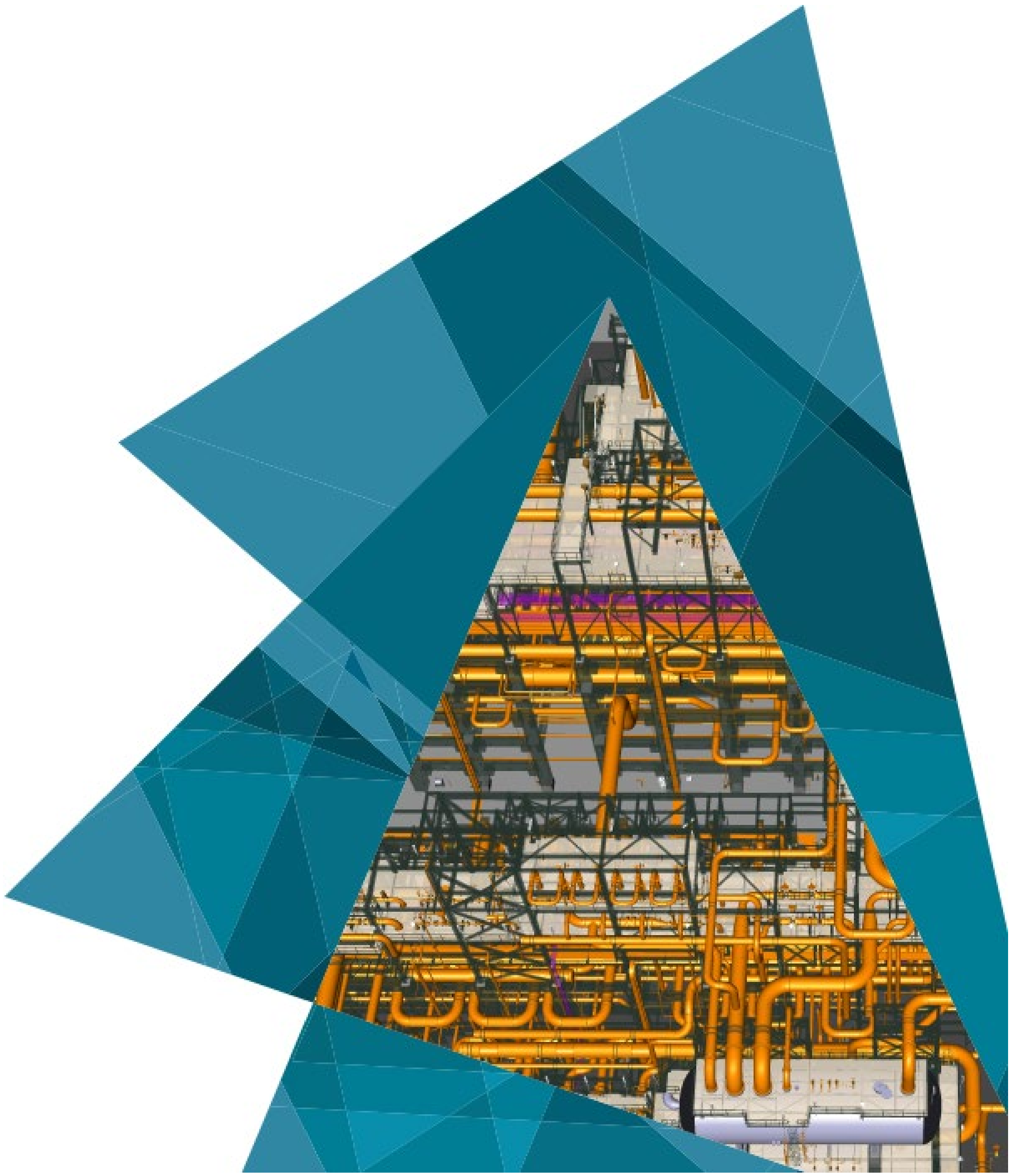
HxGN EAM GIS

Version 12.3
November 2025



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This brief provides conceptual information on the GIS module in the EAM application. It includes general information about the screens in this edition. This brief is intended to supplement the documentation of this feature. It is not comprehensive and although it contains procedural steps, it may not include all the details of this functionality.

Intended audience

This brief is intended for maintenance dispatchers, planners, managers, GIS users, and employees responsible for locating, tracking, and performing maintenance on assets or equipment dispersed across a large geographic area.

Overview

What is GIS?

A Geographic Information System (GIS) is a computer system that allows you to map, model, query, and analyze large quantities of data within a single database according to location. GIS is a tool that stores information about the world as a collection of layers that can be linked together by a common locational component such as latitude and longitude, a postal zip code, census tract name, or road and street names. These geographic references allow you to locate features on the earth's surface for analysis of patterns and trends. Dozens of map layers can be arrayed to display information about transportation networks, hydrography, population characteristics, economic activity, and political jurisdictions.

GIS systems are important to companies with assets spread over a large area such as local governments/schools, oil and gas companies, utilities, etc. These maps display assets as well as non-assets spatially via maps and help users better understand the location of the asset of interest, directions to the asset, work history of the asset, and the surrounding area of the asset in question. Therefore, it is critical for HxGN EAM to integrate with GIS applications. HxGN EAM supports map integration with ESRI, the market leader in GIS. HxGN EAM may be integrated with an ‘on prem’ ESRI GIS deployment, such as ArcGIS Enterprise (i.e., ArcGIS Server and/or Portal for ArcGIS components); or may be integrated with ESRI’s cloud-based web GIS software-as-a-service (SaaS) solution.

How do EAM and GIS integrate?

The HxGN EAM and GIS systems contain different types of data.

HxGN EAM is used primarily to track data related to equipment records defined as assets, systems, positions and locations. Typically, the EAM equipment records which integrate with GIS, are assets located over a wide area, as opposed to one central location. They can be equipment such as buildings, streetlights, and fire hydrants; or linear assets such as pipes, power lines, highways, and railroads.

GIS tracks the same data but displays it spatially and broken out into visible layers on a map. These layers are also specific types such as buildings, hydrants, pipes, and electric lines. Each layer has its own attribute table that contains unique information about each of the features in that layer, including their specific location on the map.

How can these two applications integrate so that equipment data in HxGN EAM is linked to the corresponding features in the GIS system?

HxGN EAM uses a unique GIS object identification number to data map its equipment with GIS features in the map's layer tables in the ArcGIS system. A hydrant or segment of pipe in HxGN EAM will have a unique GIS object ID and layer assigned to it that corresponds to the same GIS object ID of a specific feature in the GIS system's layer table.

The GISOBJID column must be manually added to the attribute table of each layer in GIS that you wish to integrate with HxGN EAM.

See *HxGN EAM Configuration for GIS*.

Important: If an environment or GIS configuration/capability is not mentioned specifically as being supported in this brief, HxGN EAM does not support the environment or GIS configuration/capability.

Understanding ArcGIS technology

The Esri ArcGIS platform is a suite of GIS tools and services can be used to capture, analyze, manage, and share geographic data. It includes components such as:

1. **Desktop applications:** Specifically, ArcGIS Pro, for analysis and editing of location-based feature data. Note that the legacy desktop application, ArcMap, will not be supported by Esri beyond March 2026.
2. **Server-based web GIS applications:** ArcGIS Enterprise, which combines ArcGIS Server (for hosting GIS services), Portal for ArcGIS (a web portal for collaboration and sharing), as well as other components to manage data. ArcGIS Enterprise can be deployed on-premises or in the cloud and is ideal for large organizations with specific security, compliance, and customization needs.
3. **Cloud-based web GIS solutions:** ArcGIS Online provides an alternative solution for web GIS needs; allowing users to create, edit, manage and share spatial data without the need for on-premises GIS servers.

Additional information regarding specific components of the ArcGIS platform is available from Esri directly: https://www.esri.com/en-us/arcgis/geospatial-platform/overview.

It is important to recognize that different organizations may deploy different combinations of the above tools, based on their own unique needs. However, at minimum, HxGN EAM customers who want to take full advantage of the HxGN EAM GIS integration must have access to one of the ArcGIS Desktop applications (preferably ArcGIS Pro) **AND** access to at least one of the Esri web GIS options mentioned above. For additional details regarding specific requirements, see the Advanced module requirements section of *the HxGN EAM Product Family Software Requirements*,

HxGN EAM and Esri ArcGIS platform

Communication between HxGN EAM and the ArcGIS platform is accomplished using web services. GIS map services to be displayed inside HxGN EAM are defined by installation parameters. These map services are published via the GIS as REST URLs. HxGN EAM releases prior to 11.1 utilized only SOAP URLs. However, beginning with HxGN EAM 11.1, new GIS map screens and pop-ups were developed and optimized to utilize REST services only. This has resulted in significantly improved performance as well as greater functionality and stability. Further, beginning with HxGN EAM 12.1, in addition to supporting the ArcGIS Server map service REST URL format, HxGN EAM may alternatively consume ArcGIS Online hosted feature layers, as defined by the URL of the corresponding ArcGIS Online item ID for the hosted feature layer.

HxGN EAM is using ESRI's ArcGIS Maps SDK for JavaScript to provide support for REST web services. Based on this architecture the map display works as follows:

1. When an equipment map is viewed or a map search is performed, a web service call is made to the GIS Server specified in the GISSERV installation parameter.
2. The web service scans the map layer(s) specified on the searched equipment for the unique GIS ID(s) associated to both the EAM equipment and GIS feature(s).
3. The GIS server then generates a map image showing the location of the feature(s) and makes it available in a virtual directory on the GIS server.
4. HxGN EAM retrieves it and returns it for "display" in the appropriate screen.

Note: HxGN EAM may consume either map services published to ArcGIS Enterprise (an ArcGIS Server that has been federated to an ArcGIS Portal), to a standalone ArcGIS Server, or may consume ArcGIS Online hosted feature layers (available through the ArcGIS Online item ID).

See the ArcGIS portal section for details.

See the *EAM configuration tasks for GIS* for more information on defining services.

For additional information about where to find the item ID for an ArcGIS Online item, see the following: https://community.esri.com/t5/arcgis-online-blog/where-can-i-find-the-item-id-for-an-arcgis-online/ba-p/890284.

Minimum integration requirements

Typically, HxGN EAM and GIS integration is needed for one of three scenarios. We will examine these at a high level first and then in greater detail later.

Scenario	Requirements
User has GIS implemented and is a new HxGN EAM user	The existing GIS equipment must be integrated with HxGN EAM. (This is the most common scenario.)

Scenario	Requirements
User is an existing EAM user but is a new GIS user	Existing equipment in EAM must be created as GIS features in the GIS application.
User has existing, mature EAM and GIS environments	Integrations needed where EAM equipment and GIS features already exist.

Scenario 1: Existing GIS user – implementing EAM

Existing GIS user is implementing HxGN EAM, needs to create GIS features as EAM equipment.

1 Determine which GIS layers will be integrated with HxGN EAM.

2 Add the GISOBJID and UPDATE_COUNT columns to each layer's attribute table. The GISOBJID is used to link each map feature to HxGN EAM equipment and the UPDATE_COUNT column is for tracking updates to the feature record so that attribute synchronization can be performed more efficiently. These are discussed in more detail later.

3 The map layer attribute tables contain specific data about each feature. But you will need to ensure that, at a minimum, all data required to create an HxGN EAM equipment record is accounted for. In most cases, there may be enough data here to satisfy these basic requirements such as description, status, and type. Using the HxGN EAM GIS integration toolbar, map data from the GIS attribute table for each layer to similar fields in the object table of the HxGN EAM database. The data mappings should be considered carefully before synchronization. A detailed discussion of mapping requirements is considered later.

4 Next, use the HxGN EAM GIS integration toolbar after the initial equipment creation is completed to keep both systems in sync.

Scenario 2: Existing EAM user – implementing GIS

Existing EAM user is implementing GIS, has existing equipment records such as assets, systems, and positions in EAM, and needs to create them as features in the GIS database

5 Determine which GIS layers will be integrated with HxGN EAM.

6 Add the GISOBJID and UPDATE_COUNT columns to each layer's attribute table. The GISOBJID is used to link each map feature to HxGN EAM equipment and the UPDATE_COUNT column is for tracking updates to the feature record. These are discussed in more detail later.

7 Consider which if any fields from GIS need to be available in HxGN EAM and use the integration toolbar to create the data mappings. Map fields from the layer table to corresponding fields in HxGN EAM. A detailed discussion of mapping requirements is considered later.

8 In HxGN EAM, create equipment profiles for each type of equipment that will be synchronized between HxGN EAM and GIS.

9. Create equipment classes or copies of the equipment screens to correspond with layers if needed.
10. Use the HxGN EAM GIS integration toolbar to link the various HxGN EAM equipment profiles to specific layers and then synchronize the records.

Scenario 3: User has existing HxGN EAM and GIS environments

User has existing HxGN EAM and GIS environments but needs to integrate where HxGN EAM equipment and GIS features already exist.

1. Determine which GIS layers will be integrated with HxGN EAM.
2. Add the GISOBJID and UPDATE_COUNT columns to each layer's attribute table. The GISOBJID is used to link each map feature to HxGN EAM equipment and the UPDATE_COUNT column is for tracking updates to the feature record. These are discussed in more detail later.
3. Manually insert the GISOBJIDs in the GIS database for each feature in each layer to be integrated.
4. Consider which if any fields from GIS need to be available in HxGN EAM or vice versa and use the integration toolbar to create the data mappings. Map fields from the layer table to corresponding fields in the appropriate equipment screens in HxGN EAM and the synchronize attributes.

See *Mapping data types* and *HxGN EAM Map Feature Attributes* sections for additional details.

See *EAM configuration tasks for GIS* for more information on the concepts described here.

Pre-integration key decisions

Before getting to the details of integrating the two systems, first examine decisions that must be made. As with any HxGN EAM implementation, key decisions on how to set up data are made in advance of creating it. These decisions should always be made with the goal of streamlining and enhancing the current workflow in each environment. Linking the data between HxGN EAM and GIS should be given the same careful and thoughtful consideration. These decisions were touched on earlier but some that should be of primary importance are as follows.

Map layers and HxGN EAM equipment screens

Deciding which map layers will be integrated. It is not necessary to integrate all layers with HxGN EAM for proper implementation. It is recommended to integrate only the layers that will be tracked as equipment in HxGN EAM. This should be determined before any features or equipment are created and synchronized. Often it is helpful to create classes of equipment in HxGN EAM that correspond to features types in GIS. For example, all equipment in HxGN EAM mapped to features in the Streetlights layer in GIS could be in an equipment class of Streetlights. You may also choose to make a copy of the asset screen in HxGN EAM and name it according to the equipment type or class. For example, a copy of the asset screen could be called Streetlights and have a filter that displays only equipment with class of Streetlights. Use the Field Filter setup screen to achieve this. In this way, it is possible to hide the class field on the appropriate screen and set its default value to the correct class. You might also limit access to this screen to only the users who will be planning and performing maintenance on Streetlights. Organizing it in a thoughtful way that makes sense can help manage your HxGN EAM data more effectively.

Once it is determined whether all layers should be integrated or not, another key decision is to decide if all layers should be visible in HxGN EAM. Displaying fewer layers per map usually results in better performance of the map screens in HxGN EAM. It may be determined that the map can be loaded initially with fewer layers visible by default. Layer display can be managed either in ArcMap, ArcGIS Pro or in HxGN EAM map screens. Using the map controls in HxGN EAM, layers can be enabled or disabled as needed. These preferences are then saved and tracked per user. This gives control of layer visibility depending on the job function or preference of each individual user.

In many cases, even greater flexibility is needed so HxGN EAM provides the ability to assign different maps to various users.

See the *Configuring multiple maps* section of this document for further information on limiting certain map data to only relevant users for that data.

Another decision is whether the equipment will be created in HxGN EAM first or will features be created in GIS first? Before creating HxGN EAM equipment, consider the customer needs and what makes sense in their environment. It is wise to decide the best way to set up the equipment in HxGN EAM before creating any data in GIS or creating any HxGN EAM data from GIS features. It may be helpful to review *Asset Management* and *Understanding Equipment* in the *HxGN EAM User Guide* before creating equipment records. Once the equipment is created in HxGN EAM, you will need to create data mapping for the fields to be tracked in HxGN EAM to fields in the GIS layer tables. When creating data mappings, use the Source field to determine which system owns the data on the initial creation of records. Use the Owner field to determine which system owns the data for future synchronization of specific feature attributes after the initial creation.

Most customers utilizing HxGN EAM and GIS integration prefer HxGN EAM track the actual physical work required to install a new feature in a certain area. Since the feature does not yet exist in HxGN EAM, a work order is created against a similar equipment or parent equipment. Paperwork with the details of the new feature is passed to the GIS analyst who will then create the new feature on the GIS map. Once the feature is created and approved, synchronization is run to create the corresponding equipment in HxGN EAM. Once the record exists in the two systems, the equipment on the installation work order can be updated to the new equipment.

For a detailed discussion of integration scenarios see the section *How to Integrate Existing Assets/Features (Detailed)*.

Versioning in ArcGIS

ESRI ArcGIS geodatabases feature the use of versioning for controlling database updates. Version control is the default editing environment in enterprise geodatabases and supports complex editing workflows required by enterprise GIS systems. It allows for multiple users accessing and editing data simultaneously in enterprise geodatabases. Every enterprise geodatabase has a default version named DEFAULT that is owned by the administrator. The version always exists and cannot be deleted or renamed. The DEFAULT version is typically maintained and updated over time by incorporating changes to it from edits posted to other versions that have gone through an approval process. The HxGN EAM GIS integration supports versioning but for reasons just presented, it only reads the DEFAULT version when synchronizing data between the two systems. In view of this, a key decision is the process by which GIS data revisions will be checked into production and become part of the DEFAULT version. This is critical because revisions cannot be checked into the DEFAULT version during synchronization with HxGN EAM. The synchronization process must be able to lock the data for editing. If it cannot, then the synchronization will fail. It is important to schedule map updates by GIS personnel outside of the hours set aside for manual or auto data synchronization with HxGN EAM.

Mapping data types

When creating mapping records between HxGN EAM and GIS it is not only important to consider which fields to map to each other but also the type of data that will be held in each field. Carefully consider the field properties and the type of data flowing back and forth for each mapped field. You may create mappings for various numeric, text and date fields but only fields of the same type should be mapped to one another. For example, text to text, number to number, date to date. This is because each data type is restricted to storing the data in a certain format. For example, numeric fields can be numeric-double, numeric-float, or numeric-long and each may have various scale and precision limits. Text fields are normally string fields that vary in lengths such as 20, 25, and 50 characters, etc. Date fields can be date or date/time, each requiring their own length and format depending on locale. Synchronization problems will occur when the data type and size do not match on both mapped fields. In addition, some fields in HxGN EAM round to the nearest decimal value so the data in those fields may not match GIS even after synchronization. Therefore, it is always best to carefully plan, review, and test that all field mappings are compatible in type and format with each other before live synchronization begins. In addition, the current design of the ArcGIS system will in cases allow spatial data that have geometry problems to be created. This data must be corrected using ESRI tools within Arc Map before it can be synchronized to HxGN EAM. If synchronization is attempted before correcting these issues, errors may occur, and the synchronization will fail.

Note that if custom fields or comments are used in field mappings these should be limited to a small number, 10 or less. Mapping too many custom fields can significantly slow synchronization performance.

See ESRI documentation and support for more information on resolving spatial data errors.

Configuring GIS

Open ArcMap or ArcGIS Pro (see **Notes** below on support for ArcGIS Pro) and select the GIS map containing the layers you wish to integrate. Create the GISOBJID and UPDATE_COUNT columns as required in the attribute table for each of the layers that you want to integrate with HxGN EAM. The GISOBJID column is required in all scenarios to support the HxGN EAM GIS integration; and the additional UPDATE_COUNT column may be required, depending on the value of the GISSYNCA installation parameter. When this install parameter is set to 'OFF', UPDATE_COUNT is required as this field tracks updates to GIS feature records.

There are several additional requirements related to case sensitivity for the GISOBJID and UPDATE_COUNT columns, which differ depending on which GIS application and/or version of HxGN EAM GIS is being used:

- For users of ArcMap; including all versions the HxGN EAM GIS toolbar, lower-case field names for the GISOBJID and UPDATE_COUNT fields are not supported. In addition, any alias defined for these fields must match the field name exactly.
- For users of ArcGIS Pro; with the HxGN EAM GIS Add-In prior to the 12.0.1 version, lower-case field names for the GISOBJID and UPDATE_COUNT fields are also not supported. As with ArcMap, field aliases must also match their respective field names exactly for both GISOBJID and UPDATE_COUNT fields.
- For users of ArcGIS Pro; with the HxGN EAM GIS Add-In beginning at the 12.0.1 version, the fieldname for the GISOBJID field may be defined using either entirely uppercase or entirely lowercase characters, as either 'GISOBJID' or 'gisobjid' (i.e. camel case/mixed case such as 'GiSoBjID' or similar is not supported). In this scenario also, only aliases of either 'GISOBJID' or 'gisobjid', and either 'UPDATE_COUNT' or 'update_count', are supported for those key fields.

Note: Admin-level access to ArcMap (i.e., permission to the ArcMap installation directory) is required. Likewise, admin-level access to ArcGIS Pro (i.e., permission to the ArcGIS Pro installation directory) is required when the version of the HxGN EAM GIS Add-In is v.11.7 or lower.

Next, install the HxGN EAM GIS extensions.

See EAM configuration tasks for GIS   for more detailed information on creating the GISOBJID and UPDATE_COUNT columns and installing the GIS extensions.

The HxGN EAM GIS extensions are screens developed on the .NET platform. They are installed as an interactive toolbar in ArcMap or ArcGIS Pro and function as an extension of the HxGN EAM application with limited functionality inside ArcMap or ArcGIS Pro. They are created especially for ArcGIS Desktop and are powered by HxGN EAM web services. These are the same web services used by the base HxGN EAM application so all its business rules and data integrity constraints will apply to data created and updated. The toolbar functions will not become active in ArcMap or ArcGIS Pro until at least one map layer is integrated, meaning at least one layer has the GISOBJID column.

The next step is usually to create the data mappings using the extensions as mentioned previously.

See *Mapping Data Types* and *HxGN EAM Map Feature Attributes* discussed later for more a detailed discussion of data mapping functions in the HxGN EAM toolbar.

When setting up the data mappings prior to creating features as HxGN EAM equipment, you have the option to use an equipment profile, map the individual fields in the attribute table to the HxGN EAM database fields, set the mappings to use fixed values to populate the required HxGN EAM fields or a combination of all of these. An equipment profile contains all the values necessary to create an equipment record in HxGN EAM. You may also specify other values such as department and class. The profile must be for marked as a GIS profile or it will not be available when using GIS integration.

Notes:

- GIS integration with HxGN EAM is supported for both ArcGIS Desktop applications – ArcMap and ArcGIS Pro.
- Functionality available in ArcMap via the HxGN EAM 'toolbar' (or 'extensions' as they are sometimes referred) is also available via the ArcGIS Pro Add-In; with the exceptions explained in section *"ArcGIS Pro — HxGN EAM Add-In functions"*.

If only minimal data is required to be synchronized between the two systems, then equipment profiles can be used along with a few mapped fields. Note that Profiles are not required. They are normally used if you want to create equipment or features automatically from HxGN EAM. Profiles are useful for easily providing department, organization as well as a general description when creating equipment. However, these fields may also be supplied through a specific mapping for each layer that has the values for organization and department supplied as hard coded values. If you are not automatically creating equipment or features from Inform EAM, it is recommended to use field mappings to supply the required fields for HxGN EAM records rather than using profiles. If additional data needs to be synchronized between the two systems, you may configure additional data mappings as needed to supplement profile data. Note that equipment profiles also come into play at two other points. On the GIS side, a profile must exist if using the Create Equipment function. On the HxGN EAM side, you will use profiles when creating GIS features from existing assets. Note that in HxGN EAM there is the option on the equipment record to create a GIS feature. This process requires an equipment profile to auto create a feature in GIS based the selected HxGN EAM equipment record.

Map services

HxGN EAM can be configured to consume any map services published to ArcGIS Server; or hosted feature services published to ArcGIS Online. If using REST services, you will need a minimum of two services: a service for viewing the map image (or features) in HxGN EAM, and a geocoding service for locating addresses and supporting reverse geocoding. If using SOAP services (only supported in HxGN EAM versions prior to 11.1), then an additional map service called a geoprocessing service is required for buffering objects on the map. HxGN EAM GIS Integration includes a file called HxGNTools, which is an ArcGIS buffering tool to be used as a basis for creating a geoprocessing service. REST services do not require a separate geoprocessing service. To create an image service from a map, open it in ArcMap, choose File/Share As, choose the type of service you wish to create, and the GIS system will guide you through the process. Alternatively, users of ArcGIS Pro, may select either the Share > Web Layer > Publish Web Layer or the Publish option (depending on GIS configuration) to create a map service.

See the *EAM configuration tasks for GIS* and *EAM user tasks for GIS* for more information on configuring the GISOBJID and UPDATE_COUNT columns in ArcMap or ArcGIS Pro, defining map services, and using the GIS .NET extensions.

See the ESRI documentation or support team for additional information on creating map services for ArcGIS Server and hosted feature services for ArcGIS Online.

ArcGIS portal

HxGN EAM supports the display of map services from ArcGIS Enterprise (if the map service is published to ArcGIS Server and the server is federated to the Portal), from a standalone ArcGIS Server, or from hosted feature layers published directly to ArcGIS Online.

Notes:

- ‘Web maps’ from ArcGIS Online/Portal for ArcGIS are not supported. Web maps include additional information that cannot be displayed in the HxGN EAM GIS map-based screens and popups.
- The ArcGIS User and ArcGIS Password fields on the User Setup screen will be used to associate the portal or ArcGIS Server user to the EAM user when using Token-based, secured services (see the *Supported ArcGIS Authentication Methods* section for additional details).
- The named portal user that is associated to the EAM user must have at least 1 administrative privilege granted in the portal. Otherwise, they will not be able to view these maps inside EAM.
- If GIS services are hosted in ArcGIS Online; the URL of the ArcGIS Online item ID is to be specified in the GISSERV install parameter (rather than the map service REST URL, as in the case of ArcGIS Server map services).
- Consistent with best practices, it is recommended that GIS administrations ensure that all GIS environments are updated to include available patches for ArcGIS Server, ArcGIS Web Adaptor and or Portal for ArcGIS (if used) to prevent existing bugs & vulnerabilities from impacting performance of the HxGN EAM GIS integration. For example, Esri’s “ArcGIS Web Adaptor (IIS) 11.1 Reliability Patch” addressed a known Esri issue that can impact the HxGN EAM Mobile Offline (Android) application.
- Regardless if the GIS portal in use is ArcGIS Enterprise or ArcGIS Online; users performing synchronization of EAM equipment records and GIS features using the HxGN EAM GIS integration will require, at minimum, the ability (privilege) to edit features and attributes of GIS layers. While GIS portal user types and roles may vary depending how ArcGIS Enterprise or ArcGIS Online has been configured, this privilege would generally require the GIS user to be configured with at least a Data Editor role in their GIS portal of choice. For additional information regarding ArcGIS user types, roles and privileges; see specific resources for either ArcGIS Enterprise or for ArcGIS Online.

Supported ArcGIS authentication methods

Secure your ArcGIS environment for your enterprise's security purposes. EAM supports the following security methods when authenticating with the ArcGIS platform:

1. OAuth2
2. Token-based
3. HTTP/Windows Authentication (Integrated Windows Authentication or IWA)
4. Public Key Infrastructure

Important: Public Key Infrastructure is not supported in the HxGN EAM-GIS integration.

Configure your ArcGIS platform based on your chosen authentication method, as per ESRI's documentation. The following URL provides additional details about each of these methods:

https://developers.arcgis.com/documentation/core-concepts/security-and-authentication/

See the **Unsupported Functionalities** in the *Appendix* section for functionalities not supported when Oauth and Windows authentications are used.

Oauth2

When using Oauth2 authentication, setup the ArcGIS Enterprise or ArcGIS Online environment per the following URL:

https://enterprise.arcgis.com/en/portal/latest/administer/windows/configuring-a-saml-compliant-identity-provider-with-your-portal.htm

Configure the following EAM installation parameters:

1. GISAUTH installation parameter must be set to OAUTH2.
2. MOBGPURL – Specify the ArcGIS Enterprise or ArcGIS Online URL. i.e., https://>servername>/>webadaptorname> for ArcGIS Enterprise, https://www.arcgis.com for ArcGIS Online.
    a. This install parameter is also used by the Mobile Offline application to specify the GIS portal the application will use to verify correct licensing for the mobile SDK.
3. GISAPPID – Specify the registered App ID configured for an application in ArcGIS Enterprise or ArcGIS Online.
   Details for creating an application in ArcGIS Enterprise or ArcGIS Online are as follows:
    a. Login to ArcGIS Enterprise or ArcGIS Online.
    b. Navigate to the Content tab.
    c. Click on the Add Item button and then select the "An application" link.
    d. Select the Application radio button.
    e. Enter Title and Tags information. Click on Add Item button on the pop-up.
    f. Once the application item is added then navigate to the Settings tab.
    g. Notice Data Source URL field. Specify the map service URL here.
    h. Click the Update button:
        i. Notice App ID field value. Enter this value in GISAPPID installation parameter in EAM.

  ii. Add the Redirect URL. i.e., if the EAM application is accessed using https://rhino.acme.com/ in the browser, then add this URL here. The user will be redirected to this URL with the authorization code once the authentication is done.

i. Configure sharing permission of the application you created i.e., Organization.

Token-based

When using Token-based authentication, the EAM application must be configured as followings to receive token from ArcGIS platform:

1. GISAUTH install parameter must be <blank>.
2. Navigate to the Users Setup screen. Save ESRI ArcGIS Server User and ESRI ArcGIS Server Password field values with the EAM user. This will allow an EAM application to generate a token and connect to the ArcGIS REST endpoint in a secure way.

Note: When configuring token-based authentication for a standalone ArcGIS server environment; the REFRPOL install parameter must be configured with a value other than the default value of 'no-referrer' in order to validate a token with the standalone ArcGIS server. If a value for REFRPOL as 'no-referrer' is desired, it is recommended to configure ArcGIS Server as federated with ArcGIS Enterprise, so that portal-based security is applied. See *New install parameters* section of *HxGN EAM Release Notes for 12.1.1* for additional details regarding REFRPOL install parameter. Additionally, a known issue exists for the Open Streetmap basemap option (i.e. GISBASEM install parameter as 'Open Streetmap'), in scenarios where REFRPOL install parameter is set to 'no-referrer'. If REFRPOL is set to 'no-referrer', it is recommended that another basemap be used (World Street Map, Imagery, etc.), or REFRPOL should be updated to be other than 'no-referrer'.

HTTP/Windows Authentication

When using integrated Windows authentication, the EAM application must be configured as follows:

1. GISAUTH installation parameter must be set to IWA.

See the following URL for details on configuring the portal to use Windows Authentication:

https://enterprise.arcgis.com/en/portal/latest/administer/windows/use-integrated-windows-authentication-with-your-portal.htm

Geocoding

Geocoding is required to manage address information. A geocode is simply the precise latitude and longitude coordinates of a specific address. For basic maps, typically a postal address or place name is linked to geographic coordinates from a spatial reference dataset. Reverse geocoding is very simply the same process in reverse, enriching geographic coordinates with a description of the location, typically a postal address or place name. Geocoding services are created on the GIS server and utilized by HxGN EAM when using the GIS Map Search or Call Center map to search for an address. Reverse geocoding is used when choosing to view the nearest address to a feature or point of interest on the map. HxGN EAM requires a minimum of one geocoded address locator service for the GISGEOSV install parameters. GISGEOSV supports multiple geocoding services if needed. When multiple services are specified, HxGN EAM will search each of the services' address points, calculate a match score, and display a dialog showing the highest scoring matches. The user can then choose one or more of the matching results and have it displayed on the map.

See *EAM configuration tasks for GIS* for more information on defining services also see ESRI documentation for more information on creating these services.

Configuring EAM

When configuring the HxGN EAM environment to use GIS, the basic set of records for a normal HxGN EAM installation must first exist. For example, user groups, users, organizations, and departments should exist according to the requirements of the specific environment. All of these are required for equipment creation. You may also choose to create equipment classes, equipment profiles, and departments. If equipment records will not be created from existing GIS features, then proceed with creation of HxGN EAM equipment. As mentioned earlier, decisions must be made about equipment records. Will all the equipment be assets, or will systems and positions also be needed? Will equipment structures need to be built? You may decide to use equipment profiles and equipment classes to line up with layers in the map. You may also decide to create copies of the equipment screens for each equipment class such as utility access hole, pipe, hydrants, and so forth and assign access to these specific screens only to the teams managing, planning, and performing the work on that equipment. It is always good to consult with the team doing the implementation to make these decisions since this will have a long-term impact on the system and impact its performance, efficiency, and ease of use.

Will one GIS map be used for all users or are multiple maps needed? Once this is decided, you can configure the services required to render each map in HxGN EAM. Capture the REST or SOAP URLs you will be using from each of the GIS Server service definitions and add their value to the corresponding to GIS service installation parameters.

See the *Key Decisions* section for additional considerations regarding system configuration.

HxGN EAM GIS installation parameters

HxGN EAM has several installation parameters to manage GIS configuration. The critical parameters are the ones which specify the services or ArcGIS Online items used for the rendering the map images (GISSERV) and those supporting geocoding (GISGEOSV). To display a GIS map in HxGN EAM that is searchable for specific equipment records the GISSERV must be populated with a valid ArcGIS Server map service URL or ArcGIS Online item ID URL. To activate searching by address, enter a valid ArcGIS Server geocoding service or ArcGIS Online item ID URL for GISGEOSV.

URLGIS

URLGIS supports attaching maps as documents to equipment and work orders.

See the **Appendix: Unsupported Functionalities** section for scenarios where attaching maps as documents is not supported.

Many other parameters are cosmetic in nature allowing the administrator to configure the display properties of various map controls including the size, shape, and color of points and mark ups on the map. These can be tweaked as needed as the map is used.

GISBATCH

The GISBATCH parameter is used by the HxGN EAM GIS Integration toolbar extensions to manage batch processing. The value of the parameter will define the maximum number of records contained in each batch. The parameter defaults to 1000, meaning that 1000 records will be processed per batch. If no value is specified, the system will use the default of 1000. Values can be equal to or less than 2000. If GISBATCH is > 2000, the .NET client will limit batch size to 2000. Tests show that batch sizes larger than 2000 do not yield any performance gains.

See the *Pre-integration key decisions* and *Configuring multiple maps* sections of this document for more information.

See the *EAM configuration tasks for GIS* and *EAM user tasks for GIS* for more information on GIS install parameters and defining and configuring map services.

Configuring multiple maps

HxGN EAM offers the option to display additional maps other than a default GIS map. This function is typically used by maintenance groups that cover different equipment types or a very widespread geographical area. In these cases, they need to see only the maps and features that correspond to those areas or certain equipment types for which a maintenance group may be responsible.

A team working in one geographical area needs a map containing the equipment and layout only for that area. Alternatively, the maps are for the same area but contain completely different layers that are relevant to the teams that need information about equipment only found in those layers. For example, a team maintaining a water pipe network for a certain area would only need to see layers relevant to the pipes and supporting infrastructure. They would not need to see data in layers such as electrical, streetlights or railroad.

The HxGN EAM installation parameter GISMAPS is the key to this configuration. The parameter defaults to the Global setting displaying a single map for all users. Two other options are available allowing the user access to multiple GIS maps as needed by either their Organization or Department.

The Organization setting allows you to assign multiple maps to users and have these maps available to all or only specific users in a specific organization. This is the setting typically used by groups which service different geographical areas with areas divided into separate organizations.

The Department setting allows you to assign multiple maps to users and have these maps available to all or only specific users in certain work Departments. This is the setting typically used by maintenance groups responsible for different equipment types in a common geographical area. Note that using Department maps requires department security to be enabled in HxGN EAM. This is controlled by the DEPTSEC install parameter.

Each individual map can have its own set of parameters defining the map service, geocoding services, color coding, symbology and active layers.

Note: These maps are created on the Maps screen. Maps that are consumed by the EAM desktop application and the Mobile Offline application are created on the Maps screen.

Important: In view of the flexibility provided it is important to consider all factors in the business flow of each organization and make these decisions prior to moving forward with an HxGN EAM GIS implementation.

A single map cannot be consumed by both the EAM desktop and Mobile Offline application. If the Map is to be used by Mobile Offline, the ‘Mobile Only’ checkbox MUST be selected for the map record. Else, leave this checkbox unselected for use in the desktop application.

See the EAM user tasks for GIS topic for more detailed instructions on creating the maps and associating them with organizations and departments.

See these functional briefs for more detailed instructions on configuring and using maps in the Mobile Offline application:

- *HxGN EAM Mobile Offline Configuring GIS Map View*
- *HxGN EAM Mobile Offline GIS Map View GIS Features*

Detailed view: integrating existing assets/features

Case 1: Existing GIS user is implementing HxGN EAM. GIS features need to be created as equipment in HxGN EAM

In the case where an existing GIS user is implementing HxGN EAM and GIS features need to be created as equipment; you should first determine which layers will be integrated with HxGN EAM. Next, add the GISOBJID column to each layer’s attribute table. The GISOBJID is used to link each map feature to an individual HxGN EAM equipment record. This is a one-to-one association. The column exists in both the GIS database for each feature as well as the HxGN EAM DB (r5objects/obj_gisobjid). The unique GISOBJID for each record will be the same in both systems. The map layer attribute tables also contain specific data about each feature. In most cases, there is enough data here to satisfy the basic requirements for creation of equipment in HxGN EAM (such as description, status, and type). Using the HxGN EAM GIS integration toolbar, map the data from the GIS attribute table for each layer to similar fields in the object table of the HxGN EAM database. The integration toolbar will then allow you to create the new HxGN EAM equipment records in a batch, sending them via existing EAM web services. This synchronization should be done for each layer to be integrated until all GIS features have been created as HxGN EAM equipment. The toolbar allows you to export lists of records for comparison or historical purposes.

Case 2: Existing HxGN EAM user implements GIS system. HxGN EAM equipment records such as assets, systems, and positions already exist and need to be created as features in the GIS database.

In this scenario, HxGN EAM equipment records such as assets, systems, and positions already exist and need to be linked to features in the GIS database. First, determine which layers will be integrated with HxGN EAM then add the GISOBJID column to each layer's attribute table as described in Case 1. Configure UPDATE_COUNT as needed. Consider which if any fields from GIS need to be available in EAM and use the HxGN EAM GIS integration toolbar create the data mappings. In HxGN EAM, create equipment profiles for each type of equipment that will be synchronized between HxGN EAM and GIS. You may also consider creating equipment classes to identify specific types of equipment in GIS. A profile contains the all the data required by HxGN EAM for asset creation including a class if one is specified. Once all of this has been determined, use the HxGN EAM GIS integration toolbar to link the various HxGN EAM equipment profiles to specific layers and synchronize the records.

Case 3: Existing HxGN EAM and GIS environments. Need to integrate where equipment records such as assets, systems, and positions exist in the HxGN EAM system and GIS features already exist in a mature GIS system.

In this scenario, we have existing HxGN EAM and GIS environments that have been in use for some time. GIS features exist and have been configured with the necessary data for normal GIS operations. The HxGN EAM environment has equipment with much transactional data such as structure, work orders, and cost data. Data may also be captured in custom and user defined fields of various types depending on workflows. There is now a need to integrate the two systems. First, determine which layers will be integrated with HxGN EAM then add the GISOBJID column to each layer's attribute table. Also, configure the UPDATE_COUNT column. Consider which if any fields need to be mapped between the two systems and use the HxGN EAM GIS integration toolbar create the data mappings. As mentioned before a unique GISOBJID is needed to link a GIS feature to an HxGN EAM equipment record. Normally this number is system generated by HxGN EAM when the feature record is created or when the asset is initially created. Since both records already exist and both have data that needs to be preserved, the GISOBJID must be manually created. For each feature that is to be integrated, manually enter a unique GISOBJID value in the feature table. All GIDOBJIDs that are manually created must be in a range of less than 100000000 because the HxGN EAM system generates GISOBJIDs beginning at 100000000. Carefully plan the numbering convention so that the range is well below this threshold to avoid duplicate GISOBJIDs. Note that both GISOBJID and layer must be added to each equipment record to complete the manual integration. If other equipment fields need to be populated with GIS data, it can be synchronized using the GIS Integration Toolbar.

Synchronizing data

Once the system is configured and data is being captured in both the HxGN EAM and GIS systems it important to keep them in sync. This synchronization is based on the data mappings created during the initial configuration.

Prior to any synchronization, the HxGN EAM GIS integration toolbar should be used to map any relevant data from the GIS attribute table for each layer to corresponding fields in the EAM database. These data maps will be utilized during attribute synchronization.

To restate the role of the Owner field in the data map records, when HxGN EAM is the owner the two systems will be synchronized so that the value is equal the HxGN EAM record value for the field.

If GIS is the owner, the two systems will be synchronized so that the value is equal the GIS value for the field. You will have certain data that is owned and maintained by each system. Once the mappings are finalized, you are ready to begin synchronization. Normally this is a regular process that is done by a GIS administrator at a scheduled time, daily or weekly. The process can also be scheduled as an automated task.

Manually synchronizing data in GIS

To run the process manually after the toolbar is installed on the GIS server:

1 Open ArcMap or ArcGIS Pro and invoke the **HxGN EAM Synchronize Attributes** function from the HxGN EAM GIS integration toolbar.

2 Select the layer to be synchronized.

3 Click **View Discrepancies** to find the attribute discrepancies between HxGN EAM and GIS based on the data mappings. The results are populated in the grid.

Notes: No updates take place during this phase. The system runs a query and comparison of the values of all fields mapped between the two systems for the selected layer and where Action is flagged as Copy. The results are populated in the grid.

4 Click the **Details** tab to view the individual discrepancies for each record.

5 Once the user confirms the discrepancies, click **Synchronize Discrepancies** to correct discrepancies found for individual or all records.

Scheduling auto-synchronization of data in GIS

In GIS it is also possible to schedule the process to run automatically at a specific time.

When using the HxGN EAM toolbar for ArcMap:

1 Open ArcMap or ArcGIS Pro and invoke the **HxGN EAM Configuration** function from the HxGN EAM GIS integration toolbar.

2 Open the **Data Synchronization** tab. When a record is inserted here and enabled, it uses the task scheduler in Windows to schedule and run the specified synchronization task as a scheduled task.

Creating the tasks is a two-step process:

1. Select a layer and choose from among synchronization options for creating records, synchronization attributes or both. Once the layer's synchronization record is added to the grid, you will need to create the scheduled task for it.
2. Select the record in the grid and click **Schedule Task**. The Windows task scheduler opens and creates the task automatically. Windows may prompt to provide user credentials during the task creation.

Notes: When the HxGN EAM extension for ArcMap is used to schedule auto-sync tasks, each layer will have its own synchronization task. In this scenario, it is expected that there will be scheduled tasks for each layer.

Windows task scheduler requires administrator level access. To view or edit scheduled tasks, open the Windows task scheduler. Each layer will have its own synchronization task, so there will be scheduled tasks for each layer.

When using the HxGN EAM Add-In for ArcGIS Pro:

1 Open ArcGIS Prop and invoke the **HxGN EAM Configuration** function from the HxGN EAM GIS Add-In.

2 Open the **Data Synchronization** tab. For all enabled records that exist, the Add-In uses the Windows task scheduler to run the specified synchronization task as a scheduled task.

Creating the tasks is a two-step process:

a) Select a layer and choose from among synchronization options for creating records, synchronizing attributes or both. More than one layer may be configured.

b) Click **Schedule Task for All Layers** option. The Windows task scheduler opens and creates a single task for all configured layers automatically. Windows will prompt to provide user credentials (with administrator level access) during the task creation.

Notes: Only one single synchronization task is created by the HxGN EAM ArcGIS Pro Add-In for all configured layers, unlike the HxGN EAM extension for ArcMap, which creates individual scheduled tasks for each layer. If the Add-In detects one or more previously configured and enabled scheduled tasks related to single layer(s) (i.e., a task generated via the ArcMap toolbar); the task name(s) will be identified to the user so that they can be deleted from Windows Task Scheduler. It is recommended that all previously configured single layer scheduled tasks are deleted from Windows Task Scheduler if a new comprehensive task is to be used for auto-sync;

as any previously generated single layer scheduled tasks will continue run as scheduled (i.e. generating a comprehensive task does not automatically disable or delete existing single layer tasks).

If desired, the user may also disable the single scheduled task from within the HxGN EAM ArcGIS Pro Add-In, through use of the **Disable Task** option. This option is not available for users of the HxGN EAM toolbar for ArcMap.

Viewing synchronization log files

During the synchronization process for manual and auto sync, the system generates logs as text files that can be referenced in the following locations on the Windows machine where the GIS Integration Toolbar is installed:

- The toolbar directory in the installation path of the GIS .NET extensions.

  Example:

  C:\Program Files (x86)\Hexagon\Hexagon EAM GIS Extensions\toolbar
- Depending on the Windows version logs can also be found in one of the following locations:

  C:\Documents and Settings\>username>\%appdata%\Hexagon\Hexagon EAM GIS Extensions\8.4.0.0

  C:\users\>username>\%appdata%\Roaming\Hexagon\Hexagon EAM GIS Extensions\8.4.0.0

GIS Desktop — HxGN EAM toolbar functions

The HxGN EAM GIS extensions are .NET screens installed as an interactive toolbar in ArcMap or Add-In for ArcGIS Pro acting as an extension of the HxGN EAM application and giving limited functionality inside ArcMap or ArcGIS Pro. They are created especially for ArcGIS desktop GIS applications and are powered by HxGN EAM web services. These are the same web services used by the base HxGN EAM application so all its business rules and data integrity constraints will apply to data created and updated. They are released separately as HxGN EAM GIS Integration. Once installed, the toolbar function will not become active in ArcMap or ArcGIS Pro until at least one map layer is integrated, meaning at least one layer has the required GISOBJID column.

GIS > HxGN EAM Configuration screen

This function contains three tabs: User Details, Preferences, and Data Synchronization.

User Details tab

The User Details tab allows the user to enter HxGN EAM user information such as username, password, organization, and HxGN EAM URL.

This information is validated by web services and establishes the security for all other functions in the HxGN EAM extensions as it relates to creating and updating records in the HxGN EAM system. The HxGN EAM URL and tenant are also required and used not just for validating security but also as the access point for web service calls to the HxGN EAM application server.

Preferences tab

On the Preferences tab, the user can create and edit the user preferences that will be used to create HxGN EAM equipment from within the GIS system. These preferences are associations between GIS map layers and HxGN EAM profiles that allow equipment to be automatically created in HxGN EAM from the GIS system. Note that the auto-create checkbox is used to determine if the user will be prompted to enter/modify asset information from GIS when creating an HxGN EAM equipment or if this will happen automatically behind the scenes.

Data Synchronization tab

This tab allows for scheduling automatic synchronization of data in GIS layers for options available within the HxGN GIS extensions such as creating records in either system or synchronization their mapped attributes. When a record is inserted here and enabled, it uses the task scheduler in Windows to schedule and run the task at the scheduled time. Select a layer and choose synchronization options for creating records, synchronization attributes or both. Different options can be specified for each individual layer. Once the record is added to the grid, select it again and choose Schedule Task to invoke the Windows task scheduler. Windows may ask for credentials for creating the task. Note Windows task scheduler requires administrator level access.

HxGN EAM Help

This function opens the Help feature. Help is provided for each function in the toolbar.

HxGN EAM Create Equipment

Select one or more records in a layer that are not integrated with HxGN EAM (no GISOBJID) and click HxGN EAM Create Equipment icon. The selected equipment will be created in HxGN EAM and any mapped fields with source as GIS or BOTH will also be populated on the new equipment record. The GISOBJID will be populated in the feature’s layer table and match the corresponding GIS object

ID on the equipment record in HxGN EAM. At least one preference must exist for the layer and be set to auto-create. The system will display a popup showing the results of creating the corresponding equipment. If errors occur, they will display in the popup for each failed record.

HxGN EAM Create Work Order

Select one or more equipment records in a map layer and select HxGN EAM Create Work Order. User is presented with a form to create a work order in HxGN EAM for the selected records. The form is based on the Create Work Order popup screen in HxGN EAM and has limited functionality. The form is designed for work order creation only. You cannot view any existing work order information from this form. You may enter activities, comments and populate custom fields associated with the class of the work order record. No data is saved until the work order is submitted. When the information is submitted the system will use web services to create this new work order in the HxGN EAM application, then return a success or failure message to the user in the GIS application. Additionally, the information on associated tabs will be processed and saved against the newly created work order. Some error conditions existing on tabs will be presented by the system when the work order is submitted since there is no storage for the screen.

HxGN EAM Events

Select one or more equipment records in a map layer and select HxGN EAM Events to view work orders and other events in the HxGN EAM system for the selected equipment. A popup opens to display a split list view grid with the selected equipment in the top grid and its corresponding events in the lower grid. Limited sorting and filter options are available. This is a view only popup grid.

HxGN EAM Map Feature Attributes

Note: The use of the term mapping in this document refers only to the exercise of defining the relationship between GIS and HxGN EAM attributes also referred to as data mapping.

This screen allows administrators to set up field mappings between GIS attributes for a given layer and HxGN EAM equipment field attributes. Even though the entry point for this function is not from the HxGN EAM application, the storage for the mappings is in the HxGN EAM database.

The GIS attribute lookup shows the list of fields available in the table of the selected layer. For this lookup field aliases are supported. The HxGN EAM Attribute lookup shows a list of fields in the HxGN EAM equipment table for which the user has permission including user defined fields, custom fields, and comments. If the boiler text for a user defined field has been changed in the HxGN EAM system, these aliases are not displayed in this lookup. You may link GIS related attributes to equipment attributes, including equipment user defined fields custom fields and comments. Since some attributes “are seen as” strictly maintenance related while other data may need to reside in both systems, users can choose whether this data is copied or moved to HxGN EAM and vice versa. Note that if custom fields or comments are used in field mappings these should be limited to a small number, perhaps 10 or less. Mapping too many custom fields can significantly slow synchronization performance.

These mapping will be used by the system, whenever features are created in GIS, to create the corresponding equipment automatically in HxGN EAM as well as when equipment is created in EAM to create corresponding features in GIS. The mapping function supports the use of hard coded values as well as concatenated sequenced values being pushed to HxGN EAM records. This allows more than one GIS attribute to be mapped to a single HxGN EAM attribute. When this mapping is used to create equipment, the values for each of the GIS attributes will be concatenated into a single HxGN EAM attribute.

However, the system enforces certain rules to maintain the integrity of the data in both systems. The following are mapping rules that will be enforced by the system when the record is submitted. If a rule is violated at submit time, the system will display the appropriate error message.

- Do not allow duplicate GIS Attributes or HxGN EAM Attributes for multiple records that have different Owners.
- If the Source field is ‘GIS’ or ‘Both,’ do not allow HxGN EAM Attribute, and Sequence to be duplicated for multiple records.
- If the Source field is ‘HxGN EAM’ or ‘Both,’ do not allow GIS Attribute, and Sequence to be duplicated for multiple records.
- If the Source is ‘HxGN EAM’ or ‘Both,’ do not allow HxGN EAM Attribute and Sequence to be duplicated for multiple records.
- If Source = ‘GIS’ or ‘Both,’ do not allow GIS Attribute and Sequence to be duplicated for multiple records.
- Do not allow Source, GIS Attribute or GIS Value, HxGN EAM Attribute or HxGN EAM Value to be duplicated for multiple records. Note that in addition to this scenario, if all the fields above match, except Source, and at least one of the matching records has its Source as ‘Both’ then these records will be considered duplicates as well.

See the Mapping data types section of this document for additional information.

Note: The HxGN EAM Add-In for ArcGIS Pro also provides the ability to export and import attribute mappings. Users may select the ‘Export Attributes’ option to save a file containing a list of field mapping records previously defined for a given layer; and may select the ‘Import Attributes’ option to load any previously saved field mappings.

HxGN EAM Synchronize Records

This function contains two tabs: HxGN EAM and GIS.

HxGN EAM tab

Compare GIS features with HxGN EAM equipment to provide a list of GIS Features that cannot be found within HxGN EAM. The list will display in the grid. The user will have the ability to immediately correct the discrepancies found or save them for correction at another time. All selected features will be created as equipment in HxGN EAM and any mapped fields with Source as GIS or BOTH will also be populated on the new equipment record. The GISOBJID will be populated in the feature's layer table and match the corresponding GIS object ID on the equipment record in HxGN EAM. If the GISOBJID already exists for a feature, the equipment created in HxGN EAM will be created with a matching GISOBJID. The system will display the results for each record in the grid. If errors occur, they will display for each failed record.

GIS tab

Compare GIS features and HxGN EAM equipment to provide a list of HxGN EAM equipment that cannot be found within the GIS application. The list will display in the grid. Note that the system will search all integrated layers for the equipment not just the layer selected. The user will have the ability to immediately correct the discrepancies found or save them for correction at another time. All selected equipment will be created as features in GIS and any mapped fields with source as HxGN EAM or BOTH will also be populated on the new feature record. The GISOBJID will be populated in the feature's layer table and match the corresponding GIS object ID on the equipment record in EAM. The location of the feature of the map will be determined from the X and Y coordinates in HxGN EAM if it exists or the user can use the record function to click a point on the map within Arc Map to populate the correct X and Y coordinates for the new feature. If using multiple maps functionality in HxGN EAM, the feature will be created in the user's default map if one exists, or a map can be specified by updating the map field in the grid for each feature. The system will display the results for each record in the grid. If errors occur, they will display for each failed record.

HxGN EAM Synchronize Attributes

This function contains two tabs: Synchronize Attributes and Details.

Synchronize Attributes tab

This function allows the user to compare and correct attribute discrepancies between integrated equipment/features in HxGN EAM and GIS layers based on the data mappings. There are two steps to the process. First, use View Discrepancies to find the attribute discrepancies meeting the selection criteria for the layer. No updates take place during this phase as the system only does a query and comparison of the values of all fields mapped between the two systems, for the selected Layer, and where Action is flagged as ‘Copy.’ The results are populated in the grid. To see the individual discrepancies for each record, click the Details tab. Once the user confirms the discrepancies click Synchronize Discrepancies to correct discrepancies found for all records via batch processing. The attribute values for all selected records will be updated in either HxGN EAM or GIS automatically based on the Owner for each attribute mapping. See the *Map Feature Attributes* section. The system will display the synchronization results for each record in the grid. If errors occur, they will display for each failed record.

Details tab

The details tab is for reviewing the individual attributes discrepancies on a feature-by-feature basis after running View Discrepancies from the Synchronize Attributes tab to populate the grid. The user can review only one feature/equipment record at a time from this tab. If while reviewing the user finds that the owner value of one or more fields should be changed then a new owner value can be entered for the record. If the user enters a New Owner Value for the attribute, the system will update the attribute value in both HxGN EAM and GIS with the New Owner Value.

HxGN EAM Data Filter

This function contains two tabs: Criteria and Results.

This tool provides the ability to highlight integrated features on the map that meet both the defined GIS and HxGN EAM filter criteria on the screen. Both HxGN EAM and GIS Criteria can be saved. Once the features are highlighted on the map the user can go to the Results tab to view HxGN EAM data related to the selected HxGN EAM Grid and the integrated equipment highlighted on the map. From the Results tab, data can be saved to a flat file or as a layer in the current GIS map. If the data is saved as a GIS layer, the existing tools within the GIS product can be used to perform analysis across both the geo-spatial attributes of the feature within GIS and tabular data within HxGN EAM. These results can then be displayed on a map. You may choose to enter only GIS filter criteria and have the system select the GIS features that meet these criteria on the map. In this case, no related HxGN EAM data can be displayed on the Results tab. In addition, the user may wish to enter only HxGN EAM filter criteria and have the system retrieve the selected HxGN EAM data. No features will be highlighted on the map when no GIS criterion is entered. The HxGN EAM data on the Results tab that can be viewed and saved must exist within one of the following grids:

- Grid - Equipment (BEGEQ)
- Grid - Work order and related equipment details (BEGWEQ)
- Grid -Work order and related activity details (BEGWAC)
- Grid - Equipment and related event details (BEGEQE)

- Grid - Equipment and related cost details (BEGEQC)

To query data in these grids, define Interface Permissions for the grids for the user group. This is done in HxGN EAM in the User Group screen, Interface Permissions tab. Permission can be granted for only the grids needed by the user. If the user does not have query permissions to the grid, then the Grid will not be available in the dropdown. Note that the user must have query rights in Interface Permissions to the selected grid and organization privileges to the record returned from the filter to see the record(s) on the Results tab.

Note: The buttons calling the toolbar functions will not be active until at least one map layer is integrated.

See the *HxGN EAM GIS User Guide* for more information on configuring and using these functions.

ArcGIS Pro — HxGN EAM Add-In functions

The same 'toolbar' functions described in section *"GIS Desktop — HxGN EAM toolbar functions"* are also provided through an Add-In for the ArcGIS Pro application; with exceptions as noted below.

Exceptions

The following additional options are available for the ArcGIS Pro Add-In:

- View Log Files
- Dark Mode Support

The following are not available, or are different as described, for the ArcGIS Pro Add-In:

- Create Equipment
- Create Work Order
- View Events
- User Configuration > Preferences tab
- GIS Filter

HxGN EAM application — GIS functions

EAM > Map Search screen

This is the main entry point for a GIS user in the HxGN EAM system. A GIS user typically navigates to the GIS Map Search screen to enter geographical search criteria. For example, a street address could be entered with the purpose of having the system retrieve and display the appropriate map, the street address and all equipment located within the search area. By default, the search area is limited to a single layer but by enabling the Advanced Search function, the search can be expanded to include multiple layers in the results. The user then has the option to refine the equipment displayed in the grid by choosing filter criteria. The user can filter by either GIS criteria, HxGN EAM criteria or both. The GIS filter shows a list of fields in the GIS layer table for the current active layer. Field aliases in GIS are not supported here. The non-alias field name will display in the list of fields. The Dataspy gives a range of filter options for HxGN EAM data.

Once the equipment in the grid is filtered sufficiently and the desired record set is displayed, use the toolbar functions at the bottom of the screen to interact with the equipment on the GIS map in various ways. Zoom in/out or pan to change the map view. In addition, the user may invoke the Select By Rectangle tool to select a specific area on the map and by relationship the assets shown in the equipment grid. The Select By tool shapes such as circle, rectangle, and line are available when using this tool. Other functions available in the map search screens are the abilities to view a smaller overview map showing a high level perspective, view the address nearest equipment shown on the map, measure the distance between points on the map, make sketches on the map, identify other features of interest on the map and change the display of layers on the map by setting them to display or not. Using the Visible Layers map control, map layers can be enabled or disabled as needed. These preferences are then saved and tracked per user. This gives control of layer visibility depending on the job function or preference of each individual user.

Once the user has selected the intended equipment in the grid, a range of other options is available. The user can create a work order for that equipment or create and schedule route work orders for a group of equipment located in a certain area. The system will link the map (including mark ups made by measuring, sketching, etc.) to the work order and it can be printed along with work order. In addition, the user can print the map using the print icon in the map area. The option to schedule labor for GIS work orders is also available here.

EAM > Call Center screen

The Call Center is the central form used by 311 personnel or facilities management call takers to handle incoming customer requests. From the Call Center, the user can search a GIS map to retrieve equipment for a customer request or work order. The screen design dictates that the user interacts with the map in the following ways when the Perform Map Search icon is clicked:

- If an Equipment is specified, the map opens to show that equipment

- If a Work Address is specified, the map opens to show that work address
- If no Work Address or equipment is specified, the map opens to show the default map for the user based on the value of the GISMAPS install parameter.

Once the call-takers identify the equipment record(s) of interest on the map, they can select the equipment in the grid for return to the Call Center record. They can also view work orders related to searched equipment and schedule these work orders from this screen. The functionality of this screen is like the GIS Map Search described earlier and, in most cases, has similar behavior. However, please note that these screens are not intended to be exact duplicates since the verticals that may be using the two screens have different business processes.

Key details differentiate the Call Center map from its GIS Map Search counterpart. The Call Center setup screen allows the system administrator to utilize check boxes for the following options determine if the option(s) will be available on the map search pop-up called from the Call Center. Note that once enabled these options function the same on the Call Center map as they do on the GIS Map Search, but permissions defined here apply only to the Call Center map:

- Highlight on Map
- Identify Features
- Show Children
- View Nearest Address
- Schedule WOs

GIS Attributes tab

On the GIS Attributes tab of the Call Center Setup screen, the Call Center Administrator can select polygon layer attributes to be displayed on the main contact center form. These attributes are information based only on the customer's address. Examples include Council Representative, Garbage Pickup Day, Schools, or other general information. These fields can be displayed on the contact center form as soon as an address is selected, reducing the need to search for commonly requested information.

The user may assign an Alias to each attribute. The attribute names in GIS are normally codes, which may not be suitable for display on the contact center form. If supplied, the alias will be used as a field name on the contact center.

EAM > GIS Map WO Dispatching

See the *GIS Map WO Dispatching* brief for details.

EAM > Equipment and Work Order screens > View GIS Map pop-up

On the HxGN EAM equipment and work order screens the user can invoke a popup map from the selected record to view the equipment or work order equipment location on a GIS map pop. This can be accomplished via a button or right-click option from the individual equipment or work order record. A limited number of map options are available in this popup including panning, zooming, measuring, sketching, viewing nearest address, marking map layers for display, and printing. Mark ups can be saved, and the updated map associated with the equipment record. This map can also be associated work orders for the equipment and printed along with the work order.

View GIS Map popup from Work Order and Equipment screens

In addition to view map functionality, the HxGN EAM equipment screen offers the ability to perform a map search from the equipment record. If the user clicks Perform Map Search icon in the GIS Details section of the equipment record, the system calls the GIS Map Search screen as a popup.

Full GIS Map Search functionality is available from this popup.

Identify Features

On HxGN EAM equipment screens, a button/right-click option invokes the View GIS Attributes popup for integrated equipment. The system retrieves attribute names and their values from the GIS server for the GIS feature associated to the current equipment and displays them in a list on this popup. Note this is the same popup as Identify Features from GIS Map Search screen.

ESRI Roads and Highways Extension

If you have the ESRI Roads and Highways Extension for managing linear assets such as transportation and/or other transit systems, then additional capabilities are available as part of this integration:

1. Ability to create work orders for linear assets using a map interface.
2. Ability to export (i.e., synchronize) work orders for linear assets into the GIS for map display.

Creating linear work orders from the map

Use the **Select Equipment From Map** button/right-click option on the Work Orders screen to efficiently create work orders when linear asset networks are involved. When selected, the system will display a map popup that allows the user to select 1 or more equipment, including partial linear equipment, for inclusion on the work order.

This popup can be opened when the work order is in insert mode so that equipment can be selected from the map. Once equipment is selected from the map the popup can be closed and the equipment will be returned to the work order record view. From here the user can continue to enter data on the work order prior to saving.

If the work order Equipment is populated, prior to opening the popup, the map will pan/zoom to the proper extent to show the entered equipment. The equipment selection process can start from there. If no Equipment is entered the map will open to its full extent.

When Submit is clicked inside the popup the system will retrieve the selected equipment (or segments if defined in GIS – see new parameter below) to the work order record view, overwriting the existing value if only 1 equipment is selected; Else, all selected equipment will be returned to the Equipment tab for the WO (i.e. multiple equipment work orders are created).

This popup contains the following unique capabilities:

- A tracing tool (i.e., Select By Trace) can be used to define starting and ending points of linear equipment which need work. This tool easily allows users to identify the start of the work at a specified location on 1 linear equipment then jump off onto another linear equipment and continue the 'trace' until the work end point. The traced path is highlighted and relevant equipment, along with their selected From Point and To Point will be returned to the work order. The 'trace' tool is just one method of selection. Other, more familiar, selection tools are also included.
    - The trace tool will 'snap' to features by default as your cursor nears them making selection more efficient; however, if you wish to disable 'snapping' temporarily during selection then click and hold the Ctrl key (Command key on Mac) on your keyboard during the tracing process.
- Select By Rectangle, Select By Polygon, and the Select By Freehand Polygon tools can be used to define the area of the map whose integrated equipment will be highlighted. In addition, the selection area of these tools bisects a linear asset then only that portion of the linear asset contained within the selection will be highlighted.
- Select By Point tool can be used to select one or more point equipment on the map. In addition, the user can click at a point along a linear asset to identify that point on the asset as the work location (i.e., point work order).
- Each linear equipment that is highlighted on the map using any of the tools provided will have the From Point and To Point displayed on the map in terms of the selected Reference System. For example, the From Point and To Point can be displayed in feet if this is a defined reference system for the map. However, if the map contains a second reference system, such as mileposts, the user can change the Reference System to display the From Point and To Point in terms of mileposts (i.e., ability to translate measures from one reference system to another).

Notes:

- Because this pop-up is primarily intended for customers who maintain linear asset, all maps for display here must be LRS (linear reference system) enabled i.e. The ESRI Roads and Highways extension is required to create these maps.
- This popup supports multiple maps so the user can use any of the maps for which they have access in EAM.
- Visible Layers popup – each layer can be marked as selectable. Only equipment in 'selectable' layers will be highlighted, displayed in the equipment grid, and returned to the work order.
- If the popup is opened in update mode, the system will not highlight equipment that is currently on the work order as the popup is primarily intended to be used in creating the work order.

However, the system will attempt to zoom/pan to an extent that shows all current equipment on the work order. The user can make a new selection. Any equipment selected in the popup will always be added to the existing equipment on the Equipment tab for Work Order. There is no option inside the popup to remove existing equipment prior to adding new equipment to the work order.

- Several new parameters have been created for use on this popup:
  - GISLRSWO: Defines whether the linear equipment (i.e., GIS routes) are returned to the work order or if segments are returned to the work order. This parameter value can be specified for each map in a multiple maps environment.
  - GISLRSSL: Defines LRS event layer that contains linear asset segments. These segments must be integrated to EAM equipment to be eligible for retrieval to the work order. This parameter value can be specified for each map in a multiple maps environment.
  - GISLRSMM: Determines if a 2nd map can be displayed inside the popup. The 2nd map will be displayed simultaneously next to the primary map. This parameter value is only used if the existing GISMAPS parameter is set to Organization or Department.

Exporting work orders to GIS

One of the powerful features of the Roads and Highways extension, and more specifically, a linear referencing system is the ability to locate events (or characteristics) along linear assets. Examples of these events/characteristics are speed limit, grade, pavement thickness. These events as they are known in GIS can be linear in nature or they can exist at a single point along a linear asset.

Just as with any normal feature class the GIS can display these events on the map so a user can visually see where they are along linear assets.

If you think about it an EAM work order is an event that occurs along/on the linear asset. Therefore, if can get these work orders into the GIS then the GIS can display them geographically. This is possible using the tools available on the HxGN EAM Toolbar discussed elsewhere in this document.

Synchronizing (exporting) EAM work orders into a GIS event layer is a 4-step process:

1. Create 2 event layers in the GIS (one linear based and one point based) to hold linear work orders from EAM.
2. Create 2 UDGs (user defined grids) in EAM that define the work order fields and 'where clause' for the work orders for linear assets that will be exported. Define one UDG for point work orders (From Point and To Point are populated with the same value) and the other for linear work orders (From Point and To Point are populated with different values).
   - The GIS WO Attribute Mapping Grid checkbox must be selected on the UDG record view.
   - The EAM WO code field must be included in the UDGs and must be mapped into a GIS event attribute field (see Data Synchronization section below for more details).
3. HxGN EAM Toolbar | Linear Referencing tab for HxGN EAM Configuration screen - Specify the LRS enabled map service URL in which the event layers exist. This should be the REST endpoint for the map service.

4. HxGN EAM Toolbar | Map Feature Attributes screen – Once the LRS map service URL is populated on the Linear Referencing tab of the HxGN EAM Configuration screen then the administrator can use the Map Feature Attributes screen to map EAM work order fields (i.e., fields from the UDGs discussed above) into GIS event layer attributes. Select Type = Work Orders and the UDG from which to map the EAM fields. The HxGN EAM Grid field will display these grids for selection.
    - It is not necessary to add the GISOBJID column to event layers so they can be mapped to an EAM work order UDG.
    - When mapping EAM work order fields to events the ‘Owner’ must be ‘EAM.’
5. HxGN EAM Toolbar > Data Synchronization tab for HxGN EAM Configuration screen - Once the LRS map service URL is populated on the Linear Referencing tab of the HxGN EAM Configuration screen there will be 2 additional checkboxes available here: Create WO events and Synchronize WO events. Create WO events must be selected to export EAM work orders into GIS. Synchronize WO events must be selected if the system should periodically try to keep the mapped GIS event attribute data in sync with the EAM UDG data.
    - Exporting EAM work orders into the GIS and synchronizing the data on a periodic basic can only be done using the auto-sync process (i.e., Synchronize Record and Synchronize Attributes screens cannot be used for this purpose).
    - This is a one-way process i.e., data flows from EAM to GIS. It does not flow from GIS to EAM.

ArcGIS Utility Network support

Some users of the HxGN EAM GIS integration, particularly those which manage utility and infrastructure systems (such as electric, gas, water, and telecommunications networks) may also have implemented the Esri ArcGIS Utility Network data model. The ArcGIS Utility Network (UN) uses GIS services to support visualization, analysis and editing of utility network data. Examples of map layers that might be included in a utility network include (but are not limited to) lines like pipes, wires, and cables; point features such as transformers, valves, and meters; or structures like poles, vaults and manholes.

There are various pre-requisites (established by Esri) that are associated with this optional GIS configuration. Several of these that are particularly noteworthy include the following: 1) the Utility Network requires ArcGIS Pro be used as the desktop GIS client (i.e. ArcMap may not be used with the UN); 2) that the organization's ArcGIS Server be federated with Portal for ArcGIS; and 3) that the utility network data be registered as branch versioned.

For additional details about the ArcGIS Utility Networks; see the following link:
https://pro.arcgis.com/en/pro-app/3.3/help/data/utility-network/what-is-a-utility-network-.htm
https://pro.arcgis.com/en/pro-app/3.3/help/data/utility-network/create-a-utility-network.htm
https://pro.arcgis.com/en/pro-app/latest/help/data/utility-network/faq.htm

It is also important to recognize that an ArcGIS Utility Network is accessed through a combination of services (of several different types) and service extensions that together support utility network workflows. These include:

- Map service (REST endpoint as …/MapServer)
- Feature service (REST endpoint as …/FeatureServer)
- Utility Network service (REST endpoint as …/UtilityNetworkServer)
- Network diagram service (REST endpoint as …/NetworkDiagramServer)
- Version Management service (REST endpoint as …/VersionManagementServer)

Of the above items, there are **two** which are relevant for and supported by the HxGN EAM GIS integration currently; that is, the map service; and the feature service.

Using the HxGN EAM GIS integration with ArcGIS Utility Network services

If the ArcGIS Utility Network is used in your organization; the HxGN EAM GIS integration may be used to create and synchronize integrated EAM equipment records and attributes of GIS features.

When using the integration with Utility Network-enabled GIS services; it should be recognized that all GIS features to be integrated will be accessed through feature service layers based on a portal connection. That is, when using the HxGN EAM Add-In in ArcGIS Pro, the map layers are added to the map **not** from an enterprise geodatabase/*.sde connection; but instead from a feature service connection.

Note: The data source for a layer can be confirmed by right-clicking a layer in the Contents pane, selecting Properties, and viewing the Source tab).

See the following link for additional details about adding feature service layers to an https://pro.arcgis.com/en/pro-app/3.4/help/editing/add-a-feature-service-for-editing.htm

With the above exception, configuration of the HxGN EAM GIS integration is performed in a similar manner, just as when working with GIS data that is not utility network-enabled.

In ArcGIS Pro:

- For all layers that are intended to be synchronized with EAM equipment records; the GISOBJID and UPDATE_COUNT fields must be present in each layer's attribute table. See the *Configuring GIS* section earlier in this brief for additional information about how these fields are used by the integration.
- On the Map Feature Attributes tab; field mappings are required for each layer that is to be synchronized. Once these are configured, the Synchronize Records and Synchronize Attributes options can be used to create and synchronize integrated equipment records and attributes. Auto-sync scheduled tasks may be configured as desired. Refer to the *Synchronizing data* section earlier in this brief.

In the EAM base application:

- The GISSERV install parameter should be set as the map service REST endpoint; to support display & search capabilities on the GIS Map Search screen & map-based popups in EAM.
- When configuring maps for EAM mobile applications, such as Digital Work and Mobile Offline, the MOBGMAP install parameter should be set to the feature service REST endpoint; to support creation & editing of GIS features in the mobile Map View screens.
  See the related brief, *HxGN EAM Mobile Offline Configuring GIS Map View* for additional details about configuring GIS features in both Digital Work and Mobile Offline applications.

Display of ArcGIS Utility Network data in EAM

The following differences may be observed in the HxGN EAM GIS integration, when interacting with utility network-enabled map layers as compared to those that are not:

1. **Legend**

   The legend displayed for map-based screens and popups in base EAM and for the mobile applications is expected to include one or more additional layers when working with utility network-enabled data. These may include layers such as Structure Boundary; Service Territory; Validation Errors; Junction & Edge Objects & Dirty Areas. These additional layers support advanced utility network capabilities for GIS users only; and are automatically added to both map and feature services when the ArcGIS Utility Network is published. Note that these layer(s) can be viewed; but the user cannot create new features (i.e. they are ‘calculated’; updated based upon changes to the network features), nor would it be necessary to synchronize features of these layers.

Appendix

Unsupported Functionalities

The following functionalities are not supported in the EAM-GIS integration in these configurations:

1 Associating Map as a Document Attachment to Work Orders. Map documents will not be associated to work orders, and no error will be displayed, as described in all places below if EITHER of the following are TRUE:

   a Windows Authentication (IWA) or OAUTH authentication (OAUTH2) are being used.

   b EAM is hosted (i.e., cloud-based) and GIS is on-prem.

   a. If the equipment has the **Link GIS Map to WO** check box selected on the **View GIS Map** pop up window, a map will not be attached to subsequent work orders when generated/created from the following areas:
      i. Work Requests
      ii. Release Individual PM Work Orders
      iii. Equipment tab for PM Schedules
      iv. Meter Readings
      v. Equipment tab for Maintenance Patterns
      vi. Inspection tab for Work Orders
      vii. Generate WOs
      viii. Results tab for Monitored Data
      ix. PM Schedule tab for equipment
      x. Work Orders
      xi. Call Center > Perform Map Search – Associate Map menu item will be hidden.
      xii. GIS Map Search > GIS Filter dataspy – value field LOV. LOV trigger will be hidden.
      xiii. GIS Map Search > System will not prompt the user to attach the map document:
         1. Create Quick WO
         2. Create Route/Route WO
         3. Create WO

2 The following web service scenarios are not supported if Windows Authentication (IWA) or OAUTH authentication (OAUTH2) are being used:

   a. Validation against the layer on the following screens will not take place.
      i. Call Center Setup > GIS Attributes
      ii. User Groups > GIS Preferences
      iii. Service Code > Layers

b. .NET toolbar installed in the ArcGIS Desktop product. If an LRS service is available on the **Linear Referencing tab** of the **HxGN EAM Configuration** screen on the toolbar, it will not work because the toolbar cannot perform Windows authentication or OAUTH authentication.
c. In general, any EAM webservice request that attempts to connect to the map service (or LRS service) then it will not work with Windows Authentication or OAUTH authentication.