THE INTEGRATION OF GISINTO SCHOOL MAPPING A CASE OF RAMALLAH CITY, PALESTINE.

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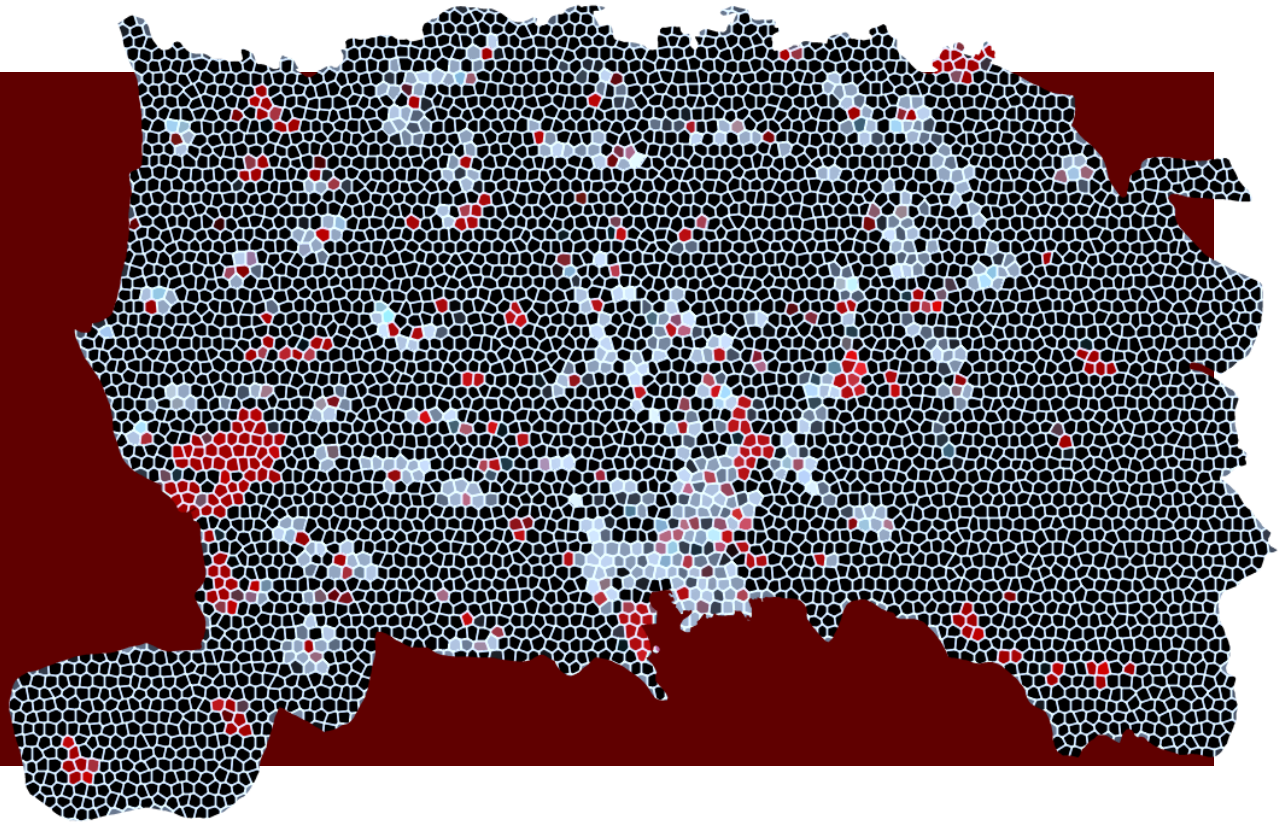
THE INTEGRATION OF GIS INTO SCHOOL MAPPING

A CASE OF RAMALLAH CITY, PALESTINE.



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INTRODUCTION

The Geographical Information System has numerous applications in urban planning and decision making regarding educational systems and schools. Since it has been a trend in supporting decision makers in general, and Ministries of education in particular (Al-Hanbali, no date).One of these applications is how the GIS software can be used to allocate new schools or perhaps extend an already existing schools.

The aim of this project is to address the integration of GIS (Geographic Information System) as an analysis tool for school mapping in Ramallah and Al-Bireh city, Palestine. Thus the project will be divided into three phases. The first phase provides an analysis tool using GIS to identify the condition of schools in Ramallah and Al-Bireh in addition to the surrounding villages, in order to identify the localities that have scarcity in schools or need an additional number of schools to cover the continuing increase in population and thus the increase in number of students. Phase two will focus on the selected city from phase one; and apply a further deeper analysis on where to allocate these new schools? What are the best locations based on a defined criteria to allocate a new school? Phase three will mainly focus on how to decide if a given land is appropriate to build a new school on (Land assessment). All of the three phases will be based on an extensive study of several layers of existing schools, infrastructure in addition to population densities, roads network, availability of emergency services etc.

LITERATURE REVIEW

"School mapping is the art and science of building geospatial databases with relational databases of educational, demographic, social and economic information for schools and educational directorates to support educational planners and decision makers." (Al-Hanbali, no date. P.2). In school mapping all decision makers from planners, architects, educators and students should participate in creating the needed GIS layers that will later contribute to the final applicable and useful map of results.

The school site: or what is also known as land for learning is a physical location known as school and linked to the surrounding environment and community, though it can be used for purposes other than education (Michael E. Ward, 1998).

PHASE ONE: Selecting the locality that has scarcity of schools within its context.

The aim of the first implementation phase is to provide a good analysis tool to analyze and study the condition of schools in Ramallah and Al-Bireh city in addition to the nearby villages, in order to be able to give suggestions using GIS of which locality needs new schools due to the scarcity of schools within, or perhaps the need for extending or renovating existing schools in a locality due to the rapid increase in population.

PHASE TWO: Selecting the appropriate land for school.

School site selection is a serious public policy decision, which involves an intensive study of land availability, land use, land ownership, accessibility, availability of utilities and many other factors might influence site selection, and later on decide whether the location of this site will allow pedestrian accessibility or the use of buses and private cars to reach the school from the surrounding neighborhood. This requires the involvement of both decision makers and local people in deciding the best location for establishing a new school (Kito and Thomas, 2011). In order to achieve a rational criteria for school mapping; several layers and aspects should be well considered:

First Knowing the Community or Territory:

Since the school is part of the community, then its location should be based on the demands of the community. Data about the residential complex locations should be presented, in addition to the location of public schools, since they are under the responsibility of the local administrative community (In our case Al-Bireh Municipality and the village senate). Further information should be collected about schools in the community showing the type of public schools (elementary, secondary and high school), in addition to the number of students enrolled in each school.

Second knowing the accessibility:

Studying the transportation system is essential in determining the optimum location for building a new school, taking into consideration the public transportation routes, types of roads (regional, local etc.…) to avoid direct access to high speed roads, furthermore it is preferable for the site to be located on two adjacent roads. While roads should allow easy walking and bicycling for the children who will attend the school. Schools should be located in areas that decrease vehicle trips and increase walkability within a residential complex. (National center for safe routes to school, 2014).

Third knowing the technical requirements:

A criteria of technical requirements should be listed mainly according to the general standards followed at that locality, or the criteria listed by the Ministry of education and meets the needs of the designer. Since no definite criteria is followed by the Ministry of education in Palestine an assumption will be made regarding all the technical requirements such as size, shape, utilities, noise level, topography/drainage and soil conditions/ plant life (Michael E. Ward, 1998).

1. Size: it varies according to the type of school wither being elementary, secondary, high school or perhaps all the types in one school. The following diagram shows the needed area for school site based on school type and area needed for each 100 students. Figure (1): Shows the standard area needed for each type of school, and the additional area for each 100 students. For example from kindergarten to grade 6 the needed area is 4 square kilometers and 1 square kilometer is needed for each 100 students according to Michael E. Ward, 1998.

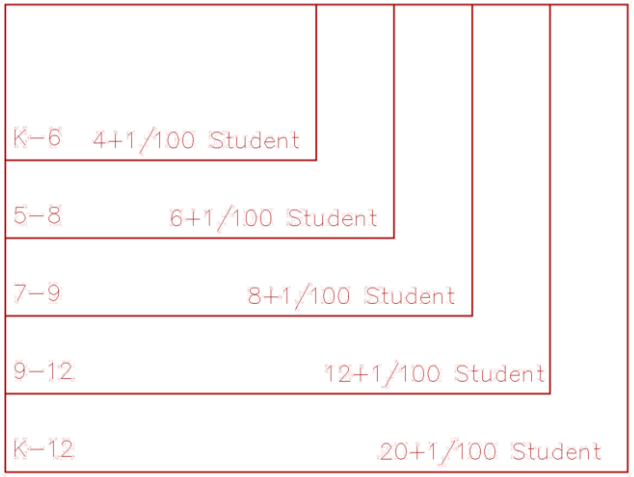


Figure (1): Standard area needed for each school level.

Source: Michael E. Ward, 1998. Edited by the author.

Any further activities and future expansions, their area should be calculated and added to the standard data given in the diagram above. For our case 20 square kilometers is needed to accommodate students from the kindergarten level to the 12 grade level.

2. Shape: Sites with rectangular form is more suitable and easiest to plan, the rectangular shape is preferred to have a ratio of approximately three to five (Michael E. Ward, 1998).

3. Sources of pollution: Any site should be far from all pollution sources including a distance between "1-5 km" radius from the heavy industry and a distance between "150 – 450 m" from heavy roads to eliminate cars pollution. Furthermore to avoid audio pollution the school site should be far from commercial zones by a radius of "1-1.5 km". (Bukhari , Z., Rodzi A. M., Noordin, 2010).

4. Topography/Drainage and Soil conditions: The site is preferred to be located on a land of gentle slope of about 10 degrees with an elevation and contour which will ensure good drainage. One should note also that the slope can be well managed by the designer on how to accommodate with it and provide all the needed playgrounds and so on. And since our design asks for integrating the agricultural activities with the school, then a choice of good soil for planting is needed. (Michael E. Ward, 1998).

Forth: Considering ABC Land classification (a special case of Palestine)

Palestinian Lands had been classified by the Israeli government in 1995 into ABC land classification; where area "A" area is under the control of the Palestinian authority and is endowed with most governmental powers, it compromises about 18% of the land in the west bank. While area "B" is under the security control by the Israeli government and the civil control is transferred to the Palestinian Authority, it compromises 22% of the land in the west bank. While area "C" is totally under the control of the Israeli government security and civil matters, it compromises 60% of the land in the west bank. .That's why this classification should be taken into consideration due to the probability of having suitable lands in area "C" which is prevented to build in (B'Tselem, 2013).

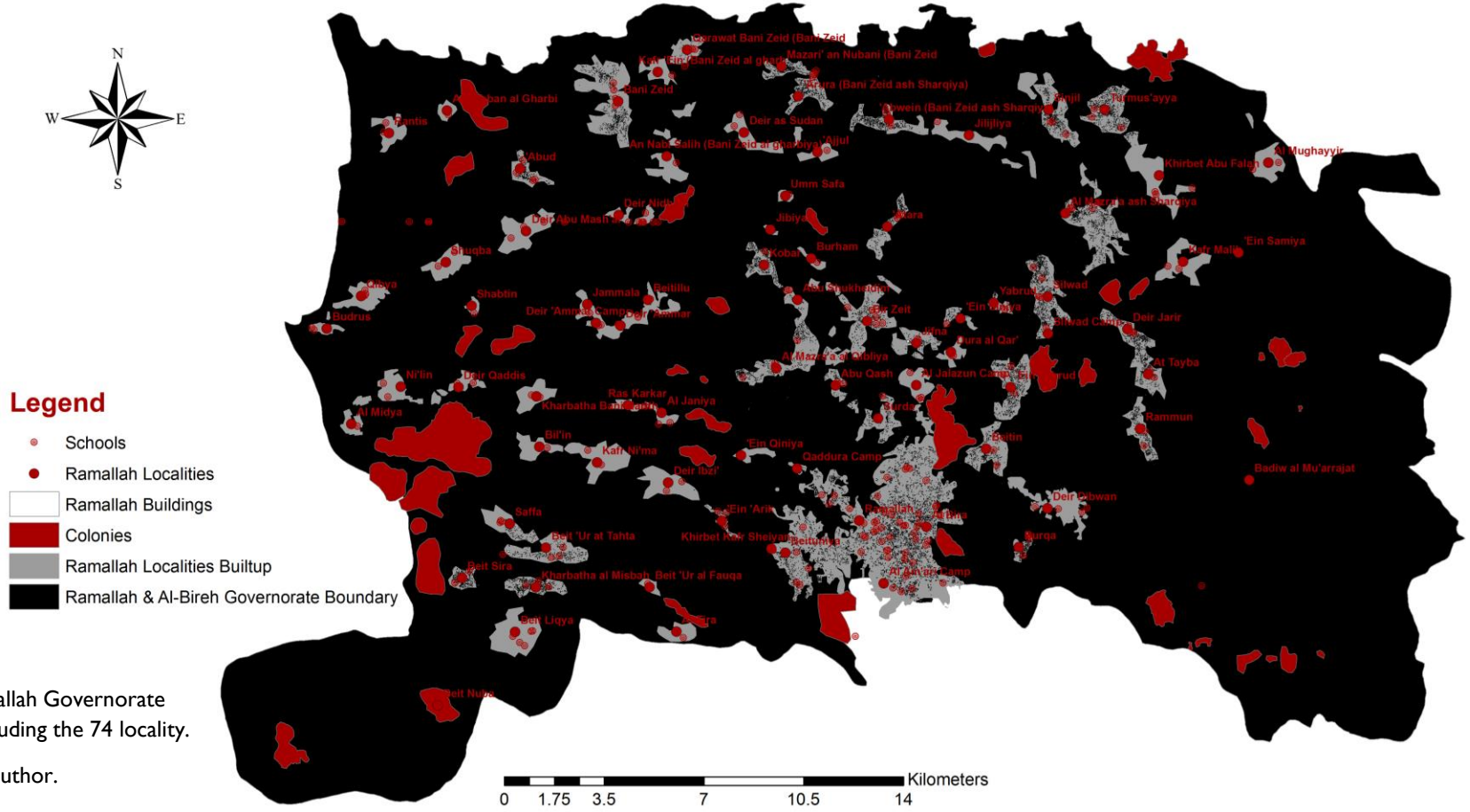
STUDY SITE

Ramallah is a City about 10 miles north of Jerusalem in Palestine. Its altitude is between 830 and 900 meters above sea level (David Ghannam, 2006-2015). As illustrated in figure (2).

Ramallah City has 74 localities, having a population of 335915 person, 82122 total number of students and 251 school (PCBS, 2014). As shown by map number (1), which illustrates the location of schools in all of the study area and table number (1) shows the population, number of students (male and female) and the number of schools in each of these localities.

Figure (2): Palestine Map showing the Palestinian territories, and the Study Site. Source: Maps of the World, 2015.

Ramallah and Al-Bireh Governorate



Map (1): Ramallah Governorate boundary including the 74 locality.

Source: The author.

Name of locality	Number of Schools	Number of Students	Population 2014	Name of Locality	Number of Schools	Number of Students	Population 2014
Krawet Bani Zeid	3	1000	3,526	Al-Mazraa El-Shrkia	4	993	5437
Bani Zeir Al-Sharkia	6	1603	6149	Deir Netham	1	210	1,063
Kur Ein	1	312	2,108	Atara	2	588	2746
Bani Zeid	3	1066	6671	Deir Abu Mesh'al	3	918	4,260
Abween	3	922	3,773	Burham	1	139	745
Turmosaia	4	932	4519	Kufor Malek	2	575	3371
Al-Liban Al-Garbia	2	393	1,785	Shukba	2	1372	5,440
Sinjel	4	1600	6334	Kobar	4	946	4448
Deir Sudan	2	528	2,408	Kebia	4	1498	5,929
Rantees	2	596	3065	Silwad	6	1964	7407
Jaljilia	1	122	896	Yabrud	1	129	779
Ajool	1	316	1496	Al-Itehad	4	1379	8229
Al-Mgaeir	2	797	2,865	Shebteen	1	266	1,021
Aboud	4	635	2521	Birzeit	7	1943	5479
Al-Nabi Saleh	1	99	646	Ein Sinya	1	193	860
Kherbit Bu Falah	4	1095	4834	Deir Jreer	3	976	4,822
Em Safa	1	131	740	Deir Ammar Camp	3	1134	2219
Budros	2	340	1,692	Dura Al Kare'	2	353	3504
Al-Zaytuna	5	1655	7488	Al-Taybeh	2	777	1,756
Jefna	1	178	2,076	Al-Jalazon Camp	5	2530	9451

Name of locality	Number of Schools	Number of Students	Population 2014	Name of Locality	Number of Schools	Number of Students	Population 2014
Abu Qash	2	392	1,698	Ramallah	23	10001	33,218
Deir Edrees	3	575	2349	Burka	4	623	2528
Ne'leen	3	1323	5,532	Atara	3	996	5,289
Ein Yabrud	3	731	3628	Beit Ur El-Tahta	14	5674	23904
Kharbtha Bani Hareth	3	889	3,443	Betunia	2	1454	6,065
Ras Karkar	2	461	2012	Al-Amari Camp	3	825	3,325
Surda	1	181	1,247	Beit Sera	4	1496	6304
Al-Jania	2	295	1407	Kharbtha El-Mesbah	2	340	1,045
Al-Media	1	292	1,574	Beit Ur El-Fo'a	1	250	1643
Ramun	3	681	3177	Al-Terah	5	2168	9,327
Kufor Ne'ma	3	1163	4,536	Beit Lekia	5	2168	9327
Bele'een	2	457	2058	Deir Debwan	5	1470	6,353
Beteen	2	492	2,592	Al-Bireh	34	13233	46212
Ein Kinia	1	192	982	Ein Ereek	4	568	1,896
Badu Al-Mua'rajat	1	56	911	Safa	3	1160	4599
Die Ebzee'	2	481	2503				

Table (1): Shows the number of schools and students in Ramallah localities.

Source: Provided by the Ministry of Education, edited by the author.

METHODOLOGY

PAHSE ONE: Selecting the locality that has scarcity of schools within its context.

DATA COLLECTION

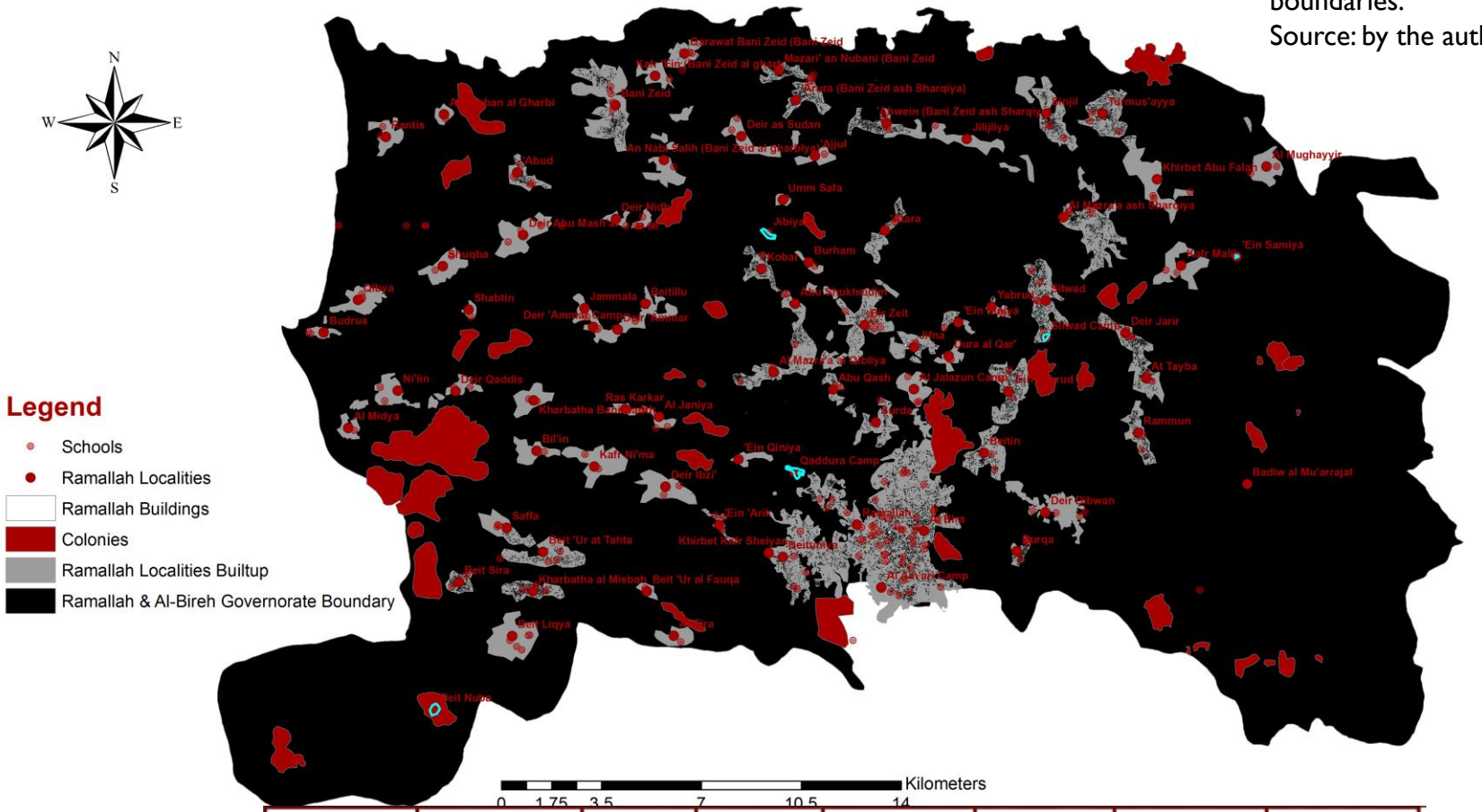
1. Excel data about the population densities in Ramallah city and its localities provided by PCBS (Palestinian Center of Bureau and Statistics) for the years 2014-2015.
2. Attribute table for the number and locations of schools in Ramallah city to be allocated in the geospatial database.
3. Geographic database files for Ramallah boundaries and districts and the location of Ramallah localities relative to Ramallah governorate boundary.

ANALYSIS AND DIGITIZATION

According to the Ministry of education a new school is established for every 300 students as an average. This requires dividing the number of students by 300 to find the number of schools needed for each locality. After checking all the geo-refrencing for all the shapefile of localities, Ramallah boundary, location of schools and colonies according to the National Palestinian Grids 1923, and applying the clip command to have all these shapefiles only for Ramallah governorate then the selection is made:

1. Selecting by attributes the localities that don't have schools within its boundaries, as shown in map (2) and table (2).
2. After adding a new field that divides the number of students by 300 the results is selected by attributes to be more than the number of schools, as shown in map (3) and table (3).

Ramallah and Al-Bireh Governorate

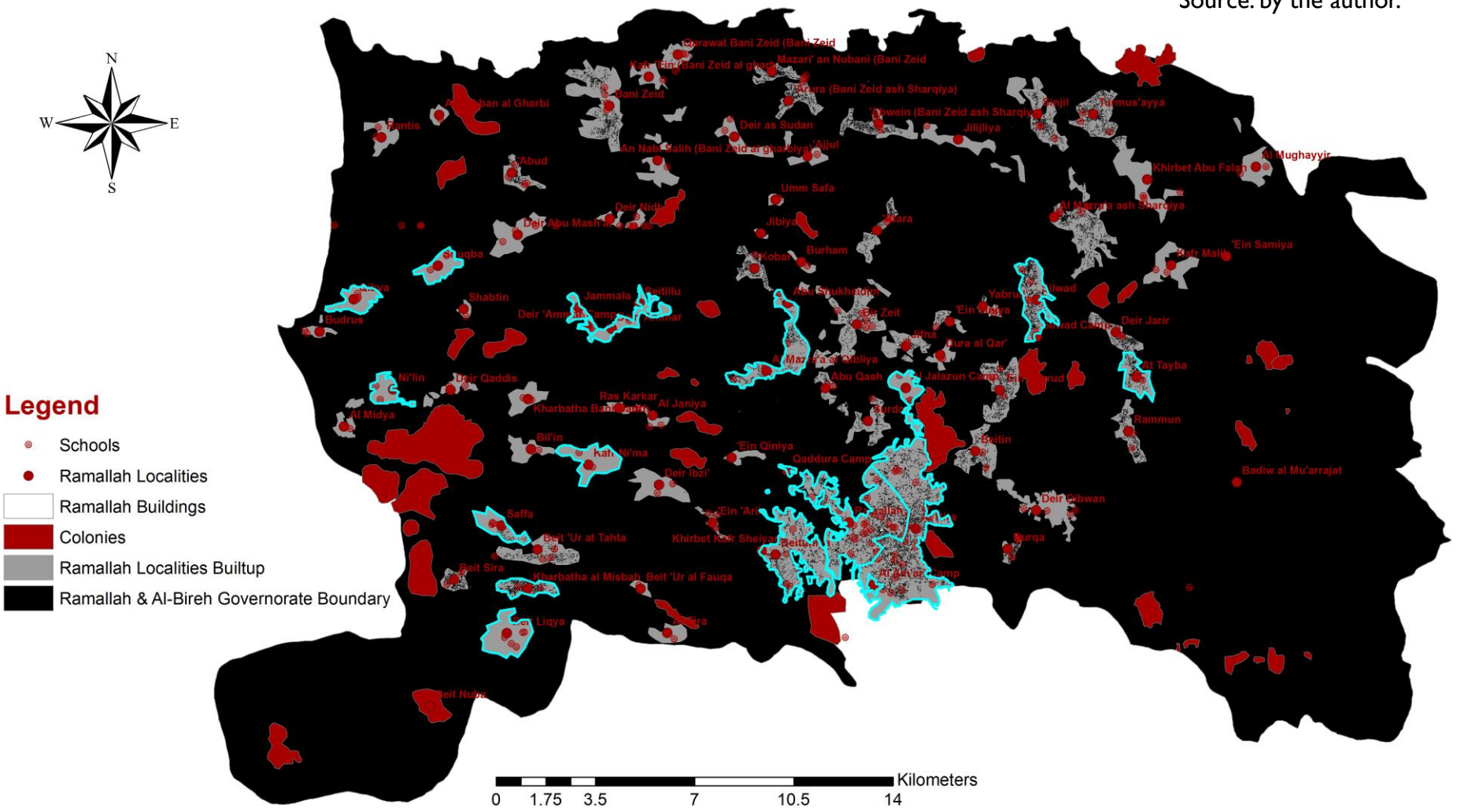


Map (2): Localities that don't have schools within their boundaries.
Source: by the author.

Table (2): Names of Localities that don't have schools within their boundaries.
Source: by the author, using GIS.

Name	Area_m2	Density	Name_new	area_perso	Pop__2014	No__School	No_Of_Stud
Jibiya	70172.40253	0.001981	0	0	341	0	60
'Ein Samiya	8199.08617	0.070618	0	0	311	0	55
Silwad Camp	32115.511337	0.011178	0	0	422	0	72
Beit Nuba	92738.919071	0.002523	0	0	358	0	65
Qaddura Camp	106586.937288	0.010658	0	0	1502	0	358

Ramallah and Al-Bireh Governorate



Map (3): Localities that are in need for establishing new schools
Source: by the author.

Name	Area_m2	Density	Name_new	area_perso	Pop__2014	No__School	No_Of_Stud
Shuqba	1009295.9045	0.004188	0	0	5440	2	1372
Qibya	1035667.73701	0.004448	0	0	5929	4	1498
Silwad	2025180.09571	0.002842	0	0	7407	6	1964
Deir 'Ammar Camp	186267.47617	0.009256	0	0	2219	3	1134
At Tayba	1104529.04163	0.001235	0	0	1756	2	777
Al Jalazun Camp	827983.76811	0.00887	0	0	9451	5	2530
Kafr Ni'ma	1602328.05884	0.0022	0	0	4536	3	1163
Al Bira	9819438.70613	0.003657	0	0	46212	34	13233
Saffa	1018874.15539	0.003508	0	0	4599	3	1160
Ramallah	6649597.73474	0.003882	0	0	33218	23	10001
Beituniya	4026464.22114	0.00465	0	0	23904	14	5674
Al Am'ari Camp	196920.893401	0.023933	0	0	6065	2	1454
Kharbatha al Misbah	981011.793839	0.004993	0	0	6304	4	1496
Beit Liqya	1947426.68358	0.003721	0	0	9327	5	2168
Qaddura Camp	106586.937288	0.010658	0	0	1502	0	358
Ni'lin	846226.284623	0.00508	0	0	5532	3	1323
Al Ithihad	1756375.72914	0	0	0	8229	4	1379
Al Zaytouna	2473848.23245	0	0	0	7488	5	1655

Table (3): Names of Localities that need extra school within their boundaries.

PHASE TWO: Selecting the appropriate land for school.

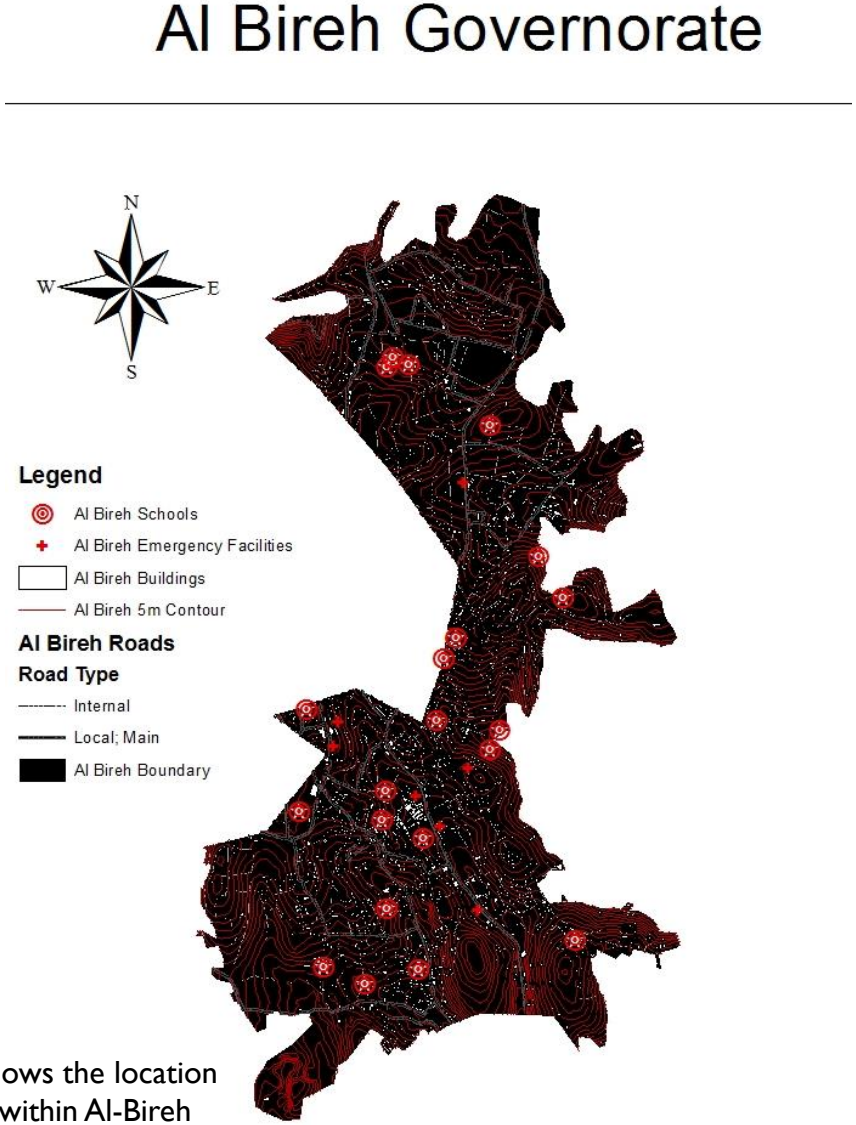
DATA COLLECTION

1. Geographical: Maps and other forms of data showing the administrative boundaries, road utilities and type of roads, land use and services.
2. Educational: Location of public and private schools, number of students in each school in addition to the type of school (elementary, secondary and high schools).
3. Distance: The elementary school should be within 800 meters walking distance, and 2500 meters walking distance for high schools according to the national center for safe routes to school.
4. Size: An assumption of 15000 to 23000 square meters has been taken regarding land selection based on the data discussed in the literature review.
5. Shape: A rectangular shape is more preferred in the case of school site selection.
6. Sources of pollution: An assumption of 1kilometer radius buffer from industrial zone is considered.
7. Topography/Drainage: A land having a slope of 10 degrees is most prefer

8. A map showing the classification of ABC areas in Palestine. An assumption of 800 m buffer from these colonies is taken into consideration.

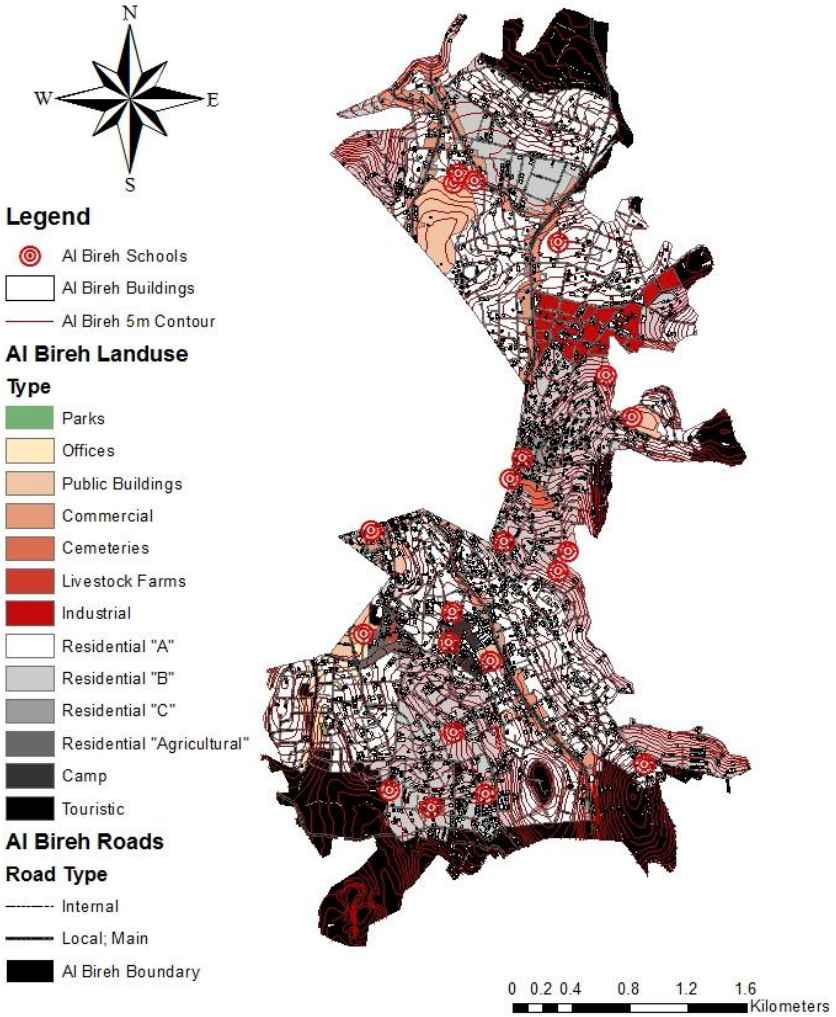
ANALYSIS AND DIGITIZATION

1. All the shapefile have been clipped to the boundaries of Al-Bireh city only and checked for the geo-refrencing. As shown in map (4-6).
2. Selection by attribute has been made for lands to be larger or equal to 15000 square meters and less than or equal to 23000 square meters and land type to be residential "A" or "B". As shown in map (7).
3. Also remove from selection lands that are classified as area "C" using selection by attributes. As shown in map (8).
4. Then remove all the lands that intersect with buildings using selection by location. As shown in map (9).
5. Taking a buffer from industrial zone for all the lands that are within a distance from industrial area of 1 kilometer and from colonies a distance of 800 meters. As shown in map (10).



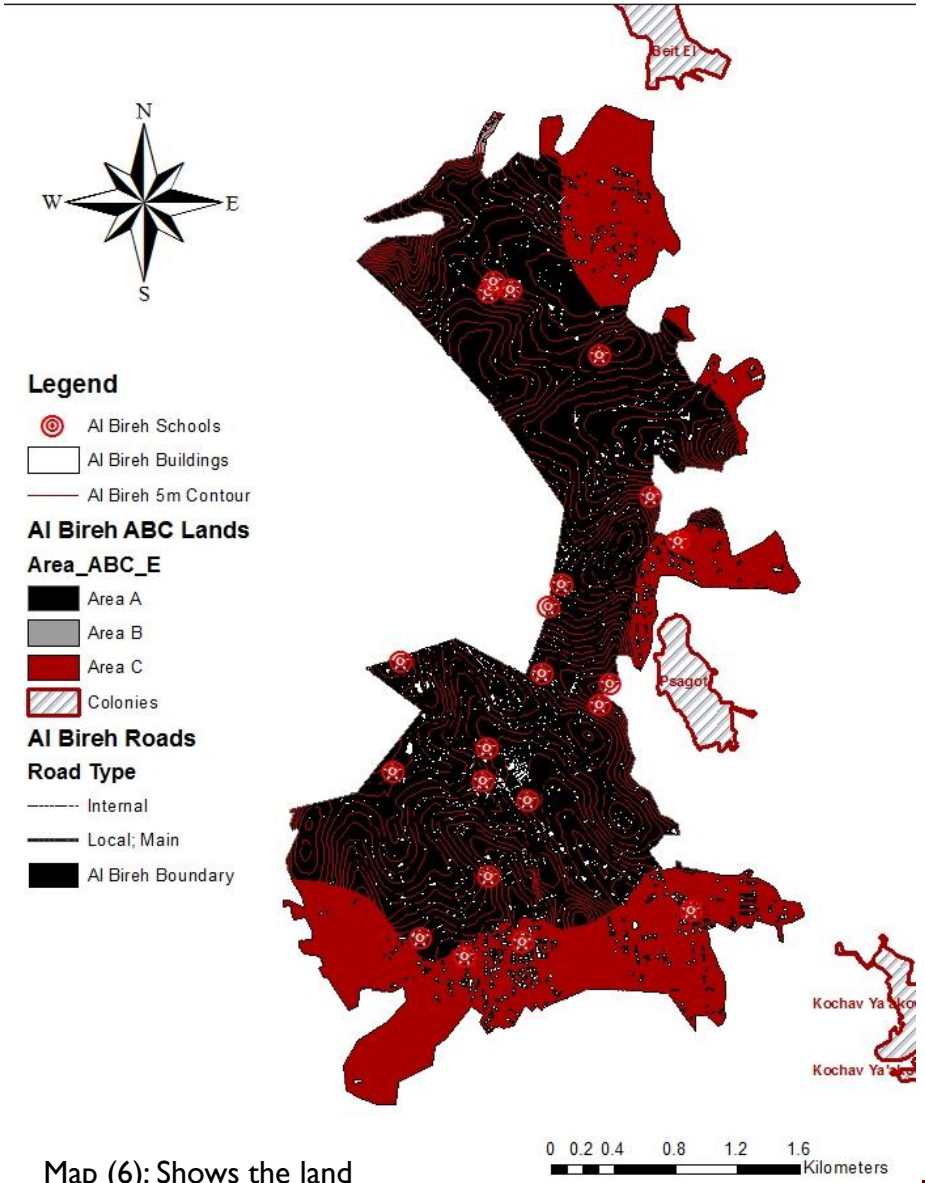
Map (4): Shows the location of schools within Al-Bireh Boundary.
Source: by the author.

Al Bireh Governorate

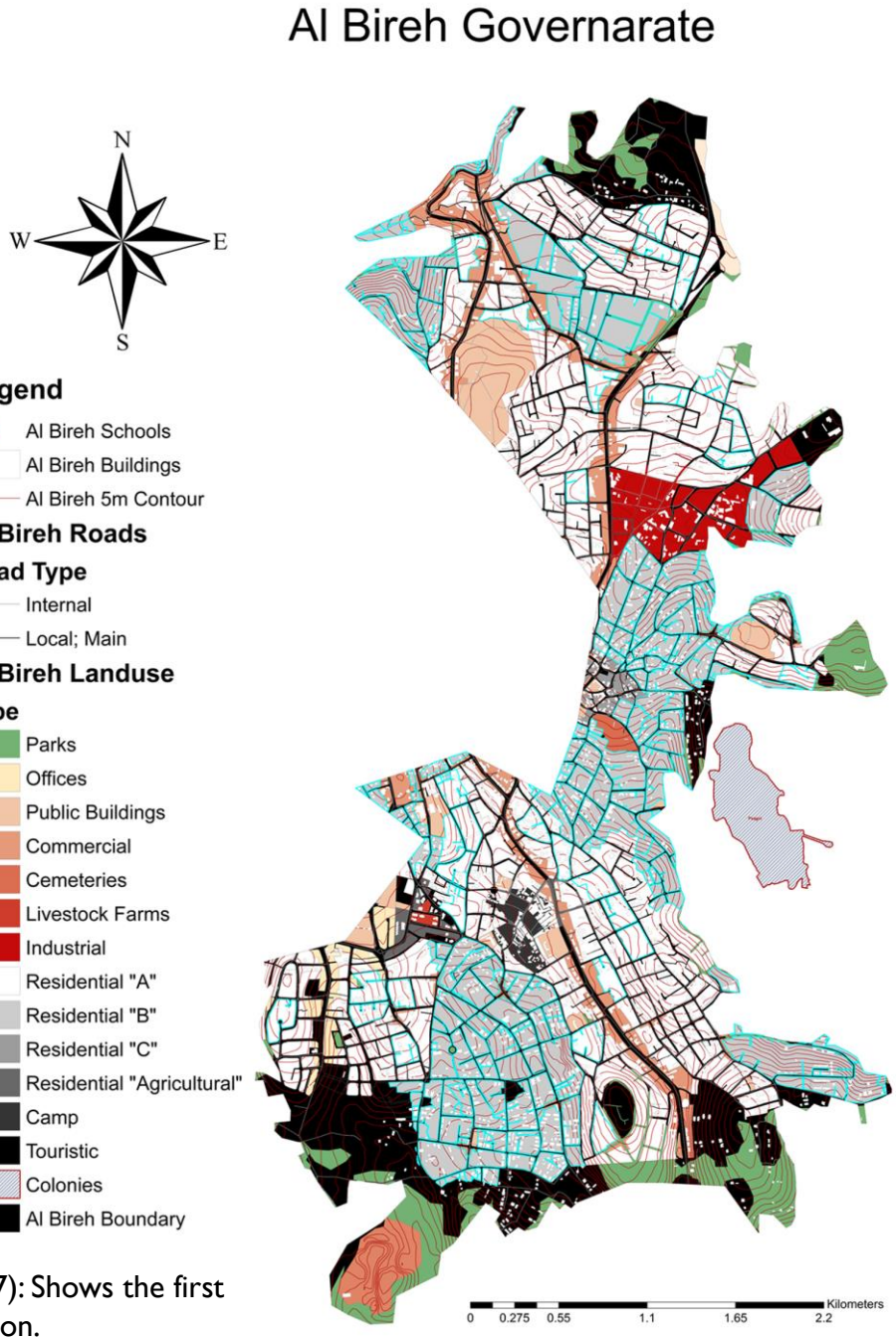


Map (5): Shows the land use of Al-Bireh city.
Source: by the author.

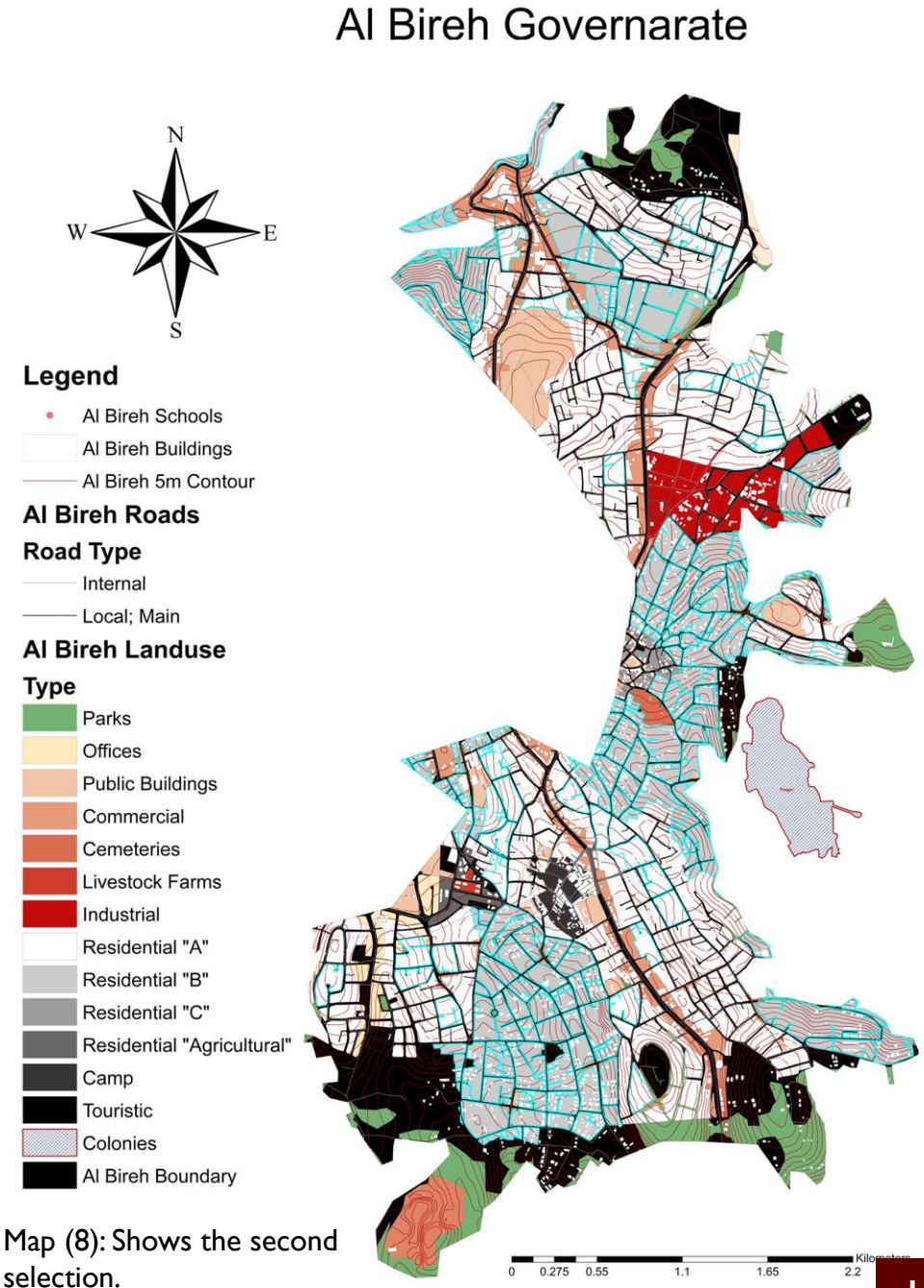
Al Bireh Governorate



Map (6): Shows the land classification(ABC) of Al-Bireh city.
Source: by the author.

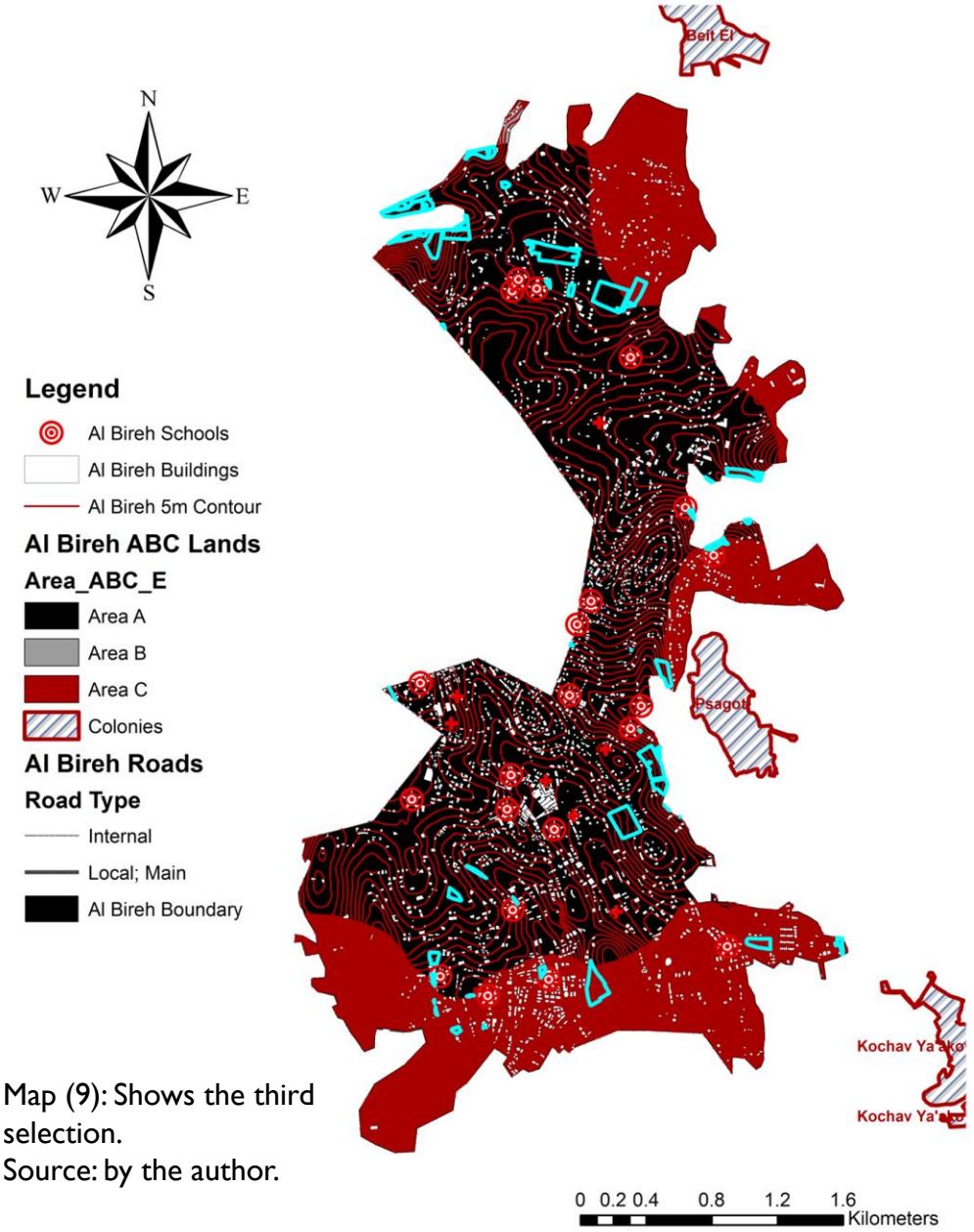


Map (7): Shows the first selection.
Source: by the author.



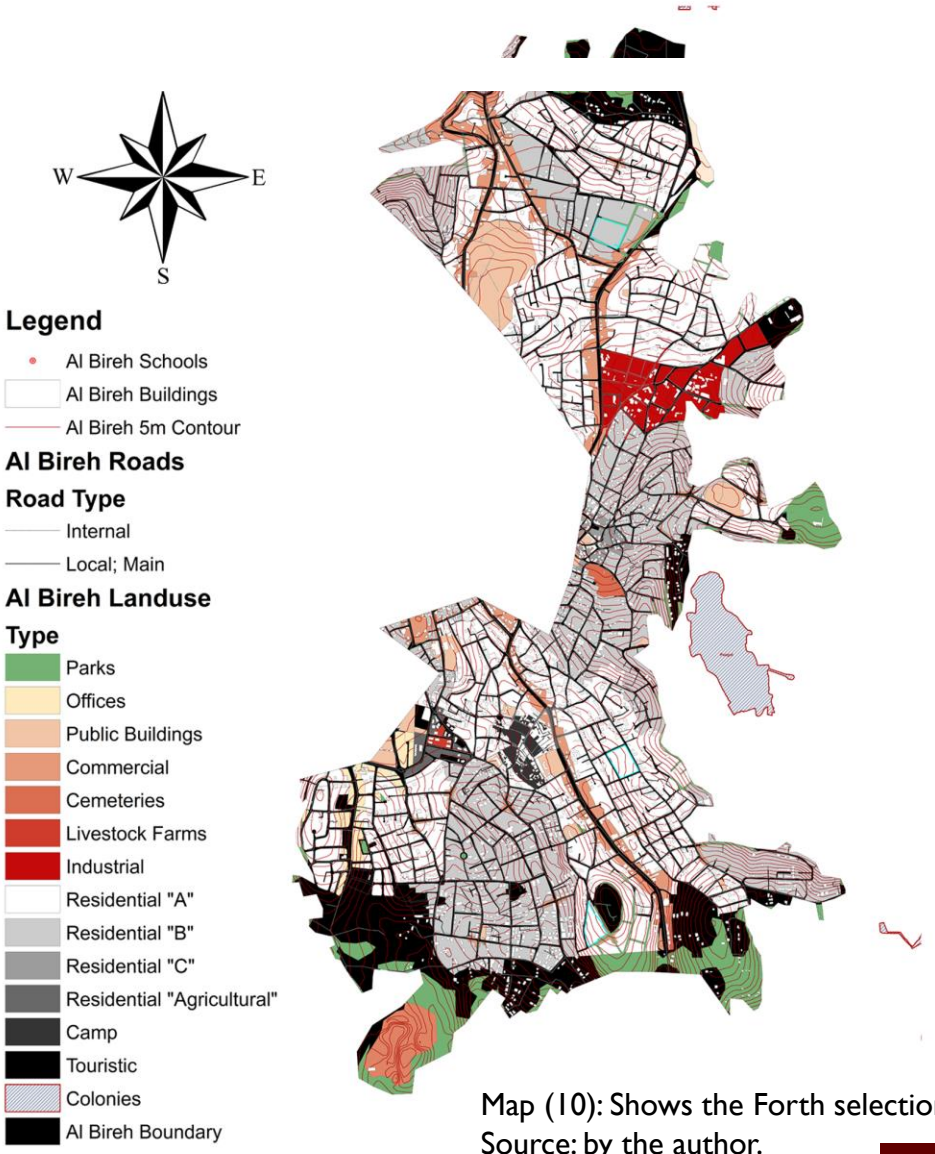
Map (8): Shows the second selection.
Source: by the author.

Al Bireh Governorate



Map (9): Shows the third selection.
Source: by the author.

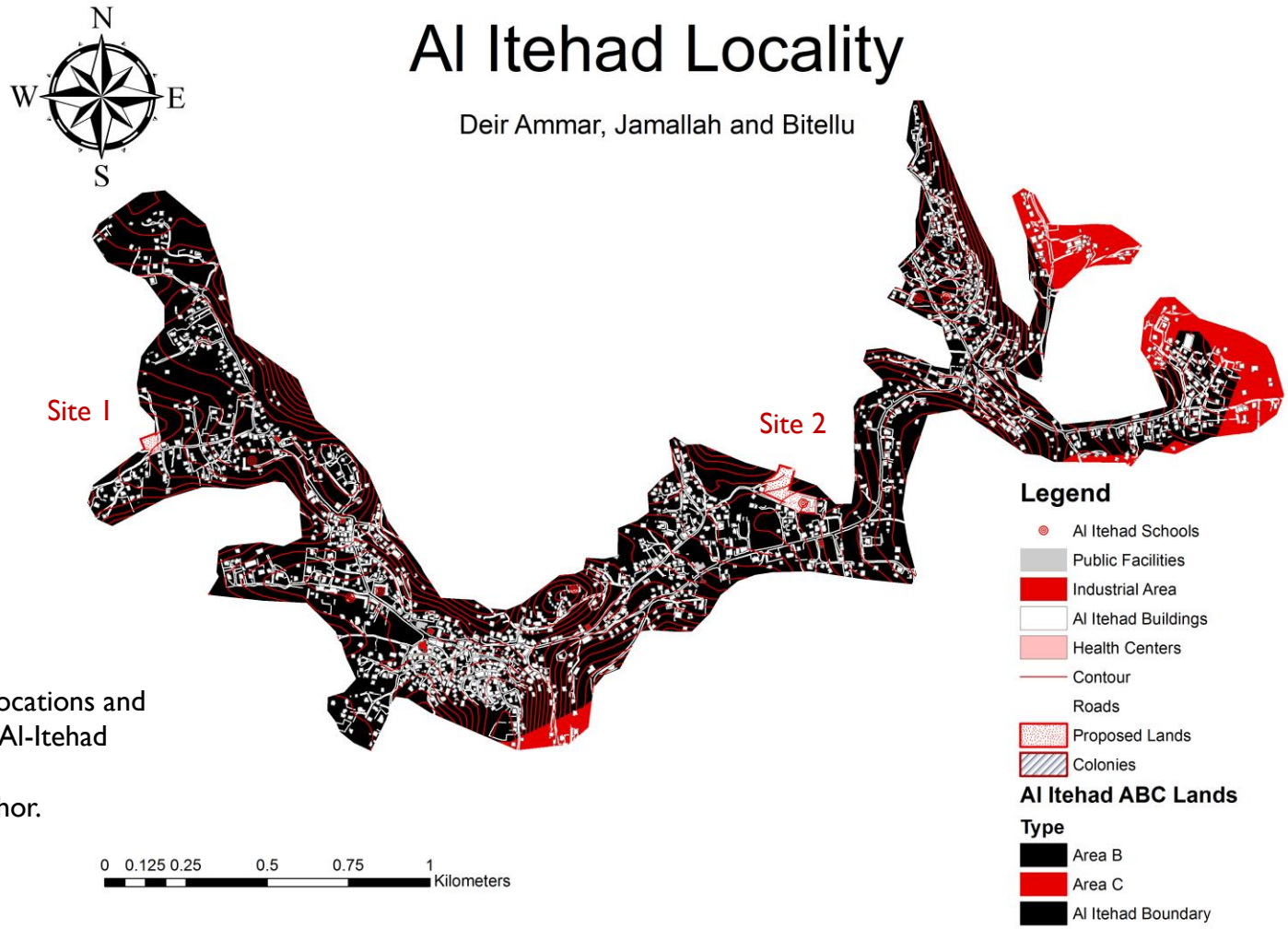
Al Bireh Governorate



Map (10): Shows the Forth selection.
Source: by the author.

PHASE TWO: Land assessment.

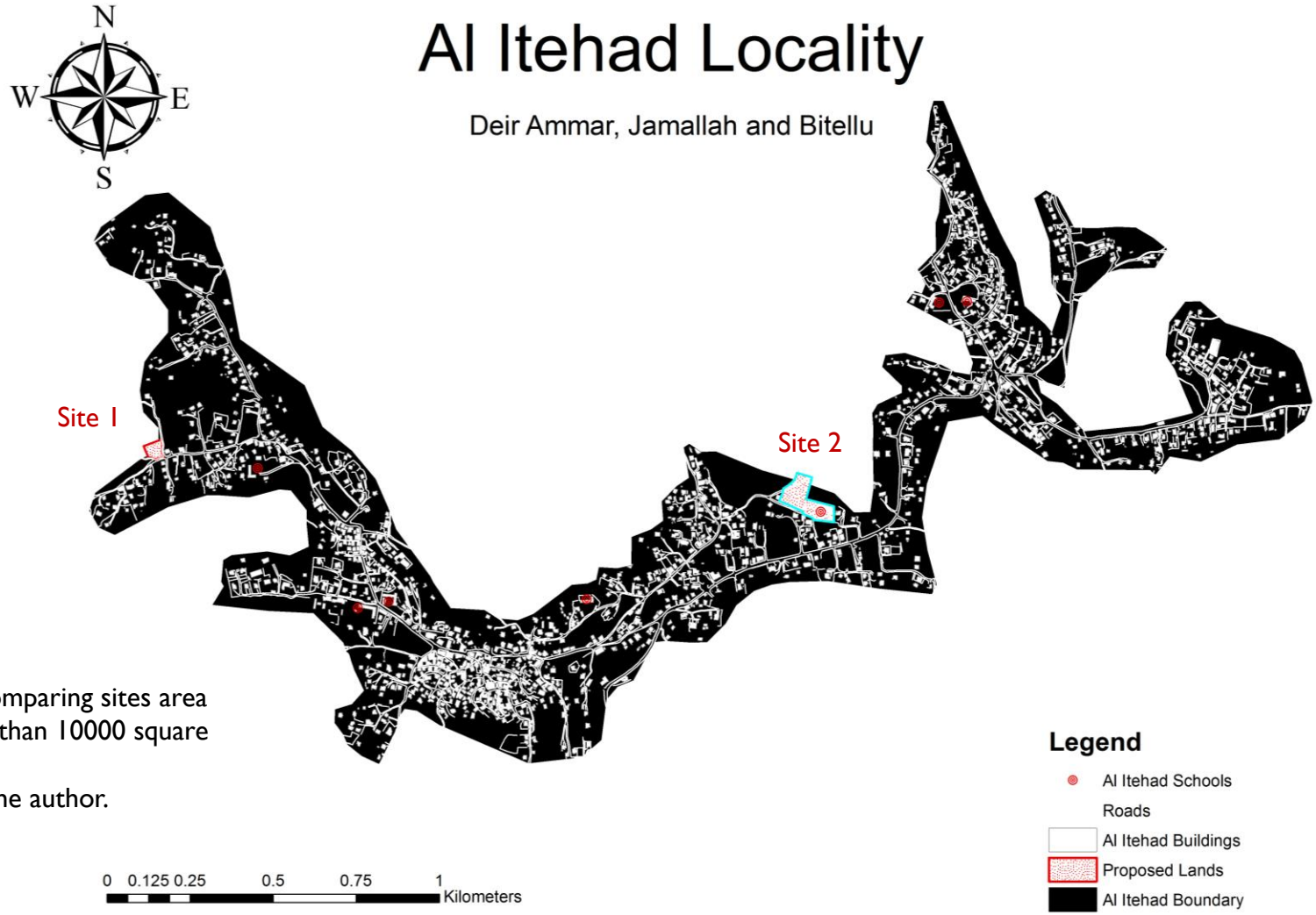
It follows the same criteria as in phase two and the same data collection in made regarding Al-Itehad locality; in order to compare which land of the two proposed lands best meets the requirements.



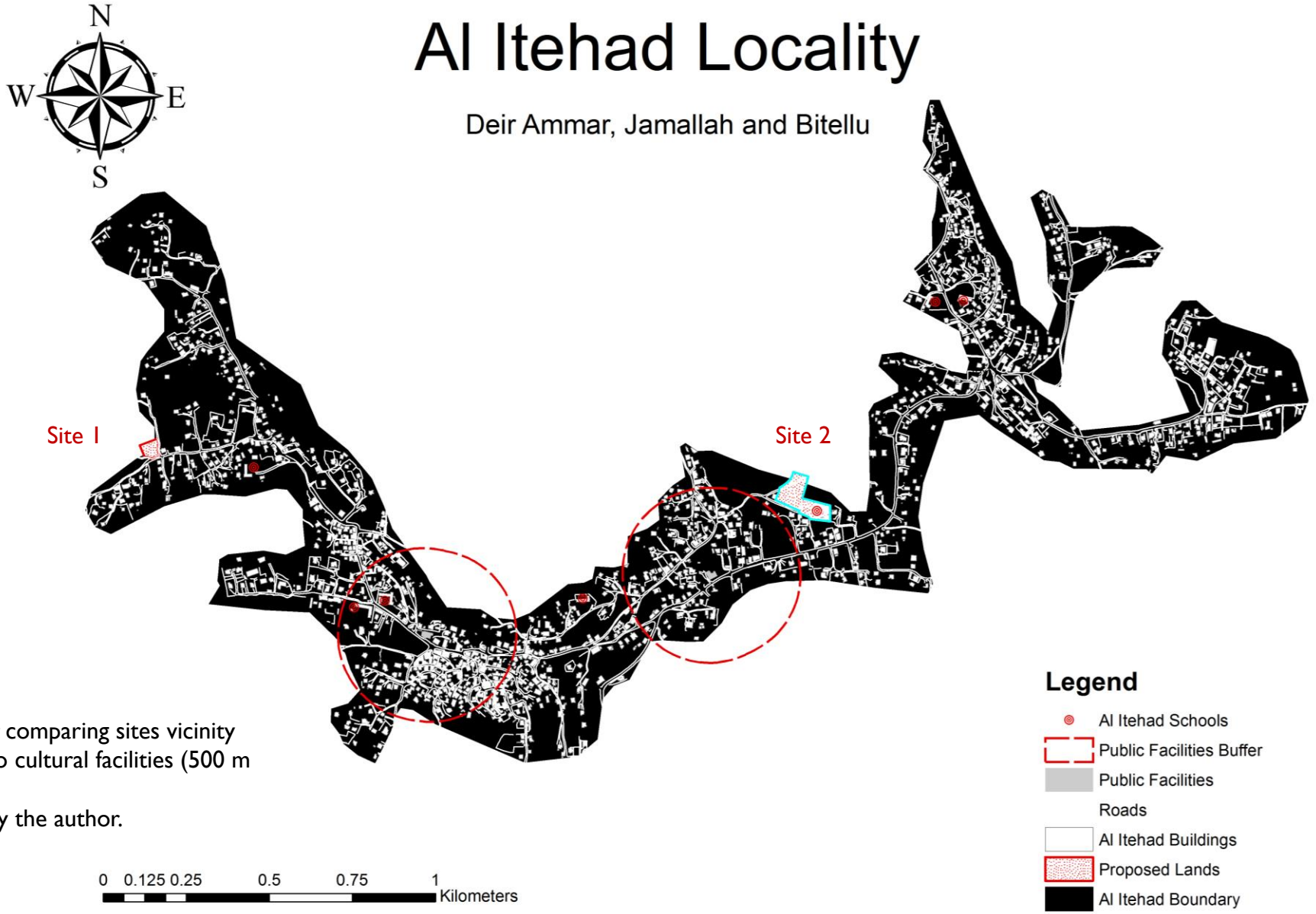
Map (11): School locations and proposed lands in Al-Itehad locality.
Source: by the author.

PHASE TWO: Land assessment.

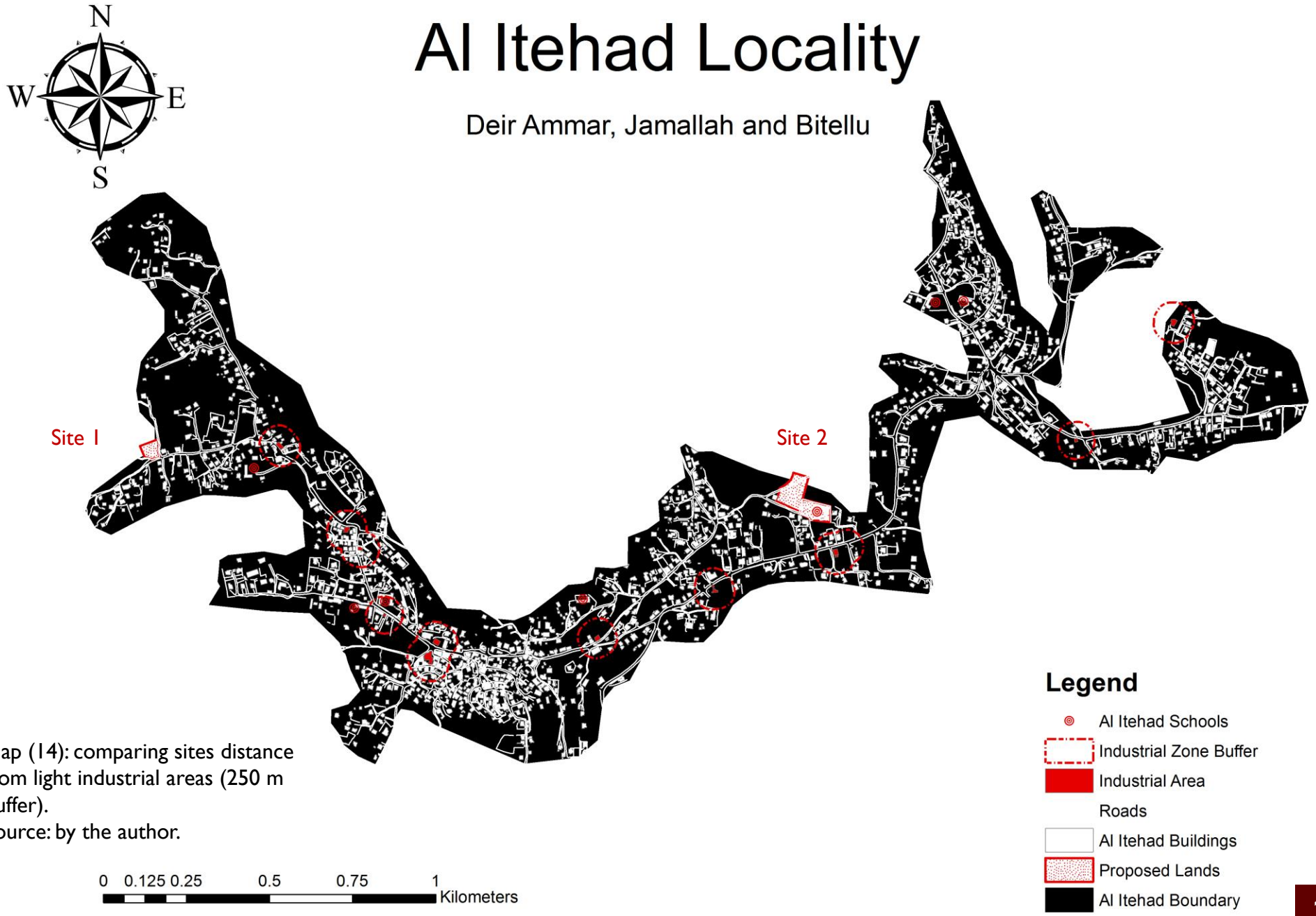
And the same selections have been made in order to compare both lands. As shown in maps (12-15)



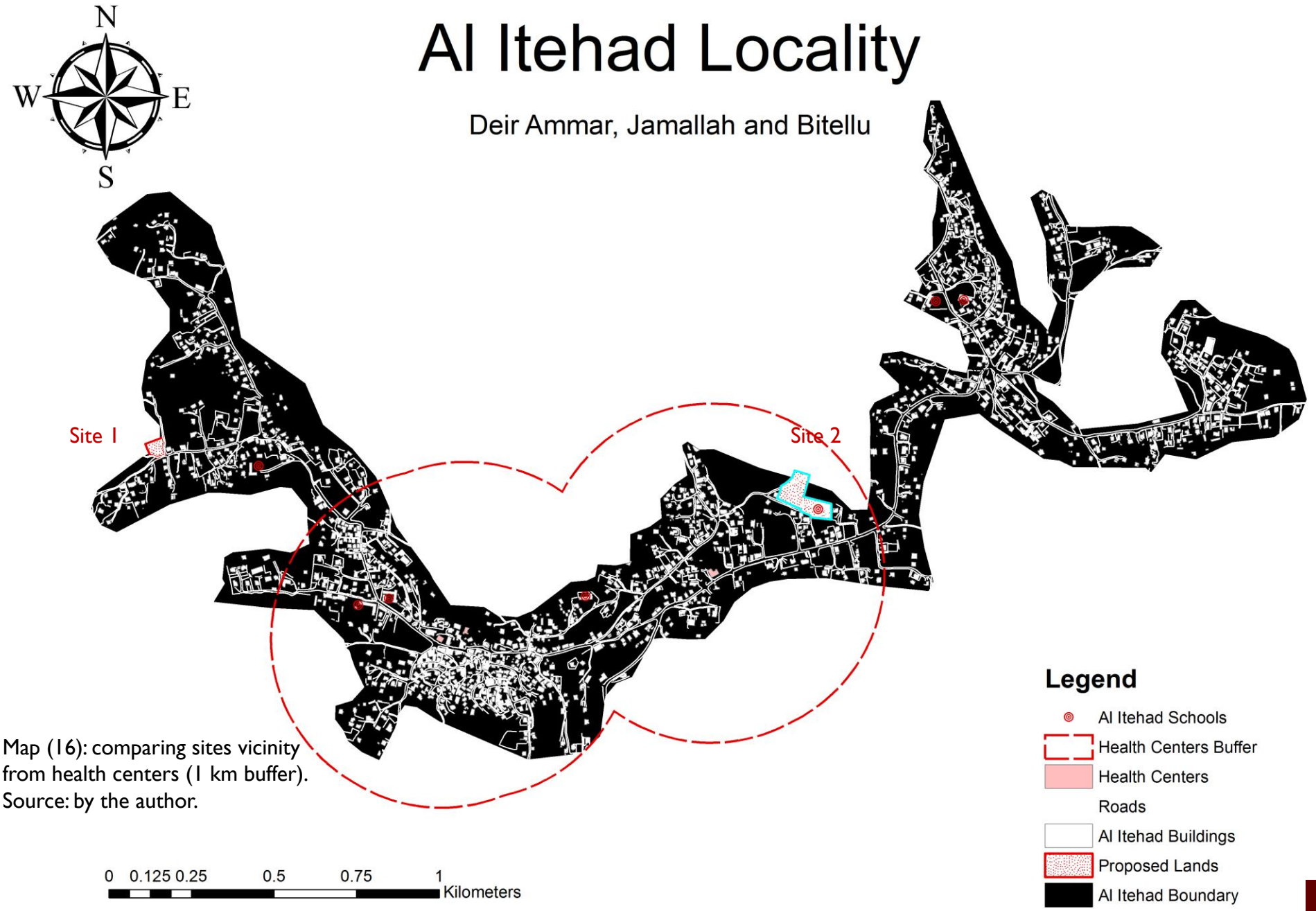
Map (12): comparing sites area to be more than 10000 square meters.
Source: by the author.



Map (13): comparing sites vicinity relative to cultural facilities (500 m buffer).
Source: by the author.



Map (14): comparing sites distance from light industrial areas (250 m buffer).
Source: by the author.



Map (16): comparing sites vicinity from health centers (1 km buffer).
Source: by the author.

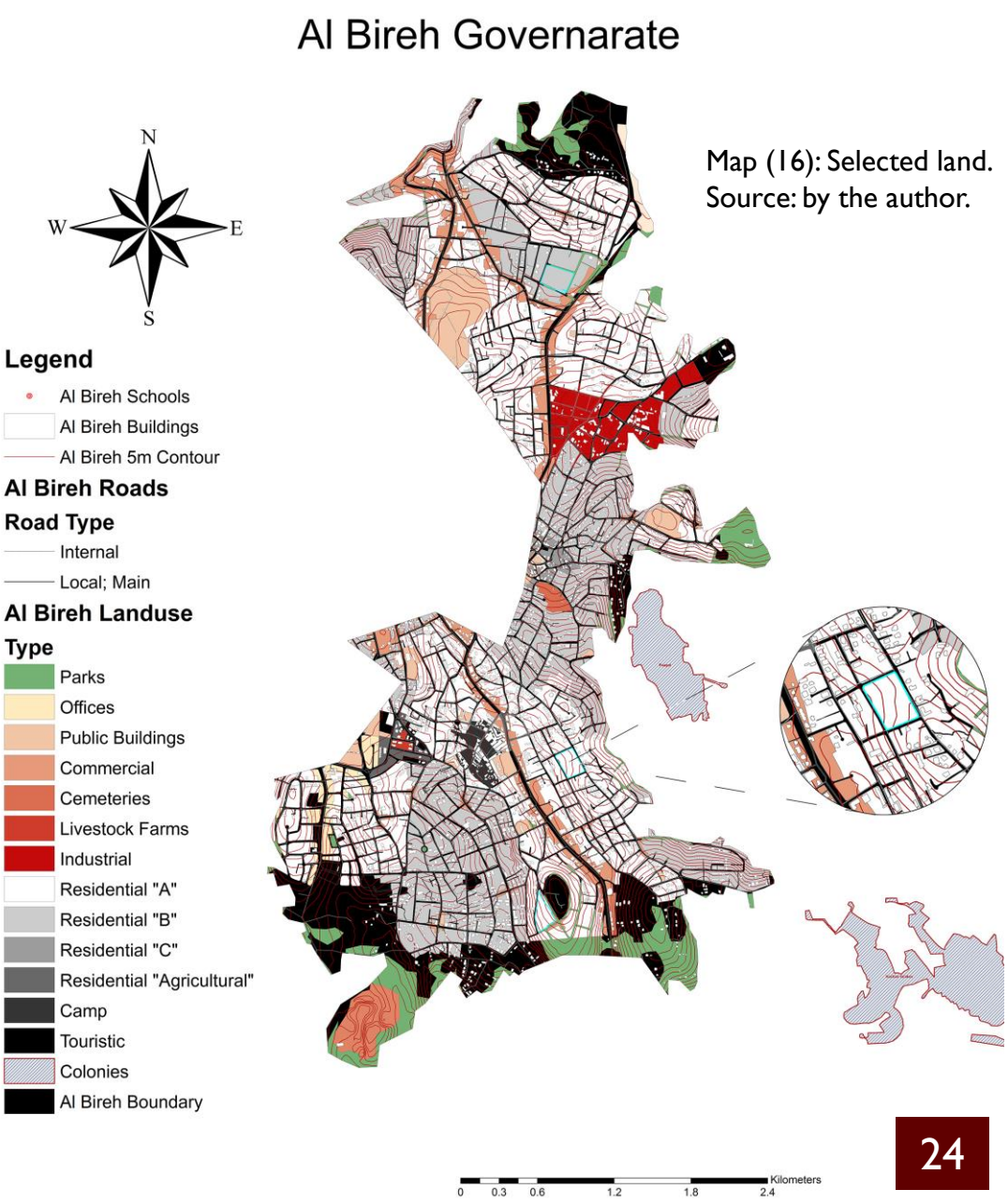
RESULTS AND CONCLUSION

PAHSE ONE: Selecting the locality that has scarcity of schools within its context.

According to GIS 18 locality out of the 74 are in need for new schools. These localities are Shuqba, Qibya, Silwad, Deir Ammar Camp, Al-Taybeh, Al-Jalazon Camp, Kufor ni'ma, Al Bira, Saffa, Ramallah, Betuniya, Al-Amari Camp, Khrbatha Al-Misbah, Beit Liqya, Qaddura Camp, Ni'lin, Al-Itehad and Al-Zaytuna. Of these localities Al-Bireh city and Al-Itehad locality has been taken as an example for more intensive study of school site selection. As shown in map (3) before.

PHASE TWO: Selecting the appropriate land for school.

According to GIS selection and a further analysis regarding the shape and visual assessment of the site; one land has been chosen as the most appropriate one. As shown in map (16).



Map (16): Selected land.
Source: by the author.

PHASE TWO: Land assessment.

Based on the GIS selection illustrated in the methodology; site two came to meet almost all of the requirements for having an area within the needed average, and located within the buffer of the health centers and cultural facilities, while being close to the light industrial zone as in site one. As shown in table (4).

Criteria	Site one	Site two
Area	Low	High
Vicinity to cultural facilities	Low	Moderate
Distance from industrial zone	Moderate	Moderate
Vicinity to health centers	Low	High

Table (4): Shows the criteria for comparing between the two proposed sites.
Source: by the author.

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