BASMATI

Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services

Baltic Explorer web-map and multi-touch application prototype

Deliverable 5.3

BONUS BASMATI
Baltic Explorer web-map and multi-touch application prototype

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BONUS BASMATI in Brief

BONUS call 2015:

Blue Baltic

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Aalborg University, Denmark (AAU)

Aarhus University, Denmark (AU)

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Latvian Institute of Aquatic Ecology, Latvia (LIAE)

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Theme 2.3 Integrated approaches to coastal management and Theme 4.1 Governance structures, policy performance and policy instruments

https://www.bonusportal.org/projects/blue_baltic_2017-2020

Project abstract:

Maritime Spatial Planning (MSP) requires a spatially explicit framework for decision-making, and on that background the overall objective of BONUS BASMATI is to develop integrated and innovative solutions for MSP from the local to the Baltic Sea Region scale. This is to be realised through multi-level governance structures and interactive information technology aiming at developing an ecologically and socio-economically sound network of protected marine areas covering the Baltic Sea. Based on the results of former MSP projects, the BONUS BASMATI project sets out to analyse governance systems and their information needs regarding MSP in the Baltic Sea region in order to develop an operational, transnational model for MSP, while maintaining compliance with existing governance systems. It also develops methods and tools for assessments of different plan-proposals, while including spatially explicit pressures and effects on maritime ecosystem services in order to create the Baltic Explorer, which is a spatial decision support system (SDSS) for the Baltic Sea region to facilitate broad access to information. During the project running until 2020, new data will be produced and tested in assessments corresponding to policy goals. The data will support the combined analysis of the three elements of the concept of ecosystem services: the capacity, flow and benefit of provisioning, regulating and cultural services. A central aim of the project is to facilitate cross-border collaboration, and the project is carried out in close cooperation with relevant stakeholders in the BSR. The impact of the project will be facilitated and assessed in transnational case studies, where integrated solutions are required. The local scale will consist of case study areas in the South-West Baltic, the Latvian territorial and EEZ waters including open part of the Baltic Sea and the Gulf of Riga, and across the region, a pan-Baltic case study will be performed.

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Report Summary

This deliverable describes the state of development of the Baltic Explorer prototype system of the BONUS BASMATI project. Baltic Explorer contains *Explorer* and *Analysis* tools. In the current phase of the prototype, the *Explorer* tool is functional online at http://balticexplorer.eu whereas the *Analysis* tools are in the final design and proof-of-concept phases and will be opened for online use later.

The *Explorer* tool allows for multi-channel collaborative work of Maritime Spatial Planning (Section 2.2.). The tool functions on standard web browsers of personal computers and mobile devices and lets multiple simultaneous end users add and edit point, area and polygon features, as well as textual and easy styling of the features. Administrators of the system are able to configure raster background maps and geographically continuous maritime geoinformation into the system, and the end users are able to use these raster layers to base their MSP work on vector layers. For the prototype use, the HELCOM background map and maritime geoinformation WMS layers are configured.

In addition to the description of the tools, this deliverable gives a detailed tutorial on the use of the *Explorer* tool based on a demonstrative use case of planning for appropriate wind farm sites and individual turbines (Section 3).

Development of Baltic Explorer will continue with finalising the first prototypes of the *Analysis* tools as well as with adding further collaborative design and functionality to the *Explorer* tool. In addition, the usability and usefulness of the Baltic Explorer prototype will be assessed through user evaluations in realistic situations with expert and non-expert users.

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1 Introduction

The Baltic Explorer[1] is to be a multi-channel spatial decision support system (SDSS) for maritime spatial planning (MSP) that will support the collaborative setting of values for different uses of marine space, as well as facilitate the negotiations between the regional stakeholders. The design and construction of the system aim at web map and multi-touch user interfaces that will support both expert and non-expert use in order to facilitate complex maritime planning in multi-partner (for example, see Figure 1) and cross-border situations.
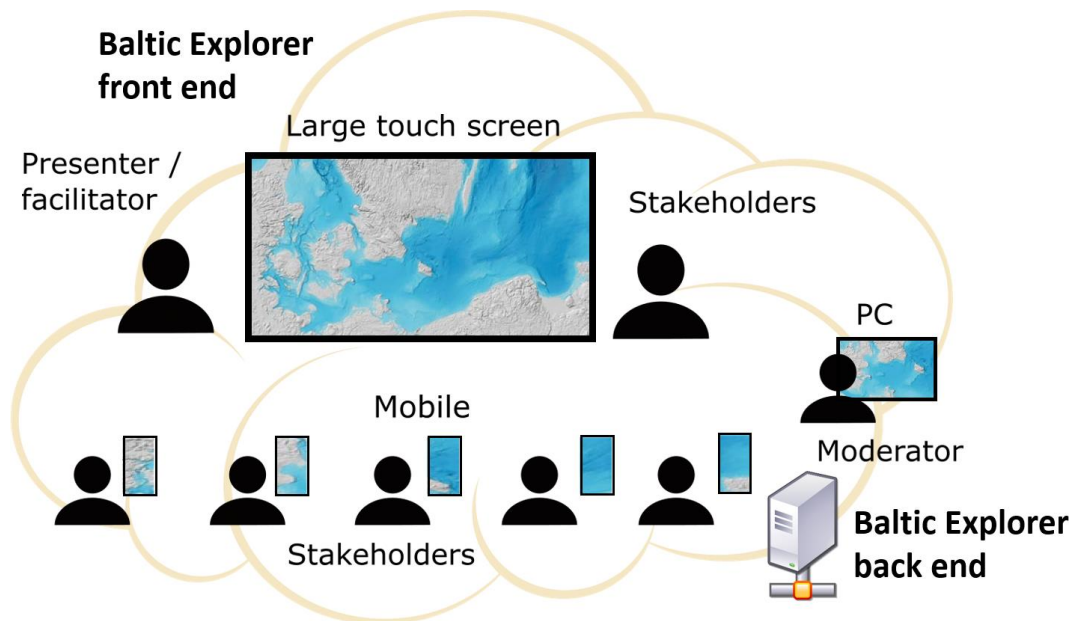

Figure 1. The Baltic Explorer will support expert and non-expert multi-partner MSP use.

The background and factors of designing and developing the Baltic Explorer are described in previous deliverables of the BONUS BASMATI project. Deliverable 3.1 (Schiele et al., 2018) describes requirements for data to be used in maritime spatial planning. Deliverable 5.1 (Koski et al., 2017) presents requirements of users for SDSS in MSP. Deliverable 5.2 (Dost et al., 2018) presents design drivers of the Baltic Explorer and introduces several technical possibilities for its development through different web mapping libraries. Deliverables 6.1. (Erkkilä-Välimäki et al., 2017) and 6.2. (Strāķe et al., 2018) specify scopes (D.6.2) and technical and data requirements (D.6.1) of the three case studies of the BONUS BASMATI project, which base the development of the Baltic Explorer.

The development of the Baltic Explorer SDSS spreads over the timespan of the BONUS BASMATI project in Work Package 5. The development is made simultaneously with the other work packages that also contribute to the setting of the final aims of the system. The development of the system strongly leans on a reiterative, agile and experimental approach so that changes can be made with a low threshold to the design of the system during the project. The description of the Baltic Explorer in this document illustrates the very first prototype that will be largely modified in the remaining of the project.

This report represents the first functional prototype of the Baltic Explorer. The report will describe the parts, structure and technical base of the system in Section 2. Consequently, in Section 3, guidance for the use of the Baltic Explorer is given through a demo showcase that allows the reader

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[1] http://balticexplorer.eu/

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to easily try the SDSS in its intended kind of use. Section 4 will introduce the planned development towards the end of the BONUS BASMATI project. Lastly, Section 5 will summarize the current state of the Baltic Explorer.

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2 Elements of Baltic Explorer

The home page and the *Explorer* tools are built by forking from the open-source project umap[2]. The pages are written in HTML, CSS and JavaScript in the front end, and with Python Django framework and a PostgreSQL database in the back end. In the front end, the *Explorer* also makes heavy use of the Leaflet web map application library with multiple third-party plugins. The Baltic Explorer follows responsive design principles, meaning that the interfaces fluently adapt to screens on most devices, as long as the devices have internet connection and a supported web browser.

2.1 Home Page

The Baltic Explorer home page acts as the access point for the tools of Baltic Explorer and helps the user to gain a better understanding of the system as a whole, and get familiar with the tools before using them (Figure 2). Through the home page, users can access the *Explorer* and *Analysis* tools, access basic information about Baltic Explorer and the BONUS BASMATI project, and view and access previously made workspaces of the *Explorer* tool. Users also log in, change their passwords and log out of Baltic Explorer at the home page.

Figure 2. The Baltic Explorer home page, at http://balticexplorer.eu/.

2.2 *Explorer* Tool

The *Explorer* tool is intended for flexible use in various MSP tasks. The prototype offers simple functionality, browsing and viewing spatial MSP data and drawing new features on the map. The *Explorer* has also been designed to be usable in devices with various screen sizes and input methods, including large touchscreens, computers, tablets and smartphones. This enables many use scenarios in the future, including scenarios that use many different devices simultaneously. The *Explorer* is accessed from the home page, either by creating a new *Explorer* workspace, or by choosing an existing one.

Workspaces can store information about who has created them (owner), their name, and a short description. In addition, all vector data layers are stored under workspaces. This includes both

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[2] http://github.com/umap-project/umap

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vector data that has been imported by system administrators, and data drawn by users on the map. Baltic Explorer system administrators can move and share vector data between multiple workspaces. Raster datasets, that is, background maps and web map service (WMS) layers, are shared between all workspaces, meaning that all available raster datasets in Baltic Explorer are always available for all workspaces.

The main element of the *Explorer* is the map window (Figure 3). The map window includes a map view with a default background map, control buttons, a scale bar, a full-screen controller and map layer attributions. There is also a menu window that appears after using some of the *Explorer's* functionality. The spatial reference system of the Baltic Explorer is ETRS89 / Lambert Azimuthal Equal Area (EPSG:3035).
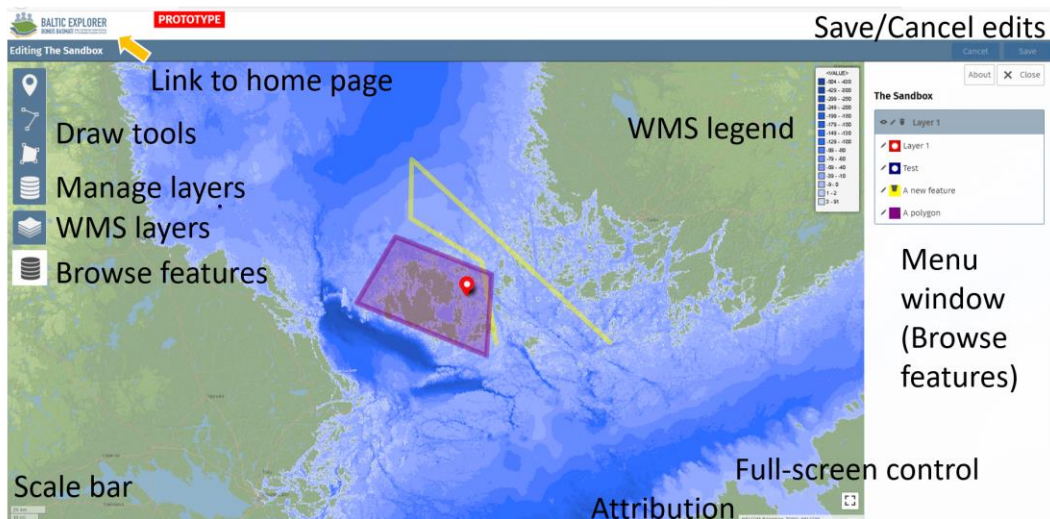

Figure 3. The Explorer tool interface in the edit mode.

The prototype has only one background map. However, Baltic Explorer has been built to allow new background maps to be added in the future, and controls for changing background maps in the interface have already been implemented, although not visible in the interface in this phase of implementation.

The *Explorer* tool has two modes: view and edit. View mode offers limited functionality. The map can be navigated by zooming and panning, and the full screen button in the lower right corner is also available. Users can view vector features on the map and browse features in the menu, and when clicking on a feature on the map, the name and description of the feature will be shown either as a popup, or in the left panel (depending on settings set by administrators). The edit mode (as in Figure 3) is accessed by clicking the edit button in the upper right corner. Clicking a vector feature in the edit mode will give the user options to either remove the feature or edit it. Users can also draw new features in the edit mode by using the feature draw buttons in the upper right corner. The edit button (and thus the edit mode), is available only to users with edit privileges. The edit privileges are workspace specific, so each workspace has their own set of rules for who can edit. Baltic Explorer system administrators can manage the edit privileges of workspaces.

New features can be drawn as points, lines, and polygons. Lines and polygons can also be multi-part, that is, multi-lines or multi-polygon, and polygons can have holes in them. Each feature has a name and a description, although both properties are optional. A feature without a name will adapt the name of its layer. The colour of each feature can also be changed, and point features can be represented by one out of four different symbols. Each vector feature belongs to a layer. Layers enable organization of the features (e.g., features could be distributed to layers based on type, or the user who created them), making it easier for users to keep track of features once the map starts to fill up. Layers are managed in the "Layer management" menu which can be accessed from the

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"Manage layers" control button. Each layer has a name and a description. Layers can also be hidden, allowing users to focus on less features at a time when the map starts to be filled with features. The default style (colour and point feature symbols) of vector features belonging to a layer can also be changed.

WMS layers can be added to the map view in the edit mode from the "WMS layers" button in the edit menu. Adding a WMS layer will also add its legend (if available) that can be collapsed into a small transparent button on the left side of the screen by clicking the legend. New WMS layers are added by Baltic Explorer system administrators, which will make the added WMS layers available to all new and existing explorer workspaces.

Multiple users can use explorer workspaces at the same time. However, simultaneous editing of a layer is not currently supported. If multiple users attempt to edit the same layer at the same time the system will give a warning when attempting to save changes and the user is presented with a choice between overwriting other users' edits and cancelling the edits.

2.3   *Analysis* Tools

The *Analysis* tools is intended for making common types of spatial analysis in various MSP tasks, but this functionality is not yet implemented in the December 2018 Baltic Explorer prototype. The planned analysis types include Cumulative Impact Assessment (CIA), co-location analysis, and suitability analysis in this order of priority. Of these, the development of CIA is furthest and the following characterises some of its' projected functionalities.

The current Baltic Explorer's CIA tool is at the proof-of-concept phase, which enables CIA at the Baltic Sea Region by making use of 19 identified pressures layers and 36 affected ecosystem components provided by HELCOM (Figure 4). The tool enables interactive CIA in the sense that the user may affect, which input layers are to be used in the analysis. The analysis results are represented in three views: text, histogram and interactive map. In the text view, user can see the maximum, minimum and other descriptive statistics of the CIA result. In the histogram view, user can see how the values of resulting CIA are distributed. In the interactive map view, user can zoom and click on any point in the map and see the CIA value for chosen specific locations.
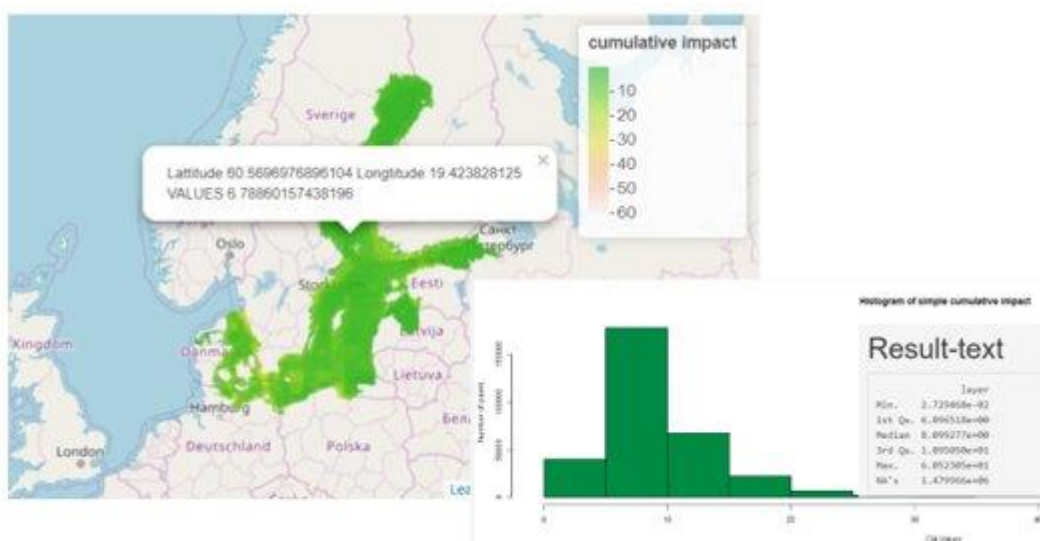

Figure 4. Data views from the current development version of the Baltic Explorer's CIA tool.

2.4 Administration Page

The system administration page enables management of user accounts and explorer workspaces in greater detail (Figure 5). The administration page is accessed using system administrator accounts. New users are created and the privileges of existing users are edited through the page. System administrators can create new, edit existing workspaces and data layers and add or remove background maps and WMS layers through the page. Local data layers in JavaScript Object Notation (JSON) file format can also be imported as new data layers into workspaces. The Baltic Explorer uses tiled background maps that are requested from web map tile services (WMTS). All background maps are required to use the same spatial reference system (EPSG:3035) and tiling scheme (e.g., resolution levels and tile size). WMS layers can be requested from any WMS service as long as the layers are provided in the spatial reference system of Baltic Explorer.

Baltic Explorer administration

AUTHENTICATION AND AUTHORIZATION		
Groups	+ Add	Change
Users	+ Add	Change

UMAP		
Background maps	+ Add	Change
Data layers	+ Add	Change
WMS layers	+ Add	Change
Workspaces	+ Add	Change

Figure 5. The administration page of Baltic Explorer.

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3   Baltic Explorer Tutorial

The prototype includes a workspace for demonstrating the different functionalities of the application. The tutorial in this section showcases the prototype's functionalities with a fictional use case where the user is tasked to plan a new wind farm to the area of their choice.

3.1   Login

To access the demo navigate to http://balticexplorer.eu in your browser (well-working browsers are Mozilla Firefox, Google Chrome, Safari and Opera). On this front page of the Baltic Explorer, you see its logo, the *Explorer* tool section, the *Analysis* tool section and previously created "Explorer workspaces" as small map blocks (Figure 2). From the upper navigation panel, choose "Log in". Log in with the username and password below.

Username: bbdemo
Password: demo1

Once logged in (as "bbdemo"), open the demo use case from the Explorer workspace list by pressing the "DEMO: Windfarms" map title. This opens a map view with HELCOM background map, wind farm points, a few user edits and three visible controls: "Enable editing", "Browse data" and "View Fullscreen". Enable fullscreen by pressing the button on the bottom right corner (Figure 3). You can exit full screen by pressing [ESC] or by pressing the "Exit Fullscreen" button on the bottom right corner. To get back to the home page, press the Baltic Explorer logo on the top left corner (Figure 3).

3.2   Browsing Features

To navigate the map use mouse scroll wheel to zoom and the primary mouse button to pan. If a touch device is being used, zooming is done with the pinch gesture and panning is done by moving a finger on the map. In order to study the displayed wind farms, open the feature browser pressing the "Browse data" button on the top left corner (Figure 3). A side panel will open on the right displaying layers and features of each layer. The map will focus on a feature and display its details by pressing the feature title on the feature browser. The details of a feature can be opened to the side panel also by pressing the feature symbol on the map.

3.3   Overlaying Data

Enable the edit mode by pressing the "Enable editing" button on the top left corner. While in the edit mode, press the "WMS layers" button (Figure 3) to open the "WMS layers" selection panel to the right. From the panel overlay data on the map by pressing any of the layer names. Open the layers that help in assessing where to plan a new wind farm. A legend for each of the open WMS layers is displayed on the top right. To hide the data and legend press the layer name again in the WMS layer panel on the right.

While in the edit mode and displaying the WMS layers of choice, navigate the map to an area suitable for a new wind farm by using mouse scroll wheel to zoom and the primary mouse button to pan. If a touch device is being used zooming is done with the pinch gesture and panning is done by moving a finger on the map. Once a suitable location is found, it's time to add a new wind farm to the location.

3.4   Adding Data

To add and edit features enable the edit mode by pressing the "Enable editing" button on the top left corner. This will open a menu with two buttons on the top right (Figure 3) that allow editing to be disabled and edits to be saved. While in the edit mode, press the "Manage layers" button from the edit menu on the top right (Figure 3). The "Layer management" panel opens to the right. Press the "Add a layer" button and give the layer a unique name and a fitting description (e.g. "This wind farm has the capacity of producing 288 MW of power.") To save the layer, press the save button on the top right. When creating new features, this layer will now be assigned to them by default.

For the purposes of this demo a polygon is created on the map to mark the area where the wind farm will be located. Individual wind turbines will be marked with point symbols on top of the polygon. To draw a polygon on the map, while in the edit mode and zoomed in close enough to the target area, press the "Draw a polygon" button. Create your wind farm area by pressing on the map to create nodes. Once your polygon is ready, click the last drawn node to finalize the shape. Finalizing the shape will open the "Feature properties" panel on the right. Fill in details about the wind farm and save the changes from the top right. To add individual wind turbines into the wind farm, press the draw a marker button from the edit menu on the top left. Press a location inside the wind farm area to add a turbine and the "Feature properties" panel will open on the right. Fill in details about the turbine and create another one. Remember to save the changes when done editing by pressing the save button on the top right while in the edit mode.

3.5   Editing Data

Notice that all the features on the map can be edited freely, even the features of other users. To try this out, while in the edit mode, open the browse data panel by pressing the "Browse data" button from the top left (Figure 3). Then from the feature list press the name of any of the features created by other users to move the map to that feature. Then press "Edit this feature" from the panel next to the title of the feature or press a symbol on the map to edit its description. Add in some relevant information (e.g. "This turbine was too close to the edge of the wind farm area") and then move the turbine closer to the centre of the wind farm by pressing the map icon of the turbine and dragging it. Remember to save the changes when done editing by pressing the save button on the top right while in the edit mode.

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4 Future Development of Baltic Explorer

The presented system is the initial prototype of Baltic Explorer and it will be further developed during the remaining half of the BONUS BASMATI project. The development uses agile principles; it is iterative and designed to adapt to changes in requirements quickly. This also requires continuous updating of the requirements and further mapping the needs of the users.

The next step in development is to finish the analysis tool prototypes that are used in the BONUS BASMATI case studies. The system will also be presented to real MSP actors, who can contribute to the direction of development efforts. The user interface will be improved as needed and suggested new functionality will be assessed and added in a prioritized order. Highest priority will be given to the functionality that is considered most crucial for real MSP.

The *Analysis* tools, that is, Cumulative Impact Assessment (CIA), co-location analysis and suitability analysis will be developed in order to be integrated in the Baltic Explorer SDSS. Demonstration of the three BONUS BASMATI case studies will be enabled through the Baltic Explorer.

Further development of the *Explorer* will focus on how the system can better support collaborative planning. While the aim so far has been to use the Explorer in group level collaborations, the web application character of the system and its current design do not rule out the possibility of it being used for a wider audience, for example, in public participatory processes.

The development will adapt principles of responsive web design in further improving the user interface of the explorer to better suit touchscreen systems of different sizes. While the interface already adapts to both smaller and larger screens, it still needs more testing, especially in environments that resemble real use cases. The current interface represents a best guess of what is needed, as more precise use cases are still to be defined. New functionality can also set new requirements for the interface. Nevertheless, the prototype enables real MSP actors to better understand what is being developed, thus enabling them to provide better input on the needed directions of future development efforts.

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Annex A. Help for the user of the prototype

Recommendations:

- Use Mozilla Firefox and Google Chrome browsers.
- Set the browser window zoom level to 100% (due to the image format of background maps in most web map applications they may not be correctly displayed at all zoom levels).
- On personal computers, the system is known to work on standard web browsers.
- On mobile devices, the system is thus far known to work on the Samsung S8 mobile phone and the Microsoft Surface Pro tablet.

Troubleshooting:

- The background map is not visible and/or the WMS layers cannot be turned on.
    - The background map and WMS layers are requested through the internet from HELCOM data and maps services. Please check that your internet connection is working. If your internet connection is working, it is likely that there is an issue in HELCOM services.

- No edit button in the Explorer tool.
    - Please check that you have signed in. Most Explorer workspaces require the user to be signed in for the edit button to appear. If you are signed in and the edit button is still not working, it is likely that you do not have edit privileges for the workspace.

- Edits are not saved.
    - There are two common occasions when edits cannot be saved:
        - No internet connection. Please check your internet connection.
        - No right to save edits. There is a known issue where in some cases users have been able to access the edit mode without having edit privileges and when not signed in. In this case, while the edit mode is available, the user will be unable to save edits.

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