

Terms of Reference

For

Development of National Geo-portal for promoting and utilizing on National Spatial Data Infrastructure (NSDI)

(Draft)

Consultancy

A. Introduction

Spatial Data Infrastructure is an institutional concept in order to respond to needs for a wide range of spatially referenced data/information in various problem solving domains. This is being facilitated by the rapid growth of geographic information system (GIS) concepts and technologies for good management of infrastructure development, sustainable economic planning, environmental conservation and a variety of other challenges that we are presently facing in our society. National Spatial Data Infrastructure (NSDI) is therefore a national endeavor that has come to be seen as the technology, policies, criteria, standards and people necessary to promote geospatial data sharing throughout all levels of government, the private and non-profit sectors and academia. NSDI is an umbrella of policies, standards and procedures under which organizations interact to foster more efficient use, management and production of spatial data. It is a part e-governance strategy of many countries.

Actually, geospatial data is an essential element that is used every day by government for policy development and execution, environmental management, disaster response, agriculture, health care, transportation planning, delivery of clean drinking water, land-records management, poverty eradication, sustainable economic development, defence as well as food security. Geospatial data is indispensable element of effective governance, including E-government, transparency in government, good science and better decision making. Considering the importance of geospatial data and its varied applications in the present context, an International Seminar on “National Spatial Data Infrastructure (NSDI) for Bangladesh” was organized 01 and 02 June 2016 by Survey of Bangladesh and JICA Bangladesh under the supervision of Ministry of Defence. Honorable Prime Minister of The People’s Republic of Bangladesh Sheikh Hasina inaugurated the seminar and talked about the importance and necessity of NSDI and issued instructions for activities to be promptly implemented for the building of NSDI.

B. Background

To find out the best fit NSDI for Bangladesh, a pilot project on NSDI (NSDI-PP) was launched on August 2017 with the overall supervision of Ministry of Defence (MoD) and financial support of Japan International Cooperation Agency (JICA). Survey of Bangladesh (SoB) being the prime organization of NSDI coordinated the overall activities. Total 15 governments and trustee organizations participated actively in the NSDI-PP and worked persistently to make this project a success. The NSDI-PP is developed on the basis of limited scale database taking only few parts of the country. The NSDI-PP is an experimental project aims to examine the function and performance of NSDI and to study on its benefits and issues prior to the introduction of the full-scale NSDI of Bangladesh. The evaluation report of the NSDI-PP was prepared by pilot project members and the NSDI-PP has ended on September 2019.

C. Objectives of the Consultancy

The objectives of the consultancy is to develop web based software, “National Geo-portal”, based on the results of the NSDI-PP evaluation report and the suggestions from the NSDI-PP members, and to share, publish and display geospatial information and/or metadata through the internet, which are managed by all government, semi-government, autonomous and non-governmental organizations. Moreover, the consultancy should support activities for promoting of utilization on NSDI to organizations which participate in NSDI working group members (NSDI-WGMs)¹ including during the development period.

D. Overview of the proposed system

The proposed software will provide an online platform to share, display and manage geospatial information and/or metadata by all government, semi-government, autonomous and non-governmental organizations.

The proposed system is positioned as the core component in the NSDI framework. When configuring the NSDI, the final form that system function will take consists of consolidation of base map data, shared thematic data or metadata form each government organization on the proposed system, and sharing/distribution of data with users according to the authority assigned to each user. The metadata for geospatial information in Bangladesh is stored on the proposed

¹ NSDI-WGMs are listed in Annex I

system, and users can easily learn about the location, quality and accuracy of that data by searching the proposed system.

By distributing SoB base map data (topographic maps, orthoimages, DEM, etc.) on the web with API (Application Programming Interface) that complies with the OGC (Open GIS Consortium) standard, users will be able to reference/utilize these maps/data as background maps in the same manner as maps provided by the Geospatial Information Authority of Japan (GSI), Google Maps and Open Street Map without preparing a data server for base map data in their own organization.

Activities to be performed by different groups via the proposed system are shown below:

General users:

- Can search metadata
- Can search geospatial data registered as open data
- Can browse geospatial data registered as open data on base map

Organization users:

- Can upload resources (layers, maps, documents, metadata) under the organization the user is belongs to
- Can browse resources of his own organization and also resources of other organizations permitted to his organizations
- Can download resources of other organizations permitted to his organizations
- Can assign necessary permission when uploads a resource. Although organization admin can edit the permission when verify
- Can monitor his own resources from the members workspace
- Edit or delete his own resources
- Can edit profile
- Create map
- Change styles of layers and maps
- Can use extended cross layer search using by his own organization and also resources of other organizations permitted to his organizations
- Can browse overlaying multiple SoB base map

Organization admin:

- Including the activities of organization users
- Can assign necessary permissions to the resources

- Can create a new section under his organization
- Can create new users under his organizations as well as under specific section
- Backup and restore all the layers of his organization from the proposed system
- Can see the recent activity
- Can see the user list
- Can enable and disable any member from his organization
- Have access to all the resources of his own organization
- Can verify or deny resource approval requests from all the users of his organization and after that send it to committee member for approval
- Can track all the user verification request, approved, user drafts, denied and verified resources.

Committee member:

- Including the activities of organization users and organization admin
- Access to admin workspace
- Can approve or deny verified resources from any organization
- Can approve or deny a Web API for distributing SoB base map from any organization

Super admin:

- Can create, update, delete sectors
- Can create users with or without the role of Committee
- The super admin is responsible for creating a new organization and update or delete old organizations, under the available type
- An organization admin should be assigned to that created organization by the super admin
- Can manage sections of index page by enabling or disabling these and can add or update slider images from the sliders
- Can manage (add, update, remove) categories to organize layers, maps, documents, metadata in several categories
- Can manage (add, update, delete) WMS servers to add more layers from any other WMS layer sources
- Can generate a Web API key for using SoB base map and provide it to any organization which Committee approved to use the Web API for distributing SoB base map
- Can manage (add, update, delete) any announcement and news system wise
- Can access all the layers and metadata by browsing the proposed system as he has the administrative permission to the proposed system

- Can access the proposed system admin panel for the whole system for any emergency update
- Can take a backup of all the database from the proposed system
- Can take a backup of all the media files of the proposed system
- Can take all the data of the proposed system

Following will be the technical features of the software:

- The software will be web based, responsive and browser and device independent
- Linux, Apache, Python, PostgreSQL, PostGIS, Open Layers, interactive mapping application such as MapServer and Geoserver will be used for the application. Therefore, the software must be developed using latest version or stable and compatible version.
- The system will be able to send email and mobile SMS notification and this should be configurable
- Users, Roles and Access management will be integrated part of the software
- The system will be able to enforce all data validation during entry and upload
- The software source code, must have sufficient comment and be delivered without encryption
- Developer must provide user manual/tutorial with screenshots and/or video
- Developer must provide detailed development documentation (work flow diagram, data flow diagram, system design document, etc.)

E. Scope of Work

The consulting firm/consultants will work closely with the SoB, NSDI-WGMs and JICA project team of “Project for establishment of national spatial data infrastructure (NSDI) for Bangladesh” (JICA Project Team) to elicit requirements and manage the software development life cycle including capacity building and knowledge transfer.

Basically, the software development is to enhance the NSDI prototype system (NSDI-PS) built in the NSDI-PP. New scratch development will be allowed, however in this case, all the functions realized by the prototype system should be covered. The specifications of the NSDI-PS are shown in Reference I.

In particular the scope of the work will be as follows:

1. **Gather requirements and development user stories/use cases:** In discussion with SoB, NSDI-WGMs and JICA Project Team, gather details of the requirements and

develop user stories: prepare a software requirements specifications (SRS) and get signed off by SoB. A tentative requirements and expected features of the software are listed in Annex II.

2. **Develop and test the web-based application:** Based on the requirements gathered, develop an application framework that includes user management, access control, security and workflow for publishing information. This application framework should be able to add modules in future and be able to share data with other applications. Test the application framework with the real users from SoB and NSDI-WGMs and gather feedback on the system.
3. **Survey on the utilization of NSDI in NSDI-WGMs:** For implementation of technical capabilities, system environment, human resource, work flow and other matters concerning geographic information at NSDI-WGMs' organizations, and work analysis should be performed. After that, discussion with SoB and NSDI-WGMs and cooperation works with them should be conducted in preparation for utilization plans after developing of the software.
4. **Finalize the web-based application:** Based on the feedback received from the testing by the real users, finalize the web-based application and prepare technical documentations, user manual, tutorial guide, tutorial video for orienting the users.
5. **Orient the users and SoB staff:** Orient the system administrators and end users of SoB and NSDI-WGMs (approx. 50 persons) on administering and using the system. Finalize the users' manual and other materials based on feedback received from the end users. Make the user manual and other materials as help file to online application so that user can refer to the manual as and when needed. **A tentative requirements and expected contents of the training are listed in Annex III**
6. **Hand over the software:** Host the online software at Bangladesh Computer Council (BCC) National Data Center designated servers and hand over the document source code, user manuals and training materials to SoB with a plan of regular maintenance.
7. **Provide troubleshooting support:** Provide troubleshooting support for at least one year after handling over the software. The support should be in person, on-site, over telephone and via email, as when necessary.

At the end of the assignment, the SoB will have a fully functional web-based application and SoB staff will be able to maintain the software.

F. Fixing vulnerabilities of the web application

The National Geo-portal will store the related information of geospatial information and publish them on web application. And also, this system will be managed user information for system administration and operation, uploading of geodatabase and metadata, system use, and so on. Therefore, it should prevent internet threats such as website defacement, viewing sensitive data stored in the database, attacking and manipulating the database, embedding fraudulent data and malware on the web site, and so on.

The web application to be developed shall be checked for vulnerabilities as listed in Annex IV, and security measures shall be taken to ensure the secure operation of the National Geo-portal.

G. Expected Deliverables

The contractor will deliver the following as part of this assignment.

1. Inception Report with updated project plan;
2. Software developed and delivered as per technical requirements stated in the scope of work and agreed through SRS;
3. Conducted orientation training for SoB and NSDI-WGMs;
4. Conducted software maintenance training for SoB IT Staffs;
5. Delivered final version of the Software along with documented source code;
6. Delivered user's manual and training materials.
7. Delivered survey report for utilization plans on NSDI by each related organizations.

H. Vendor Responsibilities

For this consultancy, the vendor will be responsible for the followings;

- Managing the software development team
- Attending the meeting, workshops, discussions with SoB and NSDI-WGMs as and when needed
- Submitting the specified deliverables to Sob and NSDI-WGMs for comments and approval

- Delivering Software using as per scope of work and signed-off SRS
- Organizing and conducting trainings of master trainers and users
- Supporting SoB and NSDI-WGMs in troubleshooting during the testing and after handing over of the software

I. SoB's responsibilities

Being the sponsor of the project, SoB will be responsible for the followings:

- Liaison with NSDI-WGMs and involving them in the process
- Assisting in setting meetings and workshops with NSDI-WGMs
- Provide technical feedback on the process, documentation and deliverables
- Provide the necessary information and materials from NSDI-WGMs in order to develop and test the software
- Review of the software and providing feedback to finalize
- Getting nominations for the master trainer and user trainings from NSDI-WGMs
- Releasing the payments upon satisfactory delivery by the vendor

J. Timeframe

The contractor will submit detail time frame for completing the assignment in light of the following tentative timeframe for the milestones.

Milestone No.	Task/Output	Deadline/Time
1	Inception report with SRS	Within 2 working weeks after starting the assignment
2	Software developed and midterm delivery using as per technical requirements stated in the scope of work and agreed in SRS	Within 2 months after starting the assignment, must be agreed and signed off by SoB and NSDI-WGMs
3	Software developed and full delivery using as per technical requirements stated in the scope of work and agreed in SRS	Within 4 months after starting the assignment, must be agreed and signed off by SoB and NSDI-WGMs
4	Surveyed on the utilization of NSDI in NSDI-WGMs	Within 4 months after starting the assignment, survey on the utilization of NSDI will be conducted by the consultant in consultation with SoB and NSDI-WGMs

Milestone No.	Task/Output	Deadline/Time
5	Conducted orientation training for SoB and NSDI-WGMs and software maintenance training for SoB IT Staffs	Within 5 months after starting the assignment, orientation training and software maintenance training will be organized and conducted by the consultant in consultation with SoB and NSDI-WGMs
6	Delivered refined final version of the Software along with documents source code, users manuals, training materials	Within 6 months the consultant will deliver the refined final software.

K. Financial proposal

The financial proposal by the firm should contain itemized cost, at least for the following broader deliverables: System analysis and requirements gathering cost; software development and testing cost; survey on the utilization of NSDI; orientation training for SoB and NSDI-WGMs; and post-handover troubleshooting support cost.

L. Proposed Payment Schedule:

The Payments are made upon satisfactory completion and acceptance by the SoB for the deliverables:

- 10% of the contract value upon submission of Inception Report and SRS (milestone 1)
- 20% of the contract value upon submission of midterm software developed as per technical requirements stated in the scope of work and SRS (milestone 2)
- 20% of the contract value upon submission of software developed as per technical requirements stated in the scope of work and SRS (milestone 3)
- 15% of the contract value upon submission of the survey report of the utilization of NSDI (milestone 4)
- 15% of the contract value upon submission of the user manuals, training materials and completion training of SoB and NSDI-WGMs (milestone 5)
- 20% of the contract value upon submission of the refined Final Version of the software along with documented source code, final users manuals and training materials (milestone 6)

M. Reporting Arrangement

The contractor will work under the overall guidance of the Surveyor General and direct supervision of the “Project for Establishment of National Spatial Data Infrastructure (NSDI) for Bangladesh” Project Officer and will report to SoB Technical Team’s leader of NSDI. As the assignment will be time constrained, the consultancy firm/consultants will provide weekly update on the progress during the assignment.

N. Minimum Qualification and Experience Required

The vendor with experience in Linux, Apache, Python, PostgreSQL, PostGIS, Open Layers, interactive mapping application development with MapServer or GeoServer may bid for this assignment. The team should consist of the following members at the minimum:

Role	Count	Responsibilities	Qualification
Project Manager	1	Responsible for the software development project and support activities for promoting of utilization on NSDI, liaison with SoB, NSDI working group members and JICA Project Team gather requirements; report on progress of development and support	M.Sc. degree, in computer science; at least 10 years’ experience in managing software project and work with GIS and/or Web map service (WMS); good skills on database and online server system management, web-application development, data security management
WebGIS Application Developer	1	Develops the application structure and web application framework using suitable open source software based on requirement gathered; develops and installs the system appropriate	B.Sc. in Computer Science/IT related subject and at least 7 years’ experience in Linux, Apache, Python, PostgreSQL, PostGIS, Open Layers, interactive mapping application development with MapServer/GeoServer; and experience of developing web application
Web Application Developer	2	Develop the application features using the open source stack based on the requirements.	B.Sc. in Computer Science/IT related subject and at least 5 years’ experience in open source stack, developing web GIS application with Mapserver/GeoServer, PostgreSQL and PostGIS. Must have sound knowledge in front end tools and technologies
GIS Database Developer	1	Database design and development as per the specification and normalize database structure for better understanding and	B.Sc. in Computer Science/IT related subject and minimum 5 years of experience in working with GIS systems, GIS data

Role	Count	Responsibilities	Qualification
		performance	processing, analysis and management.
Basic survey for NSDI utilization	1	Surveys system environment, human resource, work flow and other matters concerning geographic information at each organization; performs work analysis and makes utilization plans of NSDI.	At least 5 years' experience of work in the field of GIS and/or WMS; at least 2 years' experience in working with government institutions
Technical Trainer	1	Develops user manual, training materials; delivers training to SoB and NSDI working group member	At least 5 years' experience in technical writing and training delivery

In addition to the above, the firm should fulfill the following criteria:

- Legal establishment for a minimum of five years (proven document, e.g. trade license, VAT registration)
- Should be a national company
- JV not recommended
- Plugin development experience for ArcGIS desktop
- Experience in development of geospatial data sharing application using open source technology
- Experience in similar assignments with proven track record
- All proposed resources should be under regular payroll for last 6 months
- Should have capacity to provide post-development support for at least one year.

O. Submission of proposals

The SoB invites technical and financial proposals from eligible software company to implement the assignment. The proposals should include detailed methodology, detail work plan, a cover letter/motivation letter explaining why they are the most suitable for this assignment, and a detailed budget. A Purchase Order will be awarded based on the quality of technical and financial proposals following the SoB procurement and financial rules and regulations. Payment will be made in Bangladesh Taka (BDT) as per the SoB financial rules and payment conditions as stipulated in the service Agreement/Purchase Order and ToRs.

The interested companies are requested to submit their proposals hardcopy to the address: **Mr. XXXX, Project Officer, The Project for Establishment of National Spatial Data Infrastructure**

As of 22nd June, 2011

(NSDI) for Bangladesh, Survey of Bangladesh, Tejgaon Industrial Area, Dhaka by close of business on XX XX 2020

Annex I**List of NDSI Working Group members (as of 23rd March, 2020)**

#	Organization name	Abbreviation
1	Ministry of Defence	MoD
2	Survey of Bangladesh	SoB
3	Bangladesh Bureau of Statistics	BBS
4	Access to Information/ICT division	a2i
5	Bangladesh Computer Council	BCC
6	Local Government Engineering Department	LGED
7	Water Supply and Sewerage Authority	WASA
8	Department of Land Records and Surveys	DLRS
9	Dhaka North City Corporation	DNCC
10	Dhaka South City Corporation	DSCC
11	Institute of Water Modelling	IWM
12	Space Research and Remote Sensing Organization	SPARRSO
13	Bangladesh Meteorological Department	BMD
14	Department of Disaster Management	DDM
15	Bangladesh Water Development Board	BWDB
16	Bangladesh Inland Water Transport Authority	BIWTA
17	Water Resources Planning Organization	WARPO
18	Center for Environment and Geographic Information Services	CEGIS
19	Rajdhani Unnayan Karttripakkha	RAJUK
20	Geological Survey of Bangladesh	GSB
21	Power Development Board	PDB
22	Roads and Highways Department	RHD
23	Rural Electrification Board	REB
24	Bangladesh Telecommunication Regulatory Commission	BTRC
25	Japan International Cooperation Agency	JICA

No particular order

List of additional NDSI Working Group members (proposed)

#	Organization name	Abbreviation
1	Dhaka Mass Transit Company Limited	DMTCL
2	Soil Resource Development Institute	SRD
3	Department of Environment	DoE
4	Palli Karma Sahayak Foundation	PKSF
5	Titans Gas Transmission and Distribution Company	TITAS
6	Dhaka Electric Supply Company Limited	DESCO
7	Dhaka Power Distribution Company Limited	DPDC
8	Forest Department	FD

No particular order

Annex II

A tentative requirements and expected features of the software

In addition to the functions of the NSDI-PS, the following functions should be to be added or improved to the new software.

1. Completely new UI/UX

The National Geo-portal should focus on what user wants from NSDI. Few items below;

- a. Showcasing most common layer categories
- b. Quick, easy to use search with sophisticated result display
- c. Simplified layer upload and approval process
- d. Ensure compatibility Microsoft Edge, Firefox and Chrome
- e. A unique design

2. Tile server with caching

Since current infrastructure serves everything from on server/instance, it's recommended to move the tile server in different instances with load balancing and memory based caching for reducing I/O operation. The tile services assumed are as follows;

- a. Web map tile of SoB topographic maps
- b. Web map tile of SoB orthophoto images
- c. Web map tile of SoB DEM images
- d. Vector tile of SoB topographic maps
- e. Elevation tile of SoB DEM

3. ArcGIS extension for uploading layer

Almost all working group member use ArcGIS and they are very familiar with GDB and Shape file. A GDB can grow couple of gigabytes where a shape file can be maximum 2GB. It's being identified that, if the National Geo-portal allows user to upload a layer (GDB, SHP) from the ArcGIS, it enables user to upload layer in a background process and so big layer can be uploaded from the user PC to the National Geo-portal server. An ArcGIS user will install the plugin and the National Geo-portal tool bar item needs to be shown in ArcGIS for signing and uploading layer.

4. System wide searching

The National Geo-portal should have a nice and quick searching, which should search in layer name, tile, metadata, map, document, users and organization and grouped the search

result based on the match. That means, from the search result, if it's a layer, then navigate to layer preview page when selected.

5. Extended cross layer buffer search

Search in multiple layers against one reference layer and then highlight the buffer region with different color code for different layer. A provision to save the buffer result as a new layer. Same type of geometry will allow to create a single layer or otherwise multiple layer. All the layer attributes table needs to be shown as tab found in the given buffer. A subset of spatial selection method below might be adopted in the National Geo-portal.

Spatial selection method for target layer feature(s):

- a. contain the source layer feature
- b. intersect the source layer feature
- c. are within a distance of the source layer feature
- d. completely contain the source layer feature
- e. contain (Clementini) the source layer feature
- f. are within the source layer feature
- g. are completely within the source layer feature
- h. are within (Clementini) the source layer feature
- i. are identical to the source layer feature
- j. touch the boundary of the source layer feature
- k. share a line segment with the source layer feature
- l. are crossed by the outline of the source layer feature
- m. have their centroid in the source layer feature

6. Searching layers for a given bounding box

A set of dropdown of the catchment tree of Bangladesh such as “Select Division”, “Select District”, “Select Upazila/Thana”, “Select Union/Ward”.

Or an option to select a bounding box on the map. Then system should search all the layers has data inside that region/bounding box. A list of layers to be shown as list.

Then form the list, there will be option to filter based on category, organization and so on.

7. API

An API key will be generated for whoever wants to use the National Geo-portal API. So that, system can track which API key is being used to get data from the National Geo-portal or are

the misusing/fishing the API facilities or not. For a start following API can be exposed from the National Geo-portal.

API needs to be served from a different endpoint like `api.nsd.gov.bd`. This ensures the less load to the web server and new API can be developed and deployed without hampering the live environment.

- a. A set of API for receiving spatial, non-spatial data from the National Geo-portal. e.g: SoB base maps, administrative catchment tree like Division > District > Upazilla.Thana > Mouza. Resultant data might have the geographic information along with the search result.
- b. Elevation of a particular location. Will take longitude and latitude as input and return elevation as output.
- c. Current temperature of a particular location with forecast.

8. Overlaying multiple SoB base maps

The NSDI-PS doesn't treat tile map as layer. So during map creation, user wouldn't see the tile map as a layer. Now we need a provision to overlay one or more tile layer on top of base layer and set the opacity level to each tile layer.

A tile layer source may be in different host/computer other than the web portal.

9. Uploading and registering metadata without actual data

The NSDI-PS can be registered metadata when spatial data, table format data and time series data are uploaded. However, it is not possible to register only metadata.

Some of information prepared by each organization is not available to upload actual data in the National Geo-portal. Therefore, in order to share the existence of the data among the related organizations concerned, it is necessary to be able to register even just metadata. Metadata items shall be updated in accordance with the separately created metadata guideline.

In addition, in order to facilitate the registration of metadata, a metadata creation tool using EXCEL, etc. should be developed.

10. Improvement of clearing house function

The NSDI-PS can search layers, maps, documents, organization and user by free word, organization name and category and browse and download the result of search.

Currently, metadata guidelines are being developed at NSDI-WGMs under “the Project for Establishment of NSDI in Bangladesh”. Therefore, the clearinghouse function should be improved in accordance with the metadata guidelines.

11. Notification through SMS

The National Geo-portal organization’s user will upload data in the platform with the permission set which would then need verification of their organization admin. An admin can approve or deny. If approve, then it will be sent to the NSDI committee member for approval. If any committee member approves it, only then will it be included into the National Geo-portal live site.

In the NSDI-PS, these approval processes are conducted by e-mail. However, since the approver sometimes overlooks the e-mail, it is necessary to add a SMS notification function in order to operate the system more flexible.

12. Enhancement of system usage monitoring

In the NSDI-PS, there are some functions for system usage monitoring and system administrator can see number of counts and activities date of map loads, layer loads, document loads, pan, clicks and so on.

However, since there is no function to check each user's login status and data upload status and so on, it is a need to add a function to monitor each user's usage.

13. Bengali web site

The websites of the Bangladeshi government organizations are available in Bengali and English versions. The National Geo-portal should also prepare articles and menus in Bengali notation.

14. Loading user’s layer and editing user’s data

Some users of the National Geo-portal do not have GIS software. For such users, functions that draw figures easily and display own data without registering in database shall be added. The functions assumed are as follows;

a. Loading user’s layer

Load user’s data which format type is KML, GeoJSON, GeoTiff and CSV, and display on the map.

b. Drawing figures

Add new a user layer, and draw the new figures as point, polyline, polygon and text on the user's layer.

c. Editing and deleting figures

Edit and delete figures on the own user's layer.

d. Saving user's layer

The figures created by drawing function shall be saved as a file which format type is KML and GeoJSON.

e. Displaying user's layer

Turn on/off the display of user layers and remove them from layer list on the layer management window.

Annex III**On-site training of the National Geo-portal**

On-site training for system administrators and users should be provided to ensure the continually operation and maintenance of the National Geo-portal.

1) Persons subject to the training and contents

The persons subject to the training and contents will be listed as below.

Group	Contents	Days	Location
SoB (about X persons)	<ul style="list-style-type: none"> - Operation method - Information security education - Other lectures ※ Including strengthening capacity building to lecture other organization's trainees. 	X days	Digital Mapping Center
NSDI Working Group members (about X persons)	<ul style="list-style-type: none"> - Operation method - Information security education - Other lectures 	X days	Digital Mapping Center
System administrators (about X persons)	<ul style="list-style-type: none"> - Overview of software configuration - Data management - System operation and management - Troubleshoot 	X days	Digital Mapping Center and National Data Center (BCC)

2) Planned schedule of training

The on-site training shall, in principle, be conducted between two months and one week prior to delivery final version of system, as directed by SoB.

3) Preparation of training

The contractor should prepare the following matters and implement on-site trainings.

- Formulate the content of the training program and prepare the training implementation plan that describe training environment and methods.
- Prepare user guides and operation manuals describing how to manage and use the system.
- Deliverables for training shall be provided in hard copy and soft copy.
- Prepare training textbooks in consultation with SoB. The training text books shall be well designed to make it easy for users to learn how to use the system in a short period of time.
- The training shall be conducted at a location provided by SoB.

Annex IV**Web application security implementation**

As a security implementation of the web application, the following vulnerabilities should be checked and done fundamental solutions.

No.	Vulnerability	Fundamental solutions
1	SQL injection	<ul style="list-style-type: none"> - Built all SQL statements using placeholders. - When building an SQL statement through concatenation, make up the literals in the SQL statement correctly. - Do not write SQL statement directly in the parameter to be passed to the web application
2	OS command injection	<ul style="list-style-type: none"> - Avoid using functions which could call shell commands.
3	Directory traversal	<ul style="list-style-type: none"> - Do not specify name of files stored on the web server directly using external parameter. - Use a fixed directory to handle filenames and nullify directory names in filenames.
4	Improper session management	<ul style="list-style-type: none"> - Make session ID hard to guess. - Do not use URL parameter to store session ID. - Set the secure attribute of the cookie when using HTTPS. - Start a new session after successful login. - Issue a secret after login and authenticate the user with it whenever the user moves around the web site.
5	Cross-site scripting	<ul style="list-style-type: none"> - Perform escaping for everything to be outputted to the web page. - When outputting URLs in HTML, permit only those that start with certain patterns, such as http:// and https://. - Do not dynamically create the content of the <script>...</script> tag. - Do not allow to import style sheets from arbitrary websites. - Set the charset parameter of the HTTP Content-Type header.
6	Cross-site request forgery	<ul style="list-style-type: none"> - Access the web page, in which certain operation is to be executed, via the POST method with a secret having the previous web page insert it in its hidden field, and execute the requested operation only when the secret is correct. - Ask for password right before executing requested operation and proceed only when the password is correct. - Check the referrer whether it is the expected URL and proceed only when the URL is correct.
7	HTTP header injection	<ul style="list-style-type: none"> - Do not print out HTTP header directly and do it through an HTTP header API provided by execution environment or programming language. - If HTTP header API that offers line feed neutralization is not available for use, implement it manually.
8	Mail header injection	<ul style="list-style-type: none"> - Use the fixed values for the header elements and output all external input to the email body. - If the fixed values cannot be used for the header, use an

No.	Vulnerability	Fundamental solutions
		email-sending API offered by the web application's execution environment or language. - Do not specify the email addresses in HTML.
9	Lack of authentication and authorization	- Implement authorization as well as authentication to make sure that a login user cannot pretend to be other users and access their data.

Reference: Information-technology Promotion Agency (IPA), "How to Secure Your Website 5th Edition", 2011

Reference I

The specification of NSDI prototype system

- 1) System design document of National Spatial Data Infrastructure prototype system (NSDI-PS)
- 2) User manual for NSDI organization user version 1
- 3) User manual for NSDI super admin version 1