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SYRIA

Operationalising REACH Flood Hazard Assessments in Northwest Syria

October 2022

Cover photo credits: IDP camp in Dana
Flooded by the rain. © REACH/2021

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REACH Informing more effective humanitarian action

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PARTNERS

Overview

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. For example, recurrent heavy rains and snowstorms between 18 and 31 of January 2022, generated widespread flooding throughout Northwest Syria, affecting an estimated 250,000 IDPs. More than 287 camps and sites throughout the governorates of Idleb and Aleppo were impacted by the floods. 10,000 tents were destroyed or damaged,[1] with many roads leading to camps being cut off.[2] Thousands of households were forced to seek shelter in schools, mosques, and open spaces where winter temperatures dipped below the freezing point.[3] Camps and informal settlements are more vulnerable to flood hazards: they have a lack of functional public infrastructure, poor drainage, and their densely populated environments are not built to withstand natural hazards.[4]

> "There is a need for a planned approach for flood management and flood mitigation in Syria, informed by accurate data."
>
> Engineer from IYD

PROJECT OVERVIEW AND OBJECTIVES

The project aim was to gain a deeper understanding of the operational value of flood hazard models beyond advocacy purposes. In 2022, REACH chose to collaborate with three implementing partners (Takaful AL Sham, Global Communities and IYD) seeking to understand how the data may be integrated into the existing operational procedures of its partners. The outputs from partners varied depending on the project they were executing and their specific information needs.

The partners were chosen based on their expression of interest at the designated Settlements Working Group meeting in January 2022. Eligibility requirements included that they were currently implementating or planning a project in NWS that may benefit from the use of high resolution flood models.

FLOOD HAZARD MODELS

In 2020 and 2021, REACH conducted flood hazard assessments in Dana and Maaret Tamsrin Sub-Districts in Northwest Syria. These locations were selected based on their high IDP population, and because they have reportedly suffered from flooding on several occassions over the past years.

The flood hazard assessments are based on advanced modeling techniques using the Hydrologic Engineering Center's River Analysis System (HEC-RAS). More specifically, a two dimensional (2D) direct precipitation model was built using HEC-RAS. This method of 2D flood modeling is often referred to as a Rapid Flood Hazard Assessment (RFHA). An RFHA can provide a high-level understanding of flood hazards on a catchment-wide scale and helps to identify flood-susceptible areas. (For a more technical explanation of the model, please refer to REACH's "Rapid Flood Hazard Modelling" report.)

The models provide the flood depth and the velocity of water at each computational point within the 2.5m resolution grid in a given catchment. This data has been used to present the flood hazard paths (depth * velocity). In addition, areas with only a flood depth are presented, where the velocity of water is null, such as areas of flat land where floodwater pools. Based on this, the most vulnerable shelters and camps have been highlighted.

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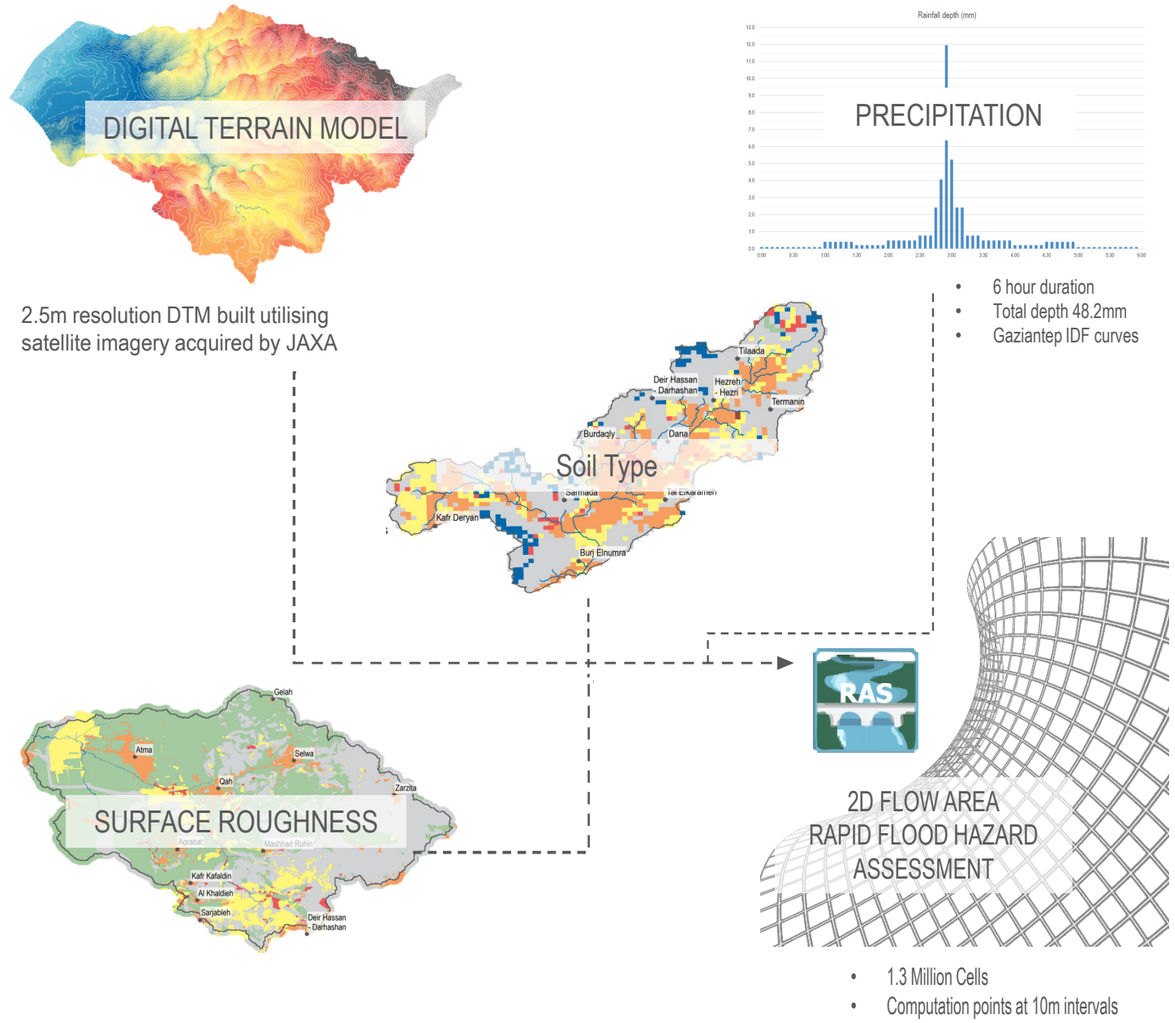


Image 1: Diagram showing data used for the flood hazard models

NOTE FOR IMPLEMENTING PARTNERS

REACH flood hazard data is now available to download here. Please see the Annex 1 on page 16 of this report for further guidance on downloading and using the data.

1 UNHCR | SEVERE WINTER WEATHER RESPONSE IN NORTH-WEST SYRIA| February 2022
2. UN News | Tens of thousands in northwest Syria lose shelter after floods inundate camps| January 2021
3. Camp Coordination and Camp Management (CCCM) bulletin | 20210201 Floods Updates| February 2021
4. UNHCR | Displacement and Disaster Risk Reduction

METHODOLOGY

Over the course of the project, four proccesses for operationalising the flood hazard data were developed: Bespoke flood hazard maps; site analysis; buildable area analysis maps; and conceptual design.

1. BESPOKE FLOOD HAZARD MAPS

As a first step for each IDP camp identified by partners, REACH created zoomed-in flood hazard maps using high-resolution satellite data and the REACH Flood Hazard model. The main goal was to ensure that REACH and the implementing partners had a shared understanding of the general flood situation at the specific camp. These maps helped partners to understand the flooding hazard at a camp level.

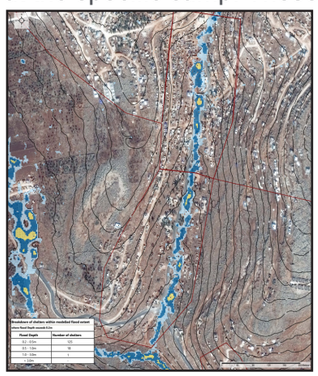


Image 2: Bespoke flood hazard map - Muzun camp

The Bespoke flood hazard maps contain four crucial elements of a flood hazard assessment in a study area. The first is the flood path, which shows where a flood is most likely to occur. The second is the shelters located within the area, which are potentially at risk of being impacted by the flood. The third element is the extent of the flooded zone, which shows the area that may be affected by the flood. Finally, the boundary of the study area's camp is displayed, which helps to define the specific area being studied.

2. SITE ANALYSIS

REACH undertook ground level site analysis activities in Atmeh camp cluster (Global Communities). Direct observation methods were used to record the location, functionality and condition of the current drainage infrastructure. In addition, the location of key service infrastructure was indentified including health facilities, education facilties, mosques, and bridges to identify infrastructure located in flood prone areas. The quality of roads, and ability to withstand flooding was also assessed.

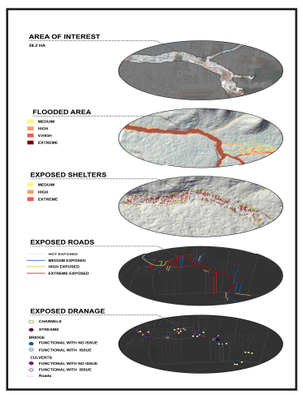


Image 3: Site analysis- Atmeh Cluster

This site analysis diagram provides a simplified overview of the key components that may be affected by floods. It shows the locations of shelters and roads that could potentially be impacted by the flood, as well as the severity of the damage to the infrastructure caused by the flood. The extent of the flood is also indicated on the diagram. Finally, the diagram shows the study area being analyzed. By studying these key components and their potential vulnerability to floods

3. BUILDABLE AREA ANALSIS

REACH created bespoke buildable area analysis maps for Al-Omran (Takaful Al-Sham) and Atmeh camp cluster (Global Communities) by combining the flood hazard model with spatial data on shelter locations, and slope analysis. The prepared maps take into account the Global Shelter Cluster's guidance on minimum shelter standards for camps,[5] to identify potentially suitable locations for shelters to be built on (no flooding, suitable density, ideal slope).

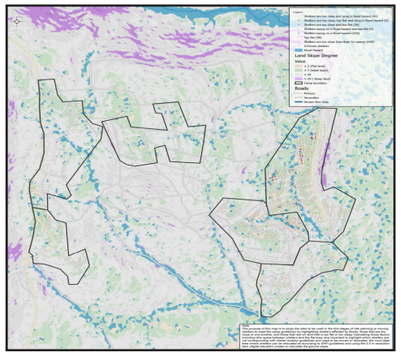


Image 4: Buildable area analysis- Al Omran Camp

The build-able area map shows the shelters that are at risk of flooding due to their location on steep slopes or flat terrain. It also identifies recommended areas for relocating these shelters, while adhering to the guidelines outlined by Sphere[5]. By analyzing this map, emergency planners can identify the most vulnerable shelters and prioritize relocation efforts to reduce the potential impact of flooding on these communities.

4. CONCEPTUAL DESIGN

To illustrate how flood hazard models can support more flood resilient camp planning, REACH together with Global Communities prepared conceptual designs for Atmeh camp cluster. These serve as an aspirational plan to mitigate flood risk. The blueprints present possible flood risk mitigation solutions in the selected camps, taking into account REACH IDP flood hazard assessments, REACH IDP flood perception assessments, SNFI guidance for dignified living conditions, and Sphere Standards.[6][7][8]

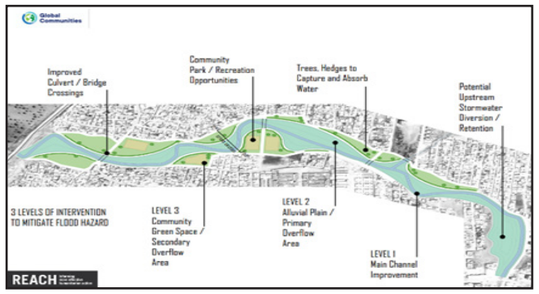


Image 5: Conceptual design example- Atmeh Cluster

The area of conceptual design displays multiple elements designed to tackle the flood zone and the intervention in three stages, aimed at reducing the risk of flooding in the impacted region

5.Sphere | The Minimum Standards for CamManagement
6. REACH | IDP Flood Perception in Camps-NorthwestSyria| February 2022
7. Shelter and NFI Cluster X-border|Reduce Flood Incidents in IDP Sites | April 2021
8. Shelter and NFI Cluster X-border | Dignified Shelters Technical Guidance | February 2022

IYD

IYD is a Turkish non-governmental, non-profit and non-political organization concerned with various humanitarian, development, and health relief fields. IYD was founded in Türkiye at the beginning of 2013, and now provides support in a number of regions both in Türkiye and Syria. IYD's mission is to provide the best humanitarian, developmental, and health services to meet the needs of people and preserve their dignity. In addition, IYD aims to improve the capacities of Syrian civil society.

IYD works across several sectors and clusters including WASH, Livelihoods, Food Security, Cash and Voucher Assistance, Health, and Shelter and Non-food items, implementing activities that include rehabilitation and reconstruction of destroyed infrastructure, the provision of full healthcare services, and in-kind and cash and voucher assistance.

IYD'S PROJECT

During the collaboration between IYD and REACH, IYD was implementing a project on WASH and site improvement activities, under CARE/BHA funding, in Dana Sub-District in Idleb Governate. IYD's activities supported 3,912 HHs, and 21,753 beneficiaries across 12 camps: Morek Al-Ezz Camps, Morek Al-Ghorabaa Camps, Morek group Camps (Tahadi, Al-Somod,AlEzz, Al-Ghorabaa), part of Deir Hassan Camps and Muzun Camp.

As a part of the project, IYD was implementing the following WASH related activities:

- Rehabilitaiton and expansion of water networks to reduce reliance on water trucking;
- Rehabilitation of sewage systems, and the safe removal of sewage waste from high-population areas
- Other site improvements including the implementation of drainage systems and road gravelling

COLLABORATION AND OPERATIONAL OUTPUTS

To meet IYD's needs to investigate the extent and severity of the floods, REACH created bespoke flood hazard maps for 12 camps. IYD was studying these camps to understand whether considerations regarding flood risk were needed in program design for these camps.

In addition, a more in-depth study for Al Muzun camp was conducted, by examining the flood severity and extent in the camp, to complement IYD's technical study. As a result, REACH detected a primary flood path that passes through Al Muzun camp, affecting a number of shelters and roadways, and shared the discovery with IYD in order for them to prepare for the project accordingly.

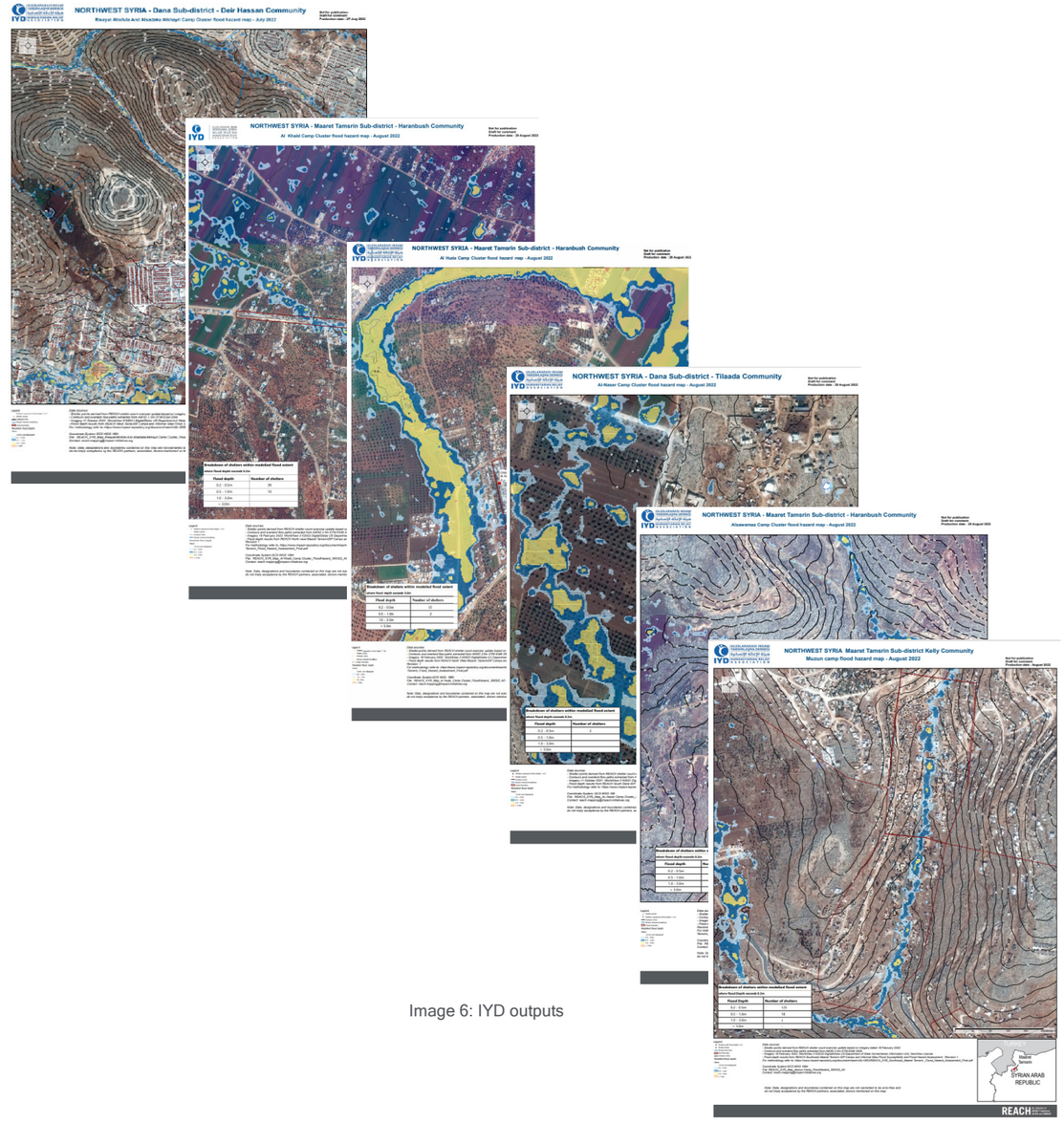


Image 6: IYD outputs

IYD: BESPOKE HAZARD MAPS

MAP: FLOOD HAZARD MAP IN AL MUZUN CAMP

In Maaret Tamsrin sub-district

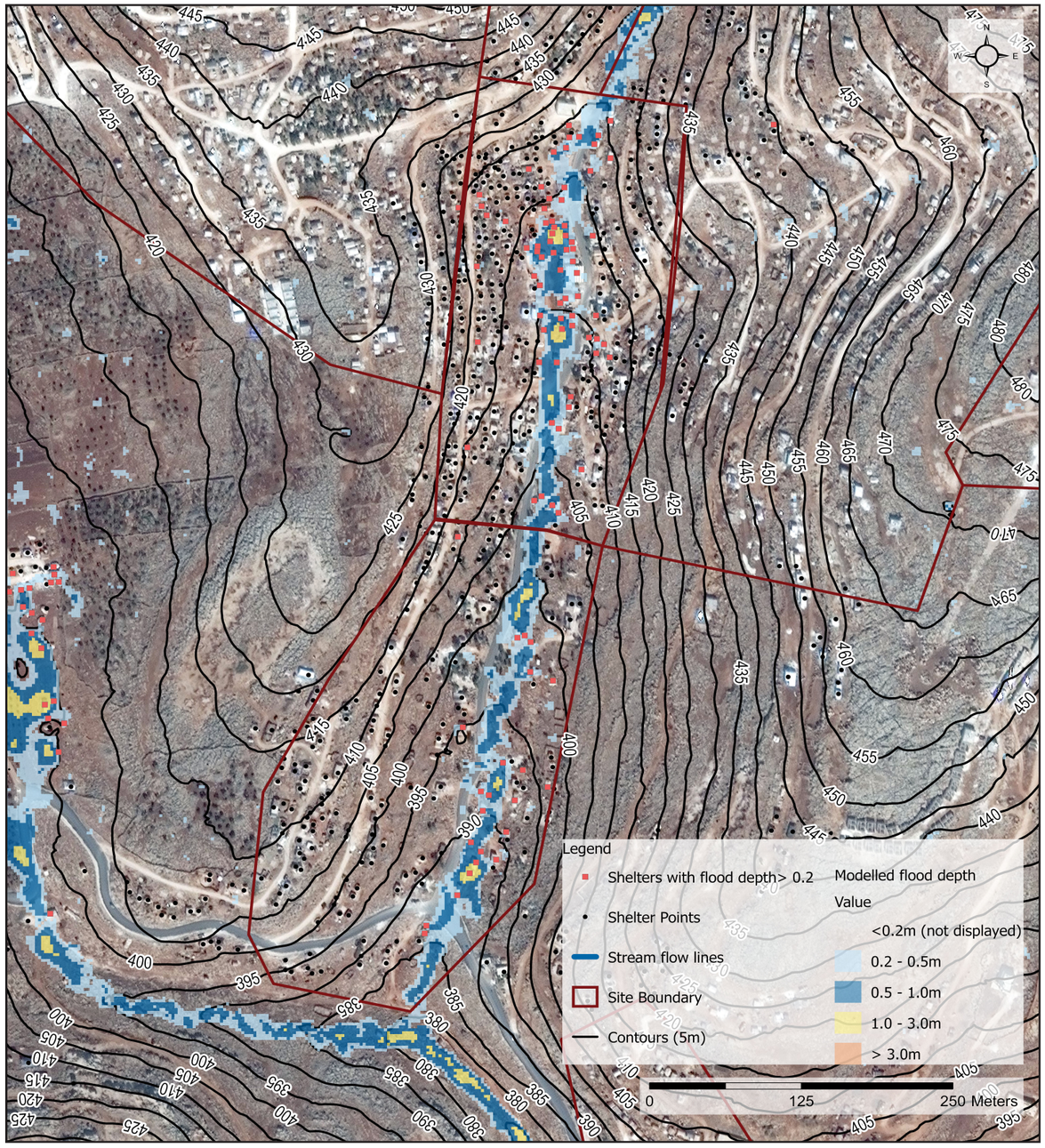


Image 7: The bespoke flood hazard map for AL Muzun camp illustrating the flood path cutting through the camp

HOW THE OUTPUT WAS UTILIZED IN PROGRAMMING

The bespoke flood hazard maps were used by IYD to support decision making on the technical approach that should be taken for each camp. For example, in Al Muzun camp, REACH's in-depth study served as the technical foundation for IYD's project design. In particular, the in-depth study, when combined with IYD's own technical on-the-ground studies, showed that current drainage and infrastructure were insufficient for heaving rains.

Based on IYD's technical study the sewage system present in the camp was primarily composed of PVC and HDPE pipes, that were just 4 inches in diameter and connected to septic tanks or a nearby sewage line. The majority of these lines were poorly implemented lying above ground and running through the flood path. As according to the REACH in-depth study, Al Muzun camp is directly located on a flood path, and considering the insufficient and poor drainage system, it was concluded that there is a significant risk of waste water overflowing the pathways in the event of heavy rain.

Considering the above, it was thus concluded that the BoQs (Bill of Quantity) were to be adjusted accordingly: Following the topographic study and the consultation with the camp management and IDPs themselves, it was concluded that the camp requires a total of 1,280 m of sewage lines, using 300mm diameter "PE" pipes, 55 manholes and a 60-meter rainwater catchment basin. Drainage lines were planned to run parallel to topographic lines and toward the sewage system.

FEEDBACK FROM IYD

Previously, historic flooding data was used when designing interventions in camps. However, this is insufficient for what is needed. Whilst this may give an indication that a camp floods, it does not provide the accurate locations needed for works. This can lead to money being wasted if infrastructure is built, that does not solve the problem. Therefore the Al Muzun hazard map recieved from REACH assisted IYD's team in planning the correct intervention design and adjusting BoQs, by highlighted the main flood path, and areas and shelter most at risk of flood impacts.

> "This map assisted our team in planning the correct intervention design. After receiving the data from the REACH team which highlighted the areas most affected by flooding and the shelters that will be in great danger, we significantly modified our BOQs to take into consideration the main flood path that the REACH study identified in Al Muzun camp."
>
> Engineer from IYD

NOTE FOR IMPLEMENTING PARTNERS

For an SoP on creating a flood hazard map for your prosed area of intervention, using the available flood hazard data, please see annex 2 on page17 of this report.

TAKAFUL AL SHAM

TAS

Takaful Al Sham (TAS) is a non-governmental civil society organization that works directly with the affected Syrian population, delivering humanitarian, relief and development assistance to alleviate suffering, improve living conditions and work towards sustainable futures. TAS works across almost all of the humanitarian sectors, including Food Security, Protection, Education, Livelihoods and Early Recovery, WASH, CCCM, and SNFI.

With TAS's active partnerships and involvement in the Northwest Syria NGO Community, TAS has also supported strategic planning, advocacy, and capacity building to reinforce and strengthen stakeholders, through engaging in the publication of working documents, and hosting and leading on a number of workshops, sessions, and working groups.

TAS' PROJECT

During 2022, TAS was implementing a project, in Al Omran camp in Maaret Tamsrin, Idleb, under the SCHF pooled fund. The objective of the project was to install dignified shelter units that would upgrade and rehabilitate the living conditions of the most vulnerable IDPs. The project supported 219 households and 1,101 beneficiaries.

Key shelter (SNFI) activities included: implementation of dignified shelters including WASH,a kitchen with cooking facilities, road gravelling in the camp, provision of a drainage system, and installation of lighting poles. Key WASH activities included: the construction of water tanks and sub-tanks, the establishment of a water network in the camp, construction of family latrine blocks with special arrangements for persons with disabilities (PWDs), installation of septic tanks and organic and waste water disposal. Additional services provided are those under Protection and Food Security to ensure that support for famailies are guaranteed.

Initial activities undertaken during the period of REACH partnership, included a technical study of the site, and consultations with the community and other stakeholders as part of the design process.

COLLABORATION AND OPERATIONAL OUTPUTS

In the beginning of the collaboration, REACH created bespoke flood hazard zoomed-in maps for four camps (Al Omran, Alkurah, Haranbush, and Medan) to meet TAS' needs to investigate the extent and severity of the floods in those camps and incorporate this information into their site selection for implementation. Moreover, REACH engineers accompanied TAS engineers on the ground,and conducted an accurate topographical study using a Total Station. As a final step, REACH provided a buildable area analysis for Al Omran camp using the topographical data, in combination with the flood model data, which contributed to the design of the final site plan and to the first BoQs calculation.

Image 8: TAS outputs

MAP: FLOOD HAZARD MAP IN HARANBOUSH 3 CAMP CLUSTER

In Maaret Tamsrin sub-district

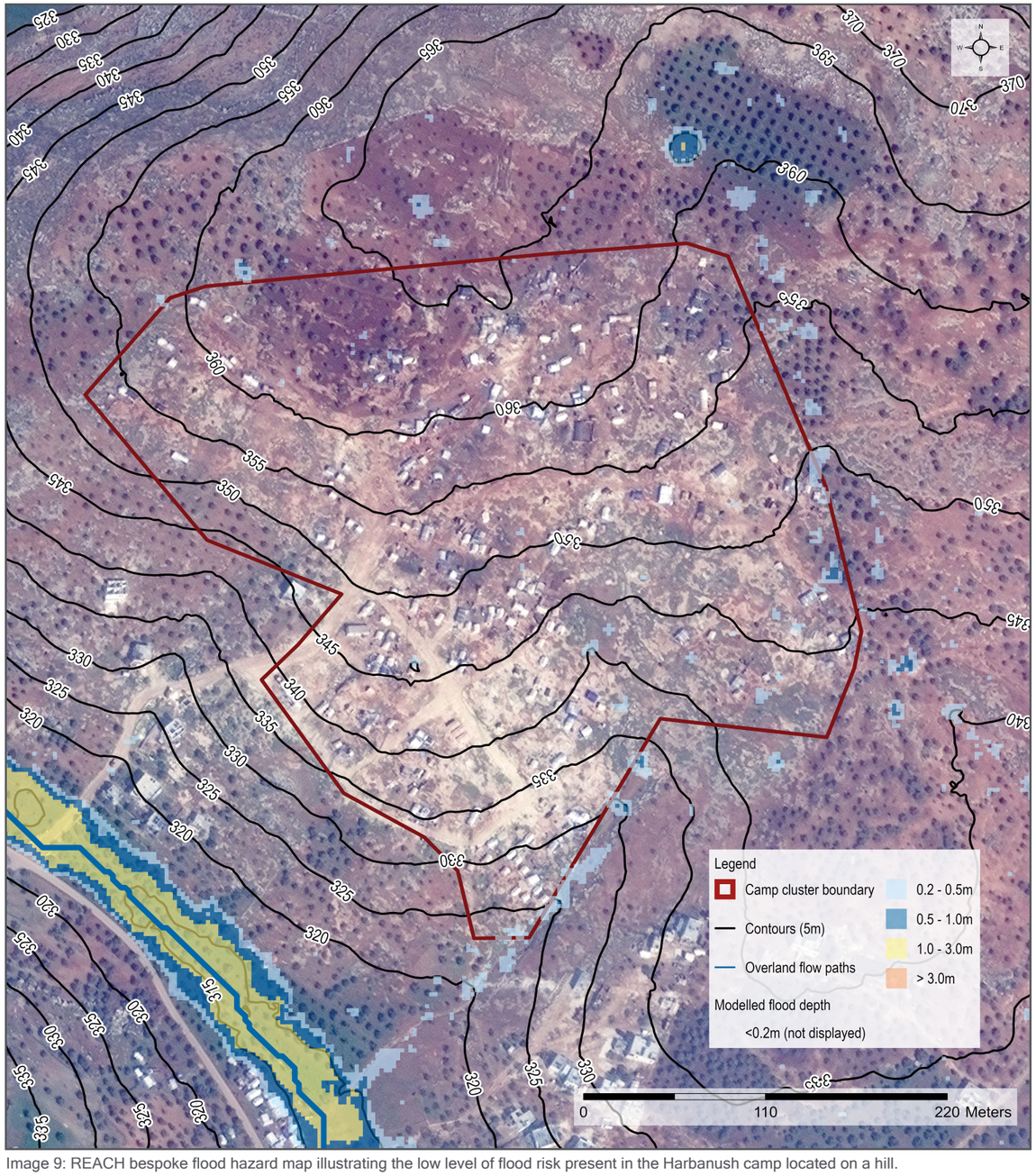


Image 9: REACH bespoke flood hazard map illustrating the low level of flood risk present in the Harbanush camp located on a hill.

HOW THE OUTPUT WAS UTILIZED IN PROGRAMMING

The bespoke flood hazard maps helped with the initial selection of sites for implementation. The maps provided an overview of the flood risks at the sites with a high level of accuracy, enabling the number of at-risk shelters and key infrastructure points, to be identified.

FEEDBACK FROM TAS

The bespoke flood hazard maps can verify which camps have the most incidents of flooding, compared to camps which are just a bit muddy, thereby supporting the identification of the most vulnerable sites. The maps also served to validate the historic flood data reported by the CCCM Cluster, as historic data only provides an indication of which sites have had flood water, and do not provide information on the severity of the hazard.

> “We used the data when we were selecting the camps on public land. The study can verify which camps have the most incidents of flooding, compared to camps which are just a bit muddy, so selection can be done in a better way.”
>
> Engineer from TAS

NOTE FOR IMPLEMENTING PARTNERS

For an SoP on creating a flood hazard map for your prosed area of intervention, using the available flood hazard data, please see annex 2 on page17 of this report.

TAKAFUL AL SHAM: BUILDABLE AREA ANALYSIS

MAP: BUILDABLE AREA MAP IN AL-OMRAN CAMP CLUSTER

In Maaret Tamsrin sub-district

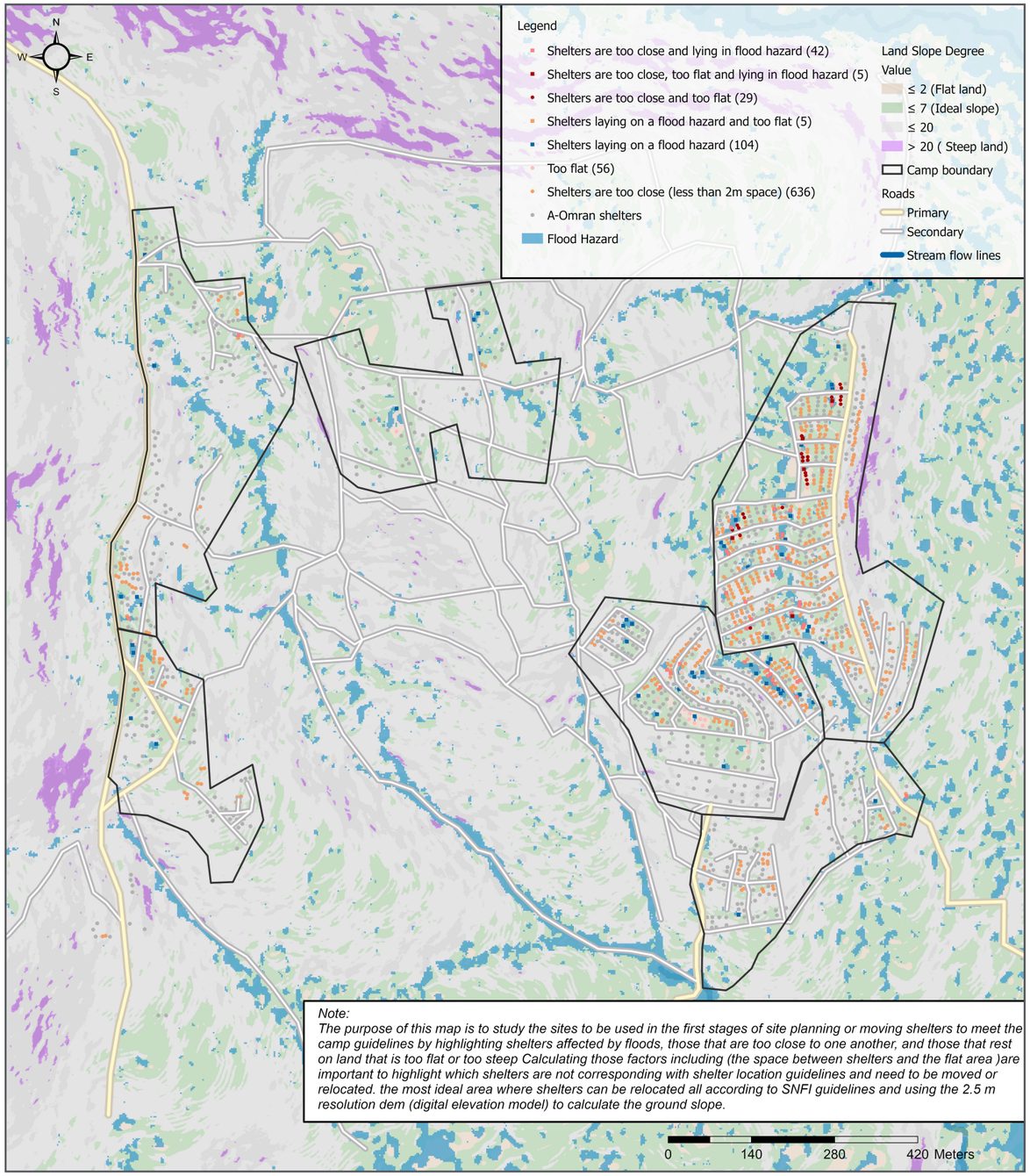


Image 10: REACH buildable area map showing the ideal locations for shelters in Al-Omran camp.

HOW THE OUTPUT WAS UTILIZED IN PROGRAMMING

Following the identification of moderate to low flood risk at Al Omran camp, REACH proceeded into preparing a buildable area analysis for the camp, which illustrated the most suitable locations for shelter units, elevated water tanks and septic tanks. The analysis also enabled the identification of roads for rehabilitation, whilst the topographical data supported the planning of required drainage systems.

Moreover, TAS conducted a topographical study using a Total Station on the ground, and then compared the results to the data provided by REACH (based on a high-resolution Digital Elevation Model). Interestingly, it was discovered that the difference between the on-the-ground topographical study and the data provided by REACH was within an acceptable tolerance. According to TAS, in future projects, the entire on-the-ground topographical analysis might be reduced down to the bare minimum to save time, effort, and resources for initial site planning activities, and developing BoQs.

FEEDBACK FROM TAS

The maps are sufficiently accurate (95% accuracy) to enable an accurate site plan to be drafted from them. The Buildable Area Analysis Maps provide important data for site planning, such as water shed analysis. This data is clearly visualized, making it easier to draft site plans and the most precise initial BoQs to be calculated. The accuracy of the data can help to minimize the difference between the activities actually implemented, as typically proposals have relied on open online sources of data which are not accurate, leading to over or under estimations.

> “The [site] plan created from REACH’s Buildable Area Analysis, was very close to the one you would come up with from a detailed survey, so [the data] can be trusteworthy and reliable.”
>
> Engineer from TAS

NOTE FOR IMPLEMENTING PARTNERS

For an SoP on undertaking buildable area analysis for your prosed area of intervention, using the available flood hazard data, please see annex 2 on page17 of this report.

GLOBAL COMMUNITIES

Global Communities is an international non-profit organization that works closely with communities worldwide to bring about sustainable changes that improve the lives and livelihoods of the vulnerable. Global Communities provides humanitarian support to vulnerable households in Syria, including WASH, food security, Shelter, Protection and Early Recovery and Livelihoods (ERL) programming since 2014.

GLOBAL COMMUNITIES PROJECT

Global Communities has been operating in Atmeh camp since 2016 as the main actor leading SNFI, WASH, and protection activities. Throughout a number of BHA and OCHA-funded programs, GC implemented several interventions under the concept of Disaster Risk Reduction (DRR) to improve access and mitigate the risk of flooding in Atmeh camp. This included the rehabilitation of camp infrastructure, i.e. road graveling and asphalting with the associated drainage, culvert rehabilitation, the creation of sidewalks, as well as the creation of rescue teams.

COLLABORATION AND OPERATIONAL OUTPUTS

In the beginning of the collaboration, REACH prepared a bespoke flood hazard map for Atmeh cluster in order to study the extent of flooding and the main flood paths. Following that, REACH proceeded with engineers from GC to conduct an infrastructure assessment and a participatory mapping exercise, which displayed the locations of drainage infrastructure and historically flood prone locations in Atmeh camp cluster.

Engineers from Global Communities and REACH visited Atmeh camp and collected data from selected camps. As a result, 16 camps were prioritize based on the REACH flood model, and eight camps were prioritized based on Global Communities' programming in Atmeh camp. Direct observation methods were employed to record the gaps that remote data analysis was unable to fill. The location, functioning, and condition of the camp's current infrastructure were recorded, focusing on the types of infrastructure that are prone to floods, or are necessaryfor flood mitigationand contingency planning. Key informal interviews with camp managers were also performed.

The main objective of the collaboration between Global Communites and REACH was to come up with an aspirational conceptual design blueprint to mitigate flooding in Atmeh. In order to do that, REACH first utilized the collected data to create a site analysis map and a layer diagram analysis to highlight the exposed area and elements such as roads, shelters, and infrastructure points. Following the analysis, a conceptual design blueprint was developed to mitigate the flooding around the frequently flooded main channel in the heart of Atmeh cluster. The conceptual design blueprint included improvement of the main channel, surrounded by a green area as an overflow and relocation of at-risk shelters to less flood prone areas in Atmeh cluster. Finally, according to SNFI guidelines, buildable area analysis was conducted to identify possible locations for relocated shelters.

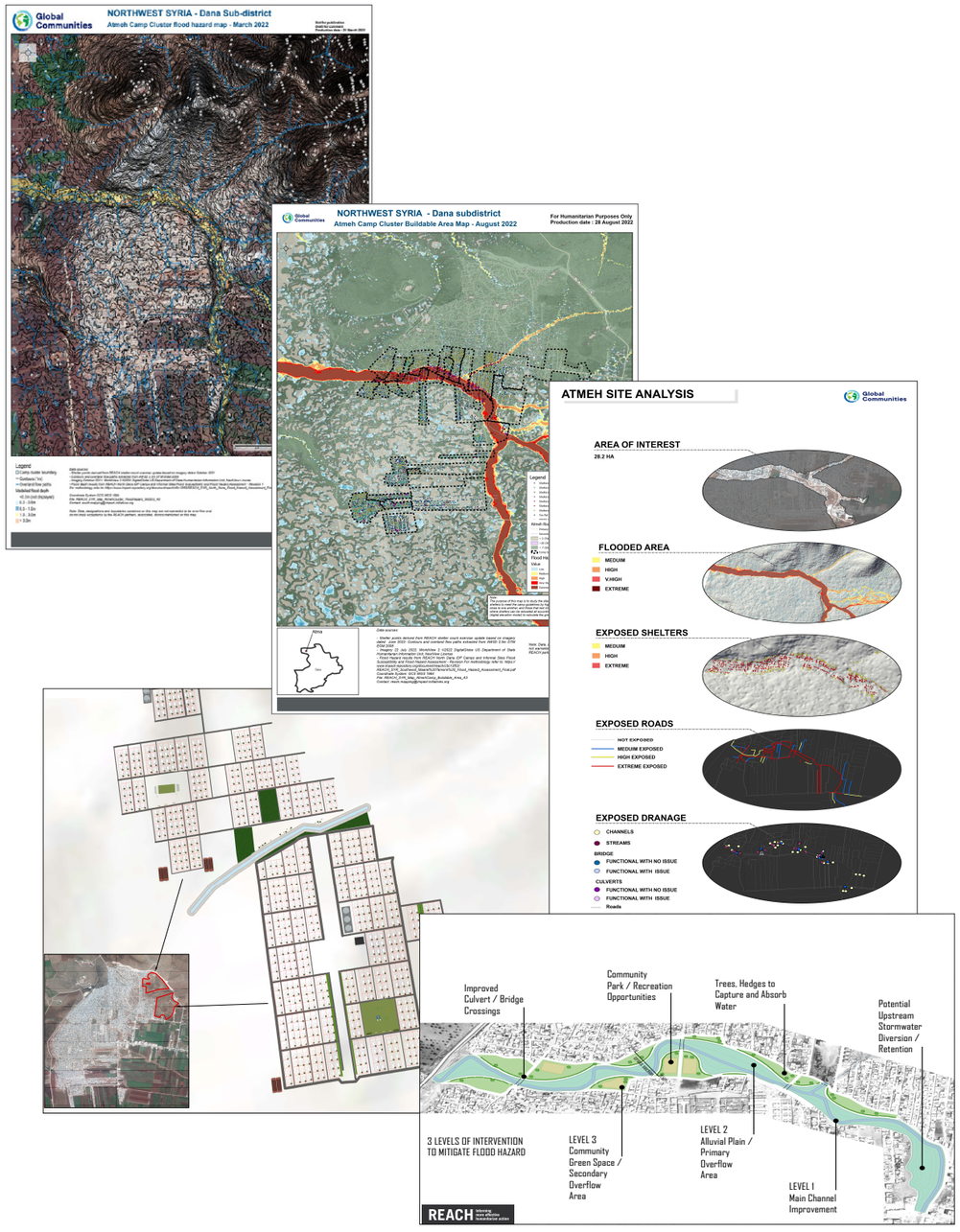


Image 11: Global Communities outputs

GLOBAL COMMUNITIES: BUILDABLE AREA AND SITE ANALYSIS

MAP: BUILDABLE AREA MAP IN ATMEH CAMP CLUSTER

In Dana sub-district

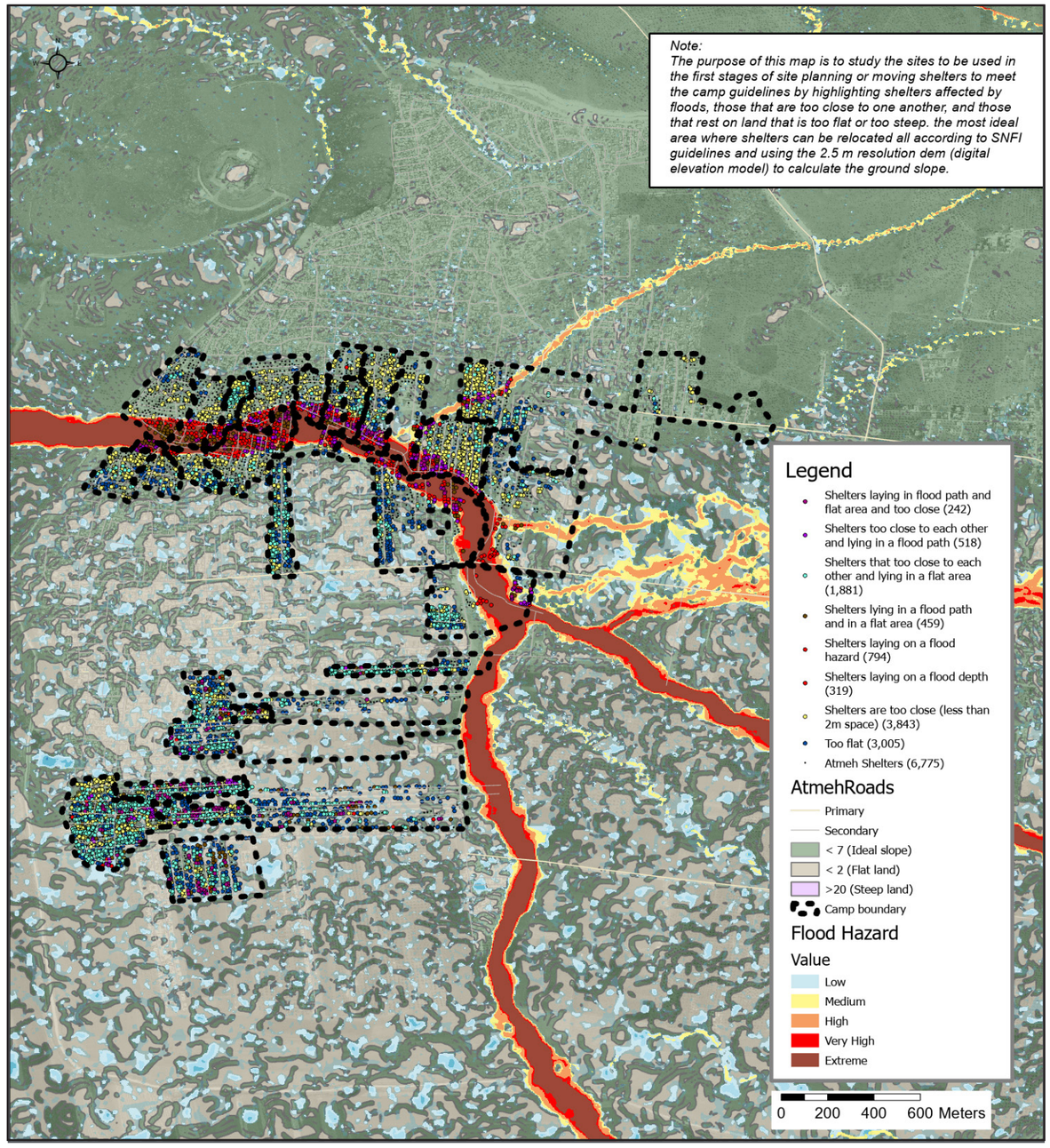


Image 12: Bulidable Area Analysis Map, highlighting shelters affected by floods, those that are too close toone another, and those that rest on land that is too flat or too steep. It also highlights the most ideal area where shelters can be relocated, according to SNFI guidelines andusing the 2.5 m resolution dem (digital elevation model) to calculate the ground slope.

MAP: ATMEH SITE ANALYSIS

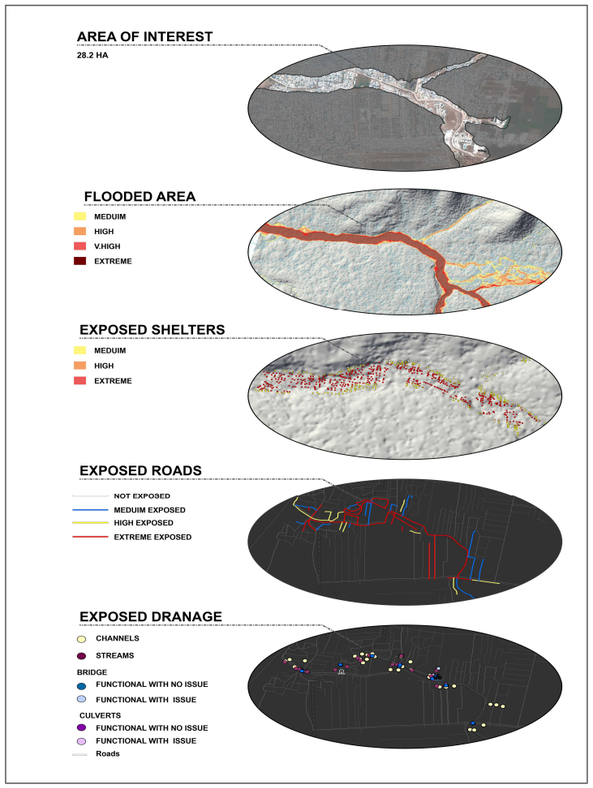


Image 13: Layer diagram analysis to highlight the exposed areas and elements (shelters, roads, and drainage) in the major flooding zone.

HOW THE OUTPUT WAS UTILIZED IN PROGRAMMING

The buildable area analysis was used to study the cluster, to highlight shelters affected by floods, those that are too close to one another, and those that rest on land that is too flat or too steep. The analysis also highlights the possible areas where shelters can be relocated, taking into account the flood data, the SNFI Cluster's guidelines on shelter density and ideal slope and using the 2.5 m resolution DEM (digital elevation model) to calculate the ground slope.

Under the current project implemented by Global communities in Atmeh camp, the layer diagram analysis can be used to easily hightlight and understand the exposed areas and elemnets and the buildable area analysis can be used for prioritizing the areas of intervention for Disaster Risk Reduction (DRR) rescue teams. In addition, this study can be used to indentify the possible relocation of at-risk shelters in the

FEEDBACK FROM GLOBAL COMMUNITIES

The outputs provided through REACH case study provide a better understanding of the current situation and need, the existing gaps, the efficiency, and sufficiency of previously provided assistance, and highlight where there is potential to maximize the impact of future interventions

> "REACH outputs are helpful for prioritizing the areas of interventions for the different SNFI activities"
>
> Engineer from Global Communities

GLOBAL COMMUNITIES: CONCEPTUAL DESIGN

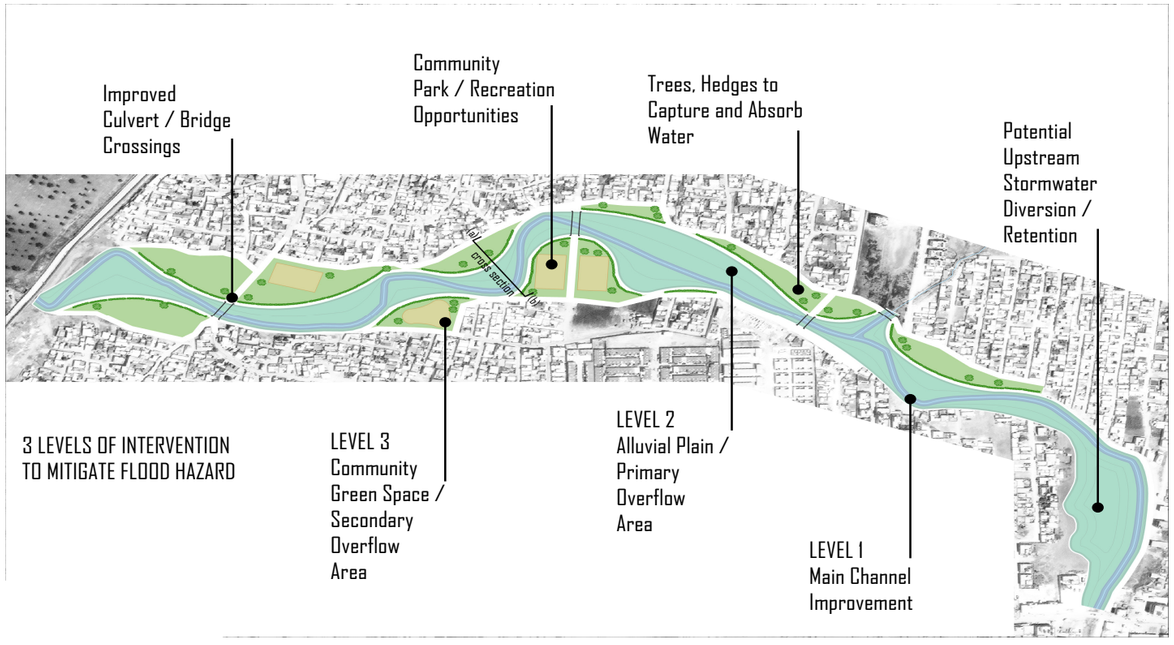


Image 14: Conceptual design site plan illustrates the site improvements in the main flood prone area in Atmeh camp cluster.

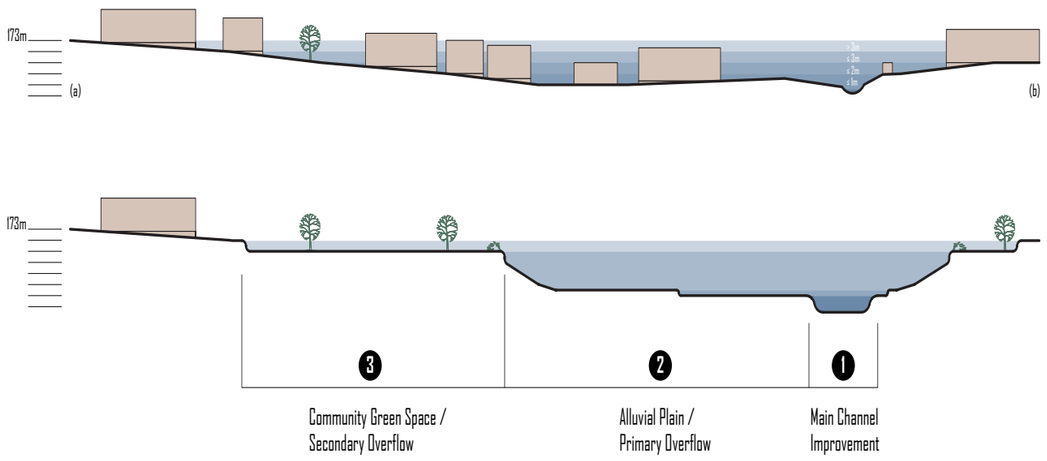


Image 15: The section on conceptual design includes two drawings: the bottom one shows proposed channel improvements for the main flood-prone area in the Atmeh camp cluster, while the top one shows the current situation in that same flood-prone area.

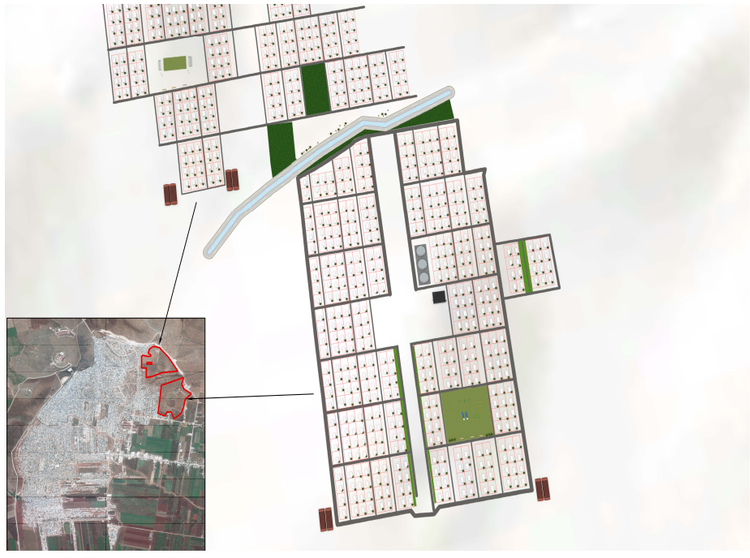


Image 16: Conceptual design site plan illustrates how at-risk shelters could be potentially relocated to less flood prone areas.

HOW THE OUTPUTS WERE UTILISED FOR PROGRAMMING :

The conceptual plan provides recommendations to achieve a safer and improved standard of living in the medium-term for the IDPs impacted by climate change driven flash flooding in Atmeh, in the event that no other durable solutions are found for the IDP community. This is in line with the recommendations by the Secretary-General's Special Representative for Disaster Risk Reduction on scaling up DRR in Humanitarian Action

To explore how flooding in Atmeh could be mitigated in the longer-term, a conceptual design for site improvements was created in the flood-prone region, including three key processes:
1) Upstream storm water diversion/retention to decrease the impact of flooding;
2) Main channel improvements to hold more water, especially in winter;
3) Creation of water absorbing green spaces around the main channel to mitigate flood impacts.

Furthermore, a conceptual site plan was created to investigate the suitable locations for exposed shelters to be moved to. The plan considered the analysis of the buildable area map to identify the most appropriate areas for the shelters to be relocated. The plan was designed in accordance with the sphere code to ensure that the shelter camp plan in the safe areas was dignified and met the required standards.

FEEDBACK FROM GLOBAL COMMUNITIES

> "GC's current scope does not include any activities which could be implemented based on this output. However, as part of our proposed area-based intervention in the camp, this study will be used to inform a second step to the current base level of flood mitigation measures."
>
> Engineer from Global Communities

CONCLUSIONS

Through the partnerships, REACH was able to identify a number of ways to utilize available flood data to support more evidence based humanitarian programming in camp settings.
To summarise, REACH was able to demonstrate the utilization of the available flood data in the following scenarios:

1) Food hazard model data can be used to identify camps or informal sites at risk of flooding, where additional studies and consideration of flood risk is required.

2) Flood hazard model data can be used to identify the most at-risk infrastructure points, roads, and shelters within a camp to inform flood mitigation programming.

3) Flood hazard model data can be used to indicate the potential severity of flooding in a camp, which can be used to inform inital BoQ estimations, and undestand potential capacity requirements for drainage and sewage infrastructure such as channels and culverts.

4) Leveraging additional buildable area analysis, the flood data can also be used for preliminary site planning activities, supporting in the indentifcation of suitable locations for shelter units and WASH an drainage infrastructure, and informing the initial BoQ calculations for site improvements;

5) Finally, the flood data can be used to guide longer-term solutions and site planning in flood prone camps.

LIMITATIONS

During the project, the following limitations were identified and should be kept in mind when planning to use REACH flood hazard model data.

1) The flood hazard and flood depth data is based on a model and does not take into account man-made infrastructure such as bridges, culverts or pipe drainage networks.

2) The flood hazard and flood depth data, is based on the medium resolution data on soil type and thus the accuracy of the data is limited by the level of detail in the soil type information available.

3) The buildable area analysis cannot be used as a sole source of data for site planning purposes, as it does not take into account other necessary considerations such as the HLP situation.

OTHER OPPORTUNITIES

1) Develop emergency early warning systems that can alert communities in advance of a potential flood event. This information can be used to inform other emergency planning activities, such as evacuation plans and relief efforts, and can help minimize the impact of flooding on vulnerable populations.

2) Conduct risk assessments at the catchment level or wider, which can inform humanitarian response planning and advocacy efforts. These assessments can identify high-risk areas and ten help prioritize resources and interventions to reduce the impact of flooding on those most affected.

Image 12: Participatory mapping between GC engineers and REACH engineers in GC office in Atmeh camp

Image 13: Undated image on flooding in Sarmada camp in Dana. Source: REACH field team

ANNEX 1: ACCESSING REACH FLOOD HAZARD DATA USING THE ONLINE DASHBOARD

ABOUT THE FLOOD HAZARD APP

REACH flood hazard and flood depth data is available to download for humanitarian use. Annex 1 explains how to access the data. The following two annexes explain how the data can be used for information products that can be used by organizations implementing projects in camps.

CATCHMENT OVERVIEW

At the time of this writing, REACH has developed flood hazard models for six watershed areas (North Dana, West Dana, South Dana, Northwest Maaret Tamsrin, Southwest Maaret Tamsrin and West Badama)

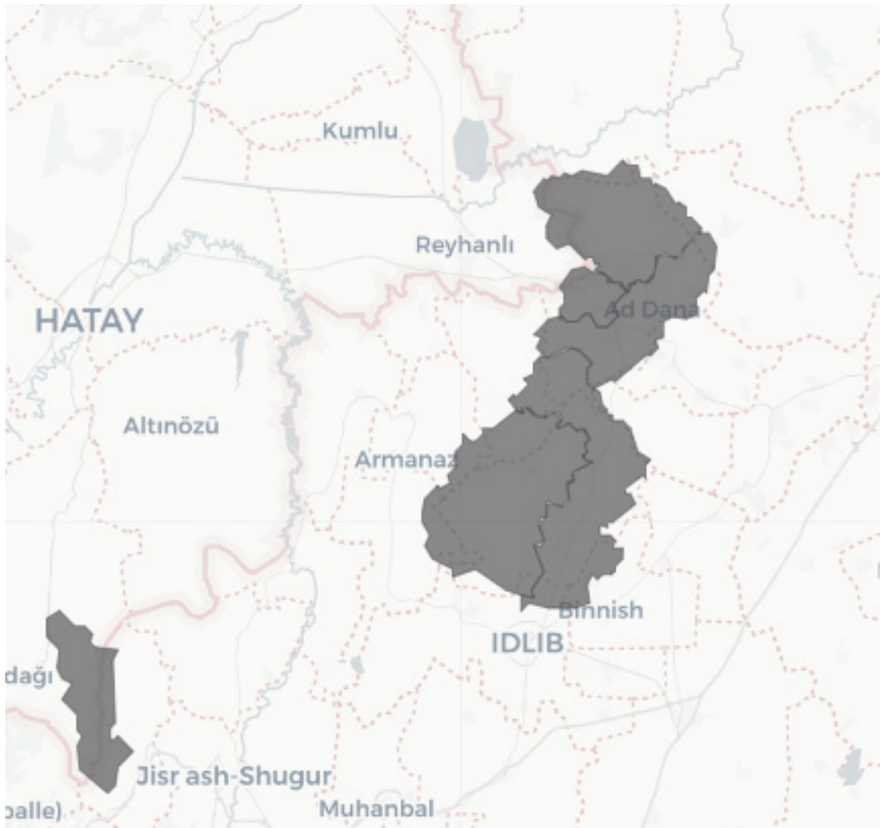
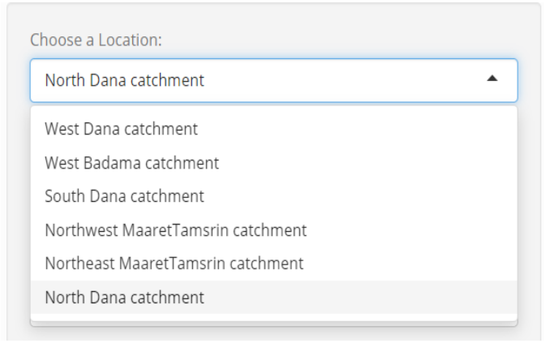
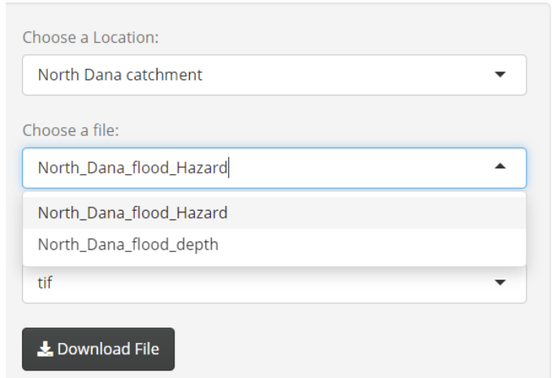


Image 14: Screen shot to via the dashboards to make the data available for download and use from your end access from here

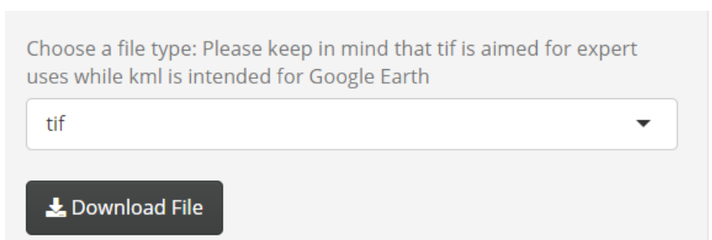
How to dowload the data
Click on the web page available here. This will lead you to the dashboard.

1. Request credentials to access the dashboard by sending an email to reach.mapping@impact-initiatives.org
2. Access the dashboard by clicking the link.
3. Select the area and select the file you wisht to download (flood hazard or flood depth). To understand the difference, please consult Annex 2.





4. Select the file type you wish to download. Kmz files can be easily explored using a software like Google Earth Pro, while the tiff file allows more advanced analysis and illustration using a GIS software.



ANNEX 2: INSTRUCTIONS ON PRODUCING BESPOKE FLOOD DEPTH OR FLOOD HAZARD MAPS

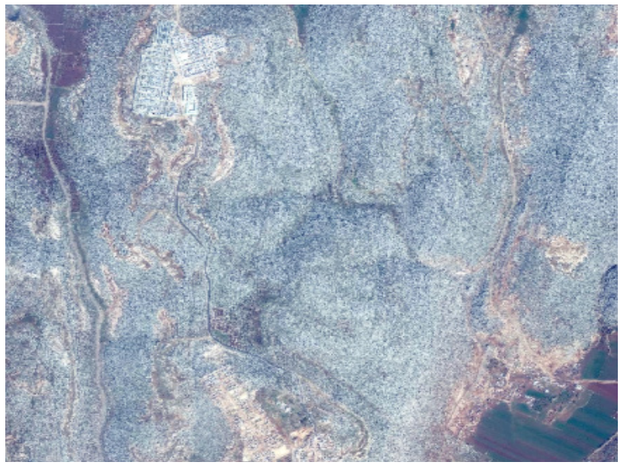
ABOUT THE FLOOD DEPTH AND FLOOD HAZARD

REACH flood analyses include data on flood depth and flood water flow velocity. The flood depth data can be accessed at the dashboard and is relevant in flat areas where water is expected to form ponds. Flood hazard is a composite indicator calculated using information on flood depth and flood water velocity (depth x velocity). Flood hazard data is particularly useful in an areas where there are slopes that cause water to move.

In order to decide whether to use the flood depth or flood hazard data, first study the area of your interest to find out whether the area is flat or sloped.

Steps to make a flood hazard map

1. Decide your area of interest and determine whether the area is flat or sloped;
2. Download the flood hazard or flood depth data in a tiff format;
3. Open your GIS software with a background satellite imagery

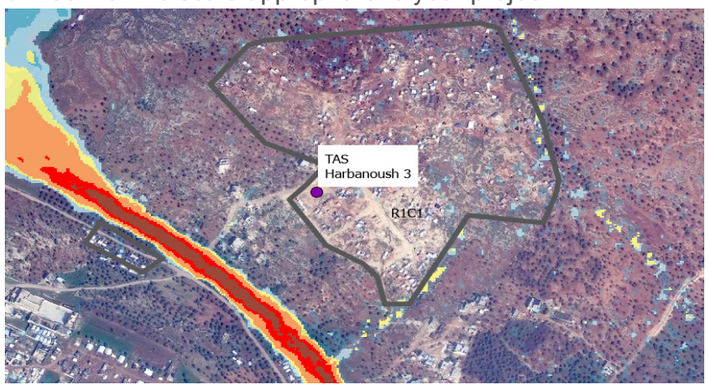


4. Open the tiff file you downloaded

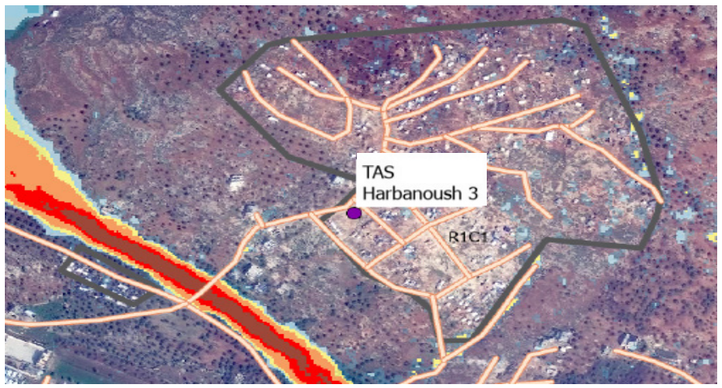
5.Classify your data (for flood hazard, please use the following scale)

Flood hazard 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

6. Zoom at the scale appropriate to your project



7.Optional: Add layers on roads and drainage into your map;



8. Produce the final output

ANNEX 3: INSTRUCTIONS ON CONDUCTING BUILDABLE AREA ANALYSIS

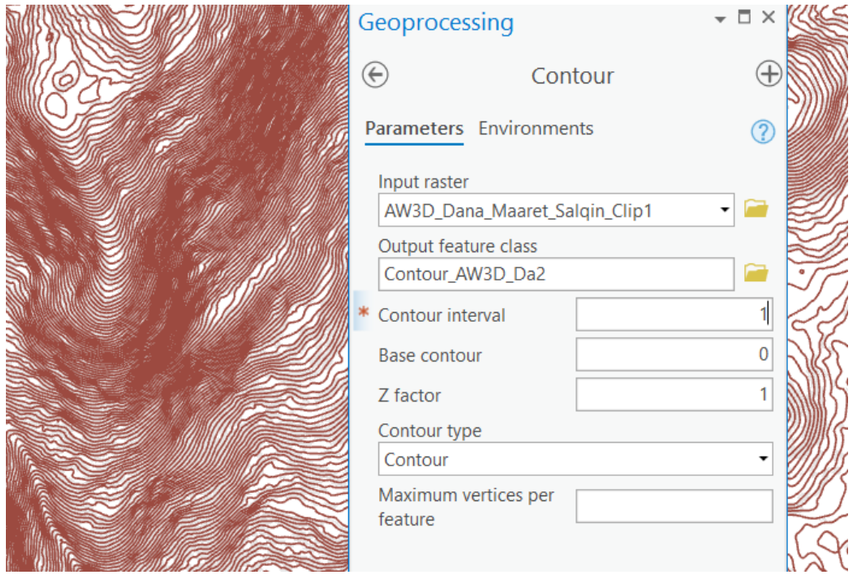
ABOUT THE BUILDABLE AREA MAPS

Note that: In order to conduct the buildable area analysis, you need to be sufficiently familiar with spatial (GIS) analysis and have access to topographical data (Total station ground survey or satellite based Digital Elevation Model (DEM)).

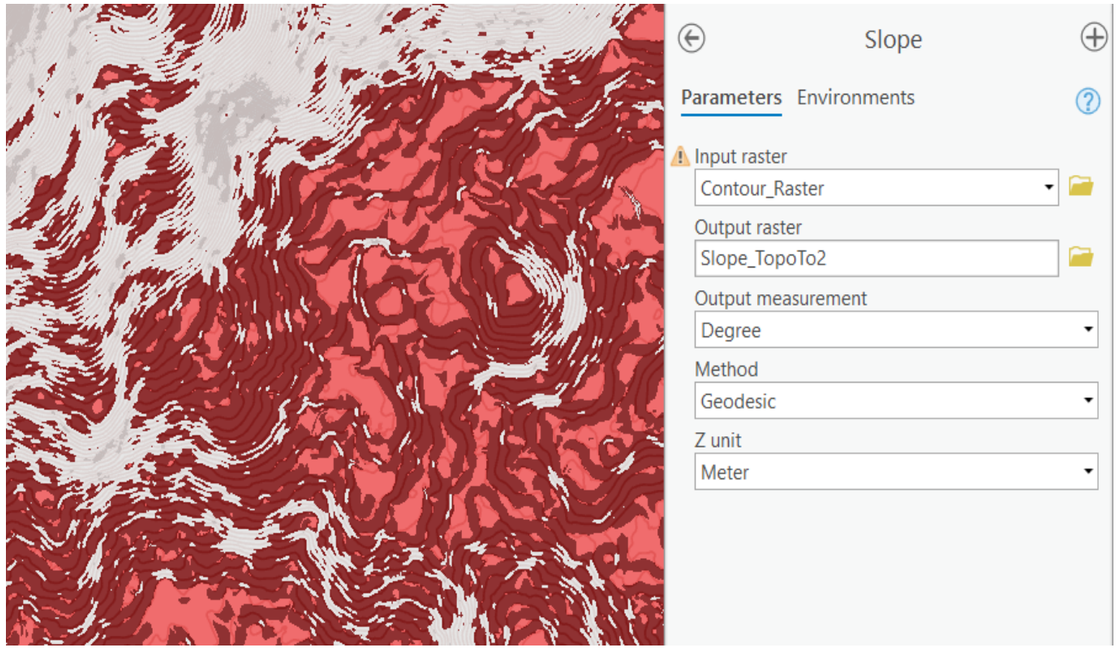
The Buildable Area Analysis can be used as a site planning tool, identifying suitable areas for infrastructure and shelter. It takes into account the shelter density, slope and flood data, and highlights the areas to avoid.

Steps to conduct the analysis:

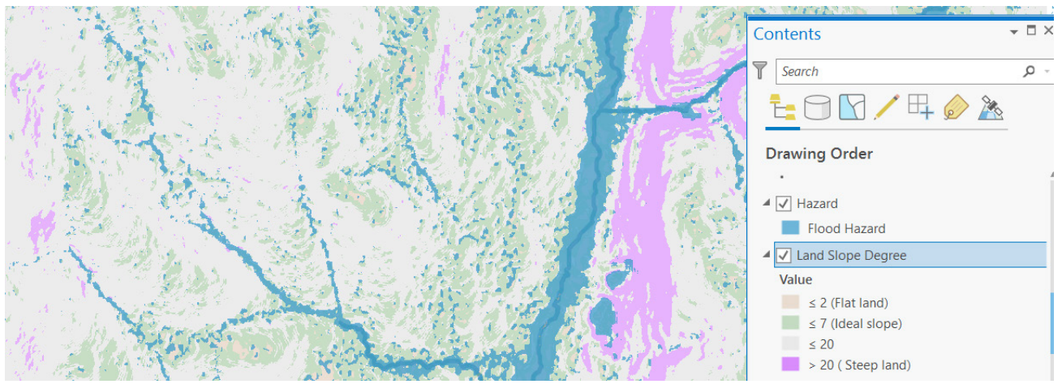
1. Determine the region or camp you need the information for.
2. Download the flood hazard and flood depth data in a tiff format.
3. Open the flood hazard data and flood depth data in your GIS software.
4. Reflect the flood hazard category by classifying the hazard and depth layers.
5. Download an open source digital elevation model. or utilize the topographic data obtained from the ground survey.
6. From your topographical data, generate contour lines using your GIS software.



7. Create a raster layer using contour line data to calculate the slop degree and slope peresent.
8. According to the SNFI guidelines,[9] a slope of less than 2 degrees is considered too flat for creating a camp, a slope of more than 20 degrees is considered too steep for establishing a camp. Thus it is suitable to use a slope between 7-20 degrees as a suitable area for buidling a camp.



9. You can easily locate the suitable land for preliminary site design or relocating shelters in hazard locations by overlaying the slope of the ground with the flood hazard and depth tiffs.



APPENDING

1. North Dana flood Hazard Assesment https://www.impact-repository.org/document/reach/c5c12f53/REACH_SYR_North_Dana_Flood_Hazard_Assessment_Final.pdf

2. South Dana Flood Hazard Assesment https://www.impact-repository.org/document/reach/b378a928/REACH_SYR_Thematic_Assessment_South-Dana-flood-simulation-report_SYR2008_August2021.pdf

3. West Dana Flood Hazard Assesment https://www.impact-repository.org/document/reach/dfb7f178/REACH_SYR_Thematic_assessment_WestDana_Flood_simulation_report_SYR2008_February2021.pdf

4.North West MarretTamsrin Assesment https://www.impact-repository.org/document/repository/cecb01b0/Northwest-Maaret-Tamsrin-IDP-Camps-and-Informal-Settlements-Flood-Simulation-Report-Syria-%E2%80%93-May-2022.pdf

5.Northeast MarretTamsrin Flood Hazard Assesment https://www.impact-repository.org/document/repository/792e98a5/REACH_SYR_Thematic_Assessment_Northeast-MaaretTamsrin_-flood-simulation-report_SYR2008_December2021.pdf

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تكافل الشام Takaful Al Sham

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ABOUT REACH INITIATIVE

REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidencebased decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITARUNOSAT)