

# Resilience Assessment Framework application – RAF APP – User guide



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## Overview

This tool provides a framework to assess urban resilience to climate change, with focus on water, considering an objective-oriented approach and four **resilience dimensions**: organisational, considering governance relationships; spatial, covering urban space and environment; functional, focused on strategic services in the city (water, wastewater, stormwater, waste, energy and mobility); and physical, centred on infrastructure of these services. The resilience objectives are described through key criteria (expressing different points of view), which are evaluated by metrics. In this given scope, the metrics are described and associated to reference values, providing a user-friendly assessment to support a structured diagnosis. The app allows the use of a defined structure based on dimensions / objectives / criteria / metrics, specifically designed to address the referred scope.

The app can be used as a tool to support assessment, diagnosis and decision-making as well as the development of resilience plans, to monitor progress of a city or service or to compare different parts of the cities or services.

## Login

A user with credentials can login into the RAF App.



Login

Username

Password

Login

## Studies

After a successful login, the user will be redirected to the *studies* page, containing all his previously saved studies (for the city and year that the user has previously created or has been assigned access).

### Studies



In this page the user can manage his previously saved studies:

- Create study: create a new study for the city or for another city
- Edit study: fill and change city information
- Clone city: make a copy of the study, e.g. for the city information in a previous year
- Check the city report: a summary of study results available for download
- Delete studies

If the city wants to assess different hazards existing in the city, different studies must be created. One study for each hazard.

For this, after creating a study and completing the assessment considering one selected hazard, the user has to clone the study already completed to assess a new hazard, giving a new name and editing only the hazard-related metrics. In case there is a service with no assessment for that hazard the user **deselects** the respective service in the RAF app - city location page - for the functional and physical dimensions.

For each study, the hazard under assessment needs to be identified and described in the City and Service profiles, in the hazard section.

However, for each hazard the user may have **different variables**.

So, when answering to the metrics of the scenarios (e.g., MP or MS) for one hazard (e.g. flooding), if there are differences regarding the impacts/consequences that depend on the type of variable, then the answer shall be done **for the variable that causes the most serious consequence**, and shall be indicated the variable in the comments. In this situation, it is still possible to create a different study for each variable if it deepens the assessment and facilitates the identification of solutions. However it is not recommended in order to keep parsimony.

## City main page

### 4.1 Upper bar

The city main page can be accessed when creating a new study or when editing a previously created study.

At the upper bar, the user has two fixed options:

- go back to studies 
- open the App user guide  (this document)

The top of the page also presents the navigation bar, where the user can select where to go next. This bar contains the main App structure: City location, the four dimensions, and the results.

## 4.1 City Location

In **City Location** the user has a tab with General information, City Profile and Service Profile.

The **General** contains generic information about the city: city name, year of the study, a map (where the user can select the city to originate coordinates), the dimensions under assessment (organisational, spatial, functional and physical) and the services that are being assessed (water, wastewater, stormwater, waste, energy and mobility) within the functional and physical dimensions.

At this stage, the user has to select which dimensions and services are being assessed in the study of the city. If a dimension is selected at this stage, it will become available to access through the navigation bar and to explore the corresponding results in the end of the navigation bar. In a similar way, if a service is selected at this stage, it will appear available when entering the functional or physical dimension, whichever applicable, and also available to explore the corresponding results. In case of combined sewer systems, both wastewater and stormwater services need to be selected and answered for the applicable metrics. Those metrics that are not applicable have to be duly identified.

**City profile** contains information relevant for understanding the city context and the results of the resilience assessment. The information in **city and service profile** is the starting point for the assessment, with some metrics where the user has to specify what will be considered in the assessment.

In this section, the city context is presented in several boxes (Geographical characteristics, Climate, Population, Economy & governance and Built environment & infrastructures). The available fields have some guidelines in grey, and a button (  ) to look for more details/explanations.

In the Climate box, some fields, when selected, unfold into other fields to complete. E.g.: if the user has data about some of the presented variables (temperature and rainfall), when selecting, more fields will unfold to complete with detailed data. Any comments should be provided in the answer field.

Climate

**Climate Type** ⓘ

**Climate and environment variables** ⓘ

Temperature (°C)

Annual T average  Average T of the coldest month  Average T of the hottest month

Rainfall (mm)

Annual R average  Average R of the wettest month  Average R of the driest month

Snowfall (cm)

Wind (km/h)

In the Hazards section, the selected hazards are numbered and unfold into a table with variables. A value with the same units used above (Climate and environment variables section) should be provided.

Hazards

Climate-related hazards ⓘ

Flooding  Combined sewer overflow (CSO)  Heat wave  Cold wave  Wind storm  Drought  Other

Scenarios

Most probable scenario characteristics ⓘ

Num	Hazard	Variable	Value
1	Flooding	Temperature	<input type="text"/>
		Rainfall	<input type="text"/>
		Snowfall	<input type="text"/>
		Wind	<input type="text"/>
		Sea level	<input type="text"/>
		(other)	<input type="text"/>
3	Heat wave	Temperature	<input type="text"/>
		Rainfall	<input type="text"/>
		Snowfall	<input type="text"/>
		Wind	<input type="text"/>
		Sea level	<input type="text"/>
		(other)	<input type="text"/>

Most severe scenario characteristics ⓘ

Num	Hazard	Variable	Value
1	Flooding	Temperature	<input type="text"/>
		Rainfall	<input type="text"/>
		Snowfall	<input type="text"/>
		Wind	<input type="text"/>
		Sea level	<input type="text"/>
		(other)	<input type="text"/>
3	Heat wave	Temperature	<input type="text"/>
		Rainfall	<input type="text"/>
		Snowfall	<input type="text"/>
		Wind	<input type="text"/>
		Sea level	<input type="text"/>
		(other)	<input type="text"/>

In the last box (Assessment scope), the user has to select the numbers correspondent to the selected hazards (Hazards section).

Assessment scope

**Area under assessment**

Metropolitan area

Urban area

Other

**Climate hazards**

Most probable scenario characteristics ⓘ  1  2  3  4  5  6  7

Most severe scenario characteristics ⓘ  1  2  3  4  5  6  7

In **Service profile**, first the user has to select the service(s) to be assessed. For this, relevant information to both service and service infrastructure is presented.

For most of the metrics, there are four fields to be completed by the utilities in charge. If the service is managed by a single utility, only the Utility 1 field should be used.

Services

Water Wastewater Stormwater Waste Energy Mobility

Context characterization

**Number of utilities** ⓘ

**Service relations between utilities** ⓘ

They serve different populations/areas

They provide complementary services for the same population/area

They provide the service to another utility under a protocol/contract

They are in concurrence in the same area

**Identification of the utility** ⓘ

XXX City Council Utility 2 Utility 3 Utility 4

**Contracts duration** ⓘ

Utility 1 Utility 2 Utility 3 Utility 4

**Developed activities** ⓘ

Utility 1 Utility 2 Utility 3 Utility 4

**Description of the area covered by services**

**Identification of the areas served by the service**

Utility 1 Utility 2 Utility 3 Utility 4

**Area (km²)**

Utility 1 Utility 2 Utility 3 Utility 4

**Inhabitants** ⓘ

Utility 1 Utility 2 Utility 3 Utility 4

**Other relevant information**

Utility 1 Utility 2 Utility 3 Utility 4

### 4.2 Dimension tabs

In the tab inside each selected dimension, a box with a dropdown menu is available (Objective and criteria box). This is where the user may select the criterion within the objective to be assessed. Once the criterion is selected, the corresponding objective will appear above.



Objective Collective Engagement And Awareness

Objective and Criteria Citizens and communities engagement

Importance Comprehensive

Ref	PI / Question	+info	City Answer	Specify why
1	<b>PI: Community or "grassroots" organizations, networks and training</b>  <b>Question:</b> Are grassroots or community organizations participating in pre-event planning and post-event response for each neighbourhood in the city?		There is involvement in diverse grassroots organizations, either in sc	
		E	Comments	
2	<b>PI: Civil society links</b>  <b>Question:</b> Are civil society organisations engaged (city DRR stakeholders have in place agreements with various NGOs, with NGO role defined in providing support in response, relief and meeting resource demands, high volunteer capacity as required, regular planning and coordination meetings)?		Yes	
		E	Comments	
3	<b>PI: Engagement of vulnerable groups of the population</b>  <b>Question:</b> There is evidence of disaster resilience planning with or for the relevant groups of vulnerable population, and there is a confirmation from those groups of effective engagement.		One or more major gaps in coverage or effective engagement.	
		E	Comments	cultural issues act as engagement barriers, for romani population. Also language barriers are detected
4	<b>PI: Citizen engagement techniques</b>  <b>Question:</b> How effective is the city at citizen engagement and communications in relation to DRR?		Multiple media channels. No inbound data collection from mobiles. I	
		C	Comments	

The table that is displayed (see above picture) shows the metrics included in the selected criterion. A table with all the metrics within the dimension is available when selecting **ALL** in dropdown menu in the Objective and criteria box.

When this option is selected (ALL), a Search box is available to find a specific metric through some keywords.

Each metric has a reference number (left column), a given name (performance indicator, PI) and question, additional information (+info) and boxes for the city answer, additional comments or specifications in case the metric does not apply.

The user can filter the metrics by **importance**, to assess a specific set of metrics. Metrics importance can be:

- **Essential:** Integrates any city assessment, applicable to any city.
- **Complementary:** Integrates evaluation of specific or detailed city aspects.
- **Comprehensive:** To a comprehensive assessment of the city, may not be applicable to all cities

As metrics importance reflects an in deeper assessment path, a sequential inclusion of metrics is done when using the importance filter (box with a drop down menu):

- When selecting the **Essential (E)** filter, the user sees only the metrics with a **performance indicator (PI)** classified as E.
- When selecting the **Complementary (C)** filter, the user sees the metrics with a **PI** classified as E and C.
- When selecting the **Comprehensive (CH)** filter the user sees all metrics.

The user can find the information above selecting

Each metric has also an for the metric explanation (in the +info column).

There are three types of metrics to answer:

- Metrics with only one answer option to pick ("select option")
- Metrics with multiple options to pick ("select all applicable")
- Metrics to answer with an estimated figure (open field)

All metrics have the option "Not applicable in the city, explain why in comments." and a box to insert additional comments is provided.

In case no option is selected, a dropdown menu (the Specify why box) is available to specify the reason why the metric is not answered.

This framework has some metrics that precede other i.e. condition the existence of others. The conditioning relation between metrics is available in the annex of this manual.

When answering any of the metrics that condition others, verify whether the answer that you provide conditions the possibility of the dependent metrics to be answered. In such case, ensure the respective dependent metrics are answered as Not Applicable. See example below.

In this case, if the answer for metric 33 is yes, the dependent metric (34) must be answered.

33	<b>PI: Early warning</b>  Question:Existence of Early Warning System for monitoring, forecasting and doing predictions on hazards (including climate change-related events)	<input type="text" value="Yes"/>	<input type="text"/>
34	<b>PI: Reach of warning</b>  Question:Percentage of population reachable by early warning systems	<input type="text" value="less than 75% reached"/>	<input type="text"/>

If the answer is no, the dependent metric will be considered as Not Applicable (this option must be selected).

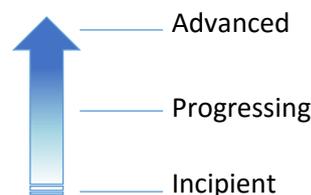
33	<b>PI: Early warning</b>  Question:Existence of Early Warning System for monitoring, forecasting and doing predictions on hazards (including climate change-related events)	<input type="text" value="No"/>	<input type="text"/>
34	<b>PI: Reach of warning</b>  Question:Percentage of population reachable by early warning systems	<input type="text" value="Not applicable in the city, explain why in comments."/>	<input type="text"/>

**Specifically, in Functional and Physical dimensions**, firstly the service(s) to assess must be chosen.

Before moving to other dimension or to the results tab, it is recommended to save your data by clicking in SAVE button, at the top right corner

## Results

Depending on the answers to the metrics, each metric /criteria/objective/dimension is classified with a **development level**: Advanced, Progressing or Incipient.



- **Advanced** metrics are those with higher development level, identified in graphs with a darker color.
- **Progressing** metrics have an intermediate development level and are identified in graphs with a color between the darker and the lighter.
- **Incipient** metrics have a lower development level and are identified in graphs with a lighter color.

The first section presents the **overall** results, gathering all dimensions' results. The user can see the overall city results in two charts (as % of all metrics of the assessment):

- Metrics in advanced, progressing or incipient level considering all resilience dimensions in the city, and also the unanswered and not applicable metrics (donut graph)
- Metrics in each development level by dimension (bar graph)

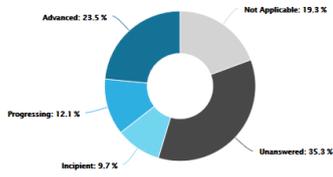
# City 1 City Plan

## Dimensions

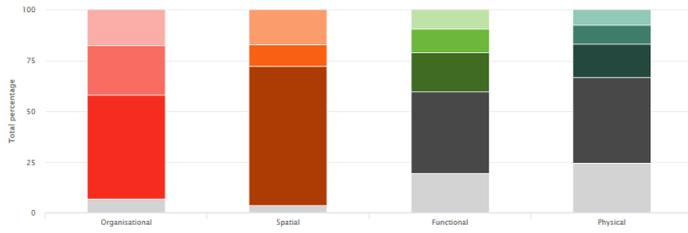
- Overall
- Organisational
- Spatial
- Functional
- Physical

City Report

Metrics within each development level for City



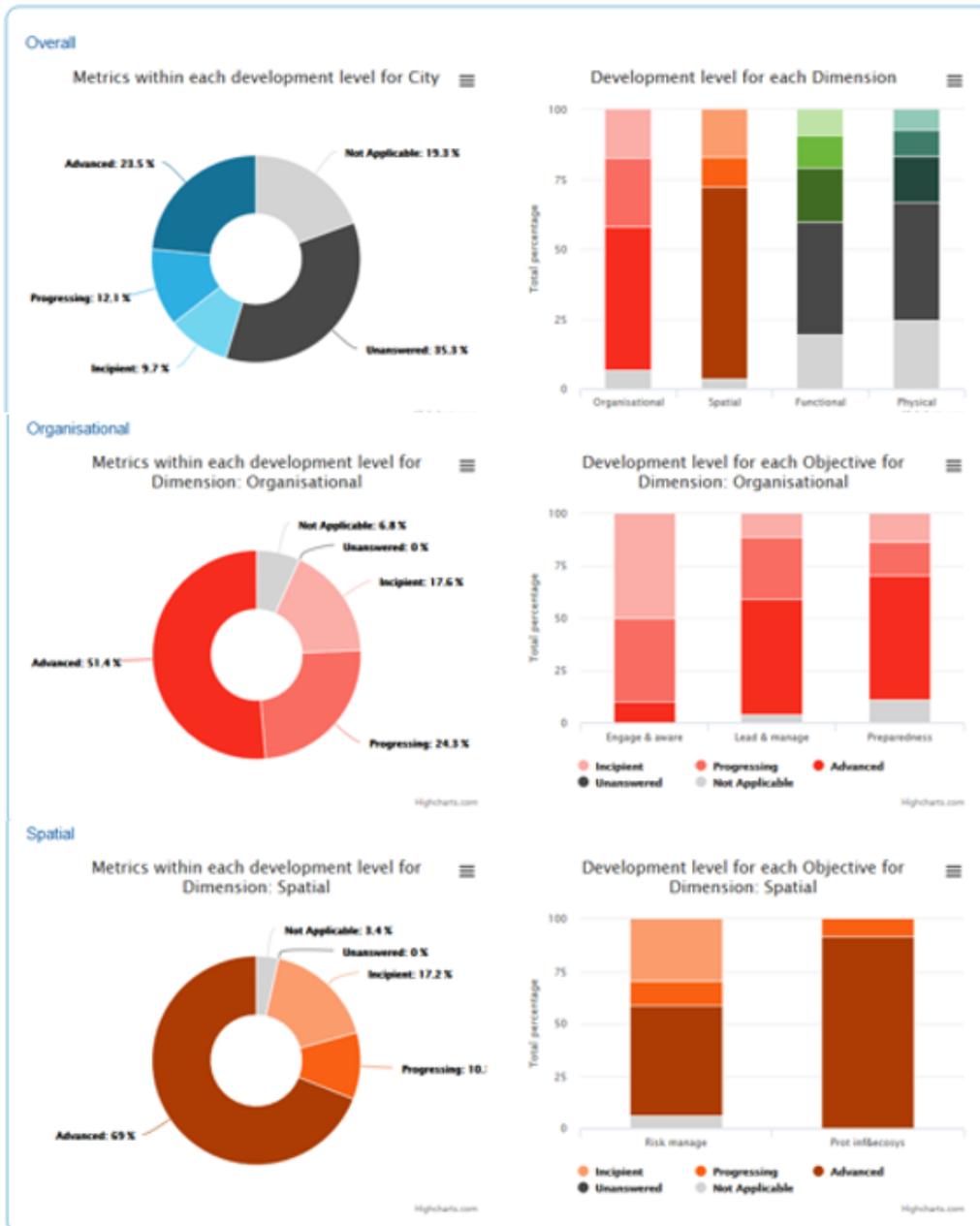
Development level for each Dimension



In **City Report**, the user can get a summary of city results (overall city results and overall results by dimension). The pdf file is available to download.

## City 1 2018 overall resilience

[Download Report](#)



The user can choose to see more detailed results entering each dimension and using the available filters.

By selecting one dimension it is possible to see the results by service (if previously chosen for assessment), objective, criteria, importance and level.

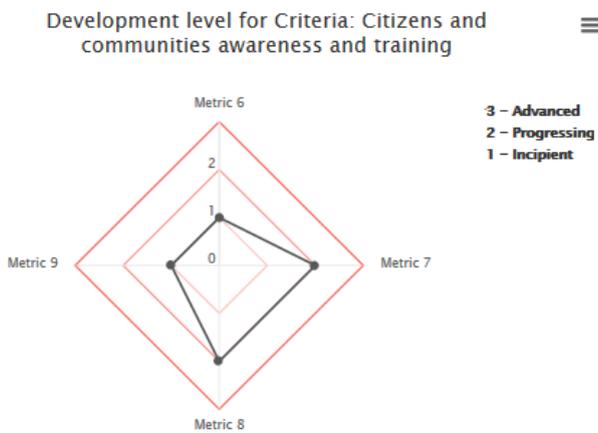
- The **assessment level** can be
  - Strategic: metrics associated with higher level of decision making in the city and long term view decisions;
  - Tactical: metrics associated with intermediate decision making and implementation levels in the city and medium term view decisions.

Either in overall or within one dimension, it is possible to compare the current study results with another study (e.g. the same city in a previous year) using the option “**Compare with**”.

In each dimension, the user may ask for the correspondent metrics table. This table will present all metrics within the dimension, the correspondent city answers and the associated development level. This metrics table is available to download (.xls file). The user can export any chart or table selecting  .

- Graph types are the same when selecting results within each dimension:
  - Organisational: overall dimension (donut) and results by objectives (bar graph)
  - Spatial: overall dimension (donut) and results by objectives (bar graph)
  - Functional: overall dimension (donut) and results by services (bar graph)
  - Physical: overall dimension (donut) and results by services (bar graph)

The user can cascade down, into more detail. For instance, when selecting results by objective, the graphs display the results for the overall objective (donut) and by criteria (bar graph). When the user is in the most detailed display of the results, i.e., selecting results by criteria, the graphs shows the overall criteria with a new graph type (spider graph for every metric within the criteria).



Specifically in this graph, when the user moves the mouse around, the metric’s development level is presented in a box along with the metric’s performance indicator (PI).

As in the other graphs, the spider graph also has an associated table with detailed information about the metrics within the selected criteria.

## Final notes

To keep the changes made by the user, it is recommended to SAVE before leaving to “studies” or to select the “Results” tab in the Navigation Bar, otherwise everything changed by the user will not be recorded:

- Data will be temporarily kept when the user edits the answers and skips between dimension tabs without saving;
- The user should **Save** when skipping between objectives or dimension tabs, if the user really wants to save permanently those changes.

The user should be aware that skipping to the “Results” tab will save automatically all the changes made. If the user wants to exit the study and discard the changes:

- The user should not move to “Results” neither use the Save button;
- The user should move directly to Studies.

Either in the dimensions or in results tabs, the **back** button will always redirect the user to City Location.

## Metrics dependencies

### Organisational

Metrics	Dependencies
O16 (if 3/2/1 selected)	O17 O18
O24 (if 3 or 2 selected)	O25 O26 O27 O28 O29
O38 (if yes)	O39
O30 (if 3/2/1 selected)	O36, O40, O46, O48
O44 (if yes)	O45
O51 (if yes)	O52 O53
O58 (if 3/2/1 selected)	O59, O60
O63 (if yes)	O64
O54 organisational (if 3/2/1 selected)	S06, S07, S08, S09, S16, S17, S27, S28; FMob12, FMob13, FMob14, FMob15, FMob16, FMob17, FMob35, FMob36, FMob38, FMob39, FMob40, FMob41, FMob42

### Functional - Water

Metrics	Dependencies
FWts01 (if yes/partially)	FWts02 FWts03
FWts06 (if yes)	FWts07
FWts56 (if 3/2/1 selected)	FWts57
FWts48 (if 3/2/1 selected)	FWts14, FWts15, FWts16, FWts17, FWts18, FWts19, FWts20, FWts21, FWts22, FWts23, FWts41, FWts42, FWts49, FWts58 to FWts67; PWts20, PWts36, PWts37, PWts38, PWts41, PWts42, PWts43, PWts44, PWts45, PWts46, PWts47, PWts48, PWts49

### Functional - Stormwater

Metrics	Dependencies
FSwt01 (if yes/partially)	FSwt02 FSwt03
FSwt06 (if yes)	FSwt07
FSwt46 (if 3/2/1 selected)	FSwt47
FSwt38 (if 3/2/1 selected)	FSwt14, FSwt15, FSwt16, FSwt17, FSwt18, FSwt31, FSwt32, FSwt39, FSwt48, FSwt49, FSwt50, FSwt51, FSwt52; PSwt20, PSwt35, PSwt36, PSwt37, PSwt40, PSwt41, PSwt42, PSwt43, PSwt44, PSwt45, PSwt46, PSwt47, PSwt48

### Functional - Energy

Metrics	Dependencies
FEne01 (if yes/partially)	FEne02 FEne03
FEne06 (if yes)	FEne07
FEne46 (if 3/2/1 selected)	FEne47
FEne38 (if 3/2/1 selected)	FEne14, FEne15, FEne16, FEne17, FEne18, FEne31, FEne32, FEne39, FEne48, FEne49, FEne50, FEne51, FEne52; PEne16, PEne30, PEne31, PEne32, PEne35, PEne36, PEne37, PEne38, PEne39, PEne40, PEne41

### Physical - Water

Metrics	Dependencies
PWts01 (if yes/partially)	PWts02 PWts03 PWts04
PWts01 (if yes/partially)	PWts36, PWts47

### Physical - Stormwater

Metrics	Dependencies
PSwt01 (if yes/partially)	PSwt02 PSwt03 PSwt04
PSwt01 (if yes/partially)	PSwt35, PSwt46

### Physical - Energy

Metrics	Dependencies
PEne01 (if yes/partially)	PEne02 PEne03 PEne04
PEne01 (if yes/partially)	PEne30, PEne39

### Spatial

Metrics	Dependencies
S01 (if yes)	S02
S09 (if yes)	S10
S14 (if 3 or 2 or 1 selected)	S15
S22 (if yes or partially)	S23, S24

### Functional - Wastewater

Metrics	Dependencies
FWwt01 (if yes/partially)	FWwt02 FWwt03
FWwt06 (if yes)	FWwt07
FWwt53 (if 3/2/1 selected)	FWwt54
FWwt45 (if 3/2/1 selected)	FWwt14, FWwt15, FWwt16, FWwt17, FWwt18, FWwt19, FWwt20, FWwt21, FWwt38, FWwt39, FWwt46, FWwt55, FWwt56, FWwt57, FWwt58, FWwt59, FWwt60, FWwt61, FWwt62, FWwt63; PWwt20, PWwt35, PWwt36, PWwt37, PWwt40, PWwt41, PWwt42, PWwt43, PWwt44, PWwt45, PWwt46, PWwt47, PWwt48

### Functional - Waste

Metrics	Dependencies
FSlw01 (if yes/partially)	FSlw02 FSlw03
FSlw06 (if yes)	FSlw07
FSlw51 (if 3/2/1 selected)	FSlw52
FSlw43 (if 3/2/1 selected)	FSlw14, FSlw15, FSlw16, FSlw17, FSlw18, FSlw19, FSlw20, FSlw36, FSlw37, FSlw44, FSlw53, FSlw54, FSlw55, FSlw56, FSlw57, FSlw58, FSlw59, FSlw60; PSlw18, PSlw35, PSlw36, PSlw37, PSlw40, PSlw41, PSlw42, PSlw43, PSlw44, PSlw45, PSlw46, PSlw47, PSlw48

### Functional - Mobility

Metrics	Dependencies
FMob01 (if existing)	FMob02 FMob03 FMob06 FMob07 FMob08

### Physical - Wastewater

Metrics	Dependencies
PWwt01 (if yes/partially)	PWwt02 PWwt03 PWwt04
PWwt01 (if yes/partially)	PWwt35, PWwt46

### Physical - Waste

Metrics	Dependencies
PSlw01 (if yes/partially)	PSlw02 PSlw03 PSlw04
PSlw01 (if yes/partially)	PSlw35, PSlw46

### Physical - Mobility

Metrics	Dependencies
PMob01 (if yes/partially)	PMob02 PMob03
PMob01 (if yes/partially)	PMob24

Organisational		Spatial	
Old REF	NEW REF	Old REF	NEW REF
1	O01	100a	S01
2	O02	100b	S02
3	O03	101	S03
4	O04	102	S04
5	O05	103	S05
6	O06	104	S06
7	O07	105	S07
8	O08	106	S08
9	O09	107a	S09
10	O10	107b	S10
12	O11	107c	S11
13	O12	108	S12
14	O13	109	S13
15	O14	110	S14
16	O15	111	S15
17a	O16	114	S16
17b	O17	115	S17
17c	O18	118	S18
18	O19	119	S19
19	O20	120	S20
20	O21	121	S21
21	O22	122	S22
22	O23	123	S23
23a	O24	124	S24
23b	O25	125	S25
23c	O26	126	S26
23d	O27	127	S27
24	O28	128	S28
25	O29	129	S29
26	O30		
27	O31		
28	O32		
29	O33		
30a	O34		
30b	O35		
31	O36		
32	O37		
33	O38		
34	O39		
35	O40		
36	O41		
37	O42		
38	O43		
39a	O44		
39b	O45		
40	O46		
41	O47		
42	O48		
43a	O49		
43b	O50		
44a	O51		
44b	O52		
44c	O53		
45	O54		
97	O55		
98	O56		
99	O57		
49	O58		
50	O59		
51a	O60		
51b	O61		
52	O62		
53a	O63		
53b	O64		
54	O65		
55a	O66		
55b	O67		
56a	O68		
56b	O69		
57	O70		
58	O71		
59	O72		
60	O73		
61	O74		



