	2,122
KAS-Kas-RS-Rh-5	PVC	90	250	0.5%	235	42	32%	88%	89	0.8	2.4	458	472	0	0	0	0	0	0	50	100%	0%	Non	65,952	73,632	0	0	0	0	0	0	24,000	188,122	4,703	930
KAS-Kas-RS-Rh-7	PVC	90	400	0.5%	377	147	36%	91%	154	1.2	4.0	0	0	1,137	0	0	0	0	0	70	100%	0%	Non	0	0	218,304	0	0	0	0	0	33,600	289,690	7,242	1,137
KAS-Kas-RS-Rh-8	PVC	90	250	0.5%	235	42	6%	54%	38	0.5	1.1	3,600	0	0	0	0	0	0	0	200	100%	0%	Non	518,400	0	0	0	0	0	0	0	96,000	706,560	17,664	3,600
KAS-Kas-RS-Rh-9	PVC	90	250	0.5%	235	42	12%	65%	52	0.6	1.5	4,208	0	0	0	0	0	0	0	400	100%	0%	Non	605,952	0	0	0	0	0	0	0	192,000	917,645	22,941	4,208
KAS-Kas-RS-Rh-10	PVC	90	250	0.5%	235	42	15%	70%	59	0.7	1.7	2,164	0	0	0	0	0	0	0	500	100%	0%	Non	311,616	0	0	0	0	0	0	0	240,000	634,358	15,859	2,164
KAS-Kas-RS-Rh-11	PVC	90	250	0.5%	235	42	15%	70%	59	0.7	1.7	4,406	0	0	0	0	0	0	0	500	100%	0%	Non	634,464	0	0	0	0	0	0	0	240,000	1,005,634	25,141	4,406
KAS-Sbe-RS-Rh-1	PVC	90	250	0.5%	235	42	7%	58%	42	0.6	1.3	750	0	0	0	0	0	0	0	0	0%	0%	Non	76,500	0	0	0	0	0	0	0	0	87,975	2,199	750
KAS-Sbe-RS-Rh-2	PVC	90	250	0.5%	235	42	4%	50%	33	0.5	1.0	1,015	0	0	0	0	0	0	0	150	100%	0%	Non	146,160	0	0	0	0	0	0	0	72,000	250,884	6,272	1,015
KAS-Sbe-RS-Rh-3	PVC	90	250	0.5%	235	42	7%	58%	42	0.6	1.3	2,400	0	0	0	0	0	0	0	250	100%	0%	Non	345,600	0	0	0	0	0	0	0	120,000	535,440	13,386	2,400
KAS-Sbe-RS-Rh-4	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	0	0	300	0	0	0	0	0	130	100%	0%	Non	0	0	57,600	0	0	0	0	0	62,400	138,000	3,450	300
BEJ-Bej-RS-Rh-1	PVC	90	250	0.5%	235	42	27%	84%	82	0.8	2.2	4,972	0	0	0	0	0	0	0	497	100%	40%	Non	835,296	0	0	0	0	0	0	0	238,656	1,235,045	30,876	4,972
BEJ-Bej-RS-Rh-2	PVC	90	250	0.5%	235	42	27%	84%	82	0.8	2.2	6,695	0	463	0	0	0	0	0	670	100%	40%	Non	1,124,760	0	100,008	0	0	0	0	0	321,360	1,778,047	44,451	7,158
BEJ-Bej-RS-Rh-3	PVC	90	250	0.5%	235	42	26%	83%	80	0.8	2.2	226	655	524	0	0	0	0	0	141	100%	40%	Non	37,968	117,900	113,184	0	0	0	0	0	67,440	386,966	9,674	1,405
BEJ-Bej-RS-Rh-4	PVC	90	250	0.5%	235	42	8%	58%	42	0.6	1.3	341	0	0	0	0	0	0	0	34	100%	40%	Non	57,288	0	0	0	0	0	0	0	16,368	84,704	2,118	341
BEJ-Bej-RS-Rh-5	PVC	90	250	0.5%	235	42	11%	65%	52	0.6	1.5	2,114	0	0	0	0	0	0	0	116	100%	40%	Non	355,152	0	0	0	0	0	0	0	55,872	472,678	11,817	2,114
BEJ-Maa-RS-Rh-1	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	22	0	0	0	0	0	0	0	10	100%	10%	Non	3,300	0	0	0	0	0	0	0	4,800	9,315	233	22
BEJ-Med-RS-Rh-1	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	31	0	0	0	0	0	0	0	70	100%	20%	Non	4,836	0	0	0	0	0	0	0	33,600	44,201	1,105	31
BEJ-Med-RS-Rh-2	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	354	0	0	0	0	0	0	0	35	100%	20%	Non	55,224	0	0	0	0	0	0	0	16,992	83,048	2,076	354
BEJ-Med-RS-Rh-3	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	196	0	0	0	0	0	0	0	25	100%	20%	Non	30,576	0	0	0	0	0	0	0	11,760	48,686	1,217	196
BEJ-Med-RS-Rh-4	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	552	0	0	0	0	0	0	0	61	100%	20%	Non	86,112	0	0	0	0	0	0	0	29,440	132,885	3,322	552
BEJ-Med-RS-Rh-5	PVC	90	250	0.5%	235	42	5%	50%	33	0.5	1.0	727	0	0	0	0	0	0	0	81	100%	20%	Non	113,412	0	0	0	0	0	0	0	38,773	175,013	4,375	727
BEJ-Med-RS-Rh-6	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	262	0	0	0	0	0	0	0	29	100%	20%	Non	40,872	0	0	0	0	0	0	0	13,973	63,072	1,577	262
BEJ-Med-RS-Rh-7	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	820	0	0	0	0	0	0	0	91	100%	20%	Non	127,920	0	0	0	0	0	0	0	43,733	197,401	4,935	820
BEJ-Nef-RS-Rh-1	PVC	90	250	0.5%	235	42	0%	22%	9	0.2	0.3	84	0	0	0	0	0	0	0	10	100%	10%	Oui	12,600	0	0	0	0	0	0	0	4,800	20,010	500	84
BEJ-Nef-RS-Rh-2	PVC	90	250	0.5%	235	42	0%	22%	9	0.2	0.3	15	0	0	0	0	0	0	0	10	100%	10%	Oui	2,250	0	0	0	0	0	0	0	4,800	8,108	203	15
BEJ-Teb-RS-Rh-1	PVC	90	250	0.5%	235	42	10%	62%	47	0.6	1.4	3,675	0	0	0	0	0	0	0	300	100%	70%	Non	683,550	0	0	0	0	0	0	0	144,000	951,683	23,792	3,675
BEJ-Teb-RS-Rh-2	PVC	90	250	0.5%	235	42	22%	79%	73	0.8	2.0	8,952	0	0	0	0	0	0	0	896	100%	70%	Non	1,665,072	0	0	0	0	0	0	0	430,080	2,409,425	60,236	8,952
BEJ-Teb-RS-Ex-2	PVC	90	250	0.5%	235	42	5%	52%	35	0.5	1.1	2,060	0	0	0	0	0	0	0	206	100%	70%	Non	383,160	0	0	0	0	0	0	0	98,880	554,346	13,859	2,060
BEJ-Tes-RS-Rh-1	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	2,812	0	0	0	0	0	0	0	282	100%	10%	Non	421,800	0	0	0	0	0	0	0	135,360	640,734	16,018	2,812
BEJ-Tes-RS-Ex-1	PVC	90	250	0.5%	235	42	1%	32%	16	0.3	0.5	476	0	0	0	0	0	0	0	48	100%	10%	Non	71,400	0	0	0	0	0	0	0	23,040	108,606	2,715	476
BEJ-Tes-RS-Ex-2	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	1,116	188	0	0	0	0	0	0	112	100%	10%	Non	167,400	30,456	0	0	0	0	0	0	53,760	289,358	7,234	1,304
SIL-Bou-RS-Rh-1	PVC	90	250	0.5%	235	42	7%	58%	42	0.6	1.3	853	0	0	0	0	0	0	0	57	10%	0%	Non	90,589	0	0	0	0	0	0	0	27,296	135,567	3,389	853
SIL-Bou-RS-Rh-2	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	1,048	0	0	0	0	0	0	0	70	100%	0%	Non	150,912	0	0	0	0	0	0	0	33,536	212,115	5,303	1,048
SIL-Bou-RS-Rh-3	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	1,929	0	0	0	0	0	0	0	129	10%	0%	Non	204,860	0	0	0	0	0	0	0	61,728	306,576	7,664	1,929
SIL-Bou-RS-Rh-4	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	2,025	0	0	0	0	0	0	0	135	10%	0%	Non	215,055	0	0	0	0	0	0	0	64,800	321,833	8,046	2,025
SIL-Sil-RS-Rh-1	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	720	0	0	0	0	0	0	0	72	100%	0%	Non	103,680	0	0	0	0	0	0	0	34,560	158,976	3,974	720
SIL-Sil-RS-Rh-2	PVC	90	250	0.5%	235	42	11%	65%	52	0.6	1.5	3,020	0	0	0	0	0	0	0	302	100%	0%	Non	434,880	0	0	0	0	0	0	0	144,960	666,816	16,670	3,020
SIL-Sil-RS-Rh-3	PVC	90	250	0.5%	235	42	6%	56%	40	0.5	1.2	634	0	0	0	0	0	0	0	63	100%	0%	Non	91,365	0	0	0	0	0	0	0	30,455	140,093	3,502	634
SIL-Sil-RS-Rh-4	PVC	90	250	0.5%	235	42	3%	43%	26	0.4	0.8	785	0	0	0	0	0	0	0	79	100%	0%	Non	113,040	0	0	0	0	0	0	0	37,680	173,328	4,333	785
SIL-Kri-RS-Ex-1	PVC	90	250	0.5%	235	42	43%	95%	106	0.9	2.7	8,973	0	0	0	0	0	0	0	897	80%	20%	Non	1,324,415	0	0	0	0	0	0	0	430,704	2,018,387	50,460	8,973
KEF-Dah-RS-Rh-3	PVC	90	250	0.5%	235	42	21%	79%	73	0.8	2.0	3,290	2,004	0	0	0	0	0	0	529	100%	20%	Non	513,240	336,672	0	0	0	0	0	0	253,920	1,269,407	31,735	5,294

Table II.1.7 - Networks Rehabilitation (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
KEF-Kef-RS-Rh-1	PVC	90	500	0.5%	471	266	36%	91%	193	1.4	5.0	0	0	0	1,960	0	0	0	0	40	100%	40%	Non	0	0	0	529,200	0	0	0	0	19,200	630,660	15,767	1,960
KEF-Kef-RS-Rh-2	PVC	90	250	0.5%	235	42	2%	38%	21	0.4	0.7	470	0	0	0	0	0	0	0	47	100%	40%	Non	78,960	0	0	0	0	0	0	0	22,560	116,748	2,919	470
KEF-Kef-RS-Rh-3	PVC	90	250	0.5%	235	42	16%	73%	64	0.7	1.8	330	0	0	0	0	0	0	0	6	100%	40%	Non	55,440	0	0	0	0	0	0	0	2,880	67,068	1,677	330
KEF-Kef-RS-Rh-4	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	690	0	0	0	0	0	0	0	69	100%	40%	Non	115,920	0	0	0	0	0	0	0	33,120	171,396	4,285	690
KEF-Kef-RS-Rh-5	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	430	0	0	0	0	0	0	0	5	100%	40%	Non	72,240	0	0	0	0	0	0	0	2,400	85,836	2,146	430
KEF-Kef-RS-Rh-6	PVC	90	250	0.5%	235	42	17%	73%	64	0.7	1.8	1,570	0	0	0	0	0	0	0	157	100%	40%	Non	263,760	0	0	0	0	0	0	0	75,360	389,988	9,750	1,570
KEF-Kef-RS-Rh-7	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	810	0	0	0	0	0	0	0	81	100%	40%	Non	136,080	0	0	0	0	0	0	0	38,880	201,204	5,030	810
KEF-Taj-RS-Rh-1	PVC	90	250	0.5%	235	42	9%	62%	47	0.6	1.4	3,200	0	0	0	0	0	0	0	320	100%	10%	Oui	480,000	0	0	0	0	0	0	0	153,600	728,640	18,216	3,200
KEF-Taj-RS-Rh-2	PVC	90	250	0.5%	235	42	6%	54%	38	0.5	1.1	1,610	0	0	0	0	0	0	0	161	100%	10%	Oui	241,500	0	0	0	0	0	0	0	77,280	366,597	9,165	1,610
KEF-Taj-RS-Rh-3	PVC	90	250	0.5%	235	42	17%	73%	64	0.7	1.8	4,210	0	0	0	0	0	0	0	421	100%	10%	Oui	631,500	0	0	0	0	0	0	0	202,080	958,617	23,965	4,210
SFA-Chi-RS-Rh-1	PVC	90	400	0.3%	377	114	23%	80%	121	0.8	2.0	0	3,470	533	0	0	0	0	0	400	100%	10%	Non	0	562,140	105,534	0	0	0	0	0	192,000	988,625	24,716	4,003
SFA-Sae-RS-Rh-1	PVC	90	400	0.5%	377	147	23%	80%	121	1.1	3.3	0	0	3,330	0	0	0	0	0	160	100%	10%	Non	0	0	659,340	0	0	0	0	0	76,800	846,561	21,164	3,330
SFA-Sak-RS-Rh-1	PVC	90	630	0.5%	600	508	23%	80%	192	1.4	5.3	467	3,292	0	0	0	2,848	0	0	330	100%	10%	Non	70,050	533,304	0	0	0	1,555,008	0	0	158,400	2,664,276	66,607	6,607
SFA-Sfs-RS-Rh-1	PVC	90	250	0.3%	235	32	25%	82%	78	0.6	1.3	540	0	0	0	0	0	0	0	54	80%	10%	Non	76,464	0	0	0	0	0	0	0	25,920	117,742	2,944	540
SFA-Sfs-RS-Rh-2	PVC	90	250	0.3%	235	32	32%	89%	92	0.7	1.5	990	0	0	0	0	0	0	0	100	80%	10%	Non	140,184	0	0	0	0	0	0	0	48,000	216,412	5,410	990
SFA-Sfs-RS-Rh-3	PVC	90	250	0.3%	235	32	17%	73%	64	0.5	1.1	17,775	0	0	0	0	0	0	0	325	80%	10%	Non	2,516,940	0	0	0	0	0	0	0	156,000	3,073,881	76,847	17,775
SFA-Sfs-RS-Rh-4	PVC	90	250	0.3%	235	32	11%	65%	52	0.5	0.9	2,045	0	0	0	0	0	0	0	205	80%	10%	Non	289,572	0	0	0	0	0	0	0	98,400	446,168	11,154	2,045
SFA-Sfs-RS-Rh-5	PVC	90	250	0.3%	235	32	26%	83%	80	0.6	1.3	3,870	0	0	0	0	0	0	0	390	80%	10%	Non	547,992	0	0	0	0	0	0	0	187,200	845,471	21,137	3,870
SFA-Sfv-RS-Rh-1	Béton Rev	90	1,000	0.3%	990	1,496	33%	89%	386	1.7	6.1	0	0	0	0	0	0	0	0	0	90%	0%	Non	0	0	0	0	0	0	0	0	0	0	0	0
SFA-Sfv-RS-Rh-2	PVC	90	250	0.3%	235	32	47%	97%	111	0.7	1.7	3,115	0	0	1,020	0	0	0	0	250	90%	0%	Non	435,477	0	0	246,024	0	0	0	0	120,000	921,726	23,043	4,135
SFA-Sfv-RS-Rh-3	PVC	90	250	0.3%	235	32	39%	93%	101	0.7	1.6	880	450	0	0	0	0	0	0	200	90%	0%	Non	123,024	68,310	0	0	0	0	0	0	96,000	330,434	8,261	1,330
SFA-Sfv-RS-Rh-4	PVC	90	500	0.3%	471	206	24%	82%	155	1.0	2.6	2,220	0	800	1,112	0	0	0	0	335	90%	0%	Non	310,356	0	150,240	268,214	0	0	0	0	160,800	1,023,052	25,576	4,132
SFA-Sfv-RS-Rh-5	PVC	90	250	0.3%	235	32	91%	113%	177	0.8	2.1	14,865	0	0	0	0	0	0	0	2230	90%	0%	Non	2,078,127	0	0	0	0	0	0	0	1,070,400	3,620,806	90,520	14,865
SFA-Sfv-RS-Rh-6	PVC	90	315	0.3%	297	60	38%	92%	125	0.8	1.9	0	4,713	0	0	0	0	0	0	236	90%	10%	Non	0	743,711	0	0	0	0	0	0	113,280	985,540	24,639	4,713
SFA-Mah-RS-Rh-1	PVC	90	315	0.3%	297	60	31%	87%	110	0.8	1.8	0	605	0	0	0	0	0	0	30	90%	10%	Non	0	95,469	0	0	0	0	0	0	14,400	126,349	3,159	605
SFA-SFS-RS-Ex-3	-	-	-	-	-	-	-	-	-	-	-	2,990	0	0	0	0	0	0	0	150	50%	0%	Non	367,770	0	0	0	0	0	0	0	72,000	505,736	12,643	2,990
SFA-Mah-RS-Ex-1	-	-	-	-	-	-	-	-	-	-	-	0	830	1,005	0	0	0	0	0	150	100%	10%	Non	0	134,460	198,990	0	0	0	0	0	72,000	466,268	11,657	1,835
JEN-Fer-RS-Rh-1	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	1,276	0	0	0	0	0	0	0	128	100%	30%	Non	206,712	0	0	0	0	0	0	0	61,440	308,375	7,709	1,276
JEN-Gha-RS-Rh-1	PVC	90	250	0.5%	235	42	7%	58%	42	0.6	1.3	3,234	830	0	0	0	0	0	0	407	100%	20%	Non	504,504	139,440	0	0	0	0	0	0	195,360	965,200	24,130	4,064
JEN-Jen-RS-Rh-1	PVC	90	250	0.5%	235	42	11%	65%	52	0.6	1.5	2,910	911	0	0	0	0	0	0	383	100%	5%	Non	427,770	144,849	0	0	0	0	0	0	183,840	869,928	21,748	3,821
JEN-Jen-RS-Rh-2	PVC	90	250	0.5%	235	42	16%	72%	61	0.7	1.7	3,435	1,110	0	765	0	0	0	0	531	100%	5%	Non	504,945	176,490	0	190,485	0	0	0	0	254,880	1,295,820	32,396	5,310
JEN-Jen-RS-Rh-3	PVC	90	250	0.5%	235	42	25%	83%	80	0.8	2.2	6,800	929	0	1,023	0	0	0	0	876	30%	5%	Non	799,680	120,398	0	220,354	0	0	0	0	420,480	1,795,049	44,876	8,752
JEN-Tab-RS-Rh-1	PVC	90	250	0.5%	235	42	31%	88%	89	0.8	2.4	930	1,656	0	0	0	0	0	0	166	100%	40%	Non	156,240	298,080	0	0	0	0	0	0	79,680	614,100	15,353	2,586
JEN-Jen-SP-Rh-3	PVC	90	500	0.5%	471	266	27%	84%	165	1.3	4.5	0	0	0	0	0	0	2,590	0	0	100%	5%	Non	0	0	0	0	0	0	1,748,250	0	0	2,010,488	50,262	2,590
JEN-Jen-SP-Rh-2	PVC	90	250	0.5%	235	42	37%	91%	97	0.9	2.5	0	317	0	0	0	0	0	0	0	100%	5%	Non	0	50,403	0	0	0	0	0	0	0	57,963	1,449	317
KEB-Keb-RS-Rh-1	PVC	90	250	0.3%	235	32	26%	83%	80	0.6	1.3	2,615	4,500	0	0	0	0	0	0	800	100%	0%	Non	376,560	702,000	0	0	0	0	0	0	384,000	1,681,944	42,049	7,115
KEB-Dou-RS-Rh-1	PVC	90	500	0.3%	471	206	21%	79%	146	0.9	2.4	0	0	390	2,061	0	0	0	0	250	90%	0%	Non	0	0	73,242	497,113	0	0	0	0	120,000	793,908	19,848	2,451
BIZ-Abd-RS-Rh-1	PVC	90	250	0.5%	235	42	22%	79%	73	0.8	2.0	0	3,350	0	60	0	0	0	0	345	100%	5%	Non	0	532,650	0	14,940	0	0	0	0	165,600	820,169	20,504	3,410
BIZ-Ali-RS-Rh-1	PVC	90	250	0.5%	235	42	23%	80%	75	0.8	2.1	1,950	0	0	0	0	0	0	0	195	100%	15%	Non	298,350	0	0	0	0	0	0	0	93,600	450,743	11,269	1,950
BIZ-Biz-RS-Rh-1	PVC	90	400	0.5%	377	147	30%	87%	139	1.1	3.7	9,350	0	0	0	0	0	0	0	1870	100%	5%	Oui	1,374,450	0	0	0	0	0	0	0	897,600	2,612,858	65,321	9,350
BIZ-Biz-RS-Rh-2	PVC	90	250	0.5%	235	42	14%	70%	59	0.7	1.7	0	850	0	0	0	0	0	0	85	100%	5%	Oui	0	135,150	0	0	0	0	0	0	40,800	202,343	5,059	850
BIZ-Biz-RS-Rh-3	PVC	90	315	0.5%	297	78	39%	93%	128	1.0	3.3	0	810	290	100	450	0	0	0	120	100%	5%	Oui	0	128,790	56,550	24,900	241,650	0	0	0	57,600	585,914	14,648	1,650
BIZ-Biz-RS-Rh-4	PVC	90	250	0.5%	235	42	9%	62%	47	0.6	1.4	0	2,300	0	0	0	0	0	0	230	100%	5%	Oui	0	365,700	0	0	0	0	0	0	110,400	547,515	13,688	2,300
BIZ-Biz-RS-Rh-6	PVC	90	250	0.5%	235	42	9%	62%	47	0.6	1.4	1,990	0	0	0	0	0	0	0	200	100%	5%	Oui	292,530	0	0	0	0	0	0	0	96,000	446,810	11,170	1,990
BIZ-Biz-RS-Rh-7	PVC	90	250	0.5%	235	42	47%	98%	113	0.9	2.8	5,800	0	0	0	0	0	0	0	390	100%	5%	Oui	852,600	0	0	0	0	0	0	0	187,200	1,195,770	29,894	5,800

Table II.1.7 - Networks Rehabilitation (3/3)
Sizing and cost estimation - 2029

Intervention code	Material	Manning n	DN	Minimum slope	Internal diameter	Full section flow - Q	q/Q	Velo-city ratio v/V	Water level in pipe	Velo-city	Shear stress	Length DN 250	Length DN 315	Length DN 400	Length DN 500	Length DN 630	Length DN 800	Length DN 1000	Length DN 1200	Laterals	Proportion of road pavement	Proportion of rocky soil	Salinity	Cost DN 250	Cost DN 315	Cost DN 400	Cost DN 500	Cost DN 630	Cost DN 800	Cost DN 1000	Cost DN 1200	Cost Laterals	Civil works cost	Operation & mainte-nance cost	Network lenght
-	-	($m^{1/3}/s$)	(mm)	(m/m)	(mm)	(L/s)	(%)	(m/s)	(mm)	(m/s)	(N/m^2)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(Un.)	(%)	(%)	Oui/Non	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(m)
BIZ-Jam-RS-Rh-1	PVC	90	250	0.5%	235	42	22%	79%	73	0.8	2.0	0	0	2,200	0	0	0	0	0	220	100%	5%	Non	0	0	429,000	0	0	0	0	0	105,600	614,790	15,370	2,200
BIZ-Jam-RS-Rh-2	PVC	90	250	0.5%	235	42	22%	79%	73	0.8	2.0	0	0	990	0	0	0	0	0	100	100%	5%	Non	0	0	193,050	0	0	0	0	0	48,000	277,208	6,930	990
BIZ-Men-RS-Rh-1	PVC	90	400	0.5%	377	147	26%	83%	128	1.1	3.5	14,500	950	0	1,900	1,450	0	0	0	1735	100%	5%	Non	2,131,500	151,050	0	473,100	543,750	0	0	0	832,800	4,752,030	118,801	18,800
BIZ-Men-RS-Rh-2	PVC	90	500	0.5%	471	266	22%	79%	146	1.2	4.1	0	0	0	2,750	0	0	0	0	275	100%	5%	Non	0	0	0	684,750	0	0	0	0	132,000	939,263	23,482	2,750
BIZ-Raf-RS-Rh-1	PVC	90	315	0.5%	297	78	28%	86%	107	1.0	2.9	6,500	0	0	0	0	0	0	0	435	100%	10%	Non	975,000	0	0	0	0	0	0	0	208,800	1,361,370	34,034	6,500
BIZ-Tin-RS-Rh-1	PVC	90	250	0.5%	235	42	45%	97%	111	0.9	2.8	3,400	0	0	0	0	0	0	0	340	100%	0%	Oui	489,600	0	0	0	0	0	0	0	163,200	750,720	18,768	3,400
BIZ-Tin-RS-Rh-2	PVC	90	315	0.5%	297	78	29%	87%	110	1.0	2.9	0	700	0	0	0	0	0	0	70	100%	0%	Oui	0	109,200	0	0	0	0	0	0	33,600	164,220	4,106	700
BIZ-Zar-RS-Rh-1	PVC	90	400	0.5%	377	147	35%	91%	154	1.2	4.0	6,750	0	480	0	0	0	0	0	725	100%	5%	Oui	992,250	0	93,600	0	0	0	0	0	348,000	1,648,928	41,223	7,230
BIZ-Zar-SP-Rh-3	PVC	70	630	0.5%	600	395	17%	75%	168	1.0	4.7	0	0	0	0	660	0	0	0	0	100%	5%	Non	0	0	0	0	247,500	0	0	0	0	284,625	7,116	660
BIZ-Mat-SP-Rh-1	-	-	-	-	-	-	-	-	-	-	-	0	0	0	200	0	0	0	0	0	100%	5%	Non	0	0	0	49,800	0	0	0	0	0	57,270	1,432	200
SID-Sid-RS-Rh-1	PVC	90	250	0.5%	235	42	12%	67%	54	0.6	1.6	4,046	0	0	0	0	0	0	0	222	100%	0%	Oui	582,579	0	0	0	0	0	0	0	106,560	792,510	19,813	4,046
SID-Sid-RS-Rh-2	PVC	90	250	0.5%	235	42	23%	80%	75	0.8	2.1	600	1,065	0	0	0	0	0	0	147	100%	0%	Oui	86,400	166,140	0	0	0	0	0	0	70,560	371,565	9,289	1,665
SID-Sid-RS-Rh-3	PVC	90	250	0.5%	235	42	6%	54%	38	0.5	1.1	495	0	0	0	0	0	0	0	49	100%	0%	Oui	71,214	0	0	0	0	0	0	0	23,520	108,944	2,724	495
SID-Sid-RS-Rh-4	PVC	90	500	0.5%	471	266	9%	62%	94	0.9	2.8	0	0	0	588	0	0	0	0	59	100%	0%	Oui	0	0	0	144,525	0	0	0	0	28,320	198,772	4,969	588
SID-Sid-RS-Rh-5	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	4,961	0	0	0	0	0	0	0	244	100%	0%	Oui	714,384	0	0	0	0	0	0	0	117,120	956,230	23,906	4,961
SID-Sid-RS-Rh-7	PVC	90	250	0.5%	235	42	24%	82%	78	0.8	2.1	1,150	986	0	0	0	0	0	0	20	100%	0%	Oui	165,600	153,816	0	0	0	0	0	0	9,600	378,368	9,459	2,136
SID-Sid-RS-Rh-8	PVC	90	250	0.5%	235	42	26%	83%	80	0.8	2.2	268	349	0	0	0	0	0	0	62	100%	0%	Oui	38,616	54,366	0	0	0	0	0	0	29,760	141,154	3,529	617
SID-Sid-RS-Rh-9	PVC	90	400	0.5%	377	147	26%	83%	128	1.1	3.5	202	0	246	0	0	0	0	0	45	100%	0%	Oui	29,078	0	47,232	0	0	0	0	0	21,600	112,596	2,815	448
SID-Sid-RS-Rh-10	PVC	90	250	0.5%	235	42	1%	26%	12	0.2	0.4	117	0	0	0	0	0	0	0	12	100%	0%	Oui	16,821	0	0	0	0	0	0	0	5,760	25,968	649	117
ZAG-Zag-RS-Rh-1	PVC	90	250	0.5%	235	42	11%	65%	52	0.6	1.5	2,250	0	0	0	0	0	0	0	225	100%	0%	Non	324,000	0	0	0	0	0	0	0	108,000	496,800	12,420	2,250
ZAG-Zag-RS-Rh-2	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	2,750	0	0	0	0	0	0	0	275	100%	0%	Non	396,000	0	0	0	0	0	0	0	132,000	607,200	15,180	2,750
ZAG-Zag-RS-Rh-3	PVC	90	250	0.5%	235	42	2%	35%	19	0.3	0.6	0	0	1,450	0	0	0	0	0	145	100%	0%	Non	0	0	278,400	0	0	0	0	0	69,600	400,200	10,005	1,450
ZAG-Zag-RS-Rh-4	PVC	90	250	0.5%	235	42	3%	40%	24	0.4	0.7	1,100	0	0	0	0	0	0	0	110	100%	0%	Non	158,400	0	0	0	0	0	0	0	52,800	242,880	6,072	1,100
ZAG-Zag-RS-Rh-5	PVC	90	250	0.5%	235	42	7%	56%	40	0.5	1.2	4,900	0	0	0	0	0	0	0	980	100%	0%	Non	705,600	0	0	0	0	0	0	0	470,400	1,352,400	33,810	4,900
ZAG-Zag-RS-Rh-6	PVC	90	250	0.5%	235	42	17%	73%	64	0.7	1.8	6,300	0	0	0	0	0	0	0	630	100%	0%	Non	907,200	0	0	0	0	0	0	0	302,400	1,391,040	34,776	6,300
ZAG-Zag-RS-Rh-7	PVC	90	315	0.5%	297	78	30%	87%	110	1.0	2.9	1,250	1,350	0	0	0	0	0	0	55	50%	0%	Non	153,750	182,250	0	0	0	0	0	0	26,400	416,760	10,419	2,600
ZAG-Ham-RS-Rh-1	PVC	90	250	0.5%	235	42	11%	65%	52	0.6	1.5	3,900	0	0	0	0	0	0	0	390	100%	75%	Non	737,100	0	0	0	0	0	0	0	187,200	1,062,945	26,574	3,900
ZAG-Ham-RS-Rh-2	PVC	90	250	0.5%	235	42	3%	45%	28	0.4	0.9	900	0	0	0	0	0	0	0	90	100%	75%	Non	170,100	0	0	0	0	0	0	0	43,200	245,295	6,132	900
ZAG-Ham-RS-Rh-3	PVC	90	250	0.5%	235	42	12%	67%	54	0.6	1.6	2,300	0	0	0	0	0	0	0	230	100%	75%	Non	434,700	0	0	0	0	0	0	0	110,400	626,865	15,672	2,300
ZAG-Ham-RS-Rh-4	PVC	90	250	0.5%	235	42	8%	60%	45	0.6	1.3	1,050	0	0	0	0	0	0	0	105	100%	75%	Non	198,450	0	0	0	0	0	0	0	50,400	286,178	7,154	1,050
ZAG-Ham-RS-Rh-5	PVC	90	250	0.5%	235	42	17%	73%	64	0.7	1.8	2,100	0	0	0	0	0	0	0	210	100%	75%	Non	396,900	0	0	0	0	0	0	0	100,800	572,355	14,309	2,100
ZAG-Ham-RS-Rh-6	PVC	90	250	0.5%	235	42	8%	60%	45	0.6	1.3	2,200	0	0	0	0	0	0	0	220	100%	75%	Non	415,800	0	0	0	0	0	0	0	105,600	599,610	14,990	2,200
ZAG-Ham-RS-Rh-7	PVC	90	250	0.5%	235	42	10%	63%	49	0.6	1.5	1,750	0	0	0	0	0	0	0	175	100%	75%	Non	330,750	0	0	0	0	0	0	0	84,000	476,963	11,924	1,750
ZAG-Ham-RS-Rh-8	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	700	0	0	0	0	0	0	0	70	100%	75%	Non	132,300	0	0	0	0	0	0	0	33,600	190,785	4,770	700
ZAG-Ham-RS-Rh-9	PVC	90	250	0.5%	235	42	2%	40%	24	0.4	0.7	3,200	0	0	0	0	0	0	0	60	100%	75%	Non	604,800	0	0	0	0	0	0	0	28,800	728,640	18,216	3,200
ZAG-Ham-RS-Rh-10	PVC	90	250	0.5%	235	42	12%	67%	54	0.6	1.6	3,650	500	0	0	0	0	0	0	365	100%	75%	Non	689,850	100,500	0	0	0	0	0	0	175,200	1,110,383	27,760	4,150
ZAG-Fah-RS-Rh-1	PVC	90	250	0.5%	235	42	4%	47%	31	0.5	0.9	1,600	0	0	0	0	0	0	0	160	100%	50%	Non	278,400	0	0	0	0	0	0	0	76,800	408,480	10,212	1,600
ZAG-Fah-RS-Rh-2	PVC	90	250	0.5%	235	42	31%	87%	87	0.8	2.3	0	4,100	0	0	0	0	0	0	410	100%	50%	Non	0	762,600	0	0	0	0	0	0	196,800	1,103,310	27,583	4,100
ZAG-Fah-RS-Rh-3	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	0	4,350	0	0	0	0	0	0	435	100%	50%	Non	0	809,100	0	0	0	0	0	0	208,800	1,170,585	29,265	4,350
ZAG-Fah-RS-Rh-4	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	2,750	0	0	0	0	0	0	0	275	100%	50%	Non	478,500	0	0	0	0	0	0	0	132,000	702,075	17,552	2,750
ZAG-Fah-RS-Rh-5	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	0	1,900	0	0	0	0	0	0	190	100%	50%	Non	0	353,400	0	0	0	0	0	0	91,200	511,290	12,782	1,900
ZAG-Fah-RS-Rh-6	PVC	90	250	0.5%	235	42	13%	68%	56	0.7	1.6	0	2,150	0	0	0	0	0	0	215	100%	50%	Non	0	399,900	0	0	0	0	0	0	103,200	578,565	14,464	2,150
ZAG-Fah-RS-Rh-7	PVC	90	250	0.5%	235	42	26%	83%	80	0.8	2.2	0	450	100	0	0	0	0	0	35	100%	50%	Non	0	83,700	22,200	0	0	0	0	0	16,800	141,105	3,528	550
ZAG-Fah-RS-Rh-8	PVC	90	250	0.5%	235	42	5%	50%	33	0.5	1.0	0	0	450	0	0	0	0	0	20	100%	50%	Non	0	0	99,900	0	0	0	0	0	9,600	125,925	3,148	450

Table II.1.8 - Interventions costs (1/3)
Investment costs

Intervention code	Gover-norate	Town	Classifica-tion	Population 2029	Investment costs								
					Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention
					Civil works	Equipment	Rising main	Civil works	Equipment	Rising main			
				(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
BIZ-Biz-RS-Rh-1	BIZ	Biz	B0	15,000							21,879	2,612,858	2,634,736
BIZ-Biz-RS-Rh-2	BIZ	Biz	B0	1,500							306,676	202,343	509,019
BIZ-Biz-RS-Rh-3	BIZ	Biz	B0	10,000								585,914	585,914
BIZ-Biz-RS-Rh-4	BIZ	Biz	B0	1,000								547,515	547,515
BIZ-Biz-RS-Rh-6	BIZ	Biz	B1	1,000								446,810	446,810
BIZ-Biz-RS-Rh-7	BIZ	Biz	B0	6,000								1,195,770	1,195,770
BIZ-Biz-RS-Ex-1	BIZ	Biz	C1	2,500							971,750		971,750
BIZ-Zar-SP-Rh-1	BIZ	Zar	B0	18,700				53,605	321,633				375,238
BIZ-Zar-SP-Rh-2	BIZ	Zar	B1	70,000				73,061	328,776				401,838
BIZ-Zar-SP-Rh-3	BIZ	Zar	B1	30,000				53,878	242,451			284,625	580,954
BIZ-Biz-SP-Ex-1	BIZ	Biz	C1	2,500	57,500	57,500	77,625						192,625
BIZ-Zar-RS-Rh-1	BIZ	Zar	B0	20,000								1,648,928	1,648,928
BIZ-Tin-RS-Rh-1	BIZ	Tin	B0	8,000								750,720	750,720
BIZ-Tin-RS-Rh-2	BIZ	Tin	B0	10,000								164,220	164,220
BIZ-Tin-RS-Ex-1	BIZ	Tin	A	2,000							363,400		363,400
BIZ-Tin-RS-Ex-2	BIZ	Tin	C0	1,500							288,363		288,363
BIZ-Tin-RS-Ex-3	BIZ	Tin	C0	600							220,800		220,800
BIZ-Tin-SP-Rh-1	BIZ	Tin	B0	12,000				53,106	159,319	159,666			372,091
BIZ-Tin-SP-Ex-1	BIZ	Tin	A	2,000	32,775	49,162	12,938						94,874
BIZ-Tin-SP-Ex-2	BIZ	Tin	C0	8,000	72,948	109,422	42,263						224,632
BIZ-Men-RS-Rh-1	BIZ	Men	B0	15,500								4,752,030	4,752,030
BIZ-Men-RS-Rh-2	BIZ	Men	B0	25,000								939,263	939,263
BIZ-Men-RS-Ex-1	BIZ	Men	C0	600							205,850		205,850
BIZ-Men-RS-Ex-2	BIZ	Men	C0	400							136,275		136,275
BIZ-Men-SP-Ex-1	BIZ	Men	C0	600	30,772	46,158	77,625						154,555
BIZ-Raf-RS-Rh-1	BIZ	Raf	A	5,000								1,361,370	1,361,370
BIZ-Raf-SP-Ex-1	BIZ	Raf	A	5,000	79,702	119,553	15,525						214,780
BIZ-Raf-SP-Ex-2	BIZ	Raf	A	4,000	70,595	105,892	21,563						198,050
BIZ-Jam-RS-Rh-1	BIZ	Jam	B0	3,500								614,790	614,790
BIZ-Jam-RS-Rh-2	BIZ	Jam	B0	3,500								277,208	277,208
BIZ-Jam-SP-Rh-1	BIZ	Jam	B0	30,000				92,529	277,588	679,995			1,050,112
BIZ-Jam-SP-Rh-2	BIZ	Jam	B0	5,000	81,132	121,698	143,233						346,063
BIZ-Abd-RS-Rh-1	BIZ	Abd	B0	3,500								820,169	820,169
BIZ-Abd-SP-Rh-1	BIZ	Abd	B0	18,700				98,233	294,699	251,850			644,782
BIZ-Ali-RS-Rh-1	BIZ	Ali	B0	3,500								450,743	450,743
BIZ-Mat-SP-Rh-1	BIZ	Mat	B0	15,000				36,751	220,508	462,990	77,050	57,270	854,570
BIZ-Mat-SP-Rh-2	BIZ	Mat	B1	12,000				27,928	41,892				69,819
ZAG-Fah-RS-Rh-1	ZAG	Fah	B0	600								408,480	408,480
ZAG-Fah-RS-Rh-2	ZAG	Fah	B0	5,000								1,103,310	1,103,310
ZAG-Fah-RS-Rh-3	ZAG	Fah	B1	2,000								1,170,585	1,170,585
ZAG-Fah-RS-Rh-4	ZAG	Fah	B1	2,000								702,075	702,075
ZAG-Fah-RS-Rh-5	ZAG	Fah	B1	2,000								511,290	511,290
ZAG-Fah-RS-Rh-6	ZAG	Fah	B1	2,000								578,565	578,565
ZAG-Fah-RS-Rh-7	ZAG	Fah	B0	4,000							69,000	141,105	210,105
ZAG-Fah-RS-Rh-8	ZAG	Fah	B0	700							32,200	125,925	158,125
ZAG-Zag-RS-Rh-1	ZAG	Zag	B0	1,300								496,800	496,800
ZAG-Zag-RS-Rh-2	ZAG	Zag	B1	400								607,200	607,200
ZAG-Zag-RS-Rh-3	ZAG	Zag	B0	200								400,200	400,200
ZAG-Zag-RS-Rh-4	ZAG	Zag	B1	300								242,880	242,880
ZAG-Zag-RS-Rh-5	ZAG	Zag	B0	800								1,352,400	1,352,400
ZAG-Zag-RS-Rh-6	ZAG	Zag	B1	2,000								1,391,040	1,391,040
ZAG-Zag-RS-Rh-7	ZAG	Zag	B1	8,000								416,760	416,760
ZAG-Zag-RS-Ex-1	ZAG	Zag	B0	150							280,888		280,888
ZAG-Zag-RS-Ex-2	ZAG	Zag	C1	200							250,700		250,700
ZAG-Zag-RS-Ex-3	ZAG	Zag	A	50							15,640		15,640
ZAG-Zag-RS-Ex-4	ZAG	Zag	B0	75							51,980		51,980
ZAG-Zag-SP-Ex-1	ZAG	Zag	B0	600	30,772	46,158	50,600						127,530
ZAG-Zag-SP-Ex-2	ZAG	Zag	A	50	46,000	46,000	10,120						102,120
ZAG-Zag-SP-Ex-3	ZAG	Zag	C1	200	57,500	57,500	10,120						125,120
ZAG-Ham-RS-Rh-1	ZAG	Ham	B1	1,300								1,062,945	1,062,945
ZAG-Ham-RS-Rh-2	ZAG	Ham	B1	400								245,295	245,295
ZAG-Ham-RS-Rh-3	ZAG	Ham	B1	1,500								626,865	626,865
ZAG-Ham-RS-Rh-4	ZAG	Ham	B1	1,000								286,178	286,178
ZAG-Ham-RS-Rh-5	ZAG	Ham	B1	2,000								572,355	572,355
ZAG-Ham-RS-Rh-6	ZAG	Ham	B1	1,000								599,610	599,610
ZAG-Ham-RS-Rh-7	ZAG	Ham	B1	1,200								476,963	476,963
ZAG-Ham-RS-Rh-8	ZAG	Ham	B1	500								190,785	190,785
ZAG-Ham-RS-Rh-9	ZAG	Ham	B1	300								728,640	728,640
ZAG-Ham-RS-Rh-10	ZAG	Ham	B1	1,500								1,110,383	1,110,383
ZAG-Ham-RS-Ex-1	ZAG	Ham	A	1							25,271		25,271

Table II.1.8 - Interventions costs (1/3)
Investment costs

Intervention code	Gover-norate	Town	Classifica-tion	Population 2029	Investment costs								
					Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention
					Civil works	Equipment	Rising main	Civil works	Equipment	Rising main			
				(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
ZAG-Ham-SP-Ex-1	ZAG	Ham	A	1	98,625	447,938	353,798						900,360
BEJ-Bej-RS-Ex-1	BEJ	Bej	A	210							9,792		9,792
BEJ-Bej-RS-Ex-2	BEJ	Bej	A	350							160,511		160,511
BEJ-Bej-RS-Rh-1	BEJ	Bej	B1	3,447								1,235,045	1,235,045
BEJ-Bej-RS-Rh-2	BEJ	Bej	B1	3,425								1,778,047	1,778,047
BEJ-Bej-RS-Rh-3	BEJ	Bej	B0	3,227								386,966	386,966
BEJ-Bej-RS-Rh-4	BEJ	Bej	B1	920								84,704	84,704
BEJ-Bej-RS-Rh-5	BEJ	Bej	B1	1,300								472,678	472,678
BEJ-Maa-RS-Rh-1	BEJ	Maa	B1	300								9,315	9,315
BEJ-Maa-SP-Ex-1	BEJ	Maa	B1	300	57,500	57,500	736						115,736
BEJ-Med-RS-Rh-1	BEJ	Med	B1	350								44,201	44,201
BEJ-Med-RS-Rh-2	BEJ	Med	B1	250								83,048	83,048
BEJ-Med-RS-Rh-3	BEJ	Med	B1	750								48,686	48,686
BEJ-Med-RS-Rh-4	BEJ	Med	B1	250								132,885	132,885
BEJ-Med-RS-Rh-5	BEJ	Med	B1	500								175,013	175,013
BEJ-Med-RS-Rh-6	BEJ	Med	B0	200								63,072	63,072
BEJ-Med-RS-Rh-7	BEJ	Med	B1	350								197,401	197,401
BEJ-Med-SP-Rh-1	BEJ	Med	B0	5,000				5,750	28,750	15,732	78,608		128,840
BEJ-Nef-RS-Ex-1	BEJ	Nef	C1	125							37,065		37,065
BEJ-Nef-RS-Ex-10	BEJ	Nef	A	135							39,848		39,848
BEJ-Nef-RS-Ex-2	BEJ	Nef	C1	50							43,516		43,516
BEJ-Nef-RS-Ex-3	BEJ	Nef	C1	25							38,732		38,732
BEJ-Nef-RS-Ex-4	BEJ	Nef	A	125							93,006		93,006
BEJ-Nef-RS-Ex-5	BEJ	Nef	D	450							186,588		186,588
BEJ-Nef-RS-Ex-6	BEJ	Nef	D	25							34,644		34,644
BEJ-Nef-RS-Ex-7	BEJ	Nef	C1	90							47,093		47,093
BEJ-Nef-RS-Ex-8	BEJ	Nef	D	200							72,594		72,594
BEJ-Nef-RS-Ex-9	BEJ	Nef	C1	15							28,808		28,808
BEJ-Nef-RS-Rh-1	BEJ	Nef	B1	50								20,010	20,010
BEJ-Nef-RS-Rh-2	BEJ	Nef	B1	75								8,108	8,108
BEJ-Nef-SP-Ex-1	BEJ	Nef	A	125	46,000	46,000	276						92,276
BEJ-Nef-SP-Ex-2	BEJ	Nef	C1	25	46,000	46,000	20,056						112,056
BEJ-Teb-RS-Ex-1	BEJ	Teb	C1	300							97,244		97,244
BEJ-Teb-RS-Ex-2	BEJ	Teb	B1	783							53,107	554,346	607,453
BEJ-Teb-RS-Rh-1	BEJ	Teb	B1	1,500								951,683	951,683
BEJ-Teb-RS-Rh-2	BEJ	Teb	B1	3,405								2,409,425	2,409,425
BEJ-Teb-SP-Ex-3	BEJ	Teb	C1	300	46,000	46,000	72,232						164,232
BEJ-Tes-RS-Ex-1	BEJ	Tes	A	240							119,255	108,606	227,861
BEJ-Tes-RS-Ex-2	BEJ	Tes	C1	462							11,017	289,358	300,375
BEJ-Tes-RS-Rh-1	BEJ	Tes	B0	1,072								640,734	640,734
BEJ-Tes-SP-Ex-1	BEJ	Tes	C1	38	46,000	46,000	3,496						95,496
SIL-Bou-RS-Rh-1	SIL	Bou	B1	1,100								135,567	135,567
SIL-Bou-RS-Rh-2	SIL	Bou	B1	308								212,115	212,115
SIL-Bou-RS-Rh-3	SIL	Bou	B1	567								306,576	306,576
SIL-Bou-RS-Rh-4	SIL	Bou	B1	594								321,833	321,833
SIL-Bou-SP-Ex-1	SIL	Bou	B1	1,100	46,000	46,000	431						92,431
SIL-Sil-RS-Rh-1	SIL	Sil	B1	317								158,976	158,976
SIL-Sil-RS-Rh-2	SIL	Sil	B1	1,330								666,816	666,816
SIL-Sil-RS-Rh-3	SIL	Sil	B1	780								140,093	140,093
SIL-Sil-RS-Rh-4	SIL	Sil	B1	346								173,328	173,328
SIL-Kri-RS-Ex-1	SIL	Kri	A	8,000							466,157	2,018,387	2,484,544
JEN-Fer-RS-Rh-1	JEN	Fer	B0	1,142							379,276	308,375	687,651
JEN-Fer-RS-Ex-1	JEN	Fer	C0	425							329,376		329,376
JEN-Fer-SP-Ex-1	JEN	Fer	C0	425	57,500	57,500	82,827						197,827
JEN-Gha-RS-Rh-1	JEN	Gha	B1	1,466								965,200	965,200
JEN-Gha-RS-Ex-1	JEN	Gha	C0	458							345,346		345,346
JEN-Gha-RS-Ex-2	JEN	Gha	A	548							246,977		246,977
JEN-Gha-SP-Ex-1	JEN	Gha	C0	458	57,500	57,500	56,695						171,695
JEN-Jen-RS-Rh-1	JEN	Jen	B1	1,379								869,928	869,928
JEN-Jen-RS-Ex-1	JEN	Jen	C0	1,077							438,409		438,409
JEN-Jen-RS-Rh-2	JEN	Jen	B1	1,912								1,295,820	1,295,820
JEN-Jen-RS-Rh-3	JEN	Jen	B1	3,154								1,795,049	1,795,049
JEN-Jen-SP-Rh-1	JEN	Jen	B1	20,000				77,195	144,741	79,971	310,213		612,119
JEN-Jen-SP-Rh-2	JEN	Jen	B1	5,000				35,785	67,098	24,174		57,963	185,021
JEN-Jen-SP-Rh-3	JEN	Jen	B0	30,000				174,021	261,031	2,519		2,010,488	2,448,057
JEN-Jen-SP-Rh-4	JEN	Jen	B1	200				28,750	28,750	10,695			68,195
JEN-Jen-SP-Ex-1	JEN	Jen	C0	1,077	57,500	57,500	41,532						156,532
JEN-Tab-RS-Rh-1	JEN	Tab	B0	4,110								614,100	614,100
JEN-Tab-RS-Ex-1	JEN	Tab	C1	800							658,105		658,105
JEN-Tab-RS-Ex-2	JEN	Tab	C1	263							607,143		607,143

Table II.1.8 - Interventions costs (1/3)
Investment costs

Intervention code	Gover-norate	Town	Classifica-tion	Population 2029	Investment costs								
					Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention
					Civil works	Equipment	Rising main	Civil works	Equipment	Rising main			
				(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
JEN-Tab-RS-Ex-3	JEN	Tab	C1	821							654,896		654,896
JEN-Tab-SP-Rh-1	JEN	Tab	B1	2,000					28,750	133,474			162,224
JEN-Tab-SP-Ex-1	JEN	Tab	C1	314	57,500	57,500	100,165						215,165
JEN-Tab-SP-Ex-2	JEN	Tab	C1	314	57,500	57,500	167,889				462,070		744,959
JEN-Bss-RS-Ex-1	JEN	Bss	C1	724							401,847		401,847
JEN-Bss-SP-Ex-1	JEN	Bss	C1	724	57,500	57,500	112,528						227,528
KEF-Dah-RS-Rh-3	KEF	Dah	B1	3,515								1,269,407	1,269,407
KEF-Dah-RS-Ex-1	KEF	Dah	C0	125							43,108		43,108
KEF-Dah-SP-Rh-1	KEF	Dah	B0	1,000					14,375				14,375
KEF-Kef-RS-Rh-1	KEF	Kef	B0	45,191								630,660	630,660
KEF-Kef-RS-Rh-2	KEF	Kef	B0	300								116,748	116,748
KEF-Kef-RS-Rh-3	KEF	Kef	B1	2,300							170,660	67,068	237,728
KEF-Kef-RS-Rh-4	KEF	Kef	B1	600								171,396	171,396
KEF-Kef-RS-Rh-5	KEF	Kef	B1	1,000								85,836	85,836
KEF-Kef-RS-Rh-6	KEF	Kef	B0	2,400								389,988	389,988
KEF-Kef-RS-Rh-7	KEF	Kef	B1	600								201,204	201,204
KEF-Kef-RS-Ex-1	KEF	Kef	C0	1,000							432,630		432,630
KEF-Kef-SP-Rh-1	KEF	Kef	B0	3,000				28,750	57,500	109,710			195,960
KEF-Kef-SP-Rh-2	KEF	Kef	B0	10,000				30,694	92,082	58,650			181,427
KEF-Kef-SP-Ex-1	KEF	Kef	C0	1,000	57,500	57,500	31,395						146,395
KEF-Taj-RS-Rh-1	KEF	Taj	B1	1,500								728,640	728,640
KEF-Taj-RS-Rh-2	KEF	Taj	B1	950								366,597	366,597
KEF-Taj-RS-Rh-3	KEF	Taj	B1	2,750								958,617	958,617
KEF-Taj-RS-Ex-1	KEF	Taj	C0	100							37,375		37,375
KEF-Taj-RS-Ex-2	KEF	Taj	A	225							49,335		49,335
KEF-Taj-RS-Ex-3	KEF	Taj	C0	300							122,590		122,590
KEF-Taj-SP-Rh-1	KEF	Taj	B1	400				5,750					5,750
KEF-Taj-SP-Ex-1	KEF	Taj	A	225	57,500	57,500	52,440						167,440
SFA-Chi-RS-Ex-1	SFA	Chi	C1	2,108							1,387,780		1,387,780
SFA-Chi-RS-Ex-2	SFA	Chi	C1	1,045							579,244		579,244
SFA-Chi-RS-Ex-3	SFA	Chi	C1	810							610,788		610,788
SFA-Chi-RS-Rh-1	SFA	Chi	B0	10,491								988,625	988,625
SFA-Sae-RS-Ex-1	SFA	Sae	C1	658							364,452		364,452
SFA-Sae-RS-Ex-2	SFA	Sae	C1	950							526,585		526,585
SFA-Sae-RS-Ex-3	SFA	Sae	C1	4,416							2,447,927		2,447,927
SFA-Sae-RS-Rh-1	SFA	Sae	B0	13,819						27,945		846,561	874,506
SFA-Sak-RS-Ex-1	SFA	Sak	C1	10,780							5,985,756		5,985,756
SFA-Sak-RS-Ex-2	SFA	Sak	C1	13,380							8,170,365		8,170,365
SFA-Sak-RS-Ex-3	SFA	Sak	C1	5,405							2,995,992		2,995,992
SFA-Sak-RS-Rh-1	SFA	Sak	B0	53,396								2,664,276	2,664,276
SFA-Ain-RS-Ex-1	SFA	Ain	C1	755							717,686		717,686
SFA-Ain-RS-Ex-2	SFA	Ain	C1	2,290							1,342,769		1,342,769
SFA-Ain-RS-Ex-3	SFA	Ain	C1	3,595							2,108,928		2,108,928
SFA-Ain-RS-Ex-4	SFA	Ain	C1	4,040							2,369,144		2,369,144
SFA-Gre-RS-Ex-1	SFA	Gre	C1	2,805							1,645,133		1,645,133
SFA-Gre-RS-Ex-2	SFA	Gre	C1	5,040							2,955,960		2,955,960
SFA-Gre-RS-Ex-3	SFA	Gre	C1	5,205							3,051,496		3,051,496
SFA-Gre-RS-Ex-4	SFA	Gre	C1	4,340							2,974,636		2,974,636
SFA-Gre-RS-Ex-5	SFA	Gre	C1	3,315							1,943,011		1,943,011
SFA-Sfs-RS-Ex-1	SFA	Sfs	C1	2,000							1,133,900		1,133,900
SFA-Sfs-RS-Ex-2	SFA	Sfs	C1	1,030							661,940		661,940
SFA-Sfs-RS-Ex-3	SFA	Sfs	B1	810							32,631	505,736	538,367
SFA-Sfs-RS-Rh-1	SFA	Sfs	B1	2,375							737,139	117,742	854,880
SFA-Sfs-RS-Rh-2	SFA	Sfs	B1	3,175							968,024	216,412	1,184,436
SFA-Sfs-RS-Rh-3	SFA	Sfs	C1	1,625								3,073,881	3,073,881
SFA-Sfs-RS-Rh-4	SFA	Sfs	B1	1,025								446,168	446,168
SFA-Sfs-RS-Rh-5	SFA	Sfs	B1	2,480							192,602	845,471	1,038,073
SFA-Sfs-SP-Ex-1	SFA	Sfs	C1	2,000	57,500	57,500	7,818						122,818
SFA-Sfv-RS-Ex-1	SFA	Sfv	C1	1,050							570,193		570,193
SFA-Sfv-RS-Ex-2	SFA	Sfv	C1	600							322,529		322,529
SFA-Sfv-RS-Ex-3	SFA	Sfv	C1	2,250							1,220,679		1,220,679
SFA-Sfv-RS-Ex-4	SFA	Sfv	C1	1,075							583,349		583,349
SFA-Sfv-RS-Ex-5	SFA	Sfv	B0	10,965							6,957,868		6,957,868
SFA-Sfv-RS-Ex-6	SFA	Sfv	C1	1,400							754,377		754,377
SFA-Sfv-RS-Ex-7	SFA	Sfv	C1	325							173,742		173,742
SFA-Sfv-RS-Rh-1	SFA	Sfv	B0	240,000			4,625,284			1,107,593	999,761		6,732,638
SFA-Sfv-RS-Rh-2	SFA	Sfv	B1	5,000								921,726	921,726
SFA-Sfv-RS-Rh-3	SFA	Sfv	B1	4,000								330,434	330,434
SFA-Sfv-RS-Rh-4	SFA	Sfv	B1	20,000								1,023,052	1,023,052
SFA-Sfv-RS-Rh-5	SFA	Sfv	B1	11,150								3,620,806	3,620,806

Table II.1.8 - Interventions costs (1/3)
Investment costs

Intervention code	Gover-norate	Town	Classifica-tion	Population 2029	Investment costs								
					Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention
					Civil works	Equipment	Rising main	Civil works	Equipment	Rising main			
				(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
SFA-Sfv-RS-Rh-6	SFA	Sfv	B0	8,100								985,540	985,540
SFA-Sfv-SP-Ex-1	SFA	Sfv	B0	1,036	46,000	46,000	54,395						146,395
SFA-Sfv-SP-Rh-1	SFA	Sfv	B0	10,000				122,407	183,610	331			306,349
SFA-Sfv-SP-Rh-2	SFA	Sfv	B0	10,000				25,784	128,918	41,400			196,102
SFA-Tyn-RS-Ex-1	SFA	Tyn	C1	390							247,572		247,572
SFA-Tyn-RS-Ex-2	SFA	Tyn	C1	3,830							2,748,822		2,748,822
SFA-Tyn-SP-Ex-1	SFA	Tyn	C1	925	57,500	57,500	27,376						142,376
SFA-Aga-RS-Ex-1	SFA	Aga	C1	1,500							946,772		946,772
SFA-Aga-RS-Ex-2	SFA	Aga	C1	1,500							313,519		313,519
SFA-Aga-SP-Ex-1	SFA	Aga	C1	3,000	57,500	57,500	6,109						121,109
SFA-Hen-RS-Ex-1	SFA	Hen	C1	1,750							1,208,938		1,208,938
SFA-Hen-RS-Ex-2	SFA	Hen	C1	1,100							729,963		729,963
SFA-Jeb-RS-Ex-1	SFA	Jeb	C1	1,000							766,993		766,993
SFA-Jeb-RS-Ex-2	SFA	Jeb	C1	1,350							1,018,958		1,018,958
SFA-Mah-RS-Ex-1	SFA	Mah	B1	10,825							1,217,275	466,268	1,683,543
SFA-Mah-RS-Ex-2	SFA	Mah	C1	2,750							1,824,245		1,824,245
SFA-Mah-SP-Ex-1	SFA	Mah	C1	410	57,500	57,500	58,039						173,039
SFA-Mah-RS-Rh-1	SFA	Mah	B1	7,500								126,349	126,349
SFA-Mah-SP-Rh-1	SFA	Mah	B1	1				23,000	34,500	46,343			103,843
KAS-Kas-RS-Rh-1	KAS	Kas	B0	64,660								2,147,970	2,147,970
KAS-Kas-RS-Rh-2	KAS	Kas	B0	6,000								251,160	251,160
KAS-Kas-RS-Rh-3	KAS	Kas	B0	750								423,163	423,163
KAS-Kas-RS-Rh-4	KAS	Kas	B0	23,000								523,738	523,738
KAS-Kas-RS-Rh-5	KAS	Kas	B0	6,000								188,122	188,122
KAS-Kas-RS-Rh-7	KAS	Kas	B0	30,000								289,690	289,690
KAS-Kas-RS-Rh-8	KAS	Kas	B0	1,000								706,560	706,560
KAS-Kas-RS-Rh-9	KAS	Kas	B0	2,000								917,645	917,645
KAS-Kas-RS-Rh-10	KAS	Kas	B0	2,500								634,358	634,358
KAS-Kas-RS-Rh-11	KAS	Kas	B0	2,500								1,005,634	1,005,634
KAS-Kas-RS-Ex-1	KAS	Kas	C1	1,000							355,190		355,190
KAS-Kas-RS-Ex-3	KAS	Kas	C1	1,000							534,658		534,658
KAS-Kas-RS-Ex-4	KAS	Kas	C1	1,250							293,888		293,888
KAS-Kas-RS-Ex-5	KAS	Kas	C1	900							307,573		307,573
KAS-Kas-RS-Ex-6	KAS	Kas	C1	750							264,989		264,989
KAS-Sbe-RS-Rh-1	KAS	Sbe	B0	1,250								87,975	87,975
KAS-Sbe-RS-Rh-2	KAS	Sbe	B0	750								250,884	250,884
KAS-Sbe-RS-Rh-3	KAS	Sbe	B0	1,250								535,440	535,440
KAS-Sbe-RS-Rh-4	KAS	Sbe	B0	650								138,000	138,000
KAS-Sbe-RS-Ex-1	KAS	Sbe	C1	75							36,225		36,225
KAS-Sbe-RS-Ex-2	KAS	Sbe	C0	950							278,990		278,990
KAS-Tel-RS-Ex-1	KAS	Tel	C0	5,950							2,513,900		2,513,900
KAS-Tel-SP-Ex-1	KAS	Tel	C0	375	57,500	57,500	73,140						188,140
KAS-Tel-SP-Ex-2	KAS	Tel	C0	375	57,500	57,500	41,573						156,573
KAS-Fei-RS-Ex-1	KAS	Fei	C0	4,950							3,078,760		3,078,760
KAS-Fei-SP-Ex-1	KAS	Fei	C0	800	57,500	57,500	123,280						238,280
KAS-Fei-SP-Ex-2	KAS	Fei	C0	1,000	57,500	57,500	58,587						173,587
SID-Sid-RS-Rh-1	SID	Sid	B0	2,000								792,510	792,510
SID-Sid-RS-Rh-2	SID	Sid	A	3,900						29,146		371,565	400,711
SID-Sid-RS-Rh-3	SID	Sid	B0	940								108,944	108,944
SID-Sid-RS-Rh-4	SID	Sid	B0	12,000								198,772	198,772
SID-Sid-RS-Rh-5	SID	Sid	B1	2,200								956,230	956,230
SID-Sid-RS-Rh-7	SID	Sid	A	4,100						108,689		378,368	487,057
SID-Sid-RS-Rh-8	SID	Sid	B1	500								141,154	141,154
SID-Sid-RS-Rh-9	SID	Sid	B0	20,000								112,596	112,596
SID-Sid-RS-Rh-10	SID	Sid	B1	100								25,968	25,968
SID-Sid-RS-Ex-1	SID	Sid	C0	800							204,993		204,993
SID-Sid-RS-Ex-2	SID	Sid	A	1,400							266,185		266,185
SID-Sid-RS-Ex-3	SID	Sid	C0	900							388,115		388,115
SID-Sid-RS-Ex-4	SID	Sid	C0	330							124,661		124,661
SID-Sid-RS-Ex-5	SID	Sid	A	1,100							81,820		81,820
SID-Sid-RS-Ex-6	SID	Sid	C0	800							212,920		212,920
SID-Sid-SP-Ex-1	SID	Sid	C0	330	57,500	57,500	37,346						152,346
KEB-Keb-RS-Rh-1	KEB	Keb	B1	4,000								1,681,944	1,681,944
KEB-Keb-RS-Ex-1	KEB	Keb	C1	1,000							285,545		285,545
KEB-Keb-SP-Rh-1	KEB	Keb	A	4,000				64,654	107,757	124,200			296,611
KEB-Keb-SP-Rh-2	KEB	Keb	A	7,500				54,930	91,550				146,480
KEB-Keb-SP-Ex-1	KEB	Keb	C1	850	57,500	57,500	76,383						191,383
KEB-Ken-RS-Ex-1	KEB	Ken	C0	3,000							1,396,733		1,396,733
KEB-Ken-RS-Ex-2	KEB	Ken	C0	5,550							1,853,678		1,853,678
KEB-Ken-RS-Ex-3	KEB	Ken	C0	3,000							1,079,850		1,079,850

Table II.1.8 - Interventions costs (1/3)
Investment costs

Intervention code	Gover-norate	Town	Classifica-tion	Population 2029	Investment costs								
					Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention
					Civil works	Equipment	Rising main	Civil works	Equipment	Rising main			
				(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
KEB-Ken-RS-Ex-4	KEB	Ken	C0	2,530							878,384		878,384
KEB-Ken-SP-Ex-1	KEB	Ken	C0	3,000	57,500	57,500	159,390						274,390
KEB-Ken-SP-Ex-2	KEB	Ken	C0	5,550	52,127	78,191	105,628				230,978		466,924
KEB-Ken-SP-Ex-3	KEB	Ken	C0	600	57,500	57,500	33,638						148,638
KEB-Ken-SP-Ex-4	KEB	Ken	C0	2,530	57,500	57,500	542,685				58,650		716,335
KEB-Kes-RS-Ex-1	KEB	Kes	C0	3,650							1,939,144		1,939,144
KEB-Kes-RS-Ex-2	KEB	Kes	C0	1,350							801,168		801,168
KEB-Kes-SP-Ex-1	KEB	Kes	C0	5,000	49,395	74,092	116,380				39,330		279,197
KEB-Kes-SP-Ex-2	KEB	Kes	C0	1,350	57,500	57,500	77,786				421,245		614,031
KEB-Dou-RS-Rh-1	KEB	Dou	B0	25,000								793,908	793,908
KEB-Dou-RS-Ex-1	KEB	Dou	C1	2,000							952,591		952,591
KEB-Dou-SP-Ex-1	KEB	Dou	C1	500	57,500	57,500	15,094						130,094
KEB-Dos-RS-Ex-1	KEB	Dos	C0	3,000							1,693,319		1,693,319
KEB-Dos-SP-Ex-1	KEB	Dos	C1	3,000	57,500	57,500	406,238				15,640		536,878
KEB-Gol-RS-Ex-1	KEB	Gol	C0	750							387,109		387,109
KEB-Sou-RS-Ex-1	KEB	Sou	C0	15,000							6,140,023		6,140,023
KEB-Sou-SP-Ex-1	KEB	Sou	C0	1,915	57,500	57,500	73,686						188,686
KEB-Sou-SP-Ex-2	KEB	Sou	C0	7,500	55,362	83,042	60,289						198,693
KEB-Sou-SP-Ex-3	KEB	Sou	C0	6,100	49,738	74,606	66,318						190,662
KEB-Sou-SP-Ex-4	KEB	Sou	C0	620	57,500	57,500	26,795						141,795
KEB-Sou-SP-Ex-5	KEB	Sou	C0	2,600	57,500	57,500	106,510						221,510
KEB-Jem-RS-Ex-1	KEB	Jem	A	3,500							1,777,440		1,777,440
KEB-Jem-SP-Ex-1	KEB	Jem	A	4,000	35,951	53,926	1,420,595				57,960		1,568,432
TOTAL					2,786,893	3,456,839	9,958,465	1,166,563	3,156,279	3,475,072	108,085,749	90,832,624	222,918,483

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
BIZ-Biz-RS-Rh-1									656	65,321	65,978
BIZ-Biz-RS-Rh-2									9,200	5,059	14,259
BIZ-Biz-RS-Rh-3										14,648	14,648
BIZ-Biz-RS-Rh-4										13,688	13,688
BIZ-Biz-RS-Rh-6										11,170	11,170
BIZ-Biz-RS-Rh-7										29,894	29,894
BIZ-Biz-RS-Ex-1									29,153		29,153
BIZ-Zar-SP-Rh-1					2,797	13,984	1,395	15,752			33,928
BIZ-Zar-SP-Rh-2					3,812	19,059	4,185	19,123			46,179
BIZ-Zar-SP-Rh-3					2,811	14,055	4,185	7,609		7,116	35,776
BIZ-Biz-SP-Ex-1	863	2,875	2,329	993							7,060
BIZ-Zar-RS-Rh-1										41,223	41,223
BIZ-Tin-RS-Rh-1										18,768	18,768
BIZ-Tin-RS-Rh-2										4,106	4,106
BIZ-Tin-RS-Ex-1									10,902		10,902
BIZ-Tin-RS-Ex-2									8,651		8,651
BIZ-Tin-RS-Ex-3									6,624		6,624
BIZ-Tin-SP-Rh-1					1,385	6,927	3,471	4,222			16,005
BIZ-Tin-SP-Ex-1	492	2,458	388	422							3,760
BIZ-Tin-SP-Ex-2	1,094	5,471	1,268	2,815							10,648
BIZ-Men-RS-Rh-1										118,801	118,801
BIZ-Men-RS-Rh-2										23,482	23,482
BIZ-Men-RS-Ex-1									6,176		6,176
BIZ-Men-RS-Ex-2									4,088		4,088
BIZ-Men-SP-Ex-1	462	2,308	2,329	298							5,396
BIZ-Raf-RS-Rh-1										34,034	34,034
BIZ-Raf-SP-Ex-1	1,196	5,978	466	1,987							9,626
BIZ-Raf-SP-Ex-2	1,059	5,295	647	1,589							8,590
BIZ-Jam-RS-Rh-1										15,370	15,370
BIZ-Jam-RS-Rh-2										6,930	6,930
BIZ-Jam-SP-Rh-1					2,414	12,069	14,783	29,960			59,226
BIZ-Jam-SP-Rh-2	1,217	6,085	4,297	3,891							15,490
BIZ-Abd-RS-Rh-1										20,504	20,504
BIZ-Abd-SP-Rh-1					2,563	12,813	5,475	38,209			59,059
BIZ-Ali-RS-Rh-1										11,269	11,269
BIZ-Mat-SP-Rh-1					1,917	9,587	10,065	15,099	2,312	1,432	40,412
BIZ-Mat-SP-Rh-2					1,457	7,285	1,601	2,036			12,380
ZAG-Fah-RS-Rh-1										10,212	10,212
ZAG-Fah-RS-Rh-2										27,583	27,583
ZAG-Fah-RS-Rh-3										29,265	29,265
ZAG-Fah-RS-Rh-4										17,552	17,552
ZAG-Fah-RS-Rh-5										12,782	12,782
ZAG-Fah-RS-Rh-6										14,464	14,464
ZAG-Fah-RS-Rh-7									2,070	3,528	5,598
ZAG-Fah-RS-Rh-8									966	3,148	4,114
ZAG-Zag-RS-Rh-1										12,420	12,420
ZAG-Zag-RS-Rh-2										15,180	15,180
ZAG-Zag-RS-Rh-3										10,005	10,005
ZAG-Zag-RS-Rh-4										6,072	6,072
ZAG-Zag-RS-Rh-5										33,810	33,810
ZAG-Zag-RS-Rh-6										34,776	34,776
ZAG-Zag-RS-Rh-7										10,419	10,419
ZAG-Zag-RS-Ex-1									8,427		8,427
ZAG-Zag-RS-Ex-2									7,521		7,521
ZAG-Zag-RS-Ex-3									469		469
ZAG-Zag-RS-Ex-4									1,559		1,559
ZAG-Zag-SP-Ex-1	462	2,308	1,518	161							4,448
ZAG-Zag-SP-Ex-2	690	2,300	304	9							3,303
ZAG-Zag-SP-Ex-3	863	2,875	304	54							4,095

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
ZAG-Ham-RS-Rh-1										26,574	26,574
ZAG-Ham-RS-Rh-2										6,132	6,132
ZAG-Ham-RS-Rh-3										15,672	15,672
ZAG-Ham-RS-Rh-4										7,154	7,154
ZAG-Ham-RS-Rh-5										14,309	14,309
ZAG-Ham-RS-Rh-6										14,990	14,990
ZAG-Ham-RS-Rh-7										11,924	11,924
ZAG-Ham-RS-Rh-8										4,770	4,770
ZAG-Ham-RS-Rh-9										18,216	18,216
ZAG-Ham-RS-Rh-10										27,760	27,760
ZAG-Ham-RS-Ex-1									758		758
ZAG-Ham-SP-Ex-1	1,479	22,397	10,614	5,365							39,855
BEJ-Bej-RS-Ex-1									294		294
BEJ-Bej-RS-Ex-2									4,815		4,815
BEJ-Bej-RS-Rh-1										30,876	30,876
BEJ-Bej-RS-Rh-2										44,451	44,451
BEJ-Bej-RS-Rh-3										9,674	9,674
BEJ-Bej-RS-Rh-4										2,118	2,118
BEJ-Bej-RS-Rh-5										11,817	11,817
BEJ-Maa-RS-Rh-1										233	233
BEJ-Maa-SP-Ex-1	863	2,875	22	17							3,776
BEJ-Med-RS-Rh-1										1,105	1,105
BEJ-Med-RS-Rh-2										2,076	2,076
BEJ-Med-RS-Rh-3										1,217	1,217
BEJ-Med-RS-Rh-4										3,322	3,322
BEJ-Med-RS-Rh-5										4,375	4,375
BEJ-Med-RS-Rh-6										1,577	1,577
BEJ-Med-RS-Rh-7										4,935	4,935
BEJ-Med-SP-Rh-1					750	2,500	342	1,192	2,358		7,142
BEJ-Nef-RS-Ex-1									1,112		1,112
BEJ-Nef-RS-Ex-10									1,195		1,195
BEJ-Nef-RS-Ex-2									1,305		1,305
BEJ-Nef-RS-Ex-3									1,162		1,162
BEJ-Nef-RS-Ex-4									2,790		2,790
BEJ-Nef-RS-Ex-5									5,598		5,598
BEJ-Nef-RS-Ex-6									1,039		1,039
BEJ-Nef-RS-Ex-7									1,413		1,413
BEJ-Nef-RS-Ex-8									2,178		2,178
BEJ-Nef-RS-Ex-9									864		864
BEJ-Nef-RS-Rh-1										500	500
BEJ-Nef-RS-Rh-2										203	203
BEJ-Nef-SP-Ex-1	690	2,300	8	14							3,012
BEJ-Nef-SP-Ex-2	690	2,300	602	5							3,597
BEJ-Teb-RS-Ex-1									2,917		2,917
BEJ-Teb-RS-Ex-2									1,593	13,859	15,452
BEJ-Teb-RS-Rh-1										23,792	23,792
BEJ-Teb-RS-Rh-2										60,236	60,236
BEJ-Teb-SP-Ex-3	690	2,300	2,167	51							5,208
BEJ-Tes-RS-Ex-1									3,578	2,715	6,293
BEJ-Tes-RS-Ex-2									331	7,234	7,564
BEJ-Tes-RS-Rh-1										16,018	16,018
BEJ-Tes-SP-Ex-1	690	2,300	105	4							3,099
SIL-Bou-RS-Rh-1										3,389	3,389
SIL-Bou-RS-Rh-2										5,303	5,303
SIL-Bou-RS-Rh-3										7,664	7,664
SIL-Bou-RS-Rh-4										8,046	8,046
SIL-Bou-SP-Ex-1	690	2,300	13	73							3,076
SIL-Sil-RS-Rh-1										3,974	3,974
SIL-Sil-RS-Rh-2										16,670	16,670

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
SIL-Sil-RS-Rh-3										3,502	3,502
SIL-Sil-RS-Rh-4										4,333	4,333
SIL-Kri-RS-Ex-1									13,985	50,460	64,444
JEN-Fer-RS-Rh-1									11,378	7,709	19,088
JEN-Fer-RS-Ex-1									9,881		9,881
JEN-Fer-SP-Ex-1	863	2,875	2,485	54							6,276
JEN-Gha-RS-Rh-1										24,130	24,130
JEN-Gha-RS-Ex-1									10,360		10,360
JEN-Gha-RS-Ex-2									7,409		7,409
JEN-Gha-SP-Ex-1	863	2,875	1,701	49							5,488
JEN-Jen-RS-Rh-1										21,748	21,748
JEN-Jen-RS-Ex-1									13,152		13,152
JEN-Jen-RS-Rh-2										32,396	32,396
JEN-Jen-RS-Rh-3										44,876	44,876
JEN-Jen-SP-Rh-1					1,259	6,293	1,739	1,821	9,306		20,418
JEN-Jen-SP-Rh-2					583	2,917	526	911		1,449	6,386
JEN-Jen-SP-Rh-3					2,270	11,349	55	5,464		50,262	69,400
JEN-Jen-SP-Rh-4					750	2,500	233	18			3,501
JEN-Jen-SP-Ex-1	863	2,875	1,246	98							5,082
JEN-Tab-RS-Rh-1										15,353	15,353
JEN-Tab-RS-Ex-1									19,743		19,743
JEN-Tab-RS-Ex-2									18,214		18,214
JEN-Tab-RS-Ex-3									19,647		19,647
JEN-Tab-SP-Rh-1					750	2,500	2,902	219			6,370
JEN-Tab-SP-Ex-1	863	2,875	3,005	360							7,103
JEN-Tab-SP-Ex-2	863	2,875	5,037	360					13,862		22,997
JEN-Bss-RS-Ex-1									12,055		12,055
JEN-Bss-SP-Ex-1	863	2,875	3,376	54							7,167
KEF-Dah-RS-Rh-3										31,735	31,735
KEF-Dah-RS-Ex-1									1,293		1,293
KEF-Dah-SP-Rh-1					750	2,500	612	258			4,120
KEF-Kef-RS-Rh-1										15,767	15,767
KEF-Kef-RS-Rh-2										2,919	2,919
KEF-Kef-RS-Rh-3									5,120	1,677	6,797
KEF-Kef-RS-Rh-4										4,285	4,285
KEF-Kef-RS-Rh-5										2,146	2,146
KEF-Kef-RS-Rh-6										9,750	9,750
KEF-Kef-RS-Rh-7										5,030	5,030
KEF-Kef-RS-Ex-1									12,979		12,979
KEF-Kef-SP-Rh-1					750	2,500	2,385	240			5,875
KEF-Kef-SP-Rh-2					801	4,004	1,275	803			6,882
KEF-Kef-SP-Ex-1	863	2,875	942	159							4,838
KEF-Taj-RS-Rh-1										18,216	18,216
KEF-Taj-RS-Rh-2										9,165	9,165
KEF-Taj-RS-Rh-3										23,965	23,965
KEF-Taj-RS-Ex-1									1,121		1,121
KEF-Taj-RS-Ex-2									1,480		1,480
KEF-Taj-RS-Ex-3									3,678		3,678
KEF-Taj-SP-Rh-1					750	2,500	2,415	77			5,742
KEF-Taj-SP-Ex-1	863	2,875	1,573	44							5,354
SFA-Chi-RS-Ex-1									41,633		41,633
SFA-Chi-RS-Ex-2									17,377		17,377
SFA-Chi-RS-Ex-3									18,324		18,324
SFA-Chi-RS-Rh-1										24,716	24,716
SFA-Sae-RS-Ex-1									10,934		10,934
SFA-Sae-RS-Ex-2									15,798		15,798
SFA-Sae-RS-Ex-3									73,438		73,438
SFA-Sae-RS-Rh-1							608			21,164	21,772
SFA-Sak-RS-Ex-1									179,573		179,573

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
SFA-Sak-RS-Ex-2									245,111		245,111
SFA-Sak-RS-Ex-3									89,880		89,880
SFA-Sak-RS-Rh-1										66,607	66,607
SFA-Ain-RS-Ex-1									21,531		21,531
SFA-Ain-RS-Ex-2									40,283		40,283
SFA-Ain-RS-Ex-3									63,268		63,268
SFA-Ain-RS-Ex-4									71,074		71,074
SFA-Gre-RS-Ex-1									49,354		49,354
SFA-Gre-RS-Ex-2									88,679		88,679
SFA-Gre-RS-Ex-3									91,545		91,545
SFA-Gre-RS-Ex-4									89,239		89,239
SFA-Gre-RS-Ex-5									58,290		58,290
SFA-Sfs-RS-Ex-1									34,017		34,017
SFA-Sfs-RS-Ex-2									19,858		19,858
SFA-Sfs-RS-Ex-3									979	12,643	13,622
SFA-Sfs-RS-Rh-1									22,114	2,944	25,058
SFA-Sfs-RS-Rh-2									29,041	5,410	34,451
SFA-Sfs-RS-Rh-3										76,847	76,847
SFA-Sfs-RS-Rh-4										11,154	11,154
SFA-Sfs-RS-Rh-5									5,778	21,137	26,915
SFA-Sfs-SP-Ex-1	863	2,875	235	172							4,144
SFA-Sfv-RS-Ex-1									17,106		17,106
SFA-Sfv-RS-Ex-2									9,676		9,676
SFA-Sfv-RS-Ex-3									36,620		36,620
SFA-Sfv-RS-Ex-4									17,500		17,500
SFA-Sfv-RS-Ex-5									208,736		208,736
SFA-Sfv-RS-Ex-6									22,631		22,631
SFA-Sfv-RS-Ex-7									5,212		5,212
SFA-Sfv-RS-Rh-1			138,759				24,078		29,993		192,829
SFA-Sfv-RS-Rh-2										23,043	23,043
SFA-Sfv-RS-Rh-3										8,261	8,261
SFA-Sfv-RS-Rh-4										25,576	25,576
SFA-Sfv-RS-Rh-5										90,520	90,520
SFA-Sfv-RS-Rh-6										24,639	24,639
SFA-Sfv-SP-Ex-1	690	2,300	1,632	36							4,658
SFA-Sfv-SP-Rh-1					1,597	7,983	7	861			10,448
SFA-Sfv-SP-Rh-2					1,121	5,605	900	1,205			8,831
SFA-Tyn-RS-Ex-1									7,427		7,427
SFA-Tyn-RS-Ex-2									82,465		82,465
SFA-Tyn-SP-Ex-1	863	2,875	821	28							4,587
SFA-Aga-RS-Ex-1									28,403		28,403
SFA-Aga-RS-Ex-2									9,406		9,406
SFA-Aga-SP-Ex-1	863	2,875	183	84							4,005
SFA-Hen-RS-Ex-1									36,268		36,268
SFA-Hen-RS-Ex-2									21,899		21,899
SFA-Jeb-RS-Ex-1									23,010		23,010
SFA-Jeb-RS-Ex-2									30,569		30,569
SFA-Mah-RS-Ex-1									36,518	11,657	48,175
SFA-Mah-RS-Ex-2									54,727		54,727
SFA-Mah-SP-Ex-1	863	2,875	1,741	72							5,550
SFA-Mah-RS-Rh-1										3,159	3,159
SFA-Mah-SP-Rh-1					750	2,500	1,007	715			4,973
KAS-Kas-RS-Rh-1										53,699	53,699
KAS-Kas-RS-Rh-2										6,279	6,279
KAS-Kas-RS-Rh-3										10,579	10,579
KAS-Kas-RS-Rh-4										13,093	13,093
KAS-Kas-RS-Rh-5										4,703	4,703
KAS-Kas-RS-Rh-7										7,242	7,242
KAS-Kas-RS-Rh-8										17,664	17,664

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
KAS-Kas-RS-Rh-9										22,941	22,941
KAS-Kas-RS-Rh-10										15,859	15,859
KAS-Kas-RS-Rh-11										25,141	25,141
KAS-Kas-RS-Ex-1									10,656		10,656
KAS-Kas-RS-Ex-3									16,040		16,040
KAS-Kas-RS-Ex-4									8,817		8,817
KAS-Kas-RS-Ex-5									9,227		9,227
KAS-Kas-RS-Ex-6									7,950		7,950
KAS-Sbe-RS-Rh-1										2,199	2,199
KAS-Sbe-RS-Rh-2										6,272	6,272
KAS-Sbe-RS-Rh-3										13,386	13,386
KAS-Sbe-RS-Rh-4										3,450	3,450
KAS-Sbe-RS-Ex-1									1,087		1,087
KAS-Sbe-RS-Ex-2									8,370		8,370
KAS-Tel-RS-Ex-1									75,417		75,417
KAS-Tel-SP-Ex-1	863	2,875	2,194	23							5,955
KAS-Tel-SP-Ex-2	863	2,875	1,247	23							5,008
KAS-Fei-RS-Ex-1									92,363		92,363
KAS-Fei-SP-Ex-1	863	2,875	3,698	50							7,486
KAS-Fei-SP-Ex-2	863	2,875	1,758	62							5,557
SID-Sid-RS-Rh-1										19,813	19,813
SID-Sid-RS-Rh-2					750	2,500	634	249		9,289	13,421
SID-Sid-RS-Rh-3										2,724	2,724
SID-Sid-RS-Rh-4										4,969	4,969
SID-Sid-RS-Rh-5										23,906	23,906
SID-Sid-RS-Rh-7					750	2,500	2,363	64		9,459	15,136
SID-Sid-RS-Rh-8										3,529	3,529
SID-Sid-RS-Rh-9										2,815	2,815
SID-Sid-RS-Rh-10										649	649
SID-Sid-RS-Ex-1									6,150		6,150
SID-Sid-RS-Ex-2									7,986		7,986
SID-Sid-RS-Ex-3									11,643		11,643
SID-Sid-RS-Ex-4									3,740		3,740
SID-Sid-RS-Ex-5									2,455		2,455
SID-Sid-RS-Ex-6									6,388		6,388
SID-Sid-SP-Ex-1	863	2,875	1,120	21							4,879
KEB-Keb-RS-Rh-1										42,049	42,049
KEB-Keb-RS-Ex-1									8,566		8,566
KEB-Keb-SP-Rh-1					937	4,685	2,700	689			9,011
KEB-Keb-SP-Rh-2					796	3,980	6,336	807			11,920
KEB-Keb-SP-Ex-1	863	2,875	2,291	110							6,139
KEB-Ken-RS-Ex-1									41,902		41,902
KEB-Ken-RS-Ex-2									55,610		55,610
KEB-Ken-RS-Ex-3									32,396		32,396
KEB-Ken-RS-Ex-4									26,352		26,352
KEB-Ken-SP-Ex-1	863	2,875	4,782	452							8,971
KEB-Ken-SP-Ex-2	782	3,910	3,169	597					6,929		15,387
KEB-Ken-SP-Ex-3	863	2,875	1,009	32							4,779
KEB-Ken-SP-Ex-4	863	2,875	16,281	1,497					1,760		23,275
KEB-Kes-RS-Ex-1									58,174		58,174
KEB-Kes-RS-Ex-2									24,035		24,035
KEB-Kes-SP-Ex-1	741	3,705	3,491	915					1,180		10,032
KEB-Kes-SP-Ex-2	863	2,875	2,334	189					12,637		18,897
KEB-Dou-RS-Rh-1										19,848	19,848
KEB-Dou-RS-Ex-1									28,578		28,578
KEB-Dou-SP-Ex-1	863	2,875	453	12							4,202
KEB-Dos-RS-Ex-1									50,800		50,800
KEB-Dos-SP-Ex-1	863	2,875	12,187	715					469		17,109
KEB-Gol-RS-Ex-1									11,613		11,613

Table II.1.8 - Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
KEB-Sou-RS-Ex-1									184,201		184,201
KEB-Sou-SP-Ex-1	863	2,875	2,211	428							6,376
KEB-Sou-SP-Ex-2	830	4,152	1,809	570							7,361
KEB-Sou-SP-Ex-3	746	3,730	1,990	764							7,229
KEB-Sou-SP-Ex-4	863	2,875	804	29							4,571
KEB-Sou-SP-Ex-5	863	2,875	3,195	442							7,374
KEB-Jem-RS-Ex-1									53,323		53,323
KEB-Jem-SP-Ex-1	539	2,696	42,618	1,785					1,739		49,377
TOTAL	41,803	172,842	298,754	28,034	35,269	165,097	96,274	147,603	3,242,572	2,270,816	6,499,065

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
BIZ-Biz-RS-Rh-1	2,634,736	2,634,736	0	9,440	0	0	90	9,350
BIZ-Biz-RS-Rh-2	509,019	509,019	0	2,440	0	0	1,590	850
BIZ-Biz-RS-Rh-3	585,914	585,914	0	1,650	0	0	0	1,650
BIZ-Biz-RS-Rh-4	547,515	547,515	0	2,300	0	0	0	2,300
BIZ-Biz-RS-Rh-6	446,810	446,810	0	1,990	0	0	0	1,990
BIZ-Biz-RS-Rh-7	1,195,770	1,195,770	0	5,800	0	0	0	5,800
BIZ-Biz-RS-Ex-1	971,750	971,750	0	5,200	0	0	5,200	0
BIZ-Zar-SP-Rh-1	375,238	53,605	321,633	0	0	0	0	0
BIZ-Zar-SP-Rh-2	401,838	73,061	328,776	0	0	0	0	0
BIZ-Zar-SP-Rh-3	580,954	338,503	242,451	660	0	0	0	660
BIZ-Biz-SP-Ex-1	192,625	135,125	57,500	600	600	0	0	0
BIZ-Zar-RS-Rh-1	1,648,928	1,648,928	0	7,230	0	0	0	7,230
BIZ-Tin-RS-Rh-1	750,720	750,720	0	3,400	0	0	0	3,400
BIZ-Tin-RS-Rh-2	164,220	164,220	0	700	0	0	0	700
BIZ-Tin-RS-Ex-1	363,400	363,400	0	2,150	0	0	2,150	0
BIZ-Tin-RS-Ex-2	288,363	288,363	0	1,900	0	0	1,900	0
BIZ-Tin-RS-Ex-3	220,800	220,800	0	1,300	0	0	1,300	0
BIZ-Tin-SP-Rh-1	372,091	212,772	159,319	890	0	890	0	0
BIZ-Tin-SP-Ex-1	94,874	45,712	49,162	100	100	0	0	0
BIZ-Tin-SP-Ex-2	224,632	115,210	109,422	300	300	0	0	0
BIZ-Men-RS-Rh-1	4,752,030	4,752,030	0	18,800	0	0	0	18,800
BIZ-Men-RS-Rh-2	939,263	939,263	0	2,750	0	0	0	2,750
BIZ-Men-RS-Ex-1	205,850	205,850	0	1,200	0	0	1,200	0
BIZ-Men-RS-Ex-2	136,275	136,275	0	900	0	0	900	0
BIZ-Men-SP-Ex-1	154,555	108,397	46,158	600	600	0	0	0
BIZ-Raf-RS-Rh-1	1,361,370	1,361,370	0	6,500	0	0	0	6,500
BIZ-Raf-SP-Ex-1	214,780	95,227	119,553	100	100	0	0	0
BIZ-Raf-SP-Ex-2	198,050	92,157	105,892	150	150	0	0	0
BIZ-Jam-RS-Rh-1	614,790	614,790	0	2,200	0	0	0	2,200
BIZ-Jam-RS-Rh-2	277,208	277,208	0	990	0	0	0	990
BIZ-Jam-SP-Rh-1	1,050,112	772,524	277,588	2,700	0	2,700	0	0
BIZ-Jam-SP-Rh-2	346,063	224,365	121,698	940	940	0	0	0
BIZ-Abd-RS-Rh-1	820,169	820,169	0	3,410	0	0	0	3,410
BIZ-Abd-SP-Rh-1	644,782	350,083	294,699	1,000	0	1,000	0	0
BIZ-Ali-RS-Rh-1	450,743	450,743	0	1,950	0	0	0	1,950
BIZ-Mat-SP-Rh-1	854,570	634,061	220,508	2,800	0	2,200	400	200
BIZ-Mat-SP-Rh-2	69,819	27,928	41,892	0	0	0	0	0
ZAG-Fah-RS-Rh-1	408,480	408,480	0	1,600	0	0	0	1,600
ZAG-Fah-RS-Rh-2	1,103,310	1,103,310	0	4,100	0	0	0	4,100
ZAG-Fah-RS-Rh-3	1,170,585	1,170,585	0	4,350	0	0	0	4,350
ZAG-Fah-RS-Rh-4	702,075	702,075	0	2,750	0	0	0	2,750
ZAG-Fah-RS-Rh-5	511,290	511,290	0	1,900	0	0	0	1,900
ZAG-Fah-RS-Rh-6	578,565	578,565	0	2,150	0	0	0	2,150
ZAG-Fah-RS-Rh-7	210,105	210,105	0	950	0	0	400	550
ZAG-Fah-RS-Rh-8	158,125	158,125	0	650	0	0	200	450
ZAG-Zag-RS-Rh-1	496,800	496,800	0	2,250	0	0	0	2,250
ZAG-Zag-RS-Rh-2	607,200	607,200	0	2,750	0	0	0	2,750
ZAG-Zag-RS-Rh-3	400,200	400,200	0	1,450	0	0	0	1,450
ZAG-Zag-RS-Rh-4	242,880	242,880	0	1,100	0	0	0	1,100
ZAG-Zag-RS-Rh-5	1,352,400	1,352,400	0	4,900	0	0	0	4,900
ZAG-Zag-RS-Rh-6	1,391,040	1,391,040	0	6,300	0	0	0	6,300
ZAG-Zag-RS-Rh-7	416,760	416,760	0	2,600	0	0	0	2,600
ZAG-Zag-RS-Ex-1	280,888	280,888	0	1,525	0	0	1,525	0

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
ZAG-Zag-RS-Ex-2	250,700	250,700	0	1,550	0	0	1,550	0
ZAG-Zag-RS-Ex-3	15,640	15,640	0	80	0	0	80	0
ZAG-Zag-RS-Ex-4	51,980	51,980	0	310	0	0	310	0
ZAG-Zag-SP-Ex-1	127,530	81,372	46,158	400	400	0	0	0
ZAG-Zag-SP-Ex-2	102,120	56,120	46,000	80	80	0	0	0
ZAG-Zag-SP-Ex-3	125,120	67,620	57,500	80	80	0	0	0
ZAG-Ham-RS-Rh-1	1,062,945	1,062,945	0	3,900	0	0	0	3,900
ZAG-Ham-RS-Rh-2	245,295	245,295	0	900	0	0	0	900
ZAG-Ham-RS-Rh-3	626,865	626,865	0	2,300	0	0	0	2,300
ZAG-Ham-RS-Rh-4	286,178	286,178	0	1,050	0	0	0	1,050
ZAG-Ham-RS-Rh-5	572,355	572,355	0	2,100	0	0	0	2,100
ZAG-Ham-RS-Rh-6	599,610	599,610	0	2,200	0	0	0	2,200
ZAG-Ham-RS-Rh-7	476,963	476,963	0	1,750	0	0	0	1,750
ZAG-Ham-RS-Rh-8	190,785	190,785	0	700	0	0	0	700
ZAG-Ham-RS-Rh-9	728,640	728,640	0	3,200	0	0	0	3,200
ZAG-Ham-RS-Rh-10	1,110,383	1,110,383	0	4,150	0	0	0	4,150
ZAG-Ham-RS-Ex-1	25,271	25,271	0	150	0	0	150	0
ZAG-Ham-SP-Ex-1	900,360	452,423	447,938	2,100	2,100	0	0	0
BEJ-Bej-RS-Ex-1	9,792	9,792	0	43	0	0	43	0
BEJ-Bej-RS-Ex-2	160,511	160,511	0	975	0	0	975	0
BEJ-Bej-RS-Rh-1	1,235,045	1,235,045	0	4,972	0	0	0	4,972
BEJ-Bej-RS-Rh-2	1,778,047	1,778,047	0	7,158	0	0	0	7,158
BEJ-Bej-RS-Rh-3	386,966	386,966	0	1,405	0	0	0	1,405
BEJ-Bej-RS-Rh-4	84,704	84,704	0	341	0	0	0	341
BEJ-Bej-RS-Rh-5	472,678	472,678	0	2,114	0	0	0	2,114
BEJ-Maa-RS-Rh-1	9,315	9,315	0	22	0	0	0	22
BEJ-Maa-SP-Ex-1	115,736	58,236	57,500	8	8	0	0	0
BEJ-Med-RS-Rh-1	44,201	44,201	0	31	0	0	0	31
BEJ-Med-RS-Rh-2	83,048	83,048	0	354	0	0	0	354
BEJ-Med-RS-Rh-3	48,686	48,686	0	196	0	0	0	196
BEJ-Med-RS-Rh-4	132,885	132,885	0	552	0	0	0	552
BEJ-Med-RS-Rh-5	175,013	175,013	0	727	0	0	0	727
BEJ-Med-RS-Rh-6	63,072	63,072	0	262	0	0	0	262
BEJ-Med-RS-Rh-7	197,401	197,401	0	820	0	0	0	820
BEJ-Med-SP-Rh-1	128,840	100,090	28,750	771	0	120	651	0
BEJ-Nef-RS-Ex-1	37,065	37,065	0	247	0	0	247	0
BEJ-Nef-RS-Ex-10	39,848	39,848	0	265	0	0	265	0
BEJ-Nef-RS-Ex-2	43,516	43,516	0	376	0	0	376	0
BEJ-Nef-RS-Ex-3	38,732	38,732	0	352	0	0	352	0
BEJ-Nef-RS-Ex-4	93,006	93,006	0	583	0	0	583	0
BEJ-Nef-RS-Ex-5	186,588	186,588	0	1,010	0	0	1,010	0
BEJ-Nef-RS-Ex-6	34,644	34,644	0	225	0	0	225	0
BEJ-Nef-RS-Ex-7	47,093	47,093	0	375	0	0	375	0
BEJ-Nef-RS-Ex-8	72,594	72,594	0	377	0	0	377	0
BEJ-Nef-RS-Ex-9	28,808	28,808	0	265	0	0	265	0
BEJ-Nef-RS-Rh-1	20,010	20,010	0	84	0	0	0	84
BEJ-Nef-RS-Rh-2	8,108	8,108	0	15	0	0	0	15
BEJ-Nef-SP-Ex-1	92,276	46,276	46,000	3	3	0	0	0
BEJ-Nef-SP-Ex-2	112,056	66,056	46,000	218	218	0	0	0
BEJ-Teb-RS-Ex-1	97,244	97,244	0	538	0	0	538	0
BEJ-Teb-RS-Ex-2	607,453	607,453	0	2,296	0	0	236	2,060
BEJ-Teb-RS-Rh-1	951,683	951,683	0	3,675	0	0	0	3,675
BEJ-Teb-RS-Rh-2	2,409,425	2,409,425	0	8,952	0	0	0	8,952

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
BEJ-Teb-SP-Ex-3	164,232	118,232	46,000	571	571	0	0	0
BEJ-Tes-RS-Ex-1	227,861	227,861	0	1,104	0	0	628	476
BEJ-Tes-RS-Ex-2	300,375	300,375	0	1,366	0	0	62	1,304
BEJ-Tes-RS-Rh-1	640,734	640,734	0	2,812	0	0	0	2,812
BEJ-Tes-SP-Ex-1	95,496	49,496	46,000	38	38	0	0	0
SIL-Bou-RS-Rh-1	135,567	135,567	0	853	0	0	0	853
SIL-Bou-RS-Rh-2	212,115	212,115	0	1,048	0	0	0	1,048
SIL-Bou-RS-Rh-3	306,576	306,576	0	1,929	0	0	0	1,929
SIL-Bou-RS-Rh-4	321,833	321,833	0	2,025	0	0	0	2,025
SIL-Bou-SP-Ex-1	92,431	46,431	46,000	5	5	0	0	0
SIL-Sil-RS-Rh-1	158,976	158,976	0	720	0	0	0	720
SIL-Sil-RS-Rh-2	666,816	666,816	0	3,020	0	0	0	3,020
SIL-Sil-RS-Rh-3	140,093	140,093	0	634	0	0	0	634
SIL-Sil-RS-Rh-4	173,328	173,328	0	785	0	0	0	785
SIL-Kri-RS-Ex-1	2,484,544	2,484,544	0	12,171	0	0	3,198	8,973
JEN-Fer-RS-Rh-1	687,651	687,651	0	3,159	0	0	1,883	1,276
JEN-Fer-RS-Ex-1	329,376	329,376	0	2,351	0	0	2,351	0
JEN-Fer-SP-Ex-1	197,827	140,327	57,500	785	785	0	0	0
JEN-Gha-RS-Rh-1	965,200	965,200	0	4,064	0	0	0	4,064
JEN-Gha-RS-Ex-1	345,346	345,346	0	2,533	0	0	2,533	0
JEN-Gha-RS-Ex-2	246,977	246,977	0	1,518	0	0	1,518	0
JEN-Gha-SP-Ex-1	171,695	114,195	57,500	580	580	0	0	0
JEN-Jen-RS-Rh-1	869,928	869,928	0	3,821	0	0	0	3,821
JEN-Jen-RS-Ex-1	438,409	438,409	0	2,990	0	0	2,990	0
JEN-Jen-RS-Rh-2	1,295,820	1,295,820	0	5,310	0	0	0	5,310
JEN-Jen-RS-Rh-3	1,795,049	1,795,049	0	8,752	0	0	0	8,752
JEN-Jen-SP-Rh-1	612,119	467,379	144,741	2,040	0	380	1,660	0
JEN-Jen-SP-Rh-2	185,021	117,923	67,098	460	0	143	0	317
JEN-Jen-SP-Rh-3	2,448,057	2,187,027	261,031	2,600	0	10	0	2,590
JEN-Jen-SP-Rh-4	68,195	39,445	28,750	100	0	100	0	0
JEN-Jen-SP-Ex-1	156,532	99,032	57,500	466	466	0	0	0
JEN-Tab-RS-Rh-1	614,100	614,100	0	2,586	0	0	0	2,586
JEN-Tab-RS-Ex-1	658,105	658,105	0	4,833	0	0	4,833	0
JEN-Tab-RS-Ex-2	607,143	607,143	0	4,750	0	0	4,750	0
JEN-Tab-RS-Ex-3	654,896	654,896	0	4,555	0	0	4,555	0
JEN-Tab-SP-Rh-1	162,224	133,474	28,750	744	0	744	0	0
JEN-Tab-SP-Ex-1	215,165	157,665	57,500	670	670	0	0	0
JEN-Tab-SP-Ex-2	744,959	687,459	57,500	3,993	1,123	0	2,870	0
JEN-Bss-RS-Ex-1	401,847	401,847	0	3,003	0	0	3,003	0
JEN-Bss-SP-Ex-1	227,528	170,028	57,500	1,030	1,030	0	0	0
KEF-Dah-RS-Rh-3	1,269,407	1,269,407	0	5,294	0	0	0	5,294
KEF-Dah-RS-Ex-1	43,108	43,108	0	230	0	0	230	0
KEF-Dah-SP-Rh-1	14,375	0	14,375	0	0	0	0	0
KEF-Kef-RS-Rh-1	630,660	630,660	0	1,960	0	0	0	1,960
KEF-Kef-RS-Rh-2	116,748	116,748	0	470	0	0	0	470
KEF-Kef-RS-Rh-3	237,728	237,728	0	1,390	0	0	1,060	330
KEF-Kef-RS-Rh-4	171,396	171,396	0	690	0	0	0	690
KEF-Kef-RS-Rh-5	85,836	85,836	0	430	0	0	0	430
KEF-Kef-RS-Rh-6	389,988	389,988	0	1,570	0	0	0	1,570
KEF-Kef-RS-Rh-7	201,204	201,204	0	810	0	0	0	810
KEF-Kef-RS-Ex-1	432,630	432,630	0	2,290	0	0	2,290	0
KEF-Kef-SP-Rh-1	195,960	138,460	57,500	530	0	530	0	0
KEF-Kef-SP-Rh-2	181,427	89,344	92,082	250	0	250	0	0

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
KEF-Kef-SP-Ex-1	146,395	88,895	57,500	210	210	0	0	0
KEF-Taj-RS-Rh-1	728,640	728,640	0	3,200	0	0	0	3,200
KEF-Taj-RS-Rh-2	366,597	366,597	0	1,610	0	0	0	1,610
KEF-Taj-RS-Rh-3	958,617	958,617	0	4,210	0	0	0	4,210
KEF-Taj-RS-Ex-1	37,375	37,375	0	250	0	0	250	0
KEF-Taj-RS-Ex-2	49,335	49,335	0	330	0	0	330	0
KEF-Taj-RS-Ex-3	122,590	122,590	0	820	0	0	820	0
KEF-Taj-SP-Rh-1	5,750	5,750	0	0	0	0	0	0
KEF-Taj-SP-Ex-1	167,440	109,940	57,500	570	570	0	0	0
SFA-Chi-RS-Ex-1	1,387,780	1,387,780	0	10,330	0	0	10,330	0
SFA-Chi-RS-Ex-2	579,244	579,244	0	4,180	0	0	4,180	0
SFA-Chi-RS-Ex-3	610,788	610,788	0	4,640	0	0	4,640	0
SFA-Chi-RS-Rh-1	988,625	988,625	0	4,003	0	0	0	4,003
SFA-Sae-RS-Ex-1	364,452	364,452	0	2,630	0	0	2,630	0
SFA-Sae-RS-Ex-2	526,585	526,585	0	3,800	0	0	3,800	0
SFA-Sae-RS-Ex-3	2,447,927	2,447,927	0	17,665	0	0	17,665	0
SFA-Sae-RS-Rh-1	874,506	874,506	0	3,480	0	150	0	3,330
SFA-Sak-RS-Ex-1	5,985,756	5,985,756	0	43,210	0	0	43,210	0
SFA-Sak-RS-Ex-2	8,170,365	8,170,365	0	57,930	0	0	57,930	0
SFA-Sak-RS-Ex-3	2,995,992	2,995,992	0	21,620	0	0	21,620	0
SFA-Sak-RS-Rh-1	2,664,276	2,664,276	0	6,607	0	0	0	6,607
SFA-Ain-RS-Ex-1	717,686	717,686	0	5,210	0	0	5,210	0
SFA-Ain-RS-Ex-2	1,342,769	1,342,769	0	9,150	0	0	9,150	0
SFA-Ain-RS-Ex-3	2,108,928	2,108,928	0	14,380	0	0	14,380	0
SFA-Ain-RS-Ex-4	2,369,144	2,369,144	0	16,150	0	0	16,150	0
SFA-Gre-RS-Ex-1	1,645,133	1,645,133	0	11,220	0	0	11,220	0
SFA-Gre-RS-Ex-2	2,955,960	2,955,960	0	20,160	0	0	20,160	0
SFA-Gre-RS-Ex-3	3,051,496	3,051,496	0	20,810	0	0	20,810	0
SFA-Gre-RS-Ex-4	2,974,636	2,974,636	0	20,832	0	0	20,832	0
SFA-Gre-RS-Ex-5	1,943,011	1,943,011	0	13,250	0	0	13,250	0
SFA-Sfs-RS-Ex-1	1,133,900	1,133,900	0	7,550	0	0	7,550	0
SFA-Sfs-RS-Ex-2	661,940	661,940	0	4,110	0	0	4,110	0
SFA-Sfs-RS-Ex-3	538,367	538,367	0	3,220	0	0	230	2,990
SFA-Sfs-RS-Rh-1	854,880	854,880	0	4,545	0	0	4,005	540
SFA-Sfs-RS-Rh-2	1,184,436	1,184,436	0	6,310	0	0	5,320	990
SFA-Sfs-RS-Rh-3	3,073,881	3,073,881	0	17,775	0	0	0	17,775
SFA-Sfs-RS-Rh-4	446,168	446,168	0	2,045	0	0	0	2,045
SFA-Sfs-RS-Rh-5	1,038,073	1,038,073	0	4,930	0	0	1,060	3,870
SFA-Sfs-SP-Ex-1	122,818	65,318	57,500	66	66	0	0	0
SFA-Sfv-RS-Ex-1	570,193	570,193	0	3,490	0	0	3,490	0
SFA-Sfv-RS-Ex-2	322,529	322,529	0	1,970	0	0	1,970	0
SFA-Sfv-RS-Ex-3	1,220,679	1,220,679	0	7,470	0	0	7,470	0
SFA-Sfv-RS-Ex-4	583,349	583,349	0	3,570	0	0	3,570	0
SFA-Sfv-RS-Ex-5	6,957,868	6,957,868	0	43,840	0	0	43,840	0
SFA-Sfv-RS-Ex-6	754,377	754,377	0	4,610	0	0	4,610	0
SFA-Sfv-RS-Ex-7	173,742	173,742	0	1,060	0	0	1,060	0
SFA-Sfv-RS-Rh-1	6,732,638	6,732,638	0	6,515	4,123	827	1,565	0
SFA-Sfv-RS-Rh-2	921,726	921,726	0	4,135	0	0	0	4,135
SFA-Sfv-RS-Rh-3	330,434	330,434	0	1,330	0	0	0	1,330
SFA-Sfv-RS-Rh-4	1,023,052	1,023,052	0	4,132	0	0	0	4,132
SFA-Sfv-RS-Rh-5	3,620,806	3,620,806	0	14,865	0	0	0	14,865
SFA-Sfv-RS-Rh-6	985,540	985,540	0	4,713	0	0	0	4,713
SFA-Sfv-SP-Ex-1	146,395	100,395	46,000	430	430	0	0	0

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
SFA-Sfv-SP-Rh-1	306,349	122,738	183,610	2	0	2	0	0
SFA-Sfv-SP-Rh-2	196,102	67,184	128,918	200	0	200	0	0
SFA-Tyn-RS-Ex-1	247,572	247,572	0	1,560	0	0	1,560	0
SFA-Tyn-RS-Ex-2	2,748,822	2,748,822	0	17,660	0	0	17,660	0
SFA-Tyn-SP-Ex-1	142,376	84,876	57,500	207	207	0	0	0
SFA-Aga-RS-Ex-1	946,772	946,772	0	5,960	0	0	5,960	0
SFA-Aga-RS-Ex-2	313,519	313,519	0	2,085	0	0	2,085	0
SFA-Aga-SP-Ex-1	121,109	63,609	57,500	50	50	0	0	0
SFA-Hen-RS-Ex-1	1,208,938	1,208,938	0	7,500	0	0	7,500	0
SFA-Hen-RS-Ex-2	729,963	729,963	0	4,500	0	0	4,500	0
SFA-Jeb-RS-Ex-1	766,993	766,993	0	4,300	0	0	4,300	0
SFA-Jeb-RS-Ex-2	1,018,958	1,018,958	0	5,700	0	0	5,700	0
SFA-Mah-RS-Ex-1	1,683,543	1,683,543	0	9,135	0	0	7,300	1,835
SFA-Mah-RS-Ex-2	1,824,245	1,824,245	0	10,940	0	0	10,940	0
SFA-Mah-SP-Ex-1	173,039	115,539	57,500	475	475	0	0	0
SFA-Mah-RS-Rh-1	126,349	126,349	0	605	0	0	0	605
SFA-Mah-SP-Rh-1	103,843	69,343	34,500	386	0	386	0	0
KAS-Kas-RS-Rh-1	2,147,970	2,147,970	0	3,910	0	0	0	3,910
KAS-Kas-RS-Rh-2	251,160	251,160	0	1,450	0	0	0	1,450
KAS-Kas-RS-Rh-3	423,163	423,163	0	2,000	0	0	0	2,000
KAS-Kas-RS-Rh-4	523,738	523,738	0	2,122	0	0	0	2,122
KAS-Kas-RS-Rh-5	188,122	188,122	0	930	0	0	0	930
KAS-Kas-RS-Rh-7	289,690	289,690	0	1,137	0	0	0	1,137
KAS-Kas-RS-Rh-8	706,560	706,560	0	3,600	0	0	0	3,600
KAS-Kas-RS-Rh-9	917,645	917,645	0	4,208	0	0	0	4,208
KAS-Kas-RS-Rh-10	634,358	634,358	0	2,164	0	0	0	2,164
KAS-Kas-RS-Rh-11	1,005,634	1,005,634	0	4,406	0	0	0	4,406
KAS-Kas-RS-Ex-1	355,190	355,190	0	2,586	0	0	2,586	0
KAS-Kas-RS-Ex-3	534,658	534,658	0	3,352	0	0	3,352	0
KAS-Kas-RS-Ex-4	293,888	293,888	0	2,583	0	0	2,583	0
KAS-Kas-RS-Ex-5	307,573	307,573	0	2,723	0	0	2,723	0
KAS-Kas-RS-Ex-6	264,989	264,989	0	2,005	0	0	2,005	0
KAS-Sbe-RS-Rh-1	87,975	87,975	0	750	0	0	0	750
KAS-Sbe-RS-Rh-2	250,884	250,884	0	1,015	0	0	0	1,015
KAS-Sbe-RS-Rh-3	535,440	535,440	0	2,400	0	0	0	2,400
KAS-Sbe-RS-Rh-4	138,000	138,000	0	300	0	0	0	300
KAS-Sbe-RS-Ex-1	36,225	36,225	0	300	0	0	300	0
KAS-Sbe-RS-Ex-2	278,990	278,990	0	1,960	0	0	1,960	0
KAS-Tel-RS-Ex-1	2,513,900	2,513,900	0	12,000	0	0	12,000	0
KAS-Tel-SP-Ex-1	188,140	130,640	57,500	424	424	0	0	0
KAS-Tel-SP-Ex-2	156,573	99,073	57,500	241	241	0	0	0
KAS-Fei-RS-Ex-1	3,078,760	3,078,760	0	21,179	0	0	21,179	0
KAS-Fei-SP-Ex-1	238,280	180,780	57,500	1,340	1,340	0	0	0
KAS-Fei-SP-Ex-2	173,587	116,087	57,500	443	443	0	0	0
SID-Sid-RS-Rh-1	792,510	792,510	0	4,046	0	0	0	4,046
SID-Sid-RS-Rh-2	400,711	400,711	0	1,857	0	192	0	1,665
SID-Sid-RS-Rh-3	108,944	108,944	0	495	0	0	0	495
SID-Sid-RS-Rh-4	198,772	198,772	0	588	0	0	0	588
SID-Sid-RS-Rh-5	956,230	956,230	0	4,961	0	0	0	4,961
SID-Sid-RS-Rh-7	487,057	487,057	0	2,852	0	716	0	2,136
SID-Sid-RS-Rh-8	141,154	141,154	0	617	0	0	0	617
SID-Sid-RS-Rh-9	112,596	112,596	0	448	0	0	0	448
SID-Sid-RS-Rh-10	25,968	25,968	0	117	0	0	0	117

Table II.1.8 - Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)	Total lenght	Total lenght	Total lenght	Total lenght
	Total cost	Cost for Civil Works	Cost for Equipment		SP-Ex	SP-Rh	RS-Ex	RS-Rh
	(TND)	(TND)	(TND)	(m)	(m)	(m)	(m)	(m)
SID-Sid-RS-Ex-1	204,993	204,993	0	1,678	0	0	1,678	0
SID-Sid-RS-Ex-2	266,185	266,185	0	1,989	0	0	1,989	0
SID-Sid-RS-Ex-3	388,115	388,115	0	3,500	0	0	3,500	0
SID-Sid-RS-Ex-4	124,661	124,661	0	866	0	0	866	0
SID-Sid-RS-Ex-5	81,820	81,820	0	499	0	0	499	0
SID-Sid-RS-Ex-6	212,920	212,920	0	1,299	0	0	1,299	0
SID-Sid-SP-Ex-1	152,346	94,846	57,500	433	433	0	0	0
KEB-Keb-RS-Rh-1	1,681,944	1,681,944	0	7,115	0	0	0	7,115
KEB-Keb-RS-Ex-1	285,545	285,545	0	1,700	0	0	1,700	0
KEB-Keb-SP-Rh-1	296,611	188,854	107,757	750	0	750	0	0
KEB-Keb-SP-Rh-2	146,480	54,930	91,550	0	0	0	0	0
KEB-Keb-SP-Ex-1	191,383	133,883	57,500	810	810	0	0	0
KEB-Ken-RS-Ex-1	1,396,733	1,396,733	0	8,900	0	0	8,900	0
KEB-Ken-RS-Ex-2	1,853,678	1,853,678	0	10,673	0	0	10,673	0
KEB-Ken-RS-Ex-3	1,079,850	1,079,850	0	6,000	0	0	6,000	0
KEB-Ken-RS-Ex-4	878,384	878,384	0	5,050	0	0	5,050	0
KEB-Ken-SP-Ex-1	274,390	216,890	57,500	1,260	1,260	0	0	0
KEB-Ken-SP-Ex-2	466,924	388,732	78,191	2,380	835	0	1,545	0
KEB-Ken-SP-Ex-3	148,638	91,138	57,500	390	390	0	0	0
KEB-Ken-SP-Ex-4	716,335	658,835	57,500	4,715	4,290	0	425	0
KEB-Kes-RS-Ex-1	1,939,144	1,939,144	0	12,150	0	0	12,150	0
KEB-Kes-RS-Ex-2	801,168	801,168	0	5,130	0	0	5,130	0
KEB-Kes-SP-Ex-1	279,197	205,105	74,092	1,205	920	0	285	0
KEB-Kes-SP-Ex-2	614,031	556,531	57,500	4,460	760	0	3,700	0
KEB-Dou-RS-Rh-1	793,908	793,908	0	2,451	0	0	0	2,451
KEB-Dou-RS-Ex-1	952,591	952,591	0	5,648	0	0	5,648	0
KEB-Dou-SP-Ex-1	130,094	72,594	57,500	175	175	0	0	0
KEB-Dos-RS-Ex-1	1,693,319	1,693,319	0	12,449	0	0	12,449	0
KEB-Dos-SP-Ex-1	536,878	479,378	57,500	4,870	4,710	0	160	0
KEB-Gol-RS-Ex-1	387,109	387,109	0	3,065	0	0	3,065	0
KEB-Sou-RS-Ex-1	6,140,023	6,140,023	0	32,500	0	0	32,500	0
KEB-Sou-SP-Ex-1	188,686	131,186	57,500	550	550	0	0	0
KEB-Sou-SP-Ex-2	198,693	115,650	83,042	450	450	0	0	0
KEB-Sou-SP-Ex-3	190,662	116,055	74,606	495	495	0	0	0
KEB-Sou-SP-Ex-4	141,795	84,295	57,500	200	200	0	0	0
KEB-Sou-SP-Ex-5	221,510	164,010	57,500	795	795	0	0	0
KEB-Jem-RS-Ex-1	1,777,440	1,777,440	0	11,200	0	0	11,200	0
KEB-Jem-SP-Ex-1	1,568,432	1,514,506	53,926	11,650	11,230	0	420	0
TOTAL	222,918,483	216,305,365	6,613,118	1,130,021	47,829	12,290	701,318	368,584

Table II.1.9 - Bond Interventions costs (1/3)
Investment costs

Intervention code	Classification	Population 2029	Investment costs: Costs SP_Ex: Civil works	Costs SP_Ex: Equipment	Costs SP_Ex: Rising main	Costs SP_Rh: Civil works	Costs SP_Rh: Equipment	Costs SP_Rh: Rising main	Costs RS_Ex	Costs RS_Rh	Total intervention	Percapita cost
		(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND/hab)
BIZ-Biz-RS-Rh-1	B0	15,000							21,879	2,612,858	2,634,736	176
BIZ-Biz-RS-Rh-2	B0	1,500							306,676	202,343	509,019	339
BIZ-Biz-RS-Rh-3	B0	10,000								585,914	585,914	59
BIZ-Biz-RS-Rh-4	B0	1,000								547,515	547,515	548
BIZ-Biz-RS-Rh-6	B1	1,000								446,810	446,810	447
BIZ-Biz-RS-Rh-7	B0	6,000								1,195,770	1,195,770	199
BIZ-Biz-RS-Ex-1 BIZ-Biz-SP-Ex-1	C1	2,500	57,500	57,500	77,625				971,750		1,164,375	466
BIZ-Zar-SP-Rh-1	B0	18,700				53,605	321,633				375,238	20
BIZ-Zar-SP-Rh-2	B1	70,000				73,061	328,776				401,838	6
BIZ-Zar-SP-Rh-3	B1	30,000				53,878	242,451			284,625	580,954	19
BIZ-Zar-RS-Rh-1	B0	20,000								1,648,928	1,648,928	82
BIZ-Tin-RS-Rh-1	B0	8,000								750,720	750,720	94
BIZ-Tin-RS-Rh-2	B0	10,000								164,220	164,220	16
BIZ-Tin-RS-Ex-1 BIZ-Tin-SP-Ex-1	A	2,000	32,775	49,162	12,938				363,400		458,274	229
BIZ-Tin-RS-Ex-2 BIZ-Tin-SP-Ex-2	C0	8,000	72,948	109,422	42,263				288,363		512,995	64
BIZ-Tin-RS-Ex-3	C0	600							220,800		220,800	368
BIZ-Tin-SP-Rh-1	B0	12,000				53,106	159,319	159,666			372,091	31
BIZ-Men-RS-Rh-1	B0	15,500								4,752,030	4,752,030	307
BIZ-Men-RS-Rh-2	B0	25,000								939,263	939,263	38
BIZ-Men-RS-Ex-1 BIZ-Men-SP-Ex-1	C0	600	30,772	46,158	77,625				205,850		360,405	601
BIZ-Men-RS-Ex-2	C0	400							136,275		136,275	341
BIZ-Raf-RS-Rh-1 BIZ-Raf-SP-Ex-1 BIZ-Raf-SP-Ex-2	A	5,000	150,297	225,445	37,088					1,361,370	1,774,199	355
BIZ-Jam-RS-Rh-1	B0	3,500								614,790	614,790	176
BIZ-Jam-RS-Rh-2	B0	3,500								277,208	277,208	79
BIZ-Jam-SP-Rh-1	B0	30,000				92,529	277,588	679,995			1,050,112	35
BIZ-Jam-SP-Rh-2	B0	5,000	81,132	121,698	143,233						346,063	69
BIZ-Abd-RS-Rh-1	B0	3,500								820,169	820,169	234
BIZ-Abd-SP-Rh-1	B0	18,700				98,233	294,699	251,850			644,782	34
BIZ-Ali-RS-Rh-1	B0	3,500								450,743	450,743	129
BIZ-Mat-SP-Rh-1	B0	15,000				36,751	220,508	462,990	77,050	57,270	854,570	57
BIZ-Mat-SP-Rh-2	B1	12,000				27,928	41,892				69,819	6
ZAG-Fah-RS-Rh-1	B0	600								408,480	408,480	681
ZAG-Fah-RS-Rh-2	B0	5,000								1,103,310	1,103,310	221
ZAG-Fah-RS-Rh-3	B1	2,000								1,170,585	1,170,585	585
ZAG-Fah-RS-Rh-4	B1	2,000								702,075	702,075	351
ZAG-Fah-RS-Rh-5	B1	2,000								511,290	511,290	256
ZAG-Fah-RS-Rh-6	B1	2,000								578,565	578,565	289
ZAG-Fah-RS-Rh-7	B0	4,000							69,000	141,105	210,105	53
ZAG-Fah-RS-Rh-8	B0	700							32,200	125,925	158,125	226
ZAG-Zag-RS-Rh-1	B0	1,300								496,800	496,800	382
ZAG-Zag-RS-Rh-2	B1	400								607,200	607,200	1,518
ZAG-Zag-RS-Rh-3	B0	200								400,200	400,200	2,001
ZAG-Zag-RS-Rh-4	B1	300								242,880	242,880	810
ZAG-Zag-RS-Rh-5	B0	800								1,352,400	1,352,400	1,691
ZAG-Zag-RS-Rh-6	B1	2,000								1,391,040	1,391,040	696
ZAG-Zag-RS-Rh-7	B1	8,000								416,760	416,760	52
ZAG-Zag-RS-Ex-1 ZAG-Zag-SP-Ex-1	B0	600	30,772	46,158	50,600				280,888		408,418	681
ZAG-Zag-RS-Ex-2 ZAG-Zag-SP-Ex-3	C1	200	57,500	57,500	10,120				250,700		375,820	1,879
ZAG-Zag-RS-Ex-3 ZAG-Zag-SP-Ex-2	A	50	46,000	46,000	10,120				15,640		117,760	2,355
ZAG-Zag-RS-Ex-4	B0	75							51,980		51,980	693
ZAG-Ham-RS-Rh-1	B1	1,300								1,062,945	1,062,945	818
ZAG-Ham-RS-Rh-2	B1	400								245,295	245,295	613
ZAG-Ham-RS-Rh-3	B1	1,500								626,865	626,865	418
ZAG-Ham-RS-Rh-4	B1	1,000								286,178	286,178	286
ZAG-Ham-RS-Rh-5	B1	2,000								572,355	572,355	286
ZAG-Ham-RS-Rh-6	B1	1,000								599,610	599,610	600
ZAG-Ham-RS-Rh-7	B1	1,200								476,963	476,963	397
ZAG-Ham-RS-Rh-8	B1	500								190,785	190,785	382
ZAG-Ham-RS-Rh-9	B1	300								728,640	728,640	2,429
ZAG-Ham-RS-Rh-10	B1	1,500								1,110,383	1,110,383	740
ZAG-Ham-RS-Ex-1 ZAG-Ham-SP-Ex-1	A	1	98,625	447,938	353,798				25,271		925,631	925,631

Table II.1.9 - Bond Interventions costs (1/3)
Investment costs

Intervention code	Classifi-cation	Population 2029	Investment costs									
			Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention	Percapita cost
			Civil works	Equipment	Rising main	Civil works	Equipment	Rising main				
		(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND/hab)
BEJ-Bej-RS-Ex-1	A	210							9,792		9,792	47
BEJ-Bej-RS-Ex-2	A	350							160,511		160,511	459
BEJ-Bej-RS-Rh-1	B1	3,447								1,235,045	1,235,045	358
BEJ-Bej-RS-Rh-2	B1	3,425								1,778,047	1,778,047	519
BEJ-Bej-RS-Rh-3	B0	3,227								386,966	386,966	120
BEJ-Bej-RS-Rh-4	B1	920								84,704	84,704	92
BEJ-Bej-RS-Rh-5	B1	1,300								472,678	472,678	364
BEJ-Maa-RS-Rh-1 BEJ-Maa-SP-Ex-1	B1	300	57,500	57,500	736					9,315	125,051	417
BEJ-Med-RS-Rh-1	B1	350								44,201	44,201	126
BEJ-Med-RS-Rh-2	B1	250								83,048	83,048	332
BEJ-Med-RS-Rh-3	B1	750								48,686	48,686	65
BEJ-Med-RS-Rh-4	B1	250								132,885	132,885	532
BEJ-Med-RS-Rh-5	B1	500								175,013	175,013	350
BEJ-Med-RS-Rh-6 BEJ-Med-SP-Rh-1	B0	5,000				5,750	28,750	15,732	78,608	63,072	191,912	38
BEJ-Med-RS-Rh-7	B1	350								197,401	197,401	564
BEJ-Nef-RS-Ex-1	C1	125							37,065		37,065	297
BEJ-Nef-RS-Ex-10	A	135							39,848		39,848	295
BEJ-Nef-RS-Ex-2	C1	50							43,516		43,516	870
BEJ-Nef-RS-Ex-4 BEJ-Nef-SP-Ex-1	A	125	46,000	46,000	276				93,006		185,282	1,482
BEJ-Nef-RS-Ex-3 BEJ-Nef-SP-Ex-2	C1	25	46,000	46,000	20,056				38,732		150,788	6,032
BEJ-Nef-RS-Ex-5	D	450							186,588		186,588	415
BEJ-Nef-RS-Ex-6	D	25							34,644		34,644	1,386
BEJ-Nef-RS-Ex-7	C1	90							47,093		47,093	523
BEJ-Nef-RS-Ex-8	D	200							72,594		72,594	363
BEJ-Nef-RS-Ex-9	C1	15							28,808		28,808	1,921
BEJ-Nef-RS-Rh-1	B1	50								20,010	20,010	400
BEJ-Nef-RS-Rh-2	B1	75								8,108	8,108	108
BEJ-Teb-RS-Ex-1 BEJ-Teb-SP-Ex-3	C1	300	46,000	46,000	72,232				97,244		261,476	872
BEJ-Teb-RS-Ex-2	B1	783							53,107	554,346	607,453	776
BEJ-Teb-RS-Rh-1	B1	1,500								951,683	951,683	634
BEJ-Teb-RS-Rh-2	B1	3,405								2,409,425	2,409,425	708
BEJ-Tes-RS-Ex-1	A	240							119,255	108,606	227,861	949
BEJ-Tes-RS-Ex-2 BEJ-Tes-SP-Ex-1	C1	462	46,000	46,000	3,496				11,017	289,358	395,871	857
BEJ-Tes-RS-Rh-1	B0	1,072								640,734	640,734	598
SIL-Bou-RS-Rh-1 SIL-Bou-SP-Ex-1	B1	1,100	46,000	46,000	431					135,567	227,999	207
SIL-Bou-RS-Rh-2	B1	308								212,115	212,115	689
SIL-Bou-RS-Rh-3	B1	567								306,576	306,576	541
SIL-Bou-RS-Rh-4	B1	594								321,833	321,833	542
SIL-Sil-RS-Rh-1	B1	317								158,976	158,976	502
SIL-Sil-RS-Rh-2	B1	1,330								666,816	666,816	501
SIL-Sil-RS-Rh-3	B1	780								140,093	140,093	180
SIL-Sil-RS-Rh-4	B1	346								173,328	173,328	501
SIL-Kri-RS-Ex-1	A	8,000							466,157	2,018,387	2,484,544	311
JEN-Fer-RS-Rh-1	B0	1,142							379,276	308,375	687,651	602
JEN-Fer-RS-Ex-1 JEN-Fer-SP-Ex-1	C0	425	57,500	57,500	82,827				329,376		527,204	1,240
JEN-Gha-RS-Rh-1	B1	1,466								965,200	965,200	658
JEN-Gha-RS-Ex-1 JEN-Gha-SP-Ex-1	C0	458	57,500	57,500	56,695				345,346		517,041	1,129
JEN-Gha-RS-Ex-2	A	548							246,977		246,977	451
JEN-Jen-RS-Rh-1 JEN-Jen-SP-Rh-1	B1	20,000				77,195	144,741	79,971	310,213	869,928	1,482,047	74
JEN-Jen-RS-Ex-1 JEN-Jen-SP-Ex-1	C0	1,077	57,500	57,500	41,532				438,409		594,941	552
JEN-Jen-RS-Rh-2 JEN-Jen-SP-Rh-2	B1	5,000				35,785	67,098	24,174		1,353,783	1,480,841	296
JEN-Jen-RS-Rh-3	B1	3,154								1,795,049	1,795,049	569
JEN-Jen-SP-Rh-3	B0	30,000				174,021	261,031	2,519		2,010,488	2,448,057	82
JEN-Jen-SP-Rh-4	B1	200				28,750	28,750	10,695			68,195	341
JEN-Tab-RS-Rh-1	B0	4,110								614,100	614,100	149
JEN-Tab-RS-Ex-1 JEN-Tab-SP-Rh-1	B1	2,000					28,750	133,474	658,105		820,328	410

Table II.1.9 - Bond Interventions costs (1/3)
Investment costs

Intervention code	Classifi-cation	Population 2029	Investment costs									
			Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention	Percapita cost
			Civil works	Equipment	Rising main	Civil works	Equipment	Rising main				
		(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND/hab)
JEN-Tab-RS-Ex-2 JEN-Tab-SP-Ex-1 JEN-Tab-SP-Ex-2	C1	314	115,000	115,000	268,054				1,069,213		1,567,266	4,991
JEN-Tab-RS-Ex-3	C1	821							654,896		654,896	798
JEN-Bss-RS-Ex-1 JEN-Bss-SP-Ex-1	C1	724	57,500	57,500	112,528				401,847		629,375	869
KEF-Dah-RS-Rh-3	B1	3,515								1,269,407	1,269,407	361
KEF-Dah-RS-Ex-1	C0	125							43,108		43,108	345
KEF-Dah-SP-Rh-1	B0	1,000					14,375				14,375	14
KEF-Kef-RS-Rh-1	B0	45,191								630,660	630,660	14
KEF-Kef-RS-Rh-2	B0	300								116,748	116,748	389
KEF-Kef-RS-Rh-3	B1	2,300							170,660	67,068	237,728	103
KEF-Kef-RS-Rh-4	B1	600								171,396	171,396	286
KEF-Kef-RS-Rh-5	B1	1,000								85,836	85,836	86
KEF-Kef-RS-Rh-6	B0	2,400								389,988	389,988	162
KEF-Kef-RS-Rh-7	B1	600								201,204	201,204	335
KEF-Kef-RS-Ex-1 KEF-Kef-SP-Ex-1	C0	1,000	57,500	57,500	31,395				432,630		579,025	579
KEF-Kef-SP-Rh-1	B0	3,000				28,750	57,500	109,710			195,960	65
KEF-Kef-SP-Rh-2	B0	10,000				30,694	92,082	58,650			181,427	18
KEF-Taj-RS-Rh-1	B1	1,500								728,640	728,640	486
KEF-Taj-RS-Rh-2	B1	950								366,597	366,597	386
KEF-Taj-RS-Rh-3	B1	2,750								958,617	958,617	349
KEF-Taj-RS-Ex-1	C0	100							37,375		37,375	374
KEF-Taj-RS-Ex-2 KEF-Taj-SP-Ex-1	A	225	57,500	57,500	52,440				49,335		216,775	963
KEF-Taj-RS-Ex-3	C0	300							122,590		122,590	409
KEF-Taj-SP-Rh-1	B1	400				5,750					5,750	14
SFA-Chi-RS-Ex-1	C1	2,108							1,387,780		1,387,780	658
SFA-Chi-RS-Ex-2	C1	1,045							579,244		579,244	554
SFA-Chi-RS-Ex-3	C1	810							610,788		610,788	754
SFA-Chi-RS-Rh-1	B0	10,491								988,625	988,625	94
SFA-Sae-RS-Ex-1	C1	658							364,452		364,452	554
SFA-Sae-RS-Ex-2	C1	950							526,585		526,585	554
SFA-Sae-RS-Ex-3	C1	4,416							2,447,927		2,447,927	554
SFA-Sae-RS-Rh-1	B0	13,819						27,945		846,561	874,506	63
SFA-Sak-RS-Ex-1	C1	10,780							5,985,756		5,985,756	555
SFA-Sak-RS-Ex-2	C1	13,380							8,170,365		8,170,365	611
SFA-Sak-RS-Ex-3	C1	5,405							2,995,992		2,995,992	554
SFA-Sak-RS-Rh-1	B0	53,396								2,664,276	2,664,276	50
SFA-Ain-RS-Ex-1	C1	755							717,686		717,686	951
SFA-Ain-RS-Ex-2	C1	2,290							1,342,769		1,342,769	586
SFA-Ain-RS-Ex-3	C1	3,595							2,108,928		2,108,928	587
SFA-Ain-RS-Ex-4	C1	4,040							2,369,144		2,369,144	586
SFA-Gre-RS-Ex-1	C1	2,805							1,645,133		1,645,133	587
SFA-Gre-RS-Ex-2	C1	5,040							2,955,960		2,955,960	587
SFA-Gre-RS-Ex-3	C1	5,205							3,051,496		3,051,496	586
SFA-Gre-RS-Ex-4	C1	4,340							2,974,636		2,974,636	685
SFA-Gre-RS-Ex-5	C1	3,315							1,943,011		1,943,011	586
SFA-Sfs-RS-Ex-1 SFA-Sfs-SP-Ex-1	C1	2,000	57,500	57,500	7,818				1,133,900		1,256,718	628
SFA-Sfs-RS-Ex-2	C1	1,030							661,940		661,940	643
SFA-Sfs-RS-Ex-3	B1	810							32,631	505,736	538,367	665
SFA-Sfs-RS-Rh-1	B1	2,375							737,139	117,742	854,880	360
SFA-Sfs-RS-Rh-2	B1	3,175							968,024	216,412	1,184,436	373
SFA-Sfs-RS-Rh-3	C1	1,625								3,073,881	3,073,881	1,892
SFA-Sfs-RS-Rh-4	B1	1,025								446,168	446,168	435
SFA-Sfs-RS-Rh-5	B1	2,480							192,602	845,471	1,038,073	419
SFA-Sfv-RS-Ex-1	C1	1,050							570,193		570,193	543
SFA-Sfv-RS-Ex-2	C1	600							322,529		322,529	538
SFA-Sfv-RS-Ex-3	C1	2,250							1,220,679		1,220,679	543
SFA-Sfv-RS-Ex-4	C1	1,075							583,349		583,349	543
SFA-Sfv-RS-Ex-5 SFA-Sfv-RS-Rh-6 SFA-Sfv-SP-Ex-1	B0	10,965	46,000	46,000	54,395				6,957,868	985,540	8,089,803	738
SFA-Sfv-RS-Ex-6	C1	1,400							754,377		754,377	539
SFA-Sfv-RS-Ex-7	C1	325							173,742		173,742	535
SFA-Sfv-RS-Rh-1	B0	240,000			4,625,284			1,107,593	999,761		6,732,638	28
SFA-Sfv-RS-Rh-2	B1	5,000								921,726	921,726	184
SFA-Sfv-RS-Rh-3	B1	4,000								330,434	330,434	83
SFA-Sfv-RS-Rh-4	B1	20,000								1,023,052	1,023,052	51

Table II.1.9 - Bond Interventions costs (1/3)
Investment costs

Intervention code	Classifi-cation	Population 2029	Investment costs									
			Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention	Percapita cost
			Civil works	Equipment	Rising main	Civil works	Equipment	Rising main				
		(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND/hab)
SFA-Sfv-RS-Rh-5	B1	11,150								3,620,806	3,620,806	325
SFA-Sfv-SP-Rh-1	B0	10,000				122,407	183,610	331			306,349	31
SFA-Sfv-SP-Rh-2	B0	10,000				25,784	128,918	41,400			196,102	20
SFA-Tyn-RS-Ex-1	C1	390							247,572		247,572	635
SFA-Tyn-RS-Ex-2 SFA-Tyn-SP-Ex-1	C1	3,830	57,500	57,500	27,376				2,748,822		2,891,198	755
SFA-Aga-RS-Ex-1 SFA-Aga-RS-Ex-2 SFA-Aga-SP-Ex-1	C1	3,000	57,500	57,500	6,109				1,260,291		1,381,400	460
SFA-Hen-RS-Ex-1	C1	1,750							1,208,938		1,208,938	691
SFA-Hen-RS-Ex-2	C1	1,100							729,963		729,963	664
SFA-Jeb-RS-Ex-1	C1	1,000							766,993		766,993	767
SFA-Jeb-RS-Ex-2	C1	1,350							1,018,958		1,018,958	755
SFA-Mah-RS-Ex-1 SFA-Mah-SP-Ex-1	B1	10,825	57,500	57,500	58,039				1,217,275	466,268	1,856,582	172
SFA-Mah-RS-Ex-2	C1	2,750							1,824,245		1,824,245	663
SFA-Mah-RS-Rh-1	B1	7,500								126,349	126,349	17
SFA-Mah-SP-Rh-1	B1	1				23,000	34,500	46,343			103,843	103,843
KAS-Kas-RS-Rh-1	B0	64,660								2,147,970	2,147,970	33
KAS-Kas-RS-Rh-2	B0	6,000								251,160	251,160	42
KAS-Kas-RS-Rh-3	B0	750								423,163	423,163	564
KAS-Kas-RS-Rh-4	B0	23,000								523,738	523,738	23
KAS-Kas-RS-Rh-5	B0	6,000								188,122	188,122	31
KAS-Kas-RS-Rh-7	B0	30,000								289,690	289,690	10
KAS-Kas-RS-Rh-8	B0	1,000								706,560	706,560	707
KAS-Kas-RS-Rh-9	B0	2,000								917,645	917,645	459
KAS-Kas-RS-Rh-10	B0	2,500								634,358	634,358	254
KAS-Kas-RS-Rh-11	B0	2,500								1,005,634	1,005,634	402
KAS-Kas-RS-Ex-1	C1	1,000							355,190		355,190	355
KAS-Kas-RS-Ex-3	C1	1,000							534,658		534,658	535
KAS-Kas-RS-Ex-4	C1	1,250							293,888		293,888	235
KAS-Kas-RS-Ex-5	C1	900							307,573		307,573	342
KAS-Kas-RS-Ex-6	C1	750							264,989		264,989	353
KAS-Sbe-RS-Rh-1	B0	1,250								87,975	87,975	70
KAS-Sbe-RS-Rh-2	B0	750								250,884	250,884	335
KAS-Sbe-RS-Rh-3	B0	1,250								535,440	535,440	428
KAS-Sbe-RS-Rh-4	B0	650								138,000	138,000	212
KAS-Sbe-RS-Ex-1	C1	75							36,225		36,225	483
KAS-Sbe-RS-Ex-2	C0	950							278,990		278,990	294
KAS-Tel-RS-Ex-1 KAS-Tel-SP-Ex-1 KAS-Tel-SP-Ex-2	C0	5,950	115,000	115,000	114,713				2,513,900		2,858,613	480
KAS-Fei-RS-Ex-1 KAS-Fei-SP-Ex-1 KAS-Fei-SP-Ex-2	C0	4,950	115,000	115,000	181,867				3,078,760		3,490,627	705
SID-Sid-RS-Rh-1	B0	2,000								792,510	792,510	396
SID-Sid-RS-Rh-2	A	3,900						29,146		371,565	400,711	103
SID-Sid-RS-Rh-3	B0	940								108,944	108,944	116
SID-Sid-RS-Rh-4	B0	12,000								198,772	198,772	17
SID-Sid-RS-Rh-5	B1	2,200								956,230	956,230	435
SID-Sid-RS-Rh-7 SID-Sid-RS-Ex-5 SID-Sid-RS-Ex-6	A	4,100						108,689	294,739	378,368	781,796	191
SID-Sid-RS-Rh-8	B1	500								141,154	141,154	282
SID-Sid-RS-Rh-9	B0	20,000								112,596	112,596	6
SID-Sid-RS-Rh-10	B1	100								25,968	25,968	260
SID-Sid-RS-Ex-1	C0	800							204,993		204,993	256
SID-Sid-RS-Ex-2	A	1,400							266,185		266,185	190
SID-Sid-RS-Ex-3	C0	900							388,115		388,115	431
SID-Sid-RS-Ex-4 SID-Sid-SP-Ex-1	C0	330	57,500	57,500	37,346				124,661		277,007	839
KEB-Keb-RS-Rh-1	B1	4,000								1,681,944	1,681,944	420
KEB-Keb-RS-Ex-1	C1	1,000							285,545		285,545	286
KEB-Keb-SP-Rh-1	A	4,000				64,654	107,757	124,200			296,611	74
KEB-Keb-SP-Rh-2	A	7,500				54,930	91,550				146,480	20
KEB-Keb-SP-Ex-1	C1	850	57,500	57,500	76,383						191,383	225
KEB-Ken-RS-Ex-1 KEB-Ken-SP-Ex-1	C0	3,000	57,500	57,500	159,390				1,396,733		1,671,123	557
KEB-Ken-RS-Ex-2 KEB-Ken-SP-Ex-2	C0	5,550	52,127	78,191	105,628				2,084,655		2,320,601	418

Table II.1.9 - Bond Interventions costs (1/3)
Investment costs

Intervention code	Classifi-cation	Population 2029	Investment costs									
			Costs SP_Ex			Costs SP_Rh			Costs RS_Ex	Costs RS_Rh	Total intervention	Percapita cost
			Civil works	Equipment	Rising main	Civil works	Equipment	Rising main				
		(hab)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND/hab)
KEB-Ken-RS-Ex-3 KEB-Ken-SP-Ex-3	C0	3,000	57,500	57,500	33,638				1,079,850		1,228,488	409
KEB-Ken-RS-Ex-4 KEB-Ken-SP-Ex-4	C0	2,530	57,500	57,500	542,685				937,034		1,594,719	630
KEB-Kes-RS-Ex-1 KEB-Kes-RS-Ex-2 KEB-Kes-SP-Ex-1 KEB-Kes-SP-Ex-2	C0	5,000	106,895	131,592	194,166				3,200,887		3,633,540	727
KEB-Dou-RS-Rh-1	B0	25,000								793,908	793,908	32
KEB-Dou-RS-Ex-1 KEB-Dou-SP-Ex-1	C1	2,000	57,500	57,500	15,094				952,591		1,082,685	541
KEB-Dos-RS-Ex-1 KEB-Dos-SP-Ex-1	C0	3,000	57,500	57,500	406,238				1,708,959		2,230,196	743
KEB-Gol-RS-Ex-1	C0	750							387,109		387,109	516
KEB-Sou-RS-Ex-1 KEB-Sou-SP-Ex-1 KEB-Sou-SP-Ex-2 KEB-Sou-SP-Ex-3 KEB-Sou-SP-Ex-4 KEB-Sou-SP-Ex-5	C0	15,000	277,599	330,149	333,598				6,140,023		7,081,368	472
KEB-Jem-RS-Ex-1 KEB-Jem-SP-Ex-1	A	4,000	35,951	53,926	1,420,595				1,835,400		3,345,872	836

Table II.1.9 - Bond Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
BIZ-Biz-RS-Rh-1									656	65,321	65,978
BIZ-Biz-RS-Rh-2									9,200	5,059	14,259
BIZ-Biz-RS-Rh-3										14,648	14,648
BIZ-Biz-RS-Rh-4										13,688	13,688
BIZ-Biz-RS-Rh-6										11,170	11,170
BIZ-Biz-RS-Rh-7										29,894	29,894
BIZ-Biz-RS-Ex-1 BIZ-Biz-SP-Ex-1	863	2,875	2,329	993					29,153		36,212
BIZ-Zar-SP-Rh-1					2,797	13,984	1,395	15,752			33,928
BIZ-Zar-SP-Rh-2					3,812	19,059	4,185	19,123			46,179
BIZ-Zar-SP-Rh-3					2,811	14,055	4,185	7,609		7,116	35,776
BIZ-Zar-RS-Rh-1										41,223	41,223
BIZ-Tin-RS-Rh-1										18,768	18,768
BIZ-Tin-RS-Rh-2										4,106	4,106
BIZ-Tin-RS-Ex-1 BIZ-Tin-SP-Ex-1	492	2,458	388	422					10,902		14,662
BIZ-Tin-RS-Ex-2 BIZ-Tin-SP-Ex-2	1,094	5,471	1,268	2,815					8,651		19,299
BIZ-Tin-RS-Ex-3									6,624		6,624
BIZ-Tin-SP-Rh-1					1,385	6,927	3,471	4,222			16,005
BIZ-Men-RS-Rh-1										118,801	118,801
BIZ-Men-RS-Rh-2										23,482	23,482
BIZ-Men-RS-Ex-1 BIZ-Men-SP-Ex-1	462	2,308	2,329	298					6,176		11,572
BIZ-Men-RS-Ex-2									4,088		4,088
BIZ-Raf-RS-Rh-1 BIZ-Raf-SP-Ex-1 BIZ-Raf-SP-Ex-2	2,254	11,272	1,113	3,576						34,034	52,250
BIZ-Jam-RS-Rh-1										15,370	15,370
BIZ-Jam-RS-Rh-2										6,930	6,930
BIZ-Jam-SP-Rh-1					2,414	12,069	14,783	29,960			59,226
BIZ-Jam-SP-Rh-2	1,217	6,085	4,297	3,891							15,490
BIZ-Abd-RS-Rh-1										20,504	20,504
BIZ-Abd-SP-Rh-1					2,563	12,813	5,475	38,209			59,059
BIZ-Ali-RS-Rh-1										11,269	11,269
BIZ-Mat-SP-Rh-1					1,917	9,587	10,065	15,099	2,312	1,432	40,412
BIZ-Mat-SP-Rh-2					1,457	7,285	1,601	2,036			12,380
ZAG-Fah-RS-Rh-1										10,212	10,212
ZAG-Fah-RS-Rh-2										27,583	27,583
ZAG-Fah-RS-Rh-3										29,265	29,265
ZAG-Fah-RS-Rh-4										17,552	17,552
ZAG-Fah-RS-Rh-5										12,782	12,782
ZAG-Fah-RS-Rh-6										14,464	14,464
ZAG-Fah-RS-Rh-7									2,070	3,528	5,598
ZAG-Fah-RS-Rh-8									966	3,148	4,114
ZAG-Zag-RS-Rh-1										12,420	12,420
ZAG-Zag-RS-Rh-2										15,180	15,180
ZAG-Zag-RS-Rh-3										10,005	10,005
ZAG-Zag-RS-Rh-4										6,072	6,072
ZAG-Zag-RS-Rh-5										33,810	33,810
ZAG-Zag-RS-Rh-6										34,776	34,776
ZAG-Zag-RS-Rh-7										10,419	10,419
ZAG-Zag-RS-Ex-1 ZAG-Zag-SP-Ex-1	462	2,308	1,518	161					8,427		12,875
ZAG-Zag-RS-Ex-2 ZAG-Zag-SP-Ex-3	863	2,875	304	54					7,521		11,616
ZAG-Zag-RS-Ex-3 ZAG-Zag-SP-Ex-2	690	2,300	304	9					469		3,772
ZAG-Zag-RS-Ex-4									1,559		1,559
ZAG-Ham-RS-Rh-1										26,574	26,574
ZAG-Ham-RS-Rh-2										6,132	6,132
ZAG-Ham-RS-Rh-3										15,672	15,672
ZAG-Ham-RS-Rh-4										7,154	7,154
ZAG-Ham-RS-Rh-5										14,309	14,309
ZAG-Ham-RS-Rh-6										14,990	14,990

Table II.1.9 - Bond Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
ZAG-Ham-RS-Rh-7										11,924	11,924
ZAG-Ham-RS-Rh-8										4,770	4,770
ZAG-Ham-RS-Rh-9										18,216	18,216
ZAG-Ham-RS-Rh-10										27,760	27,760
ZAG-Ham-RS-Ex-1 ZAG-Ham-SP-Ex-1	1,479	22,397	10,614	5,365					758		40,613
BEJ-Bej-RS-Ex-1									294		294
BEJ-Bej-RS-Ex-2									4,815		4,815
BEJ-Bej-RS-Rh-1										30,876	30,876
BEJ-Bej-RS-Rh-2										44,451	44,451
BEJ-Bej-RS-Rh-3										9,674	9,674
BEJ-Bej-RS-Rh-4										2,118	2,118
BEJ-Bej-RS-Rh-5										11,817	11,817
BEJ-Maa-RS-Rh-1 BEJ-Maa-SP-Ex-1	863	2,875	22	17						233	4,009
BEJ-Med-RS-Rh-1										1,105	1,105
BEJ-Med-RS-Rh-2										2,076	2,076
BEJ-Med-RS-Rh-3										1,217	1,217
BEJ-Med-RS-Rh-4										3,322	3,322
BEJ-Med-RS-Rh-5										4,375	4,375
BEJ-Med-RS-Rh-6 BEJ-Med-SP-Rh-1					750	2,500	342	1,192	2,358	1,577	8,719
BEJ-Med-RS-Rh-7										4,935	4,935
BEJ-Nef-RS-Ex-1									1,112		1,112
BEJ-Nef-RS-Ex-10									1,195		1,195
BEJ-Nef-RS-Ex-2									1,305		1,305
BEJ-Nef-RS-Ex-4 BEJ-Nef-SP-Ex-1	690	2,300	8	14					2,790		5,803
BEJ-Nef-RS-Ex-3 BEJ-Nef-SP-Ex-2	690	2,300	602	5					1,162		4,759
BEJ-Nef-RS-Ex-5									5,598		5,598
BEJ-Nef-RS-Ex-6									1,039		1,039
BEJ-Nef-RS-Ex-7									1,413		1,413
BEJ-Nef-RS-Ex-8									2,178		2,178
BEJ-Nef-RS-Ex-9									864		864
BEJ-Nef-RS-Rh-1										500	500
BEJ-Nef-RS-Rh-2										203	203
BEJ-Teb-RS-Ex-1 BEJ-Teb-SP-Ex-3	690	2,300	2,167	51					2,917		8,125
BEJ-Teb-RS-Ex-2									1,593	13,859	15,452
BEJ-Teb-RS-Rh-1										23,792	23,792
BEJ-Teb-RS-Rh-2										60,236	60,236
BEJ-Tes-RS-Ex-1									3,578	2,715	6,293
BEJ-Tes-RS-Ex-2 BEJ-Tes-SP-Ex-1	690	2,300	105	4					331	7,234	10,663
BEJ-Tes-RS-Rh-1										16,018	16,018
SIL-Bou-RS-Rh-1 SIL-Bou-SP-Ex-1	690	2,300	13	73						3,389	6,465
SIL-Bou-RS-Rh-2										5,303	5,303
SIL-Bou-RS-Rh-3										7,664	7,664
SIL-Bou-RS-Rh-4										8,046	8,046
SIL-Sil-RS-Rh-1										3,974	3,974
SIL-Sil-RS-Rh-2										16,670	16,670
SIL-Sil-RS-Rh-3										3,502	3,502
SIL-Sil-RS-Rh-4										4,333	4,333
SIL-Kri-RS-Ex-1									13,985	50,460	64,444
JEN-Fer-RS-Rh-1									11,378	7,709	19,088
JEN-Fer-RS-Ex-1 JEN-Fer-SP-Ex-1	863	2,875	2,485	54					9,881		16,158
JEN-Gha-RS-Rh-1										24,130	24,130
JEN-Gha-RS-Ex-1 JEN-Gha-SP-Ex-1	863	2,875	1,701	49					10,360		15,848
JEN-Gha-RS-Ex-2									7,409		7,409
JEN-Jen-RS-Rh-1 JEN-Jen-SP-Rh-1					1,259	6,293	1,739	1,821	9,306	21,748	42,166

Table II.1.9 - Bond Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
JEN-Jen-RS-Ex-1 JEN-Jen-SP-Ex-1	863	2,875	1,246	98					13,152		18,234
JEN-Jen-RS-Rh-2 JEN-Jen-SP-Rh-2					583	2,917	526	911		33,845	38,781
JEN-Jen-RS-Rh-3										44,876	44,876
JEN-Jen-SP-Rh-3					2,270	11,349	55	5,464		50,262	69,400
JEN-Jen-SP-Rh-4					750	2,500	233	18			3,501
JEN-Tab-RS-Rh-1										15,353	15,353
JEN-Tab-RS-Ex-1 JEN-Tab-SP-Rh-1					750	2,500	2,902	219	19,743		26,113
JEN-Tab-RS-Ex-2 JEN-Tab-SP-Ex-1 JEN-Tab-SP-Ex-2	1,725	5,750	8,042	721					32,076		48,314
JEN-Tab-RS-Ex-3									19,647		19,647
JEN-Bss-RS-Ex-1 JEN-Bss-SP-Ex-1	863	2,875	3,376	54					12,055		19,222
KEF-Dah-RS-Rh-3										31,735	31,735
KEF-Dah-RS-Ex-1									1,293		1,293
KEF-Dah-SP-Rh-1					750	2,500	612	258			4,120
KEF-Kef-RS-Rh-1										15,767	15,767
KEF-Kef-RS-Rh-2										2,919	2,919
KEF-Kef-RS-Rh-3									5,120	1,677	6,797
KEF-Kef-RS-Rh-4										4,285	4,285
KEF-Kef-RS-Rh-5										2,146	2,146
KEF-Kef-RS-Rh-6										9,750	9,750
KEF-Kef-RS-Rh-7										5,030	5,030
KEF-Kef-RS-Ex-1 KEF-Kef-SP-Ex-1	863	2,875	942	159					12,979		17,817
KEF-Kef-SP-Rh-1					750	2,500	2,385	240			5,875
KEF-Kef-SP-Rh-2					801	4,004	1,275	803			6,882
KEF-Taj-RS-Rh-1										18,216	18,216
KEF-Taj-RS-Rh-2										9,165	9,165
KEF-Taj-RS-Rh-3										23,965	23,965
KEF-Taj-RS-Ex-1									1,121		1,121
KEF-Taj-RS-Ex-2 KEF-Taj-SP-Ex-1	863	2,875	1,573	44					1,480		6,834
KEF-Taj-RS-Ex-3									3,678		3,678
KEF-Taj-SP-Rh-1					750	2,500	2,415	77			5,742
SFA-Chi-RS-Ex-1									41,633		41,633
SFA-Chi-RS-Ex-2									17,377		17,377
SFA-Chi-RS-Ex-3									18,324		18,324
SFA-Chi-RS-Rh-1										24,716	24,716
SFA-Sae-RS-Ex-1									10,934		10,934
SFA-Sae-RS-Ex-2									15,798		15,798
SFA-Sae-RS-Ex-3									73,438		73,438
SFA-Sae-RS-Rh-1							608			21,164	21,772
SFA-Sak-RS-Ex-1									179,573		179,573
SFA-Sak-RS-Ex-2									245,111		245,111
SFA-Sak-RS-Ex-3									89,880		89,880
SFA-Sak-RS-Rh-1										66,607	66,607
SFA-Ain-RS-Ex-1									21,531		21,531
SFA-Ain-RS-Ex-2									40,283		40,283
SFA-Ain-RS-Ex-3									63,268		63,268
SFA-Ain-RS-Ex-4									71,074		71,074
SFA-Gre-RS-Ex-1									49,354		49,354
SFA-Gre-RS-Ex-2									88,679		88,679
SFA-Gre-RS-Ex-3									91,545		91,545
SFA-Gre-RS-Ex-4									89,239		89,239
SFA-Gre-RS-Ex-5									58,290		58,290
SFA-Sfs-RS-Ex-1 SFA-Sfs-SP-Ex-1	863	2,875	235	172					34,017		38,161
SFA-Sfs-RS-Ex-2									19,858		19,858
SFA-Sfs-RS-Ex-3									979	12,643	13,622
SFA-Sfs-RS-Rh-1									22,114	2,944	25,058
SFA-Sfs-RS-Rh-2									29,041	5,410	34,451

Table II.1.9 - Bond Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
SFA-Sfs-RS-Rh-3										76,847	76,847
SFA-Sfs-RS-Rh-4										11,154	11,154
SFA-Sfs-RS-Rh-5									5,778	21,137	26,915
SFA-Sfv-RS-Ex-1									17,106		17,106
SFA-Sfv-RS-Ex-2									9,676		9,676
SFA-Sfv-RS-Ex-3									36,620		36,620
SFA-Sfv-RS-Ex-4									17,500		17,500
SFA-Sfv-RS-Ex-5 SFA-Sfv-RS-Rh-6 SFA-Sfv-SP-Ex-1	690	2,300	1,632	36					208,736	24,639	238,032
SFA-Sfv-RS-Ex-6									22,631		22,631
SFA-Sfv-RS-Ex-7									5,212		5,212
SFA-Sfv-RS-Rh-1			138,759				24,078		29,993		192,829
SFA-Sfv-RS-Rh-2										23,043	23,043
SFA-Sfv-RS-Rh-3										8,261	8,261
SFA-Sfv-RS-Rh-4										25,576	25,576
SFA-Sfv-RS-Rh-5										90,520	90,520
SFA-Sfv-SP-Rh-1					1,597	7,983	7	861			10,448
SFA-Sfv-SP-Rh-2					1,121	5,605	900	1,205			8,831
SFA-Tyn-RS-Ex-1									7,427		7,427
SFA-Tyn-RS-Ex-2 SFA-Tyn-SP-Ex-1	863	2,875	821	28					82,465		87,052
SFA-Aga-RS-Ex-1 SFA-Aga-RS-Ex-2 SFA-Aga-SP-Ex-1	863	2,875	183	84					37,809		41,814
SFA-Hen-RS-Ex-1									36,268		36,268
SFA-Hen-RS-Ex-2									21,899		21,899
SFA-Jeb-RS-Ex-1									23,010		23,010
SFA-Jeb-RS-Ex-2									30,569		30,569
SFA-Mah-RS-Ex-1 SFA-Mah-SP-Ex-1	863	2,875	1,741	72					36,518	11,657	53,725
SFA-Mah-RS-Ex-2									54,727		54,727
SFA-Mah-RS-Rh-1										3,159	3,159
SFA-Mah-SP-Rh-1					750	2,500	1,007	715			4,973
KAS-Kas-RS-Rh-1										53,699	53,699
KAS-Kas-RS-Rh-2										6,279	6,279
KAS-Kas-RS-Rh-3										10,579	10,579
KAS-Kas-RS-Rh-4										13,093	13,093
KAS-Kas-RS-Rh-5										4,703	4,703
KAS-Kas-RS-Rh-7										7,242	7,242
KAS-Kas-RS-Rh-8										17,664	17,664
KAS-Kas-RS-Rh-9										22,941	22,941
KAS-Kas-RS-Rh-10										15,859	15,859
KAS-Kas-RS-Rh-11										25,141	25,141
KAS-Kas-RS-Ex-1									10,656		10,656
KAS-Kas-RS-Ex-3									16,040		16,040
KAS-Kas-RS-Ex-4									8,817		8,817
KAS-Kas-RS-Ex-5									9,227		9,227
KAS-Kas-RS-Ex-6									7,950		7,950
KAS-Sbe-RS-Rh-1										2,199	2,199
KAS-Sbe-RS-Rh-2										6,272	6,272
KAS-Sbe-RS-Rh-3										13,386	13,386
KAS-Sbe-RS-Rh-4										3,450	3,450
KAS-Sbe-RS-Ex-1									1,087		1,087
KAS-Sbe-RS-Ex-2									8,370		8,370
KAS-Tel-RS-Ex-1 KAS-Tel-SP-Ex-1 KAS-Tel-SP-Ex-2	1,725	5,750	3,441	47					75,417		86,380
KAS-Fei-RS-Ex-1 KAS-Fei-SP-Ex-1 KAS-Fei-SP-Ex-2	1,725	5,750	5,456	112					92,363		105,406
SID-Sid-RS-Rh-1										19,813	19,813
SID-Sid-RS-Rh-2					750	2,500	634	249		9,289	13,421
SID-Sid-RS-Rh-3										2,724	2,724
SID-Sid-RS-Rh-4										4,969	4,969

Table II.1.9 - Bond Interventions costs (2/3)
Annual operating and maintenance cost

Intervention code	Annual operating and maintenance cost										
	Costs SP_Ex				Costs SP_Rh				Costs RS_Ex	Costs RS_Rh	Total intervention
	Civil works	Equipment	Rising main	Energy	Civil works	Equipment	Rising main	Energy			
	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)	(TND/year)
SID-Sid-RS-Rh-5										23,906	23,906
SID-Sid-RS-Rh-7 SID-Sid-RS-Ex-5 SID-Sid-RS-Ex-6					750	2,500	2,363	64	8,842	9,459	23,978
SID-Sid-RS-Rh-8										3,529	3,529
SID-Sid-RS-Rh-9										2,815	2,815
SID-Sid-RS-Rh-10										649	649
SID-Sid-RS-Ex-1									6,150		6,150
SID-Sid-RS-Ex-2									7,986		7,986
SID-Sid-RS-Ex-3									11,643		11,643
SID-Sid-RS-Ex-4 SID-Sid-SP-Ex-1	863	2,875	1,120	21					3,740		8,619
KEB-Keb-RS-Rh-1										42,049	42,049
KEB-Keb-RS-Ex-1									8,566		8,566
KEB-Keb-SP-Rh-1					937	4,685	2,700	689			9,011
KEB-Keb-SP-Rh-2					796	3,980	6,336	807			11,920
KEB-Keb-SP-Ex-1	863	2,875	2,291	110							6,139
KEB-Ken-RS-Ex-1 KEB-Ken-SP-Ex-1	863	2,875	4,782	452					41,902		50,873
KEB-Ken-RS-Ex-2 KEB-Ken-SP-Ex-2	782	3,910	3,169	597					62,540		70,997
KEB-Ken-RS-Ex-3 KEB-Ken-SP-Ex-3	863	2,875	1,009	32					32,396		37,174
KEB-Ken-RS-Ex-4 KEB-Ken-SP-Ex-4	863	2,875	16,281	1,497					28,111		49,627
KEB-Kes-RS-Ex-1 KEB-Kes-RS-Ex-2 KEB-Kes-SP-Ex-1 KEB-Kes-SP-Ex-2	1,603	6,580	5,825	1,104					96,027		111,138
KEB-Dou-RS-Rh-1										19,848	19,848
KEB-Dou-RS-Ex-1 KEB-Dou-SP-Ex-1	863	2,875	453	12					28,578		32,780
KEB-Dos-RS-Ex-1 KEB-Dos-SP-Ex-1	863	2,875	12,187	715					51,269		67,909
KEB-Gol-RS-Ex-1									11,613		11,613
KEB-Sou-RS-Ex-1 KEB-Sou-SP-Ex-1 KEB-Sou-SP-Ex-2 KEB-Sou-SP-Ex-3 KEB-Sou-SP-Ex-4 KEB-Sou-SP-Ex-5	4,164	16,507	10,008	2,233					184,201		217,113
KEB-Jem-RS-Ex-1 KEB-Jem-SP-Ex-1	539	2,696	42,618	1,785					55,062		102,700

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
BIZ-Biz-RS-Rh-1	2,634,736	2,634,736	0	9,440
BIZ-Biz-RS-Rh-2	509,019	509,019	0	2,440
BIZ-Biz-RS-Rh-3	585,914	585,914	0	1,650
BIZ-Biz-RS-Rh-4	547,515	547,515	0	2,300
BIZ-Biz-RS-Rh-6	446,810	446,810	0	1,990
BIZ-Biz-RS-Rh-7	1,195,770	1,195,770	0	5,800
BIZ-Biz-RS-Ex-1 BIZ-Biz-SP-Ex-1	1,164,375	1,106,875	57,500	5,800
BIZ-Zar-SP-Rh-1	375,238	53,605	321,633	0
BIZ-Zar-SP-Rh-2	401,838	73,061	328,776	0
BIZ-Zar-SP-Rh-3	580,954	338,503	242,451	660
BIZ-Zar-RS-Rh-1	1,648,928	1,648,928	0	7,230
BIZ-Tin-RS-Rh-1	750,720	750,720	0	3,400
BIZ-Tin-RS-Rh-2	164,220	164,220	0	700
BIZ-Tin-RS-Ex-1 BIZ-Tin-SP-Ex-1	458,274	409,112	49,162	2,250
BIZ-Tin-RS-Ex-2 BIZ-Tin-SP-Ex-2	512,995	403,573	109,422	2,200
BIZ-Tin-RS-Ex-3	220,800	220,800	0	1,300
BIZ-Tin-SP-Rh-1	372,091	212,772	159,319	890
BIZ-Men-RS-Rh-1	4,752,030	4,752,030	0	18,800
BIZ-Men-RS-Rh-2	939,263	939,263	0	2,750
BIZ-Men-RS-Ex-1 BIZ-Men-SP-Ex-1	360,405	314,247	46,158	1,800
BIZ-Men-RS-Ex-2	136,275	136,275	0	900
BIZ-Raf-RS-Rh-1 BIZ-Raf-SP-Ex-1 BIZ-Raf-SP-Ex-2	1,774,199	1,548,754	225,445	6,750
BIZ-Jam-RS-Rh-1	614,790	614,790	0	2,200
BIZ-Jam-RS-Rh-2	277,208	277,208	0	990
BIZ-Jam-SP-Rh-1	1,050,112	772,524	277,588	2,700
BIZ-Jam-SP-Rh-2	346,063	224,365	121,698	940
BIZ-Abd-RS-Rh-1	820,169	820,169	0	3,410
BIZ-Abd-SP-Rh-1	644,782	350,083	294,699	1,000
BIZ-Ali-RS-Rh-1	450,743	450,743	0	1,950
BIZ-Mat-SP-Rh-1	854,570	634,061	220,508	2,800
BIZ-Mat-SP-Rh-2	69,819	27,928	41,892	0
ZAG-Fah-RS-Rh-1	408,480	408,480	0	1,600
ZAG-Fah-RS-Rh-2	1,103,310	1,103,310	0	4,100
ZAG-Fah-RS-Rh-3	1,170,585	1,170,585	0	4,350
ZAG-Fah-RS-Rh-4	702,075	702,075	0	2,750
ZAG-Fah-RS-Rh-5	511,290	511,290	0	1,900
ZAG-Fah-RS-Rh-6	578,565	578,565	0	2,150
ZAG-Fah-RS-Rh-7	210,105	210,105	0	950
ZAG-Fah-RS-Rh-8	158,125	158,125	0	650
ZAG-Zag-RS-Rh-1	496,800	496,800	0	2,250
ZAG-Zag-RS-Rh-2	607,200	607,200	0	2,750
ZAG-Zag-RS-Rh-3	400,200	400,200	0	1,450
ZAG-Zag-RS-Rh-4	242,880	242,880	0	1,100
ZAG-Zag-RS-Rh-5	1,352,400	1,352,400	0	4,900
ZAG-Zag-RS-Rh-6	1,391,040	1,391,040	0	6,300
ZAG-Zag-RS-Rh-7	416,760	416,760	0	2,600

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
ZAG-Zag-RS-Ex-1 ZAG-Zag-SP-Ex-1	408,418	362,260	46,158	1,925
ZAG-Zag-RS-Ex-2 ZAG-Zag-SP-Ex-3	375,820	318,320	57,500	1,630
ZAG-Zag-RS-Ex-3 ZAG-Zag-SP-Ex-2	117,760	71,760	46,000	160
ZAG-Zag-RS-Ex-4	51,980	51,980	0	310
ZAG-Ham-RS-Rh-1	1,062,945	1,062,945	0	3,900
ZAG-Ham-RS-Rh-2	245,295	245,295	0	900
ZAG-Ham-RS-Rh-3	626,865	626,865	0	2,300
ZAG-Ham-RS-Rh-4	286,178	286,178	0	1,050
ZAG-Ham-RS-Rh-5	572,355	572,355	0	2,100
ZAG-Ham-RS-Rh-6	599,610	599,610	0	2,200
ZAG-Ham-RS-Rh-7	476,963	476,963	0	1,750
ZAG-Ham-RS-Rh-8	190,785	190,785	0	700
ZAG-Ham-RS-Rh-9	728,640	728,640	0	3,200
ZAG-Ham-RS-Rh-10	1,110,383	1,110,383	0	4,150
ZAG-Ham-RS-Ex-1 ZAG-Ham-SP-Ex-1	925,631	477,694	447,938	2,250
BEJ-Bej-RS-Ex-1	9,792	9,792	0	43
BEJ-Bej-RS-Ex-2	160,511	160,511	0	975
BEJ-Bej-RS-Rh-1	1,235,045	1,235,045	0	4,972
BEJ-Bej-RS-Rh-2	1,778,047	1,778,047	0	7,158
BEJ-Bej-RS-Rh-3	386,966	386,966	0	1,405
BEJ-Bej-RS-Rh-4	84,704	84,704	0	341
BEJ-Bej-RS-Rh-5	472,678	472,678	0	2,114
BEJ-Maa-RS-Rh-1 BEJ-Maa-SP-Ex-1	125,051	67,551	57,500	30
BEJ-Med-RS-Rh-1	44,201	44,201	0	31
BEJ-Med-RS-Rh-2	83,048	83,048	0	354
BEJ-Med-RS-Rh-3	48,686	48,686	0	196
BEJ-Med-RS-Rh-4	132,885	132,885	0	552
BEJ-Med-RS-Rh-5	175,013	175,013	0	727
BEJ-Med-RS-Rh-6 BEJ-Med-SP-Rh-1	191,912	163,162	28,750	1,033
BEJ-Med-RS-Rh-7	197,401	197,401	0	820
BEJ-Nef-RS-Ex-1	37,065	37,065	0	247
BEJ-Nef-RS-Ex-10	39,848	39,848	0	265
BEJ-Nef-RS-Ex-2	43,516	43,516	0	376
BEJ-Nef-RS-Ex-4 BEJ-Nef-SP-Ex-1	185,282	139,282	46,000	586
BEJ-Nef-RS-Ex-3 BEJ-Nef-SP-Ex-2	150,788	104,788	46,000	570
BEJ-Nef-RS-Ex-5	186,588	186,588	0	1,010
BEJ-Nef-RS-Ex-6	34,644	34,644	0	225
BEJ-Nef-RS-Ex-7	47,093	47,093	0	375
BEJ-Nef-RS-Ex-8	72,594	72,594	0	377
BEJ-Nef-RS-Ex-9	28,808	28,808	0	265
BEJ-Nef-RS-Rh-1	20,010	20,010	0	84
BEJ-Nef-RS-Rh-2	8,108	8,108	0	15
BEJ-Teb-RS-Ex-1 BEJ-Teb-SP-Ex-3	261,476	215,476	46,000	1,109
BEJ-Teb-RS-Ex-2	607,453	607,453	0	2,296

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
BEJ-Teb-RS-Rh-1	951,683	951,683	0	3,675
BEJ-Teb-RS-Rh-2	2,409,425	2,409,425	0	8,952
BEJ-Tes-RS-Ex-1	227,861	227,861	0	1,104
BEJ-Tes-RS-Ex-2 BEJ-Tes-SP-Ex-1	395,871	349,871	46,000	1,404
BEJ-Tes-RS-Rh-1	640,734	640,734	0	2,812
SIL-Bou-RS-Rh-1 SIL-Bou-SP-Ex-1	227,999	181,999	46,000	858
SIL-Bou-RS-Rh-2	212,115	212,115	0	1,048
SIL-Bou-RS-Rh-3	306,576	306,576	0	1,929
SIL-Bou-RS-Rh-4	321,833	321,833	0	2,025
SIL-Sil-RS-Rh-1	158,976	158,976	0	720
SIL-Sil-RS-Rh-2	666,816	666,816	0	3,020
SIL-Sil-RS-Rh-3	140,093	140,093	0	634
SIL-Sil-RS-Rh-4	173,328	173,328	0	785
SIL-Kri-RS-Ex-1	2,484,544	2,484,544	0	12,171
JEN-Fer-RS-Rh-1	687,651	687,651	0	3,159
JEN-Fer-RS-Ex-1 JEN-Fer-SP-Ex-1	527,204	469,704	57,500	3,136
JEN-Gha-RS-Rh-1	965,200	965,200	0	4,064
JEN-Gha-RS-Ex-1 JEN-Gha-SP-Ex-1	517,041	459,541	57,500	3,113
JEN-Gha-RS-Ex-2	246,977	246,977	0	1,518
JEN-Jen-RS-Rh-1 JEN-Jen-SP-Rh-1	1,482,047	1,337,306	144,741	5,861
JEN-Jen-RS-Ex-1 JEN-Jen-SP-Ex-1	594,941	537,441	57,500	3,456
JEN-Jen-RS-Rh-2 JEN-Jen-SP-Rh-2	1,480,841	1,413,743	67,098	5,770
JEN-Jen-RS-Rh-3	1,795,049	1,795,049	0	8,752
JEN-Jen-SP-Rh-3	2,448,057	2,187,027	261,031	2,600
JEN-Jen-SP-Rh-4	68,195	39,445	28,750	100
JEN-Tab-RS-Rh-1	614,100	614,100	0	2,586
JEN-Tab-RS-Ex-1 JEN-Tab-SP-Rh-1	820,328	791,578	28,750	5,577
JEN-Tab-RS-Ex-2 JEN-Tab-SP-Ex-1 JEN-Tab-SP-Ex-2	1,567,266	1,452,266	115,000	9,413
JEN-Tab-RS-Ex-3	654,896	654,896	0	4,555
JEN-Bss-RS-Ex-1 JEN-Bss-SP-Ex-1	629,375	571,875	57,500	4,033
KEF-Dah-RS-Rh-3	1,269,407	1,269,407	0	5,294
KEF-Dah-RS-Ex-1	43,108	43,108	0	230
KEF-Dah-SP-Rh-1	14,375	0	14,375	0
KEF-Kef-RS-Rh-1	630,660	630,660	0	1,960
KEF-Kef-RS-Rh-2	116,748	116,748	0	470
KEF-Kef-RS-Rh-3	237,728	237,728	0	1,390
KEF-Kef-RS-Rh-4	171,396	171,396	0	690
KEF-Kef-RS-Rh-5	85,836	85,836	0	430
KEF-Kef-RS-Rh-6	389,988	389,988	0	1,570
KEF-Kef-RS-Rh-7	201,204	201,204	0	810
KEF-Kef-RS-Ex-1 KEF-Kef-SP-Ex-1	579,025	521,525	57,500	2,500

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
KEF-Kef-SP-Rh-1	195,960	138,460	57,500	530
KEF-Kef-SP-Rh-2	181,427	89,344	92,082	250
KEF-Taj-RS-Rh-1	728,640	728,640	0	3,200
KEF-Taj-RS-Rh-2	366,597	366,597	0	1,610
KEF-Taj-RS-Rh-3	958,617	958,617	0	4,210
KEF-Taj-RS-Ex-1	37,375	37,375	0	250
KEF-Taj-RS-Ex-2 KEF-Taj-SP-Ex-1	216,775	159,275	57,500	900
KEF-Taj-RS-Ex-3	122,590	122,590	0	820
KEF-Taj-SP-Rh-1	5,750	5,750	0	0
SFA-Chi-RS-Ex-1	1,387,780	1,387,780	0	10,330
SFA-Chi-RS-Ex-2	579,244	579,244	0	4,180
SFA-Chi-RS-Ex-3	610,788	610,788	0	4,640
SFA-Chi-RS-Rh-1	988,625	988,625	0	4,003
SFA-Sae-RS-Ex-1	364,452	364,452	0	2,630
SFA-Sae-RS-Ex-2	526,585	526,585	0	3,800
SFA-Sae-RS-Ex-3	2,447,927	2,447,927	0	17,665
SFA-Sae-RS-Rh-1	874,506	874,506	0	3,480
SFA-Sak-RS-Ex-1	5,985,756	5,985,756	0	43,210
SFA-Sak-RS-Ex-2	8,170,365	8,170,365	0	57,930
SFA-Sak-RS-Ex-3	2,995,992	2,995,992	0	21,620
SFA-Sak-RS-Rh-1	2,664,276	2,664,276	0	6,607
SFA-Ain-RS-Ex-1	717,686	717,686	0	5,210
SFA-Ain-RS-Ex-2	1,342,769	1,342,769	0	9,150
SFA-Ain-RS-Ex-3	2,108,928	2,108,928	0	14,380
SFA-Ain-RS-Ex-4	2,369,144	2,369,144	0	16,150
SFA-Gre-RS-Ex-1	1,645,133	1,645,133	0	11,220
SFA-Gre-RS-Ex-2	2,955,960	2,955,960	0	20,160
SFA-Gre-RS-Ex-3	3,051,496	3,051,496	0	20,810
SFA-Gre-RS-Ex-4	2,974,636	2,974,636	0	20,832
SFA-Gre-RS-Ex-5	1,943,011	1,943,011	0	13,250
SFA-Sfs-RS-Ex-1 SFA-Sfs-SP-Ex-1	1,256,718	1,199,218	57,500	7,616
SFA-Sfs-RS-Ex-2	661,940	661,940	0	4,110
SFA-Sfs-RS-Ex-3	538,367	538,367	0	3,220
SFA-Sfs-RS-Rh-1	854,880	854,880	0	4,545
SFA-Sfs-RS-Rh-2	1,184,436	1,184,436	0	6,310
SFA-Sfs-RS-Rh-3	3,073,881	3,073,881	0	17,775
SFA-Sfs-RS-Rh-4	446,168	446,168	0	2,045
SFA-Sfs-RS-Rh-5	1,038,073	1,038,073	0	4,930
SFA-Sfv-RS-Ex-1	570,193	570,193	0	3,490
SFA-Sfv-RS-Ex-2	322,529	322,529	0	1,970
SFA-Sfv-RS-Ex-3	1,220,679	1,220,679	0	7,470
SFA-Sfv-RS-Ex-4	583,349	583,349	0	3,570
SFA-Sfv-RS-Ex-5 SFA-Sfv-RS-Rh-6 SFA-Sfv-SP-Ex-1	8,089,803	8,043,803	46,000	48,983
SFA-Sfv-RS-Ex-6	754,377	754,377	0	4,610
SFA-Sfv-RS-Ex-7	173,742	173,742	0	1,060
SFA-Sfv-RS-Rh-1	6,732,638	6,732,638	0	6,515
SFA-Sfv-RS-Rh-2	921,726	921,726	0	4,135
SFA-Sfv-RS-Rh-3	330,434	330,434	0	1,330
SFA-Sfv-RS-Rh-4	1,023,052	1,023,052	0	4,132

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
SFA-Sfv-RS-Rh-5	3,620,806	3,620,806	0	14,865
SFA-Sfv-SP-Rh-1	306,349	122,738	183,610	2
SFA-Sfv-SP-Rh-2	196,102	67,184	128,918	200
SFA-Tyn-RS-Ex-1	247,572	247,572	0	1,560
SFA-Tyn-RS-Ex-2 SFA-Tyn-SP-Ex-1	2,891,198	2,833,698	57,500	17,867
SFA-Aga-RS-Ex-1 SFA-Aga-RS-Ex-2 SFA-Aga-SP-Ex-1	1,381,400	1,323,900	57,500	8,095
SFA-Hen-RS-Ex-1	1,208,938	1,208,938	0	7,500
SFA-Hen-RS-Ex-2	729,963	729,963	0	4,500
SFA-Jeb-RS-Ex-1	766,993	766,993	0	4,300
SFA-Jeb-RS-Ex-2	1,018,958	1,018,958	0	5,700
SFA-Mah-RS-Ex-1 SFA-Mah-SP-Ex-1	1,856,582	1,799,082	57,500	9,610
SFA-Mah-RS-Ex-2	1,824,245	1,824,245	0	10,940
SFA-Mah-RS-Rh-1	126,349	126,349	0	605
SFA-Mah-SP-Rh-1	103,843	69,343	34,500	386
KAS-Kas-RS-Rh-1	2,147,970	2,147,970	0	3,910
KAS-Kas-RS-Rh-2	251,160	251,160	0	1,450
KAS-Kas-RS-Rh-3	423,163	423,163	0	2,000
KAS-Kas-RS-Rh-4	523,738	523,738	0	2,122
KAS-Kas-RS-Rh-5	188,122	188,122	0	930
KAS-Kas-RS-Rh-7	289,690	289,690	0	1,137
KAS-Kas-RS-Rh-8	706,560	706,560	0	3,600
KAS-Kas-RS-Rh-9	917,645	917,645	0	4,208
KAS-Kas-RS-Rh-10	634,358	634,358	0	2,164
KAS-Kas-RS-Rh-11	1,005,634	1,005,634	0	4,406
KAS-Kas-RS-Ex-1	355,190	355,190	0	2,586
KAS-Kas-RS-Ex-3	534,658	534,658	0	3,352
KAS-Kas-RS-Ex-4	293,888	293,888	0	2,583
KAS-Kas-RS-Ex-5	307,573	307,573	0	2,723
KAS-Kas-RS-Ex-6	264,989	264,989	0	2,005
KAS-Sbe-RS-Rh-1	87,975	87,975	0	750
KAS-Sbe-RS-Rh-2	250,884	250,884	0	1,015
KAS-Sbe-RS-Rh-3	535,440	535,440	0	2,400
KAS-Sbe-RS-Rh-4	138,000	138,000	0	300
KAS-Sbe-RS-Ex-1	36,225	36,225	0	300
KAS-Sbe-RS-Ex-2	278,990	278,990	0	1,960
KAS-Tel-RS-Ex-1 KAS-Tel-SP-Ex-1 KAS-Tel-SP-Ex-2	2,858,613	2,743,613	115,000	12,665
KAS-Fei-RS-Ex-1 KAS-Fei-SP-Ex-1 KAS-Fei-SP-Ex-2	3,490,627	3,375,627	115,000	22,962
SID-Sid-RS-Rh-1	792,510	792,510	0	4,046
SID-Sid-RS-Rh-2	400,711	400,711	0	1,857
SID-Sid-RS-Rh-3	108,944	108,944	0	495
SID-Sid-RS-Rh-4	198,772	198,772	0	588
SID-Sid-RS-Rh-5	956,230	956,230	0	4,961
SID-Sid-RS-Rh-7 SID-Sid-RS-Ex-5 SID-Sid-RS-Ex-6	781,796	781,796	0	4,650

Table II.1.9 - Bond Interventions costs (3/3)
Investment costs and lenght summary

Intervention code	Investment costs			Total lenght (network and rising mains)
	Total cost	Cost for Civil Works	Cost for Equipment	
	(TND)	(TND)	(TND)	(m)
SID-Sid-RS-Rh-8	141,154	141,154	0	617
SID-Sid-RS-Rh-9	112,596	112,596	0	448
SID-Sid-RS-Rh-10	25,968	25,968	0	117
SID-Sid-RS-Ex-1	204,993	204,993	0	1,678
SID-Sid-RS-Ex-2	266,185	266,185	0	1,989
SID-Sid-RS-Ex-3	388,115	388,115	0	3,500
SID-Sid-RS-Ex-4 SID-Sid-SP-Ex-1	277,007	219,507	57,500	1,299
KEB-Keb-RS-Rh-1	1,681,944	1,681,944	0	7,115
KEB-Keb-RS-Ex-1	285,545	285,545	0	1,700
KEB-Keb-SP-Rh-1	296,611	188,854	107,757	750
KEB-Keb-SP-Rh-2	146,480	54,930	91,550	0
KEB-Keb-SP-Ex-1	191,383	133,883	57,500	810
KEB-Ken-RS-Ex-1 KEB-Ken-SP-Ex-1	1,671,123	1,613,623	57,500	10,160
KEB-Ken-RS-Ex-2 KEB-Ken-SP-Ex-2	2,320,601	2,242,410	78,191	13,053
KEB-Ken-RS-Ex-3 KEB-Ken-SP-Ex-3	1,228,488	1,170,988	57,500	6,390
KEB-Ken-RS-Ex-4 KEB-Ken-SP-Ex-4	1,594,719	1,537,219	57,500	9,765
KEB-Kes-RS-Ex-1 KEB-Kes-RS-Ex-2 KEB-Kes-SP-Ex-1 KEB-Kes-SP-Ex-2	3,633,540	3,501,948	131,592	22,945
KEB-Dou-RS-Rh-1	793,908	793,908	0	2,451
KEB-Dou-RS-Ex-1 KEB-Dou-SP-Ex-1	1,082,685	1,025,185	57,500	5,823
KEB-Dos-RS-Ex-1 KEB-Dos-SP-Ex-1	2,230,196	2,172,696	57,500	17,319
KEB-Gol-RS-Ex-1	387,109	387,109	0	3,065
KEB-Sou-RS-Ex-1 KEB-Sou-SP-Ex-1 KEB-Sou-SP-Ex-2 KEB-Sou-SP-Ex-3 KEB-Sou-SP-Ex-4 KEB-Sou-SP-Ex-5	7,081,368	6,751,219	330,149	34,990
KEB-Jem-RS-Ex-1 KEB-Jem-SP-Ex-1	3,345,872	3,291,946	53,926	22,850

Table II.1.10
Summary of characteristics of network interventions by Governorate

Governorate	Number of towns	Gravity networks				Rising mains			Pumping Stations		
		Laterals	Rehabilitation	Extension	Total	Rehabilitation	Extension	Total	Rehabilitation	Extension	Total
		(un.)	(km)	(km)	(km)	(km)	(km)	(km)	(no.)	(no.)	(no.)
Béja	6	4,217	38.3	7.2	45.5	0.1	0.8	1.0	1	5	6
Bizerte	9	8,540	70.7	14.7	85.5	6.8	2.8	9.6	8	7	15
Jendouba	5	4,040	28.7	32.9	61.7	1.4	4.7	6.0	5	6	11
Kasserine	4	5,885	30.4	48.7	79.1	0.0	2.4	2.4	0	4	4
Kebili	8	10,013	9.6	121.0	130.6	0.8	27.9	28.6	2	15	17
Kef	3	2,140	20.6	5.0	25.6	0.8	0.8	1.6	4	2	6
Sfax	12	27,886	73.8	454.5	528.3	1.6	5.4	6.9	3	5	8
Sidi Bouzid	1	1,472	15.1	9.8	24.9	0.9	0.4	1.3	0	1	1
Siliana	3	1,834	20.0	3.2	23.2	0.0	0.0	0.0	0	1	1
Zaghouan	3	6,285	61.5	4.2	65.7	0.0	2.7	2.7	0	4	4
Total	**54**	**72,312**	**368.6**	**701.3**	**1,069.9**	**12.3**	**47.8**	**60.1**	**23**	**50**	**73**

Table II.1.11
Summary of characteristics of network interventions by Town

Governorate	Town	Gravity networks				Rising mains			Pumping Stations		
		Lateral	Rehabili-tation	Extension	Total	Rehabili-tation	Extension	Total	Rehabili-tation	Extension	Total
		(un.)	(km)	(km)	(km)	(km)	(km)	(km)	(no.)	(no.)	(no.)
BEJ	Bej	1,561	16.0	1.0	17.0	0.0	0.0	0.0	0	0	0
BEJ	Maa	10	0.0	0.0	0.0	0.0	0.0	0.0	0	1	1
BEJ	Med	392	2.9	0.7	3.6	0.1	0.0	0.1	1	0	1
BEJ	Nef	263	0.1	4.1	4.2	0.0	0.2	0.2	0	2	2
BEJ	Teb	1,476	14.7	0.8	15.5	0.0	0.6	0.6	0	1	1
BEJ	Tes	515	4.6	0.7	5.3	0.0	0.0	0.0	0	1	1
BIZ	Abd	345	3.4	0.0	3.4	1.0	0.0	1.0	1	0	1
BIZ	Ali	195	2.0	0.0	2.0	0.0	0.0	0.0	0	0	0
BIZ	Biz	3,595	22.6	6.9	29.5	0.0	0.6	0.6	0	1	1
BIZ	Jam	320	3.2	0.0	3.2	2.7	0.9	3.6	1	1	2
BIZ	Mat	0	0.2	0.4	0.6	2.2	0.0	2.2	2	0	2
BIZ	Men	2,150	21.6	2.1	23.7	0.0	0.6	0.6	0	1	1
BIZ	Raf	435	6.5	0.0	6.5	0.0	0.3	0.3	0	2	2
BIZ	Tin	775	4.1	5.4	9.5	0.9	0.4	1.3	1	2	3
BIZ	Zar	725	7.2	0.0	7.2	0.0	0.0	0.0	3	0	3
JEN	Bss	201	0.0	3.0	3.0	0.0	1.0	1.0	0	1	1
JEN	Fer	435	1.3	4.2	5.5	0.0	0.8	0.8	0	1	1
JEN	Gha	686	4.1	4.1	8.1	0.0	0.6	0.6	0	1	1
JEN	Jen	2,089	20.8	4.7	25.4	0.6	0.5	1.1	4	1	5
JEN	Tab	629	2.6	17.0	19.6	0.7	1.8	2.5	1	2	3
KAS	Fei	990	0.0	21.2	21.2	0.0	1.8	1.8	0	2	2
KAS	Kas	2,970	25.9	13.2	39.2	0.0	0.0	0.0	0	0	0
KAS	Sbe	735	4.5	2.3	6.7	0.0	0.0	0.0	0	0	0
KAS	Tel	1,190	0.0	12.0	12.0	0.0	0.7	0.7	0	2	2
KEB	Dos	600	0.0	12.6	12.6	0.0	4.7	4.7	0	1	1
KEB	Dou	750	2.5	5.6	8.1	0.0	0.2	0.2	0	1	1
KEB	Gol	150	0.0	3.1	3.1	0.0	0.0	0.0	0	0	0
KEB	Jem	700	0.0	11.6	11.6	0.0	11.2	11.2	0	1	1
KEB	Keb	1,000	7.1	1.7	8.8	0.8	0.8	1.6	2	1	3
KEB	Ken	2,813	0.0	32.6	32.6	0.0	6.8	6.8	0	4	4
KEB	Kes	1,000	0.0	21.3	21.3	0.0	1.7	1.7	0	2	2
KEB	Sou	3,000	0.0	32.5	32.5	0.0	2.5	2.5	0	5	5
KEF	Dah	554	5.3	0.2	5.5	0.0	0.0	0.0	1	0	1
KEF	Kef	544	6.3	3.4	9.6	0.8	0.2	1.0	2	1	3
KEF	Taj	1,042	9.0	1.4	10.4	0.0	0.6	0.6	1	1	2
SFA	Aga	330	0.0	8.0	8.0	0.0	0.1	0.1	0	1	1
SFA	Ain	2,150	0.0	44.9	44.9	0.0	0.0	0.0	0	0	0
SFA	Chi	1,193	4.0	19.2	23.2	0.0	0.0	0.0	0	0	0
SFA	Gre	4,141	0.0	86.3	86.3	0.0	0.0	0.0	0	0	0
SFA	Hen	570	0.0	12.0	12.0	0.0	0.0	0.0	0	0	0
SFA	Jeb	470	0.0	10.0	10.0	0.0	0.0	0.0	0	0	0
SFA	Mah	1,092	2.4	18.2	20.7	0.4	0.5	0.9	1	1	2
SFA	Sae	1,365	3.3	24.1	27.4	0.2	0.0	0.2	0	0	0
SFA	Sak	6,244	6.6	122.8	129.4	0.0	0.0	0.0	0	0	0
SFA	Sfs	2,283	28.2	18.3	46.5	0.0	0.1	0.1	0	1	1
SFA	Sfv	7,205	29.2	71.6	100.8	1.0	4.6	5.6	2	1	3
SFA	Tyn	844	0.0	19.2	19.2	0.0	0.2	0.2	0	1	1
SID	Sid	1,472	15.1	9.8	24.9	0.9	0.4	1.3	0	1	1
SIL	Bou	390	5.9	0.0	5.9	0.0	0.0	0.0	0	1	1
SIL	Kri	927	9.0	3.2	12.2	0.0	0.0	0.0	0	0	0
SIL	Sil	516	5.2	0.0	5.2	0.0	0.0	0.0	0	0	0
ZAG	Fah	1,740	17.9	0.0	17.9	0.0	0.0	0.0	0	0	0
ZAG	Ham	1,915	22.3	0.2	22.4	0.0	2.1	2.1	0	1	1
ZAG	Zag	2,630	21.4	4.1	25.4	0.0	0.6	0.6	0	3	3
Total	**54**	**72,312**	**368.6**	**701.3**	**1,069.9**	**12.3**	**47.8**	**60.1**	**23**	**50**	**73**

Table II.1.12
Summary of investement costs by Governorate

Governorate	Rehabilitation					Extension					Total Rehabilitation + Extension
	Gravity networks	Rising mains	Pumping stations		Total	Gravity networks	Rising mains	Pumping stations		Total	
	Civil works	Civil works	Civil works	Eq. and electrical installations		Civil works	Civil works	Civil works	Eq. and electrical installations		
	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
Beja	9,693,332	15,732	5,750	28,750	9,743,564	1,151,426	96,796	241,500	241,500	1,731,222	11,474,785
Bizerte	17,712,542	1,554,501	489,093	1,886,866	21,643,002	2,592,043	390,770	425,423	609,385	4,017,621	25,660,622
Jendouba	7,916,923	250,832	315,751	530,369	9,013,875	4,833,657	561,636	345,000	345,000	6,085,293	15,099,168
Kasserine	8,100,338	0	0	0	8,100,338	7,664,173	296,579	230,000	230,000	8,420,753	16,521,090
Kebili	2,475,852	124,200	119,584	199,307	2,918,944	20,008,785	3,287,413	817,573	938,859	25,052,629	27,971,573
Kef	4,986,161	168,360	65,194	163,957	5,383,672	855,698	83,835	115,000	115,000	1,169,533	6,553,205
Sfax	17,179,046	1,223,612	171,191	347,028	18,920,877	68,509,439	4,779,021	276,000	276,000	73,840,460	92,761,337
Sidi Bouzid	3,086,107	137,834	0	0	3,223,941	1,278,693	37,346	57,500	57,500	1,431,039	4,654,980
Siliana	4,133,692	0	0	0	4,133,692	466,157	431	46,000	46,000	558,588	4,692,280
Zaghouan	15,548,633	0	0	0	15,548,633	725,679	424,638	232,897	597,596	1,980,809	17,529,441
Total	**90,832,624**	**3,475,072**	**1,166,563**	**3,156,279**	**98,630,537**	**108,085,749**	**9,958,465**	**2,786,893**	**3,456,839**	**124,287,946**	**222,918,483**

Table II.1.13
Summary of investement costs by Town

Governorate	Town	Rehabilitation					Extension					Total Rehabilitation + Extension
		Gravity networks	Rising mains	Pumping stations		Total	Gravity networks	Rising mains	Pumping stations		Total	
		Civil works	Civil works	Civil works	Equipment and electrical installations		Civil works	Civil works	Civil works	Equipment and electrical installations		
		(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
BEJ	Bej	3,957,440	0	0	0	3,957,440	170,304	0	0	0	170,304	4,127,743
BEJ	Maa	9,315	0	0	0	9,315	0	736	57,500	57,500	115,736	125,051
BEJ	Med	744,308	15,732	5,750	28,750	794,540	78,608	0	0	0	78,608	873,148
BEJ	Nef	28,118	0	0	0	28,118	621,891	20,332	92,000	92,000	826,223	854,341
BEJ	Teb	3,915,453	0	0	0	3,915,453	150,351	72,232	46,000	46,000	314,583	4,230,036
BEJ	Tes	1,038,698	0	0	0	1,038,698	130,272	3,496	46,000	46,000	225,768	1,264,466
BIZ	Abd	820,169	251,850	98,233	294,699	1,464,951	0	0	0	0	0	1,464,951
BIZ	Ali	450,743	0	0	0	450,743	0	0	0	0	0	450,743
BIZ	Biz	5,591,208	0	0	0	5,591,208	1,300,305	77,625	57,500	57,500	1,492,930	7,084,138
BIZ	Jam	891,998	679,995	92,529	277,588	1,942,110	0	143,233	81,132	121,698	346,063	2,288,172
BIZ	Mat	57,270	462,990	64,679	262,400	847,339	77,050	0	0	0	77,050	924,389
BIZ	Men	5,691,293	0	0	0	5,691,293	342,125	77,625	30,772	46,158	496,680	6,187,973
BIZ	Raf	1,361,370	0	0	0	1,361,370	0	37,088	150,297	225,445	412,829	1,774,199
BIZ	Tin	914,940	159,666	53,106	159,319	1,287,031	872,563	55,200	105,722	158,584	1,192,069	2,479,100
BIZ	Zar	1,933,553	0	180,545	892,861	3,006,958	0	0	0	0	0	3,006,958
JEN	Bss	0	0	0	0	0	401,847	112,528	57,500	57,500	629,375	629,375
JEN	Fer	308,375	0	0	0	308,375	708,652	82,827	57,500	57,500	906,479	1,214,854
JEN	Gha	965,200	0	0	0	965,200	592,323	56,695	57,500	57,500	764,018	1,729,218
JEN	Jen	6,029,248	117,359	315,751	501,619	6,963,977	748,621	41,532	57,500	57,500	905,154	7,869,131
JEN	Tab	614,100	133,474	0	28,750	776,324	2,382,214	268,054	115,000	115,000	2,880,267	3,656,591
KAS	Fei	0	0	0	0	0	3,078,760	181,867	115,000	115,000	3,490,627	3,490,627
KAS	Kas	7,088,039	0	0	0	7,088,039	1,756,298	0	0	0	1,756,298	8,844,337
KAS	Sbe	1,012,299	0	0	0	1,012,299	315,215	0	0	0	315,215	1,327,514
KAS	Tel	0	0	0	0	0	2,513,900	114,713	115,000	115,000	2,858,613	2,858,613
KEB	Dos	0	0	0	0	0	1,708,959	406,238	57,500	57,500	2,230,196	2,230,196
KEB	Dou	793,908	0	0	0	793,908	952,591	15,094	57,500	57,500	1,082,685	1,876,593
KEB	Gol	0	0	0	0	0	387,109	0	0	0	387,109	387,109
KEB	Jem	0	0	0	0	0	1,835,400	1,420,595	35,951	53,926	3,345,872	3,345,872
KEB	Keb	1,681,944	124,200	119,584	199,307	2,125,036	285,545	76,383	57,500	57,500	476,928	2,601,964
KEB	Ken	0	0	0	0	0	5,498,272	841,340	224,627	250,691	6,814,930	6,814,930
KEB	Kes	0	0	0	0	0	3,200,887	194,166	106,895	131,592	3,633,540	3,633,540
KEB	Sou	0	0	0	0	0	6,140,023	333,598	277,599	330,149	7,081,368	7,081,368
KEF	Dah	1,269,407	0	0	14,375	1,283,782	43,108	0	0	0	43,108	1,326,890
KEF	Kef	1,662,900	168,360	59,444	149,582	2,040,287	603,290	31,395	57,500	57,500	749,685	2,789,972
KEF	Taj	2,053,854	0	5,750	0	2,059,604	209,300	52,440	57,500	57,500	376,740	2,436,344
SFA	Aga	0	0	0	0	0	1,260,291	6,109	57,500	57,500	1,381,400	1,381,400
SFA	Ain	0	0	0	0	0	6,538,526	0	0	0	6,538,526	6,538,526
SFA	Chi	988,625	0	0	0	988,625	2,577,811	0	0	0	2,577,811	3,566,436
SFA	Gre	0	0	0	0	0	12,570,236	0	0	0	12,570,236	12,570,236
SFA	Hen	0	0	0	0	0	1,938,900	0	0	0	1,938,900	1,938,900
SFA	Jeb	0	0	0	0	0	1,785,950	0	0	0	1,785,950	1,785,950
SFA	Mah	592,617	46,343	23,000	34,500	696,460	3,041,520	58,039	57,500	57,500	3,214,559	3,911,019

Table II.1.13
Summary of investement costs by Town

Governorate	Town	Rehabilitation					Extension					Total Rehabilitation + Extension
		Gravity networks	Rising mains	Pumping stations		Total	Gravity networks	Rising mains	Pumping stations		Total	
		Civil works	Civil works	Civil works	Equipment and electrical installations		Civil works	Civil works	Civil works	Equipment and electrical installations		
		(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)	(TND)
SFA	Sae	846,561	27,945	0	0	874,506	3,338,965	0	0	0	3,338,965	4,213,471
SFA	Sak	2,664,276	0	0	0	2,664,276	17,152,112	0	0	0	17,152,112	19,816,388
SFA	Sfs	5,205,408	0	0	0	5,205,408	3,726,236	7,818	57,500	57,500	3,849,053	9,054,462
SFA	Sfv	6,881,558	1,149,324	148,191	312,528	8,491,601	11,582,498	4,679,679	46,000	46,000	16,354,178	24,845,779
SFA	Tyn	0	0	0	0	0	2,996,394	27,376	57,500	57,500	3,138,770	3,138,770
SID	Sid	3,086,107	137,834	0	0	3,223,941	1,278,693	37,346	57,500	57,500	1,431,039	4,654,980
SIL	Bou	976,092	0	0	0	976,092	0	431	46,000	46,000	92,431	1,068,523
SIL	Kri	2,018,387	0	0	0	2,018,387	466,157	0	0	0	466,157	2,484,544
SIL	Sil	1,139,213	0	0	0	1,139,213	0	0	0	0	0	1,139,213
ZAG	Fah	4,741,335	0	0	0	4,741,335	101,200	0	0	0	101,200	4,842,535
ZAG	Ham	5,900,018	0	0	0	5,900,018	25,271	353,798	98,625	447,938	925,631	6,825,649
ZAG	Zag	4,907,280	0	0	0	4,907,280	599,208	70,840	134,272	149,658	953,978	5,861,258
Total		**90,832,624**	**3,475,072**	**1,166,563**	**3,156,279**	**98,630,537**	**108,085,749**	**9,958,465**	**2,786,893**	**3,456,839**	**124,287,946**	**222,918,483**

Annex-II.2

Drawings

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
	GOUVERNORATE DE ZAGHOUAN		
01.DE-U.001(00)	Plan Géneral (General plan) Gouvernorate de Zaghouan (Zaghouan Governorate)	2011-08-02	341001U0010.DWG
01.DE-U.002(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Zaghouan - El Fahs Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U0020.DWG
01.DE-U.003(00)	Solution proposée (Proposed solution) Zaghouan - El Fahs Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U0020.DWG
01.DE-U.004(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Zaghouan - Zaghouan Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U0040.DWG
01.DE-U.005(00)	Solution proposée (Proposed solution) Zaghouan - Zaghouan Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U0040.DWG
01.DE-U.006(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Zaghouan - Hammam Zriba Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U0061.DWG
01.DE-U.007(01)	Solution proposée (Proposed solution) Zaghouan - Hammam Zriba Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U0061.DWG
	GOUVERNORATE DE BEJA		
01.DE-U.100(00)	Plan Géneral (General plan) Gouvernorate de Béja (Beja Governorate)	2011-08-02	341001U1000.DWG
01.DE-U.101(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Nefza Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1010.DWG
01.DE-U.102(00)	Solution proposée (Proposed solution) Béja - Nefza Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1010.DWG
01.DE-U.103(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Teboursouk Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1030.DWG
01.DE-U.104(00)	Solution proposée (Proposed solution) Béja - Teboursouk Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1030.DWG
01.DE-U.105(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Testour Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1050.DWG
01.DE-U.106(00)	Solution proposée (Proposed solution) Béja - Testour Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1050.DWG
01.DE-U.107(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Medjez El Bab Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1070.DWG

Client:
Client:

JAPAN INTERNATIONAL COOPERATION AGENCY

Marché:
Contract:

Etude Préliminaire pour le project d'amélioration de l'environement des eaux et des eaux usées des villes rurales de la République de Tunisie.

Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.

Stade du Marché:
Stage of Contract:

ETUDE PRELIMINAIRE
Preparatory Survey

LISTE DES DESSINS
Drawings List

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A.
A Subsidiary of INGÉROP
INGÉROSEC

Dessin Drawn	RSO		Nº. de la Liste: List Number: 01.LD-001(01)
Verifié Verified	TJC		
Approuvé Approved	PCM		Nº. du Marché: Contract number.: PCM 3410
Date Date	2011-12-16	Fich.: File: 341001LD0011.DWG	Feuille: Sheet: 1/10

Table II.2.1 - Drawings list

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.108(00)	Solution proposée (Proposed solution) Béja - Medjez El Bab Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1070.DWG
01.DE-U.109(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Maaghoula Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1090.DWG
01.DE-U.110(00)	Solution proposée (Proposed solution) Béja - Maaghoula Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U1090.DWG
01.DE-U.111(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Béja - Béja Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U1111.DWG
01.DE-U.112(01)	Solution proposée (Proposed solution) Béja - Béja Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U1111.DWG
	GOUVERNORATE DE SILIANA		
01.DE-U.200(00)	Plan Géneral (General plan) Gouvernorate de Siliana (Siliana Governorate)	2011-08-08	341001U2000.DWG
01.DE-U.201(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Siliana - Siliana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2010.DWG
01.DE-U.202(00)	Solution proposée (Proposed solution) Siliana - Siliana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2010.DWG
01.DE-U.203(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Siliana - Krib Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2030.DWG
01.DE-U.204(00)	Solution proposée (Proposed solution) Siliana - Krib Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2030.DWG
01.DE-U.205(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Siliana - Bouarada Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2050.DWG
01.DE-U.206(00)	Solution proposée (Proposed solution) Siliana - Bouarada Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-08	341001U2050.DWG
	GOUVERNORATE DE JENDOUBA		
01.DE-U.300(00)	Plan Géneral (General plan) Gouvernorate de Jendouba (Jendouba Governorate)	2011-06-29	341001U3000.DWG
01.DE-U.301(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-06-29	341001U3010.DWG
01.DE-U.302(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-06-29	341001U3010.DWG
01.DE-U.303(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-06-29	341001U3010.DWG
01.DE-U.304(01)	Solution proposée (Proposed solution) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-12-16	341001U3011.DWG
01.DE-U.305(00)	Solution proposée (Proposed solution) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-06-29	341001U3010.DWG
01.DE-U.306(00)	Solution proposée (Proposed solution) Jendouba - Tabarka Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-06-29	341001U3010.DWG
01.DE-U.307(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Fernana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3070.DWG

LISTE DES DESSINS List of Drawings	**Nº. de la Liste:** List Number:	01.LD-001(01)	Feuille: 2/10 Sheet:
	Nº. du Marché: Contract N.:	PCM 3410	**Fichier:** 341001LD0011.DWG File:

Table II.2.1 - Drawings list

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.308(00)	Solution proposée (Proposed solution) Jendouba - Fernana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3070.DWG
01.DE-U.309(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Bousselem Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3090.DWG
01.DE-U.310(00)	Solution proposée (Proposed solution) Jendouba - Bousselem Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3090.DWG
01.DE-U.311(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Jendouba Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-06-29	341001U3110.DWG
01.DE-U.312(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Jendouba Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-06-29	341001U3110.DWG
01.DE-U.313(00)	Solution proposée (Proposed solution) Jendouba - Jendouba Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-06-29	341001U3110.DWG
01.DE-U.314(00)	Solution proposée (Proposed solution) Jendouba - Jendouba Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-06-29	341001U3110.DWG
01.DE-U.315(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Jendouba - Ghardimaou Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3150.DWG
01.DE-U.316(00)	Solution proposée (Proposed solution) Jendouba - Ghardimaou Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-06-29	341001U3150.DWG
	GOUVERNORATE DE KEF		
01.DE-U.400(00)	Plan Général (General plan) Gouvernorate de Kef (Kef Gouvernorate)	2011-08-02	341001U4000.DWG
01.DE-U.401(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kef - Kef Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U4010.DWG
01.DE-U.402(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kef - Kef Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-12-16	341001U4011.DWG
01.DE-U.403(00)	Solution proposée (Proposed solution) Kef - Kef Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U4010.DWG
01.DE-U.404(00)	Solution proposée (Proposed solution) Kef - Kef Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U4010.DWG
01.DE-U.405(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kef - Dahmani Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U4050.DWG
01.DE-U.406(00)	Solution proposée (Proposed solution) Kef - Dahmani Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U4050.DWG
01.DE-U.407(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kef - Tajerouine Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U4070.DWG
01.DE-U.408(00)	Solution proposée (Proposed solution) Kef - Tajerouine Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U4070.DWG
	GOUVERNORATE DE BIZERTE		
01.DE-U.500(00)	Plan Géneral (General plan) Gouvernorate de Bizerte (Bizerte Governorate)	2011-08-02	341001U5000.DWG
01.DE-U.501(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-02	341001U5010.DWG

LISTE DES DESSINS List of Drawings	Nº. de la Liste: List Number:	01.LD-001(01)	Feuille: Sheet: 3/10
	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.502(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-02	341001U5010.DWG
01.DE-U.503(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U5010.DWG
01.DE-U.504(00)	Solution proposée (Proposed solution) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-02	341001U5010.DWG
01.DE-U.505(00)	Solution proposée (Proposed solution) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-02	341001U5010.DWG
01.DE-U.506(00)	Solution proposée (Proposed solution) Bizerte - Menzel Bourguiba / Tinja Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U5010.DWG
01.DE-U.507(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 1/4	2011-08-02	341001U5070.DWG
01.DE-U.508(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 2/4	2011-08-02	341001U5070.DWG
01.DE-U.509(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 3/4	2011-08-02	341001U5070.DWG
01.DE-U.510(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 4/4	2011-12-16	341001U5071.DWG
01.DE-U.511(00)	Solution proposée (Proposed solution) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 1/4	2011-08-02	341001U5070.DWG
01.DE-U.512(00)	Solution proposée (Proposed solution) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 2/4	2011-08-02	341001U5070.DWG
01.DE-U.51300)	Solution proposée (Proposed solution) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 3/4	2011-08-02	341001U5070.DWG
01.DE-U.514(01)	Solution proposée (Proposed solution) Bizerte - Bizerte Schemá Général (Key Plan) - Feuille (Sheet) 4/4	2011-12-16	341001U5071.DWG
01.DE-U.515(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Alia Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5150.DWG
01.DE-U.516(00)	Solution proposée (Proposed solution) Bizerte - Alia Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5150.DWG
01.DE-U.517(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Raf Raf Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5170.DWG
01.DE-U.518(00)	Solution proposée (Proposed solution) Bizerte - Raf Raf Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5170.DWG
01.DE-U.519(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Menzel Abderahmen Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5190.DWG
01.DE-U.520(00)	Solution proposée (Proposed solution) Bizerte - Menzel Abderahmen Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U5190.DWG
01.DE-U.521(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Menzel Jamil Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U5211.DWG
01.DE-U.522(01)	Solution proposée (Proposed solution) Bizerte - Menzel Jamil Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-12-16	341001U5211.DWG
01.DE-U.523(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-02	341001U5230.DWG
01.DE-U.524(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-02	341001U5230.DWG
01.DE-U.525(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U5230.DWG

LISTE DES DESSINS	Nº. de la Liste: List Number:	01.LD-001(01)	Feuille: Sheet: 4/10
List of Drawings	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Table II.2.1 - Drawings list

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.526(00)	Solution proposée (Proposed solution) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-02	341001U5230.DWG
01.DE-U.527(00)	Solution proposée (Proposed solution) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-02	341001U5230.DWG
01.DE-U.528(00)	Solution proposée (Proposed solution) Bizerte - Mateur Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U5230.DWG
	GOUVERNORATE DE KEBILI		
01.DE-U.600(00)	Plan Général (General plan) Gouvernorate de Kebili (Kebili Gouvernorate)	2011-08-02	341001U6000.DWG
01.DE-U.601(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6010.DWG
01.DE-U.602(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6010.DWG
01.DE-U.603(00)	Solution proposée (Proposed solution) Kebili - Kebili Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6010.DWG
01.DE-U.604(00)	Solution proposée (Proposed solution) Kebili - Kebili Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6010.DWG
01.DE-U.605(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 1/4	2011-08-02	341001U6050.DWG
01.DE-U.606(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 2/4	2011-08-02	341001U6050.DWG
01.DE-U.607(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 3/4	2011-08-02	341001U6050.DWG
01.DE-U.608(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 4/4	2011-08-02	341001U6050.DWG
01.DE-U.609(00)	Solution proposée (Proposed solution) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 1/4	2011-08-02	341001U6050.DWG
01.DE-U.610(00)	Solution proposée (Proposed solution) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 2/4	2011-08-02	341001U6050.DWG
01.DE-U.611(00)	Solution proposée (Proposed solution) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 3/4	2011-08-02	341001U6050.DWG
01.DE-U.612(00)	Solution proposée (Proposed solution) Kebili - Kebili Nord Schemá Général (Key Plan) - Feuille (Sheet) 4/4	2011-08-02	341001U6050.DWG
01.DE-U.613(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Sud Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6130.DWG
01.DE-U.614(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Kebili Sud Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6130.DWG
01.DE-U.615(00)	Solution proposée (Proposed solution) Kebili - Kebili Sud Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6130.DWG
01.DE-U.616(00)	Solution proposée (Proposed solution) Kebili - Kebili Sud Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6130.DWG
01.DE-U.617(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Douz Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U6170.DWG
01.DE-U.618(00)	Solution proposée (Proposed solution) Kebili - Douz Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U6170.DWG

LISTE DES DESSINS List of Drawings	Nº. de la Liste: List Number:	01.LD-001(01)	Feuille: Sheet: 5/10
	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Table II.2.1 - Drawings list

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.619(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Douz Sud Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6170.DWG
01.DE-U.620(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Douz Sud Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6170.DWG
01.DE-U.621(00)	Solution proposée (Proposed solution) Kebili - Douz Sud Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6170.DWG
01.DE-U.622(00)	Solution proposée (Proposed solution) Kebili - Douz Sud Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6170.DWG
01.DE-U.623(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-12-16	341001U6171.DWG
01.DE-U.624(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-12-16	341001U6171.DWG
01.DE-U.625(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U6170.DWG
01.DE-U.626(01)	Solution proposée (Proposed solution) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-12-16	341001U6171.DWG
01.DE-U.627(01)	Solution proposée (Proposed solution) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-12-16	341001U6171.DWG
01.DE-U.628(00)	Solution proposée (Proposed solution) Kebili - Jemna Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-02	341001U6170.DWG
01.DE-U.629(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - El Golaa Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U6170.DWG
01.DE-U.630(00)	Solution proposée (Proposed solution) Kebili - El Golaa Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-02	341001U6170.DWG
01.DE-U.631(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Souk Lahad Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6310.DWG
01.DE-U.632(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kebili - Souk Lahad Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6310.DWG
01.DE-U.633(00)	Solution proposée (Proposed solution) Kebili - Souk Lahad Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-02	341001U6310.DWG
01.DE-U.634(00)	Solution proposée (Proposed solution) Kebili - Souk Lahad Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-02	341001U6310.DWG
	GOUVERNORATE DE SFAX		
01.DE-U.700(00)	Gouvernorate de Sfax (Sfax Governorate) Plan Géneral (General plan)	2011-08-14	341001U7000.DWG
01.DE-U.701(00)	Grande Ville de Sfax (Sfax Métropole) Plan Géneral (General plan)	2011-08-14	341001U7010.DWG
01.DE-U.702(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 1/24	2011-08-14	341001U7020.DWG
01.DE-U.703(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 2/24	2011-12-16	341001U7021.DWG
01.DE-U.704(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 3/24	2011-08-14	341001U7020.DWG
01.DE-U.705(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 4/24	2011-08-14	341001U7020.DWG

LISTE DES DESSINS List of Drawings	**Nº. de la Liste:** List Number:	01.LD-001(01)	Feuille: Sheet: 6/10
	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.706(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 5/24	2011-08-14	341001U7020.DWG
01.DE-U.707(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 6/24	2011-08-14	341001U7020.DWG
01.DE-U.708(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 7/24	2011-12-16	341001U7021.DWG
01.DE-U.709(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 8/24	2011-12-16	341001U7021.DWG
01.DE-U.710(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 9/24	2011-08-14	341001U7020.DWG
01.DE-U.711(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 10/24	2011-08-14	341001U7020.DWG
01.DE-U.712(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 11/24	2011-08-14	341001U7020.DWG
01.DE-U.713(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 12/24	2011-08-14	341001U7020.DWG
01.DE-U.714(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 13/24	2011-08-14	341001U7020.DWG
01.DE-U.715(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 14/24	2011-12-16	341001U7021.DWG
01.DE-U.716(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 15/24	2011-08-14	341001U7020.DWG
01.DE-U.717(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 16/24	2011-12-16	341001U7021.DWG
01.DE-U.718(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 17/24	2011-08-14	341001U7020.DWG
01.DE-U.719(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 18/24	2011-08-14	341001U7020.DWG
01.DE-U.720(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 19/24	2011-08-14	341001U7020.DWG
01.DE-U.721(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 20/24	2011-08-14	341001U7020.DWG
01.DE-U.722(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 21/24	2011-08-14	341001U7020.DWG
01.DE-U.723(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 22/24	2011-08-14	341001U7020.DWG
01.DE-U.724(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 23/24	2011-08-14	341001U7020.DWG
01.DE-U.725(01)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 24/24	2011-12-16	341001U7021.DWG
01.DE-U.726(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 1/24	2011-08-14	341001U7020.DWG
01.DE-U.727(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 2/24	2011-12-16	341001U7021.DWG
01.DE-U.728(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 3/24	2011-12-16	341001U7021.DWG
01.DE-U.729(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 4/24	2011-08-14	341001U7020.DWG

LISTE DES DESSINS List of Drawings	**Nº. de la Liste:** List Number:	01.LD-001(01)	Feuille: Sheet: 7/10
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Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.730(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 5/24	2011-12-16	341001U7021.DWG
01.DE-U.731(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 6/24	2011-08-14	341001U7020.DWG
01.DE-U.732(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 7/24	2011-12-16	341001U7021.DWG
01.DE-U.733(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 8/24	2011-12-16	341001U7021.DWG
01.DE-U.734(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 9/24	2011-08-14	341001U7020.DWG
01.DE-U.735(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 10/24	2011-08-14	341001U7020.DWG
01.DE-U.736(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 11/24	2011-12-16	341001U7021.DWG
01.DE-U.737(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 12/24	2011-12-16	341001U7021.DWG
01.DE-U.738(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 13/24	2011-08-14	341001U7020.DWG
01.DE-U.739(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 14/24	2011-12-16	341001U7021.DWG
01.DE-U.740(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 15/24	2011-08-14	341001U7020.DWG
01.DE-U.741(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 16/24	2011-12-16	341001U7021.DWG
01.DE-U.742(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 17/24	2011-12-16	341001U7021.DWG
01.DE-U.743(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 18/24	2011-08-14	341001U7020.DWG
01.DE-U.744(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 19/24	2011-08-14	341001U7020.DWG
01.DE-U.745(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 20/24	2011-08-14	341001U7020.DWG
01.DE-U.746(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 21/24	2011-08-14	341001U7020.DWG
01.DE-U.747(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 22/24	2011-12-16	341001U7021.DWG
01.DE-U.748(00)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 23/24	2011-08-14	341001U7020.DWG
01.DE-U.749(01)	Solution proposée (Proposed solution) Grande Ville de Sfax (Sfax Métropole) Schemá Général (Key Plan) - Feuille (Sheet) 24/24	2011-12-16	341001U7021.DWG
01.DE-U.750(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sfax - Agareb Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-14	341001U7020.DWG
01.DE-U.751(00)	Solution proposée (Proposed solution) Sfax - Agareb Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-14	341001U7020.DWG
01.DE-U.752(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sfax - Hencha Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-14	341001U7020.DWG
01.DE-U.753(00)	Solution proposée (Proposed solution) Sfax - Hencha Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-14	341001U7020.DWG

LISTE DES DESSINS List of Drawings	**Nº. de la Liste:** List Number:	01.LD-001(01)	Feuille: Sheet: 8/10
	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Table II.2.1 - Drawings list

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-U.754(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sfax - Jebeniana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-14	341001U7540.DWG
01.DE-U.755(00)	Solution proposée (Proposed solution) Sfax - Jebeniana Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-14	341001U7540.DWG
01.DE-U.756(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sfax - Mahres Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-14	341001U7560.DWG
01.DE-U.757(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sfax - Mahres Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-14	341001U7560.DWG
01.DE-U.758(00)	Solution proposée (Proposed solution) Sfax - Mahres Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-14	341001U7560.DWG
01.DE-U.759(00)	Solution proposée (Proposed solution) Sfax - Mahres Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-14	341001U7560.DWG
	GOUVERNORATE DE KASSERINE		
01.DE-U.800(00)	Plan Général (General plan) Gouvernorate de Kasserine (Kasserine Gouvernorate)	2011-08-10	341001U8000.DWG
01.DE-U.801(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-10	341001U8010.DWG
01.DE-U.802(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-10	341001U8010.DWG
01.DE-U.803(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-10	341001U8010.DWG
01.DE-U.804(00)	Solution proposée (Proposed solution) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 1/3	2011-08-10	341001U8010.DWG
01.DE-U.805(00)	Solution proposée (Proposed solution) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 2/3	2011-08-10	341001U8010.DWG
01.DE-U.806(00)	Solution proposée (Proposed solution) Kasserine - Cité Kasserine Schemá Général (Key Plan) - Feuille (Sheet) 3/3	2011-08-10	341001U8010.DWG
01.DE-U.807(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Feriana Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-10	341001U8070.DWG
01.DE-U.808(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Feriana Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-10	341001U8070.DWG
01.DE-U.809(00)	Solution proposée (Proposed solution) Kasserine - Cité Feriana Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-10	341001U8070.DWG
01.DE-U.810(00)	Solution proposée (Proposed solution) Kasserine - Cité Feriana Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-10	341001U8070.DWG
01.DE-U.811(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Thala Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-10	341001U8110.DWG
01.DE-U.812(00)	Solution proposée (Proposed solution) Kasserine - Cité Thala Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-10	341001U8110.DWG
01.DE-U.813(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Kasserine - Cité Sbeitla Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-10	341001U8130.DWG
01.DE-U.814(00)	Solution proposée (Proposed solution) Kasserine - Cité Sbeitla Schemá Général (Key Plan) - Feuille (Sheet) 1/1	2011-08-10	341001U8130.DWG

LISTE DES DESSINS	**Nº. de la Liste:** List Number:	01.LD-001(01)	**Feuille:** Sheet:	9/10
List of Drawings	**Nº. du Marché:** Contract N.:	PCM 3410	**Fichier:** File:	341001LD0011.DWG

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
	GOUVERNORATE DE SIDI BOUZID		
01.DE-U.900(00)	Plan Général (General plan) Gouvernorate de Sidi Bouzid (Sidi bouzid Gouvernorate)	2011-08-10	341001U9000.DWG
01.DE-U.901(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sidi Bouzid Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-10	341001U9010.DWG
01.DE-U.902(00)	Situation actuelle. Caractérisation et diagnostique (Current situation. Characterization and assessment) Sidi Bouzid Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-10	341001U9010.DWG
01.DE-U.903(00)	Solution proposée (Proposed solution) Sidi Bouzid Schemá Général (Key Plan) - Feuille (Sheet) 1/2	2011-08-10	341001U9010.DWG
01.DE-U.904(00)	Solution proposée (Proposed solution) Sidi Bouzid Schemá Général (Key Plan) - Feuille (Sheet) 2/2	2011-08-10	341001U9010.DWG
	TYPES STANDARD DES STATIONS DE POMPAGE (STANDARD TYPES OF PUMPING STATION)		
01.DE-U.950(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP1A	2011-09-09	341001U9500.DWG
01.DE-U.955(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP1B	2011-09-09	341001U9550.DWG
01.DE-U.960(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP2A. Feuille (Sheet) 1/2	2011-09-09	341001U9600.DWG
01.DE-U.961(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP2A. Feuille (Sheet) 2/2	2011-09-09	341001U9610.DWG
01.DE-U.965(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP2B. Feuille (Sheet) 1/2	2011-09-09	341001U9650.DWG
01.DE-U.966(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP2B. Feuille (Sheet) 2/2	2011-09-09	341001U9660.DWG
01.DE-U.970(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP3A	2011-09-09	341001U9700.DWG
01.DE-U.975(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP3B. Feuille (Sheet) 1/2	2011-09-09	341001U9750.DWG
01.DE-U.976(00)	Types standard des stations de pompage (Standard types of pumping station). Type SP3B. Feuille (Sheet) 2/2	2011-09-09	341001U9756.DWG

LISTE DES DESSINS List of Drawings	Nº. de la Liste: List Number:	01.LD-001(01)	Feuille: Sheet: 10/10
	Nº. du Marché: Contract N.:	PCM 3410	Fichier: File: 341001LD0011.DWG

Table II.2.1 - Drawings list

Annex-II.2.2 – Networks drawings

Refer to A3 format separate volume

Annex-III

WASTE WATER TREATMENT PLANT

Annex-III.1

Summary tables

ANNEX III.1

Table III.1.1 - Summary table. Current situation

CHARACTERISTICS	BEJA WWTP	MEDJEZ EL-BAB WWTP	TABARKA WWTP	JENDOUBA WWTP	SILIANA WWTP
LOCATION					
Governorate	Béja	Béja			
Commune	Béja	Medjez El-Bab	Tabarka	Jendouba	Siliana
FIRST OPERATION YEAR	1994	1994	1993	1994	2000
DESIGN DATA					
Population	144 000 hab.eq.	40 000 hab.eq.	45 000 hab.eq.	70 000 hab.eq.	51 000 hab.eq.
Average daily inflow	14 000 m^3/day	4 500 m^3/day	5 500 m^3/day	8 000 m^3/day	4 500 m^3/day
Maximum inflow		540 m^3/hr		900 m^3/hr	
Organic load (BOD_5)	7 800 kg/day	2 000 kg/day	1 825 kg/day	3 400 kg/day	4 530 kg/day
RECEIVING WATER					
Name	Béja River	Medjerda River	Kébir River	Medjerda River	Siliana River
Sensitive environment downstream	Sidi Salem Lake	-	Plages de Tabarka	Réservoir de Sidi Salem	-
Wastewater reuse	✓	✓	✓	✓	✓
QUALITY OF TREATED WASTEWATERS					
BOD_5	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2
COD	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2
TSS	30 mg/L	30 mg/L	30 mg/L	30 mg/L	30 mg/L
N_T	11 mg/L N	11 mg/L N	11 mg/L N	11 mg/L N	11 mg/L N
Nitrate	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3
P_T	0,05 mg/L P	0,05 mg/L P	0,05 mg/L P	0,05 mg/L P	0,05 mg/L P
Fecal coliforms	2 000/100 mL	2 000/100 mL	2 000/100 mL	2 000/100 mL	2 000/100 mL
Fecal streptococus	1 000/100 mL	1 000/100 mL	1 000/100 mL	1 000/100 mL	1 000/100 mL
Salmonelles	Absence	Absence	Absence	Absence	Absence
Choleric vibrions	Absence	Absence	Absence	Absence	Absence
EXISTING TREATMENT LINE					
Liquid phase	Screening, grit and grease removal; Biological treatment in 4 lines with 5 aerated tanks each; Chemical removal of Phosphorus; Sludge sedimentation in 4 secondary clarifiers	Raw wastewater elevation by 2 Archimedes screws; Screening, grit and grease removal; Biological treatment in 2 lines with 3 aerated tanks each; Chemical removal of Phosphorus; Sludge sedimentation in 2 secondary clarifiers	Screening, grit and grease removal; Biological treatment in 1 line with 4 aerated tanks; Sludge sedimentation in 1 secondary clarifier	Raw wastewater elevation by 3 Archimedes screws; Screening, grit and grease removal; Biological treatment in 2 lines with 6 aerated tanks each; Chemical removal of Phosphorus; Sludge sedimentation in 2 secondary clarifiers	Screening, grit and grease removal; Biological treatment in 2 lines with 1 aerated tanks each (oxidation ditch); Chemical removal of Phosphorus; Sludge sedimentation in 2 secondary clarifiers
Solid phase	Thickening; Dewatering in sludge drying beds	Thickening; Dewatering in sludge drying beds	Thickening; Dewatering in sludge drying beds	Thickening; Dewatering in sludge drying beds	Thickening; Dewatering in sludge drying beds
Odour phase	-	-	-	-	-
MAIN LIMITATIONS IDENTIFIED					
Industrial wastewater treatment management	✓				
Aeration of biological reactors	✓	✓	✓	✓	
Agitation of biological reactors	✓	✓			✓
Foaming in aerated tanks			✓		
Presence of salinity in wastewater			✓		
Biological nitrogen removal dificulty	✓	✓	✓	✓	
Wastewater desinfection	✓	✓	✓	✓	✓
Sludge recycling	✓	✓	✓	✓	
Excess activated sludge purge	✓	✓	✓	✓	
Sludge dewatering	✓	✓	✓		✓
AVAILABLE LAND FOR EXPANSION					
Availability	✓	✓	-	✓	✓
Area	2 ha	2,5 ha	-	2 ha	-

ANNEX III.1

Table III.1.2 - Summary table. Proposed solution

CHARACTERISTICS	BEJA WWTP	MEDJEZ EL-BAB WWTP	TABARKA WWTP	JENDOUBA WWTP	SILIANA WWTP
DESIGN DATA					
Population	143,586 p.e.	39,592 p.e.	44,509 p.e.	104,988 p.e.	37,650 p.e.
Average daily inflow	12,994 m^3/d	5,429 m^3/d	8,510 m^3/d	11,703 m^3/d	4,086 m^3/d
Maximum inflow	1,054 m^3/h	540 m^3/h	700 m^3/h	900 m^3/h	562 m^3/h
Organic load (BOD_5)	8,615 kg/d	2,376 kg/d	2,671 kg/d	4,200 kg/d	1,694 kg/d
QUALITY OF TREATED WASTEWATERS					
BOD_5	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2	30 mg/L O_2
COD	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2	90 mg/L O_2
TSS	30 mg/L	30 mg/L	30 mg/L	30 mg/L	30 mg/L
N_T	11 mg/L N	11 mg/L N	11 mg/L N	11 mg/L N	11 mg/L N
Nitrate	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3	50 mg/L NO_3
P_T	0.05 mg/L P	0.05 mg/L P	0.05 mg/L P	0.05 mg/L P	0.05 mg/L P
Fecal coliforms	2,000/100 mL	2,000/100 mL	2,000/100 mL	2,000/100 mL	2,000/100 mL
Fecal streptococus	1,000/100 mL	1,000/100 mL	1,000/100 mL	1,000/100 mL	1,000/100 mL
Salmonelles	Absence	Absence	Absence	Absence	Absence
Choleric vibrions	Absence	Absence	Absence	Absence	Absence
STUDIED TREATMENT SOLUTIONS					
Solution 1	Activated sludge in extended aeration mode				
Solution 2	Activated sludge in conventional aeration mode with mesophilic anaerobic digestion of sludge and energy recovery (combined heat and power technology) of biogas				
Solution 3	Anaerobic digestion pre-treatment of the yeast wastewater; Wastewater treatment by activated sludge in extended aeration mode	Activated sludge in conventional aeration mode with mesophilic anaerobic digestion of sludge and combustion of excess biogas			
PROPOSED TREATMENT SOLUTION					
Solution 1					
Liquid phase	Grit retention in tank; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 5 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 5 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 2 Archimedes screws; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 2 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 2 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 3 Archimedes screws; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 2 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 2 lines; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation
Solid phase	Thickening; Thickened sludge storage; Dewatering in centrifuge	Thickening; Thickened sludge storage; Dewatering in centrifuge	Thickening; Thickened sludge storage; Dewatering in centrifuge	Thickening; Thickened sludge storage; Dewatering in centrifuge	Thickening; Thickened sludge storage; Dewatering in centrifuge
Odour phase	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter
Solution 2					
Liquid phase	Grit retention in tank; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 2 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 4 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 2 Archimedes screws; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 3 Archimedes screws; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation
Solid phase	Thickening; Mesophilic anaerobic digestion with energy recovery of biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion with energy recovery of biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion with energy recovery of biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion with energy recovery of biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion with energy recovery of biogas; Dewatering by centrifuge
Odour phase	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter
Solution 3					
Liquid phase	Anaerobic digestion of yeast wastewater in UASB reactor; Grit retention in tank; Screening, grit and grease removal; Biological treatment (activated sludge in extended aeration mode) in 4 lines aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 4 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 2 Archimedes screws; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Raw wastewater elevation by 3 Archimedes screws; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1 line aerated by diffused air; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation	Grit retention in tank; Screening, grit and grease removal; Primary treatment; Biological treatment (activated sludge in conventional aeration mode) in 1; Biological removal of nitrogen; Chemical precipitation of phosphorus; Sludge sedimentation in 2 secondary clarifiers; Filtration and desinfection by UV radiation
Solid phase	Thickening; Thickened sludge storage; Dewatering in centrifuge	Thickening; Mesophilic anaerobic digestion and incineration of the excess biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion and incineration of the excess biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion and incineration of the excess biogas; Dewatering by centrifuge	Thickening; Mesophilic anaerobic digestion and incineration of the excess biogas; Dewatering by centrifuge
Odour phase	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter	Odour treatment in biofilter
SUGGESTED INTERVENTIONS FOR THE 3 SOLUTIONS	1. Installation of final desinfection by UV radiation; 2. Mechanical dewatering of sludge;				
	3. Replacement of surface aerators by diffused aeration system; 4. Installation of an internal nitrate recirculation; 5. Construction of pumping stations regarding sludge recirculation and sludge purge.				-

Annex-III.2

Beja WwTP tables

WWTP of BEJA

Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Screening
No.	2 Mechanical operated

ILLUSTRATIVE PICTURES


REMARKS	- The screening devices present generalized stainless steel corrosion. - The flow partition gate presents the painting somewhat degraded and blemished on the floor column and on the gear box with hand wheel. - The screenings conveyer is working in reasonably conditions. The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to state that the equipment seems to be painted to avoid corrosion increase. - Dedicated silos were installed to store the industrial effluent, which would then be gradually fed to the treatment. However, the system clogged almost immediately after entering service and is currently out of service. - The flow measurement is at the station entrance.
RECOMMENDATIONS	- The screening devices are working however need an overhaul and should be replaced. - The painted parts should be rehabilitated applying a new coat of paint after the proper surface preparation (trailer, gates, etc…).

WWTP of BEJA

Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Grit and grease removal
No.	One scraper working on two channels chamber with aeration, bottom grit pumping and surface grease removal.

ILLUSTRATIVE PICTURES

Grit & grease chamber

Scraper bridge

Scraper bridge wheel

Scraper bridge motorization

Side guiding wheel

REMARKS	- The scraper bridge suffers from some deviation on the longitudinal movement. - The scraper bridge wheels present a high level of degradation. Nevertheless, is possible to see that has taken place some replacement of these components. - The grit classifier on the scraper is not working properly and presents some degraded painting and corrosion. - In general, the scraper bridge presents a high level of corrosion and aging.
RECOMMENDATIONS	- The scraper is working however needs an overhaul and should be replaced. - The grit classifier operation needs to be improved, possibly with the installation of dedicated equipment for this function.

Table III.2.1.1.1 – Electromechanical equipment

ILLUSTRATIVE PICTURES
  Blowers / Grease pumping circuit

REMARKS	- The pump and the aeration for the grease removal are installed in an underground chamber. This chamber is not in adequate environmental conditions, it presents a humid atmosphere and water spilled on the floor. - The blowers for the aeration are working; nevertheless they present a state of some degradation, being dirty and dusty. - The grease pumping circuit is out of service. It was reported to the consultant team that it clogged immediately after the start of the installation and was abandoned ever since. The grease is sucked directly from the grease pit on the surface.
RECOMMENDATIONS	- The blowers are working however need an overhaul and their replacement should eventually be considered on a medium term. - In case ONAS considers the present solution for grease removal inadequate, as terms of an easy and practical exploitation activity, it will be necessary to improve the grease removal circuit considering a revision of pipes diameters and pump selection.

WWTP of BEJA

Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – aeration tanks
No.	20 Aeration tanks with surface aerators

ILLUSTRATIVE PICTURES

REMARKS	- Generally, the surface aerators present a reasonably state taking in consideration their working conditions. - The submersible agitators which were outside of the tanks were in a fairly good state. - The gates under service generally presented rusted frames, but fairly reasonable state for the respective floor column and hand wheel. - The operation of the surface aerators it is not automated, as in an automation system, which integrates a measurement of the dissolved oxygen in the tank.
RECOMMENDATIONS	- The aeration method selected for these tank dimensions is not adequate for the oxygen needs of the process. The tanks are too deep for this type of aeration equipment. Therefore, it is proposed the replacement of these aerators by a diffused aeration mode. - The oldest and most damaged gates should be replaced. - Automation should be increased specially focusing on integration between oxygen probes in the aeration tanks and the aeration working hours.

Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – secondary clarifier
No.	4

ILLUSTRATIVE PICTURES

scraper bridge

Sludge extraction channel

Sludge extraction pump

REMARKS	- Generally, the scrapers present a reasonably state taking in consideration their working conditions. - The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase. - It was reported to the consultant team that the sludge scrapers should be renewed due to high wear.
RECOMMENDATIONS	- The scrapers are working however need an overhaul and should be considered the replacement of the bottom sludge scrapers.

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Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – sludge recycling management
No.	2 Flow partition valves

ILLUSTRATIVE PICTURES
 Sludge flow partition valve  Valve electrically actuated

REMARKS	- The valves present a high level of deterioration, particularly the electric actuator. Nevertheless it is possible to state that the electric actuator seems to be painted to avoid corrosion increase. - The valve is electrically actuated but the sludge flow partition is manually operated; it is hard to manage the treatment process in terms of sludge purging and sludge recycling, caused by the old-fashioned free surface flow recycling system and its inefficient flow measurement.
RECOMMENDATIONS	- The solution to be proposed intends to build a dedicated station pump for sludge recycling and sludge purging including flow measurement and pumps with frequency variation in order to improve the management of the treatment process.

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Table III.2.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Sludge thickener
No.	2 Sludge thickeners (square plan) with mechanical scraper bridge

ILLUSTRATIVE PICTURES

Thickener scraper bridge

REMARKS	- The bridges painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase.
RECOMMENDATIONS	- The scrapers are working however needs an overhaul.

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Table III.2.1.1.2 – Civil Engineering

UNIT/OPERATION	Civil Engineering
No.	

ILLUSTRATIVE PICTURES	
Photo 1: Aeration Tanks	Photo 2: Aeration Tanks
	
Photo 3: Supports of the scraper	Photo 4: Supports of the scraper
	
Photo 5: Expansion joints (Aeration Tanks)	
	

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Table III.2.1.1.2 – Civil Engineering

SPECIFICATIONS	This wastewater treatment plant was built in 1994. It is conceived to allow a theoretical flow of 14,000 m^3/day. The practical average flow is equal to 7500 m^3/day. The reinforced concrete works are half-buried. The foundations are superficial or probably on coarse concrete (to be confirmed by the documents of Civil Engineering, checking/verification file that is not available to this date).
DIAGNOSIS	- The reinforced concrete works do not present any apparent degradations or cracking. (Photo 1, 2) - On the other hand, we could observe a concrete break-up at the head of screens receiving the supports of the scraper. This can be due to the absence of steels of surface (hoops) sufficient to receive the localized forces as well as steels for the balance of corners. These degradations are localized and the remainders of structures do not present important degradations or cracking. (Photo 3, 4) - The works are separated by the expansion joints which are found in a worn state, if not degraded condition. The joints are provided with by water-stops. (Photo 5)

BEJA WWTP

Table III.2.2.1 - Design data

Design Data

Parameter	Unit	Year	
		2011	**2029**
<u>Population served</u>			
Domestic population	p.e	65,560	78,419
Industrial population	p.e	42,500	65,167
Touristic population	p.e	0	0
Total population	p.e	108,060	143,586
Peak Factors			
Domestic peak factor	-	1.53	1.53
Industrial peak factor	-	2.0	2.0
Touristic peak factor	-	-	-
Return factor			
Domestic return factor	%	80%	80%
Industrial and touristic return factor	%	90%	90%
Per capita flow and load factors			
Per capita water consumption			
domestic	L/capita/d	113	148
industrial	L/capita/d	-	-
touristic	L/capita/d	-	-
Domestic and touristic per capita loading factors			
TSS	g/capita/d	90	90
BOD_5	g/capita/d	60	60
COD	g/capita/d	120	120
Total Nitrogen (TN)	g/capita/d	8	8
Total Phosphorus (TP)	g/capita/d	1.5	1.5
Fecal Coliforms	CFU/capita/d	1.00E+11	1.00E+11

<u>Wastewater inflows</u>			
Domestic average daily flow (Adf)	m^3/d	5,944	9,294
	L/s	68.8	107.6
Domestic peak flow	m^3/h	380	591
	L/s	105.4	164.2
Industrial average daily flow	m^3/d	300	3,700
	L/s	3.5	42.8
Industrial peak flow	m^3/h	25	308
	L/s	6.9	85.6
Touristic average daily flow	m^3/d	0	0
	L/s	0	0
Touristic peak flow	m^3/h	0	0
	L/s	0	0

Table III.2.2.1 - Design data

Parameter	Unit	Year	
		2011	2029
Infiltration flow (40% Adf)	L/s	27.5	43.0
Total average daily flow (domestic + industrial + touristic)	m^3/d	6,244	12,994
Total average daily flow (domestic + industrial + touristic) + infiltratior	m^3/d	8,621	16,712
Total peak flow	m^3/h	504	1 054
	L/s	139.9	292.8
Loadings			
Domestic + touristic			
TSS	kg/d	5,900	7,058
BOD_5	kg/d	3,934	4,705
COD	kg/d	7,867	9,410
TN	kg/d	524	627
TP	kg/d	98	118
Fecal Coliforms	CFU/d	6.56E+15	7.84E+15
Industrial			
TSS	kg/d	1,470	2,830
BOD_5	kg/d	2,550	3,910
COD	kg/d	4,500	7,900
TN	kg/d	37	455
TP	kg/d	3	37
Total			
TSS	kg/d	7,370	9,888
BOD_5	kg/d	6,484	8,615
COD	kg/d	12,367	17,310
TN	kg/d	561	1,082
TP	kg/d	101	155
Fecal Coliforms	CFU/d	6.56E+15	7.84E+15
Concentrations (1)			
Domestic + touristic			
TSS	mg/L	993	759
BOD_5	mg/L	662	506
COD	mg/L	1,324	1,012
TN	mg/L	88	67
TP	mg/L	17	13
Fecal Coliforms	CFU/100mL	1.10E+08	8.44E+07

Table III.2.2.1 - Design data

Parameter	Unit	Year	
		2011	2029
Industrial			
TSS	mg/L	4,900	765
BOD_5	mg/L	8,500	1,057
COD	mg/L	15,000	2,135
TN	mg/L	123	123
TP	mg/L	10	10
Total without infiltration			
TSS	mg/L	1,180	761
BOD_5	mg/L	1,038	663
COD	mg/L	1,981	1,332
TN	mg/L	90	83
TP	mg/L	16	12
Fecal Coliforms	CFU/100mL	1.05E+08	6.03E+07

(1) Without infiltration

Table III.2.3.1 - Yeast wastewater anaerobic pre-treatment (Solution 3)

Operation: Yeast wastewaters anaerobic pretreatment in UASB

Parameter	Unit	Year 2011	Year 2029
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	300	300
Peak flow (Pf)	m^3/h	38	38
	L/s	10	10
Design flow	m^3/h	25	25
	L/s	7	7
BOD_5 loading	kg/d	2,550	2,550
COD loading	kg/d	4,500	4,500
TSS loading	kg/d	1,470	1,470
pH	-	6.5 - 7.5	6.5 - 7.5
Design Criteria			
Number of UASB	un	1	
Type	-	circular plant	
Operational average temperature	ºC	25	
Retention time (Pf)	h	10 - 14	
Charge volumique	kg $COD/m^3/d$	4 - 15	
Charge hydraulique	$m^3/m^2/h$	1	
Peripheral depth	m	6	
Inclinaison de fund	º	45 - 60	
BOD_5 loading reduction	%	75	
COD loading reduction	%	75	
TSS loading reduction	%	75	
Sludge production	kg TSS/kg COD rer	0.6	
Produced sludge concentration	kg/m^3	30	
Design results			
Equalization basin			
Volume	m^3	100	
Depth	m	3	
Surface	m^2	40	
Side length	m	6	
UASB			
Minimum volume	m^3	94	
Adopted useful volume (criteria- retention time)	m^3	350	
Adopted total volume	m^3	438	
Surface	m^2	58	
Diameter	m	8.6	
Total depth	m	7.5	

Table III.2.3.1 - Yeast wastewater anaerobic pre-treatment (Solution 3)

Parameter	Unit	Year	
		2011	**2029**
Operational conditions			
Retention time			
Adf	h	28	28
Pf	h	14	14
Volumic loading	kg DCO/m^3/d	10	10
Hydraulic loading rate	$m^3/m^2/h$	0.4	0.4
Sludge production	kg/d	2,025	2,025
	m^3/d	67.5	67.5

Table III.2.3.2 - Preliminary Treatment

Operation: Grit retention

Parameter	Unit	Year 2011	Year 2029
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	6,244	12,994
Maximum design flow (Mdf)	m^3/h	504	1,054
	L/s	140	293
Design Criteria			
Number of basins	un	2	
Type	-	circular plant	
Retention time (Mdf)	min	15	
Peripheral depth	m	3	
Design Results			
Total volume	m^3	264	
Unitary volume	m^3	132	
Unitary surface area	m^2	44	
Diameter	m	7.5	
Existing infrastructures operational conditions			
Retention time			
Adf	min	61	29
Mdf	min	31	15

Table III.2.3.3 - Preliminary Treatment

Operation: Screening

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Mechanical Screening			
Number of screening devices working in parallel	un.	2	
Screen bars spacing	mm	12	
Bars thickness	mm	10	
Channel width	m	2 x 1,4	
Channel depth	m	-	
Unitary power of screening devices	kW/un.	-	
Maximum flow capacity	m^3/h	4,680	
Manually Cleaned Coarse Screens			
Number of coarse screens	un.	-	
Screen bars spacing	mm	-	
Channel width	m	-	
Channel depth	m	-	
Influent wastewater flows and loads			
Population	p.e.	65,560	78,419
Average daily flow (Adf)	m^3/d	6,244	12,994
Peak flow (Pf)	m^3/h	504	1,054
	L/s	140	293
Design Criteria			
Velocity through clean bar screen	m/s	1.2	
Approach velocity	m/s	0.3 - 0.9	
Maximum degree of clogging	%	50	
Channel depth	m	-	
Kirschmer factor	-	1.94	
Channel freeboard	m	≥ 0,3	
Volume of screenings per capita	L/capita/year	6	
Bulk density of removed screenings	kg/L	0.95	
Screenings removal rate	%	95	

Table III.2.3.3 - Preliminary Treatment

Parameter	Unit	Year	
		2011	2029
Existing infrastructures operational conditions			
Effective open area (Pf)	m^2	0.23	0.49
Total cross-sectional area	m^2	0.43	0.89
Height of the liquid upstream	m	0.15	0.32
Approach velocity (Pf)	m/s	0.33	0.33
Approach velocity (Adf)	m/s	0.08	0.08
Channel freeboard	m	-	-
Headloss through clogged screens	mm WC	7.1	7.1
Screenings characteristics and quantities			
Volumetric flow of incoming wet screenings	L/d	1,078	1,289
Mass flow of incoming wet screenings	kg/d	1,024	1,225
Volumetric flow of removed wet screenings	kg/d	973	1,163
Mass flow of removed wet screenings	m^3/d	1.02	1.22

Table III.2.3.4 - Preliminary Treatment

Operation: Grit and Grease Removal

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of chambers	un.	1 x 2 basins	
Type	-	rectangular plant, aerated	
Length	m	15	
Total width	m	10	
Depth	m	4	
Grit cross-sectional area	m^2	18	
Grease cross-sectional area	m^2	8	
Total surface	m^2	150	
Total wet volume	m^3	390	
Number of grit pumps	un.	2	
Unitary power of grit pumps	kW/un.	-	
Number of air compressors	un.	2+1	
Unitary power of air compressors	kW/un.	-	
Number of scraper bridges	un.	1	
Unitary power of scraper bridges	kW/un.	-	
Influent wastewater flows and loads			
Population	p.e.	65,560	78,419
Average daily flow (Adf)	m^3/d	6,244	12,994
Peak flow (Pf)	m^3/h	504	1,054
	L/s	140	293
Design Criteria			
Retention time (Pf)	min	10 - 15	
Hydraulic loading rate (Pf)	$m^3/m^2/h$	10 - 15	
Specific air flow	L/s/m	5	
	m^3 air/h/m^3	1,5	
Headloss in the aeration system	% submergence	30	
Volume of grit per capita	L/capita/year	7	
Grit removal rate	%	95	
Volume of oil & grease per capita	g/capita/d	31	
Bulk density of removed oil & grease	kg/L	0.8	
Oil & grease removal rate	%	30	

Table III.2.3.4 - Preliminary Treatment

Parameter		Unit	Year 2011	Year 2029
Existing infrastructures operational conditions				
Retention time				
	Adf	min	90	43
	Pf	min	46	22
Hydraulic loading rate				
	Adf	$m^3/m^2/h$	1.7	3.6
	Pf	$m^3/m^2/h$	3.4	7.0
Volumetric flow of incoming grit		L/d	1,257	1,504
Mass flow of incoming grit		kg/d	1,886	2,256
Volumetric flow of removed grit		kg/d	1,792	2,143
Mass flow of removed grit		m^3/d	478	571
Volumetric flow of grit after classification		m^3/d	1.33	1.59
Mass flow of grit after classification		kg/d	1,593	1,905
Runoff flow		m^3/d	476	570
Mass flow of incoming oil & grease		kg/d	1,356	2,823
Volumetric flow of incoming oil & grease		L/d	1,696	3,529
Mass flow of removed oil & grease		kg/d	407	847
Volumetric flow of removed oil & grease		m^3/d	51	106

Table III.2.4.1 - Primary settling (Solution 2)

Operation: Primary settling

Parameter	Unit	Year	
		2011	2029
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	7,114	14,133
Peak flow (Pf)	m^3/h	504	1,054
	L/s	140	293
TSS Concentration	kg/m^3	1.2	0.8
TSS loading	kg/d	8,441	11,298
Design Criteria			
Hydraulic loading rate (Adf)	$m^3/m^2/h$	< 1,5	
Retention time (Pf)	h	> 2	
Depth	m	3.5	
SS concentration in primary sludge	kg/m^3	20	
SS removal rate	%	50	
Weir loading rate (Pf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of primary sludge pumps	un.	2	
Design results			
Number of primary settling tanks	un	2	
Type	-	rectangular plant	
Total surface	m^2	703	
Unitary surface	m^2	351	
Length	m	27	
Unitary width	m	13	
Unitary volume	m^3	1,230	
Total volume	m^3	2,460	
Scum pumps capacity	m^3/h	18	
Unitary capacity of primary sludge pumps	m^3/h	18	
Operational conditions			
Hydraulic loading rate (Pf)	$m^3/m^2/h$	0.7	1.5
Retention time (MPf)	h	4.9	2.3
Primary sludge production	kg/d	4,220	5,649
	m^3/d	211.0	282.5
Scum production	kg/d	71	141
	m^3/d	0.07	0.15

Table III.2.5.1 - Biological Treatment (Solution 1)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	4	
Number of basins in series in each treatment line	un.	5	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	4,322	
Liquid depth	m	4.6	
Each basin volume	m^3	994	
Total volume	m^3	19,880	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 55 (max)	
Influent wastewater flows and loads			
Population	p.e.	108,060	143,586
Average daily flow (Adf)	m^3/d	7,121	14,139
Peak flow (Pf)	m^3/h	504	1,054
TSS	kg/d	8,144	10,898
BOD	kg/d	6,870	9,120
TN	kg/d	604	1,139
TP	kg/d	110	166
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
N_T	mg/L	-	11
P_T	mg/L	-	0.05

Table III.2.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.75	
MLVSS in aeration tanks	kg/m^3	3.38	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.03	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	5	
Number of nitrate recycle pumps	un.	6 (3 x 1+1)	
Number of sludge recycle pumps	un.	25	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peaking factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	5+1	

Table III.2.5.1 - Biological Treatment (Solution 1)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.10	0.14
Fv		kgBOD/m^3/d	0.35	0.46
Design results				
Total biological volume		m^3	-	24,850
Anoxic zone volume		m^3	-	4,966
Anoxic volume / Total volume		-	-	0.20
Aerobic zone volume		m^3	-	19,884
Number of operating lines		un.	-	5
Unitary capacity of air compressors		m^3/h	-	3,933
Unitary capacity of nitrate recycle pumps		m^3/h	-	353
Unitary capacity of sludge recycle pumps (4)		m^3/h	-	353
Unitary capacity of sludge recycle pumps (2)		m^3/h	-	177
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.08	0.11
Fv		kgBOD/m^3/d	0.28	0.37
Sludge age		d	26	20
Minimum sludge recycle		m^3/d	3,560	7,069
Maximum sludge recycle		m^3/d	10,681	21,208
Minimum nitrate recycle		m^3/d	7,121	14,139
Maximum nitrate recycle		m^3/d	21,363	42,416
Required oxygen for oxidation of organic material		kgO_2/d	3,661	4,783
	peak	kgO_2/h	168	219
Required oxygen for endogenous metabolism		kgO_2/d	5,032	5,032
	peak	kgO_2/h	210	210
Required oxygen for oxidation of ammonia		kgO_2/d	1,137	2,966
	peak	kgO_2/h	71	185
Oxygen recovered from denitrification		kgO_2/d	396	1,108
	peak	kgO_2/h	25	69
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	9,435	11,673
	peak	kgO_2/h	424	545
SOR - Standard Oxygen Requirement		kgO_2/d	15,459	19,726
	peak	kgO_2/h	644	822
Total air flow required		m^3/d	369,883	471,971
		m^3/h	15,412	19,665

Table III.2.5.2 - Biological Teatment (Solution 2)

Operation: Biological organic matter removal (activated sludge in conventional aeration)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	4	
Number of basins in series in each treatment line	un.	5	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	4,322	
Liquid depth	m	4.6	
Each basin volume	m^3	994	
Total volume	m^3	19 880	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 55 (max)	
Influent wastewater flows and loads			
Population	p.e.	108,060	143,586
Average daily flow (Adf)	m^3/d	6,903	13,850
Peak flow (Pf)	m^3/h	504	1,054
TSS	kg/d	4,220	5,649
BOD	kg/d	5,264	6,990
TN	kg/d	552	1,046
TP	kg/d	98	149
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	kg/d	-	11
TP	kg/d	-	0.05

Table III.2.5.2 - Biological Teatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.2 - 0.5	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.5 - 1.2	
Sludge age	d	8	
MLSS in aeration tanks	kg/m^3	3.5	
MLVSS/ MLSS ratio	-	0.7	
MLVSS in aeration tanks	kg/m^3	2.45	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.075	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	10	
Number of nitrate recycle pumps	un.	2	
Number of sludge recycle pumps	un.	4 (2 x 1+1)	
Aeration system			
a'	kgO/kgBOD	0.50	
b'	kgO/kgMVS/d	0.08	
Peaking factor for BOD removal	-	1.2	
Nitrification peak factor	-	1.8	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	2+1	

Table III.2.5.2 - Biological Teatment (Solution 2)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.11	0.14
Fv		kgBOD/m^3/d	0.26	0.35
Design results				
Total biological volume		m^3	9,940	9,940
Anoxic zone volume		m^3	3,975	3,975
Anoxic volume / Total volume		-	0.40	0.40
Aerobic zone volume		m^3	5,965	5,965
Number of operating lines		un.	2	2
Unitary capacity of air compressors		m^3/h	-	6,045
Unitary capacity of nitrate recycle pumps		m^3/h	-	866
Unitary capacity of sludge recycle pumps		m^3/h	-	433
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.22	0.29
Fv		kgBOD/m^3/d	0.53	0.70
Sludge age		d	10	8
Minimum sludge recycle		m^3/d	3,451	6,925
Maximum sludge recycle		m^3/d	10,354	20,775
Minimum nitrate recycle		m^3/d	6,903	13,850
Maximum nitrate recycle		m^3/d	20,709	41,551
Required oxygen for oxidation of organic material		kgO_2/d	2,529	3,287
	peak	kgO_2/h	126	164
Required oxygen for endogenous metabolism		kgO_2/d	1,948	1,948
	peak	kgO_2/h	81	81
Required oxygen for oxidation of ammonia		kgO_2/d	1,257	3,023
	peak	kgO_2/h	94	227
Oxygen recovered from denitrification		kgO_2/d	433	1,121
	peak	kgO_2/h	33	84
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	5,301	7,137
	peak	kgO_2/h	269	388
SOR - Standard Oxygen Requirement		kgO_2/d	8,416	12,126
	peak	kgO_2/h	351	505
Total air flow required		m^3/d	201,354	290,142
		m^3/h	8,390	12,089

Table III.2.5.3 - Biological Treatment (Solution 3)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	4	
Number of basins in series in each treatment line	un.	5	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	4,322	
Liquid depth	m	4.6	
Each basin volume	m^3	994	
Total volume	m^3	19 880	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 55 (max)	
Influent wastewater flows and loads			
Population	p.e.	108,060	143,586
Average daily flow (Adf)	m^3/d	6,856	13,874
Peak flow (Pf)	m^3/h	504	1,054
TSS	kg/d	6,806	9,561
BOD	kg/d	4,840	7,090
TN	kg/d	564	1,098
TP	kg/d	105	161
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	kg/d	-	11
TP	kg/d	-	0.05

Table III.2.5.3 - Biological Treatment (Solution 3)

Parameter	Unit	Year 2011	Year 2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.75	
MLVSS in aeration tanks	kg/m^3	3.38	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO$_3$/kgMSV/d	0.04	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	4	
Number of nitrate recycle pumps	un.	4 (2 x 1+1)	
Number of sludge recycle pumps	un.	20	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peaking factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	4+1	

Table III.2.5.3 - Biological Treatment (Solution 3)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.07	0.11
Fv		kgBOD/m^3/d	0.24	0.36
Design results				
Total biological volume		m^3	-	19,880
Anoxic zone volume		m^3	-	3,967
Anoxic volume / Total volume		-	-	0.20
Aerobic zone volume		m^3	-	15,913
Number of operating lines		un.	-	4
Unitary capacity of air compressors		m^3/h	-	3,602
Unitary capacity of nitrate recycle pumps		m^3/h	-	434
Unitary capacity of sludge recycle pumps		m^3/h	-	434
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.07	0.11
Fv		kgBOD/m^3/d	0.24	0.36
Sludge age		d	29	20
Minimum sludge recycle		m^3/d	3,428	6,937
Maximum sludge recycle		m^3/d	10,284	20,811
Minimum nitrate recycle		m^3/d	6,856	13,874
Maximum nitrate recycle		m^3/d	20,568	41,622
Required oxygen for oxidation of organic material		kgO_2/d	2,549	3,671
	peak	kgO_2/h	117	168
Required oxygen for endogenous metabolism		kgO_2/d	4,026	4,026
	peak	kgO_2/h	168	168
Required oxygen for oxidation of ammonia		kgO_2/d	1,398	3,227
	peak	kgO_2/h	87	202
Oxygen recovered from denitrification		kgO_2/d	495	1,200
	peak	kgO_2/h	31	75
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	7,477	9,723
	peak	kgO_2/h	341	463
SOR - Standard Oxygen Requirement		kgO_2/d	10,652	14,452
	peak	kgO_2/h	444	602
Total air flow required		m^3/d	254,864	345,784
		m^3/h	10,619	14,408

Table III.2.5.4 - Phosphorus Removal (Solutions 1 and 3)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.0	3.0
Flocculant - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	15	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	43	78
	mg/L	6.0	5.5
Al quantity required	kg/d	129	235
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	1,595	2,899
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	3,191	5,797
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	2.5	4.5
	m^3/year	896	1,628
Dosage tank minimum volume	m^3	-	67
Unitary capacity of dosing pumps	L/h	102	186
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	198	359
Hydroxides	kg/d	286	521
Physico-chemical sludge quantity produced	kg/d	484	880
	m^3/d	60.5	110.0

Table III.2.5.5 - Phosphorus Removal (Solution 2)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.6	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD$_5$	50.6	65.7
Phosphorus in treated effluent	mg/L	0.06	0.04
Al to be dosed	molAl/molP	3.0	3.0
Flocculant - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	15	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	47	82
	mg/L	6.9	5.9
Al quantity required	kg/d	142	247
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	1,756	3,052
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	3,511	6,105
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	2.7	4.7
	m^3/year	986	1,714
Dosage tank minimum volume	m^3	19	19
Unitary capacity of dosing pumps	L/h	113	196
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	217.6	378.4
Hydroxides	kg/d	315.2	548.1
Physico-chemical sludge quantity produced	kg/d	532.9	926.4
	m^3/d	66.6	115.8

Table III.2.5.6 - Biological Treatment (Solution 1)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	4 x 2 basins	
Type	-	rectangular plant	
Length	m	34	
Unitary width	m	7.25	
Depth	m	3.30	
Unitary surface	m^2	493	
Total surface	m^2	1,972	
Unitary volume	m^3	1,627	
Total volume	m^3	6,508	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	2	
Unitary capacity of scum pumps	m^3/h	5	
Number of biological sludge pumps	un.	8	
Unitary capacity of biological sludge pumps	m^3/h	144	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	7,121	14,139
Maximum design flow (Mdf) [(1)]	m^3/h	504	1,054
	L/s	140	293
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	32,044	63,625
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	4 (2 x 1+1)	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.26	0.53
Retention time (Mdf)	h	12.9	6.2
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	44	90
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.1	0.2

Table III.2.5.6 - Biological Treatment (Solution 1)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Number of secondary clarifiers	un.	5 x 2 basins	
Type	-	rectangular plant	
Length	m	34	
Unitary width	m	7.25	
Depth	m	3.30	
Total surface	m^2	2,465	
Total volume	m^3	8,135	
Operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.20	0.43
Retention time (Mdf)	h	16.2	7.7
Solids loading rate (Mdf+ Frec.)	$kgMS/m^2/d$	35	72
Solids volumic loading (Mdf)	$m^3MS/m^2/h$	0.1	0.2
Scum production	kg/d	71	141
	m^3/d	0.07	0.15
Unitary capacity of scum pumps	m^3/h	18	18
Unitary capacity of excess sludge pumps	m^3/h	18	23

Table III.2.5.7 - Biological Treatment (Solution 2)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	4 x 2 basins	
Type	-	rectangular plant	
Length	m	34	
Unitary width	m	7.25	
Depth	m	3.30	
Unitary surface	m^2	493	
Total surface	m^2	1,972	
Unitary volume	m^3	1,627	
Total volume	m^3	6,508	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	2	
Unitary capacity of scum pumps	m^3/h	5	
Number of biological sludge pumps	un.	8	
Unitary capacity of biological sludge pumps	m^3/h	144	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	6,903	13,850
Maximum design flow (Mdf) (1)	m^3/h	504	1,054
	L/s	140	293
TSS concentration	kg/m^3	3.5	3.5
TSS loads	kg/d	24,160	48,476
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	2+2	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.26	0.53
Retention time (Mdf)	h	12.9	6.2
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	34	69
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.1	0.2
Scum production	kg/d	69.0	138.5
	m^3/d	0.07	0.15
Unitary capacity of scum pumps	m^3/h	18	18
Unitary capacity of excess sludge pumps	m^3/h	20	20

Table III.2.5.8 - Biological Treatment (Solution 3)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	4 x 2 basins	
Type	-	rectangular plant	
Length	m	34	
Unitary width	m	7	
Depth	m	3	
Unitary surface	m^2	493	
Total surface	m^2	1,972	
Unitary volume	m^3	1,627	
Total volume	m^3	6,508	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	2	
Unitary capacity of scum pumps	m^3/h	5	
Number of biological sludge pumps	un.	8	
Unitary capacity of biological sludge pumps	m^3/h	144	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	6 856	13,874
Maximum design flow (Mdf) (1)	m^3/h	504	1,054
	L/s	140	293
TSS concentration	kg/m^3	5	4.5
TSS loads	kg/d	30 852	62,433
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	4 (2 x 1+1)	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.26	0.53
Retention time (Mdf)	h	12.9	6.2
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	43	89
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.1	0.2
Scum production	kg/d	68.6	138.7
	m^3/d	0.07	0.15
Unitary capacity of scum pumps	m^3/h	18	18
Unitary capacity of excess sludge pumps	m^3/h	18	23

Table III.2.6.1 - Filtration and Disinfection

Operation: Filtration and disinfection of secondary effluent

Parameter	Unit	Year 2011	Year 2029
Filtration			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	504	1,054
	L/s	140	293
TSS concentration	kg/d	30	30
Design criteria			
TSS concentration in filtrate effluent	mg/L	< 20	
Design results			
Feeding pumps to the filters			
Type	-	Centrifuge, multicellulair	
Number of pumps	un.	1+1	
Capacity	m^3/h	1,054	
Filter			
Type	-	métallique, auto-nettoyant	
Capacity	m^3/h	1,054	
Disinfection			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	504	1,054
	L/s	140	293
TSS concentration	mg/L	20	20
Inlet fecal coliforms concentration	CFU / 100 mL	1.10E+08	8.44E+07
Design criteria			
Outlet fecal coliforms concentration	CFU / 100 mL	2,000	
Outlet fecal streptococcus concentration	CFU / 100 mL	1,000	
Design UV transmittance (at 254 nm)	%	> 55	
Minimum radiation dosage	mJ/cm^2	25	

Table III.2.7.1 - Sludge Treatment (Solution 1)

Operation: Thickening

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	2	
Type	-	square plant	
Side length	m	9	
Maximum depth	m	4	
Unitary surface	m^2	80	
Total surface	m^2	160	
Unitary volume	m^3	280	
Total volume	m^3	560	
Unitary power of scraper bridges	kW/un.	0.25	
Influent sludge flows and loads			
Excess activated sludge average flow	m^3/d	832	1,087
Physico-chemical sludge average flow	m^3/d	61	110
Total sludge flow	m^3/d	893	1,197
TSS loading	kg/d	7,141	9,576
TSS concentration	kg/m^3	8.0	8.0
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Number of thickened sludge pumps	un.	3	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	5.6	7.5
Solids loading rate	$kgSS/m^2/d$	44.6	59.8

Table III.2.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year 2011	Year 2029
Design results			
Number of thickeners	un	-	3
Type	-	-	square plant
Requested unitary volume	m^3	-	504
Minimum unitary surface	m^2	-	80
Adopted side length	m	-	9
Unitary surface	m^2	-	80
Total surface	m^2	-	240
Adopted height	m	-	4.0
Unitary volume	m^3	-	280
Total volume	m^3	-	840
Unitary capacity of thickened sludge pumps	m^3/h	-	18
Operational conditions			
Number of thickeners operating	un.	3	3
Hydraulic loading rate	$m^3/m^2/d$	4	5
Solids loading rate	$kgSS/m^2/d$	30	40
Thickening sludge flow	m^3/d	893	1,197
Thickening sludge solids content	kg/d	7,141	9,576
Thickened sludge flow	m^3/d	226	303
Thickened sludge solids content	kg/d	6,784	9,097
Supernatant flow	m^3/d	666	894
Supernatant solids content	kg/d	357	479
Supernatant solids concentration	mg/L	536	536

Operation: Thickened sludge storage

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	226	303
Thickened sludge solids content	kg/d	6,784	9,097
Design criteria			
Minimum retention time	d	2	
Depth	m	3	
Number of thickened sludge pumps	un.	2	
Design results			
Requested volume	m^3	606	
Surface	m^2	202	
Side length	m	14	
Number of submersible agitators	un.	2	
Unitary capacity of thickened sludge pumps	m^3/h	40	

Table III.2.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year	
		2011	**2029**
Operational conditions			
Retention time	d	2.7	2.0

Table III.2.7.2 - Sludge Treatment (Solution 2)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	2	
Type	-	square plant	
Side length	m	9	
Maximum depth	m	4	
Unitary surface	m^2	80	
Total surface	m^2	160	
Unitary volume	m^3	280	
Total volume	m^3	560	
Unitary power of scraper bridges	kW/un.	0.25	
Influent sludge flows and loads			
Primary sludge average flow	m^3/d	211	282
Excess activated sludge average flow	m^3/d	632	822
Physico-chemical sludge average flow	m^3/d	67	116
Total sludge flow	m^3/d	910	1,220
TSS loading	kg/d	9,810	13,150
TSS concentration	kg/m^3	10.8	10.8
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	40	
Number of thickened sludge pumps	un.	4	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	5.7	7.6
Solids loading rate	$kgSS/m^2/d$	61.3	82.2

Table III.2.7.2 - Sludge Treatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Design results			
Number of thickeners	un	4	
Type	-	square plant	
Requested unitary volume	m^3	329	
Minimum unitary surface	m^2	320	
Adopted side length	m	9	
Unitary surface	m^2	80	
Total surface	m^2	518	
Adopted height	m	3.5	
Total volume	m^3	1,120	
Unitary volume	m^3	280	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	3	4
Thickening sludge flow	m^3/d	910	1,220
Thickening sludge solids content	kg/d	9,810	13,150
Thickened sludge flow	m^3/d	233	312
Thickened sludge solids content	kg/d	9,320	12,493
Hydraulic loading rate	$m^3/m^2/d$	3.8	3.8
Solids loading rate	$kgSS/m^2/d$	41	41

Table III.2.7.3 - Sludge Treatment (Solution 3)

Operation: Thickening

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	2	
Type	-	square plant	
Side length	m	9	
Maximum depth	m	4	
Unitary surface	m^2	80	
Total surface	m^2	160	
Unitary volume	m^3	280	
Total volume	m^3	560	
Unitary power of scraper bridges	kW/un.	0.25	
Influent sludge flows and loads			
UASB sludge average flow	m^3/d	68	68
Excess activated sludge average flow	m^3/d	579	834
Physico-chemical sludge average flow	m^3/d	61	110
Total sludge flow	m^3/d	707	1,012
TSS loading	kg/d	7,144	9,579
TSS concentration	kg/m^3	10.1	9.5
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Number of thickened sludge pumps	un.	3	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	4.4	6.3
Solids loading rate	$kgSS/m^2/d$	44.6	59.9

Table III.2.7.3 - Sludge Treatment (Solution 3)

Parameter	Unit	Year 2011	Year 2029
Design results			
Number of thickeners	un	-	3
Type	-	-	square plant
Requested unitary volume	m^3	-	504
Minimum unitary surface	m^2	-	80
Adopted side length	m	-	9
Unitary surface	m^2	-	80
Total surface	m^2	-	240
Adopted height	m	-	4.0
Unitary volume	m^3	-	280
Total volume	m^3	-	840
Unitary capacity of thickened sludge pumps	m^3/h	-	18
Operational conditions			
Number of thickeners operating	un.	3	3
Hydraulic loading rate	$m^3/m^2/d$	3	4
Solids loading rate	$kgSS/m^2/d$	30	40
Thickening sludge flow	m^3/d	707	1,012
Thickening sludge solids content	kg/d	7,144	9,579
Thickened sludge flow	m^3/d	226	303
Thickened sludge solids content	kg/d	6,787	9,100
Supernatant flow	m^3/d	481	708
Supernatant solids content	kg/d	357	479
Supernatant solids concentration	mg/L	742	676

Operation: Thickened sludge storage

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	226	303
Thickened sludge solids content	kg/d	6,787	9,100
Design criteria			
Minimum retention time	d	2	
Depth	m	3	
Number of thickened sludge pumps	un.	2	
Design results			
Requested volume	m^3	607	
Surface	m^2	202	
Side length	m	14	
Number of submersible agitators	un.	2	
Unitary capacity of thickened sludge pumps	m^3/h	40	

Table III.2.7.3 - Sludge Treatment (Solution 3)

Parameter	**Unit**	**Year**	
		2011	**2029**
Operational conditions			
Retention time	d	2.7	2.0

Table III.2.8.1 - Sludge Treatment (Solution 2)

Operation: Anaerobic mesophilic digestion

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	233	312
Thickened sludge solids content	kg/d	9,320	12,493
Solids concentration	kg/m^3	40	40
SSV/SST	%	60	60
SSV loading	kg/d	5,592	7,496
Design criteria			
Digester			
Number of digesters	un.	2	
Average digestion temperature	ºC	35	
Minimum retention time	h	10 - 20	
SSV removal rate	%	50	
Solids loading	$kgMVS/m^3/d$	1,6 - 4,8	
Most unfavorable sludge temperature	ºC	15	
Sludge bulk density	kg/m^3	1,000	
Digester slope bottom	º	30	
Sludge recycle for mixing	-	5,0 x Vdigestion /d	
Gasholder			
Number of gasholders	un.	2	
Biogas production	$m^3/kgSVS$	0.9	
Minimum retention time	h	8	
Flare			
Requested capacity	m^3/h	1,5 x produced biogas	
Design results			
Digester			
Requested total volume	m^3	5,622	
Requested unitary volume	m^3	2,811	
Adopted diameter	m	20	
Adopted surface	m^2	314	
Conical zone height	m	5.8	
Cylindrical zone height	m	7	
Total height	m	12.8	
Adopted unitary useful volume	m^3	2,811	
Adopted total useful volume	m^3	5,622	
Freeboard	m	1	
Adopted total volume	m^3	3,125	
Relation H cylindrical zone /D	-	0.35	
Wall height buried	m	6	
Recycle sludge for mixing	m^3/d	28,110	

Table III.2.8.1 - Sludge Treatment (Solution 2)

Parameter	Unit	Year 2011	Year 2029
Gasholder			
Requested volume	m^3	1,130	
Requested unitary volume	m^3	565	
Minimum sphere diameter	m	10.3	
Adopted sphere diameter	m	10.5	
Adopted unitary volume	m^3	606	
Adopted total volume	m^3	1,212	
Flare			
Requested capacity	m^3/h	220	
Operational conditions			
Digester			
Solids loading	kgSVS/m^3/d	0.99	1.33
Minimum retention time	d	24.1	18.0
VSS removed	kg/d	2,796	3,748
Digested sludge flow	m^3/d	233	312
Digested sludge solids content	kg/d	6,524	8,745
Solids concentration	kg/m^3	28	28
Produced biogas	m^3/d	2,516	3,373
Gasholder			
Retention time	h	11.6	8.6

Operation: Alkalinity control

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	233.0	312.3
Design criteria			
Inflow alkalinity	mg$CaCO_3$/L	200	
Biogas CO_2 content	%	30%	
Requested alkalinity for pH=7,0	mg$CaCO_3$/L	1,935	
Milk of lime concentration	kgCaO/m^3	50	
Hydrated lime bulk density	kg/m^3	600	
Autonomy of the lime silo	d	10	

Table III.2.8.1 - Sludge Treatment (Solution 2)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Alkalinity to be added	$mgCaCO_3/L$	1,735	1,735
	$kgCaCO_3/d$	404.2	541.9
Lime to be added	kgCaO/d	226.6	303.7
Hydrated lime to be added	$kgCa(OH)_2/d$	299.2	401.1
Milk of lime total flow	m^3/d	4.5	6.1
Lime silo volume	m^3	-	10.0
Adopted diameter	m	-	2.0
Useful height	m	-	4.3
Total height	m	-	6.7

Table III.2.8.2 - Sludge Treatment (Solution 2)

Operation: Energy recovery - Cogeneration

Parameter	Unit	Year	
		2011	**2029**
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	233.0	312.3
Produced biogas	m^3/d	2,516	3,373
SSV removed	kg/d	2,796	3,748
Design criteria			
Average temperture of digestion	ºC	35	
Sludge bulk density	kg/m^3	1,000	
Sludge specific heat	kcal/kg/ºC	1.01	
Heat exchanger efficiency			
water/sludge	%	90	
water/sludge	%	85	
Biogas Lower Heating Value (LHV)	kWh/m^3	6.38	
Natural gas Lower Heating Value (LHV)	kWh/m^3	10.53	
Moto-generators			
Number of moto-generators to be installed	un.	2	
Working period	h/d	16	
Electrical efficiency	%	35	
Efficiency of the moto-generators	%	90	
Thermal energy recovery from the moto-generators			
from the cooling water	%	37%	
from the exhaust gases	%	18%	
Digesters loss of heat			
Heat transfer coefficient, U			
walls above the ground	$W/m^2.Cº$	2.57	
walls buried	$W/m^2.Cº$	0.94	
cover	$W/m^2.Cº$	2.79	
bottom	$W/m^2.Cº$	1.51	
Most unfavorable temperatures during winter			
air	ºC	5	
ground	ºC	10	
sludge	ºC	15	

Table III.2.8.2 - Sludge Treatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Operational conditions			
Biogas use			
Biogas energy potential	kWh/d	16,054	21,520
Power from the biogas produced	kW	1,003	1,345
Nominal output of electric power	kWh/d	5,619	7,532
	kW	351	471
Nominal output thermal power	kcal/d	6,707,590	8,991,177
	kWh/d	7,800	10,455
Heating needs for digestion			
Heat loss surface			
walls above the ground	m^2	-	64
walls buried	m^2	-	377
cover	m^2	-	314
bottom	m^2	-	363
Digester heat loss, during winter			
walls above the ground	kcal/d	-	101,253
walls buried	kcal/d	-	182,302
cover	kcal/d	-	542,854
bottom	kcal/d	-	282,868
Total	kcal/d	-	2,218,552
Requested sludge heating	kcal/d	4,706,525	6,308,853
Total energy needs	kcal/d	6,925,077	8,527,405
Moto-generators			
Requested gas power	kW	1,036	1,275
Thermal energy from the exhaust gases	kcal/d	2,180,117	2,684,553
Thermal energy from the cooling water	kcal/d	4,744,960	5,842,852
Total thermal energy	kcal/d	6,925,077	8,527,405
Unitary power of the moto-generators	kW	-	248
Biogas consumption	m^3/h	162	200
Natural gas consumption	m^3/h	98	121
Additional consumption of natural gas			
Energy deficit	kcal/d	217,487	-463,772
Additional consumption of natural gas	m^3/d	49	0
Electric power generated by natural gas	kWh/d	182	0
Electric power production			
Total electric power production	kWh/d	5,801	7,532
Average working period of the moto-generators	h/d	17	17
Maximum consumption of natural gas	m^3/s	-	0.034

Table III.2.9.1 - Sludge Treatment (Solution 1)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	226	303
Thickened sludge solids concentration	kg/m^3	30	30
Thickened sludge solids content	kg/d	6,784	9,097
Design criteria			
Number of units	un	2	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	40	
	kg/h	1,061	
Required capacity of polymer equipment	L/h	4,000	
In-line dilution system flow	m^3/h	6	
Operational conditions			
Dewatering sludge flow	m^3/d	317	425
	m^3/h	53	71
Dewatering sludge solids content	kg/d	9,497	12,736
	kg/h	1,583	2,123
Dewatered sludge daily flow	m^3/d	45	60
Dewatered sludge solids content	kg/d	9,022	12,099
Sludge liquor solids content	kg/d	475	637
Sludge liquor flow (1)	m^3/d	289	382
Number of dewatered sludge containers (10 m^3 each)	un.	5	6
Polymer consumption	kg/d	57.0	76.4
	kg/h	9.5	12.7
Polymer mother solution flow	m^3/d	11.4	15.3
	L/h	1,899	2,547
Polymer diluted solution flow	m^3/h	9.5	12.7
Dilution water flow	m^3/h	7.6	10.2

(1) it includes centrifuge rinse water

Table III.2.9.2 - Sludge Treatment (Solution 2)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	233.0	312.3
Thickened sludge solids concentration	kg/m^3	28	28
Thickened sludge solids content	kg/d	6,524	8,745
Design criteria			
Number of units	un	2	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	40	
	kg/h	1,020	
Required capacity of polymer equipment	L/h	4,000	
In-line dilution system flow	m^3/h	6	
Operational conditions			
Dewatering sludge flow	m^3/d	326	437
	m^3/h	54.4	72.9
Dewatering sludge solids content	kg/d	9,133	12,243
Dewatered sludge daily flow	m^3/d	1,522	2,040
Dewatered sludge solids content	kg/d	43	58
Sludge liquor solids content	kg/d	8,677	11,631
Sludge liquor flow [(1)]	m^3/d	457	612
Sludge liquor solids concentration	mg/L	301	397
Number of dewatered sludge containers (10 m^3 each)	un.	4	6
Polymer consumption	kg/d	54.8	73.5
	kg/h	9.1	12.2
Polymer mother solution flow	m^3/d	11.0	14.7
	L/h	1,827	2,449
Polymer diluted solution flow	m^3/h	9.1	12.2
Dilution water flow	m^3/h	7.3	9.8

[(1)] it includes centrifuge rinse water

Table III.2.9.3 - Sludge Treatment (Solution 3)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	226	303
Thickened sludge solids concentration	kg/m^3	30	30
Thickened sludge solids content	kg/d	6,787	9,100
Design criteria			
Number of units	un	2	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	40	
	kg/h	1,062	
Required capacity of polymer equipment	L/h	4,000	
In-line dilution system flow	m^3/h	6	
Operational conditions			
Dewatering sludge flow	m^3/d	317	425
	m^3/h	52.8	70.8
Dewatering sludge solids content	kg/d	9,501	12,740
Dewatered sludge daily flow	m^3/d	1,584	2,123
Dewatered sludge solids content	kg/d	45	61
Sludge liquor solids content	kg/d	9,026	12,103
Sludge liquor flow (1)	m^3/d	475	637
Sludge liquor solids concentration	mg/L	289	382
Number of dewatered sludge containers (10 m^3 each)	un.	5	6
Polymer consumption	kg/d	57.0	76.4
	kg/h	9.5	12.7
Polymer mother solution flow	m^3/d	11.4	15.3
	L/h	1,900	2,548
Polymer diluted solution flow	m^3/h	9.5	12.7
Dilution water flow	m^3/h	7.6	10.2

(1) it includes centrifuge rinse water

Table III.2.9.4 - Sludge Treatment (Solution 1)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of drying beds	un.	54	
Type	-	rectangular plant (35 m x 10 m)	
Unitary surface	m^2	350	
Total surface	m^2	18,900	
Unitary volume	m^3	70	
Total volume	m^3	3,780	
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	226	303
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	6,784	9,097
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0.17 - 0.32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	131	176
Drying time	d	16.7	12.5

Table III.2.9.5 - Sludge Treatment (Solution 2)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of drying beds	un.	54	
Type	-	rectangular plant (35 m x 10 m)	
Unitary surface	m^2	350	
Total surface	m^2	18,900	
Unitary volume	m^3	70	
Total volume	m^3	3,780	
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	233	312
Drying solids (DS) concentration	kg/m^3	28	28
DS loading	kg/d	6,524	8,745
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	126	169
Drying time	d	16.2	12.1

Table III.2.9.6 - Sludge Treatment (Solution 3)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of drying beds	un.	54	
Type	-	rectangular plant (35 m x 10 m)	
Unitary surface	m^2	350	
Total surface	m^2	18,900	
Unitary volume	m^3	70	
Total volume	m^3	3,780	
Influent sludge flows and loads			
Thickened sludge average flow	m^3/d	226	303
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	6,787	9,100
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	131	176
Drying time	d	16.7	12.5

Table III.2.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	2	2	0	2.20	3.0	13.2
Mechanical screen	2	2	0	0.75	3.0	4.5
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	4.00	12.0	96.0
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Secondary treatment						
Submersible mixer - anoxic tanks	5	5	0	7.50	24.0	900.0
Submersible mixer - aerobic tanks	20	20	0	7.50	8.0	1,200.0
Air compressor	6	5	1	90.00	16.0	7,200.0
Ventilator of the compressors' building	2	2	0	0.75	16.0	24.0
Scraper bridge of the secondary clarifiers	5	5	0	1.10	24.0	132.0
Biological sludge pump	10	10	0	3.00	6.0	180.0
Sludge recirculation pump	4	2	2	11.00	24.0	528.0
Sludge recirculation pump	2	1	1	7.50	24.0	180.0
Excess sludge extraction pump	4	2	2	2.20	17.1	75.2
Excess sludge extraction pump	2	1	1	2.20	17.1	37.6
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	5	5	0	4.00	24.0	480.0
Mixer of the aluminium sulphate dosing tank	2	2	0	1.10	24.0	52.8
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	55.00	12.3	2,711.8
Filters with automatic cleaning	4	4	0	0.37	12.3	18.2
UV ray disinfection unit	2	2	0	15.00	12.3	369.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0
Treatment of the sludge						
Scraper bridge of the thickener	3	3	0	0.25	24.0	18.0
Thickened sludge pump	3	3	0	1.10	5.6	18.5
Mixer of the thickened sludge storage tank	2	2	0	0.75	24.0	36.0
Thickened sludge pump	2	2	0	4.00	5.3	42.5
Centrifuge	2	2	0	55.00	5.3	583.7
Polymer preparation equipment	1	1	0	1.10	5.3	5.8
Polymer dosing pump	2	1	1	2.20	5.3	11.7
Lift screw of dewatered sludge	2	2	0	1.10	5.3	11.7
Run-off water pump	2	1	1	1.50	3.0	4.5

Table III.2.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	18.50	24.0	444
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	115	103	12	314.11	-	15,526

Table III.2.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	2	2	0	2.20	3.0	13.2
Mechanical screen	2	2	0	0.75	3.0	4.5
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	4.00	12.0	96.0
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	8.0	12.0
Scum lift pump - primary sedimentation tank	2	1	1	0.55	3.0	1.7
Secondary treatment						
Submersible mixer - anoxic tanks	4	4	0	7.50	24.0	720.0
Submersible mixer - aerobic tanks	6	6	0	7.50	8.0	360.0
Air compressor	3	2	1	132.00	16.0	4,224.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	4	4	0	1.10	24.0	105.6
Biological sludge pump	8	8	0	2.20	6.0	105.6
Sludge recirculation pump	4	2	2	15.00	24.0	720.0
Excess sludge extraction pump	4	4	0	2.20	24.0	211.2
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	2	2	0	7.50	24.0	360.0
Mixer of the aluminium sulphate dosing tank	2	2	0	0.25	24.0	12.0
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	55.00	12.3	2,711.8
Filters with automatic cleaning	4	4	0	0.37	12.3	18.2
UV ray disinfection unit	2	2	0	15.00	12.3	369.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.2.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	4	4	0	0.25	24.0	24.0
Thickened sludge pump	4	4	0	1.10	4.3	19.1
Sludge recirculation pump in order to mix the digester	6	4	2	15.00	24.0	1,440.0
Heating sludge pump	2	2	0	30.00	20.0	1,200.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	2	0	2.20	16.0	70.4
Pump for water/sludge heat exchanger	2	1	1	2.20	0.0	0.0
Hot water pump for the boiler	2	1	1	5.50	18.0	99.0
Biogas compressor to supply the moto-generators	2	2	0	5.50	16.0	176.0
Pump for cooling liquid/water heat exchanger	3	2	1	2.20	18.0	79.2
Pump for exhaust gas/water heat exchanger	1	1	0	4.00	0.0	0.0
Centrifuge	1	1	0	50.00	5.5	273.3
Polymer preparation equipment	1	1	0	1.10	5.5	6.0
Polymer dosing pump	2	1	1	2.20	5.5	12.0
Lift screw of dewatered sludge	1	1	0	1.10	5.5	6.0
Run-off water pump	2	1	1	1.50	3.0	4.5
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	18.50	24.0	444
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	110	96	14	419.76	-	14 165
Electricity requirement (kWh/year)	-	-	-	-	-	5,138,851
Electricity produced by cogeneration (kWh/year)	-	-	-	-	-	2,749,187
Electricity purchased from the public network (kWh/year)	-	-	-	-	-	2,389,664

Table III.2.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Yeast wastewater pretreatment						
Equalization basin pump	2	1	1	2.20	12	26.4
Preliminary treatment						
Grit extraction system by "air-lift"	2	2	0	2.20	3.0	13.2
Mechanical screen	2	2	0	0.75	3.0	4.5
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	4.00	12.0	96.0
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Secondary treatment						
Submersible mixer - anoxic tanks	4	4	0	7.50	24.0	720.0
Submersible mixer - aerobic tanks	16	16	0	7.50	8.0	960.0
Air compressor	5	4	1	75.00	16.0	4,800.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	4	4	0	1.10	24.0	105.6
Biological sludge pump	8	8	0	2.20	12.0	211.2
Sludge recirculation pump	4	2	2	15.00	24.0	720.0
Excess sludge extraction pump	4	2	2	2.20	18.4	81.0
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	4	4	0	4.00	24.0	384.0
Mixer of the aluminium sulphate dosing tank	2	2	0	0.25	24.0	12.0
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	55.00	12.3	2,711.8
Filters with automatic cleaning	4	4	0	0.37	12.3	18.2
UV ray disinfection unit	2	2	0	15.00	12.3	369.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.2.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	3	3	0	0.25	24.0	18.0
Thickened sludge pump	3	3	0	1.10	5.6	18.5
Mixer of the thickened sludge storage tank	2	2	0	0.75	24.0	36.0
Thickened sludge pump	2	2	0	4.00	5.3	42.5
Centrifuge	2	2	0	55.00	5.3	583.9
Polymer preparation equipment	1	1	0	1.10	5.3	5.8
Polymer dosing pump	2	1	1	2.20	5.3	11.7
Lift screw of dewatered sludge	2	2	0	1.10	5.3	11.7
Run-off water pump	2	1	1	1.50	3.0	4.5
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	18.50	24.0	444
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	102	91	11	293.96	-	12,569

Annex-III.3

Medjez El Bab WwTP tables

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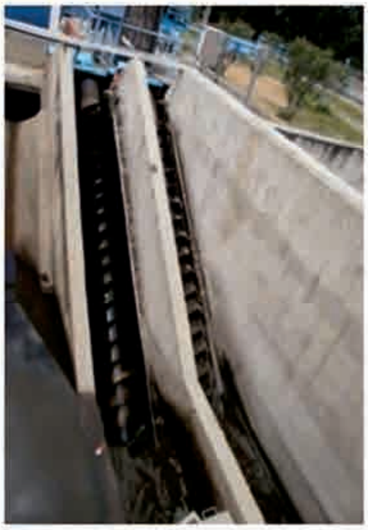
Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Inlet flow – initial elevation
No.	Two Archimedean screws

ILLUSTRATIVE PICTURES



REMARKS	- The Archimedean screws were operational. The smallest presented some corrosion on the thread. The biggest appeared to be in better working conditions than the other. - The paint presented some points of corrosion, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase and it was possible to see some painted metal shields over sensible parts of the mechanisms to protect them from the weather conditions and also as a health and safety concern for the operators.
RECOMMENDATIONS	- Necessary overhaul of the screw threads. Particularly the smallest screw, a possible replacement should be considered.

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Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Screening
No.	One mechanical operated and one manually operated in the bypass channel

ILLUSTRATIVE PICTURES

REMARKS	- The screening device at the inlet needs to be repaired in order to prevent the screenings from falling out of the device. Generalized stainless steel corrosion on the device. - It was reported to the consultant team the occurrence of frequent outages at the pretreatment (reaching the end of its operating life and corrosion) - The screenings conveyer working in reasonable conditions. The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase. - The screenings trailer presents a high level of corrosion and the painting is degraded and blemished. - Electrical cabinets are covered with metal shields to protect them from weather conditions such as excess exposure to sun light - The electrical equipment and measuring instruments have been rehabilitated in 2007 - The flow measurement is at the station entrance and was recently reinstalled.
RECOMMENDATIONS	- The bar screen is working however needs an overhaul and replacement should eventually be considered. - The screenings trailer needs an overhaul.

Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Grit and grease removal
No.	One scraper working on two channels chamber with aeration, bottom grit pumping and surface grease removal.

ILLUSTRATIVE PICTURES

REMARKS	- The flow partition gate presents some level of corrosion on the floor column and on the gear box with hand wheel. - The scraper bridge suffers from some deviation on the longitudinal movement. - The scraper bridge wheels present a high level of degradation. - The grit classifier on the scraper is not working properly and presents some degraded painting. - It was reported to the consultant team the occurrence of frequent outages at the pretreatment (reaching the end of its operating life and corrosion). - Electrical cabinet is covered with metal shield to protect them from weather conditions such as excess exposure to sun light - The electrical equipment and measuring instruments have been rehabilitated in 2007.
RECOMMENDATIONS	- The scraper is working however needs an overhaul and replacement should eventually be considered. - The grit classifier operation needs to be improved, possibly with the installation of dedicated equipment for this function.

Table III.3.1.1.1 – Electromechanical equipment

ILLUSTRATIVE PICTURES


REMARKS	- The pump and the aeration for the grease removal are installed in an underground chamber. This chamber is not in adequate environmental conditions, it presents a humid atmosphere and water spilled on the floor; possibly caused by rain water infiltration. - The blowers for the aeration are working; nevertheless they present a state of some degradation, being dirty and dusty. - The grease pumping circuit is out of service. It was reported to the consultant team that it clogged immediately after the start of the installation and was abandoned ever since. The grease is sucked directly from the grease pit on the surface.
RECOMMENDATIONS	- The blowers are working however need an overhaul and replacement should be considered on a medium term. - In case ONAS considers the present solution for grease removal inadequate, in benefit of an easy and practical exploitation activity, it will be necessary to improve the grease removal circuit considering a revision of pipes diameters and pump selection.

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Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – aeration tanks
No.	6 Aeration tanks with surface aerators

ILLUSTRATIVE PICTURES

REMARKS	- Generally, the surface aerators present a reasonably state taking in consideration their working conditions. - The gates and the submersible agitators observed on the tanks which were out of service were in a fairly good state. - The operation of the surface aerators it is not automated, as in an automation system, which integrates a measurement of the dissolved oxygen within the tank.
RECOMMENDATIONS	- The aeration method selected for these tank dimensions is not adequate for the oxygen needs of the process. The tanks are too deep for this type of aeration equipment. Therefore, it is proposed the replacement of these aerators by a diffused aeration mode. - Automation should be increased specially focusing on integration between oxygen probes in the aeration tanks and the aeration working hours.

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Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – secondary clarifier
No.	2

ILLUSTRATIVE PICTURES

scraper bridge — scraper actuator mechanism — Sludge extraction — scraper side traction — Sludge extraction pump

REMARKS	- Generally, the scrapers present a reasonably state taking in consideration their working conditions. - The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to state that the equipment seems to be painted to avoid corrosion increase. - It was reported to the consultant team that the sludge scrapers should be renewed due to high wear.
RECOMMENDATIONS	- The scrapers are working however an overalll and the replacement of the bottom sludge scrapers need should be considered.

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Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – sludge recycling management
No.	2 Flow partition valves

ILLUSTRATIVE PICTURES


Sludge flow partition valve


Valve electrically actuated

REMARKS	- The valve presents a reasonably state taking in consideration their working conditions. - The valve is electrically actuated but the sludge flow partition is manually operated; it is hard to manage the treatment process in terms of sludge purging and sludge recycling, caused by the old-fashioned free surface flow recycling system and its inefficient flow measurement.
RECOMMENDATIONS	- The solution to be proposed intends to build a dedicated station pump for sludge recycling and sludge purging including flow measurement and pumps with frequency variation in order to improve the management of the treatment process.

Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Sludge thickener
No.	1 Sludge thickener (square plan) with mechanical scraper bridge

ILLUSTRATIVE PICTURES

Sludge thickener

Thickener scraper bridge

Sludge extraction pump

REMARKS	- The bridge painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to state that the equipment seems to be painted to avoid corrosion increase. - The sludge pump (to feed the drying beds) presents a high level of deterioration and is installed in an underground chamber. This chamber is not in very good environmental conditions, it presents water (and oil) spilled on the floor; possibly caused by rain water infiltration.
RECOMMENDATIONS	- The scraper bridge is working however needs an overhaul and the rehabilitation of the bridge by application of new coat of paint after proper surface preparation should be considered. - The sludge pump and motor seem to be beyond repair, a replacement should be considered.

Table III.3.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Dewatering
No.	14 Drying beds

ILLUSTRATIVE PICTURES

Drying beds

Feeding sludge pipes and valves

REMARKS	- It was reported to the consultant team that, during Winter, the drying beds capacity is not enough for sludge dewatering. - It was reported to the consultant team that the beds drainage system is in poor condition and requires rehabilitation (layers of sand and gravel mixed with sludge and clogging) - It was reported to the consultant team that a suitable machine is missing to handle the dried sludge.
RECOMMENDATIONS	- The proposed solution intends to change the actual dewatering system to a mechanical sludge dewatering system such as a centrifuge or a belt press.

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Table III.3.1.1.2 – Civil Engineering

UNIT/OPERATION	Civil Engineering
No.	

ILLUSTRATIVE PICTURES	
Photo 1: Aeration Tanks	Photo 2: Aeration Tanks
	
Photo 3: Joint (Aeration Tanks)	Photo 4: Joint (Aeration Tanks)
	
Photo 5: Raft foundation (Aeration Tanks)	Photo 6: Basement floor
	

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Table III.3.1.1.2 – Civil Engineering

SPECIFICATIONS	The wastewater treatment plant was built in 1994. It is conceived to allow a theoretical flow of 4350 m^3/day. The practical average flow is equal to 2000 m^3/day and the peak reaches 2500 m^3/day. The collected water is wastewater from the population and rain water (no water is coming from the factories). The inlet of water in arrival displays a diameter equal to 800 mm. The wastewater treatment plant consists of a pumping station, a screen cleaner, grit basin, basins of ventilation, a decanter, and a thickener. The aeration tank have the following dimensions (approximately): 47.45 m x 30 m x 7.55m (height) The decanter has the approximate dimensions of 26 m x 30 m x 5.60 m (height). The reinforced concrete works are half-buried. The foundations are superficial on raft foundations. The reinforced concrete structures include the following items: - A main raft foundation, - Extreme screens in contact with the ground, - Screens and transverse screen girders, - Beams and posts. These structures are separated at the same time on the level of the screens as well as at the level of the raft foundation through the expansion joints at approx. every 6 to 8 m. The foundation of the works is of superficial type, on raft foundations resting on a blinding concrete. According to Plan No. 3.3.6. 00 B of the checking/verification file, the type of concrete used for the reinforced concrete structures is the B27 type. The coating of steels: nonaggressive medium as for the screens not in permanent contact with water 2 cm; the raft foundation with face not in contact with water 3 cm; for the walls in contact with the corrosive ambient (water present permanently) 4 cm.
DIAGNOSIS	- The reinforced concrete works do not present any apparent degradations or cracking. (Photo 1, 2) - On the other hand, the joints are found in a degraded condition. (Photo 3, 4) - In one of the buildings of aeration tank, the joint of the raft foundation has suffered serious degradations which led to the increase of the ground water through the raft foundation of the building. (Photo 5) - In the basement floor of the building, there is moisture found in the interior face of a wall. (Photo 6)

Table III.3.2.1 - Design data

Design Data

Parameter	Unit	Year	
		2011	2029
Population served			
Domestic population	p.e	20,113	24,644
Industrial population	p.e	2,681	14,948
Touristic population	p.e	0	0
Total population	p.e	22,794	39,592
Peak Factors			
Domestic peak factor	-	1.56	1.54
Industrial peak factor	-	2.0	2.0
Touristic peak factor	-	-	-
Return factor			
Domestic return factor	%	80%	80%
Industrial and touristic return factor	%	90%	90%
Per capita flow and load factors			
Per capita water consumption			
domestic	L/capita/d	124	162
industrial	L/capita/d	-	-
touristic	L/capita/d	-	-
Domestic and touristic per capita loading factors			
TSS	g/capita/d	90	90
BOD_5	g/capita/d	60	60
COD	g/capita/d	120	120
Total Nitrogen (TN)	g/capita/d	8	8
Total Phosphorus (TP)	g/capita/d	1.5	1.5
Fecal Coliforms	CFU/capita/d	1.00E+11	1.00E+11

Wastewater inflows			
Domestic average daily flow (Adf)	m^3/d	1,989	3,186
	L/s	23.0	36.9
Domestic peak flow	m^3/h	129	205
	L/s	35.8	57.0
Industrial average daily flow	m^3/d	402	2,242
	L/s	4.7	26.0
Industrial peak flow	m^3/h	33.5	186.8
	L/s	9.3	51.9
Touristic average daily flow (occupancy rate = 100%)	m^3/d	0.0	0.0
	L/s	0.0	0.0
Touristic peak flow	m^3/h	0.0	0.0
	L/s	0.0	0.0

Table III.3.2.1 - Design data

Parameter	Unit	Year	
		2011	**2029**
Infiltration flow	L/s	9.2	14.8
Total average daily flow (domestic + industrial + touristic)	m^3/d	2,391	5,429
Total average daily flow (domestic + industrial + touristic) + infiltration	m^3/d	3,187	6,703
Total peak flow	m^3/h	196	445
	L/s	54.3	123.6
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
Loadings			
Domestic + touristic			
TSS	kg/d	1,810	2,218
BOD_5	kg/d	1,207	1,479
COD	kg/d	2,414	2,957
TN	kg/d	161	197
TP	kg/d	30	37
Fecal Coliforms	CFU/d	2.01E+15	2.46E+15
Industrial			
TSS	kg/d	161	897
BOD_5	kg/d	161	897
COD	kg/d	402	2,242
TN	kg/d	50	277
TP	kg/d	4	22
Total			
TSS	kg/d	1,971	3,115
BOD_5	kg/d	1,368	2,376
COD	kg/d	2,816	5,199
TN	kg/d	211	474
TP	kg/d	34	59
Fecal Coliforms	CFU/d	2.01E+15	2.46E+15

Table III.3.2.1 - Design data

Parameter	**Unit**	**Year**	
		2011	**2029**
Concentrations (2)			
Domestic + touristic			
TSS	mg/L	910	696
BOD_5	mg/L	607	464
COD	mg/L	1213	928
TN	mg/L	81	62
TP	mg/L	15	12
Fecal Coliforms	CFU/100mL	1.01E+08	7.73E+07
Industrial			
TSS	mg/L	400	400
BOD_5	mg/L	400	400
COD	mg/L	1,000	1,000
TN	mg/L	123	123
TP	mg/L	10	10
Total without infiltration			
TSS	mg/L	824	574
BOD_5	mg/L	572	438
COD	mg/L	1,177	958
TN	mg/L	88	87
TP	mg/L	14	11
Fecal Coliforms	CFU/100mL	8.41E+07	4.54E+07

(1) Maximum flow pumped by 2 existant Archimedean screws.

(2) Without infiltration

Table III.3.3.1 - Preliminary treatment

Operation: Grit retention

Parameter	Unit	Year	
		2011	**2029**
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,391	5,429
Maximum design flow (Mdf)	m^3/h	540	540
	L/s	150	150
Design Criteria			
Number of basins	un	1	
Type	-	circular plant	
Retention time (Mdf)	min	15	
Peripheral depth	m	3	
Design Results			
Total volume	m^3	135	
Unitary volume	m^3	135	
Unitary surface area	m^2	45	
Diameter	m	7.5	
Existing infrastructures operational conditions			
Retention time			
Adf	min	81	36
Mdf	min	15	15

Table III.3.3.2 - Preliminary Treatment

Operation: Screening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Mechanical Screening			
Number of screening devices working in parallel	un.	1	
Screen bars spacing	mm	12	
Bars thickness	mm	10	
Channel width	m	1.1	
Channel depth	m	1.0	
Unitary power of screening devices	kW/un.	0.75	
Maximum flow capacity	m^3/h	540	
Manually Cleaned Coarse Screens			
Number of coarse screens	un.	-	
Screen bars spacing	mm	-	
Channel width	m	-	
Channel depth	m	-	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	20,113	24,644
Average daily flow (Adf)	m^3/d	2,391	5,429
Maximum design flow (Mdf) [(1)]	m^3/h	540	540
	L/s	150	150
Design Criteria			
Velocity through clean bar screen	m/s	1.2	
Approach velocity	m/s	0.3 - 0.9	
Maximum degree of clogging	%	50	
Channel depth	m	-	
Kirschmer factor	-	1.94	
Channel freeboard	m	≥ 0,3	
Volume of screenings per capita	L/capita/year	6	
Bulk density of removed screenings	kg/L	0.95	
Screenings removal rate	%	95	

Table III.3.3.2 - Preliminary Treatment

Parameter	Unit	Year	
		2011	2029
Existing infrastructures operational conditions			
Effective open area (Mdf)	m^2	0.25	0.25
Total cross-sectional area	m^2	0.46	0.46
Height of the liquid upstream	m	0.42	0.42
Approach velocity (Mdf)	m/s	0.33	0.33
Approach velocity (Adf)	m/s	-	-
Channel freeboard	m	-	-
Headloss through clogged screens	mm WC	7.1	7.1
Screenings characteristics and quantities			
Volumetric flow of incoming wet screenings	L/d	331	405
Mass flow of incoming wet screenings	kg/d	314	385
Volumetric flow of removed wet screenings	kg/d	298	366
Mass flow of removed wet screenings	m^3/d	0.31	0.38

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.3.3 - Preliminary Treatment

Operation: Grit and Grease Removal

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of chambers	un.	1 x 2 basins	
Type	-	rectangular plant, aerated	
Length	m	12	
Total width	m	8	
Depth	m	3	
Grit cross-sectional area	m^2	12	
Grease cross-sectional area	m^2	6	
Total surface	m^2	96	
Total wet volume	m^3	216	
Number of grit pumps	un.	2	
Unitary power of grit pumps	kW/un.	-	
Number of air compressors	un.	2+1	
Unitary power of air compressors	kW/un.	2.2	
Number of scraper bridges	un.	1	
Unitary power of scraper bridges	kW/un.	-	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	20,113	24,644
Average daily flow (Adf)	m^3/d	2,391	5,429
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
Design Criteria			
Retention time (Mdf)	min	10 - 15	
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	10 - 15	
Specific air flow	L/s/m	5	
	m^3 air/h/m^3	1,5	
Headloss in the aeration system	% submergence	30	
Volume of grit per capita	L/capita/year	7	
Grit removal rate	%	95	
Quantity of oil & grease per capita	g/capita/d	31	
Bulk density of removed oil & grease	kg/L	0.8	
Oil & grease removal rate	%	30	

Table III.3.3.3 - Preliminary Treatment

Parameter		Unit	Year 2011	Year 2029
Existing infrastructures operational conditions				
Retention time				
	Adf	min	130	57
	Mdf	min	24	24
Hydraulic loading rate				
	Adf	$m^3/m^2/h$	1.0	2.4
	Mdf	$m^3/m^2/h$	5.6	5.6
Volumetric flow of incoming grit		L/d	386	473
Mass flow of incoming grit		kg/d	579	709
Volumetric flow of removed grit		kg/d	550	673
Mass flow of removed grit		m^3/d	147	180
Volumetric flow of grit after classification		m^3/d	0.41	0.50
Mass flow of grit after classification		kg/d	489	599
Runoff flow		m^3/d	146	179
Mass flow of incoming oil & grease		kg/d	337	764
Volumetric flow of incoming oil & grease		L/d	421	955
Mass flow of removed oil & grease		kg/d	101	229
Volumetric flow of removed oil & grease		m^3/d	13	29

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.4.1 - Primary settling (Solutions 2 and 3)

Operation: Primary settling

Parameter	Unit	Year 2011	Year 2029
Influent wastewater flows and loads (with process wastewaters)			
Average daily flow (Adf)	m^3/d	2,592	5,758
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
TSS Concentration	kg/m^3	0.9	0.6
TSS loading	kg/d	2,223	3,528
Design Criteria			
Hydraulic loading rate (Adf)	$m^3/m^2/h$	< 1,5	
Retention time (Mdf)	h	> 2	
Depth	m	3.3	
SS concentration in primary sludge	kg/m^3	20	
SS removal rate	%	50	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of primary sludge pumps	un.	2	
Design results			
Number of primary settling tanks	un	2	
Type	-	rectangular plant	
Total surface	m^2	360	
Unitary surface	m^2	180	
Length	m	20	
Unitary width	m	9	
Unitary volume	m^3	594	
Total volume	m^3	1,188	
Scum pumps capacity	m^3/h	18	
Unitary capacity of primary sludge pumps	m^3/h	18	
Operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.5	1.5
Retention time (Mdf)	h	2.2	2.2
Primary sludge production	kg/d	1,112	1,764
	m^3/d	55.6	88.2
Scum production	kg/d	26	58
	m^3/d	0.03	0.06

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.5.1 - Biological Treatment (Solution 1)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in series in each treatment line	un.	3	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	1,297	
Liquid depth	m	5.05	
Each basin volume	m^3	1,091	
Total volume	m^3	6,546	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 34 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	22,794	39,592
Average daily flow (Adf)	m^3/d	2,576	5,740
Maximum design flow (Mdf) (1)	m^3/h	540	540
TSS	kg/d	2,130	3,387
BOD	kg/d	1,447	2,511
TN	kg/d	219	489
TP	kg/d	36	62
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.3.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.8	
MLVSS in aeration tanks	kg/m^3	3.6	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.04	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	6	
Number of nitrate recycle pumps	un.	2	
Number of sludge recycle pumps	un.	1+1	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peaking factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	2+1	

Table III.3.5.1 - Biological Treatment (Solution 1)

Parameter		Unit	Year 2011	Year 2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.06	0.11
Fv		kgBOD/m^3/d	0.22	0.38
Design results				
Total biological volume		m^3	-	6,546
Anoxic zone volume		m^3	-	2,186
Anoxic volume / Total volume		-	-	0.33
Aerobic zone volume		m^3	-	4,360
Number of operating lines		un.	-	2
Unitary capacity of air compressors		m^3/h	-	3,202
Unitary capacity of nitrate recycle pumps		m^3/h	-	359
Unitary capacity of sludge recycle pumps		m^3/h	-	359
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.061	0.107
Fv		kgBOD/m^3/d	0.22	0.38
Sludge age		d	34	20
Minimum sludge recycle		m^3/d	1,288	2,870
Maximum sludge recycle		m^3/d	3,864	8,610
Minimum nitrate recycle		m^3/d	2,576	5,740
Maximum nitrate recycle		m^3/d	7,728	17,221
Required oxygen for oxidation of organic material		kgO_2/d	753	1 287
	peak	kgO_2/h	35	59
Required oxygen for endogenous metabolism		kgO_2/d	1,414	1,414
	peak	kgO_2/h	59	59
Required oxygen for oxidation of ammonia		kgO_2/d	638	1 575
	peak	kgO_2/h	40	98
Oxygen recovered from denitrification		kgO_2/d	247	621
	peak	kgO_2/h	15	39
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	2,558	3,654
	peak	kgO_2/h	118	177
SOR - Standard Oxygen Requirement		kgO_2/d	4,266	6,424
	peak	kgO_2/h	178	268
Total air flow required		m^3/d	102,065	153,696
		m^3/h	4,253	6,404

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.5.2 - Biological Treatment (Solutions 2 and 3)

Operation: Biological organic matter removal (activated sludge in conventional aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in series in each treatment line	un.	3	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	1,297	
Liquid depth	m	5.05	
Each basin volume	m^3	1,091	
Total volume	m^3	6,546	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 34 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	22,794	39,592
Average daily flow (Adf)	m^3/d	2,536	5,670
Maximum design flow (Mdf) (1)	m^3/h	540	540
TSS	kg/d	1,112	1,764
BOD	kg/d	1,120	1,937
TN	kg/d	202	451
TP	kg/d	32	56
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.3.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.2 - 0.5	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.5 - 1.2	
Sludge age	d	8	
MLSS in aeration tanks	kg/m^3	3.5	
MLVSS/ MLSS ratio	-	0.7	
MLVSS in aeration tanks	kg/m^3	2.45	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.075	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	4	
Number of nitrate recycle pumps	un.	1	
Number of sludge recycle pumps	un.	1+1	
Aeration system			
a'	kgO/kgBOD	0.50	
b'	kgO/kgMVS/d	0.08	
Peaking factor for BOD removal	-	1.2	
Nitrification peak factor	-	1.8	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	1+1	

Table III.3.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter		Unit	Year 2011	Year 2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.07	0.12
Fv		kgBOD/m^3/d	0.17	0.30
Design results				
Total biological volume		m^3	3,273	3,273
Anoxic zone volume		m^3	1,080	1,637
Anoxic volume / Total volume		-	0.33	0.50
Aerobic zone volume		m^3	2,193	1,637
Number of operating lines		un.	-	1
Unitary capacity of air compressors		m^3/h	-	4,389
Unitary capacity of nitrate recycle pumps		m^3/h	-	709
Unitary capacity of sludge recycle pumps		m^3/h	-	354
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.140	0.242
Fv		kgBOD/m^3/d	0.342	0.592
Sludge age		d	14	8
Minimum sludge recycle		m^3/d	1,268	2,835
Maximum sludge recycle		m^3/d	3,804	8,504
Minimum nitrate recycle		m^3/d	2,536	5,670
Maximum nitrate recycle		m^3/d	7,608	17,009
Required oxygen for oxidation of organic material		kgO_2/d	522	883
	peak	kgO_2/h	26	44
Required oxygen for endogenous metabolism		kgO_2/d	642	642
	peak	kgO_2/h	27	27
Required oxygen for oxidation of ammonia		kgO_2/d	633	1 535
	peak	kgO_2/h	47	115
Oxygen recovered from denitrification		kgO_2/d	251	601
	peak	kgO_2/h	19	45
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	1,546	2,459
	peak	kgO_2/h	81	141
SOR - Standard Oxygen Requirement		kgO_2/d	2,546	4,403
	peak	kgO_2/h	106	183
Total air flow required		m^3/d	60,912	105,347
		m^3/h	2,538	4,389

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.5.3 - Phosphorus Removal (Solution 1)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.5
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.0	3.0
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	15	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	22	39
	mg/L	8.6	6.7
Al quantity required	kg/d	820	1,435
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	26	15
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	1,641	2,871
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	1.3	2.2
	m^3/year	461	806
Dosage tank minimum volume	m^3	33.1	33.1
Unitary capacity of dosing pumps	L/h	92	92
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	102	178
Hydroxides	kg/d	147	258
Physico-chemical sludge quantity produced	kg/d	249	436
	m^3/d	31.1	54.5

Table III.3.5.4 - Phosphorus Removal (Solutions 2 and 3)

Operation: Chemical phosphorus removal

Parameter	Unit	Year 2011	Year 2029
Design criteria			
Phosphorus to remove by precipitation	%	99.6	99.5
Phosphorus assimilated on biological treatment	%/100kgBOD$_5$	10.4	17.7
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.0	3.0
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	15	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	22	38
	mg/L	8.6	6.8
Al quantity required	kg/d	66	115
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	809	1419
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	1,619	2,838
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	1.2	2.2
	m^3/year	454	797
Dosage tank minimum volume	m^3	33	33
Unitary capacity of dosing pumps	L/h	91	91
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	100.3	175.9
Hydroxides	kg/d	145.3	254.8
Physico-chemical sludge quantity produced	kg/d	245.6	430.7
	m^3/d	30.7	53.8

Table III.3.5.5 - Biological treatment (Solution 1)

Operation: Clarification

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	2 x 2 basins	
Type	-	rectangular plant	
Length	m	25.0	
Unitary width	m	7.25	
Depth	m	3.30	
Unitary surface	m^2	363	
Total surface	m^2	725	
Unitary volume	m^3	1,188	
Total volume	m^3	2,376	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	1	
Unitary capacity of scum pumps	m^3/h	18	
Number of biological sludge pumps	un.	4	
Unitary capacity of biological sludge pumps	m^3/h	182	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,576	5,740
Maximum design flow (Mdf) [1]	m^3/h	540	540
	L/s	150	150
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	11,592	25,831
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8.0	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.74	0.74
Retention time (Mdf)	h	4.4	4.4
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	96.4	116.1
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.3	0.3
Scum production	kg/d	26	57
	m^3/d	0.03	0.06
Unitary capacity of excess sludge pumps	m^3/h	18.0	18.0

[1] Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.5.6 - Biological treatment (Solutions 2 and 3)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	2 x 2 basins	
Type	-	rectangular plant	
Length	m	25.0	
Unitary width	m	7.25	
Depth	m	3.30	
Unitary surface	m^2	181	
Total surface	m^2	725	
Unitary volume	m^3	598	
Total volume	m^3	2,376	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	1	
Unitary capacity of scum pumps	m^3/h	18	
Number of biological sludge pumps	un.	4	
Unitary capacity of biological sludge pumps	m^3/h	182	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,536	5,670
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
TSS concentration	kg/m^3	3.5	3.5
TSS loads	kg/d	8,877	19,844
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.74	0.74
Retention time (Mdf)	h	4.4	4.4
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	75	90
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.3	0.3
Scum production	kg/d	25.4	56.7
	m^3/d	0.03	0.06
Unitary capacity of excess sludge pumps	m^3/h	18	18

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.6.1 - Filtration and Disinfection

Operation: Filtration and disinfection of secondary effluent

Parameter	Unit	Year	
		2011	**2029**
Filtration			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
TSS concentration	kg/d	30	30
Design criteria			
TSS concentration in filtrate effluent	mg/L	< 20	
Design results			
Feeding pumps to the filters			
Type	-	Centrifuge, multicellulair	
Number of pumps	un.	1+1	
Capacity	m^3/h	540	
Filter			
Type	-	métallique, auto-nettoyant	
Capacity	m^3/h	540	
Disinfection			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	540	540
	L/s	150	150
TSS concentration	mg/L	20	20
Inlet fecal coliforms concentration	CFU / 100 mL	1.01E+08	7.73E+07
Design criteria			
Outlet fecal coliforms concentration	CFU / 100 mL	2 000	
Outlet fecal streptococcus concentration	CFU / 100 mL	1 000	
Design UV transmittance (at 254 nm)	%	> 55	
Minimum radiation dosage	mJ/cm^2	25	

(1) Maximum flow pumped by 2 existant Archimedean screws.

Table III.3.7.1 - Sludge Treatment (Solution 1)

Operation: Thickening

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	9	
Maximum depth	m	4	
Unitary surface	m^2	80	
Total surface	m^2	80	
Unitary volume	m^3	280	
Total volume	m^3	280	
Unitary power of scraper bridges	kW/un.	0.25	
Influent sludge flows and loads			
Excess activated sludge average flow	m^3/d	171	292
Physico-chemical sludge average flow	m^3/d	31	54
Total sludge flow	m^3/d	202	347
TSS loading	kg/d	1,619	2,775
TSS concentration	kg/m^3	8.0	8.0
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Existing infrastructures operational conditions			
Thickening sludge flow	m^3/d	202.4	346.9
Thickening sludge solids content	kg/d	1,619	2,775
Thickened sludge flow	m^3/d	51	88
Thickened sludge solids content	kg/d	1,538	2,636
Supernatant flow	m^3/d	151.1	259.0
Supernatant solids content	kg/d	80.9	138.7
Supernatant solids concentration	mg/L	535.7	535.7
Hydraulic loading rate	$m^3/m^2/d$	2.5	4.3
Solids loading rate	$kgSS/m^2/d$	20.2	34.7

Table III.3.7.1 - Sludge Treatment (Solution 1)

Parameter	**Unit**	**Year**	
		2011	**2029**

Operation: Thickened sludge storage

Parameter	**Unit**	**Year 2011**	**Year 2029**
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	51	88
Thickened sludge solids content	kg/d	1,538	2,636
Design criteria			
Minimum retention time	d	3	
Depth	m	2.5	
Number of thickened sludge pumps	un.	1+1	
Design results			
Requested volume	m^3	264	
Surface	m^2	105	
Side length	m	10	
Number of submersible agitators	un.	1	
Unitary capacity of thickened sludge pumps	m^3/h	21	
Operational conditions			
Retention time	d	5.1	3.0

Table III.3.7.2 - Sludge treatment (Solutions 2 and 3)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	9	
Maximum depth	m	4	
Unitary surface	m^2	80	
Total surface	m^2	80	
Unitary volume	m^3	280	
Total volume	m^3	280	
Unitary power of scraper bridges	kW/un.	-	
Influent sludge flows and loads			
Primary sludge average flow	m^3/d	56	88
Excess activated sludge average flow	m^3/d	150	254
Physico-chemical sludge average flow	m^3/d	31	54
Total sludge flow	m^3/d	236	396
TSS loading	kg/d	2,558	4,226
TSS concentration	kg/m^3	10.8	10.7
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	40	
Number of thickened sludge pumps	un.	2+1	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	3.0	4.9
Solids loading rate	$kgSS/m^2/d$	32.0	52.8

Table III.3.7.2 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Number of thickeners	un	2	
Type	-	square plant	
Requested surface	m^2	106	
Total surface	m^2	160	
Unitary surface	m^2	80	
Unitary minimum volume	m^3	196	
Adopted height	m	3.5	
Total volume	m^3	560	
Unitary volume	m^3	280	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	1	2
Thickening sludge flow	m^3/d	236	396
Thickening sludge solids content	kg/d	2,558	4,226
Thickened sludge flow	m^3/d	61	100
Thickened sludge solids content	kg/d	2,430	4,015
Hydraulic loading rate	$m^3/m^2/d$	3.0	2.5
Solids loading rate	$kgSS/m^2/d$	32	26

Table III.3.8.1 - Sludge treatment (Solutions 2 and 3)

Operation: Anaerobic mesophilic digestion

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	61	100
Thickened sludge solids content	kg/d	2 430	4 015
Solids concentration	kg/m^3	40	40
SSV/SST	%	60	60
SSV loading	kg/d	1,458	2 409
Design criteria			
Digester			
Number of digesters	un.	1	
Average digestion temperature	ºC	35	
Minimum retention time	h	10 - 20	
SSV removal rate	%	50	
Solids loading	$kgMVS/m^3/d$	1,6 - 4,8	
Most unfavorable sludge temperature	ºC	15	
Sludge bulk density	kg/m^3	1 000	
Digester slope bottom	º	30	
Sludge recycle for mixing	-	5,0 x Vdigestion /d	
Gasholder			
Number of gasholders	un.	1	
Biogas production	$m^3/kgSVS$	0.9	
Minimum retention time	h	8	
Flare			
Requested capacity	m^3/h	1,5 x produced biogas	
Design results			
Digester			
Requested total volume	m^3	1,807	
Requested unitary volume	m^3	1,807	
Adopted diameter	m	15	
Adopted surface	m^2	177	
Conical zone height	m	4.3	
Cylindrical zone height	m	8.8	
Total height	m	13.1	
Adopted unitary useful volume	m^3	1,807	
Adopted total useful volume	m^3	1,807	
Freeboard	m	1	
Adopted total volume	m^3	1,984	
Relation H cylindrical zone /D	-	0.59	
Wall height buried	m	5	
Recycle sludge for mixing	m^3/d	9,035	

Table III.3.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Gasholder			
Requested volume	m^3	370	
Requested unitary volume	m^3	370	
Minimum sphere diameter	m	8.9	
Adopted sphere diameter	m	9.0	
Adopted unitary volume	m^3	382	
Adopted total volume	m^3	382	
Flare			
Requested capacity	m^3/h	70	
Operational conditions			
Digester			
Solids loading	kgSVS/m^3/d	0.81	1.33
Minimum retention time	d	29.7	18.0
VSS removed	kg/d	729	1,205
Digested sludge flow	m^3/d	61	100
Digested sludge solids content	kg/d	1,701	2,811
Solids concentration	kg/m^3	28	28
Produced biogas	m^3/d	656	1,084
Gasholder			
Retention time	h	14.0	8.5

Operation: Alkalinity control

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	60.8	100.4
Design criteria			
Inflow alkalinity	mg$CaCO_3$/L	200	
Biogas CO_2 content	%	30%	
Requested alkalinity for pH=7,0	mg$CaCO_3$/L	1,935	
Milk of lime concentration	kgCaO/m^3	50	
Hydrated lime bulk density	kg/m^3	600	
Autonomy of the lime silo	d	10	

Table III.3.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Alkalinity to be added	$mgCaCO_3/L$	1,735	1,735
	$kgCaCO_3/d$	105.4	174.2
Lime to be added	kgCaO/d	59.1	97.6
Hydrated lime to be added	$kgCa(OH)_2/d$	78.0	128.9
Milk of lime total flow	m^3/d	1.2	2.0
Lime silo volume	m^3	-	10.0
Adopted diameter	m	-	2.0
Useful height	m	-	4.3
Total height	m	-	6.7

Table III.3.8.2 - Sludge treatment (Solution 2)

Operation: Energy recovery - Cogeneration

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	60.8	100.4
Produced biogas	m^3/d	656	1,084
SSV removed	kg/d	729	1,205
Design criteria			
Average temperture of digestion	ºC	35	
Sludge bulk density	kg/m^3	1,000	
Sludge specific heat	kcal/kg/ºC	1.01	
Heat exchanger efficiency			
water/sludge	%	90	
water/sludge	%	85	
Biogas Lower Heating Value (LHV)	kWh/m^3	6.38	
Natural gas Lower Heating Value (LHV)	kWh/m^3	10.53	
Moto-generators			
Number of moto-generators to be installed	un.	2	
Working period	h/d	16	
Electrical efficiency	%	35	
Efficiency of the moto-generators	%	90	
Thermal energy recovery from the moto-generators			
from the cooling water	%	37	
from the exhaust gases	%	18	
Digesters loss of heat			
Heat transfer coefficient, U			
walls above the ground	$W/m^2.C^o$	2.57	
walls buried	$W/m^2.C^o$	0.94	
cover	$W/m^2.C^o$	2.79	
bottom	$W/m^2.C^o$	1.51	
Most unfavorable temperatures during winter			
air	ºC	5	
ground	ºC	10	
sludge	ºC	15	

Table III.3.8.2 - Sludge treatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Operational conditions			
Biogas use			
Biogas energy potential	kWh/d	4,186	6,916
Power from the biogas produced	kW	262	432
Nominal output of electric power	kWh/d	1,465	2,421
	kW	92	151
Nominal output thermal power	kcal/d	1,749,107	2,889,675
	kWh/d	2,034	3,360
Heating needs for digestion			
Heat loss surface			
walls above the ground	m^2	-	179
walls buried	m^2	-	236
cover	m^2	-	177
bottom	m^2	-	204
Digester heat loss, during winter			
walls above the ground	kcal/d	-	283,903
walls buried	kcal/d	-	113,938
cover	kcal/d	-	305,355
bottom	kcal/d	-	158,825
Total	kcal/d	-	862,022
Requested sludge heating	kcal/d	1,227,298	2,027,603
Total energy needs	kcal/d	2,089,321	2,889,625
Moto-generators			
Requested gas power	kW	312	327
Thermal energy from the exhaust gases	kcal/d	657,749	909,697
Thermal energy from the cooling water	kcal/d	1,431,572	1,979,928
Total thermal energy	kcal/d	2,089,321	2,889,625
Unitary power of the moto-generators	kW	-	84
Biogas consumption	m^3/h	49	68
Natural gas consumption	m^3/h	30	41
Additional consumption of natural gas			
Energy deficit	kcal/d	340,214	-50
Additional consumption of natural gas	m^3/d	77	0
Electric power generated by natural gas	kWh/d	285	0
Electric power production			
Total electric power production	kWh/d	1,750	2,421
Average working period of the moto-generators	h/d	15	16
Maximum consumption of natural gas	m^3/s	-	0.011

Table III.3.9.1 - Sludge Treatment (Solution 1)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	51	88
Dewatering sludge solids concentration	kg/m^3	30	30
Dewatering sludge solids content	kg/d	1,538	2,636
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	21	
	kg/h	615	
Required capacity of polymer equipment	L/h	1,107	
In-line dilution system flow	m^3/h	5	
Operational conditions			
Dewatering sludge flow	m^3/d	72	123
	m^3/h	12.0	20.5
Dewatering sludge solids content	kg/d	2,153	3,691
	kg/h	359	615
Dewatered sludge daily flow	m^3/d	10	18
Dewatered sludge solids content	kg/d	2,046	3,506
Sludge liquor solids content	kg/d	108	185
Sludge liquor flow (1)	m^3/d	71	114
Number of dewatered sludge containers (10 m^3 each)	un.	1	2
Polymer consumption	kg/d	12.9	22.1
	kg/h	2.2	3.7
Polymer mother solution flow	m^3/d	2.6	4.4
	L/h	431	738
Polymer diluted solution flow	m^3/h	2.2	3.7
Dilution water flow	m^3/h	1.7	3.0

(1) it includes centrifuge rinse water

Table III.3.9.2 - Sludge treatment (Solutions 2 and 3)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	60.8	100.4
Dewatering sludge solids concentration	kg/m^3	28	28
Dewatering sludge solids content	kg/d	1,701	2,811
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	23	
	kg/h	656	
Required capacity of polymer equipment	L/h	1,000	
In-line dilution system flow	m^3/h	5	
Operational conditions			
Dewatering sludge flow	m^3/d	85	141
	m^3/h	14.2	23.4
Dewatering sludge solids content	kg/d	2,382	3,935
	kg/h	397	656
Dewatered sludge daily flow	m^3/d	11	19
Dewatered sludge solids content	kg/d	2,263	3,738
Sludge liquor solids content	kg/d	119	197
Sludge liquor flow (1)	m^3/d	92	140
Number of dewatered sludge containers (10 m^3 each)	un.	1	2
Polymer consumption	kg/d	14.3	23.6
	kg/h	2.4	3.9
Polymer mother solution flow	m^3/d	2.9	4.7
	L/h	476	787
Polymer diluted solution flow	m^3/h	2.4	3.9
Dilution water flow	m^3/h	1.9	3.1

(1) it includes centrifuge rinse water

Table III.3.9.3 - Sludge Treatment - alternative (Solution 1)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of drying beds	un.	14	
Type	-	rectangular plant (35 m x 10 m)	
Unitary surface	m^2	350	
Total surface	m^2	4,900	
Unitary volume	m^3	70	
Total volume	m^3	980	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	51	88
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	1,538	2,636
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	115	196
Drying time	d	19.1	11.2

Table III.3.9.4 - Sludge treatment - alternative (Solutions 2 and 3)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of drying beds	un.	14	
Type	-	rectangular plant (35 m x 10 m)	
Unitary surface	m^2	350	
Total surface	m^2	4,900	
Unitary volume	m^3	70	
Total volume	m^3	980	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	61	100
Drying solids (DS) concentration	kg/m^3	28	28
DS loading	kg/d	1,701	2,811
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	127	209
Drying time	d	16.1	9.8

Table III.3.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	2.20	10.1	22.1
Archimedes' Screw - 100 L/s	1	1	0	3.90	10.1	39.2
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	10.1	44.2
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	0.37	3.0	1.1
Secondary treatment						
Submersible mixer - anoxic tanks	2	2	0	7.50	24.0	360.0
Submersible mixer - aerobic tanks	4	4	0	7.50	8.0	240.0
Air compressor	3	2	1	75.00	16.0	2,400.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.00	6.0	72.0
Sludge recirculation pump	2	1	1	15.00	24.0	360.0
Excess sludge extraction pump	2	1	1	1.10	19.3	21.2
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	2	2	0	4.00	24.0	192.0
Mixer of the aluminium sulphate dosing tank	2	2	0	0.25	24.0	12.0
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	10.1	1,115.9
Filters with automatic cleaning	3	3	0	0.25	10.1	7.5
UV ray disinfection unit	1	1	0	15.00	10.1	150.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0
Treatment of the sludge						
Scraper bridge of the thickener	1	1	0	0.25	24.0	6.0
Thickened sludge pump	1	1	0	1.10	4.9	5.4
Mixer of the thickened sludge storage tank	1	1	0	0.75	24.0	18.0
Thickened sludge pump	2	1	1	2.20	6.0	13.2
Centrifuge	1	1	0	30.00	6.0	180.0
Polymer preparation equipment	1	1	0	1.10	6.0	6.6
Polymer dosing pump	2	1	1	0.75	6.0	4.5
Lift screw of dewatered sludge	1	1	0	1.10	6.0	6.6
Run-off water pump	2	1	1	1.50	3.0	4.5

Table III.3.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	63	53	10	243.8	-	5,676

Table III.3.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	2.20	10.1	22.1
Archimedes' Screw - 100 L/s	1	1	0	3.90	10.1	39.2
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	10.1	44.2
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	8.	12.0
Scum lift pump - primary sedimentation tank	2	1	1	0.55	3.0	1.7
Secondary treatment						
Submersible mixer - anoxic tanks	1	1	0	7.50	24.0	180.0
Submersible mixer - aerobic tanks	2	2	0	7.50	8.0	120.0
Air compressor	2	1	1	90.00	16.0	1,440.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.00	6.0	72.0
Sludge recirculation pump	2	1	1	15.00	24.0	360.0
Excess sludge extraction pump	2	1	1	1.10	17.1	18.8
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	1	1	0	7.50	24.0	180.0
Mixer of the aluminium sulphate dosing tank	2	2	0	0.25	24.0	12.0
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	10.1	1,115.9
Filters with automatic cleaning	3	3	0	0.25	10.1	7.5
UV ray disinfection unit	1	1	0	15.00	10.1	150.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.3.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	2.8	6.1
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	2	0	2.20	16.0	70.4
Pump for water/sludge heat exchanger	2	1	1	2.20	0.0	0.0
Hot water pump for the boiler	2	1	1	4.00	18.0	72.0
Biogas compressor to supply the moto-generators	2	2	0	4.00	16.0	128.0
Pump for cooling liquid/water heat exchanger	3	2	1	2.20	18.0	79.2
Pump for exhaust gas/water heat exchanger	1	1	0	1.50	0.0	0.0
Digested sludge pump	2	1	1	3.00	6.0	18.0
Centrifuge	1	1	0	30.00	6.0	180.0
Polymer preparation equipment	1	1	0	1.10	6.0	6.6
Polymer dosing pump	2	1	1	0.75	6.0	4.5
Lift screw of dewatered sludge	1	1	0	1.10	6.0	6.6
Run-off water pump	2	1	1	1.50	3.0	4.5
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	83	68	15	310.1	-	5,833
Electricity requirement (kWh/year)	-	-	-	-	-	2,106,574
Electricity produced by cogeneration (kWh/year)	-	-	-	-	-	883,562
Electricity purchased from the public network (kWh/year)	-	-	-	-	-	1,223,012

Table III.3.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	2.20	10.1	22.1
Archimedes' Screw - 100 L/s	1	1	0	3.90	10.1	39.2
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	10.1	44.2
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	8.	12.0
Scum lift pump - primary sedimentation tank	2	1	1	0.55	3.0	1.7
Secondary treatment						
Submersible mixer - anoxic tanks	1	1	0	7.50	24.0	180.0
Submersible mixer - aerobic tanks	2	2	0	7.50	8.0	120.0
Air compressor	2	1	1	90.00	16.0	1,440.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.00	6.0	72.0
Sludge recirculation pump	2	1	1	15.00	24.0	360.0
Excess sludge extraction pump	3	2	1	1.18	17.1	40.4
Scum pump	2	1	1	0.55	3.0	1.7
Tertiary treatment						
Nitrate recirculation pump	1	1	0	7.50	24.0	180.0
Mixer of the aluminium sulphate dosing tank	2	2	0	0.25	24.0	12.0
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	10.1	1,115.9
Filters with automatic cleaning	3	3	0	0.25	10.1	7.5
UV ray disinfection unit	1	1	0	15.00	10.1	150.8
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.3.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	5.6	12.3
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	1	1	2.20	16.0	35.2
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	0.75	18.0	13.5
Digested sludge pump	2	1	1	3.00	6.0	18.0
Centrifuge	1	1	0	30.00	6.0	180.0
Polymer preparation equipment	1	1	0	1.10	6.0	6.6
Polymer dosing pump	2	1	1	0.75	6.0	4.5
Lift screw of dewatered sludge	1	1	0	1.10	6.0	6.6
Run-off water pump	2	1	1	1.50	3.0	4.5
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	77	63	14	307.03	-	5,632

Annex-III.4

Tabarka WwTP tables

Table III.4.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Screening
No.	One mechanical operated and one manually operated in the bypass channel

ILLUSTRATIVE PICTURES

Screening · Bar screen · Corroded metal grids

Bar screen motorization · Hopper for screenings · Gate with twisted spindle

REMARKS	- There is no flow measurement at the plant entrance. - The screening device presents in large scale a high level of corrosion, possibly due to the proximity of the sea in addition to its wastewater working environment. All the mechanisms were wide open being exposed to weather conditions. - The screenings are sent to transport through a hopper in stainless steel. This presented some level of corrosion and does not seem to be the best solution for this function. - The gates presented a high level of deterioration.
RECOMMENDATIONS	- The bar screen should be replaced and a screenings conveyer should be implemented. - The gates should be fully replaced. - All the ironmongery (such as floor grids) should be beneficiated regarding coating protection.

WWTP of TABARKA

Table III.4.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Grit and grease removal
No.	One scraper working on two channels chamber with aeration, bottom grit pumping and surface grease removal.

ILLUSTRATIVE PICTURES

Scraper bridge

Blowers

Grease scraper & switch limit

Scraper bridge wheel

Grit trailer

REMARKS	- In general, the scraper bridge presents a very high level of deterioration. - The scraper bridge suffers from deviation on the longitudinal movement. - The scraper bridge wheels present a high level of degradation. - There is no grit classifier. The grit trailer carries a great amount of water. It was reported to the consultant team the bad performance of the grit pumps. - The electrical component of the equipment presents a high level of degradation. - The blowers for the aeration are working and present a reasonably state of preservation.
RECOMMENDATIONS	- The scraper bridge should be replaced. - The grit classifier operation needs to be improved, possibly with the installation of dedicated equipment for this function.

WWTP of TABARKA

Table III.4.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – aeration tanks
No.	4 Aeration tanks with floating surface aerators

ILLUSTRATIVE PICTURES

Floating surface aerator

Electrical installation Valves

REMARKS	- Generally, the floating surface aerators present a reasonably state taking in consideration their working conditions. - There are no submersible agitators. - The valves generally presented a state of advanced corrosion. - The electrical components present a very high stage of degradation and lack of protection against weather exposure. - The operation of the surface aerators it is not automated, as in an automation system, which integrates a measurement of the dissolved oxygen within the tank.
RECOMMENDATIONS	- The aeration method currently in place is not as efficient for the oxygen needs of the process as a diffused aeration mode. Therefore, it is proposed the replacement of these aerators by a diffused aeration mode. - The electrical installation needs to be fully revised. - Valves should be beneficiated regarding coating protection. - Automation should be increased specially focusing on integration between oxygen probes in the aeration tanks and the aeration working hours.

Table III.4.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – secondary clarifier
No.	1

ILLUSTRATIVE PICTURES


REMARKS	- Generally, the scraper bridge presents a very high level of deterioration. - The scraper bridge suffers from deviation on the longitudinal movement. There is a big gap between its guiding wheel and the clarifier wall. - The scraper bridge wheels present a high level of degradation. - In general, the ironmongery presents a high level of corrosion, possibly due to the proximity of the sea in addition to its wastewater working environment. - It was reported to the consultant team that the control cable is replaced 3 times per year. - It was reported to the consultant team that each sludge extraction pump is revised once a year. - The free surface flow recycling system and the sludge flow partition solution are out-dated and cause an impediment to the good management of the treatment process.
RECOMMENDATIONS	- The scraper should be replaced. - For sludge recycling system, the solution to be proposed intends to build a dedicated station pump for sludge recycling and sludge purging including flow measurement and pumps with frequency variation in order to improve the management of the treatment process.

WWTP of TABARKA

Table III.4.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Sludge thickener and drying beds
No.	1 Sludge thickener (square plan) with mechanical scraper bridge

ILLUSTRATIVE PICTURES


REMARKS	- The bridge painting is somewhat degraded and blemished in some places. - The sludge pumping station to feed the thickener presents hydraulic problems. It was reported to the consultant team some issues of pit overflow and submersible pumps malfunctioning. - It was reported to the consultant team that drying beds have started a rehabilitation program in 2009 due to the proliferation of a huge amount of flies. They will be resumed in 2011.
RECOMMENDATIONS	- The scraper bridge is working however needs an overhaul. - The sludge pumping solution has to be revised and integrated with a whole design solution for the WWTP.

WWTP of TABARKA

Table III.4.1.1.2 – Civil Engineering

UNIT/OPERATION	Civil Engineering
No.	

<table>
<tr><td colspan="2">ILLUSTRATIVE PICTURES</td></tr>
<tr><td>Photo 1: Aeration Tanks</td><td>Photo 2: Scraper</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Photo 3: Aeration Tanks</td><td>Photo 4: Aeration Tanks</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Photo 5: Screening</td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Table III.4.1.1.2 – Civil Engineering

SPECIFICATIONS	The structures of the wastewater treatment plant are made out of reinforced concrete. They are formed by a raft foundation, extreme screens in contact with the ground (half-buried works), of the screens and intermediate screens beams, and posts and beams. These structures are separated by expansion joints with water-stop. The foundations of the works are superficial while resting on blinding concrete (thickness 10 cm) and a blocking layer (crushed at 40/70) for the drainage and protection layers.
DIAGNOSIS	- The structures are in a good state, and it does not present any particular disorders (remarkable cracks, differential settlements etc.). - We can observe also a concrete break-up at the head of the screens receiving the supports of the scraper. This can be due to the absence of surface steels (hoops) sufficient to receive localized forces as well as steels for the balance of the corners. These degradations are localized and the remainder of structures does not present any important degradations or cracking. (Photo 2) - On the other hand, the works are separated by expansion joints which are encountered in a worn condition, if not degraded state. The joints are provided with water-stops. (Photo 3, 4) - There was an increase of the height of two walls, namely one in the station of pre-treatment and the other in the sludge basin. In both cases, this increase is due to the excess of the level of wastewater, or to the excess of sludge in the second case. (Photo 5)

Table III.4.2.1 - Design data

Design Data

Parameter		Unit	Year	
			2011	2029
Population served				
Domestic population		p.e	21,239	31,322
Industrial population		p.e	1,192	3,787
Touristic population		p.e	5,304	9,400
Total population		p.e	27,735	44,509
Peak Factors				
Domestic peak factor		-	1.6	1.5
Industrial peak factor		-	2.0	2.0
Touristic peak factor		-	2.0	2.0
Return factor				
Domestic return factor		%	80	80
Industrial and touristic return factor		%	90	90
Per capita flow and load factors				
Per capita water consumption				
	domestic	L/capita/d	113	148
	industrial	L/capita/d	-	-
	touristic	L/capita/d	500	500
Domestic and touristic per capita loading factors				
	TSS	g/capita/d	90	90
	BOD_5	g/capita/d	60	60
	COD	g/capita/d	120	120
	Total Nitrogen (TN)	g/capita/d	8	8
	Total Phosphorus (TP)	g/capita/d	1.5	1.5
	Fecal Coliforms	CFU/capita/d	1.00E+11	1.00E+11
Wastewater inflows				
Domestic average daily flow (Adf)		m^3/d	1,925	3,712
		L/s	22.3	43.0
Domestic peak flow		m^3/h	125	238
		L/s	34.7	66.2
Industrial average daily flow		m^3/d	179	568
		L/s	2.1	6.6
Industrial peak flow		m^3/h	15	47
		L/s	4.1	13.1
Touristic average daily flow (occupancy rate = 100%)		m^3/d	2,387	4,230
		L/s	27.6	49.0
Touristic peak flow		m^3/h	199	353
		L/s	55.3	97.9

Table III.4.2.1 - Design data

Parameter	Unit	Year	
		2011	**2029**
Infiltration flow	L/s	8.9	17.2
Total average daily flow (domestic + industrial + touristic)	m^3/d	4,491	8,510
Total average daily flow (domestic + industrial + touristic) + infiltratior	m^3/d	5,261	9,995
Total peak flow	m^3/h	371	700
	L/s	103.0	194.5
Maximum design flow (Mdf) (1)	m^3/h	378	700
	L/s	105	194
Loadings			
Domestic + touristic			
TSS	kg/d	2,389	3,665
BOD_5	kg/d	1,593	2,443
COD	kg/d	3,185	4,887
TN	kg/d	212	326
TP	kg/d	40	61
Fecal Coliforms	CFU/d	2.65E+15	4.07E+15
Industrial			
TSS	kg/d	72	227
BOD_5	kg/d	72	227
COD	kg/d	179	568
TN	kg/d	22	70
TP	kg/d	2	6
Total			
TSS	kg/d	2,460	3,892
BOD_5	kg/d	1,664	2,671
COD	kg/d	3,364	5,455
TN	kg/d	234	396
TP	kg/d	42	67
Fecal Coliforms	CFU/d	2.65E+15	4.07E+15

Table III.4.2.1 - Design data

Parameter	Unit	Year	
		2011	**2029**
Concentrations (2)			
Domestic + touristic			
TSS	mg/L	554	461
BOD_5	mg/L	369	308
COD	mg/L	739	615
TN	mg/L	49	41
TP	mg/L	9	8
Fecal Coliforms	CFU/100mL	6.16E+07	5.13E+07
Industrial			
TSS	mg/L	400	400
BOD_5	mg/L	400	400
COD	mg/L	1,000	1,000
TN	mg/L	123	123
TP	mg/L	10	10
Total without infiltration			
TSS	mg/L	548	457
BOD_5	mg/L	371	314
COD	mg/L	749	641
TN	mg/L	52	47
TP	mg/L	9	8
Fecal Coliforms	CFU/100mL	5.91E+07	4.78E+07

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

(2) Without infiltration

Table III.4.3.1 - Traitement préliminaire

Operation: Grit retention

Parameter	Unit	Year	
		2011	2029
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	4,491	8,510
Maximum design flow (Mdf)	m^3/h	378	700
	L/s	105	194
Design Criteria			
Number of basins	un	1	
Type	-	square plant (existing thickener)	
Retention time (Mdf)	min	15	
Design Results			
Total volume	m^3	144	
Unitary surface area	m^2	36	
Existing infrastructures operational conditions			
Retention time			
Adf	min	46	24
Mdf	min	23	12

Table III.4.3.2 - Preliminary Treatment

Operation: Screening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Mechanical Screening			
Number of screening devices working in parallel	un.	1	
Screen bars spacing	mm	12	
Bars thickness (1)	mm	10	
Channel width	m	0.6	
Channel depth	m	-	
Unitary power of screening devices	kW/un.	1.1	
Maximum flow capacity	m^3/h	756	
Manually Cleaned Coarse Screens			
Number of coarse screens	un.	1	
Screen bars spacing	mm	40	
Channel width	m	0.6	
Channel depth	m	-	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	26,543	40,722
Average daily flow (Adf)	m^3/d	4,491	8,510
Maximum design flow (Mdf) (2)	m^3/h	378	700
	L/s	105	194
Design Criteria			
Velocity through clean bar screen	m/s	1.2	
Approach velocity	m/s	0,3 - 0,9	
Maximum degree of clogging	%	74.26875814	
Channel depth	m	-	
Kirschmer factor	-	1.94	
Channel freeboard	m	≥ 0,3	
Volume of screenings per capita	L/capita/year	6.0	
Bulk density of removed screenings	kg/L	0.95	
Screenings removal rate	%	95	

Table III.4.3.2 - Preliminary Treatment

Parameter	Unit	Year	
		2011	2029
Existing infrastructures operational conditions			
Effective open area (Mdf)	m^2	0.26	0.26
Total cross-sectional area	m^2	0.48	0.48
Height of the liquid upstream	m	0.80	0.80
Approach velocity (Mdf)	m/s	0.22	0.41
Approach velocity (Adf)	m/s	0.11	0.21
Channel freeboard	m	-	-
Headloss through clogged screens	mm WC	3.2	10.8
Screenings characteristics and quantities			
Volumetric flow of incoming wet screenings	L/d	436	669
Mass flow of incoming wet screenings	kg/d	415	636
Volumetric flow of removed wet screenings	kg/d	394	604
Mass flow of removed wet screenings	m^3/d	0.41	0.64

(1) Addmitted value

(2) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.3.3 - Preliminary Treatment

Operation: Grit and Grease Removal

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of chambers	un.	1	
Type	-	rectangular plant, aerated	
Length	m	10	
Total width	m	5.7	
Depth	m	4	
Grit cross-sectional area	m^2	11	
Grease cross-sectional area	m^2	11	
Total surface	m^2	57	
Total wet volume	m^3	228	
Number of grit pumps	un.	1	
Unitary power of grit pumps	kW/un.	3.8	
Unitary capacity of grit pumps	m^3/h	30	
Number of air compressors	un.	1+1	
Unitary power of air compressors	kW/un.	2.2	
Number of scraper bridges	un.	1	
Unitary power of scraper bridges	kW/un.	0.12	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	26,543	40,722
Average daily flow (Adf)	m^3/d	4,491	8,510
Maximum design flow (Mdf) [(1)]	m^3/h	378	700
	L/s	105	194
Design Criteria			
Retention time (Mdf)	min	10 - 15	
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	10 - 15	
Specific air flow	L/s/m	5.0	
	m^3 air/h/m^3	1,5	
Headloss in the aeration system	% submergence	30	
Volume of grit per capita	L/capita/year	7.0	
Grit removal rate	%	95	
Volume of oil & grease per capita	g/capita/d	36	
Bulk density of removed oil & grease	kg/L	0.8	
Oil & grease removal rate	%	30	

Table III.4.3.3 - Preliminary Treatment

Parameter		Unit	Year 2011	Year 2029
Existing infrastructures operational conditions				
Retention time				
	Adf	min	73	39
	Mdf	min	36	20
Hydraulic loading rate				
	Adf	$m^3/m^2/h$	3.3	6.2
	Mdf	$m^3/m^2/h$	6.6	12.3
Volumetric flow of incoming grit		L/d	509	781
Mass flow of incoming grit		kg/d	764	1,171
Volumetric flow of removed grit		kg/d	725	1,113
Mass flow of removed grit		m^3/d	193	297
Volumetric flow of grit after classification		m^3/d	0.54	0.82
Mass flow of grit after classification		kg/d	645	989
Runoff flow		m^3/d	193	296
Mass flow of incoming oil & grease		kg/d	774	1,466
Volumetric flow of incoming oil & grease		L/d	967	1,832
Mass flow of removed oil & grease		kg/d	232	440
Volumetric flow of removed oil & grease		m^3/d	29	55

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.4.1 - Primary settling (Solutions 2 and 3)

Operation: Primary settling

Parameter	Unit	Year 2011	Year 2029
Influent wastewater flows and loads (with process wastewaters)			
Average daily flow (Adf)	m^3/d	4,729	8,882
Maximum design flow (Mdf) (1)	m^3/h	378	700
	L/s	105	194
TSS Concentration	kg/m^3	0.6	0.5
TSS loading	kg/d	2,765	4,372
Design Criteria			
Hydraulic loading rate (Adf)	$m^3/m^2/h$	< 1,5	
Retention time (Mdf)	h	> 2	
Depth	m	3.0	
SS concentration in primary sludge	kg/m^3	20	
SS removal rate	%	50	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of primary sludge pumps	un.	2.0	
Design results			
Number of primary settling tanks	un	2	
Type	-	rectangular plant	
Total surface	m^2	467	
Unitary surface	m^2	233	
Length	m	20	
Width	m	12	
Real unitary surface	m^2	240	
Unitary volume	m^3	720	
Total volume	m^3	1,440	
Scum pumps capacity	m^3/h	18	
Unitary capacity of primary sludge pumps	m^3/h	18	
Operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.8	1.5
Retention time (Mdf)	h	3.8	2.1
Primary sludge production	kg/d	1,383	2,186
	m^3/d	69.1	109.3
Scum production	kg/d	47	89
	m^3/d	0.05	0.09

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.5.1 - Biological Treatment (Solution 1)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	1	
Number of basins in series in each treatment line	un.	4	
Each basin side length	m	18.0	
Each basin surface	m^2	324	
Total surface	m^2	1 296	
Liquid depth	m	3.8	
Each basin volume	m^3	1 231	
Total volume	m^3	4 925	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	-	
Aeration power (2 velocities)	kW	38 (min) - 40,3 (max) 21 (min) - 22,5 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	27,735	44,509
Average daily flow (Adf)	m^3/d	4,708	8,850
Maximum design flow (Mdf) [(1)]	m^3/h	378	700
TSS	kg/d	2,648	4,189
BOD	kg/d	1,758	2,819
TN	kg/d	245	412
TP	kg/d	44	70
Existing treatment line ≈ 60 %			
Average daily flow (Adf)	m^3/d	2,825	5,310
Maximum design flow (Mdf)	m^3/h	227	420
TSS	kg/d	1,589	2,513
BOD	kg/d	1,055	1,691
TN	kg/d	147	247
TP	kg/d	26	42
New treatment line ≈ 40 %			
Average daily flow (Adf)	m^3/d	1,883	3,540
Maximum design flow (Mdf)	m^3/h	151	280
TSS	kg/d	1,059	1,676
BOD	kg/d	703	1,128
TN	kg/d	98	165
TP	kg/d	17	28

Table III.4.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year 2011	Year 2029
Effluent required quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.8	
MLVSS in aeration tanks	kg/m^3	3.60	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.036	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	6	
Number of nitrate recycle pumps	un.	2+0	
Number of sludge recycle pumps	un.	2+2	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peaking factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	

Table III.4.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	0.2	
Number of air compressors	un.	2+1	
Existing infrastructures operational conditions			
F/M	kgBOD/kgMLVSS/d	0.10	0.16
Fv	kgBOD/m^3/d	0.36	0.57
Design results			
Total biological volume	m^3	-	7,762
Total anoxic volume	m^3	-	1,800
Total aerobic volume	m^3	-	5,962
Treatment line 1 (existing)			
Biological volume	m^3	-	4,925
Anoxic Volume	m^3	-	1,231
Ratio Vanoxic/Vtotal	-	-	0.25
Aerobic volume	m^3	-	3,694
Unitary capacity of air compressors	m^3/h	-	4,091
Unitary capacity of nitrate recycle pumps	m^3/h	-	664
Unitary capacity of sludge recycle pumps	m^3/h	-	332
Treatment line 2 (new)			
Biological volume	m^3	-	2,837
Anoxic Volume	m^3	-	568
Ratio Vanoxic/Vtotal	-	-	0.20
Aerobic volume	m^3	-	2,269
Unitary capacity of air compressors	m^3/h	-	2,582
Unitary capacity of nitrate recycle pumps	m^3/h	-	443
Unitary capacity of sludge recycle pumps	m^3/h	-	221
Operational conditions - Treatment line 1			
F/M	kgBOD/kgMLVSS/d	0.059	0.095
Fv	kgBOD/m^3/d	0.214	0.343
Sludge age	d	32	20
Minimum sludge recycle	m^3/d	1,412	2,655
Maximum sludge recycle	m^3/d	4,237	7,965
Minimum nitrate recycle	m^3/d	2,825	5,310
Maximum nitrate recycle	m^3/d	8,475	15,930

Table III.4.5.1 - Biological Treatment (Solution 1)

Parameter		Unit	Year 2011	Year 2029
Required oxygen for oxidation of organic material		kgO_2/d	534	843
	peak	kgO_2/h	24	39
Required oxygen for endogenous metabolism		kgO_2/d	1,064	1,064
	peak	kgO_2/h	44	44
Required oxygen for oxidation of ammonia		kgO_2/d	411	712
	peak	kgO_2/h	26	44
Oxygen recovered from denitrification		kgO_2/d	135	225
	peak	kgO_2/h	8	14
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	1,873	2,393
	peak	kgO_2/h	86	113
SOR - Standard Oxygen Requirement		kgO_2/d	3,114	4,104
	peak	kgO_2/h	130	171
Total air flow required		m^3/d	74,501	98,182
		m^3/h	3,104	4,091
Operational conditions - Treatment line 2				
F/M		kgBOD/kgMLVSS/d	0.069	0.110
Fv		$kgBOD/m^3/d$	0.248	0.397
Sludge age		d	32	20
Minimum sludge recycle		m^3/d	942	1,770
Maximum sludge recycle		m^3/d	2,825	5,310
Minimum nitrate recycle		m^3/d	1,883	3,540
Maximum nitrate recycle		m^3/d	5,650	10,620
Required oxygen for oxidation of organic material		kgO_2/d	356	562
	peak	kgO_2/h	16	26
Required oxygen for endogenous metabolism		kgO_2/d	613	613
	peak	kgO_2/h	26	26
Required oxygen for oxidation of ammonia		kgO_2/d	274	475
	peak	kgO_2/h	17	30
Oxygen recovered from denitrification		kgO_2/d	90	150
	peak	kgO_2/h	6	9
AOTR - Average Oxygen Theoretical Required		kgO_2/d	1,152	1,499
	peak	kgO_2/h	53	72
SOR - Standard Oxygen Requirement		kgO_2/d	1,930	2,590
	peak	kgO_2/h	80	108
Total air flow required		m^3/d	46,189	61,976
		m^3/h	1,925	2,582

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.5.2 - Biological Treatment (Solutions 2 and 3)

Operation: Biological organic matter removal (activated sludge in conventional aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	1	
Number of basins in series in each treatment line	un.	4	
Each basin side length	m	18.0	
Each basin surface	m^2	324	
Total surface	m^2	1,296	
Liquid depth	m	3.8	
Each basin volume	m^3	1,231	
Total volume	m^3	4,925	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	-	
Aeration power (2 velocities)	kW	38 (min) - 40,3 (max) 21 (min) - 22,5 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	27,735	44,509
Average daily flow (Adf)	m^3/d	4,660	8,772
Maximum design flow (Mdf) (1)	m^3/h	378	700
TSS	kg/d	1,383	2,186
BOD	kg/d	1,362	2,183
TN	kg/d	225	379
TP	kg/d	39	63
Effluent required quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.4.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.2 - 0.5	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.5 - 1.2	
Sludge age	d	8	
MLSS in aeration tanks	kg/m^3	3.5	
MLVSS/ MLSS ratio	-	0.7	
MLVSS in aeration tanks	kg/m^3	2.45	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.07	
Sludge production	kgMLSS/kgBOD/d	1.03	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	4	
Number of nitrate recycle pumps	un.	1+0	
Number of sludge recycle pumps	un.	1+1	
Aeration system			
a'	kgO/kgBOD	0.50	
b'	kgO/kgMVS/d	0.08	
Peaking factor for BOD removal	-	1.2	
Nitrification peak factor	-	1.8	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.09	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	1+1	

Table III.4.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.11	0.18
Fv		kgBOD/m^3/d	0.28	0.44
Design results				
Total biological volume		m^3	2,462	3,693
Anoxic zone volume		m^3	616	1,231
Anoxic volume / Total volume		-	0.25	0.33
Aerobic zone volume		m^3	1,847	2,462
Unitary capacity of air compressors		m^3/h	-	4,954
Unitary capacity of nitrate recycle pumps		m^3/h	-	1,097
Unitary capacity of sludge recycle pumps		m^3/h	-	548
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.226	0.241
Fv		kgBOD/m^3/d	0.553	0.591
Sludge age		d	6	8
Minimum sludge recycle		m^3/d	2,330	4,386
Maximum sludge recycle		m^3/d	6,990	13,159
Minimum nitrate recycle		m^3/d	4,660	8,772
Maximum nitrate recycle		m^3/d	13,980	26,317
Required oxygen for oxidation of organic material		kgO_2/d	611	960
	peak	kgO_2/h	31	48
Required oxygen for endogenous metabolism		kgO_2/d	483	724
	peak	kgO_2/h	20	30
Required oxygen for oxidation of ammonia		kgO_2/d	686	1 181
	peak	kgO_2/h	51	89
Oxygen recovered from denitrification		kgO_2/d	231	393
	peak	kgO_2/h	17	29
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	1,548	2,472
	peak	kgO_2/h	85	137
SOR - Standard Oxygen Requirement		kgO_2/d	3,067	4,969
	peak	kgO_2/h	128	207
Total air flow required		m^3/d	73,382	118,890
		m^3/h	3,058	4,954

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.5.3 - Phosphorus Removal (Solution 1)

Operation: Chemical phosphorus removal

Parameter	Unit	Year 2011	Year 2029
Design criteria			
Phosphorus to remove by precipitation	%	99.5	99.4
Phosphorus assimilated on biological treatment	%/100kgBOD$_5$	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	24	15
Number of dosing pumps	un.	2+2	2+2
Design results			
Treatment line 1 (existing)			
Phosphorus to be removed by chemical precipitation	kg/d	16	26
	mg/L	5.8	5.0
Al quantity required	kg/d	49	79
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	607	980
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	1,214	1,961
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	0.9	1.5
	m^3/year	341	550
Dosage tank minimum volume	m^3	23	23
Unitary capacity of dosing pumps	L/h	63	63
Treatment line 2 (new)			
Phosphorus to be removed by chemical precipitation	kg/d	11	18
	mg/L	5.8	5.0
Al quantity required	kg/d	33	53
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	405	654
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	809	1,307
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	0.6	1.0
	m^3/year	227	367
Dosage tank minimum volume	m^3	15	15
Unitary capacity of dosing pumps	L/h	42	42

Table III.4.5.3 - Phosphorus Removal (Solution 1)

Parameter	Unit	Year 2011	Year 2029
Operational conditions			
Treatment line 1 (existing)			
Physico-chemical sludge produced			
Phosphates	kg/d	75	122
Hydroxides	kg/d	109	176
Physico-chemical sludge quantity produced	kg/d	184	298
	m^3/d	23.0	37.2
Treatment line 2 (new)			
Physico-chemical sludge produced			
Phosphates	kg/d	50	81
Hydroxides	kg/d	73	117
Physico-chemical sludge quantity produced	kg/d	123	198
	m^3/d	15.3	24.8

Table III.4.5.4 - Phosphorus Removal (Solutions 2 and 3)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.5	99.4
Phosphorus assimilated on biological treatment	%/100kgBOD$_5$	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	24	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	27	44
	mg/L	5.8	5.0
Al quantity required	kg/d	81	131
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	998	1,613
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	1,996	3,226
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	1.5	2.5
	m^3/year	560	906
Dosage tank minimum volume	m^3	37	37
Unitary capacity of dosing pumps	L/h	103	103
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	124	200
Hydroxides	kg/d	179	290
Physico-chemical sludge quantity produced	kg/d	303	490
	m^3/d	37.9	61.2

Table III.4.5.5 - Biological treatment (Solution 1)

Operation: Clarification

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	1	
Type	-	rectangular plant	
Length	m	35.0	
Unitary width	m	11.0	
Depth	m	4.0	
Unitary surface	m^2	385	
Total surface	m^2	385	
Unitary volume	m^3	1,540	
Total volume	m^3	1,540	
Unitary power of scraper bridges	kW/un.	0.25	
Number of biological sludge pumps	un.	3.00	
Unitary capacity of biological sludge pumps	m^3/h	90.00	
Number of thickening sludge pumps	un.	1.00	
Unitary capacity of thickening sludge pumps	m^3/h	15.00	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	4,708	8,850
Maximum design flow (Mdf) [(1)]	m^3/h	378	700
	L/s	105	194
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	21,187	39,826
Treatment line 1 (existing)			
Average daily flow (Adf)	m^3/d	2,825	5,310
Maximum design flow (Mdf)	m^3/h	227	420
	L/s	63	117
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	12,712	23,895
Treatment line 2 (new)			
Average daily flow (Adf)	m^3/d	1,883	3,540
Maximum design flow (Mdf)	m^3/h	151	280
	L/s	42	78
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	8,475	15,930
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Depth	m	3.0	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8.0	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of biological sludge pumps	un.	3	
Number of scum pumps	un.	2+2	
Number of excess sludge pumps	un.	2+2	

Table III.4.5.5 - Biological treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.98	1.82
Retention time (Mdf)	h	4.1	2.2
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	161	300
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.4	0.8
Design results			
Treatment line 1 (existing)			
Number of secondary clarifiers	un	1.0	
Type	-	rectangular plant	
Depth	m	4.0	
Length	m	35.0	
Width	m	11.0	
Unitary surface	m^2	385	
Total surface	m^2	385	
Unitary volume	m^3	1,540	
Total volume	m^3	1,540	
Unitary capacity of biological sludge pumps	m^3/h	114	
Unitary capacity of scum pumps	m^3/h	18.0	
Unitary capacity of excess sludge pumps	m^3/h	18.0	
Treatment line 2 (new)			
Number of secondary clarifiers	un	1.0	
Type	-	rectangular plant	
Requested unitary surface	m	311	
Depth	m	3.0	
Length	m	21.0	
Width	m	15.0	
Unitary surface	m^2	315	
Total surface	m^2	315	
Unitary volume	m^3	945	
Total volume	m^3	945	
Unitary capacity of biological sludge pumps	m^3/h	76	
Unitary capacity of scum pumps	m^3/h	18.0	
Unitary capacity of excess sludge pumps	m^3/h	18.0	

Table III.4.5.5 - Biological treatment (Solution 1)

Parameter	Unit	Year	
		2011	**2029**
Operational conditions			
Treatment line 1 (existing)			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.59	1.09
Retention time (Mdf)	h	6.8	3.7
Solids loading rate (Adf+ Frec.)	$kgSS/m^2/d$	170	184
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	96.6	179.9
Scum production	kg/d	0	0
	m^3/d	28.25 0.03	53.10 0.06
Treatment line 2 (new)			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.48	0.89
Retention time (Mdf)	h	6.3	3.4
Solids loading rate (Adf+ Frec.)	$kgSS/m^2/d$	79	147
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.2	0.4
Scum production	kg/d	19	35
	m^3/d	0.02	0.04

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.5.6 - Biological treatment (Solutions 2 and 3)

Operation: Clarification

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	1	
Type	-	rectangular plant	
Length	m	35.0	
Unitary width	m	11.0	
Depth	m	4.0	
Unitary surface	m^2	385	
Total surface	m^2	385	
Unitary volume	m^3	1,540	
Total volume	m^3	1,540	
Unitary power of scraper bridges	kW/un.	0.25	
Number of biological sludge pumps	un.	3.00	
Unitary capacity of biological sludge pumps	m^3/h	90.00	
Number of thickening sludge pumps	un.	1.00	
Unitary capacity of thickening sludge pumps	m^3/h	15.00	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	4,660	8,772
Maximum design flow (Mdf) (1)	m^3/h	378	700
	L/s	105	194
TSS concentration	kg/m^3	3.5	3.5
TSS loads	kg/d	16,310	30,704
Secondary clarifier 1 - existing			
Average daily flow (Adf)	m^3/d	2,825	5,310
Maximum design flow (Mdf)	m^3/h	227	420
	L/s	63	117
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	9,786	18,422
Secondary clarifier 2 - new			
Average daily flow (Adf)	m^3/d	1,883	3,540
Maximum design flow (Mdf)	m^3/h	151	280
	L/s	42	78
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	6,524	12,281

Table III.4.5.6 - Biological treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Depth	m	4.0	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8.0	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of biological sludge pumps	un.	3	
Number of scum pumps	un.	1+1	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.98	1.82
Retention time (Mdf)	h	4.1	2.2
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	125	232
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.3	0.6
Design results			
Secondary clarifier 1 - existing			
Number of secondary clarifiers	un	1.0	
Type	-	rectangular plant	
Depth	m	4.0	
Length	m	35.0	
Width	m	11.0	
Unitary surface	m^2	385	
Total surface	m^2	385	
Unitary volume	m^3	1,540	
Total volume	m^3	1,540	
Unitary capacity of biological sludge pumps	m^3/h	112	
Secondary clarifier 2 - new			
Number of secondary clarifiers	un	1.0	
Type	-	rectangular plant	
Requested unitary surface	m	311.1	
Depth	m	3	
Length	m	21.0	
Width	m	15.0	
Unitary surface	m^2	315.0	
Total surface	m^2	315	
Unitary volume	m^3	945	
Total volume	m^3	945	
Unitary capacity of biological sludge pumps	m^3/h	75	
Unitary capacity of scum pumps	m^3/h	18	
Unitary capacity of excess sludge pumps	m^3/h	18	

Table III.4.5.6 - Biological treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Operational conditions			
Secondary clarifier 1 - existing			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.59	1.09
Retention time (Mdf)	h	6.8	3.7
Solids loading rate (Adf+ Frec.)	$kgSS/m^2/d$	97	180
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.3	0.5
Scum production	kg/d	28	53
	m^3/d	0.03	0.06
Secondary clarifier 2 - new			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	0.48	0.89
Retention time (Mdf)	h	6.3	3.4
Solids loading rate (Adf+ Frec.)	$kgSS/m^2/d$	79	147
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.2	0.4
Scum production	kg/d	19	35
	m^3/d	0.02	0.04

(1) At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.6.1 - Filtration and Disinfection

Operation: Filtration and disinfection of secondary effluent

Parameter	Unit	Year	
		2011	2029
Filtration			
Influent wastewater flows and loads			
Maximum design flow (Mdf) [(1)]	m^3/h	378	700
	L/s	105	194
TSS concentration	kg/d	30	30
Design criteria			
TSS concentration in filtrate effluent	mg/L	< 20	
Design results			
Feeding pumps to the filters			
Type	-	Centrifuge, multicellular	
Number of pumps	un.	3.0	
Capacity	m^3/h	700	
Filter			
Type	-	metallic, self-cleaning	
Capacity	m^3/h	700	
Disinfection			
Influent wastewater flows and loads			
Maximum design flow (Mdf) [(1)]	m^3/h	378	700
	L/s	105	194
TSS concentration	mg/L	20	20
Inlet fecal coliforms concentration	CFU / 100 mL	6.16E+07	5.13E+07
Design criteria			
Outlet fecal coliforms concentration	CFU / 100 mL	2,000	
Outlet fecal streptococcus concentration	CFU / 100 mL	1,000	
Design UV transmittance (at 254 nm)	%	> 55	
Minimum radiation dosage	mJ/cm^2	25	

[(1)] At year zero, this flow corresponds to the maximum capacity of the WWTP upstream pumping stations

Table III.4.7.1 - Sludge Treatment (Solution 1)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	6.0	
Maximum depth	m	4.0	
Unitary surface	m^2	36	
Total surface	m^2	36	
Unitary volume	m^3	144	
Total volume	m^3	144	
Unitary power of scraper bridges	kW/un.	0.18	
Influent sludge flows and loads			
Excess activated sludge average flow	m^3/d	202	319
Physico-chemical sludge average flow	m^3/d	38	62
Total sludge flow	m^3/d	240	381
TSS loading	kg/d	1,924	3,049
TSS concentration	kg/m^3	8.0	8.0
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Number of thickened sludge pumps	un.	2	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	6.7	10.6
Solids loading rate	$kgSS/m^2/d$	53.4	84.7

Table III.4.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Design results			
Number of thickeners	un	2	
Type	-	circular plant	
Requested unitary volume	m^3	160	
Minimum unitary surface	m^2	51	
Minimum unitary diameter	m	50.8	
Adopted diameter	m	8.0	
Depth	m	4.4	
Total surface	m^2	101	
Unitary surface	m^2	50.3	
Unitary volume	m^3	208	
Total volume	m^3	416	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	1.0	2.0
Thickening sludge flow	m^3/d	240	381
Thickening sludge solids content	kg/d	1,924	3,049
Thickened sludge flow	m^3/d	61	97
Thickened sludge solids content	kg/d	1,828	2,897
Hydraulic loading rate	$m^3/m^2/d$	4.8	3.8
Solids loading rate	$kgSS/m^2/d$	38.3	30.3
Supernatant flow	m^3/d	180	285
Supernatant solids content	kg/d	96	152
Supernatant solids concentration	mg/L	536	536

Operation: Thickened sludge storage

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	61	97
Thickened sludge solids content	kg/d	1,828	2,897
Design criteria			
Minimum retention time	d	3	
Depth	m	2	
Number of thickened sludge pumps	un.	1+1	

Table III.4.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Requested volume	m^3	290	
Side length	m	12.5	
Surface	m^2	156	
Volume	m^3	313	
Number of submersible agitators	un.	1	
Unitary capacity of thickened sludge pumps	m^3/h	23.0	
Operational conditions			
Retention time	d	5	3

Table III.4.7.2 - Sludge treatment (Solutions 2 and 3)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	6.0	
Maximum depth	m	4.0	
Unitary surface	m^2	36	
Total surface	m^2	36	
Unitary volume	m^3	144	
Total volume	m^3	144	
Unitary power of scraper bridges	kW/un.	0.18	
Influent sludge flows and loads			
Primary sludge average flow	m^3/d	69	109
Excess activated sludge average flow	m^3/d	157	247
Physico-chemical sludge average flow	m^3/d	38	61
Total sludge flow	m^3/d	264	418
TSS loading	kg/d	2,945	4,653
TSS concentration	kg/m^3	11.1	11.1
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	40	
Number of thickened sludge pumps	un.	2	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	7.3	11.6
Solids loading rate	$kgSS/m^2/d$	81.8	129.3

Table III.4.7.2 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design results			
Number of thickeners	un	2	
Type	-	circular plant	
Requested unitary volume	m^3	182	
Minimum unitary surface	m^2	78	
Minimum unitary diameter	m	9.9	
Diameter	m	10.0	
Depth		4.5	
Total surface	m^2	157	
Unitary surface	m^2	78.5	
Unitary volume	m^3	328	
Total volume	m^3	655	
Unitary capacity of thickened sludge pumps	m^3/h	18.0	
Operational conditions			
Number of thickeners operating	un.	1.0	2.0
Thickening sludge flow	m^3/d	264	418
Thickening sludge solids content	kg/d	2,945	4,653
Thickened sludge flow	m^3/d	70	111
Thickened sludge solids content	kg/d	2,797	4,421
Hydraulic loading rate	$m^3/m^2/d$	3.4	2.7
Solids loading rate	$kgSS/m^2/d$	37.5	29.6
Supernatant flow	m^3/d	194	307
Supernatant solids content	kg/d	147	233
Supernatant solids concentration	mg/L	757	757

Table III.4.8.1 - Sludge treatment (Solutions 2 and 3)

Operation: Anaerobic mesophilic digestion

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	70	111
Thickened sludge solids content	kg/d	2 797	4 421
Solids concentration	kg/m^3	40	40
SSV/SST	%	60	60
SSV loading	kg/d	1,678	2 652
Design criteria			
Digester			
Number of digesters	un.	1	
Average digestion temperature	ºC	35	
Minimum retention time	h	10 - 20	
SSV removal rate	%	50	
Solids loading	$kgMVS/m^3/d$	1,6 - 4,8	
Most unfavorable sludge temperature	ºC	15	
Sludge bulk density	kg/m^3	1 000	
Digester slope bottom	º	30	
Sludge recycle for mixing	-	5,0 x $V_{digestion}$	
Number of pumps of digested sludge	un.	1+1	
Gasholder			
Number of gasholders	un.	1	
Biogas production	$m^3/kgSVS$	0.9	
Minimum retention time	h	8	
Flare			
Requested capacity	m^3/h	1,5 x Produced biogas	
Design results			
Digester			
Requested total volume	m^3	1,989	
Requested unitary volume	m^3	1,989	
Adopted diameter	m	18.0	
Adopted surface	m^2	254	
Conical zone height	m	5.2	
Cylindrical zone height	m	6.1	
Total height	m	11.3	
Adopted unitary useful volume	m^3	1,989	
Adopted total useful volume	m^3	1,989	
Freeboard	m	1.0	
Adopted total volume	m^3	2,243	
Relation H cylindrical zone /D	-	0.34	
Wall height buried	m	5.50	
Recycle sludge for mixing	m^3/d	9,945	
Unitary capacity of digested sludge pumps	m^3/h	26	

Table III.4.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Gasholder			
Requested volume	m^3	400	
Requested unitary volume	m^3	400	
Minimum sphere diameter	m	9.1	
Adopted sphere diameter	m	9.0	
Adopted unitary volume	m^3	382	
Adopted total volume	m^3	382	
Flare			
Requested capacity	m^3/h	80	
Operational conditions			
Digester			
Solids loading	$kgSVS/m^3/d$	0.8	1.3
Minimum retention time	d	28	18
VSS removed	kg/d	839	1,326
Digested sludge flow	m^3/d	70	111
Digested sludge solids content	kg/d	1,958	3,094
Solids concentration	kg/m^3	28	28
Produced biogas	m^3/d	755	1,194
Gasholder			
Retention time	h	12.1	7.7

Operation: Alkalinity control

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	69.9	110.5
Design criteria			
Inflow alkalinity	$mgCaCO_3/L$	200	
Biogas CO_2 content	%	30	
Requested alkalinity for pH=7,0	$mgCaCO_3/L$	1,935	
Milk of lime concentration	$kgCaO/m^3$	50	
Hydrated lime bulk density	kg/m^3	600	
Autonomy of the lime silo	d	10	

Table III.4.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Alkalinity to be added	$mgCaCO_3/L$	1,735	1,735
	$kgCaCO_3/d$	121.3	191.7
Lime to be added	kgCaO/d	68.0	107.5
Hydrated lime to be added	$kgCa(OH)_2/d$	89.8	141.9
Milk of lime total flow	m^3/d	1.4	2.1
Lime silo volume	m^3	-	10.0
Adopted diameter	m	-	2.0
Useful height	m	-	4.3
Total height	m	-	6.7

Table III.4.8.2 - Sludge treatment (Solution 2)

Operation: Energy recovery - Cogeneration

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	69.9	110.5
Produced biogas	m^3/d	755	1,194
SSV removed	kg/d	839	1,326
Design criteria			
Average temperture of digestion	ºC	35	
Sludge bulk density	kg/m^3	1,000	
Sludge specific heat	kcal/kg/ºC	1.01	
Heat exchanger efficiency			
water/sludge	%	90	
water/sludge	%	85	
Biogas Lower Heating Value (LHV)	kWh/m^3	6.38	
Natural gas Lower Heating Value (LHV)	kWh/m^3	10.53	
Moto-generators			
Number of moto-generators to be installed	un.	2	
Working period	h/d	16.0	
Electrical efficiency	%	35	
Efficiency of the moto-generators	%	90	
Thermal energy recovery from the moto-generators			
from the cooling water	%	37	
from the exhaust gases	%	18	
Digesters loss of heat			
Heat transfer coefficient, U			
walls above the ground	$W/m^2.Cº$	2.57	
walls buried	$W/m^2.Cº$	0.94	
cover	$W/m^2.Cº$	2.79	
bottom	$W/m^2.Cº$	1.51	
Most unfavorable temperatures during winter			
air	ºC	5	
ground	ºC	10	
sludge	ºC	15	

Table III.4.8.2 - Sludge treatment (Solution 2)

Parameter	Unit	Year 2011	Year 2029
Operational conditions			
Biogas use			
Biogas energy potential	kWh/d	4,819	7,615
Power from the biogas produced	kW	301	476
Nominal output of electric power	kWh/d	1,687	2,665
	kW	105	167
Nominal output thermal power	kcal/d	2,013,299	3,181,489
	kWh/d	2,341	3,699
Heating needs for digestion			
Heat loss surface			
walls above the ground	m^2	-	33
walls buried	m^2	-	311
cover	m^2	-	254
bottom	m^2	-	294
Digester heat loss, during winter			
walls above the ground	kcal/d	-	52,371
walls buried	kcal/d	-	150,399
cover	kcal/d	-	439,711
bottom	kcal/d	-	228,902
Total	kcal/d	-	871,383
Requested sludge heating	kcal/d	1,412,675	2,232,360
Total energy needs	kcal/d	2,284,058	3,103,743
Moto-generators			
Requested gas power	kW	342	464
Thermal energy from the exhaust gases	kcal/d	719,055	977,104
Thermal energy from the cooling water	kcal/d	1,565,002	2,126,639
Total thermal energy	kcal/d	2,284,058	3,103,743
Unitary power of the moto-generators	kW	-	90
Biogas consumption	m^3/h	54	73
Natural gas consumption	m^3/h	32	44
Additional consumption of natural gas			
Energy deficit	kcal/d	270,758	-77,746
Additional consumption of natural gas	m^3/d	62	-18
Electric power generated by natural gas	kWh/d	227	0
Electric power production			
Total electric power production	kWh/d	1,913	2,665
Average working period of the moto-generators	h/d	12	16
Maximum consumption of natural gas	m^3/s	-	0.012

Table III.4.9.1 - Sludge Treatment (Solution 1)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	61	97
Dewatering sludge solids concentration	kg/m^3	30	30
Dewatering sludge solids content	kg/d	1,828	2,897
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	1+1	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	23.0	
	kg/h	676	
Unitary capacity of dewatering sludge pumps	m^3/h	23.0	
Required capacity of polymer equipment	L/h	1,217	
In-line dilution system flow	m^3/h	4.1	
Operational conditions			
Dewatering sludge flow	m^3/d	85	135
	m^3/h	14	23
Dewatering sludge solids content	kg/d	2,559	4,056
	kg/h	426	676
Dewatered sludge daily flow	m^3/d	12	19
Dewatered sludge solids content	kg/d	2,431	3,853
Sludge liquor solids content	kg/d	128	203
Sludge liquor flow (1)	m^3/d	82	125
Number of dewatered sludge containers (10 m^3 each)	un.	1	2
Polymer consumption	kg/d	15.4	24.3
	kg/h	2.6	4.1
Polymer mother solution flow	m^3/d	3.1	4.9
	L/h	512	811
Polymer diluted solution flow	m^3/h	15.4	24.3
Dilution water flow	m^3/h	12.3	19.5

(1) it includes centrifuge rinse water

Table III.4.9.2 - Sludge treatment (Solutions 2 and 3)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	70	111
Dewatering sludge solids concentration	kg/m^3	28	28
Dewatering sludge solids content	kg/d	1,958	3,094
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	1+1	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	26.0	
	kg/h	722	
Unitary capacity of dewatering sludge pumps	m^3/h	26.0	
Required capacity of polymer equipment	L/h	1,300	
In-line dilution system flow	m^3/h	4.3	
Operational conditions			
Dewatering sludge flow	m^3/d	98	155
	m^3/h	16	26
Dewatering sludge solids content	kg/d	2,741	4,332
	kg/h	457	722
Dewatered sludge daily flow	m^3/d	13	21
Dewatered sludge solids content	kg/d	2,604	4,116
Sludge liquor solids content	kg/d	137	217
Sludge liquor flow (1)	m^3/d	94	143
Number of dewatered sludge containers (10 m^3 each)	un.	1	2
Polymer consumption	kg/d	16.4	26.0
	kg/h	2.7	4.3
Polymer mother solution flow	m^3/d	3.3	5.2
	L/h	548	866
Polymer diluted solution flow	m^3/h	16.4	26.0
Dilution water flow	m^3/h	13.2	20.8

(1) it includes centrifuge rinse water

Table III.4.9.3 - Sludge Treatment - alternative (Solution 1)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of drying beds	un.	6	
Type	-	rectangular plant (40 m x 18 m)	
Unitary surface	m^2	720	
Total surface	m^2	4,320	
Unitary volume	m^3	144	
Total volume	m^3	864	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	61	97
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	1,828	2,897
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	154	245
Drying time	d	14.2	8.9

Table III.4.9.4 - Sludge treatment - alternative (Solutions 2 and 3)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of drying beds	un.	6	
Type	-	rectangular plant (40 m x 18 m)	
Unitary surface	m^2	720	
Total surface	m^2	4,320	
Unitary volume	m^3	144	
Total volume	m^3	864	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	70	111
Drying solids (DS) concentration	kg/m^3	28	28
DS loading	kg/d	1,958	3,094
Design criteria			
Mass loading rate	kgDS/m^2/year	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	kgDS/m^2/year	165	261
Drying time	d	12.4	7.8

Table III.4.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	2	1	1	2.20	16.0	35.2
Grit pump	1	1	0	3.80	3.0	11.4
Grit classifier	1	1	0	0.37	3.0	1.1
Secondary treatment						
Treatment line 1						
Submersible mixer - anoxic tanks	1	1	0	7.50	24.0	180.0
Submersible mixer - aerobic tanks	3	3	0	7.50	8.0	180.0
Air compressor	2	1	1	90.00	16.0	1,440.0
Ventilator of the compressors' building	1	1	0	0.55	16.0	8.8
Scraper bridge of the secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump	3	3	0	2.20	6.0	39.6
Sludge recirculation pump	2	1	1	11.00	24.0	264.0
Excess sludge extraction pump	2	1	1	1.10	12.7	14.0
Scum pump	2	1	1	1.10	3.0	3.3
Treatment line 2						
Submersible mixer - anoxic tanks	1	1	0	7.50	24.0	180.0
Submersible mixer - aerobic tanks	1	1	0	7.50	8.0	60.0
Air compressor	1	1	0	55.00	16.0	880.0
Ventilator of the compressors' building	1	1	0	0.55	16.0	8.8
Scraper bridge of the secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump	3	3	0	1.10	6.0	19.8
Sludge recirculation pump	2	1	1	7.50	24.0	180.0
Excess sludge extraction pump	2	1	1	1.10	8.5	9.3
Scum pump	2	1	1	1.10	3.0	3.3
Tertiary treatment						
Treatment line 1						
Nitrate recirculation pump	1	1	0	7.50	24.0	180.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Treatment line 2						
Nitrate recirculation pump	1	1	0	4.00	24.0	96.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3

Table III.4.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Feeding pump to the filters	3	3	0	45.00	12.2	1,641.1
Filters with automatic cleaning	3	3	0	0.18	12.2	6.6
UV ray disinfection unit	1	1	0	15.00	12.2	182.3
Hydropneumatic station	1	1	0	4.00	3.0	12.0
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	2.7	5.9
Mixer of the thickened sludge storage tank	1	1	0	0.75	24.0	18.0
Thickened sludge pump	2	1	1	2.20	5.9	12.9
Centrifuge	1	1	0	30.00	5.9	176.3
Polymer preparation equipment	1	1	0	1.10	5.9	6.5
Polymer dosing pump	2	1	1	0.75	5.9	4.4
Lift screw of dewatered sludge	1	1	0	1.10	5.9	6.5
Run-off water pump	2	1	1	1.10	3.0	3.3
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	70	57	13	351.96	-	6,428

Table III.4.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Initial pumping station	3	2	1	7.50	12.2	182.4
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	2	1	1	2.20	16.0	35.2
Grit lift pump	1	1	0	3.80	3.0	11.4
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	3.04	4.6
Scum lift pump - primary sedimentation tank	2	1	1	1.10	3.0	3.3
Secondary treatment						
Submersible mixer - anoxic tanks	2	2	0	7.50	24.0	360.0
Submersible mixer - tanks aerobiques	2	2	0	7.50	8.0	120.0
Air compressor	2	1	1	110.00	16.0	1,760.0
Ventilator of the compressors' building	1	1	0	0.55	16.0	8.8
Scraper bridge of the existing secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump of the existing secondary clarifier	3	3	0	1.50	6.0	27.0
Scraper bridge of the new secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump of the new secondary clarifier	3	3	0	1.10	6.0	19.8
Sludge recirculation pump	2	1	1	18.50	24.0	444.0
Excess sludge extraction pump	2	1	1	1.10	17.1	18.8
Scum pump - secondary clarifiers	2	1	1	1.10	3.0	3.3
Tertiary treatment						
Nitrate recirculation pump	1	1	0	11.00	24.0	264.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	45.00	12.2	1,641.1
Filters with automatic cleaning	3	3	0	0.18	12.2	6.6
UV ray disinfection unit	1	1	0	15.00	12.2	182.3
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.4.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	3.1	6.8
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	1	1	3.00	0.0	0.0
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	2.20	0.0	0.0
Biogas compressor to supply the moto-generators	2	2	0	2.20	16.0	70.4
Pump for cooling liquid/water heat exchanger	2	2	0	4.00	16.0	128.0
Pump for exhaust gas/water heat exchanger	3	2	1	2.20	18.0	79.2
Digested sludge pump	2	1	1	3.00	6.0	17.9
Centrifuge	1	1	0	30.00	6.0	178.5
Polymer preparation equipment	1	1	0	1.10	6.0	6.5
Polymer dosing pump	2	1	1	0.75	6.0	4.5
Lift screw of dewatered sludge	1	1	0	1.10	6.0	6.5
Run-off water pump	2	1	1	1.10	3.0	3.3
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	79	65	14	353.13	-	7,111
Electricity requirement (kWh/year)	-	-	-	-	-	2,538,430
Electricity produced by cogeneration (kWh/year)	-	-	-	-	-	972,788
Electricity purchased from the public network (kWh/year)	-	-	-	-	-	1,565,642

Table III.4.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Initial pumping station	3	2	1	7.50	12.2	182.4
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	2	1	1	2.20	16.0	35.2
Grit lift pump	1	1	0	3.80	3.0	11.4
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	3.04	4.6
Scum lift pump - primary sedimentation tank	2	1	1	1.10	3.0	3.3
Secondary treatment						
Submersible mixer - anoxic tanks	2	2	0	7.50	24.0	360.0
Submersible mixer - tanks aerobiques	2	2	0	7.50	8.0	120.0
Air compressor	2	1	1	110.00	16.0	1,760.0
Ventilator of the compressors' building	1	1	0	0.55	16.0	8.8
Scraper bridge of the existing secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump of the existing secondary clarifier	3	3	0	1.50	6.0	27.0
Scraper bridge of the new secondary clarifier	1	1	0	1.10	24.0	26.4
Biological sludge pump of the new secondary clarifier	3	3	0	1.10	6.0	19.8
Sludge recirculation pump	2	1	1	18.50	24.0	444.0
Excess sludge extraction pump	2	1	1	1.10	17.1	18.8
Scum pump - secondary clarifiers	2	1	1	1.10	3.0	3.3
Tertiary treatment						
Nitrate recirculation pump	1	1	0	11.00	24.0	264.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	45.00	12.2	1,641.1
Filters with automatic cleaning	3	3	0	0.18	12.2	6.6
UV ray disinfection unit	1	1	0	15.00	12.2	182.3
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.4.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	3.1	6.8
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	1	1	3.00	0.0	0.0
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	2.20	0.0	0.0
Digested sludge pump	2	1	1	3.00	6.0	17.9
Centrifuge	1	1	0	30.00	6.0	178.5
Polymer preparation equipment	1	1	0	1.10	6.0	6.5
Polymer dosing pump	2	1	1	0.75	6.0	4.5
Lift screw of dewatered sludge	1	1	0	1.10	6.0	6.5
Run-off water pump	2	1	1	1.10	3.0	3.3
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	72	59	13	344.73	-	6,834

Annex-III.5

Jendouba WwTP tables

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Inlet flow – initial elevation
No.	3 Archimedean screws

ILLUSTRATIVE PICTURES

Archimedean screw pumps

Replacement operation

Archimedean screw pump

Archimedean screw pump motorization

REMARKS	- The Archimedean screws were under a replacement operation. All presented an advanced stage of corrosion and degradation. - Civil construction seemed inadequate (larger) for the Archimedean screws size. It was possible to see a lot of waste deposited along the sides of the screws.
RECOMMENDATIONS	- The screw pumps should be replaced. - Replacement in course.

Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Screening
No.	One mechanical operated and one manually operated in the bypass channel

ILLUSTRATIVE PICTURES

Bar screen Conveyor Trailer

REMARKS	- The screening device presents widespread stainless steel corrosion. - It was reported to the consultant team that the raking action of the bar screen operates in manual, since the programmer does not exist on the market. - The screenings conveyor is working in reasonable conditions. The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to state that the equipment seems to be painted to avoid corrosion increase. - Electrical cabinets covered with metal shields for protection from weather conditions such as excess exposure to sun light.
RECOMMENDATIONS	- The bar screen is working however needs an overhaul and should be replaced.

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Grit and grease removal
No.	One scraper working on two channels chamber with aeration, bottom grit pumping and surface grease removal.

ILLUSTRATIVE PICTURES


REMARKS	- There is a flow measurement at the plant entrance. - The flow partition gate works reasonably well and presents a fairly good state. - The scraper bridge suffers from some deviation on the longitudinal movement. - The scraper bridge wheels present a high level of degradation. - The grit classifier on the scraper is not working properly. It was reported to the consultant team the poor performance of the grit pumps. - The electrical component of the equipment presents a high level of degradation. - The equipment for grease removal and the aeration for grit removal are installed in an underground chamber. This chamber is not in adequate environmental conditions, it presents a humid atmosphere and water spilled on the floor; possibly caused by rain water infiltration. - The blowers for the aeration are working; nevertheless they present a somewhat degraded condition, as evidenced from its dirty and dusty

	condition. - The grease pumping circuit is out of service. It was reported to the consultant team that it clogged immediately after the start of the installation and was abandoned ever since. The grease is sucked directly from the grease pit on the surface.
RECOMMENDATIONS	- The scraper is working however needs an overhaul and should be replaced. - The grit classifier operation needs to be improved, possibly with the installation of dedicated equipment for this function. - The blowers are working however need an overhaul and eventually consider their replacement on a medium term. - In case ONAS considers the present solution for grease removal inadequate, in benefit of an easy and practical exploitation activity, it will be necessary to improve the grease removal circuit considering a revision of pipes diameters and pump selection.

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – aeration tanks
No.	12 Aeration tanks with surface aerators and submersible agitators

ILLUSTRATIVE PICTURES

Surface aerator

Motor & gear box

Gates

Submersible agitator

Gate frame detail

REMARKS	- Generally, the surface aerators present a reasonably state taking in consideration their working conditions. It was possible to see that lubricating has been carried out on gear boxes. - The submersible agitators which were outside of the tanks were in a fairly good state. - It was reported to the consultant team that the submersible agitators were serviced four times per year and the surface aerator gear boxes were serviced once a year. - The gates under service generally presented rusted frames, but fairly reasonable state for the respective floor column and hand wheel. - The operation of the surface aerators it is not automated, as in an automation system, which integrates a measurement of the dissolved oxygen within the tank.
RECOMMENDATIONS	- The aeration method selected for these tank dimensions is not adequate for the oxygen needs of the process. The tanks are too deep for this type of aeration equipment. Therefore, it is proposed the replacement of these aerators by a diffused aeration mode.

Table III.5.1.1.1 – Electromechanical equipment

	- The oldest and most damaged gates should be replaced. - Automation should be increased specially focusing on integration between oxygen probes in the aeration tanks and the aeration working hours.

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – secondary clarifier
No.	2

ILLUSTRATIVE PICTURES

scraper bridge

scraper side rail

scraper side traction and switch limit

Scraper actuator mechanism

REMARKS	- Generally, the scrapers present a reasonably state taking in consideration their working conditions. - The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase. - It was reported to the consultant team that the sludge scrapers should be renewed due to high wear and an abnormal consumption of wheels and their bearings.
RECOMMENDATIONS	- The scrapers are working however need an overhaul. It should be considered the replacement of some entire structures of the equipment such as the bottom sludge scraper and the driving wheels structure. - Some civil construction rehabilitation should be considered, especially on the side rails of the scraper bridge.

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – sludge recirculation management
No.	2 Flow partition valves

ILLUSTRATIVE PICTURES

Sludge flow partition valve

Valve electrically actuated

Sludge recycling channel and partition valve

REMARKS	- The valves present a reasonably state taking in consideration their working conditions. - The valve is electrically actuated but the sludge flow partition is manually operated; it is hard to manage the treatment process in terms of sludge purging and sludge recycling, caused by the old-fashioned free surface flow recycling system and its inefficient flow measurement.
RECOMMENDATIONS	- The solution to be proposed intends to build a dedicated station pump for sludge recycling and sludge purging including flow measurement and pumps with frequency variation in order to improve the management of the treatment process.

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Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Sludge thickener and drying beds
No.	1 Sludge thickener (square plan) with mechanical scraper bridge

ILLUSTRATIVE PICTURES

Sludge thickener

Sludge extraction pump

Sludge pump to feed drying beds

REMARKS	- The bridge painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to state that the equipment seems to be painted to avoid corrosion increase. - The sludge pumps (to feed the thickener) are installed in an underground chamber. This chamber is not in adequate environmental conditions, it presents a humid atmosphere. - The sludge pump (to feed the drying beds) is also installed in the underground chamber. There is water (and oil) spilled on the floor; possibly caused by rain water infiltration.
RECOMMENDATIONS	- The sludge pumps (to feed the thickener) present a high level of wear and tear, a replacement should be considered. - The scraper bridge is working however needs an overhaul.

Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Service water
No.	1 Hydropneumatical central

ILLUSTRATIVE PICTURES

Hydropneumatical central for service water

REMARKS	- The service water (wash water) circuit, especially the pumping and pressure vessel component were in very poor condition. - The equipments are installed in the underground chamber, which is not in adequate environmental conditions. The chamber presents a humid atmosphere and there is water (and oil) spilled on the floor; possibly caused by rain water infiltration.
RECOMMENDATIONS	- The entire pumping system should be replaced.

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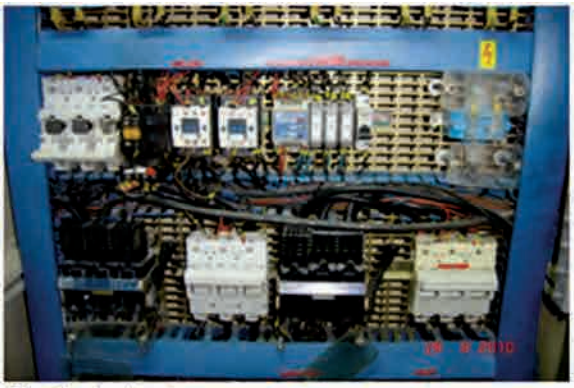
Table III.5.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Electrical conditions
No.	-

ILLUSTRATIVE PICTURES


Electrical cabinets


Battery capacitors

REMARKS	- The cabinets presented some level of deterioration and components congestion. - The location of the battery capacitors, which are currently over the electrical cabinets, is not considered adequate.
RECOMMENDATIONS	- The electrical installation should be revised.

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Table III.5.1.1.2 – Civil Engineering

UNIT/OPERATION	Civil Engineering
No.	

<table>
<tr><td colspan="2">ILLUSTRATIVE PICTURES</td></tr>
<tr><td>Photo 1: Aeration Tanks</td><td>Photo 2: Thickener</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Photo 3: Clack (Aeration Tanks)</td><td>Photo 4: Clack (Aeration Tanks)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Photo 5: Expansion joints (Aeration Tanks)</td><td>Photo 6: Basement floor</td></tr>
<tr><td></td><td></td></tr>
</table>

Table III.5.1.1.2 – Civil Engineering

<table>
<tr><td>SPECIFICATIONS</td><td>
The characteristics of the wastewater treatment plant of Jendouba built for Year 2005 are as follows:

Flow of dimensioning 8000 m^3/day
Peak time outflow 904 m^3/hr.

The capacities of the facilities are as follows:

Grit chamber:

Length =12 m, Width = 8 m, Depth = 3 m
Volume of sand = 144 m^3
Floating volume = 72 m^3
Total volume =216 m^3

Aeration tank (number=12):

Length =14.7 m, Width = 14.7 m, Depth = 4.6 m
Volume of a basin = 994 m^3
Total volume of the 12 basins =11928 m^3

Clarifier:

Length =30 m, Width = 7.25 m, Depth = 3.2 m
Total volume =696 m^3

Thickener:

Length =9 m, Width = 9 m, Depth = 4 m
Total volume =280 m^3

Drying bed (number : 26 beds):

Length =35 m, Width = 10 m
Surface = 9100 m^2
Total volume =280 m^3

The reinforced concrete works are half-buried. The structures of these works are formed by a raft foundation, extreme screens in contact with the ground, screens and transverse screen girders, and beams and posts. The structures are separated by the expansion joints on the level of the raft foundation and screens. The joints are of type of water-stop.
According to Plan No. 32401 C of BET BREDERO dated on 18/10/1991, the foundation of the works approved by the ONAS are of surface type, resting on a layer of quarry run of a thickness equal to 50 cm + a blinding concrete (thickness=10 cm).
The concrete that has been used is proportioned to 354 kg of cement per m3 of concrete. It is the equivalent of B27.
</td></tr>
</table>

Table III.5.1.1.2 – Civil Engineering

DIAGNOSIS	- The structures of the station display a normal operating condition. The dimensions and design of the works respect the conditions of resistance, namely absence of disorders in the normal operation of the works, absence of remarkable differential settlement of the foundations, absence of cracks in important number and dimensions, etc. (Photo 1, 2) - In addition, some disorders could be noted: 1) We observe concrete break-ups of the structures in several places. This is due probably to non-conformity of coating (Photo 3, 4), 2) The expansion joints are in worn state and sometimes in degraded condition (Photo 5), 3) Below the stations, we could observe also infiltrations of water due to the presence of the micro-cracks (Photo 6). **In conclusion:** The structures of the station present a general state of normal operation, except for some anomalies, especially the presence of break-up of the concrete due to non-conformity of the steel coating.

Table III.5.2.1 - Design data

Design Data

Parameter	Unit	Year	
		2011	2029
<u>**Population served**</u>			
Domestic population	p.e	54,088	64,988
Industrial population	p.e	2,196	40,000
Touristic population	p.e	0	0
Total population	p.e	56,284	104,988
Peak Factors			
Domestic peak factor	-	1.5	1.5
Industrial peak factor	-	2.0	2.0
Touristic peak factor	-	2.0	2.0
Return factor			
Domestic return factor	%	80	80
Industrial and touristic return factor	%	90	90
Per capita flow and load factors			
Per capita water consumption			
domestic	L/capita/d	113	148
industrial	L/capita/d	-	-
touristic	L/capita/d	500	500
Domestic and touristic per capita loading factors			
TSS	g/capita/d	90	90
BOD_5	g/capita/d	40	40
COD	g/capita/d	120	120
Total Nitrogen (TN)	g/capita/d	8	8
Total Phosphorus (TP)	g/capita/d	1.5	1.5
Fecal Coliforms	CFU/capita/d	1.00E+11	1.00E+11
<u>***Wastewater inflows***</u>			
Domestic average daily flow (Adf)	m^3/d	4,904	7,703
	L/s	56.8	89.2
Domestic peak flow	m^3/h	314	491
	L/s	87.2	136.3
Industrial average daily flow	m^3/d	220	4,000
	L/s	2.5	46.3
Industrial peak flow	m^3/h	18	333
	L/s	5.1	92.6
Touristic average daily flow (occupancy rate = 100%)	m^3/d	0.0	0.0
	L/s	0.0	0.0
Touristic peak flow	m^3/h	0.0	0.0
	L/s	0.0	0.0

Table III.5.2.1 - Design data

Parameter	Unit	Year	
		2011	2029
Infiltration flow	L/s	13.5	21.1
Total average daily flow (domestic + industrial + touristic)	m^3/d	5,123	11,703
Total average daily flow (domestic + industrial + touristic) + infiltration	m^3/d	6,285	13,528
Total peak flow	m^3/h	380	900
	L/s	105.7	250.0
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
Loadings			
Domestic + touristic			
TSS	kg/d	4,868	5,849
BOD_5	kg/d	2,164	2,600
COD	kg/d	6,491	7,799
TN	kg/d	433	520
TP	kg/d	81	97
Fecal Coliforms	CFU/d	5.41E+15	6.50E+15
Industrial			
TSS	kg/d	88	1,600
BOD_5	kg/d	88	1,600
COD	kg/d	220	4,000
TN	kg/d	27	494
TP	kg/d	2	40
Total			
TSS	kg/d	4,956	7,449
BOD_5	kg/d	2,251	4,200
COD	kg/d	6,710	11,799
TN	kg/d	460	1 014
TP	kg/d	83	137
Fecal Coliforms	CFU/d	5.41E+15	6.50E+15

Table III.5.2.1 - Design data

Parameter	Unit	Year	
		2011	**2029**
Concentrations (2)			
Domestic + touristic			
TSS	mg/L	993	759
BOD_5	mg/L	441	337
COD	mg/L	1,324	1,012
TN	mg/L	88	67
TP	mg/L	17	13
Fecal Coliforms	CFU/100mL	1.10E+08	8.44E+07
Industrial			
TSS	mg/L	400	400
BOD_5	mg/L	400	400
COD	mg/L	1,000	1,000
TN	mg/L	123	123
TP	mg/L	10	10
Total without infiltration			
TSS	mg/L	967	637
BOD_5	mg/L	439	359
COD	mg/L	1,310	1,008
TN	mg/L	90	87
TP	mg/L	16	12
Fecal Coliforms	CFU/100mL	1.06E+08	5.55E+07

(1) Maximum flow pumped by 3 existant Archimedean screws.

(2) Without infiltration

Table III.5.3.1 - Preliminary Treatment

Operation: Grit retention

Parameter	Unit	Year	
		2011	**2029**
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	5,123	11,703
Maximum design flow (Mdf)	m^3/h	900	900
	L/s	250	250
Design Criteria			
Number of basins	un	1	
Type	-	circular plant	
Retention time (Mdf)	min	15	
Design Results			
Total volume	m^3	225	
Unitary volume	m^3	225	
Unitary surface area	m^2	75	
Diameter	m	10.0	
Existing infrastructures operational conditions			
Retention time			
Adf	min	63	28
Mdf	min	15	15

Table III.5.3.1 - Preliminary Treatment

Operation: Screening

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Mechanical Screening			
Number of screening devices working in parallel	un.	1	
Screen bars spacing	mm	12	
Bars thickness	mm	10	
Channel width	m	1.1	
Channel depth	m	-	
Unitary power of screening devices	kW/un.	-	
Maximum flow capacity	m^3/h	900	
Manually Cleaned Coarse Screens			
Number of coarse screens	un.	-	
Screen bars spacing	mm	-	
Channel width	m	-	
Channel depth	m	-	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	54,088	64,988
Average daily flow (Adf)	m^3/d	5,123	11,703
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
Design Criteria			
Velocity through clean bar screen	m/s	1.2	
Approach velocity	m/s	0.3 - 0.9	
Maximum degree of clogging	%	52.03732436	
Channel depth	m	-	
Kirschmer factor	-	1.94	
Channel freeboard	m	≥ 0.3	
Volume of screenings per capita	L/capita/year	6.0	
Bulk density of removed screenings	kg/L	0.95	
Screenings removal rate	%	95	

Table III.5.3.1 - Preliminary Treatment

Parameter	Unit	Year	
		2011	2029
Existing infrastructures operational conditions			
Effective open area (Mdf)	m^2	0.48	0.48
Total cross-sectional area	m^2	0.88	0.88
Height of the liquid upstream	m	0.80	0.80
Approach velocity (Mdf)	m/s	0.28	0.28
Approach velocity (Adf)	m/s	0.07	0.15
Channel freeboard	m	-	-
Headloss through clogged screens	mm WC	5.3	5.3
Screenings characteristics and quantities			
Volumetric flow of incoming wet screenings	L/d	889	1068
Mass flow of incoming wet screenings	kg/d	845	1015
Volumetric flow of removed wet screenings	kg/d	802	964
Mass flow of removed wet screenings	m^3/d	0.84	1.01

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.3.2 - Preliminary Treatment

Operation: Grit and Grease Removal

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of chambers	un.	1 x 2 basins	
Type	-	rectangular plant, aerated	
Length	m	12	
Total width	m	8	
Depth	m	3	
Grit cross-sectional area	m^2	12	
Grease cross-sectional area	m^2	6	
Total surface	m^2	96	
Total wet volume	m^3	216	
Number of grit pumps	un.	2	
Unitary power of grit pumps	kW/un.	-	
Number of air compressors	un.	2+1	
Unitary power of air compressors	kW/un.	-	
Number of scraper bridges	un.	1	
Unitary power of scraper bridges	kW/un.	-	
Influent wastewater flows and loads			
Population (excluding industrial population)	p.e.	54,088	64,988
Average daily flow (Adf)	m^3/d	5,123	11,703
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
Design Criteria			
Retention time (Mdf)	min	10 - 15	
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	10 - 15	
Specific air flow	L/s/m	5.0	
	m^3 air/h/m^3	1,5	
Headloss in the aeration system	% submergence	30	
Volume of grit per capita	L/capita/year	7.0	
Grit removal rate	%	95	
Quantity of oil & grease per capita	g/capita/d	28	
Bulk density of removed oil & grease	kg/L	0.8	
Oil & grease removal rate	%	30	

Table III.5.3.2 - Preliminary Treatment

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
Retention time				
	Adf	min	61	27
	Mdf	min	14	14
Hydraulic loading rate				
	Adf	$m^3/m^2/h$	3.0	6.8
	Mdf	$m^3/m^2/h$	12.5	12.5
Volumetric flow of incoming grit		L/d	1,037	1,246
Mass flow of incoming grit		kg/d	1,556	1,870
Volumetric flow of removed grit		kg/d	1,478	1,776
Mass flow of removed grit		m^3/d	394	474
Volumetric flow of grit after classification		m^3/d	1.09	1.32
Mass flow of grit after classification		kg/d	1,314	1,579
Runoff flow		m^3/d	393	472
Mass flow of incoming oil & grease		kg/d	797	1 820
Volumetric flow of incoming oil & grease		L/d	996	2,275
Mass flow of removed oil & grease		kg/d	239	546
Volumetric flow of removed oil & grease		m^3/d	30	68

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.4.1 - Primary settling (Solutions 2 and 3)

Operation: Primary settling

Parameter	Unit	Year 2011	Year 2029
Influent wastewater flows and loads (with process wastewaters)			
Average daily flow (Adf)	m^3/d	5,525	12,382
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
TSS Concentration	kg/m^3	1.0	0.7
TSS loading	kg/d	5,502	8,343
Design Criteria			
Hydraulic loading rate (Adf)	$m^3/m^2/h$	< 1,5	
Retention time (Mdf)	h	> 2	
Depth	m	3.0	
SS concentration in primary sludge	kg/m^3	20	
SS removal rate	%	50	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of primary sludge pumps	un.	2.0	
Design results			
Number of primary settling tanks	un	2	
Type	-	rectangular plant	
Total surface	m^2	600	
Unitary surface	m^2	300	
Length	m	30.0	
Unitary width	m	10.0	
Unitary volume	m^3	900	
Total volume	m^3	1,800	
Scum pumps capacity	m^3/h	18	
Unitary capacity of primary sludge pumps	m^3/h	18	
Operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.5	1.5
Retention time (Mdf)	h	2.0	2.0
Primary sludge production	kg/d	2,751	4,172
	m^3/d	137.6	208.6
Scum production	kg/d	55	124
	m^3/d	0.06	0.13

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.5.1 - Biological Treatment (Solution 1)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in series in each treatment line	un.	2 x 3	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	2,593	
Liquid depth	m	4.6	
Each basin volume	m^3	994	
Total volume	m^3	11,928	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 43 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	56,284	104,988
Average daily flow (Adf)	m^3/d	5,419	12,241
Maximum design flow (Mdf) [(1)]	m^3/h	900	900
TSS	kg/d	5,213	7,922
BOD	kg/d	2,380	4,436
TN	kg/d	474	1,040
TP	kg/d	86	143
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.5.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year 2011	Year 2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	$kgBOD/m^3/d$	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.8	
MLVSS in aeration tanks	kg/m^3	3.60	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	$gN\text{-}NO_3/kgMSV/d$	0.03	
Sludge production	kgMLSS/kgBOD/d	1.0	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	12	
Number of nitrate recycle pumps	un.	4+0	
Number of sludge recycle pumps	un.	1+1	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peak factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.24	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	4+1	

Table III.5.5.1 - Biological Treatment (Solution 1)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.06	0.10
Fv		kgBOD/m^3/d	0.20	0.37
Design results				
Total biological volume		m^3	5,964	11,928
Anoxic zone volume		m^3	2,982	5,964
Anoxic volume / Total volume		-	0.50	0.50
Aerobic zone volume		m^3	2,982	5,964
Unitary capacity of air compressors		m^3/h	-	2,794
Unitary capacity of nitrate recycle pumps		m^3/h	-	383
Unitary capacity of sludge recycle pumps		m^3/h	-	765
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.111	0.103
Fv		kgBOD/m^3/d	0.200	0.372
Sludge age		d	18	20
Minimum sludge recycle		m^3/d	2,709	6,120
Maximum sludge recycle		m^3/d	8,128	18,361
Minimum nitrate recycle		m^3/d	5,419	12,241
Maximum nitrate recycle		m^3/d	16,257	36,722
Required oxygen for oxidation of organic material		kgO_2/d	1,220	2,238
	peak	kgO_2/h	56	103
Required oxygen for endogenous metabolism		kgO_2/d	1,288	2,576
	peak	kgO_2/h	54	107
Required oxygen for oxidation of ammonia		kgO_2/d	1,539	3,544
	peak	kgO_2/h	96	221
Oxygen recovered from denitrification		kgO_2/d	586	1 160
	peak	kgO_2/h	37	73
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	3,461	7,198
	peak	kgO_2/h	169	359
SOR - Standard Oxygen Requirement		kgO_2/d	5,283	11,212
	peak	kgO_2/h	220	467
Total air flow required		m^3/d	126,414	268,258
		m^3/h	5,267	11,177

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.5.2 - Biological Treatment (Solutions 2 and 3)

Operation: Biological organic matter removal (activated sludge in conventional aeration)

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in series in each treatment line	un.	2 x 3	
Each basin side length	m	14.7	
Each basin surface	m^2	216	
Total surface	m^2	2,593	
Liquid depth	m	4.6	
Each basin volume	m^3	994	
Total volume	m^3	11,928	
Aeration system	-	surface aeration	
Number of aerators in each basin	un.	1	
Number of agitators in each basin	un.	1	
Aeration power (2 velocities)	kW	12 (min) - 43 (max)	
Influent wastewater flows and loads (with process wastewaters)			
Population	p.e.	56,284	104,988
Average daily flow (Adf)	m^3/d	5,388	12,173
Maximum design flow (Mdf) (1)	m^3/h	900	900
TSS	kg/d	2,751	4,172
BOD	kg/d	1,893	3,485
TN	kg/d	438	961
TP	kg/d	78	129
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.5.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.2 - 0.5	
Volumetric organic loading rate (Fv)	$kgBOD/m^3/d$	0.5 - 1.2	
Sludge age	d	8	
MLSS in aeration tanks	kg/m^3	3.5	
MLVSS/ MLSS ratio	-	0.7	
MLVSS in aeration tanks	kg/m^3	2.45	
TKN in effluent	mg/L N	1.0	
Denitrification rate at tank temperature	$gN\text{-}NO_3/kgMSV/d$	0.09	
Sludge production	kgMLSS/kgBOD/d	1.2	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Internal nitrate recycle			
min.	%Adf	100	
max.	%Adf	300	
Number of mixers	un.	6	
Number of nitrate recycle pumps	un.	2+0	
Number of sludge recycle pumps	un.	1+1	
Aeration system			
a'	kgO/kgBOD	0.50	
b'	kgO/kgMVS/d	0.08	
Peak factor for BOD removal	-	1.2	
Nitrification peak factor	-	1.8	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.24	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.2	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Number of air compressors	un.	2+1	

Table III.5.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
F/M		kgBOD/kgMLVSS/d	0.06	0.12
Fv		kgBOD/m^3/d	0.16	0.29
Design results				
Total biological volume		m^3	2,982	5,964
Anoxic zone volume		m^3	1,491	2,982
Anoxic volume / Total volume		-	0.50	0.50
Aerobic zone volume		m^3	1,491	2,982
Unitary capacity of air compressors		m^3/h	-	4,438
Unitary capacity of nitrate recycle pumps		m^3/h	-	761
Unitary capacity of sludge recycle pumps		m^3/h	-	761
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.259	0.239
Fv		kgBOD/m^3/d	0.317	0.584
Sludge age		d	7	8
Minimum sludge recycle		m^3/d	2,694	6,087
Maximum sludge recycle		m^3/d	8,082	18,260
Minimum nitrate recycle		m^3/d	5,388	12,173
Maximum nitrate recycle		m^3/d	16,163	36,520
Required oxygen for oxidation of organic material		kgO_2/d	866	1,560
	peak	kgO_2/h	43	78
Required oxygen for endogenous metabolism		kgO_2/d	584	1 169
	peak	kgO_2/h	24	49
Required oxygen for oxidation of ammonia		kgO_2/d	1,487	3,408
	peak	kgO_2/h	112	256
Oxygen recovered from denitrification		kgO_2/d	566	1,298
	peak	kgO_2/h	42	97
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	2,371	4,839
	peak	kgO_2/h	137	285
SOR - Standard Oxygen Requirement		kgO_2/d	4,266	8,903
	peak	kgO_2/h	178	371
Total air flow required		m^3/d	102,072	213,010
		m^3/h	4,253	8,875

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.5.3 - Phosphorus Removal (Solution 1)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	24	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	64	101
	mg/L	11.8	8.3
Al quantity required	kg/d	191	304
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	2,362	3,759
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	4,725	7,519
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	3.6	5.8
	m^3/year	1,327	2,111
Dosage tank minimum volume	m^3	87	87
Unitary capacity of dosing pumps	L/h	241	241
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	293	466
Hydroxides	kg/d	424	675
Physico-chemical sludge quantity produced	kg/d	717	1,141
	m^3/d	89.6	142.6

Table III.5.5.4 - Phosphorus Removal (Solutions 2 and 3)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	2029
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Aluminium Sulphate - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	24	15
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	60	97
	mg/L	11.2	8.0
Al quantity required	kg/d	181	292
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	2,242	3,609
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	4,479	7,207
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	3.4	5.5
	m^3/year	1,258	2,024
Dosage tank minimum volume	m^3	83	83
Unitary capacity of dosing pumps	L/h	231	231
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	278	447
Hydroxides	kg/d	402	647
Physico-chemical sludge quantity produced	kg/d	680	1,094
	m^3/d	85.0	136.7

Table III.5.5.5 - Biological treatment (Solution 1)

Operation: Clarification

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	4 basins	
Type	-	rectangular plant	
Length	m	30	
Unitary width	m	7.25	
Depth	m	3.20	
Unitary surface	m^2	218	
Total surface	m^2	870	
Unitary volume	m^3	696	
Total volume	m^3	2,784	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	-	
Unitary capacity of scum pumps	m^3/h	-	
Number of biological sludge pumps	un.	4	
Unitary capacity of biological sludge pumps	m^3/h	144	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	5,419	12,241
Maximum design flow (Mdf) [(1)]	m^3/h	900	900
	L/s	250	250
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	24,385	55,084
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Depth	m	3.2	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8.0	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.0	1.0
Retention time (Mdf)	h	3.1	3.1
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	140	175
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.5	0.5
Scum production	kg/d	54	122
	m^3/d	0.06	0.13
Unitary capacity of excess sludge pumps	m^3/h	18.0	27.1

[(1)] Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.5.6 - Biological treatment (Solutions 2 and 3)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	4 basins	
Type	-	rectangular plant	
Length	m	30	
Unitary width	m	7.25	
Depth	m	3.20	
Unitary surface	m^2	218	
Total surface	m^2	870	
Unitary volume	m^3	696	
Total volume	m^3	2,784	
Unitary power of scraper bridges	kW/un.	-	
Number of scum pumps	un.	-	
Unitary capacity of scum pumps	m^3/h	-	
Number of biological sludge pumps	un.	4	
Unitary capacity of biological sludge pumps	m^3/h	144	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	5,388	12,173
Maximum design flow (Mdf) [(1)]	m^3/h	900	900
	L/s	250	250
TSS concentration	kg/m^3	3.5	3.5
TSS loads	kg/d	18,857	42,607
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Depth	m	3.2	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8.0	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of excess sludge pumps	un.	1+1	
Existing infrastructures operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.0	1.0
Retention time (Mdf)	h	3.1	3.1
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	109	136
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.4	0.4
Scum production	kg/d	54	122
	m^3/d	0.06	0.13
Unitary capacity of excess sludge pumps	m^3/h	18.0	24.4

[(1)] Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.6.1 - Filtration and Disinfection

Operation: Filtration and disinfection of secondary effluent

Parameter	Unit	Year 2011	Year 2029
Filtration			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
TSS concentration	kg/d	30	30
Design criteria			
TSS concentration in filtrate effluent	mg/L	< 20	
Design results			
Feeding pumps to the filters			
Type	-	Centrifuge, multicellular	
Number of pumps	un.	4.0	
Capacity	m^3/h	900	
Filter			
Type	-	metallic, self-cleaning	
Capacity	m^3/h	900	
Disinfection			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	900	900
	L/s	250	250
TSS concentration	mg/L	20	20
Inlet fecal coliforms concentration	CFU / 100 mL	1.10E+08	8.44E+07
Design criteria			
Outlet fecal coliforms concentration	CFU / 100 mL	2,000	
Outlet fecal streptococcus concentration	CFU / 100 mL	1,000	
Design UV transmittance (at 254 nm)	%	> 55	
Minimum radiation dosage	mJ/cm^2	25	

(1) Maximum flow pumped by 3 existant Archimedean screws.

Table III.5.7.1 - Sludge Treatment (Solution 1)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	9.0	
Maximum depth	m	4.0	
Unitary surface	m^2	81	
Total surface	m^2	81	
Unitary volume	m^3	280	
Total volume	m^3	280	
Unitary power of scraper bridges	kW/un.	-	
Influent sludge flows and loads			
Excess activated sludge average flow	m^3/d	277	509
Physico-chemical sludge average flow	m^3/d	90	143
Total sludge flow	m^3/d	367	651
TSS loading	kg/d	2,935	5,210
TSS concentration	kg/m^3	8.0	8.0
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Number of thickened sludge pumps	un.	2	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	4.5	8.0
Solids loading rate	$kgSS/m^2/d$	36.2	64.3

Table III.5.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year	
		2011	**2029**
Design results			
Number of thickeners	un	2	
Type	-	square plant	
Requested unitary volume	m^3	274	
Minimum unitary surface	m^2	87	
Adopted side length	m	9.0	
Unitary surface	m^2	81	
Total surface	m^2	162	
Adopted height	m	4.0	
Unitary volume	m^3	280	
Total volume	m^3	560	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	1.0	2.0
Thickening sludge flow	m^3/d	367	651
Thickening sludge solids content	kg/d	2,935	5,210
Thickened sludge flow	m^3/d	93	165
Thickened sludge solids content	kg/d	2,788	4,949
Hydraulic loading rate	$m^3/m^2/d$	4.5	4.0
Solids loading rate	$kgSS/m^2/d$	36.2	32.2
Supernatant flow	m^3/d	274	486
Supernatant solids content	kg/d	147	260
Supernatant solids concentration	mg/L	536	536

Operation: Thickened sludge storage

Parameter	Unit	Year	
		2011	**2029**
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	93	165
Thickened sludge solids content	kg/d	2,788	4,949
Design criteria			
Minimum retention time	d	2	
Depth	m	3	
Number of thickened sludge pumps	un.	2	

Table III.5.7.1 - Sludge Treatment (Solution 1)

Parameter	Unit	Year	
		2011	2029
Design results			
Requested volume	m^3	330	
Side length	m	10.5	
Surface	m^2	110	
Adopted volume	m^3	331	
Number of submersible agitators	un.	1	
Unitary capacity of thickened sludge pumps	m^3/h	20	
Operational conditions			
Retention time	d	4	2

Table III.5.7.2 - Sludge treatment (Solutions 2 and 3)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	square plant	
Side length	m	9.0	
Maximum depth	m	4.0	
Unitary surface	m^2	81	
Total surface	m^2	81	
Unitary volume	m^3	280	
Total volume	m^3	280	
Unitary power of scraper bridges	kW/un.	-	
Influent sludge flows and loads			
Primary sludge average flow	m^3/d	138	209
Excess activated sludge average flow	m^3/d	249	448
Physico-chemical sludge average flow	m^3/d	85	137
Total sludge flow	m^3/d	471	794
TSS loading	kg/d	5,422	8,853
TSS concentration	kg/m^3	11.5	11.2
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	40	
Number of thickened sludge pumps	un.	2	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	5.8	9.8
Solids loading rate	$kgSS/m^2/d$	66.9	109.3

Table III.5.7.2 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design results			
Number of thickeners	un	2	
Type	-	square plant	
Requested unitary volume	m^3	346	
Minimum unitary surface	m^2	148	
Adopted side length	m	9.0	
Unitary surface	m^2	81	
Total surface	m^2	162	
Adopted height	m	4.0	
Unitary volume	m^3	280	
Total volume	m^3	560	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	2.0	2.0
Thickening sludge flow	m^3/d	471	794
Thickening sludge solids content	kg/d	5,422	8,853
Thickened sludge flow	m^3/d	129	210
Thickened sludge solids content	kg/d	5,151	8,410
Hydraulic loading rate	$m^3/m^2/d$	2.9	4.9
Solids loading rate	$kgSS/m^2/d$	33.5	54.6
Supernatant flow	m^3/d	343	584
Supernatant solids content	kg/d	271	443
Supernatant solids concentration	mg/L	791	759

Table III.5.8.1 - Sludge treatment (Solutions 2 and 3)

Operation: Anaerobic mesophilic digestion

Parameter	Unit	Year	
		2011	**2029**
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	129	210
Thickened sludge solids content	kg/d	5,151	8,410
Solids concentration	kg/m^3	40	40
SSV/SST	%	60	60
SSV loading	kg/d	3,091	5,046
Design criteria			
Digester			
Number of digesters	un.	2	
Average digestion temperature	ºC	35	
Minimum retention time	h	10 - 20	
SSV removal rate	%	50	
Solids loading	$kgMVS/m^3/d$	2.4 - 6.4	
Most unfavorable sludge temperature	ºC	15	
Sludge bulk density	kg/m^3	1,000	
Digester slope bottom	º	30	
Sludge recycle for mixing	-	5,0 x $V_{digestion}$	
Number of pumps of digested sludge	un.	2	
Gasholder			
Number of gasholders	un.	2	
Biogas production	$m^3/kgSVS$	0.9	
Minimum retention time	h	8	
Flare			
Requested capacity	m^3/h	1,5 x Produced biogas	
Design results			
Digester			
Requested total volume	m^3	3,785	
Requested unitary volume	m^3	1,892	
Adopted diameter	m	18.0	
Adopted surface	m^2	254	
Conical zone height	m	5.2	
Cylindrical zone height	m	5.7	
Total height	m	10.9	
Adopted unitary useful volume	m^3	1,892	
Adopted total useful volume	m^3	3,784	
Freeboard	m	1.0	
Adopted total volume	m^3	4,293	
Relation H cylindrical zone /D	-	0.32	
Wall height buried	m	5.20	
Recycle sludge for mixing	m^3/d	9,460	
Unitary capacity of digested sludge pumps	m^3/h	25	

Table III.5.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Gasholder			
Requested volume	m^3	760	
Requested unitary volume	m^3	380	
Minimum sphere diameter	m	9.0	
Adopted sphere diameter	m	9.0	
Adopted unitary volume	m^3	382	
Adopted total volume	m^3	763	
Flare			
Requested capacity	m^3/h	150	
Operational conditions			
Digester			
Solids loading	$kgSVS/m^3/d$	0.8	1.3
Minimum retention time	d	29	18
VSS removed	kg/d	1,545	2,523
Digested sludge flow	m^3/d	129	210
Digested sludge solids content	kg/d	3,606	5,887
Solids concentration	kg/m^3	28	28
Produced biogas	m^3/d	1,391	2,271
Gasholder			
Retention time	h	13.1	8.0

Operation: Alkalinity control

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	128.8	210.3
Design criteria			
Inflow alkalinity	$mgCaCO_3/L$	200	
Biogas CO_2 content	%	30	
Requested alkalinity for pH=7,0	$mgCaCO_3/L$	1,935	
Milk of lime concentration	$kgCaO/m^3$	50	
Hydrated lime bulk density	kg/m^3	600	
Autonomy of the lime silo	d	10	

Table III.5.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design results			
Alkalinity to be added	$mgCaCO_3/L$	1,735	1,735
	$kgCaCO_3/d$	223.4	364.8
Lime to be added	kgCaO/d	125.2	204.4
Hydrated lime to be added	$kgCa(OH)_2/d$	165.4	270.0
Milk of lime total flow	m^3/d	2.5	4.1
Lime silo volume	m^3	-	10.0
Adopted diameter	m	-	2.0
Useful height	m	-	4.3
Total height	m	-	6.7

Table III.5.8.2 - Sludge treatment (Solution 2)

Operation: Energy recovery - Cogeneration

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	128.8	210.3
Produced biogas	m^3/d	1,391	2,271
SSV removed	kg/d	1,545	2,523
Design criteria			
Average temperture of digestion	ºC	35	
Sludge bulk density	kg/m^3	1,000	
Sludge specific heat	kcal/kg/ºC	1.01	
Heat exchanger efficiency			
water/sludge	%	90	
water/sludge	%	85	
Biogas Lower Heating Value (LHV)	kWh/m^3	6.38	
Natural gas Lower Heating Value (LHV)	kWh/m^3	10.53	
Moto-generators			
Number of moto-generators to be installed	un.	2	
Working period	h/d	16.0	
Electrical efficiency	%	35	
Efficiency of the moto-generators	%	90	
Thermal energy recovery from the moto-generators			
from the cooling water	%	37	
from the exhaust gases	%	18	
Digesters loss of heat			
Heat transfer coefficient, U			
walls above the ground	$W/m^2.Cº$	2.57	
walls buried	$W/m^2.Cº$	0.94	
cover	$W/m^2.Cº$	2.79	
bottom	$W/m^2.Cº$	1.51	
Most unfavorable temperatures during winter			
air	ºC	5	
ground	ºC	10	
sludge	ºC	15	

Table III.5.8.2 - Sludge treatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Operational conditions			
Biogas use			
Biogas energy potential	kWh/d	8,874	14,488
Power from the biogas produced	kW	555	905
Nominal output of electric power	kWh/d	3,106	5,071
	kW	194	317
Nominal output thermal power	kcal/d	3,707,433	6,053,023
	kWh/d	4,311	7,038
Heating needs for digestion			
Heat loss surface			
walls above the ground	m^2	-	28
walls buried	m^2	-	294
cover	m^2	-	254
bottom	m^2	-	294
Digester heat loss, during winter			
walls above the ground	kcal/d	-	45,077
walls buried	kcal/d	-	142,195
cover	kcal/d	-	439,711
bottom	kcal/d	-	228,902
Total	kcal/d	-	1,711,771
Requested sludge heating	kcal/d	2,601,400	4,247,234
Total energy needs	kcal/d	4,313,172	5,959,005
Moto-generators			
Requested gas power	kW	645	891
Thermal energy from the exhaust gases	kcal/d	1,357,850	1,875,983
Thermal energy from the cooling water	kcal/d	2,955,321	4,083,022
Total thermal energy	kcal/d	4,313,172	5,959,005
Unitary power of the moto-generators	kW	-	173
Biogas consumption	m^3/h	101	140
Natural gas consumption	m^3/h	61	85
Additional consumption of natural gas			
Energy deficit	kcal/d	605,738	-94,018
Additional consumption of natural gas	m^3/d	138	-21
Electric power generated by natural gas	kWh/d	507	0
Electric power production			
Total electric power production	kWh/d	3,613	5,071
Average working period of the moto-generators	h/d	12	16
Maximum consumption of natural gas	m^3/s	-	0.024

Table III.5.9.1 - Sludge Treatment (Solution 1)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	93	165
Dewatering sludge solids concentration	kg/m^3	30	30
Dewatering sludge solids content	kg/d	2,788	4,949
Design criteria			
Number of units	un	2	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	2	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	20	
	kg/h	577	
Unitary capacity of dewatering sludge pumps	m^3/h	20.0	
Required capacity of polymer equipment	L/h	2,079	
In-line dilution system flow	m^3/h	6.9	
Operational conditions			
Dewatering sludge flow	m^3/d	130	231
	m^3/h	22	38
Dewatering sludge solids content	kg/d	3,903	6,929
	kg/h	651	1 155
Dewatered sludge daily flow	m^3/d	19	33
Dewatered sludge solids content	kg/d	3,708	6,582
Sludge liquor solids content	kg/d	195	346
Sludge liquor flow (1)	m^3/d	130	216
Number of dewatered sludge containers (10 m^3 each)	un.	2	3
Polymer consumption	kg/d	23.4	41.6
	kg/h	3.9	6.9
Polymer mother solution flow	m^3/d	4.7	8.3
	L/h	781	1,386
Polymer diluted solution flow	m^3/h	23.4	41.6
Dilution water flow	m^3/h	18.7	33.3

(1) it includes centrifuge rinse water

Table III.5.9.2 - Sludge treatment (Solutions 2 and 3)

Operation: Mechanical dewatering

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	129	210
Dewatering sludge solids concentration	kg/m^3	28	28
Dewatering sludge solids content	kg/d	3,606	5,887
Design criteria			
Number of units	un	2	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	2	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	25	
	kg/h	687	
Unitary capacity of dewatering sludge pumps	m^3/h	25.0	
Required capacity of polymer equipment	L/h	2,473	
In-line dilution system flow	m^3/h	8.2	
Operational conditions			
Dewatering sludge flow	m^3/d	180	294
	m^3/h	30	49
Dewatering sludge solids content	kg/d	5,048	8,242
Dewatered sludge daily flow	m^3/d	841	1 374
Dewatered sludge solids content	kg/d	24	39
Sludge liquor solids content	kg/d	4,796	7,830
Sludge liquor flow [(1)]	m^3/d	252	412
Number of dewatered sludge containers (10 m^3 each)	un.	174	273
Sludge liquor solids concentration	mg/L	2	4
Polymer consumption	kg/d	30.3	49.5
	kg/h	5.0	8.2
Polymer mother solution flow	m^3/d	6.1	9.9
	L/h	1,010	1,648
Polymer diluted solution flow	m^3/h	30.3	49.5
Dilution water flow	m^3/h	24.2	39.6

[(1)] it includes centrifuge rinse water

Table III.5.9.3 - Sludge Treatment - alternative (Solution 1)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of drying beds	un.	26	
Type	-	rectangular plant	
Unitary surface	m^2	350	
Total surface	m^2	9,100	
Unitary volume	m^3	70	
Total volume	m^3	1,820	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	93	165
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	2,788	4,949
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	112	199
Drying time	d	19.6	11.0

Table III.5.9.4 - Sludge treatment - alternative (Solutions 2 and 3)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of drying beds	un.	26	
Type	-	rectangular plant	
Unitary surface	m^2	350	
Total surface	m^2	9,100	
Unitary volume	m^3	70	
Total volume	m^3	1,820	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	129	210
Drying solids (DS) concentration	kg/m^3	28	28
DS loading	kg/d	3,606	5,887
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	145	236
Drying time	d	14.1	8.7

Table III.5.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	4.00	13.0	52.0
Archimedes' Screw - 100 L/s	2	2	0	10.00	13.0	260.1
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	16.0	70.4
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Secondary treatment						
Submersible mixer - anoxic tanks	6	6	0	7.50	24.0	1,080.0
Submersible mixer - aerobic tanks	6	6	0	7.50	8.0	360.0
Air compressor	5	4	1	75.00	16.0	4,800.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.80	6.0	91.2
Sludge recirculation pump	2	1	1	30.00	24.0	720.0
Excess sludge extraction pump	2	1	1	2.20	24.0	52.8
Scum pump	2	1	1	0.75	3.0	2.3
Tertiary treatment						
Nitrate recirculation pump	4	4	0	4.00	24.0	384.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	45.00	13.0	2,340.5
Filters with automatic cleaning	4	4	0	0.25	13.0	13.0
UV ray disinfection unit	1	1	0	22.00	13.0	286.1
Hydropneumatic station	1	1	0	4.00	3.0	12.0
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	4.6	10.1
Mixer of the thickened sludge storage tank	1	1	0	0.75	24.0	18.0
Thickened sludge pump	2	2	0	2.20	5.8	25.4
Centrifuge	2	2	0	30.00	5.8	346.4
Polymer preparation equipment	1	1	0	1.10	5.8	6.4
Polymer dosing pump	2	1	1	1.50	5.8	8.7
Lift screw of dewatered sludge	1	1	0	1.10	5.8	6.4
Run-off water pump	2	1	1	1.10	3.0	3.3

Table III.5.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	**Units**			**Installed unit power** (kW)	**Average function.** (h/d)	**Energy consumption** (kWh/d)
	Total	**In service**	**In reserve**			
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	77	69	8	292.54	-	11,541

Table III.5.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	4.00	13.0	52.0
Archimedes' Screw - 100 L/s	2	2	0	10.00	13.0	260.1
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	16.0	70.4
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	5.79	8.7
Scum lift pump - primary sedimentation tank	2	1	1	0.55	3.0	1.7
Secondary treatment						
Submersible mixer - anoxic tanks	3	3	0	7.50	24.0	540.0
Submersible mixer - aerobic tanks	3	3	0	7.50	8.0	180.0
Air compressor	3	2	1	90.00	16.0	2,880.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.80	6.0	91.2
Sludge recirculation pump	2	1	1	30.00	24.0	720.0
Excess sludge extraction pump	2	1	1	2.20	24.0	52.8
Scum pump	2	1	1	0.75	3.0	2.3
Tertiary treatment						
Nitrate recirculation pump	2	2	0	7.50	24.0	360.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	45.00	13.0	2,340.5
Filters with automatic cleaning	4	4	0	0.25	13.0	13.0
UV ray disinfection unit	1	1	0	22.00	13.0	286.1
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.5.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	5.8	12.8
Sludge recirculation pump in order to mix the digester	6	4	2	11.00	24.0	1,056.0
Heating sludge pump	2	2	0	22.00	20.0	880.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	2	2	0	0.75	24.0	36.0
Biogas compressor to supply the boiler	2	1	1	2.20	0.0	0.0
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	3.00	0.0	0.0
Biogas compressor to supply the moto-generators	2	2	0	2.20	16.0	70.4
Pump for cooling liquid/water heat exchanger	2	2	0	4.00	16.0	128.0
Pump for exhaust gas/water heat exchanger	3	2	1	2.20	18.0	79.2
Digested sludge pump	2	2	0	3.00	5.9	35.3
Centrifuge	2	2	0	30.00	5.9	353.2
Polymer preparation equipment	1	1	0	1.10	5.9	6.5
Polymer dosing pump	2	1	1	1.50	5.9	8.8
Lift screw of dewatered sludge	1	1	0	1.50	5.9	8.8
Run-off water pump	2	1	1	0.55	3.0	1.7
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	95	81	14	366.19	-	11,300
Electricity requirement (kWh/year)	-	-	-	-	-	4,081,196
Electricity produced by cogeneration (kWh/year)	-	-	-	-	-	1,850,803
Electricity purchased from the public network (kWh/year)	-	-	-	-	-	2,230,393

Table III.5.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Archimedes' Screw - 50 L/s	1	1	0	4.00	13.0	52.0
Archimedes' Screw - 100 L/s	2	2	0	10.00	13.0	260.1
Mechanical screen	1	1	0	0.75	3.0	2.3
Screenings belt conveyor	1	1	0	1.10	3.0	3.3
Scraper bridge of the aerated grit and grease chamber	1	1	0	0.55	24.0	13.2
Air compressor	3	2	1	2.20	16.0	70.4
Grit lift pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.50	3.0	4.5
Grit classifier	1	1	0	0.37	3.0	1.1
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	2	0	0.75	5.79	8.7
Scum lift pump - primary sedimentation tank	2	1	1	0.55	3.0	1.7
Secondary treatment						
Submersible mixer - anoxic tanks	3	3	0	7.50	24.0	540.0
Submersible mixer - aerobic tanks	3	3	0	7.50	8.0	180.0
Air compressor	3	2	1	90.00	16.0	2,880.0
Ventilator of the compressors' building	1	1	0	0.75	16.0	12.0
Scraper bridge of the secondary clarifiers	2	2	0	1.10	24.0	52.8
Biological sludge pump	4	4	0	3.80	6.0	91.2
Sludge recirculation pump	2	1	1	30.00	24.0	720.0
Excess sludge extraction pump	2	1	1	2.20	24.0	52.8
Scum pump	2	1	1	0.75	3.0	2.3
Tertiary treatment						
Nitrate recirculation pump	2	2	0	7.50	24.0	360.0
Mixer of the aluminium sulphate dosing tank	1	1	0	0.55	24.0	13.2
Aluminium sulphate dosing pump	2	1	1	0.37	24.0	8.9
Feeding pump to the filters	4	4	0	45.00	13.0	2,340.5
Filters with automatic cleaning	4	4	0	0.25	13.0	13.0
UV ray disinfection unit	1	1	0	22.00	13.0	286.1
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.5.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.25	24.0	12.0
Thickened sludge pump	2	2	0	1.10	5.8	12.8
Sludge recirculation pump in order to mix the digester	6	4	2	11.00	24.0	1,056.0
Heating sludge pump	2	2	0	22.00	20.0	880.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	2	2	0	0.75	24.0	36.0
Biogas compressor to supply the boiler	2	1	1	2.20	16.0	35.2
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	3.00	18.0	54.0
Digested sludge pump	2	2	0	3.00	5.9	35.3
Centrifuge	2	2	0	30.00	5.9	353.2
Polymer preparation equipment	1	1	0	1.10	5.9	6.5
Polymer dosing pump	2	1	1	1.50	5.9	8.8
Lift screw of dewatered sludge	1	1	0	1.50	5.9	8.8
Run-off water pump	2	1	1	0.55	3.0	1.7
Treatment of odours						
Extraction ventilator of contaminated air	1	1	0	15.00	24.0	360
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	88	75	13	357.79	-	11,112

Annex-III.6

Siliana WwTP tables

Table III.6.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Screening
No.	One mechanical operated and one manually operated in the bypass channel, additionally one rotating sieve

ILLUSTRATIVE PICTURES


REMARKS	- In general, the equipment presents a very good state of preservation and working performance taking in consideration their operating in a wastewater working environment. - The rotating sieve presents some corrosion on its motorization. - There is a flow measurement at the plant entrance.
RECOMMENDATIONS	- The step screen is working however should have an overhaul. - The motorization of the rotating sieve should be refurbished with the application of a new coating treatment to prevent corrosion increase.

Table III.6.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Grit and grease removal
No.	One scraper working on two channels chamber with aeration, bottom grit pumping and surface grease removal.

ILLUSTRATIVE PICTURES

REMARKS	- In general, the equipment presents a very good state of preservation and working performance taking in consideration their operating in a wastewater working environment. - The equipment for the grease and grit removal such as the blowers and grease pump are installed in an underground chamber. This chamber is not in adequate environmental conditions, it presents a humid atmosphere. - The blowers for the aeration are working; nevertheless they present a state of some degradation, being dirty and dusty. - The grease pumping circuit is out of service. It was reported to the consultant team that it clogged immediately after the start of the installation and was abandoned ever since. The grease is sucked directly from the grease pit at the surface.
RECOMMENDATIONS	- The blowers are working however an overall and their replacement need should eventually be considered on a medium term. - In case ONAS considers the present solution for grease removal inadequate, as terms of an easy and practical exploitation activity, it will be necessary to improve the grease removal circuit considering a revision of pipes diameters and pump selection.

WWTP of SILIANA
Table III.6.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – aeration tanks
No.	2 Oxidation ditches with surface aeration rotors

ILLUSTRATIVE PICTURES

REMARKS	- Generally, the aeration rotors present a reasonably state taking in consideration their working conditions. The civil construction supporting the rotors presented some heavy deterioration caused by the wastewater attack. - There are no submersible agitators to assure a proper flow conditions in the oxidation ditches. - The effluent regulator valve presents a very good state of preservation, but the electrical cabinet is uncovered. - It was reported to the consultant team the need to replace the oxygen probes. - The operation of the aeration rotors it is not automated, as in an automation system, which integrates a measurement of the dissolved oxygen within the tank.
RECOMMENDATIONS	- The civil construction supporting the rotors needs urgent rehabilitation and proper treatment to prevent wastewater corrosive attack. - It is necessary to install submersible agitators to assure adequate flow conditions in the ditches. - The electrical cabinets should be covered with shields for protection from weather conditions such as excess exposure to sun light. - Automation should be increased specially focusing on integration between oxygen probes in the aeration tanks and the aeration working hours.

WWTP of SILIANA

Table III.6.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Biological treatment – secondary clarifier
No.	2 Circular clarifiers

ILLUSTRATIVE PICTURES

REMARKS	- Generally, the scrapers present a reasonably state taking in consideration their working conditions. - The painting is somewhat degraded and blemished in certain areas, nevertheless it is possible to sate that the equipment seems to be painted to avoid corrosion increase.
RECOMMENDATIONS	- The scrapers are working however need an overhaul, especially on the motorization. - The electrical cabinets should be covered with shields for protection from weather conditions such as excess exposure to sun light.

Table III.6.1.1.1 – Electromechanical equipment

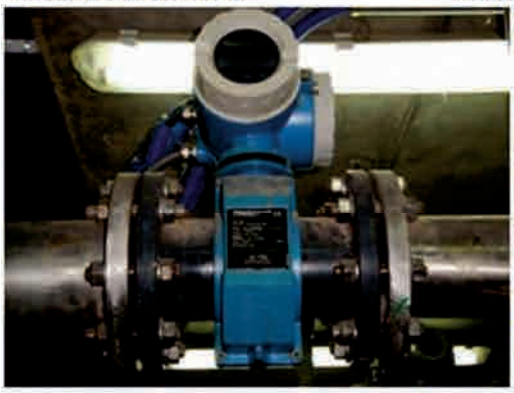
UNIT/OPERATION	Biological treatment – sludge recycle management
No.	1 Sludge pumping station

ILLUSTRATIVE PICTURES

Sludge pumping chamber

Excess sludge pumps

Recycle sludge pumps



Excess sludge electromagnetic flowmeter

Recycle sludge electromagnetic flowmeter

REMARKS	- In general, all the equipment presents a very good state of preservation and working performance taking in consideration their operating in an underground chamber. This chamber presents a humid atmosphere.
RECOMMENDATIONS	- The equipment needs an overhaul and the chamber would benefit of a suitable ventilation systems and some cleaning frequency.

Table III.6.1.1.1 – Electromechanical equipment

UNIT/OPERATION	Sludge thickener and drying beds
No.	1 Sludge thickener (circular) with mechanical scraper bridge

ILLUSTRATIVE PICTURES

REMARKS	- The scraper and its motorization present a very good state of preservation and working performance. - The sludge pump (to feed the drying beds) is also installed in the underground chamber. Nevertheless, the pump presents a very good state of preservation and working performance. - It was reported to the consultant team that, during winter, the drying beds capacity is not enough for sludge dewatering. - It was reported to the consultant team that the beds drainage system is in poor condition and require rehabilitation (layers of sand and gravel mixed with sludge and clogging) - It was reported to the consultant team that is missing a suitable machine to handle the dried sludge.
RECOMMENDATIONS	- The solution suggested for the drying beds intends to change the actual dewatering system to a mechanical sludge dewatering system such as a centrifuge or a belt press.

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Table III.6.1.1.2 – Civil Engineering

UNIT/OPERATION	Civil Engineering
No.	

ILLUSTRATIVE PICTURES	
Photo 1: Grit and grease removal	Photo 2: Aeration Tanks
	
Photo 3: Aeration Tanks	Photo 4: Aeration Tanks
	
Photo 5: Secondary Clarifier	
	

Table III.6.1.1.2 – Civil Engineering

<table>
<tr><td>SPECIFICATIONS</td><td>
The project of wastewater treatment plant of Siliana was undertaken for duration of normal operating up to 2011 for the Station of Purification and up to 2016 for the networks.
Moreover, it was provided, when designing the station of purification, a flexibility of a period of five years. This delay will make it possible to reconsider the dimensioning of the station and to provide for the extensions starting from 2016.
The station of purification thus conceived would be thus able to treat the wastewater even up to Year 2016, without decreasing the output of the purification in an important manner and without being compelled to undertake important works of extension. The sanitation network is also conceived to allow the drainage of wastewater within the urban perimeter of the city up to the same period of time.
The maximum capacity of collected water is 4530 m^3/day for a total of 51,000 inhabitants.
The dimensions and capacity of the facilities are:
➢ Grit chambers:
- Length =19.3 m, Width =5.7 m, Height=3.85 m
- Surface=110 m^2
- Volume=424 m^3
➢ Channel of oxidation:
- Length =45 m, Width =20 m, Height=4.3 m
- Surface=900 m^2
- Volume=3900 m^3
➢ Secondary settling tank: (number=2, of cylindrical form)
- Diameter =8 m, Height=4.6 m
- Surface =50,24 m^2
- Volume=250 m^3
➢ Drying bed:
- Length =26 m,Width =6 m, Height=0.65 m
- Surface=156 m^2
- Total surface =8736 m^2
The structures of the station of purification are made out of reinforced concrete. They are formed by a raft foundation, extreme screens in contact with the ground (half-buried works), the intermediate screens beam and screens, and the posts and beams.
These structures are separated by the expansion joints with water-stop.
</td></tr>
</table>

WWTP of SILIANA

Table III.6.1.1.2 – Civil Engineering

DIAGNOSIS	- The structures are in a good state, and it does not present particular disorders (remarkable cracks, differential settlements etc.). It should be noted also that, in spite of the permanent presence of aggressive water, the walls of the works are not affected by this medium. (Photo 1, 2) - The joints do not show any apparent degradation. - The structures do not show any degradations or apparent cracking. - Some concrete break-ups at the head of screens have been observed but they remain much localized. **In conclusion:** the structures of the station are in a better state than the other stations.

SILIANA WWTP

Table III.6.2.1 - Design data

Design Data

Parameter	Unit	Year	
		2011	2029
<u>Population served</u>			
Domestic population	p.e	25,322	31,855
Industrial population	p.e	2,079	5,796
Touristic population	p.e	0	0
Total population	p.e	27,402	37,650
Peak Factors			
Domestic peak factor	-	1.6	1.5
Industrial peak factor	-	2.0	2.0
Touristic peak factor	-	2.0	2.0
Return factor			
Domestic return factor	%	80	80
Industrial and touristic return factor	%	90	90
Per capita flow and load factors			
Per capita water consumption			
domestic	L/capita/d	103	135
industrial	L/capita/d	-	-
touristic	L/capita/d	500	500
Domestic and touristic per capita loading factors			
TSS	g/capita/d	90	90
BOD_5	g/capita/d	45	45
COD	g/capita/d	120	120
Total Nitrogen (TN)	g/capita/d	8	8
Total Phosphorus (TP)	g/capita/d	1.5	1.5
Fecal Coliforms	CFU/capita/d	1.00E+11	1.00E+11
<u>Wastewater inflows</u>			
Domestic average daily flow (Adf)	m^3/d	2,087	3,432
	L/s	24.2	39.7
Domestic peak flow	m^3/h	135	221
	L/s	37.6	61.3
Industrial average daily flow	m^3/d	234	652
	L/s	2.7	7.5
Industrial peak flow	m^3/h	19	54
	L/s	5.4	15.1
Touristic average daily flow (occupancy rate = 100%)	m^3/d	0.0	0.0
	L/s	0.0	0.0
Touristic peak flow	m^3/h	0.0	0.0
	L/s	0.0	0.0

Table III.6.2.1 - Design data

Parameter	Unit	Year	
		2011	2029
Infiltration flow	L/s	16.9	27.8
Total average daily flow (domestic + industrial + touristic)	m^3/d	2,321	4,084
Total average daily flow (domestic + industrial + touristic) + infiltratior	m^3/d	3,782	6,487
Total peak flow	m^3/h	216	375
	L/s	59.9	104.2
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
Loadings			
Domestic + touristic			
TSS	kg/d	2,279	2,867
BOD_5	kg/d	1,140	1,433
COD	kg/d	3,039	3,823
TN	kg/d	203	255
TP	kg/d	38	48
Fecal Coliforms	CFU/d	2.53E+15	3.19E+15
Industrial			
TSS	kg/d	94	261
BOD_5	kg/d	94	261
COD	kg/d	234	652
TN	kg/d	29	80
TP	kg/d	2	7
Total			
TSS	kg/d	2,373	3,128
BOD_5	kg/d	1,233	1,694
COD	kg/d	3,273	4,475
TN	kg/d	231	335
TP	kg/d	40	54
Fecal Coliforms	CFU/d	2.53E+15	3.19E+15

Table III.6.2.1 - Design data

Parameter	Unit	Year	
		2011	**2029**
Concentrations (2)			
Domestic + touristic			
TSS	mg/L	1,092	835
BOD_5	mg/L	546	418
COD	mg/L	1,456	1,114
TN	mg/L	97	74
TP	mg/L	18	14
Fecal Coliforms	CFU/100mL	1.21E+08	9.28E+07
Industrial			
TSS	mg/L	400	400
BOD_5	mg/L	400	400
COD	mg/L	1,000	1,000
TN	mg/L	123	123
TP	mg/L	10	10
Total without infiltration			
TSS	mg/L	1,022	766
BOD_5	mg/L	531	415
COD	mg/L	1,410	1,096
TN	mg/L	100	82
TP	mg/L	17	13
Fecal Coliforms	CFU/100mL	1.09E+08	7.80E+07

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

(2) Without infiltration

Table III.6.3.1 - Preliminary Treatment

Operation: Grit retention

Parameter	Unit	Year	
		2011	**2029**
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,321	4,084
Maximum design flow (Mdf)	m^3/h	504	562
	L/s	140	156
Design Criteria			
Number of basins	un	1	
Type	-	circular plant	
Retention time (Mdf)	min	15	
Peripheral depth	m	3	
Design Results			
Total volume	m^3	141	
Unitary volume	m^3	141	
Unitary surface area	m^2	47	
Diameter	m	8	
Existing infrastructures operational conditions			
Retention time			
Adf	min	87	50
Mdf	min	17	15

Table III.6.3.2 - Preliminary Treatment

Operation: Screening

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Mechanical Screening			
Number of screening devices working in parallel	un.	1	
Screen bars spacing	mm	6	
Bars thickness	mm	6	
Channel width	m	0.6	
Channel depth	m	0.8	
Unitary power of screening devices	kW/un.	0.37	
Maximum flow capacity	m^3/h	140	
Manually Cleaned Coarse Screens			
Number of coarse screens	un.	1	
Screen bars spacing	mm	10	
Channel width	m	0.6	
Channel depth	m	0.8	
Additional mechanical screening - rotating sieve			
Number of devices	un.	1	
Mesh	mm	1.5	
Unitary power of screening devices	kW/un.	0.5	
Maximum flow capacity	m^3/h	10	
Influent wastewater flows and loads			
Population	p.e.	25,322	31,855
Average daily flow (Adf)	m^3/d	2,321	4,084
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
Design Criteria			
Velocity through clean bar screen	m/s	1.2	
Approach velocity	m/s	0.3 - 0.9	
Maximum degree of clogging	%	-	
Channel depth	m	0.8	
Kirschmer factor	-	1.94	
Channel freeboard	m	≥ 0,3	
Volume of screenings per capita	L/capita/year	6	
Bulk density of removed screenings	kg/L	0.95	
Screenings removal rate	%	95	

Table III.6.3.2 - Preliminary Treatment

Parameter	**Unit**	**Year**	
		2011	**2029**
Existing infrastructures operational conditions			
Effective open area (Mdf)	m^2	0.12	0.13
Total cross-sectional area	m^2	0.23	0.26
Height of the liquid upstream	m	0.47	0.52
Approach velocity (Mdf)	m/s	0.60	0.60
Approach velocity (Adf)	m/s	0.12	0.18
Channel freeboard	m	0.33	0.28
Headloss through clogged screens	mm WC	25.2	25.2
Screenings characteristics and quantities			
Volumetric flow of incoming wet screenings	L/d	416	524
Mass flow of incoming wet screenings	kg/d	395	497
Volumetric flow of removed wet screenings	kg/d	376	473
Mass flow of removed wet screenings	m^3/d	0.40	0.50

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.3.3 - Preliminary Treatment

Operation: Grit and Grease Removal

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of chambers	un.	2	
Type	-	rectangular plant, aerated	
Length	m	17	
Total width	m	4.4	
Depth	m	2.3	
Grit cross-sectional area	m^2	7.36	
Grease cross-sectional area	m^2	2.76	
Total surface	m^2	74.8	
Total wet volume	m^3	172.04	
Number of grit pumps	un.	2	
Unitary capacity of grit pumps	m^3/h	-	
Unitary power of grit pumps	kW/un.	36	
Number of air compressors	un.	2	
Unitary power of air compressors	kW/un.	3 ; 1,5	
Number of scraper bridges	un.	1	
Unitary power of scraper bridges	kW/un.	-	
Influent wastewater flows and loads			
Population	p.e.	25,322	31,855
Average daily flow (Adf)	m^3/d	2,321	4,084
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
Design Criteria			
Retention time (Mdf)	min	10 - 15	
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	10 - 15	
Specific air flow	L/s/m	5	
	m^3 air/h/m^3	1,5	
Headloss in the aeration system	% submergence	30	
Volume of grit per capita	L/capita/year	7	
Grit removal rate	%	95	
Volume of oil & grease per capita	g/capita/d	25	
Bulk density of removed oil & grease	kg/L	0.8	
Oil & grease removal rate	%	30	

Table III.6.3.3 - Preliminary Treatment

Parameter		Unit	Year	
			2011	2029
Existing infrastructures operational conditions				
Retention time				
	Adf	min	107	61
	Mdf	min	20	18
Hydraulic loading rate				
	Adf	$m^3/m^2/h$	1.3	2.3
	Mdf	$m^3/m^2/h$	6.7	7.5
Volumetric flow of incoming grit		L/d	486	611
Mass flow of incoming grit		kg/d	728	916
Volumetric flow of removed grit		kg/d	692	871
Mass flow of removed grit		m^3/d	185	232
Volumetric flow of grit after classification		m^3/d	0.51	0.64
Mass flow of grit after classification		kg/d	615	774
Runoff flow		m^3/d	184	232
Mass flow of incoming oil & grease		kg/d	453	796
Volumetric flow of incoming oil & grease		L/d	566	995
Mass flow of removed oil & grease		kg/d	136	239
Volumetric flow of removed oil & grease		m^3/d	17	30

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.4.1 - Primary settling (Solutions 2 and 3)

Operation: Primary settling

Parameter	Unit	Year	
		2011	2029
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,535	4,368
Maximum design flow (Mdf) [1]	m^3/h	504	562
	L/s	140	156
TSS Concentration	kg/m^3	1.0	0.8
TSS loading	kg/d	2,652	3,499
Design Criteria			
Hydraulic loading rate (Adf)	$m^3/m^2/h$	< 1,5	
Retention time (Mdf)	h	> 2	
Depth	m	3.0	
SS concentration in primary sludge	kg/m^3	20	
SS removal rate	%	50	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Number of scum pumps	un.	1+1	
Number of excess sludge pumps	un.	1+1	
Design results			
Number of primary settling tanks	un	1	
Type	-	circular plant	
Requested surface	m^2	375	
Minimum requested diameter	m	375	
Adopted diameter	m	22	
Unitary surface	m	380	
Unitary volume	m^3	1,140	
Total volume	m^3	1,140	
Unitary capacity of scum pumps	m^3/h	18	
Unitary capacity of primary sludge pumps	m^3/h	18	
Operational conditions			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.3	1.5
Retention time (Mdf)	h	2.3	2.0
Primary sludge production	kg/d	1,326	1,750
	m^3/d	66.3	87.5
Scum production	kg/d	25	44
	m^3/d	0.03	0.05

[1] This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.5.1 - Biological Treatment (Solution 1)

Operation: Biological organic matter removal (activated sludge in extended aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in each treatment line - oxidation ditches	un.	1	
Each basin side length	m	20.3	
Each basin surface	m^2	-	
Total surface	m^2	-	
Liquid depth	m	3.4	
Each basin volume	m^3	3,900	
Total volume	m^3	7,800	
Aeration system	-	aeration rotors	
Number of aerators in each basin	un.	2	
Number of agitators in each basin	un.	-	
Aeration power	kW	-	
Influent wastewater flows and loads			
Population	p.e.	27,402	37,650
Average daily flow (Adf)	m^3/d	2,487	4,307
Maximum design flow (Mdf) (1)	m^3/h	504	562
TSS	kg/d	2,515	3,321
BOD	kg/d	1,305	1,791
TN	kg/d	239	346
TP	kg/d	42	56
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
PT	mg/L	-	0.05

Table III.6.5.1 - Biological Treatment (Solution 1)

Parameter	Unit	Year 2011	Year 2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.04 - 0.12	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.1 - 0.4	
Sludge age	d	20	
MLSS in aeration tanks	kg/m^3	4.5	
MLVSS/ MLSS ratio	-	0.80	
MLVSS in aeration tanks	kg/m^3	3.6	
TKN in effluent	mg/L N	1	
Denitrification rate at tank temperature	gN-NO_3/kgMSV/d	0.03	
Sludge production	kgMLSS/kgBOD/d	1	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Number of agitators	un.	4	
Aeration system			
a'	kgO/kgBOD	0.55	
b'	kgO/kgMVS/d	0.06	
Peak factor for BOD removal	-	1.1	
Nitrification peak factor	-	1.5	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.24	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2.0	
Air density at 20 ºC	kg/m^3	1.20	
Air oxygen content	%	23.2	
Oxygen transfer rate	%	15.0	
Existing infrastructures operational conditions			
F/M	kgBOD/kgMLVSS/d	0.05	0.06
Fv	kgBOD/m^3/d	0.17	0.23

Table III.6.5.1 - Biological Treatment (Solution 1)

Parameter		Unit	Year	
			2011	2029
Design results				
Total biological volume		m^3	3,900	7,800
Anoxic zone volume		m^3	1,170	2,341
Anoxic volume / Total volume		-	0.3	0.3
Aerobic zone volume		m^3	2,730	5,459
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.093	0.064
Fv		kgBOD/m^3/d	0.167	0.230
Sludge age		d	14	20
Minimum sludge recycle		m^3/d	1,244	2,154
Maximum sludge recycle		m^3/d	3,731	6,461
Required oxygen for oxidation of organic material		kgO_2/d	676	914
	peak	kgO_2/h	31	42
Required oxygen for endogenous metabolism		kgO_2/d	842	1 685
	peak	kgO_2/h	35	70
Required oxygen for oxidation of ammonia		kgO_2/d	754	1 112
	peak	kgO_2/h	47	70
Oxygen recovered from denitrification		kgO_2/d	287	424
	peak	kgO_2/h	18	26
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	1,986	3,287
	peak	kgO_2/h	95	155
SOR - Standard Oxygen Requirement		kgO_2/d	2,977	4,846
	peak	kgO_2/h	124	202

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.5.2 - Biological Treatment (Solutions 2 and 3)

Operation: Biological organic matter removal (activated sludge in conventional aeration)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	2	
Number of basins in each treatment line - oxidation ditches	un.	1	
Each basin side length	m	20.3	
Each basin surface	m^2	-	
Total surface	m^2	-	
Liquid depth	m	3.4	
Each basin volume	m^3	3,900	
Total volume	m^3	7,800	
Aeration system	-	aeration rotors	
Number of aerators in each basin	un.	2	
Number of agitators in each basin	un.	-	
Aeration power (2 velocities)	kW	-	
Influent wastewater flows and loads			
Population	p.e.	27,402	37,650
Average daily flow (Adf)	m^3/d	2,469	4,281
Maximum design flow (Mdf) (1)	m^3/h	504	562
TSS	kg/d	1,326	1,750
BOD	kg/d	1,030	1,410
TN	kg/d	221	319
TP	kg/d	38	51
Effluent quality			
BOD	mg/L	-	30
COD	mg/L	-	90
TSS	mg/L	-	30
TN	mg/L	-	11
TP	mg/L	-	0.05

Table III.6.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design Criteria			
Aeration tank			
Tank temperature	ºC	15	
Massic loading rate (Food-to-Microorganism Ratio, F/M)	kgBOD/kgMLVSS/d	0.2 - 0.5	
Volumetric organic loading rate (Fv)	kgBOD/m^3/d	0.5 - 1.2	
Sludge age	d	8	
MLSS in aeration tanks	kg/m^3	3.50	
MLVSS/ MLSS ratio	-	0.70	
MLVSS in aeration tanks	kg/m^3	2.45	
TKN in effluent	mg/L N	1	
Denitrification rate at tank temperature	gN-NO$_3$/kgMSV/d	0.09	
Sludge production	kgMLSS/kgBOD/d	1.15	
Excess activated sludge solids concentration	kg/m^3	8	
Sludge recycle solids concentration	kg/m^3	8	
Sludge recycle			
min.	%Adf	50	
max.	%Adf	150	
Number of agitators	un.	4	
Aeration system			
a'	kgO/kgBOD	0.50	
b'	kgO/kgMVS/d	0.08	
Peak factor for BOD removal	-	1.2	
Nitrification peak factor	-	1.8	
Oxygen consumed / N oxidized	kgO/kgN	4.30	
Oxygen released /N denitrified	kgO/kgN	2.86	
Recovery of O_2 released by denitrification	-	0.70	
Solubility correction factor, F_s	-	1.24	
Standard temperature	ºC	20	
Process temperature	ºC	15	
Temperature correction factor	-	1.024	
alpha coefficient, a	-	0.80	
beta coefficient, b	-	0.95	
Oxygen saturation concentration			
at reference temperature	mg/L	9.17	
at process temperature	mg/L	10.15	
Dissolved oxygen in tanks	mg/L	2	
Air density at 20 ºC	kg/m^3	1.20	
Air oxygen content	%	23.20	
Oxygen transfer rate	%	15	
Existing infrastructures operational conditions			
F/M	kgBOD/kgMLVSS/d	0.05	0.07
Fv	kgBOD/m^3/d	0.13	0.18

Table III.6.5.2 - Biological Treatment (Solutions 2 and 3)

Parameter		Unit	Year	
			2011	**2029**
Design results				
Total biological volume		m^3	1,900	1,900
Anoxic zone volume		m^3	950	950
Anoxic volume / Total volume		-	0.50	0.50
Aerobic zone volume		m^3	950	950
Operational conditions				
F/M		kgBOD/kgMLVSS/d	0.221	0.303
Fv		kgBOD/m^3/d	0.542	0.742
Sludge age		d	11	8
Minimum sludge recycle		m^3/d	1,234	2,140
Maximum sludge recycle		m^3/d	3,703	6,421
Required oxygen for oxidation of organic material		kgO_2/d	478	641
	peak	kgO_2/h	24	32
Required oxygen for endogenous metabolism		kgO_2/d	372	372
	peak	kgO_2/h	16	16
Required oxygen for oxidation of ammonia		kgO_2/d	734	1 079
	peak	kgO_2/h	55	81
Oxygen recovered from denitrification		kgO_2/d	279	411
	peak	kgO_2/h	21	31
AOTR - Average Theoretical Oxygen Requirement		kgO_2/d	1,304	1,681
	peak	kgO_2/h	73	98
SOR - Standard Oxygen Requirement		kgO_2/d	2,295	3,051
	peak	kgO_2/h	96	127

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.5.3 - Phosphorus Removal (Solution 1)

Operation: Chemical phosphorus removal

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of treatment lines	un.	1	
Flocculant reagent	-	aluminium sulphate	
Flocculant preparation basin	-	plastic	
diameter	m	2.2	
depth	m	2.0	
Concentration	%	40	
Flocculant density	kg/L	1.7	
Solution density	kg/L	1.3	
Dilution basin capacity	L	500	
Number of agitators	un.	2.0	
Unitary power of agitators	kW/un.	0.37	
Number of dosing pumps	un.	1+1	
Unitary power of dosing pumps	kW/un.	0.37	
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Flocculant - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	20.15	15.00
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	29	40
	mg/L	11.9	9.2
Al quantity required	kg/d	88	119
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	1,093	1,468
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	2,186	2,937
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	1.7	2.3
	m^3/year	614	825
Dosage tank minimum volume	m^3	34	34
Unitary flow of dosing pumps	L/h	94	94
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	135	182
Hydroxides	kg/d	196	264
Physico-chemical sludge quantity produced	kg/d	332	446
	m^3/d	41.5	55.7

Table III.6.5.4 - Phosphorus Removal (Solutions 2 and 3)

Operation: Chemical phosphorus removal

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of treatment lines	un.	1	
Flocculant reagent	-	aluminium sulphate	
Flocculant preparation basin	-	plastic	
diameter	m	2.2	
depth	m	2	
Concentration	%	40	
Flocculant density	kg/L	1.7	
Solution density	kg/L	1.28	
Dilution basin capacity	L	500	
Number of agitators	un.	2	
Unitary power of agitators	kW/un.	0.37	
Number of dosing pumps	un.	1+1	
Unitary power of dosing pumps	kW/un.	0.37	
Design criteria			
Phosphorus to remove by precipitation	%	99.7	99.6
Phosphorus assimilated on biological treatment	%/100kgBOD_5	1.0	1.0
Phosphorus in treated effluent	mg/L	0.05	0.05
Al to be dosed	molAl/molP	3.00	3.00
Flocculant - $Al_2(SO_4)_3.18H_2O$			
Dilution	%	50	50
Density	kg/m^3	1,300	1,300
Dosage tank minimum autonomy	d	20.20	15.00
Number of dosing pumps	un.	1+1	1+1
Design results			
Phosphorus to be removed by chemical precipitation	kg/d	28	38
	mg/L	11.4	8.9
Al quantity required	kg/d	85	114
$Al_2(SO_4)_3.18H_2O$ quantity required	kg/d	1,046	1,408
$Al_2(SO_4)_3.18H_2O$ commercial solution quantity required	kg/d	2,091	2,816
$Al_2(SO_4)_3.18H_2O$ commercial solution volume required	m^3/d	1.6	2.2
	m^3/year	587	791
Dosage tank minimum volume	m^3	32	32
Unitary flow of dosing pumps	L/h	90	90
Operational conditions			
Physico-chemical sludge produced			
Phosphates	kg/d	130	175
Hydroxides	kg/d	188	253
Physico-chemical sludge quantity produced	kg/d	317	427
	m^3/d	39.7	53.4

Table III.6.5.5 - Biological treatment (Solution 1)

Operation: Clarification

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	2	
Type	-	circular plant	
Diameter	m	25	
Depth (at 2/3 of the radius)	m	3.9	
Unitary surface	m^2	491	
Total surface	m^2	982	
Unitary volume	m^3	1,909	
Total volume	m^3	3,819	
Unitary power of scraper bridges	kW/un.	6	
Number of scum pumps	un.	2	
Unitary capacity of scum pumps	m^3/h	25	
Number of biological sludge pumps	un.	1+1	
Unitary capacity of biological sludge pumps	m^3/h	504	
Number of thickening sludge pumps	un.	1+1	
Unitary capacity of thickening sludge pumps	m^3/h	43	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,487	4,307
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
TSS concentration	kg/m^3	4.5	4.5
TSS loads	kg/d	11,193	19,383
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Existing infrastructures operational conditions			
Number of secondary clarifiers in operation	un.	1	2
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.0	0.6
Retention time (Mdf)	h	3.8	6.8
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	134	82
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.5	0.3

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.5.6 - Biological treatment (Solutions 2 and 3)

Operation: Clarification

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of secondary clarifiers	un.	2	
Type	-	circular plant	
Diameter	m	25	
Depth (at 2/3 of the radius)	m	3.9	
Unitary surface	m^2	491	
Total surface	m^2	982	
Unitary volume	m^3	1,909	
Total volume	m^3	3,819	
Unitary power of scraper bridges	kW/un.	6	
Number of scum pumps	un.	2	
Unitary capacity of scum pumps	m^3/h	25	
Number of biological sludge pumps	un.	1+1	
Unitary capacity of biological sludge pumps	m^3/h	504	
Number of thickening sludge pumps	un.	1+1	
Unitary capacity of thickening sludge pumps	m^3/h	43	
Influent wastewater flows and loads			
Average daily flow (Adf)	m^3/d	2,469	4,281
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
TSS concentration	kg/m^3	3.5	3.5
TSS loads	kg/d	8,641	14,983
Design criteria			
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	< 0,9	
Retention time (Mdf)	h	> 1,5	
Assumed SVI of sludge	mL/g	100	
MLSS in activated sludge	kg/m^3	8	
Weir loading rate (Mdf)	$m^3/m/d$	< 370	
Specific scum production	kg/m^3	0.01	
Scum bulk density	kg/m^3	950	
Existing infrastructures operational conditions			
Number of secondary clarifiers in operation	un.	1	2
Hydraulic loading rate (Mdf)	$m^3/m^2/h$	1.0	0.6
Retention time (Mdf)	h	3.8	6.8
Solids loading rate (Mdf+ Frec.)	$kgSS/m^2/d$	104	63
Solids volumic loading (Mdf)	$m^3SS/m^2/h$	0.36	0.20

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.6.1 - Filtration and Disinfection

Operation: Filtration and disinfection of secondary effluent

Parameter	Unit	Year	
		2011	**2029**
Filtration			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
TSS concentration	kg/d	30	30
Design criteria			
TSS concentration in filtrate effluent	mg/L	< 20	
Design results			
Feeding pumps to the filters			
Type	-	Centrifuge, multicellular	
Number of pumps	un.	3.0	
Capacity	m^3/h	562	
Filter			
Type	-	metallic, self-cleaning	
Capacity	m^3/h	562	
Disinfection			
Influent wastewater flows and loads			
Maximum design flow (Mdf) (1)	m^3/h	504	562
	L/s	140	156
TSS concentration	mg/L	20	20
Inlet fecal coliforms concentration	CFU / 100 mL	1.21E+08	9.28E+07
Design criteria			
Outlet fecal coliforms concentration	CFU / 100 mL	2,000	
Outlet fecal streptococcus concentration	CFU / 100 mL	1,000	
Design UV transmittance (at 254 nm)	%	> 55	
Minimum radiation dosage	mJ/cm^2	25	

(1) This flow corresponds to the maximum capacity of the WWTP upstream pumping station

Table III.6.7.1 - Sludge Treatment (Solution 1)

Operation: Thickening

Parameter	Unit	Year 2011	Year 2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	circular plant	
Diameter	m	8	
Depth	m	4.6	
Unitary surface	m^2	50	
Total surface	m^2	50	
Unitary volume	m^3	230	
Total volume	m^3	230	
Unitary power of scraper bridges	kW/un.	0.37	
Number of thickened sludge pumps	un.	1	
Unitary flow of thickened sludge pumps	m^3/h	36	
Influent sludge flows and loads			
Excess activated sludge average flow	m^3/d	154	208
Physico-chemical sludge average flow	m^3/d	41	56
Total sludge flow	m^3/d	195	263
TSS loading	kg/d	1,562	2,107
TSS concentration	kg/m^3	8.0	8.0
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	30	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	3.9	5.3
Solids loading rate	$kgSS/m^2/d$	31.2	42.1
Thickened sludge flow	m^3/d	49	67
Thickened sludge solids content	kg/d	1,484	2,002
Supernatant flow	m^3/d	145.8	196.7
Supernatant solids content	kg/d	78.1	105.4
Supernatant solids concentration	mg/L	535.7	535.7

Table III.6.7.1 - Sludge Treatment (Solution 1)

Operation: Thickened sludge storage

Parameter	Unit	Year	
		2011	**2029**
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	49	67
Thickened sludge solids content	kg/d	1,484	2,002
Design criteria			
Minimum retention time	d	3	
Depth	m	2	
Number of thickened sludge pumps	un.	1+1	
Design results			
Requested volume	m^3	200	
Side length	m	7	
Surface	m^2	49	
Number of submersible agitators	un.	1	
Unitary flow of thickened sludge pumps	m^3/h	16	
Operational conditions			
Retention time	d	4	3

Table III.6.7.2 - Sludge Treatment (Solutions 2 and 3)

Operation: Thickening

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of sludge thickeners	un.	1	
Type	-	circular plant	
Diameter	m	8	
Depth	m	4.6	
Unitary surface	m^2	50	
Total surface	m^2	50	
Unitary volume	m^3	230	
Total volume	m^3	230	
Unitary power of scraper bridges	kW/un.	0.37	
Number of thickened sludge pumps	un.	1	
Unitary flow of thickened sludge pumps	m^3/h	36	
Influent sludge flows and loads			
Primary sludge average flow	m^3/d	66	87
Excess activated sludge average flow	m^3/d	137	184
Physico-chemical sludge average flow	m^3/d	40	53
Total sludge flow	m^3/d	243	325
TSS loading	kg/d	2,742	3,651
TSS concentration	kg/m^3	11.3	11.2
Design criteria			
Height	m	3 - 4	
Solids loading rate	$kg/m^2/d$	< 40	
Hydraulic loading rate	$m^3/m^2/d$	4	
Minimum retention time	h	24	
Solids retention	%	95	
SS of thickened sludge	kg/m^3	40	
Number of thickened sludge pumps	un.	2	
Existing infrastructures operational conditions			
Hydraulic loading rate	$m^3/m^2/d$	4.9	6.5
Solids loading rate	$kgSS/m^2/d$	54.8	73.0

Table III.6.7.2 - Sludge Treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design results			
Number of thickeners	un	2	
Type	-	circular plant	
Requested unitary volume	m^3	143	
Minimum unitary surface	m^2	61	
Adopted side length	m	8	
Unitary surface	m^2	50	
Total surface	m^2	101	
Adopted height	m	4.6	
Unitary volume	m^3	230	
Total volume	m^3	460	
Unitary capacity of thickened sludge pumps	m^3/h	18	
Operational conditions			
Number of thickeners operating	un.	1.0	2.0
Thickening sludge flow	m^3/d	243	325
Thickening sludge solids content	kg/d	2,742	3,651
Thickened sludge flow	m^3/d	65	87
Thickened sludge solids content	kg/d	2,605	3,468
Hydraulic loading rate	$m^3/m^2/d$	4.8	3.2
Solids loading rate	$kgSS/m^2/d$	54.6	36.3
Supernatant flow	m^3/d	178	238
Supernatant solids content	kg/d	137	183
Supernatant solids concentration	mg/L	769	766

Table III.6.8.1 - Sludge treatment (Solutions 2 and 3)

Operation: Anaerobic mesophilic digestion

Parameter	Unit	Year	
		2011	**2029**
Influent sludge flows and loads			
Thickened sludge flow	m^3/d	65	87
Thickened sludge solids content	kg/d	2,605	3,468
Solids concentration	kg/m^3	40	40
SSV/SST	%	60	60
SSV loading	kg/d	1,563	2,081
Design criteria			
Digester			
Number of digesters	un.	1	
Average digestion temperature	ºC	35	
Minimum retention time	h	10 - 20	
SSV removal rate	%	50	
Solids loading	$kgMVS/m^3/d$	2,4 - 6,4	
Most unfavorable sludge temperature	ºC	15	
Sludge bulk density	kg/m^3	1 000	
Digester slope bottom	º	30	
Sludge recycle for mixing	-	5,0 x $V_{digestion}$	
Number of pumps of digested sludge	un.	1+1	
Gasholder			
Number of gasholders	un.	1	
Biogas production	$m^3/kgSVS$	0.9	
Minimum retention time	h	8	
Flare			
Requested capacity	m^3/h	1,5 x Produced biogas	
Design results			
Digester			
Requested total volume	m^3	1,561	
Requested unitary volume	m^3	1,561	
Adopted diameter	m	16	
Adopted surface	m^2	201	
Conical zone height	m	4.6	
Cylindrical zone height	m	6.2	
Total height	m	10.8	
Adopted unitary useful volume	m^3	1,561	
Adopted total useful volume	m^3	1,561	
Freeboard	m	1	
Adopted total volume	m^3	1,762	
Relation H cylindrical zone /D	-	0.39	
Wall height buried	m	4.60	
Recycle sludge for mixing	m^3/d	7,805	
Unitary capacity of digested sludge pumps	m^3/h	21	

Table III.6.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year 2011	Year 2029
Gasholder			
Requested volume	m^3	320	
Requested unitary volume	m^3	320	
Minimum sphere diameter	m	8.5	
Adopted sphere diameter	m	9.0	
Adopted unitary volume	m^3	382	
Adopted total volume	m^3	382	
Flare			
Requested capacity	m^3/h	60	
Operational conditions			
Digester			
Solids loading	$kgSVS/m^3/d$	1.0	1.3
Minimum retention time	d	24	18
VSS removed	kg/d	782	1,040
Digested sludge flow	m^3/d	65	87
Digested sludge solids content	kg/d	1,824	2,428
Solids concentration	kg/m^3	28	28
Produced biogas	m^3/d	703	936
Gasholder			
Retention time	h	13.0	9.8

Operation: Alkalinity control

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	65.1	86.7
Design criteria			
Inflow alkalinity	$mgCaCO_3/L$	200	
Biogas CO_2 content	%	30	
Requested alkalinity for pH=7,0	$mgCaCO_3/L$	1,935	
Milk of lime concentration	$kgCaO/m^3$	50	
Hydrated lime bulk density	kg/m^3	600	
Autonomy of the lime silo	d	10	

Table III.6.8.1 - Sludge treatment (Solutions 2 and 3)

Parameter	Unit	Year	
		2011	2029
Design results			
Alkalinity to be added	$mgCaCO_3/L$	1,735	1,735
	$kgCaCO_3/d$	113.0	150.4
Lime to be added	kgCaO/d	63.3	84.3
Hydrated lime to be added	$kgCa(OH)_2/d$	83.6	111.4
Milk of lime total flow	m^3/d	1.3	1.7
Lime silo volume	m^3	-	10.0
Adopted diameter	m	-	2.0
Useful height	m	-	4.3
Total height	m	-	6.7

Table III.6.8.2 - Sludge treatment (Solution 2)

Operation: Energy recovery - Cogeneration

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Digesting sludge flow	m^3/d	65.1	86.7
Produced biogas	m^3/d	703	936
SSV removed	kg/d	782	1,040

Parameter	Unit	Value
Design criteria		
Average temperture of digestion	ºC	35
Sludge bulk density	kg/m^3	1,000
Sludge specific heat	kcal/kg/ºC	1.01
Heat exchanger efficiency		
water/sludge	%	90
water/sludge	%	85
Biogas Lower Heating Value (LHV)	kWh/m^3	6.38
Natural gas Lower Heating Value (LHV)	kWh/m^3	10.5
Moto-generators		
Number of moto-generators to be installed	un.	2
Working period	h/d	16
Electrical efficiency	%	35
Efficiency of the moto-generators	%	90
Thermal energy recovery from the moto-generators		
from the cooling water	%	37
from the exhaust gases	%	18
Digesters loss of heat		
Heat transfer coefficient, U		
walls above the ground	$W/m^2.C^o$	2.57
walls buried	$W/m^2.C^o$	0.94
cover	$W/m^2.C^o$	2.79
bottom	$W/m^2.C^o$	1.51
Most unfavorable temperatures during winter		
air	ºC	5
ground	ºC	10
sludge	ºC	15

Table III.6.8.2 - Sludge treatment (Solution 2)

Parameter	Unit	Year	
		2011	2029
Operational conditions			
Biogas use			
Biogas energy potential	kWh/d	4,488	5,974
Power from the biogas produced	kW	280	373
Nominal output of electric power	kWh/d	1,571	2,091
	kW	98	131
Nominal output thermal power	kcal/d	1,874,899	2,496,051
	kWh/d	2,180	2,902
Heating needs for digestion			
Heat loss surface			
walls above the ground	m^2	-	82
walls buried	m^2	-	231
cover	m^2	-	201
bottom	m^2	-	232
Digester heat loss, during winter			
walls above the ground	kcal/d	-	130,201
walls buried	kcal/d	-	111,812
cover	kcal/d	-	347,426
bottom	kcal/d	-	180,644
Total	kcal/d	-	770,083
Requested sludge heating	kcal/d	1,315,563	1,751,408
Total energy needs	kcal/d	2,085,646	2,521,491
Moto-generators			
Requested gas power	kW	312	377
Thermal energy from the exhaust gases	kcal/d	656,592	793,803
Thermal energy from the cooling water	kcal/d	1,429,053	1,727,688
Total thermal energy	kcal/d	2,085,646	2,521,491
Unitary power of the moto-generators	kW	-	73
Biogas consumption	m^3/h	49	59
Natural gas consumption	m^3/h	30	36
Additional consumption of natural gas			
Energy deficit	kcal/d	210,747	25,439
Additional consumption of natural gas	m^3/d	48	6
Electric power generated by natural gas	kWh/d	176	21
Electric power production			
Total electric power production	kWh/d	1,747	2,112
Average working period of the moto-generators	h/d	13	16
Maximum consumption of natural gas	m^3/s	-	0.010

Table III.6.9.1 - Sludge Treatment (Solution 1)

Operation: Mechanical dewatering

Parameter	Unit	Year 2011	Year 2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	49	67
Dewatering sludge solids concentration	kg/m^3	30	30
Dewatering sludge solids content	kg/d	1,484	2,002
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	1+1	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	16	
	kg/h	467	
Unitary capacity of dewatering sludge pumps	m^3/h	16	
Required capacity of polymer equipment	L/h	841	
In-line dilution system flow	m^3/h	0.5	
Operational conditions			
Dewatering sludge flow	m^3/d	69	93
	m^3/h	12	16
Dewatering sludge solids content	kg/d	2,077	2,803
	kg/h	346	467
Dewatered sludge daily flow	m^3/d	10	13
Dewatered sludge solids content	kg/d	1,973	2,662
Sludge liquor solids content	kg/d	104	140
Sludge liquor flow (1)	m^3/d	68	89
Number of dewatered sludge containers (10 m^3 each)	un.	1	1
Polymer consumption	kg/d	12.5	16.8
	kg/h	2.1	2.8
Polymer mother solution flow	m^3/d	2.5	3.4
	L/h	415.4	560.5
Polymer diluted solution flow	m^3/h	12.5	16.8
Dilution water flow	m^3/h	10.0	13.5

(1) it includes centrifuge rinse water

Table III.6.9.2 - Sludge Treatment (Solutions 2 and 3)

Operation: Mechanical dewatering

Parameter	Unit	Year	
		2011	2029
Influent sludge flows and loads			
Dewatering sludge flow	m^3/d	65	87
Dewatering sludge solids concentration	kg/m^3	28	28
Dewatering sludge solids content	kg/d	1,824	2,428
Design criteria			
Number of units	un	1	
Working days per week	d/week	5	
Working time per day	h/d	6	
Solids retention	%	95	
Dewatered sludge solids concentration	kg/m^3	200	
Number of dewatering sludge pumps	un.	1+1	
Autonomy of dewatered sludge storage	d	7	
Polymer dosage	kg/t DS	6	
Polymer mother solution concentration	%(w/v)	0.5	
Polymer solution concentration at injection point	%(w/v)	0.1	
Polymer storage autonomy	d	30	
Polymer supply conditions	kg/bag	25	
Design results			
Adopted capacity of each machine	m^3/h	21	
	kg/h	566	
Unitary capacity of dewatering sludge pumps	m^3/h	21	
Required capacity of polymer equipment	L/h	1,020	
In-line dilution system flow	m^3/h	0.6	
Operational conditions			
Dewatering sludge flow	m^3/d	91	121
	m^3/h	15	20
Dewatering sludge solids content	kg/d	2,553	3,399
	kg/h	425	566
Dewatered sludge daily flow	m^3/d	12	16
Dewatered sludge solids content	kg/d	2,425	3,229
Sludge liquor solids content	kg/d	128	170
Sludge liquor flow (1)	m^3/d	88	114
Number of dewatered sludge containers (10 m^3 each)	un.	1	2
Polymer consumption	kg/d	15.3	20.4
	kg/h	2.6	3.4
Polymer mother solution flow	m^3/d	3.1	4.1
	L/h	510.6	679.8
Polymer diluted solution flow	m^3/h	15.3	20.4
Dilution water flow	m^3/h	12.3	16.3

(1) it includes centrifuge rinse water

Table III.6.9.3 - Sludge Treatment - alternative (Solution 1)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	2029
Characteristics of existing infrastructures			
Number of drying beds	un.	56	
Type	-	rectangular plant (25 m x 5 m)	
Unitary surface	m^2	125	
Total surface	m^2	7,000	
Unitary volume	m^3	38	
Total volume	m^3	2,100	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	49	67
Drying solids (DS) concentration	kg/m^3	30	30
DS loading	kg/d	1,484	2,002
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	77	104
Drying time	d	42.5	31.5

Table III.6.9.4 - Sludge treatment - alternative (Solutions 2 and 3)

Operation: Dewatering in sludge drying beds (alternative dewatering)

Parameter	Unit	Year	
		2011	**2029**
Characteristics of existing infrastructures			
Number of drying beds	un.	56	
Type	-	rectangular plant (25 m x 5 m)	
Unitary surface	m^2	125	
Total surface	m^2	7,000	
Unitary volume	m^3	38	
Total volume	m^3	2,100	
Influent sludge flows and loads			
Dewatering sludge average flow	m^3/d	65	87
Drying solids (DS) concentration	kg/m^3	28	28
DS loading	kg/d	1,824	2,428
Design criteria			
Mass loading rate	$kgDS/m^2/year$	< 120	
Specific drying surface	m^2/hab	0,17 - 0,32	
Requested drying time	d	30	
Dewatered sludge solids content	kg/m^3	200	
Existing infrastructures operational conditions			
Mass loading rate	$kgDS/m^2/year$	95	127
Drying time	d	32.2	24.2

Table III.6.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.37	3.0	1.1
Rotary screen	1	1	0	0.50	3.0	1.5
Screenings belt conveyor	1	1	0	0.37	3.0	1.1
Scraper bridge of the aerated grit and grease chamber	1	1	0	3.00	24.0	72.0
Air compressor	2	1	1	3.00	16.0	48.0
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	3.00	3.0	9.0
Secondary treatment						
Submersible mixer	4	4	0	2.30	24.0	220.8
Aeration rotors	4	4	0	45.00	16.0	2,880.0
Scraper bridge of the secondary clarifiers	2	2	0	6.00	24.0	288.0
Sludge recirculation pump	2	1	1	18.00	12.8	230.7
Excess sludge extraction pump	2	1	1	2.20	6.1	13.4
Scum pump	2	2	0	1.10	3.0	6.6
Tertiary treatment						
Mixer of the aluminium sulphate dosing tank	1	1	0	0.37	24.0	8.9
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	7.3	806.7
Filters with automatic cleaning	3	3	0	0.20	7.3	4.4
UV ray disinfection unit	1	1	0	15.00	7.3	109.0
Hydropneumatic station	1	1	0	4.00	3.0	12.0
Treatment of the sludge						
Scraper bridge of the thickener	1	1	0	0.37	24.0	8.9
Thickened sludge pump	1	1	0	2.20	1.9	4.1
Mixer of the thickened sludge storage tank	1	1	0	0.75	24.0	18.0
Thickened sludge pump	2	1	1	1.50	5.8	8.8
Centrifuge	1	1	0	30.00	5.8	175.2
Polymer preparation equipment	1	1	0	1.10	5.8	6.4
Polymer dosing pump	2	1	1	0.75	5.8	4.4
Lift screw of dewatered sludge	1	1	0	1.10	5.8	6.4
Run-off water pump	2	1	1	5.00	3.0	15.0

Table III.6.10.1 - Energy balance for the design horizon year (Solution 1)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	52	44	8	206.16	-	5,257

Table III.6.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.37	3.0	1.1
Rotary screen	1	1	0	0.50	3.0	1.5
Screenings belt conveyor	1	1	0	0.37	3.0	1.1
Scraper bridge of the aerated grit and grease chamber	1	1	0	3.00	24.0	72.0
Air compressor	2	1	1	3.00	16.0	48.0
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	3.00	3.0	9.0
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	1	1	0.75	4.86	3.6
Scum lift pump - primary sedimentation tank	2	1	1	1.10	3.0	3.3
Secondary treatment						
Submersible mixer	2	2	0	2.30	24.0	110.4
Aeration rotors	2	2	0	45.00	16.0	1,440.0
Scraper bridge of the secondary clarifiers	2	2	0	6.00	24.0	288.0
Sludge recirculation pump	2	1	1	18.00	12.7	229.3
Excess sludge extraction pump	2	1	1	2.00	5.5	11.0
Scum pump	2	1	1	1.10	3.0	3.3
Tertiary treatment						
Mixer of the aluminium sulphate dosing tank	1	1	0	0.37	24.0	8.9
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	7.3	806.7
Filters with automatic cleaning	3	3	0	0.20	7.3	4.4
UV ray disinfection unit	1	1	0	15.00	7.3	109.0
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.6.10.2 - Energy balance for the design horizon year (Solution 2)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.37	24.0	17.8
Thickened sludge pump	2	2	0	1.50	2.4	7.2
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	1	1	2.20	0.0	0.0
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	3.00	18.0	54.0
Biogas compressor to supply the moto-generators	2	2	0	2.20	16.0	70.4
Pump for cooling liquid/water heat exchanger	2	2	0	4.00	16.0	128.0
Pump for exhaust gas/water heat exchanger	3	2	1	2.20	18.0	79.2
Digested sludge pump	2	1	1	2.20	5.8	12.7
Centrifuge	1	1	0	30.00	5.8	173.4
Polymer preparation equipment	1	1	0	1.10	5.8	6.4
Polymer dosing pump	2	1	1	0.75	5.8	4.3
Lift screw of dewatered sludge	1	1	0	1.10	5.8	6.4
Run-off water pump	2	1	1	5.00	3.0	15.0
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	73	58	15	261.01	-	5,180
Electricity requirement (kWh/year)	-	-	-	-	-	1,869,518
Electricity produced by cogeneration (kWh/year)	-	-	-	-	-	770,981
Electricity purchased from the public network (kWh/year)	-	-	-	-	-	1,098,538

Table III.6.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Preliminary treatment						
Grit extraction system by "air-lift"	1	1	0	2.20	3.0	6.6
Mechanical screen	1	1	0	0.37	3.0	1.1
Rotary screen	1	1	0	0.50	3.0	1.5
Screenings belt conveyor	1	1	0	0.37	3.0	1.1
Scraper bridge of the aerated grit and grease chamber	1	1	0	3.00	24.0	72.0
Air compressor	2	1	1	3.00	16.0	48.0
Grit pump	2	2	0	5.00	3.0	30.0
Grease conveying screw	1	1	0	1.10	3.0	3.3
Grit classifier	1	1	0	3.00	3.0	9.0
Primary treatment						
Scraper bridge of the primary sedimentation tank	2	2	0	1.10	24.0	52.8
Primary sludge pump	2	1	1	0.75	4.86	3.6
Scum lift pump - primary sedimentation tank	2	1	1	1.10	3.0	3.3
Secondary treatment						
Submersible mixer	2	2	0	2.30	24.0	110.4
Aeration rotors	2	2	0	45.00	16.0	1,440.0
Scraper bridge of the secondary clarifiers	2	2	0	6.00	24.0	288.0
Sludge recirculation pump	2	1	1	18.00	12.7	229.3
Excess sludge extraction pump	2	1	1	2.00	5.5	11.0
Scum pump	2	1	1	1.10	3.0	3.3
Tertiary treatment						
Mixer of the aluminium sulphate dosing tank	1	1	0	0.37	24.0	8.9
Aluminium sulphate dosing pump	2	1	1	0.18	24.0	4.3
Feeding pump to the filters	3	3	0	37.00	7.3	806.7
Filters with automatic cleaning	3	3	0	0.20	7.3	4.4
UV ray disinfection unit	1	1	0	15.00	7.3	109.0
Hydropneumatic station	1	1	0	4.00	3.0	12.0

Table III.6.10.3 - Energy balance for the design horizon year (Solution 3)

Equipment	Units			Installed unit power (kW)	Average function. (h/d)	Energy consumption (kWh/d)
	Total	In service	In reserve			
Treatment of the sludge						
Scraper bridge of the thickener	2	2	0	0.37	24.0	17.8
Thickened sludge pump	2	2	0	1.50	2.4	7.2
Sludge recirculation pump in order to mix the digester	3	2	1	11.00	24.0	528.0
Heating sludge pump	1	1	0	22.00	20.0	440.0
Refrigeration dryer	1	1	0	1.50	24.0	36.0
Ventilator of the gasometer	1	1	0	0.75	24.0	18.0
Biogas compressor to supply the boiler	2	1	1	2.20	16.0	35.2
Pump for water/sludge heat exchanger	2	1	1	4.00	18.0	72.0
Hot water pump for the boiler	1	1	0	3.00	18.0	54.0
Digested sludge pump	2	1	1	2.20	5.8	12.7
Centrifuge	1	1	0	30.00	5.8	173.4
Polymer preparation equipment	1	1	0	1.10	5.8	6.4
Polymer dosing pump	2	1	1	0.75	5.8	4.3
Lift screw of dewatered sludge	1	1	0	1.10	5.8	6.4
Run-off water pump	2	1	1	5.00	3.0	15.0
Treatment of odours						
Extraction ventilator of contaminated air	2	1	1	7.50	24.0	180
Electrical installations						
Interior Installations	-	-	-	5.00	12.0	60
Exterior installations	-	-	-	1.00	12.0	12
TOTAL	66	52	14	252.61	-	4,938

Annex-III.7

Drawings

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
	STEP DE BEJA		
01.DE-T.001(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE BEJA - SOLUTION 1 (BEJA WWTP - SOLUTION 1)	2011-08-31	341001T0010.DWG
01.DE-T.002(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE BEJA - SOLUTION 1 (BEJA WWTP - SOLUTION 1)	2011-08-31	341001T0020.DWG
01.DE-T.003(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE BEJA - SOLUTION 2 (BEJA WWTP - SOLUTION 2)	2011-08-31	341001T0030.DWG
01.DE-T.004(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE BEJA - SOLUTION 2 (BEJA WWTP - SOLUTION 2)	2011-08-31	341001T0040.DWG
01.DE-T.005(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE BEJA - SOLUTION 3 (BEJA WWTP - SOLUTION 3)	2011-08-31	341001T0050.DWG
01.DE-T.006(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE BEJA - SOLUTION 3 (BEJA WWTP - SOLUTION 3)	2011-08-31	341001T0060.DWG
	STEP DE MEDJEZ EL-BAB		
01.DE-T.101(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE MEDJEZ EL-BAB - SOLUTION 1 (MEDJEZ EL-BAB WWTP - SOLUTION 1)	2011-08-31	341001T1010.DWG
01.DE-T.102(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE MEDJEZ EL-BAB - SOLUTION 1 (MEDJEZ EL-BAB WWTP - SOLUTION 1)	2011-08-31	341001T1020.DWG
01.DE-T.103(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE MEDJEZ EL-BAB - SOLUTION 2 (MEDJEZ EL-BAB WWTP - SOLUTION 2)	2011-08-31	341001T1030.DWG
01.DE-T.104(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE MEDJEZ EL-BAB - SOLUTION 2 (MEDJEZ EL-BAB WWTP - SOLUTION 2)	2011-08-31	341001T1040.DWG
01.DE-T.105(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE MEDJEZ EL-BAB - SOLUTION 3 (MEDJEZ EL-BAB WWTP - SOLUTION 3)	2011-08-31	341001T1050.DWG
01.DE-T.106(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE MEDJEZ EL-BAB - SOLUTION 3 (MEDJEZ EL-BAB WWTP - SOLUTION 3)	2011-08-31	341001T1060.DWG
	STEP DE TABARKA		
01.DE-T.201(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE TABARKA - SOLUTION 1 (MEDJEZ EL-BAB WWTP - SOLUTION 1)	2011-08-31	341001T2010.DWG
01.DE-T.202(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE TABARKA - SOLUTION 1 (TABARKA WWTP - SOLUTION 1)	2011-08-31	341001T2020.DWG
01.DE-T.203(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE TABARKA - SOLUTION 2 (TABARKA WWTP - SOLUTION 2)	2011-08-31	341001T2030.DWG

Client:
Client:
JAPAN INTERNATIONAL COOPERATION AGENCY

Marché:
Contract:
Etude Préliminaire pour le project d'amélioration de l'environement des eaux et des eaux usées des villes rurales de la République de Tunisie.
Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.

Stade du Marché:
Stage of Contract:
ETUDE PRELIMINAIRE
Preparatory Survey

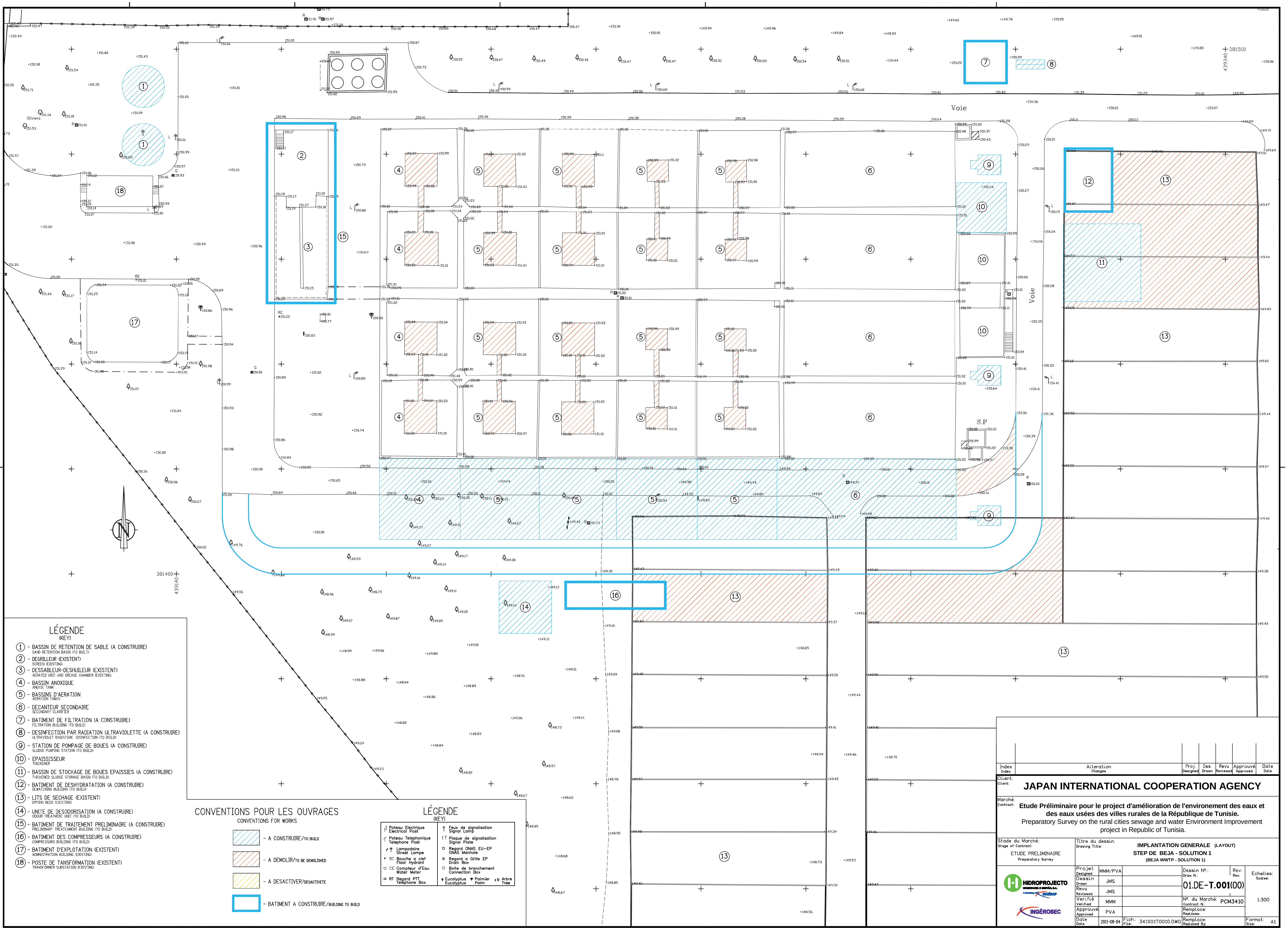
LISTE DES DESSINS
Drawings List

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A.
A Subsidiary of INGÉROP
INGÉROSEC

Dessin Drawn	JMS		Nº. de la Liste: List Number: 01.LDT-001(00)
Verifié Verified	PVA		
Approuvé Approved	PCM		Nº. du Marché: Contract number.: PCM 3410
Date Date	2011-08-05	Fich.: File: 341001LDT0010.DWG	Feuille: Sheet: 1/2

Dessin Nº.: Drawing N.:	Titre du dessin Drawing title	Date Date	Fichier File
01.DE-T.204(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE TABARKA - SOLUTION 2 (TABARKA WWTP - SOLUTION 2)	2011-08-31	341001T2040.DWG
01.DE-T.205(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE TABARKA - SOLUTION 3 (TABARKA WWTP - SOLUTION 3)	2011-08-31	341001T2050.DWG
01.DE-T.206(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE TABARKA - SOLUTION 3 (TABARKA WWTP - SOLUTION 3)	2011-08-31	341001T2060.DWG
	STEP DE JENDOUBA		
01.DE-T.301(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE JENDOUBA - SOLUTION 1 (JENDOUBA WWTP - SOLUTION 1)	2011-08-31	341001T3010.DWG
01.DE-T.302(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE JENDOUBA - SOLUTION 1 (JENDOUBA WWTP - SOLUTION 1)	2011-08-31	341001T3020.DWG
01.DE-T.303(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE JENDOUBA - SOLUTION 2 (JENDOUBA WWTP - SOLUTION 2)	2011-08-31	341001T3030.DWG
01.DE-T.304(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE JENDOUBA - SOLUTION 2 (JENDOUBA WWTP - SOLUTION 2)	2011-08-31	341001T3040.DWG
01.DE-T.305(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE JENDOUBA - SOLUTION 3 (JENDOUBA WWTP - SOLUTION 3)	2011-08-31	341001T3050.DWG
01.DE-T.306(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE JENDOUBA - SOLUTION 3 (JENDOUBA WWTP - SOLUTION 3)	2011-08-31	341001T3060.DWG
	STEP DE SILIANA		
01.DE-T.401(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE SILIANA - SOLUTION 1 (SILIANA WWTP - SOLUTION 1)	2011-08-31	341001T4010.DWG
01.DE-T.402(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE SILIANA - SOLUTION 1 (SILIANA WWTP - SOLUTION 1)	2011-08-31	341001T4020.DWG
01.DE-T.403(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE SILIANA - SOLUTION 2 (SILIANA WWTP - SOLUTION 2)	2011-08-31	341001T4030.DWG
01.DE-T.404(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE SILIANA - SOLUTION 2 (SILIANA WWTP - SOLUTION 2)	2011-08-31	341001T4040.DWG
01.DE-T.405(00)	IMPLANTATION GENERALE (LAYOUT) STEP DE SILIANA - SOLUTION 3 (SILIANA WWTP - SOLUTION 3)	2011-08-31	341001T4050.DWG
01.DE-T.406(00)	SCHEMA FONCTIONNEL (TREATMENT SCHEME) STEP DE SILIANA - SOLUTION 3 (SILIANA WWTP - SOLUTION 3)	2011-08-31	341001T4060.DWG

LISTE DES DESSINS List of Drawings	Nº. de la Liste: List Number: 01.LDT-001(00)	Feuille: Sheet: 2/2
	Nº. du Marché: Contract N.: PCM 3410	Fichier: File: 341001LDT0010.DWG


Voie
Voie
S.P
381500
439340
381400
439140
LÉGENDE
(KEY)
1 - BASSIN DE RETENTION DE SABLE (A CONSTRUIRE)
SAND RETENTION BASIN (TO BUILT)
2 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
3 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
4 - BASSIN ANOXIQUE
ANOXIC TANK
5 - BASSINS D'AERATION
AERATION TANKS
6 - DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
7 - BATIMENT DE FILTRATION (A CONSTRUIRE)
FILTRATION BUILDING (TO BUILD)
8 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE)
ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
9 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE)
SLUDGE PUMPING STATION (TO BUILD)
10 - EPAISSISSEUR
THICKENER
11 - BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE)
THICKENED SLUDGE STORAGE BASIN (TO BUILD)
12 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
13 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
14 - UNITE DE DESODORISATION (A CONSTRUIRE)
ODOUR TREATMENT UNIT (TO BUILD)
15 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE)
PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
16 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
COMPRESSORS BUILDING (TO BUILD)
17 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMINISTRATION BUILDING (EXISTING)
18 - POSTE DE TANSFORMATION (EXISTENT)
TRANSFORMER SUBSTATION (EXISTING)
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS
- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
LÉGENDE
(KEY)
Poteau Electrique
Electrical Post
Poteau Telephonique
Telephone Post
Lampadaire
Street Lampe
BC Bouche a clef
Floor Hydrant
CE Compteur d'Eau
Water Meter
RT Regard PTT
Telephone Box
Feux de signalisation
Signal Lamp
Plaque de signalisation
Signal Plate
Regard ONAS EU-EP
ONAS Manhole
Regard a Grille EP
Drain Box
Boite de branchement
Connection Box
Eucalyptus
Eucalyptus
Palmier
Palm
Arbre
Tree
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Client:
JAPAN INTERNATIONAL COOPERATION AGENCY
Marché:
Contract:
Etude Préliminaire pour le project d'amélioration de l'environement des eaux et des eaux usées des villes rurales de la République de Tunisie.
Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.
Stade du Marché:
Stage of Contract:
ETUDE PRELIMINAIRE
Preparatory Survey
Títre du dessin:
Drawing Title:
IMPLANTATION GENERALE (LAYOUT)
STEP DE BEJA - SOLUTION 1
(BEJA WWTP - SOLUTION 1)
HIDROPROJECTO
INGÉROP
INGÉROSEC
Projet
Designed
MMM/PVA
Dessin
Drawn
JMS
Revu
Reviewed
JMS
Verifié
Verified
MMM
Approuvé
Approved
PVA
Date
Date
2011-08-04
Fich.:
File:
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Dessin Nº.:
Draw N.:
01.DE-T.001(00)
Rev.
Rev.
Nº. du Marché:
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Scales:
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Size:
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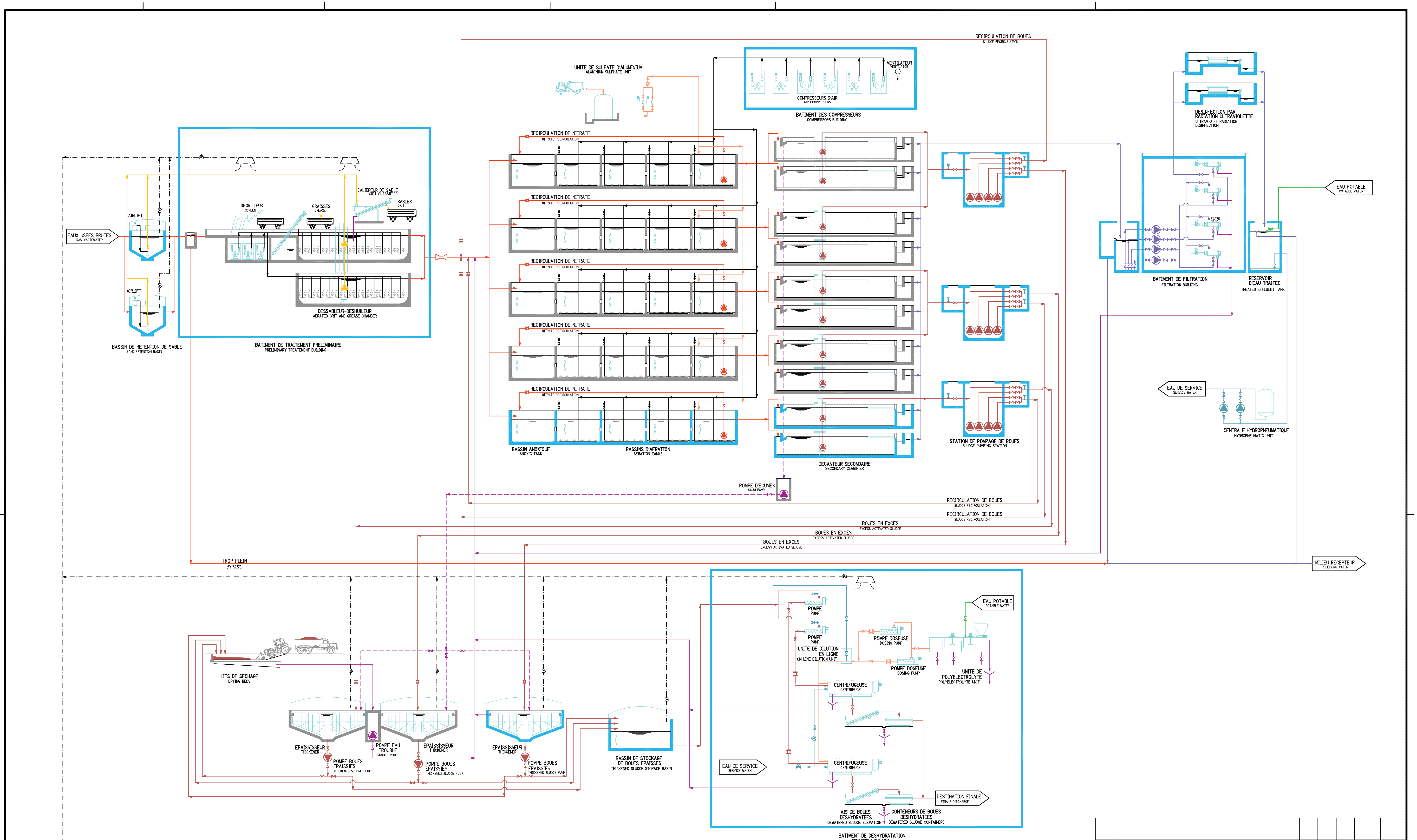

CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR PROCESS UNITS

- EXISTANT/EXISTING
- A CONSTRUIRE/TO BUILD

CONVENTIONS

- EAUX USEES/RAW WASTEWATER
- EAUX TRAITEES/TREATED EFFLUENT
- BOUES/SLUDGE
- EAU POTABLE/POTABLE WATER
- EAU DE SERVICE/SERVICE WATER
- SURNAGEANT/EAUX DE RUISSELLEMENT SUPERNATANT/PROCESS WASTEWATERS
- ECUMES/SCUM
- SOUS-PRODUITS/BY-PRODUCTS
- REACTIFS CHIMIQUES/CHEMICAL REAGENTS
- AIR COMPRIME/COMPRESSED AIR
- BIOGAZ/BIOGAS
- GAZ NATUREL/NATURAL GAS
- LIQUIDE REFROIDISSEMENT/COOLANT
- AIR A DESODORISER/AIR TO BE DESODORIZED

SYMBOLES/SYMBOLS

- ROBINET/GATE VALVE
- CLAPET DE RETENUE/RETENTION VALVE
- CANAL/VENTURI CHANNEL
- DEBITMETRE/FLOWMETER
- RACCORD RAPIDE/QUICK COUPLING
- POMPE/PUMP
- VANNE DE REGULATION/REGULATION VALVE

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Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.

Stade du Marché: / Stage of Contract: ETUDE PRELIMINAIRE / Preparatory Survey

Titre du dessin: / Drawing Title: **SCHEMA FONCTIONNEL (TREATMENT SCHEME)**
STEP DE BEJA - SOLUTION 1
(BEJA WWTP - SOLUTION 1)

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A. A Subsidiary of INGÉROP
INGÉROSEC

Projet / Designed	MMM/PVA	
Dessin / Drawn	JMS	
Revu / Reviewed	JMS	
Verifié / Verified	PVA	
Approuvé / Approved	PCM	
Date / Date	2011-08-02	Fich.: / File: 341001T0020.DWG

Dessin Nº.: / Draw N.: 01.DE-T.002 Rev. / Rev.: (00)
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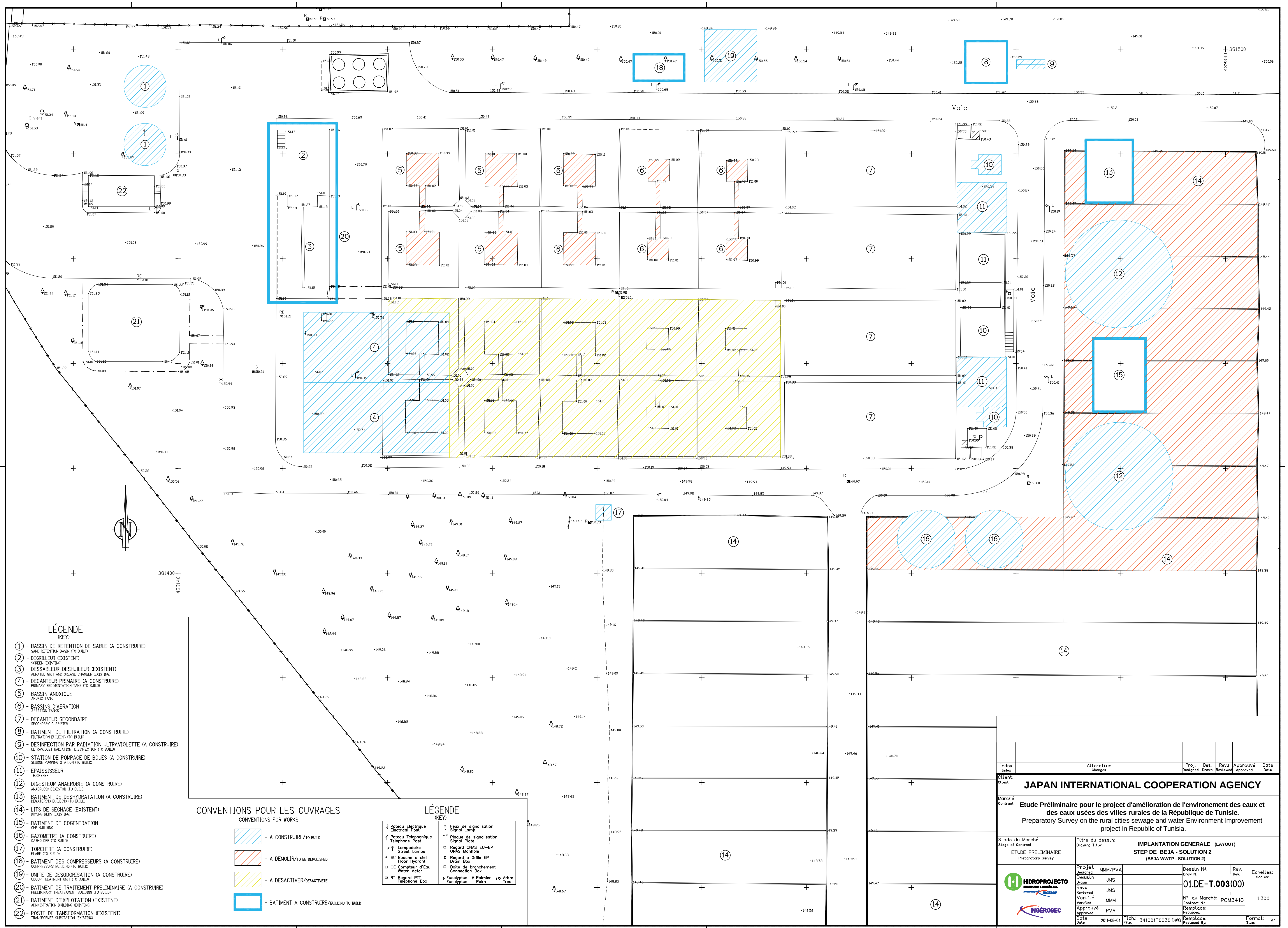

Voie
LÉGENDE
(KEY)
1 - BASSIN DE RETENTION DE SABLE (A CONSTRUIRE)
SAND RETENTION BASIN (TO BUILT)
2 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
3 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
4 - DECANTEUR PRIMAIRE (A CONSTRUIRE)
PRIMARY SEDIMENTATION TANK (TO BUILD)
5 - BASSIN ANOXIQUE
ANOXIC TANK
6 - BASSINS D'AERATION
AERATION TANKS
7 - DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
8 - BATIMENT DE FILTRATION (A CONSTRUIRE)
FILTRATION BUILDING (TO BUILD)
9 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE)
ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
10 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE)
SLUDGE PUMPING STATION (TO BUILD)
11 - EPAISSISSEUR
THICKENER
12 - DIGESTEUR ANAEROBIE (A CONSTRUIRE)
ANAEROBIC DIGESTOR (TO BUILD)
13 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
14 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
15 - BATIMENT DE COGENERATION
CHP BUILDING
16 - GAZOMETRE (A CONSTRUIRE)
GASHOLDER (TO BUILD)
17 - TORCHERE (A CONSTRUIRE)
FLARE (TO BUILD)
18 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
COMPRESSORS BUILDING (TO BUILD)
19 - UNITE DE DESODORISATION (A CONSTRUIRE)
ODOUR TREATMENT UNIT (TO BUILD)
20 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE)
PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
21 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMNISTRATION BUILDING (EXISTING)
22 - POSTE DE TANSFORMATION (EXISTENT)
TRANSFORMER SUBSTATION (EXISTING)
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS
- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
LÉGENDE
(KEY)
Poteau Electrique
Electrical Post
Poteau Telephonique
Telephone Post
Lampadaire
Street Lampe
BC Bouche a clef
Floor Hydrant
CE Compteur d'Eau
Water Meter
RT Regard PTT
Telephone Box
Feux de signalisation
Signal Lamp
Plaque de signalisation
Signal Plate
Regard ONAS EU-EP
ONAS Manhole
Regard a Grille EP
Drain Box
Boite de branchement
Connection Box
Eucalyptus
Eucalyptus
Palmier
Palm
Arbre
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Marché:
Contract:
Etude Préliminaire pour le project d'amélioration de l'environement des eaux et des eaux usées des villes rurales de la République de Tunisie.
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Stade du Marché:
Stage of Contract:
ETUDE PRELIMINAIRE
Preparatory Survey
Títre du dessin:
Drawing Title:
IMPLANTATION GENERALE (LAYOUT)
STEP DE BEJA - SOLUTION 2
(BEJA WWTP - SOLUTION 2)
Projet Designed MMM/PVA
Dessin Drawn JMS
Revu Reviewed JMS
Verifié Verified MMM
Approuvé Approved PVA
Date Date 2011-08-04
Fich.: File: 341001T0030.DWG
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Rev. Rev.
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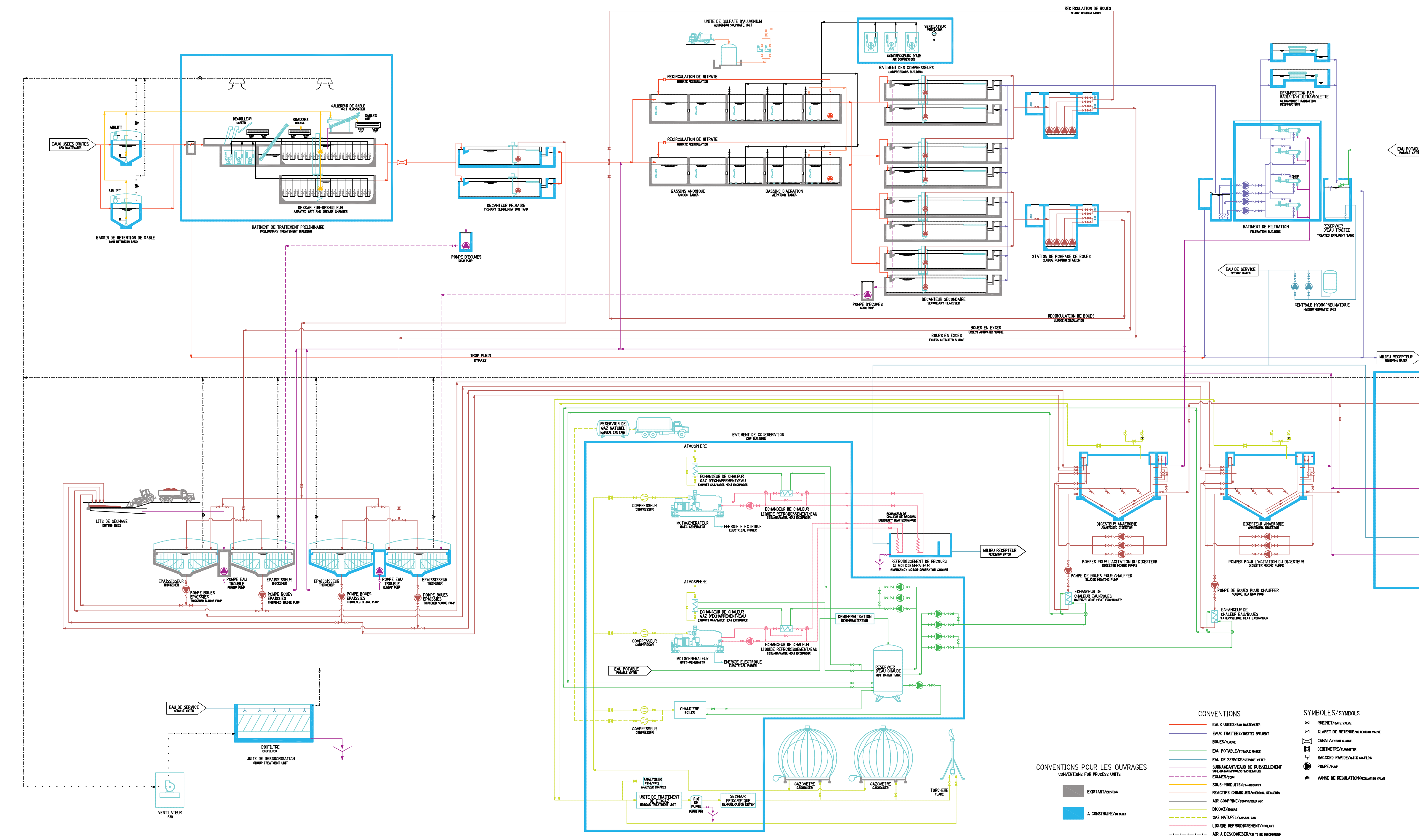
HIDROPROJECTO
INGÉROSEC



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Stade du Marché:
Stage of Contract:
ETUDE PRELIMINAIRE
Preparatory Survey

Titre du dessin:
Drawing Title:
SCHEMA FONCTIONNEL (TREATMENT SCHEME)
STEP DE BEJA - SOLUTION 2
(BEJA WWTP - SOLUTION 2)

HIDROPROJECTO
A Subsidiary of INGÉROP
INGÉROSEC

Projet Designed	MMM/PVA	Dessin Nº.: Draw N.: 01.DE-T.004	Rev. Rev. (00)
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Revu Reviewed	JMS		
Verifié Verified	PVA	Nº. du Marché: Contract N.: PCM3410	Echelles: Scales: ————
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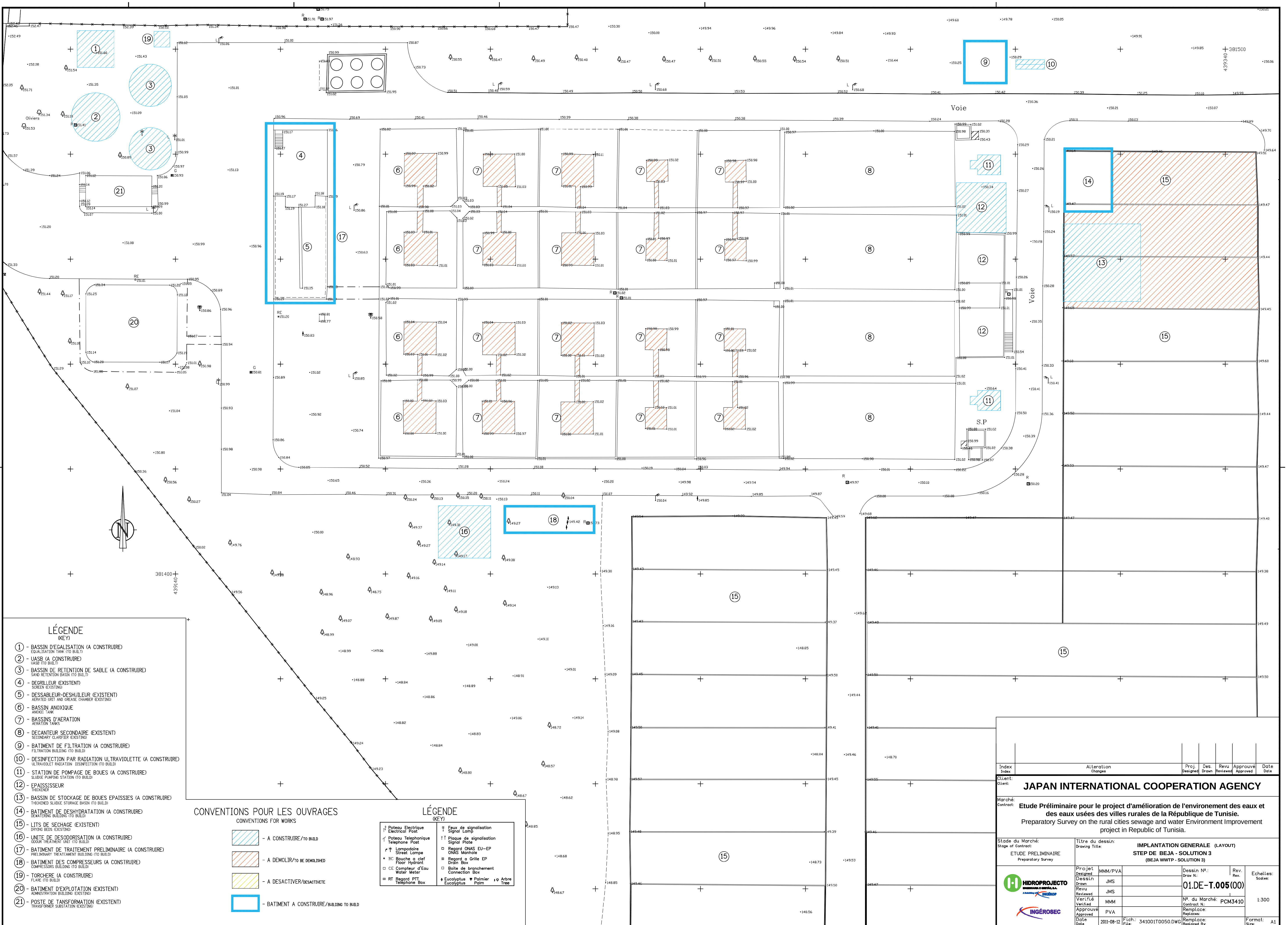

LÉGENDE
(KEY)

1. BASSIN D'EGALISATION (A CONSTRUIRE) – EQUALISATION TANK (TO BUILT)
2. UASB (A CONSTRUIRE) – UASB (TO BUILT)
3. BASSIN DE RETENTION DE SABLE (A CONSTRUIRE) – SAND RETENTION BASIN (TO BUILT)
4. DEGRILLEUR (EXISTENT) – SCREEN (EXISTING)
5. DESSABLEUR-DESHUILEUR (EXISTENT) – AERATED GRIT AND GREASE CHAMBER (EXISTING)
6. BASSIN ANOXIQUE – ANOXIC TANK
7. BASSINS D'AERATION – AERATION TANKS
8. DECANTEUR SECONDAIRE (EXISTENT) – SECONDARY CLARIFIER (EXISTING)
9. BATIMENT DE FILTRATION (A CONSTRUIRE) – FILTRATION BUILDING (TO BUILD)
10. DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE) – ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
11. STATION DE POMPAGE DE BOUES (A CONSTRUIRE) – SLUDGE PUMPING STATION (TO BUILD)
12. EPAISSISSEUR – THICKENER
13. BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE) – THICKENED SLUDGE STORAGE BASIN (TO BUILD)
14. BATIMENT DE DESHYDRATATION (A CONSTRUIRE) – DEWATERING BUILDING (TO BUILD)
15. LITS DE SECHAGE (EXISTENT) – DRYING BEDS (EXISTING)
16. UNITE DE DESODORISATION (A CONSTRUIRE) – ODOUR TREATMENT UNIT (TO BUILD)
17. BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE) – PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
18. BATIMENT DES COMPRESSEURS (A CONSTRUIRE) – COMPRESSORS BUILDING (TO BUILD)
19. TORCHERE (A CONSTRUIRE) – FLARE (TO BUILD)
20. BATIMENT D'EXPLOTATION (EXISTENT) – ADMINISTRATION BUILDING (EXISTING)
21. POSTE DE TANSFORMATION (EXISTENT) – TRANSFORMER SUBSTATION (EXISTING)

CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS

- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD

LÉGENDE
(KEY)

Poteau Electrique / Electrical Post	Feux de signalisation / Signal Lamp
Poteau Telephonique / Telephone Post	Plaque de signalisation / Signal Plate
Lampadaire / Street Lampe	Regard ONAS EU-EP / ONAS Manhole
BC Bouche a clef / Floor Hydrant	Regard a Grille EP / Drain Box
CE Compteur d'Eau / Water Meter	Boite de branchement / Connection Box
RT Regard PTT / Telephone Box	Eucalyptus / Eucalyptus; Palmier / Palm; Arbre / Tree

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Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.

Stade du Marché: / Stage of Contract: ETUDE PRELIMINAIRE / Preparatory Survey

Títre du dessin: / Drawing Title: **IMPLANTATION GENERALE (LAYOUT)**
STEP DE BEJA - SOLUTION 3
(BEJA WWTP - SOLUTION 3)

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A. – A Subsidiary of INGÉROP
INGÉROSEC

Projet / Designed	MMM/PVA		Dessin Nº.: / Draw N.: 01.DE-T.005	Rev. / Rev. (00)
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Revu / Reviewed	JMS			
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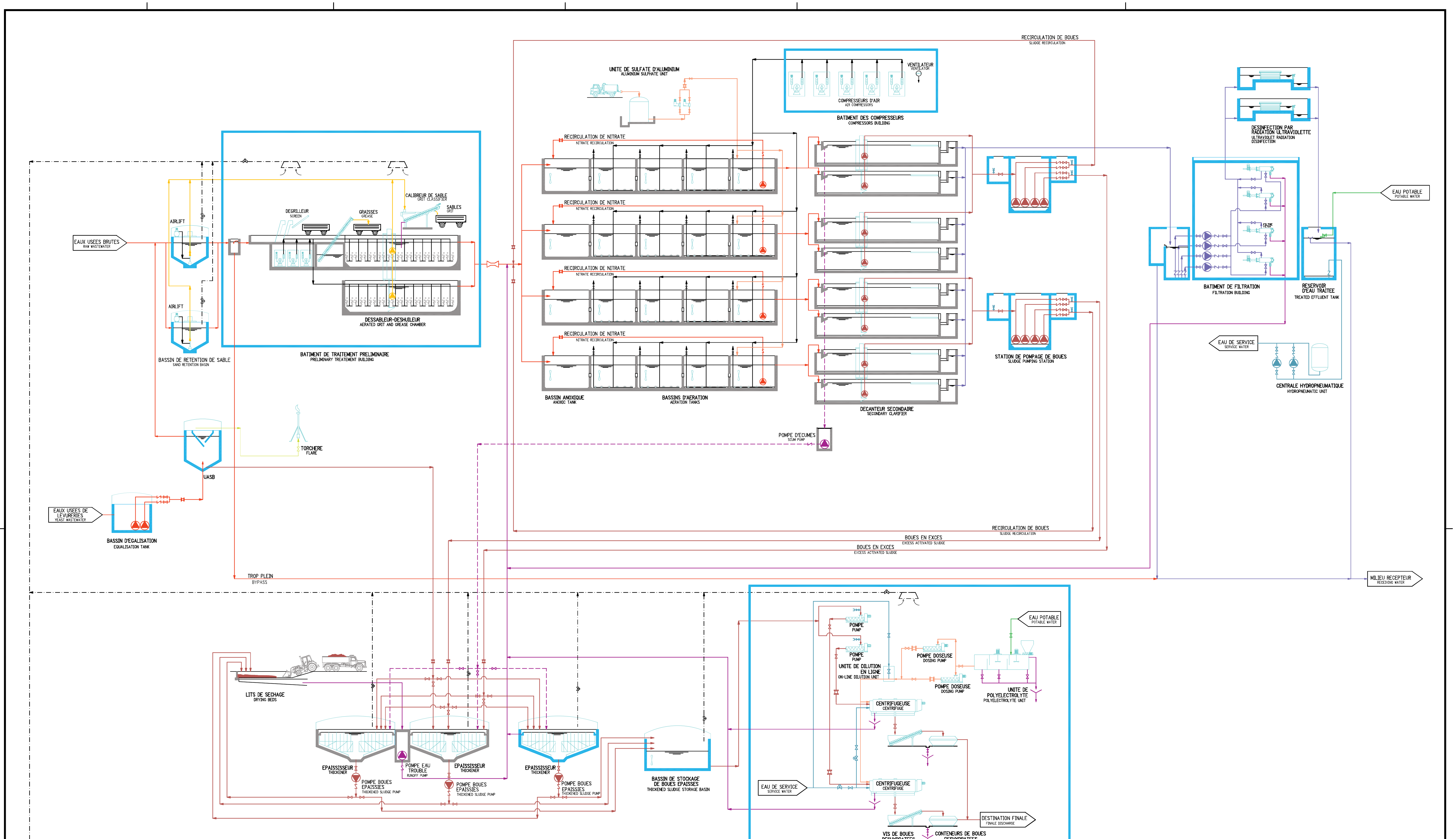

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Stage of Contract:
ETUDE PRELIMINAIRE
Preparatory Survey

Títre du dessin:
Drawing Title:
SCHEMA FONCTIONNEL (TREATMENT SCHEME)
STEP DE BEJA - SOLUTION 3
(BEJA WWTP - SOLUTION 3)

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A.
A Subsidiary of INGÉROP
INGÉROSEC

Projet Designed	MMM/PVA	
Dessin Drawn	JMS	
Revu Reviewed	JMS	
Verifié Verified	PVA	
Approuvé Approved	PCM	
Date Date	2011-08-02	Fich.: File: 341001T0060.DWG

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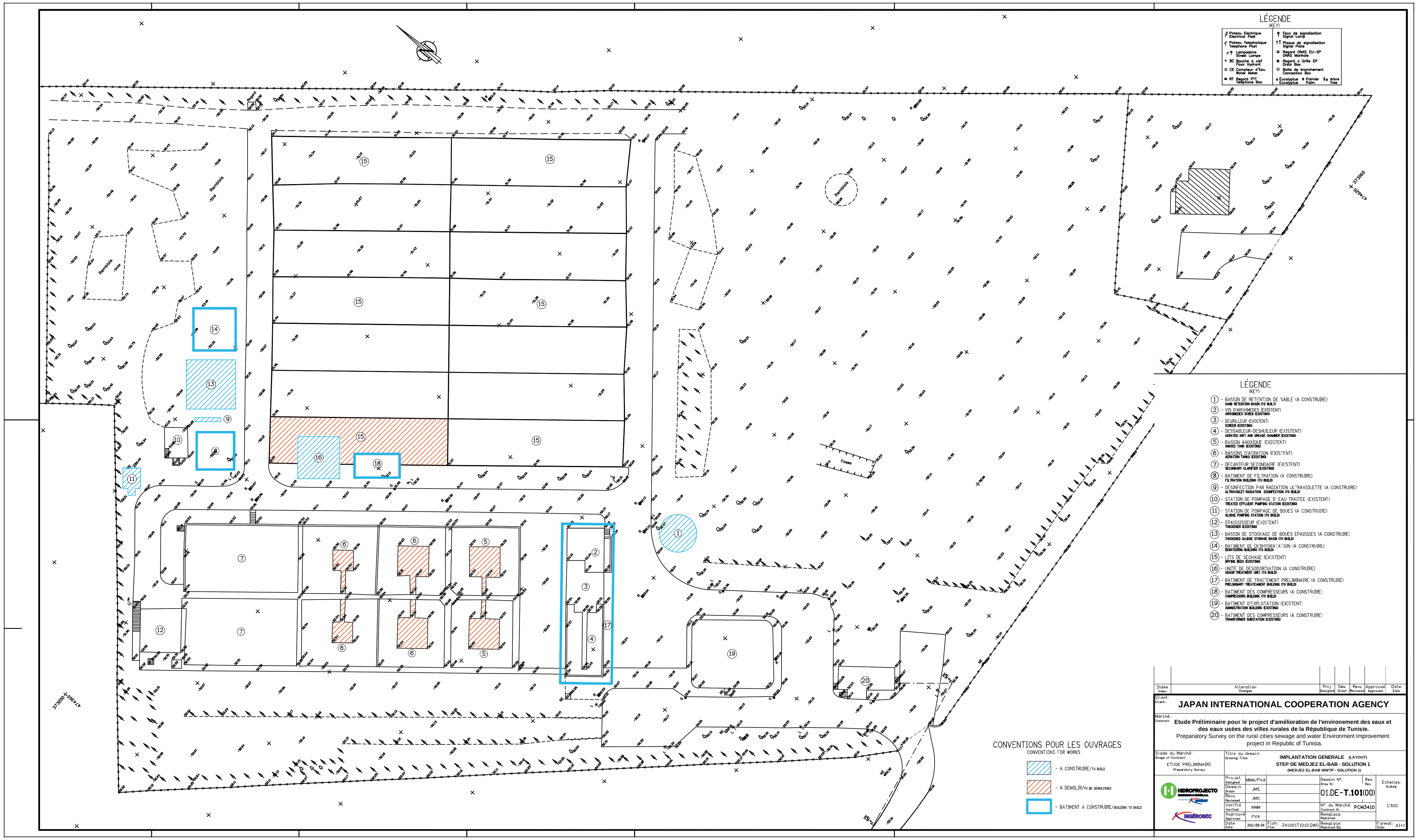
LÉGENDE
(KEY)
1 - BASSIN DE RETENTION DE SABLE (A CONSTRUIRE)
SAND RETENTION BASIN (TO BUILT)
2 - VIS D'ARCHIMEDES (EXISTENT)
ARCHIMEDES SCREW (EXISTING)
3 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - BASSIN ANOXIQUE (EXISTENT)
ANOXIC TANK (EXISTING)
6 - BASSINS D'AERATION (EXISTENT)
AERATION TANKS (EXISTING)
7 - DECANTEUR SECONDAIRE (EXISTENT)
SECONDARY CLARIFIER (EXISTING)
8 - BATIMENT DE FILTRATION (A CONSTRUIRE)
FILTRATION BUILDING (TO BUILD)
9 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE)
ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
10 - STATION DE POMPAGE D' EAU TRAITEE (EXISTENT)
TREATED EFFLUENT PUMPING STATION (EXISTING)
11 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE)
SLUDGE PUMPING STATION (TO BUILD)
12 - EPAISSISSEUR (EXISTENT)
THICKENER (EXISTING)
13 - BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE)
THICKENED SLUDGE STORAGE BASIN (TO BUILD)
14 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
15 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
16 - UNITE DE DESODORISATION (A CONSTRUIRE)
ODOUR TREATMENT UNIT (TO BUILD)
17 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE)
PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
18 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
COMPRESSORS BUILDING (TO BUILD)
19 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMNISTRATION BUILDING (EXISTING)
20 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
TRANSFORMER SUBSTATION (EXISTING)
CONVENTIONS POUR LES OUVRAGES
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- A DEMOLIR/TO BE DEMOLISHED
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
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(MEDJEZ EL-BAB WWTP - SOLUTION 1)
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INGÉROSEC
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Dessin Drawn JMS
Revu Reviewed JMS
Verifié Verified MMM
Approuvé Approved PVA
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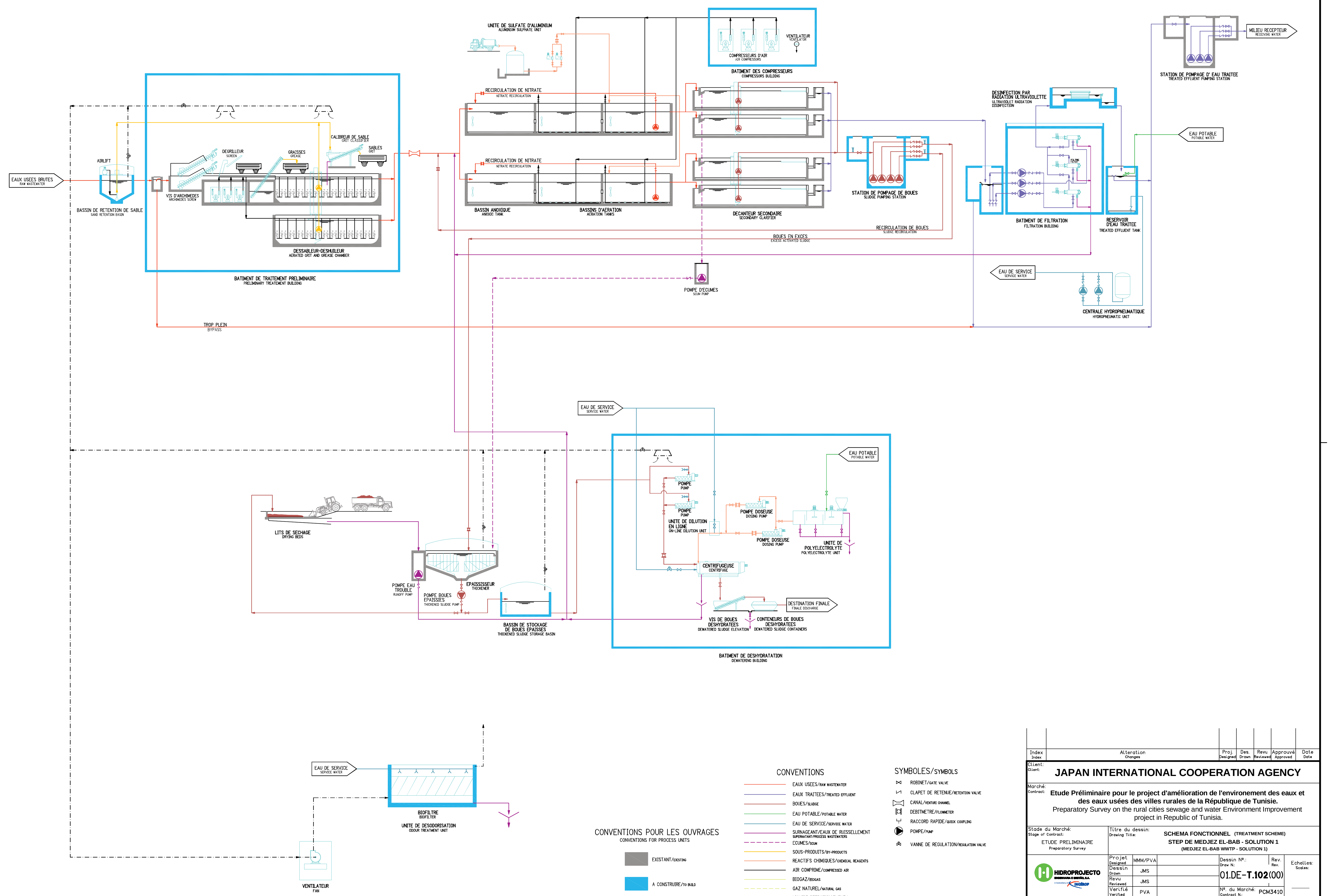

CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR PROCESS UNITS

- EXISTANT/EXISTING
- A CONSTRUIRE/TO BUILD

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- EAU DE SERVICE/SERVICE WATER
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- SOUS-PRODUITS/BY-PRODUCTS
- REACTIFS CHIMIQUES/CHEMICAL REAGENTS
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HIDROPROJECTO ENGENHARIA E GESTÃO, S.A. — A Subsidiary of INGÉROP
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ARCHIMEDES SCREW (EXISTING)
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4 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - DECANTEUR PRIMAIRE (A CONSTRUIRE)
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6 - BASSIN ANOXIQUE (EXISTENT)
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8 - DECANTEUR SECONDAIRE (EXISTENT)
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CHP BUILDING
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INGÉROSEC
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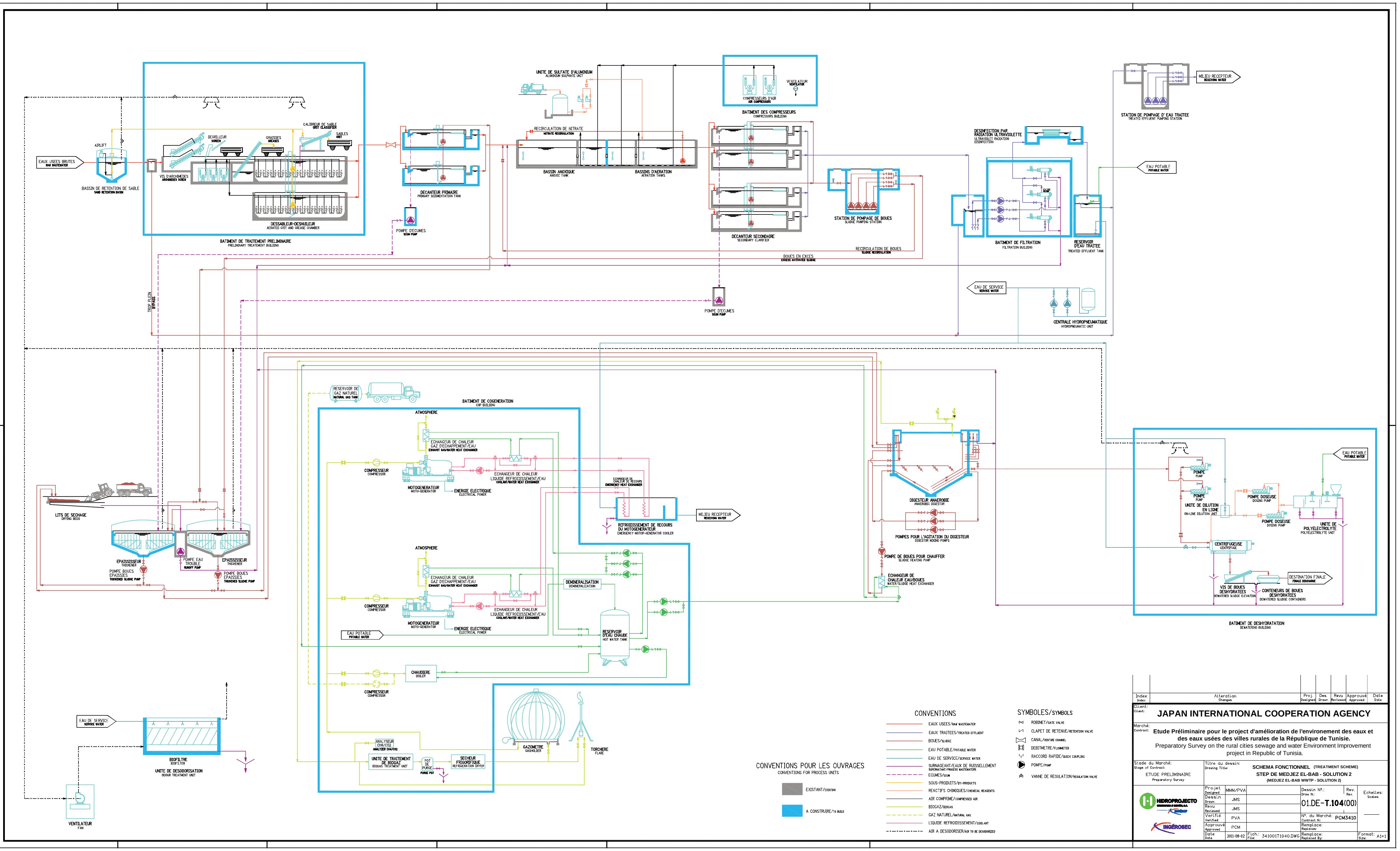

BATIMENT DE TRAITEMENT PRELIMINAIRE
PRELIMINARY TREATMENT BUILDING
EAUX USEES BRUTES
RAW WASTEWATER
BASSIN DE RETENTION DE SABLE
DESSABLEUR-DESHUILEUR
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DECANTEUR PRIMAIRE
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POMPE D'ECUMES
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BASSIN ANOXIQUE
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AERATION TANKS
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COMPRESSORS BUILDING
DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
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RECIRCULATION DE BOUES
BOUES EN EXCES
DESINFECTION PAR RADIATION ULTRAVIOLETTE
ULTRAVIOLET RADIATION DISINFECTION
BATIMENT DE FILTRATION
FILTRATION BUILDING
RESERVOIR D'EAU TRAITEE
TREATED EFFLUENT TANK
STATION DE POMPAGE D'EAU TRAITEE
TREATED EFFLUENT PUMPING STATION
MILIEU RECEPTEUR
EAU POTABLE
EAU DE SERVICE
CENTRALE HYDROPNEUMATIQUE
TROP PLEIN
BYPASS
LITS DE SECHAGE
DRYING BEDS
EPAISSISSEUR
THICKENER
POMPE EAU TROUBLE
POMPE BOUES EPAISSIES
BATIMENT DE COGENERATION
CHP BUILDING
RESERVOIR DE GAZ NATUREL
ATMOSPHERE
ECHANGEUR DE CHALEUR GAZ D'ECHAPPEMENT/EAU
LIQUIDE REFROIDISSEMENT/EAU
COMPRESSEUR
MOTOGENERATEUR
ENERGIE ELECTRIQUE
DEMINERALISATION
REFROIDISSEMENT DE RECOURS DU MOTOGENERATEUR
RESERVOIR D'EAU CHAUDE
HOT WATER TANK
CHAUDIERE
BOILER
ANALYSEUR CH_4/CO_2
UNITE DE TRAITEMENT DE BIOGAZ
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GAZOMETRE
GASHOLDER
TORCHERE
FLARE
DIGESTEUR ANAEROBIE
ANAEROBIC DIGESTER
POMPES POUR L'AGITATION DU DIGESTEUR
POMPE DE BOUES POUR CHAUFFER
ECHANGEUR DE CHALEUR EAU/BOUES
BATIMENT DE DESHYDRATATION
DEWATERING BUILDING
POMPE DOSEUSE
UNITE DE DILUTION EN LIGNE
UNITE DE POLYELECTROLYTE
CENTRIFUGEUSE
VIS DE BOUES DESHYDRATEES
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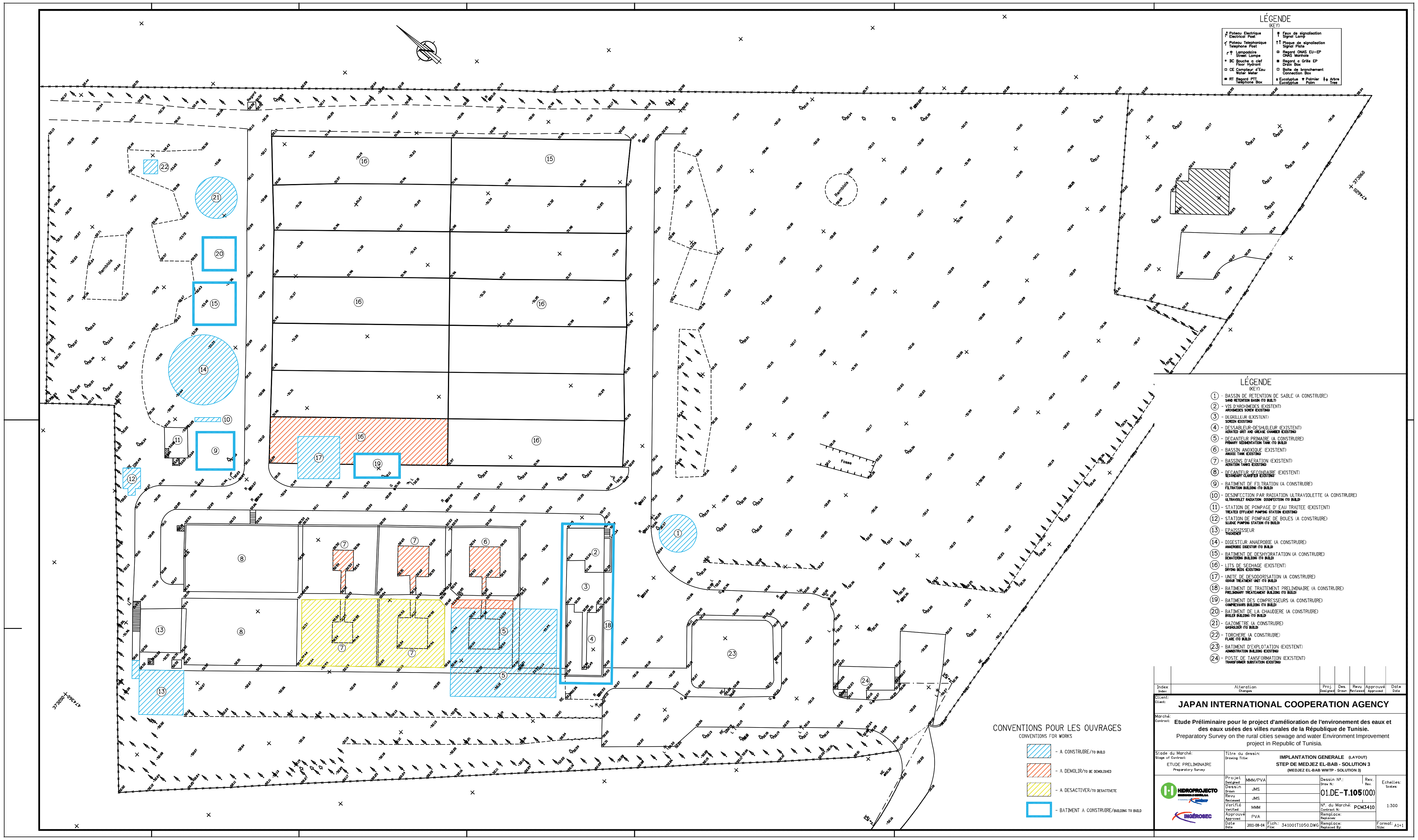

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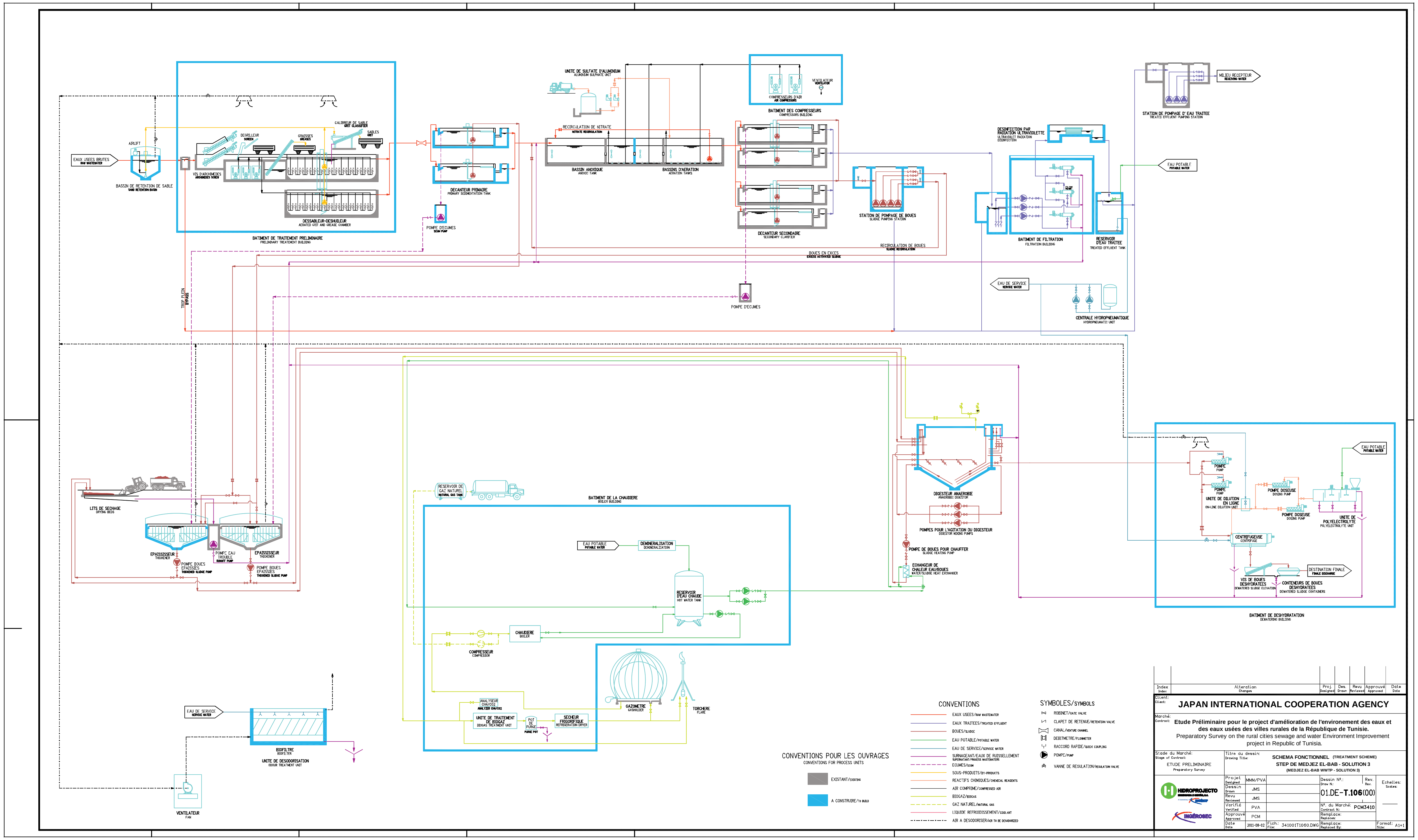
EAUX USEES BRUTES
RAW WASTEWATER
AIRLIFT
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SAND RETENTION BASIN
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NITRATE RECIRCULATION
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HYDROPNEUMATIC UNIT
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POMPE EAU TROUBLE
RUNOFF PUMP
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THICKENED SLUDGE PUMP
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COMPRESSEUR
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ANALYSEUR CH4/CO2
ANALYZER CH4/CO2
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PURGE POT
SECHEUR FRIGORIFIQUE
REFRIGERATION DRYER
GAZOMETRE
GASHOLDER
TORCHERE
FLARE
EAU DE SERVICE
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POMPES POUR L'AGITATION DU DIGESTEUR
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WATER/SLUDGE HEAT EXCHANGER
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PUMP
POMPE
PUMP
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POMPE DOSEUSE
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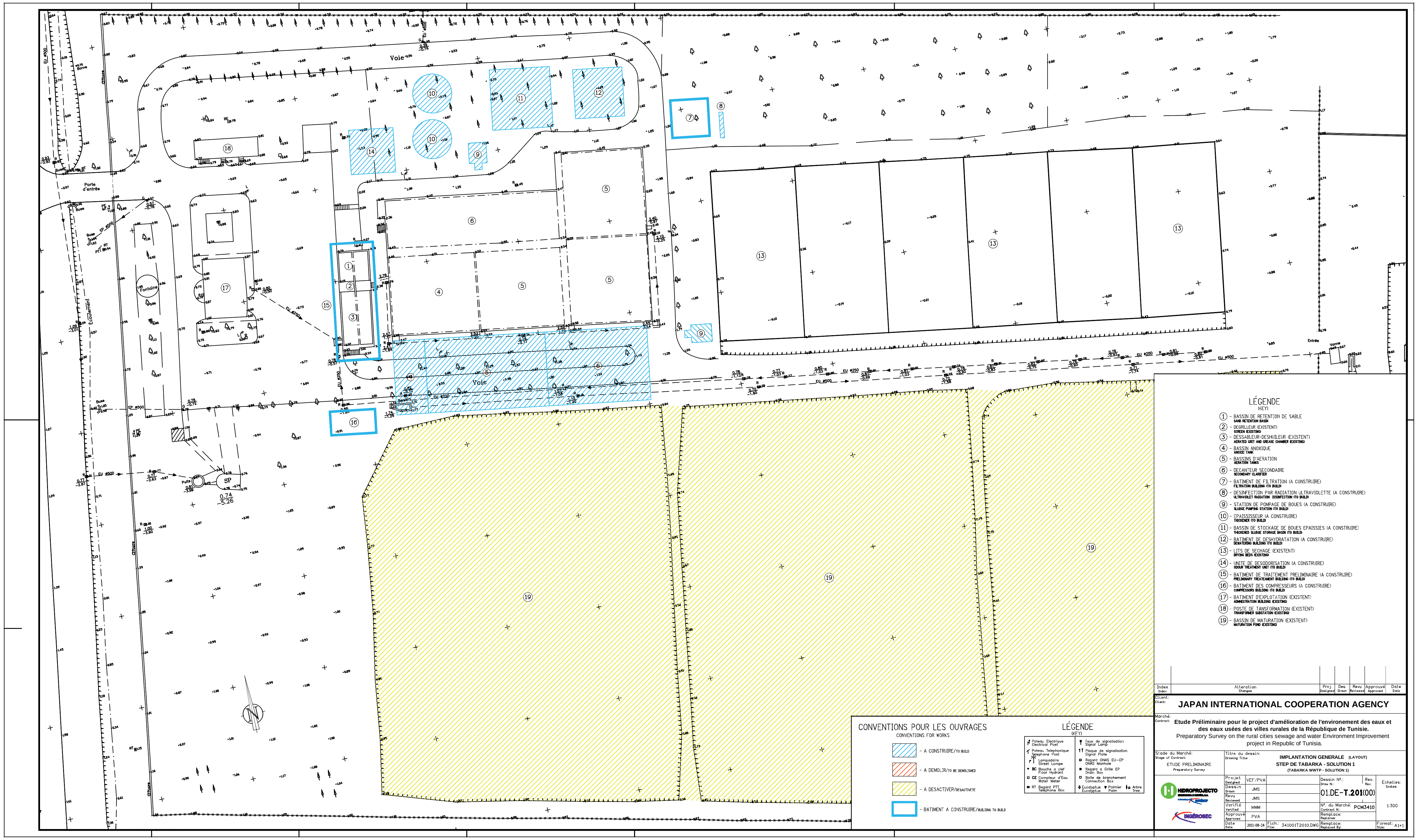

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Porte d'entrée
Fontaine
Entrée
Vanne
EU ø500
EU ø250
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LÉGENDE
(KEY)
1 - BASSIN DE RETENTION DE SABLE
SAND RETENTION BASIN
2 - DEGRILLEUR (EXISTENT)
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SLUDGE PUMPING STATION (TO BUILD)
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THICKENER (TO BUILD)
11 - BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE)
THICKENED SLUDGE STORAGE BASIN (TO BUILD)
12 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
13 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
14 - UNITE DE DESODORISATION (A CONSTRUIRE)
ODOUR TREATMENT UNIT (TO BUILD)
15 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE)
PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
16 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
COMPRESSORS BUILDING (TO BUILD)
17 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMINISTRATION BUILDING (EXISTING)
18 - POSTE DE TANSFORMATION (EXISTENT)
TRANSFORMER SUBSTATION (EXISTING)
19 - BASSIN DE MATURATION (EXISTENT)
MATURATION POND (EXISTING)
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS
- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
LÉGENDE
(KEY)
Poteau Electrique Electrical Post
Poteau Telephonique Telephone Post
Lampadaire Street Lampe
BC Bouche a clef Floor Hydrant
CE Compteur d'Eau Water Meter
RT Regard PTT Telephone Box
Feux de signalisation Signal Lamp
Plaque de signalisation Signal Plate
Regard ONAS EU-EP ONAS Manhole
Regard a Grille EP Drain Box
Boite de branchement Connection Box
Eucalyptus Eucalyptus
Palmier Palm
Arbre Tree
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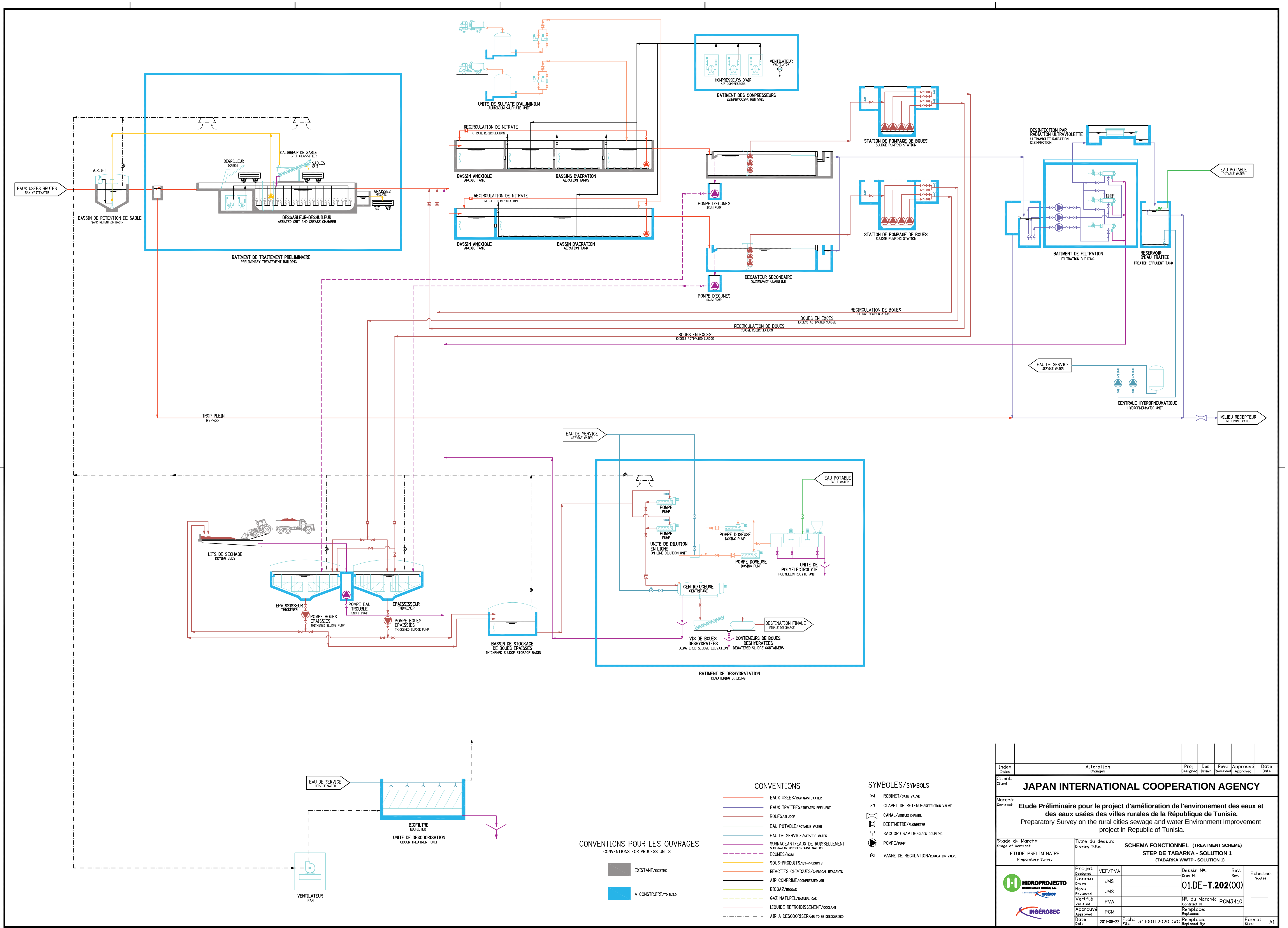

EAUX USEES BRUTES
RAW WASTEWATER
AIRLIFT
BASSIN DE RETENTION DE SABLE
SAND RETENTION BASIN
DEGRILLEUR
SCREEN
CALIBREUR DE SABLE
GRIT CLASSIFIER
SABLES
GRIT
GRAISSES
GREASE
DESSABLEUR-DESHUILEUR
AERATED GRIT AND GREASE CHAMBER
BATIMENT DE TRAITEMENT PRELIMINAIRE
PRELIMINARY TREATMENT BUILDING
UNITE DE SULFATE D'ALUMINIUM
ALUMINIUM SULPHATE UNIT
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NITRATE RECIRCULATION
BASSIN ANOXIQUE
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AERATION TANKS
BASSIN D'AERATION
AERATION TANK
COMPRESSEURS D'AIR
AIR COMPRESSORS
VENTILATEUR
VENTILATOR
BATIMENT DES COMPRESSEURS
COMPRESSORS BUILDING
STATION DE POMPAGE DE BOUES
SLUDGE PUMPING STATION
POMPE D'ECUMES
SCUM PUMP
DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
DESINFECTION PAR RADIATION ULTRAVIOLETTE
ULTRAVIOLET RADIATION DESINFECTION
EAU POTABLE
POTABLE WATER
BATIMENT DE FILTRATION
FILTRATION BUILDING
RESERVOIR D'EAU TRAITEE
TREATED EFFLUENT TANK
RECIRCULATION DE BOUES
SLUDGE RECIRCULATION
BOUES EN EXCES
EXCESS ACTIVATED SLUDGE
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SERVICE WATER
CENTRALE HYDROPNEUMATIQUE
HYDROPNEUMATIC UNIT
TROP PLEIN
BYPASS
MILIEU RECEPTEUR
RECEIVING WATER
LITS DE SECHAGE
DRYING BEDS
EPAISSISSEUR
THICKENER
POMPE BOUES EPAISSIES
THICKENED SLUDGE PUMP
POMPE EAU TROUBLE
RUNOFF PUMP
BASSIN DE STOCKAGE DE BOUES EPAISSIES
THICKENED SLUDGE STORAGE BASIN
POMPE
PUMP
UNITE DE DILUTION EN LIGNE
ON-LINE DILUTION UNIT
POMPE DOSEUSE
DOSING PUMP
UNITE DE POLYELECTROLYTE
POLYELECTROLYTE UNIT
CENTRIFUGEUSE
CENTRIFUGE
VIS DE BOUES DESHYDRATEES
DEWATERED SLUDGE ELEVATION
CONTENEURS DE BOUES DESHYDRATEES
DEWATERED SLUDGE CONTAINERS
DESTINATION FINALE
FINALE DISCHARGE
BATIMENT DE DESHYDRATATION
DEWATERING BUILDING
BIOFILTRE
BIOFILTER
UNITE DE DESODORISATION
ODOUR TREATMENT UNIT
VENTILATEUR
FAN
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CONVENTIONS FOR PROCESS UNITS
EXISTANT/EXISTING
A CONSTRUIRE/TO BUILD
CONVENTIONS
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SURNAGEANT/EAUX DE RUISSELLEMENT
SUPERNATANT/PROCESS WASTEWATERS
ECUMES/SCUM
SOUS-PRODUITS/BY-PRODUCTS
REACTIFS CHIMIQUES/CHEMICAL REAGENTS
AIR COMPRIME/COMPRESSED AIR
BIOGAZ/BIOGAS
GAZ NATUREL/NATURAL GAS
LIQUIDE REFROIDISSEMENT/COOLANT
AIR A DESODORISER/AIR TO BE DESODORIZED
SYMBOLES/SYMBOLS
ROBINET/GATE VALVE
CLAPET DE RETENUE/RETENTION VALVE
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ENGENHARIA E GESTÃO, S.A.
A Subsidiary of INGÉROP
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Dessin
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JMS
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PCM
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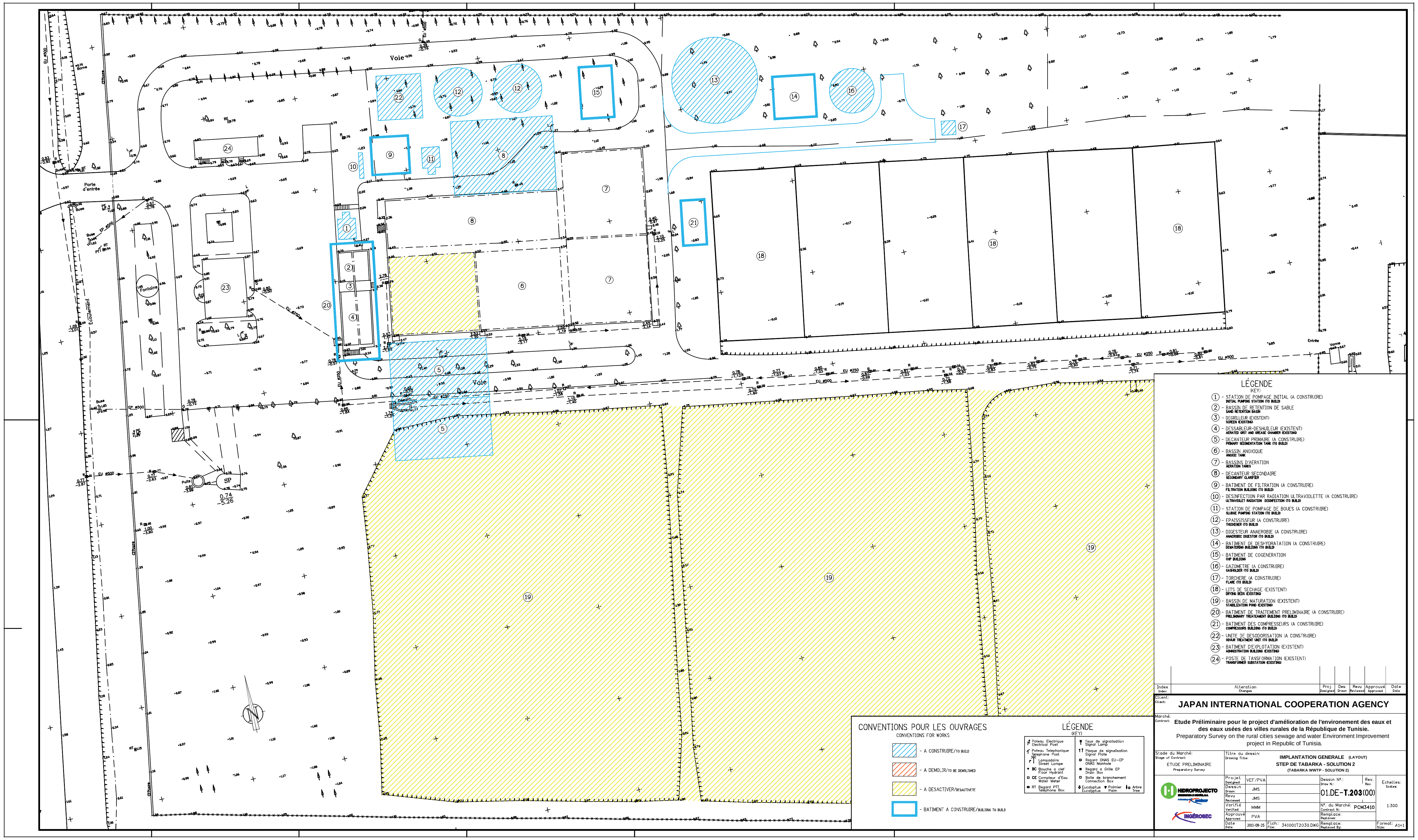

Voie
Porte d'entrée
Fontaine
SP
Entrée
Vanne
EU ϕ500
EU ϕ250
LÉGENDE
(KEY)
1 - STATION DE POMPAGE INITIAL (A CONSTRUIRE)
INITIAL PUMPING STATION (TO BUILD)
2 - BASSIN DE RETENTION DE SABLE
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SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - DECANTEUR PRIMAIRE (A CONSTRUIRE)
PRIMARY SEDIMENTATION TANK (TO BUILD)
6 - BASSIN ANOXIQUE
ANOXIC TANK
7 - BASSINS D'AERATION
AERATION TANKS
8 - DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
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FILTRATION BUILDING (TO BUILD)
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ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
11 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE)
SLUDGE PUMPING STATION (TO BUILD)
12 - EPAISSISSEUR (A CONSTRUIRE)
THICKENER (TO BUILD)
13 - DIGESTEUR ANAEROBIE (A CONSTRUIRE)
ANAEROBIC DIGESTOR (TO BUILD)
14 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
15 - BATIMENT DE COGENERATION
CHP BUILDING
16 - GAZOMETRE (A CONSTRUIRE)
GASHOLDER (TO BUILD)
17 - TORCHERE (A CONSTRUIRE)
FLARE (TO BUILD)
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STABILIZATION POND (EXISTING)
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CONVENTIONS FOR WORKS
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- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
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Plaque de signalisation Signal Plate
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Boite de branchement Connection Box
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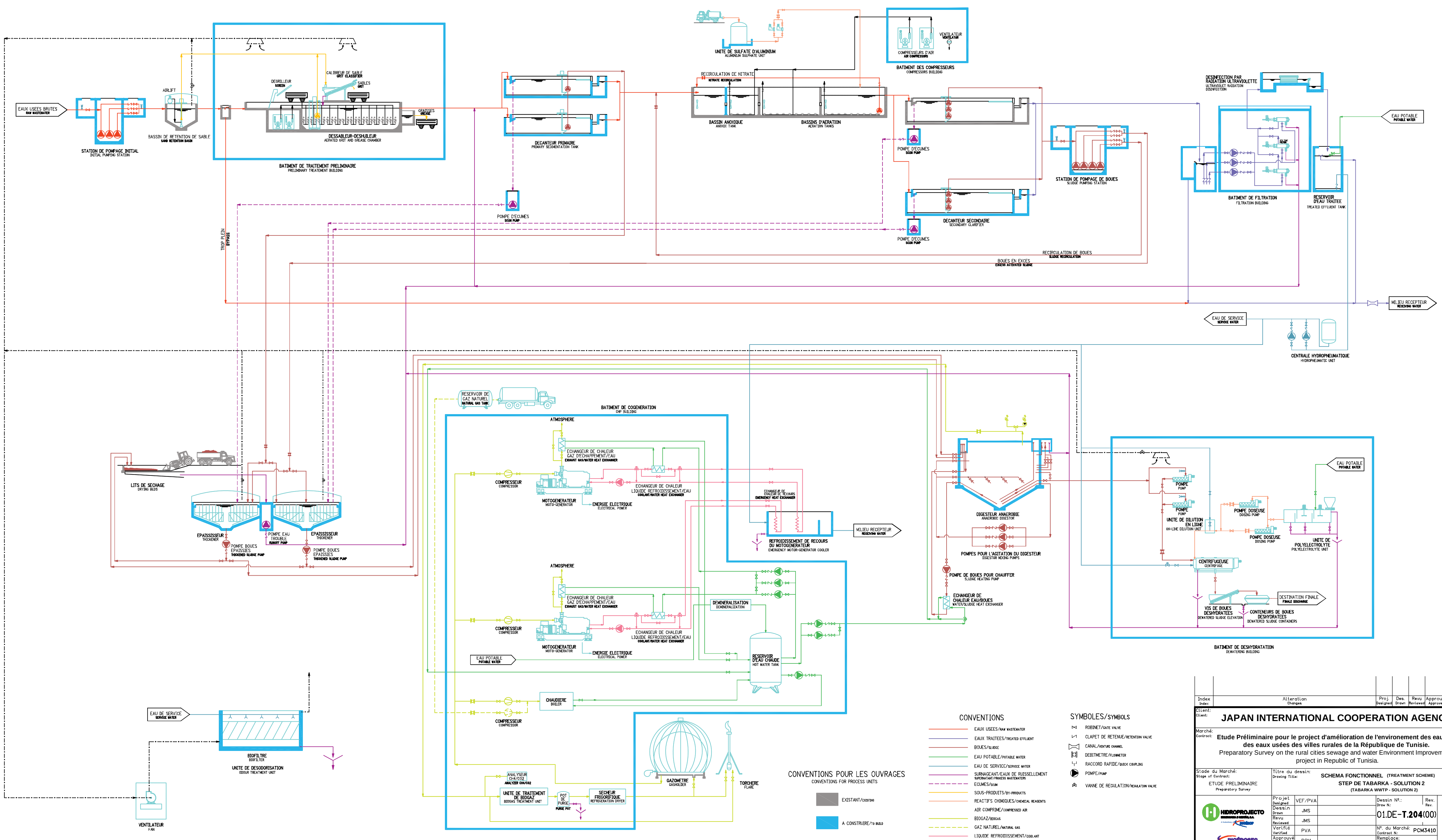

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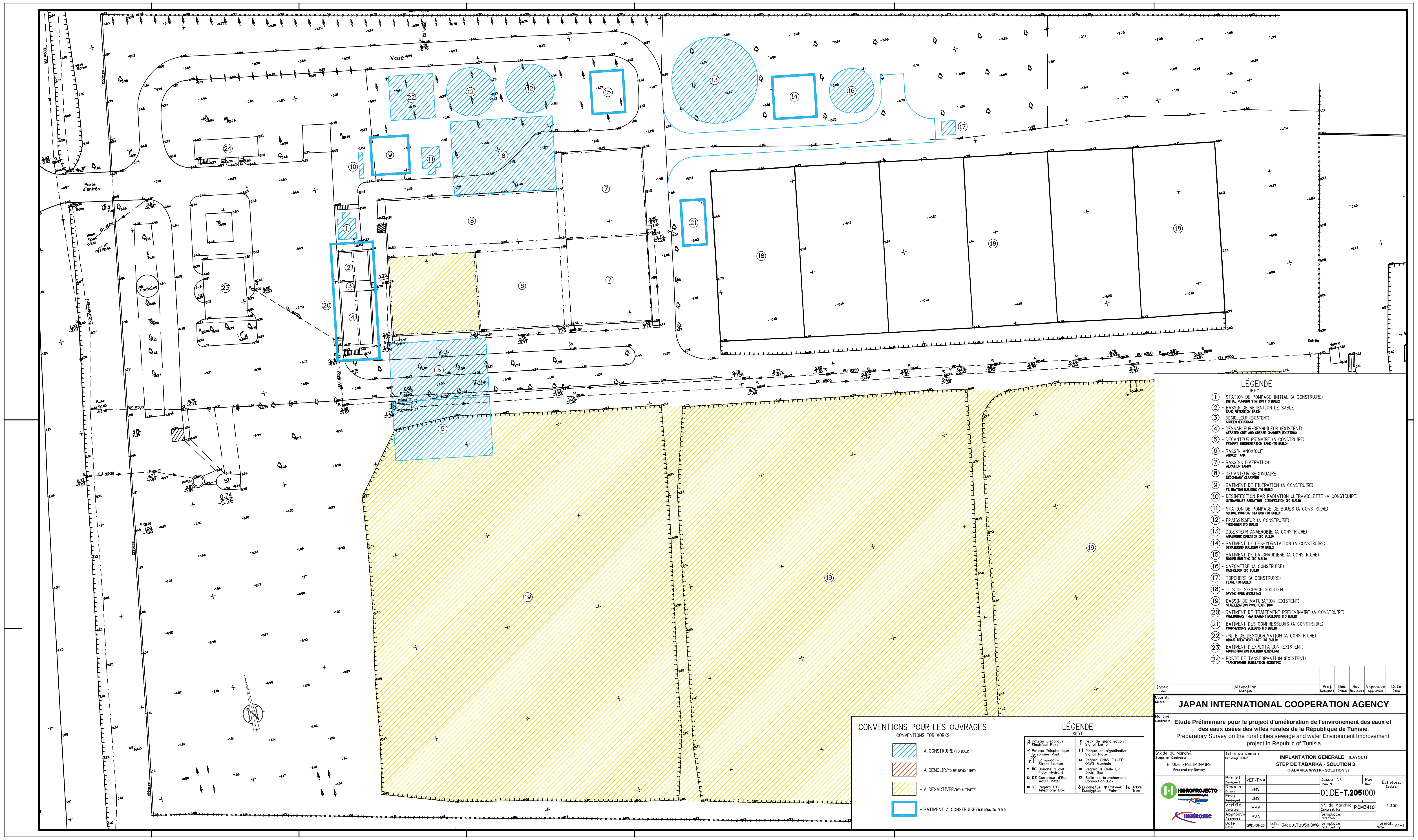

LÉGENDE
(KEY)
1 - STATION DE POMPAGE INITIAL (A CONSTRUIRE) INITIAL PUMPING STATION (TO BUILD)
2 - BASSIN DE RETENTION DE SABLE SAND RETENTION BASIN
3 - DEGRILLEUR (EXISTENT) SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT) AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - DECANTEUR PRIMAIRE (A CONSTRUIRE) PRIMARY SEDIMENTATION TANK (TO BUILD)
6 - BASSIN ANOXIQUE ANOXIC TANK
7 - BASSINS D'AERATION AERATION TANKS
8 - DECANTEUR SECONDAIRE SECONDARY CLARIFIER
9 - BATIMENT DE FILTRATION (A CONSTRUIRE) FILTRATION BUILDING (TO BUILD)
10 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE) ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
11 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE) SLUDGE PUMPING STATION (TO BUILD)
12 - EPAISSISSEUR (A CONSTRUIRE) THICKENER (TO BUILD)
13 - DIGESTEUR ANAEROBIE (A CONSTRUIRE) ANAEROBIC DIGESTOR (TO BUILD)
14 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE) DEWATERING BUILDING (TO BUILD)
15 - BATIMENT DE LA CHAUDIERE (A CONSTRUIRE) BOILER BUILDING (TO BUILD)
16 - GAZOMETRE (A CONSTRUIRE) GASHOLDER (TO BUILD)
17 - TORCHERE (A CONSTRUIRE) FLARE (TO BUILD)
18 - LITS DE SECHAGE (EXISTENT) DRYING BEDS (EXISTING)
19 - BASSIN DE MATURATION (EXISTENT) STABILIZATION POND (EXISTING)
20 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE) PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
21 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE) COMPRESSORS BUILDING (TO BUILD)
22 - UNITE DE DESODORISATION (A CONSTRUIRE) ODOUR TREATMENT UNIT (TO BUILD)
23 - BATIMENT D'EXPLOTATION (EXISTENT) ADMNISTRATION BUILDING (EXISTING)
24 - POSTE DE TANSFORMATION (EXISTENT) TRANSFORMER SUBSTATION (EXISTING)
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS
- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
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- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
LÉGENDE
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INGÉROSEC
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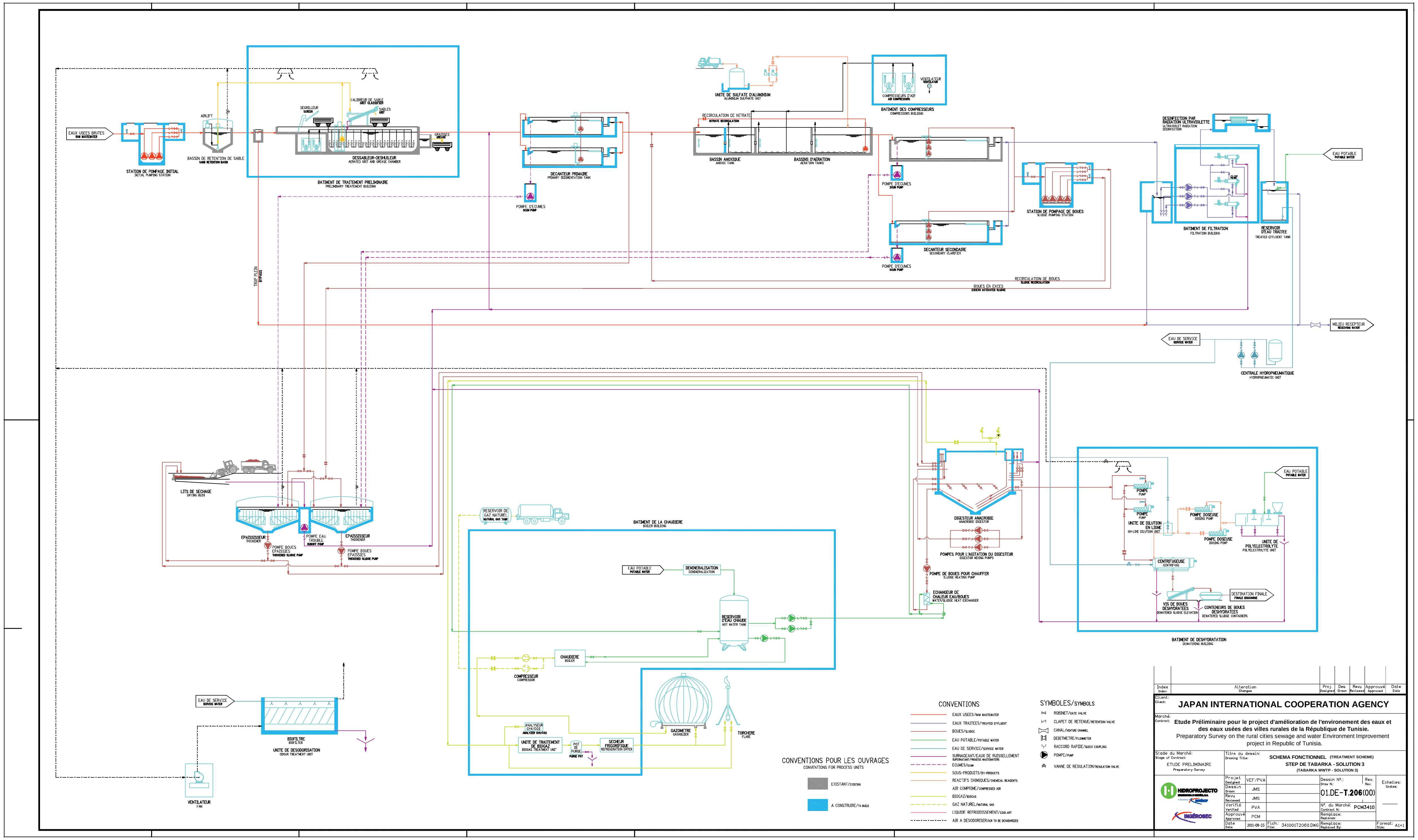
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RAW WASTEWATER
STATION DE POMPAGE INITIAL
INITIAL PUMPING STATION
AIRLIFT
BASSIN DE RETENTION DE SABLE
SAND RETENTION BASIN
DEGRILLEUR
SCREEN
CALSSIFICATEUR DE SABLE
GRIT CLASSIFIER
SABLES
GRIT
DESSABLEUR-DESHUILEUR
AERATED GRIT AND GREASE CHAMBER
BATIMENT DE TRAITEMENT PRELIMINAIRE
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DECANTEUR PRIMAIRE
PRIMARY SEDIMENTATION TANK
POMPE D'ECUMES
SCUM PUMP
UNITE DE SULFATE D'ALUMINIUM
ALUMINIUM SULPHATE UNIT
RECIRCULATION DE NITRATE
NITRATE RECIRCULATION
BASSIN ANOXIQUE
ANOXIC TANK
BASSINS D'AERATION
AERATION TANKS
COMPRESSEURS D'AIR
AIR COMPRESSORS
VENTILATEUR
BATIMENT DES COMPRESSEURS
COMPRESSORS BUILDING
STATION DE POMPAGE DE BOUES
SLUDGE PUMPING STATION
DECANTEUR SECONDAIRE
SECONDARY CLARIFIER
RECIRCULATION DE BOUES
SLUDGE RECIRCULATION
BOUES EN EXCES
EXCESS ACTIVATED SLUDGE
TROP PLEIN
BYPASS
DESINFECTION PAR RADIATION ULTRAVIOLETTE
ULTRAVIOLET RADIATION DISINFECTION
BATIMENT DE FILTRATION
FILTRATION BUILDING
RESERVOIR D'EAU TRAITEE
TREATED EFFLUENT TANK
EAU POTABLE
POTABLE WATER
MILIEU RECEPTEUR
RECEIVING WATER
EAU DE SERVICE
SERVICE WATER
CENTRALE HYDROPNEUMATIQUE
HYDROPNEUMATIC UNIT
LITS DE SECHAGE
DRYING BEDS
EPAISSISSEUR
THICKENER
POMPE EAU TROUBLE
POMPE BOUES EPAISSIES
THICKENED SLUDGE PUMP
RESERVOIR DE GAZ NATUREL
NATURAL GAS TANK
BATIMENT DE LA CHAUDIERE
BOILER BUILDING
EAU POTABLE
POTABLE WATER
DEMINERALISATION
DEMINERALIZATION
RESERVOIR D'EAU CHAUDE
HOT WATER TANK
CHAUDIERE
BOILER
COMPRESSEUR
COMPRESSOR
ANALYSEUR CH4/CO2
UNITE DE TRAITEMENT DE BIOGAZ
BIOGAS TREATMENT UNIT
POT DE PURGE
PURGE POT
SECHEUR FRIGORIFIQUE
REFRIGERATION DRYER
GAZOMETRE
GASHOLDER
TORCHERE
FLARE
DIGESTEUR ANAEROBIE
ANAEROBIC DIGESTER
POMPES POUR L'AGITATION DU DIGESTEUR
DIGESTER MIXING PUMPS
POMPE DE BOUES POUR CHAUFFER
SLUDGE HEATING PUMP
ECHANGEUR DE CHALEUR EAU/BOUES
WATER/SLUDGE HEAT EXCHANGER
POMPE
PUMP
UNITE DE DILUTION EN LIGNE
ON-LINE DILUTION UNIT
POMPE DOSEUSE
DOSING PUMP
UNITE DE POLYELECTROLYTE
POLYELECTROLYTE UNIT
CENTRIFUGEUSE
CENTRIFUGE
DESTINATION FINALE
FINAL DISCHARGE
VIS DE BOUES DESHYDRATEES
DEWATERED SLUDGE ELEVATION
CONTENEURS DE BOUES DESHYDRATEES
DEWATERED SLUDGE CONTAINERS
BATIMENT DE DESHYDRATATION
DEWATERING BUILDING
EAU DE SERVICE
SERVICE WATER
BIOFILTRE
BIOFILTER
UNITE DE DESODORISATION
ODOUR TREATMENT UNIT
VENTILATEUR
FAN
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR PROCESS UNITS
EXISTANT/EXISTING
A CONSTRUIRE/TO BUILD
CONVENTIONS
EAUX USEES/RAW WASTEWATER
EAUX TRAITEES/TREATED EFFLUENT
BOUES/SLUDGE
EAU POTABLE/POTABLE WATER
EAU DE SERVICE/SERVICE WATER
SURNAGEANT/EAUX DE RUISSELLEMENT
SUPERNATANT/PROCESS WASTEWATERS
ECUMES/SCUM
SOUS-PRODUITS/BY-PRODUCTS
REACTIFS CHIMIQUES/CHEMICAL REAGENTS
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LIQUIDE REFROIDISSEMENT/COOLANT
AIR A DESODORISER/AIR TO BE DESODORIZED
SYMBOLES/SYMBOLS
ROBINET/GATE VALVE
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DEBITMETRE/FLOWMETER
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POMPE/PUMP
VANNE DE REGULATION/REGULATION VALVE
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Revu / Reviewed JMS
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Approuvé / Approved PCM
Date / Date 2011-08-23
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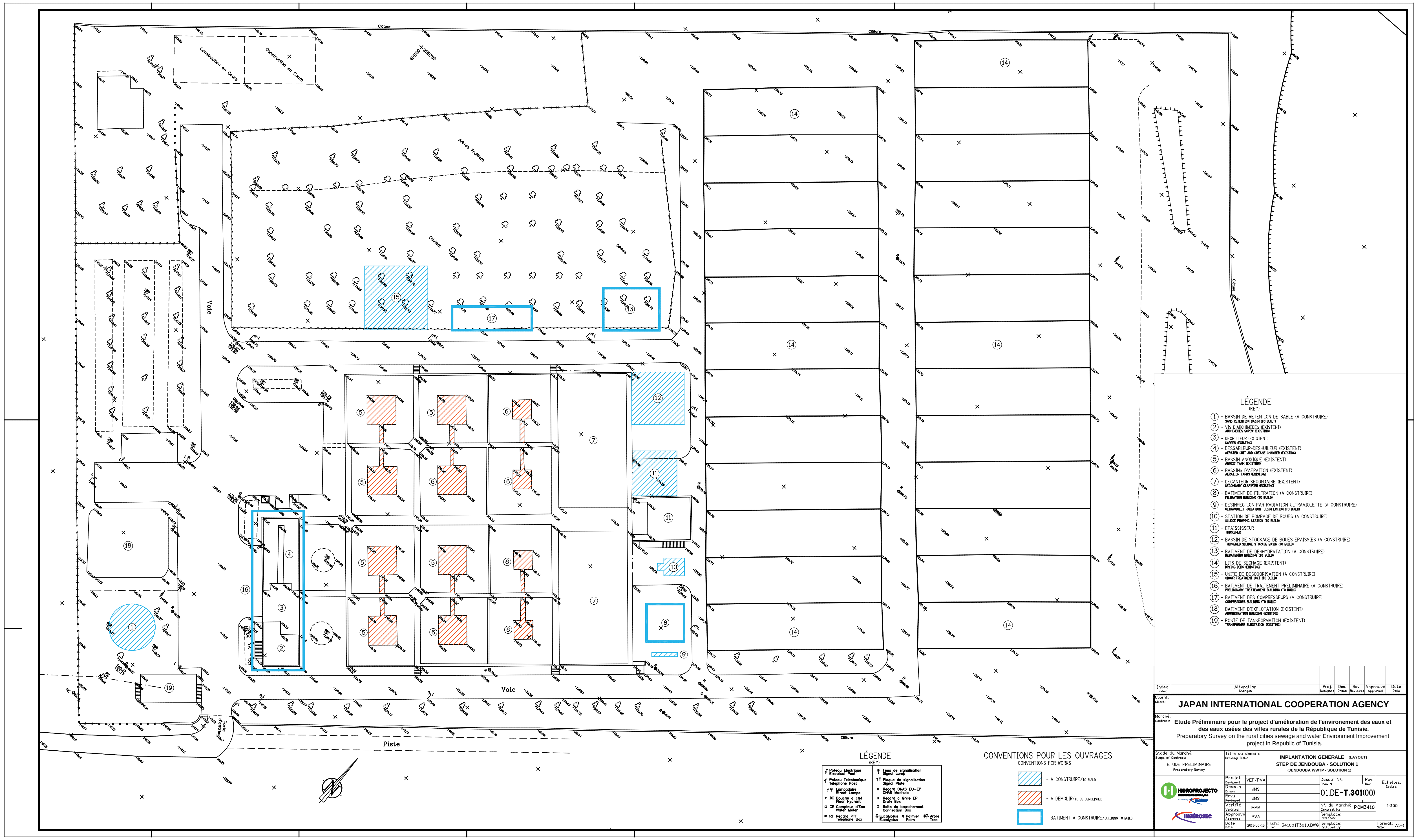

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Voie
Piste
LÉGENDE
(KEY)
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SAND RETENTION BASIN (TO BUILT)
2 - VIS D'ARCHIMEDES (EXISTENT)
ARCHIMEDES SCREW (EXISTING)
3 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - BASSIN ANOXIQUE (EXISTENT)
ANOXIC TANK (EXISTING)
6 - BASSINS D'AERATION (EXISTENT)
AERATION TANKS (EXISTING)
7 - DECANTEUR SECONDAIRE (EXISTENT)
SECONDARY CLARIFIER (EXISTING)
8 - BATIMENT DE FILTRATION (A CONSTRUIRE)
FILTRATION BUILDING (TO BUILD)
9 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE)
ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
10 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE)
SLUDGE PUMPING STATION (TO BUILD)
11 - EPAISSISSEUR
THICKENER
12 - BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE)
THICKENED SLUDGE STORAGE BASIN (TO BUILD)
13 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
14 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
15 - UNITE DE DESODORISATION (A CONSTRUIRE)
ODOUR TREATMENT UNIT (TO BUILD)
16 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE)
PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
17 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
COMPRESSORS BUILDING (TO BUILD)
18 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMNISTRATION BUILDING (EXISTING)
19 - POSTE DE TANSFORMATION (EXISTENT)
TRANSFORMER SUBSTATION (EXISTING)
LÉGENDE
(KEY)
Poteau Electrique / Electrical Post
Poteau Telephonique / Telephone Post
Lampadaire / Street Lampe
BC Bouche a clef / Floor Hydrant
CE Compteur d'Eau / Water Meter
RT Regard PTT / Telephone Box
Feux de signalisation / Signal Lamp
Plaque de signalisation / Signal Plate
Regard ONAS EU-EP / ONAS Manhole
Regard a Grille EP / Drain Box
Boite de branchement / Connection Box
Eucalyptus / Eucalyptus
Palmier / Palm
Arbre / Tree
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INGÉROSEC
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Dessin / Drawn: JMS
Revu / Reviewed: JMS
Verifié / Verified: MMM
Approuvé / Approved: PVA
Date / Date: 2011-08-18
Fich. / File: 341001T3010.DWG
Dessin Nº. / Draw N.: 01.DE-T.301(00)
Rev. / Rev.
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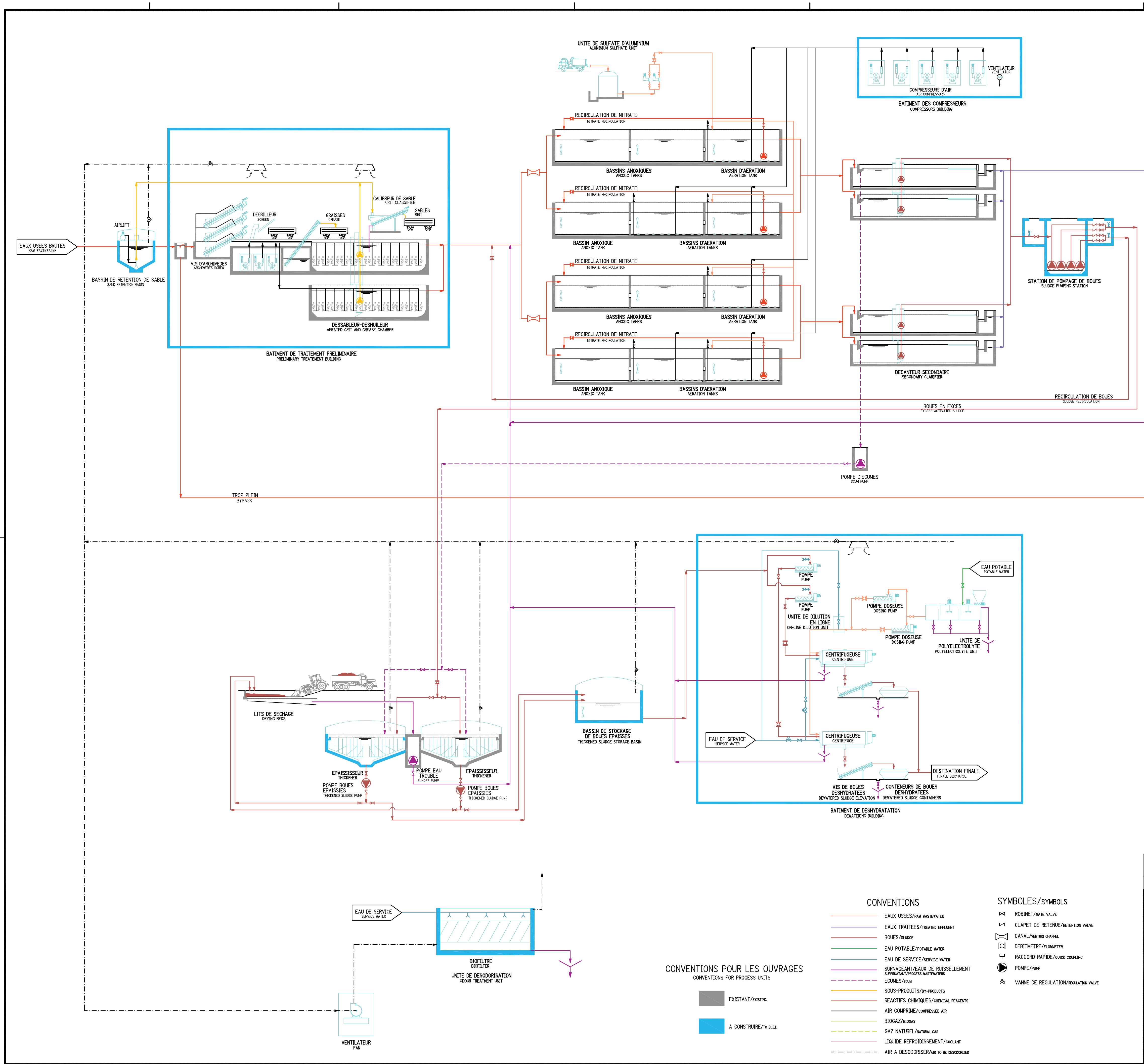

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(JENDOUBA WWTP - SOLUTION 1)

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A. A Subsidiary of INGÉROP
INGÉROSEC

Projet / Designed	VEF/PVA	
Dessin / Drawn	JMS	
Revu / Reviewed	JMS	
Verifié / Verified	PVA	
Approuvé / Approved	PCM	
Date / Date	2011-08-17	Fich.: / File: 341001T3020.DWG

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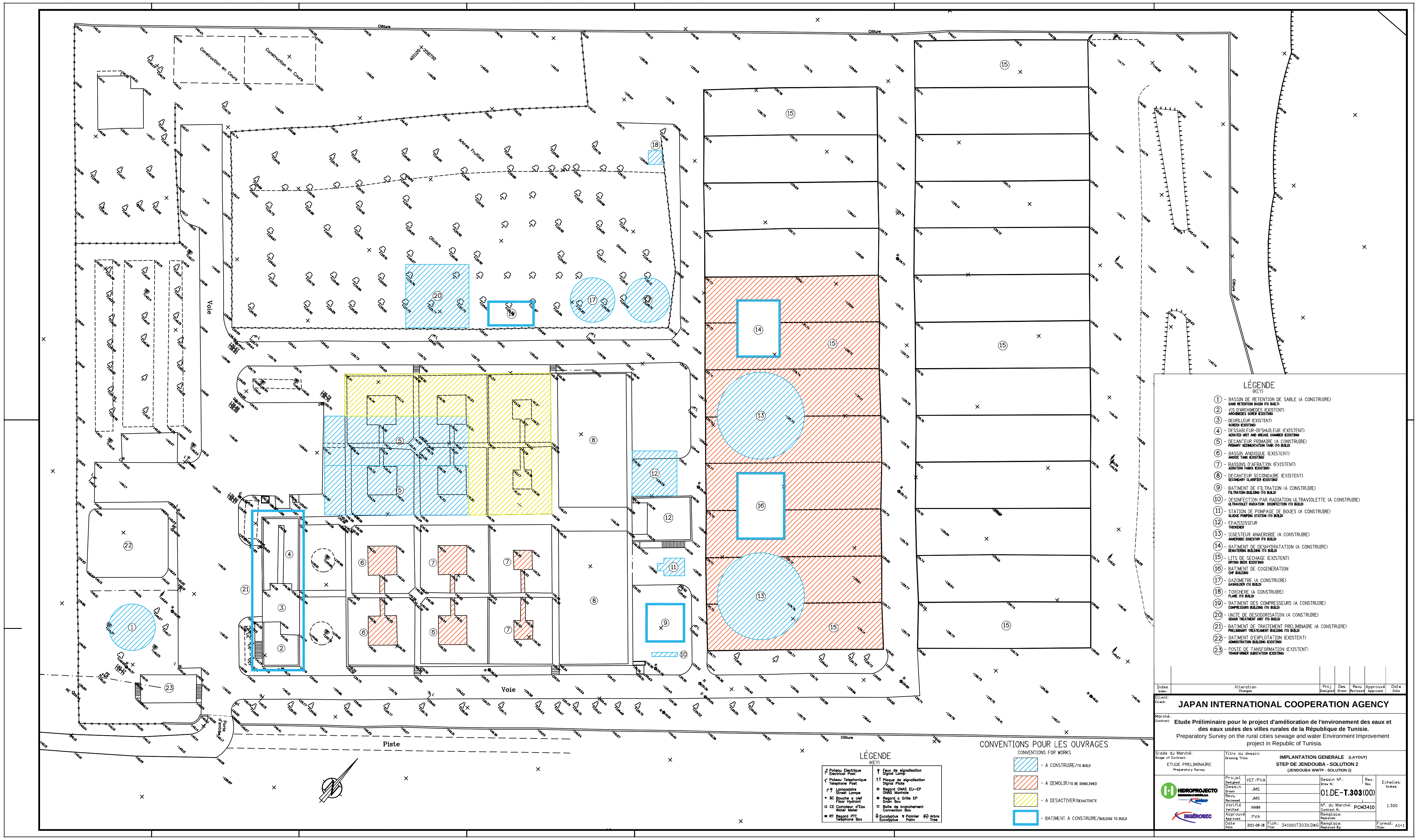
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Piste
LÉGENDE
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SAND RETENTION BASIN (TO BUILT)
2 - VIS D'ARCHIMEDES (EXISTENT)
ARCHIMEDES SCREW (EXISTING)
3 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - DECANTEUR PRIMAIRE (A CONSTRUIRE)
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6 - BASSIN ANOXIQUE (EXISTENT)
ANOXIC TANK (EXISTING)
7 - BASSINS D'AERATION (EXISTENT)
AERATION TANKS (EXISTING)
8 - DECANTEUR SECONDAIRE (EXISTENT)
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12 - EPAISSISSEUR
THICKENER
13 - DIGESTEUR ANAEROBIE (A CONSTRUIRE)
ANAEROBIC DIGESTOR (TO BUILD)
14 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE)
DEWATERING BUILDING (TO BUILD)
15 - LITS DE SECHAGE (EXISTENT)
DRYING BEDS (EXISTING)
16 - BATIMENT DE COGENERATION
CHP BUILDING
17 - GAZOMETRE (A CONSTRUIRE)
GASHOLDER (TO BUILD)
18 - TORCHERE (A CONSTRUIRE)
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19 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE)
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20 - UNITE DE DESODORISATION (A CONSTRUIRE)
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PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
22 - BATIMENT D'EXPLOTATION (EXISTENT)
ADMINISTRATION BUILDING (EXISTING)
23 - POSTE DE TANSFORMATION (EXISTENT)
TRANSFORMER SUBSTATION (EXISTING)
LÉGENDE
(KEY)
Poteau Electrique Electrical Post
Poteau Telephonique Telephone Post
Lampadaire Street Lampe
BC Bouche a clef Floor Hydrant
CE Compteur d'Eau Water Meter
RT Regard PTT Telephone Box
Feux de signalisation Signal Lamp
Plaque de signalisation Signal Plate
Regard ONAS EU-EP ONAS Manhole
Regard a Grille EP Drain Box
Boite de branchement Connection Box
Eucalyptus Eucalyptus
Palmier Palm
Arbre Tree
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(JENDOUBA WWTP - SOLUTION 2)
HIDROPROJECTO
INGÉROSEC
Projet Designed VEF/PVA
Dessin Drawn JMS
Revu Reviewed JMS
Verifié Verified MMM
Approuvé Approved PVA
Date Date 2011-08-18
Fich.: File: 341001T3030.DWG
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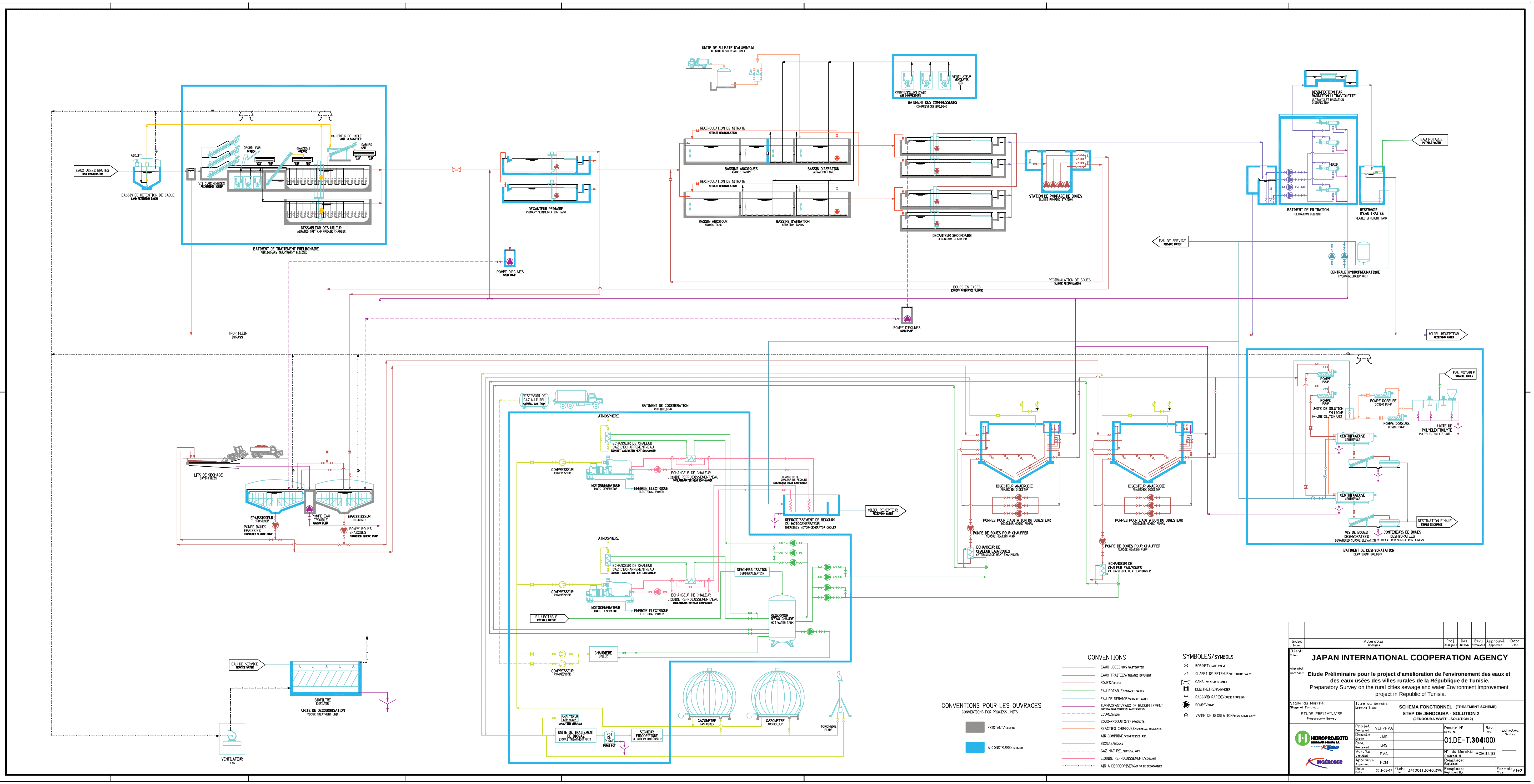

EAUX USEES BRUTES
BASSIN DE RETENTION DE SABLE
BATIMENT DE TRAITEMENT PRELIMINAIRE
DESSABLEUR-DESHUILEUR
DECANTEUR PRIMAIRE
POMPE D'ECUMES
UNITE DE SULFATE D'ALUMINIUM
BATIMENT DES COMPRESSEURS
BASSINS ANOXIQUES
BASSIN D'AERATION
BASSIN ANOXIQUE
BASSINS D'AERATION
RECIRCULATION DE NITRATE
DECANTEUR SECONDAIRE
STATION DE POMPAGE DE BOUES
RECIRCULATION DE BOUES
BOUES EN EXCES
DESINFECTION PAR RADIATION ULTRAVIOLETTE
BATIMENT DE FILTRATION
RESERVOIR D'EAU TRAITEE
EAU POTABLE
EAU DE SERVICE
CENTRALE HYDROPNEUMATIQUE
MILIEU RECEPTEUR
TROP PLEIN
LITS DE SECHAGE
EPAISSISSEUR
POMPE BOUES EPAISSIES
BATIMENT DE COGENERATION
RESERVOIR DE GAZ NATUREL
ATMOSPHERE
ECHANGEUR DE CHALEUR GAZ D'ECHAPPEMENT/EAU
COMPRESSEUR
MOTOGENERATEUR
ENERGIE ELECTRIQUE
ECHANGEUR DE CHALEUR LIQUIDE REFROIDISSEMENT/EAU
REFROIDISSEMENT DE RECOURS DU MOTOGENERATEUR
DEMINERALISATION
RESERVOIR D'EAU CHAUDE
CHAUDIERE
UNITE DE TRAITEMENT DE BIOGAZ
SECHEUR FRIGORIFIQUE
GAZOMETRE
TORCHERE
BIOFILTRE
UNITE DE DESODORISATION
VENTILATEUR
DIGESTEUR ANAEROBIE
POMPES POUR L'AGITATION DU DIGESTEUR
POMPE DE BOUES POUR CHAUFFER
ECHANGEUR DE CHALEUR EAU/BOUES
CENTRIFUGEUSE
UNITE DE POLYELECTROLYTE
POMPE DOSEUSE
UNITE DE DILUTION EN LIGNE
VIS DE BOUES DESHYDRATEES
CONTENEURS DE BOUES DESHYDRATEES
DESTINATION FINALE
BATIMENT DE DESHYDRATATION
CONVENTIONS POUR LES OUVRAGES
EXISTANT
A CONSTRUIRE
CONVENTIONS
EAUX USEES
EAUX TRAITEES
BOUES
EAU POTABLE
EAU DE SERVICE
SURNAGEANT/EAUX DE RUISSELLEMENT
ECUMES
SOUS-PRODUITS
REACTIFS CHIMIQUES
AIR COMPRIME
BIOGAZ
GAZ NATUREL
LIQUIDE REFROIDISSEMENT
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CANAL
DEBITMETRE
RACCORD RAPIDE
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Preparatory Survey
Titre du dessin:
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(JENDOUBA WWTP - SOLUTION 2)
HIDROPROJECTO
INGÉROSEC
Projet VEF/PVA
Dessin JMS
Revu JMS
Verifié PVA
Approuvé PCM
Date 2011-08-17
Fich.: 341001T3040.DWG
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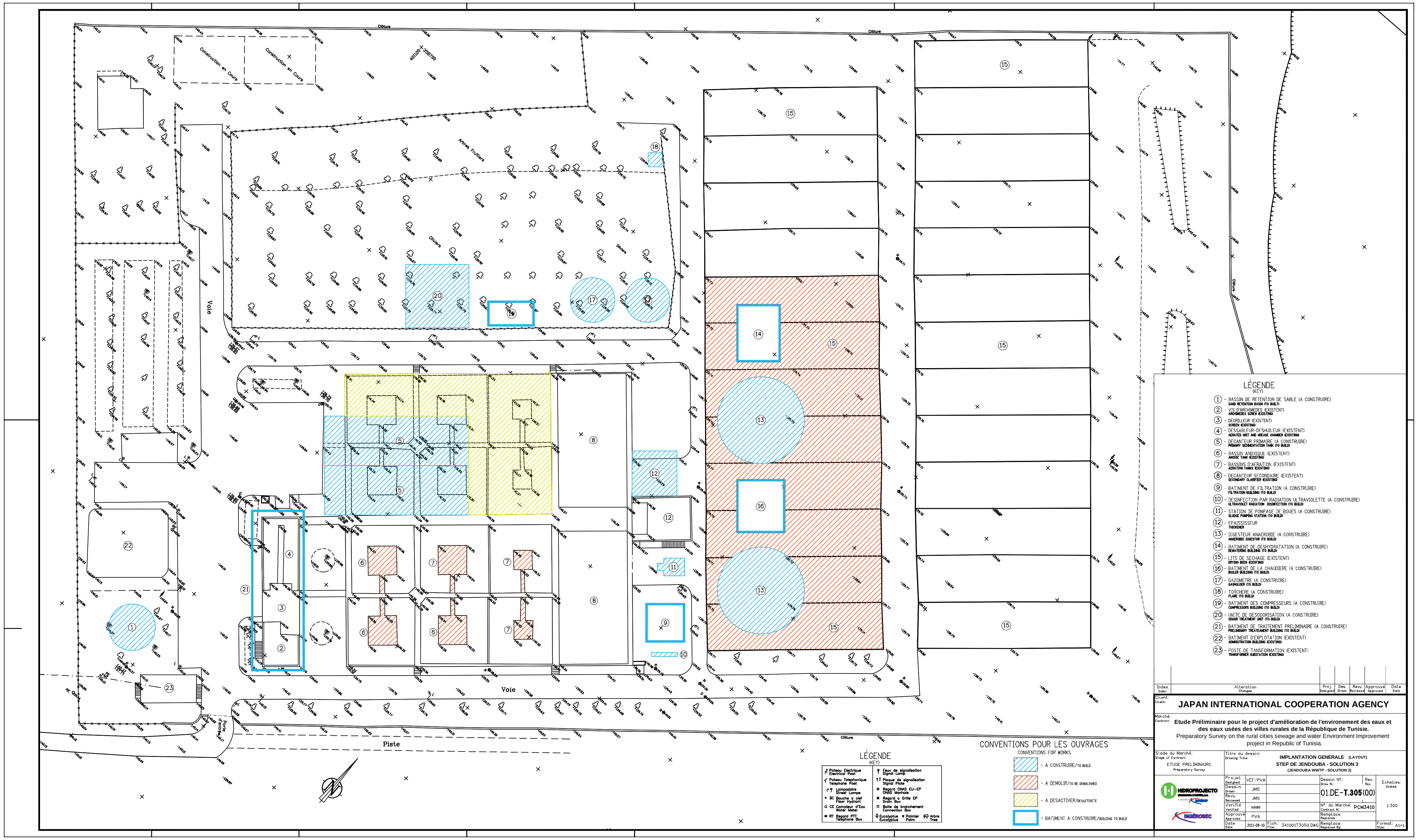
Clôture
Voie
Voie
Piste
LÉGENDE
(KEY)
Poteau Electrique Electrical Post
Poteau Telephonique Telephone Post
Lampadaire Street Lampe
BC Bouche a clef Floor Hydrant
CE Compteur d'Eau Water Meter
RT Regard PTT Telephone Box
Feux de signalisation Signal Lamp
Plaque de signalisation Signal Plate
Regard ONAS EU-EP ONAS Manhole
Regard a Grille EP Drain Box
Boite de branchement Connection Box
Eucalyptus Eucalyptus
Palmier Palm
Arbre Tree
CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR WORKS
- A CONSTRUIRE/TO BUILD
- A DEMOLIR/TO BE DEMOLISHED
- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
LÉGENDE
(KEY)
1 - BASSIN DE RETENTION DE SABLE (A CONSTRUIRE) SAND RETENTION BASIN (TO BUILT)
2 - VIS D'ARCHIMEDES (EXISTENT) ARCHIMEDES SCREW (EXISTING)
3 - DEGRILLEUR (EXISTENT) SCREEN (EXISTING)
4 - DESSABLEUR-DESHUILEUR (EXISTENT) AERATED GRIT AND GREASE CHAMBER (EXISTING)
5 - DECANTEUR PRIMAIRE (A CONSTRUIRE) PRIMARY SEDIMENTATION TANK (TO BUILD)
6 - BASSIN ANOXIQUE (EXISTENT) ANOXIC TANK (EXISTING)
7 - BASSINS D'AERATION (EXISTENT) AERATION TANKS (EXISTING)
8 - DECANTEUR SECONDAIRE (EXISTENT) SECONDARY CLARIFIER (EXISTING)
9 - BATIMENT DE FILTRATION (A CONSTRUIRE) FILTRATION BUILDING (TO BUILD)
10 - DESINFECTION PAR RADIATION ULTRAVIOLETTE (A CONSTRUIRE) ULTRAVIOLET RADIATION DISINFECTION (TO BUILD)
11 - STATION DE POMPAGE DE BOUES (A CONSTRUIRE) SLUDGE PUMPING STATION (TO BUILD)
12 - EPAISSISSEUR THICKENER
13 - DIGESTEUR ANAEROBIE (A CONSTRUIRE) ANAEROBIC DIGESTOR (TO BUILD)
14 - BATIMENT DE DESHYDRATATION (A CONSTRUIRE) DEWATERING BUILDING (TO BUILD)
15 - LITS DE SECHAGE (EXISTENT) DRYING BEDS (EXISTING)
16 - BATIMENT DE LA CHAUDIERE (A CONSTRUIRE) BOILER BUILDING (TO BUILD)
17 - GAZOMETRE (A CONSTRUIRE) GASHOLDER (TO BUILD)
18 - TORCHERE (A CONSTRUIRE) FLARE (TO BUILD)
19 - BATIMENT DES COMPRESSEURS (A CONSTRUIRE) COMPRESSORS BUILDING (TO BUILD)
20 - UNITE DE DESODORISATION (A CONSTRUIRE) ODOUR TREATMENT UNIT (TO BUILD)
21 - BATIMENT DE TRAITEMENT PRELIMINAIRE (A CONSTRUIRE) PRELIMINARY TREATEAMENT BUILDING (TO BUILD)
22 - BATIMENT D'EXPLOTATION (EXISTENT) ADMINISTRATION BUILDING (EXISTING)
23 - POSTE DE TANSFORMATION (EXISTENT) TRANSFORMER SUBSTATION (EXISTING)
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(JENDOUBA WWTP - SOLUTION 3)
HIDROPROJECTO
INGÉROSEC
Projet Designed VEF/PVA
Dessin Drawn JMS
Revu Reviewed JMS
Verifié Verified MMM
Approuvé Approved PVA
Date Date 2011-08-19
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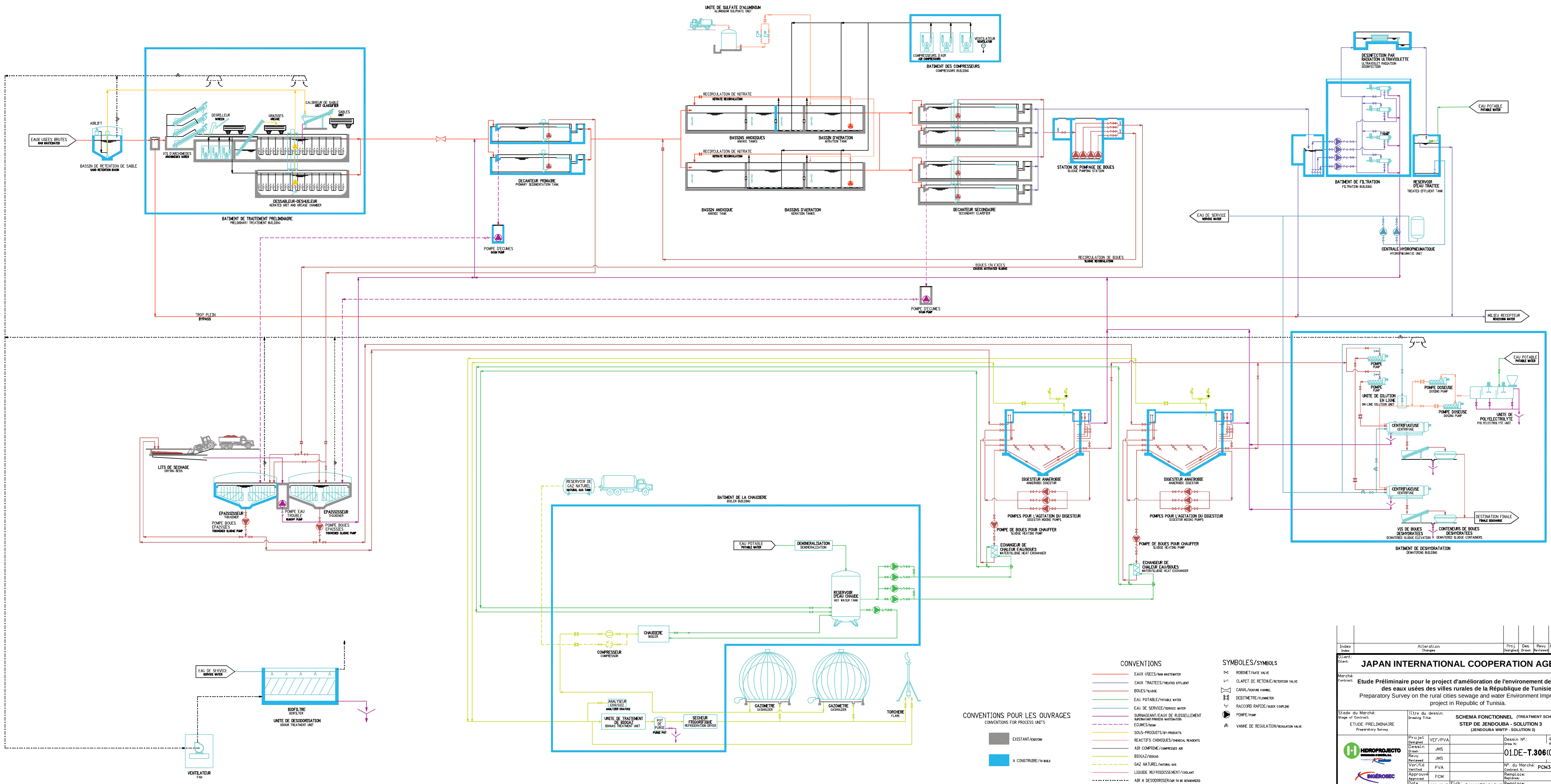

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Stade du Marché / Stage of Contract: ETUDE PRELIMINAIRE / Preparatory Survey

Títre du dessin / Drawing Title: **SCHEMA FONCTIONNEL (TREATMENT SCHEME)**
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(JENDOUBA WWTP - SOLUTION 3)

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Dessin / Drawn	JMS	
Revu / Reviewed	JMS	
Verifié / Verified	PVA	
Approuvé / Approved	PCM	
Date / Date	2011-08-17	Fich. / File: 341001T3060.DWG

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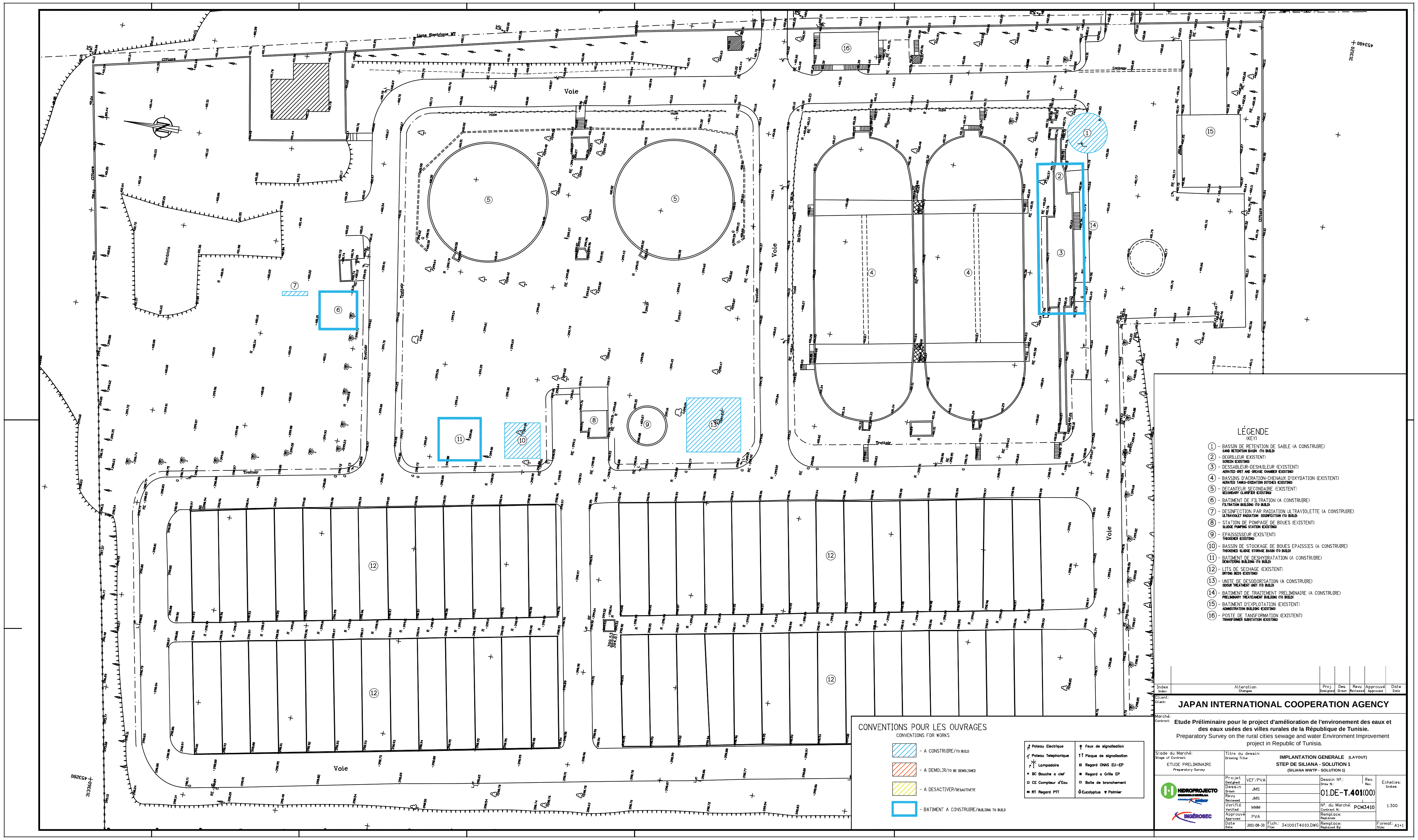
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Trottoir
Remblais
LÉGENDE
(KEY)
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SAND RETENTION BASIN (TO BUILD)
2 - DEGRILLEUR (EXISTENT)
SCREEN (EXISTING)
3 - DESSABLEUR-DESHUILEUR (EXISTENT)
AERATED GRIT AND GREASE CHAMBER (EXISTING)
4 - BASSINS D'AERATION-CHENAUX D'OXYDATION (EXISTENT)
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5 - DECANTEUR SECONDAIRE (EXISTENT)
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6 - BATIMENT DE FILTRATION (A CONSTRUIRE)
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8 - STATION DE POMPAGE DE BOUES (EXISTENT)
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9 - EPAISSISSEUR (EXISTENT)
THICKENER (EXISTING)
10 - BASSIN DE STOCKAGE DE BOUES EPAISSIES (A CONSTRUIRE)
THICKENED SLUDGE STORAGE BASIN (TO BUILD)
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- A DESACTIVER/DESACTIVETE
- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
Poteau Electrique
Poteau Telephonique
Lampadaire
BC Bouche a clef
CE Compteur d'Eau
RT Regard PTT
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Plaque de signalisation
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INGÉROSEC
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Dessin Drawn JMS
Revu Reviewed JMS
Verifié Verified MMM
Approuvé Approved PVA
Date Date 2011-08-30
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Rev. Rev. (00)
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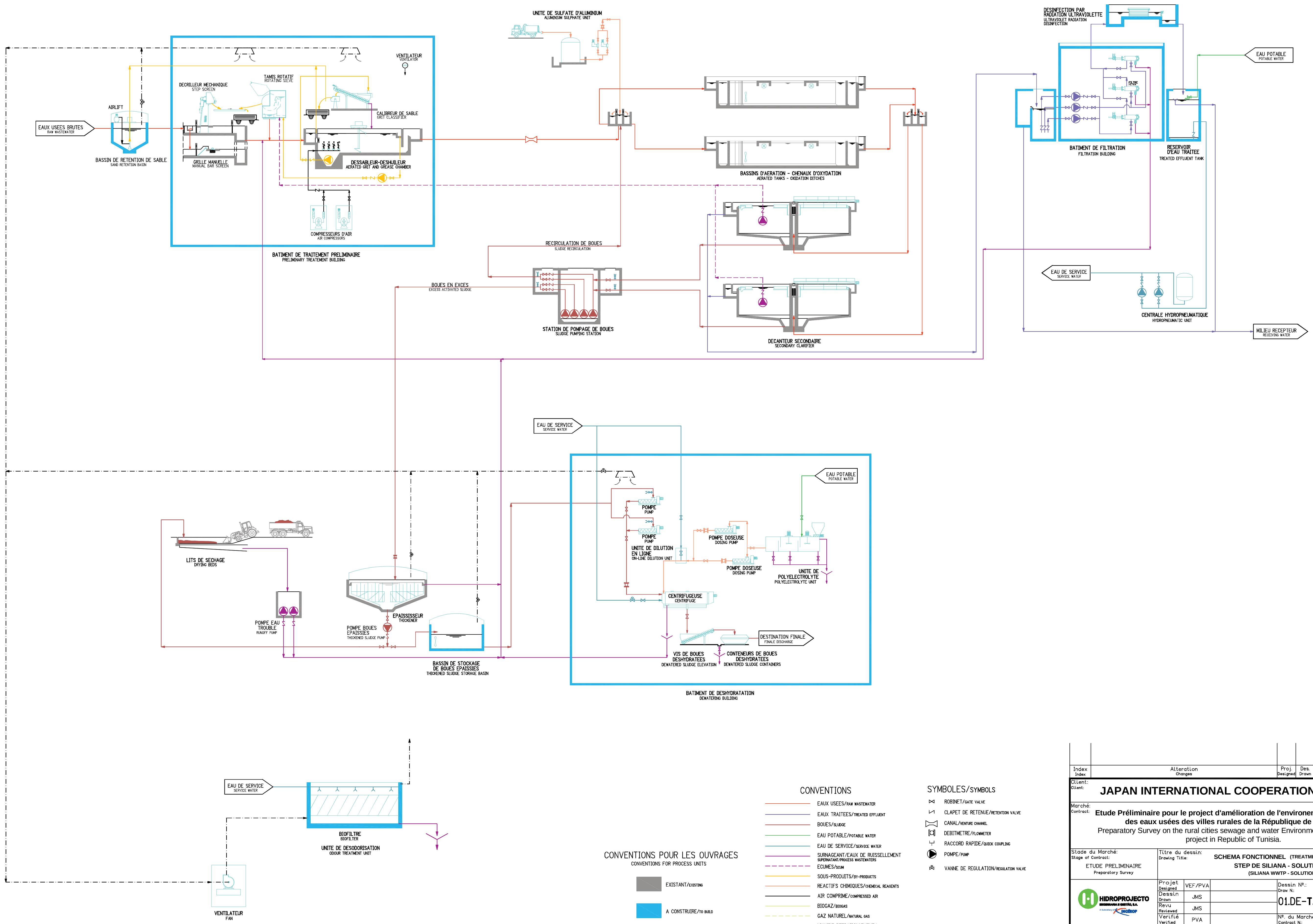

CONVENTIONS POUR LES OUVRAGES
CONVENTIONS FOR PROCESS UNITS

EXISTANT/EXISTING
A CONSTRUIRE/TO BUILD

CONVENTIONS

EAUX USEES/RAW WASTEWATER
EAUX TRAITEES/TREATED EFFLUENT
BOUES/SLUDGE
EAU POTABLE/POTABLE WATER
EAU DE SERVICE/SERVICE WATER
SURNAGEANT/EAUX DE RUISSELLEMENT
SUPERNATANT/PROCESS WASTEWATERS
ECUMES/SCUM
SOUS-PRODUITS/BY-PRODUCTS
REACTIFS CHIMIQUES/CHEMICAL REAGENTS
AIR COMPRIME/COMPRESSED AIR
BIOGAZ/BIOGAS
GAZ NATUREL/NATURAL GAS
LIQUIDE REFROIDISSEMENT/COOLANT
AIR A DESODORISER/AIR TO BE DESODORIZED

SYMBOLES/SYMBOLS

ROBINET/GATE VALVE
CLAPET DE RETENUE/RETENTION VALVE
CANAL/VENTURI CHANNEL
DEBITMETRE/FLOWMETER
RACCORD RAPIDE/QUICK COUPLING
POMPE/PUMP
VANNE DE REGULATION/REGULATION VALVE

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Preparatory Survey on the rural cities sewage and water Environment Improvement project in Republic of Tunisia.

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SCHEMA FONCTIONNEL (TREATMENT SCHEME)
STEP DE SILIANA - SOLUTION 1
(SILIANA WWTP - SOLUTION 1)

HIDROPROJECTO ENGENHARIA E GESTÃO, S.A.
A Subsidiary of INGÉROP
INGÉROSEC

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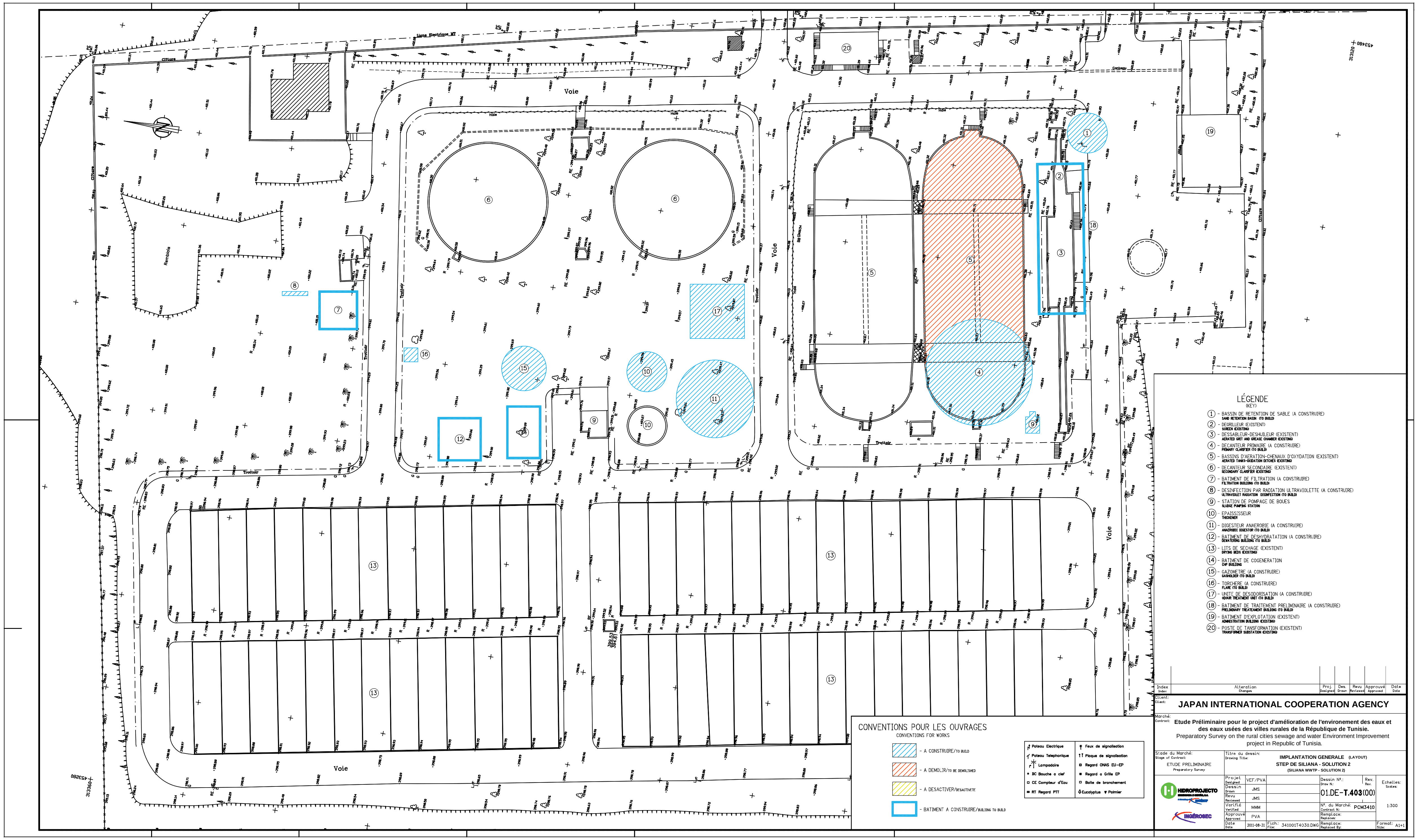
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9 - STATION DE POMPAGE DE BOUES
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10 - EPAISSISSEUR
THICKENER
11 - DIGESTEUR ANAEROBIE (A CONSTRUIRE)
ANAEROBIC DIGESTOR (TO BUILD)
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13 - LITS DE SECHAGE (EXISTENT)
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19 - BATIMENT D'EXPLOTATION (EXISTENT)
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20 - POSTE DE TANSFORMATION (EXISTENT)
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- BATIMENT A CONSTRUIRE/BUILDING TO BUILD
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Poteau Telephonique
Lampadaire
BC Bouche a clef
CE Compteur d'Eau
RT Regard PTT
Feux de signalisation
Plaque de signalisation
Regard ONAS EU-EP
Regard a Grille EP
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INGÉROSEC
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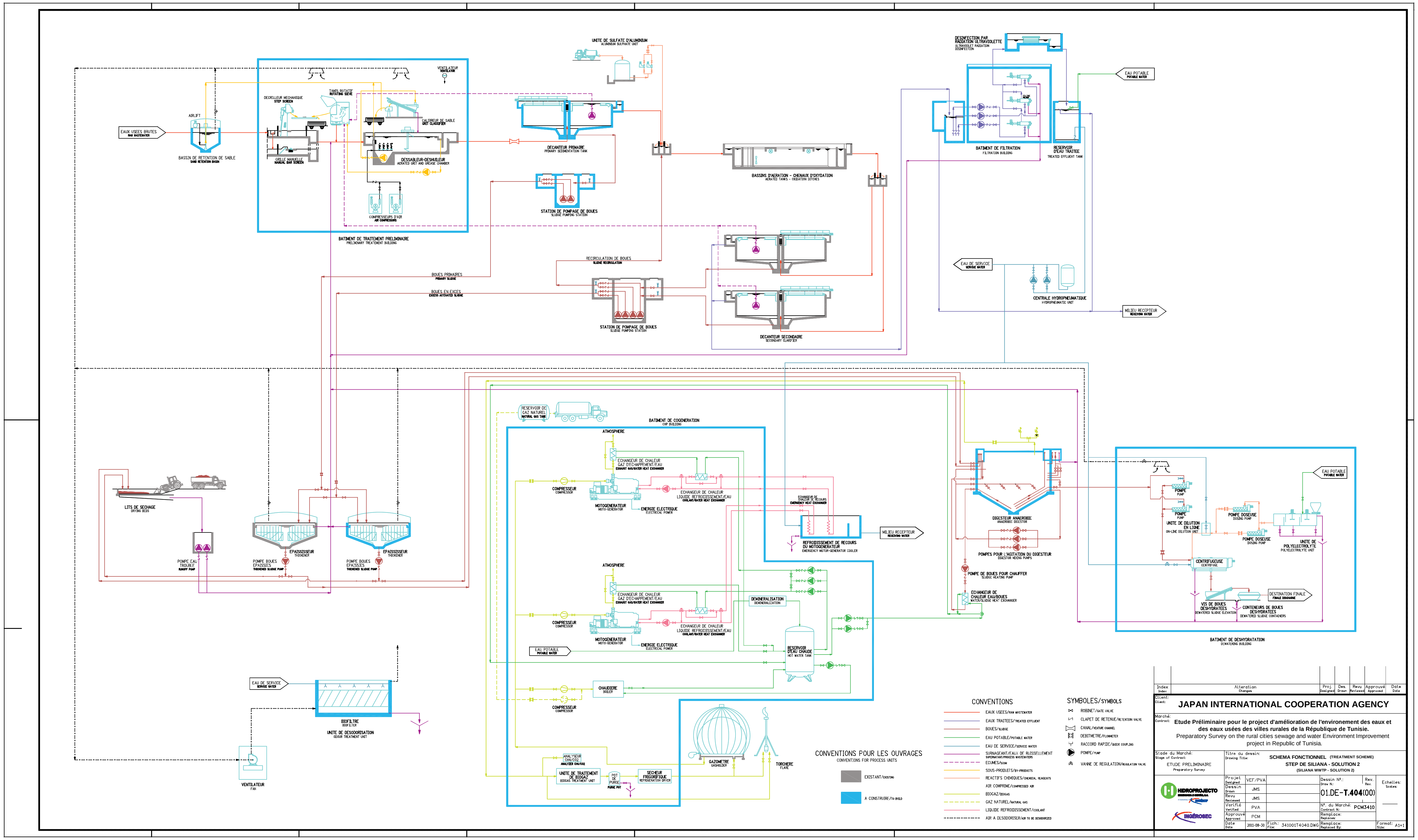
EAUX USEES BRUTES
BASSIN DE RETENTION DE SABLE
BATIMENT DE TRAITEMENT PRELIMINAIRE
DESSABLEUR-DESHUILEUR
COMPRESSEURS D'AIR
UNITE DE SULFATE D'ALUMINIUM
DECANTEUR PRIMAIRE
STATION DE POMPAGE DE BOUES
BASSINS D'AERATION - CHENAUX D'OXYDATION
BOUES PRIMAIRES
BOUES EN EXCES
RECIRCULATION DE BOUES
DECANTEUR SECONDAIRE
DESINFECTION PAR RADIATION ULTRAVIOLETTE
BATIMENT DE FILTRATION
RESERVOIR D'EAU TRAITEE
EAU POTABLE
EAU DE SERVICE
CENTRALE HYDROPNEUMATIQUE
MILIEU RECEPTEUR
LITS DE SECHAGE
EPAISSISSEUR
RESERVOIR DE GAZ NATUREL
BATIMENT DE COGENERATION
ATMOSPHERE
MOTOGENERATEUR
COMPRESSEUR
ENERGIE ELECTRIQUE
DEMINERALISATION
RESERVOIR D'EAU CHAUDE
CHAUDIERE
GAZOMETRE
TORCHERE
DIGESTEUR ANAEROBIE
BATIMENT DE DESHYDRATATION
CENTRIFUGEUSE
UNITE DE POLYELECTROLYTE
DESTINATION FINALE
BIOFILTRE
UNITE DE DESODORISATION
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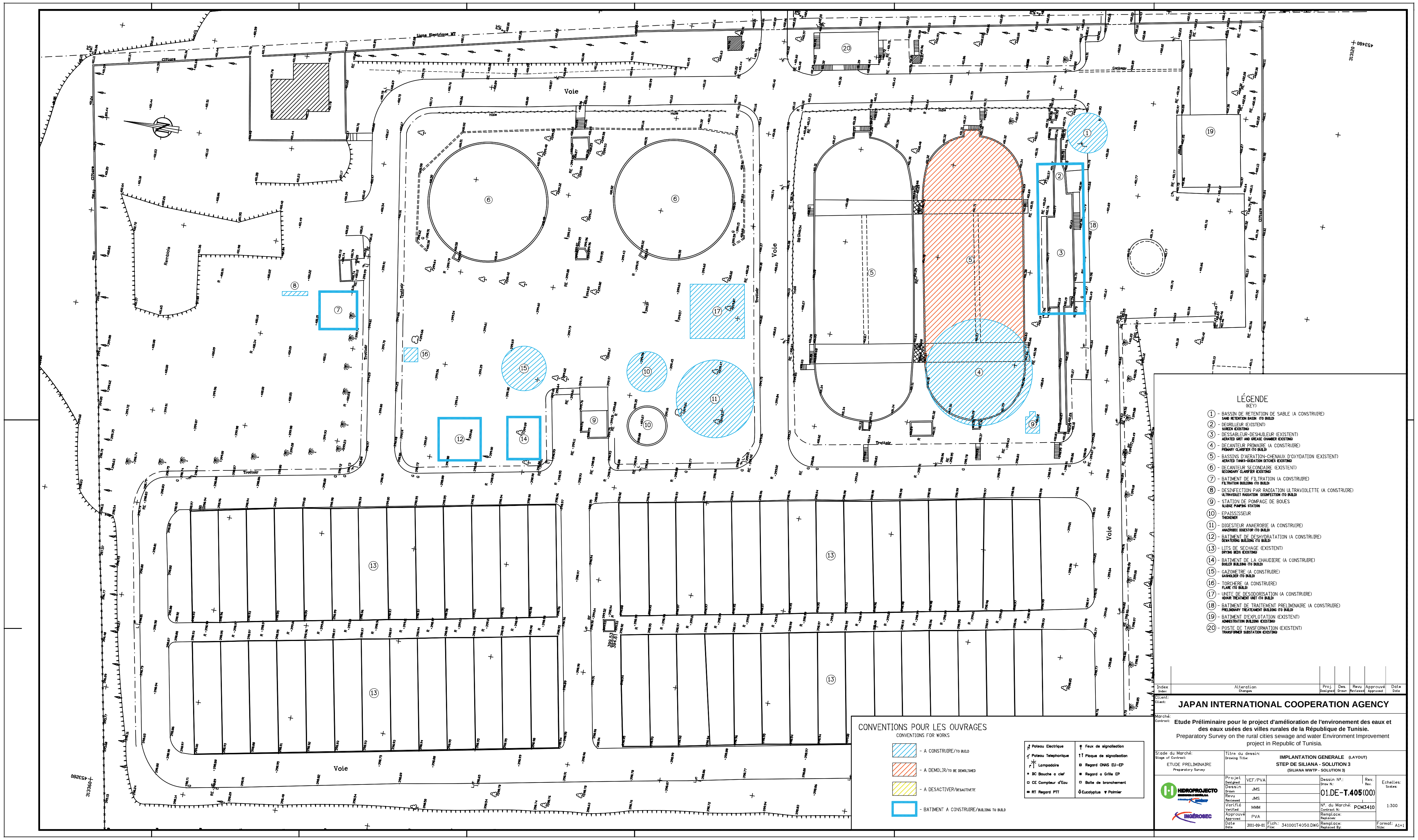

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LÉGENDE
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1 - BASSIN DE RETENTION DE SABLE (A CONSTRUIRE) SAND RETENTION BASIN (TO BUILD)
2 - DEGRILLEUR (EXISTENT) SCREEN (EXISTING)
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Poteau Telephonique
Lampadaire
BC Bouche a clef
CE Compteur d'Eau
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Feux de signalisation
Plaque de signalisation
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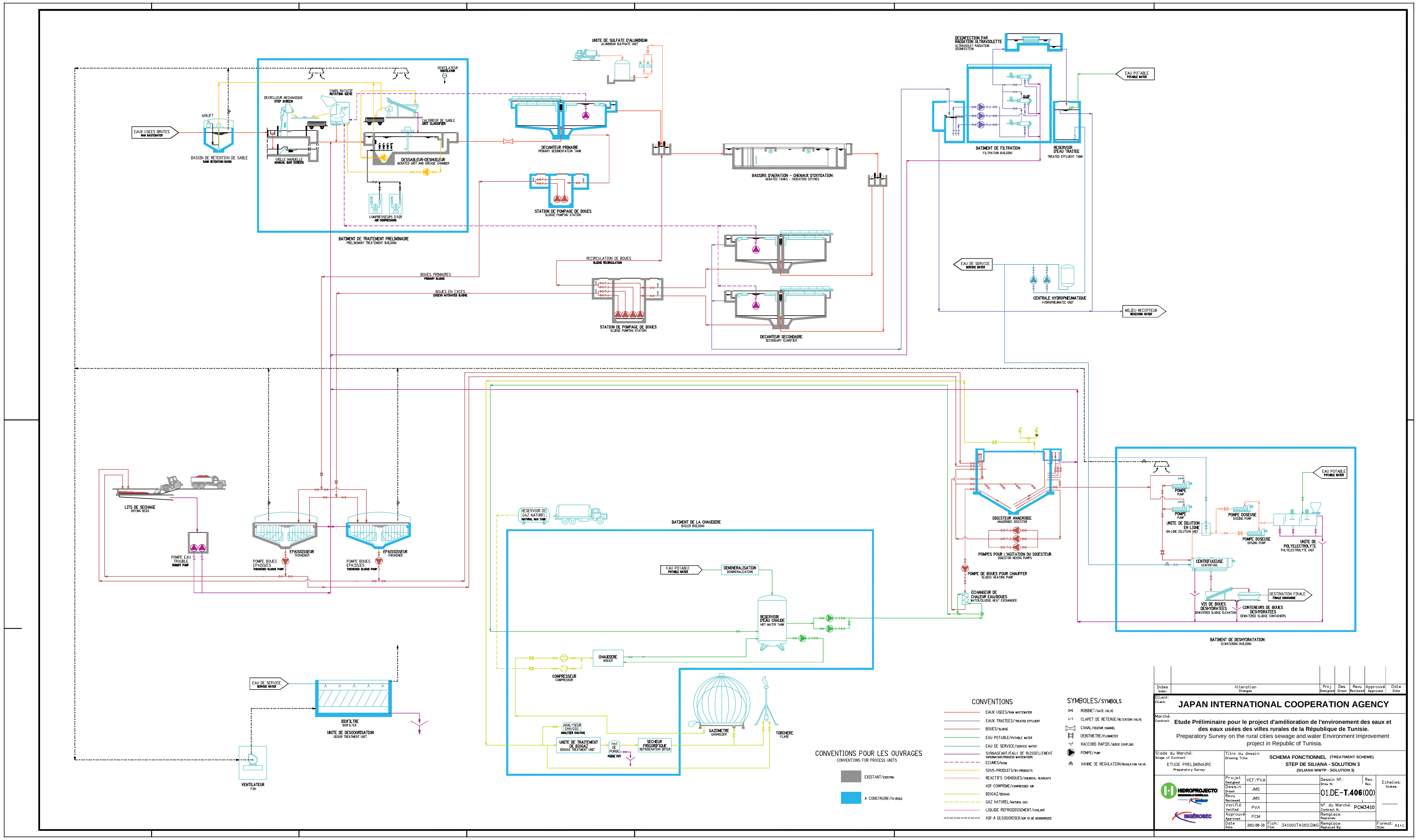

EAUX USEES BRUTES
BASSIN DE RETENTION DE SABLE
AIRLIFT
DEGRILLEUR MECANIQUE
TAMIS ROTATIF
GRILLE MANUELLE
CLASSIFICATEUR DE SABLE
DESSABLEUR-DESHUILEUR
COMPRESSEURS D'AIR
BATIMENT DE TRAITEMENT PRELIMINAIRE
VENTILATEUR
UNITE DE SULFATE D'ALUMINIUM
DECANTEUR PRIMAIRE
STATION DE POMPAGE DE BOUES
BASSINS D'AERATION - CHENAUX D'OXYDATION
DESINFECTION PAR RADIATION ULTRAVIOLETTE
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BOUES PRIMAIRES
BOUES EN EXCES
STATION DE POMPAGE DE BOUES
DECANTEUR SECONDAIRE
LITS DE SECHAGE
POMPE EAU TROUBLE
EPAISSISSEUR
POMPE BOUES EPAISSIES
RESERVOIR DE GAZ NATUREL
BATIMENT DE LA CHAUDIERE
DEMINERALISATION
RESERVOIR D'EAU CHAUDE
CHAUDIERE
COMPRESSEUR
ANALYSEUR CH4/CO2
UNITE DE TRAITEMENT DE BIOGAZ
POT DE PURGE
SECHEUR FRIGORIFIQUE
GAZOMETRE
TORCHERE
DIGESTEUR ANAEROBIE
POMPES POUR L'AGITATION DU DIGESTEUR
POMPE DE BOUES POUR CHAUFFER
ECHANGEUR DE CHALEUR EAU/BOUES
POMPE
UNITE DE DILUTION EN LIGNE
POMPE DOSEUSE
UNITE DE POLYELECTROLYTE
CENTRIFUGEUSE
DESTINATION FINALE
VIS DE BOUES DESHYDRATEES
CONTENEURS DE BOUES DESHYDRATEES
BATIMENT DE DESHYDRATATION
BIOFILTRE
UNITE DE DESODORISATION
VENTILATEUR
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INGÉROSEC
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Annex-III.8

Tables of costs

BEJA WWTP

Table III.8.1.1 - Investment cost

	Treatment stages	Solution 1			Solution 2			Solution 3		
		Civil works	Electrical and mechanical equipments	Total (TND)	Civil works	Electrical and mechanical equipments	Total (TND)	Civil works	Electrical and mechanical equipments	Total (TND)
1	***Liquid phase treatment***									
1.0	Yeast wastewater's pretreatment	0	0	0	0	0	0	216 732	69,666	286,398
1.1	Preliminary treatment	372,276	340,631	712,907	372,276	340,631	712,907	372,276	340,631	712,907
1.2	Primary treatment	0	0	0	606,102	182,051	788,153	0	0	0
1.3	Biological treatment	587,355	1,148,361	1,735,715	208,224	524,982	733,207	309,827	742,806	1,052,633
1.3.1	Biological reactors	438,276	712,386	1,150,662	142,570	277,913	420,482	244,173	484,469	728,642
1.3.2	Secondary clarifiers	149,078	435,975	585,054	65,655	247,070	312,724	65,655	258,337	323,991
1.4	Tertiary treatment	104 353	595 874	700 226	104 353	529 001	633 354	104 353	567 730	672 083
1.4.1	Biological nitrogen removal	0	140 717	140 717	0	73 844	73 844	0	112 573	112 573
1.4.2	Chemical phosphorus removal	0	38 964	38 964	0	38 964	38 964	0	38 964	38 964
1.4.3	Disinfection	104 353	416 193	520 546	104 353	416 193	520 546	104 353	416 193	520 546
2	***Solid phase treatment***									
2.1	Thickening	126,882	151,678	278,560	52,184	306,455	358,639	126,882	151,678	278,560
2.2	Digestion	0	0	0	781,942	1,062,405	1,844,347	0	0	0
2.3	Cogeneration	0	0	0	41,155	2,735,241	2,776,396	0	0	0
2.4	Sludge dewatering	164,820	447,336	612,156	164,820	447,336	612,156	164,820	447,336	612,156
3	***Odour control***									
3.1	Deodorisation	121 710	133 792	255 503	121 710	133 792	255 503	121 710	133 792	255 503
4	***Miscellaneous***									
4.1	Landscaping	264,794	0	264,794	302,622	0	302,622	264,794	0	264,794
4.2	Site and preliminary works	576 209	0	576 209	658 525	0	658 525	617 367	0	617 367
4.3	Electrical equipments, instrumentation, automation and control	8 479	2621 683	2630 162	8 479	3084 333	3092 812	8 479	2621 683	2630 162
	TOTAL	2,326,879	5,883,472	8,231,851	3,422,392	9,811,845	13,234,237	2,307,241	5,540,939	7,848,180

BEJA WWTP

Table III.8.1.2- Total costs estimation (present value) - Solution 1

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011	#REF!	2,278,935	0	0	0	0
2012	#REF!	2,415,826	0	0	0	0
2013	#REF!	2,552,718	0	0	0	0
2014	#REF!	2,689,609	0	0	0	0
2015	#REF!	2,826,501	0	0	0	0
2016	1.000	2,963,393	7,766,234	0	7,766,234	7,766,234
2017	0.971	3,100,284	0	0	0	0
2018	0.943	3,237,176	0	0	0	0
2019	0.915	3,374,067	0	2,092,524	2,092,524	1,914,956
2020	0.888	3,510,959	0	2,146,151	2,146,151	1,906,828
2021	0.863	3,647,850	0	2,199,779	2,199,779	1,897,549
2022	0.837	3,784,742	0	2,253,406	2,253,406	1,887,192
2023	0.813	3,921,634	0	2,307,034	2,307,034	1,875,830
2024	0.789	4,058,525	0	2,360,662	2,360,662	1,863,528
2025	0.766	4,195,417	0	2,414,289	2,414,289	1,850,352
2026	0.744	4,332,308	0	2,467,917	2,467,917	1,836,362
2027	0.722	4,469,200	0	2,521,544	2,521,544	1,821,617
2028	0.701	4,606,091	0	2,575,172	2,575,172	1,806,174
2029	0.681	4,742,983	0	2,628,799	2,628,799	1,790,084
	TOTAL	66,708,217	7,766,234	25,967,277	33,733,511	**28,216,704**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

Table III.8.1.3- Total costs estimation (present value) - Solution 2

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011	#REF!	2,278,935	0	0	0	0
2012	#REF!	2,415,826	0	0	0	0
2013	#REF!	2,552,718	0	0	0	0
2014	#REF!	2,689,609	0	0	0	0
2015	#REF!	2,826,501	0	0	0	0
2016	1.000	2,963,393	12,768,620	0	12,768,620	12,768,620
2017	0.971	3,100,284	0	0	0	0
2018	0.943	3,237,176	0	0	0	0
2019	0.915	3,374,067	0	1,941,655	1,941,655	1,776,889
2020	0.888	3,510,959	0	1,982,707	1,982,707	1,761,609
2021	0.863	3,647,850	0	2,023,759	2,023,759	1,745,712
2022	0.837	3,784,742	0	2,064,810	2,064,810	1,729,246
2023	0.813	3,921,634	0	2,105,862	2,105,862	1,712,259
2024	0.789	4,058,525	0	2,146,914	2,146,914	1,694,794
2025	0.766	4,195,417	0	2,187,965	2,187,965	1,676,893
2026	0.744	4,332,308	0	2,229,017	2,229,017	1,658,598
2027	0.722	4,469,200	0	2,270,069	2,270,069	1,639,946
2028	0.701	4,606,091	0	2,311,121	2,311,121	1,620,974
2029	0.681	4,742,983	0	2,352,172	2,352,172	1,601,715
	TOTAL	66,708,217	12,768,620	23,616,051	36,384,671	**31,387,255**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

Table III.8.1.4 - Total costs estimation (present value) - Solution 3

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011	#REF!	2,278,935	0	0	0	0
2012	#REF!	2,415,826	0	0	0	0
2013	#REF!	2,552,718	0	0	0	0
2014	#REF!	2,689,609	0	0	0	0
2015	#REF!	2,826,501	0	0	0	0
2016	1.000	2,963,393	7,382,563	0	7,382,563	7,382,563
2017	0.971	3,100,284	0	0	0	0
2018	0.943	3,237,176	0	0	0	0
2019	0.915	3,374,067	0	1,983,641	1,983,641	1,815,313
2020	0.888	3,510,959	0	2,033,219	2,033,219	1,806,488
2021	0.863	3,647,850	0	2,082,796	2,082,796	1,796,638
2022	0.837	3,784,742	0	2,132,374	2,132,374	1,785,830
2023	0.813	3,921,634	0	2,181,951	2,181,951	1,774,126
2024	0.789	4,058,525	0	2,231,529	2,231,529	1,761,590
2025	0.766	4,195,417	0	2,281,107	2,281,107	1,748,278
2026	0.744	4,332,308	0	2,330,684	2,330,684	1,734,248
2027	0.722	4,469,200	0	2,380,262	2,380,262	1,719,552
2028	0.701	4,606,091	0	2,429,839	2,429,839	1,704,240
2029	0.681	4,742,983	0	2,479,417	2,479,417	1,688,362
	TOTAL	66,708,217	7,382,563	24,546,819	31,929,383	**26,717,229**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

MEDJEZ EL-BAB WWTP

Table III.8.2.1 - Investment cost

Treatment stages		Solution 1			Solution 2			Solution 3		
		Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total
1	***Liquid phase treatment***									
1.1	Preliminary treatment	239,048	363,821	602,869	239,048	363,821	602,869	239,048	363,821	602,869
1.2	Primary treatment	0	0	0	359,611	148,955	508,566	359,611	148,955	508,566
1.3	Biological treatment	124,526	365,230	489,756	113,964	253,032	366,995	106,335	253,032	359,367
1.3.1	Biological reactors	79,680	242,235	321,914	69,117	130,037	199,154	61,488	130,037	191,525
1.3.2	Secondary clarifiers	44,847	122,995	167,842	44,847	122,995	167,842	44,847	122,995	167,842
1.4	Tertiary treatment	36 033	303 972	340 004	36 033	284 607	320 639	36 033	284 607	320 639
1.4.1	Biological nitrogen removal	0	56 287	56 287	0	36 922	36 922	0	36 922	36 922
1.4.2	Chemical phosphorus removal	0	21 125	21 125	0	21 125	21 125	0	21 125	21 125
1.4.3	Disinfection	36 033	226 560	262 592	36 033	226 560	262 592	36 033	226 560	262 592
2	***Solid phase treatment***									
2.1	Thickening	37,196	27,322	64,518	26,092	95,485	121,578	26,092	95,485	121,578
2.2	Digestion	0	0	0	250,986	660,676	911,662	250,986	660,676	911,662
2.3	Cogeneration	0	0	0	13,210	1,272,454	1,285,664	0	0	0
2.4	Sludge dewatering	117,134	204,209	321,343	117,134	204,726	321,859	117,134	204,726	321,859
3	***Odour control***									
3.1	Deodorisation	39 299	102 574	141 873	39 299	102 574	141 873	39 299	102 574	141 873
4	***Miscellaneous***									
4.1	Landscaping	166,468	0	166,468	166,468	0	166,468	166,468	0	166,468
4.2	Site and preliminary works	270 015	0	270 015	270 015	0	270 015	270 015	0	270 015
4.3	Electrical equipments, instrumentation, automation and control	2 203	1394 166	1396 369	2 203	1742 708	1744 911	2 203	1568 437	1570 640
	TOTAL	1,031,921	3,089,487	4,121,408	1,634,061	5,457,232	7,091,293	1,613,223	4,010,507	5,623,729

Table III.8.2.2- Total costs estimation (present value) - Solution 1

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011	0.000	872,846	0	0	0	0
2012	0.000	934,434	0	0	0	0
2013	0.000	996,022	0	0	0	0
2014	0.000	1,057,609	0	0	0	0
2015	0.000	1,119,197	0	0	0	0
2016	1.000	1,180,785	3,793,215	0	3,793,215	3,793,215
2017	0.971	1,242,373	0	0	0	0
2018	0.943	1,303,961	0	0	0	0
2019	0.915	1,365,549	0	819,511	819,511	749,969
2020	0.888	1,427,137	0	843,105	843,105	749,088
2021	0.863	1,488,725	0	866,698	866,698	747,622
2022	0.837	1,550,313	0	890,292	890,292	745,605
2023	0.813	1,611,901	0	913,885	913,885	743,073
2024	0.789	1,673,489	0	937,479	937,479	740,055
2025	0.766	1,735,077	0	961,073	961,073	736,582
2026	0.744	1,796,665	0	984,666	984,666	732,684
2027	0.722	1,858,253	0	1,008,260	1,008,260	728,388
2028	0.701	1,919,841	0	1,031,853	1,031,853	723,721
2029	0.681	1,981,429	0	1,055,447	1,055,447	718,708
	TOTAL	27,115,607	3,793,215	10,312,270	14,105,484	**11,908,709**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

MEDJEZ EL-BAB WWTP

Table III.8.2.3- Total costs estimation (present value) - Solution 2

Year	**DF**	**Q**	**FIC**	**OC**	**TC**	**TDC = RTA** (1)
	-	m^3/year	TND	TND	TND	TND
2011	0.000	872,846	0	0	0	0
2012	0.000	934,434	0	0	0	0
2013	0.000	996,022	0	0	0	0
2014	0.000	1,057,609	0	0	0	0
2015	0.000	1,119,197	0	0	0	0
2016	1.000	1,180,785	6,763,100	0	6,763,100	6,763,100
2017	0.971	1,242,373	0	0	0	0
2018	0.943	1,303,961	0	0	0	0
2019	0.915	1,365,549	0	795,858	795,858	728,323
2020	0.888	1,427,137	0	814,860	814,860	723,993
2021	0.863	1,488,725	0	833,863	833,863	719,297
2022	0.837	1,550,313	0	852,865	852,865	714,261
2023	0.813	1,611,901	0	871,867	871,867	708,908
2024	0.789	1,673,489	0	890,869	890,869	703,261
2025	0.766	1,735,077	0	909,872	909,872	697,341
2026	0.744	1,796,665	0	928,874	928,874	691,169
2027	0.722	1,858,253	0	947,876	947,876	684,766
2028	0.701	1,919,841	0	966,878	966,878	678,149
2029	0.681	1,981,429	0	985,881	985,881	671,337
	TOTAL	27,115,607	6,763,100	9,799,563	16,562,663	**14,483,904**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

(1) Pour IRT=3%; NAV=0

MEDJEZ EL-BAB WWTP

Table III.8.2.4 - Total costs estimation (present value) - Solution 3

Year	DF	Q	FIC	OC	TC	TDC = RTA (1)
	-	m^3/year	TND	TND	TND	TND
2011	0.000	872,846	0	0	0	0
2012	0.000	934,434	0	0	0	0
2013	0.000	996,022	0	0	0	0
2014	0.000	1,057,609	0	0	0	0
2015	0.000	1,119,197	0	0	0	0
2016	1.000	1,180,785	5,295,536	0	5,295,536	5,295,536
2017	0.971	1,242,373	0	0	0	0
2018	0.943	1,303,961	0	0	0	0
2019	0.915	1,365,549	0	862,474	862,474	789,286
2020	0.888	1,427,137	0	886,122	886,122	787,308
2021	0.863	1,488,725	0	909,769	909,769	784,775
2022	0.837	1,550,313	0	933,416	933,416	781,722
2023	0.813	1,611,901	0	957,064	957,064	778,180
2024	0.789	1,673,489	0	980,711	980,711	774,182
2025	0.766	1,735,077	0	1,004,358	1,004,358	769,757
2026	0.744	1,796,665	0	1,028,006	1,028,006	764,933
2027	0.722	1,858,253	0	1,051,653	1,051,653	759,737
2028	0.701	1,919,841	0	1,075,300	1,075,300	754,194
2029	0.681	1,981,429	0	1,098,948	1,098,948	748,330
	TOTAL	27,115,607	5,295,536	10,787,821	16,083,358	**13,787,939**

(1) Pour IRT=3%; NAV=0

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

TABARKA WWTP

Table III.8.3.1 - Investment cost

Treatment stages		Solution 1			Solution 2			Solution 3		
		Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total
1	***Liquid phase treatment***									
1.1	Preliminary treatment	218,021	192,473	410,494	357,858	331,899	689,757	357,858	331,899	689,757
1.2	Primary treatment	0	0	0	414,611	159,987	574,599	414,611	159,987	574,599
1.3	Biological treatment	523,830	696,025	1,219,855	182,129	504,491	686,621	182,129	504,491	686,621
1.3.1	Biological reactors	386,653	291,996	678,649	44,953	188,718	233,671	44,953	188,718	233,671
1.3.2	Secondary clarifiers	137,176	404,029	541,206	137,176	315,773	452,950	137,176	315,773	452,950
1.4	Tertiary treatment	39 471	316 637	356 108	39 471	291 592	331 063	39 471	291 592	331 063
1.4.1	Biological nitrogen removal	0	65 065	65 065	0	40 020	40 020	0	40 020	40 020
1.4.2	Chemical phosphorus removal	0	21 125	21 125	0	21 125	21 125	0	21 125	21 125
1.4.3	Disinfection	39 471	230 447	269 917	39 471	230 447	269 917	39 471	230 447	269 917
2	***Solid phase treatment***									
2.1	Thickening	74,298	103,936	178,234	52,822	95,485	148,308	52,822	95,485	148,308
2.2	Digestion	0	0	0	272,176	667,248	939,425	272,176	667,248	939,425
2.3	Cogeneration	0	0	0	14,325	1,345,341	1,359,666	0	0	0
2.4	Sludge dewatering	118,968	195,431	314,399	118,968	195,689	314,657	118,968	195,689	314,657
3	***Odour control***									
3.1	Deodorisation	43 046	115 953	158 999	43 046	150 739	193 785	43 046	150 739	193 785
4	***Miscellaneous***									
4.1	Landscaping	172,326	0	172,326	172,326	0	172,326	172,326	0	172,326
4.2	Site and preliminary works	515 820	0	515 820	515 820	0	515 820	515 820	0	515 820
4.3	Electrical equipments, instrumentation, automation and control	2 394	1454 109	1456 503	2 394	1817 637	1820 030	2 394	1635 873	1638 267
	TOTAL	1,708,172	3,199,741	4,907,913	2,185,946	5,685,285	7,871,231	2,171,621	4,158,181	6,329,802

Table III.8.3.2- Total costs estimation (present value) - Solution 1

Year	DF -	Q m^3/year	FIC TND	OC TND	TC TND	TDC = RTA [1] TND
2011		1,639,250	0	0	0	0
2012		1,720,752	0	0	0	0
2013		1,802,254	0	0	0	0
2014		1,883,756	0	0	0	0
2015		1,965,258	0	0	0	0
2016	1.000	2,046,761	4,782,737	0	4,782,737	4,782,737
2017	0.971	2,128,263	0	0	0	0
2018	0.943	2,209,765	0	0	0	0
2019	0.915	2,291,267	0	821,725	821,725	751,995
2020	0.888	2,372,769	0	841,283	841,283	747,469
2021	0.863	2,454,271	0	860,841	860,841	742,569
2022	0.837	2,535,774	0	880,399	880,399	737,320
2023	0.813	2,617,276	0	899,956	899,956	731,747
2024	0.789	2,698,778	0	919,514	919,514	725,873
2025	0.766	2,780,280	0	939,072	939,072	719,720
2026	0.744	2,861,782	0	958,630	958,630	713,311
2027	0.722	2,943,284	0	978,188	978,188	706,664
2028	0.701	3,024,787	0	997,745	997,745	699,799
2029	0.681	3,106,289	0	1,017,303	1,017,303	692,734
	TOTAL	45,082,615	4,782,737	10,114,656	14,897,393	**12,751,937**

[1] Pour IRT=3%; NAV=0

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

Table III.8.3.3- Total costs estimation (present value) - Solution 2

Year	**DF** -	**Q** m³/year	**FIC** TND	**OC** TND	**TC** TND	**TDC = RTA [1]** TND
2011		1,639,250	0	0	0	0
2012		1,720,752	0	0	0	0
2013		1,802,254	0	0	0	0
2014		1,883,756	0	0	0	0
2015		1,965,258	0	0	0	0
2016	1.000	2,046,761	7,746,055	0	7,746,055	7,746,055
2017	0.971	2,128,263	0	0	0	0
2018	0.943	2,209,765	0	0	0	0
2019	0.915	2,291,267	0	983,135	983,135	899,708
2020	0.888	2,372,769	0	1,004,548	1,004,548	892,528
2021	0.863	2,454,271	0	1,025,961	1,025,961	885,003
2022	0.837	2,535,774	0	1,047,373	1,047,373	877,159
2023	0.813	2,617,276	0	1,068,786	1,068,786	869,021
2024	0.789	2,698,778	0	1,090,198	1,090,198	860,613
2025	0.766	2,780,280	0	1,111,611	1,111,611	851,957
2026	0.744	2,861,782	0	1,133,024	1,133,024	843,076
2027	0.722	2,943,284	0	1,154,436	1,154,436	833,989
2028	0.701	3,024,787	0	1,175,849	1,175,849	824,717
2029	0.681	3,106,289	0	1,197,261	1,197,261	815,277
	TOTAL	45,082,615	7,746,055	11,992,182	19,738,237	**17,199,101**

[1] Pour IRT=3%; NAV=0

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

TABARKA WWTP

Table III.8.3.4 - Total costs estimation (present value) - Solution 3

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011		1,639,250	0	0	0	0
2012		1,720,752	0	0	0	0
2013		1,802,254	0	0	0	0
2014		1,883,756	0	0	0	0
2015		1,965,258	0	0	0	0
2016	1.000	2,046,761	6,204,626	0	6,204,626	6,204,626
2017	0.971	2,128,263	0	0	0	0
2018	0.943	2,209,765	0	0	0	0
2019	0.915	2,291,267	0	1,038,096	1,038,096	950,005
2020	0.888	2,372,769	0	1,062,827	1,062,827	944,308
2021	0.863	2,454,271	0	1,087,557	1,087,557	938,137
2022	0.837	2,535,774	0	1,112,288	1,112,288	931,524
2023	0.813	2,617,276	0	1,137,019	1,137,019	924,500
2024	0.789	2,698,778	0	1,161,749	1,161,749	917,096
2025	0.766	2,780,280	0	1,186,480	1,186,480	909,338
2026	0.744	2,861,782	0	1,211,211	1,211,211	901,255
2027	0.722	2,943,284	0	1,235,942	1,235,942	892,870
2028	0.701	3,024,787	0	1,260,672	1,260,672	884,210
2029	0.681	3,106,289	0	1,285,403	1,285,403	875,297
	TOTAL	45,082,615	6,204,626	12,779,244	18,983,870	**16,273,165**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

JENDOUBA WWTP

Table III.8.4.1 - Investment cost

Treatment stages		Solution 1			Solution 2			Solution 3		
		Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total
1	***Liquid phase treatment***									
1.1	Preliminary treatment	418,803	694,781	1,113,584	418,803	694,781	1,113,584	418,803	694,781	1,113,584
1.2	Primary treatment	0	0	0	572,464	171,019	743,484	572,464	171,019	743,484
1.3	Biological treatment	199,430	678,726	878,156	149,669	454,331	604,000	149,669	454,331	604,000
1.3.1	Biological reactors	139,657	484,469	624,126	89,896	260,074	349,969	89,896	260,074	349,969
1.3.2	Secondary clarifiers	59,774	194,257	254,031	59,774	194,257	254,031	59,774	194,257	254,031
1.4	Tertiary treatment	79 794	434 389	514 183	79 794	395 659	475 453	79 794	395 659	475 453
1.4.1	Biological nitrogen removal	0	112 573	112 573	0	73 844	73 844	0	73 844	73 844
1.4.2	Chemical phosphorus removal	0	38 964	38 964	0	38 964	38 964	0	38 964	38 964
1.4.3	Disinfection	79 794	282 851	362 645	79 794	282 851	362 645	79 794	282 851	362 645
2	***Solid phase treatment***									
2.1	Thickening	95,488	103,936	199,424	29,658	95,485	125,144	29,658	95,485	125,144
2.2	Digestion	0	0	0	568,397	943,053	1,511,450	568,397	943,053	1,511,450
2.3	Cogeneration	0	0	0	29,916	1,997,769	2,027,684	0	0	0
2.4	Sludge dewatering	145,327	337,532	482,860	145,327	342,039	487,366	145,327	342,039	487,366
3	***Odour control***									
3.1	Deodorisation	72 420	115 953	188 374	72 420	115 953	188 374	72 420	115 953	188 374
4	***Miscellaneous***									
4.1	Landscaping	279,737	0	279,737	279,737	0	279,737	279,737	0	279,737
4.2	Site and preliminary works	622 067	0	622 067	622 067	0	622 067	622 067	0	622 067
4.3	Electrical equipments, instrumentation, automation and control	5 654	2101 001	2106 655	5 654	2626 251	2631 905	5 654	2363 626	2369 280
	TOTAL	1,918,721	4,685,661	6,604,382	2,973,907	8,055,684	11,029,592	2,943,992	5,795,291	8,739,282

Table III.8.4.2- Total costs estimation (present value) - Solution 1

Year	DF	Q	FIC	OC	TC	TDC = RTA [(1)]
	-	m^3/year	TND	TND	TND	TND
2011		1,869,966	0	0	0	0
2012		2,003,381	0	0	0	0
2013		2,136,797	0	0	0	0
2014		2,270,212	0	0	0	0
2015		2,403,628	0	0	0	0
2016	1.000	2,537,043	6,385,039	0	6,385,039	6,385,039
2017	0.971	2,670,459	0	0	0	0
2018	0.943	2,803,874	0	0	0	0
2019	0.915	2,937,290	0	1,789,919	1,789,919	1,638,030
2020	0.888	3,070,705	0	1,840,121	1,840,121	1,634,924
2021	0.863	3,204,121	0	1,890,323	1,890,323	1,630,609
2022	0.837	3,337,536	0	1,940,524	1,940,524	1,625,158
2023	0.813	3,470,952	0	1,990,726	1,990,726	1,618,642
2024	0.789	3,604,367	0	2,040,928	2,040,928	1,611,127
2025	0.766	3,737,783	0	2,091,129	2,091,129	1,602,676
2026	0.744	3,871,198	0	2,141,331	2,141,331	1,593,351
2027	0.722	4,004,614	0	2,191,532	2,191,532	1,583,210
2028	0.701	4,138,029	0	2,241,734	2,241,734	1,572,307
2029	0.681	4,271,445	0	2,291,936	2,291,936	1,560,697
	TOTAL	58,343,401	6,385,039	22,450,203	28,835,242	**24,055,770**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[(1)] Pour IRT=3%; NAV=0

Table III.8.4.3- Total costs estimation (present value) - Solution 2

Year	DF	Q	FIC	OC	TC	TDC = RTA (1)
	-	m^3/year	TND	TND	TND	TND
2011		1,869,966	0	0	0	0
2012		2,003,381	0	0	0	0
2013		2,136,797	0	0	0	0
2014		2,270,212	0	0	0	0
2015		2,403,628	0	0	0	0
2016	1.000	2,537,043	10,810,249	0	10,810,249	10,810,249
2017	0.971	2,670,459	0	0	0	0
2018	0.943	2,803,874	0	0	0	0
2019	0.915	2,937,290	0	1,741,673	1,741,673	1,593,877
2020	0.888	3,070,705	0	1,783,963	1,783,963	1,585,028
2021	0.863	3,204,121	0	1,826,254	1,826,254	1,575,342
2022	0.837	3,337,536	0	1,868,544	1,868,544	1,564,876
2023	0.813	3,470,952	0	1,910,835	1,910,835	1,553,684
2024	0.789	3,604,367	0	1,953,125	1,953,125	1,541,815
2025	0.766	3,737,783	0	1,995,416	1,995,416	1,529,320
2026	0.744	3,871,198	0	2,037,706	2,037,706	1,516,245
2027	0.722	4,004,614	0	2,079,997	2,079,997	1,502,634
2028	0.701	4,138,029	0	2,122,288	2,122,288	1,488,530
2029	0.681	4,271,445	0	2,164,578	2,164,578	1,473,972
	TOTAL	58,343,401	10,810,249	21,484,379	32,294,628	**27,735,573**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

(1) Pour IRT=3%; NAV=0

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Table III.8.4.4 - Total costs estimation (present value) - Solution 3

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011		1,869,966	0	0	0	0
2012		2,003,381	0	0	0	0
2013		2,136,797	0	0	0	0
2014		2,270,212	0	0	0	0
2015		2,403,628	0	0	0	0
2016	1.000	2,537,043	8,519,939	0	8,519,939	8,519,939
2017	0.971	2,670,459	0	0	0	0
2018	0.943	2,803,874	0	0	0	0
2019	0.915	2,937,290	0	1,844,170	1,844,170	1,687,676
2020	0.888	3,070,705	0	1,893,696	1,893,696	1,682,524
2021	0.863	3,204,121	0	1,943,222	1,943,222	1,676,241
2022	0.837	3,337,536	0	1,992,749	1,992,749	1,668,896
2023	0.813	3,470,952	0	2,042,275	2,042,275	1,660,557
2024	0.789	3,604,367	0	2,091,802	2,091,802	1,651,288
2025	0.766	3,737,783	0	2,141,328	2,141,328	1,641,150
2026	0.744	3,871,198	0	2,190,855	2,190,855	1,630,202
2027	0.722	4,004,614	0	2,240,381	2,240,381	1,618,499
2028	0.701	4,138,029	0	2,289,907	2,289,907	1,606,095
2029	0.681	4,271,445	0	2,339,434	2,339,434	1,593,041
	TOTAL	58,343,401	8,519,939	23,009,819	31,529,758	**26,636,107**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

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Table III.8.5.1 - Investment cost

	Treatment stages	Solution 1			Solution 2			Solution 3		
		Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total	Civil works	Electrical and mechanical equipments	Total
1	***Liquid phase treatment***									
1.1	Preliminary treatment	304,635	78,163	382,798	304,635	78,163	382,798	304,635	78,163	382,798
1.2	Primary treatment	0	0	0	409,545	148,955	558,501	409,545	148,955	558,501
1.3	Biological treatment	0	102,339	102,339	41,062	58,211	99,273	41,062	58,211	99,273
1.3.1	Biological reactors	0	88,256	88,256	41,062	44,128	85,190	41,062	44,128	85,190
1.3.2	Secondary clarifiers	0	14,083	14,083	0	14,083	14,083	0	14,083	14,083
1.4	Tertiary treatment	34 665	247 685	282 349	34 665	247 685	282 349	34 665	247 685	282 349
1.4.1	Biological nitrogen removal	0	0	0	0	0	0	0	0	0
1.4.2	Chemical phosphorus removal	0	21 125	21 125	0	21 125	21 125	0	21 125	21 125
1.4.3	Disinfection	34 665	226 560	261 224	34 665	226 560	261 224	34 665	226 560	261 224
2	***Solid phase treatment***									
2.1	Thickening	17,500	17,229	34,728	25,962	46,428	72,391	25,962	46,428	72,391
2.2	Digestion	0	0	0	242,779	663,962	906,741	242,779	663,962	906,741
2.3	Cogeneration	0	0	0	12,778	1,186,752	1,199,530	0	0	0
2.4	Sludge dewatering	116,426	192,098	308,524	116,426	204,209	320,635	116,426	204,209	320,635
3	***Odour control***									
3.1	Deodorisation	37 825	98 114	135 940	37 825	98 114	135 940	37 825	98 114	135 940
4	***Miscellaneous***									
4.1	Landscaping	164,288	0	164,288	164,288	0	164,288	164,288	0	164,288
4.2	Site and preliminary works	380 961	0	380 961	380 961	0	380 961	380 961	0	380 961
4.3	Electrical equipments, instrumentation, automation and control	2 132	1369 973	1372 105	2 132	1712 466	1714 598	2 132	1541 219	1543 351
	TOTAL	1,058,431	2,105,601	3,164,032	1,773,057	4,444,947	6,218,004	1,760,280	3,086,948	4,847,228

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Table III.8.5.2- Total costs estimation (present value) - Solution 1

Year	**DF**	**Q**	**FIC**	**OC**	**TC**	**TDC = RTA** (1)
	-	m^3/year	TND	TND	TND	TND
2011		847,142	0	0	0	0
2012		882,899	0	0	0	0
2013		918,656	0	0	0	0
2014		954,413	0	0	0	0
2015		990,169	0	0	0	0
2016	1.000	1,025,926	3,164,032	0	3,164,032	3,164,032
2017	0.971	1,061,683	0	0	0	0
2018	0.943	1,097,440	0	0	0	0
2019	0.915	1,133,197	0	836,633	836,633	765,638
2020	0.888	1,168,953	0	851,330	851,330	756,396
2021	0.863	1,204,710	0	866,028	866,028	747,043
2022	0.837	1,240,467	0	880,725	880,725	737,593
2023	0.813	1,276,224	0	895,422	895,422	728,060
2024	0.789	1,311,981	0	910,119	910,119	718,456
2025	0.766	1,347,738	0	924,816	924,816	708,794
2026	0.744	1,383,494	0	939,513	939,513	699,086
2027	0.722	1,419,251	0	954,210	954,210	689,342
2028	0.701	1,455,008	0	968,907	968,907	679,572
2029	0.681	1,490,765	0	983,605	983,605	669,787
	TOTAL	22,210,116	3,164,032	10,011,308	13,175,340	**11,063,800**

(1) Pour IRT=3%; NAV=0

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

Table III.8.5.3- Total costs estimation (present value) - Solution 2

Year	DF	Q	FIC	OC	TC	TDC = RTA [1]
	-	m^3/year	TND	TND	TND	TND
2011		847,142	0	0	0	0
2012		882,899	0	0	0	0
2013		918,656	0	0	0	0
2014		954,413	0	0	0	0
2015		990,169	0	0	0	0
2016	1.000	1,025,926	6,218,004	0	6,218,004	6,218,004
2017	0.971	1,061,683	0	0	0	0
2018	0.943	1,097,440	0	0	0	0
2019	0.915	1,133,197	0	844,533	844,533	772,867
2020	0.888	1,168,953	0	857,009	857,009	761,441
2021	0.863	1,204,710	0	869,484	869,484	750,025
2022	0.837	1,240,467	0	881,960	881,960	738,627
2023	0.813	1,276,224	0	894,435	894,435	727,258
2024	0.789	1,311,981	0	906,911	906,911	715,924
2025	0.766	1,347,738	0	919,386	919,386	704,633
2026	0.744	1,383,494	0	931,862	931,862	693,393
2027	0.722	1,419,251	0	944,337	944,337	682,209
2028	0.701	1,455,008	0	956,813	956,813	671,089
2029	0.681	1,490,765	0	969,288	969,288	660,038
	TOTAL	22,210,116	6,218,004	9,976,016	16,194,021	**14,095,507**

DF - Discount factor
Actualization tax = 3%
Q - Flow
FIC - Fixed investment costs
OC - Operating costs
TC - Total costs
TDC - Total discounted costs
UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

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Table III.8.5.4 - Total costs estimation (present value) - Solution 3

Year	**DF** -	**Q** m^3/year	**FIC** TND	**OC** TND	**TC** TND	**TDC = RTA [1]** TND
2011		847,142	0	0	0	0
2012		882,899	0	0	0	0
2013		918,656	0	0	0	0
2014		954,413	0	0	0	0
2015		990,169	0	0	0	0
2016	1.000	1,025,926	4,847,228	0	4,847,228	4,847,228
2017	0.971	1,061,683	0	0	0	0
2018	0.943	1,097,440	0	0	0	0
2019	0.915	1,133,197	0	877,900	877,900	803,402
2020	0.888	1,168,953	0	892,503	892,503	792,978
2021	0.863	1,204,710	0	907,107	907,107	782,478
2022	0.837	1,240,467	0	921,710	921,710	771,918
2023	0.813	1,276,224	0	936,314	936,314	761,309
2024	0.789	1,311,981	0	950,918	950,918	750,663
2025	0.766	1,347,738	0	965,521	965,521	739,992
2026	0.744	1,383,494	0	980,125	980,125	729,305
2027	0.722	1,419,251	0	994,729	994,729	718,613
2028	0.701	1,455,008	0	1,009,332	1,009,332	707,925
2029	0.681	1,490,765	0	1,023,936	1,023,936	697,251
	TOTAL	22,210,116	4,847,228	10,460,096	15,307,323	**13,103,063**

DF - Discount factor

Actualization tax = 3%

Q - Flow

FIC - Fixed investment costs

OC - Operating costs

TC - Total costs

TDC - Total discounted costs

UTC - Updated total recipe

[1] Pour IRT=3%; NAV=0

Annex-III.9

Detailed tables of costs for selected solution

Table III.9.1.1 - Liquid phase treatment

Refer to Table 3.3-9 of section "3.3.3.4 Solution 3" of the report for a detailed description of diagnosis and proposed solution of the equipments.

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

1.0 - YEAST WASTEWATER'S PRETREATMENT

Civil Works				
Civil Works	—	—	—	216,732

Equipement				
Initial lifting and equalisation of the yeast wastewater	2.20	12,769	2	25,538
Measurement of the flow of the yeast wastewater	-	3,521	1	3,521
Flare		40,607	1	40,607
Total Equipement 1.0				69,666

TOTAL 1.0 (Civil Works + Equipement)	286,398

1.1 - PRELIMINARY TREATMENT

Civil Works				
Civil Works	—	—	—	372,276

Equipement				
Grit extraction system by “air-lift”	2.20	42,250	2	84,500
Mechanical multi-rake bar screen	0.75	39,668	2	79,336
Measurement of the difference in water level (screening)	—	2,817	2	5,634
Belt conveyor	1.10	—	1	—
Scraper bridge (grit and grease extraction in a double aerated channel)	0.55	65,723	1	65,723
Grit pumps (grit and grease extraction in a double aerated channel)	5.00	9,389	2	18,778
Grit classifier (grit and grease extraction in a double aerated channel)	0.37	28,871	1	28,871
Compressors (grit and grease extraction in a double aerated channel)	4.00	12,769	3	38,307
Grease removal via a screw conveyor (grit and grease extraction in a double aerated channel)	1.50	19,482	1	19,482
Measurement of effluent flow	—	—	—	—
Total Equipement 1.1				340,631

TOTAL 1.1 (Civil Works + Equipement)	712,907

Table III.9.1.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.3 - SECONDARY OR BIOLOGICAL TREATMENT				
1.3.1 - BIOLOGICAL REACTOR				
Civil Works				
Civil Works	—	—	—	244,173
Equipement				
Aeration	75.00	92,763	5	463,814
Oxygen measurement (aeration tank)	-	5,164	4	20,656
Mixing	7.50	—	20	—
Total Equipement 1.3.1				484,469
TOTAL 1.3.1 (Civil Works + Equipement)				728,642
1.3.2 - SECONDARY CLARIFIERS				
Civil Works				
Civil Works	—	—	—	65,655
Equipement				
Scraper bridges (secondary clarifiers)	1.10	7,042	4	28,168
Biological sludge lift pumps (secondary clarifiers)	2.20	—	—	—
Sludge recirculation pump	15.00	36,406	4	145,624
Measurement of the flow of sludge recirculation	-	5,164	2	10,328
Excess sludge extraction pump	2.20	16,266	4	65,064
Measurement of the flow of excess sludge	-	3,051	3	9,153
Total Equipement 1.3.2				258,337
TOTAL 1.3.2 (Civil Works + Equipement)				323,992
TOTAL Civil Works 1.3 (Civil Works 1.3.1 + 1.3.2)				309,828
TOTAL Equipement 1.3 (Equipement 1.3.1 + 1.3.2)				742,806
TOTAL 1.3 (Civil Works + Equipement)				1,052,634

Table III.9.1.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.4 - TERTIARY TREATMENT				
1.4.1 - BIOLOGICAL NITROGEN REMOVAL				
Equipement				
Nitrate recirculation pump	4.00	22,979	4	91,917
Measurement of the flow of nitrate recirculation	-	5,164	4	20,656
Total Equipement 1.4.1				112,573
1.4.2 - CHEMICAL PHOSPHORUS REMOVAL				
Equipement				
Dosing pump of aluminium sulphate and dosing circuit	0.37	19,482	2	38,964
1.4.3 - DISINFECTION				
Civil Works				
Civil Works	—	—	—	104,353
Equipement				
Multicellular vertical feeding pumps	55.00	28,829	4	115,316
Self-cleaning pressure filters	0.37	21,702	4	86,809
Ultraviolet radiation system in the open channel	15.00	107,034	2	214,068
Total Equipement 1.4.3				416,193
TOTAL 1.4.3 (Civil Works + Equipement)				520,546
TOTAL Civil Works 1.4				104,353
TOTAL Equipement 1.4 (Equipement 1.4.1 + 1.4.2 + 1.4.3)				567,730
TOTAL 1.4 (Civil Works + Equipement)				672,083

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Table III.9.1.2 - Solid phase (or sludge) treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

2.1 -THICKENING

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	126,882
Equipement				
Scraper bridge (thickener)	0.25	33,800	3	101,400
Thickened sludge pumps	1.10	13,943	3	41,828
Submersible mixer (thickened sludge storage tank)	0.75	8,450	1	8,450
Total Equipement 2.1				151,678
TOTAL 2.1 (Civil Works + Equipement)				278,560

2.4 -SLUDGE DEWATERING

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	164,820
Equipement				
Lift pump to raise the thickened sludge to the centrifugal clarifier	4.00	22,979	2	45,958
Centrifugal clarifier	55.00	158,439	2	316,878
Polymer preparation equipment	1.10	25,350	1	25,350
Polymer dosing pump	2.20	16,665	2	33,330
Lifting the dewatered sludge	1.10	12,910	2	25,820
Total Equipement 2.4				447,336
TOTAL 2.4 (Civil Works + Equipement)				612,156

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Table III.9.1.3 - Gas phase treatment (Odour control)

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
3.1 - DEODORISATION				
Civil Works				
Civil Works	–	–	–	121,710
Equipement				
Contaminated air treatment system	18.50	133,792	1	133,792
TOTAL 3.1 (Civil Works + Equipement)				255,503

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Table III.9.1.4 - Miscellaneous

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
4.1 - LANDSCAPING				
Civil Works				
Civil Works	—	—	—	264,794
4.2 - SITE AND PRELIMINARY WORKS				
Civil Works				
Civil Works	—	—	—	617,367
4.3 - ELECTRICAL EQUIPMENTS, INSTRUMENTATION, AUTOMATION AND CONTROL				
Civil Works				
Civil Works	—	—	—	8,479
*Equipement**				
MV-LV transformation station	—	—	—	—
Low voltage cupboard	—	—	—	—
Command station with master control panel	—	—	—	—
Total Equipement 4.3				2,621,683
TOTAL 4.3 (Civil Works + Equipement)				2,630,162

* the cost of electrical equipment is determined according to an estimate corresponding to a proportion of 45% of total cost of all equipments

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Table III.9.2.1 - Liquid phase treatment

Refer to Table 3.4-7 of section "3.4.3.2 Solution 1" of the report for a detailed description of diagnosis and proposed solution of the equipments.

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.1 - PRELIMINARY TREATMENT				
Civil Works				
Civil Works	—	—	—	239,048
Equipement				
Grit extraction system by “air-lift”	2.20	42,250	1	42,250
Archimedes screw n°1	2.20	140,834	1	140,834
Archimedes screw n°2	3.90	—		—
Mechanical multi-rake bar screen	0.75	39,668	1	39,668
Measurement of the difference in water level (screening)	—	—		—
Belt conveyor	1.10	—		—
Scraper bridge (grit and grease extraction in a double aerated channel)	0.55	53,986	1	53,986
Grit pumps (grit and grease extraction in a double aerated channel)	5.00	9,389	2	18,778
Grit classifier (grit and grease extraction in a double aerated channel)	0.37	28,871	1	28,871
Compressors (grit and grease extraction in a double aerated channel)	2.20	7,981	3	23,943
Grease removal via a screw conveyor (grit and grease extraction in a double aerated channel)	1.10	15,492	1	15,492
Measurement of effluent flow	—		—	—
Total Equipement 1.1				363,821
TOTAL (Civil Works + Equipement) 1.1				602,869
1.3 - SECONDARY OR BIOLOGICAL TREATMENT				
1.3.1 - BIOLOGICAL REACTOR				
Civil Works				
Civil Works	—	—	—	79,680
Equipement				
Aeration	75.00	77,302	3	231,907
Oxygen measurement (aeration tank)	-	5,164	2	10,328
Mixing	7.50	—	6	—
Total Equipement 1.3.1				242,235
TOTAL (Civil Works + Equipement) 1.3.1				321,914

Table III.9.2.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.3.2 - SECONDARY CLARIFIERS				
Civil Works				
Civil Works	—	—	—	44,847
Equipement				
Scraper bridges (secondary clarifiers)	1.10	7,042	2	14,083
Biological sludge lift pumps (secondary clarifiers)	3.00	—	—	—
Sludge recirculation pump	15.00	36,406	2	72,811
Measurement of the flow of sludge recirculation	-	5,164	1	5,164
Excess sludge extraction pump	1.10	13,943	2	27,885
Measurement of the flow of excess sludge	-	3,051	1	3,051
Total Equipement 1.3.2				122,995
TOTAL 1.3.2 (Civil Works + Equipement)				167,842
TOTAL Civil Works 1.3 (Civil Works 1.3.1 + 1.3.2)				124,526
TOTAL Equipement 1.3 (Equipement 1.3.1 + 1.3.2)				365,230
TOTAL 1.3 (Civil Works + Equipement)				489,756

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Table III.9.2.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.4 - TERTIARY TREATMENT				
1.4.1 - BIOLOGICAL NITROGEN REMOVAL				
Equipement				
Nitrate recirculation pump	4.00	22,980	2	45,959
Measurement of the flow of nitrate recirculation	-	5,164	2	10,328
Total Equipement 1.4.1				56,287
1.4.2 - CHEMICAL PHOSPHORUS REMOVAL				
Equipement				
Dosing pump of aluminium sulphate and dosing circuit	0.18	10,563	2	21,125
1.4.3 - DISINFECTION				
Civil Works				
Civil Works	—	—	—	36,033
Equipement				
Multicellular vertical feeding pumps	37.00	22,026	3	66,078
Self-cleaning pressure filters	0.25	17,816	3	53,448
Ultraviolet radiation system in the open channel	15.00	107,034	1	107,034
Total Equipement 1.4.3				226,560
TOTAL 1.4.3 (Civil Works + Equipement)				262,592
TOTAL Civil Works 1.4				36,033
TOTAL Equipement 1.4 (Equipement 1.4.1 + 1.4.2 + 1.4.3)				303,972
TOTAL 1.4 (Civil Works + Equipement)				340,005

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Table III.9.2.2 - Solid phase (or sludge) treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

2.1 -THICKENING

Civil Works				
Civil Works	—	—	—	37,196

Equipement				
Scraper bridge (thickener)	0.25	4,929	1	4,929
Thickened sludge pumps	1.10	13,943	1	13,943
Submersible mixer (thickened sludge storage tank)	0.75	8,450	1	8,450
Total Equipement 2.1				27,322

TOTAL 2.1 (Civil Works + Equipement)	64,518

2.4 -SLUDGE DEWATERING

Civil Works				
Civil Works	—	—	—	117,134

Equipement				
Lift pump to raise the thickened sludge to the centrifugal clarifier	2.20	8,779	2	17,557
Centrifugal clarifier	30.00	126,751	1	126,751
Polymer preparation equipment	1.10	18,590	1	18,590
Polymer dosing pump	0.75	12,910	2	25,820
Lifting the dewatered sludge	1.10	15,492	1	15,492
Total Equipement 2.4				204,209

TOTAL 2.4 (Civil Works + Equipement)	321,343

MEDJEZ EL BAB WwTP
Table III.9.2.3 - Gas phase treatment (Odour control)

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
3.1 - DEODORISATION				
Civil Works				
Civil Works	—	—	—	39,299
Equipement				
Contaminated air treatment system	7.50	102,574	1	102,574
TOTAL 3.1 (Civil Works + Equipement)				141,873

MEDJEZ EL BAB WwTP
Table III.9.2.4 - Miscellaneous

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

4.1 - LANDSCAPING

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	166,468

4.2 - SITE AND PRELIMINARY WORKS

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	270,015

4.3 - ELECTRICAL EQUIPMENTS, INSTRUMENTATION, AUTOMATION AND CONTROL

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	2,203
*Equipement**				
MV-LV transformation station	—	—	—	—
Low voltage cupboard	—	—	—	—
Command station with master control panel	—	—	—	—
Total Equipement 4.3				1,394,166
TOTAL 4.3 (Civil Works + Equipement)				1,396,369

* the cost of electrical equipment is determined according to an estimate corresponding to a proportion of 45% of total cost of all equipments

TABARKA WwTP

Table III.9.3.1 - Liquid phase treatment

Refer to Table 3.5-7 of section "3.5.3.2 Solution 1" of the report for a detailed description of diagnosis and proposed solution of the equipments.

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

1.1 - PRELIMINARY TREATMENT

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	218,021

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Equipement				
Grit extraction system by “air-lift”	2.20	42,250	1	42,250
Mechanical multi-rake bar screen	0.75	39,668	1	39,668
Measurement of the difference in water level (screening)	—	2,817	1	2,817
Screw conveyor	1.10	15,492	1	15,492
Scraper bridge (grit and grease extraction in a double aerated channel)	0.55	53,986	1	53,986
Grit pumps (grit and grease extraction in a double aerated channel)	5.00	9,389	1	9,389
Grit classifier (grit and grease extraction in a double aerated channel)	0.37	28,871	1	28,871
Compressors (grit and grease extraction in a double aerated channel)	2.20	—	2	—
Total Equipement 1.1				192,473

TOTAL (Civil Works + Equipement) 1.1	410,494

1.3 - SECONDARY OR BIOLOGICAL TREATMENT

1.3.1 - BIOLOGICAL REACTOR

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	386,653

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Equipement				
Aeration	90.00	62,437	2	124,874
Compressors (new)	55.00	107,034	1	107,034
Oxygen measurement (aeration tank)	-	5,164	2	10,327
Mixing	7.50	12,440	4	49,761
Total Equipement 1.3.1				291,996

TOTAL (Civil Works + Equipement) 1.3.1	678,649

Table III.9.3.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.3.2 - SECONDARY CLARIFIERS				
Civil Works				
Civil Works	—	—	—	137,176
Equipement				
Scraper bridges (secondary clarifiers)	1.10	53,986	2	107,973
Biological sludge lift pumps (secondary clarifiers)	2.20	16,266	3	48,799
Biological sludge lift pumps (new line)	1.10	13,943	3	41,828
Sludge recirculation pump	11.00	34,856	2	69,713
Sludge recirculation pump (new line)	7.50	31,758	2	63,517
Measurement of the flow of sludge recirculation	-	5,164	2	10,328
Excess sludge extraction pump	1.10	13,943	4	55,770
Measurement of the flow of excess sludge	-	3,051	2	6,103
Total Equipement 1.3.2				404,029
TOTAL 1.3.2 (Civil Works + Equipement)				541,206
TOTAL Civil Works 1.3 (Civil Works 1.3.1 + 1.3.2)				523,830
TOTAL Equipement 1.3 (Equipement 1.3.1 + 1.3.2)				696,025
TOTAL 1.3 (Civil Works + Equipement)				1,219,855

Table III.9.3.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.4 - TERTIARY TREATMENT				
1.4.1 - BIOLOGICAL NITROGEN REMOVAL				
Equipement				
Nitrate recirculation pump	7.50	31,758	1	31,758
Nitrate recirculation pump (new line)	4.00	22,979	1	22,979
Measurement of the flow of nitrate recirculation	-	5,164	2	10,328
Total Equipement 1.4.1				65,065
1.4.2 - CHEMICAL PHOSPHORUS REMOVAL				
Equipement				
Dosing pump of aluminium sulphate and dosing circuit	0.18	10,563	2	21,125
1.4.3 - DISINFECTION				
Civil Works				
Civil Works	—	—	—	39,471
Equipement				
Multicellular vertical feeding pumps	37.00	23,322	3	69,966
Self-cleaning pressure filters	0.25	17,816	3	53,447
Ultraviolet radiation system in the open channel	15.00	107,034	1	107,034
Total Equipement 1.4.3				230,447
TOTAL 1.4.3 (Civil Works + Equipement)				269,917
TOTAL Civil Works 1.4				39,471
TOTAL Equipement 1.4 (Equipement 1.4.1 + 1.4.2 + 1.4.3)				316,637
TOTAL 1.4 (Civil Works + Equipement)				356,108

TABARKA WwTP
Table III.9.3.2 - Solid phase (or sludge) treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

2.1 -THICKENING

Civil Works				
Civil Works	—	—	—	74,298

Equipement				
Scraper bridge (thickener)	0.25	33,800	2	67,601
Thickened sludge pumps	1.10	13,943	2	27,885
Submersible mixer (thickened sludge storage tank)	0.75	8,450	1	8,450
Total Equipement 2.1				103,936

TOTAL 2.1 (Civil Works + Equipement)	178,234

2.4 -SLUDGE DEWATERING

Civil Works				
Civil Works	—	—	—	118,968

Equipement				
Lift pump to raise the thickened sludge to the centrifugal clarifier	2.20	8,779	1	8,779
Centrifugal clarifier	30.00	126,751	1	126,751
Polymer preparation equipment	1.10	18,590	1	18,590
Polymer dosing pump	0.75	12,910	2	25,820
Lifting the dewatered sludge	1.10	15,492	1	15,492
Total Equipement 2.4				195,431

TOTAL 2.4 (Civil Works + Equipement)	314,399

TABARKA WwTP

Table III.9.3.3 - Gas phase treatment (Odour control)

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
3.1 - DEODORISATION				
Civil Works				
Civil Works	—	—	—	43,046
Equipement				
Contaminated air treatment system	7.50	115,953	1	115,953
TOTAL 3.1 (Civil Works + Equipement)				158,999

TABARKA WwTP
Table III.9.3.4 - Miscellaneous

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

4.1 - LANDSCAPING

Civil Works				
Civil Works	—	—	—	172,326

4.2 - SITE AND PRELIMINARY WORKS

Civil Works				
Civil Works	—	—	—	515,820

4.3 - ELECTRICAL EQUIPMENTS, INSTRUMENTATION, AUTOMATION AND CONTROL

Civil Works				
Civil Works	—	—	—	2,394

*Equipement**				
MV-LV transformation station	—	—	—	—
Low voltage cupboard	—	—	—	—
Command station with master control panel	—	—	—	—
Total Equipement 4.3				1,454,109

TOTAL 4.3 (Civil Works + Equipement)	1,456,503

* the cost of electrical equipment is determined according to an estimate corresponding to a proportion of 45% of total cost of all equipments

JENDOUBA WwTP

Table III.9.4.1 - Liquid phase treatment

Refer to Table 3.6-7 of section "3.6.3.2 Solution 1" of the report for a detailed description of diagnosis and proposed solution of the equipments.

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.1 - PRELIMINARY TREATMENT				
Civil Works				
Civil Works	—	—	—	418,803
Equipement				
Grit extraction system by "air-lift"	2.20	42,250	1	42,250
Archimedes screw n°1	4.00	140,834	1	140,834
Archimedes screw n°2	10.00	152,570	2	305,141
Mechanical multi-rake bar screen	0.75	53,986	1	53,986
Measurement of the difference in water level (screening)	—	2,817	1	2,817
Belt conveyor	1.10	—		—
Scraper bridge (grit and grease extraction in a double aerated channel)	0.55	58,681	1	58,681
Grit pumps (grit and grease extraction in a double aerated channel)	5.00	9,389	2	18,778
Grit classifier (grit and grease extraction in a double aerated channel)	0.37	28,871	1	28,871
Compressors (grit and grease extraction in a double aerated channel)	2.20	7,981	3	23,943
Grease removal via a screw conveyor (grit and grease extraction in a double aerated channel)	1.50	19,482	1	19,482
Measurement of effluent flow	—		—	—
Total Equipement 1.1				694,781
TOTAL (Civil Works + Equipement) 1.1				1,113,584
1.3 - SECONDARY OR BIOLOGICAL TREATMENT				
1.3.1 - BIOLOGICAL REACTOR				
Civil Works				
Civil Works	—	—	—	139,657
Equipement				
Aeration	75.00	92,763	5	463,814
Oxygen measurement (aeration tank)	-	5,164	4	20,655
Mixing	7.50	—	12	—
Total Equipement 1.3.1				484,469
TOTAL (Civil Works + Equipement) 1.3.1				624,126

Table III.9.4.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.3.2 - SECONDARY CLARIFIERS				
Civil Works				
Civil Works	—	—	—	59,774
Equipement				
Scraper bridges (secondary clarifiers)	1.10	7,042	2	14,083
Biological sludge lift pumps (secondary clarifiers)	3.80	—	—	—
Sludge recirculation pump	30.00	69,713	2	139,426
Measurement of the flow of sludge recirculation	-	5,164	1	5,164
Excess sludge extraction pump	2.20	16,266	2	32,533
Measurement of the flow of excess sludge	-	3,051	1	3,051
Total Equipement 1.3.2				194,257
TOTAL 1.3.2 (Civil Works + Equipement)				254,031
TOTAL Civil Works 1.3 (Civil Works 1.3.1 + 1.3.2)				199,430
TOTAL Equipement 1.3 (Equipement 1.3.1 + 1.3.2)				678,726
TOTAL 1.3 (Civil Works + Equipement)				878,156

JENDOUBA WwTP

Table III.9.4.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.4 - TERTIARY TREATMENT				
1.4.1 - BIOLOGICAL NITROGEN REMOVAL				
Equipement				
Nitrate recirculation pump	4.00	22,979	4	91,917
Measurement of the flow of nitrate recirculation	-	5,164	4	20,656
Total Equipement 1.4.1				112,573
1.4.2 - CHEMICAL PHOSPHORUS REMOVAL				
Equipement				
Dosing pump of aluminium sulphate and dosing circuit	0.18	19,482	2	38,964
1.4.3 - DISINFECTION				
Civil Works				
Civil Works	—	—	—	79,794
Equipement				
Multicellular vertical feeding pumps	45.00	23,322	4	93,289
Self-cleaning pressure filters	0.25	17,815	4	71,262
Ultraviolet radiation system in the open channel	22.00	118,301	1	118,301
Total Equipement 1.4.3				282,851
TOTAL 1.4.3 (Civil Works + Equipement)				362,645
TOTAL Civil Works 1.4				79,794
TOTAL Equipement 1.4 (Equipement 1.4.1 + 1.4.2 + 1.4.3)				434,389
TOTAL 1.4 (Civil Works + Equipement)				514,183

JENDOUBA WwTP

Table III.9.4.2 - Solid phase (or sludge) treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
2.1 -THICKENING				
Civil Works				
Civil Works	—	—	—	95,488
Equipement				
Scraper bridge (thickener)	0.25	33,800	2	67,600
Thickened sludge pumps	1.10	13,943	2	27,886
Submersible mixer (thickened sludge storage tank)	0.75	8,450	1	8,450
Total Equipement 2.1				103,936
TOTAL 2.1 (Civil Works + Equipement)				199,424
2.4 -SLUDGE DEWATERING				
Civil Works				
Civil Works	—	—	—	145,327
Equipement				
Lift pump to raise the thickened sludge to the centrifugal clarifier	2.20	8,779	2	17,557
Centrifugal clarifier	30.00	126,750	2	253,501
Polymer preparation equipment	1.10	18,590	1	18,590
Polymer dosing pump	1.50	16,196	2	32,392
Lifting the dewatered sludge	1.10	15,492	1	15,492
Total Equipement 2.4				337,532
TOTAL 2.4 (Civil Works + Equipement)				482,860

JENDOUBA WwTP

Table III.9.4.3 - Gas phase treatment (Odour control)

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
3.1 - DEODORISATION				
Civil Works				
Civil Works	—	—	—	72,420
Equipement				
Contaminated air treatment system	7.50	115,953	1	115,953
TOTAL 3.1 (Civil Works + Equipement)				188,374

Table III.9.4.4 - Miscellaneous

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
4.1 - LANDSCAPING				
Civil Works				
Civil Works	—	—	—	279,737
4.2 - SITE AND PRELIMINARY WORKS				
Civil Works				
Civil Works	—	—	—	622,067
4.3 - ELECTRICAL EQUIPMENTS, INSTRUMENTATION, AUTOMATION AND CONTROL				
Civil Works				
Civil Works	—	—	—	5,654
*Equipement**				
MV-LV transformation station	—	—	—	—
Low voltage cupboard	—	—	—	—
Command station with master control panel	—	—	—	—
Total Equipement 4.3				2,101,001
TOTAL 4.3 (Civil Works + Equipement)				2,106,655

* the cost of electrical equipment is determined according to an estimate corresponding to a proportion of 45% of total cost of all equipments

Table III.9.5.1 - Liquid phase treatment

Refer to Table 3.7-7 of section "3.7.3.2 Solution 1" of the report for a detailed description of diagnosis and proposed solution of the equipments.

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

1.1 - PRELIMINARY TREATMENT

Civil Works				
Civil Works	—	—	—	304,635

Equipement				
Grit extraction system by “air-lift”	2.20	42,250	1	42,250
Mechanical step screen	0.37	—	1	—
Rotary screen	0.50	—	1	—
Measurement of the difference in water level (screening)	—	—	1	—
Belt conveyor	0.37	—		—
Scraper bridge (grit and grease extraction in a double aerated channel)	3.00	—	1	—
Grit pumps (grit and grease extraction in a double aerated channel)	5.00	—	2	—
Grit classifier (grit and grease extraction in a double aerated channel)	3.00	—	1	—
Compressors (grit and grease extraction in a double aerated channel)	1.50	6,807	3	20,421
Grease removal via a screw conveyor (grit and grease extraction in a double aerated channel)	1.10	15,492	1	15,492
Measurement of effluent flow	—		—	—
Total Equipement 1.1				78,163

TOTAL 1.1 (Civil Works + Equipement)	382,798

1.3 - SECONDARY OR BIOLOGICAL TREATMENT

1.3.1 - BIOLOGICAL REACTOR

Equipement				
Aeration	45.00	—	4	—
Oxygen measurement (aeration tank)	-	5,164	2	10,328
Mixing	7.50	19,482	4	77,928
Total Equipement 1.3.1				88,256

Table III.9.5.1 - Liquid phase treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
1.3.2 - SECONDARY CLARIFIERS				
Equipement				
Scraper bridges (secondary clarifiers)	6.00	7,042	2	14,083
Sludge recirculation pump	18.00	—	2	—
Measurement of the flow of sludge recirculation	-	—	1	—
Excess sludge extraction pump	2.20	—	2	—
Measurement of the flow of excess sludge	-	—	1	—
Total Equipement 1.3.2				14,083
TOTAL 1.3 (Equipement)				102,339
1.4 - TERTIARY TREATMENT				
1.4.2 - CHEMICAL PHOSPHORUS REMOVAL				
Equipement				
Dosing pump of aluminium sulphate and dosing circuit	0.18	10,563	2	21,125
1.4.3 - DISINFECTION				
Civil Works				
Civil Works	—	—	—	34,665
Equipement				
Multicellular vertical feeding pumps	37.00	22,026	3	66,078
Self-cleaning pressure filters	0.25	17,816	3	53,448
Ultraviolet radiation system in the open channel	15.00	107,034	1	107,034
Total Equipement 1.4.3				226,560
TOTAL 1.4.3 (Civil Works + Equipement)				261,224
TOTAL Equipement 1.4 (Equipement 1.4.2 + 1.4.3)				247,685
TOTAL 1.4 (Civil Works + Equipement)				282,349

SILIANA WwTP

Table III.9.2.2 - Solid phase (or sludge) treatment

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)

2.1 -THICKENING

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	17,500

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Equipement				
Scraper bridge (thickener)	0.37	—	1	—
Thickened sludge pumps	2.20	8,779	1	8,779
Submersible mixer (thickened sludge storage tank)	0.75	8,450	1	8,450
Total Equipement 2.1				17,229

TOTAL 2.1 (Civil Works + Equipement)	34,728

2.4 -SLUDGE DEWATERING

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Civil Works				
Civil Works	—	—	—	116,426

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
Equipement				
Lift pump to raise the thickened sludge to the centrifugal clarifier	1.50	8,004	2	16,008
Centrifugal clarifier	30.00	116,188	1	116,188
Polymer preparation equipment	1.10	18,590	1	18,590
Polymer dosing pump	0.75	12,910	2	25,820
Lifting the dewatered sludge	1.10	15,492	1	15,492
Total Equipement 2.4				192,098

TOTAL 2.4 (Civil Works + Equipement)	308,524

SILIANA WwTP
Table III.9.5.3 - Gas phase treatment (Odour control)

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
3.1 - DEODORISATION				
Civil Works				
Civil Works	—	—	—	37,825
Equipement				
Contaminated air treatment system	7.50	98,114	1	98,114
TOTAL 3.1 (Civil Works + Equipement)				135,939

SILIANA WwTP
Table III.9.5.4 - Miscellaneous

Item	Unit power (kW)	Unit price (TND)	Quantity	Total cost (TND)
4.1 - LANDSCAPING				
Civil Works				
Civil Works	—	—	—	164,288
4.2 - SITE AND PRELIMINARY WORKS				
Civil Works				
Civil Works	—	—	—	380,961
4.3 - ELECTRICAL EQUIPMENTS, INSTRUMENTATION, AUTOMATION AND CONTROL				
Civil Works				
Civil Works	—	—	—	2,132
*Equipement**				
MV-LV transformation station	—	—	—	—
Low voltage cupboard	—	—	—	—
Command station with master control panel	—	—	—	—
Total Equipement 4.3				1,369,973
TOTAL 4.3 (Civil Works + Equipement)				1,372,105

* the cost of electrical equipment is determined according to an estimate corresponding to a proportion of 65% of total cost of all equipments

Annex-VI

INITIAL ENVIRONMENTAL EXAMINATION

Annex-VI

Monitoring form (ONAS official form)

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

	RAINY DAYS	WATER VOLUME TREATED			Re-use of treated water	Number of certified analyses / total number of analyses						Detritus screening	Evacuated sand
		per month	Average in m^3/d	max/day		Stop of the plant	Transparency > 30cm	Matter can be settled in 2h < 0.2	TSS < 30mg/l	BOD5<30mg/l	COD < 90mg/l		
Column No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Unit	u	m^3	m^3/d	m^3/d	m^3	d	u	u	u	u	u	m^3	m^3
January													
February													
March													
April													
May													
June													
July													
August													
September													
October													
November													
December													

Total													
Average													

Previously													
Variation (+ or -)													

Chief of the plant	Purification Division
Regional Manager	

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

	Sludge																				
	Primary Humid non-stabilized sludge (Processes at medium load)			ACTIVATED			Stabilized Sludge						Thickened sludge (before drying)			Dried Sludge					
							Aerobic stabilization			Sludge digestion						Natural drying			Mechanical dehydration		
	Volume	IL	TSS	TSS	IL	Dissolved oxygen	Volume	TDS	IL	Volume	TDS	IL	Volume	TDS	IL	Volume	IL	Dry content	Volume	IL	Dry content
Column No.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Unit	m^3	%	g/l	g/l	%	mg/l	m^3	g/l	%	m^3	g/l	%	m^3	g/l	%	m^3	%	%	m^3	%	%
January																					
February																					
March																					
April																					
May																					
June																					
July																					
August																					
September																					
October																					
November																					
December																					

Total																					
Average																					

Previously																					
Variation (+ or -)																					

Works to be planned for the next year:

* Maintenance of electromechanical equipment

* Maintenance of green spaces of the plant

* Transportation of stocked sludge in the plant to public disposal site

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

	Polymer consumption	Consumption of phosphate removal product	Working hours	Energy consumption	Load in BOD_5				Purification treatment efficiency
					Inflow		Outflow		
					Concentration	Daily load	Concentration	Daily load	
Column No.	35	36	37	38	39	40	41	42	43
Unit			H	KWh	mg/l	Kg/d	mg/l	Kg/d	%
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									

Total									
Average									

Previously									
Variation (+ or -)									

SUGGESTIONS

* Furnish a tractor for the operation of the plant

* Change the location of the phosphate removal unit

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

	COD		TSS		Conductivity		Inflow				Outflow			
	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Total N	N-NO3	N-NO2	Pt	Total N	N-NO3	N-NO2	Pt
Column No.	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Unit	mg/l	mg/l	mg/l	mg/l	U	U	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
January														
February														
March														
April														
May														
June														
July														
August														
September														
October														
November														
December														

Total														
Average														

Previously														
Variation (+ or -)														

REMARKS

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

TREATED WASTEWATETDS

	Heavy metals							Bacteriology	
	Pb	Hg	CU	Ni	Zn	Cr tot	Cd	Fecal Coliform (FC)	Number of analyses
Column No.	58	59	60	61	62	63	64	65	66
Unit	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100ml	MPN/100ml
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									

Total									
Average									

Previously									
Variation (+ or -)									

REMARKS

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

SLUDGE ANALYSES

	Heavy metals							Bacteriology	
	Pb	Hg	CU	Ni	Zn	Cr tot	Cd	Fecal Coliform (FC)	Number of analyses
Column No.	67	68	69	70	71	72	73	74	75
Unit	mg/kgDM	mg/kgDM	mg/kgDM	mg/kgDM	mg/kgDM	mg/kgDM	mg/kgDM	MPN/gDM	MPN/gDM
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									

Total									
Average									

Previously									
Variation (+ or -)									

REMARKS

ANNUAL REPORT

Department: Regional Direction:

WwTP: Year:

	OPERATIONAL COSTS										
	Salary for staff	Energy	Maintenance	Maintenance green spaces	Treatment products for odors and others	Various and consumable products (SONEDE, Tel, ...)	Mud discharge cost	POLYMETDS	Phosphate Removal Products	Subcontracting costs of the plant (privatization)	Subcontracting costs of the plant (spin-out)
Column No.	76	77	78	79	80	81	82	83	84	85	86
Unit	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar	Dinar
January											
February											
March											
April											
May											
June											
July											
August											
September											
October											
November											
December											

Total											
Average											

Previously											
Variation (+ or -)											

Remarks:

ANNUAL REPORT

Department: Regional Direction:

Number of agents:

WwTP: Year:

Line No.	Data	Units	This Year	Previous Year	Variation (+ or -)
1	Total population of the city	Inhabitants			
2	Total capacity of the linked hotels	Beds			
3	ONAS SUBSCRIPTIONS (and connected to the plant)	Units			
4	Domestic	Units			
5	Tourist (number of hotels)	Units			
6	Industrial (number of units)	Units			
7	CONNECTIONS TO THE PLANT (B)	Eq. inhab			
8	Domestic (number of inhabitants)	Eq. inhab			
9	Tourist (over-night stays per year /365)	Eq. inhab			
10	Industrial (inhabitant equivalent)	Eq. inhab			
11	Daily average FLOW = Collar 2/(365-Col6)	m3/d			
12	Specific REJECTION = (m^3/d)/B	L/inhab/d			
13	Specific VOLUME for fresh sludge (col 20 x 1000) / ((365-col6)xB)	L/inhab/d			
14	Specific LOAD for BOD_5 at input (col40x 1000)/B	g/inhab/d			
15	Specific CONSUMPTION of electric energy col38/B	kwh/eq.inhab/year			
16	Specific polymer CONSUMPTION (Col29*1000) col20 x col22	kg/kgDM			
17	Annual operating EXPENDITURES = (D) D = col72x1.2+col(73+74+75+76+77+78+79+80+81)	Dinar/year			
18	OPERATING EFFICIENCY	% BOD_5 eliminated			
19	PURIFICATION IN BOD_5				
20	Energetic	kwh/kgBO			

		D_5 eliminated			
21	COST:	D/kgBOD_5 eliminated			
22	per kg BOD5 eliminated = D/col34-col36)				
23	per m³ of purified water = D/col2	D/m3			
24	per plant branch = D/B	D/inhab/year			
25	BY-PRODUCT SALES REVENUE: purified water	DTotal/year			

ONAS (Office National de l'Assainissement, National Sanitation Office)

Monthly operation report

Summary: for the month of XXXX 20XX

Department: Regional Direction: WwTP Code:	Process: Load in BOD5: Flow (m3/d) : Equiv/H:

<table>
<tr><td rowspan="3">Designation</td><td rowspan="3">Unit</td><td rowspan="2">month (n-1)</td><td colspan="2">month (n)</td><td colspan="2" rowspan="2">Variation in %</td></tr>
<tr><td>Previous Year</td><td>Current Year</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>(3) – (2)</td><td>(3) – (1)</td></tr>
<tr><td>Treated vol./month</td><td>m^3/month</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Average flow/day</td><td>m^3/d</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Reused treated volume</td><td>m^3/month</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Average flow/day reused</td><td>m^3/d</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Monthly energy consumption</td><td>Kwh/month</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Average cons./d</td><td>Kwh/d</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Energetic efficiency</td><td>Kwh/Kg BOD_5</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Produced humid sludge</td><td>m^3</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

WATER QUALITY

<table>
<tr><td colspan="2">Inflow WwTP</td><td colspan="2">Outflow WwTP</td></tr>
<tr><td>BOD_5 (CONCENTRATION)</td><td></td><td>BOD_5 (CONCENTRATION)</td><td></td></tr>
<tr><td>BOD_5 Daily load</td><td></td><td>BOD_5 Daily load</td><td></td></tr>
<tr><td>COD</td><td></td><td>COD</td><td></td></tr>
<tr><td>TSS</td><td></td><td>TSS</td><td></td></tr>
<tr><td>Conductivity</td><td></td><td>Conductivity</td><td></td></tr>
<tr><td>Purification efficiency</td><td></td><td>Salinity</td><td></td></tr>
</table>

STAFF of the WwTP

WORDING	EFFECTIVE	DAYS				
		ABSENCE	REINFORCEMENT (+)	REINFORCEMENT (-)	NET D.
Assistant Engineer					
Technical operator					
Temporary worker					
Driver					
Watchman					

ROLLING AND FIXED MATERIAL (*)

Wording	Registration	Position	Fuel consumption	OBSERVATIONS
		operation rest failure	Petrol Gas oil	
Generator				Missing a tractor for the operation of the plant

Observations:

Chief of the WwTP DERI Regional Manager

(*) Tractor, motor pump, lawn mower, …..

ONAS – RD:

		Rains	Air Temperature	Detritus	Sands	Fats	Flow	Color	Temperature	BOD_5	COD	TSS	MD_{2h}	Conductivity	PH	Cl	Electricity	Cosφ	N-NO3	N-NH4	N-NO2	Pt	OBSERVATIONS
Date				m^3	m^3	m^3	m^3/d		˚C	mg/l	mg/l	mg/l	ml/l	us/cm		mg/l	Kwh/d		mg/l	mg/l	mg/l	mg/l	
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	1																						
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Minimum																							
Maximum																							

		Outflow																Reused	OBSERVATIONS
		Conductivity	Saline	Cl -	BOD5	COD	TSS	MD2h	PH	OPERATING EFFICIENCY		N-NO3	N-NH4	N-NO2	Pt	Transparency			
																D1	D2		
Date		us/cm	g/l	mg/l	mg/l	mg/l	mg/l	mg/l		Energetic kwh/kg BOD5eliminated	Purification °/°	mg/l	mg/l	mg/l	mg/l	cm	cm	m3	
Day	1	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
	2																		
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Average																			
Minimum																			
Maximum																			

		Oxidation ditch No.1					Oxidation ditch No. 2					Recirculation sludge			Excess Mud		Thickened Sludge			OBSERVATIONS
		MD	TSS	IL	IM	O2	MD	TSS	IL	IM	O2	Flow	Recirculation	MD	Flow	TSS	Flow	TSS	IL	
Date		ml/l	g/l	%	ml/g	ml/g	ml/l	g/l	%	ml/g	ml/g	m3	%	ml/l	m3	g/l	m3	g/l	%	
Day	1	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	2																			
	3																			
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Total																				
Average																				
Minimum																				
Maximum																				

		Drying beds							OBSERVATIONS		
		Filling of beds		Dried evacuated sludge			Matter	Evacuated liquid sludge out of WwTP	Chief of WwTP	Chief of DERI	Regional Manager
		Quantity	Bed No.	Quantity	Bed	Drying process duration	dry				
Date		m3	Filled	m3	No.	days	%	m3			
Day	1	61	62	63	64	65	66	67	68	69	70
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