

REQUEST FOR EXPRESSIONS OF INTEREST (CONSULTING SERVICES – FIRMS SELECTION)

COMMONWEALTH OF DOMINICA

DISASTER VULNERABILITY REDUCTION PROJECT

Loan No./Credit No./ Grant No.: **TF016912/Credit No.5495-DM/Grant No.TF016955**

Assignment Title: Consulting Services for Training and Technical Assistance for the Development and Support of the DOMINODE Spatial Data Sharing Platform

Reference No.: PPCR/DVRP/CS-06/18

The Government of the Commonwealth of Dominica has received financing from the World Bank toward the cost of the Disaster Vulnerability Reduction Project, and intends to apply part of the proceeds for consulting services.

The consulting services (“the Services”) include Training and Technical Assistance for the Development and Support of the DOMINODE Spatial Data Sharing Platform. The assignment is expected to continue for the duration of the Disaster Vulnerability Reduction Project contingent on the performance of the firm in achieving the objectives outlined in the Terms of Reference and is expected to commence in February 2019.

The detailed Terms of Reference (TOR) for the assignment is attached to this Request for Expression of Interest.

The Ministry of Environment, Climate Resilience, Disaster Management and Urban Renewal now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The shortlisting criteria are:

- Demonstrable experience in the development and support of complex applications based on the GeoNode, Geonetwork, or an equivalent web based spatial data management platform within the last 2 years.
- Demonstrable experience in Ubuntu Linux Server Support within the last 5 years including delivery of training in Linux systems administration.
- Demonstrable experience in the last 3 years with automation and virtualization technologies preferably; ansible, vagrant and Citrix XenServer (or equivalent virtualization environment).
- Demonstrable experience in the use of cloud technologies for spatial data management and delivery of high availability geospatial applications.
- Demonstrable experience with GeoServer, or equivalent FOSS map server, deployment and development in the last 5 years.

- Experience with catalog service for the web metadata catalogs and ISO 19115 based metadata implementations.
- Demonstrated experience in developing high quality web and print cartographic products for topographic mapping.
- Experience in preparing budgets and training plans.
- Experience with the following technologies is desirable: vector tile servers, tile creation tools, WebGL based point cloud/map viewers, open source GIS data collection solutions, sensor web APIs, RESTful APIs.
- Experience working in developing countries, especially in the Caribbean region is highly desirable.

Key Experts will not be evaluated at the shortlisting stage.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank's "Procurement Regulations for IPF Borrowers" July 2016 revised November 2017 and August 2018 ("Procurement Regulations"), setting forth the World Bank's policy on Conflict of Interest.

Consultants may associate with other firms to enhance their qualifications, but should indicate clearly whether the association is in the form of a joint venture and/or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected.

A Consultant will be selected in accordance with the Consultant Qualification Selection (CQS) Procurement method set out in the Procurement Regulations.

Further information can be obtained at the address below during office hours 0800 to 1700 hours on Mondays and 0800 to 1600 hours from Tuesdays to Fridays.

Expressions of interest must be delivered in a written form to the address below (in person, or by mail, or by fax, or by e-mail) by 1500 hours on January 18, 2019.

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World Bank Pilot Programme for Climate Resilience/ Disaster Vulnerability Reduction Project (PPCR/DVRP)

Terms of Reference

For Consultancy Services to Provide Training and Technical Assistance for the Development and Support of the DomiNode Spatial Data Sharing Platform

1. Background

In 2012, the Government of the Commonwealth of Dominica (GoCD), supported by the World Bank began an initiative to create a National Spatial Data Infrastructure (NSDI). These efforts have resulted in the creation of a National Spatial Data Sharing Application, named the ‘DomiNode’. The current iteration of the DomiNode is based on the GeoNode open source spatial data management platform and is hosted on an Ubuntu Server Operating System and can be viewed publicly at <http://dominode.dm>. Maintenance of the platform and hosted data are carried out through the collaboration of the Information and Communication Technology Unit (ICTU), the Physical Planning Division (PPD) and the Lands and Surveys Division (L&SD). The virtual server and GeoNode software are maintained by a dedicated ICT Officer and data on the platform is maintained by GIS Officers at PPD and L&SD. Hurricane Maria (Sept. 2017) severely impacted the physical ICT infrastructure of the GoCD and the capacity to support the platform presently is limited. Therefore the firm will be expected to host the platform on cloud based virtual infrastructure until such time that it can be transferred to GoCD infrastructure. The DomiNode is currently being supported by the Project Coordination Unit (PCU) of the Disaster Vulnerability Reduction Project (DVRP). An inter-governmental Geospatial Technical Working Group is in place and the PCU is in the process of seeking the institutionalization of this group in order to formalize roles and responsibilities and steer the development of the NSDI. While it is the intention of the GoCD to continue to use the GeoNode software, the firm may propose alternatives which meet the requirements of the GoCD. Free and Open Source Software is preferred by the GoCD and recurring costs are a major concern which the firm is expected to address.

The Disaster Vulnerability Reduction Project is a Government of the Commonwealth of Dominica project which is being financed under the World Bank’s Pilot Project for Climate Resilience (PPCR). The DVRP is aimed at reducing vulnerability to natural hazards and climate change impacts in Dominica through investment in resilient infrastructure, as well as improved hazard data collection and monitoring systems. As such, to further the development of the NSDI and build disaster resilience in Dominica, a number of geospatial data development initiatives were launched as part of the DVRP and significant resources under this project has also been committed to the development of geospatial capacity within the government.

These initiatives include a LiDAR Topography and Bathymetry Survey for the island of Dominica, Hydrometeorological Network upgrade, National Soil Survey and Forestry Inventory.

A major objective of the DVRP is to ensure that products generated from these data development activities be shared using the DomiNode platform. In addition to the data being produced under the DVRP, a number of datasets based on previous topographic mapping and other projects exist within various GoCD agencies. Since the beginning of the NSDI initiative, these datasets have been collected and documented with the eventual goal of upload to the DomiNode.

While significant progress has been made in the implementation of the DomiNode, issues remain around the reliability and accessibility of the platform as well as the authoritativeness of the hosted data. To address these issues, a geospatial work plan was put into place in 2016 and many of the planned activities have been included within this *Terms of Reference*. To aid the GoCD in successfully implementing the NSDI, the DVRP is seeking the services of a qualified firm to provide technical assistance and undertake a series of training activities related to the development of the DomiNode platform and supporting processes.

2. Objectives

- The Primary Objective of these services will be to develop the DomiNode into a reliable and sustainable platform for authoritative spatial data relating to the Commonwealth of Dominica.
- The firm will be expected to assist in strengthening the operational capacity of GoCD agencies in building capacity in maintaining the ICT aspects of the DomiNode platform.
- The firm will also assist in developing applications which will encourage the adoption of the DomiNode platform through providing user friendly access to selected datasets and building the capacity of the GoCD to build applications on the DomiNode tailored to agency workflows. The proposed Hydromet Information System should also be linked to the DomiNode.
- The firm will assist with the development of the NSDI through building capacity in data management and dissemination including standards for metadata, cartography, licensing, and spatial accuracy assessment.

3. Scope of Services

To meet the objectives outlined, the firm should undertake the scope of services listed in Tasks 3.1 to 3.6 in these *Terms of Reference*. Prior to commencing work, the Firm will submit a work plan detailing how they plan to deliver the services to meet the objectives of this project. The work plan will include a proposed schedule and deliverables. Throughout each task, the Firm shall engage with and seek endorsement from key stakeholders and present relevant work.

The collected material, data and all final products shall be made readily available to the Beneficiary Agencies responsible for this project and remains the property of the GoCD.

3.1 Update of the DomiNode

At the beginning of this consultancy, the firm will carry out an update and migration of the existing DomiNode platform from the current GeoNode 2.4 platform to the latest stable release of GeoNode, or another SDMP as proposed by the firm and agreed to by the client, on the latest Long Term Support (LTS) version of Ubuntu Server (18.04 as of the writing of these *Terms of Reference*) compatible with the proposed SDMP. All subsequent services in these *Terms of Reference* will be based upon the version of the DomiNode and server in production subsequent to the completion of the update. The updated system will be secured according to the measures outlined in Task 3.2.2 of these *Terms of Reference*. In the near future, the server is expected to host terabytes of geospatial data, in expectation of this; the firm will propose ways to streamline future backups through separating the data storage and software components of the DomiNode, and if possible, include this separation in the update of the DomiNode. The firm will also be responsible for putting into place a process for secure data uploads to the cloud platform and supervise the upload of the LiDAR and Satellite and Aerial Imagery datasets to the cloud platform.

The firm will work with the GoCD to construct a cloud deployment of the updated platform and train officers in the maintenance of the platform. The cloud deployment will be created in a form that can be transferred to the physical infrastructure at the GoCD in the future and the firm will provide directions on the transfer process. After being put into production, the firm will carry out and document a basic QA/QC of the platform to ensure that all major functionality is available (map creation, layer uploads and downloads, search, user management, document uploads and downloads).

3.2 Development of Standard Operating Procedures

The firm will develop a series of Standard Operating Procedures (SOPs) for maintenance of the spatial data management platform and operating system and assist the GoCD in implementing the procedures through tasks 3.2.1 to 3.2.2 in this *Terms of Reference*. The firm is expected to continue to develop and refine these SOPs throughout the duration of the assignment.

3.2.1 Standard Maintenance and Updates

The firm will create a ‘DomiNode Maintenance Guide’ for the GoCD which will detail regular tasks to be performed by the GoCD relating to the maintenance of the spatial data management platform (SDMP) and related software as well as the Server Operating System. Tasks will be detailed in an easy to understand step-by-step manner including relevant screen captures, code snippets and references to external documentation. The guide will also contain a proposed calendar schedule for maintenance tasks, including an estimated amount of time, in minutes, required for each task. In addition to standard maintenance tasks, the guide will also contain a series of common troubleshooting tasks relating to the SDMP, the map server used, server networking, and the Server Operating System. The troubleshooting tasks will include details regarding understanding relevant software logs and testing procedures.

The GoCD recognizes that regular updates are required to maintain DomiNode, but in the past these updates have required extensive personnel time to perform due to a need for a complete

reinstallation of the server operating system and SDMP. The GoCD understands that there are automation tools which would streamline the migration and deployment process in the case of major updates. The firm will provide guidance and instruction to GoCD staff in the use of automation and virtualization tools, such as; Aptitude, Ansible, Docker, Vagrant, etc. to use to automate major updates to the platform. The GoCD currently uses Citrix XenServer to manage the deployment of virtual servers, including the DomiNode, the virtualization platform may change as the network is rebuilt but the ICTU will continue to make use of virtual servers. The firm will investigate, and document, the automation of provisioning of the DomiNode virtual server in whichever environment is used by ICTU at the time, as part of its instructions for deployment of the platform locally.

3.2.2 Security

The firm will provide instruction to GoCD staff in Ubuntu Server and SDMP hardening tasks such as the set-up of firewalls, SSL on the SDMP/map servers, user and group permissions as well as the use of intrusion monitoring software, security testing software, data encryption and any other aspects of Ubuntu Server and SDMP security deemed important by the ICTU in agreement with the firm. These security considerations will be included in the update task 3.1 in these *Terms of Reference*.

The firm will provide guidance to the GoCD on secure methods of allowing access to the file system of the server to DomiNode administration staff from the LSD and PPD in order to be able to transfer large datasets to and from the server as well as execute SDMP management commands and other data management related tasks. The firm will also work with the LSD to collect all data from Continuously Operating Reference Stations (CORS) currently operated by the GoCD, on the DomiNode server to allow safe and secure read-only access to GoCD users. This will also apply to other data being collected under the DVRP as required by the client.

3.3 On-Demand Technical Support and Updates

The firm will provide support to the GoCD in ensuring that the platform remains online and accessible to stakeholders as well as updated with the latest stable software. As part of this task, the firm will make available a maximum of 10 hours a month for remote support to GoCD officers, as requested or as necessary to assist in restoring the platform in case of downtime. The support will be provided remotely through phone or online platforms, as deemed appropriate by the client. The firm will document all support provided under this agreement and include details of the type of support provided, date and actions taken within the regular reports detailed in Section 5.

Apart from the on-demand support, the firm will assist the GoCD in performing major software updates for both the SDMP software and the Ubuntu Server operating system, as detailed in task 3.2.1 of these *Terms of Reference*. For the operating system, the firm will ensure that major security fixes and patches are regularly installed and the system version remains the latest long term support (LTS) version (currently 18.04) compatible with the SDMP software. In performing updates, the firm will document the activities undertaken in a way as to be repeatable by GoCD officers and include this documentation in the SOPs.

The firm will be expected to provide these services until the end of the DVRP or another date as agreed to in consultation between the firm and the client.

3.4 Extending the DomiNode

The firm will work with the GoCD officers to develop apps to extend the ability of the DomiNode to disseminate geospatial data and information products. In developing these applications, the firm will make available a cloud-based staging environment (which may be remotely hosted provided that the data ownership concerns in Task 3.2.2 of these *Terms of Reference* are adequately addressed) where GoCD officers may test new apps before being added to the production server. The firm will work under the supervision of LSD and PPD to develop a basic QA/QC procedure with the intention that it be used before apps are accepted for inclusion within the production DomiNode.

The firm will provide all source code in apps accepted to be used in production in an un-compiled and documented format. The firm will also provide documentation regarding the development environment used to create the apps in a way such that GoCD officers may replicate the development process. Licensing of apps developed by the firm will be agreed to in consultation with the client with the consideration that if made open source, all details which may compromise the security of GoCD systems must be omitted.

All custom apps will include a responsive interface appropriate for viewing on both desktop and mobile devices unless otherwise indicated or agreed to in consultation with the client.

3.4.1 Continuously Operating Reference Sites (CORS)

The GoCD currently operates four (4) high accuracy GNSS base-stations, which report observations in RINEX, Leica, and Trimble formats. These observations are useful for the post-processing of GNSS observations by surveyors and other data collection personnel. It is the intention of the GoCD to consolidate the collection of these data and streamline access.

The firm will work with the GoCD to consolidate all CORS data on a single server and develop a web based access to this server with read only access (as detailed in Task 3.2.2 of these *Terms of Reference*).

To streamline the use of these data, the firm will develop an app to extend the DomiNode interface to allow for easy access to the CORS datasets. The app shall:

- Provide an interactive web-map based view of station locations (as points) and status (online/offline/under repair). Additional details such as station names, coordinates, owner and other details deemed necessary by the client may be included in a popup or sidebar for each point on the map.

- Provide the ability to select a site, then as a sidebar or popup interface provide an interface for the user to select a date range of observations to download.
- Provide the ability to control user access to the app by DomiNode administrators. Full public access will be restricted and downloads will require a user account allowed to download by administrators.
- Allow the download of data as a .zip file.
- Implement basic error handling within the app and will include messages on the interface in the case that the date range selected is invalid or data is unavailable.
- Provide warnings to the user in case they have selected a large download (over 50 MB).
- Provide a disclaimer before download and terms of use for user acceptance. The text of this disclaimer will be provided by the LSD.
- Downloading will require confirmation that the user downloading is human (Captcha or similar).
- Human readable logs will be kept of access to the app along with user logons and downloads.

3.4.2 LiDAR Data Dissemination

As part of the DVRP the GoCD has contracted a firm to carry out Bathymetric and Topographic LiDAR surveys as well as Aerial Photography of the country and produce derived data products. The data products¹ will be hosted on the DomiNode and will require substantial amounts of storage and bandwidth to deliver effectively to stakeholders. The firm will work with the GoCD to ensure that these datasets are uploaded effectively to the DomiNode and are accessible to users through the SDMP download, layer, and map interfaces and will propose and implement approaches to reduce server load.

The firm will develop an interface within the DomiNode for viewing and disseminating LiDAR point clouds in a LAS/LAZ format. The firm will extend the DomiNode to create interfaces including:

- A web based 3D viewer for LiDAR point clouds (classified) using WebGL technologies. The user requirements will be determined by the client in consultation with the firm.
- A download interface allowing downloads of LiDAR data in a LAZ (LASZip) format. The interface will be a map with a uniform grid over Dominica and the surrounding marine areas. Each grid cell will have an associated LAS tile and the user will be able to select and download one or more tiles depending on server capacity limitations.
- User access to the interfaces will be controlled by DomiNode administrators.

3.4.3 Integration of Sensor Data

Under the DVRP, hydro-meteorological sensors have been installed across Dominica. The firm

¹ These data products may include; Digital Elevation Models (1 m GSD), Digital Surface Models, Digital Bathymetry, Aerial Photography (20 cm GSD), Vector datasets including roadlines, watersheds,

will provide access to the observations collected by these sensors through the DomiNode interface, including, a RESTful API for accessing observations. The firm will create a graphic interface for accessing observations based on client requirements including charting and other visualizations as well as download in common spreadsheet formats.

3.4.4 Mobile Data Collection Applications

The GoCD through the DVRP has purchased a number of Android and Windows based rugged tablets for field data collection, originally planned to be used with Open Data Kit (ODK). The firm will advise the GoCD with respect to android and iOS based mobile data collection options linked to the DomiNode. The recommended system should allow both offline and online data collection, viewing and editing of data layers on DomiNode, as well as syncing with datasets on the DomiNode. The firm will advise on the necessary infrastructure for the successful utilization of the mobile data collections tools within the offices of the administrators of SDMP (ICTU, PPD and LSD), and other agencies of the Technical Working Group.

3.5 Spatial Data Infrastructure Support

The GoCD intends to be able to provide authoritative spatial datasets through the DomiNode. To this end, a number of initiatives have been included in past Geospatial Work Plans to create QA/QC processes and documentation for datasets before they are made available on the DomiNode. The following activities are proposed to enhance the integrity of the DomiNode platform and hosted datasets:

3.5.1 Data licensing and Dissemination

The firm will advise the GoCD in the selection of data license agreement(s) and Terms of Use appropriate for the platform and data contained therein. Once the terms and/or license agreements are selected, the firm will assist the GoCD in adding appropriate messaging to the DomiNode platform such that users will be aware of their rights relating to the use of data contained on the platform as well as the liability of the GoCD and disclaimers for users. The firm will also assist in developing a data request process along with a data request form hosted on the DomiNode. The agreements should be in line with the laws of the Commonwealth of Dominica and the policies of the GoCD.

3.5.2 Data Assessment Process

The firm will review the feasibility of implementing the proposed National Geospatial Data Assessment process detailed in Annex 1 of these *Terms of Reference* within the DomiNode. The firm will make suggestions regarding how the process may be implemented on the platform and, working in agreement with the PPD and LSD, will implement data assessment processes within the DomiNode platform.

3.5.3 Development of Cartographic Standards

The LSD has been seeking to develop a, 'Cartographic Standards Guide' for all national base map layers and all other layers at the client's discretion (Annex 1) for the purpose of providing a

new Dominica Topographic Basemap along the lines of national basemaps used by Switzerland, Australia and Austria. The firm will work with, train and instruct the LSD in developing styles appropriate for professional online and print topographic mapping at various scales including 1:2500, 1:10000, 1:25,000, 1: 50,000 and other scales as agreed in consultation between the firm and the LSD. These styles will be for available national base map layers including; contours and topography, roads, trails and paths, land cover and land use, buildings, natural features and parks, administrative borders, place names (English and Kweyol), and other features deemed important to include in a basemap by LSD in consultation with the firm. The firm will not be expected to create any new datasets. The firm will also create example map templates within DomiNode based on the cartographic standards and instruct GoCD staff in creating and using maps on DomiNode.

These styles will be developed in an easy to use open source GIS platform such as QGIS and will be easily transferable to map server and DomiNode and the cartographic standards guide will include step by step documentation of how to create, edit, print, upload and use styles within DomiNode.

As part of this activity, the firm will provide instruction and access to a map tile creation software/service for the duration of this activity which provides a GUI for styling and outputting image and vector tiles compatible with OGC Vector tile/TMS/WMTS, or equivalent, standards. They will be expected to instruct officers to produce tiles compatible with the cartographic standard.

Finally, the firm will be expected to create a workflow for printing of topographic maps on paper to create attractive and easily usable paper mapping products at various scales and paper sizes.

3.5.4 Development of Metadata Standards

The PPD has been investigating a ISO 19115 compliant metadata standard meant for implementation within DomiNode. The data assessment procedures detailed in Appendix 1 detail the proposed metadata assessment steps. The firm will work with the PPD to perform any customization to the metadata model within DomiNode to ensure it contains the requested attributes. The firm will then work with the PPD to develop a procedure for validating metadata for layers added to the DomiNode.

3.5.5 Optimization of Large Datasets for Web Services

The LiDAR and OPM activity will produce very high resolution datasets which will be difficult to serve using web services without processing and optimization. LSD has also been collecting their own drone data. The firm will investigate large raster and vector datasets (over 1 GB in size) within the GoCD spatial data inventory and optimize these datasets for use in web mapping services. The optimization process and software used will be made available to the GoCD and instruction will be provided to officers. Ideally, free and open source software will be used for the optimization process.

3.5.6 Introduction of Cloud Based Analysis and Processing Tools

The firm will work with the LSD and PPD to determine possible cloud based tools, such as Google Earth Engine and cloud hosted Jupyter notebook, which they can use in their workflows. Other possible tools include cloud based drone imagery processing for LSD.

3.5.7 Budgeting and Recurring Costs

The firm will assist the GoCD in budgeting for the maintenance of the NSDI, and particularly the SDMP and related components. Minimizing recurring costs to a level which can be supported by the budgets of participating agencies is critical. Cloud services used under this project, for instance, must have a long term recurring cost which is possible with the budgets of participating agencies. Yearly budgets for maintenance of all hardware and software required for maintaining the processes and systems created under this project, or deemed vital for the NSDI by the GoCD, will be developed by the firm for a period of 5 years from the start of this contract.

3.6 Hands-On Training and On Site Activities

The firm is expected to provide extensive training and capacity building support to GoCD staff. Much of this support will be delivered remotely but the firm will be expected to undertake at least three on-island training sessions, each lasting approximately 5 days. The firm may also propose off-island training and/or remote training services. The GoCD may request additional training / support to meet the needs of specific departments. Other on-site activities may be required and will be determined in consultation between the client and the firm and included within the work plan of the firm. The trainings will be attended by 10-15 persons. Off island training may be given to a maximum of 4 persons and travel costs will be covered by the firm.

The first training session is anticipated to cover activities as detailed in Tasks 3.1 to 3.4 of these *Terms of Reference* and will include hands-on training with selected SOPs, and the development of extension applications to the DomiNode. The exact content of the training will be based on client needs and capacity as determined by the firm.

The second training session will cover the NSDI support activities detailed in Task 3.5 of this *Terms of Reference* as well as basic to users and administrators of the SDMP in the following areas:

- Layer access, uploading and editing
- Group and permission management
- Map creation and editing
- Use of custom apps

To facilitate these trainings, the GoCD will provide access to suitable training facilities with reliable broadband connectivity (ethernet and mobile), access to a working projector, and access to the DomiNode web application. All training participants will be equipped with computers

capable of running the DomiNode web application and meeting the minimum requirements as specified by the firm.

4. Duration of Assignment

This assignment is expected to continue for the duration of the DVRP contingent on the performance of the firm in achieving the objectives outlined in these Terms of Reference.

5. Deliverables

The table below summarizes the deliverables the firm is expected to provide as well as proposed timelines. In addition to these deliverables, the firm will provide a report every 2 months to the PPD and LSD outlining progress, obstacles, support provided including support provided as per Section 3.3 of these *Terms of Reference* and updated activity timelines.

Deliverable	Format	Time after commencement of contract
Proposed Work Plan	Microsoft Word (.docx)	2 weeks
Proposed Budget (Section 3.5.7)	Microsoft Office	As agreed to within the accepted work plan of the firm.
Updated DomiNode platform as detailed in Section 3.1 and optimization (3.5.5)	Demo on staging environment	As agreed to within the accepted work plan of the firm.
Draft DomiNode Maintenance Guide and SOPs including Security measures as detailed in Section 3.2.1 and 3.2.2.	Online and print as agreed to with the client	As agreed to within the accepted work plan of the firm
Data use disclaimer/license	Implemented on staging environment	5 weeks
Mobile data collection implementation plan (Section 3.4.5)	Microsoft Word (.docx)	As agreed to within the accepted work plan of the firm
Updated DomiNode platform	Staging pushed to Production environment	As agreed to within the accepted work plan of the firm
CORS App (Section 3.4.1)	Staging Environment	As agreed to within the accepted work plan of the firm
Implementation Plan: -LiDAR interface (Section 3.4.2) -Sensor Data (Section 3.4.3) -Data Assessment Process (Section 3.5.2)	Microsoft Word (.docx)	Delivery schedule will be determined based on consultation with the client.

Deliverable	Format	Time after commencement of contract
Draft Cartographic Standards Guide (Section 3.5.3)	Microsoft Word (.docx) and other formats as agreed to in consultation with the client.	10 weeks
Draft Metadata Standards (Section 3.5.4)	As agreed in consultation with the client	10 weeks
Cloud processing tutorial (Section 3.5.6)	As agreed in consultation with the client and Microsoft office	As agreed to within the accepted work plan of the firm
Production DomiNode Update	CORS App, analytics, data request form, cartographic standards and metadata standards implemented.	As agreed to within the accepted work plan of the firm
Production DomiNode Update	LiDAR and aerial photography products added, other apps as promised in the implementation plan.	As agreed to within the accepted work plan of the firm
Project Completion Report detailing results, findings and proposed next steps.	Microsoft Word (.docx)	Upon conclusion of the activity.

6. Qualifications

- The firm will have demonstrable experience in the development and support of complex applications based on the GeoNode, Geonetwork, or an equivalent web based spatial data management platform within the last 2 years.
- The firm will have demonstrable experience in Ubuntu Linux Server Support within the last 5 years including delivery of training in Linux systems administration.
- Demonstrable experience in the last 3 years with automation and virtualization technologies preferably; ansible, vagrant and Citrix XenServer (or equivalent virtualization environment).
- Demonstrable experience in the use of cloud technologies for spatial data management and delivery of high availability geospatial applications.
- Demonstrable experience with GeoServer, or equivalent FOSS map server, deployment and development in the last 5 years.

- Experience with catalog service for the web metadata catalogs and ISO 19115 based metadata implementations.
- Demonstrated experience in developing high quality web and print cartographic products for topographic mapping.
- Experience in preparing budgets and training plans.
- Experience with the following technologies is desirable: vector tile servers, tile creation tools, WebGL based point cloud/map viewers, open source GIS data collection solutions, sensor web APIs, RESTful APIs.
- Experience working in developing countries, especially in the Caribbean region is highly desirable.

7. Supervision

The firm will report to the LSD and PPD, and upon request, the ministerial sub-committee with responsibility for overseeing the DVRP process.

Administrative and financial matters related to this activity will be handled by the PCU.

All reports should be submitted and approved by the Client before presented in workshops/meetings.

ANNEX – PROPOSED DATA ASSESSMENT PROCESS

The GoCD aims to guarantee the authoritativeness of its geospatial data by creating three categories of data accuracy defined as follows:

National Basemap Layers

National Basemap layers are considered datasets of national importance for both government and public use. In the past, these data would have been made available on national topographic maps. This will include features such as roads, contours (topography), buildings, and ortho-imagery. The full list of base layers is undergoing development. These layers will pass through the most practically rigorous QA/QC process and will be assessed for meeting the map accuracy standards for multiple scale levels as well as metadata and cartography standards developed by the GoCD. Once verified, these data will form the national basemap which will be made available in printed and digital form.

Core Layers

Core layers are datasets which are of national/local importance but not part of the national basemap. These may include hazard and geology maps. These data will also pass through a QA/QC process which will assess accuracy (relative to the base layers) and metadata completeness as well as data protection concerns. Unlike the data used in the national basemap, the release of core layers may be restricted to certain government agencies only.

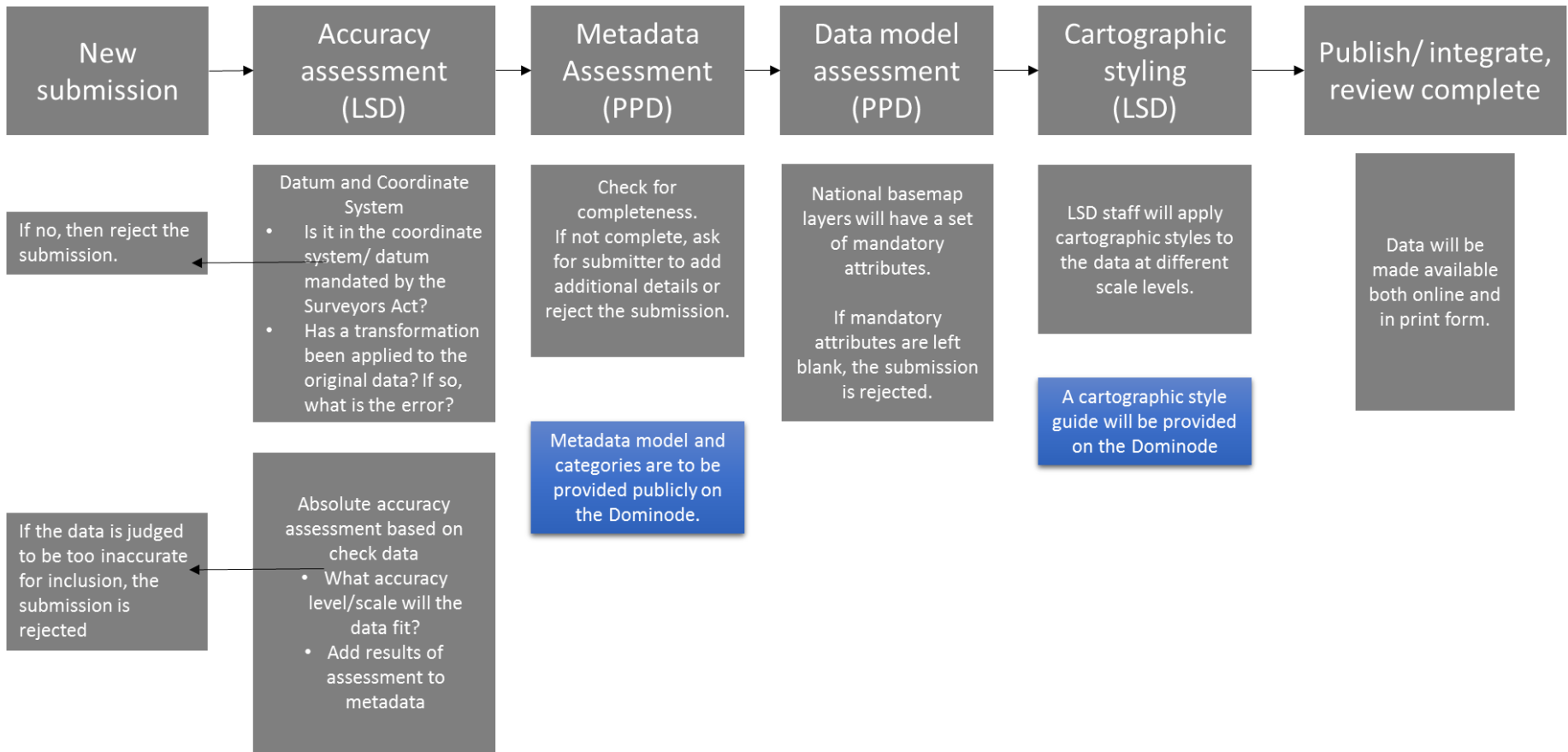
Project Layers

Project layers are considered ‘in-progress’ datasets which are actively under development and not ready or not intended for inclusion in the core or national layers. Data of this nature will still be required to have clear metadata indicating its purpose. If made public, a disclaimer is to be added in the layer description that this dataset has not passed through the official quality assessment process. Any maps created with this data are expected to provide a similar disclaimer.

Review of National Basemap Data

LSD – Lands and Surveys Division

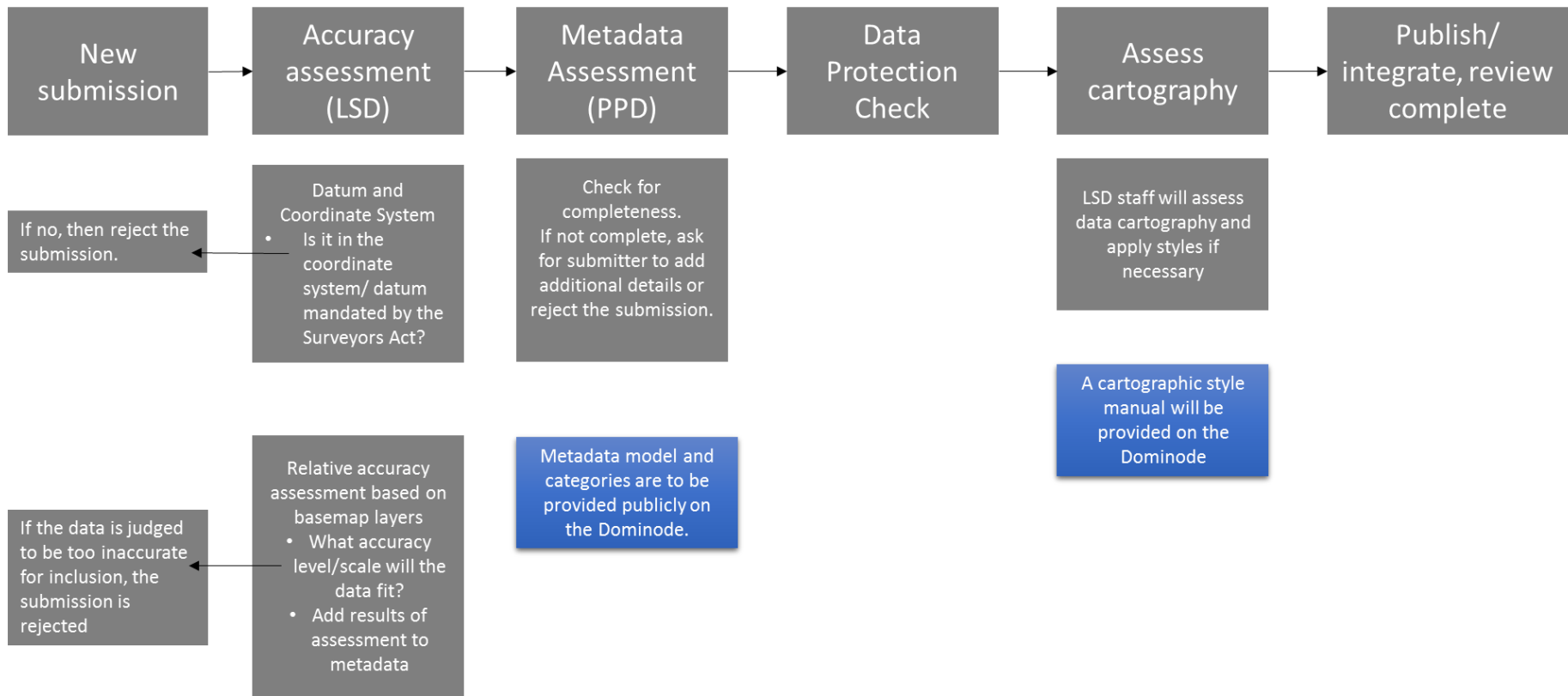
PPD – Physical Planning Division RSD – Road Surveys Division



Review of Core Data

LSD – Lands and Surveys Division

PPD – Physical Planning Division



Project Data Process

