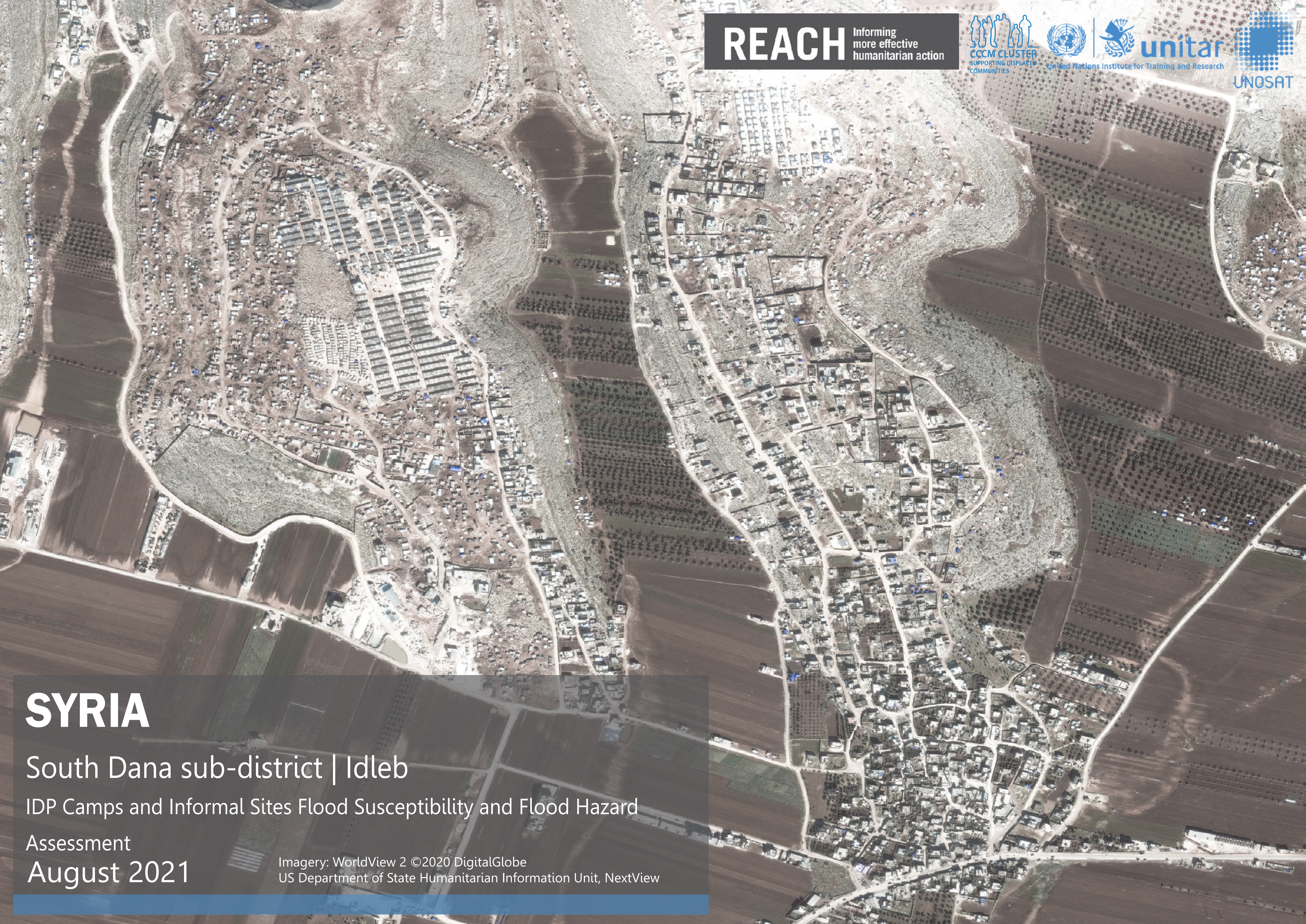


SYRIA

South Dana sub-district | Idleb

IDP Camps and Informal Sites Flood Susceptibility and Flood Hazard Assessment

August 2021

Imagery: WorldView 2 ©2020 DigitalGlobe
US Department of State Humanitarian Information Unit, NextView

CONTENTS

CONTEXT

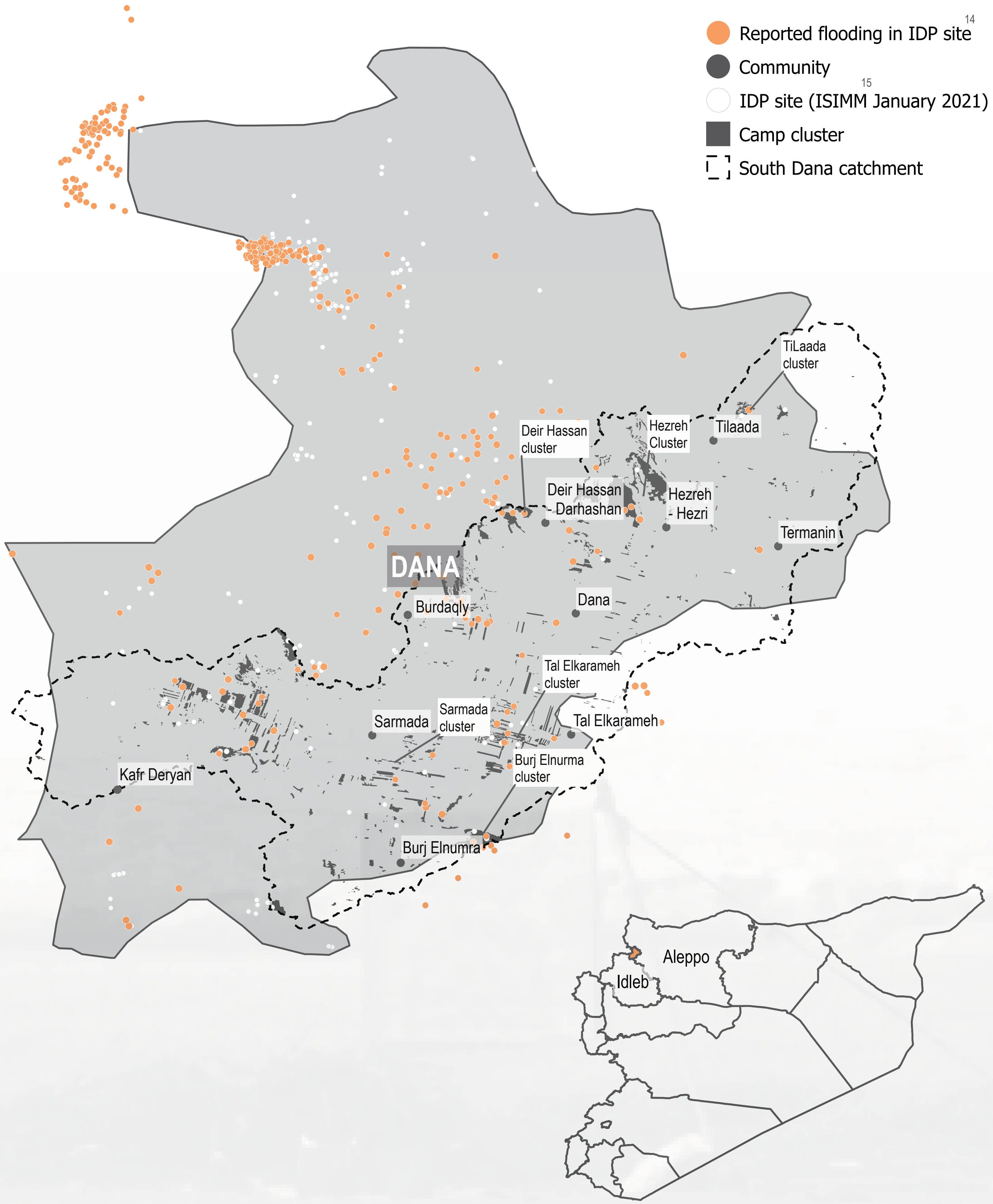
In northwest Syria winter storms have the potential to generate devastating floods which have a disproportionate effect on internally displaced persons (IDPs) living in camps and informal sites. Recurrent heavy rain between 14 and 31 January 2021 generated widespread flooding throughout northwest Syria, affecting an estimated 122,953 internally displaced people (IDPs)[1] and resulting in the death of a child and injuries to three other individuals.[2] More than 300 camps and sites throughout the governorates of Idleb and Aleppo were impacted by the floods, 8400 shelters were reportedly destroyed, while a further 13,800 shelters suffered some level of damage.[3] Thousands of households were forced to seek shelter in schools, mosques and open spaces where winter temperatures dipped below freezing.[4]

Winter flooding within IDP camps and sites throughout Idleb and western Aleppo has been a recurrent problem for several years, the recent devastation suffered by vulnerable populations in these locations is tragically only the most recent example following many similar previous events in the past. In November 2016, camps in Dana sub-district were impacted by flooding which inundated tents and accessways causing destruction of property and movement difficulties.[5] In December 2018 another severe storm resulted in widespread flooding throughout Idleb and Aleppo, and damage to tents and property was reported in more than 60 camps.[6] Again, in March 2019 heavy rainfall caused severe flash flooding in the region, damaging road infrastructure and destroying food stocks.[7] In June 2020 heavy rain in Ma'aret Tamsrin, south of Dana sub-district, caused severe flooding, resulting in the loss of three lives,[8] and reportedly destroying hundreds of shelters and putting sanitation facilities out of service.[9]

IDPs are among the population groups most vulnerable to the impacts of disasters associated with natural hazards for a number of reasons. The primary reasons are linked with the locations and living conditions of the sites where IDPs live. IDP sites and settlements are frequently located on land that has traditionally been considered uninhabitable due to environmental factors such as steep terrain, rocky or arid ground, or land that is known to be prone to seasonal flooding. Moreover, IDPs in camps and informal sites often live in densely populated environments and in shelters that are not designed to resist natural hazards.[10] In addition to the immediate hazard flash floods present to people and property, poor drainage and persistent standing water in and around shelters can lead to numerous health and sanitation problems in camps and informal sites extending the adverse effects of flooding beyond the event itself. Lastly, the current outbreak of COVID-19 and the rising number of confirmed cases in northwest Syria,[11] addto the particularly concerning situation in the camps and informal sites this upcoming winter.

Since the beginning of winter 2019 the number of IDPs living in Dana sub-district has increased by more than 35% from 617,000 IDPs in November 2019 to 845,000 in August 2020 following an escalation in conflict in early 2020.[12] As of July 2021 IDP numbers in Dana sub-district are 916,273.[13] Increased migration to areas with already high numbers of IDP populations is likely to result in IDPs living in increasingly dense living settings in locations considered less suitable for habitation and potentially more exposed to natural hazards like flooding.

This output presents the results of a flood hazard assessment undertaken by REACH with the aim of highlighting shelters located within IDP sites which may be most susceptible to flood hazards. The assessment focuses on the catchment of South Dana sub-district which includes Tilaada, Sarmada, Kafr Deryan, Dana, Tal Ekaramehj and Deir Hassan camp clusters which have reportedly experienced flooding on multiple occasions since 2016.

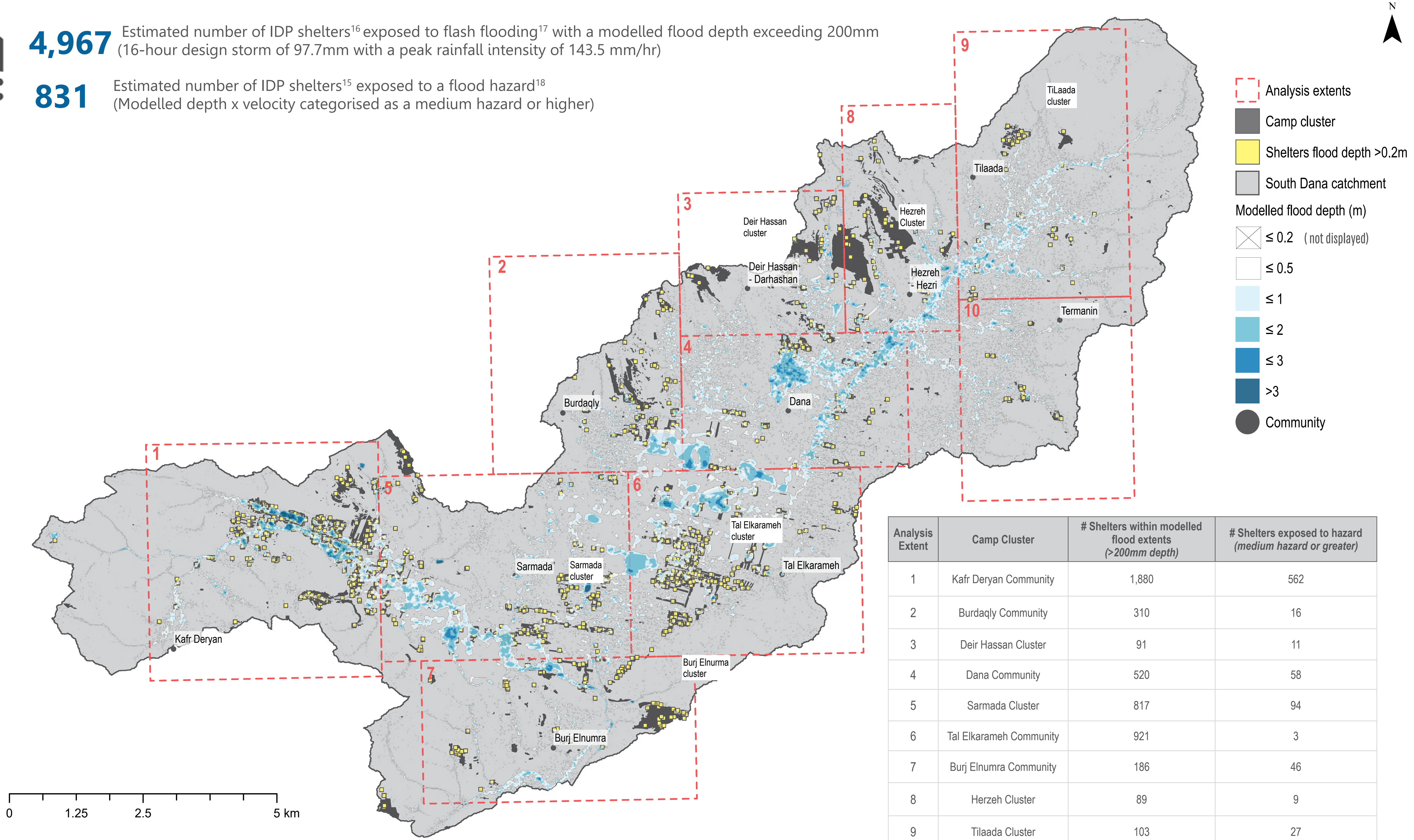


1 Tens of thousands of Syrians on the run due to floods | 25 Jan 2021
2 AL JAZEERA | Child dies as heavy rains | 19 Jan 2021
3 Tens of thousands in northwest Syria lose shelter after floods inundate camps|Jan 2021
4 CCCM bulletin | 20210201 Floods Updates - Monday 1 February 2021
5 Assistance Coordination Unit (ACU) | Winter Needs In Northern Syria | November 2016
6 REACH | North-west Syria:Inter-sector Rapid Needs Assessment - Flood Impact | January 2019
7 Northern Syria flooding | 20 Dec 2019
8 Daily Sabah | UN calls for safer living conditions after storms kill 3 children in Syria's tent camps | June 2020
9 United Nations Office for the Coordination of Humanitarian Affairs (OCHA) | Situation Report No. 16 | June 2020
10 United Nations High Commissioner for Refugees (UNHCR) | Displacement and Disaster Risk Reduction
11 Médecins Sans Frontières (MSF) | Ten-fold increase in COVID-19 cases adds new challenges in northwest Syria | September 2020
12 Humanitarian Needs Assessment Program (HNAP) | Mobility needs monitoring | November 2019 & August 2020
13 OCHA population task force July 2021
14 Flood affected sites data provided by CCCM cluster updated to August 2021
15 IDP Sites Integrated Monitoring Matrix

KEY FINDINGS

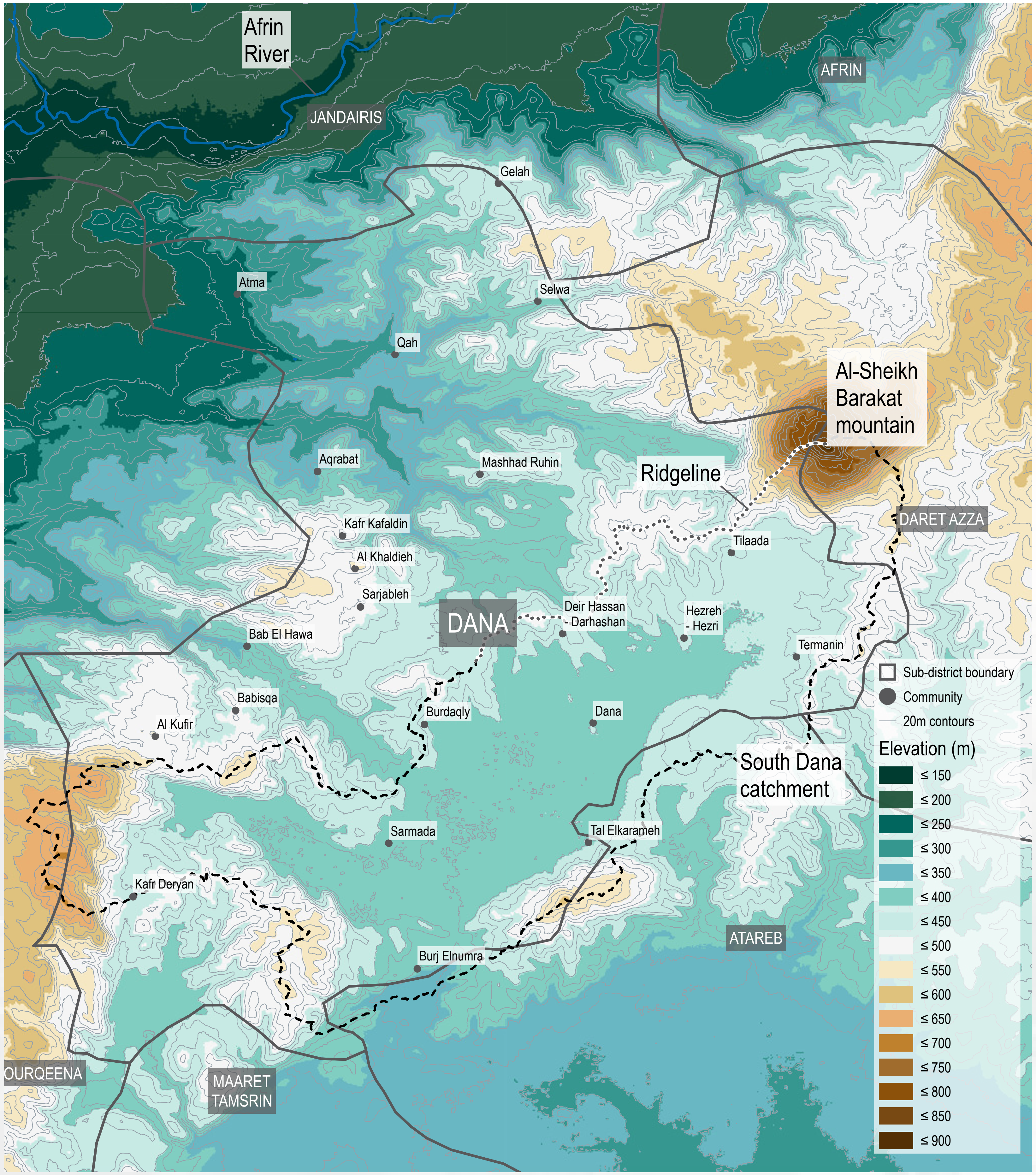
4,967 Estimated number of IDP shelters[16] exposed to flash flooding[17] with a modelled flood depth exceeding 200mm (16-hour design storm of 97.7mm with a peak rainfall intensity of 143.5 mm/hr)

831 Estimated number of IDP shelters[15] exposed to a flood hazard[18] (Modelled depth x velocity categorised as a medium hazard or higher)



Analysis Extent	Camp Cluster	# Shelters within modelled flood extents *(>200mm depth)*	# Shelters exposed to hazard *(medium hazard or greater)*
1	Kafr Deryan Community	1,880	562
2	Burdaqly Community	310	16
3	Deir Hassan Cluster	91	11
4	Dana Community	520	58
5	Sarmada Cluster	817	94
6	Tal Elkarameh Community	921	3
7	Burj Elnumra Community	186	46
8	Herzeh Cluster	89	9
9	Tilaada Cluster	103	27
10	Termanin Community	36	5
11	Others	14	-

16 REACH | Satellite detected shelters/structures 24 August 2020
17 Flash flooding is generated by heavy rainfall over a short period of time. Flash floods are characterised as having relatively high peak discharges and short response times between rainfall and the onset of flooding, usually within 12 hours | World Meteorological Organization - No.577
18 A flood hazard is a product of both flood depth and flood velocity. This output utilises a flood hazard classification based on simplified D*V severity grid symbolisation categories published by the US Federal Emergency Management Agency (FEMA) | Guidance for Flood Risk Analysis and Mapping

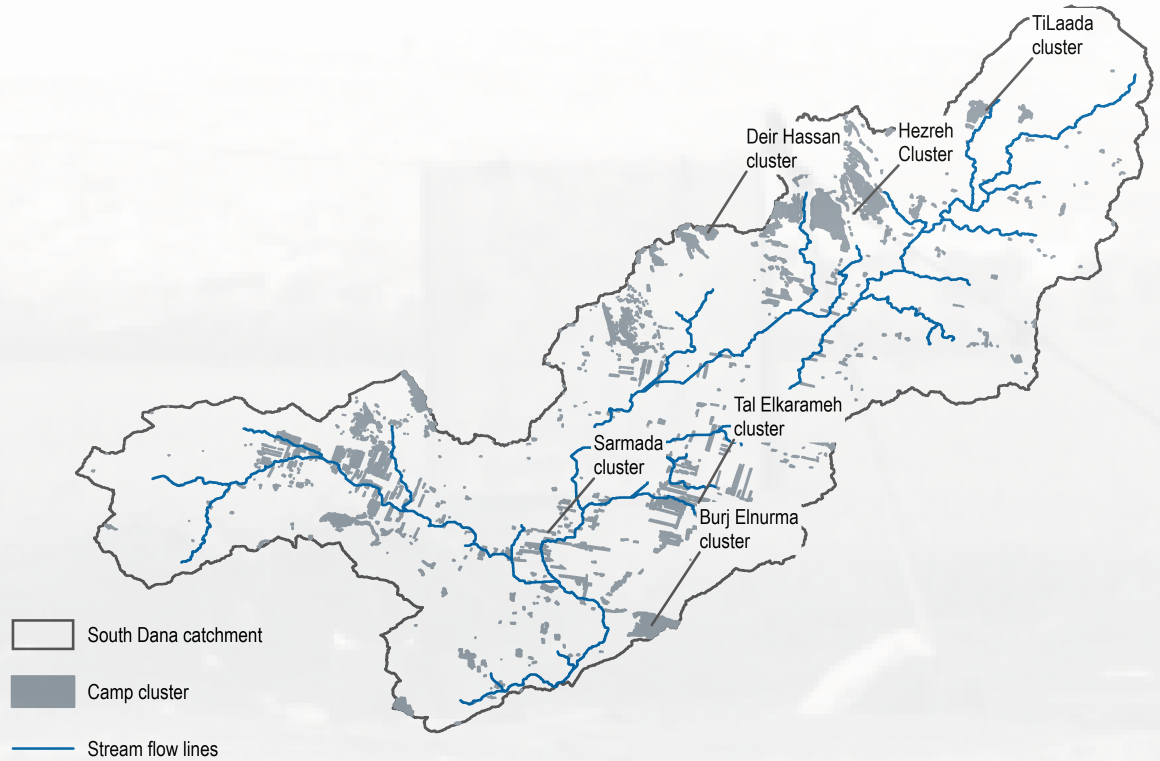


CATCHMENT CHARACTERISTICS

Dana sub-district is divided roughly in half along a central ridgeline which runs east to west via the communities of Tilaada, Deir Hassan and Sarjableh. The southern catchment comprised of the Dana and Atareb plains is relatively flat, in contrast the northern catchment is mountainous and steeply sloped.

The catchment of southern Dana can be further divided into a northeast sub-catchment and a southwest sub-catchment. The northeastern catchment is bounded to the north by al-Sheikh Barakat mountain, with a maximum elevation 850m above sea level. The catchment runs south through Tilaada and passes through the Dana plains via the communities of Hezreh and Deir Hassan towards Sarmada. The southwestern catchment is bounded by the ridgelines of the al-Halqa and Barisha mountain ranges along its western edge in the vicinity of Al Kufir and Kafr Deryan communities. The catchment slopes eastwards from a maximum elevation of approximately 650m above sea level down towards Sarmada and the Dana plains, where it merges with the northeastern catchment at an elevation approximately 380m above sea level. From there the catchment continues south exiting to the Atareb plains via Burj Elnumra at an elevation approximately 350m above sea level.

The extent of the south Dana catchment was delineated from a 2.5m resolution Digital Terrain Model (DTM) utilising SAGA terrain analysis - hydrology and channel tools (fill sinks Wang & Liu; catchment area; channel network; watershed basins). The result of these processes is shown below.

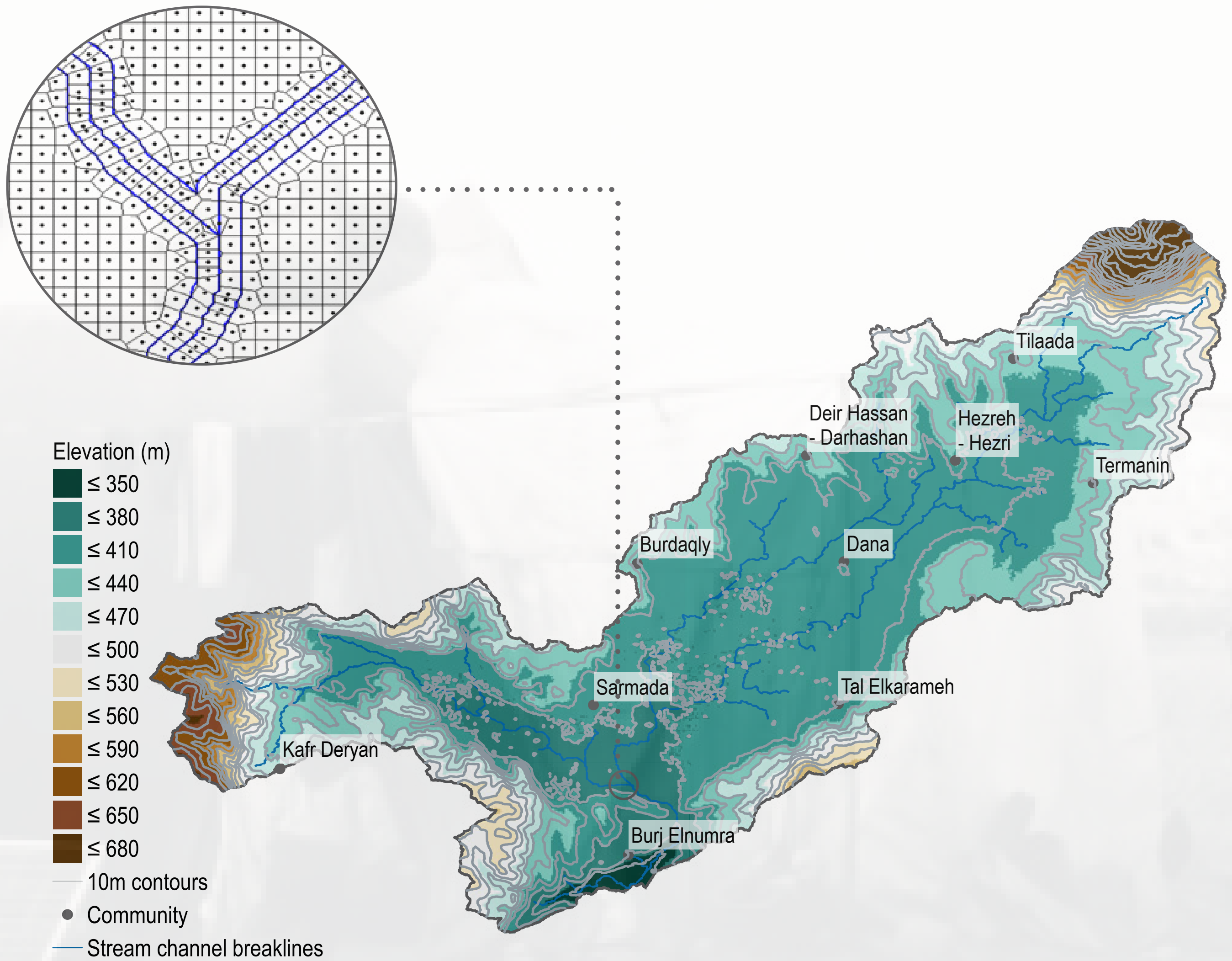


Rapid Flood Hazard Assessment

A direct precipitation two-dimensional (2D) hydraulic model was built using HEC-RAS in order to provide insights on flash flooding in southen Dana catchment during heavy rainfall events. This method of 2D flood modelling is often referred to as a Rapid Flood Hazard Assessment (RFHA). A RFHA can provide a high-level understanding of flood hazards on a catchment wide scale and helps to identify flood susceptible areas. The following section outlines the methodology utilised to obtain the flood extents and flood depth x velocity results presented in this output.

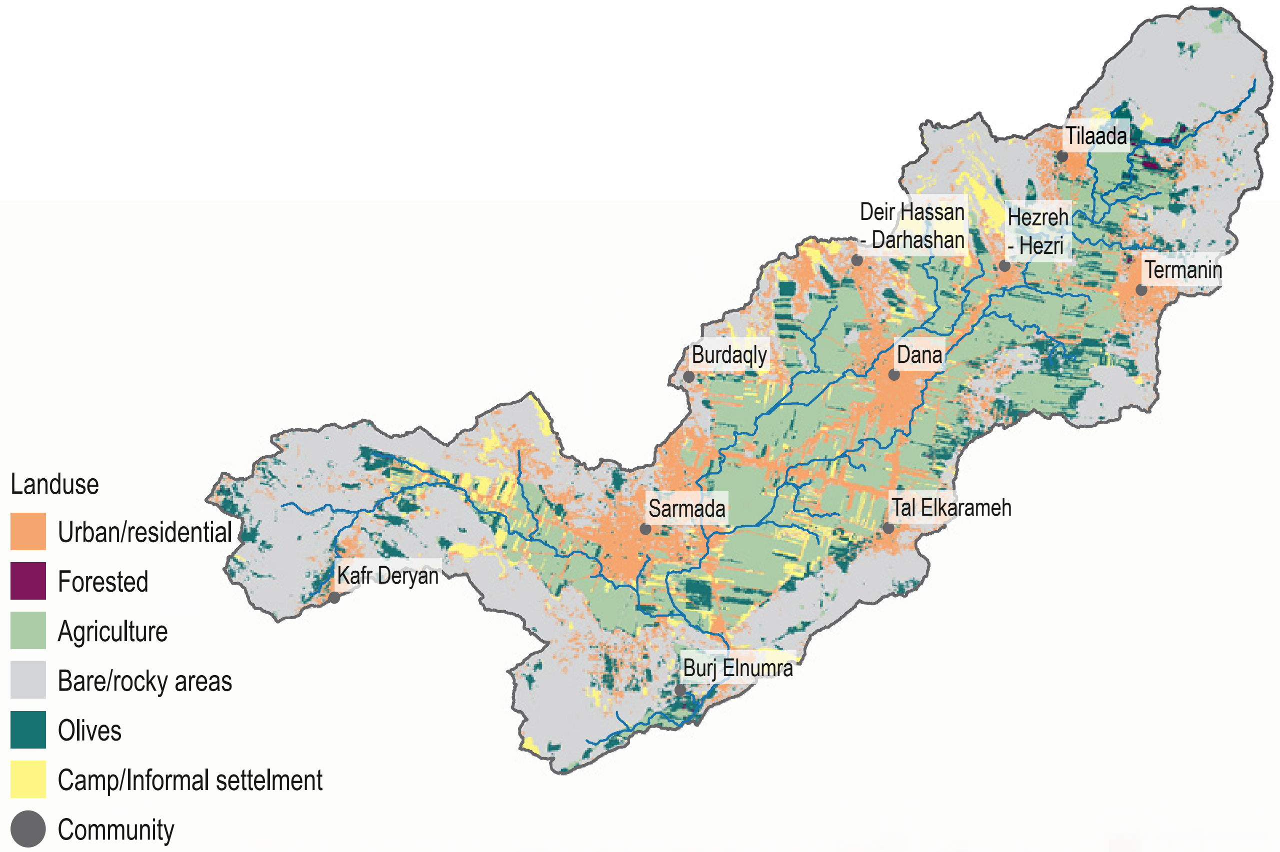
Model Inputs - Terrain/2D flow area

The terrain utilised for the HEC-RAS analysis is a 2.5m resolution DTM built utilising satellite imagery acquired by the Advanced Land Observing Satellite of the Japan Aerospace Exploration Agency (JAXA). The raw surface model has been processed to remove anomalies and adjusted to account for the presence of trees and structures.[19] The 2D flow area extents were defined in the HEC-RAS model environment and model computation points were generated at 10m intervals. Additional computation points were added along stream centrelines and along the stream banks of lower reaches to improve the resolution of the 2D flow area in these locations by enforcing breaklines. The 2D flow area contains a total of 952,374 cells and computation points.



Model Inputs - Landuse and roughness parameters

South Dana catchment was delineated into six different landuse categories using satellite imagery and a method based on machine learning.[20] The results can be seen in the figure below. Each category was assigned a roughness coefficient (Manning's n) which was subsequently utilised as an input parameter for the HEC-RAS



The Manning's n values assigned to the different landuses are provided in the table below:[21]

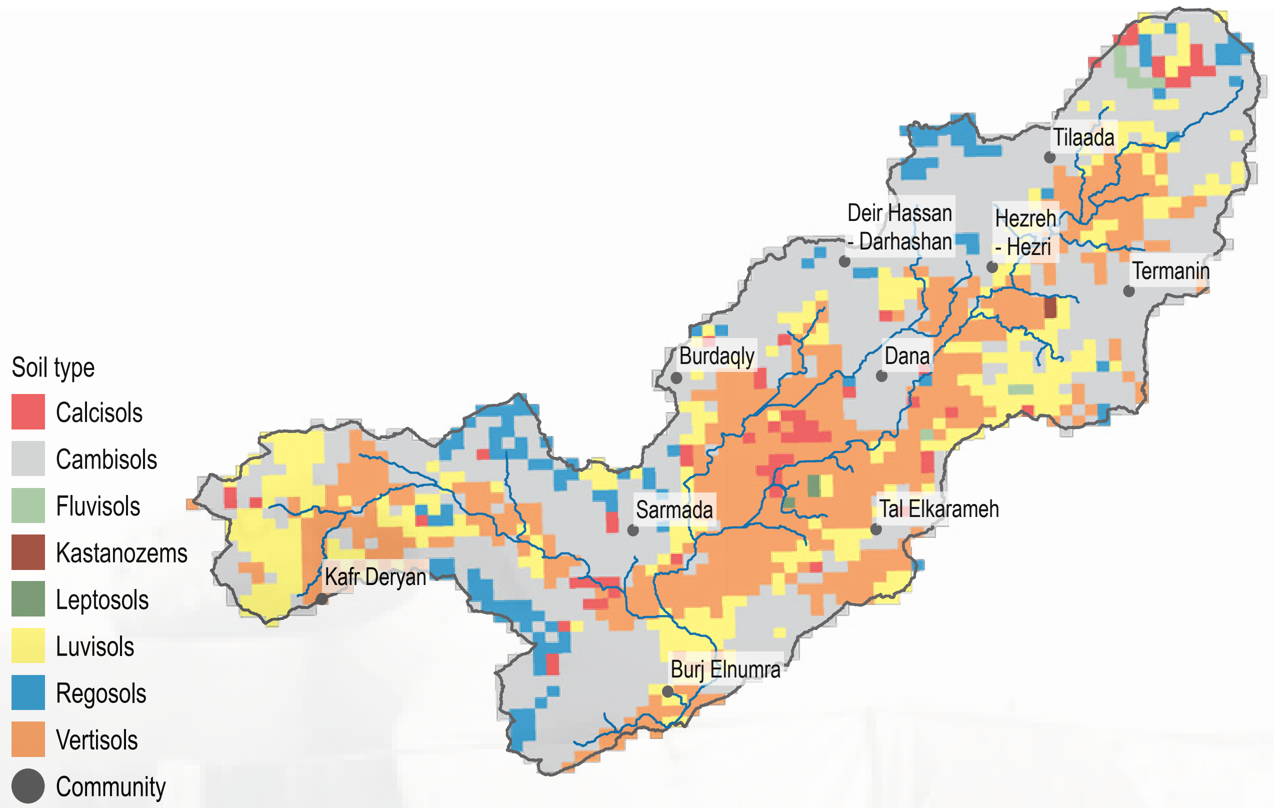
Landuse Category	Manning's n value
Bare/ rocky areas	0.04
Olives orchard	0.05
Agriculture areas	0.06
Forested areas	0.07
Camp/ Informal settlement	0.1
Urban/ residential areas	0.1

19 For more information on the digital terrain model utilised for the model build refer to AW3D product details | https://www.aw3d.jp/en/products/standard/
20 Land cover classification method available at | https://github.com/victor-m-olsen/nature-food
21 Manning's n values were based on reference tables for Manning's n values for Channels, Closed Conduits Flowing Partially Full, and Corrugated Metail Pipes (Chow, 1959) | http://www.fsl.orst.edu/geowater/FX3/help/8_Hydraulic_Reference/Mannings_n_Tables.htm

Model Inputs - Soil type and infiltration loss parameters

The Soil Conservation Service (SCS) Curve Number method was used to estimate losses due to infiltration for different soil types and land uses.

Data on the most probable soil types within the catchment was obtained from the International Soil Reference and Information Centre's (SRIC) soilgrids information system.[22]



SRIC soil type	SCS Hydrologic soil group
Calcisols	Group C
Cambisols	Group C
Fluvisols	Group C
Kastanozems	Group C
Leptosols	Group C
Luvisols	Group C
Regosols	Group C
Vertisols	Group D

Infiltration Classification

The catchment was classified into different hydrologic soil groups based on the soil types and assigned SCS curve numbers for each of the landuses defined in the previous section. Curve numbers were integrated into an infiltration layer file and used as an input in the HEC-RAS model.

The SCS curve numbers assigned to the different landuses and soil types are provided in the table below.[23]

Landuse Category	Curve Number – type C soil	Curve Number – type D soil
Camp/ Informal settlement	86	89
Urban/ residential areas	90	92
Bare/ rocky areas	86	89
Agriculture areas	84	88
Olives orchard	82	85
Forested areas	77	83

22 https://soilgrids.org/
23 Curve numbers based on guidance from the HEC-RAS 2D user's manual https://www.hec.usace.army.mil/confluence/rasdocs/r2dum/latest/developing-a-terrain-model-and-geospatial-layers/infiltration-methods

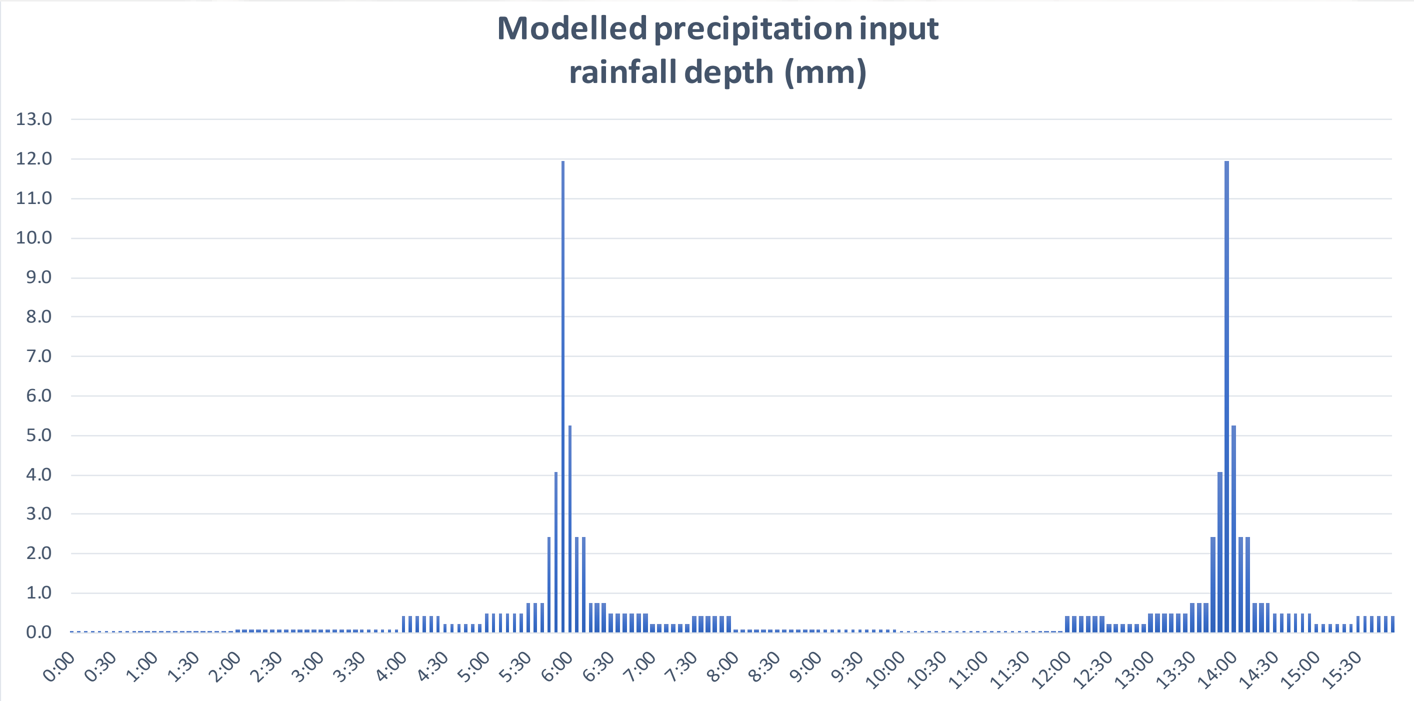
Boundary Conditions

A review of available regional precipitation data, rainfall gauge data and remote sensing datasets was undertaken in order to define appropriate rainfall inputs for the hydraulic model. In the absence of rainfall gauge data or associated statistical analysis of rainfall within northwest Syria, the precipitation data utilised as an input in the model was drawn from an intensity duration frequency (IDF) analysis undertaken for the city of Gaziantep[24] located in Turkey, approximately 120 km northeast of northern Dana. The precipitation input utilised in the model was derived from IDF curves using the alternating block method. Eleven storms with a 25-year return period ranging in duration from 5 minutes to 12 hours were combined to synthesize hyetograph with a peak rainfall intensity of 143.5 mm/hr and a total storm depth of 51.7 mm.

Preliminary model runs highlighted a large volume of storage in the uppermost north-eastern section of the catchment. A single 12 hour 25 year recurrence interval storm event did not contribute enough accumulated rainfall to exceed the storage capacity of the upper catchment and generate runoff. Consequently, peak flows downstream were dampened. In an effort to model a "worst case scenario" event the modelled precipitation inputs were modified to simulate the impact of a high intensity storm arriving after considerable accumulated rainfall had saturated the upper catchment, limiting the volume of active storage capacity remaining at the time of the storm's peak. This was achieved by adding an additional 4 hour 25 year recurrence interval storm to the end of the modelled precipitation input (shown below). The total depth of the modelled 16 hour storm is 97.7mm.

As a second source of rainfall estimates, NASA's Global Precipitation Measurement (GPM) dataset was reviewed usingGoogle Earth Engine in order to compare the synthesized design storm, with estimates of extreme rainfall inside Syria.Rainfall depths were extracted from the GPM dataset for dates of reported flooding in northwest Syria. Several large storm events in northwest Syria were identified including one rainfall event on 16-18 January 2021 centred south of the study area in Darkosh with an accumulated rainfall depth over 48 hours of 100mm. The majority of the storms depth (76mm) fell within a 24 hour period. This observed extreme rainfall event is comparable to the design storm in terms of total accumulated depth.

A normal depth boundary was applied along the South east edge of the 2D flow area east of Burj El numra community. The normal depth boundary was calculated based on a channel slope of 1.0%.



Unsteady Flow Analysis Parameters

An unsteady flow analysis was run in HEC-RAS with a simulation time window of 54 hours. The additional 38 hours were added to the simulation at the end of the 16 hour precipitation input to ensure the receding limb of the runoff hydrograph was adequately captured despite the long lag time of the catchment. A computation timestep of 2 seconds was used for the simulation.

Hazard Classification

The severity of a flood hazard is a product of both the flood depth and flood velocity. Studies undertaken around the world aimed at classifying modelled depth x velocity results into flood severity categories have focused on identifying hazardous floodplain conditions for people attempting to wade through floodwater, vehicles moving through floodwater and buildings and structures located within the floodplain. The approach that has been adopted for this analysis is the simplified approach presented in the US Federal Emergency Management Agency guidance on Flood Depth and Analysis Grids.[25] The flood severity categories used to produce the hazard maps included in this output are provided below:

Flood severity category	Depth x Velocity Range (m^2/s)
Low	< 0.2
Medium	0.2 - 0.5
High	0.5 - 1.5
Very High	1.5 - 2.5
Extreme	> 2.5

Limitations

A RFHA is a simplified modelling approach which is suitable for obtaining a 'big picture' perspective of flooding over an assessed area, it is not intended to provide precise flood depths and extents. The results presented in this output should be considered as estimates, to be confirmed and validated with subsequent analysis at the individual site level.

The following should be considered when viewing the results presented in this output

- Hydraulic structures such as bridges and culverts, piped drainage networks, irrigation canals and open channels have not been included in the hydraulic model
- Obstructions to flow such as buildings, parked vehicles and vegetation are not included directly in the model. The effect of obstructions on the modelled flow regime are approximated by the selection of surface roughness parameters
- The modelled terrain was not validated and may not reflect recent changes to the landform resulting from natural or engineered changes in stream morphology or cut and fill earthworks operations.
- The HEC-RAS hydraulic model is neither calibrated nor validated
- Rainfall inputs are applied directly onto the 2D flow area as a single time series without spatial variability.

For questions or comments on the methodology please contact: mena.reach@impact-initiatives.org

24 Yuce, Mehmet & Deger, İbrahim | Rainfall Intensity-Duration-Frequency Analysis for the City of Gaziantep | April 2019
25 FEMA | Guidance for Flood Risk Analysis and Mapping | February 2018

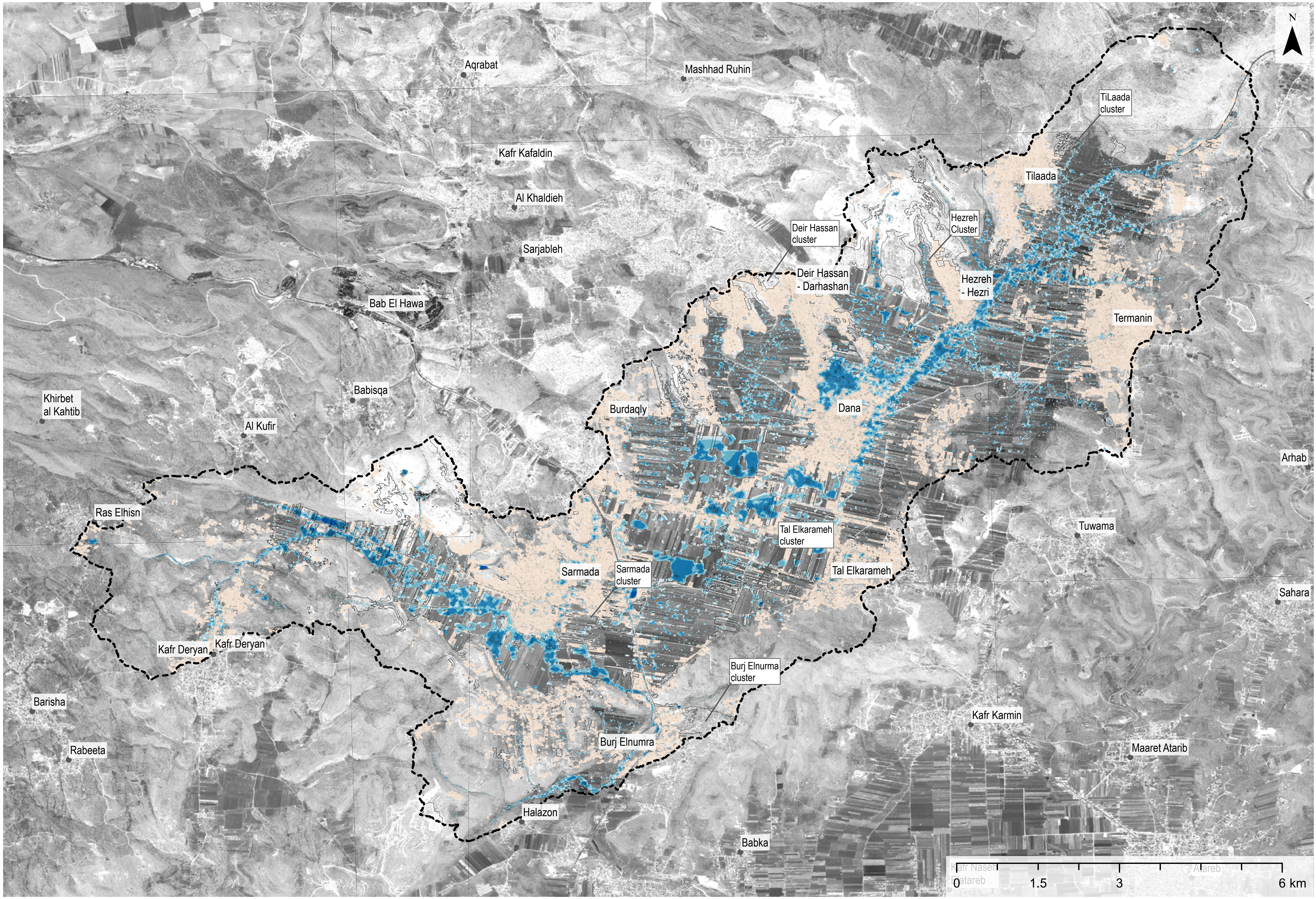
MODELLED FLOOD DEPTH RESULTS - CATCHMENT OVERVIEW

4,967

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood

0.2 - 0.5m	2,281
0.5 - 1.0m	1,663
1.0 - 3.0m	987
>3.0m	36



Populated area

- IDP sites/settlements
- Residential area
- Community

Modelled flood depth (m)

- ≤ 0.2 (not displayed)
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3
- >3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license

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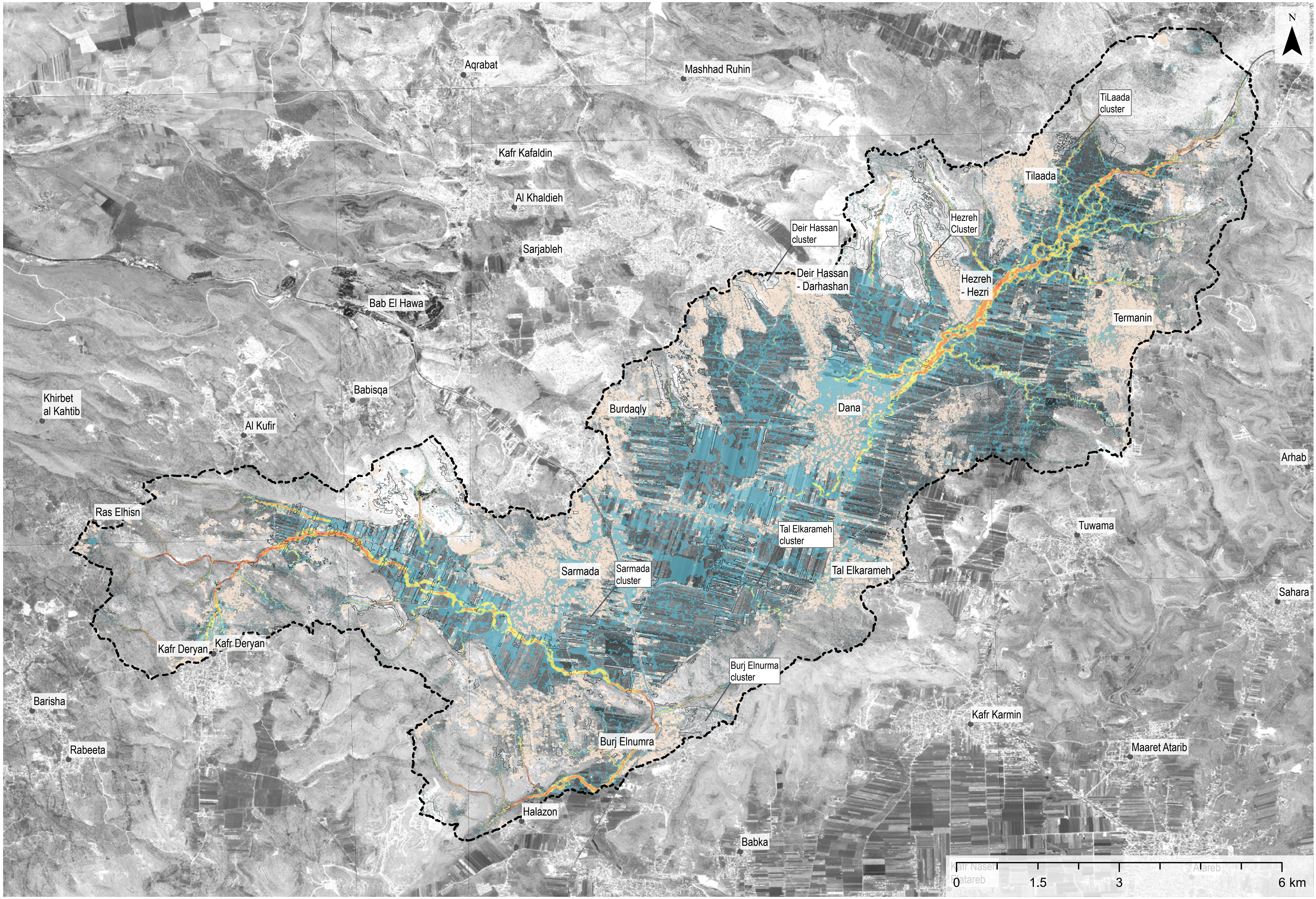
FLOOD HAZARD CLASSIFICATION - CATCHMENT OVERVIEW

831

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	597
High	230
Very High	4
Extreme	0



Populated area

- IDP sites/settlements
- Residential area
- Community

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping](#)

Satellite imagery:
WV01 from 20 August 2020
Copyright: © 2020 DigitalGlobe
Source: US Department of State, Humanitarian Information Unit, NextView license

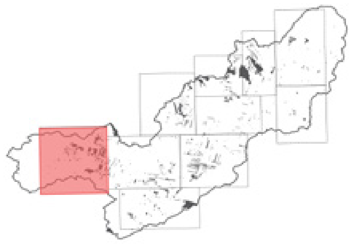
MODELLED FLOOD DEPTH RESULTS - Kafr Deryan Community

1,880

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood

0.2 - 0.5m	680
0.5 - 1.0m	594
1.0 - 3.0m	570
>3.0m	36



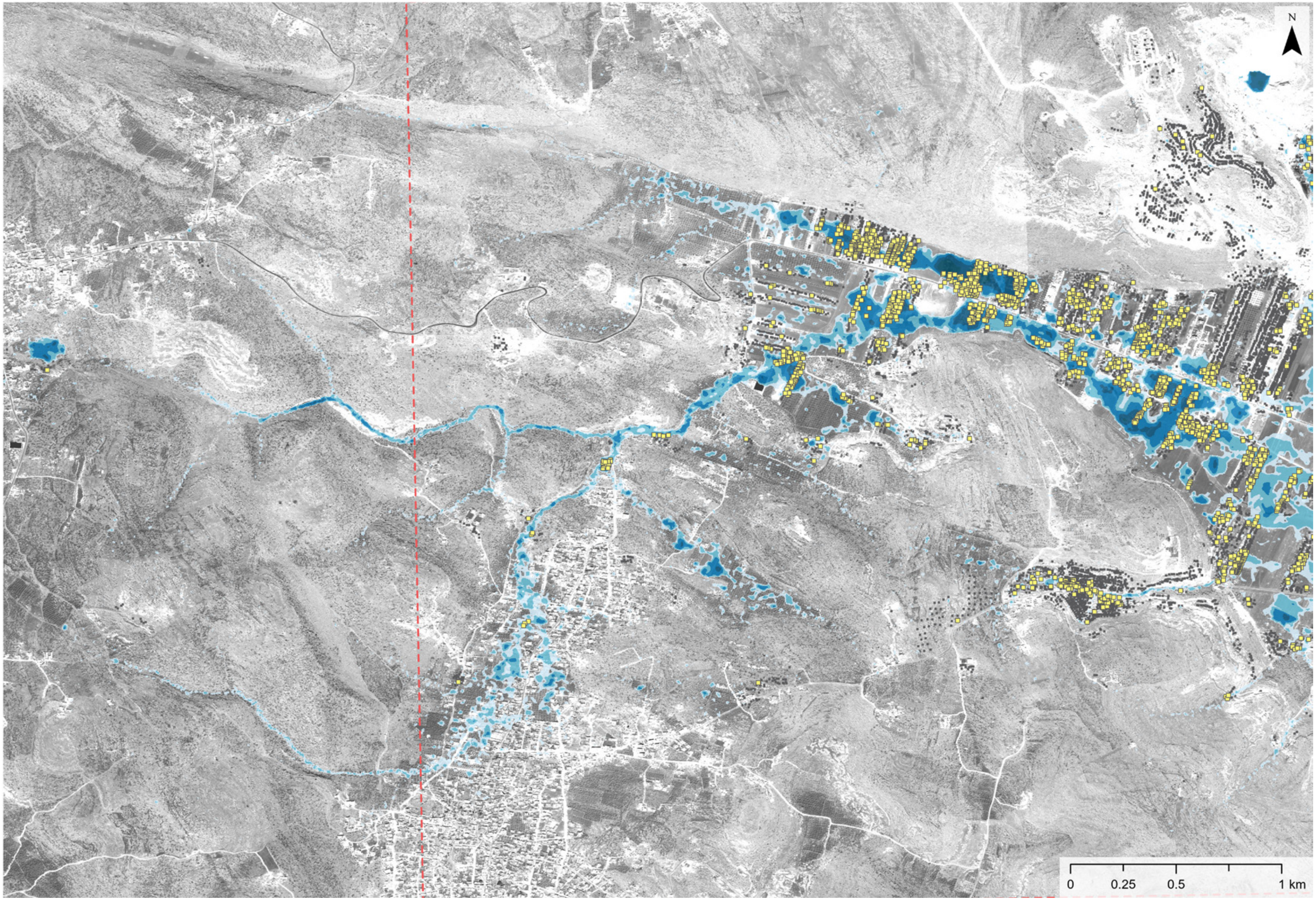
Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

- ≤ 0.2 (not displayed)
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3
- >3



Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
Copyright: © 2020 DigitalGlobe
Source: US Department of State, Humanitarian Information Unit, NextView license

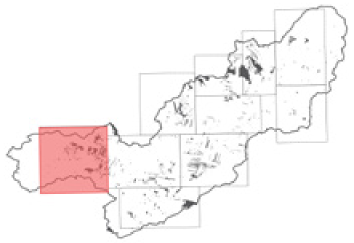
FLOOD HAZARD CLASSIFICATION - Kafr Deryan Community

562

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	348
High	210
Very High	4
Extreme	0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

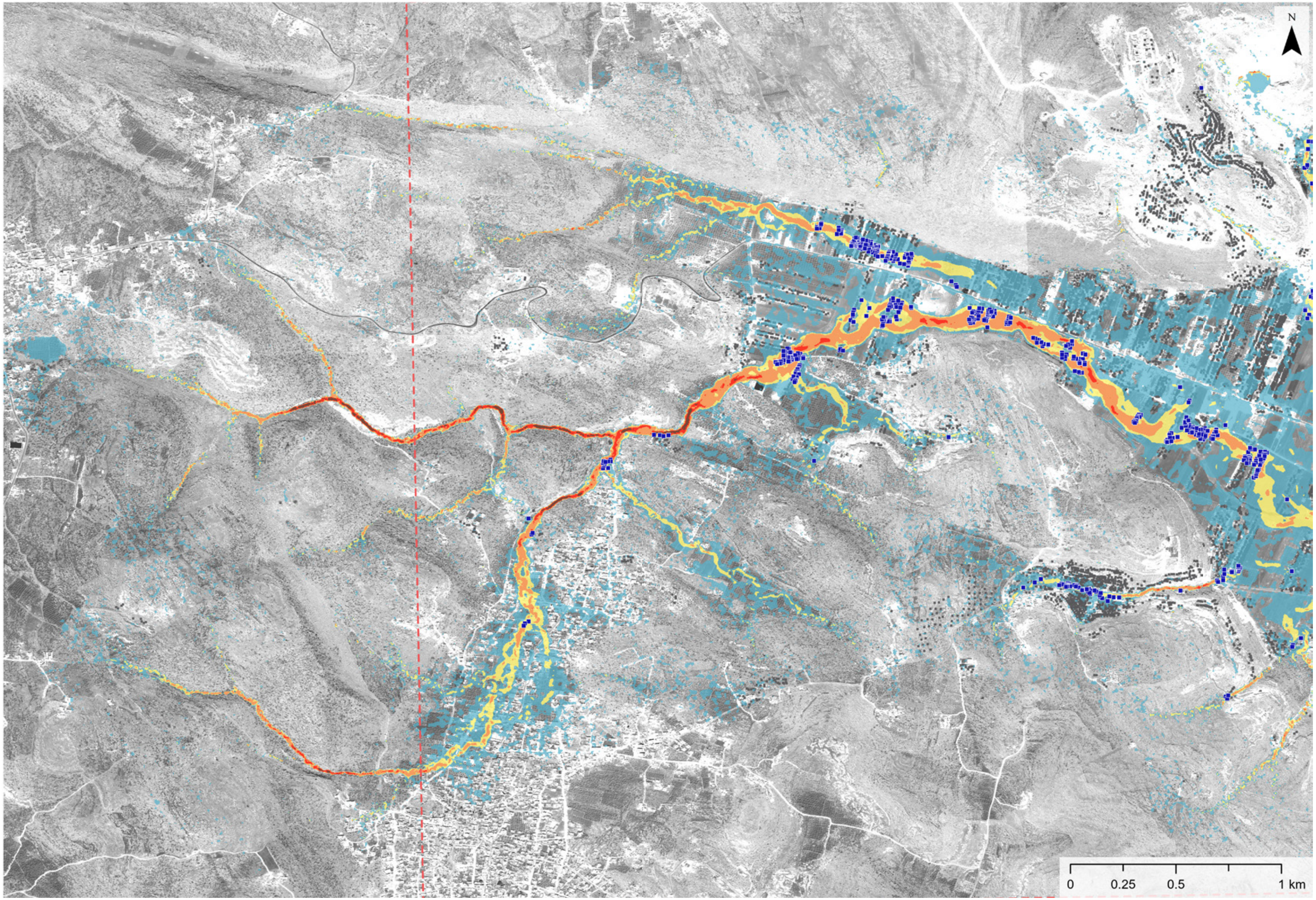
Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
Copyright: © 2020 DigitalGlobe
Source: US Department of State, Humanitarian Information Unit, NextView license



MODELLED FLOOD DEPTH RESULTS - Burdaqly Community

310

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

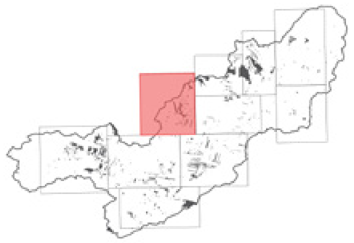
Breakdown of shelters within modelled flood

0.2 - 0.5m 185

0.5 - 1.0m 95

1.0 - 3.0m 30

>3.0m 0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

≤ 0.2 (not displayed)

≤ 0.5

≤ 1

≤ 2

≤ 3

>3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
Copyright: © 2020 DigitalGlobe
Source: US Department of State, Humanitarian Information Unit, NextView license

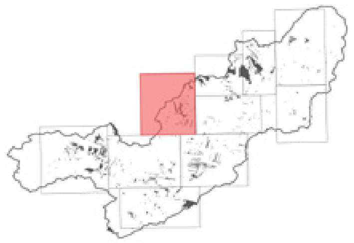
FLOOD HAZARD CLASSIFICATION - Burdaqly Community

16

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	16
High	0
Very High	0
Extreme	0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

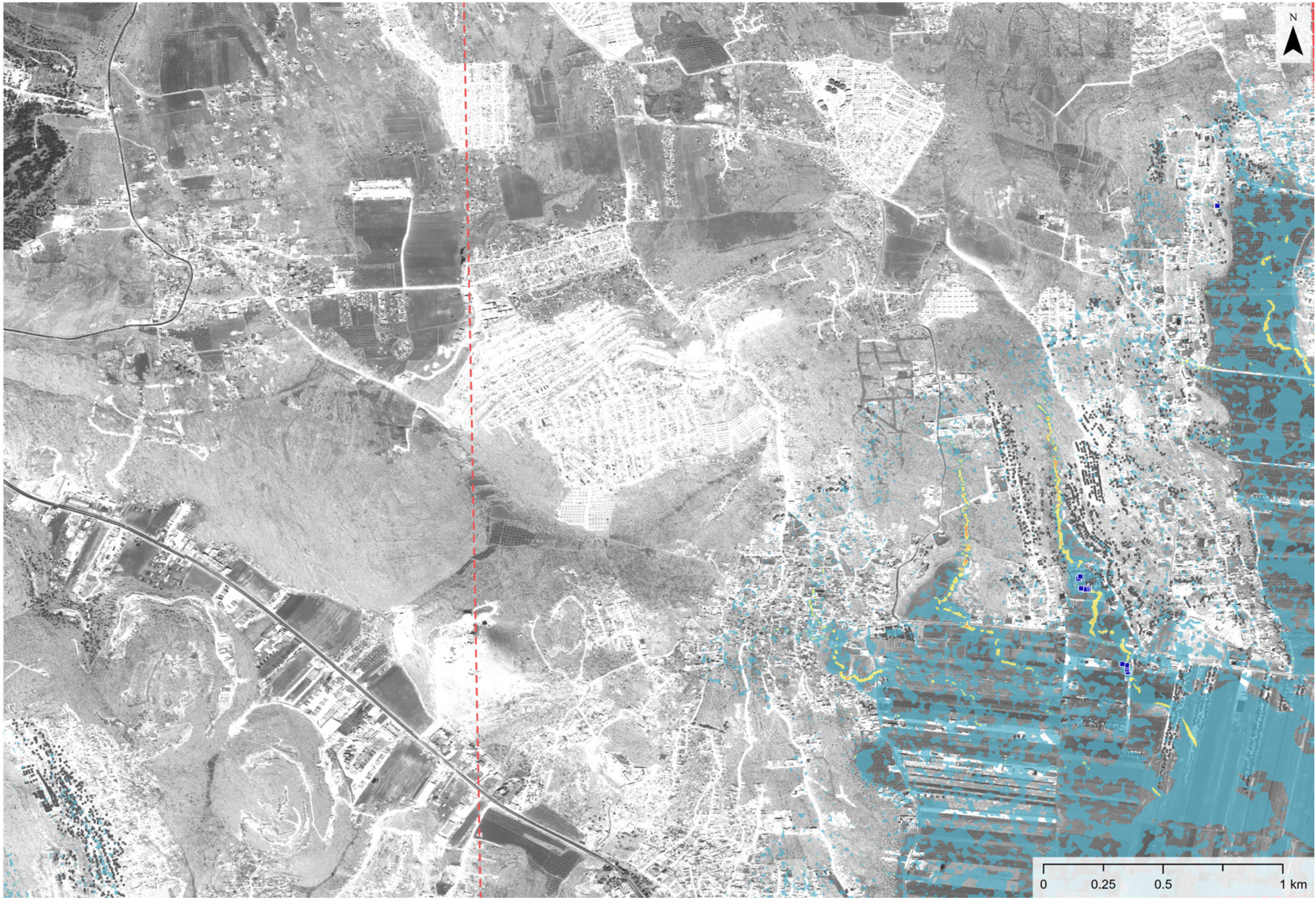
Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
Copyright: © 2020 DigitalGlobe
Source: US Department of State, Humanitarian Information Unit, NextView license



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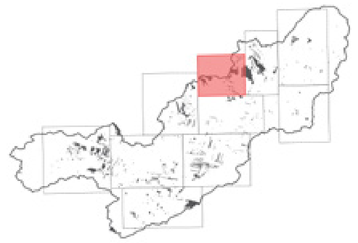
MODELLED FLOOD DEPTH RESULTS - Deir Hassan Cluster

91

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood

0.2 - 0.5m	64
0.5 - 1.0m	25
1.0 - 3.0m	2
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

≤ 0.2 (not displayed)

≤ 0.5

≤ 1

≤ 2

≤ 3

>3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

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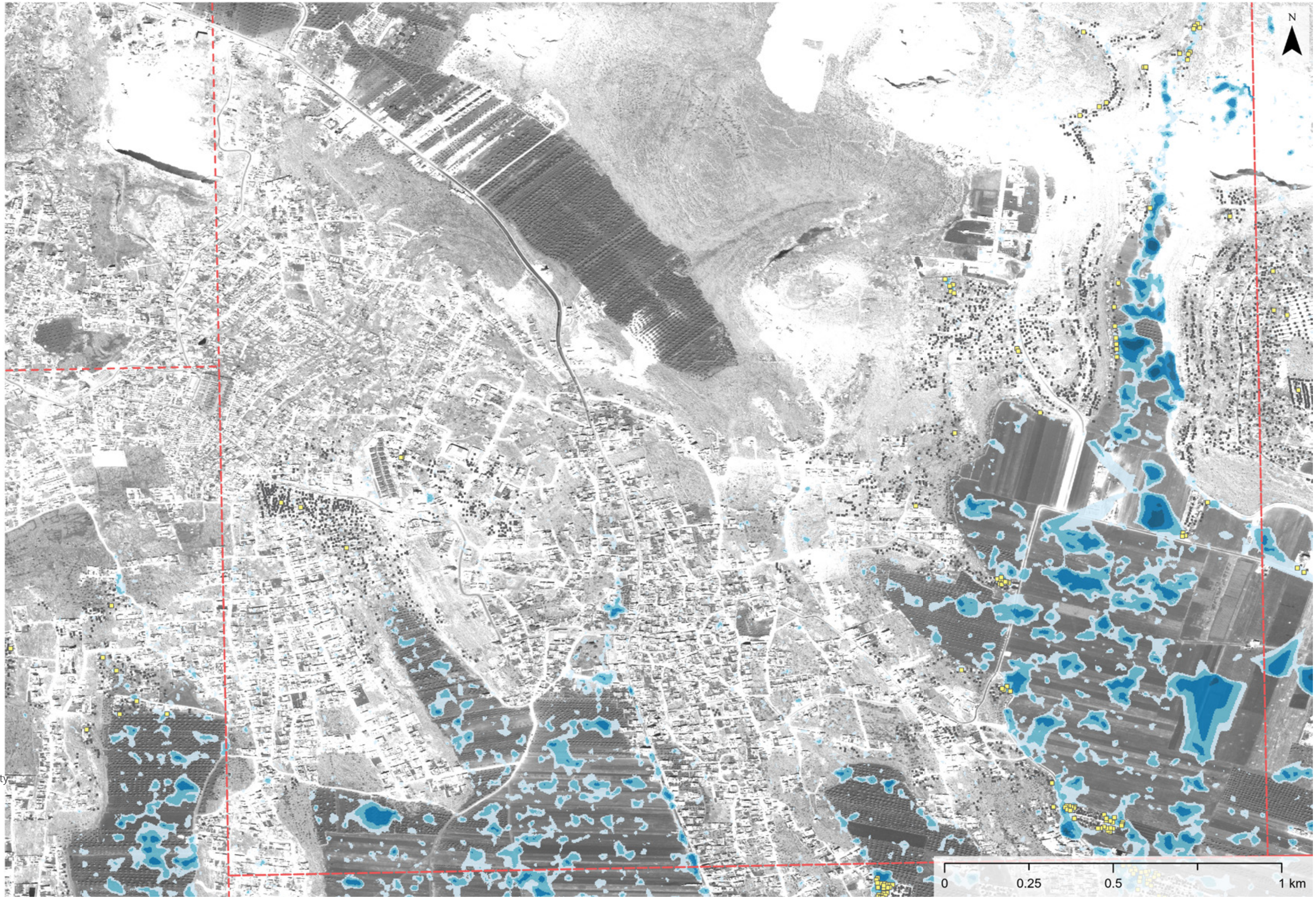

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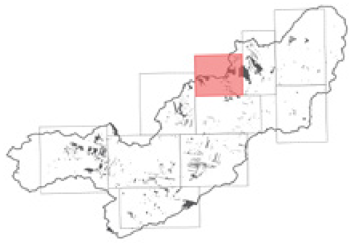
FLOOD HAZARD CLASSIFICATION - Deir Hassan Cluster

11

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	11
High	0
Very High	0
Extreme	0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
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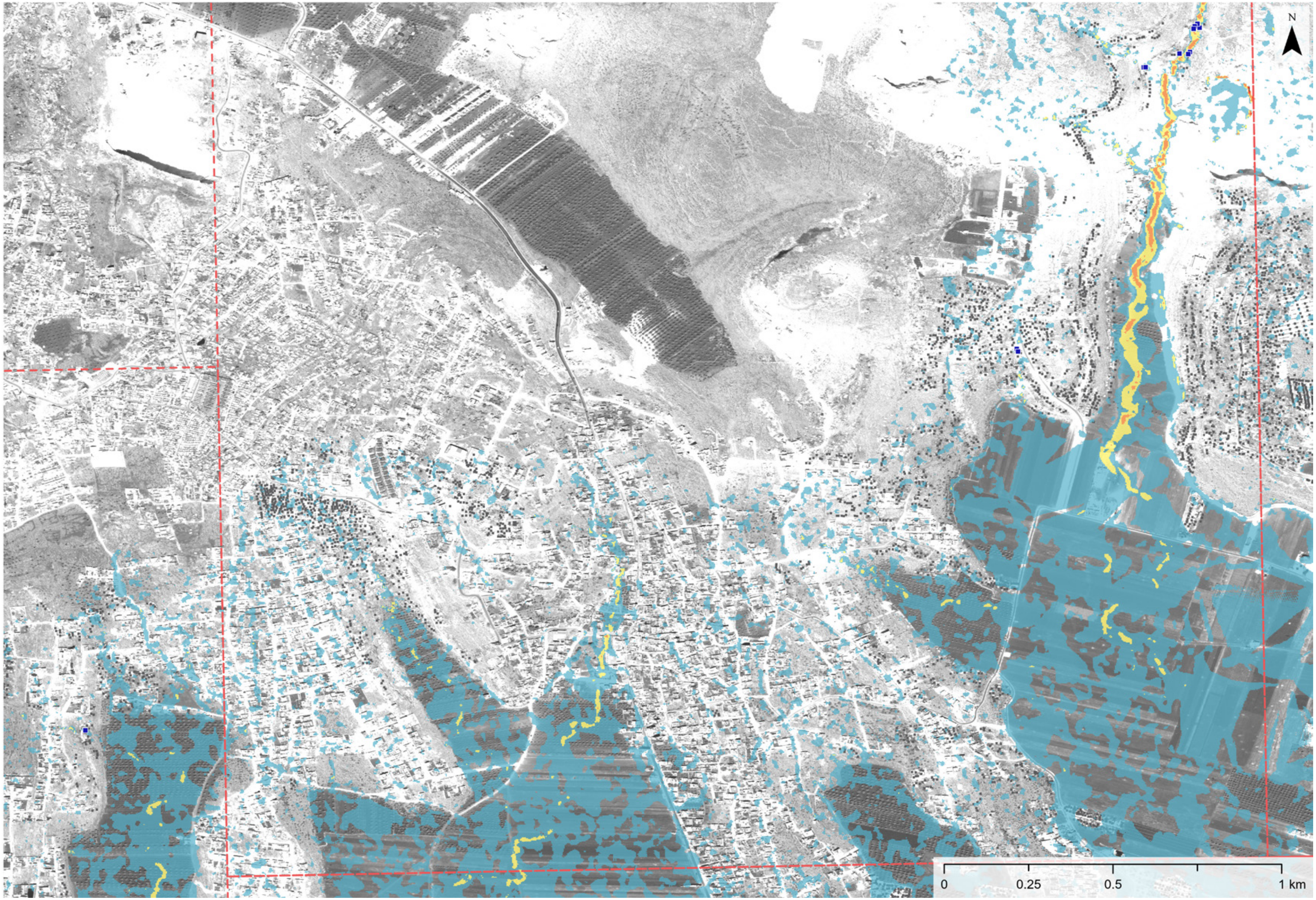

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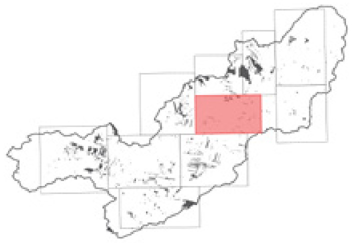
520

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	214
0.5 - 1.0m	202
1.0 - 3.0m	104
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

- ≤ 0.2 (not displayed)
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3
- >3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
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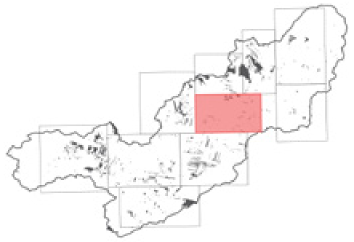
FLOOD HAZARD CLASSIFICATION - Dana Community

58

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	54
High	4
Very High	0
Extreme	0



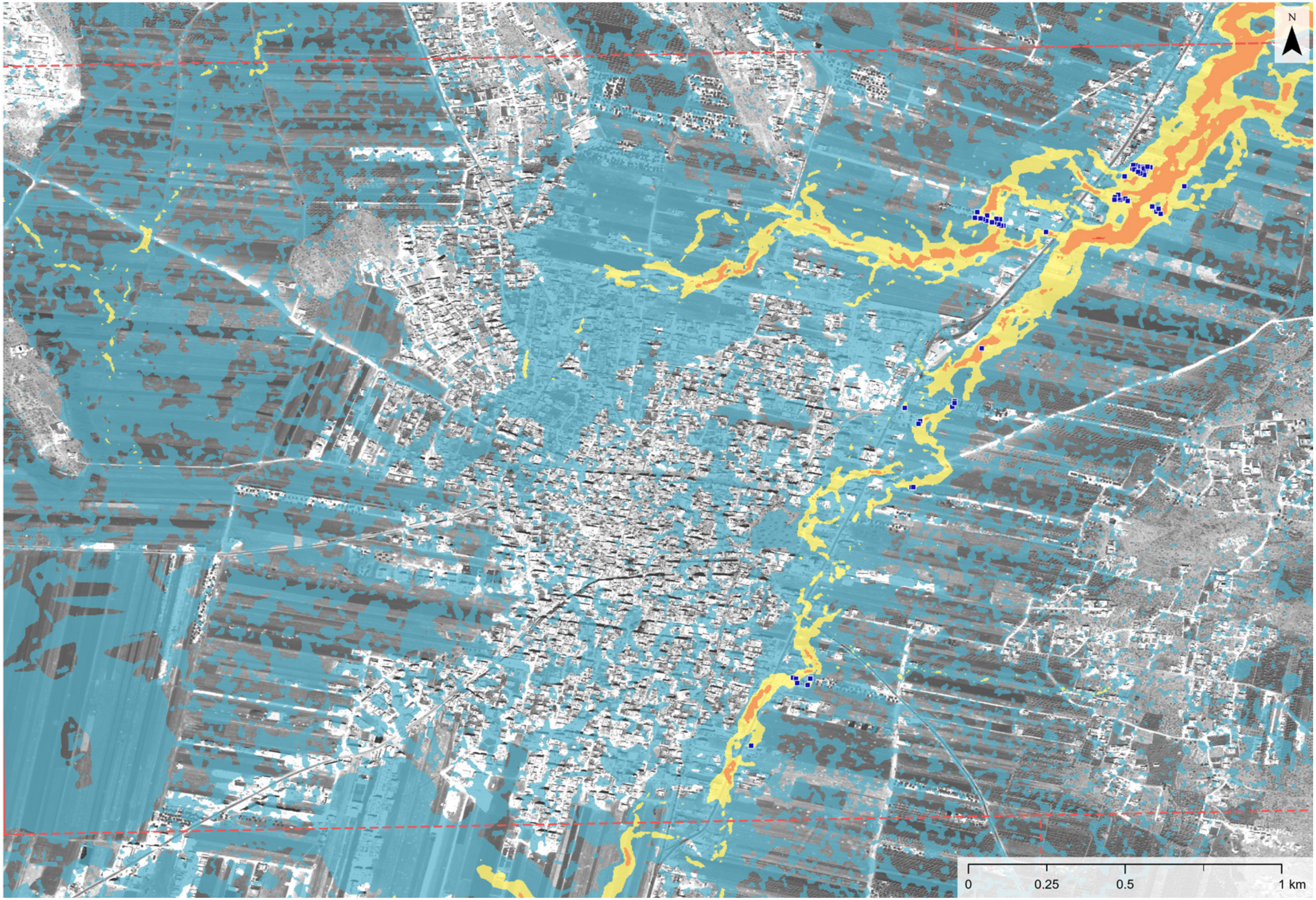
Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme



Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license

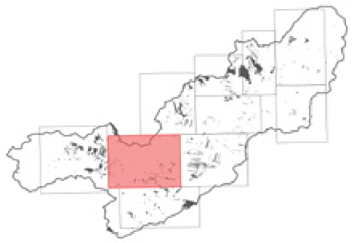
MODELLED FLOOD DEPTH RESULTS - Sarmada Cluster

817

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	342
0.5 - 1.0m	309
1.0 - 3.0m	166
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

≤ 0.2 (not displayed)

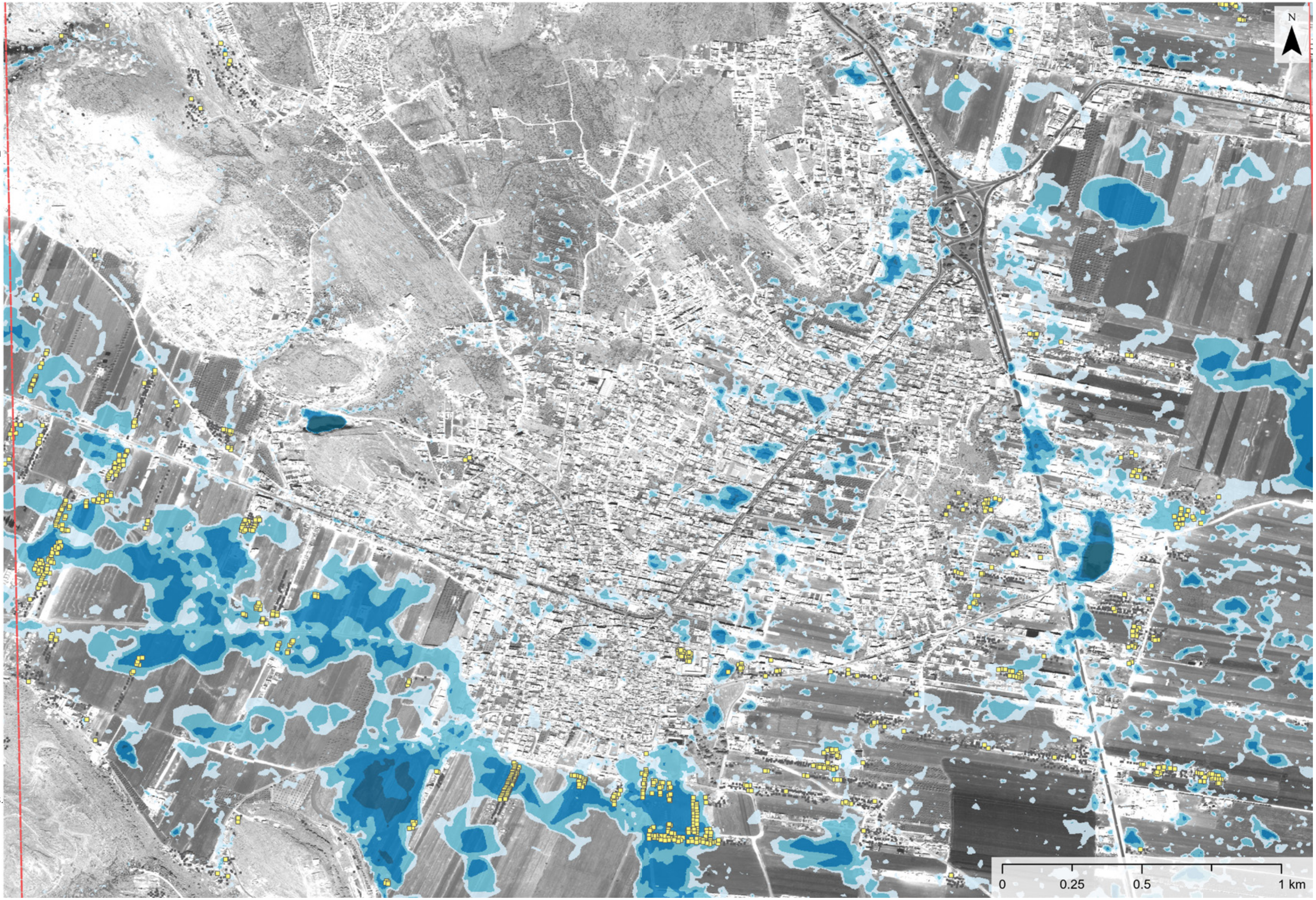
≤ 0.5

≤ 1

≤ 2

≤ 3

>3



Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
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FLOOD HAZARD CLASSIFICATION - Sarmada Cluster

94

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

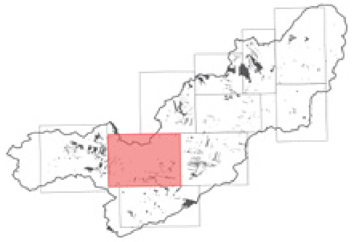
Breakdown of shelter exposure to flood hazards

Medium 92

High 2

Very High 0

Extreme 0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

Flood hazard classification

Low

Medium

High

Very High

Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
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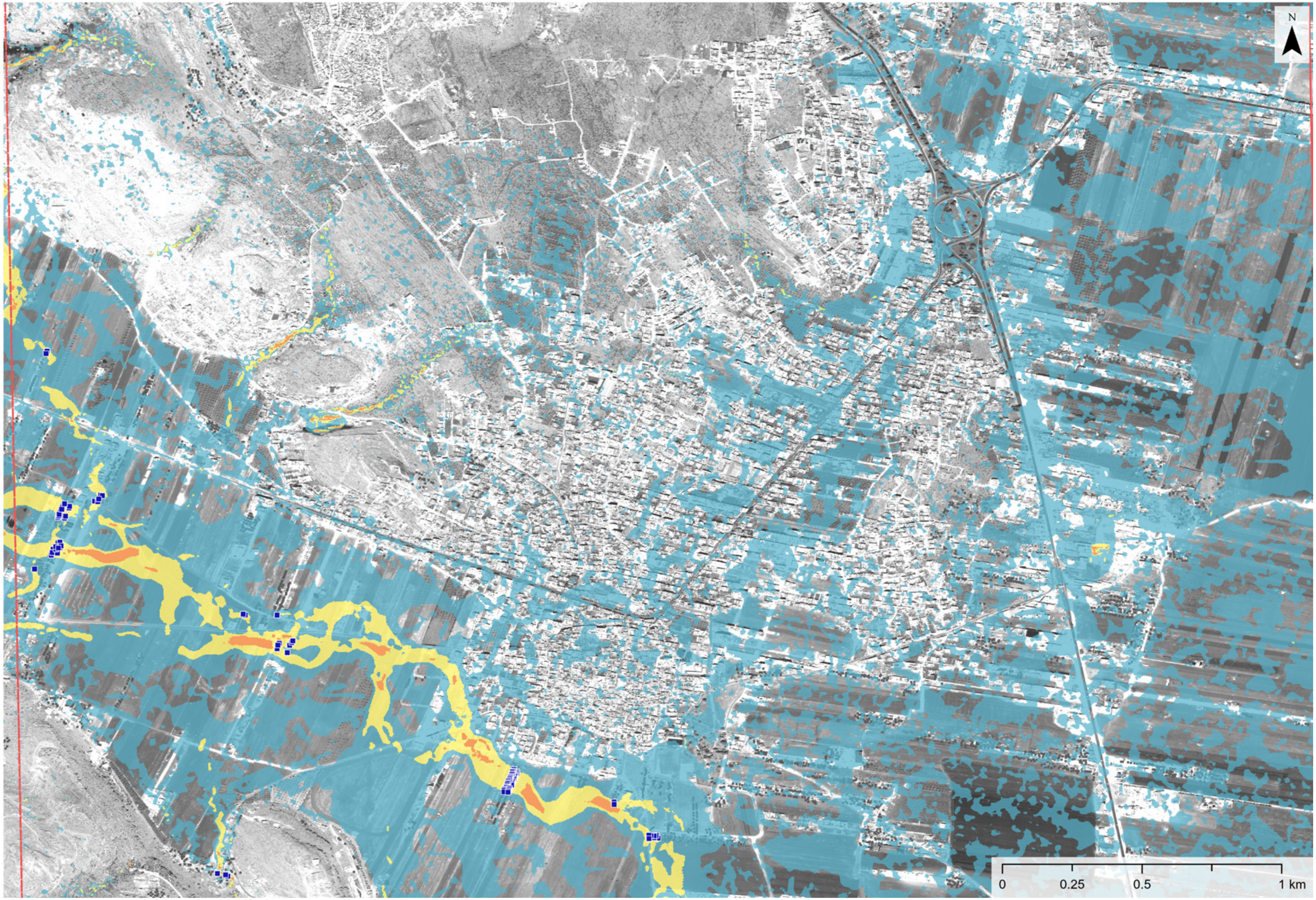

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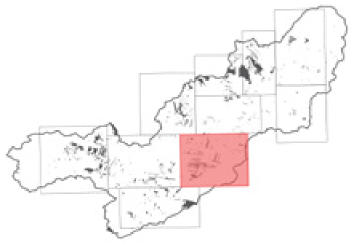
MODELLED FLOOD DEPTH RESULTS - Tal Elkarameh Community

921

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	522
0.5 - 1.0m	348
1.0 - 3.0m	51
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

≤ 0.2 (not displayed)

≤ 0.5

≤ 1

≤ 2

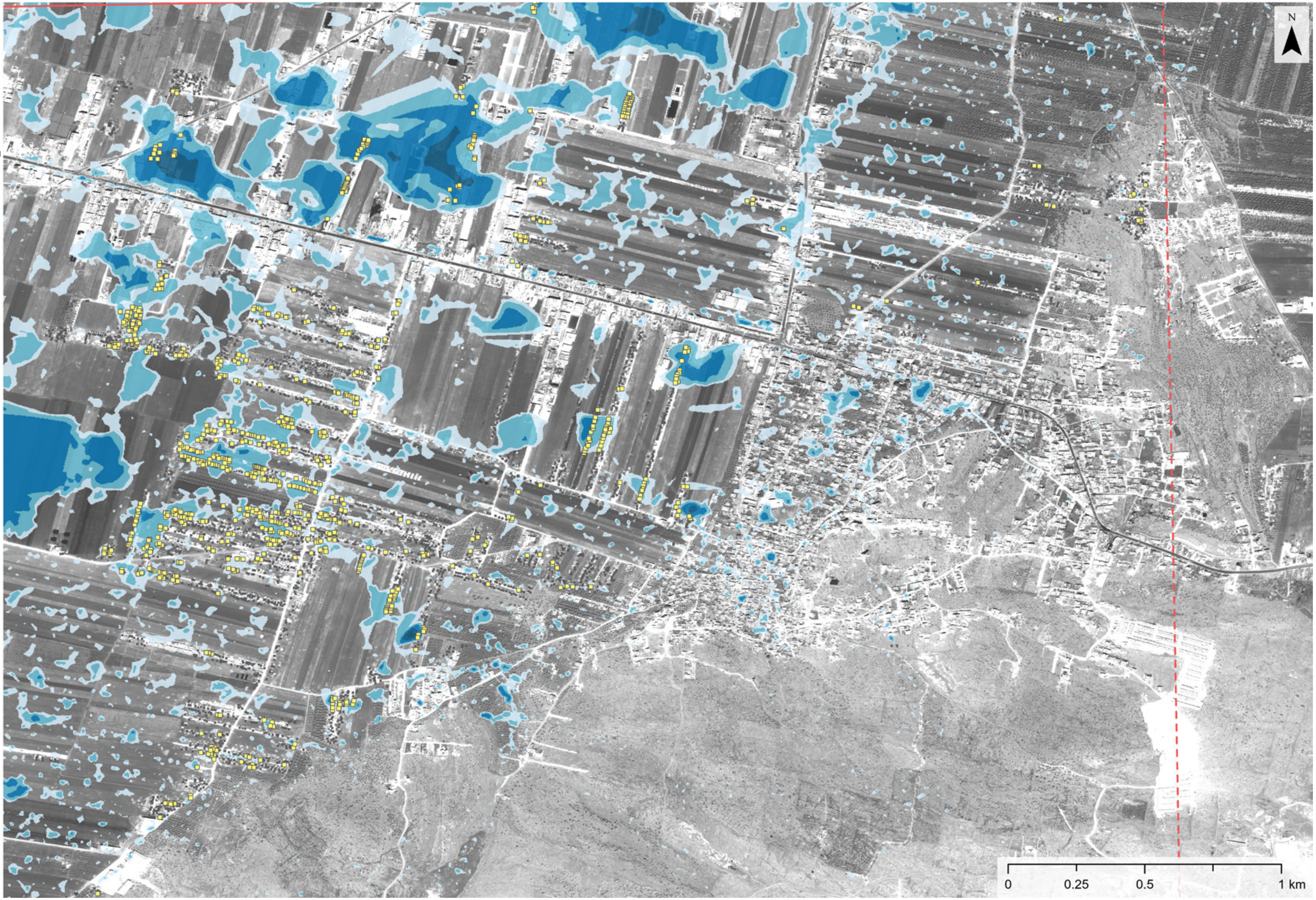
≤ 3

>3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license



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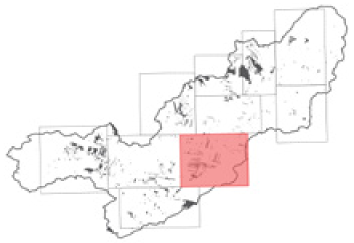
FLOOD HAZARD CLASSIFICATION - Tal Elkarameh Community

3

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	3
High	0
Very High	0
Extreme	0



- Shelters exposed to flood hazard (medium hazard or greater)
- Analysis extent
- Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
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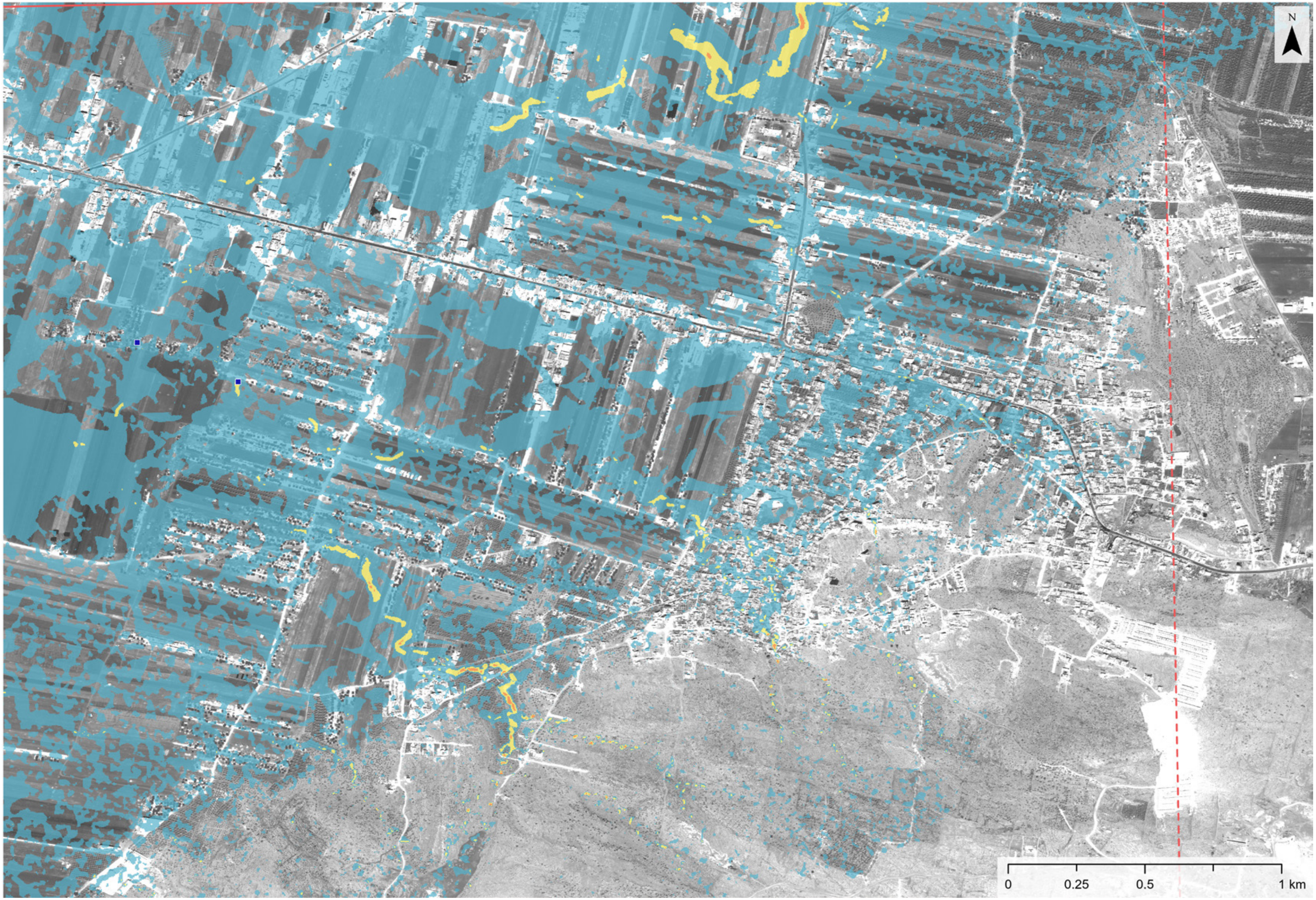


MODELLED FLOOD DEPTH RESULTS - Burj Elnumra Community

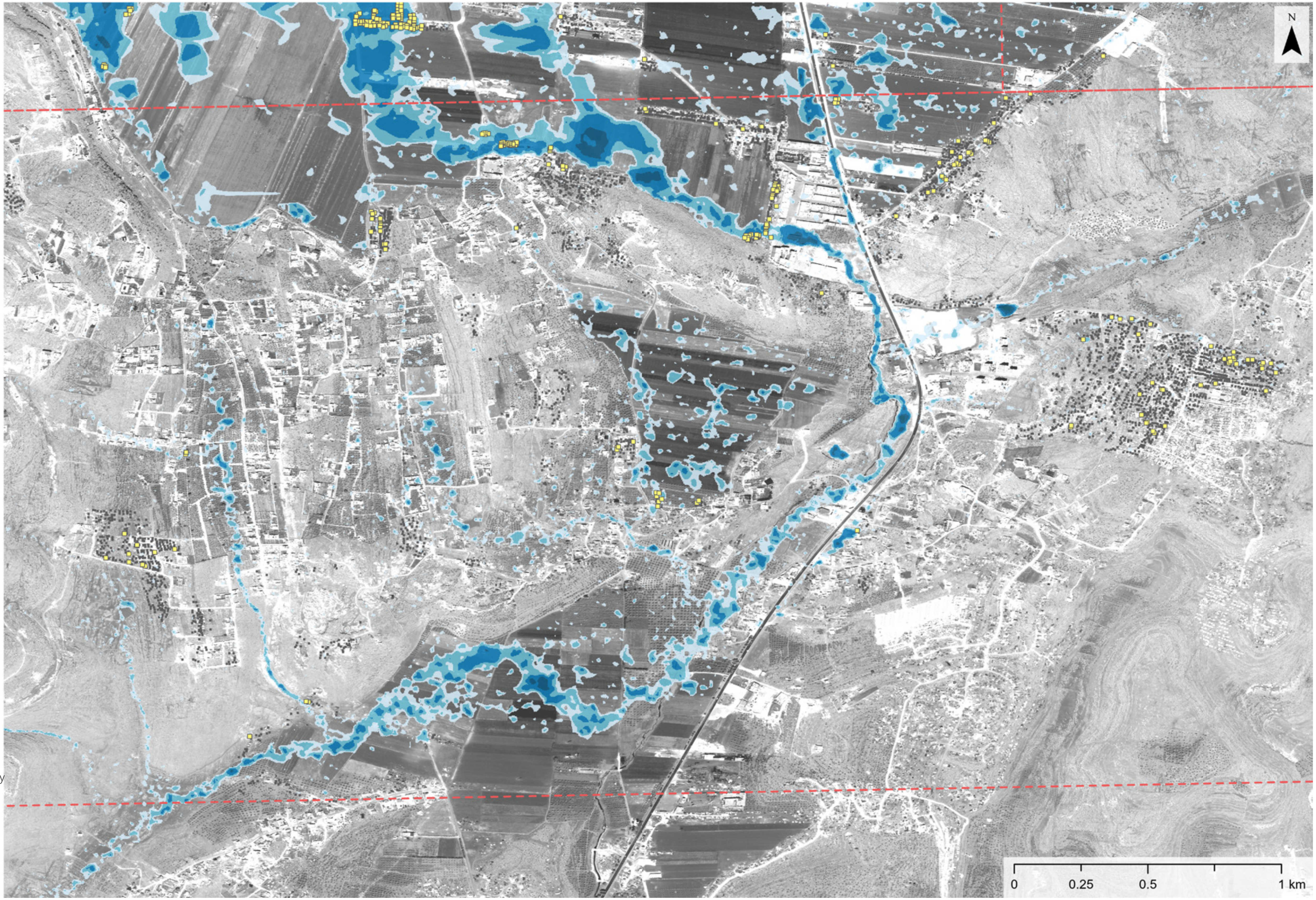
186
Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	117
0.5 - 1.0m	38
1.0 - 3.0m	31
>3.0m	0

Shelters flood depth >0.2m
Analysis extent
Shelters (February 2021)

Modelled flood depth (m)
≤ 0.2 (not displayed)
≤ 0.5
≤ 1
≤ 2
≤ 3
>3



Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
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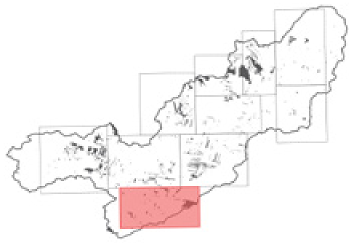
FLOOD HAZARD CLASSIFICATION - Burj Elnumra Community

46

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled

Breakdown of shelter exposure to flood hazards

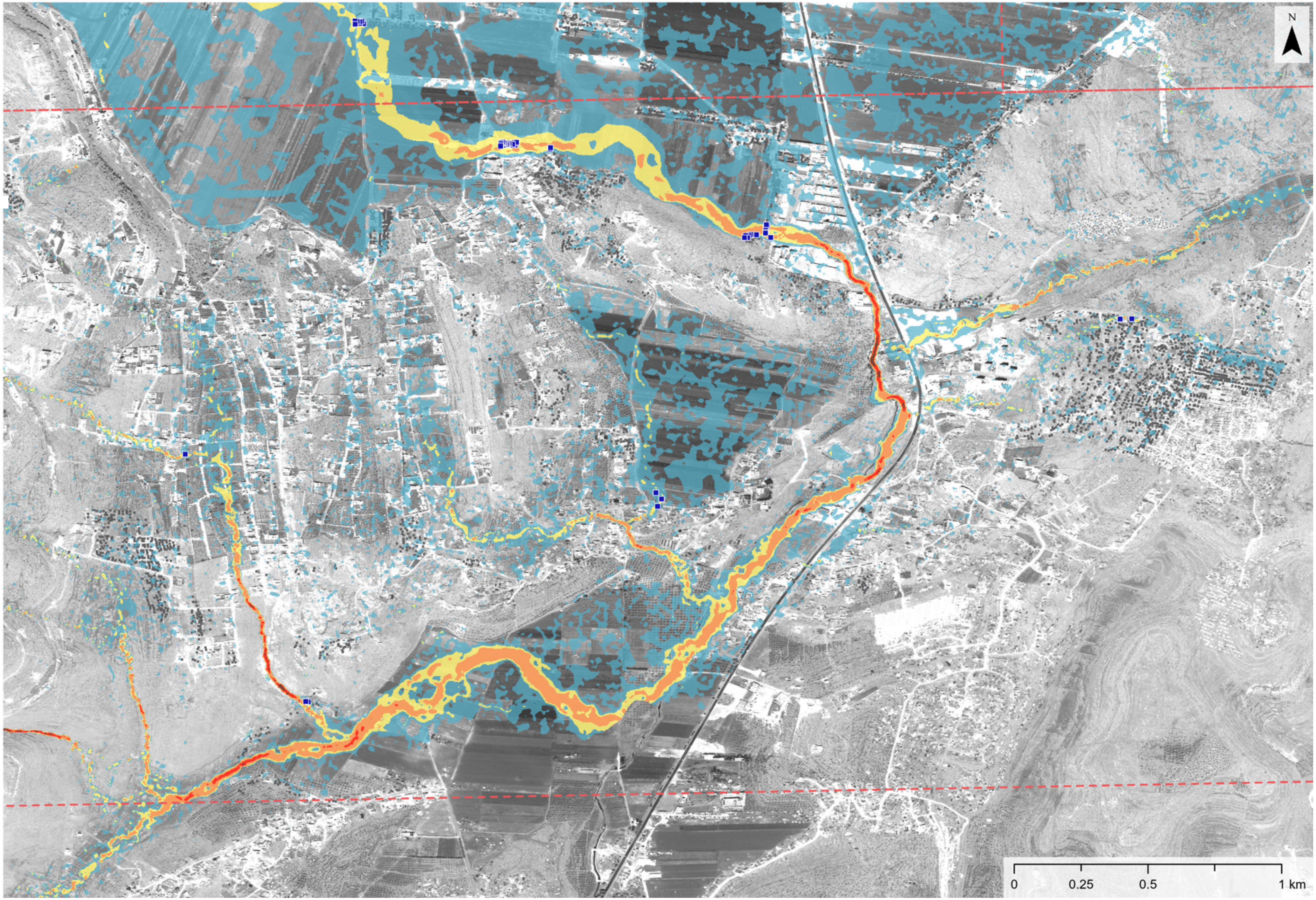
Medium	35
High	10
Very High	1
Extreme	0



- Shelters exposed to flood hazard (medium hazard or greater)
- Analysis extent
- Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme



Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license

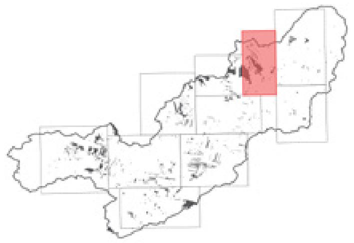
MODELLED FLOOD DEPTH RESULTS - Herzeh Cluster

89

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	59
0.5 - 1.0m	22
1.0 - 3.0m	8
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

- ≤ 0.2 (not displayed)
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3
- >3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
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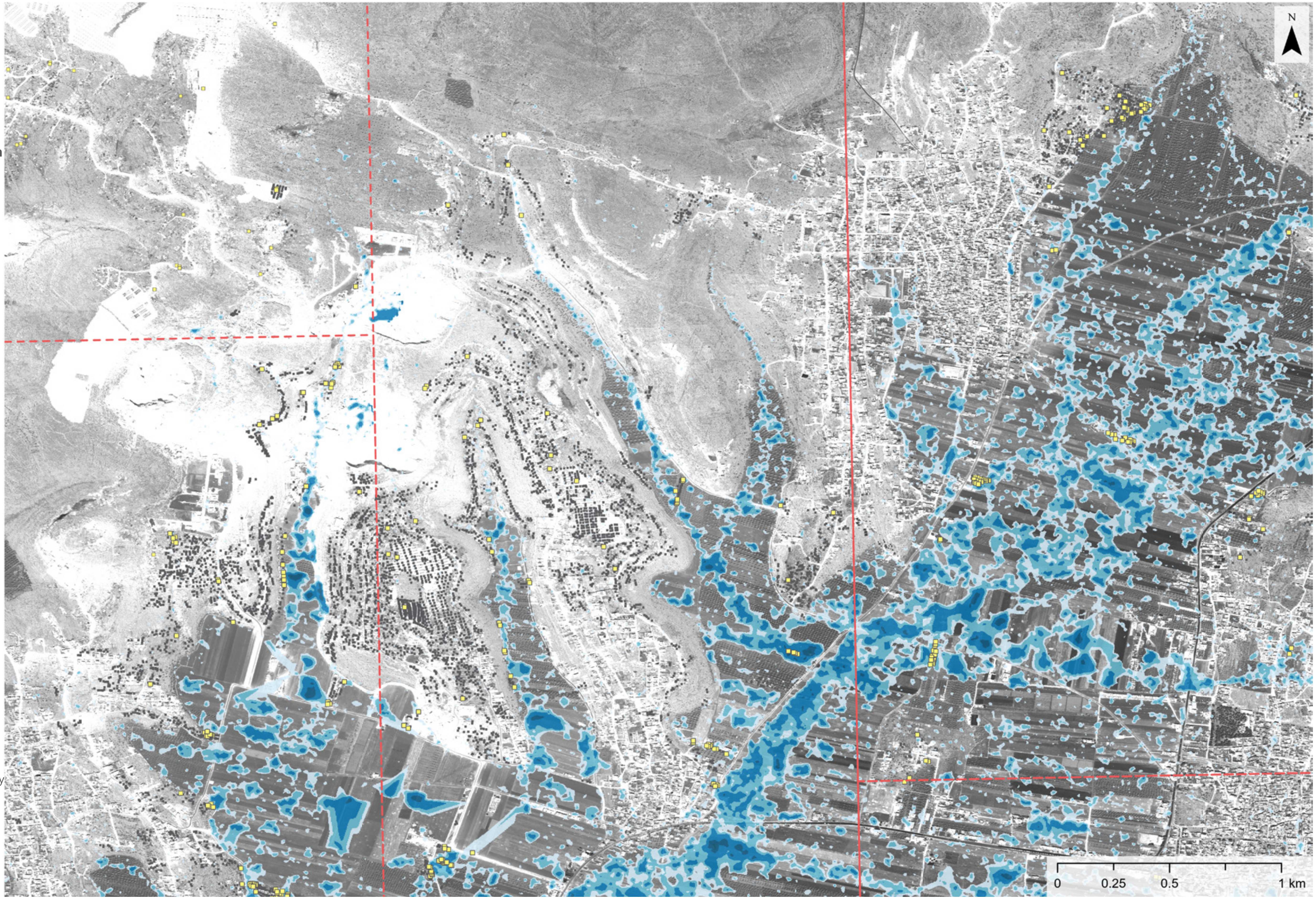

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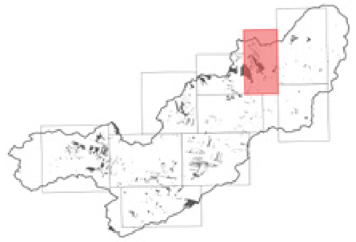
FLOOD HAZARD CLASSIFICATION - Herzeh Cluster

9

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	7
High	2
Very High	0
Extreme	0



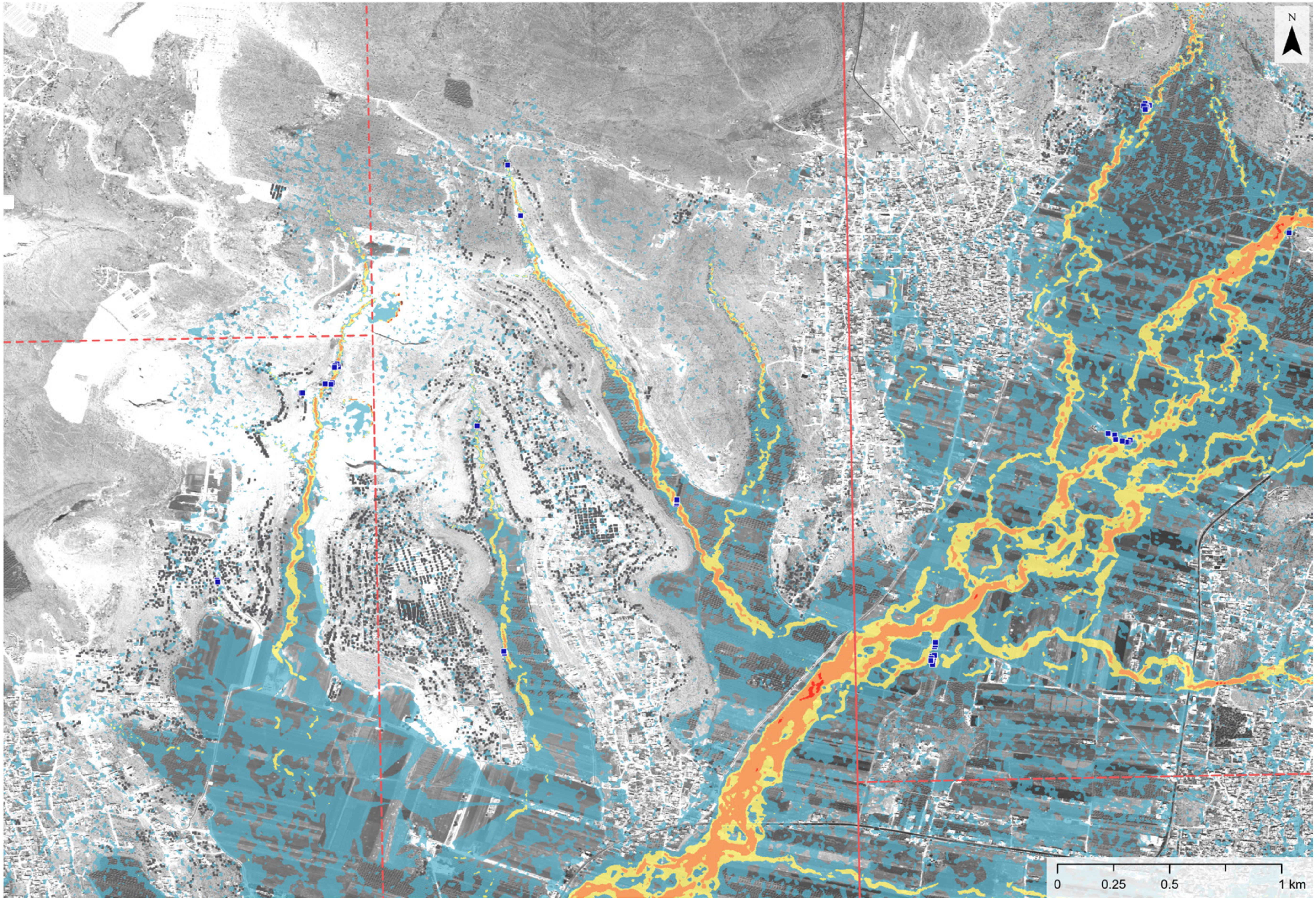
Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme



Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020
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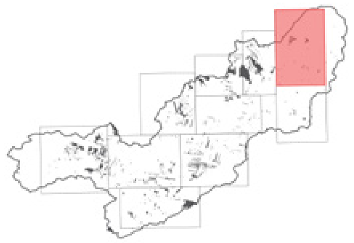
MODELLED FLOOD DEPTH RESULTS - Tilaada Cluster

103

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	54
0.5 - 1.0m	32
1.0 - 3.0m	17
>3.0m	0



Shelters flood depth >0.2m

Analysis extent

Shelters (February 2021)

Modelled flood depth (m)

≤ 0.2 (not displayed)

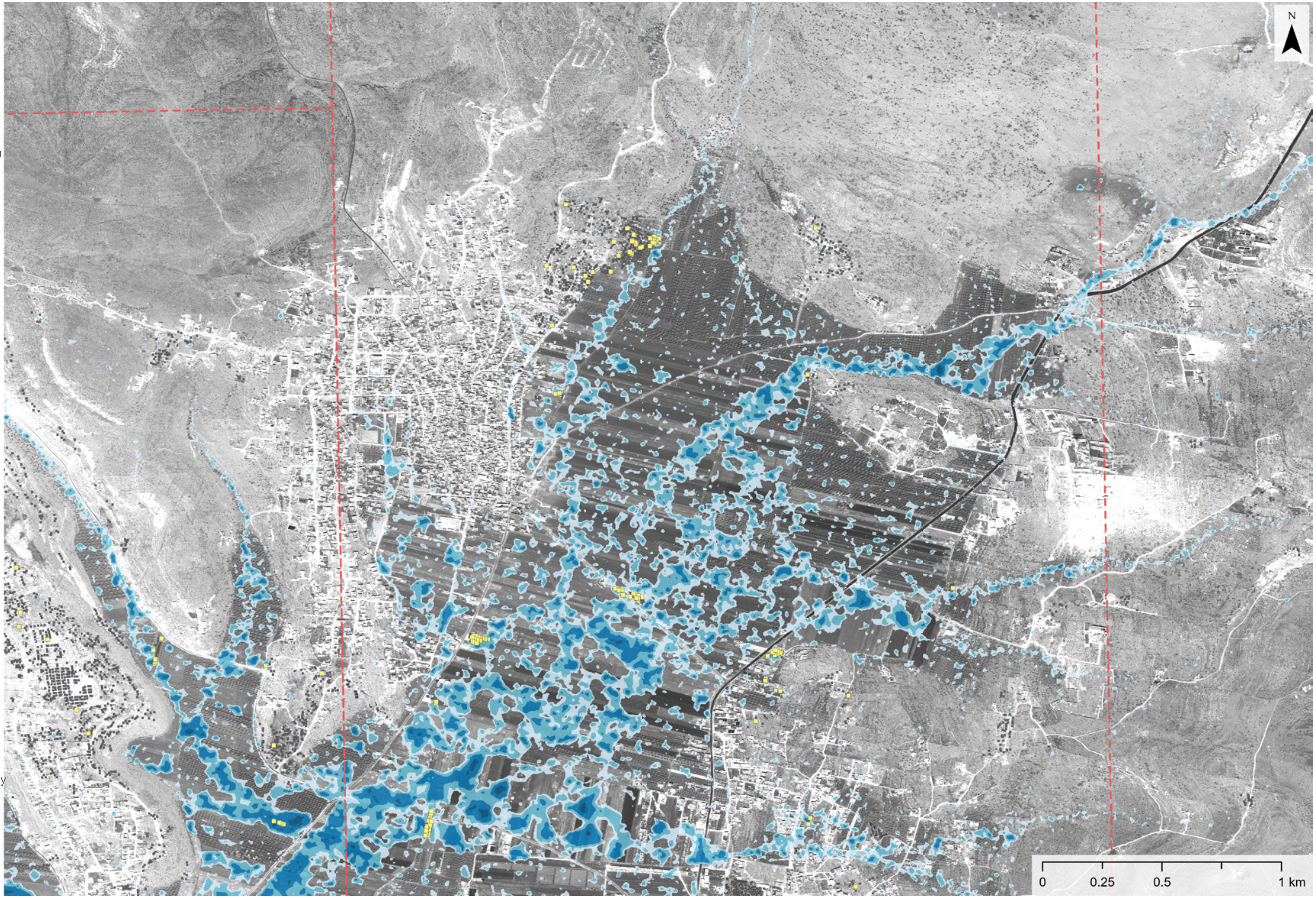
≤ 0.5

≤ 1

≤ 2

≤ 3

>3



Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020
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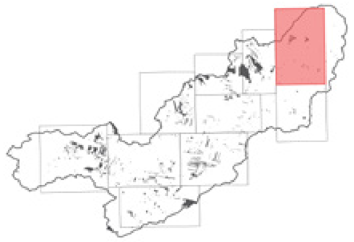
FLOOD HAZARD CLASSIFICATION - Tilaada Cluster

27

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	26
High	1
Very High	0
Extreme	0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

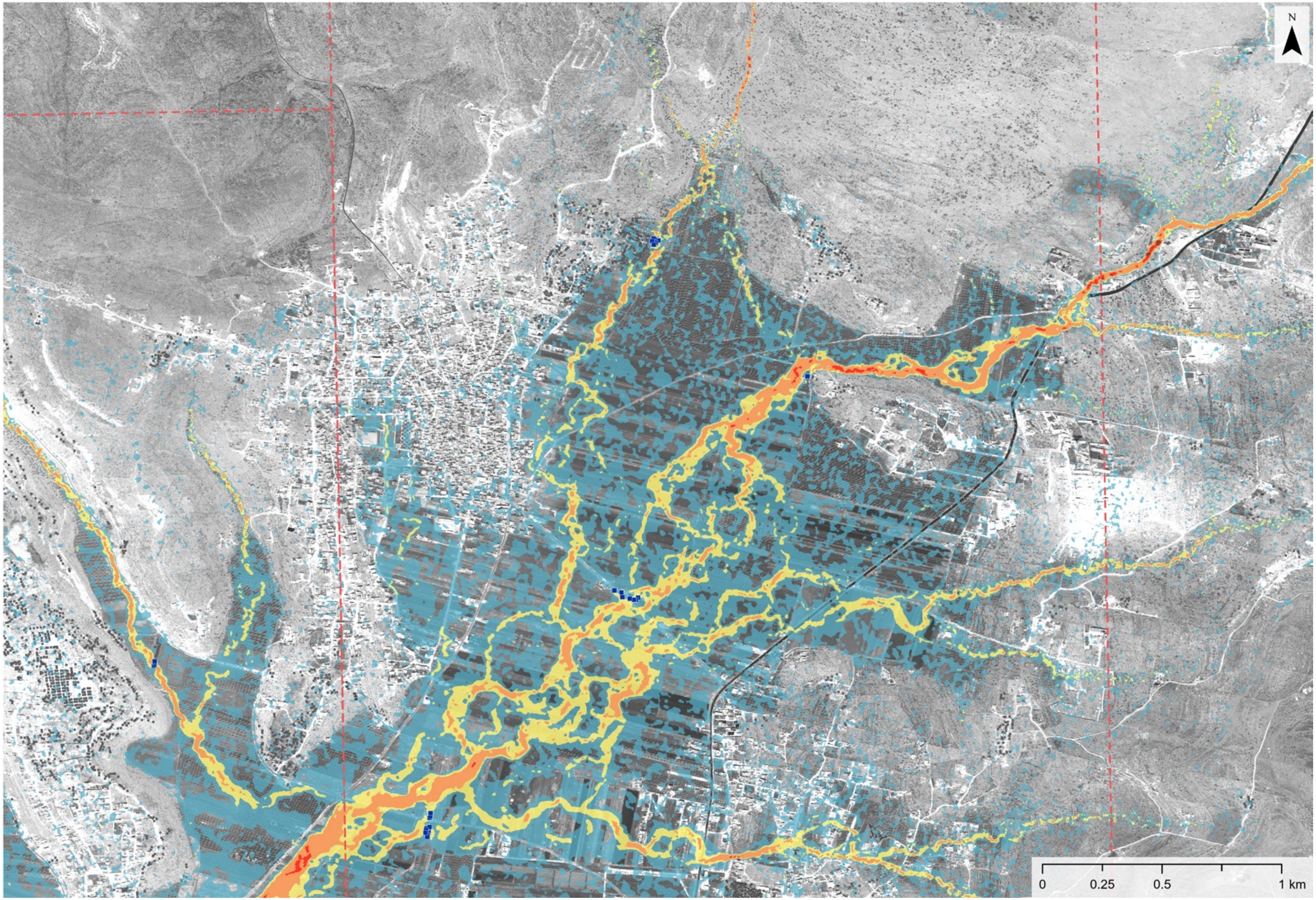
Flood hazard classification

- Low
- Medium
- High
- Very High
- Extreme

Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA [Guidance for Flood Risk Analysis and Mapping]

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license



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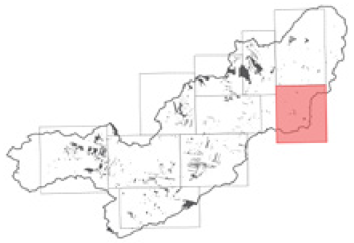
MODELLED FLOOD DEPTH RESULTS - Termanin Community

36

Shelters lie within the modelled flood extents. Where flood depth exceeds 200mm

Breakdown of shelters within modelled flood extents

0.2 - 0.5m	27
0.5 - 1.0m	6
1.0 - 3.0m	3
>3.0m	0



Shelters flood depth >0.2m
Analysis extent
Shelters (February 2021)

Modelled flood depth (m)
≤ 0.2 (not displayed)
≤ 0.5
≤ 1
≤ 2
≤ 3
>3

Modelled flood extents calculated based on 25-year design storm derived from IDF curves for the city of Gaziantep, Turkey. Peak rainfall intensity is 143.5 mm/hr and the total storm depth is 97.7 mm over 16 hours.

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license

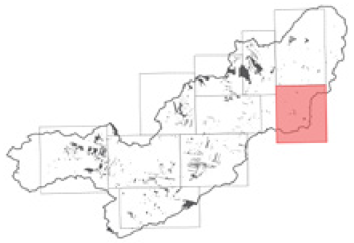
FLOOD HAZARD CLASSIFICATION - Termanin Community

5

Shelters are exposed to a flood hazard categorized as a medium severity hazard or higher based on modelled depth x velocity

Breakdown of shelter exposure to flood hazards

Medium	5
High	0
Very High	0
Extreme	0



Shelters exposed to flood hazard (medium hazard or greater)

Analysis extent

Shelters (February 2021)

Flood hazard classification

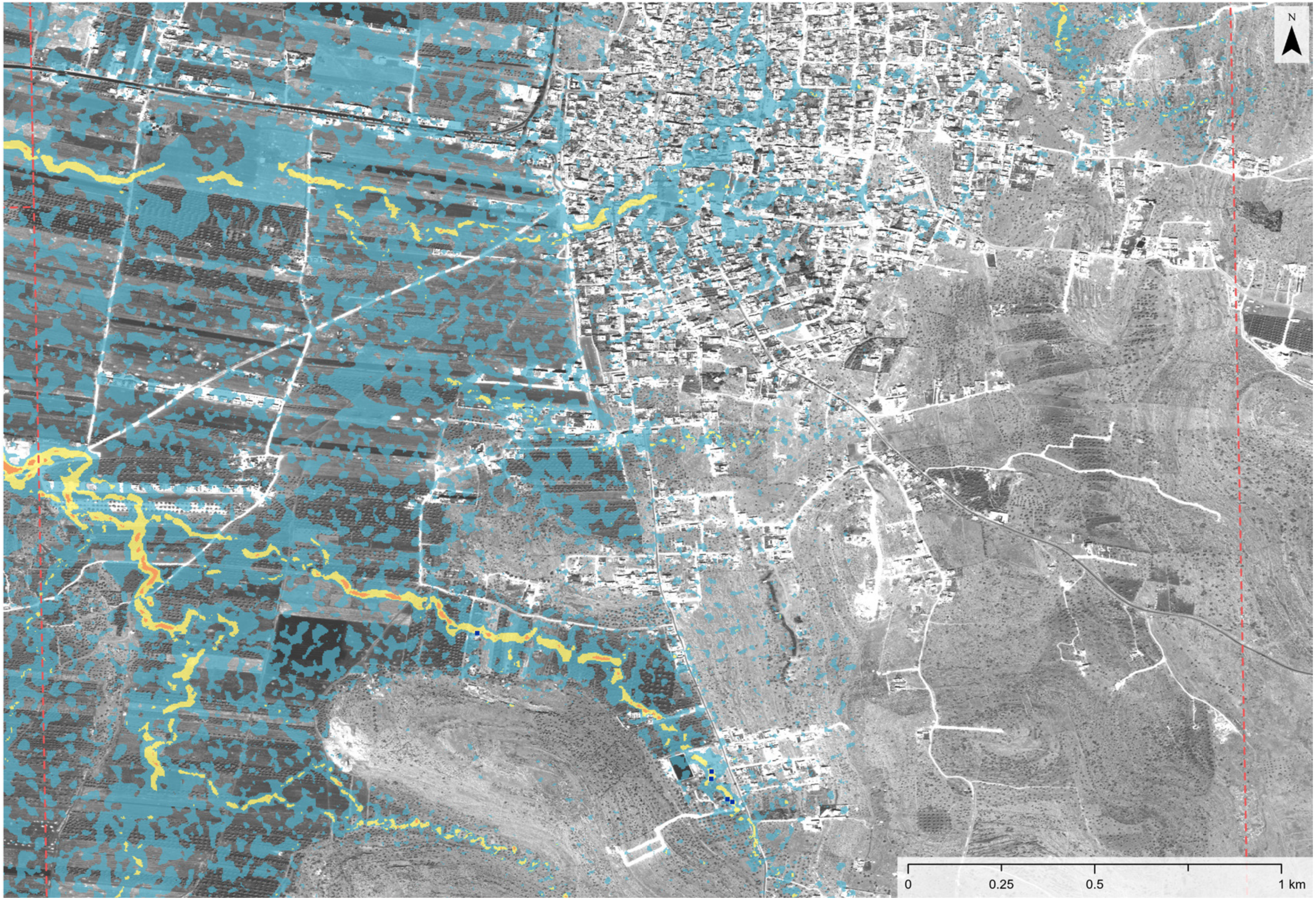
Low

Medium

High

Very High

Extreme



Flood hazard classification based on simplified D*V severity grid symbolisation categories by FEMA Guidance for Flood Risk Analysis and Mapping

Satellite imagery:
WV01 from 20 August 2020

Source: US Department of State, Humanitarian Information Unit, NextView license