

URBAN RESILIENCE PLATFORM

Haul it All!

How planning and optioneering can reduce negative impacts of large scale material movements; from Aleppo to Brussels.



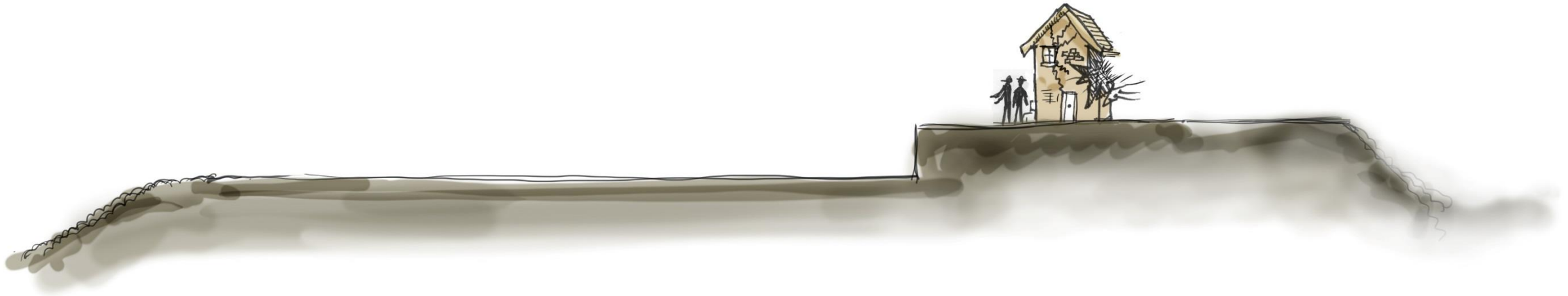


Is it the time for material efficiency?

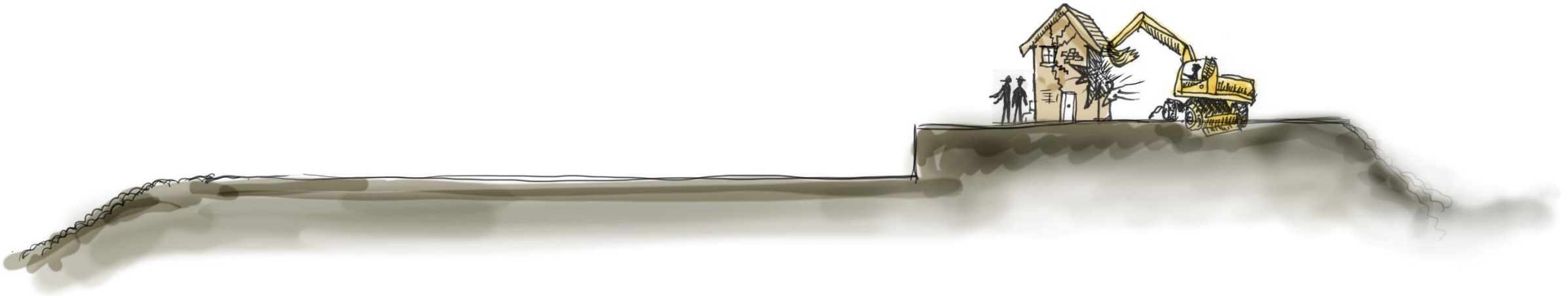


Yes.

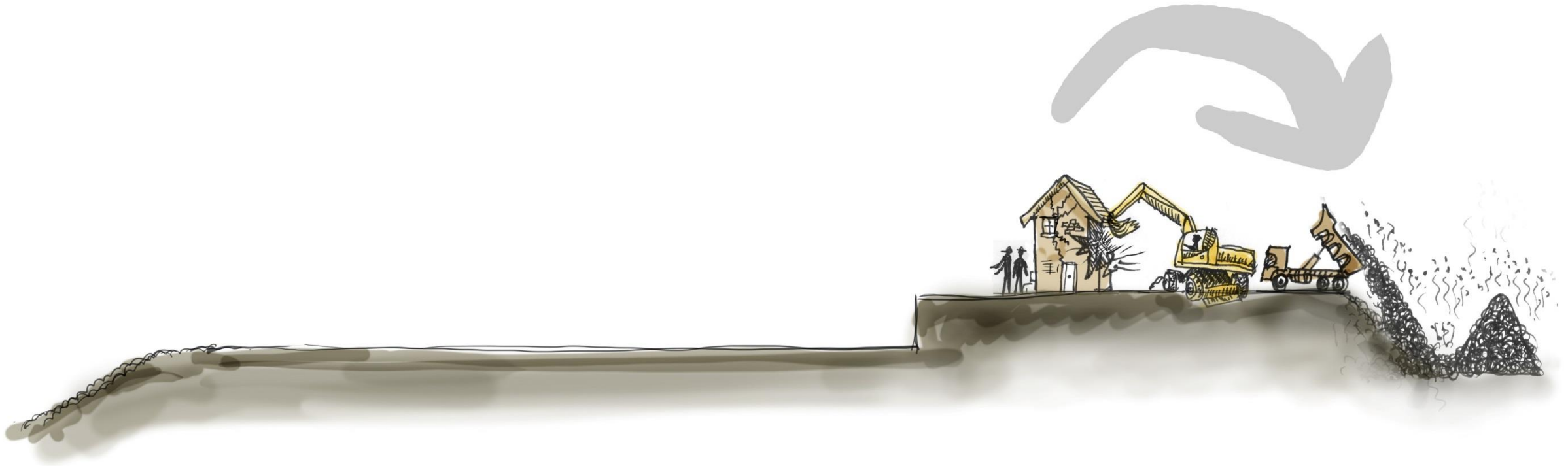
Debris Recycling: Damaged Buildings



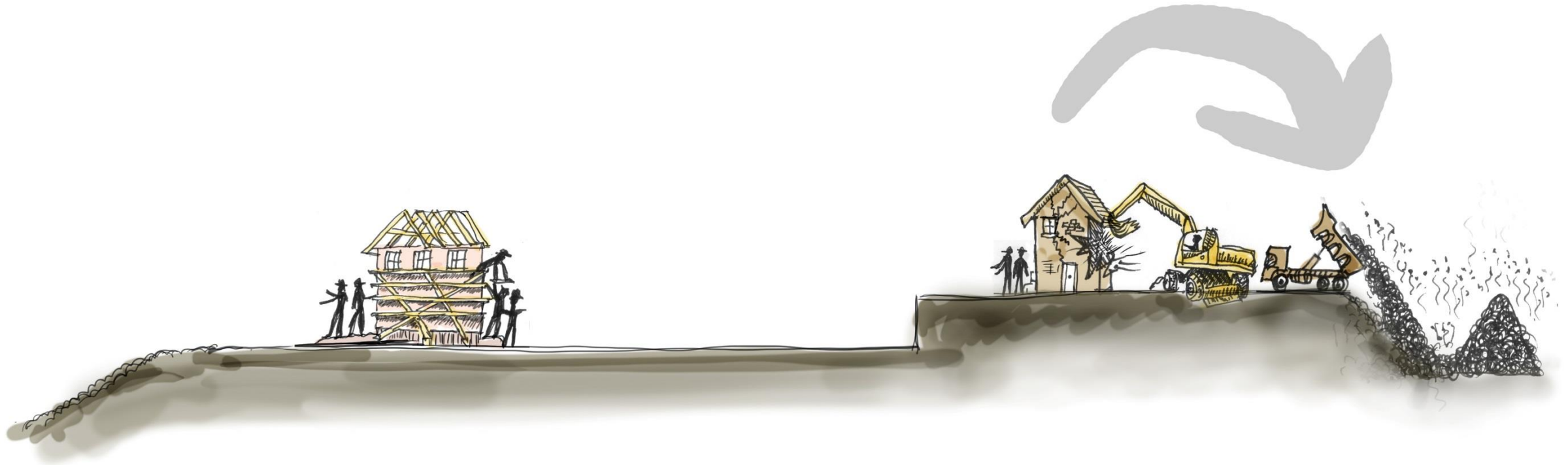
Demolition of Damaged Buildings



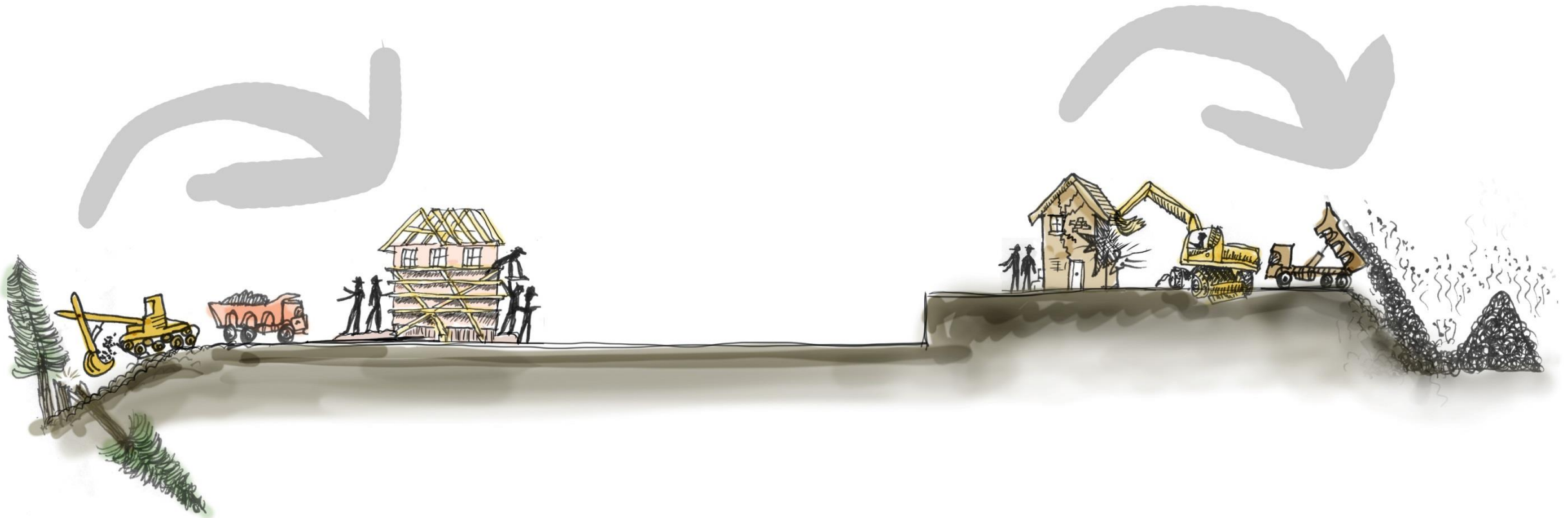
Disposal of Demolition Debris



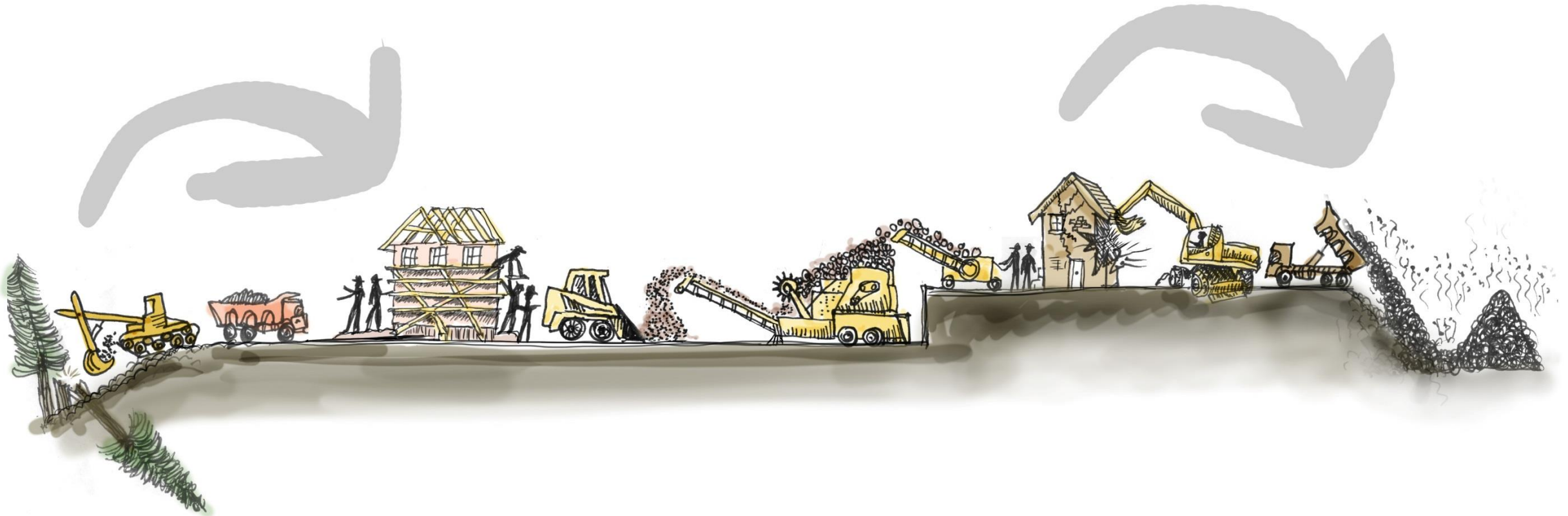
Reconstruction and Rehabilitation



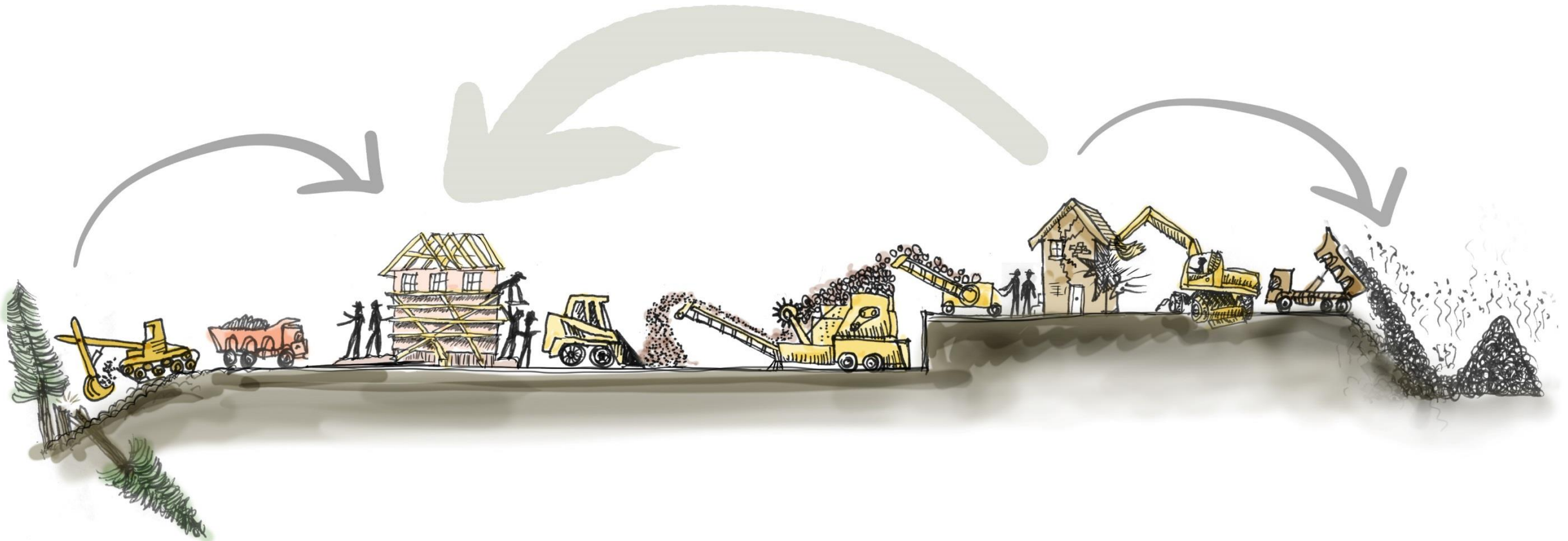
Supply of (Re)Construction Materials



Missing Link: Debris Recycling



Optimal Debris Recycling




A case study of
Aleppo, Syria: Data
from February
2017



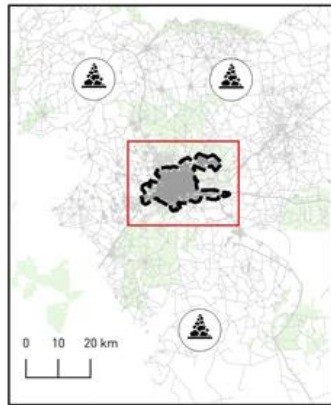
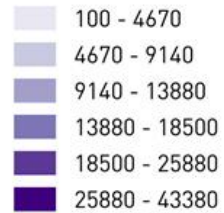
Aleppo: Debris Scenario 1 Haul it'all


Scenario 01
Dispose All

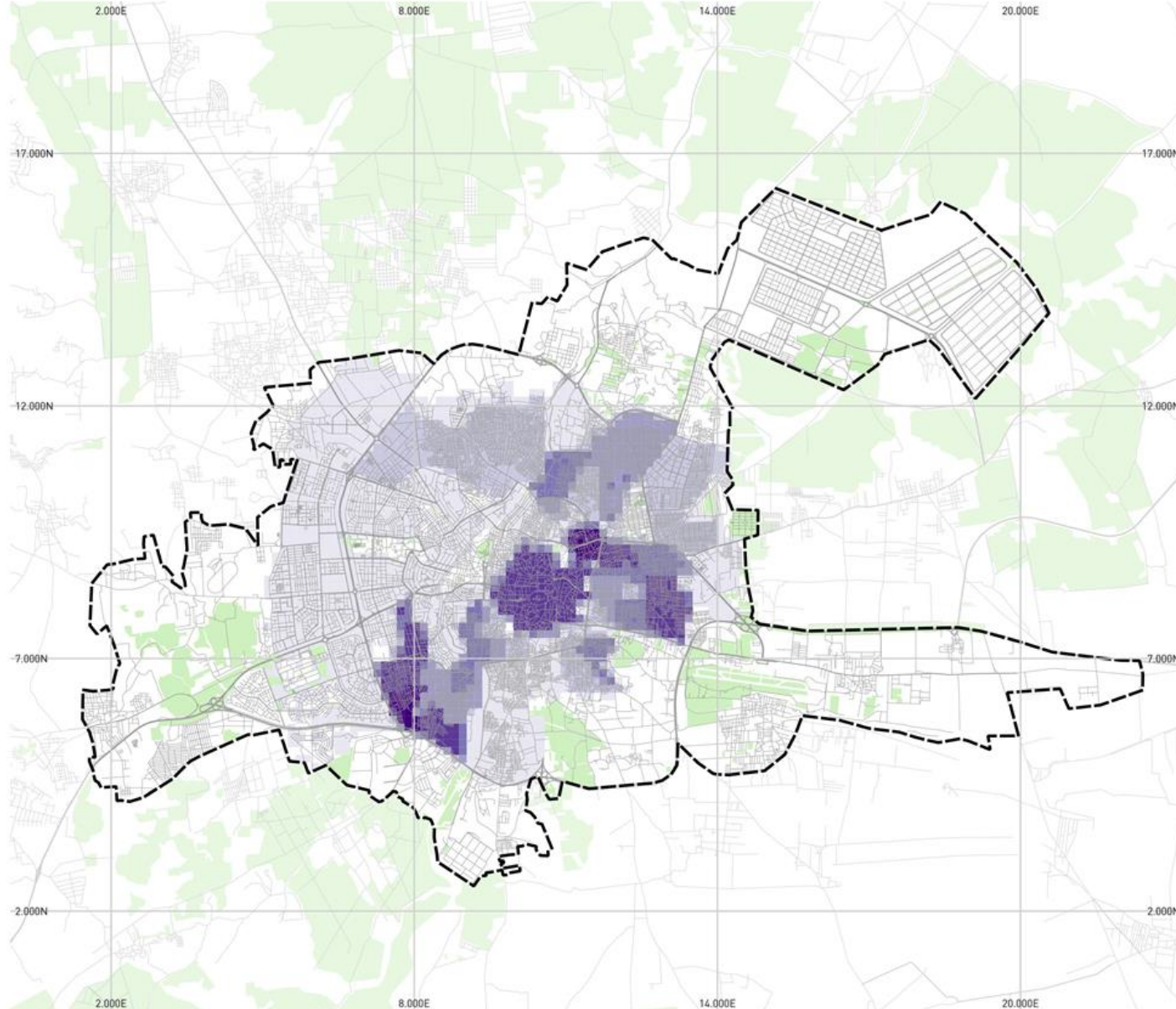
 Aleppo City Boundaries

 Disposal Sites

Estimated residential
debris (tonne)



 Datum: WGS 1984
Coordinate System: Universal
Transverse Mercator 37N



Residential debris management
Preliminary outputs

Time to clear (months)	149,1
Cost to Clear (\$)	253 979 050
Total distance covered (km)	71 491 700
CO2e from Trucking (tonnes)	72 695 019
Fuel Consumption from Trucking (l of diesel)	18 684 000
Cost of Trucking (\$)	178 729 250
Material Recovered for Reconstruction (tonnes)	-
Material Recovered for Reconstruction (%)	0%
Material Disposed (tonnes)	14 857 880
Material Disposed (% of total)	100%
Reprocessing Work Days	-
Reprocessing Full time equivalent Jobs	-
Water required per day (m3)	-
Water Required Over Whole Program (m3)	-
Value of Recovered Material in Market (\$)	-

ROEDOWN









URP

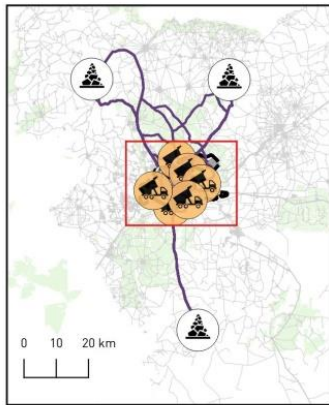
Aleppo: Debris Scenario 2 Localised Recycling

Scenario 02 Inner City Crushing

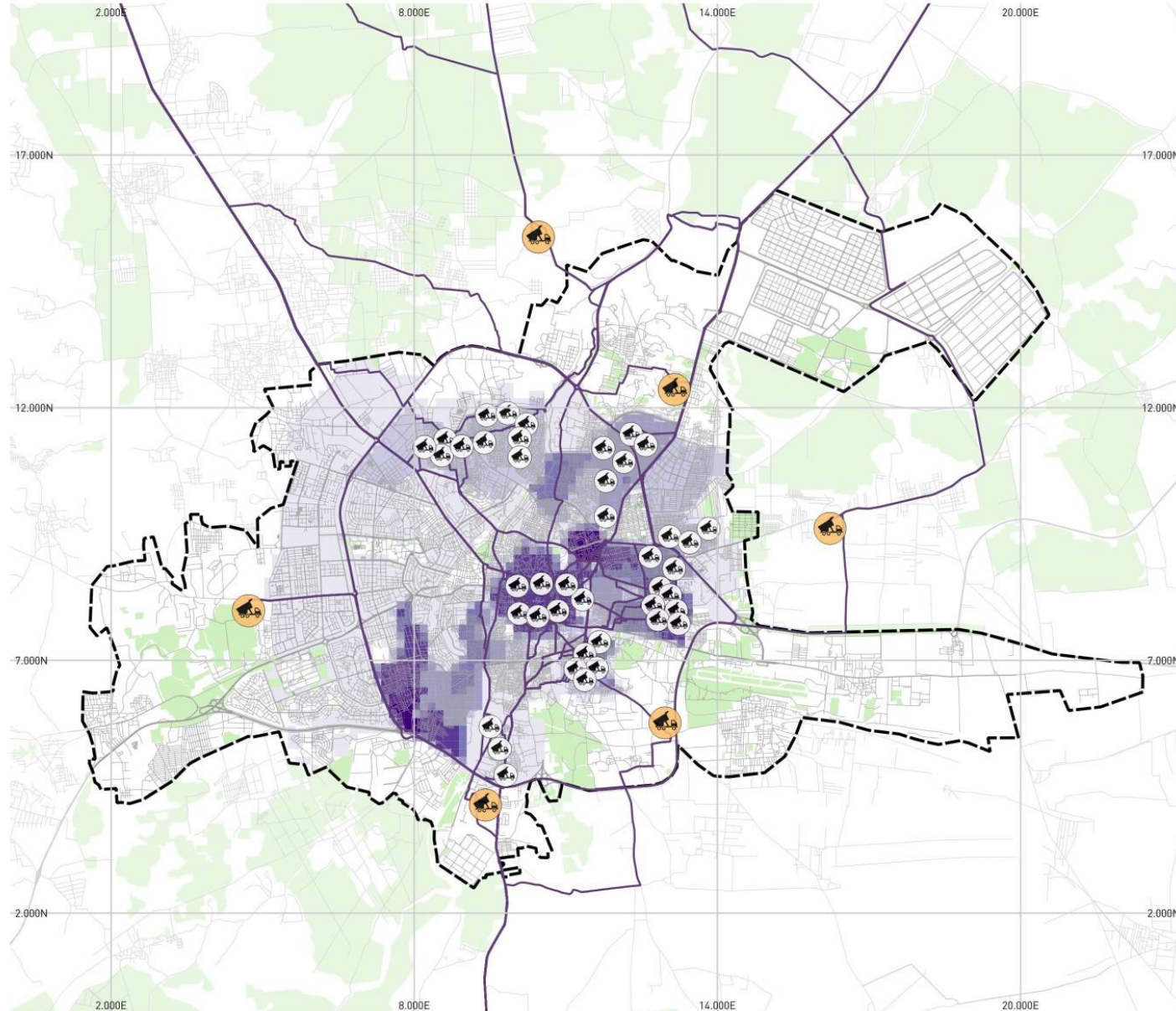
-  Aleppo City Boundaries
-  Disposal Sites
-  Medium crusher
-  Small crusher
-  Least cost routes

Estimated residential debris (tonne)

-  100 - 4670
-  4670 - 9140
-  9140 - 13880
-  13880 - 18500
-  18500 - 25880
-  25880 - 43380



Datum: WGS 1984
Coordinate System: Universal Transverse Mercator 37N



Residential debris management Preliminary outputs

Time to clear (months)	76,9
Cost to Clear (\$)	133 063 952
Total distance covered (km)	26 227 009
CO2e from Trucking (tonnes)	26 668 451
Fuel Consumption from Trucking (l of diesel)	6 854 423
Cost of Trucking (\$)	65 567 523
Material Recovered for Reconstruction (tonnes)	9 688 400
Material Recovered for Reconstruction (%)	63%
Material Disposed (tonnes)	5 655 800
Material Disposed (% of total)	37%
Reprocessing Work Days	786 160
Reprocessing Full time equivalent Jobs	335
Water required per day (m3)	114 000
Water Required Over Whole Program (m3)	178 364 000
Value of Recovered Material in Market (\$)	107 520 000



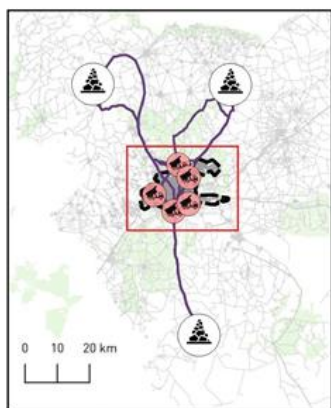
Aleppo: Debris Scenario 3 Centralised Recycling

Scenario 03 Suburban Crushing

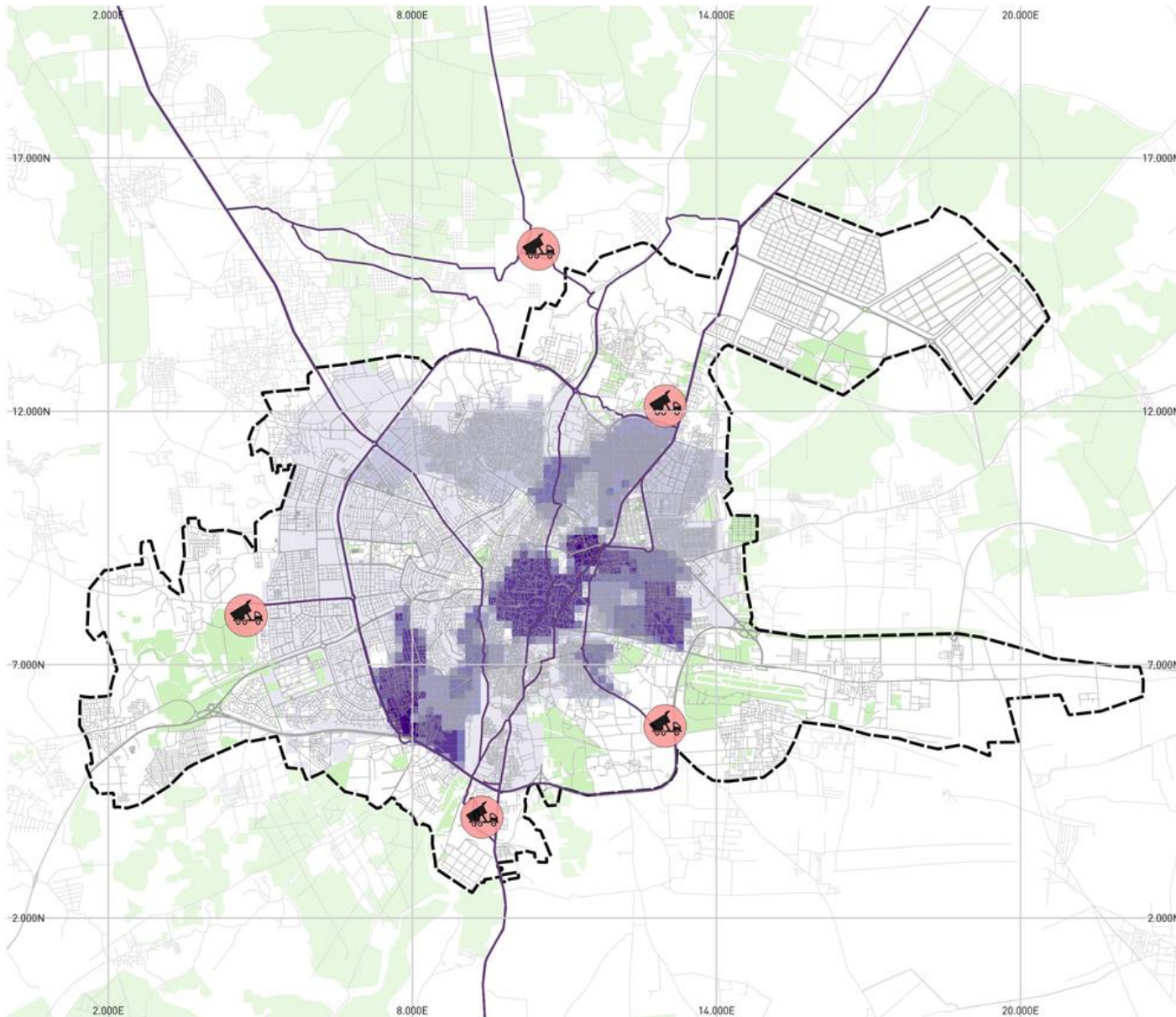
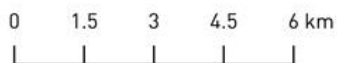
- Aleppo City Boundaries
- Disposal Sites
- Large Crushers
- Least cost routes

Estimated residential debris (tonne)

- 100 - 4670
- 4670 - 9140
- 9140 - 13880
- 13880 - 18500
- 18500 - 25880
- 25880 - 43380

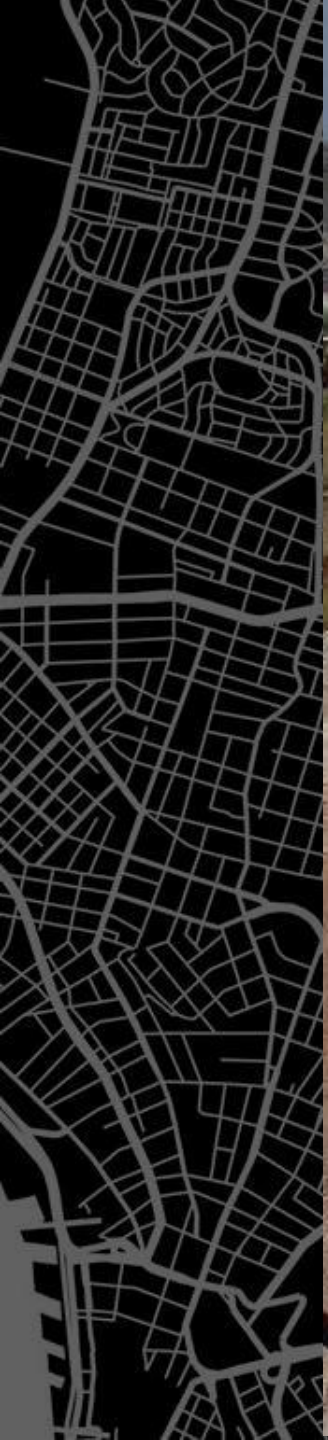


Datum: WGS 1984
Coordinate System: Universal Transverse Mercator 37N

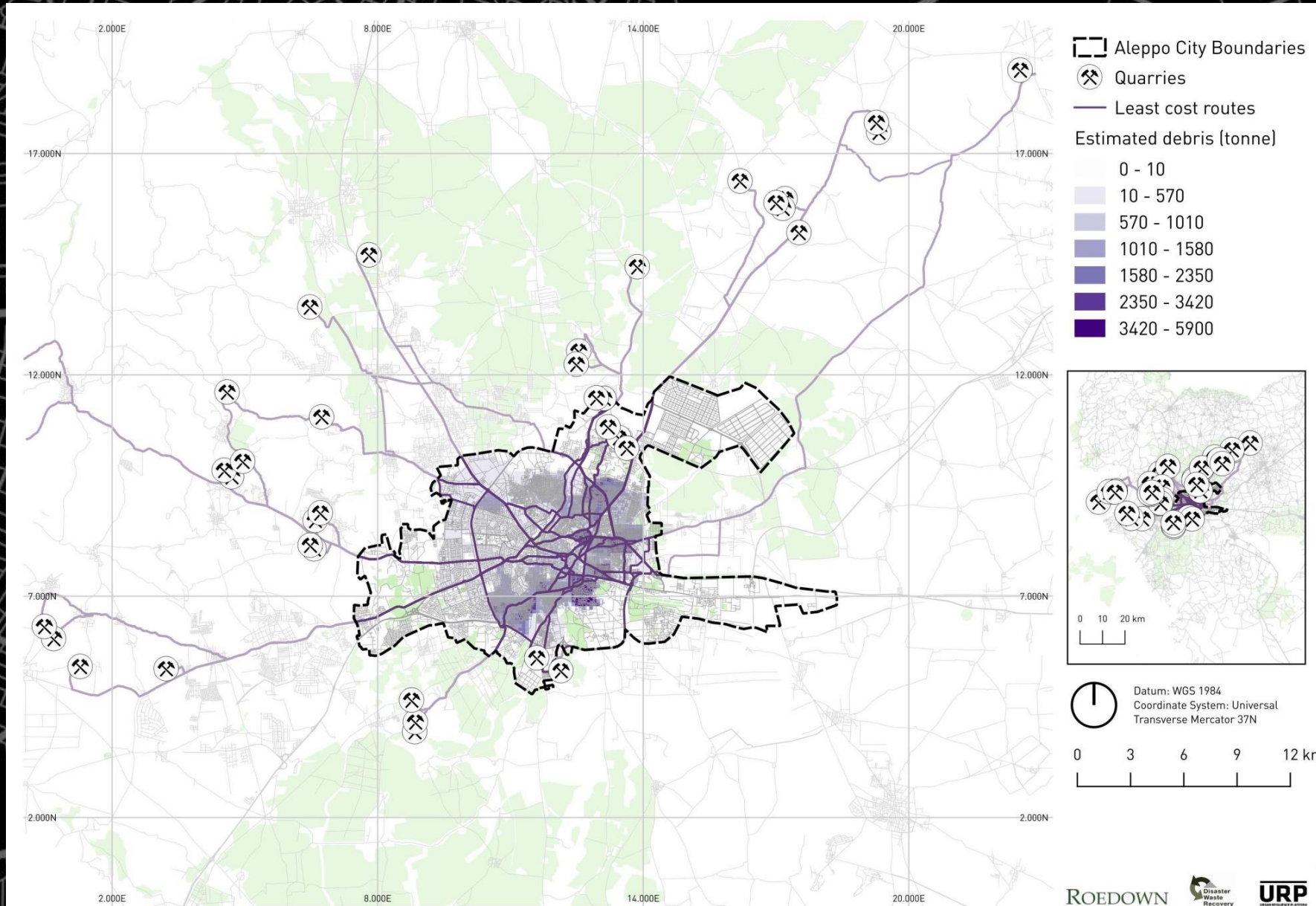


Residential debris management Preliminary outputs

Time to clear (months)	71,6
Cost to Clear (\$)	112 215 519
Total distance covered (km)	25 992 337
CO2e from Trucking (tonnes)	26 429 829
Fuel Consumption from Trucking (l of diesel)	6 793 091
Cost of Trucking (\$)	64 980 842
Material Recovered for Reconstruction (tonnes)	9 153 200
Material Recovered for Reconstruction (%)	61%
Material Disposed (tonnes)	5 741 768
Material Disposed (% of total)	39%
Reprocessing Work Days	109 120
Reprocessing Full time equivalent Jobs	50
Water required per day (m3)	50 000
Water Required Over Whole Program (m3)	109 120 000
Value of Recovered Material in Market (\$)	99 840 000



Aleppo: Quarries



How does it work?

Damage Assessment

Architectural Assessment

Debris Quantification and Localisation

Do-Nothing Scenario

Existing Infrastructure

Existing Rolling Stock



Results

Disposal Sites

Transfer Stations

Crushers / Recycling

State of the roads

Number and type of vehicles

Capacity, Speed

Unit Costs

Capital Expenditure

Operational Costs

Material Efficiency

Environmental Impact

Job Creation

Scenario 1

Additional Infrastructure

Additional Rolling Stock



Results

Scenario 2

Scenario 3

Estimating Debris Quantities

Method must remain adaptable

Focus on "Good Enough" data confidence

Damage Assessment

Point Data:

- High
- Medium
- Low

Cadastral Data
(OSM, official...)

Polygon Data

- Building Footprint
- Amenity
- Construction Type

Architectural Data
(Building Types)

Tabular Data

- List of Types
- Concentration of Types Across City
- Debris Generation Rates per Type

Questions

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