GraniteNet Software Generic Specifications for Optional Modules (for publishing a generic specification)

a. The software shall be a universal package which can be installed with additional customized optional modules depending on the requirements of the user.

b. The software shall offer the following optional modules to provide the relevant functions as noted by their descriptions below:

Optional Modules

a. **Main Asset Inspection**. The inspection software shall include an optional Main Inspection module to capture inspection data, observation details, video, and pictures which are all linked to the mainline structure.

b. **Lateral Asset Inspection**. The inspection software shall include an optional Lateral Inspection module to capture inspection data, observation details, video, and pictures which are all linked to the lateral structure.

c. **Manhole, Structure & Nodes Inspection.** The inspection software shall include an optional Manhole, Structure & Nodes module to capture inspection and observation details that shall be linked to the manhole, structure or node.

d. **CUES Pipe Score for NASSCO Codes**. The CUES Total Pipe Score for NASSCO Module calculates a supplemental pipe score using a proprietary CUES algorithm for inspections that use NASSCO's PACP, LACP, or MACP codes. The Total Pipe Score rating is calculated using a specialized formula that weighs the number (or density) of defects relative to either the entire length of the pipe or a specific segment length of the pipe to calculate an overall pipe score value from 0 to 100, with 0 being a perfect pipe and 100 the worst pipe.

e. **PACP**. The inspection software shall include an optional NASSCO PACP Compatibility, Import, and Export Module. The Export process will validate the PACP data and reject any non-compliant inspections, notifying the user via log files so that a corrective action can be implemented. The Import process of PACP files will reject any non-compliant inspection, and notify the user of the reasons. The optional module will support either V6 or V7 of the PACP standard.

f. **MACP**. The inspection software shall include an optional NASSCO MACP Compatibility, Import, and Export Module. The Export process will validate the MACP data and reject any non-compliant inspections, notifying the user via log files so that a corrective action can be implemented. The Import process of MACP files will reject any non-compliant inspection, and notify the user of the reasons. The optional module will support either V6 or V7 of the MACP standard.

g. **LACP**. The inspection software shall include an optional NASSCO LACP Compatibility, Import, and Export Module. The Export process will validate the LACP data and reject any non-compliant inspections, notifying the user via log files so that a corrective action can be implemented. The Import process of LACP files will reject any non-compliant inspection, and notify the user of the reasons. The optional module will support either V6 or V7 of the LACP standard.

h. **Prescriptive Planning Module**. The inspection software shall offer an optional annual automated decision support tool that prescribes rehabilitation/replacement actions to take against pipeline assets based on the types and severities of PACP observation codes. Using a formula within the inspection software, a flexible decision matrix will automate the decision(s) for assets based on the rules set by the Engineering Department. Courses of action such as "Replace within one year", "Replace immediately – imminent failure likely", "Point repair – Severe", "Full Lining", "Dig and Replace", "Heavy Clean and CIPP",

"Reinspect (5 yrs)", "Reinspect (10 yrs)", etc. shall streamline operations and be made visible in GIS for planning. Both PACP and Formula Fields Modules are prerequisites to utilize this module.

i. **Distance Acquisition**. The inspection software shall include an optional Distance Acquisition module to capture mainline, lateral, and node observation distances from titlers, text overlays, distance counters and other hardware devices.

j. **Video Indexing**. The inspection software shall include a Video Indexing module to link observation distances to a particular point in the related video during playback.

k. **Analog Video Recording**. The inspection software shall include an optional Analog Video Recording module to record analog live video to a digital file using either the MPEG1, MPEG2, MPEG4, MPEG4 AVC (H.264) or WMV formats.

l. **Digital Video Recording**. The inspection software shall include an optional Digital Video Recording module to record digital live video (at resolutions up to 1080p), from either an HDMI or SDI source, to a digital file using either MPEG4, MPEG4 AVC (H.264), or WMV formats.

m. **Image Capture**. The inspection software shall include an optional Image Capture module to record analog live video still frames to a digital file using either the JPEG or PNG formats.

n. **Software Titling**. The inspection software shall include an optional Software or Digital Titling module to overlay inspection, or observation information on the digital video file, using user selectable fonts and colors.

o. **Media Linking**. The inspection software shall include an optional Media Linking module to link third party videos, pictures, reports, or other documents to inspection, asset, or observation records.

p. **GPS/GNSS Collection**. The inspection software shall include an optional GPS/GNSS module to enable real-time collection of GPS coordinates. The inspection software will integrate with GIS, GPS, and selected CMMS systems.

q. **User Management**. The inspection software shall include an optional User Management module to create user accounts and define their level of access, employment details, or security privileges to the software. The User Management module allows administrators to create user accounts for the inspection software and define access permissions to specific features and functions. The module also provides the ability to create roles for similar user groups (e.g. the engineering department) and assign these roles to the inspection software user accounts. Proper deployment of the user management module ensures that each user of the software has a management-defined set of privileges to the system.

r. **ESRI Interface (Map View).** An interactive and integrated GIS map shall be viewable from within the software and allow for the initiation of inspection, creation of multiple inspections in a project format, viewing, exporting, burning, and reporting of inspections for selected assets, map layer management, customizable filtering capabilities for selection of map features, customizable filtering capabilities for creating dynamic (color-coded) layers of map features, and zooming to specific assets from selected feature.

- The software shall enable integration with ESRI's ArcGIS software using the ArcGIS Runtime SDK for .NET.

- The inspection software shall include an optional ESRI ArcGIS integrated map viewer to manage inspections, scheduling/planning tasks, generating reports, performing searches, creating dynamic color coded layers for assets and pending/completed inspections, and other basic map functions (zooming, identifying, extents, search/find, measure) directly from the integrated map.

- The inspection software's integrated map viewer shall include support for opening an ESRI ArcGIS Map (mxd), an ESRI ArcPro mobile map package (MMPK), and importing feature classes from a MMPK into a runtime map

- The inspection software's integrated map viewer shall include support for adding online basemaps from topographic, streets, or imagery to a runtime map

- The inspection software's integrated map viewer shall include support for adding data from an online ArcGIS Web Service and an online ArcGIS Web Map to a runtime map

- The inspection software's integrated map viewer shall include support for adding offline data from a mobile map package (MMPK), a tile package (TPK), a vector tile package (VTPK), raster data source, runtime content (.geodatabase), and shapefile(s) to a runtime map

- The inspection software's integrated map viewer shall include support for adding dynamic color-coded layers from a predefined list and custom filters that can be generated on the fly to a an ESRI ArcGIS map (mxd) or a runtime map

- The inspection software's integrated map viewer shall include support for exporting the runtime map to a KML file.

- The inspection software's integrated map viewer shall include grouping of layers within the runtime map

- The inspection software's integrated map viewer shall include support for configuring display settings, transparency, labels, selectability, and visibility within the runtime map

- The inspection software's integrated map viewer shall include support for saving the runtime map with a specific name

- The inspection software's integrated map viewer shall include support for signing into ArcGIS Online.

- The inspection software's integrated map viewer shall include support for "getting google directions" via a specific location selected on the map or the current location (if GPS enabled) and specified end location

- The inspection software's integrated map viewer shall include support for ESRI's "find by address"

- The inspection software shall provide a 'zoom to GPS location' capability when a GPS device is connected to show the location of the inspection vehicle or a particular known structure's location.

- The software shall enable structures, observations, entry points, etc. to be estimated with GPS coordinates, entered manually, by clicking on the map, by copy/paste, or captured from a GPS or GNSS receiver.

- The software shall provide the ability to use the GIS map within the viewer to select assets, review inspections, and run reports.

- The software shall provide the ability to use the integrated GIS map to show a recently completed inspection for a selected asset.

- The software shall provide the ability to use the integrated GIS map to zoom to a selected defect from an inspection.

- The software shall provide the ability to print from the integrated GIS map.

- The software shall capture GPS "accuracy" parameters (i.e., number of satellites, signal to noise Ratio, HDOP, PDOP, etc.)

- The software shall provide an ESRI ArcMap tool bar allowing linking of assets from an ESRI ArcGIS map (mxd) to the software's database to 'zoom to asset' and show the properties of the selected asset.

- The software shall provide an ESRI ArcMap tool bar allowing linking of assets from an ESRI ArcGIS map (mxd) to the software's database to open the last inspection of selected asset.

- The software shall provide an ESRI ArcMap tool bar allowing linking of assets from an ESRI ArcGIS map to the software's database to be able to select assets from the map and generate inspection projects for the selected assets.

- The software shall allow the ability for easily switching between different map sources.

s. **ESRI Import**. The inspection software shall include an optional ESRI ArcGIS import module to enable bi-directional integration using the ESRI's ArcObjects SDK (or ArcRuntime SDK for .NET) with ESRI's ArcGIS software or ESRI's ArcGIS Published Feature Services via ESRI's ArcGIS Online or ESRI's ArcGIS Portal. **Software that simply "toggles" or enables a "cut-and-paste" method of data exchange shall be deemed unacceptable**. The Database and Software program shall be able to import and export asset data, export Inspection Observations, and export pipeline inspection scores to an ArcGIS 10.x system (shape files, personal geodatabase, File Geodatabase, SDE Geodatabase, or Published Feature Services) utilizing the network features or precision factor to associate Sewer, Storm or combined Mains with corresponding Node and Lateral assets. Both an "import" and "export" profile shall be provided in the software to strictly control the attributes exchanged between the systems.

- The "import" and "export" profiles shall allow for data type conversions when the source and destination field types are not the same (i.e. allow for data type conversion of a float to an integer.)

- The inspection software shall allow imported asset data from GIS to be filterable to bring in all asset data (full asset inventory) or selected assets/pipelines based on some attribute within the GIS source feature class, or based on the nonexistence of an asset (new asset only import) within the inspection software's database

- The inspection software shall export the links for inspection videos and still images, associated with an inspection as attributes to the ESRI ArcGIS source file

- The software shall allow collection/storage of GIS coordinates imported from an existing ArcGIS database (shape files, personal geodatabase, File geodatabase, SDE geodatabase, or Published Feature Services).

- The software shall include support for ArcGIS Online and ArcGIS Portal connections

- The software shall include options to define feature class relationships via a geometric network, coordinates with a precision factor, and by data fields

- The software shall include the option to import attribute code values into the software's database when field-mapped to a code group within the software. The following three options shall exist: (i) skip if not in the code group, (ii) import and add to the code group, (iii) import but do not add to the code group

- The software shall include the option to import GIS domain values/codes to overwrite the code values within the software's database

- The software shall include support for ESRI's subtypes

- The software shall include support for "renaming existing assets" where the old ID gets renamed to the new ID during the import process.

- The inspection software shall allow exported asset data from the software's database to GIS to be filterable to export all asset data, new only, or existing only.

- The inspection software shall allow exported assets to be filterable to allow for only selected assets/pipelines based on some attribute or inspection date.

- The inspection software shall allow exported asset's coordinates to be exported to GIS

- The inspection software shall allow for inspection observations to be exported

t. **Scheduler**. The inspection software shall include an optional Scheduler module to plan one time or repeating automated procedures between field units and office locations on a daily, weekly, monthly, or yearly schedule. The available procedures shall be:

- Data Transfer: The software shall be able to schedule export or synchronization tasks between databases without the need for human intervention.

- ArcGIS Transfer: The software shall be able to schedule seamless data exchanges between GIS and the software's database without the need for human intervention. ESRI Import Module is required.

- Cityworks Transfer: The software shall be able to schedule seamless data exchanges between Trimble's Cityworks software and the software's database without the need for human intervention. Cityworks Module is required.

- IPS Transfer: The software shall be able to schedule seamless data exchanges between Infor Public Sector Module (previously known as Hansen v8) software and the software's database without the need for human intervention. IPS Module is required.

- MAXIMO Transfer: The software shall be able to schedule seamless data exchanges between MAXIMO software and the software's database without the need for human intervention. MAXIMO Module is required.

- Report Generation: The software shall be able to schedule the generation of specific reports via email (SMTP) as a PDF, HTML, excel, text, etc. attachment to recipients without human intervention.

u. **Formula Fields**. The Formula Fields Module allows an Engineer to import custom formulas (constructed in a wide range of 3rd party programming tools) into the formula manager tool within GraniteNet to apply a custom formula to any field which is capable of triggering an action, performing calculations, or initiating any other user-defined activity. The Formula Fields Module allows users to customize scoring algorithms, total-up field quantities, and determine calculated values based on the data entered during inspections.

A custom formula can be run against any "regular" field that is not already classified as a scoring field in GraniteNet. The module enables the ability to create/delete/edit formulas to place custom values on certain inspection observations. When the Formula Fields Module is used in conjunction with either the CUES or NASSCO "Pipe Score" Modules, the custom formulas will be protected (quarantined) from being shared elsewhere. The module also enables Engineers to recalculate scores on inspections created by other GraniteNet Inspection Editions that also had the formula fields module enabled.

However it should be known that custom formula scores cannot be calculated for:

1. Inspections created in a GraniteNet Inspection Edition that did not have the formula fields module enabled and activated.

2. Inspections imported from a PACP/LACP transfer file.

v. **CUES Pipe Score for CUES Codes**. The CUES Pipe Score for CUES codes module rates any observation and create scores for mainlines and laterals (Total Pipe Score, Maximum/Mean/Sum Score, Sum of the Defects score, etc.). A scoring system incorporated in the software shall assist the user/management personnel in making proper pipe condition assessments. Scoring is to be based upon grades assigned to observation codes and calculated using either standard or customer specific algorithms. Grades can be programmed to be dependent to secondary properties like pipe size, type, weather, etc. Only Administrators shall be allowed/able to make changes to grade and scoring algorithm values.

w. **Data Transfer**. The inspection software shall include an optional Data Transfer module to allow the user to export or import information between GraniteNet databases.

x. **Web Synchronization**. The inspection software shall include an optional WebSync module to allow the transfer of data and media over the Web back and forth between the office and the field units (truck computers, mobile equipment, and laptops/tablets). WebSync uses internet connectivity to transmit encrypted inspection data and video (TLS 1.2+ encryption) wirelessly to the office or Cloud. Software that does not truly synchronize data and, instead, merely makes a copy of it in location such as Drop Box or Google   Docs shall not be acceptable. WebSync shall be configurable to be triggered upon the stopping of an inspection or other custom frequencies. If data transmission is interrupted due to connectivity   issues, WebSync will re-initiate its session from where it left off and resume the transfer from that point when a suitable connection is obtained. If a session can't be completed, a log file will display the result and the inspection information - and the media will remain on the sender's computer until it can be re-tried, when better connectivity is available. WebSync can be set to transmit inspection data only (in small file sizes) and skip sending media files if they are not required daily. For example, some users will   synchronize inspection information throughout the day but choose to synchronize the video media at the end of the week, perhaps when the users/vehicles are back in the yard with access to the network. The inspection software's WebSync Module is required on the field unit(s) and must implement an ASP.NET instance hosted securely on the local network using an IIS server with Oracle 11.x or SQL DB 2008 R2-2019. The software shall also be offered as a Cloud-hosted service as well.

y. **Report Designer.** The inspection software shall include an optional Report Designer module to create or modify report templates. The software shall allow users to create additional reports as needed using a report creation wizard to easily guide the user.

z. **Management Console**. The inspection software shall include an optional Management Console module to allow the user to modify panes, create fields, add codes, and other database management functions.

aa. **CUES Codes Standard**. The inspection software shall include an optional CUES Standard module that includes the default CUES code system, field structures, and reports.

bb. **DUC Video Recording**. The inspection software shall include an optional Digital Universal Camera (DUC) Video Recording module to record digital video from a CUES Digital Universal Camera to a digital file.

cc. **DUC Flat Generation**. The inspection software shall include an optional DUC Flat Generation module to create side scanning flat images from a CUES Digital Universal Camera (DUC) digital file.

dd. **DUC Review**. The inspection software shall include an optional DUC Review module to play back digital video and flat images from a CUES Digital Universal Camera (DUC) digital file.

ee. **Inclinometer**. An inclination module is available for determining the slope of a pipe. The inclination graph is produced during the inspection and while entering inspection data. The user can visually see the slope of the pipe at any point in time during the inclination survey.

ff. **Import From SPiDER**. The inspection software shall support the Spherical Imagery Digitally Enhanced Rendering 360 Scanner/PointCloud technology by enabling users to import SPiDER data and media to automatically create (node) inspections within the software so that post processing in accordance with industry standards can be completed and retained in the inspection software. SPiDER inspections shall be associated to specific assets within ESRI ArcGIS. Imported inspection data shall be prepopulated within the software to streamline post processing analysis and spatially linked archival within the inspection software.

gg. **Automatic Grout**. The inspection software shall offer an optional module able to integrate with the CUES "Automated Grout Control System" known as "Easy Grout" which displays packer pressure, sleeve/vacuum pressure, and pump speed. The Grout Module shall automate the process within the inspection software and retain all grout functions via a mouse. It must have an on-screen display of pressure and air test to visually determine pass/fail for the pipe joint grouting process including recording the sequence of packer and sleeve inflations, pressure readings, grout material pumped, gel time, start time, duration, etc. to provide detailed analysis of each grout operation for precise quality assurance without requiring the operator to manually input the information into the inspection software.

hh. **MAXIMO Interface**. The IBM MAXIMO Module offers the ability to collect TV inspection data by utilizing the existing MAXIMO Code System and will complete inspections in the field from Work Orders that have been transferred from the Maximo v.7 program. Completed inspections are then transferred to the office for a true bi-directional process.

ii. **Azteca Cityworks Interface**. The Azteca Cityworks Module offers the ability to collect TV inspection data for field maintenance activities between Cityworks Server v2014 and later releases. Users can create, start and complete Work Order tasks directly from Cityworks Server's Work Order form by intuitively clicking a button in Cityworks to start an inspection in the inspection software. The module shall use JSON (Java Script Object Notation) web services to accomplish true bi-directional integration; obsolete SOAP methods will be deemed unacceptable.

jj. **EN 13508-2 Standard**. The inspection software shall include an optional EN13508-2 Standard module that includes the default EN13508-2 code system, field structures, and reports.

kk. **MPEG4 H.264**. The inspection software shall include an optional MPEG4 H.264 Video Recording module to record digital video from an analog live video source to a digital file. The H.264 video recording module allows GraniteNet in the field to record video in the H.264 format (.mp4). It's a high-quality, low file size format that can also be streamed via the web. The MPEG H.264 Module is not needed to playback H.264 video.

ll. **IPS (HANSEN) interface**. The Infor Public Sector Module (previously known as Hansen v8) allows the field operator to locate tasks assigned to him/her in the desired Project in GraniteNet and then complete these tasks. For ease-of-use, all of the imported data is automatically pre-loaded in the applicable fields in GraniteNet. After the operator completes the inspection(s) in the field, the completed inspections are transferred to the IPS server through a scheduled export process daily, weekly or on any customized schedule desired. After an export from GraniteNet to IPS, users can view the completed inspection attributes, observations and associated images conveniently inside the IPS application. Additionally the asset inspection in IPS is linked to completed tasks in GraniteNet.

mm. **SCREAM interface**. The inspection software shall include an optional SCREAM interface allows the import of information stored on a database that follows the SCREAM standard and structure.

nn. **Excel interface**. The inspection software includes an optional Excel interface that allows the import of asset information stored on a Microsoft Excel file. The user can create a custom field mapping profile to match the Excel table fields to GraniteNet Mainline, Lateral, or Node assets. Multiple field mapping profiles can be created and saved to be run as needed.

oo.   **Gas Module**. The optional Gas Inspection Module includes a Gas industry set of codes, field structures, forms, and reports for the following tasks: Excavation (associated with Lateral and Mainline asset types); Post Verification (associated with Lateral and Mainline asset types); and Pre Locate (associated with Lateral and Mainline asset types). The Excavation, Post Verification, and Pre Locate Tasks are used to prevent cross bore situations and generate customized reports. These reports include Gas Lateral Damage, Gas Lateral Excavation, Gas Lateral Locating with Sketch, Gas Lateral Locating and Map, and more.

pp.   **Sonar Data Recording**. The Sonar Data Recording Module operates with the CUES Sonar System to provide dimensional data on silt level, grease accumulation, pipe deformation, offsets, etc., below the waterline during a mainline inspection. Sonar information is digitally saved and can be used to perform measurements, reports, or capture still images in the truck or in the office.   The Sonar Module allows user to display data in real-time and record it simultaneously with the live video to identify and measure structural and maintenance issues in Sewer or Storm pipes. Observations can be entered using any code system and are linked to the right frame of both Sonar and Video recordings.   Pipe capacity loss can be calculated as a percentage of the total pipe flow capacity. The thickness of sediment or debris is used to graphically display the level of sediment along the pipe and estimate the total volume of sediment for removal purposes.