CS 551 Drainage Surveys - Survey deliverables (Survey Owner)

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

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 13 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 8 and 10.
- You will receive guidance on reporting the results of your checking back to the Survey Contractor. This is covered in module 9.
- Module 11 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 12.
- There is a form in module 13 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 staff who may act as Survey Owner to commission drainage surveys and who will receive and need to check the survey deliverables, particularly:

- New starters in Operations Planning and Development (both in the drainage asset team and outside of it) who will need to commission drainage surveys on

a regular basis.

- Operations Scheme Delivery personnel who may need to commission drainage surveys as part of scheme development.
- Operations Service Delivery personnel who may occasionally need specific types of quick and simple drainage surveys to investigate live flooding incidents.
- Major Projects project managers for awareness of the drainage survey deliverables required of their supply chain.
- Safety, Engineering and Standards (SES) personnel for an overview of the CS 551 drainage survey deliverables.

This course will also be relevant to members of the National Highways supply chain who may need to act as Survey Owner to commission drainage surveys and who will receive and need to check the survey deliverables, specifically:

- Scheme Delivery Framework (SDF) external designers who will need to commission drainage surveys as part of scheme development.
- Major Projects contractors and designers who will need to commission pre-works surveys for scheme design and post-construction completion surveys.
- Any other consultants or contractors in the supply chain who may need to commission drainage surveys.

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 1 - CS 551 deliverables

Module 2 - The checking process

Module 3 - General checks

Module 4 - Checking PDF reports

Module 5 - Checking CAD drawings

Module 6 - Checking AGS data

Module 7 - Checking photographs and videos

Module 8 - Checking the proprietary viewer

Module 9 - Responding to the Survey Contractor

Module 10 - Final checks

Module 11 - 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*.

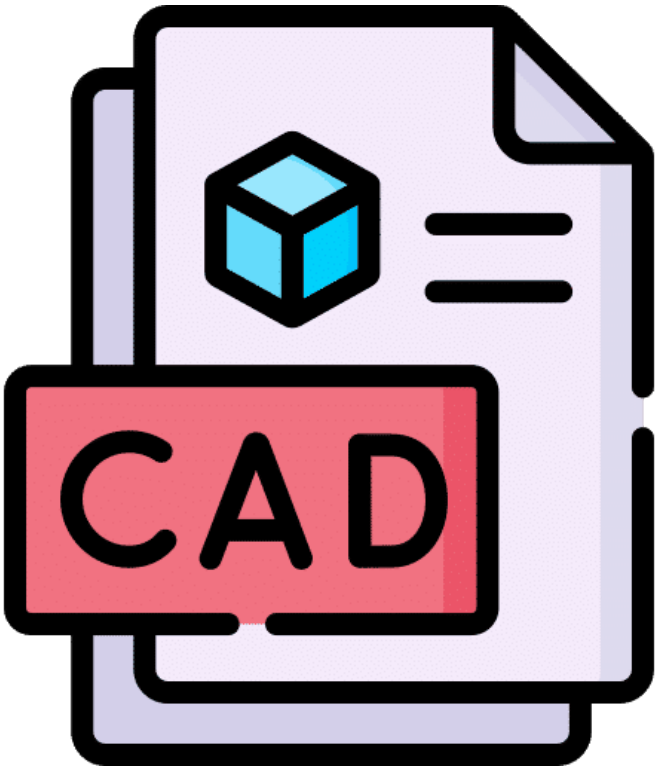
The GDMS shapefile format uses the industry standard Esri format for sharing geospatial data between Geographic Information Systems (GIS). GDMS shapefiles must contain specific fields which are documented in “GDMS Drainage Data Formats”, available to download from https://downloads.gdms.assetia.cloud.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



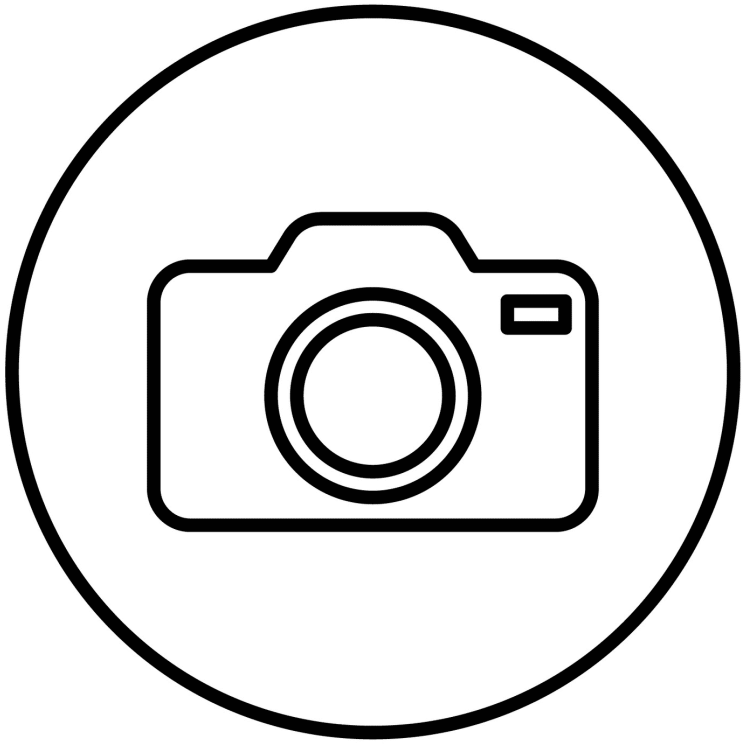
AGS data

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/.

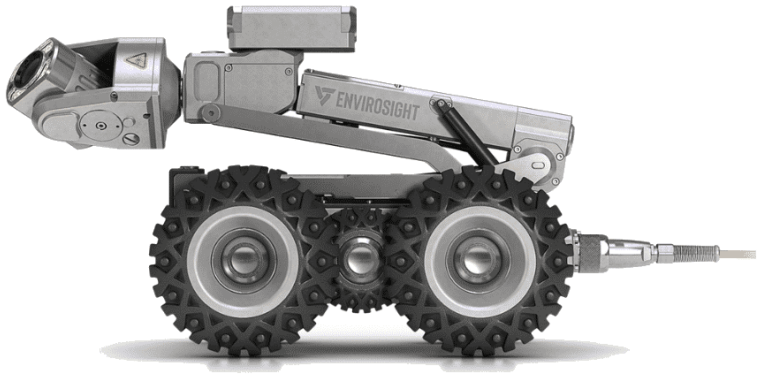
Photographs

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.



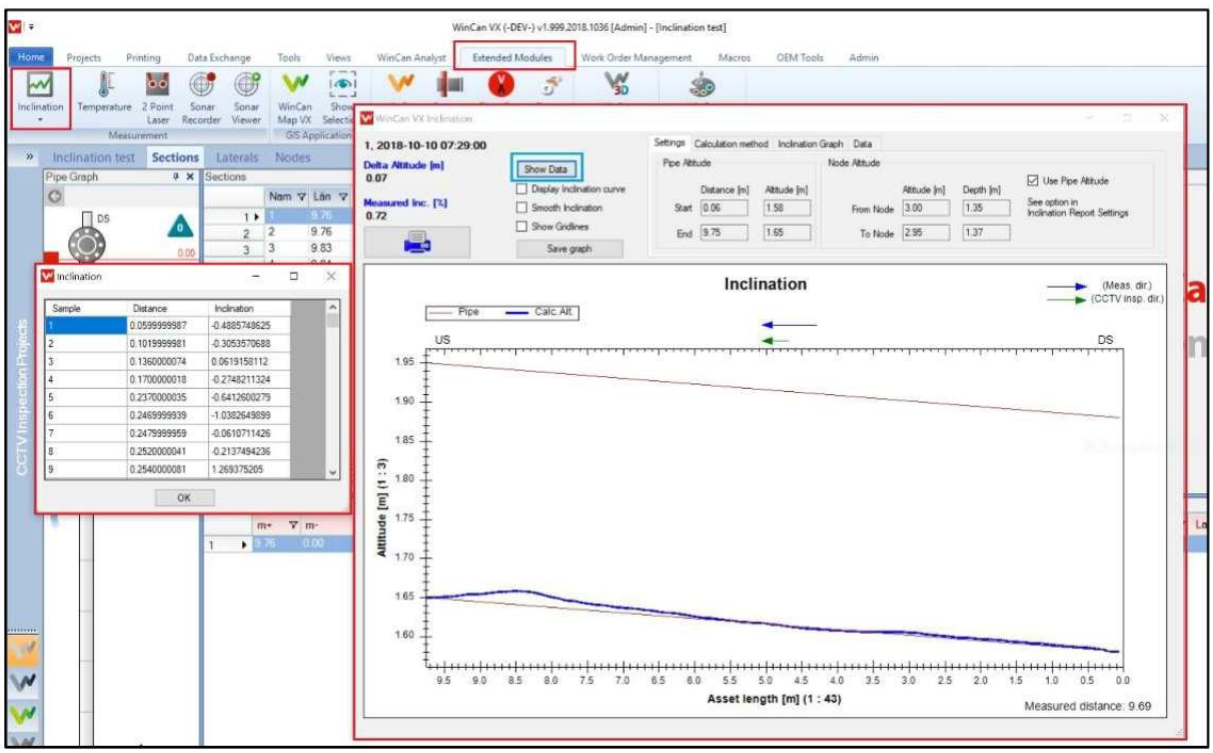
Video

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 11 which is common to both courses.

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

> This is the course for the Survey Owner, there is a separate eLearning course for the OD DLE: *CS 551 Drainage Surveys - Survey deliverables (DLE).* It is useful for you to have a general

understanding of the checks that the OD DLE should carry out on the deliverables by reviewing the summary tables in module 11.

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 summary 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 11.

Module 3 - General checks

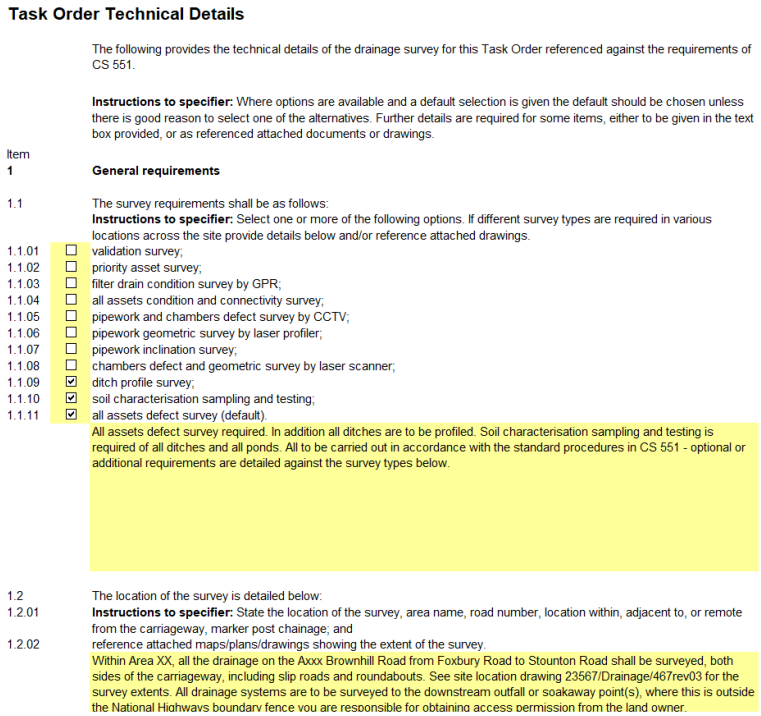
Step by step general checks

Before you get into the detailed checking of each deliverable, there are some general checks that should be performed to see if the scope of works you instructed in the Task Order has been carried out.

This checking process has 5 steps.

Step 1

Have the instructed surveys been carried out?



Task Order Technical Details

The following provides the technical details of the drainage survey for this Task Order referenced against the requirements of CS 551.

Instructions to specifier: Where options are available and a default selection is given the default should be chosen unless there is good reason to select one of the alternatives. Further details are required for some items, either to be given in the text box provided, or as referenced attached documents or drawings.

Item		
1		**General requirements**
1.1		The survey requirements shall be as follows: **Instructions to specifier:** Select one or more of the following options. If different survey types are required in various locations across the site provide details below and/or reference attached drawings.
1.1.01	☐	validation survey;
1.1.02	☐	priority asset survey;
1.1.03	☐	filter drain condition survey by GPR;
1.1.04	☐	all assets condition and connectivity survey;
1.1.05	☐	pipework and chambers defect survey by CCTV;
1.1.06	☐	pipework geometric survey by laser profiler;
1.1.07	☐	pipework inclination survey;
1.1.08	☐	chambers defect and geometric survey by laser scanner;
1.1.09	☑	ditch profile survey;
1.1.10	☑	soil characterisation sampling and testing;
1.1.11	☑	all assets defect survey (default).
		All assets defect survey required. In addition all ditches are to be profiled. Soil characterisation sampling and testing is required of all ditches and all ponds. All to be carried out in accordance with the standard procedures in CS 551 - optional or additional requirements are detailed against the survey types below.
1.2		The location of the survey is detailed below:
1.2.01		**Instructions to specifier:** State the location of the survey, area name, road number, location within, adjacent to, or remote from the carriageway, marker post chainage; and
1.2.02		reference attached maps/plans/drawings showing the extent of the survey.
		Within Area XX, all the drainage on the Axxx Brownhill Road from Foxbury Road to Stounton Road shall be surveyed, both sides of the carriageway, including slip roads and roundabouts. See site location drawing 23567/Drainage/467rev03 for the survey extents. All drainage systems are to be surveyed to the downstream outfall or soakaway point(s), where this is outside the National Highways boundary fence you are responsible for obtaining access permission from the land owner.

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

Check category: **Must** Responsible: **Survey Owner**

Check back to the Task Order for the survey and see what survey and testing types you instructed. Check through the deliverables to see if you have all the surveys and testing that you were expecting.

Step 2

Is the survey extent as instructed?

Check category: **Must** Responsible: **Survey Owner**

Check back to the Task Order and the drawings you issued with it, to remind yourself of the survey location and extent that you instructed. Look through the deliverables to see if the extent is as you intended. In particular, check that the survey extends as far as the outfall(s) or soakaway(s) (unless you instructed otherwise).

Step 3

Are there valid reasons why the survey was not as instructed in the Task Order?

Check category: **Must** Responsible: **Survey Owner**

If you find that the deliverables you have received do not match either the survey type(s) or the survey extent that you instructed in the Task Order, is there any valid reason for this? Did you instruct a change in scope after issuing the Task Order, either in writing or verbally? Did the Survey Contractor report access issues to you during the works, and you agreed that the works could be varied? Did the Survey Contractor inform you that they had equipment problems and had to curtail the survey? Is there any explanation in the PDF report of why the scope is not as instructed?

If there is no valid explanation, then you should go back to the Survey Contractor and seek clarification. You may then decide that what you have received is not acceptable and that the Survey Contractor has to return to site to complete the works. Therefore, there is no point in you wasting your time on a detailed check of this set of deliverables.

Step 4

Are the required and instructed optional deliverables all included?

Check category: **Must** Responsible: **Survey Owner**

Before you get into the detailed checking you should do a quick review to determine whether all the deliverables required by CS 551, and any optional deliverables that you instructed in the Task Order, have all been provided. If not, you may decide to ask the Survey Contractor to provide these before you begin your detailed checking.

Step 5

Have subcontractors been used?

Check category: **Should** Responsible: **Survey Owner**

The Survey Contractor must have informed you before the start of the survey and testing if they intended to subcontract any of the works and in that case obtained your permission. You may find indications in the PDF report, in the survey metadata, or in the photographs or videos, that a subcontractor was used that you were not aware of. This may only come to light once you get into the detailed checking.

If this happens, you should seek clarification from the main Survey Contractor on what part of the works the subcontractor carried out. As a minimum you should increase the level of your intended checking of those

deliverables. If you subsequently find that the standard of work is not acceptable, then you may decide to instruct the main Survey Contractor to repeat the works or reissue the deliverables as appropriate.

Module 4 - Checking PDF reports

Step by step PDF report checks

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. Most of the reports provide: 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.

This checking process has 7 steps.

Step 1

Is the report complete?

Report

5.23 A report shall be provided in PDF format presenting the following:

1) a graphical output of the filter drain condition survey trace provided to scale as a digital image for each length of filter drain surveyed showing the following:
   a) the unique asset reference of the filter drain;
   b) the unique references of the nodes at each end of the filter drain, whether they are physical assets or not;
   c) distance along the filter drain in metres from the upstream end;
   d) a vertical trace of the survey results colour coded in accordance with the equipment calibration; and,
   e) vertical distance down the trace with a scale in 0.1-m increments;
2) an interpretation of each survey trace dividing the trace longitudinally into zones of interpreted void ratio carried out in accordance with Table 5.23.1;
3) overall service and structural condition grades for each filter drain determined;
4) a summary of those sections of filter drain with an interpreted overall poor void ratio or standing water; and,
5) recommendations for the location and nature of any remedial works or further investigations.

NOTE Two graphical traces can be provided for each filter drain to achieve optimum results, one for the upper level to approximately 300 mm depth and the second for the lower level to the carrier pipe, or to the base of the filter drain where there is no carrier pipe.

This extract from CS 551 gives a detailed list of the PDF report requirements for Filter drain condition survey by GPR.

Check category: **Must** Responsible: **Survey Owner**

All of the CS 551 survey and test methods that require (or optionally require) a PDF report, provide a detailed list of what the report should contain. Check that everything is included.

You may have instructed additional reporting in the Task Order; check back whether this is the case, and that it has been provided.

Step 2

Does any tabulated data agree with the appropriate data deliverables?

Check category: **Should** Responsible: **Survey Owner**

The report may be required to include tabular summaries of the defect data in each asset surveyed, or the results of all of the laboratory tests. Where this is the case spot check between the PDF report and the defect observations or AGS laboratory test data, that the results agree.

The defect observations are contained within the “observation.dbf” file provided with the shapefiles. DBF files can be opened for viewing in spreadsheet software such as Excel or in GIS software. The “observation.dbf” file includes fields such as the supplier’s asset reference, chainage (for observations in continuous assets) and observation code. Guidance on how to use a GIS to view the survey data is given in the companion eLearning course for OD DLEs: *CS 551 Drainage Surveys - Survey deliverables (DLE).*

Particular notice should be made that the chainages in the observation.dbf file are measured with 0 at the upstream end of the asset, which may be the opposite end to the survey start. The PDF report should indicate the flow direction of the continuous asset, allowing you to verify the chainages are in the correct order and have been reversed if necessary.

The observation.dbf file may contain numerical scores for observations that relate to the service or structural condition of the asset. It should be

noted that GDMS will recalculate these using the NH scoring definition when the data is imported. If the scores are not provided in the observation.dbf file, or are different to the NH scoring definition, then this will not have any impact on the imported data in GDMS.

Step 3

Do the schematic drawings agree with the appropriate data deliverable?

Check category: **Should** Responsible: **Survey Owner**

The report may be required to include schematic drawings of sections of pipework or chambers. These are most easily spot checked against the proprietary viewer (where you have instructed its provision in the Task Order).

Step 4

Do the summary tables agree with the appropriate data deliverable?

Check category: **Should** Responsible: **Survey Owner**

The report may be required to include other summary tables. For example, summarising surveyed assets, abandoned surveys, pipe jetting and root cutting. These are most easily spot checked against the proprietary viewer (where you have instructed its provision in the Task Order).

Step 5

Are quality control procedures evidenced?

Check category: **Could** Responsible: **Survey Owner**

For the majority of CS 551 survey methods that require a PDF report, the report specification requires the inclusion of details of the quality control procedures. Refer to the quality control requirements section of the relevant survey method in the CS 551 standard to understand what should be included.

Step 6

Does any interpretation look satisfactory?

Check category: **Must** Responsible: **Survey Owner**

The following CS 551 survey and testing methods require the Survey Contractor or testing laboratory to provide an interpretation of the results or a recommendation based on an interpretation of the results:

- Filter drain condition survey by GPR requires provision of interpreted void ratio and recommended remedial works or further investigation.
- Pipework and chambers defect survey by CCTV requires provision of indicative remediation.
- Soil characterisation sampling and testing requires provision of sample and asset level characterisation of the hazardous nature.
- All assets defect survey requires provision of indicative remediation.

From a quick review of the report do these interpretations and recommendations look sensible and acceptable?

All other survey methods require some degree of interpretation and understanding on the part of the surveyor, but that has to be assumed is part of their training. There is a separate eLearning course on the training

requirements and how the contractors should evidence them: *CS 551 Drainage surveys – Survey skills and competencies.*

Step 7

Does it all look “sensible”?

Check category: **Must** Responsible: **Survey Owner**

This is an engineering judgement call. You have determined whether the PDF report agrees with the other data deliverables, and that all aspects of the survey or testing requirements have been covered, but does it all look sensible? Whether it is right or not, is a different matter, and not possible to judge without delving into the other deliverables and may be carrying out a site visit.

Module 5 - Checking CAD drawings

Step by step CAD drawing checks

All CAD drawings are to be provided in three formats. All of the drainage content checks can be done on the PDF versions, whilst the CAD format checks require the DWG or DXF files to be viewed in CAD software.

This checking process has 6 steps.

Step 1

Are all the required drawings and drawing parts present?

CAD drawing files

11.19 CAD drawing files in DWG, DXF and PDF formats shall be provided showing the following:

1) the extent of the completed survey;
2) the location and unique DDMS reference number of each drainage asset surveyed;
3) a plan of each ditch with the location and unique reference number of each cross-sectional profile;
4) a series of cross-sectional profiles cross-referenced to the locational plan;
5) the overall service and structural condition grade of each asset;
6) any errors in any provided drawings or layout data noted during the survey;
7) overlaid on available base mapping showing the highway, highway boundary, structures and other reference features of the surveyed corridor and the national grid.

This extract from CS 551 gives a list of the CAD drawing requirements for Ditch profile surveys.

Check category: **Must** Responsible: **Survey Owner**

View the PDF drawings. For each survey method that requires CAD drawings, CS 551 gives a detailed specification of what the drawings should contain. Go through the specification and check that everything has been included. You may have instructed additional drawings in the Task Order; check back whether this is the case, and that they have been provided.

Step 2

Are the drawings 2D or 3D as required?

	CAD drawing files
10.43	A CAD drawing file of the 3D graphical representation of the internal surface of each surveyed chamber shall be provided in DWG, DXF and PDF file formats referenced to the national survey grid and national survey datum stated by the Overseeing Organisations in the NAAs to CD 535 [Ref 8.N] .

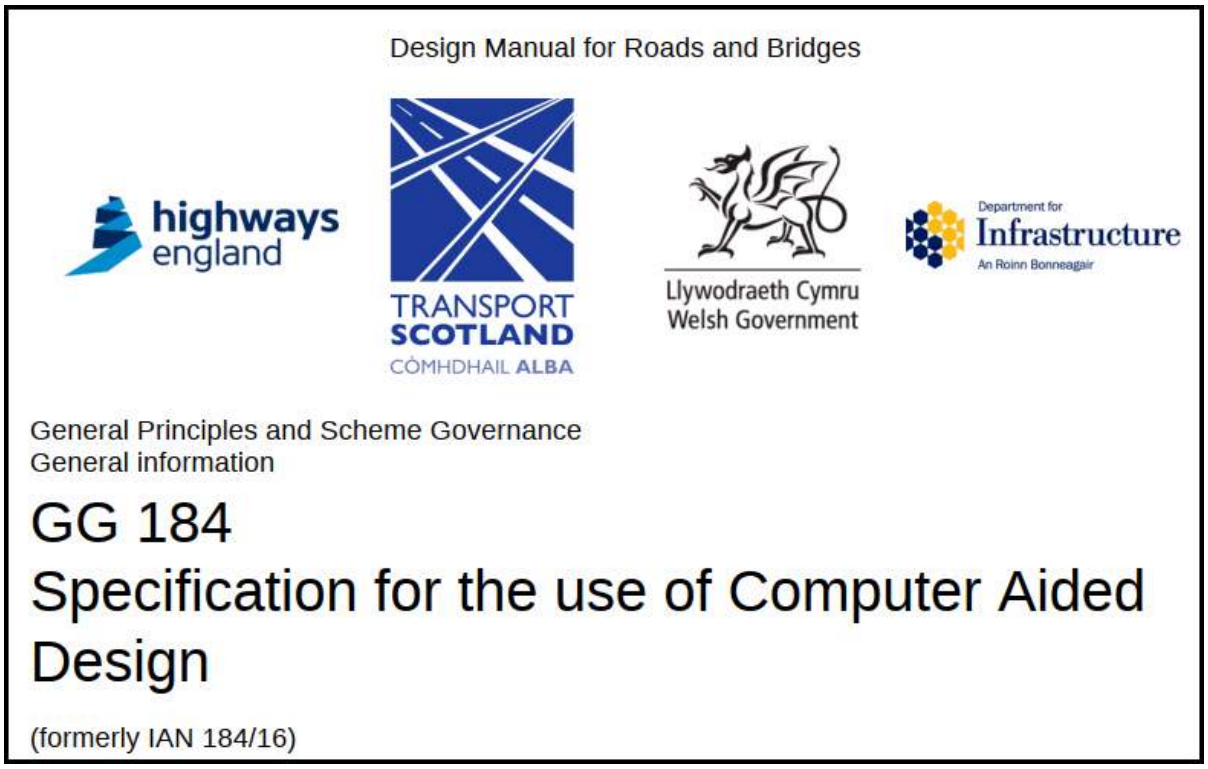
This extract from CS 551 states that CAD drawings for Chambers defect and geometric survey by laser scanner must be produced in 3D.

Check category: **Could** Responsible: **Survey Owner**

Import the DWG or DXF files into CAD and determine whether the drawings have been drawn in 2D or 3D. Some of the CS 551 survey types specifically require 3D CAD drawings, but for others (such as cross-sections) 2D CAD is acceptable.

Step 3

Do the drawings conform to GG 184?



Check category: **Should** Responsible: **Survey Owner**

GG 184 Specification for the use of Computer Aided Design and its associated England National Application Annex can be downloaded from https://www.standardsforhighways.co.uk/. The specification applies to all National Highways projects irrespective of scope or size. Much of GG 184 relates to details of drawing formats, layouts and structure and is designed to ensure that data embedded within the drawing can be shared across systems and projects. These requirements are quite technical and are best reviewed by an experienced CAD technician.

The particular requirements that relate to drainage survey drawings that should be checked within the CAD software are:

- Ordnance Survey National Grid and Newlyn Datum shall be used.
- There are specific requirements for title blocks, file naming, layer naming, line styles and fonts.
- 3D CAD is the default, and any 2D representations are to be derived from the 3D model. This may or may not be relevant to the drainage drawings, depending on the content.
- The drawings shall be in model space (i.e. OS grid and datum) coordinated in metres. Drawing frames and title blocks shall be in paper space.

Step 4

Do the drawings agree with the GDMS shapefile data and/or the PDF report?

Check category: **Should** Responsible: **Survey Owner**

View the PDF drawings. Where CS 551 requires the CAD drawings to show the same data as either the GDMS shapefiles or the PDF report, then check that the drawings agree with the other deliverables, and vice versa. For example:

- For pipework and chambers defect survey by CCTV a survey inventory drawing may be requested that shows the layout of the surveyed assets. This should agree with the GDMS shapefiles.
- For chambers defect and geometric survey by laser scanner the PDF report is required to contain a schematic drawing of each chamber in plan and section. This should be compared to the 3D CAD drawing of the same chamber.

Step 5

Are the drawings complete?

7.51.2	Three sets of CAD drawing files in DWG, DXF and PDF formats may be additionally provided, showing the following: 1) survey inventory drawings, showing: a) the extent of the completed survey; b) the location, asset type, unique reference number, and layout of each drainage asset surveyed; c) the connectivity and flow direction between assets; d) any errors in any provided drawings or layout data noted during the survey; and, e) overlaid on available base mapping showing the highway, highway boundary, structures and other reference features of the surveyed corridor and the national grid.

This extract from CS 551 gives a detailed list of the CAD drawing contents for Pipework and chambers defect survey by CCTV.

Check category: **Must** Responsible: **Survey Owner**

Some of the CS 551 CAD drawing specifications give a detailed list of what should be on each drawing. View the PDF drawings and spot check that everything is present, but also look for obvious omissions such as: north arrows, scale bars, dimensions, GDMS asset IDs, grid coordinates and levels, records of who drew and who checked the drawing, survey date and drawing date, drawing number, issue number and drawing status.

Step 6

Do the drawings look “sensible”?

Check category: **Must** Responsible: **Survey Owner**

Using your drainage knowledge, and the knowledge of your drainage assets, do the drawings look sensible?

You will not be able to answer the question of whether they are correct or not, without a site visit, and even then, if the drawing is of some internal or below ground asset detail, you will not be able to tell. But if you have serious doubts about the accuracy or completeness of any of the drawings, a site visit may be necessary.

Module 6 - Checking AGS data

Step by step AGS data checks

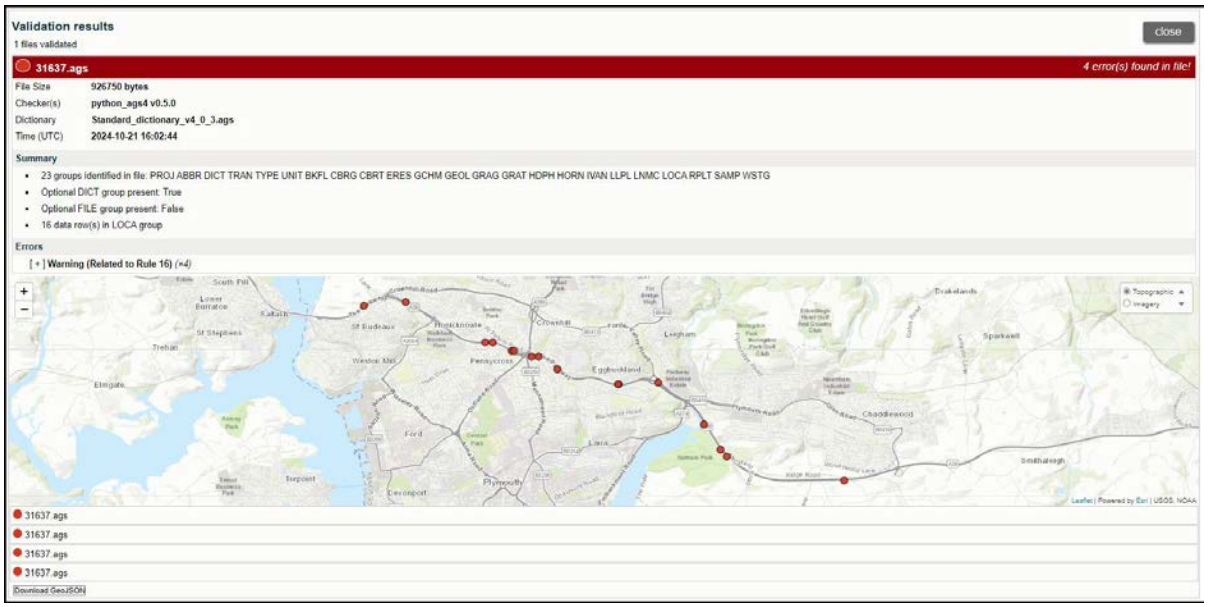
An AGS data file provides the results of *Soil characterisation sampling and testing* in a machine-readable format. It allows you, for example, to do further analysis of the chemical testing data in a spreadsheet without having to re-enter the data.

The Survey Owner may wish to consult with members of the NH Geotechnical team who are most likely to be familiar with AGS format data and interpretation of its contents, for assistance with the checks in this module.

This checking process has 7 steps.

Step 1

Is the AGS format valid?



Example output from the BGS online AGS file validator tool includes a map of the sampling points.

Check category: **Must** Responsible: **Survey Owner**

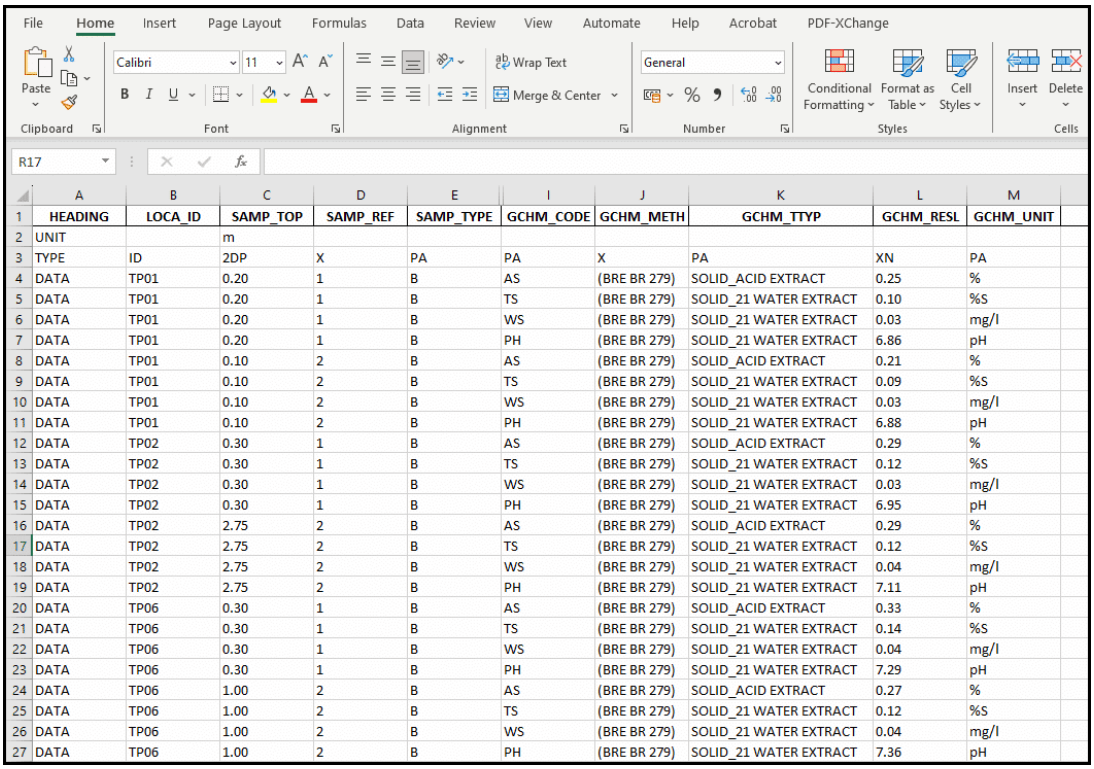
The AGS format is rigidly defined, and any .ags file must strictly comply with the appropriate version of the format. The AGS provide a free format validator desktop app, see https://www.ags.org.uk/data-format/ags-validator/. The British Geological Survey (BGS) also provide a free online tool with similar functionality, see https://agsapi.bgs.ac.uk/.

The term “validator” is used rather than “checker”, to clarify that the tools only validate against the AGS data format, they do not “check” the accuracy of the data contained in the file.

Run the app or the online tool on each .ags file and report any errors to the testing laboratory, via the drainage Survey Contractor.

Step 2

View the data in Excel



	A	B	C	D	E	I	J	K	L	M
1	HEADING	LOCA_ID	SAMP_TOP	SAMP_REF	SAMP_TYPE	GCHM_CODE	GCHM_METH	GCHM_TTYP	GCHM_RESL	GCHM_UNIT
2	UNIT		m							
3	TYPE	ID	2DP	X	PA	PA	X	PA	XN	PA
4	DATA	TP01	0.20	1	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.25	%
5	DATA	TP01	0.20	1	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.10	%S
6	DATA	TP01	0.20	1	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.03	mg/l
7	DATA	TP01	0.20	1	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	6.86	pH
8	DATA	TP01	0.10	2	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.21	%
9	DATA	TP01	0.10	2	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.09	%S
10	DATA	TP01	0.10	2	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.03	mg/l
11	DATA	TP01	0.10	2	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	6.88	pH
12	DATA	TP02	0.30	1	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.29	%
13	DATA	TP02	0.30	1	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.12	%S
14	DATA	TP02	0.30	1	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.03	mg/l
15	DATA	TP02	0.30	1	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	6.95	pH
16	DATA	TP02	2.75	2	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.29	%
17	DATA	TP02	2.75	2	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.12	%S
18	DATA	TP02	2.75	2	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.04	mg/l
19	DATA	TP02	2.75	2	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	7.11	pH
20	DATA	TP06	0.30	1	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.33	%
21	DATA	TP06	0.30	1	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.14	%S
22	DATA	TP06	0.30	1	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.04	mg/l
23	DATA	TP06	0.30	1	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	7.29	pH
24	DATA	TP06	1.00	2	B	AS	(BRE BR 279)	SOLID_ACID EXTRACT	0.27	%
25	DATA	TP06	1.00	2	B	TS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.12	%S
26	DATA	TP06	1.00	2	B	WS	(BRE BR 279)	SOLID_21 WATER EXTRACT	0.04	mg/l
27	DATA	TP06	1.00	2	B	PH	(BRE BR 279)	SOLID_21 WATER EXTRACT	7.36	pH

An example AGS file converted to, and opened in, Excel, with chemical test results in columns K to M.

Check category: **Should** Responsible: **Survey Owner**

The .ags file is a text format used to transfer data reliably between organisations in the site investigation industry, independent of software, hardware or operating system. There are various commercial software tools available for creating, editing and viewing .ags files, see https://www.ags.org.uk/data-format/software/. However, the BGS provide a free online tool to convert an .ags file to Excel .xlsx format, see https://agsapi.bgs.ac.uk/. This tool may be used to convert and then view

the data in Excel for checking purposes, but you are advised against creating or editing data in Excel and converting back to .ags format unless you are competent in handling .ags files.

Step 3

Does the data agree with the PDF report?

Check category: **Should** Responsible: **Survey Owner**

Convert and view the AGS data in Excel. Spot-check that the data in the .ags file agrees with the tabulated data in the PDF report, and vice versa.

Step 4

Has the required sampling frequency been achieved?

Check category: **Could** Responsible: **Survey Owner**

The CS 551 method for *Ditch profile surveys* gives the required spacing for the surveying of ditch cross sections, stating that the nature and thickness of detritus in the base of the ditch is to be investigated at every cross section, and that selected locations are to be sampled for testing. The CS 551 method for *Soil characterisation sampling and testing* gives the requirements for the sampling frequency.

Spot check that the number of samples tested for each drainage asset matches, or exceeds, the required sampling frequency. If the sampling

frequency significantly exceeds the requirements you should ask, why, as this has a cost implication for the survey and testing.

Step 5

Have the appropriate tests been carried out?

Check category: **Should** Responsible: **Survey Owner**

The CS 551 method for *Soil characterisation sampling and testing* requires that a pre-sitework study be carried out to assign the source of the run-off into the drainage asset being sampled to one, or more, of four categories. This then determines which suites of chemical tests should be carried out on the samples.

Spot check the laboratory's decisions by either reviewing the pre-sitework findings (if given in the PDF report) or make your own assessment of the likely run-off from GDMS mapping and aerial photography. Then review whether the appropriate suite of tests has been carried out, and hence

determine if they have tested for the full list of chemical determinands required.

Step 6

Do the results look “sensible”?

Check category: **Must** Responsible: **Survey Owner**

You know where the drainage assets are that were sampled, so does the hazardous/non-hazardous characterisation match what you would expect?

You would expect that a ditch at the top of a cutting next to farmland would be non-hazardous. Whilst a ditch in a similar situation taking the run-off from an adjacent industrial estate may well be hazardous. Any ditch or pond draining the carriageway may be hazardous.

If there are any surprises, you should look more closely at the pre-sitework study (if included in the PDF report), the test results, and the sample and asset characterisation (see next Step).

Step 7

Does the sample and asset characterisation agree with the data?

Check category: **Should** Responsible: **Survey Owner**

The characterisation process should comply with the requirements of *Environment Agency (2018) Technical Guidance WM3, 'Waste Classification: Guidance on the classification and assessment of waste'.* If you are going to check that the characterisation has been carried out correctly you should use the HazWasteOnline tool: https://www.hazwasteonline.com/. The tool providers offer training in its use and the characterisation process.

Check the characterisation of samples from any drainage assets where the hazardous/non-hazardous characterisation is not as you expected.

Having checked the sample characterisation, you can then check the asset characterisation using the WM3 process.

Any discrepancy with the reported characterisation should be fed back to the testing laboratory via the drainage Survey Contractor.

Module 7 - Checking photographs and videos

Step by step photograph and video checks

Digital photographs are required for most of the survey types, whilst video recordings are required for pipework CCTV and chamber laser scanning surveys to record the full survey. Photographs and videos are intended to illustrate both the typical condition and nature of the asset, and to show the detail of specific defects.

This checking process has 4 steps.

Step 1

Are the required photographs and videos included?

7.32	Photographs shall be taken of all chambers and gullies surveyed as follows: 1) general location photograph of the chamber/gully prior to removal of the cover/grating; 2) vertical photograph looking down the chamber/gully with cover/grating removed, prior to any cleaning; 3) vertical photograph looking down the chamber/gully with cover/grating removed, following any cleaning; 4) additional photographs to show specific defects; 5) orientation of photographs to be recorded along with direction of flow; and, 6) photographs 1) to 3) above to be recorded as "general photograph" observations.

This extract from CS 551 gives the photograph requirements for Pipework and chambers defect survey by CCTV.

Check category: **Must** Responsible: **Survey Owner**

Each of the CS 551 survey methods that require photographs gives a list of what photographs are required, and for long continuous assets, the frequency of photographs is stated. Spot check that the required photographs have been taken.

For pipework CCTV and chamber laser scans continuous videos of the survey are required. Check that if multiple surveys of the pipe or chamber have been done, or if it has been surveyed in both directions, that you can unambiguously determine which survey pass the video relates to. The videos are to be overlaid with key information that identifies the asset being surveyed and the distance along the survey. Check that the

distance recording has been zeroed at the start of the survey pass and matches the GDMS shapefiles data.

Step 2

Is the quality and resolution acceptable?

Out of focus CCTV pipework photograph.

Check category: **Should** Responsible: **Survey Owner**

Spot check some photographs and a section or two of the video(s) to see if the quality is acceptable. Is the lighting good? Is the camera in focus and the lens clean? There may be visibility issues that are beyond the control of the Survey Contractor if the pipe or chamber is part filled with water, or the atmosphere is very humid.

Step 3

Are they adequately referenced in the data?

Check category: **Should** Responsible: **Survey Owner**

Both the photographs and the videos are to be recorded and cross referenced in the GDMS shapefiles data, so that the defects and features in the data can be matched to the relevant photograph(s) and the appropriate location in the video, and vice versa. You should spot check that this cross referencing has been carried out correctly – this is most easily done using the optional proprietary viewer (if you have requested it in the Task Order), see the next module.

Step 4

Do they comply with GDPR?

Check category: **Should** Responsible: **Survey Owner**

The *European General Data Protection Regulation (GDPR)* implemented in the UK through the *Data Protection Act 2018*, requires that personal data is protected and not shared. This means that photographs and videos that will be shared on GDMS must not contain identifiable human faces or vehicle registration plates. You should spot check the photographs of above ground drainage assets and the start/end of below ground videos to ensure that faces and number plates have not been inadvertently included. If they have, then the Survey Contractor must either cut out or redact these images.

Module 8 - Checking the proprietary viewer

Step by step proprietary viewer checks

For the pipework and chamber laser scanning surveys where multiple deliverables are collected 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.

This checking process has 3 steps.

Step 1

Are all the components and data required to drive the viewer present?

Check category: **Should** Responsible: Survey Owner

The proprietary viewer should be pulling in all of the data deliverables. Do there appear to be any gaps in the functionality of the viewer, for example, are the photographs missing?

Step 2

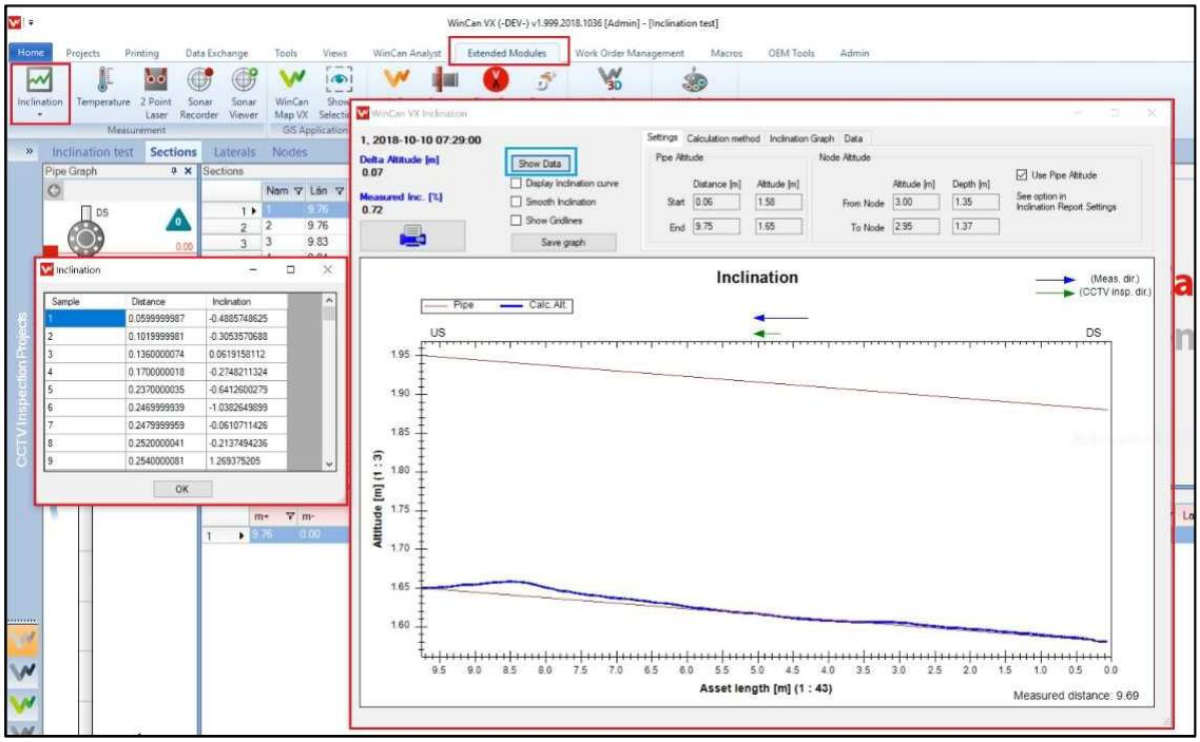
Does the data behind the viewer appear to be the same as the individual deliverables?

Check category: **Should** Responsible: Survey Owner

Spot check that the data the proprietary viewer is showing you is the same as you have in the GDMS shapefiles, photograph and video deliverables, and aligns with the CAD drawings.

Step 3

Does it work?

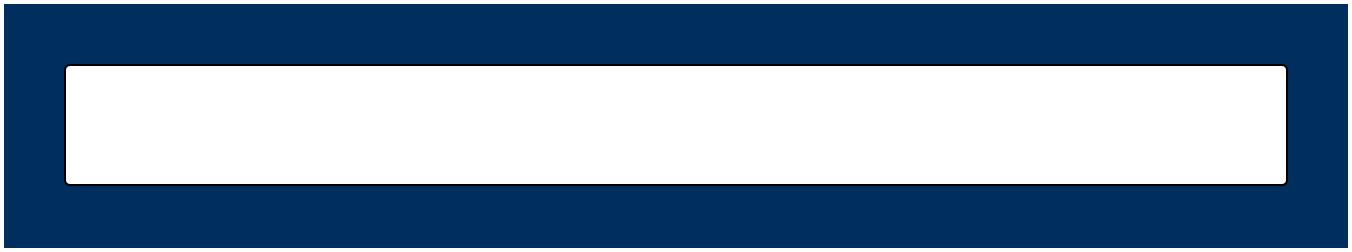


Proprietary viewer for Pipework inclination surveys (image courtesy of WinCan).

Check category: **Must** Responsible: Survey Owner

Jump along the length of the pipe or down the depth of the chamber in the viewer and spot check that the video, defect data and defect photographs are all linked. Focus in on a series of defects and confirm

that what you can see in the photographs and video agrees with the defect type, location, extent and severity recorded in the observation.dbf.



Module 9 - 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 10 - Final checks

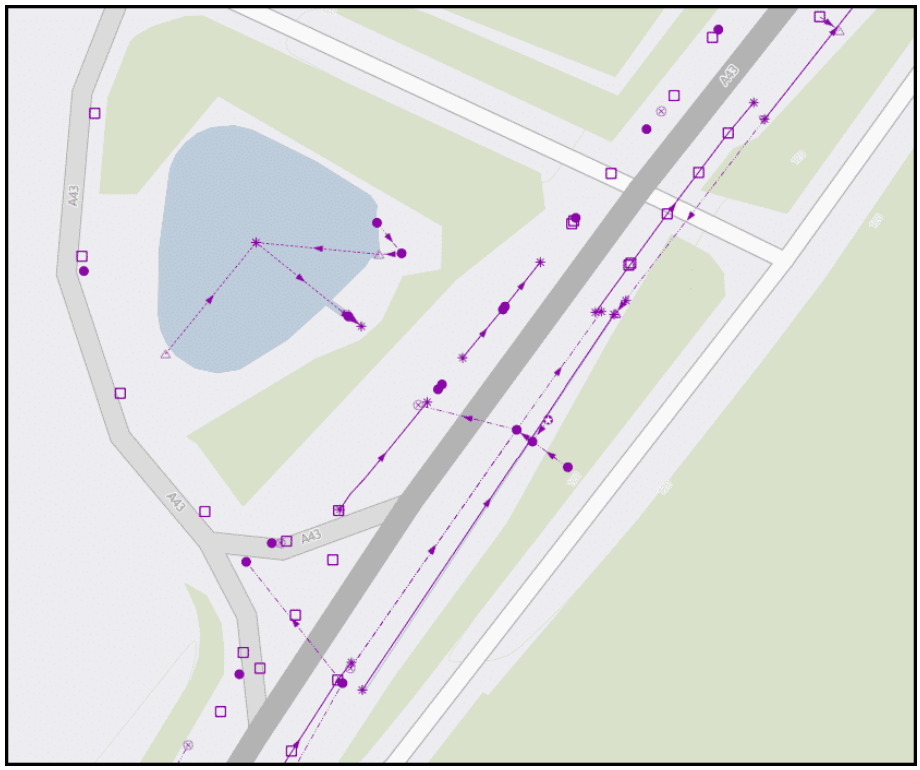
Step by step Final checks

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 11 - 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 shapefile 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.*