

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
--	---	--

Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission (APEMAIA)

WP1103 – WebGIS Implementation

DEL005 – Practical guide for the use and maintenance of the WebGIS (SW001).

Contract n. 2023-39-HH.0

CUP n. F83D23000210005

ASI CONTRACT N°	2023-39-HH.0		
PROJECT NAME	Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission (APEMAIA)	CONTRACTOR	National Research Council – Institute of Atmospheric Pollution Research
PROJECT MANAGER	Maria Adamo (CNR-ITIAm)	DATE SUBMITTED	17/09/2026
AUTHOR	M. Aquilino, M. Adamo, S. Fuina, M. De Lucia (CNR-ITIAm)	CONTRACTOR'S REFERENCE	Issue:02 Rev.:00 Date:25/09/2026
PROJECT BEGIN DATE	26/09/2023	PROJECT END DATE	25/09/2026



Institute of
Atmospheric Pollution
Research
National Research Council of Italy

Project:
APEMAIA

Contract n.
2023-39-HH.0

Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001

Issue/Rev.:01/00

Date: 25/09/2026

Pages: 19

EXECUTIVE SUMMARY

This document provides a practical guide for the WebGIS prototype developed under WP1103 WebGIS Implementation within the APEMAIA project. It translates the work-package objectives into an operational description of platform functions, architecture, use, maintenance, security, and technical acceptance.

SW001 has been deployed as an operational WebGIS prototype for the APEMAIA project. The platform is publicly accessible at:

<https://webgis-iti-am-bari.cloud.ba.infn.it/>

The deployed platform provides catalogue, mapping, metadata, access-control and interoperability functions. It is prepared to receive project datasets, metadata records, maps and derived products.

DEL005 is the principal support material supplied with the prototype.



TABLE OF CONTENTS

1. AIM OF THE DOCUMENT	5
1.1. Scope and intended audience	5
1.2. Applicable and reference documents	5
1.3. Acronyms and abbreviations.....	6
2. PLATFORM OBJECTIVES AND APEMAIA REQUIREMENTS	7
2.1. Requirements basis and APEMAIA scope	7
2.2. Core functions	8
2.3. Users, groups and permissions	9
2.4. Future resource publication workflow.....	10
3. DATA CLASSIFICATION AND METADATA	10
3.1. Metadata principles	11
3.2. Metadata review process.....	11
4. SYSTEM ARCHITECTURE AND DEPLOYMENT.....	11
4.1. Application components	12
4.2. Software baseline	12
4.3. Containerised deployment.....	13
4.4. Network and access controls	13
4.5. Persistent data and backup.....	14
5. PLATFORM DELIVERY AND DATA RESPONSIBILITIES	14
6. USER GUIDE	14
6.1. Access and navigation	14
6.2. Discovering resources	15
6.3. Uploading datasets and documents.....	16
6.4. Metadata maintenance.....	16
6.5. Styles, maps, dashboards and GeoStories	16
6.6. Download and sharing.....	17



Institute of
Atmospheric Pollution
Research
National Research Council of Italy

Project:
APEMAIA

Contract n.
2023-39-HH.0

Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001

Issue/Rev.:01/00

Date: 25/09/2026

Pages: 19

7.	ADMINISTRATION AND MAINTENANCE	17
7.1.	Routine service checks	17
7.2.	Backup and restore	18
7.3.	Updates and security maintenance	18
7.4.	Logs, cache and storage	18
8.	DOCUMENTATION AND SUPPORT MATERIALS	18
9.	VERIFICATION AND ACCEPTANCE.....	19

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

1. AIM OF THE DOCUMENT

This document provides practical guidance for the use and maintenance of the APEMAIA WebGIS prototype developed under WP1103 WebGIS Implementation. The platform has been installed and configured on the target infrastructure and is available to authorised users through its public HTTPS address.

The guide describes the implemented platform functions, operating rules, administration and maintenance procedures. It also identifies the information that should be maintained when project datasets, metadata records, maps and other resources are subsequently published.

At the moment, SW001 will be delivered as a configured technical container without project datasets or metadata records.

1.1. Scope and intended audience

The guide covers the functions available for the future publication and management of geospatial datasets, metadata, maps, dashboards, GeoStories, and supporting documents. It also addresses user and group configuration, access permissions, containerised deployment, backup, updates, security controls, monitoring, and the supporting documentation supplied with the prototype.

It does not replace the detailed administration manuals of GeoNode, GeoServer, PostgreSQL, or the hosting infrastructure. It also does not assign responsibility for producing, validating, curating, or continuously updating project datasets and metadata. Those responsibilities remain with the organisations or project teams that own and provide the resources.

1.2. Applicable and reference documents

Reference	Document
AD 1	ASI Contract No. 2023-39-HH.0
AD 2	Subcontract CNR-IIA and DIF, Prot. CNR-IIA No. 0276290 of 21/09/2023
AD 3	Subcontract CNR-IIA and ARPA, Prot. CNR-IIA No. 0273735 of 19/09/2023
AD 4	APEMAIA DEL004 User Requirement Document, preliminary version



Reference	Document
AD 5	APEMAIA DEL006 Dissemination and Exploitation Plan
AD 6	APEMAIA DEL001.1 Progress Report, including the Preliminary Validation Plan

1.3. Acronyms and abbreviations

Acronym	Description
APEMAIA	Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission
ASI	Agenzia Spaziale Italiana
CNR-IIA	National Research Council of Italy, Institute of Atmospheric Pollution Research
CSW	Catalogue Service for the Web
GIS	Geographic Information System
GWC	GeoWebCache
OGC	Open Geospatial Consortium
PM	Particulate matter
VM	Virtual machine
WebGIS	Web Geographic Information System
WFS	Web Feature Service

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

Acronym	Description
WMS	Web Map Service
WP	Work Package

2. PLATFORM OBJECTIVES AND APEMAIA REQUIREMENTS

The WebGIS prototype will provide an integrated technical environment in which authorised project teams may subsequently publish and share research products. At delivery, the platform is considered an empty container: it provides the catalogue, mapping, access-control, and interoperability functions.

2.1. Requirements basis and APEMAIA scope

The functional scope of SW001 is based on the preliminary requirements study carried out for a broader CNR-IIA data-sharing platform. For this deliverable, only the capabilities relevant to the APEMAIA project have been retained and reformulated. Institute-wide governance processes and requirements concerning unrelated research groups are not part of the APEMAIA implementation.

Experience gained from an earlier experimental GeoNode environment helped identify practical needs concerning catalogue navigation, metadata, access permissions, maps and operational maintenance. SW001 is nevertheless a new implementation configured specifically for APEMAIA; the previous environment is not part of the delivered system or its acceptance evidence.

The adopted requirements describe capabilities of the technical container. Because SW001 is delivered without a committed population of project resources, acceptance verifies that these functions are available and can be demonstrated with temporary test content, not that project datasets or metadata have already been supplied.

Requirement	APEMAIA scope adopted for SW001
APE-DR-01	Manage raster resources used by APEMAIA, including GeoTIFF at least.
APE-DR-02	Manage common geographic vector resources and their coordinate reference information.
APE-DR-03	Associate tabular files and supporting project documents, including CSV, spreadsheet, PDF and image resources.
APE-FR-01	Provide administrative management of users, groups, roles and resource-level permissions.
APE-FR-02	Allow authorised users to upload or register resources and describe them with title, abstract, project, owner, creator, keywords, licence, spatial coverage and temporal coverage.
APE-FR-03	Support catalogue discovery and filtering by project, resource type, keyword, owner and spatial or temporal characteristics.
APE-FR-04	Preview geographic resources and allow authorised users to configure layer styles and combine resources into interactive maps.
APE-FR-05	Support time-enabled visualisation when the source resource and configured service expose temporal information.
APE-FR-06	Support controlled sharing and download according to ownership, licence and assigned permissions.
APE-IR-01	Expose the required geospatial services through standard OGC interfaces and the approved reverse-proxy paths.

2.2. Core functions

GeoNode provides the functional basis of the platform. The planned configuration supports the following activities:

- upload geospatial datasets and supporting documents, including vector, tabular, raster, PDF, image, and video resources;
- create, review, and maintain metadata associated with each resource;
- edit vector geometries and attributes when the contributor has the required permissions;
- apply cartographic styles and preview published layers;
- combine resources into maps, dashboards, and GeoStories;
- search, filter, group, visualise, and download resources through the catalogue;
- manage time-enabled views where the source data include temporal information;
- control access and editing privileges through user profiles and groups.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

2.3. Users, groups and permissions

Access can be profile-based when user accounts and project resources are introduced. Each user should authenticate with an individual account and receive permissions consistent with their assigned role and group membership.

Role	Typical responsibility
Platform administrator	Manage configuration, services, users, global permissions, backups, updates, and incident response.
Group manager	Manage group membership and review the publication and sharing rules applied to group resources.
Contributor	Upload datasets and documents, complete metadata, configure styles, and create maps or other derived resources.
Registered user	Discover and use resources according to the permissions granted by owners and groups.
Anonymous visitor	Access only resources explicitly approved for public dissemination.

Table 1-User roles and responsibilities in the WebGIS platform.

The prototype supports platform administrators, group managers, contributors, registered users, and anonymous visitors; the definitive assignment of these roles remains an operational decision for the platform owner.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
--	---	--

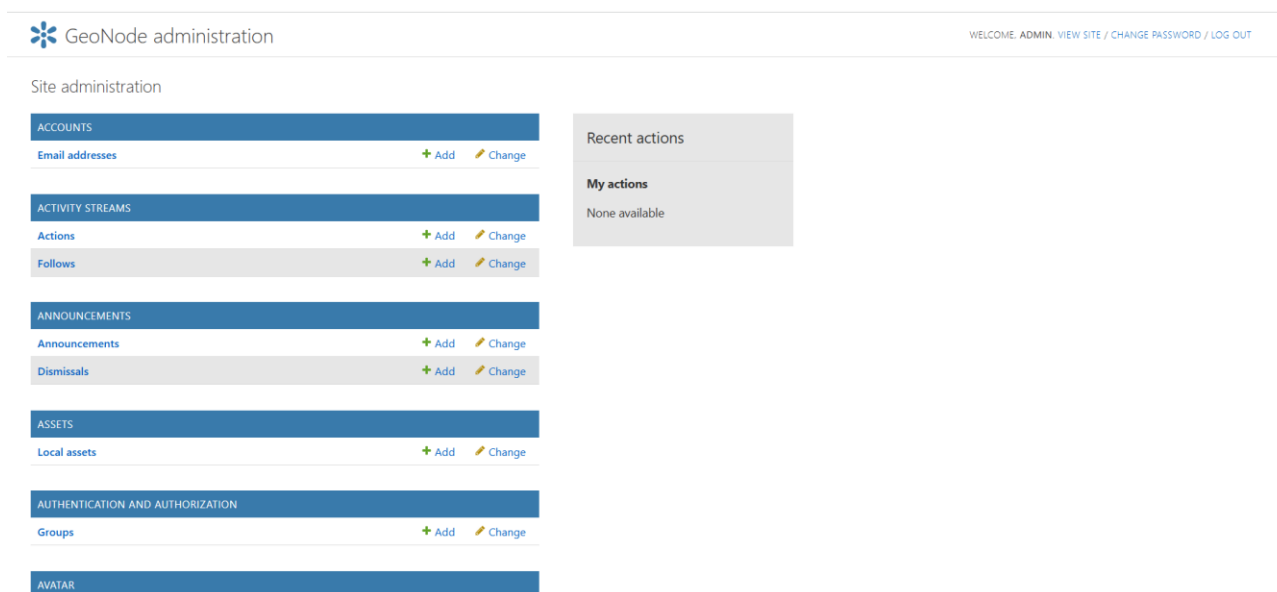


Figure 2-1: Administrative interface supporting management of platform resources, users and publication settings.

2.4. Future resource publication workflow

1. The contributor verifies the source file, coordinate reference system, ownership, licence, and publication constraints.
2. The resource is uploaded to the platform or registered as an approved remote service.
3. Mandatory metadata and the agreed classification fields are completed.
4. The contributor checks the preview, extent, attributes, temporal information, and cartographic representation.
5. Permissions are assigned to the relevant users, groups, registered community, or public audience.
6. The group manager or designated reviewer performs the publication review when the adopted workflow requires approval.
7. The published resource is tested through catalogue search, visualisation, and authorised download.

3. DATA CLASSIFICATION AND METADATA

When the platform is populated, resource owners should adopt a shared classification system to organise information assets contributed by different research groups. Categories, keywords, responsible groups, projects, spatial coverage, temporal coverage, and resource types should use agreed values wherever possible. Definition and maintenance of those values are data-governance responsibilities and are not part of delivery of the empty technical container.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

3.1. Metadata principles

Metadata provide structured information that can be interpreted by users and software. Each record should enable a third party to identify the resource, understand its purpose and limitations, determine its origin and responsible parties, and establish whether and how it can be accessed or reused.

- descriptive metadata, including title, abstract, topic, keywords, spatial and temporal extent;
- administrative metadata, including owner, responsible organisation, licence, access conditions, and publication status;
- technical metadata, including format, coordinate reference system, data type, lineage, and update frequency;
- structural metadata describing relationships among datasets, maps, documents, services, and derived products;
- quality and use information, including validation status, known limitations, and appropriate applications.

3.2. Metadata review process

Before any future public release, the group that owns the resource should verify that required fields are complete, terminology follows the agreed scheme, links and contacts are current, access conditions are explicit, and the abstract allows a user outside the producing team to understand the resource. Geographic resources should also be checked for coordinate reference system, bounding box, spatial resolution, and temporal extent. These checks concern future content governance rather than acceptance of the initially empty SW001 container.

4. SYSTEM ARCHITECTURE AND DEPLOYMENT

GeoNode is composed of specialised services rather than a single application. The services exchange data through an internal container network and expose the user interface through a reverse proxy. Persistent data must be stored outside the lifecycle of individual containers.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
--	---	--

4.1. Application components

Component	Role
Nginx	Terminates or proxies web traffic and exposes the GeoNode and GeoServer paths through the approved public endpoints.
GeoNode and Django	Provide the catalogue, accounts, permissions, metadata workflows, APIs, and application logic.
Celery and Redis	Execute and coordinate background activities required by the application.
MapStore	Provides interactive maps, dashboards, and GeoStories in the web client.
GeoServer and GeoWebCache	Publish OGC services, render layers, enforce geospatial access rules, and cache map tiles.
PostgreSQL and PostGIS	Store application information and spatial datasets.
pyCSW	Supports standards-based catalogue interoperability.

Table 2-Main components of the WebGIS platform and their respective roles.

4.2. Software baseline

The implementation baseline adopted for SW001 is GeoNode 5.1.0 with GeoServer 2.28.5 and GeoTools 34.5, PostgreSQL 15 with PostGIS 3.5, and Redis 7 on Ubuntu Server 24.04 LTS.

The deployed implementation baseline is GeoNode 5.1.0 with GeoServer 2.28.5 and GeoTools 34.5, PostgreSQL 15 with PostGIS 3.5, and Redis 7 on Ubuntu Server 24.04 LTS. The services are deployed through Docker Compose using persistent storage and recorded container-image digests.

This baseline was selected as a maintained and mutually compatible component set suitable for providing catalogue, mapping, metadata, access-control and interoperability capabilities required by APEMAIA.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.: 01/00 Date: 25/09/2026 Pages: 19
--	---	---

Future updates should be assessed and tested as a compatible set of components rather than by replacing individual services independently.

4.3. Containerised deployment

Docker Compose is the reference orchestration method for the proposed single-VM installation. Each service runs in a dedicated container, while networks and persistent volumes define communication and data retention. This model supports repeatable installation and controlled replacement of application containers without discarding databases, uploaded resources, or configuration data.

The production deployment uses Docker Compose on a single virtual machine with a dedicated persistent data volume. Application services communicate through an internal container network, while the public interface is provided through a reverse proxy.

PostgreSQL, Redis, GeoNode application services and GeoServer are not directly exposed to the public network. Public access is provided through the HTTPS endpoint of the reverse proxy.

4.4. Network and access controls

Endpoint	Production rule
TCP 443	Public HTTPS access through the reverse proxy.
TCP 80	Not routinely exposed. It is opened temporarily, on request, only for ACME HTTP-01 certificate issuance or renewal, and may be closed again after successful validation.
TCP 22	Administrative SSH access restricted to authorised networks or VPN and public-key authentication.
TCP 8000 and 8080	GeoNode and GeoServer application ports remain internal or bound only to the loopback interface for testing.
TCP 5432 and 6379	PostgreSQL and Redis remain accessible only within the container network.

Table 3-Network endpoints and their production access rules.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

4.5. Persistent data and backup

At delivery, the backup scope must include the initial databases, the GeoServer data directory, environment and deployment configuration, and the information required to reproduce the running image set.

When the platform is populated, uploaded media and other persistent project resources must also be included. Backups should be written to storage independent of the VM and accompanied by integrity checks.

- perform scheduled logical backups of the GeoNode and spatial databases;
- archive uploaded files, GeoServer configuration, and deployment configuration;
- protect secrets separately and avoid storing unencrypted credentials in the backup catalogue;
- record checksums and backup completion logs;
- perform periodic test restores in an isolated environment;
- retain a documented rollback point before each application or database upgrade.

5. PLATFORM DELIVERY AND DATA RESPONSIBILITIES

SW001 has been delivered as a configured and functioning WebGIS platform for APEMAIA. The service is available at <https://webgis-iti-am-bari.cloud.ba.infn.it/> and provides the technical functions required for catalogue management, access control, visualisation and publication of interoperable geospatial resources.

The platform is not intended to imply a committed final catalogue of project content at delivery. Project datasets, metadata, maps and derived products may be published subsequently by authorised users, subject to scientific validation, ownership, licensing, confidentiality and publication decisions by the relevant resource owners.

6. USER GUIDE

6.1. Access and navigation

The platform is available at <https://webgis-iti-am-bari.cloud.ba.infn.it/>. Users access public resources through the HTTPS interface; administrative and editing functions require authentication with an authorised account. After authentication, the main navigation provides access to datasets, maps, GeoStories, dashboards, documents, groups and the personal profile. The functions displayed depend on the account permissions.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> APEMAIA Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.: 01/00 Date: 25/09/2026 Pages: 19
--	---	---

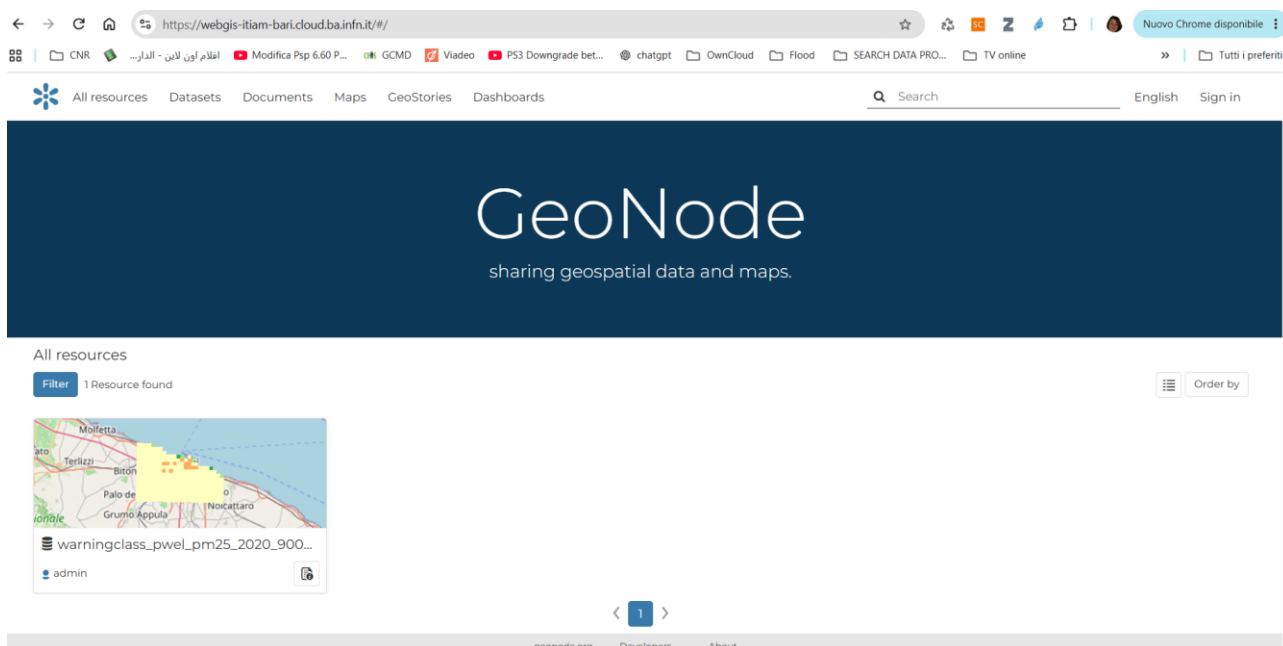


Figure 6-1: – Public APEMAIA WebGIS homepage and resource catalogue, available through the HTTPS service endpoint.

6.2. Discovering resources

Here, some simple instructions for discovering uploaded resource:

1. Open the resource catalogue.
2. Enter a keyword or use the available filters for resource type, category, owner, group, date, region, or keyword.
3. Open the resource page and review the abstract, responsible party, spatial and temporal coverage, licence, and access permissions.
4. Use the preview or map view to inspect the resource before downloading or reusing it.



Institute of
Atmospheric Pollution
Research
National Research Council of Italy

Project:
APEMAIA

Contract n.
2023-39-HH.0

Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001

Issue/Rev.:01/00

Date: 25/09/2026

Pages: 19

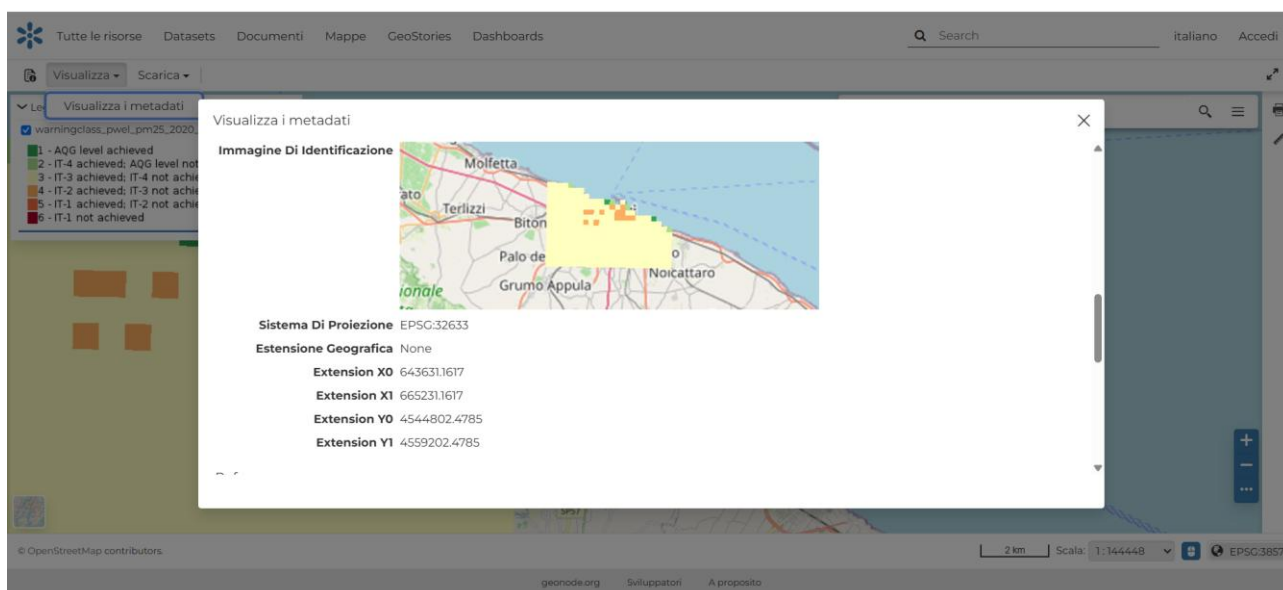


Figure 6-2: Example of a resource detail page showing descriptive metadata, access information and geographic preview.

6.3. Uploading datasets and documents

Here, the list of instructions for uploading additional resource:

1. Select the appropriate upload or add-resource command.
2. Choose the validated source file and any required companion files.
3. Confirm the detected resource type and coordinate reference information.
4. Complete the mandatory metadata and shared classification fields.
5. Assign ownership and access permissions.
6. Save the resource, verify the preview, and correct any validation warning before publication.

6.4. Metadata maintenance

Resource owners are responsible for keeping descriptions, contacts, licences, update frequency, temporal coverage, and related links current. Metadata should be revised whenever the underlying dataset is replaced, its scope changes, or its access conditions are modified.

6.5. Styles, maps, dashboards and GeoStories

Contributors may configure the visual style of a layer and combine approved resources into maps. Dashboards may add charts or indicators linked to map content, while GeoStories provide a narrative sequence that combines maps, text, images, and other media. Derived products must retain clear links to their source datasets and respect the permissions applied to those sources.



6.6. Download and sharing

Download options depend on the resource type, available formats, and assigned permissions. Before sharing a resource outside the project, users must verify that public access is authorised, the licence is explicit, sensitive attributes are absent, and the metadata identify the correct responsible organisation.

7. ADMINISTRATION AND MAINTENANCE

7.1. Routine service checks

The designated platform operator should check container health, application logs, database availability, disk utilisation, backup results, certificate expiry, and the availability of the public interface. A service that restarts repeatedly or reports an unhealthy state should be investigated before public use continues.

Check	Expected evidence
Container status	All required services are running and report a healthy state where health checks are defined.
Web access	The public HTTPS homepage, authenticated access, catalogue navigation and the main administration functions have been verified in the deployed environment.
GeoServer access	OGC requests are reachable only through the approved reverse-proxy path.
Database	Both application and spatial databases accept internal connections and have recent successful backups.
Storage	System and data volumes remain below the agreed utilisation threshold; logs and caches are controlled.

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> APEMAIA Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
--	---	--

Check	Expected evidence
Certificates	The initial HTTPS certificate issuance and public HTTPS access have been verified. Certificate renewal follows the documented manual operational procedure.

Table 4-Acceptance checks and expected evidence for the WebGIS platform delivery.

7.2. Backup and restore

Backup completion is not sufficient evidence of recoverability. At an agreed interval, the designated platform operator should restore the databases and configuration archives into an isolated test environment and verify that the initial application state and administrative access are recovered. After future population, the restore test should also cover the persistent resources then present in the platform.

7.3. Updates and security maintenance

The platform operator should perform regular backups and verify that the system can be restored. Updates should be preceded by a backup and, where practicable, tested in a separate environment, followed by basic functional and security checks.

Databases and internal services should not be publicly exposed. The production configuration should retain the available security protections, avoid unrestricted access rules and default administrative passwords, and use documented software versions.

7.4. Logs, cache and storage

Application, reverse-proxy, GeoServer, database, and system logs should be retained according to an agreed policy and rotated before they can exhaust the system volume. GeoWebCache content is reproducible and should not be treated as the sole copy of source data. Cache growth must be monitored and limited according to available storage and service demand.

8. DOCUMENTATION AND SUPPORT MATERIALS

DEL005 is the principal practical support material for the use and maintenance of SW001. Selected screenshots or annotated images may be added where they materially improve understanding of access, navigation, resource upload, metadata entry, permissions and routine administration.

Further technical information is available in the official documentation:

 Institute of Atmospheric Pollution Research National Research Council of Italy	<i>Project:</i> <i>APEMAIA</i> Contract n. 2023-39-HH.0	Doc. N.: DEL_005_CNR_ITIAm_RF_EN-001 Issue/Rev.:01/00 Date: 25/09/2026 Pages: 19
---	---	--

- GeoNode: <https://docs.geonode.org/>
- GeoServer: <https://docs.geoserver.org/>

Users and administrators should refer to documentation compatible with the deployed software baseline.

Manual section	Purpose
User procedures	Explain access, catalogue navigation, upload, metadata, permissions, maps, downloads, and sharing functions available when the platform is populated.
Administration procedures	Describe service checks, logs, backup, restore, security updates, certificates, storage, and incident information required by the designated operator.
Optional illustrations	Selected screenshots or annotated images may be added to clarify steps that are difficult to understand from text alone.

Table 5-Structure and purpose of the platform operational manual.

9. VERIFICATION AND ACCEPTANCE

The WebGIS prototype has been installed and made accessible in the target environment. Public HTTPS access, administrative authentication, catalogue navigation, GeoServer integration and the publication workflow for a test geospatial resource have been verified.

Delivery concerns the configured operational platform and this practical guide. The subsequent population, scientific validation and curation of project resources remain the responsibility of the relevant resource owners.