CS 551 Drainage Surveys - Survey deliverables (DLE)

national highways

Introduction

All surveys of the National Highways drainage asset must be carried out in accordance with the Design Manual for Roads and Bridges (DMRB) Standard CS 551 on *Drainage surveys*, no matter whether the survey is commissioned by National Highways, or a member of the supply chain, and no matter what the purpose of the survey.

This course provides details of the CS 551 drainage survey deliverables and how to check them. There are two versions of the course, one for Survey Owners and one for Operations Directorate Drainage Liaison Engineers (OD DLEs), and their delegates.

This is the course for the OD DLE, there is a separate eLearning course for the Survey Owner: *CS 551 Drainage Surveys - Survey deliverables (Survey Owner).*

The course refers to the 2025 version of CS 551 and its associated England National Application Annex (ENAA). It also refers to the 2025 version of CD 535 *Drainage asset data and risk management* and its associated ENAA. The course references the National Highways Geotechnical and Drainage Management Service (GDMS) which replaced the Highways Agency Drainage Data Management System

(HADDMS) in October 2024 as the primary repository for National Highways' drainage asset and flooding data.

You will get maximum benefit out of this course if you already have some familiarity with CS 551, CD 535 and using GDMS.

What will you learn from this course?
This course is in 11 modules.

- Once you have completed this course, you will have an understanding of the various types of CS 551 drainage survey deliverable. This is covered in module 1.
- You will have an overview of the deliverables checking process and the responsibilities of both the Survey Owner and the OD DLE. This is covered in module 2.
- You will be taken through a systematic process for checking drainage survey deliverables. This is covered in modules 3 to 5, 7 and 8.
- You will receive guidance on reporting the results of your checking back to the Survey Contractor. This is covered in module 6.
- Module 9 provides a summary of the deliverables checking process, and covers both the Survey Owner and OD DLE aspects.
- You will be able to demonstrate your level of understanding of the course content by completing a scored quiz in module 10.
- There is a form in module 11 to submit a record of your training for it to be recognised by National Highways.

Who is the course for?
This course is for National Highways OD DLEs (or their delegates) who will need to carry out the assurance role on survey deliverables and upload/import the deliverables to GDMS, irrespective of whether the Survey Owner is within OD, or some other part of NH or in a contractor within the NH supply chain.

Quiz

There is a scored quiz at the end of the course with a minimum of 80% pass mark.

Instructions

- Use your mouse wheel to scroll down through each module and click on the interactive elements when prompted.
- Click on the icon at the top left to show or hide the menu. You can move back to a previous module once you are part way through the course, and you can then skip forward to where you have got to without having to repeat all the modules. But you cannot skip forwards beyond where you have got to in the course.
- Click on the *Start course* button above to begin.

List of course modules

As you progress through the course the button to the right of each module below will show where you have got to.

Module 9 - Summary

Module 1 - CS 551 deliverables

Click on the icon top left to hide or show the side menu.

For each of the survey and testing types in CS 551 there is a sub-section in the standard titled *Reporting requirements*, that details the specific deliverables for each method. CS 551 makes it clear which deliverables are required outputs for each survey or test, and which ones may be optionally requested by the Survey Owner in the Task Order that instructs the works. There is a separate eLearning course covering the use of the Task Order: *CS 551 Drainage surveys – Survey procurement.*

CS 551 survey or testing type	Deliverable type						
	GDMS shapefiles	PDF report	CAD drawings	AGS data	Photographs	Video	Proprietary viewer
Validation survey	R				R		
Priority asset survey	R				R		
Filter drain condition survey by GPR	R	R			R		
All assets condition and connectivity survey	R				R		
Pipework and chambers defect survey by CCTV	R	O	O		R	R	O
Pipework geometric survey by laser profiler	R	R	R				O
Pipework inclination survey	R	R					O
Chambers defect and geometric survey by laser scanner	R	O	R O		R	R	O
Ditch profile survey		R	R		R		
Soil characterisation sampling and testing		R		R			
All assets defect survey	R	R	R		R	R	
Key							
R Required							
O Optional (instructed in the Task Order)							

CS 551 deliverables summary

The required and optional deliverables for each CS 551 survey and test type are summarised in the table by deliverable type.

Click on the image to enlarge it. Click again to shrink.

Each of the deliverable types is described below.

Click on the + symbols to expand.

GDMS shapefiles

For almost all survey types GDMS shapefiles are required. This is the most important deliverable from the survey. These contain the location, asset type, unique asset reference, geometry, inventory and condition information for each drainage asset surveyed. They also record how the assets connect together to form drainage systems and the water flow direction through the system.

Separate shapefiles are provided for the three main types of assets: point assets, continuous assets and, where present, region assets. Within a single survey, a single shapefile is provided for each of these three main types of assets. Additional database files in DBF format are included for continuous asset component data and detailed observations.

All survey methods require that if there is any pre-existing drainage data on GDMS this data shall be downloaded and provided to the Survey Contractor in GDMS shapefile format. The contractor then updates the data in the field, recording any new or changed assets and retaining any assets that do not require an update as these must be included in the round-tripping process. If any assets are to be removed then these assets must be deleted from the shapefile data and, once imported back to GDMS, the assets will be archived. On completion of the survey, the checked data is re-uploaded and imported back onto GDMS as a new version of the data in the same GDMS shapefile format. This is the drainage survey data round-tripping process that is described in the GDMS eLearning course on *Drainage data*.

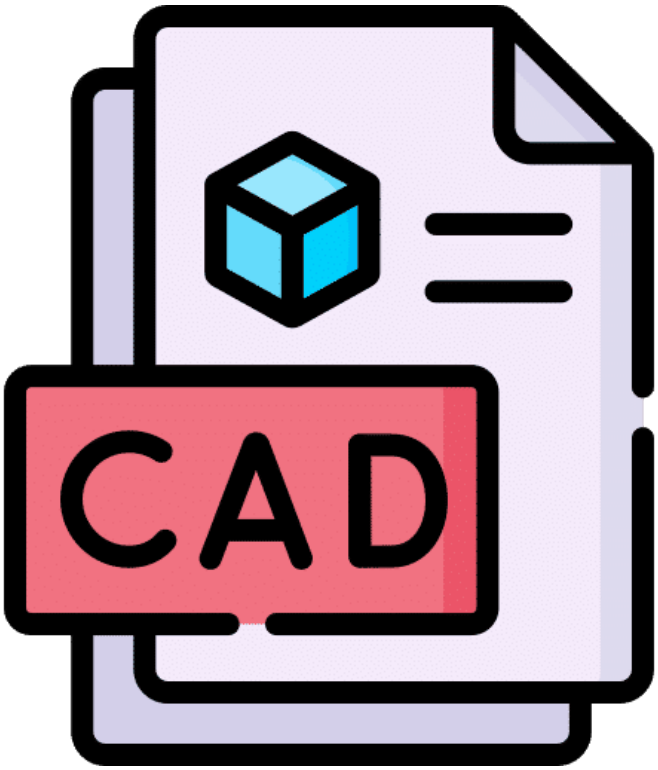
The GDMS shapefile format uses the industry standard Esri format for sharing geospatial data between Geographic Information Systems (GIS). GDMS shapefiles must contain specific fields which are documented in “GDMS Drainage Data Formats”, available to download from https://downloads.gdms.assetia.cloud. GDMS shapefiles can be opened and viewed in any GIS that reads Esri shapefiles.

PDF report

PDF format reports are required (or optional) for most of the survey and testing types. The reports are used to record any information or data that cannot be readily recorded in a machine-readable format. The required specific contents of the report vary by survey type and are detailed in CS 551, but they generally include: a description of the works carried out including location, equipment and method; quality control procedures; specific graphical plots, diagrams, drawings, tables or summaries of outputs; and for some surveys or tests there is a requirement to include an interpretation of the results.

CAD drawings

CAD (Computer Aided Design) drawings are required (or optional) for many of the survey types. CS 551 requires the drawings to be submitted in two machine-readable formats (DWG and DXF), which can be output by almost all CAD software, and also in PDF format. The CAD drawings may be in either 2D or 3D format, depending on the requirements of the specific survey type and are to conform to the requirements of National Highways standard *GG 184 Specification for the use of Computer Aided Design*.



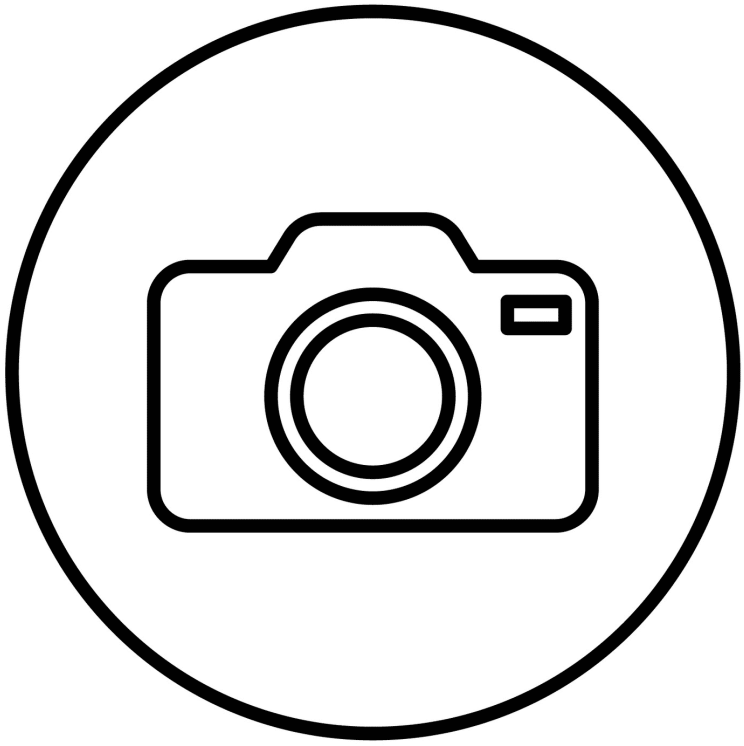
AGS data

The laboratory test results produced as part of *Soil characterisation, sampling and testing* are to be provided as an electronic data file in the AGS data transfer format. The AGS format is a well-established data file format used by the geotechnical and geoenvironmental industries for the transfer of testing data in a machine-readable format. All chemical testing laboratories working in this field should be able to output the test results in this format.

The most recent version of the AGS format is to be used and is described on the Association of Geotechnical & Geoenvironmental Specialists website: https://www.ags.org.uk/data-format/.

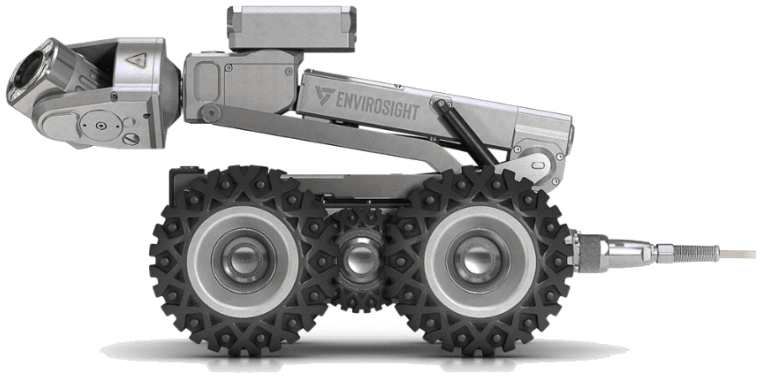
Photographs

Digital photographs are required for most of the survey types. They are intended to illustrate both the typical condition and nature of the asset, and to show the detail of specific defects. All photographs are to be in colour, in JPEG file format with a minimum resolution stated for each survey type.



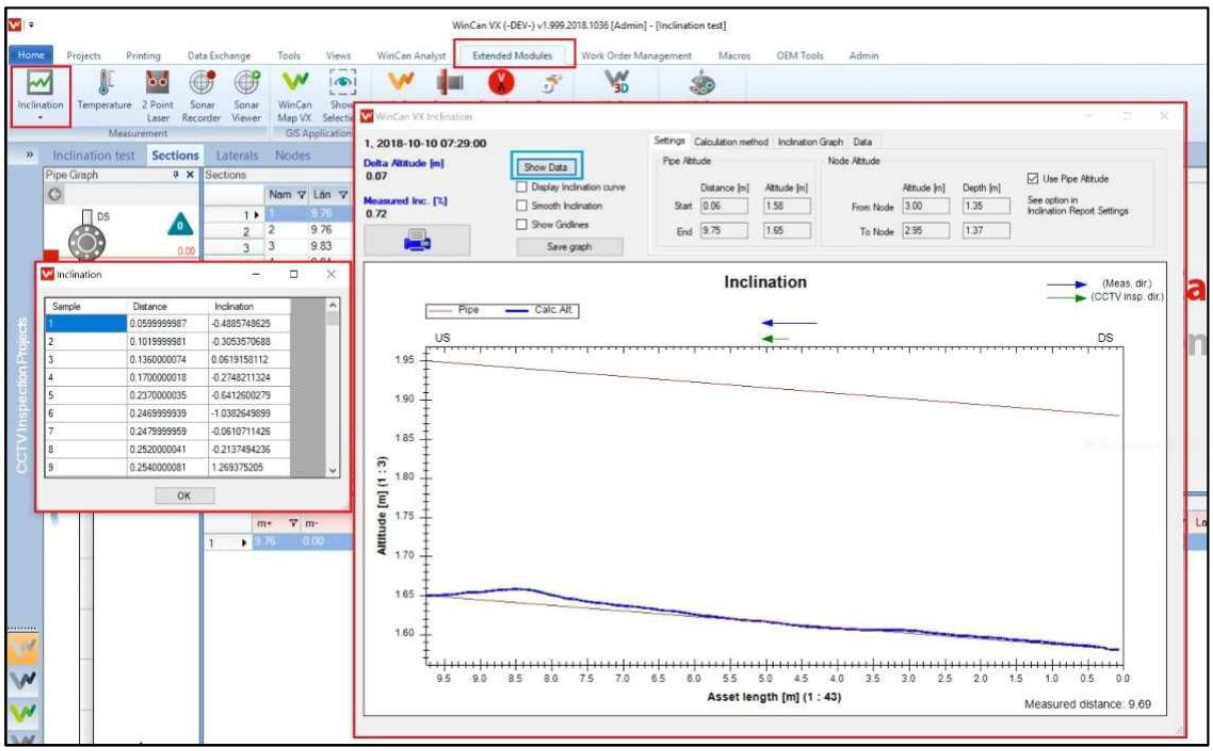
Video

Video recordings are required for pipework CCTV and chamber laser scanning surveys. They record the full survey of the asset and show both the general condition and the detail of specific defects. All videos are to be in colour, in MPEG file format with a minimum resolution and frame rate stated for each survey type.



Proprietary viewer —

For the pipework and chamber laser scanning surveys where multiple deliverables are collected (coded survey data, photographs, videos and scans) the Survey Owner may optionally request that the data provided be packaged with a proprietary viewer software that links all the deliverables together. This allows the survey data to be viewed in conjunction with the video, photographs and scans, such that viewing an asset or observation in the data will automatically retrieve the associated section of video or scan and the relevant photographs. This makes viewing and interpretation of the data considerably easier and quicker. However, it should be noted, that if the viewer software is an executable file (.exe) it cannot be received or used by NH. The viewer software is to have an unrestricted licence.


WinCan VX (-DEV-) v1.999.2018.1036 [Admin] - [Inclination test]
Home
Projects
Printing
Data Exchange
Tools
Views
WinCan Analyst
Extended Modules
Work Order Management
Macros
OEM Tools
Admin
Inclination
Temperature
2 Point Laser
Sonar Recorder
Sonar Viewer
WinCan Map VX
Measurement
GIS Application
Inclination test
Sections
Laterals
Nodes
Pipe Graph
Sections
CCTV Inspection Projects
Inclination
Sample
Distance
Inclination
1 0.0599999987 -0.4885748625
2 0.1019999981 -0.3053570688
3 0.1360000074 0.0619158112
4 0.1700000018 -0.2748211324
5 0.2370000035 -0.6412600279
6 0.2469999939 -1.0382649899
7 0.2479999959 -0.0610711426
8 0.2520000041 -0.2137494236
9 0.2540000081 1.269375205
OK
WinCan VX Inclination
1, 2018-10-10 07:29:00
Delta Altitude [m]
0.07
Measured Inc. [%]
0.72
Show Data
Display Inclination curve
Smooth Inclination
Show Gridlines
Save graph
Settings
Calculation method
Inclination Graph
Data
Pipe Altitude
Distance [m]
Altitude [m]
Start 0.06 1.58
End 9.75 1.65
Node Altitude
Altitude [m]
Depth [m]
From Node 3.00 1.35
To Node 2.95 1.37
Use Pipe Altitude
See option in Inclination Report Settings
Inclination
(Meas. dir.)
(CCTV insp. dir.)
Pipe
Calc. Alt.
US
DS
Altitude [m] (1 : 3)
Asset length [m] (1 : 43)
Measured distance: 9.69

Module 2 - The checking process

Who is responsible for the checking?

There is a separate eLearning course on roles and responsibilities: *CS 551 Drainage Surveys - Survey roles and responsibilities,* that sets out the end-to-end process for carrying out a CS 551 drainage survey. The key aspects of the process related to survey deliverables are as follows:

- A draft set of survey and testing deliverables is submitted by the Survey Contractor to the Survey Owner for checking for compliance with the Task Order, the CS 551 specification and the GDMS Data Formats documentation.
- The Operations Directorate Drainage Liaison Engineer (OD DLE), or their delegate, also has an assurance role to check that the deliverables meet the requirements.
- If any data is missing, or not in accordance with the specification, the Survey Contractor must address the matters and re-issue the deliverables.

- Following acceptance of the draft deliverables, the Survey Contractor submits a final set of survey and testing deliverables to the Survey Owner for checking and to the OD DLE, or their delegate, for assurance. If any errors or omissions are found the Survey Contractor must correct the matter and re-issue the deliverables.
- Once assured, the DLE, or their delegate, from OD uploads the shapefile(s) and other deliverables to GDMS. The DLE should inform the Survey Owner, Commercial and Procurement (C&P) and the Survey Contractor that the deliverables are accepted and the works are complete.

Therefore, the checking and assurance of the survey deliverables is split between the Survey Owner and the OD DLE. The Survey Owner has overall responsibility for the checking of the deliverables. The OD DLE assurance role should focus on the machine-readable asset data (in shapefile format) that will be uploaded to the GDMS database.

Module title	Survey Owner course	OD DLE course
CS 551 deliverables	Yes	Yes
The checking process	Yes	Yes
General checks	Yes	No
Checking GDMS shapefile format	No	Yes
Checking GDMS shapefile coverage	No	Yes
Checking GDMS shapefile usage	No	Yes
Checking PDF reports	Yes	No
Checking CAD drawings	Yes	No
Checking AGS data	Yes	No
Checking photographs and videos	Yes	No
Checking the proprietary viewer	Yes	No
Responding to the Survey Contractor	Yes	Yes
Data upload and import checks	No	Yes
Final checks	Yes	Yes
Summary	Yes	Yes
Quiz	Yes	Yes
Course completion	Yes	Yes

Contents summary of the survey deliverables eLearning courses

There are therefore two eLearning training courses on survey deliverables with the coverage as shown in the table. The suggested split in responsibilities for each check is indicated in the two courses and summarised in the tables in module 9 which is common to both courses.

Click on the image to enlarge it. Click again to shrink.

> This is the course for the OD DLE, there is a separate eLearning course for the Survey Owner: *CS 551 Drainage Surveys - Survey deliverables (Survey Owner).* It is useful for you to have a general understanding of the checks that the Survey Owner should carry out on the deliverables by reviewing the summary tables in module 9.

If you are an OD DLE (or their delegate) and may occasionally also be the Survey Owner, you should take both courses, there is only a small overlap in content between them.

How much checking do you need to do?

The answer to that question depends on how well you know (and trust) your drainage Survey Contractor. If you are using a Technical Surveys and Testing (TST) contractor, and you know them well, and they produce high quality work, then your checking need be only light touch spot checks. But if this is the first time you have worked with the particular Survey Contractor, you should do a thorough check of all deliverables. Whichever is the case, it is the GDMS shapefiles that are the most important deliverable and should receive the most detailed checking.

Check category	Known and trusted Survey Contractor	Unknown Survey Contractor
	Suggested light touch checking scope	Suggested thorough checking scope
Must	Include	Include
Should	Exclude	Include
Could	Exclude	Include

Check categories summary table

To help you plan your checking, each check in the following sections and modules has been categorised as either Must, Should or Could. The suggested two extreme checking regimes are shown in the table.

Click on the image to enlarge it. Click again to shrink.

Where you know the Survey Contractor, but their previous performance has been a bit patchy, you might decide to do all the Must and Should checks, or to do all the Must checks and spot check the Should items where you know the Survey Contractor has previously had issues.

You may set out with a plan to do either a light touch or thorough check, but then as you work through the checking process you find either more or less issues than you were expecting. If this happens you should revise your checking plan accordingly.

RAG rating	RAG description	Outcome
Red	Major issues found. Data is unacceptable. Could not, or must not, be uploaded to GDMS.	Significant office-based rework and/or field-based resurvey required by the Survey Contractor.
Amber	Some issues found, but no showstoppers preventing upload of the data to GDMS. The issue should be addressed if possible.	Some office-based rework required by the Survey Contractor.
Green	No issues found OR only a few minor issues found.	The data is “good enough”. No action required by the Survey Contractor.

RAG rating table

Recording the results of your checking

As you complete each of the detailed checks you should record the outcome. A RAG rating system is suggested in the table. A suggested recording spreadsheet is provided on the downloads page of GDMS and is shown in module 9.

Module 3 - Checking GDMS shapefile format

The GDMS shapefiles are the most important survey deliverable and should receive the most detailed checking.

The way that the GDMS shapefile is formatted is rigidly defined, and GDMS provides some automated checks to test for compliance with these requirements. However, there are additional manual checks that you should do to ensure that the data contains all of the elements that it should.

All of the checks in this process flow are relevant to all survey types that require GDMS shapefile submissions.

Step by step GDMS shapefile format checks

The following process steps include some detailed recipes (in yellow boxes) for carrying out some of the checks. You may wish to refer to these recipes in the PDF version of this course when working through the checks, but you will not be tested on these aspects in the Quiz at the end of this course.

This checking process has 8 steps.

Step 1

Is the GDMS shapefile format valid?

Check category: **Must** Responsible: **OD DLE**

The Survey Contractor should have carried out a trial upload of the shapefiles to GDMS to check that the format is valid, and could potentially be imported into the system, although they do not have the access permissions to do the import. This trial upload produces a report of both errors and warnings. Errors will prevent the data from being uploaded to GDMS and are of two types:

- **Critical errors** such as format errors that prevent full checks being carried out, or that the data is in legacy HADDMS format.

- **Other errors** that allow a full check to be carried out, but do not permit the data to be imported into GDMS. Such errors include omitting data from a mandatory field, using incorrect codes or referencing a connected asset that hasn't been included.

The Survey Contractor must address any and all errors before the data can be uploaded to GDMS for you to check.

If the data is in the legacy HADDMS format, then the GDMS support team can provide a conversion by sending it to support@hagdms.com. The GDMS support team will return the converted files back to you but will not address any other errors or limitations. If the files are not in the legacy HADDMS format or not of sufficient quality that they can be converted, the GDMS support team will advise you of this, and you will need to return the files to the Survey Contractor for correction, either so that they are of sufficient quality to be converted, or by doing the conversion to GDMS format themselves.

You should repeat the trial upload of submitted shapefiles and review the warnings that remain within the data and that the Survey Contractor has decided to ignore, to see if you are happy with the quantity and nature of the warnings. In order to upload any shapefiles to GDMS, you should have carried out and passed the relevant eLearning training courses on the "*Drainage asset data*" module. As a minimum you should complete the "Review access" course, which shows how to upload a set of GDMS shapefiles for checking and access the check results.

The GDMS checks will report any remaining warnings which may be of two types:

- **Data loss warnings** that indicate assets have been omitted from the uploaded data that, on GDMS, currently include valuable information such as condition data, attached files or priority asset data. These warnings do not prevent the data being imported, except this must be by a user with the “Manage” access level.
- **Other warnings** that should be reviewed as they may indicate other data quality issues. These do not prevent the data being imported.

Although the GDMS upload checks are a very quick means of checking many aspects of the data they are entirely machine-driven and, even if they pass with no errors or warnings, cannot guarantee the data meets the specific requirements of your survey. They should be primarily considered as a way of checking whether the data *could* be imported into GDMS, not to determine that it definitely *should*. Therefore, prior to proceeding to import any shapefile data, the following checking steps should also be carried out. A large number of warnings may indicate that the data is of lower quality than you were expecting and you should review your checking plan. For example, do you now need to spot check, or thoroughly check, some or all of the Should checks in the following steps, which you weren’t previously planning to do.

Step 2

Open the shapefile in a GIS

Check category: **Should** Responsible: **OD DLE**

A GDMS shapefile can be opened and viewed in any GIS software that can import standard Esri shapefiles. You can use the commercial ArcGIS software, or the free QGIS (https://qgis.org/) or any other GIS software that can handle Esri shapefiles.

To open a GDMS shapefile in ArcGIS:

1. Either:
   - Select “Add Data” > “Data” from the menu, then browse to and select the shapefiles you wish to view.
   - Or, drag and drop the .shp files from File Explorer directly into the ArcGIS Map.

2. While adding the shapefiles, if you are asked to specify the coordinate system, ensure you choose British National Grid (EPSG:27700).

3. To theme a layer (change its colour or style), right-click it in the contents pane, select “Symbology”. The panel that appears will allow you to theme the entire layer all the same “Single Symbol” or categorised by “Unique Values” based on one of the fields in the data.

4. For further assistance with ArcGIS features, click the “Help” ribbon above the map.

To open a GDMS shapefile in QGIS:

1. Change the project Coordinate Reference System to OSGB by going to the “Project > Properties” menu item. In the “CRS” section enter

"27700" in the filter and select OSGB36 (EPSG:27700).

2. Either:

   - Select "Layer > Add Layer > Add Vector Layer" from the menu, then browse to and select the shapefiles you wish to view.
   - Or, drag and drop the shapefiles from File Explorer directly into the QGIS window.

3. While adding the shapefiles, if you are asked to specify the coordinate reference system, ensure you choose OSGB36 (EPSG:27700).

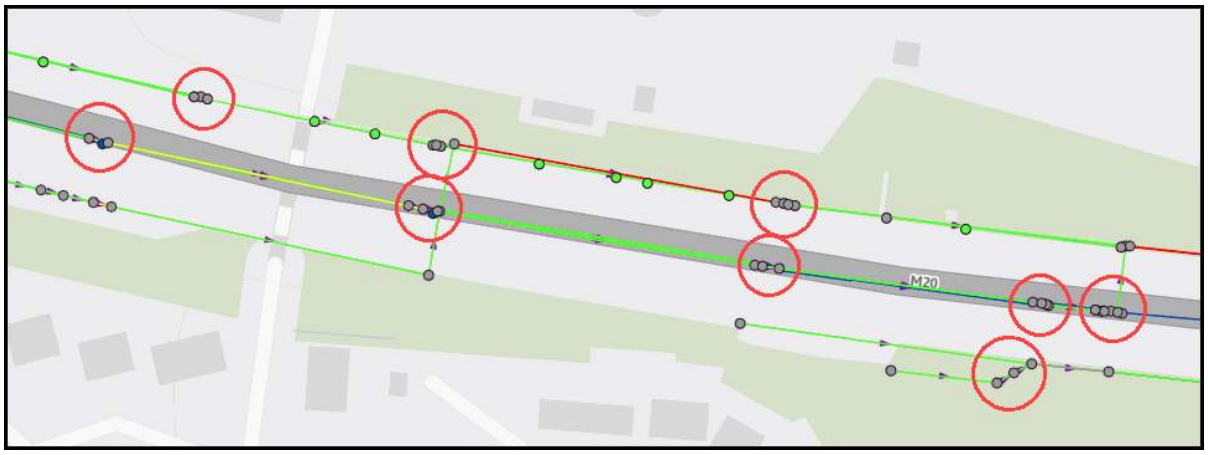
4. To theme a layer (change its colour or style), right-click it in the legend, select "Properties", then the "Symbology" section. At the top of the screen an option allows you to theme the entire layer all the same ("single symbol") or "categorised" based on one of the fields in the data.

5. For further assistance with QGIS features, click the "Help" button provided at the bottom right of all popup windows.

It is also helpful to have OS background mapping and up to date high resolution aerial photography for a corridor along the SRN. NH users should contact the NH GIS team for guidance on how to obtain this data: Geographic_Information@nationalhighways.co.uk. Non-NH users will need to license this data from commercial providers or use equivalent open-source data sets.

Step 3

Is there missing condition data?



In this GDMS example some of the chambers have condition (the green points) but many chambers (the grey points circled) do not have condition data. The clusters of chambers look unusual and need further investigation.

Check category: **Should** Responsible: **OD DLE**

For those survey types that record asset condition (Pipework geometric survey by laser profiler, Pipework inclination survey, Ditch profile survey, Validation survey and Soil characterisation sampling and testing, do not record asset condition), all of the surveyed assets will have either:

- An asset level structural and service condition grade recorded.
- Or detailed condition observations that GDMS will use to calculate the asset level structural and service grades when the data is uploaded and imported into GDMS.

Check for service and condition grades using the GIS.

To carry out the check in a GIS:

Use the GIS functionality to select all those assets that are missing a structural and/or service asset level condition grade. The relevant fields are SERV_GRADE and STRU_GRADE in each of the point, continuous and region asset shapefiles.

Grades 1–5 indicate that condition has been successfully assessed. Grade 9 indicates that assessment was attempted but was not possible. Any other value or a blank indicates that no assessment of condition was attempted during the survey.

To select assets that do not have an acceptable grade in these fields in GIS you can specify the filter criteria: “SERV_GRADE IS NULL OR SERV_GRADE NOT IN ('1','2','3','4','5','9') OR STRU_GRADE IS NULL OR STRU_GRADE NOT IN ('1','2','3','4','5','9')”.

Cross check with Step 4 whether these assets have detailed condition observations. If any assets are missing condition information (both asset level and observation level), check whether these assets were included in the scope of the survey. If so, find out from the Survey Contractor if there is any explanation for the missing data. Depending on the response, you may decide to instruct the Survey Contractor to return to site to survey the condition of these assets.

Step 4

Is defect observation data included?

Check category: **Should** Responsible: **OD DLE**

For those survey types that record detailed defect observations (principally pipe and chamber defect surveys) the observation data is contained within a separate observations database (dbf) file.

Check the observation data in the GIS or in Excel.

To carry out the check in a GIS or Excel:

To review this data drag the observation.dbf file into your GIS and open the data table. If this does not work in your GIS software you can open a dbf file in Excel but be aware that you must not save the file from Excel as it would overwrite, or potentially corrupt, the dbf. Spot check that the expected observation data is present.

Step 5

Have the asset attributes been fully populated?

Check category: **Should** Responsible: **OD DLE**

GDMS will check the drainage shapefiles to ensure all of the mandatory fields have been populated for all records.

However, GDMS will not check optional fields. If there are non-mandatory fields that your survey requires to be populated you should check in the GIS that these are present in the data.

To carry out the check in a GIS:

In your GIS software view the attribute data in a grid, and sort by each of the relevant fields in turn. As you sort by a field, any blank values should appear at either the top or bottom. Alternatively, you can filter to blank values:

- text type fields that are blank might either be NULL or an empty string ‘’
- non-text fields that are blank might either be NULL or may be 0 as the shapefile/DBF format does not permit blank numeric fields. The GDMS shapefile format provides all optional numeric fields as text to avoid them being filled with 0s.

Many of the inventory fields for continuous assets are contained in the “component.dbf” file. You should ensure that you check this file in addition to the asset shapefiles. If the data is in the legacy HADDMS format, then these fields will be in the continuous asset shapefile instead and there will be no “component.dbf” file.

The uploaded data must include all of the assets in the asset systems, including those that are only being round-tripped. If your survey does not require that round-tripped assets are fully updated, then there may be

greater tolerance of blank fields for such assets, provided that existing data in GDMS for the asset is also blank.

Step 6

Has certainty been adequately assigned to the data?

Check category: **Should** Responsible: **OD DLE**

CD 535 requires that the certainty of the connectivity and flow direction be recorded in the inventory data for all continuous assets. The CS 551 test method for all assets condition and connectivity survey provides tabular guidance on how to assess certainty for both connectivity and flow direction.

In the continuous asset shapefile, the certainty is recorded in the following fields:

- CERT_CONN = connectivity certainty
- FLOW_DIR = flow direction certainty

For both fields, each continuous asset must have either a “Y” (certain) or “N” (uncertain). Any other value or a blank will result in an error when uploading the data to GDMS.

Use GDMS and/or the GIS to check these two certainty fields.

To carry out the check in GDMS and/or a GIS:

You can identify blanks by uploading the data to GDMS for checking and reviewing any errors related to these fields. Alternatively, use GIS software to filter the assets with a blank in either of the two fields above. If there are any blanks, the data should be returned for correction.

You can identify assets with uncertainty by using the GIS software to select assets with an “N” in either of the certainty fields.

Are there many assets where the connectivity and/or flow direction is recorded as uncertain? If a questionably high number of assets are recorded as uncertain, it would be appropriate to raise this with the Survey Contractor for an explanation.

Step 7

Has validation status been adequately assigned to the data?

Check category: **Should** Responsible: **OD DLE**

A significant proportion of the GDMS drainage asset data was originally derived by digitising paper drawings, both as-built and design drawings. CD 535 requires that inventory data that has not been derived from a field survey is marked as “Unvalidated”. Once the assets have been surveyed and confirmed by field survey then their validation status is changed as appropriate to “Confirmed”, “Modified” or “New” to indicate they are now validated.

The validation status is recorded against the point assets in the STATUS field of the shapefile. Validation status is not recorded for continuous assets or region assets; it is instead inferred from the validation status of the point asset(s) they are directly connected to.

You should check that all of the surveyed assets are marked as validated.

To carry out the check in a GIS:

You should use the GIS to select all surveyed assets where the STATUS field is “Unvalidated”.

You should also check whether any of the surveyed assets do not have validation status populated as GDMS would default it to “Unvalidated”.

If the STATUS field is not present at all then the data should be rejected, because GDMS would set the validation status to “Unvalidated” for all of the point assets.

Step 8

Has asset ownership been correctly assigned?

Check category: **Should** Responsible: **OD DLE**

Some of the drainage surveyed may not be owned or maintained by NH, but by others. This is particularly the case at junctions where drainage off the main carriageway is likely to be owned and maintained by the Local Authority. You should check that asset ownership and maintenance responsibility has been correctly assigned in the data.

All assets have an OWNER field in the shapefile data which is populated with a two letter Ownership code as follows: NH (National Highways), LA (Local Authority), PR (Private), PU (Public) or OT (Other, with the details given in a Remarks field).

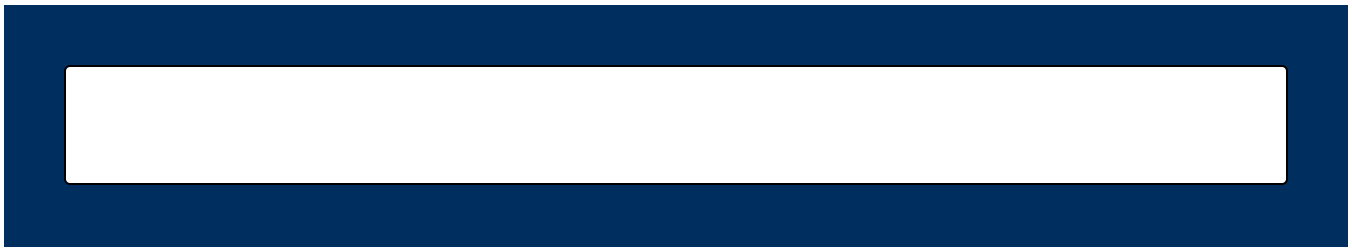
All assets also have a RESP_MAINT field used to record who is responsible for maintaining the asset, which may be different from the asset owner. The field can take the following two or three letter codes: NH (National Highways), EA (Environment Agency), IDB (Internal Drainage Board), LA (Local Authority), PR (Private), PU (Public) or OT (Other).

You should check these two fields in the GIS.

To carry out the check in a GIS:

Use the GIS to select all assets where either of these fields is NULL to check for missing attribution. Also check for where either field is not NH and decide whether ownership and maintenance responsibility has been correctly assigned in the data.

Note that the RESP_MAINT field is relatively new and may not have been populated where the data is historic and has been round-tripped without being updated in the survey.



Module 4 - Checking GDMS shapefile coverage

This module provides a set of checks that you should carry out to determine if the shapefile contents have been compiled correctly, checking that nothing is missing and that the data agrees with the other survey deliverables.

All of the checks in this process flow are relevant to *Pipework and chambers defect survey by CCTV* and *All assets defect survey*. However, only some of the checks are relevant to all other survey types, whilst the remaining checks are only relevant to selected survey types.

Step by step GDMS shapefile coverage checks

The following process steps include some detailed recipes (in yellow boxes) for carrying out some of the checks. You may wish to refer to these recipes in the PDF version of this course when working through the checks, but you will not be tested on these aspects in the Quiz at the end of this course.

This checking process has 6 steps.

Step 1

What data has been deleted, changed or added?

Check category: **Must** Responsible: **OD DLE**

It is important that existing data has been round-tripped, rather than creating completely new data for each survey. You can review this in the following ways:

- As covered in the GDMS eLearning training course (see module 3 Step 1), GDMS provides a facility to view the uploaded data on the map, prior to importing it into the live database. This facility is only available for data that passed checking with no errors. Unless you are expecting all of the assets to be newly added, then you should see that the majority of assets are indicated as either “Updated” or “Roundtripped”. If they are all shown as “New” then importing the data would only create new records, and not update any existing asset data.

- While reviewing the data in GIS software (see module 3 Step 2) you can also see how many assets are “New” by looking at the “ASSET_REF” field. If this is blank, then the asset will be treated as a “New” asset.

- In the GDMS map preview, if any assets that are currently in the drainage system(s) being re-uploaded were not included in the uploaded data, then they will be shown as “Archived”. Importing the dataset would archive these assets, effectively removing them from the live data on GDMS. You should check that you are expecting

these assets to be archived. The Upload Task screen will show “data loss warnings” if any of these existing assets to be archived already have condition data or attached files on GDMS, or if they are priority assets, indicating that they have valuable data that will be lost to live view on GDMS. Although archiving does not remove the data from the system, it is not possible to reverse archiving.

- If an entire existing asset system has not been included in the uploaded data, then this existing asset system will not be affected by importing the data. While viewing the map preview, only the assets affected by the import will be highlighted; other assets will be shown with their normal colouring (dark purple). If you were expecting all assets within the catchment to be included, then you should review whether these assets have been omitted, or if the asset system should be archived afterwards.
- When GDMS checks the data, some errors may indicate that data has been omitted. For example, if a continuous asset references an upstream point asset that is not present, this will result in an error.
- The warning check results should also be reviewed to see if these indicate any loss of data. Although data with warnings can be imported, these can indicate data quality issues.

Step 2

Has the survey data been correctly combined with existing GDMS data?

Check category: **Should** Responsible: **OD DLE**

CS 551 requires that all drainage surveys round-trip the GDMS data. It defines the process for maintaining existing data on GDMS as one-version-of-the-truth for drainage inventory and condition data. This is achieved by downloading the available data before a survey commences, and then checking, updating or adding to it in the field, before uploading and importing it back into GDMS including any unchanged data. This will replace the previous version of the data on GDMS and become the latest version-of-the-truth.

Viewing all of the submitted data for a catchment in the GIS, do you have a single survey shapefile for the whole catchment, or separate shapefiles for each drainage system within the catchment; both of which are acceptable. However, if you have multiple overlapping surveys for a given drainage system it suggests that the data has not been correctly round-tripped.

A shapefile contains separate files for point, continuous and region drainage assets. Only the point file is mandatory for a GDMS submission. The continuous and region files are not required if there are no continuous drainage assets (this would be very unusual) or no region drainage assets (this is more common). However, it is good practice for the Survey

Contractor to include an empty file to positively show that there are no assets of that type.

Step 3

Does the data agree with the aerial photography?

In this GDMS example a gully can be clearly seen (circled) on the aerial photography that is not in the GDMS data. The adjacent gullies and chambers have been correctly captured in the data.

Check category: **Should** Responsible: **OD DLE**

In your chosen GIS software, view the survey data overlaid on the high-resolution aerial photography. Depending on the quality and resolution of the aerial photography you have you will be able to see some of the surface visible drainage assets.

Gullies in the carriageway will be the most obvious. Have all of these been picked up by the survey? Depending on the amount of vegetation on the verges and earthworks, you may also be able to pick up chamber covers, filter drains, ditches, channels and ponds. Have all of these been picked

up by the survey? If a few individual drainage assets are missing from the survey, particularly if there is a consistent spacing of the gullies and chambers on the aerial photography, that is not matched by the survey, then you should ask the Survey Contractor to check if they have missed these assets.

If there is a consistent positional misalignment between the survey and the aerial photography that might be due to poor georeferencing of the aerial photography, but it could also be due to a systematic surveying error. If there is poor agreement, or random disagreement, between the survey and the aerial photography, and you know that the drainage has recently been renewed, or partly renewed, then the survey probably post-dates the aerial photography. You should check that the data agrees with any as-built or design drawings before ignoring the discrepancies.

Step 4

Does every catchment have at least one outfall or soakaway?

Check category: **Should** Responsible: **OD DLE**

Every highway drainage catchment should have at least one outfall or soakaway. The outfall(s) may discharge to a watercourse, tidal waters or a sewer, or a combination of these. Soakaway(s) will discharge to the ground. A catchment may have any number of outfalls or soakaways and may have a mixture of both asset types.

There are only two exceptions to this:

- All of the carriageway drainage in a catchment is over-the-edge and there is no adjacent ditch to collect the flow and channel it to

an outfall point.

- All of the outfalls and soakaways in the catchment are outside the fence and in the Task Order you instructed the Survey Contractor to stay within the fence.

You should check in the GIS whether every catchment has at least one outfall or soakaway.

To carry out the check in a GIS:

Use the GIS functionality to select all of the outfalls and soakaways:

- The “ITEM_TY_CO” field has a two-letter code for the asset type.
- Outfalls are point assets with an ITEM_TY_CO of “OU”. If the data is in legacy HADDMS format, the “OF” code might also be used for outfalls.
- Soakaways can be one of several asset types:
    - Point asset soakaway chambers have an ITEM_TY_CO of “SO”. If the data is in legacy HADDMS format, the “SK” code might also be used.
    - Point asset soakaway boreholes have an ITEM_TY_CO of “SB”.
    - Continuous asset soakaway trenches have an ITEM_TY_CO of “ST”.
    - Region asset infiltration basins have an ITEM_TY_CO of “IB”.
- If there is no outfall because all of the carriageway drainage in the catchment is over-the-edge with no adjacent ditch, has this been correctly recorded in the data? Over the edge (informal) drainage can be identified by filtering the continuous asset shapefile to ITEM_TY_CO = ‘OE’. This should be present as a single asset running parallel to the carriageway, over the relevant extent.

From the layout of the drainage does it look like there should be more outfalls and/or soakaways than have been recorded? Look at the downstream endpoints of each drainage system in the catchment and see what asset type has been recorded. Does it look like the surveyor has confused outfalls and outlets, or is the last asset a ghost node or phantom node (these checks are covered in the next module), or is the layout of the drainage confused, and it is not obvious where the outfalls or soakaways may be located? Clarification is required from the Survey Contractor if any of these issues are found.

Step 5

Have the outputs from multiple survey types been integrated together?

Check category: **Should** Responsible: **OD DLE**

If a pipework laser profiler and/or pipework inclination survey has been carried out, CS 551 requires that the reporting of these survey methods is integrated into the reporting of the associated pipework CCTV survey. Has this been done?

An all assets defect survey consists of a pipework and chambers defect survey by CCTV combined with an all assets condition and connectivity survey of the remaining drainage asset types. CS 551 requires that the two survey methods are combined into a single data package for each catchment. Furthermore, an all assets defect survey may additionally include other survey types, all of which are to be combined into the single data package. Has this been done?

Step 6

Does the data agree with the photographs and video?

Check category: Could Responsible: OD DLE

You should be able to spot check that the coded defect information agrees with what you can see on the photographs and video. This is rather tedious to do unless you have requested the optional proprietary viewer (see module 1) that links all the data together, or you have a full licence to the WinCan software. Using either of these tools, spot check a number of defects, checking that you (more or less) agree with the defect type, location, orientation, severity and extent.

Module 5 - Checking GDMS shapefile usage

This module contains a series of checks to determine if the survey has been carried out correctly and that the asset type definitions given in CD 535 have been used as intended.

All of the checks in this process flow are relevant to *Pipework and chambers defect survey by CCTV* and *All assets defect survey*. However, only some of the checks are relevant to all other survey types, whilst the remaining checks are only relevant to selected survey types.

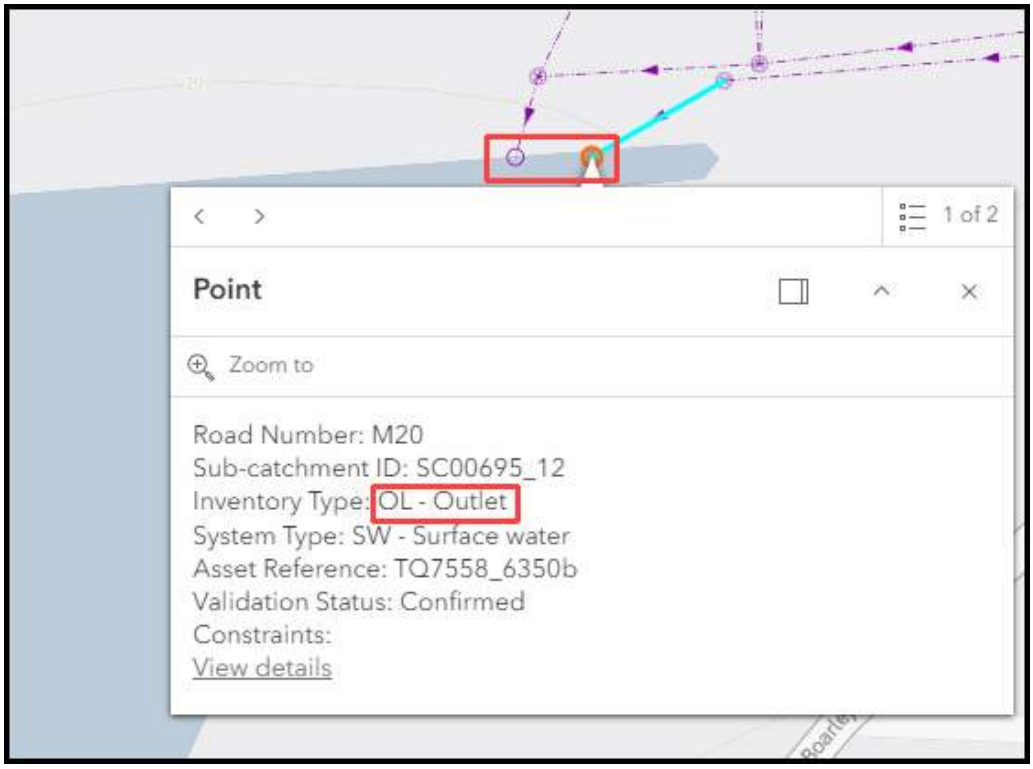
Step by step GDMS shapefile usage checks

The following process steps include some detailed recipes (in yellow boxes) for carrying out some of the checks. You may wish to refer to these recipes in the PDF version of this course when working through the checks, but you will not be tested on these aspects in the Quiz at the end of this course.

This checking process has 5 steps.

Step 1

Have the outfall and outlet asset types been assigned correctly?



In this GDMS example a pipe discharges into a pond that is the end of NH's maintenance responsibility. The discharge point is shown as an outlet. It should have been an outfall, similar to the adjacent outfall (open circle).

Check category: **Should** Responsible: **OD DLE**

Some surveyors confuse the definition of outfall and outlet. The CD 535 definitions are as follows:

Outfall: An outfall is located at the downstream end of the NH highway drainage system where it discharges into a third-party drainage system, such as a watercourse, tidal waters or a sewer.

- An outfall demarcates the limit of NH's ownership and responsibility for maintaining the highways drainage asset.
- Outfalls can occur at a physical asset, such as an outlet from a pipe, or at a location where there is no physical asset, such as a point along a ditch (that may coincide with the NH boundary fence).
- Where an asset such as an outlet or standalone flow control device is located at an outfall location, its asset type is recorded as an outfall.
- An outfall is a point asset with only upstream connectivity when it discharges into a watercourse or tidal waters. However, downstream connectivity may be recorded when the drainage discharges into a sewer or Local Authority drainage, although the downstream assets will have an ownership that is not NH.
- All outfalls are included within the priority asset register on GDMS as they have the potential to pollute the water environment.

Outlet: An outlet is the point at which water flows from a sub-surface continuous asset (such as a pipe or a culvert) into an open surface continuous asset (such as a ditch) or region asset (such as a pond).

- An outlet demarcates the change from sub-surface to surface flow.
- An outlet can be a formal physical asset with various attributes such as flow controls, headwall, apron, guardrail etc. or it may be an informal asset with the pipe discharging straight into the ditch with no formal structure.
- Where an outlet has a flow control device, but is not at an outfall location, its asset type is recorded as an outlet and the nature of the

flow control is recorded as part of the inventory information for the outlet.

- An outlet controls surface waters and protects adjacent infrastructure.
- An outlet is a point asset with both upstream and downstream connectivity.
- An outlet is only included within the GDMS priority asset register if it is also an outfall, in which case it is described as an outfall.

Examples of outfalls and outlets are given in the eLearning course *CS 551 Drainage Surveys – Survey type and extents* and example uses are given in CD 535 Appendix A2.

Common mistakes and misconceptions about outfalls and outlets:

- The outfall is located at the last downstream outlet on the drainage system. This is not correct. The outfall may be further downstream from the last outlet and have no physical structure.
- An outlet always has a headwall, if it doesn't then it is a ghost node. This is not correct. An informal outlet has no headwall, the pipe discharges directly into the ditch or pond.
- Where a pipe discharges into a pond it is the inlet to the pond. This is not correct. It is the outlet from the pipe.
- Where the water in a pond discharges into a pipe this is the outlet from the pond. This is not correct. It is the inlet to the pipe.
- The outfall is always the discharge point on the riverbank. This is not correct. The outfall demarcates the limit of NH's ownership and

may be upstream of the riverbank.

- Where NH's ownership ends at the riverbank and there is an outlet with a headwall, the outlet should be included in the GDMS priority asset register. This is not correct. The outlet is also the outfall point, and it is to be recorded as an outfall so that it is included in the GDMS priority asset register.
- Where piped drainage discharges into a third-party sewer it is an outlet. This is not correct. It is an outfall.

Check in the GIS that outfall and outlet type has been correctly assigned.

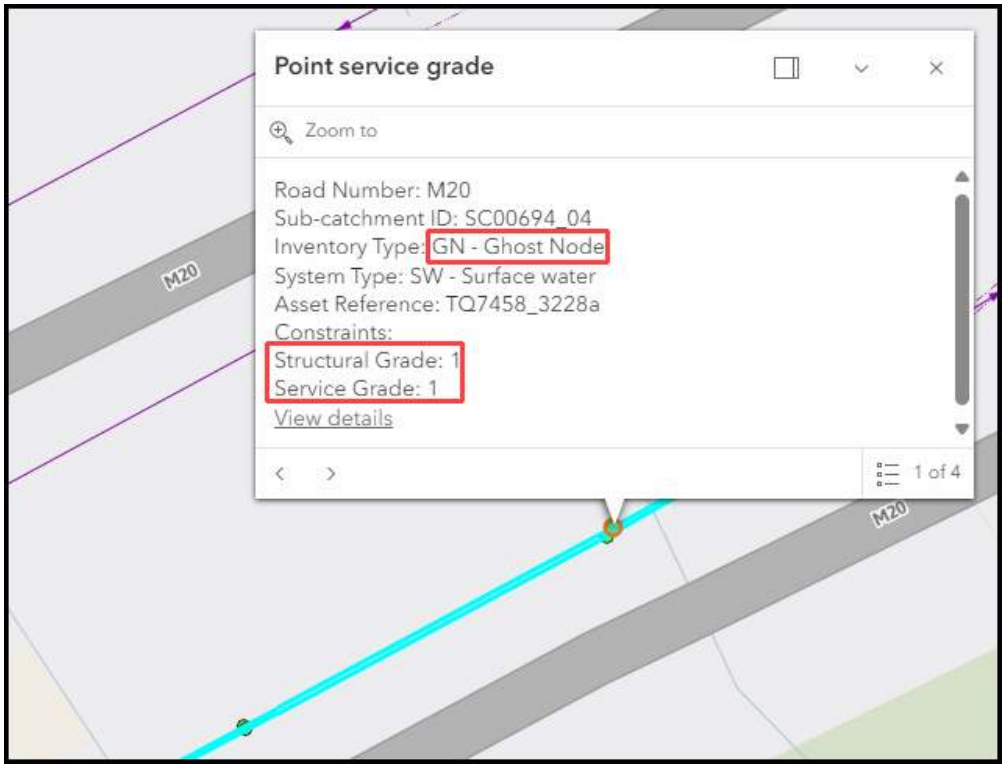
To carry out the check in a GIS:

Use the GIS to select the outfalls and outlets. Outfalls and outlets can be identified by filtering the point asset shapefile to ITEM_TY_CO = 'OU' or 'OL' respectively. If the shapefile is in the legacy HADDMS format, then outfalls might also have an ITEM_TY_CO = 'OF'.

Have the outfall and outlet asset types been used correctly and consistently?

Step 2

Has condition been assigned to network modelling nodes or connectors?



In this GDMS example a ghost node has both structural and service condition grade 1 because there are associated observations in the observation.dbf file.

Check category: **Should** Responsible: **OD DLE**

The network modelling items must not have condition assigned to them, as they are not physical assets.

Use the GIS to check the network modelling items for condition data.

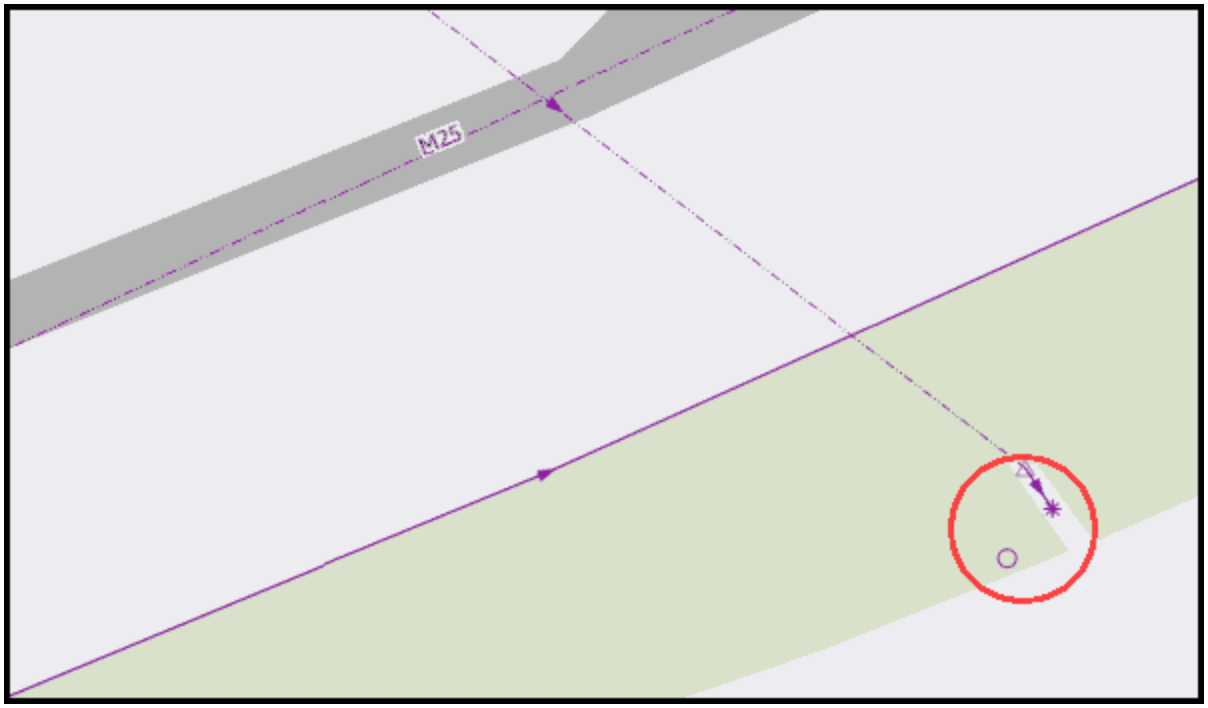
To carry out the check in a GIS:

Use the GIS functionality to check whether any of the ghost nodes, phantom nodes, region nodes, connector nodes, phantom connectors or region connectors have a structural and/or service condition grade as follows:

- Check that the SERV_GRADE and STRU_GRADE fields are blank or 0 for all assets with the following ITEM_TY_CO:
    - point assets: GN, PN, RN, CN
    - continuous assets: PL, RC
- For all of the above assets, also check that the observation.dbf file does not include any observations. The presence of any observations for these assets will result in them having condition grades of 1 calculated.

Step 3

Have phantom nodes and connectors been used correctly?



In this GDMS example the phantom node at the end of the ditch (circled star) should have been either a continuation of the ditch to the outfall (circled open circle) or a phantom connector to the outfall if it goes back into pipe where the route of which is unknown.

Check category: **Should** Responsible: **OD DLE**

Some surveyors may not use phantom nodes and phantom connectors correctly or consistently. Phantom nodes and connectors should be used to indicate uncertainty i.e. the surveyor was unable to survey the asset, but they have made their best guess.

Example uses of phantom nodes include:

- A phantom node is a network modelling point item that provides an upstream or downstream end point of a drainage system, when the nature of the drainage system beyond the phantom node is unknown.
- The drainage may be unknown because either there are no as-built drawings or it has not been surveyed.
- Once information is available, phantom nodes should be replaced with the correct asset information.

Example uses of phantom connectors include:

- A phantom connector is a network modelling continuous item that represents a connection between two known point assets in which the route of the continuous connection between them is unknown, but there is some degree of certainty that the two are connected.
- A phantom connector can be used if an area of an as-built drawing is obscured, or where a below ground pipework survey has not been carried out but the pipework route can be established with some degree of certainty, for example by dye tracing.
- A single phantom connector can represent several assets in reality. This is distinct from other types of continuous asset with uncertain connectivity, where the nature of the item is otherwise known.
- Once information is available, phantom connectors should be replaced with the correct asset information.

Example uses of phantom nodes and phantom connectors are given in CD 535 Appendix A2.

Common mistakes with phantom nodes and connectors:

- The point assets at each end of a phantom connector have their actual physical asset type recorded and are not recorded as phantom nodes.
- A phantom node or connector should not be the downstream endpoint of a drainage system following a recent survey. The surveyor should have followed the drainage to the outfall or soakaway (unless you instructed otherwise). A phantom node must not be used in place of an outfall on the basis the drainage downstream of the outfall has not been surveyed.

Check the phantom nodes and connectors in the GIS.

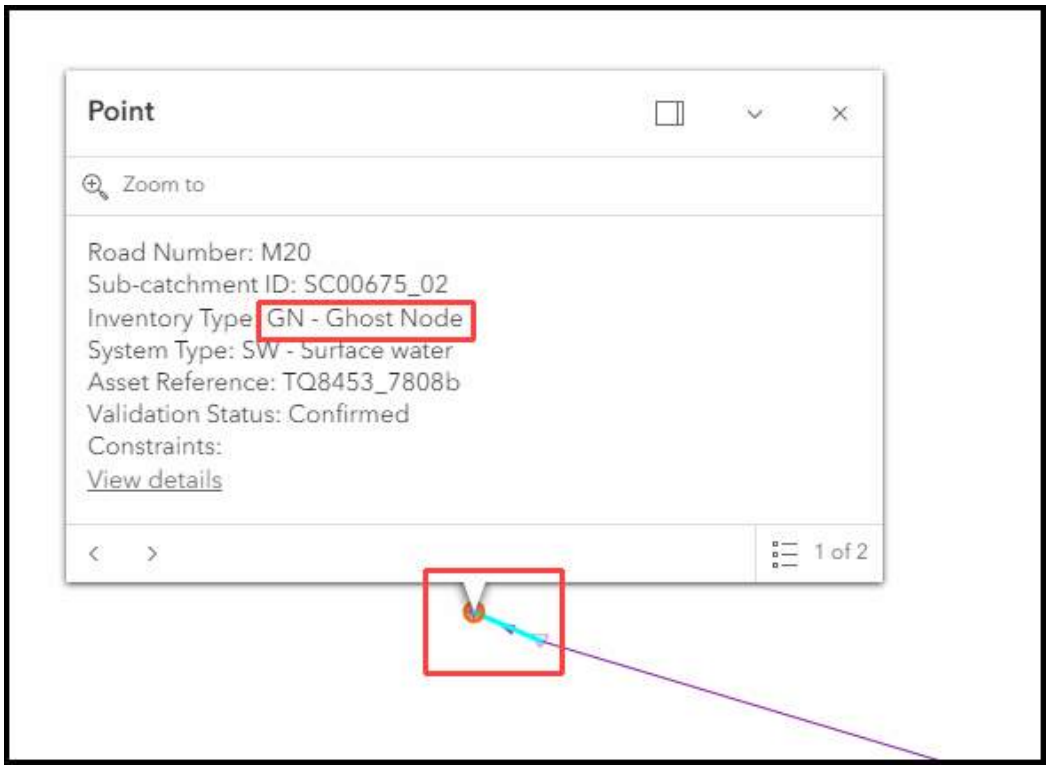
To carry out the check in a GIS:

Use the GIS to select the phantom nodes and connectors. Phantom nodes can be identified by filtering the point asset shapefile to ITEM_TY_CO = 'PN'. Phantom connectors can be identified by filtering the continuous asset shapefile to ITEM_TY_CO = 'PL'.

Have the phantom nodes and connectors been used correctly, or should they be other node or continuous asset types in some instances?

Step 4

Have ghost nodes been used correctly?



In this GDMS example a ghost node is shown at the end of a short section of gravity main which just stops. The ghost node should have been a phantom node to indicate that the continuation of the gravity main is unknown.

Check category: **Should** Responsible: **OD DLE**

Some surveyors may not use ghost nodes correctly or consistently. A ghost node is a network modelling point item used to complete a drainage network by representing a node that is not a physical asset. The ghost node allows connectivity between assets to be defined, by satisfying the requirement that all continuous assets must have an upstream and downstream point.

Example uses of ghost nodes include:

- At the ends of ditches or other continuous assets where there is no physical point asset.
- At the connection between two surface assets such as a ditch and a pond, where there is no physical asset, such as a flow control device.
- At the connections between sections of a herringbone drain, where there is no physical asset.
- Where there is a watershed and a continuous asset (such as a ditch) falls in two directions away from the watershed, the asset must be split. Two separate ghost nodes are added at the split point to mark the ends of two new continuous assets. Hence, the two parts of the original continuous asset will now be in separate drainage systems and separate catchments.

Common mistakes with ghost nodes:

- The point where a pipe discharges into a pond and there is no physical headwall is not a ghost node, it is an outlet.
- The point where an adjacent farmer's land drain discharges into the cutoff ditch at the top of a cutting and there is no physical headwall is not a ghost node, it is an outlet.
- The point where a ditch flows into a pipe and there is no physical headwall is not a ghost node, it is an inlet.
- The location of a bend or corner in a ditch at which it changes direction is not a ghost node, it is not a node at all.

- The location at which a ditch passes under the NH's boundary fence and marks the end of NH's ownership of the drainage system, but there is no physical asset, and the ditch continues both sides of the fence. This is not a ghost node, it is an outfall.
- The below ground point where a gully outlet connects to the main roadside carrier pipe is not a ghost node, it is a connector node.
- The point at which the survey information stops on a continuous asset. It is not the end of the drainage system, it is just that there is no survey information beyond that point. It is not a ghost node, it is a phantom node.
- A ghost node should not be the downstream endpoint of a drainage system. The surveyor should have followed the system to the outfall or soakaway (unless you instructed otherwise).

Check the ghost nodes in the GIS.

To carry out the check in a GIS:

Use the GIS to select all the ghost nodes. Ghost nodes can be identified by filtering the point asset shapefile to ITEM_TY_CO = 'GN'.

Have the ghost nodes been used correctly, or should they be other node types in some instances?

Step 5

Are there too many condition grade 0 and 9 assets?

A parked car on the chamber cover preventing surveying.

Check category: **Could** Responsible: **OD DLE**

Where a survey has been carried out but the condition has not been assessed for an asset, the structural and/or service grade should be recorded as either grade 0 (or blank) or grade 9, with the following meanings:

- Grade 0 (or blank) means that no assessment of the condition was attempted. For example, where assessment of an asset's condition was intended but not possible due to practicalities such as a lack of suitable traffic management or VRS over an access cover, the

condition grade(s) that could not be assessed are recorded as grade 0 (or left blank).

- Grade 9 means that a condition assessment was attempted but was not possible. For example, if the visibility or access was obstructed by extensive vegetation, the condition grade(s) that could not be assessed are recorded as grade 9. Where the service condition of an asset could not be assessed due to a structural defect, such as a seized cover, the structural grade is assessed if possible and recorded as grade 1 to 5, and a service grade of 9 is recorded.

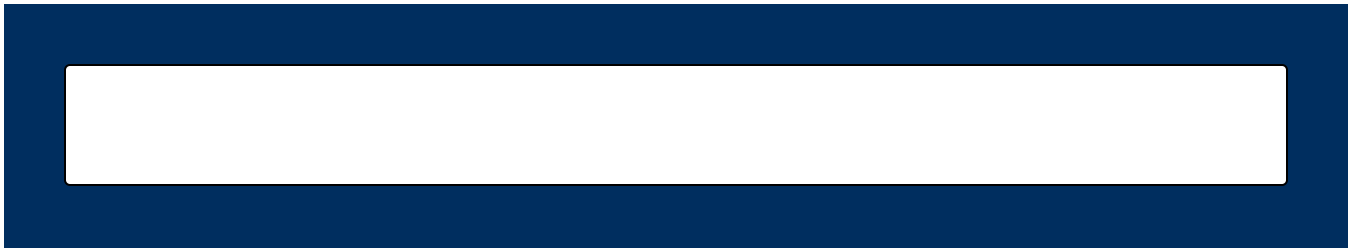
CS 551 requires that the survey team spend up to 15 minutes trying to open or remove a chamber cover or gully grating so that the asset can be surveyed (and this time is deemed to be allowed for in the rates for the survey). Also, where any pipework or culvert is secured behind a trash screen or flap valve the screen or flap valve shall be lifted or removed to facilitate access, and securely replaced immediately on completion of the survey. Furthermore, the TST survey contract contains items for vegetation clearance and clearance of inlets and outlets, that should be used to find assets that are obscured.

Check for 0 and 9 condition grades in the GIS.

To carry out the check in a GIS:

Use the GIS to select all assets with a condition grade of 0 or 9. Filter the point assets, continuous assets and region assets shapefiles to where SERV_GRADE is blank/null, 0 or 9, or STRU_GRADE is blank/null, 0 or 9.

If there are lots of grades 0 and 9, it may mean that the survey team has not spent the allotted time trying to find or open the asset, or that vegetation clearance should have been carried out. You may decide to instruct the Survey Contractor to return to site for another attempt at finding and/or opening these assets. Any assets included in the data that are being round-tripped should still have the same grade as they do on GDMS and must not be changed to 0 or 9.



Module 6 - Responding to the Survey Contractor

Step by step process for responding to the Survey Contractor

Once the checking process is complete the Survey Owner and OD DLE will need to respond back to the Survey Contractor with comments on any issues found, and instructions on what to do about them. Appropriate protocols and procedures for these communications should be established.

This process has 4 steps.

Step 1

Agreeing the communication chain

Category: **Must** Responsible: **Survey Owner**

If you are using a TST Survey Contractor, you will know them well, and will have regular direct contact with them. So, hopefully resolving issues with the deliverables should be straightforward.

However, if you are working on scheme delivery or a major project, the Survey Contractor may be a subcontractor to the main Tier 1 contractor, and the testing laboratory will be yet further down the supply chain. At an early stage in the works, you should establish the communications protocols, and in particular whether you can communicate directly with the Survey Contractor and the testing laboratory to discuss and resolve issues, or whether all communications must go through the main contractor, which will hamper matters.

Particular problems arise with post-construction drainage surveys. By the time you receive the first draft survey data for checking, the construction works may have finished and the project team who were involved in the

site works disbanded. In this situation resolving problems with the survey data becomes difficult and often protracted. Particularly so, if there is no contractual relationship (direct or indirect) between the Survey Contractor and you, the checker. The Survey Contractor may already have been paid and will have little incentive to rework the survey deliverables. In this situation, it is only worth expending so much time and energy trying to get the survey data corrected. You must then decide if it is better to have some data, albeit of poor quality, rather than discarding it. If you decide to import the data to GDMS it is worth attaching a file note to the activity set of the survey recording the known issues with the data. Alternatively, you may decide to use your TST contractor to carry out some office-based corrections or clean-up, but they will not be able to correct for missing or erroneous data.

Step 2

Responding at Draft submission stage

Category: **Must** Responsible: **Survey Owner** + **OD DLE**

Having now completed, RAGed and recorded your detailed checks of the Draft deliverables, you should stand back from what you have found and make some decisions:

- Are the outstanding issues that you have found minor and few and can be ignored, and hence, you can instruct the Survey Contractor to proceed with issuing the Final deliverables package? For example, the RAG status is mostly Green, there are only a few Ambers that are mostly against Should or Could items, and there are no Reds.

- Or, at the other extreme, is the data so poor, or has some glaring holes in it, that you are going to instruct the Survey Contractor to return to site to address the issues? For example, the RAG status is mostly Red, and all of the Must items are either Red or Amber. This decision should not be taken lightly as it will no doubt cause a contractual battle.

- If neither of the above apply, then are the issues you have found all of equal importance? Are you going to feed all of them back to the Survey Contractor and instruct them to fix them all, or are you going to be selective in what you give them and instruct them to do? For example, no action required on RAG status Green items, and you may decide that they only need to action Red Shoulds, and all Red and Amber Musts.

- How many times are you prepared to go round the Draft submission/checking and commenting loop? See Step 4.

Those issues that you decide to feed back to the Survey Contractor and/or testing laboratory should follow the agreed communications protocol (see Step 1). The comments may be transmitted by the following suggested methods:

- For the GDMS shapefiles, prepare a comments log, either as a table in Word or in Excel, one line per comment. You should also attach the CSV format check output from GDMS. The comments log will be a mixture of general comments that apply throughout the submission, and asset specific comments that you can reference to either the ASSET_REF or SUPP_REF contained within the data. Your Survey Contractor can then add a responses column to the table to say how they have addressed the matter in their re-submission.

- For any PDF reports, you can use PDF mark-up comment bubbles or text boxes for specific items and cover general items in your covering email.
- For any CAD drawings, you can use the redlining capability in your CAD software to mark-up specific items or use comment bubbles or text boxes on the PDF versions and cover general items in your covering email.
- For any AGS data, if your comments are high level only, put them in your covering email. But if you need to get down to individual asset or sample level, then a comments log approach would be suitable.
- Comments on photographs, videos and the proprietary viewer are likely to be high level and can be included in your covering email.

However you decide to respond back to your contractor, a meeting to talk through the issues is likely to be helpful, so that they understand what they have to do to correct matters.

Step 3

Responding at Final submission stage

Category: **Must** Responsible: **Survey Owner** + **OD DLE**

Hopefully, by the time you have approved the draft data, the Final submission should be satisfactory. Your checking of the Final submission can be light touch, focussed on the matters you identified in the earlier drafts.

Step 4

How many times do you go round the loop?

Category: **Must** Responsible: **Survey Owner** + **OD DLE**

This is a judgement call.

If this is the first time you have worked with this Survey Contractor and the Draft submissions are getting noticeably better with each iteration, then it is worth plugging on to help them get up their learning curve. Conversely, if the data is unsatisfactory, and the Draft submissions are not getting any better with each iteration, then you might have to take the difficult decision to abandon the effort and have some tough financial discussions with the Survey Contractor, before getting a Survey Contractor that you know and trust to repeat the works.

If you have already been round the Draft submission/checking loop two or three times, and the outstanding issues are now few and minor you might decide that the pragmatic approach is to either:

1. Ignore them and move on to Final submission stage on the basis that the quality is pretty good, just not quite perfect.
2. Or, if this is the Final submission, and you know how to fix the issue, then just fix it yourself, to bring the matter to a close. Fixing it yourself should be limited to minor issues such as using the GIS to change an outlet to an outfall or correcting a couple of flow directions.

Module 7 - Data upload and import checks

Step by step data upload and import checks

Once the checking indicates that a suitable set of deliverables has been submitted, the data and associated documents can be uploaded to GDMS, which provides some additional checking processes.

Step 1

Upload and import data into GDMS.

Check category: **Must** Responsible: **OD DLE**

There are two steps to getting survey data into GDMS:

1. **Uploading the data onto the system:** This allows automated checks to be carried out. If the data passes those checks an additional analysis is presented for your review.
2. **Importing the data into the system:** Only once the data has passed all of the online checks and (the appropriate) offline checks (detailed in the previous modules), can it then be imported into GDMS to update the live databases.

You may upload the data for checking as many times as necessary, as this does not affect the live data. However, you may only import the data once. If the data would need modifying after import, it must be downloaded from GDMS, edited offline and round-tripped.

To upload and import survey data to GDMS, you must have done and passed the GDMS eLearning course on *Drainage asset data* at the appropriate access level. Survey contractors who only need to upload data and run the online checking process will require Review level access. To be able to upload, check and import the data into GDMS, and if necessary, download data, will require either Edit or Manage level access. All data is imported to GDMS by the OD DLE or their delegate.

Once you have completed your checking of the Final submission, then the GDMS shapefiles can be imported into GDMS. The other deliverables can then be attached to the imported data as follows:

- GDMS can accept the following file types for upload: CSV, DGN, DOC, DOCX, DWF, DWG, DXF, EMF, JPEG, JPG, PDF, PNG, TIF, TXT, XLS, XLSM, XLSX.
- If the attached files are included within the zip file containing the shapefiles, then the total zip file size cannot be more than 750MB and the ATT_DOCs field that is used to reference the attached files to specific assets/observations by comma separating the filenames has a 254 character limit.
- File names of attached documents should be kept short and related to the content. A poor example would be MH4022X_5fe38670-0d9b-40a3-a26e-0d01051182fa065ff0f3-7240-441b-b266-b448a3b163c8.jpg. A better example would be FMC4000X_0_1.jpg.
- Deliverables that relate to just one drainage asset, or a small number of assets, should be attached to that asset/those assets or the relevant asset component(s). This can either be done by referencing the files within the shapefiles and including them in the upload, or it can be done after import on the relevant GDMS asset or asset component screen.
- Deliverables that relate to the whole survey, or many assets within the survey, should be attached to the activity set for the survey. This can be done after importing the shapefiles.
- The file extension of .ags data files should be changed to .csv before uploading.

- The photographs will generally be uploaded and imported as part of the GDMS shapefiles package. Any photographs not included within the GDMS shapefiles package can be individually attached to the activity set, drainage asset, component or observation to which they relate.
- Video files are voluminous and (currently) are not to be uploaded or imported into GDMS.
- The software viewer package is only intended for offline use and must not be uploaded to GDMS.

Step 2

Has the data uploaded and imported correctly?

Check category: **Must** Responsible: **OD DLE**

Once all the data has been uploaded and imported into GDMS, you should give it a check to see that everything is as expected.

Zoom into the surveyed catchment on GDMS and pan around the drainage data. Have you got the full survey coverage that you were expecting? Has it correctly round-tripped and replaced the previous data? Switch on the condition layers, are all the assets showing both structural and service condition?

Has the asset theming worked correctly? Do you see the outfall, gully, filter drain etc symbology where you expect?

If it looks like something has gone wrong with the data upload or import process, contact GDMS support for help: support@hagdms.com.

Step 3

Do all the links and attachments work?

Check category: **Must** Responsible: **OD DLE**

Spot check a few assets by drilling down from the map. Do you get to the detailed asset data, and can you see that the survey date is updated? Do the priority assets (outfalls, soakaways and culverts) appear in the relevant priority asset register, and have they inherited their previous risk status? Do the appropriate assets have photographs attached? Do the relevant assets have PDF reports, CAD drawings or AGS data attached, and can you download them? If any data was attached to activity sets, can you see it and download it?

Step 4

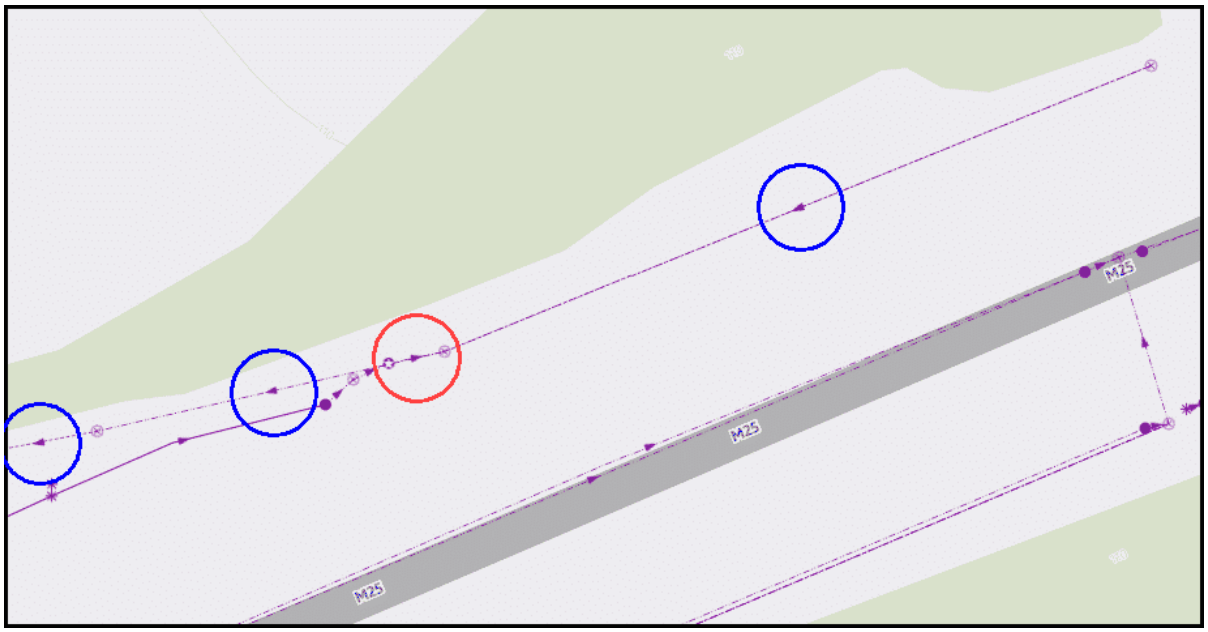
Are the drainage systems correct?

Check category: **Must** Responsible: **OD DLE**

GDMS automatically creates drainage systems during the upload and import process i.e. it identifies all the assets that are connected together and assigns a common drainage system ID to them. Check that you do not have more drainage systems than you were expecting – this may indicate that there is a connectivity break in the data not previously spotted.

Step 5

Are flow directions consistent?



In this GDMS example the red circled flow direction arrow is inconsistent with the blue circled flow directions in the drainage system, it should be pointing to the outfall which is off the image to the left.

Check category: **Should** Responsible: **OD DLE**

Are the flow directions all consistently going in the same direction towards the outfall or soakaway?

Module 8 - Final checks

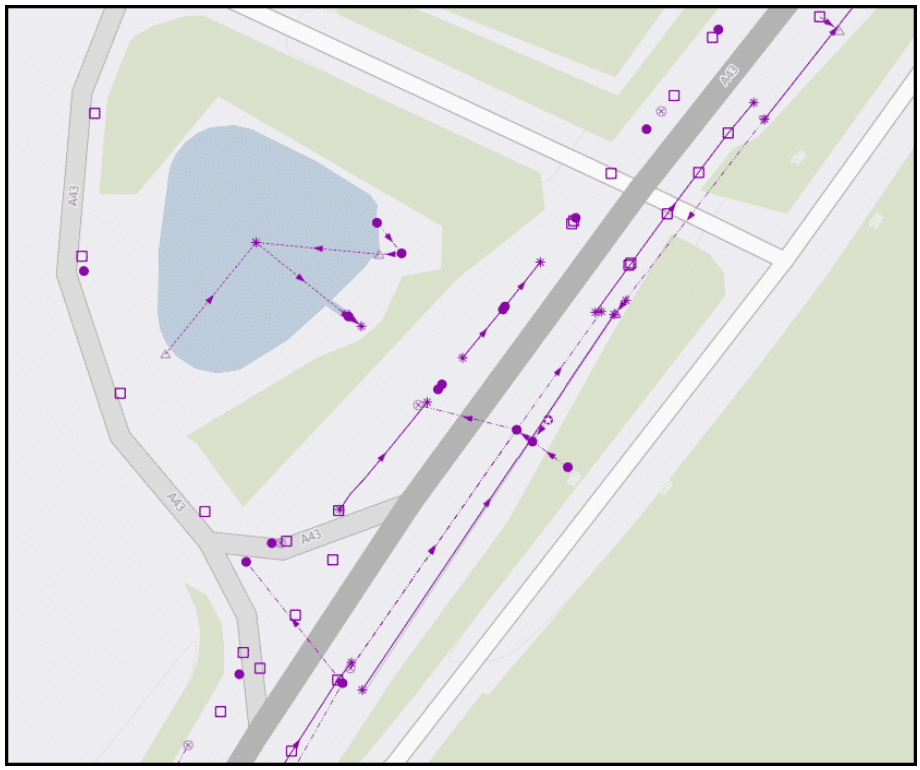
Step by step Final checks

Once the shapefile data and associated deliverables are imported into GDMS the data should be reviewed on the GDMS map by both the Survey Owner and the OD DLE for a final set of checks.

This checking process has 4 steps.

Step 1

Does the drainage layout look “sensible” and “complete”?



In this GDMS example the survey is clearly incomplete. Many of the gullies (open squares) are not connected to any pipework. The carriageway drainage is not connected to the pond and its associated drainage assets. There are several sections of ditch, pipework and filter drain that are unconnected, and end in ghost nodes (stars), which if anything, should have been phantom nodes.

Check category: **Must** Responsibility: **Survey Owner** + **OD DLE**

Using your drainage knowledge, and the knowledge of your drainage assets, does the data look sensible and complete? Is the layout of the assets what you would expect? Do the assets connect together in a way that makes sense? Does it look like there is missing survey data?

Step 2

Is it right?

Check category: **Must** Responsibility: **Survey Owner** + **OD DLE**

The OD DLE's checking against recent aerial photography will help to give you some confidence that the inventory of surface visible assets has been correctly and fully recorded. But you will not be able to tell anything about below ground assets or current asset condition.

You will not be able to more thoroughly answer this question without a site visit, and even then, you will only be able to check the surface visible assets in areas that can be safely accessed. The Survey Owner and the OD DLE should jointly review the *Drainage survey deliverables checking record* (see next module) and decide on your confidence level in the deliverables received. If you have serious concerns about the accuracy or

completeness of any of the data, a site visit may be necessary, before deciding how to respond to the Survey Contractor.

Step 3

What do you do about any issues found?

Check category: **Must** Responsibility: **Survey Owner** + **OD DLE**

If you find any issues with the data at this stage you have to decide if anything needs to be done to correct it, or whether it is “good enough”.

If something has slipped through the previous checking, does it really need to be changed, or can it be left. If you feel that it must be changed, then that means round-tripping the data to the Survey Contractor and going through all the checking process again.

Step 4

Checking the Survey Contractor's invoice.

Check category: **Must** Responsibility: **Survey Owner**

There is a separate eLearning course that includes the NH invoice checking and approvals process: *CS 551 Drainage Surveys - Survey procurement,* to which you should refer for the steps to go through to check and approve the Survey Contractor's invoice.

Module 9 - Summary

Drainage survey deliverables checking steps summary

The deliverables checking steps described in both versions of this eLearning course are summarised in the following tables. Each of the checks are listed showing which of the two eLearning courses the checks relate to. A few items are common to both versions of the course.

Click on the images to enlarge them. Click again to shrink.

General checks

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	General checks	1	Have the instructed surveys been carried out?	Must	Survey Owner
		2	Is the survey extent as instructed?	Must	Survey Owner
		3	Are there valid reasons why the survey was not as instructed in the Task Order?	Must	Survey Owner
		4	Are the required and instructed optional deliverables all included?	Must	Survey Owner
		5	Have subcontractors been used?	Should	Survey Owner

General checks in Survey Owner's course

Checking GDMS shapefiles format

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
OD DLE	Checking GDMS shapefile format	1	Is the GDMS shapefile format valid?	Must	OD DLE
		2	Open the shapefile in a GIS	Should	OD DLE
		3	Is there missing condition data?	Should	OD DLE
		4	Is defect observation data included?	Should	OD DLE
		5	Have the asset attributes been fully populated?	Should	OD DLE
		6	Has certainty been adequately assigned to the data?	Should	OD DLE
		7	Has validation status been adequately assigned to the data?	Should	OD DLE
		8	Has asset ownership been correctly assigned?	Should	OD DLE

Checking GDMS shapefile format in OD DLE's course

Checking GDMS shapefile coverage

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
OD DLE	Checking GDMS shapefile coverage	1	What data has been deleted, changed or added?	Must	OD DLE
		2	Has the survey data been correctly combined with existing GDMS data?	Should	OD DLE
		3	Does the data agree with the aerial photography?	Should	OD DLE
		4	Does every catchment have at least one outfall or soakaway?	Should	OD DLE
		5	Have the outputs from multiple survey types been integrated together?	Should	OD DLE
		6	Does the data agree with the photographs and video?	Could	OD DLE

Checking GDMS shapefile coverage in OD DLE's course

Checking GDMS shapefile usage

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
OD DLE	Checking GDMS shapefile usage	1	Have the outfall and outlet asset types been assigned correctly?	Should	OD DLE
		2	Has condition been assigned to network modelling nodes or connectors?	Should	OD DLE
		3	Have phantom nodes and connectors been used correctly?	Should	OD DLE
		4	Have ghost nodes been used correctly?	Should	OD DLE
		5	Are there too many condition grade 0 and 9 assets?	Could	OD DLE

Checking GDMS shapefile usage in OD DLE's course

Checking PDF reports

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	Checking PDF reports	1	Is the report complete?	Must	Survey Owner
		2	Does any tabulated data agree with the appropriate data deliverables?	Should	Survey Owner
		3	Do the schematic drawings agree with the appropriate data deliverable?	Should	Survey Owner
		4	Do the summary tables agree with the appropriate data deliverable?	Should	Survey Owner
		5	Are quality control procedures evidenced?	Could	Survey Owner
		6	Does any interpretation look satisfactory?	Must	Survey Owner
		7	Does it all look “sensible”?	Must	Survey Owner

Checking PDF reports in Survey Owner's course

Checking CAD drawings

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	Checking CAD drawings	1	Are all the required drawings and drawing parts present?	Must	Survey Owner
		2	Are the drawings 2D or 3D as required?	Could	Survey Owner
		3	Do the drawings conform to GG 184?	Should	Survey Owner
		4	Do the drawings agree with the GDMS shapefile data and/or the PDF report?	Should	Survey Owner
		5	Are the drawings complete?	Must	Survey Owner
		6	Do the drawings look "sensible"?	Must	Survey Owner

Checking CAD drawings in Survey Owner's course

Checking AGS data

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	Checking AGS data	1	Is the AGS format valid?	Must	Survey Owner
		2	View the data in Excel	Should	Survey Owner
		3	Does the data agree with the PDF report?	Should	Survey Owner
		4	Has the required sampling frequency been achieved?	Could	Survey Owner
		5	Have the appropriate tests been carried out?	Should	Survey Owner
		6	Do the results look "sensible"?	Must	Survey Owner
		7	Does the sample and asset characterisation agree with the data?	Should	Survey Owner

Checking AGS data in Survey Owner's course

Checking photographs and videos

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	Checking photographs and videos	1	Are the required photographs and videos included?	Must	Survey Owner
		2	Is the quality and resolution acceptable?	Should	Survey Owner
		3	Are they adequately referenced in the data?	Should	Survey Owner
		4	Do they comply with GDPR?	Should	Survey Owner

Checking photographs and videos in Survey Owner's course

Checking proprietary viewer

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner	Checking the proprietary viewer	1	Are all the components and data required to drive the viewer present?	Should	Survey Owner
		2	Does the data behind the viewer appear to be the same as the individual deliverables?	Should	Survey Owner
		3	Does it work?	Must	Survey Owner

Checking proprietary viewer in Survey Owner's course

Responding to the Survey Contractor

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner + OD DLE	Responding to the Survey Contractor	1	Agreeing the communication chain	Must	Survey Owner
		2	Responding at Draft submission stage	Must	Survey Owner + OD DLE
		3	Responding at Final submission stage	Must	Survey Owner + OD DLE
		4	How many times do you go round the loop?	Must	Survey Owner + OD DLE

Responding to the Survey Contractor in both the Survey Owner's and OD DLE's courses

Data upload and import checks

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
OD DLE	Data upload and import checks	1	Upload and import data into GDMS	Must	OD DLE
		2	Has the data uploaded and imported correctly?	Must	OD DLE
		3	Do all the links and attachments work?	Must	OD DLE
		4	Are the drainage systems correct?	Must	OD DLE
		5	Are flow directions consistent?	Should	OD DLE

Data upload and import checks in the OD DLE's course

Final checks

Course version	Module title	Process step	Process step description	Check category	Checking responsibility
Survey Owner + OD DLE	Final checks	1	Does the drainage layout look “sensible” and "complete"?	Must	Survey Owner + OD DLE
		2	Is it right?	Must	Survey Owner + OD DLE
		3	What do you do about any issues found?	Must	Survey Owner + OD DLE
		4	Checking the Survey Contractor's invoice	Must	Survey Owner

Final checks in both the Survey Owner's and OD DLE's courses

Drainage survey deliverables checking record	
Area / Contract	
Task Order number	
Task Order name	
Survey Owner	
OD DLE	
OD DLE delegated checker	
Survey Contractor	
Testing Laboratory	
Draft/Final submission	
Submission number	
Submission date	

Course version	Module title	Process step	Process step description	Check category	Checking responsibility	Deliverables check RAG	Comments
Survey Owner	General checks	1	Have the instructed surveys been carried out?	Must	Survey Owner		
		2	Is the survey extent as instructed?	Must	Survey Owner		
		3	Are there valid reasons why the survey was not as instructed in the Task Order?	Must	Survey Owner		
		4	Are the required and instructed optional deliverables all included?	Must	Survey Owner		
		5	Have subcontractors been used?	Should	Survey Owner		
OD DLE	Checking GDMS shapefile format	1	Is the GDMS shapefile format valid?	Must	OD DLE		
		2	Open the shapefile in a GIS	Should	OD DLE	NA	
		3	Is there missing condition data?	Should	OD DLE		
		4	Is defect observation data included?	Should	OD DLE		
		5	Have the asset attributes been fully populated?	Should	OD DLE		
		6	Has certainty been adequately assigned to the data?	Should	OD DLE		
		7	Has validation status been adequately assigned to the data?	Should	OD DLE		
		8	Has asset ownership been correctly assigned?	Should	OD DLE		
OD DLE	Checking GDMS shapefile coverage	1	What data has been deleted, changed or added?	Must	OD DLE		
		2	Has the survey data been correctly combined with existing GDMS data?	Should	OD DLE		
		3	Does the data agree with the aerial photography?	Should	OD DLE		
		4	Does every catchment have at least one outfall or soakaway?	Should	OD DLE		
		5	Have the outputs from multiple survey types been integrated together?	Should	OD DLE		
		6	Does the data agree with the photographs and video?	Could	OD DLE		
OD DLE	Checking GDMS shapefile usage	1	Have the outfall and outlet asset types been assigned correctly?	Should	OD DLE		
		2	Has condition been assigned to network modelling nodes or connectors?	Should	OD DLE		
		3	Have phantom nodes and connectors been used correctly?	Should	OD DLE		
		4	Have ghost nodes been used correctly?	Should	OD DLE		
		5	Are there too many condition grade 0 and 9 assets?	Could	OD DLE		
Survey Owner	Checking PDF reports	1	Is the report complete?	Must	Survey Owner		
		2	Does any tabulated data agree with the appropriate data deliverables?	Should	Survey Owner		
		3	Do the schematic drawings agree with the appropriate data deliverable?	Should	Survey Owner		
		4	Do the summary tables agree with the appropriate data deliverable?	Should	Survey Owner		
		5	Are quality control procedures evidenced?	Could	Survey Owner		
		6	Does any interpretation look satisfactory?	Must	Survey Owner		
		7	Does it all look "sensible"?	Must	Survey Owner		
Survey Owner	Checking CAD drawings	1	Are all the required drawings and drawing parts present?	Must	Survey Owner		
		2	Are the drawings 2D or 3D as required?	Could	Survey Owner		
		3	Do the drawings conform to GG 184?	Should	Survey Owner		
		4	Do the drawings agree with the GDMS shapefile data and/or the PDF report?	Should	Survey Owner		
		5	Are the drawings complete?	Must	Survey Owner		
		6	Do the drawings look "sensible"?	Must	Survey Owner		
Survey Owner	Checking AGS data	1	Is the AGS format valid?	Must	Survey Owner		
		2	View the data in Excel	Should	Survey Owner	NA	
		3	Does the data agree with the PDF report?	Should	Survey Owner		
		4	Has the required sampling frequency been achieved?	Could	Survey Owner		
		5	Have the appropriate tests been carried out?	Should	Survey Owner		
		6	Do the results look "sensible"?	Must	Survey Owner		
		7	Does the sample and asset characterisation agree with the data?	Should	Survey Owner		
Survey Owner	Checking photographs and videos	1	Are the required photographs and videos included?	Must	Survey Owner		
		2	Is the quality and resolution acceptable?	Should	Survey Owner		
		3	Are they adequately referenced in the data?	Should	Survey Owner		
		4	Do they comply with GDPR?	Should	Survey Owner		
Survey Owner	Checking the proprietary viewer	1	Are all the components and data required to drive the viewer present?	Should	Survey Owner		
		2	Does the data behind the viewer appear to be the same as the individual deliverables?	Should	Survey Owner		
		3	Does it work?	Must	Survey Owner		
Survey Owner + OD DLE	Responding to the Survey Contractor	1	Agreeing the communication chain	Must	Survey Owner	NA	
		2	Responding at Draft submission stage	Must	Survey Owner + OD DLE	NA	
		3	Responding at Final submission stage	Must	Survey Owner + OD DLE	NA	
		4	How many times do you go round the loop?	Must	Survey Owner + OD DLE	NA	
OD DLE	Data upload and import checks	1	Upload and import data into GDMS	Must	OD DLE	NA	
		2	Has the data uploaded and imported correctly?	Must	OD DLE		
		3	Do all the links and attachments work?	Must	OD DLE		
		4	Are the drainage systems correct?	Must	OD DLE		
		5	Are flow directions consistent?	Should	OD DLE		
Survey Owner + OD DLE	Final checks	1	Does the drainage layout look "sensible" and "complete"?	Must	Survey Owner + OD DLE		
		2	Is it right?	Must	Survey Owner + OD DLE		
		3	What do you do about any issues found?	Must	Survey Owner + OD DLE	NA	
		4	Checking the Survey Contractor's invoice	Must	Survey Owner	NA	

Drainage surveys deliverables checking record

Downloadable record sheet

A suggested *Drainage surveys deliverables checking record* is available as an Excel file on the downloads page of GDMS. Go to https://downloads.gdms.assetia.cloud/ and download the *Drainage surveys deliverables checking record.*

Click on the image to enlarge it. Click again to shrink.

The record sheet covers all of the checks in both the Survey Owner's and OD DLE's versions of this eLearning course. A RAG column is included that allows you to record a Red, Amber or Green rating for each of the checks, as suggested in module 2. You should write some brief comments about each of the checks, so that when the Survey Owner and OD DLE come to do a final review of the deliverables, there is a brief description of any issues found.

Downloadable course PDF

The two versions of this eLearning course are available as PDF documents on the downloads page of GDMS. You may find it useful to refer to the PDF as you work through the various checks. Go to https://downloads.gdms.assetia.cloud/ and download either:

- *CS 551 Drainage Surveys - Survey deliverables (Survey Owner) – Course PDF.*

- *CS 551 Drainage Surveys - Survey deliverables (OD DLE) – Course PDF.*