



## RESEARCH ARTICLE

### Solid waste management in non-State armed group-controlled areas of Syria case study - Jisr-Ash-Shugur-district

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## ABSTRACT

The purpose of this study (technical assessment) is to understand the effect of the Syrian crisis on the solid waste management (SWM) sector in Non-State Armed Group (NSAG) controlled areas and define the worst communities located in Jisr-Ash-Shugur-district (JASD)/Idleb governorate of Syria. The assessment showed that: SWM sector, in general, is not supported by Non-governmental organizations (NGOs). The number of communities of JASD is ninety-nine about 262,246 persons (113382 Internally Displaced Persons (IDPs), 147,449 resident population, 1,415 returnees, and population) live in it, all these local councils are not received or supported by SW equipment, tools, and machines, About seventy communities out of ninety-nine communities (92,195 persons of 262,246 persons) of JASD does not have dedicated works for solid waste collection, and Eighty 80 communities (120,237 persons of 262,246 persons) do not have SW containers, and 67 communities (77,195 persons of 262,246 do not have solid waste tractors with a trails are necessary for SWM. the average, maximum and minimum of SW production per capita at JASD communities (0.21; 0.79; 0.02) kg day<sup>-1</sup>. All the landfills of JASD are not sanitary and could be considered a randomly dumps.

**Keywords:** Jisr-Ash-Shugur, solid waste, the Syrian crisis

## 1. INTRODUCTION

Waste management accordingly from concept and practices that are used in different countries there are differences, particularly between developed and developing countries [1]. Solid wastes are any non-liquid wastes that arise from human and animal activities and are discarded as useless or unwanted [2]. Currently, several countries have realized that the way they manage their solid wastes does not satisfy the objectives of sustainable development throughout the world [3,4]. There have been lots of solid waste materials disposed into the environment more especially in the developing countries where solid waste management has been a huge problem. [5]. Environmental pollution has affected the human world since early times and is still growing due to excessive growth in developing countries. Municipal solid waste (MSW) normally is a product of human activities [6]. Also, MSW is usually considered as the waste that is generated from human settlements, small industries,

commercial and municipal activities [7] the general sources of MSW are showed in Table1.

Though solid waste management (SWM) is one of the mandatory functions for improvement of urban lifestyle [8], an integrated SWM is one of the major challenges for sustainable development [9].

In developing countries such as Syria open randomly dumpsites are common, because of the low budget for waste disposal. It also could be a serious threat to groundwater resources and soil, the contamination of soil by heavy metal can cause adverse effects on human health, animals and soil productivity [10]. The crisis in Syria continues to have a profound impact on people across the country. Countless civilians have been killed and injured as a direct result of hostilities, with 45 percent of the injured expected to sustain a permanent impairment. [11]. SWM systems in Syria are overstrained with the high influx of internally displaced persons (IDPs) destruction and/or damages of basic infrastructure [12,13], and the equipment and heavy machinery normally used for SWM are often

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looted, destroyed, and not functioning due to the need of new spare parts and maintenance. This contributes to large amounts of garbage piled up in the streets, deteriorating the environmental and health situation and further exacerbating difficult living conditions [13].

At NSAG controlled areas of Syria, the local councils which are considered a local authority, these local councils always face difficulties during their work due to lack of the fund, and the main resource of their fund is a grant from local and international NGOs especially which have registration in Turkey, SWM services are primarily provided by local authorities in most parts of Syria and usually provide a basic level of service.

Before the start of conflict in Syria in 2011, nearly 80% of population in Syria were served by well-developed, state-owned, centrally-managed SWM which related to ministry of local administration and environment, the municipality of each village, town, and city is responsible for SWM, The solid waste collection (SWC) method were assessed in 2018 by the collaborative effort of the Whole of Syria coordination team, water, sanitation and hygiene (WASH) partners, From Syria, Turkey, Jordan, Iraq and Lebanon Humanitarian Hubs [13], Table 2 showed collection methods and its percentage for JASD subdistrict [13].

**Table 1.** The general sources of MSW [7]

Source	Activities, typical amenities, or locations where wastes are generated	Types of SW
Residential	Single-family and multi-family home, low, medium, and high-rise apartments, etc.	Food wastes, rubbish, paper waste, ashes, special wastes.
Commercial and institutional	Warehouses, restaurants, markets, office buildings, hotels, shopping malls, schools, print shops, auto repair shops, medical facilities and institutions, prisons.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes.
Open areas	Streets, alleys, parks, vacant lots, playgrounds, beaches, highways, recreational areas, marriage halls, etc.	Street sweepings, roadside litter, rubbish, and other special wastes.
Treatment plant sites	Water, sewage and industrial wastewater treatment processes.	Treatment plant sludges.

**Table 2.** Solid waste collection methods and its percentage of JASD subdistrict

Subdistrict	Solid waste disposed of a household to a dumping location station	Solid waste left in public areas	Public solid waste collection free	Private garbage collection paid	Garbage buried or burned
Jisr-Ash-Shugur	34.04%	6.38%	3.19%	55.32%	6.38%
Badama	1.05%	10.53%	48.42%	40.00%	0.00%
Darkosh	29.47%	29.47%	9.47%	58.95%	3.16%
Janudiyeh	2.11%	1.05%	20.00%	76.84%	1.05%

The author hopes from this research to give a deep understanding about the situation of SWM in the NSAG controlled areas of Syria, these areas suffer from the lack of financial resources to conduct a good SWM, the goals of this research are:

- 1-Determine the amount of the solid waste generated in the NSAG controlled areas of Syria, case study "JASD which located in Idleb governorate.
- 2-Determine the quantity and the volume of MSW of some communities of JASD Determine the urgent needs for SWM of JASD.
- 3-Get a deep understanding of SWM of Non-State Armed Group (NSAG) controlled areas of Syria.
- 4-Determine the needs of solid waste management of the communities of JASD.
- 5-Give technical information for the donors and None government organization (NGO) to do a good response in JASD.

## 2. METHODS

This research focuses on JASD which located at Idleb governorate of Syria as showed in Fig 1, which is located in NSAG-controlled areas since the end of 2012. the total number of populations is about 262,246 persons (113,382 Internally Displaced Persons (IDPs), 147,449 resident population, 1,415 returnees, and population) as showed in Table 3 [15], According to Assistance Coordination Unit (ACU) reports [16]: during 2018 the number of Cutaneous leishmaniases registered cases of Darkosh subdistrict is: 1,062, Janudiyeh subdistrict is: 771, Jisr-Ash-Shugur subdistrict is: 453, and Badama subdistrict is:100, which is considered so risk and related to the bad solid waste management of JASD.

Syrian Engineers for Construction and Development (SECD) organization, which located in Turkey and work inside Turkey and Syria, conducted a WASH response for IDPs in the north of Syria funded by United Nations Office for the Coordination of Humanitarian Affairs (OCHA)/Syria Cross Border Humanitarian Fund (SCHF) as showed in the Fig 2.



**Fig 1.** Idleb governorate, JASD district and its subdistricts location (green color)

During this response, SECD team conducted a deep technical assessment for solid waste services sector at the communities of JASD using questioners, and physical measures in the field about ten engineers worked in this assessment and SECD staff visited ninety-nine communities located at JASD. The assessment is a consideration as an integral part to the assessment which was conducted by the author and ten technical engineers from SECD team in addition to thirty-nine local councils of the targeted area are involved in the study.



**Fig 2.** Some pics of SWM of JASD district

**Table 3.** The total number of populations of JASD communities

Subdistrict	Community	Res pop	Returnees	IDPs	Population
	Upper Sheikh Sindyan	90	0	0	90
	Msheirfeh (Jisr-Ash-Shugur)	676	21	234	931
	Sali	997	49	353	1399
	Maalaqa - Bishlamon	2218	15	501	2734
	Balmis	3105	0	603	3708
	Salhiyeh (Jisr-Ash-Shugur)	201	0	13	214
	Bsheiriyeh - Bello	3469	0	923	4392
	Um Rish	2152	0	198	2350
	Bteibat	120	0	39	159
	Mintar (Jisr-Ash-Shugur)	584	0	56	640
	Upper Shghur	1225	32	1495	2752
	Eshtabraq	58	0	159	217
	Jisr-Ash-Shugur	14518	224	3454	18196
	Bzeit	1058	72	47	1177
	Bkafla	305	0	115	420
	Ein Elhamra	1346	25	948	2319
	Ghassaniyeh (Jisr-Ash-Shugur)	0	0	965	965
	Ein Elsoda (Jisr-Ash-Shugur)	1003	13	1251	2267
	Kafir (Jisr-Ash-Shugur)	1531	98	0	1629
Jisr-Ash-Shugur	Qaysiyeh	1424	15	231	1670
	Alyeh (Jisr-Ash-Shugur)	0	0	214	214

	Jannet Elqora	530	64	439	1033
	Ghanya	196	40	0	236
	Sokkariyeh (Jisr-Ash-Shugur)	1208	0	332	1540
	Sabileh	193	0	130	323
	Western Marj Akhdar	8866	0	718	9584
	Um Elgar	13	15	0	28
	Dgali	879	0	135	1014
	Eastern Marj Akhdar	3814	0	1942	5756
	Tal Awar	723	42	57	822
	Tal Hamki	172	0	28	200
	Frikeh (Jisr-Ash-Shugur)	1540	31	346	1917
	Watba	619	0	33	652
	Marj Elzohur	573	0	86	659
	Kniset Nakhleh	1727	0	673	2400
	Al Areen - Kastanah Fawqan	720	0	192	912
	Jeb Alsafa	526	0	52	578
	Qulaia	344	0	0	344
	Qirmida	308	0	24	332
	Muntar Tahtani	266	0	23	289
	Al Karnaza	222	0	39	261
	Frikka al Abeed	241	5	6	252
	Arzaghan Fawqani	720	0	91	811
	Ziyadiyeh (Jisr-Ash-Shugur)	1073	241	59	1373
	Baksariya	1265	405	1000	2670
	Yunesiyeh	25	0	0	25
	Badama	2845	0	655	3500
	Armala	955	0	1653	2608
	Hanbushiyeh	1840	0	3338	5178
	Ein El-Bayda (Badama)	638	0	2888	3526
Badama	Kherbet Eljoz	2058	0	21534	23592
	Shaturiyeh	1000	0	900	1900
	Najiyeh	1000	0	50	1050
	Ramliyah	618	0	570	1188
	Maraand	460	0	130	590
	Zoainieh	618	0	515	1133
	Safiyat	65	0	30	95
	Sawadiya - Nabhan	1960	0	115	2075
	Turin	215	0	15	230
	Zarzur (Darkosh)	5458	0	2627	8085
	Ghazala - Mgheidleh	1350	0	369	1719
Darkosh	Jamiliya (Darkosh)	0	0	988	988
	Ramadiyeh (Darkosh)	785	0	145	930
	Mazuleh	1823	0	678	2501
	Matleh - Batlaya	721	0	26	747
	Amud (Darkosh)	1493	0	444	1937

	Sadiyeh - Bsentiya	1038	0	269	1307
	Thahr	1383	0	655	2038
	Andnaniyeh - Farjein	1192	0	729	1921
	Dorriyeh	533	0	5205	5738
	Zahraa - Kherbet Amud	1273	0	1067	2340
	Sheikh Issa Elashury	1058	0	251	1309
	Darkosh	17811	0	7325	25136
	Zanbaqi (co)	783	0	3843	4626
	Mreimin (Darkosh)	2425	0	3141	5566
	Kharab Khalil (Darkosh)	365	0	101	466
	Kharab Amer	625	0	80	705
	Kharab Sultan	396	0	39	435
	Almilk	223	0	0	223
	Alshamra	275	0	83	358
	Magharet Jamous	140	0	31	171
	Alfauri	583	0	25	608
	Al Hamia	621	0	69	690
	Al-Hafriya	1035	0	218	1253
	Haj Nayef	1545	0	483	2028
	Janudiyeh	8718	0	6268	14986
	Yaqubiyeh	100	0	2640	2740
	Hassaniyeh - Hatya	987	8	2694	3689
	Qaderiyeh - Qayqun	2303	0	1180	3483
	Maland	2658	0	2250	4908
	Qanniyeh (Janudiyeh)	244	0	1920	2164
Janudiyeh	Mudiah - Luxin	153	0	605	758
	Nasra (Janudiyeh)	0	0	1035	1035
	Foz - Zuf	698	0	9522	10220
	Tiba - Katrin	0	0	65	65
	Jdidet Eljisir	183	0	2045	2228
	Athar	693	0	165	858
	Hamama - Kafr Debbin	8285	0	3475	11760
	Al Marjeh	378	0	30	408
	<b>Total</b>	<b>147449</b>	<b>1415</b>	<b>113382</b>	<b>262246</b>

The SW system of JASD as all other subdistricts of Syria consists of the following parts: SWC

- 1- SW container.
- 2- Tractors with a trailer for solid waste collection (SWC).
- 3- SW compactor which is used only in big cities.
- 4- Randomly open dump for final disposal of SW.

All communities of JASD use tractor with a trailer for SWC and also only two communities use Solid waste compactor in addition to the tractors with trailers.

### 3. RESULTS AND DISCUSSION

The technical and need assessments were conducted by the author and SECD team during March and July and August of 2019 for SW system for all the communities which located in JASD. The results of the assessment are shown in Tables 4-7, and Table 8, these tables are so useful to determine the solid waste management needs in each community , the Table 4 and Table5 showed the availability of instruments and machines of SWM of the communities of JASD, such as : Number of SWM workers, number of tractor with a trail, number of garbage tank and Number of garbage compactor, the Availability of support for SWM ,and equipment and stationaries, these values are so

important and can give the evidence about SWM ,An example of the community do not have a solid waste workers the value is 0, and if the local council do not have tractor with a trail to collect SM the value is 0, and this is an evidence that the solid waste management is so bad and the local council need a tractor with a trail,. Also the Table 6 showed SWC methods of the communities of JASD, which give in evidence about the SWM situation, if the greater value of %SW amount left

in public areas without collection, the worse the situation, on other hand, if the greater value of %SW collection free by the local council , the better the situation. also, the Table 7 showed the solid waste collection frequency (SWCF) the which give the evidence about the SWM situation, if the greater value of SWCF, the better the situation, and the random method is considered the worst situation.

**Table 4.** The availability of instruments and machines of SWM of the communities of JASD

Sub-district	Community	Number of SWM workers	Number of tractors with trails	Number of garbage tank	Number of Garbage compactor
	Upper Sheikh Sindyan	0	0	0	0
	Msheirfeh (Jisr-Ash-Shugur)	0	0	0	0
	Sali	0	0	0	0
	Maalaqa - Bishlamon	4	1	82	0
	Balmis	0	0	0	0
	Salhiyeh (Jisr-Ash-Shugur)	0	0	0	0
	Bsheiriyeh - Bello	3	1	20	0
	Um Rish	0	0	0	0
	Bteibat	0	0	0	0
	Mintar (Jisr-Ash-Shugur)	0	0	0	0
	Upper Shghur	0	0	0	0
	Eshtabraq	0	0	0	0
	Jisr-Ash-Shugur	12	1	380	0
	Bzeit	0			
	Bkafla	0	0	0	0
Jisr-Ash-Shugur)	Ein Elhamra	0	0	0	0
	Ghassaniyeh (Jisr-Ash-Shugur)	0	0	0	0
	Ein Elsoda (Jisr-Ash-Shugur)	0	0	0	0
	Kafir (Jisr-Ash-Shugur)	6	1	100	
	Qaysiyeh	3	1	0	0
	Alyeh (Jisr-Ash-Shugur)	0	0	0	0
	Jannet Elqora	0	0	0	0
	Ghanya	0	0	0	0
	Sokkariyeh (Jisr-Ash-Shugur)	0	0	0	0
	Sabileh	0	0	0	0
	Western Marj Akhdar	4	1	0	0
	Um Elgar	0	0	0	0
	Dgali	0	0	0	0
	Eastern Marj Akhdar	0	0	0	0
	Tal Awar	0	0	0	0
	Tal Hamki	0	0	0	0

	Frikeh (Jisr-Ash-Shugur)	0	0	0	0
	Watba	0	0	0	0
	Marj Elzohur	0	0	50	0
	Kniset Nakhleh	3	1	0	0
	Al Areen - Kastanah Fawqan	3	1	0	0
	Jeb Alsafa	0	0	0	0
	Qulaia	0	0	0	0
	Qirmida	0	0	0	0
	Muntar Tahtani	0	0	0	0
	Al Karnaza	0	0	0	0
	Frikka al Abeed	0	0	0	0
	Arzaghan Fawqani	0	0	0	0
	Ziyadiyah (Jisr-Ash-Shugur)	0	0	0	0
	Baksariya	1	1	0	0
	Yunesiyeh	0	0	0	0
	Badama	4	1	0	
	Armala	0	0	0	0
	Hanbushiyeh	4	1	15	0
	Ein El-Bayda (Badama)	7	1	30	0
Badama	Kherbet Eljoz	2	1	100	0
	Shaturiyeh	2	1	40	
	Najiyeh	3	1	0	0
	Ramliyah	3	1	0	0
	Maraand	0	0	0	0
	Zoainieh	0	0	0	0
	Safiyat	0	0	0	0
	Sawadiya - Nabhan	0	0	0	0
	Turin	0	0	0	0
	Zarzur (Darkosh)	0	3	50	0
	Ghazala - Mgheidleh	0	0	0	0
	Jamiliya (Darkosh)	0	0	0	0
	Ramadiyah (Darkosh)	0	0	0	0
	Mazuleh	0	0	0	0
	Matleh - Batlaya	0	0	0	0
Darkosh	Amud (Darkosh)	3	1	0	0
	Sadiyah - Bsentiya	0	0	0	0
	Thahr	0	0	0	0
	Andnaniyah - Farjein	2	2	0	0
	Dorriyah	0	1	0	0
	Zahraa - Kherbet Amud	0	0	0	0
	Sheikh Issa Elashury	0	0	0	
	Darkosh	7	1	10	0
	Zanbaqi (co)	0	0	0	0

	Mreimin (Darkosh)	0	0	0	0
	Kharab Khalil (Darkosh)	0	0	0	0
	Kharab Amer	0	0	0	0
	Kharab Sultan	0	0	0	0
	Almilk	0	0	0	0
	Alshamra	0	0	0	0
	Magharet Jamous	0	0	0	0
	Alfauri	0	0	0	0
	Al Hamia	0	0	0	0
	Al-Hafriya	0	0	0	0
	Haj Nayef	0	0	0	0
	Janudiyeh	10	1	48	0
	Yaqubiyeh	3	1	0	0
	Hassaniyeh - Hatya	3	1	80	0
	Qaderiyeh - Qayqun	2	1	0	0
	Maland	1	4	0	0
	Qanniyeh (Janudiyeh)	3	1	3	0
Janudiyeh	Mudiah - Luxin	1	2	4	0
	Nasra (Janudiyeh)	0	0	0	0
	Foz - Zuf	7	1	35	0
	Tiba - Katrin	0	0	0	0
	Jdidet Eljisir	3	1	14	0
	Athar	0	0	0	0
	Hamama - Kafr Debbin	6	1	50	0
	Al Marjeh	0	0	0	0

**Table 5 .** The Availability of support for SWM of the communities of JASD

Sub-district	Community	Availability of support		
		Salaries for workers	Fuel for SW vehicle	Equipment and stationaries
Jisr-Ash-Shugur	Upper Sheikh Sindyan	NO	NO	NO
	Msheirfeh (Jisr-Ash-Shugur)	NO	NO	NO
	Sali	NO	NO	NO
	Maalaqa - Bishlamon	NO	NO	NO
	Balmis	NO	NO	NO
	Salhiyeh (Jisr-Ash-Shugur)	NO	NO	NO
	Bsheiriyeh - Bello	NO	NO	NO
	Um Rish	NO	NO	NO
	Bteibat	NO	NO	NO
	Mintar (Jisr-Ash-Shugur)	NO	NO	NO
	Upper Shghur	NO	NO	NO
	Eshtabraq	NO	NO	NO
	Jisr-Ash-Shugur	NO	NO	NO
	Bzeit	NO	NO	NO



Bkafila	NO	NO	NO
Ein Elhamra	NO	NO	NO
Ghassaniyeh (Jisr-Ash-Shugur)	NO	NO	NO
Ein Elsoda (Jisr-Ash-Shugur)	NO	NO	NO
Kafir (Jisr-Ash-Shugur)	NO	NO	NO
Qaysiyeh	NO	NO	NO
Alyeh (Jisr-Ash-Shugur)	NO	NO	NO
Jannet Elqora	NO	NO	NO
Ghanya	NO	NO	NO
Sokkariyeh (Jisr-Ash-Shugur)	NO	NO	NO
Sabileh	NO	NO	NO
Western Marj Akhdar	NO	NO	NO
Um Elgar	NO	NO	NO
Dgali	NO	NO	NO
Eastern Marj Akhdar	NO	NO	NO
Tal Awar	NO	NO	NO
Tal Hamki	NO	NO	NO
Frikeh (Jisr-Ash-Shugur)	NO	NO	NO
Watba	NO	NO	NO
Marj Elzohur	NO	NO	NO
Kniset Nakhleh	NO	NO	NO
Al Areen - Kastanah Fawqan	NO	NO	NO
Jeb Alsafa	NO	NO	NO
Qulaia	NO	NO	NO
Qirmida	NO	NO	NO
Muntar Tahtani	NO	NO	NO
Al Karnaza	NO	NO	NO
Frikka al Abeed	NO	NO	NO
Arzaghan Fawqani	NO	NO	NO
Ziyadiyeh (Jisr-Ash-Shugur)	NO	NO	NO
Baksariya	NO	NO	NO
Yunesiyeh	NO	NO	NO
Badama	NO	NO	NO
Armala	NO	NO	NO
Hanbushiyeh	YES	YES	YES
Badama	Ein El-Bayda (Badama)	YES	YES
Kherbet Eljoz	NO	NO	NO
Shaturiyeh	NO	NO	NO
Najiyeh	NO	NO	NO
Ramliyeh	NO	NO	NO
Maraand	NO	NO	NO

	Zoainieh	NO	NO	NO
	Safiyat	NO	NO	NO
	Sawadiya - Nabhan	NO	NO	NO
	Turin	NO	NO	NO
	Zarzur (Darkosh)	NO	NO	NO
	Ghazala - Mgheidleh	NO	NO	NO
	Jamiliya (Darkosh)	NO	NO	NO
	Ramadiyah (Darkosh)	NO	NO	NO
	Mazuleh	NO	NO	NO
	Matleh - Batlaya	NO	NO	NO
	Amud (Darkosh)	NO	NO	NO
	Sadiyah - Bsentiya	NO	NO	NO
	Thahr	NO	NO	NO
	Andnaniyeh - Farjein	NO	NO	NO
	Dorriyeh	NO	NO	NO
Darkosh	Zahraa - Kherbet Amud	NO	NO	NO
	Sheikh Issa Elashury	NO	NO	NO
	Darkosh	NO	NO	NO
	Zanbaqi (co)	NO	NO	NO
	Mreimin (Darkosh)	NO	NO	NO
	Kharab Khalil (Darkosh)	NO	NO	NO
	Kharab Amer	NO	NO	NO
	Kharab Sultan	NO	NO	NO
	Almilk	NO	NO	NO
	Alshamra	NO	NO	NO
	Magharet Jamous	NO	NO	NO
	Alfauri	NO	NO	NO
	Al Hamia	NO	NO	NO
	Al-Hafriya	NO	NO	NO
	Haj Nayef	NO	NO	NO
	Janudiyeh	Janudiyeh	NO	NO
Yaqubiyeh		NO	NO	NO
Hassaniyeh - Hatya		NO	NO	NO
Qaderiyeh - Qayqun		NO	NO	NO
Maland		NO	NO	NO
Qanniyeh (Janudiyeh)		NO	NO	NO
Mudiah - Luxin		NO	NO	NO
Nasra (Janudiyeh)		NO	NO	NO
Foz - Zuf		YES	YES	YES
Tiba - Katrin		NO	NO	NO
Jdidet Eljjsr		NO	NO	NO
Athar		NO	NO	NO
Hamama - Kafr Debbin		NO	NO	NO
Al Marjeh		NO	NO	NO

**Table 6.** The SWC methods of the communities of JASD

Sub-district	Community	SW disposed of by household to a dumping location station (%)	% SW amount left in public areas without collection and disposal (%)	%SW collection free by the local council (%)
Jisr-Ash-Shugur	Upper Sheikh Sindyan	65%	35%	0%
	Msheirfeh (Jisr-Ash-Shugur)	%70	%30	%0
	Sali	%30	%60	%0
	Maalaqa - Bishlamon	%0	%35	%65
	Balmis	%30	%30	%40
	Salhiyeh (Jisr-Ash-Shugur)	%65	%35	%0
	Bsheiriyeh - Bello	%10	%30	%60
	Um Rish	%30	%40	%30
	Bteibat	%65	35%	%0
	Mintar (Jisr-Ash-Shugur)	%60	%40	%0
	Upper Shghur	%50	%50	%0
	Eshtabraq	%65	35%	%0
	Jisr-Ash-Shugur	%0	%20	%80
	Bzeit	%60	%40	%0
	Bkafla	%65	%35	%0
	Ein Elhamra	%5000	50%	%0
	Ghassaniyeh (Jisr-Ash-Shugur)	%20	%30	%50
	Ein Elsoda (Jisr-Ash-Shugur)	%60	%40	%0
	Kafir (Jisr-Ash-Shugur)	%10	20%	%70
	Qaysiyeh	%0	%30	%70
	Alyeh (Jisr-Ash-Shugur)	%70	%0	%0
	Jannet Elqora	%60	40%	%0
	Ghanya	%60	%40	%0
	Sokkariyeh (Jisr-Ash-Shugur)	%40	%60	%0
	Sabileh	%60	40%	%0
	Western Marj Akhdar	%5	%20	%75
	Um Elgar	%40	%60	%0
	Dgali	%50	20%	%30
	Eastern Marj Akhdar	%50	%50	%0
	Tal Awar	%50	%50	%0
	Tal Hamki	%40	60%	%0
	Frikeh (Jisr-Ash-Shugur)	65%	35%	%0
Watba	%40	%60	%0	

	Marj Elzohur	%50	50%	%0
	Kniset Nakhleh	%0	%30	%70
	Al Areen - Kastanah Fawqan	%0	%30	%70
	Jeb Alsafa	%30	%40	%30
	Qulaia	%30	%40	%30
	Qirmida	%50	%50	%0
	Muntar Tahtani	%60	40%	%0
	Al Karnaza	%65	%35	%0
	Frikka al Abeed	65%	35%	%0
	Arzaghan Fawqani	70%	30%	%0
	Ziyadiyah (Jisr-Ash-Shugur)	30%	30%	40%
	The average value:	43%	38%	18%
Badama	Thahr	20%	20%	60%
	Yunesiyeh	50%	50%	0%
	Badama	5%	20%	75%
	Armala	50%	50%	0%
	Hanbushiyeh	0%	0%	100%
	Ein El-Bayda (Badama)	0%	0%	100%
	Kherbet Eljoz	0%	0%	0%
	Shaturiyeh	10%	30%	60%
	Najiyeh	15%	25%	60%
	Ramliyeh	15%	25%	60%
	Maraand	40%	60%	0%
	Zoainieh	65%	35%	0%
	Safiyat	0%	0%	0%
	The average value:	21%	24%	40%
Darkosh	Sawadiya - Nabhan	50%	50%	0%
	Turin	60%	40%	0%
	Zarzur (Darkosh)	20%	20%	60%
	Ghazala - Mgheidleh	60%	40%	0%
	Jamiliya (Darkosh)	50%	50%	0%
	Ramadiyah (Darkosh)	50%	50%	0%
	Mazuleh	60%	40%	0%
	Matleh - Batlaya	10%	30%	60%
	Amud (Darkosh)	10%	20%	70%
	Sadiyah - Bsentiya	60%	40%	0%
	Thahr	50%	50%	0%
	Andnaniyeh - Farjein	20%	20%	60%
	Dorriyeh	50%	50%	0%
	Zahraa - Kherbet Amud	50%	50%	0%

	Sheikh Issa Elashury	65%	35%	0%
	Darkosh	0%	20%	80%
	Zanbaqi (co)	50%	50%	0%
	Mreimin (Darkosh)	45%	55%	0%
	Kharab Khalil (Darkosh)	25%	35%	40%
	Kharab Amer	40%	60%	0%
	Kharab Sultan	50%	50%	0%
	Almilk	65%	35%	0%
	Alshamra	60%	40%	0%
	Magharet Jamous	10%	40%	50%
	Alfauri	10%	50%	40%
	Al Hamia	50%	50%	0%
	Al-Hafriya	50%	50%	0%
	Haj Nayef	50%	50%	0%
	The average value:	42%	42%	16%
Janudiyeh	Janudiyeh	0%	10%	90%
	Yaqubiyeh	0%	15%	85%
	Hassaniyeh - Hatya	5%	15%	80%
	Qaderiyeh - Qayqun	5%	25%	70%
	Maland	5%	30%	65%
	Qanniyeh (Janudiyeh)	10%	20%	70%
	Mudiah - Luxin	20%	30%	50%
	Nasra (Janudiyeh)	50%	50%	0%
	Foz - Zuf	0%	0%	100%
	Tiba - Katrin	50%	50%	0%
	Jdidet Eljisir	30%	30%	40%
	Athar	50%	25%	25%
	Hamama - Kafr Debbin	5%	15%	80%
	Al Marjeh	50%	50%	0%
	The average value:	20%	26%	54%
		The average value of JASC:	36%	36%

**Table 7.** The solid waste collection frequency (SWCF) of the communities of JASD

Subdistrict	Community	More than 3 times per week	Once a week	Once every two weeks or more	Randomly
Jisr-Ash-Shugur	Upper Sheikh Sindyan				Yes
	Msheirfeh (Jisr-Ash-Shugur)				Yes
	Sali				Yes
	Maalaqa - Bishlamon		Yes		
	Balmis				Yes
	Salhiyeh (Jisr-Ash-Shugur)				Yes

	Bsheiriyeh - Bello	Yes	
	Um Rish		Yes
	Bteibat		Yes
	Mintar (Jisr-Ash-Shugur)		Yes
	Upper Shghur		Yes
	Eshtabraq		Yes
	Jisr-Ash-Shugur	Yes	
	Bzeit		Yes
	Bkafila		Yes
	Ein Elhamra		Yes
	Ghassaniyeh (Jisr-Ash-Shugur)		Yes
	Ein Elsoda (Jisr-Ash-Shugur)		Yes
	Kafir (Jisr-Ash-Shugur)	Yes	
	Qaysiyeh	Yes	
	Alyeh (Jisr-Ash-Shugur)		Yes
	Jannet Elqora		Yes
	Ghanya		Yes
	Sokkariyeh (Jisr-Ash-Shugur)		Yes
	Sabileh		Yes
	Western Marj Akhdar	Yes	
	Um Elgar		Yes
	Dgali		Yes
	Eastern Marj Akhdar		Yes
	Tal Awar		Yes
	Tal Hamki		Yes
	Frikeh (Jisr-Ash-Shugur)		Yes
	Watba		Yes
	Marj Elzohur		Yes
	Kniset Nakhleh	Yes	
	Al Areen - Kastanah Fawqan		Yes
	Jeb Alsafa		Yes
	Qulaia		Yes
	Qirmida		Yes
	Muntar Tahtani		Yes
	Al Karnaza		Yes
	Frikka al Abeed		Yes
	Arzaghan Fawqani		Yes
	Ziyadiyeh (Jisr-Ash-Shugur)		Yes
	Baksariya		Yes
Badama	Yunesiyeh		Yes
	Badama	Yes	

	Armala		Yes
	Hanbushiyeh	Yes	
	Ein El-Bayda (Badama)	Yes	
	Kherbet Eljuz		Yes
	Shaturiyeh	Yes	
	Najiyeh	Yes	
	Ramliyah	Yes	
	Maraand		Yes
	Zoainieh		Yes
	Safiyat		Yes
	Sawadiya - Nabhan		Yes
	Turin		Yes
	Zarzur (Darkosh)		Yes
	Ghazala - Mgheidleh		Yes
	Jamilya (Darkosh)		Yes
	Ramadiyeh (Darkosh)		Yes
	Mazuleh		Yes
	Matleh - Batlaya		Yes
	Amud (Darkosh)		Yes
	Sadiyeh - Bsentiya		Yes
	Thahr		Yes
	Andnaniyeh - Farjein	Yes	
	Dorriyeh		Yes
Darkosh	Zahraa - Kherbet Amud		Yes
	Sheikh Issa Elashury		Yes
	Darkosh		Yes
	Zanbaqi (co)		Yes
	Mreimin (Darkosh)		Yes
	Kharab Khalil (Darkosh)		Yes
	Kharab Amer		Yes
	Kharab Sultan		Yes
	Almilk		Yes
	Alshamra		Yes
	Magharet Jamous		Yes
	Alfauri		Yes
	Al Hamia		Yes
	Al-Hafriya		Yes
	Haj Nayef		Yes
	Janudiyeh	Yes	
	Yaqubiyeh	Yes	
Janudiyeh	Hassaniyeh - Hatya	Yes	
	Qaderiyeh - Qayqun		Yes
	Maland	Yes	
	Qanniyeh (Janudiyeh)		Yes

Mudiah - Luxin		Yes
Nasra (Janudiyeh)		Yes
Foz - Zuf	Yes	
Tiba - Katrin		Yes
Jdidet Eljisir		Yes
Athar		Yes
Hamama - Kafr Debbin	Yes	
Al Marjeh		Yes

**Table 8.** The quantity, the volume of SW of the communities of JASD

Sub-district	Community	MSW production (m3)	MSW production liter per capita	Quantity of MSW (kg/day)	Quantity of MSW (kg .cap-1. day-1)	The distance of the random land -fill (km)
	Upper Sheikh Sindyan	N/A	N/A	N/A	N/A	N/A
	Msheirfeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	5
	Sali	N/A	N/A	N/A	N/A	0
	Maalaqa - Bishlamon	1.5	0.5	300	0.1	1.5
	Balmis	N/A	N/A	N/A	N/A	5
	Salhiyeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Bsheiriyeh - Bello	1	0.2	200	0.0	1
	Um Rish	N/A	N/A	N/A	N/A	1
	Bteibat	N/A	N/A	N/A	N/A	2
	Mintar (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Upper Shghur	N/A	N/A	N/A	N/A	N/A
	Eshtabraq	N/A	N/A	N/A	N/A	N/A
Jisr-Ash-Shugur	Jisr-Ash-Shugur	60	3.3	12000	0.7	4
	Bzeit	N/A	N/A	N/A	N/A	2
	Bkafla	N/A	N/A	N/A	N/A	N/A
	Ein Elhamra	N/A	N/A	N/A	N/A	N/A
	Ghassaniyeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Ein Elsoda (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	3
	Kafir (Jisr-Ash-Shugur)	3	1.8	600.00	0.4	3
	Qaysiyeh	1	0.6	200.00	0.1	5
	Alyeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Jannet Elqora	N/A	N/A	N/A	N/A	3
	Ghanya	N/A	N/A	N/A	N/A	N/A
	Sokkariyeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Sabileh	N/A	N/A	N/A	N/A	N/A



	Western Marj Akhdar	2	0.2	400	0.0	2
	Um Elgar	0	0.0	0.00	0.0	N/A
	Dgali	0	0.0	0.00	0.0	1
	Eastern Marj Akhdar	2	0.3	400	0.1	2
	Tal Awar	N/A	N/A	N/A	N/A	1
	Tal Hamki	N/A	N/A	N/A	N/A	N/A
	Frikeh (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	N/A
	Watba	N/A	N/A	N/A	N/A	N/A
	Marj Elzohur	N/A	N/A	N/A	N/A	2
	Kniset Nakhleh	0.5	0.2	100.00	0.042	7
	Al Areen - Kastanah Fawqan	1	1.1	200.00	0.2	2
	Jeb Alsafa	N/A	N/A	N/A	N/A	1
	Qulaia	N/A	N/A	N/A	N/A	1
	Qirmida	N/A	N/A	N/A	N/A	N/A
	Muntar Tahtani	N/A	N/A	N/A	N/A	N/A
	Al Karnaza	N/A	N/A	N/A	N/A	1
	Frikka al Abeed	N/A	N/A	N/A	N/A	N/A
	Arzaghan Fawqani	N/A	N/A	N/A	N/A	N/A
	Ziyadiyah (Jisr-Ash-Shugur)	N/A	N/A	N/A	N/A	3
	Baksariya	N/A	N/A	N/A	N/A	N/A
	Yunesiyeh	N/A	N/A	N/A	N/A	N/A
Badama	Badama	6	1.7	1200	0.3	3
	Armala	3	1.2	600	0.2	2
	Hanbushiyeh	4	0.8	800	0.2	2
	Ein El-Bayda (Badama)	4.5	1.3	900	0.3	2
	Kherbet Eljoz	10	0.4	2000	0.1	N/A
	Shaturiyeh	3	1.6	600	0.3	2
	Najiyeh	2	1.9	400	0.4	1
	Ramliyeh	1	0.8	200	0.2	2
	Maraand	N/A	N/A	N/A	N/A	N/A
	Zoainieh	N/A	N/A	N/A	N/A	N/A
	Safiyat	N/A	N/A	N/A	N/A	N/A
	Sawadiya - Nabhan	N/A	N/A	N/A	N/A	N/A
	Turin	N/A	N/A	N/A	N/A	10
Darkosh	Zarzur (Darkosh)	4	0.5	800.00	0.1	1
	Ghazala - Mgheidleh	N/A	N/A	N/A	N/A	N/A
	Jamiliya (Darkosh)	N/A	N/A	N/A	N/A	N/A
	Ramadiyah (Darkosh)	N/A	N/A	N/A	N/A	N/A

Mazuleh	N/A	N/A	N/A	N/A	N/A
Matleh - Batlaya	N/A	N/A	N/A	N/A	N/A
Amud (Darkosh)	4	2.1	800	0.4	1
Sadiyeh - Bsentiya	N/A	N/A	N/A	N/A	4
Thahr	N/A	N/A	N/A	N/A	N/A
Andnaniyeh - Farjein	2	1.0	400	0.2	3
Dorriyeh	2	0.3	400	0.1	2
Zahraa - Kherbet Amud	4	1.7	800	0.3	2
Sheikh Issa Elashury	N/A	N/A	N/A	N/A	10
Darkosh	3	0.1	600	0.0	15
Zanbaqi	1	0.2	200	0.0	N/A
Mreimin (Darkosh)	N/A	N/A	N/A	N/A	3
Kharab Khalil (Darkosh)	N/A	N/A	N/A	N/A	10
Kharab Amer	N/A	N/A	N/A	N/A	N/A
Kharab Sultan	N/A	N/A	N/A	N/A	N/A
Almilk	N/A	N/A	N/A	N/A	N/A
Alshamra	N/A	N/A	N/A	N/A	3
Magharet Jamous	N/A	N/A	N/A	N/A	10
Alfauri	N/A	N/A	N/A	N/A	0
Al Hamia	N/A	N/A	N/A	N/A	3
Al-Hafriya	N/A	N/A	N/A	N/A	0
Haj Nayef	N/A	N/A	N/A	N/A	0
Janudiyeh	3	0.2	600	0.04	2
Yaqubiyeh	4	1.5	800	0.3	4
Hassaniyeh - Hatya	N/A	N/A	N/A	N/A	10
Qaderiyeh - Qayqun	1	0.3	200	0.1	5
Maland	2	0.4	400	0.1	2
Qanniyeh (Janudiyeh)	3	1.4	600	0.3	5
Janudiyeh Mudiah - Luxin	3	4.0	600	0.8	2
Nasra (Janudiyeh)	2	1.9	400	0.4	2
Foz - Zuf	8	0.8	1600	0.2	1
Tiba - Katrin	N/A	N/A	N/A	N/A	2
Jdidet Eljisir	N/A	N/A	N/A	N/A	N/A
Athar	N/A	N/A	N/A	N/A	N/A
Hamama - Kafr Debbin	8	0.7	1600	0.1	2
Al Marjeh	N/A	N/A	N/A	N/A	N/A

N/A: Not available because the local council do not collect solid waste and the people through it in a randomly way

1. About seventy communities out of ninety-nine communities (92195 persons of 262246 persons) of JASD do not have dedicated works for solid waste collection, and eighty communities (120237 persons of 262,246 persons) do not have SW containers, and sixty-seven communities (77,195 persons of 262,246 do not have solid waste tractors with a trails are necessary for SWC) as showed in Fig 3, this is considered an evidence of the bad state of SWM, the local councils do not have enough resources for buying SW containers, the cost of each one is about 40\$ with capacity 0.1 m<sup>3</sup> that can serve 80-120 persons.



Fig 3. The gaps of solid waste management in JASD

2. The number of local councils JASD is ninety-nine, and all these local councils are not received or supported by SW equipment, tools and machines, and only three local councils (hosted 18,924 persons of 262,246) are supported by salaries for the solid waste workers, fuel for the tractors and solid waste tools of SWM from SECD, as showed in Fig 4, this support is not sustainable, also only for four months. In general the SW sector is not supported by NGOs in a good way so the environment is polluted and cutaneous leishmaniasis registered cases during 2018 [13].

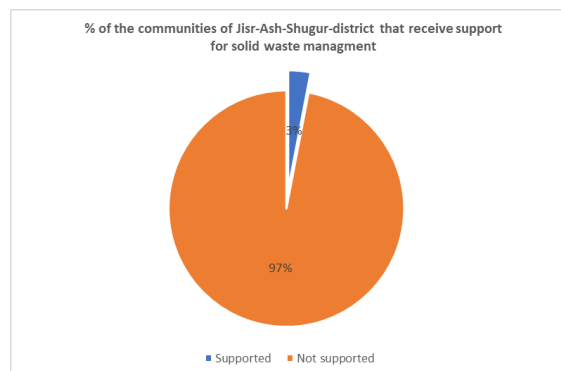


Fig 4. Showed the percent of the communities of JASD that received support for solid waste management

3. Only 26% of SW amount of JASD collected by the local councils ( Public solid waste collection) without any fees, The larger the ratio, the better, because it indicates that more waste is collected and transported, and 36% of SW left in public areas which could be the cause of many diseases, and Solid waste disposed of the household to a dumping location station 36%, Darkosh - district considered the worth district of JASD according to SWM because only 16% of SW amount is collected by the local councils ,so during 2018 the number of Cutaneous leishmaniases registered cases of Darkosh subdistrict is: 1062 which considered too high and Darkosh subdistrict need urgent support and solid waste service response.

4. SWCF values differ from one community to other, the SWCF of sixty-eight communities (152,847 persons of 262,246 ) of JASD is conducted Randomly, two communities (7,136 people) Once every two weeks or more, and thirteen Communities (87,517 of 242,682 persons) the SWCF is at least three times per week, and six Communities (15,569 persons) : Once every two weeks. As showed in Fig 5, before the crisis of Syria at 2011, The SWC was performed daily by the local council, the SWCF once per a week or two weeks are considered too low, it must be at least two times per a week in the crisis [17].

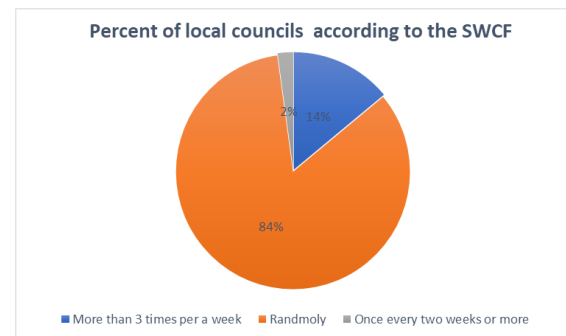


Fig 5. SWCF of JACD communities

5. The total volume of MSW production of JASD cannot measure in an accurate method because the solid waste collection are conducted randomly, But for the communities which the solid waste quantity can be measured, the average, maximum and minimum of SW production per capita at JASD communities is (1.07; 3.96; 0.12) liter day<sup>-1</sup> and (0.21; 0.79; 0.02) kg day<sup>-1</sup>. and the average SW production per capita value for JASD is 1.07 liter day<sup>-1</sup>, 0.21 kg.day<sup>-1</sup>, these values are similar to the value recognized by the world bank [18] and to SECD assessment [12].

6. There are fifty-eight random landfills at least of JASD. which considered a spot of pollution, resources of bad odors and one of the roots causes of cutaneous leishmaniasis, in other hand the average, maximum and minimum distance between the center of the community and the random landfills is (3.33;15.1) km respectively, it is highly recommended that only one or two sanitary landfills be conducted for JASD instead of 58 randomly landfills.

7. The maximum Cutaneous leishmaniasis cases of Darkosh: 1,062, Janudiyeh: 771, Jisr-Ash-Shugur :453, and Badama:100. cases during the 2018 year [16], which is considered so risk and related to the bad solid waste management of JASD.

#### 4. CONCLUSIONS

The SWM management of Jisr-Ash-Shugur-district controlled areas considered very bad because of the shortage of financial and human resources and the NGOs did not support Jisr-Ash-Shugur-district the solid waste management in general , It is highly recommended that UNICEF (the United Nations International Children's Emergency Fund) , SCHF, and the other donors give the priorities to conduct solid waste management in Jisr-Ash-Shugur so the environment polluted and the cutaneous leishmaniasis increases day by day. The local councils of NSAG area

need urgent support and training for operation SWM in a good way.

Effective SWC will reduce the cutaneous leishmaniasis cases and the pollution of the environment.

It is highly recommended to establish a general management of solid waste for JASD to achieve a best service of SWM and use the available resources in a good way and take a benefit of the studies which related to the developing countries to convert solid waste into useful products, such used rubber tire pyrolysis of waste tire rubber to produce liquid fuel. [19], recycling of waste plastics for utilization it as an energy source [20] and Biodiesel production from waste oils [21].

## 5. ACKNOWLEDGMENTS

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