Irish INSPIRE Implementation Programme

INSPIRE Network Services and Data Specifications pilot

Project Report and Recommendations

INSPIRE Technical Sub-committee
September 2012

Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

Marine Institute
Foras na Mara

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

Purpose of this document

This report documents the findings of the Irish Spatial Data Infrastructure (ISDI) pilot project for INSPIRE data publishing and Network Services. The primary audience for this report is the ISDI/INSPIRE Committees and the DPER Spatial Information Working Group. This report delivers a description of the technical requirements and an example of a solution for the publication of Irish INSPIRE data services. This report also makes a number of recommendations to advise government and other public bodies on what is required to meet their spatial data publishing obligations under the terms of the INSPIRE Directive.

Version History

Version	Contributors	Organisation	Description	Release Date
1.0	Gareth John, Trevor Alcorn	DECLG/Marine Institute/DAHG	First public release	11/09/2012

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1. Introduction

1.1. Overview of INSPIRE Directive

The implementation of an Irish Spatial Data Infrastructure has been legally mandated by the INSPIRE Directive (2007/2/EC) of the European Parliament establishing an Infrastructure for Spatial Information in the European Community. The INSPIRE Directive entered into force on the 15th May 2007 and was transposed into Irish law through Statutory Instrument 382/2010.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas:

- Metadata
- Data Specifications
- Network Services
- Data and Service Sharing
- Monitoring and Reporting

These Implementing Rules are adopted as Commission Decisions or Regulations, and are binding in their entirety.

1.2. Aim of INSPIRE pilot project

The Department of Arts, Heritage and the Gaeltacht (DAHG) and the Marine Institute (MI) are both defined as Legally Mandated Organisations under the terms of the INSPIRE Directive. Both organisations are partners in the Irish Spatial Data Infrastructure (ISDI) project and are required under the INSPIRE Directive to publish spatial data on the environment following specific INSPIRE **Data Specifications** (data models) and to publish them on the internet using web services called "**Network Services**".

The aim of this pilot project was to explore the level of effort required to satisfy the Implementing Rules for INSPIRE Data Specifications and Network Services. The results of this pilot project will be used to inform and advise other public bodies in the Irish Spatial Data Infrastructure on the effort required to meet their obligation as legally mandated organisations under the INSPIRE Directive.

This pilot is a pathfinder project for the Work Package #9 and Work Package #10 deliverables detailed in the **Irish INSPIRE Implementation Programme**[1].

1.3. Project Objectives

The project outline objectives are defined as follows:

- Assess the effort involved in transforming spatial data under the administration of the Department of Arts, Heritage and the Gaeltacht and the Marine Institute (MI) into the INSPIRE Protected Sites Data Specification model.

- Assess the effort required to represent and maintain the Protected Sites Data Specification model on the internet as Network Services.

[1]. Department of Environment, Community and Local Government. INSPIRE Technical sub-committee (2011). Irish INSPIRE Implementation Programme.

- Evaluate the effectiveness of the ArcGIS for INSPIRE software for delivering a compliant solution to meet Irish public bodies obligations for INSPIRE Data Specifications and Network Services.

- Examine the feasibility of a cost-efficient 'Shared Service' approach for INSPIRE network services and ISDI delivery.

- Test the Network Services and hosting solutions against the Quality of Service requirements of the INSPIRE Network Services Regulation.

- Investigate licensing and security options for INSPIRE Network Services.

- Use the experience gained in this pilot to advise other Irish Spatial Data Infrastructure partners on the level of effort required to conform with the INSPIRE Directive and associated regulations.

- Leverage the investment made in INSPIRE implementation to improve spatial data sharing and modelling in the Irish public sector.

1.4. Project Design

Design Phase

The initial design phase of the pilot project was carried out by the project partners through research and in consultation with ESRI Ireland, Con terra and with advice from Land and Property Services Northern Ireland. Best practice and pilot implementations from other EU public authorities involved in INSPIRE were also examined, in particular the UK Location Programme and the UK Open Data portal: data.gov.uk.

The outcome of the project design consultation phase was to subdivide the project into distinct delivery areas:

Delivery areas

- INSPIRE Data Specification Audit
- INSPIRE Data Specification Transformation
- INSPIRE Network Services Publishing
- INSPIRE Service Metadata publishing
- INSPIRE Data Sharing and Licensing arrangements
- INSPIRE Compliance Testing
- Recommendations for INSPIRE/ISDI Implementation

Specific deliverables

The following table lists the specific deliverables for this project by the relevant delivery area:

INSPIRE Data Specification Audit
Deliverable(s):
➢ List of spatial data sets and spatial data objects for each INSPIRE Data Specification in the pilot

INSPIRE Data Specification Transformation
Deliverable(s):
➢ Source data sets are transformed into the required INSPIRE Data Specification compliant GML schema. ➢ ISDI re-use cases in other public bodies examined.

INSPIRE Network Service Publishing
Deliverable(s):
➢ INSPIRE Protected Sites data published through INSPIRE compliant Network Services. ➢ ArcGIS for INSPIRE View and Download Service solution tested against the INSPIRE Implementing Rules for Network Services.

INSPIRE Service Metadata Publishing
Deliverable(s):
➢ INSPIRE compliant service and data set metadata created for Protected Sites services using the ISDI Metadata Profile. ➢ INSPIRE compliant service metadata published through the ISDI Discovery Service and harvested by the EU Geoportal.

INSPIRE Data Sharing and Licensing
Deliverable(s):
➢ INSPIRE licensing terms agreed. ➢ INSPIRE Data Sharing Agreement signed by project partners ➢ INSIRE Network Services licensing and security solution evaluated.

INSPIRE Compliance Testing
Deliverable(s):
➢ Design a methodology for INSPIRE compliance testing ➢ Evaluate INSPIRE compliance testing tools

Recommendations for INSPIRE/ISDI Implementation
Deliverable(s):
➢ Recommendations to INSPIRE Steering committee on INSPIRE implementation strategy ➢ Recommendations on leveraging investments made for INSPIRE to increase spatial data sharing between Irish public bodies.

Table 1. INSPIRE pilot project deliverables

2. INSPIRE Data Specification Audit

2.1. INSPIRE Protected Sites Data Specification overview

The INSPIRE Protected Sites Data Specification (Version 3.1) was chosen as the theme to be delivered for this pilot project. The Data Specification documentation is available for download from the INSPIRE website.[2]

The Data Specification documentation defines INSPIRE Protected Sites as being located in terrestrial, aquatic and marine environments, and may be under either public or private ownership. They may include localities with protection targets defined by different sectors and based on different objectives. Objectives for protection may include: the conservation of nature; the protection and maintenance of biological diversity and of natural resources and the protection of person-made objects including buildings, prehistoric and historic archaeological sites, other cultural objects, or sites with specific geological, hydrogeological or geomorphological value. Protected Sites may receive protection due to more than one type of objective, and may have a double or multifarious designation status.

Protected sites may differ greatly in their reasons for protection, their designation and their management. Examples of legislation under which Protected Sites included in this INSPIRE theme are designated, managed and regulated include:

- the Habitats Directive (1992) (Directive 92/43/EC);
- the Birds Directive (1979) (Directive 79/409/EC);
- the Water Framework Directive (2000) (Directive 2000/60/EEC)
- Marine Strategy Framework Directive (2008) (Directive 2008/56/EC)
- the World Heritage Convention (1975);
- the Ramsar Convention (1971);
- the Barcelona Convention (1976);
- the Helsinki Convention (1974);
- the OSPAR Convention (1992) and
- the national laws of each European country and EU and international sector policies (for example, relating to nature conservation, forests or fisheries).[3]

The features to be included in the INSPIRE Data Specification on Protected Sites must have the following characteristics:

- Protected Sites have a **known location, boundary and area**, based on formal, legal or administrative agreements. i.e. has a polygon area/boundary

- The protection of the site must be defined by **legislation** (whether international, European Community or national)

- The protection of the Site must be for **specific conservation objectives**, whether nature, cultural or other conservation.

- Protected Sites may overlap if they are of a different designation, but do not necessarily provide complete and contiguous coverage of an entire Member State.

[2] European Commission (2010), INSPIRE Data Specification on *Protected sites* – Guidelines, version 3.1. Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2

[3] Ibid. p.4

2.2. Audit methodology

The audit for INSPIRE spatial data sets followed the methodology outlined in the *Guidelines for INSPIRE Implementation in Public Bodies*[4], with an additional view to prioritising the data sets that contain spatial objects specifically mentioned in the Data Specification model documentation.

2.3. Protected Sites data sets identified

The following data sets were identified for the Irish implementation of the Protected Sites Data Specification deliverable:

Public body	Spatial data set identified	Relevant Legislation
Department of Arts, Heritage and the Gaeltacht	Special Areas of Conservation (SAC)	Habitats Directive 1992 (Natura 2000)
Department of Arts, Heritage and the Gaeltacht	Special Protection Area (SPAs)	Birds Directive 1979 (Natura 2000)
Department of Arts, Heritage and the Gaeltacht	Natural Heritage Area (NHAs)	Wildlife Amendment Act 2000
Department of Arts, Heritage and the Gaeltacht	Sites and Monuments Record/ Record of Monuments and Places	National Monuments Act(s)
Local Authorities (many)	Record of Protected Structures	Planning and Development Act 2000
Local Authorities (many)	Architectural Conservation Areas	Planning and Development Act 2000
Local Authorities (many)	Tree Preservation Orders	Planning and Development Act 2000
Geological Survey of Ireland	Geological Heritage Sites	Habitats Directive 1992 (Natura 2000)/ Wildlife Amendment Act 2000
Marine Institute	Biologically Sensitive Area	Marine Strategy Framework Directive (2008)
Marine Institute	Designated Marine Protected Area	Habitats Directive 1992 (Natura 2000)
Marine Institute	Offshore Special Areas of Conservation (SAC)	Habitats Directive 1992 (Natura 2000)
Department of Arts, Heritage and the Gaeltacht /Marine Institute	Onshore Special Areas of Conservation (SAC)	Habitats Directive 1992 (Natura 2000)

Table 2. Spatial data sets identified for INSPIRE Protected Sites Data Specification

[4] Department of Environment and Local Government (2011), *Implementing the INSPIRE Directive regulations in public bodies*, Dublin. Available: http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,27309,en.pdf

3. INSPIRE Data Specification Transformation

3.1. Overview

The INSPIRE directive classifies spatial data into 34 environmental spatial data themes, which are listed in Annexes 1, 2 and 3 of the directive. Each of the spatial data themes has its own **Data Specification** model associated with it. The Data Specification documentation aims to harmonise datasets to facilitate the identified INSPIRE spatial data theme use case requirements. This will ensure their interoperability between public bodies and the wider European INSPIRE network.

The initial ISDI guidelines to the Irish INSPIRE regulations suggested two separate approaches for the publication of Irish INSPIRE Data Specifications: [5]

Option 1: Public bodies publish their own spatial data to INSPIRE schema

> *This involves public bodies transforming their spatial data into the relevant INSPIRE Data Specification schema themselves for publication. Integration into the national version of the INSPIRE spatial data theme will occur through web services and will be presented through the national ISDI Geoportal website.*

Option 2: Public bodies publish spatial data via a central ISDI transformation service to INSPIRE Schema

> *This involves public bodies supplying their data in its native format to a central resource, either through on-line services or offline means. The data is then transformed either automatically or manually into the relevant national view of the INSPIRE spatial data theme and published into the INSPIRE network.*

This pilot examines Option 2 with the Department of Arts, Heritage and the Gaeltacht acting as the central shared transformation service manually transforming the source data into the INSPIRE model.

3.2. Publishing INSPIRE Protected Sites as a 'Shared Service'

The DAHG has been proposed to act as a test 'ISDI Shared Service' provider for the INSPIRE Protected Sites Data Specification and transforms/publishes other public bodies source spatial data (GSI and multiple local authorities). The DAHG owns the majority of the spatial data identified under the INSPIRE Protected Sites theme, and has an existing GIS publishing capability in-house.

Public body	**Protected Sites spatial data set to be published**
Department of Arts, Heritage and the Gaeltacht	Special Areas of Conservation (SAC)
Department of Arts, Heritage and the Gaeltacht	Special Protection Area (SPAs)
Department of Arts, Heritage and the Gaeltacht	Natural Heritage Area (NHAs)
Department of Arts, Heritage and the Gaeltacht	Sites and Monuments Record/ Record of Monuments and Places
Local Authorities (approx. 34)	Record of Protected Structures
Local Authorities (approx. 34)	Architectural Conservation Areas
Local Authorities (approx. 34)	Tree Preservation Orders

[5] Ibid. p. 18

Geological Survey of Ireland	Geological Heritage Sites

Table 3. List of DAHG Shared Service data sets.

3.3. DAHG business case to act as Protected Sites Shared Service provider

The DAHG also has an incentive to publish other public bodies' spatial data at a national level as they have a re-use case for the spatial data sets produced by the local authorities and the Geological Survey of Ireland.

Record of Protected Structures (RPS)

There is an identified re-use case at a national level for policy purposes and for local authority reporting under the Planning and Development Act 2000. Local Authorities are obliged to inform DAHG of any additions, deletions or amendments to the RPS under the Act.

Architectural Conservation Areas (ACA)

The Architectural Conservation Area (ACA) data set is complimentary to the Record of Protected Structures in that it aims to identify areas of special character and architectural interest and to preserve that special character. It is created under the Planning and Development Act 2000.

Geological Heritage Areas

The Irish Geological Heritage Programme is identifying and selecting the very best national sites for NHA designation, to represent the country's geology. It is also identifying many sites of national or local geological heritage importance, which are classed as County Geological Sites (CGS). The National Parks and Wildlife Service are interested in compiling this data set to a national level to use as a reference in their NHA designation workflow.

Tree Preservation Orders (TPOs)

Tree Preservation Orders are also of an interest for re-use at a national level for biodiversity assessment and conservation. The data set is created under the requirements of the Planning and Development Act 2000.

3.4. Protected Sites shared service re-use in other public bodies

In line with the objectives of the National Spatial Strategy[6] and the Irish Spatial Data Infrastructure[7] (ISDI) policy, these data sets when collated to national level for INSPIRE by DAHG will also be made available to other government public bodies that have a business re-use case for the data sets, the main re-use cases would be in:

- Heritage Council
- Department of Environment, Community and Local Government (MyPlan GIS system)
- Property Registration Authority of Ireland
- Local Authority Development Plans
- Water Framework Directive reporting

[6] Department of Environment and Local Government (2002), *The National Spatial Strategy, 2002 – 2020, 'People, Places and* Potential', Dublin.

[7] Department of Environment and Local Government (2002), *Irish Spatial Data Infrastructure Consultation*. Available: http://www.irishspatialstrategy.ie/isdi

- Marine Strategy Framework Directive reporting

3.5. Standardising local authority data sets – ISDI national data schemas

It will be necessary to devise a harmonised national data schema for the local authority spatial data sets to meet the needs of the ISDI shared service re-use cases mentioned above. It is intended that the ISDI publishing schemas will be a 'stepping stone' to the INSPIRE Data Specification (the INSPIRE Protected Sites model is less detailed).

3.6. Proposed Local Authority ISDI/INSPIRE publishing workflow

The diagram below outlines a proposed publishing workflow which is designed to maximise the re-use of the shared spatial data that will be collected from local authority sources for the Irish INSPIRE Protected Sites services. The re-use of regional level data through national level spatial data services will mean that further data sharing benefits will be realised for the Irish Spatial Data Infrastructure before publishing into the INSPIRE model at the European level.

This approach will be recommended for all the local authority data sets that are listed under the different INSPIRE themes. This is deemed to be the most cost-efficient method of publishing INSPIRE data from local authorities and reflects the approach that is being taken for local authorities in Northern Ireland and in the UK

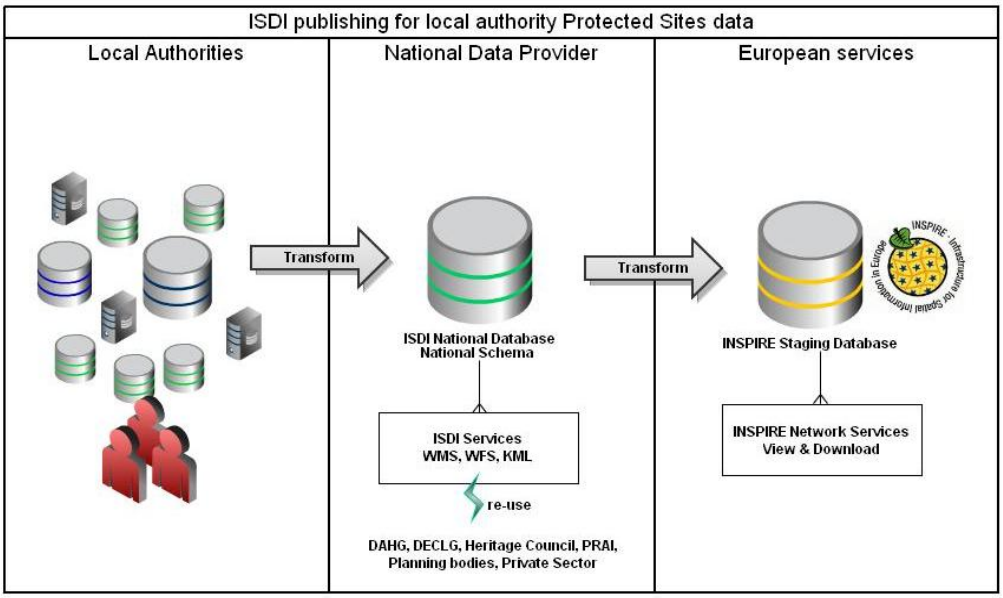


Figure 1. Proposed workflow for local authority INSPIRE Protected Sites data publishing

3.7. ISDI national data schemas

It is proposed that national level re-use cases will be looked at for each dataset and where necessary an ISDI national data schema will be introduced for publication. This centralised national level approach has already been used in the MyPlan project run by DECLG to collate the Development Plan zoning data from every local authority.

3.8. Pilot INSPIRE transformation solution

For this pilot project the project partners elected to evaluate the ArcGIS for INSPIRE[8] software from ESRI Ireland and con terra INSPIRE Solution Pack for INSPIRE[9] workbench to transform their in-house source data into the INSPIRE Protected Sites Data Specification schemas.

3.9. Con terra INSPIRE Solution Pack for FME and ArcGIS for INSPIRE

ESRI Ireland drew on the expertise of a partner company Con terra to provide an implementation of their INSPIRE Solution Pack for INSPIRE, an FME workbench solution which was used to transform the DAHG and MI spatial data sets into the target INSPIRE Data Specifications and GML models.

The FME software was used to harmonise the disparate data sources to the common destination model. This is carried out through a process called 'schema mapping' via FME Workbench Transformers, which involves logically mapping the attributes and geometry of the local source data to the required geometry and attributes of the GML schema for the Protected Sites Data Specification. The ESRI approach uses an ESRI 'staging' geodatabase which has tables and fields that are based on the INSPIRE Protected Sites GML schema.

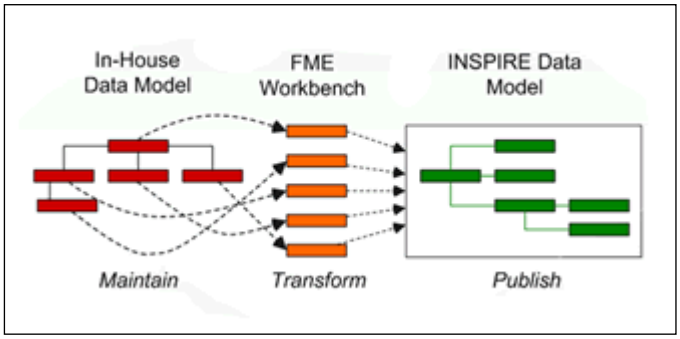


Figure 2. INSPIRE schema mapping workflow.
(Source: Image courtesy of Con terra)

The compliant INSPIRE Protected Sites GML and Network Services are published from the ESRI INSPIRE staging geodatabase through the ArcGIS for INSPIRE software (an add-on to ESRI ArcGIS Server).

[8] ESRI Inc. ArcGIS for INSPIRE web page. Available: http://www.esri.com/software/arcgis/arcgis-for-inspire/index.html
[9] Con terra GmbH. Conterra Solution Pack for INSPIRE web page . Available: http://www.conterra.de/en/products/fme/desktop/desktop-inspire-solution.shtm

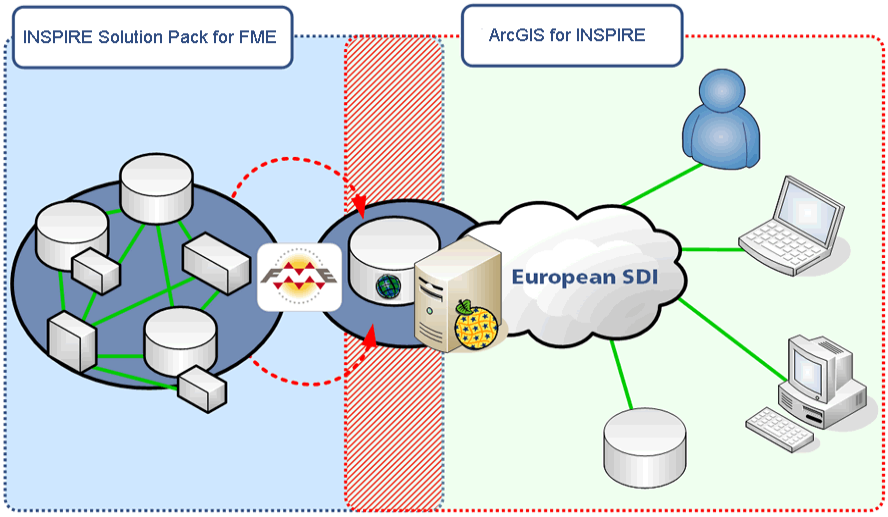


Figure 3. INSPIRE data publishing solution using Con terra INSPIRE Solution Pack for FME and ArcGIS for INSPIRE (Source: Image courtesy of Con terra)

3.10. Protected Sites schema mapping

For this pilot it was decided to use the Simple Schema option from the Protected Sites Data Specification[10]. The Protected Sites model is one of the easier models to implement in the Annex 1 Data Specifications; there is only one Feature Type, a "Protected Site", and many of the attributes are voidable.

Protected Sites Schema (Simple)

Feature Type	Attribute	Obligation (Mandatory / Optional)	Voidable Yes /No	Description
Protected Site				
	Geometry	M	N	
	inspireID	M	N	Global Unique identifier with a versioning element[11]
	legalFoundationDate	M	Y	Real world object date
	legalFoundationDocument	M	Y	URL to relevant Protected Sites legislation
	siteDesignation	M	Y	INSPIRE Protected Sites classification code list of different designations e.g. Natura 2000, UNESCO, Ramsar, etc. Can have >1 per site.
	siteName	O	Y	Name of site. May be expressed in different

[10] European Commission (2010), INSPIRE Data Specification on *Protected sites* – Guidelines, version 3.1. Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2

[11] COMMISSION REGULATION (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services.
Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:323:0011:0102:EN:PDF

				languages.
	siteProtectionClassification	M	Y	Code list to classify the Protected Site feature type i.e. natureConservation, archaeological, cultural, ecological Landscape, environment, geological

Table 4. Protected Sites feature type and main attribution required for the Simple Schema

3.11. Protected Sites - Designations used to classify features in pilot

The Irish source spatial data sets were schema mapped to the ESRI staging geodatabase and the Site Designations in Table 5 were attributed to the mapped Protected Sites feature types.

Protected Site Designation	**Protection classification**
Natura2000DesignationValue	
	specialAreaOfConservation
	specialProtectionArea
UNESCOWorldHeritage DesignationValue	
	cultural
National (Irish specific designations)	
	Geological
	Archaeological
	Architectural
	Natural

Table 5. Protected Sites designations used in Pilot

Where a source data set Protected Site did not fit logically in one of the Data Specification's official designations, they were designated under the 'National' legislation designation. This was employed for the Protected Sites gathered from the following source spatial data sets: Natural Heritage Areas (Wildlife Amendment Act 2000); Geological Heritage Areas (proposed NHAs); Archaeological Survey of Ireland (National Monuments Acts); Record of Protected Structures and Architectural Conservation Areas and Tree Preservation Orders (Planning and Development Act 2000).

3.12. Future Natura 2000 Protected Sites schema option

There will be an option for a dedicated Natura2000 schema in the future for official reporting of DAHG Natura 2000 spatial data sets to Europe. These will be used eventually by the National Parks and Wildlife Service for their spatial data publishing. Therefore it was decided that a separate service for each designation type would be set up, as different public bodies will be using different schemas for the delivery of their Protected Sites data into the European INSPIRE network.

4. INSPIRE Network Service publishing

4.1. Overview

The INSPIRE Directive obliges Member States to operate a network of the following services available to the public for spatial data sets and services for which metadata has been created:

- **Discovery services**
- **View services**
- **Download services**
- Transformation services
- Services allowing spatial data services to be invoked

This pilot aims to deliver the INSPIRE Protected Sites data for Ireland through View and Download services. These view and download network services will be discoverable through the existing **Irish Spatial Data Exchange (ISDE)** Discovery Service**.**

The following were identified as Network Services deliverables for this project:

- INSPIRE Protected Sites data published through INSPIRE compliant Network Services.
- 'ArcGIS for INSPIRE' View and Download Service solution tested against the INSPIRE Implementing Rules for Network Services.

4.2. INSPIRE View Services requirements

The following INSPIRE Implementing Rules (IR) documentation was used to design the User Acceptance Test Cases for INSPIRE View Services delivered by this pilot project:

- Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (INSPIRE Network Services regulation)[12].
- INSPIRE Technical Guidance for INSPIRE View Services (version 3.1) [13]

N.B. The Network Services regulation is a legally binding document, whilst the INSPIRE Technical Guidelines are deemed as an advisory solution to the regulation. The INSPIRE Network Services regulation provides the formal legal requirements for the operations of INSPIRE View Services and INSPIRE Download Services. Figure 4 below distinguishes the difference between the Implementing Rules (Directive and supporting regulations) and the INSPIRE Technical Guidance.

[12] Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (INSPIRE Network Services regulation.
Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:274:0009:0018:EN:PDF

[13] INSPIRE Technical Guidance for INSPIRE View Services (version 3.1).
Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5

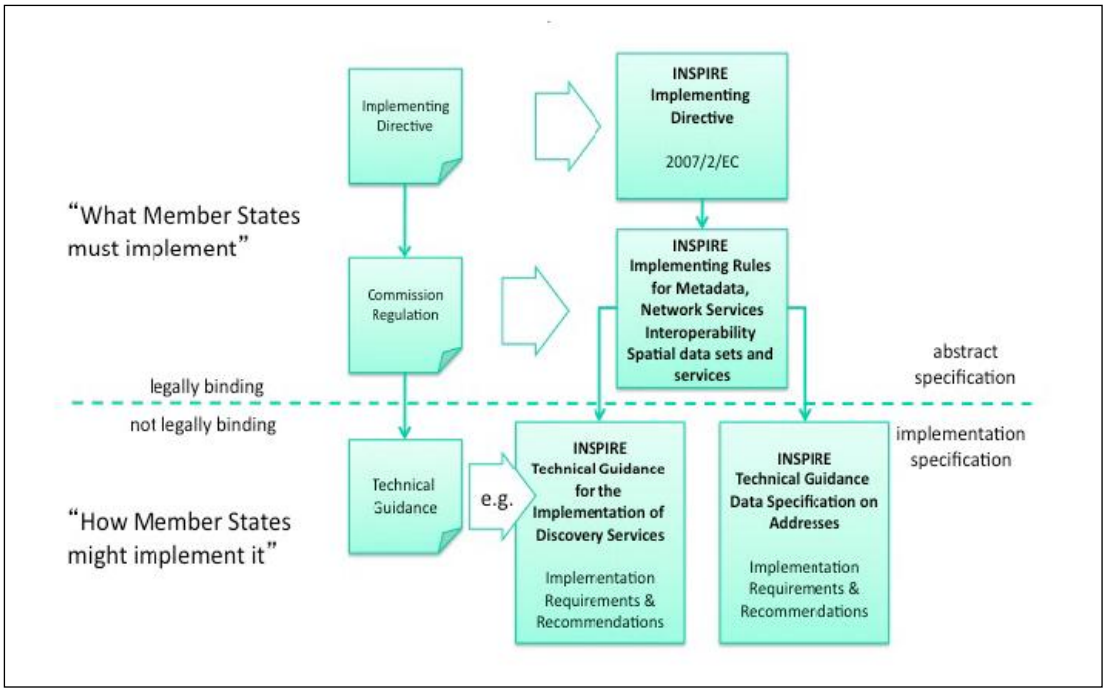


Figure 4. INSPIRE Implementing Rules and INSPIRE Technical Guidance. Source: Image courtesy of JRC, European Commission.

The INSPIRE Technical Guidance for View Services (version 3.1) offers a viable delivery solution based on an extended implementation of the [**I**SO 19128] – Web Map Service (WMS version 1.3). In summary, regular WMS services are tagged with INSPIRE metadata elements through declared extended capabilities elements in the GetCapabilities response from the WMS. This response is described in the Network Services Regulation as the **Get View Service Metadata** operation.

This pilot tests the requirements from both sets of documentation. The INSPIRE View Service profile is designed to implement the following operations which are mandated in the Network Service regulation:

4.3. INSPIRE View Service operations

A compliant INSPIRE View Service must support the following operations:

Operation	Role
Get View Service Metadata	Provides all necessary information about the service and describes service capabilities
Get Map	Returns a map containing the geographic and thematic information coming from the available spatial datasets. This map is a spatially referenced image
Link View Service	Allows a Public Authority or a Third Party to declare a View Service for the viewing of its resources through the Member State View Service while maintaining the viewing capability at the Public Authority or the Third party location

Table 6. INSPIRE View Service operations

4.4. Get View Service Metadata operation

Options for delivery

There are two separate 'Scenarios' (options) advised in the INSPIRE Technical Guidance for providing the extra INSPIRE elements needed for the Get View Service Metadata operation:

Scenario 1 **INSPIRE service metadata record held in a Discovery Service is referenced through an extended capability tag.**

This scenario involves adding a URL reference to an online INSPIRE (ISDI) metadata resource in the extended INSPIRE capabilities through the <inspire_common:MetadataURL> tag

Scenario 2 **Use (extended) capabilities to map all INSPIRE metadata elements to the [ISO 19128] – WMS 1.3.0 elements.**

This scenario involves mapping all INSPIRE metadata elements to [ISO 19128] – WMS 1.3.0 elements. (JRC provide an INSPIRE schema to cover these elements)

This pilot project elected to use Scenario 2, as it was fully supported in the ArcGIS for INSPIRE software and allowed a complete evaluation of the software's capability to provide a complete solution. Scenario 1 was also possible through the use of ISDI metadata records and was tested and may be used when a permanent ISDI Geoportal and Discovery Service is in place (with a permanent URL to facilitate CSW requests).

Get View Service Metadata response parameters

Metadata Parameter	Description
View Service Metadata	The View Service Metadata parameters shall at least contain the INSPIRE metadata elements of the View Service according to the INSPIRE Metadata Regulation for describing Spatial Data Services. The additional elements not covered by the standard WMS metadata elements are to be mapped through the Extended Capabilities section of the WMS Capabilities details.
Operations Metadata	The Operation Metadata parameter describes the operations of the View Service and shall contain as a minimum a description of the data exchanged and the network address of each operation.
Languages	Two language parameters shall be provided: 1. the Response Language parameter indicating the natural language used in the Get Service Metadata Response parameters, 2. the Supported Languages parameter containing the list of the natural languages supported by this View Service

<table>
<tr><td>Layers Metadata</td><td colspan="2">The following metadata elements must be provided for each layer element in the INSPIRE View Service GetCapabilities response.</td></tr>
<tr><td></td><td>Metadata Element</td><td>Description</td></tr>
<tr><td></td><td>Resource Title</td><td>The title of the layer, used for human communication, for presentation of the layer, e.g. in a menu</td></tr>
<tr><td></td><td>Resource Abstract</td><td>Layer abstract</td></tr>
<tr><td></td><td>Keyword</td><td>Additional keywords</td></tr>
<tr><td></td><td>Geographic Bounding Box</td><td>The minimum bounding rectangle in all supported Coordinate Reference Systems of the area covered by the layer</td></tr>
<tr><td></td><td>Unique Resource Identifier</td><td>The Unique Resource Identifier of the resource used to create the layer</td></tr>
<tr><td></td><td>Name</td><td>Harmonised name of the layer</td></tr>
<tr><td></td><td>Coordinate Reference Systems</td><td>List of Coordinate Reference Systems in which the layer is available</td></tr>
<tr><td></td><td>Styles</td><td>List of the rendering styles available for the layer.
A style shall be composed of a title and a unique identifier</td></tr>
<tr><td></td><td>Legend URL</td><td>Location of the legend for each style, language and dimension pairs</td></tr>
<tr><td></td><td>Dimension Pairs</td><td>Indicates the supported two dimensional axis pairs for multi-dimensional spatial data sets and spatial data sets series</td></tr>
</table>

Table 7. Details of Get View Service Metadata response

The Get View Service Metadata operation is implemented using the GetCapabilties request parameters from the WMS [ISO 19128] standard.

4.5. Get Map Operation

The GetMap operation as per WMS [ISO 19128] standard returns a map. Upon receiving a GetMap request, a WMS shall either satisfy the request or issue a service exception. The INSPIRE Network Services regulation states that "*…this map is an image spatially referenced*": the GetMap request is georeferencing the returned image at least by the use of the Bounding box and Coordinate Reference System.

The table below shows the INSPIRE parameters that shall be used within the WMS GetMap operation according to the INSPIRE Network Services regulation:

Parameter	Description
Layers	List of layer names to be included in the map
Styles	List of style to be used for each layer
Coordinate Reference System	Coordinate Reference System of the map
Bounding box	The 4 corner Coordinate of the two dimensional map for the selected Dimension pair and in the selected Coordinate Reference System
Image width	The map width in pixels
Image height	The map height in pixels
Image format	The output image format
Language	Language to be used for the response

Table 8. Details of Get Map response

These parameters were advertised as being included in the ArcGIS for INSPIRE software and were detailed in the User Acceptance Scripts for the Compliancy testing of INSPIRE View services published as part of this project.

4.6. Link View Service operation

The INSPIRE Network Services Regulation describes the Link View Service operation as:

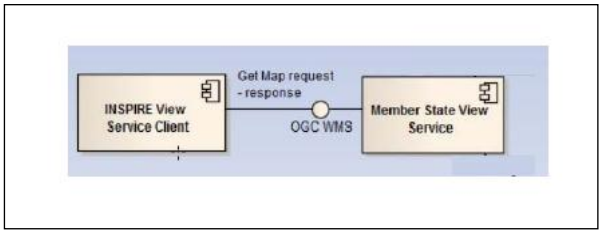
"*The Link View Service operation allows a Public Authority or a Third Party to declare a View Service for the viewing of its resources through the Member State View Service while maintaining the viewing capability at the Public Authority or the Third-party location.*

Furthermore, the Link View Service parameter shall provide all information about the Public Authority's or Third Party's View Service compliant with this regulation, enabling the Member State View Service to get a map from the Public Authority's or Third Party's View Service and to collate it with other maps."[14]

Link View Service options

The INSPIRE Technical Guidance for View Services[15] offers a choice of three possible solutions for the delivery architecture of this operation.[16]

- **Centralised Scenario**



[14] Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (INSPIRE Network Services regulation.
Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:274:0009:0018:EN:PDF

[15] INSPIRE Technical Guidance for INSPIRE View Services (version 3.1).
Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5

[16] ibid. pp.50-53

Figure 5. Link View Service - centralised scenario. Source: JRC

All View Service metadata, viewing capabilities and View Services centralised at national level in one centralised Member State INSPIRE View Service.

- **View client scenario**

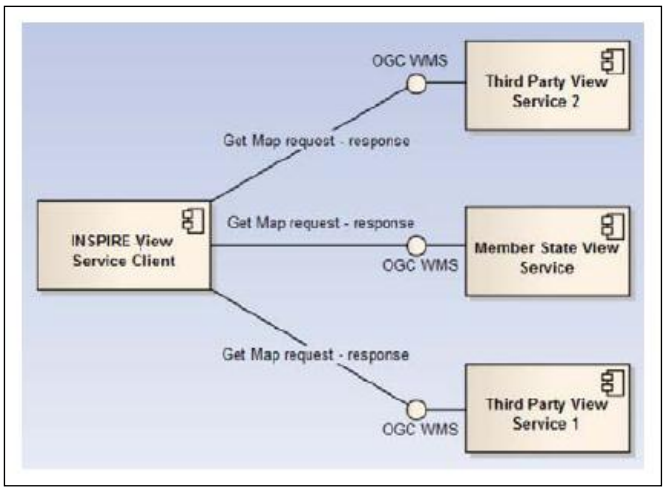


Figure 6. Link View Service - view client scenario. Source: JRC

The collation of maps served by different View Services is handled by the client application. The client consumes View Services that are discovered via the Discover Metadata operation at the Member State's location and are published at different locations.

- **View service scenario**

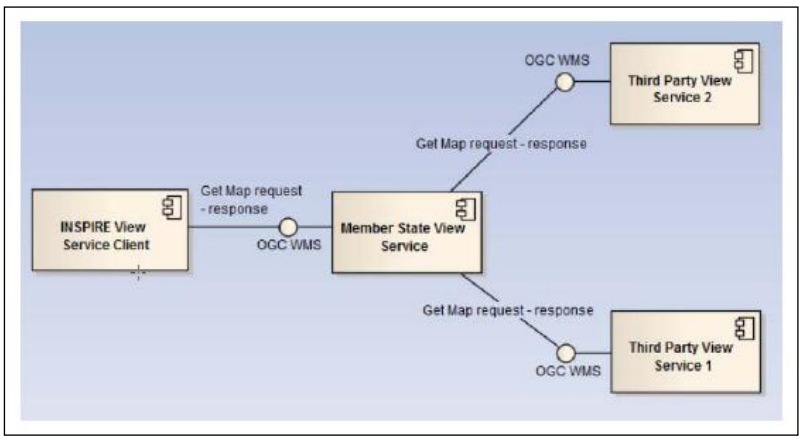


Figure 7. Link View Service - view service scenario. Source: JRC

In this case the Member State's View Service supports cascading and is responsible for collating the maps from third party View Service providers. E.g. the Member State View Service collates maps that are served locally with maps that are served remotely by a Third Party; the Member State's View Service shall include the service's layer metadata in his own service metadata (capabilities document).

Pilot approach to Link View Service

For this pilot, it was advised to explore the delivery of the **Centralised Scenario** and **View Client Scenario**. This was due to the limitations of the pilot's test server environment and on advice of ESRI Inc. on the optimum use of the ArcGIS for INSPIRE Software.

4.7. Other parameters for INSPIRE View Service publishing

Coordinate Reference Systems

INSPIRE View Service layers must be able to be simultaneously viewed using a single coordinate reference system and the View Service shall support at least the Coordinate Reference Systems in Annex I, point 1 of Directive 2007/2/EC. [17]

Image Format

INSPIRE View Services must support at least one of the following image formats:

- the Portable Network Graphics (PNG) format,
- the Graphics Interchange Format (GIF), without compression

4.8. INSPIRE Download Services requirements

The following documentation was consulted to design the INSPIRE Download Services delivered in the pilot:

- Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (INSPIRE Network Services regulation).
- Draft Technical Guidance for the implementation of INSPIRE Download Services Version 2.0
- Technical Guidance for the implementation of INSPIRE Download Services Version 3.0

N.B. As stated previously, the Network Services regulation is a legally binding document, whilst the INSPIRE Technical Guidelines are provided as a suggested technical solution to the regulation.

N.B. The draft version of the Technical Guidance was at the time of project kick-off being updated and the next version of the guidelines will have considerable changes for advised solutions. As such the Download Service software offered by Open Source and Proprietary solutions may change.

4.9. INSPIRE Download Services operations

In order to be in conformity with Article 11(1) (c) of Directive 2007/2/EC, the Download Service shall at least provide the operations listed below:

Operation	Role
Get Download Service Metadata	Provides all necessary information about the service, the available Spatial Data Sets, and describes the service capabilities.
Get Spatial Data Set	The Get Spatial Data Set operation allows the retrieval of a Spatial Data Set.

[17] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

Describe Spatial Data Set	This operation returns the description of all the types of Spatial Objects contained in the Spatial Data Set.
Link Download Service	Allows the declaration, by a Public Authority or a Third Party, of the availability of a Download Service for downloading Spatial Data Sets or, where practicable, Spatial Objects, through the Member State's Download Service while maintaining the downloading capability at the Public Authority or the Third Party location.

Table 9. INSPIRE Download Service operations

4.10. Options for INSPIRE Download Service Implementation

The INSPIRE Network Services Regulation provides two abstract options for the delivery of INSPIRE Download Services:

1. **Pre-defined dataset download service(s)*;***

   A pre-defined dataset download service provides for the simple download of pre-defined datasets (or pre-defined parts of a dataset) with no ability to query datasets or select user-defined subsets of datasets. A pre-defined dataset or a pre-defined part of a dataset could be (for example) a file stored in a dataset repository, which can be downloaded as a complete unity with no possibility to change content, whether encoding, the CRS of the coordinates, etc.

2. **Direct access download service(s**);

   A direct access download service extends the functionality of a pre-defined dataset download service to include the ability to query and download subsets of datasets. The direct access download service allows more control over the download than the simple download of a pre-defined dataset or pre-defined part of a dataset. It can therefore be considered to be more advanced than pre-defined dataset download. In this case, the spatial information is typically stored in a repository (e.g. a database) and only accessible through a middleware data management system (although the precise implementation may vary). The term direct access is used to mean the capability of a client application or client service to interact directly with the contents of the repository, e.g. by retrieving parts of the repository based upon a query. The query can be based upon spatial or temporal criteria, or by specific properties of the instances of the spatial object types contained in the repository.

This pilot explored both options based using WFS services to provide the download services for the Protected Sites data. This approach was implemented using the ArcGIS for INSPIRE software add-on for ArcGIS Server.[18]

4.11. Get Download Service Metadata operation

The Download Service INSPIRE metadata elements (spatial data service metadata) are made available via WFS through the ows:ExtendedCapabilites container xml element in the WFS GetCapabilities response. The INSPIRE metadata elements are published according to an extension schema within the *inspire_dls:ExtendedCapabilities* element. The INSPIRE extension schema is published and maintained by the JRC in the European Commission.

[18] Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (INSPIRE Network Services regulation. Parts A & B & C
Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:274:0009:0018:EN:PDF

The Get Download Service Metadata details in the GetCapabilities response xml also lists the required operations metadata, response and supported languages, spatial data sets metadata and corresponding Coordinate Reference Systems.

Options for delivery

Similar to the INSPIRE View Services Technical Guidance, there are two separate 'Scenarios' (options) advised in the INSPIRE Download Services Technical Guidance for providing the extra INSPIRE metadata elements needed for the Get Download Service Metadata operation:

Scenario 1 **INSPIRE service metadata record held in a Discovery Service is referenced through an Extended Capability element.**

This scenario involves adding a URL reference to an online INSPIRE (ISDI) metadata resource in the service's Extended Capabilities through the <inspire_common:MetadataURL> xml element.

Scenario 2 **Use (extended) capabilities to map all INSPIRE metadata elements to the [ISO 19142] – WFS 2.0 elements.**

This scenario involves mapping all INSPIRE metadata elements to [ISO 19128] – WFS 2.0 extended capabilities xml elements. (JRC provide an INSPIRE schema to cover the elements required)

This pilot project elected to use Scenario 2, as the approach is supported in draft in the ArcGIS for INSPIRE software. (ESRI Inc. will be updating the software as the Technical Guidance for Download services are progressed.) Scenario 1 is feasible through the use of ISDI metadata records and as in the case of the View services was tested as proof as concept.

4.12. Get Download Service metadata request

Metadata Parameter	Description
Download Service Metadata	The Download Service Metadata parameters shall at least contain the INSPIRE metadata elements of the Download Service according to the INSPIRE Metadata Regulation for describing Spatial Data Services. The additional elements not covered by the standard WFS metadata elements are to be mapped through the Extended Capabilities section of the WFS Capabilities details.
Operations Metadata	The Operations metadata parameter provides metadata about the operations implemented by the Download Service. It shall at least provide a description of each operation, including as a minimum a description of the data exchanged and the network address.
Languages	Two language parameters shall be provided: 3. the Response Language parameter indicating the natural language used in the Get Download Service Metadata Response parameters, 4. the Supported Languages parameter containing the list of the natural languages supported by this view service.
Spatial Data Sets Metadata parameters	The INSPIRE metadata elements of the available Spatial Data Sets shall be provided. In addition, for each Spatial Data Set, the list of those Coordinate Reference Systems referred to in Regulation (EU) No 1089/2010 which are available shall also be provided.

Table 10. Get Download Service Metadata request parameters description

4.13. Get Spatial Data Set Operation

Get Spatial Data Set request

The Get Spatial Data Set request must support the following parameters:

Request parameters	Description
Language	The Language parameter shall indicate the natural language requested for the Spatial Data Set
Spatial Dataset Identifier	The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the Spatial Data Set.
Coordinate Reference System	The Coordinate Reference System parameter shall contain one of the Coordinate Reference Systems referred to in Annex I, point 1 of Directive 2007/2/EC. [19]

Table 11. Get Spatial Data Set request parameters description

[19] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Annex I

Get Spatial Data Set response

Therefore, the Get Spatial Data Set response parameter shall be the requested Spatial Data Set in the requested language and in the requested Coordinate Reference System.

4.14. Describe Spatial Data Set Operation

Describe Spatial Data Set request

The Describe Spatial Data Set request shall contain the following parameters:

Request parameters	Description
Language	The Language parameter shall indicate the natural language requested for the description of the Spatial Objects type.
Spatial Data Set Identifier parameter	The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the Spatial Data Set.

Table 12. Describe Spatial Data Set request parameters description

Describe Spatial Data Set response

The Describe Spatial Data Set response parameter shall be the description of the Spatial Objects in the requested Spatial Data Set and in the requested language.

4.15. Link Download Service operation

The following definition of this operation is given in the INSPIRE Network Services regulation:

"Allows the declaration, by a Public Authority or a Third Party, of the availability of a Download Service for downloading Spatial Datasets or, where practicable, Spatial Objects, through the Member State's Download Service while maintaining the downloading capability at the Public Authority or the Third Party location."

Link Download Service request parameter

The following definition of this operation is given in the INSPIRE Network Services regulation:

"The Link Download Service request parameter shall provide all information about the Public Authority's or Third Party's Download Service compliant with this Regulation, enabling the Member State Download Service to provide access to Spatial Data Sets and, where practicable, to Spatial Objects from the Public Authority's or Third Party's Download Service." [20]

4.16. Get Spatial Object operation (applicable to direct Access download services)

Get Spatial Object request

The Get Spatial Object request shall support the following parameters:

[20] COMMISSION REGULATION (EC) No 976/2009 of 19 October 2009
implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services

Request parameters	Description
Language	The Language parameter shall indicate the natural language requested for the description of the Spatial Objects type.
Spatial Data Set Identifier	The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the required Spatial Data Set. Where the parameter is not provided, it shall be assumed that all available Spatial Data Sets have been selected.
Coordinate Reference System	The Coordinate Reference System parameter shall contain one of the Coordinate Reference Systems included in the list of Coordinate Reference Systems set out in Regulation (EU) No 1089/2010.
Query	The query parameter shall be composed of the search criteria: ○ **Unique Resource Identifier** of Spatial Data Set, ○ **Key attributes** and the relationship between Spatial Objects as set out in Regulation (EU) No 1089/2010; in particular the Unique Identifier of Spatial Object and the temporal dimension characteristics, including the date of update. ○ **Bounding box**, expressed in any of the Coordinate Reference Systems listed in Regulation (EU) No 1089/2010. ○ **Spatial Data Theme**.

Table 13. Get Spatial Object request parameters description

Get Spatial Object response

The Get Spatial Object response shall contain the following parameters:

- **Spatial Objects Set**

The Spatial Objects Set parameter shall be the set of Spatial Objects which complies with Regulation (EU) No 1089/2010 and fulfils the search criteria in the query, in the requested language and in the Coordinate Reference System.

- **Spatial Objects Set Metadata**

The Spatial Objects Set Metadata parameter shall contain at least the INSPIRE metadata elements of the set of Spatial Objects.

4.17. Describe Spatial Object Type operation (applicable to direct access download services)

Describe Spatial Object Type request parameters

Request parameters	Description
Language	The Language parameter shall indicate the natural language requested for the description of the Spatial Objects type.
Spatial Object Type	The Spatial Object Type parameter shall contain the language-neutral name of the Spatial Object Type as specified in Regulation (EU) No 1089/2010. Where the parameter is not provided, it shall be assumed that all types of Spatial Objects have been selected.

Table 14. Describe Spatial Object Type request parameters description

Describe Spatial Object Type response parameters

The Describe Spatial Object type response parameter shall be the description of the spatial object type, in conformity with Regulation (EU) No 1089/2010.

5. Delivering View and Download Services with ArcGIS for INSPIRE and Con Terra INSPIRE Solution Pack for FME

5.1. INSPIRE Data Transformation

5.2. ArcGIS for INSPIRE and Con Terra INSPIRE Solution Pack for FME

ArcGIS for INSPIRE and Con Terra's INSPIRE Solution Pack for FME were chosen as the software solution to deliver the Network Services and the transformed Protected Sites data. The software is provided as an add-on module to ArcGIS Server and FME respectively, which the project partners are already using to deliver their in-house GIS workflows.

The ArcGIS for INSPIRE software package consists of the following elements:

- An **ArcGIS Server extension** to serve INSPIRE-compliant View and Download services.
- INSPIRE-compliant **Geodatabase templates** for extracting, transforming, and loading (ETL) geospatial information from existing databases into INSPIRE-compliant geodatabases.
- The open source **ESRI Geoportal Server** and add-ons catalogue and index INSPIRE-compliant metadata and serves an INSPIRE compliant Discovery Service.

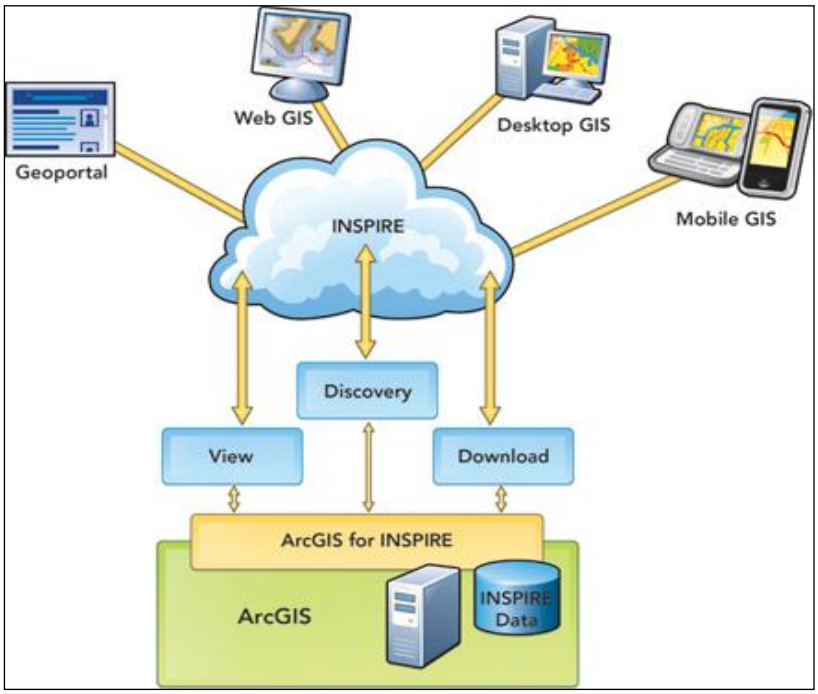


Figure 8. ArcGIS for INSPIRE delivery solution Source: ESRI Inc.

This pilot project employed the View and Download Service solution from ArcGIS for INSPIRE, and the INSPIRE geodatabase templates for the target schemas in the INSPIRE Data Specification Transformation Process.

The **INSPIRE Solution Pack for FME** was developed by Con Terra to simplify the complex schema mapping in FME from source data models to the INSPIRE geodatabase templates. The Solution Pack is based on standard FME technology and extends the existing functionality with additional

FME workbench logic that supports the mapping to the respective INSPIRE Data Specification models.

The Irish Spatial Data Exchange (ISDE) discovery service and metadata editor were used for the view and download service metadata publishing workflow for this project (see section 6).

5.3. Project Platform

The software for the View and Download Network Services is hosted on a Windows virtual server on an Amazon EC cloud instance with the following specification:

- 7.5 GB memory
- 4 EC2 Compute Units (2 virtual cores with 2 EC2 Compute Units each)
- Windows Server 2008
- I/O Performance: High
- API name: m1.large
- 1 x 35GB ebs volume
- 1 x 100GB ebs volume
- ArcGIS for Server 10
- ArcGIS for Desktop 10
- Con Terra INSPIRE Solution Pack for FME
- Postgres database

5.4. Publishing INSPIRE View Services

Once the Transformation Process is completed and the data has been stored in the relevant INSPIRE Geodatabase template, it is straight-forward to publish the necessary INSPIRE View Service using the ArcGIS for INSPIRE add-on for ArcGIS for Server.

The process is similar to publishing a regular WMS service in ArcGIS for Server; the end-user adds the relevant data layers from the source database to a map document (mxd) using a simple INSPIRE toolset, tailors the map to their needs in ArcGIS for Desktop and saves as a Map Service Definition document (msd). The ArcGIS for Server service creation wizard is used to link the INSPIRE services to the source .MSD document.

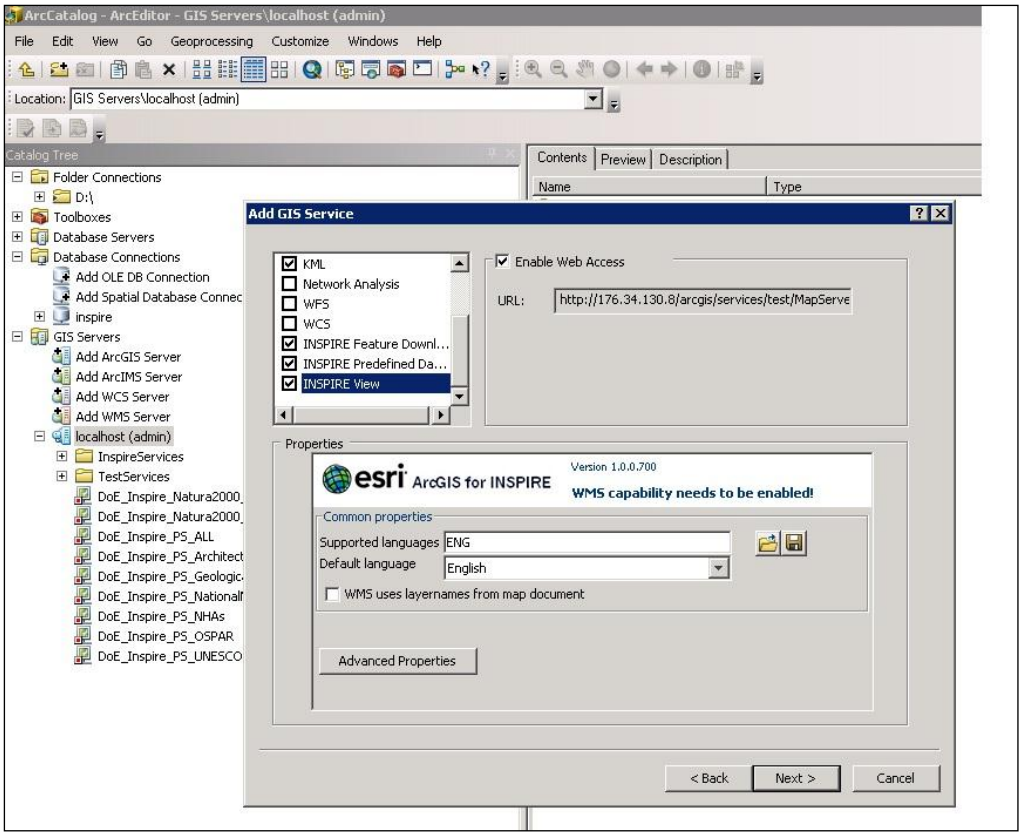


Figure 9. Enabling the INSPIRE services in the ArcGIS for INSPIRE add-on for ArcGIS Server

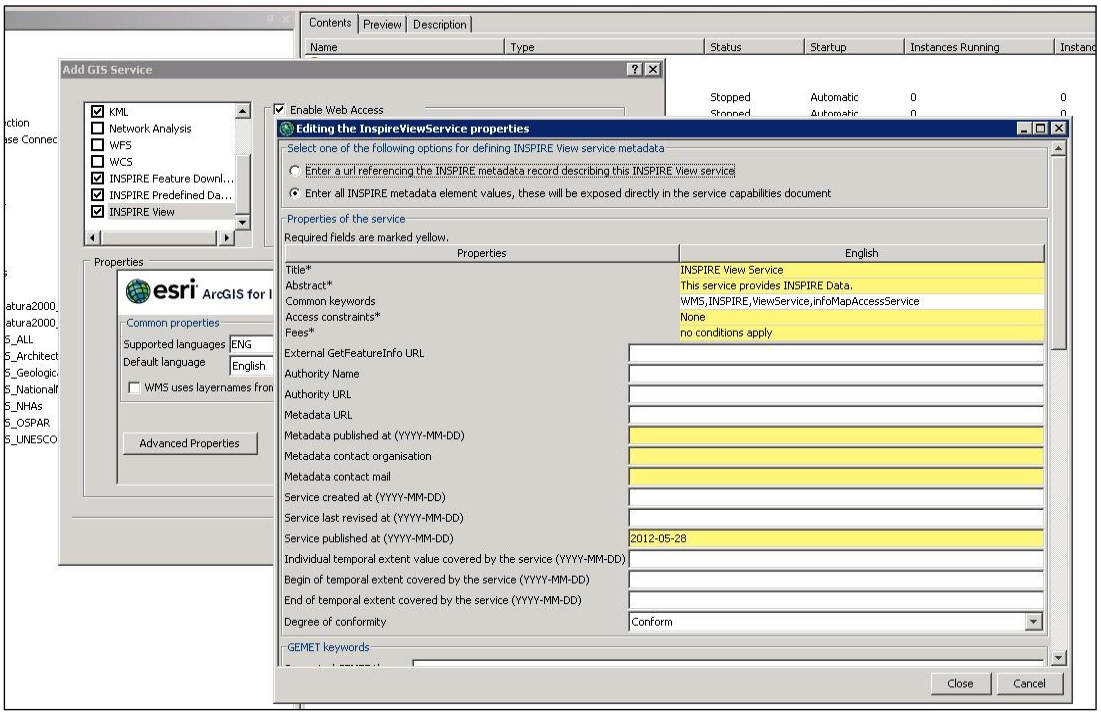


Figure 10. Choosing the Get View Service Metadata operation scenario and inputting INSPIRE service metadata elements into the WMS 'extended capabilities'.

5.5. Get View Service Metadata operation – populating INSPIRE services 'Extended Capabilities' schema

Figure 10 above shows the advanced properties dialogue box which extends the profile of a basic OGC WMS 1.3.0 service to allow for the required INSPIRE metadata elements for the JRC extended capabilities schema and to support the multilingualism requirements.

Both scenarios of INSPIRE view services metadata publishing are supported[21] by ArcGIS for INSPIRE. The dialogue box above allows the user the option of linking out to an ISDE record through a CSW GetRecordByID (scenario1) or alternatively to author all the metadata directly in the INSPIRE View Service GetCapabilities response (scenario 2).

Scenario 1 example: Get View Service Metadata
http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SPAs/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0

[The response references the following metadata record URL (GetRecordByID CSW request) through an extended capabilities tag:
http://geonetwork2.compass.ie/geonetwork/srv/en/csw?request=GetRecordById&service=CSW&version=2.0.2&id=7165feb3-8761-47f2-9e18-0927abf616e8&OutputSchema=http://www.isotc211.org/2005/gmd&elementSetName=full&outputSchema=http://www.isotc211.org/2005/gmd&elementSetName=full]

Scenario 2 example: Get View Service Metadata
(INSPIRE Metadata elements embedded in WMS Extended Capabilities tags)
http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SACs/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0

Both scenarios were tested as shown above, however the second scenario option was used for this pilot in order to fully evaluate the ArcGIS for INSPIRE View Service solution, and also to evaluate the independent schema published by the JRC for the extended capabilities elements.

The following INSPIRE View Services were published as part of this pilot:

INSPIRE View Service Name	Service connect point
INSPIRE Protected Sites - Natura 2000 Special Areas of Conservation	http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SACs/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0
INSPIRE Protected Sites - Natura 2000 Special Protection Areas	http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SPAs/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0
INSPIRE Protected Sites - Natura 2000 Natural Heritage Areas	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSNHAs/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0
INSPIRE Protected Sites - Archaeological Survey of Ireland	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSNationalMonument/MapServer/InspireViewService?re

[21] INSPIRE Technical Guidance for INSPIRE View Services (version 3.1).
Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5

	quest=getcapabilities&service=wms&version=1.3.0
INSPIRE Protected Sites - Geological Heritage Sites	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSGeological/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0
INSPIRE Protected Sites - Architectural Heritage	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSArchitectural/MapServer/InspireViewService?request=getcapabilities&service=wms&version=1.3.0

Table 15. Showing INSPIRE View Service name and endpoints published.

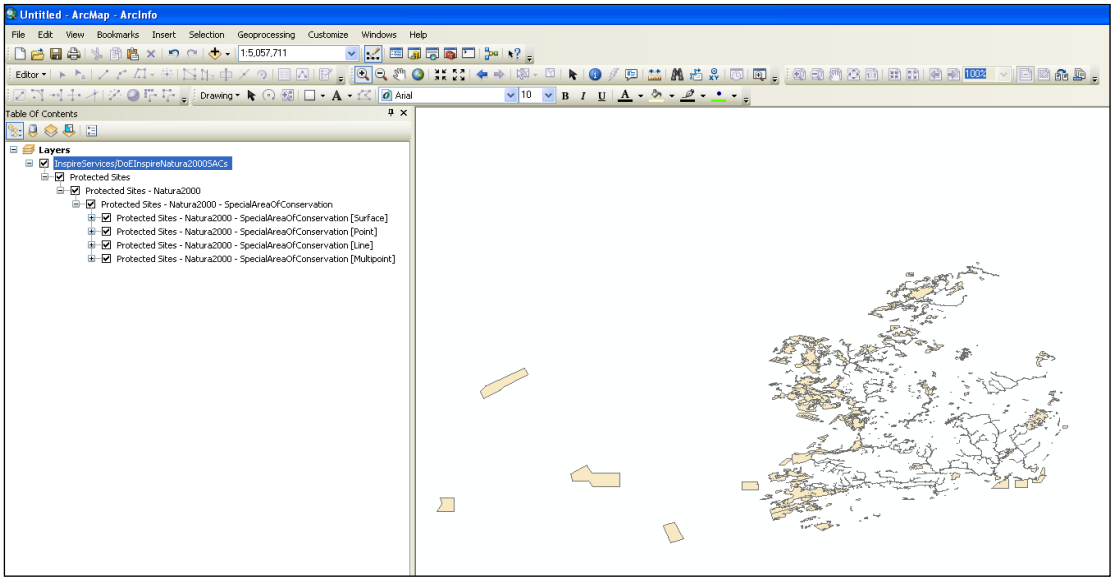


Figure 11. INSPIRE View Service appearing as a layer in ArcGIS for Desktop ArcMap client

5.6. Link View Service

From the three options given in the INSPIRE Technical Guidance for View Services, it was advised to follow the assumptions of the **Centralised Scenario** and/or the **View Client Scenario**. This was on advice of ESRI Inc. on the best use of the ArcGIS for INSPIRE Software and due to the limitations of the pilot's test server environment. The ISDE Discovery Service and Map Client was used to facilitate the **View Client Scenario.**

A combination of the **Centralised Scenario** and **View Client Scenarios** will be recommended for the publication of Ireland's Network Services for INSPIRE Data Specifications delivery.

5.7. Publishing INSPIRE Download Services

As noted previously, the INSPIRE Technical Guidance for Download Services was only available as a draft version for this pilot. Therefore, the solution provided by ESRI in ArcGIS for INSPIRE may be subject to change as the operational version of the guidelines have only been released in June 2012. However, for the purpose of this pilot the solution is sufficient to be able to assess the technical effort required for INSPIRE Download Service publishing.

Options for Download Service Implementation

The INSPIRE Technical Guidelines for Download Service offers two options for INSPIRE Download services:

1. **Predefined dataset download or part of datasets** (static File download e.g. GML or a set Web Feature Service query)
2. **Direct Access download service** (Web Feature Service)

ArcGIS for INSPIRE supports both options for publishing the download services for the Protected Sites services as it is supported by the ArcGIS for INSPIRE software. This pilot followed the second option based using Direct Access WFS to provide the download services for Protected Sites.

INSPIRE Direct Access Download Services (WFS-based)

INSPIRE Download Service Name	Service connect point
INSPIRE Protected Sites - Natura 2000 Special Areas of Conservation	http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SACs/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS
INSPIRE Protected Sites - Natura 2000 Special Protection Areas	http://176.34.130.8/arcgis/services/InspireServices/DoEInspireNatura2000SPAs/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS
INSPIRE Protected Sites - Natura 2000 Natural Heritage Areas	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSNHAs/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS
INSPIRE Protected Sites - Archaeological Survey of Ireland	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSNationalMonument/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS
INSPIRE Protected Sites - Geological Heritage Sites	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSGeological/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS
INSPIRE Protected Sites - Architectural Heritage	http://176.34.130.8/arcgis/services/InspireServices/DoEInspirePSArchitectural/MapServer/InspireFeatureDownloadService?request=GetCapabilities&service=WFS

Table 16. Protected Sites INSPIRE download services created

5.8. Get Download Service Metadata

The Get Download Service Metadata operation will be a WFS GetCapabilities response, which includes the download service INSPIRE metadata, operations metadata, response and supported languages, spatial data sets metadata and their corresponding CRS. For scenario 1, a metadata record for the Download Service shall be available in a Discovery Service. The Resource Locator metadata element for the Download Service shall contain a link to the GetCapabilities of the WFS.

5.9. Get Spatial Data Set

The Get Spatial Data Set operation allows the retrieval of a source Spatial Dataset.

Pre-defined spatial datasets in different CRS/datasetID/language combinations can be retrieved using Stored Queries in the ArcGIS for INSPIRE pre-defined Download Service option. A GetFeature request is made to an ArcGIS for INSPIRE WFS that uses a StoredQuery for the pre-defined dataset. The WFS shall return a set of features corresponding to the pre-defined data set in the requested language and CRS.

Direct Access download services were tested and passed the UAT scripts produced as part of this project.

5.10. Describe Spatial Data Set

The WFS shall return a valid Capabilities document in the requested language, which returns a description of all the types of Spatial Objects contained in the Spatial Data Set. The spatial object types are described in the WFS GetCapabilities response which returns a valid Capabilities document in the requested language identifying the spatial object types available.

5.11. Link Download Service

To be implemented by uploading the Download Service INSPIRE metadata to the INSPIRE network as referred to in Article 11 using the PublishMetadata function of an INSPIRE compliant discovery service. The Resource Locator metadata element of the Download Service metadata record shall contain a link to the Atom Feed and/or the WFS GetCapabilities document.

5.12. Get Spatial Object

This operation allows the retrieval of Spatial Objects based upon a query. The WFS provides support for ad-hoc queries as defined in the Technical Guidance Requirement 61.

- "Unique Resource Identifier" of Spatial Data Set
- Temporal Dimension characteristics ie. the date of update
- Bounding box
- Spatial Data Theme
- Search Criteria
    - Logical operators
    - Comparison operators

A GetFeature request with required query arguments is made to the WFS and the WFS returns a set of features that meet the requirements of the query expression.

5.13. Describe Spatial Object Type

This operation returns the description of the specified Spatial Objects types. A DescribeFeatureType request is made to the WFS and the WFS responds with the XML schema for the requested Spatial Object types.

6. Creating INSPIRE service metadata and publishing via the ISDE Discovery Service

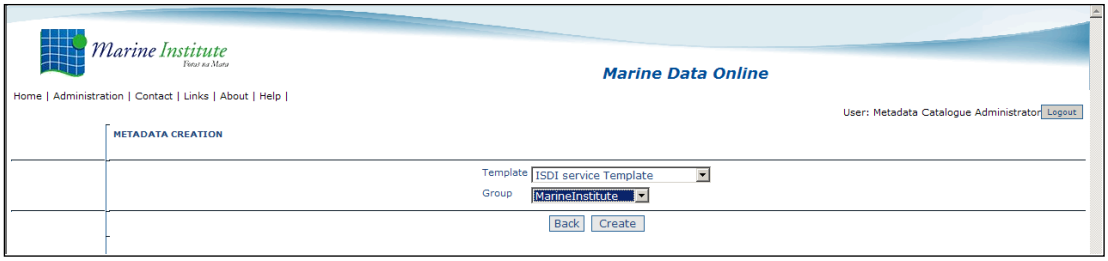
6.1. ISDI Metadata Profile for INSPIRE

The ISDI Metadata Profile identifies the metadata elements required by any organisation to accurately describe the types of spatial resources that may be searched for through an INSPIRE (compliant) Discovery Service. The ISDI Metadata Profile is designed to support the documentation and discovery of terrestrial and marine spatial dataset(s), spatial dataset series and spatial data service(s), recognising the data management and sharing requirements within the ISDI community.

The ISDI Metadata Profile has been authored in accordance with the rules established by the International Standards Organisation (i.e. ISO) by the Marine Institute with guidance by the partners in the Irish Spatial Data Exchange project (ISDE). The ISDI Metadata Profile is a subset of the ISO 19115 international standard for describing geographic information and services. This includes all ISO 19115 core metadata elements. The ISDI Metadata Profile has defined supplementary elements, code lists and vocabularies to assist in the description of a spatial dataset, a spatial dataset series and a spatial data service following the INSPIRE implementing rules. These supplementary elements have been guided by the INSPIRE Directive and have been implemented according to version 1.1 and version 1.2 of the INSPIRE Metadata Implementing Rules and technical guidelines.

6.2. ISDE Discovery Service and GeoNetwork ISDI Metadata Profile editor

The Irish Spatial Data Exchange (ISDE) discovery service was used to publish the necessary INSPIRE metadata records for the services created by this pilot. The ISDE project has produced an INSPIRE/ISDI Metadata Profile and complimentary metadata editor based within the open source software product 'GeoNetwork. The GeoNetwork metadata editor is used to produce the necessary INSPIRE metadata records to facilitate the publication of data sets and services into the Irish INSPIRE infrastructure.



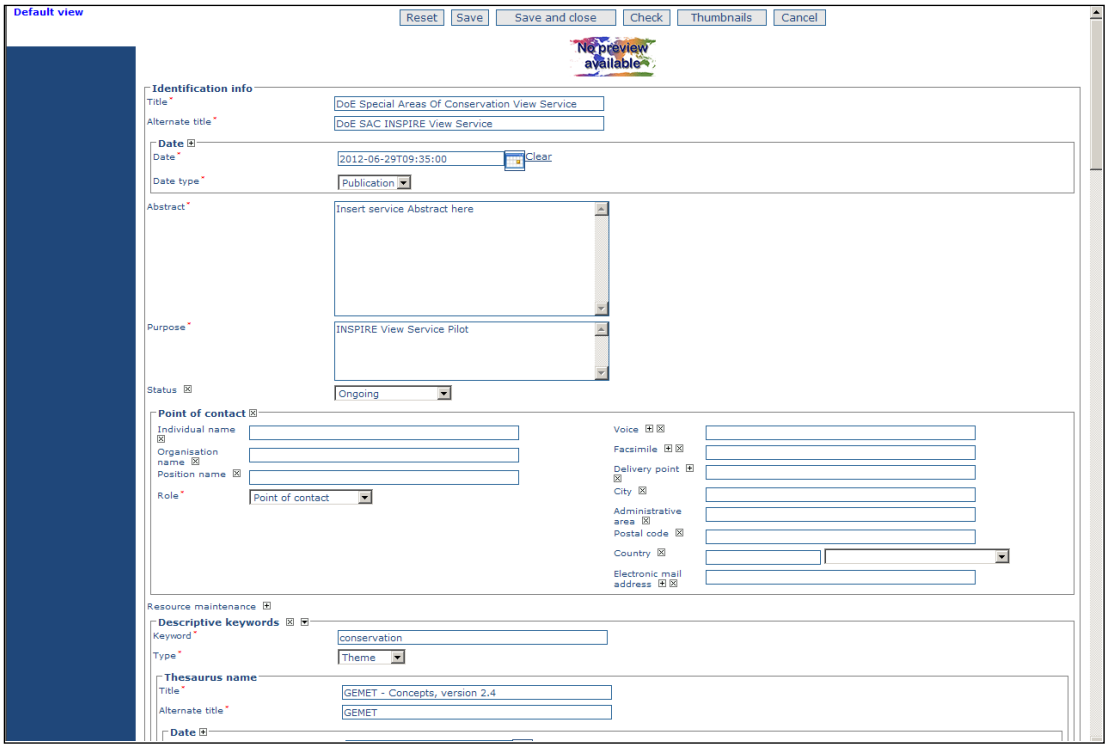


Figure 12. Editing INSPIRE 'service' metadata record following ISDI GeoNetwork template.

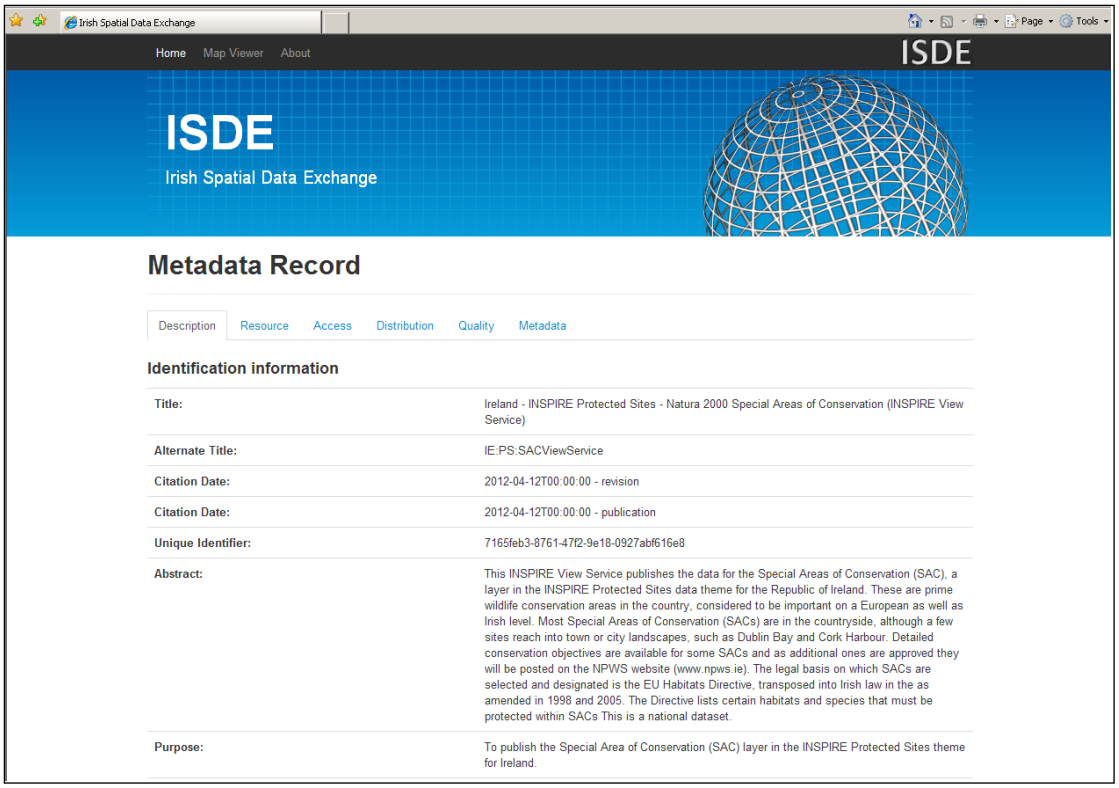


Figure 13. Discovering INSPIRE metadata in the national ISDE Discovery Service

The links to the metadata records for the services created as part of this project are listed in the table below.

INSPIRE Service Name	ISDE service metadata record URL
INSPIRE Protected Sites - Natura 2000 Special Areas of Conservation (View Service)	http://catalogue.isde.ie/#/7165feb3-8761-47f2-9e18-0927abf616e8
INSPIRE Protected Sites - Natura 2000 Special Protection Areas (View Service)	http://catalogue.isde.ie/#/d2974027-267f-4f64-82a6-76d9e7a60e92
INSPIRE Protected Sites - Natura 2000 Natural Heritage Areas (View Service)	http://catalogue.isde.ie/#/8e4675f6-7415-4f36-bec4-6deaf6c997a6
INSPIRE Protected Sites - Archaeological Survey of Ireland (View Service)	http://catalogue.isde.ie/#/65096662-a7bb-4ff0-88b5-1be08fb20471
INSPIRE Protected Sites - Geological Heritage Sites (View Service)	http://catalogue.isde.ie/#/ad07eeaa-2593-45db-835e-033b89bd052b
INSPIRE Protected Sites - Architectural Heritage (View Service)	http://catalogue.isde.ie/#/d615ce5c-3021-49ce-9e51-958b8fbeae36
INSPIRE Protected Sites - Natura 2000 Special Areas of Conservation (Download Service)	http://catalogue.isde.ie/#/8db8f9ab-e624-4880-8f91-9108304c437a
INSPIRE Protected Sites - Natura 2000 Special Protection Areas (Download Service)	http://catalogue.isde.ie/#/39907a62-3b74-4d9c-9dff-88a5f5a43c1e
INSPIRE Protected Sites - Natura 2000 Natural Heritage Areas (Download Service)	http://catalogue.isde.ie/#/b23a4d7c-8307-445a-99c5-006f3078647a
INSPIRE Protected Sites - Archaeological Survey of Ireland (Download Service)	http://catalogue.isde.ie/#/99befec1-fcf8-48ce-8b2f-2906f8642dc1
INSPIRE Protected Sites - Geological Heritage Sites (Download Service)	http://catalogue.isde.ie/#/0bf221ef-b148-474e-9443-b561ac040f69
INSPIRE Protected Sites - Architectural Heritage (Download Service)	http://catalogue.isde.ie/#/bf96b7bb-7c22-4003-a378-489e69b3e3f4

Table 17. ISDE service metadata records created for Protected Sites services

6.3. Environmental Protection Agency (EPA) online ISDI metadata editor

The EPA have developed an online metadata editor to allow editing and validating their implementation of the ISDI Metadata profile. This editor pictured below is available at

- http://gis.epa.ie/metadata/editor/

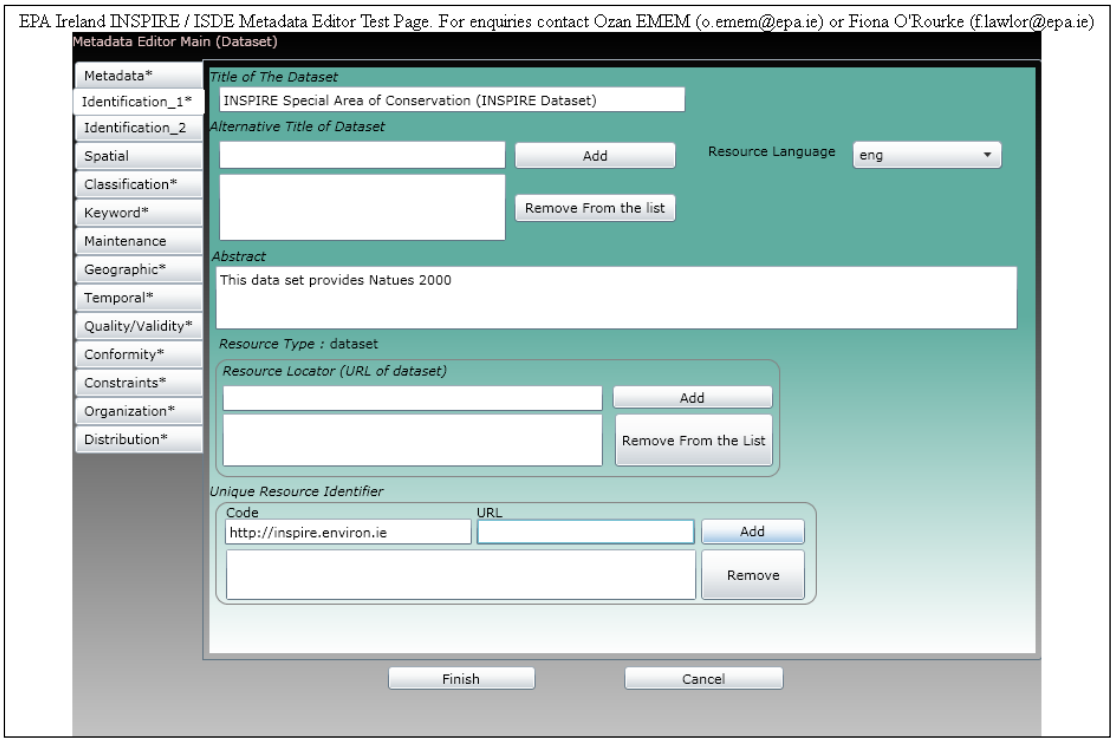


Figure 14. EPA online ISDE metadata editor

This editor allows in-line validation of metadata records against the online INSPIRE schematron and the ISO 19139 schemas.

7. INSPIRE Data Sharing and Licensing arrangements

In accordance with the data sharing requirements prescribed by the INSPIRE Directive Article 17 and the INSPIRE Data and Service Sharing Regulation[22], transitional INSPIRE data sharing and licensing arrangements have been rolled out as part of this pilot.

7.1. ISDI INSPIRE Data Sharing Agreement

The ISDI INSPIRE Data Sharing Agreement prepared by DECLG has been signed by all the public bodies participating in this pilot.

The Agreement introduces the required 'measures'[23] that facilitate the sharing and 'INSPIRE use' of INSPIRE spatial data sets and services for the following scenarios:

- between Irish public bodies;
- between Irish public bodies and institutions and bodies of the European Community;
- between Irish public bodies and bodies established by international agreements to which the European Community and Member States are parties;
- between Irish public bodies and public bodies from other member states.

7.2. ISDI Licences

When data has been requested under the terms of the INSPIRE regulations for what is determined to be legitimate environmental public tasks, Irish public bodies must deliver the data sets and network services accompanied by the appropriate ISDI licence.

ISDI Basic Licence (Irish PSI Licence)

This licence covers the INSPIRE data sets or services that are free to re-use for commercial and non-commercial purpose(s) and are disseminated under government copyright with a basic attribution requirement. The Irish PSI licence is to be used in this case for INSPIRE data publishing.[24] This licence is comparable to the INSPIREI Basic Licence template.

ISDI INSPIRE Specific Licence

This licence covers INSPIRE data sets and services which are not free to re-use for all purposes, and may have charges/licensing that apply or restricted use conditions for specific re-use scenarios. This licence is available as a template and it is the responsibility of the data owner and publisher to adapt the optional elements of the licence to their specific INSPIRE publication

[22] Commission Regulation (EU) No 268/2010 of 29 March 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the access to spatial data sets and services of the Member States by Community institutions and bodies under harmonised conditions.

[23] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Article 17(1).

[24] Department of Finance (2005). *Irish Public Sector Information Licence* Available: http://www.psi.gov.ie/files/2010/03/PSI-Licence.pdf . Last accessed 01/12/2011.

needs. The tailored licences may then be implemented into an ISDI geo-rights management workflow.

7.3. Geo-rights Management and federated licencing

Although initially deemed out of scope for this project, it was decided in the design phase to trial the Con terra sdi.suite software – licenseManager, securityManager and serviceMonitor modules - on the pilot INSPIRE Network Services. This software is currently being used in the upgrade of the Northern Ireland SDI portal – Spatial NI (formerly the Northern Ireland GeoHub). DECLG have liaised with Land and Property Services Northern Ireland on their experience of using the software to facilitate their business processes.

The requirement to secure and license web services is prevalent in most modern NSDI implementations and had been identified by the INSPIRE Data Sharing sub-committee as a significant area of technical and financial effort for INSPIRE implementation in Ireland. It is required to address Article 17 of the INSPIRE Directive on removing 'obstacles' at the point of use for the re-use of INSPIRE data in public bodies, and to provide the framework for developing e-commerce as required under Article 14 (4).

Whilst there are no Intellectual Property Rights protection issues involved in any of the source data sets for the INSPIRE Protected Sites Pilot, the opportunity arose to test-drive a solution for geo-rights management software in the form of Con terra securityManager and licenseManager.

Con terra LicenseManager

LicenseManager is used to define, organise and apply license and price models within service-based Spatial Data Infrastructures. It enables license-based access to spatial data services by enforcing agreement with user conditions, use restrictions, and price/fee models, whenever a service is accessed by a user.

LicenseManager directly compliments the Security Manager module of the sdi.suite software. It provides a tool with which license models can be defined, and through which a user can then access services. The license is concluded electronically and enforced when the service is accessed. Price or usage-fee models can be individually determined and assigned to commercially offered spatial data services. The price structure ranges from simple flat rates to complex, use-dependent models (pay per use), which also incorporate discounts and multiple-use reductions.

In addition, LicenseManager can be used to define re-use conditions for spatial data services, for instance, explicitly excluding the commercial use of services. This results in what is known as a click-through license, which resembles the method by which license conditions are accepted by a user whenever they install a software programme. It makes it possible for both public and private service providers to enforce agreement with users regarding license and user conditions.

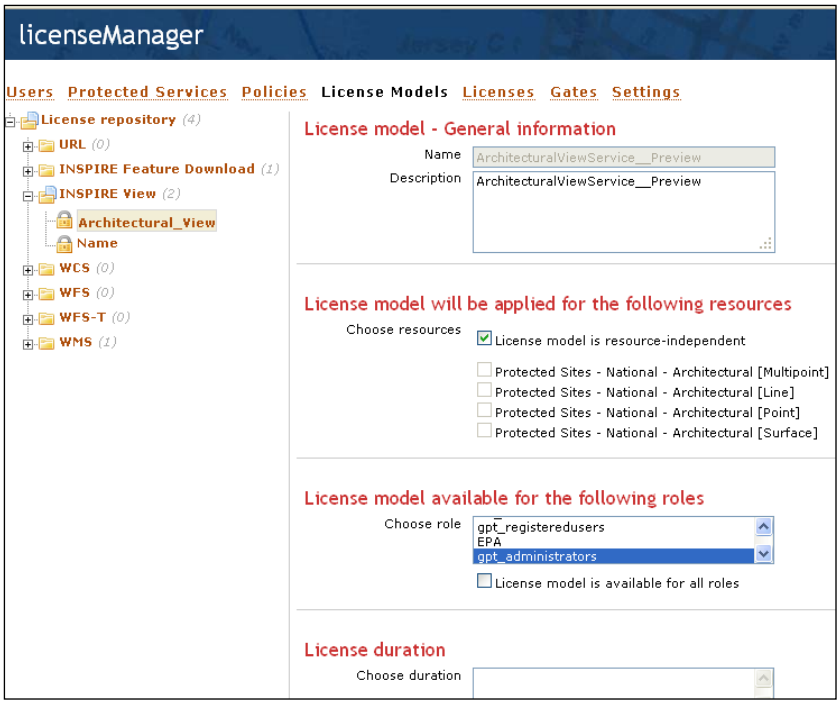


Figure 15. Screenshot of licence model editing in LicenseManager

Con terra SecurityManager

SecurityManager allows organisations to manage the access of authorised users to secured/restricted spatial data services. It provides protection against unauthorised access for OGC WMS, WFS, WFS-T, WCS, Esri ArcGIS Server/ArcIMS services and also for static file downloads (specified URLS). Access constraints may be introduced either at the service function level or on the content level (e.g. a layer in a WMS or WFS service). SecurityManager will also allow the restriction of web services to a defined geographic extent such as a local authority area.

SecurityManager uses the OASIS XACML and SAML standards for describing policy sets, as well as for authentication and single sign-on purposes. WS-Security ensures XML/SOAP messaging between authorized users and resources is securely encrypted and signed. A common access approach using "HTTP Basic Authentication" is also available as shown in the example below. User and policy management in securityManager can be performed via a browser-based administrative interface. It is also possible to incorporate existing user management systems such as LDAP by simple configuration.

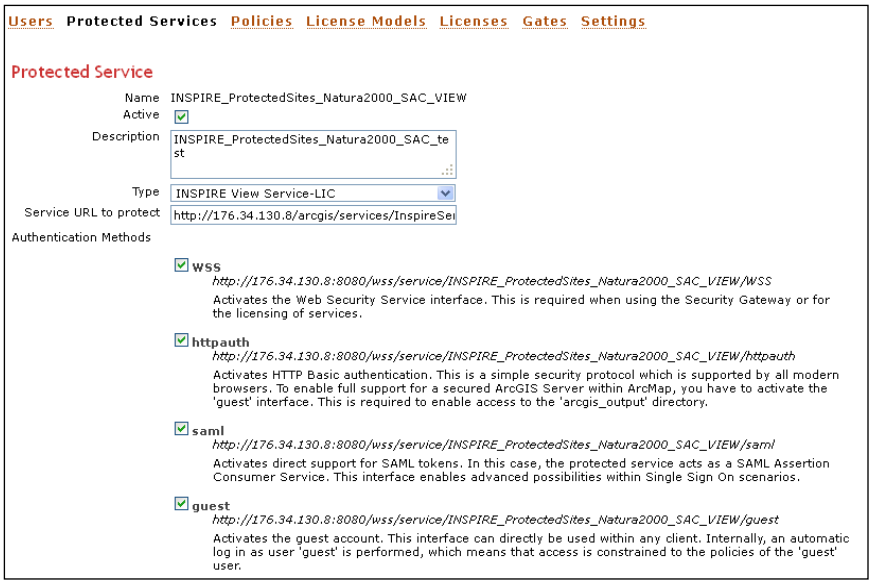


Figure 16. Screenshot of parameters being set for a secured service in SecurityManager

Sample Http authentication URL end-point for 'ISDI Basic Licence' click-through

This is an example of a Http authentication URL end point generated by LicenseManager to allow access to a resource which was secured at the service level using Security Manager. This end point has been issued to an end-user after a click-through negotiation of the terms Irish PSI Licence to access the INSPIRE Protected Sites Natura2000 SAC view service:

http://176.34.130.8:8080/wss/service/INSPIRE_ProtectedSites_Natura2000_SAC/httpauth/licid-UUID_20120601-121845-963-31271-6198

ServiceMonitor

Con terra sdi.suite also provides Service Monitor, a module that can monitor geographic services such as the INSPIRE pilot Protected Sites services for performance and reliability and can notify administrators if services become unavailable. Availability, Performance and Capacity criteria are defined by the INSPIRE regulation on Network Services. It is discussed further in section 8.2 as a toolset for Quality of Service monitoring for INSPIRE Network Services.

Geo-rights management current developments

At the time of writing there is significant progress being made in this area and the technical specifications and toolsets are changing to solve the data sharing and e-commerce requirements of INSPIRE. Some notable examples are:

- OGC Interoperability experiment with Shibboleth architecture.
- UK Location Business Interoperability Working Group
- Con terra software upgrade coming to accommodate Shibboleth and SAML 2.0.

It is clear that INSPIRE, SDI and Open Data data sharing initiatives are developing this area rapidly. It is recommended that ISDI carry out a dedicated project on Data Sharing and IPR management for an SOA data network based on web services. This project should aim to remove obstacles to data sharing for re-use of data sets and services in line with the objectives of the INSPIRE Directive and international best practice in other Spatial Data Infrastructures.

8. INSPIRE Publishing - compliancy testing

As part of the pilot project, an analysis into possible methodologies for INSPIRE data publishing compliancy testing were carried out.

The main areas for INSPIRE data publishing and compliance monitoring was identified as:

- INSPIRE Network Service operation testing
- INSPIRE Network Service Quality of Service testing
- INSPIRE Data Specification compliancy testing
- INSPIRE metadata compliancy testing
- INSPIRE Data Sharing and Licensing compliance.
- INSPIRE Monitoring and Reporting compliance

8.1. INSPIRE Network Service operation testing

A number of test solutions were suggested for the compliance testing of the INSPIRE network service operation testing (e.g. Get View Service Metadata, language support) produced through this pilot. By far the most comprehensive of all online testing services was the **GDI-DE Test Suite**[25], which is part of the German spatial data infrastructure. The GDI-DE online abstract test suites were used to guide the pilot compliance testing for INSPIRE Network service operation testing. This suite was used for the User Acceptance Testing of the INSPIRE Network Services produced by this pilot.

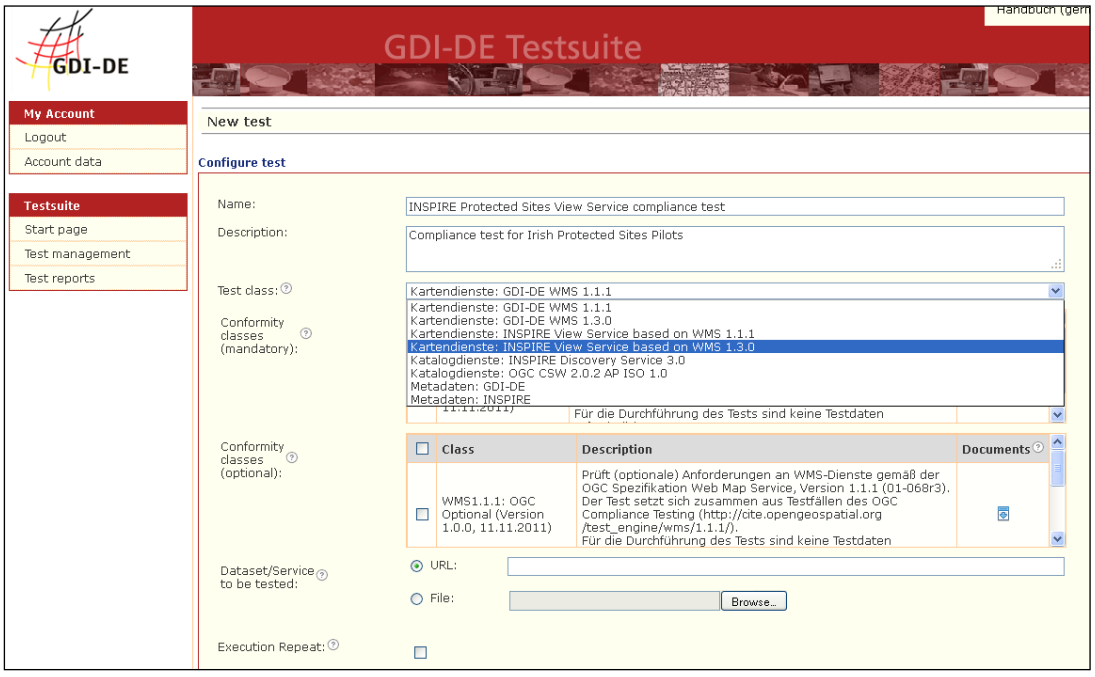


Figure 15. GDI-DE Test Suite online INSPIRE testing tool

8.2. INSPIRE Network Service Quality of Service testing

The requirements of the INSPIRE Network Service regulation with regards to performance, capacity and availability of INSPIRE Network Services are the following:

[25] http://testsuite.gdi-de.org/gdi/ accessed 30/05/2012

- **PERFORMANCE**: For a 470 Kilobytes image (e.g. 800 × 600 pixels with a colour depth of 8 bits), the response time for sending the initial response to a Get Map Request to a View Service shall be maximum 5 seconds in normal situation. Normal situation represent periods out of peak load. It is set at 90% of the time.

- **CAPACITY**: The minimum number of served simultaneous service requests to a View Service according to the performance quality of service shall be 20 per second.

- **AVAILABILITY**: Available 99% of the time
  The following graphic represents the important stages in an INSPIRE publishing workflow for compliance testing.

These requirements for Quality of Service compliance are broad and open to interpretation; the Technical Guidance for View Services offers a normalised testing procedure based on a specific interpretation of these parameters.

Using serviceMonitor to monitor Quality of Service

Meeting the Quality of Service requirements was deemed to be outside of the scope of this INSPIRE pilot, however, it was agreed that a procedure for testing should be examined, and the gap between the pilot environment and conformity would be documented.

The Department of Environment, Community and Local Government had trial use of the Con terra Service Monitor to assess the performance of the pilot INSPIRE View and Download services against the requirements of the Network Services regulations. The INSPIRE View Service for the Natura 2000 Special Protection Areas was selected for Quality of Service monitoring. The View Service was performing well below the necessary performance requirements based on GetMap requests to the service.

It is recommended by this pilot that a more powerful robust solution is specified for central INSPIRE services for the Irish Spatial Data Infrastructure and that the normalized procedure for Quality of Service monitoring is followed (only exists for View services at the time of writing[26]). This will involve Quality of Service monitoring in two locations: on the server side and on a central node in the Member State infrastructure.

[26] INSPIRE Technical Guidance for INSPIRE View Services (version 3.1).
Available: http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5

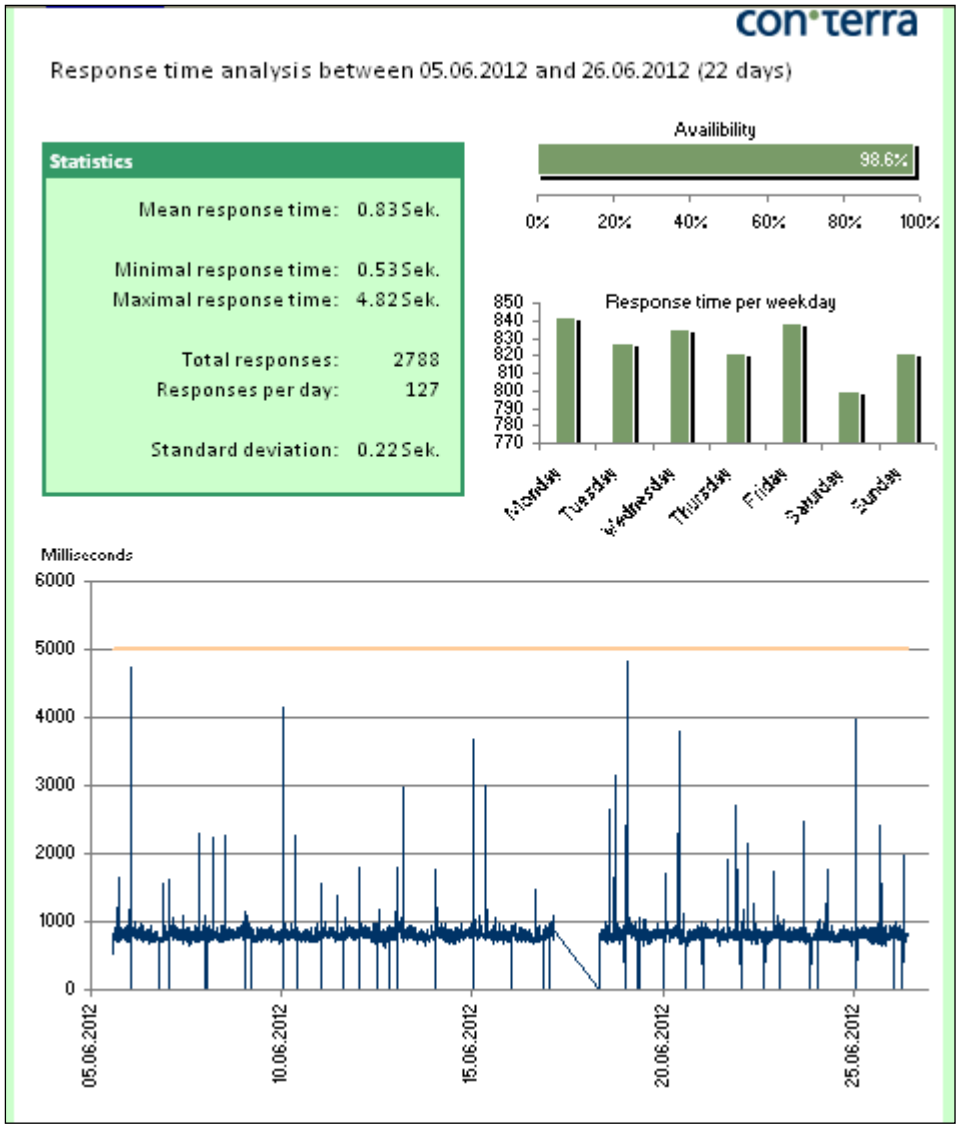


Figure 16. Example Service Monitor report showing Quality of Service monitoring of a Marine Institute WMS service.

8.3. INSPIRE Data Specification compliancy testing

INSPIRE GML data being provided through Irish INSPIRE Download Services will be validated by DECLG; there will be the following checks carried out:

1. **Conceptual Consistency**: that the INSPIRE model has been applied correctly and logically mapped successfully to allow the data to be declared 'fit for purpose' for the use-cases that the Data Specification documentation outlines.
2. **Positional and Topological consistency**: the data produced will be checked to evaluate its level of positional and topological consistency according to the requirements of the INSPIRE Data Specifications.
3. **Technical Consistency**: that the GML produced is both well-formed and also valid against the official INSPIRE Data Specification schemas and the OGC schemas.

8.4. INSPIRE metadata compliancy testing

The ISDE GeoNetwork metadata editor was used for the authoring of the ISDI INSPIRE metadata records for the INSPIRE Network Services. GeoNetwork allows for a validation routine to be run during inline editing of metadata records, and also during metadata catalogues harvesting workflows.

The EPA editor allows for metadata to be edited and validated against the JRC INSPIRE schematron and against the ISO 191139 xml schemas.

N.B. It is imperative that the Irish INSPIRE implementation develops metadata tools that enforce valid and INSPIRE compliant metadata authoring.

N.B. Some metadata fields will still have to monitored for consistency, quality and INSPIRE compliance: the level of detail should be sufficient for an end-user to determine the 'fitness for purpose' of the data set; the keywords chosen should be appropriate and from approved vocabularies; namespaces and identifiers should be applied in line with ISDI policy, etc.

8.5. INSPIRE Data Sharing arrangements - compliancy

Ordnance Survey Great Britain carried out an analysis of the main requirements for INSPIRE data sharing under the INSPIRE Directive Article 17. This was presented as a series of "Measures for 'measures' " at the INSPIRE conference 2011.[27] The same methodology was used to analyse existing data sharing in ISDE - the ISDE Memorandum of Understanding and to upgrade it to the ISDI INSPIRE Data Sharing Agreement.

Measures for 'measures'

1. **must** enable public authorities to gain access to the datasets and services
2. **must** enable public authorities to exchange and use them to deliver their public environmental tasks
3. **must** not create practical obstacles at the point of use
4. **must** respect the public authorities' self-financing requirements
5. **must** be open to public authorities of other Member States
6. **must** be open to bodies established by international agreements to which the Community and Member States are parties
7. **may** have charges but they **must** be fully compatible with the general aim of facilitating sharing
8. **may** have charges but they **must** be the minimum required to ensure the necessary quality and supply, together with reasonable ROI
9. **may** be accompanied by conditions on their use set by national law
10. **may** be limited for reasons of justice, public security, national defence or international relations.

Figure.17. Summary Measures identified to make Data Sharing Arrangements INSPIRE-compliant

The measures covered by the new ISDI INSPIRE Data and Services Sharing Agreement will enable the necessary parties to gain access to INSPIRE Protected Sites spatial data sets and services and to exchange and use those spatial data sets and services under the terms of the INSPIRE Directive and the supporting INSPIRE Data Sharing Regulations.

[27] Clare Hadley and Dominic Cuthbert (2011) "Ten measures for measures – are our data sharing arrangements INSPIRE-compliant?" – OSGB presentation at INSPIRE Conference 2011)

The INSPIRE Data and Services Sharing Agreement has been signed by the public bodies participating in this pilot.

9. Recommendations

The following recommendations for the technical implementation of the INSPIRE Directive in Ireland are forwarded to the INSPIRE/ISDI Steering Committee for consideration. The recommendations are based on the experience gained from this INSPIRE pilot project and as a result of a review of recent Irish e-government Strategy 2012-2015, policy and international best practice.

The main recommendations from this project are:

1) Publish INSPIRE Spatial Data Through Shared Services
2) Create INSPIRE Theme Delivery Plans
3) Publish Local Authority INSPIRE Data at National Level
4) Publish INSPIRE Data as Open Data
5) Publish INSPIRE Data as Linked Data
6) Evaluate INSPIRE Publishing Software
7) Align work of ISDI/INSPIRE Committee with DEPR GIS Working Group and Open Data Working Group

Recommendation #1- Publish INSPIRE Spatial Data through Shared Services

A completely federated data publishing approach to the INSPIRE Directive in Ireland is deemed to be, firstly, prohibitively expensive to implement, and secondly, difficult to coordinate due to the complexity of the publishing tasks required to become technically INSPIRE compliant.

Where possible, it is recommended to implement the technical infrastructure for INSPIRE delivery through shared services organized through strategic 'Publishing Nodes' in an Irish Spatial Data Infrastructure (ISDI).

Policy Context

Further to the statutory obligation to deliver the INSPIRE Infrastructure and data under the INSPIRE regulations and Directive, the proposal for implementing shared services for INSPIRE is also in line with current e-government policy and the vision of the CIO Council for the use of ICT shared services for data publishing and sharing in government.

eGovernment Strategy 2012-2015 – Department of Public Expenditure and Reform[28]

The INSPIRE shared service proposal is aligned with the following actions in the "Supporting Public Service Reform eGovernment Strategy 2012 – 2015"

- **Action 27** – Public bodies will evaluate the potential for exploiting digital mapping and GIS technologies in ways that are affordable, sustainable and of relevance to the customer bases of their services, taking into account the personal or commercial sensitivities of the data.

- **Action 28** – Public bodies will identify data sets they hold that contain location based data and will make these details available to other public bodies where appropriate to reduce duplication and to facilitate greater area-based targeting of public services.

[28] *Department of Public Expenditure and Reform Supporting Public Service Reform: eGovernment 2012 – 2015*

Cloud Computing Strategy – Department of Public Expenditure and Reform[29]

The proposed shared services will be in line with the "Cloud Computing Strategy" which was recently published by the Department of Public Expenditure and Reform:

- An INSPIRE Shared Service "sets a course for centralising and implementing our common ICT needs as a set of shared services"[30]
- An INSPIRE Shared Service could also lead to 'Data Centre Rationalisation'.
- The proposed INSPIRE Shared Service could also meet the DEPR specification of a "Public" or a "Public Community Cloud".

Benefits of an INSPIRE Shared Service

The main advantages of a Shared Service approach as discussed in the INSPIRE Technical sub-committee may be seen as:

- Shared Services represent a cost efficient solution for the Irish INSPIRE technical delivery architecture.
- INSPIRE compliance testing can be controlled and monitored centrally.
- It will be easier to manage and coordinate a common approach to INSPIRE Network Services, i.e. uniform approach to options in the INSPIRE Technical Guidance
- INSPIRE Unique Identifiers and an ISDI data registry will be simpler to organise and maintain.
- Obstacles to data sharing between public bodies will be reduced through the increased coordination and liaison needed for data sharing through shared services.
- The solution needed for the necessary geo-rights management, licensing and e-commerce will be implemented more efficiently if there are less access nodes in the government network.
- Implementing harmonised open licensing terms will also be facilitated by having less points of re-use.
- The proposed shared services provide a possible opportunity to reuse INSPIRE shared service arrangements through concurrently publishing source data into Open Data formats and making it available as Linked Data from official sets of managed URIs. This approach will simplify co-ordination when also developing the E-government Strategy action points for Open/Linked Data.[31]

Disadvantages of an INSPIRE Shared Service

The main disadvantages of an INSPIRE Shared Service were highlighted by the INSPIRE Technical sub-committee as:

- Shared Service solutions does not suit the business processes in some public bodies who are already engaged in established 'Big Data' publication workflows.
- There may be a risk of a lapse in data currency between the source live data set version and the INSPIRE version published at European level through Network Services.
- It may be slower for public bodies to publish data if large volume data sets need to be transferred over the internet to a centralised shared service.

[29] Department of Public Expenditure and Reform. Supporting Public Sector Reform: Cloud Computung Strategy. June 2012.
Available: http://per.gov.ie/wp-content/uploads/Cloud-Computing-Strategy.pdf
[30] Ibid.

[31] Actions 21,22 and 23 of E-government Strategy 2012-2015

Shared Service model options for INSPIRE Data Publishing

Model 1: **Centralised Shared Service**

The proposed INSPIRE Shared Service(s) could be provided in line with the DEPR specification of a "Public Cloud" or a "Public Community Cloud" implementation and would be able to supply the following:

Platform/ Infrastructure as a Service (IaaS & PaaS):
- Compute, storage and associated services
- INSPIRE Geoportal website
- Database services
- Federated Authentication services (Georights Management)

Software as a Service (Saas):
- Metadata Discovery Service (Irish Spatial Data Exchange)
- Online metadata editor (ISDI Metadata profile)
- Online Spatial Data Services (web mapping)
- Spatial Data download service
- Open Data format download
- Geo-rights management and authentication services

Spatial NI - example of a centralized Shared Service for INSPIRE data publishing

Spatial NI is the Northern Ireland portal for Geographic Information. This portal has been developed by Land & Property Services (LPS) in order to further the Northern Ireland Geographic Information Strategy and to comply with the EU INSPIRE Directive.

The purpose of the Spatial NI portal is to help civil service, public service, emergency service, elected representatives, educators, academics, Students, non-Governmental organisations and the public to find and use geographic information and to view it in conjunction with the high quality map data produced by LPS.

Spatial NI - Key features

- Centralised spatial data warehouse for Northern Ireland.
- Acts as a central store for government spatial data.
- Searchable metadata catalogue that complies with the UK GEMINI standard (equivalent to ISDE Discovery Service and ISDI metadata profile).
- Comprehensive geo-rights management system. This allows data providers to control the level of access to their data.
- Public bodies have access to the public sector data under the terms of the Northern Ireland Mapping Agreement.
- Map viewing and GIS capability.
- Capable of integrating data from most common GI formats.

- Developed in line with Open Data standards of geographic data and systems.

Model 2: **Thematic Shared Service**

A Thematic Public Cloud Shared Service model is in effect what was followed for the INSPIRE Protected Sites pilot. In Section 3.2 (p. 10) of this report, the Department of Arts, Heritage and the Gaeltacht were proposed to act as a test 'ISDI Shared Service' provider for the INSPIRE Protected Sites Data Theme and published other public bodies source spatial data (GSI and multiple local authorities).

The DAHG owns the majority of the spatial data identified under the INSPIRE Protected Sites theme, has an existing GIS publishing capability in-house, and also has the business case to collect and re-use the other data involved in the Protected Sites theme – GSI and Local Authorities.

DataShare – example of a thematic Shared Service using a hybrid-cloud platform

This is a collaborative geoportal project undertaken by the UK's Environment Agency (EA) and the Department for Environment, Food and Rural Affairs.

Datashare is a shared service which was developed to help the EA fulfill their data publishing obligations with regards to the Freedom of Information, Access to Information on the Environment, Public Sector Information, and INSPIRE regulations. It provides a cost effective publishing solution and access to spatial data to staff, contractors & professional partners. It has been online since July 2009.

DataShare provides a data download and view service capability which is designed to also provide INSPIRE compliant Network Services and Data for EA and DEFRA.

DataShare - Key features

- The DataShare shared service is offered for voluntary adoption to organisations in the **DEFRA Network**.
- **Defra, English Heritage, Environment Agency, Forestry Commission, British Waterways, Natural England, and the UK Hydrographic Office** currently all avail of the service.
- The **Environment Agency** takes the lead for the procurement of the systems, and software solutions for the service (including INSPIRE Network services and data modeling).
- A **Data Publishers Working Group** is responsible for the technical direction, monitoring progress/resolving risks, usability testing, metadata, data & support info. supply
- A **Compliance Board** is responsible for cost allocation, direction, risk mitigation, sign-off
- The following statistics on the performance of the shared service are available for 2009-2012:
    - 70 data layers available for download
    - >3,300 registered users (15 user types)
    - >24,000 data orders (peak = 1,003 in a single day)
    - 95% of all orders are downloaded by static download or WFS

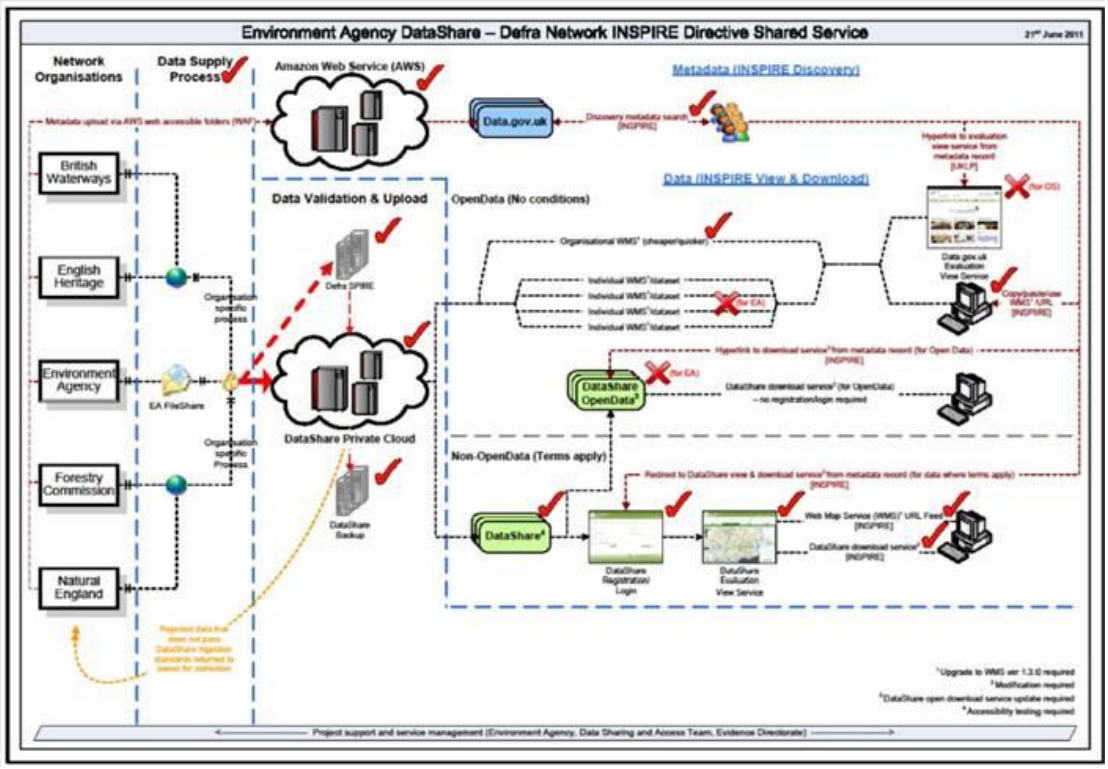


Figure 18. Diagram showing DataShare INSPIRE data publishing architecture

DataShare INSPIRE View Services

INSPIRE View Services are also provided through the DataShare shared service. They are available to browse here:
http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/inspireDataWms.xml

DataShare INSPIRE Download Services

Work is ongoing on INSPIRE download services for the DataShare INSPIRE data sets.

Public bodies publishing INSPIRE Data outside of a shared service

Public bodies may elect not to publish to an INSPIRE publishing shared service for a number of reasons; it may not suit their existing business processes for the following reasons:

- their INSPIRE data is already being reported to the EU/Global Level via existing spatial data projects e.g. One Geology, MyOcean;
- the INSPIRE data holding is physically very large and not suitable to publishing centrally e.g. Land Cover raster datasets;
- data protection issues apply to the data involved.

ISDI Partner Collaboration on Solutions

It is recommended that Public bodies wishing to publish their own INSPIRE data outside of the proposed INSPIRE publishing shared service(s) should evaluate proprietary, Open Source solution and international best practice and subsequently collaborate on a community solution to their INSPIRE publishing needs.

Open Source developments for INSPIRE data publishing should be coordinated between the ISDI public bodies involved and the INSPIRE Technical sub-committee should remain the focus for these developments.

INSPIRE Publishing Software - Compliance Testing

Regardless of the INSPIRE software solution followed, INSPIRE software compliance will be tested by DECLG and the INSPIRE Technical Sub-committee, using the test suites utilized in the Protected Sites Pilot. The INSPIRE Technical Sub-committee will also use third party INSPIRE test suites to evaluate any proposed software to be used in Irish Public Bodies.

Recommendation #2- Create INSPIRE Theme Delivery Plans

It is recommended that an "INSPIRE Theme Delivery Plan" is authored for each INSPIRE Theme/Data Specification. The INSPIRE Theme Delivery Plan is to outline the methodology to be followed by data providers to contribute to the publication and update of the Irish INSPIRE Theme Network Services.

Lead Authorities by INSPIRE theme

The INSPIRE Theme Delivery Plans are to be coordinated by a nominated lead authority who is a data provider for the theme, has domain knowledge and the necessary spatial data expertise available. The provisional lead authorities are outlined in the table below (Only INSPIRE themes involved in the current Irish Monitoring and Reporting are currently included):

INSPIRE Theme	Lead authority
Annex1	
Geographical names	Ordnance Survey Ireland
Administrative units	Ordnance Survey Ireland
Addresses	Ordnance Survey Ireland /An Post *datasets included to be reviewed
Cadastral parcels	Property Registration Authority of Ireland
Transport networks	Department of Environment, Community and Local Government * initial coordination – to be handed on to data providers
Hydrography	Environmental Protection Agency
Protected sites	Department of Arts, Heritage and the Gaeltacht
Annex2	
Elevation	Geological Survey of Ireland/ Department of Communications, Energy and Natural Resources
Land Cover	Department of Environment, Community and Local Government
Orthoimagery	Ordnance Survey Ireland
Geology	Geological Survey of Ireland
Annex 3	
Statistical units	Central Statistics Office
Buildings	Ordnance Survey Ireland
Soil	Geological Survey of Ireland /Teagasc
Land use	Department of Environment, Community and Local Government
Human health and safety	To be confirmed
Utility and Government services	Office of Public Works
Environmental monitoring facilities	Environmental Protection Agency

Production and industrial facilities	Department of Enterprise, Trade and Employment
Agricultural and aquacultural facilities	Department of Agriculture, Food and the Marine
Population distribution - demography	Central Statistics Office
Area management /restriction/regulation zones	Department of Environment, Community and Local Government
Natural risk zones	Geological Survey of Ireland
Atmospheric conditions	Met Eireann
Meteorological geographical features	Met Eireann
Ocean features	Marine Institute
Sea regions	Marine Institute / Department of Communications, Energy and Natural Resources
Bio-geographical regions	Environmental Protection Agency
Habitats and biotopes	Department of Arts, Heritage and the Gaeltacht
Species distribution	National Biodiversity Data Centre
Energy resources	Department of Communications, Energy and Natural Resources
Mineral Resources	Department of Communications, Energy and Natural Resources

Table 18. Lead agencies for the coordination of INSPIRE Delivery Plans

Content of INSPIRE Theme Delivery Plans

The INSPIRE Theme Delivery Plans are proposed to cover the following topics (a generic template will be devised by the Department of Environment, Community and Local Government to support this).

Publishing workflow and system architecture

How the data will be collected, modeled, and delivered into the relevant Data Specification and INSPIRE Network Services.

Data Provider Working Group

The Data Provider Working Group should be ideally made up of domain experts with experience in digital spatial data. The groups will be needed for initial and data set reviews and the data transformation/modeling process. The membership of each group should be detailed in the INSPIRE Theme Delivery Plan.

Identification of ISDI re-use cases

Other re-use cases for the INSPIRE Theme data sets being collected should be analysed. Where necessary harmonising schemas for these other ISDI re-use cases may be implemented before a transformation to the INSPIRE model is carried out.

Inspire theme data update cycle

The Theme Delivery Plan should details the agreed update cycle for the spatial objects in the INSPIRE Theme Data Specification.

Data exchange formats and system interfaces

Agree data exchange formats and system interoperability arrangements where necessary.

Quality control

Each INSPIRE Theme Data Specification will have specific requirements with regards to data quality assessment and documentation e.g. Conceptual consistency, topological consistency.

The Data Provider Working Group must analyse the data quality requirements for INSPIRE and also any other identified ISDI re-use case.

ISDI data improvement plans

Where there is a identified need to improve data quality or modelling in the source data, there should be a plan coordinated to improve the source data sets over the medium term.

INSPIRE auditing

Regular re-audits for newly created INSPIRE data sets per theme will be required to be carried out by the Data Providers Working Group.

Recommendation #3- Publish Local Authority INSPIRE data sets at national level

It is proposed that local authority level data is amalgamated and published through national level ISDI spatial data services prior to publication to INSPIRE Data Specifications /Network Services. This will mean that further data sharing benefits will be realised for the Irish Spatial Data Infrastructure before publishing into the INSPIRE network at the European level.

This approach will be recommended for all the local authority data sets that are listed under the different INSPIRE themes. This is deemed to be the most cost-efficient method of publishing INSPIRE data from local authorities and reflects the approach that is being taken for local authorities in Northern Ireland and in the UK.

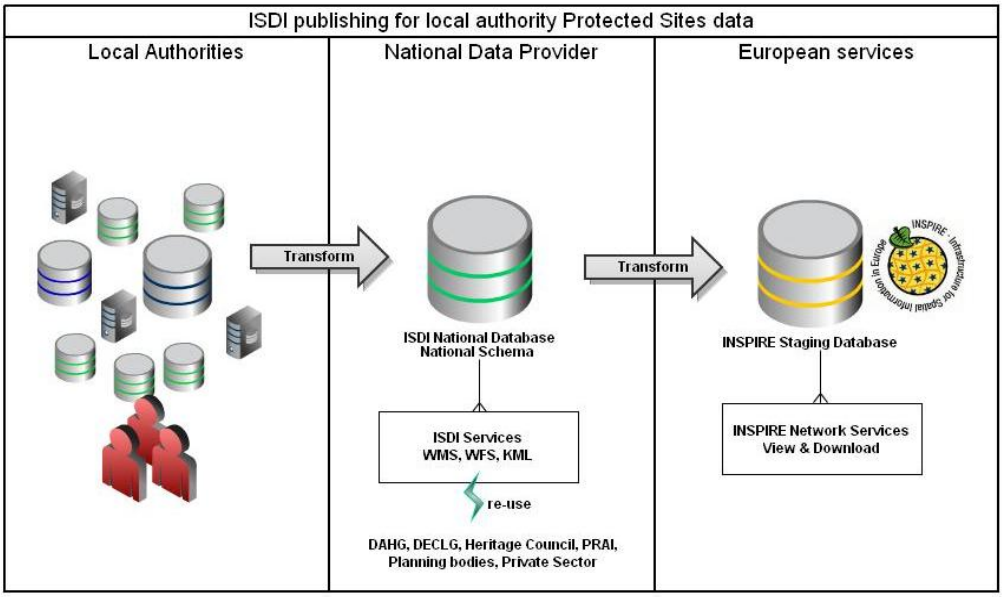


Figure 19. Proposed workflow for local authority INSPIRE Protected Sites data publishing

The re-use cases for the national level local authority spatial data services will be examined as part of the consultation with Working Groups for the INSPIRE Theme Delivery Plans.

Recommendation #4- Publish INSPIRE Data as Open Data

The processes and SDI business workflows being set up by the INSPIRE Implementation Programme may be used by all public bodies to address additional data publishing policy areas such as:

- PSI Directive and Open Data actions in e-government policy
- Access to Information on the Environment regulations
- Freedom of Information regulations

INSPIRE data sharing and re-use terms must also be organized formally under the terms of the INSPIRE Data Sharing regulation, the Irish INSPIRE regulations and Article 17 of the Directive. The following recommendations for data sharing and re-use aim to introduce measures to remove obstacles to data sharing between Irish public bodies:

Create an Irish Open Government Licence Framework

- Recommend that the Irish government creates a data licence framework suitable to satisfy Open Data and INSPIRE data sharing requirements.
- Harmonise current data licensing in ISDI around the existing PSI Licence .

Ensure interoperability between ISDI/INSPIRE CSW metadata catalogues and Open Data project CKAN metadata catalogues

- Establish a project to examine interoperability between ISDE metadata CSW catalogues with CKAN metadata catalogue for a potential data.gov.ie PSI portal.

Recommendation #5 – Publish INSPIRE Data as Linked Data

Linked Data is about using the Web to connect related data that wasn't previously linked, or using the Web to lower the barriers to linking data currently linked using other methods. Key technologies that support Linked Data are URIs (a generic means to identify entities or concepts in the world), HTTP (a simple yet universal mechanism for retrieving resources, or descriptions of resources), and RDF (a generic graph-based data model with which to structure and link data that describes things in the world).[32]

[32] Linked Data project website FAQ. Available at: http://linkeddata.org/faq.

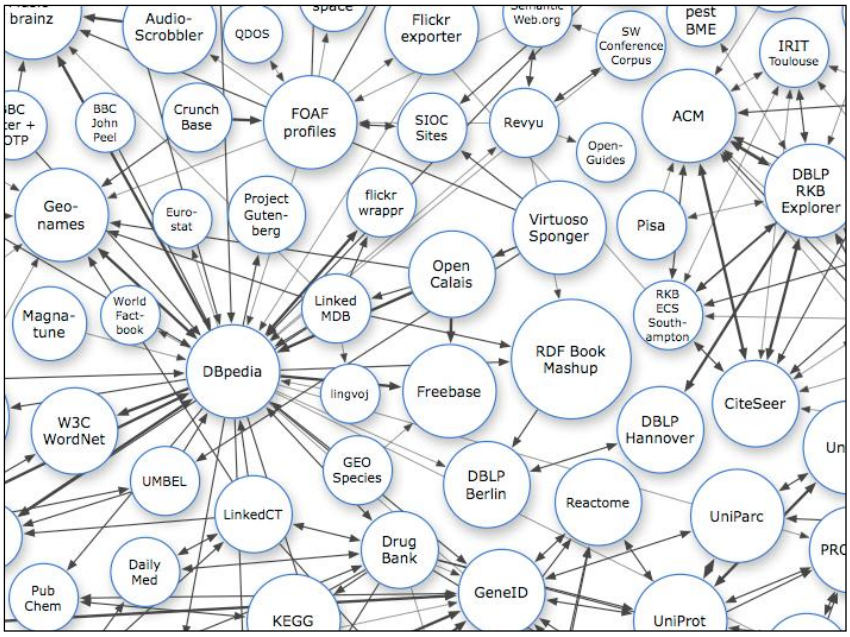


Figure 20. Diagram showing Part of the Linking Open (LOD) Data Project Cloud graph

It is recommended that the INSPIRE/Steering Committee should consider following the following actions points on linked data for INSPIRE publishing:

- Maximise the re-use of INSPIRE data for other purposes outside of the public task for commercial and non-commercial purposes, according to the objectives of the PSI Directive and Open Data movement.
- Align ISDI/INSPIRE data publishing with Open Linked Data publishing approaches as driven by data.gov.uk, data.gov.eu, Dublinked etc.
- Devise common spatial URI sets as part of INSPIRE shared service publishing. Organise the URIs to be persistent and centralised around the data.gov.ie subdomain for spatial objects, spatial things and data set Identifiers.
- Explore Linked Data and semantic web applications for the INSPIRE URI sets in line with other Irish Open Data projects.

Recommendation #6 – Evaluate INSPIRE Publishing Software

It is recommended that any INSPIRE publishing software being evaluated for use in a public body or through an INSPIRE shared service should be reviewed with the INSPIRE Technical Sub-committee. It is also essential that duplication of effort is avoided in the development or tailoring of software solutions by public bodies for INSPIRE publishing.

Proprietary software options

There are a number of spatial data software vendors that provide INSPIRE publishing/modelling software solutions. The Protected Sites pilot used ArcGIS for INSPIRE as it was immediately available to the project partners for trial through their existing support contracts, however it should be noted that there are a number of different vendor-led solutions available on the market.

Any proprietary solutions considered by public bodies should be also subjected to the rigorous UAT routines that were utilised in the Protected Sites pilot project. Any prospective tender for INSPIRE

publishing services should be forwarded to the INSPIRE Technical sub-committee to allow the technical requirements to be reviewed.

Open Source software options

There are a number of INSPIRE open source software suites being collaborated on and developed by spatial data interest communities across Europe, e.g. GeoNetwork, GeoServer, Deegree, Mapserver, PostGIS, GeoKettle etc. It is important that ISDI partners in interested in Open Source solutions, especially those choosing to publish to INSPIRE data themselves, collaborate in this area for INSPIRE data publishing.

Irish Spatial Data Exchange (ISDE) - The Irish Spatial Data Exchange is a collaborative Open Source project that has established a national level INSPIRE Discovery Service. A discovery service makes it possible to search for spatial datasets, services and applications on the basis of the content of the corresponding metadata (ie. description) and to display the content of the metadata. The Irish Spatial Data Exchange has been linked into the JRC Geoportal as the Irish National INSPIRE Discovery Service

Ordnance Survey of Great Britain (UK Location) and IGN France Geoserver project – an example of collaboration on INSPIRE View and Download Services

Certain open source projects are being heavily invested into by European Governments, e.g. GeoNetwork and Geoserver project are openly being supported by the UK Location Programme and IGN France. Ordnance Survey Great Britain is implementing INSPIRE servicesusing the open source GeoServer platform, and is collaborating with IGN France to create a fully INSPIRE

The Nordic Open Source Initiative Network (NOSIN) – an example of collaboration on national geoportals

The Nordic Open Source Initiative Network" (NOSIN) is a forum for general cooperation on open source software used in national spatial data infrastructures in the Nordic countries. The initiative is used for sharing project experience and reducing costs. The results are shared freely with everyone involved.

The creation of NOSIN was motivated by a successful cooperation on GeoNetwork for Discovery Services. This cooperation was based on a requirement to implement national geoportals within the Nordic countries in order to support spatial data infrastructures meeting the requirements of the INSPIRE Directive. In 2009, the mapping authorities in Finland, Norway, Sweden, and Denmark agreed that the development of national geoportals should be a subject of cooperation; this lead to the creation of The Nordic initiative and the development of GeoNetwork for the implementation of the Nordic national geoportals. The cooperation on GeoNetwork is not limited to just the Nordic countries, the Netherlands and Scotland has also shared its experiences of using GeoNetwork for national geoportals.

Recommendation #7 – Align work of ISDI/INSPIRE Committee with DEPR Spatial Information Working Group and Open Data Working Group

The work of the ISDI/INSPIRE Committee must align its work with the future policy direction coming out of the DPER working group on Spatial Information and also the DPER PSI/Open Data Working group. Both of these groups have been set up as part of the recent eGovernment Strategy and

technical synergies have been identified between these work areas and the ISDI/INSPIRE Committee for the following topics:

- Government metadata profiles and vocabularies
- Metadata catalogue interoperability
- Government data licencing frameworks
- Government data exchange/publishing formats
- Linked Data and Sematic Web publishing
- Data Sharing Agreements for Government

It is important that developments in these three Committees/Working Groups are communicated and that system interoperability and data sharing/licencing arrangements are coordinated in a complimentary manner.