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SOFTWARE PRODUCT

GEOINFORMATION SYSTEM «PANORAMA»
(GIS Panorama)

Applied tasks. Import and export data of Shapefile format

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ANNOTATION

This document provides guidance on the implementation import and export of spatial data using Geoinformation system «Panorama» (GIS Panorama) PARB.00046-04.

This document contains methodological instructions for import and export of spatial data containing digital topographic maps, presented in Shapefile format.

CONTENTS

1 GENERAL INFORMATION

1.1 Description of the data format

Shapefile is a vector format of geographic files. It is developed and supported (regulated) by ESRI to provide data exchange between ESRI products and other programs. Shapefile format is used for import and export of spatial data using Geoinformation system «Panorama» (GIS Panorama) PARB.00046-04 (hereinafter – GIS Panorama).

Shapefile format allows you to store different types of geometric objects, which are described in the Table 1.

Table 1 -   Description of geometric objects

Designation		Type	It corresponds to the nature of localization
Esri	**Import**		
Point	P	Point	Point
PolyLine	L	Polyline is an object consisting of one or more lines (broken lines)	Linear
Polygon	S	Polygon (can consist of several parts with voids)	Area
MultiPoint	MP	Multipoint - an object consisting of several dots	Point
PointZ	PZ	Point in 3D (XYZ)	Point
PolyLineZ	LZ	Polyline in 3D (XYZ)	Linear
PolygonZ	SZ	Polygon in 3D (XYZ)	Area
MultiPointZ	MPZ	Multi-point in 3D (XYZ)	Point
PointM	PM	Point with any measured value	Point, characteristic «M» is not processed
PolyLineM	LM	Polyline with any measured values	Linear, the characteristic «M» is not processed
PolygonM	SM	Polygon with any measured values	Area, the characteristic «M» is not processed
MultiPointM	MPM	Multi-point with any measured values	Point, characteristic «M» is not processed
MultiPatch	MPS	Triangulation surfaces	Not processed

A single file can store objects of only one type.

When loading objects of the type «Point» from Shapefile, point objects are formed. Each unique object is assigned the unique semantic description from the corresponding entry in the table DBF.

When loading objects of the type «Multi-point» from Shapefile, point objects are formed. All created objects are assigned the identical semantic description from the corresponding entry in the table DBF.

When loading objects of the type «Polyline» from Shapefile, linear objects are formed. If there are more than one line in the polyline, they are arranged in the form of sub-objects. Each unique object is assigned the unique semantic description from the corresponding entry in the table DBF.

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When loading objects of the type «Polygon» from Shapefile, area objects are formed. If there is more than one component in the polygon, an automatic analysis of the input is performed. Automatic determination of non-overlapping main contours and their sub-objects is performed, including taking into account nesting («bagel in a bagel»). Each unique object is assigned the unique semantic description, from the corresponding record in the table DBF. When creating (in the process of spatial analysis) additional independent objects, they are assigned the identical semantic description.

When objects of type PZ, LZ, SZ are processed, objects with three-dimensional metric are formed.

The data set is in format Shapefile, it is the set of files with the same names and different extensions.

When exporting data from the format Shapefile, the following files are used:

- the main file (SHP) containing a spatial (coordinate) description of the loaded objects in a metric (X, Y) or geodetic (B, L) coordinate system;
- the attribute data file (DBF), containing a semantic description of the loaded objects;
- the project file (PRJ) containing a description for the mathematical basis of the data being loaded (description of the parameters for the coordinate system, ellipsoid, projection).

The main file contains a spatial metric description of the loaded vector objects in the form of sets for spatial coordinates of points (nodes).

The attribute data file is in the format DBF. One row of the table corresponds to one object in the main file. The correspondence between objects and attributes is based on the record number.

Table names in the file DBF have a limit on the number of characters (no more than 10). In view of the fact that the initial names of the database fields from which the sets of SHP-files are obtained can be more than 10 symbols in size, while the data is being uploaded from the database, XML files are generated, in which for each particular data set, there is a correspondence of full and short names.

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2   IMPORTING DATA

2.1   Description of the input data

Data import is described on the example of digital topographic maps in the standard national engraving of the Socialist Republic of Vietnam (DTM SRV). The data are arranged according to the nomenclature sheets, each nomenclature sheet is in a separate folder. Each folder has a name corresponding to the nomenclature of the sheet placed in it. Individual groups of digits are separated by the symbol «_», for example: 5651_1_DB, 5651_4_TN.

Spatial data are conditionally divided into layers. Each folder of the nomenclature contains folders containing map layers: BienGioiDiaGioi, CoSoDoDac, DanCuCoSoHaTang, DiaHinh, GiaoThong, PhuBeMat, QuanSu and ThuyHe. All the layer folders are always present in the folder of Nomenclature sheet, even if nothing is contained in them.

The layer folder contains file sets. A set of files with the same name and different extensions, the same objects contains, for example:
-   DiaPhan.cpg;
-   DiaPhan.dbf;
-   DiaPhan.prj;
-   DiaPhan.sbn;
-   DiaPhan.sbx;
-   DiaPhan.shp;
-   DiaPhan.shp.xml;
-   DiaPhan.shx.

During the import process, files with extensions are processed:
-   SHP (it contains the spatial metric description of the map objects);
-   DBF (it contains the attributive semantic description of map objects);
-   PRJ (it contains the description of the coordinate system for input data);
-   SHP.XML (it contains the description for the structure of the table, including the correspondence between full and short names of fields in the table DBF).

2.2   Preparatory work

Preparatory work consists in the formation and configuration of a digital classifier (RSC file), as well as the configuration of additional files used when importing data.

For forming the design of behind the frame for the nomenclature sheet, it is necessary to have a special object «Sheet-frame» (code 91000000). The object «Sheet-frame» must contain the metric of a frame for a field of the nomenclature sheet (5 or more points) and the following attributes:
-   name of the map;
-   name of the nomenclature sheet;
-   data on the change in magnetic declination;
-   names of countries and provinces that fall on the territory of the sheet.

Typically, there are no such objects in the source sets of SHP-files. During import from the format Shapefile, the object's metric «Sheet-frame» is automatically created (calculated from the sheet's nomenclature). To place into the object «Sheet-frame» the sheet attributes, required for the creation the design of beyond the frame, it is necessary to have the file viet25t.rsc.frame.xml. This file must be located in the service folder of parameters for import-export Shapefile. The full name of the file is:

c:\Program Files\Panorama\Panorama13\Maptoshp\viet25t.rsc\viet25t.rsc.frame.xml

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The file viet25t.rsc.frame.xml must match the classifier viet25t.rsc and to contain attributive data for each nomenclature sheet. For the sheet with nomenclature 5651-3-TN the following data should be contained:

```
<sheet id="1368" name = "5651-3-TN">
<tag name="MAPID" value="BangChap25K"/>
<tag name="GRIDNAME" value="L"/>
<tag name="REVSYM" value="4"/>
<tag name="SHAPE_LENG" value="0.50000000000"/>
<tag name="SHAPE_AREA" value="0.01562500000"/>
<tag name="TENMANH" value="PHA THANH"/>
<tag name="SOPHIENHIE" value="5651 III TN"/>
<tag name="TENQUOCGIA" value="Việt Nam; Lào"/>
<tag name="TENTINH" value="Điện Biên; LuôngPhơRaBăng"/>
<tag name="TENHUYEN" value="Điện Biên; Mương Ngoi"/>
<tag name="DOLECHTU" value="Độ lệch từ đo năm 1981"/>
<tag name="GOCBACOVUO" value="0041'"/>
<tag name="GOCBACOV_1" value="0033'"/>
<tag name="GOCBACTHAT" value="0008'"/>
<tag name="KHOANGCAOD" value="Khoảng cao đều đường bình độ cơ bả"/>
<tag name="LYGIAC6000" value="0-02; 0-11; 0-09"/>
<tag name="LYGIAC6400" value="0-02; 0-12; 0-10"/>
</sheet>
```

A node «sheet» should contain the nomenclature sheet, consisting of Latin characters, as a separator of groups for digits - the symbol «–», for example: 5651-3-DB.

2.3   Data import

Data import is performed by using the procedure «Import Shape-files»: File - Importing vector data from ... - The set of files Shape (SHP). In this case, a folder is selected in which there are folders with nomenclature sheets of the map. The import of digital topographic map for the Socialist Republic of Vietnam (DTM SRV) is carried out using the digital classifier viet25t.rsc. The classifier can be created and configured in advance using means of GIS Panorama.

The digital classifier (RSC) should contain the following descriptions:
- palette in format RGB used to display objects on the screen;
- palette in format CMYK used to create images for offset printing;
- TrueType fonts used to display map inscriptions;
- map layers, corresponding to the classifier, used to create the initial data of the set Shapefile;
- semantic characteristics used to describe the attributes of objects;
- description for the graphical representation of objects (conventional signs).

The import of the set SHP files allows you to download in the following ways:
1) The original data can be uploaded to one common map in format SIT or SITX (without layout into nomenclature sheets). In this case, all objects are recorded to one sheet without the object «Sheet-frame». If there is no «Sheet-frame» object on the map, any operations can be performed for search, measurement, computation, height matrix, etc. But it will be impossible to perform tasks of generalizing a topographic map and design a map sheet for publication.
2) The source data can be loaded into a multi-sheet map in format MAP. The objects of such map are recorded in separate sheets corresponding to the nomenclatures of the data being downloaded. This map has the same capabilities as the map SIT (SITX). In addition, in each sheet of the map in the format MAP, it is created an object «Sheet-frame» corresponding to the sheet nomenclature. The presence of the object «Sheet-frame» provides the ability to perform

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the tasks of generalizing the topographic map and processing the map sheet for publication. The limitation of this method is the impossibility of loading data that territorially belong to different six-degree zones. Map sheets in format MAP have to belong to one six-degree zone.

3) The source data can be loaded into a multi-sheet map with a common project in format MPT. Objects of such map are recorded in separate sheets (in format SIT or SITX) corresponding to the nomenclatures of the data being downloaded. Such map has the same capabilities as a common map in the format SIT (SITX). This method allows you to perform data loading in the case of sheets belonging to different six-degree zones.

In the process of importing data from one source set (file), several types of objects can be generated. The identification of the object type is performed in accordance with the value of the alphanumeric code for the object defined in the digital classifier, and present in the initial attribute description in the field MADOITUONG.

If the digital classifier contains descriptions of all types for loadable objects, then it is not necessary to configure additional codes. In this case, it is necessary:
- enable the option «Object code»;
- as a field with a code, select the value MADOITUONG;
- select «Alphanumeric code» as the code type.

If there is no description of any kind object in the digital classifier, objects of this type will be loaded into the system layer in the form of service objects with preservation of all metric and attributive data.

2.4 Additional data processing

2.4.1 Map processing under the scenario

Upon completion of data loading, additional processing of data under the scenario is performed. The processing scenario is contained in the XML file with FROMSHP extension. At presence in the system directory of FROMSHP file corresponding to the classifier, the automatic choice of the scenario file is carried out. The file viet25t.fromshp corresponds to the classifier viet25t.rsc.

The example of a scenario file is given in the Appendix 1. Description of the scenario keywords is shown in the Table 2.

Table 2 -   Description of the scenario keywords

Element	Description
shptomap	The main element of the XML file (*)
* \ rscname	File name of the digital classifier RSC
* \ dbf \ code	Format of string variables of DBF files
* \ fields	Description of DBF file fields
* \ fields \ item \ name="objectcode"	DBF field, which contains the object code
*** \ verificationframe**	**Task «Check of sheets frames»**
* \ verificationframe \ step	The step of clarifying the frame of the nomenclature map sheet at expansion of the western and eastern borders of the sheet
*** \ classification**	**Task «Additional classification»**
* \ classification \ set \ name="Cliffs along rivers"	Parameters of the set «Cliffs along rivers»
* \ classification \ set \ mode="distance"	Mode of calculating the distance between objects
* \ classification \ set \ semantic="31300"	Number of semantics for recording the distance between objects
* \ classification \ set \ analyzed \ key	List of keys of analyzed objects (rivers)

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Element	Description
* \ classification \ set \ processed \ key	List of keys of processed objects (cliffs)
*** \ creation**	**Task «Automatic creation of objects»**
* \ creation \ set \ name="Point objects for polygons"	Parameters of the set «Point objects for polygons»
* \ creation \ set \ mode="center"	Mode of calculating a point position
* \ creation \ set \ newsemantic="9"	Number of semantics for recording the label text
* \ creation \ set \ operation	Parameters of the object creation operation
* \ creation \ set \ operation \ key	Key of analyzed object by which the metric of point object for drawing the label is calculated
* \ creation \ set \ operation \ semantic	Number of semantics containing the text for drawing the label
* \ creation \ set \ operation \ newkey	Key of the point object to be created
*** \ alignment**	**Task «Orientation of vector signs »**
* \ alignment \ set \ name="Overpasses along rivers"	Parameters of the set «Overpasses along rivers»
* \ alignment \ set \ distance="1"	Distance (in meters on the terrain) from the vector symbol (overpasses) up to the contour of analyzed object (river)
* \ alignment \ set \ radius="0"	Radius of search of heights difference, used for determining a direction of a current (0 - is not used)
* \ alignment \ set \ orientation="parallel"	The mode of orienting a vector sign along (parallel to) the analyzed linear object
* \ alignment \ set \ analyzed \ key	List of keys of analyzed objects (rivers)
* \ alignment \ set \ processed \ key	List of keys of processed objects (overpasses)
* \ alignment \ set \ name="Thresholds perpendicular to rivers"	Parameters of the set «Thresholds perpendicular to rivers»
* \ alignment \ set \ name="Buildings along roads"	Parameters of the set «Buildings along roads»
* \ alignment \ set \ name="Bridges along roads"	Parameters of the set «Bridges along roads»
*** \ directionchange**	**Task «Specifying a direction of digitizing borders of territories»**
* \ directionchange \ left="715"	Number of semantics, which contains the name of the province on the left. Specifying a direction is performed to ensure the correct position of the border relative to the territories. The direction of border digitization is used to correctly sign the border of territories
* \ directionchange \ right="716"	Number of semantics, which contains the name of the province on the right
* \ directionchange \ set \ name="Provincial administrative territory"	Parameters of the set «Provincial administrative territories»
* \ directionchange \ set \ analyzed \ key	List of keys of analyzed objects (territories)
* \ directionchange \ set \ processed \ key	List of keys of processed objects (borders)
* \ directionchange \ set \ name="Counties"	Parameters of the set «Counties»
*** \ labelcreating**	**Task «Automatic arrangement of labels»**

Element	Description
	Parameters of drawing labels are contained in the file viet25t.ilb. Customization of parameters is described in item 2.6 of the document «Application tasks» PARB.00227-01 98 10.
* \ mapsorting	**Task «Map Objects Sorting»**
* \ mapsorting \ regime="0"	Mode of map sorting (0 – to sort all)

2.4.2   Verification of data

After the data import has been completed, the result of the procedure should be analyzed: the absence of objects in the system layer and the absence of errors in the download protocols. If it is necessary, eliminate the causes of errors and retry the download.

In addition, it is recommended to perform general verification of downloaded data using GIS Panorama (see document «Quality control of vector map» PARB.00046-04 98 06).

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3   DATA EXPORT

3.1   Preparatory work

Preparatory work consists in the formation and configuration of the digital classifier (RSC file), as well as the configuration of additional files used for exporting data.

To ensure the re-import of the data exported to Shapefile, when exporting data to the set Shapefile (SHP, DBF, PRJ), it is automatically added the identical by name of the set XML-file, kept in a folder of service parameters for import /export of GIS:

c:\Program Files\Panorama\Panorama13\Maptoshp\viet25t.rsc\

This file contains a list of matching the full names for the semantics keys and short field names of the table DBF.

3.2   Export data

In the process of exporting the map, which is a multi-sheet area of works (MAP), consisting of nomenclature sheets of DTM SRV, it is automatically generated a set of folders with names corresponding to the nomenclatures of the map sheets. In the folder with the nomenclature, folders are created, with names corresponding to the names of the layers for the classifier of the map being uploaded. Data sets containing map objects are unloaded into the layer folders.

When exporting map objects, set files are assigned names according to the short names of objects in the map classifier. If the classifier objects (of the same type) have an identically short name, such objects are uploaded to one file.

Field names in DBF files are generated in accordance with the short names of the corresponding semantic characteristics in the digital map classifier.

The names of the layer folders are formed according to the layer names in the classifier.

The correspondence for the names of folders to the names of the layers, the correspondence of the field names of the tables DBF and the names for the semantics of the classifier, the list of the paged layers, objects and semantics are contained in the export parameters file viet25t.rsc.toshp, which is part of the GIS installation kit. When expanding the list of objects and semantic characteristics in the map classifier, you should make appropriate changes to the export parameters file.

Description of the keywords is shown in the Table 3. The example of export parameters file (viet25t.rsc.toshp) is shown in Appendix 2.

Table 3 -   Description of the keywords of TOSHP file

Element	Description
maptoshp	The main element of the XML file (*)
* \ dbffields	Description of DBF file fields
*** \ dbffields \ field**	**Parameters of the field**
* \ dbffields \ field id="500" name="maNhanDang"	Semantic characteristic 500 (object ID) do record in the field «maNhanDang»
* \ dbffields \ field id="503" name="maDoiTuong"	Semantic characteristic 500 (alphanumeric code) write in the field «maDoiTuong»
* \ folders	Description of the contents of folders
*** \ folders \ layer**	**Parameters of the layer**
* \ folders \ layer id="1" name="ThuyHe"	Objects of layer 1 write to the folder «ThuyHe»
*** \ folders \ layer \ object**	**Parameters of the object**
* \ folders \ layer \ object key="RanhGioiBai" name ="RanhGioiBai"	Object semantics with the key (short object name in the classifier) «RanhGioiBai» should be written to the RanhGioiBai.dbf
* \ folders \ layer \ object \ field id="500"	Save semantic characteristic 500

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Export of the map, to format Shapefile, is executed in the following sequence:
1) Open the map created by the classifier viet25t.rsc: File - Open the map (MAP, SIT, SITX or MPT).
2) Open the data export dialog: File - Export to ... - ArcView files (SHP).
3) Specify the export parameters file (viet25t.rsc.toshp). Full file name: c:\Program Files\Panorama\Panorama13\Maptoshp\viet25t.rsc.toshp.
4) Click «Execute» and «Exit».

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APPENDIX 1   EXAMPLE OF FILE FROMSHP

```xml
<?xml version="1.0" encoding="UTF-8"?>
<shptomap rscname="viet25t.rsc">
 <dbf code="utf-8"/>
 <code type="text"/>
 <fields>
  <item name="objectcode">maDoiTuong</item>
 </fields>

 <verificationframe name="Verification of sheet frame" nameru="Проверка рамок листов" step="10">
  <set></set>
 </verificationframe>

 <classification name="Additional classification" nameru="Дополнительная классификация">
  <set name="Cliffs along rivers" nameru="Обрывы вдоль рек" mode="distance" semantic="31300" distance="0"
notturn="0">
   <analyzed>

<key>KenhMuongL,L00000005492,SongSuoiL,L0000000549,L000000054910,L00000005496,L00000005494,L00
000005372,SongSuoiA,C0000000544</key>
   </analyzed>
   <processed>
   <key>L0000000745,L0000000714</key>
   </processed>
  </set>
 </classification>

 <creation name="Automatic creation of objects" nameru="Автоматическое создание объектов">
  <set name="Point objects for polygons" nameru="Точечные объекты для полигонов" mode="center"
newsemantic="9">
   <operation> <key>CauGiaoThongL</key> <semantic>9</semantic> <newkey>P00850</newkey> </operation>
   <operation>     <key>CauGiaoThongL</key>     <semantic>4001</semantic>     <newkey>P00851</newkey>
</operation>
  </set>
 </creation>

 <alignment name="Vector objects orientation" nameru="Ориентирование векторных знаков">
  <set name="Overpasses along rivers" nameru="Путепроводы вдоль рек" distance="1" radius="0"
orientation="parallel">
  <analyzed>

<key>KenhMuongL,L00000005492,SongSuoiL,L0000000549,L000000054910,L00000005496,L00000005494,L00
000005372,SongSuoiA,C0000000544</key>
   </analyzed>
   <processed>

<key>CongGiaoThongP,V00000005605,V00000005603,V00000005602,V0000000560,V00000005601,V00000005
604</key>
   </processed>
  </set>

  <set name="Thresholds perpendicular to rivers" nameru="Пороги перпендикулярно рекам" distance="1"
radius="10" orientation="perpendicular">
  <analyzed>

<key>KenhMuongL,L00000005492,SongSuoiL,L0000000549,L000000054910,L00000005496,L00000005494,L00
000005372,SongSuoiA,C0000000544</key>
   </analyzed>
   <processed>
   <key>V00000005011</key>
   </processed>
```

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```
  </set>

  <set name="Buildings along roads" nameru="Строения вдоль дорог" distance="100" radius="0"
orientation="parallel" notturn="20">
   <analyzed>

<key>L00000006058,L00000006051,L00000006052,L00000006055,L0000000605,L00000006054,L00000006057,
L00000006042</key>
   </analyzed>
   <processed>
    <key>P0000000657</key>
   </processed>
  </set>

  <set name="Bridges along roads" nameru="Мосты вдоль дорог" distance="1" radius="10" orientation="parallel"
notturn="0">
   <analyzed>

<key>L00000006058,L00000006051,L00000006052,L00000006055,L0000000605,L00000006054,L00000006057,
L00000006042</key>
   </analyzed>
   <processed>

<key>CauGiaoThongP,V00000006013,V00000006015,V000000060110,V00000006011,V0000000601,V00000006
014,V000000060111,V00000006012,V0000000501</key>
   </processed>
  </set>
 </alignment>

 <directionchange name="Direction change" nameru="Изменение направления цифрования по семантике">
  <set name="Provincial administrative territory" nameru="Провинциальные административные территории">
   <analyzed>
    <key>C0000000790</key>
   </analyzed>
   <processed>
    <key>C0000000797</key>
   </processed>
  </set>

  <set name="Counties" nameru="Уезды">
   <analyzed>
    <key>C0000000791</key>
   </analyzed>
   <processed>
    <key>C0000000798</key>
   </processed>
  </set>
 </directionchange>

 <labelcreating name="Labels creating" nameru="Нанесение подписей">
  <set></set>
 </labelcreating>

 <mapsorting name="Sorting map objects" nameru="Сортировка объектов карты" regime="0">
  <set></set>
 </<mapsorting>

</shptomap>
```

APPENDIX 2   EXAMPLE OF FILE TOSHP

```xml
<?xml version="1.0" encoding="UTF-8"?>
<maptoshp>
<dbffields>
<field id="500" name="maNhanDang"/>
<field id="501" name="NGAYTHUNHA"/>
<field id="502" name="NGAYCAPNHA"/>
<field id="503" name="maDoiTuong"/>
…
<field id="9016" name="SEM_9016"/>
</dbffields>
<folders>
<layer id="1" name="ThuyHe">
<object key="RanhGioiBai" name ="RanhGioiBai">
<field id="500"/>
<field id="501"/>
<field id="502"/>
<field id="503"/>
<field id="504"/>
<field id="505"/>
<field id="506"/>
<field id="5003"/>
<field id="5001"/>
</object>
<object key="DapP" name ="DapP">
<field id="507"/>
<field id="509"/>
<field id="500"/>
<field id="501"/>
<field id="502"/>
<field id="503"/>
<field id="10"/>
<field id="9"/>
<field id="504"/>
<field id="505"/>
<field id="506"/>
<field id="5003"/>
<field id="5032"/>
<field id="5022"/>
<field id="5033"/>
</object>
…
<object key="BaiCanBaiNgamP" name ="BaiCanBaiNgamP">
<field id="512"/>
<field id="500"/>
<field id="501"/>
<field id="502"/>
<field id="503"/>
<field id="9"/>
<field id="511"/>
<field id="504"/>
<field id="505"/>
<field id="506"/>
</object>
</layer>
</folders>
</maptoshp>
```

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CHANGE LOG SHEET

Cha nges	Numbers of sheets (pages)				All sheets (pages) in document.	Docum ent	Incoming №. escort- tional document and the date	Sign atur e	Date
	changed	replac es	new	cancell ed					

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