Section 7 - HRSD Building Information Model (BIM) Requirements

I. Introduction

A. Preface

This document presents HRSD's BIM Requirements with a focus on Revit. These requirements and associated Revit template set a minimum standard to establish consistency throughout projects. This document provides guidance on setting up and executing a project using Revit.

These requirements shall be used in conjunction with each project specific BIM Execution Plan. The BIM Execution Plan includes project specific planning including team members and roles, software, and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project specific LOD requirements, etc. It shall be set up by the project BIM lead in close coordination with the HRSD project manager and consultant project manager.

B. Overview

This manual will serve as an HRSD style guide for the use of Revit BIM software and define the practice common to all drawings produced for HRSD projects. This manual is intended to be used alongside HRSD, the project template, and the shared parameter file.

II. Level of Development (LOD) Tables

The following LOD (Level of Development) tables are based on the AIA Level of Development definitions. These tables shall be used in conjunction with the project BIM Execution Plan to coordinate BIM model development with individual project goals and milestones. These tables provide general LOD outlines and may not fully represent individual project requirements or specific mentions of required components. The designer shall use his/her best judgment, based on these tables and coordination with the project team, to meet project goals and/or milestones outlined in the Project BIM Execution Plan. All components in a specific discipline model shall be represented at similar LOD, and special care must be taken when importing models from third parties (vendor websites). These models are often detailed to a much higher level than content created by the modeling standards established in this document. Refer to Family Creation Requirements - Paragraph VII for more information.

The LOD definitions below are written to dictate the production of individual model elements (mechanical equipment, walls, framing, etc.) represented within discipline project model files. These definitions contribute the project file as a whole but are not an indication of project milestones. Refer to Paragraph II, Section A for information about the level of development of project model files at various project milestones.

Basic LOD Definitions	
LOD 100	LOD 100 elements are schematic representations (linework and/or basic masses) of large equipment and structure elements. LOD 100 elements represent the approximate maximum size, quantity, orientation, and relative location to other elements, but not necessarily their actual shape. LOD 100 elements are generally used to develop preliminary layouts. Any information gathered from LOD 100 model elements must be considered approximate.
LOD 200	Model element satisfies LOD 100 requirements. Model element is recognizable as the component it represents. Models may be represented as volumes or space reservations for component appurtenances, such as piping, conduit, cable tray, fastening, or support devices, etc. Non-graphical information (data parameters) may be attached to model element. LOD 200 models are generally used to refine layouts further. Any information gathered from LOD 200 model elements must be considered approximate.
LOD 300	Model element satisfies LOD 200 and lower requirements. Model element represents accurate size, location, orientation, and count of specified/proposed equipment. This information can be obtained directly from the element without the need to refer to non-model elements such as annotations, dimensions, or notes. <u>LOD 300 model requirements as it pertains to the creation of HRSD contract drawings:</u> • The model element should be easily identifiable from any view when placed on a contract drawing at a scale of 1/4”=1’-0” and printed half size (11”x17”). • No part of the model should print as an unidentifiable black mass. • No part of the real-world object, represented by the model, that does not contribute to the easy identification of the model should be represented, i.e., nuts, bolts, heat sinks, dials, etc. • Model contains IFC data parameters established in HRSD template when applicable. • Model includes non-graphical information required for the population of tags, tables, and other annotation elements.
LOD 350	Model element satisfies LOD 300 and lower requirements. Model element contains elements necessary for connections and coordination with other attached or nearby model elements. <u>LOD 350 model requirements as it pertains to the creation of HRSD contract drawings:</u> • All LOD 300 requirements and elements necessary for connection to other objects. Pipe, duct, electrical connectors, etc.

LOD 400	Model element satisfies LOD 350 and lower requirements. Model element contains detailed components sufficient for fabrication and assembly. <u>LOD 400 model requirements as it pertains to the creation of HRSD contract drawings:</u> • These models would be used for the fabrication of equipment and building components and would contain more information than necessary to produce contract drawings. • Models developed to this LOD are beyond the scope of HRSD project work.
LOD 500	Model satisfies LOD 400 requirements. Model incorporates field verified measurements. <u>LOD 500 model requirements as it pertains to the creation of HRSD contract drawings:</u> • Models developed to this LOD are beyond the scope of HRSD project work.

A. Model and Contract Drawing Content by Project Milestone

The following tables outline the content required for various project milestones. These milestones offer basic guidelines and may not address the requirements of all projects. It is the responsibility of the design team and the HRSD project manager to determine the development of project models and contract drawings to suit the needs of individual projects. Project specific LOD requirements shall be defined in the project BIM Execution Plan.

Process Mechanical

Project Milestone	**Project Milestone Requirements**

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major process mechanical equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: large containment vessels (tanks, bins, etc.), pumps, centrifuges, screens, etc.
	• Layout dimensions and equipment orientations are approximate and may change upon further model development

Process Mechanical

Project Milestone	Project Milestone Requirements

PER Final	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and processes. All process equipment represented at PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed process mechanical items.
	  o If existing process mechanical model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary process mechanical equipment:
	  o Layout of process mechanical equipment shall accurately represent size, quantity, shape, and location.
	  o Process mechanical equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed
	  ▪ When multiple manufacturers are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.
	  o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage
	  o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.
	• Preliminary process mechanical piping, fittings, and accessories:
	  o Process flow conveying piping 3” diameter and greater, valves, fittings and pipe accessories sized per process engineer’s calculations
	  o Layout of process mechanical piping equipment shall accurately represent size, quantity, shape, and location
	  o Accurate dimensional, piping system, pipe size and pipe elevation data can be pulled from the model for production of contract drawings
	
	Contract drawings include:
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections

Process Mechanical

Project Milestone	Project Milestone Requirements
	○ Refer to Paragraph IX Section F for general information about plans and sections • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. ○ Size, system abbreviation and centerline elevation (CL) for all process flow conveying piping ○ Descriptive tags of valves and pipe accessories, i.e., “8” BUTTERFLY VALVE” ○ Descriptive text relating to process mechanical equipment, i.e., “POLYMER TRANSFER PUMP” ○ Overall dimensions of rooms and/or tank and channel dimensions ○ Elevations of all major floors
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Further development of process mechanical piping: ○ Ancillary piping and associated valves and fittings not conveying process flow ○ Ancillary pipe accessories represented (Dismantling joints, expansion couplings, flushing connections, sample ports, etc.) ○ Small diameter piping 1” - 3” diameter and all associated fittings and valves ○ Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements • Instrumentation associated with all represented equipment: ○ This would mostly apply to instrumentation items that require power, i.e., temperature elements and transmitters, flow elements and transmitters, level sensors and transmitters, etc. ○ Instrument designation and description can be pulled from model elements • Additional process mechanical equipment not represented in PER documents • Further refinement of process mechanical equipment and piping layout representing further design • Chemical storage and distribution systems including but not limited to bulk chemical storage tanks, day tanks, metering pumps, skid mounted

Process Mechanical

Project Milestone	Project Milestone Requirements
	make-up units, major supply and distribution piping, and associated valves • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in PER documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Additional section and plan views, if additional plan views are necessary, generally at a larger scale than those present in PER drawings further detailing design • Dimensions of major pipe penetrations, pipe headers and equipment • Standard details and standard detail callouts • Additional callouts of any additional equipment, piping, or pipe accessories • Instrumentation tags for all process mechanical equipment (pumps, motor operated valves, sensors, etc.) that require power • Descriptive tags relating to instrumentation elements
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels and local control stations located and coordinated with Electrical and Instrumentation • Seal water assemblies located if applicable • Pipe supports, to the extent specified by the project BIM Execution Plan, but in particular, supports for pipe systems that experience substantial force due to expansion and contraction during operation • Further refinement of process mechanical equipment and piping layout as well as any related equipment representing further design. • Further refinement of chemical storage and distribution systems, associated piping and valves • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text • Details of unique process mechanical equipment, equipment configurations or equipment connections • Detailed notes dictating the specifics of construction that may not be clearly represented graphically

Process Mechanical

Project Milestone	Project Milestone Requirements

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Final routing of all process piping 1" diameter and greater with all necessary pipe accessories, fittings, and valves
	  o Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements
	• Final placement of process mechanical equipment developed to LOD 350
	• All process mechanical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD process mechanical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).
	• Accurate representations of proposed process mechanical equipment, piping, valves, and pipe accessories developed to LOD 350
	• Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline
	• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping

Process Mechanical

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements modeled to as-built size, type and location
	  ○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.).
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed which may differ from the proposed model and drawings
	• Model reflects all changes made to proposed process mechanical design during construction
	• All Process Mechanical equipment models include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  ○ All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping
	• Dimensions and annotation modified to reflect as-built conditions

Structural Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major structural elements represented at LOD 100 or 200
	  o Major structural elements include but are not limited to: wall, floor slabs, columns and column grids, etc.
	
	Layout dimensions, element sizes and orientations are approximate and may change upon further model development.

PER Final	Structural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic structural layout. All structural elements represented for the PER and beyond shall be modeled to LOD 300.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o If existing structural model exists, there is no need to remove or hide content for the sake of consistency.
	• Major load bearing walls and floors sized based standard practice
	• Major structural framing based on standard practice
	  o Any column grids associated with preliminary columns
	• Conceptual layout of access stairs and platforms with any framing that may impact accessibility to equipment or equipment areas
	  o Framing that does not meet that criteria does not need to be modeled.
	  o Input from structural engineer may be required
	• Equipment pads under all present equipment as required
	• Openings for any required equipment access
	• Grated openings and access hatches/doors
	
	Drawings include:

Structural Model

Project Milestone	Project Milestone Requirements

	Consult HRSD project manager regarding the inclusion of structural drawings for the Final PER.
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Overall, out-to-out dimensions
	• Interior-to-interior dimensions of spaces
	  o Thicknesses of walls and floors is not required at this stage
	• Dimensions between column grids and from grids to walls where applicable
	• Elevations of all major floors shown in sections with spot elevations shown in plan only when elevations cannot be called out in sections

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Major load bearing walls and floors updated to reflect structural engineer's calculations
	• Minor framing sized per design engineer's calculations
	  o Platform framing and other minor supports
	• Foundation elements:
	  o Spread footings, slab turn downs, trench and sump builddowns, etc.
	• Roof support systems:
	  o Precast panels, metal decking, metal decking with concrete, trusses, bar joists, embedded grating seats, etc.
	• Expansion joints in concrete where required
	• Inter-discipline coordination and conflict resolution (clash detection)
	
	Contract drawings include:
	
	• All requirements defined in the PER Final milestone and those defined in this section
	• Updates to any annotation present in the PER documents reflecting model changes, if applicable
	• Additional dimensions indicating thicknesses of structural elements
	• Plans and sections:
	  o Plans (overall and enlarged when required)

Structural Model

Project Milestone	Project Milestone Requirements
	○ Overall sections ○ Partial sections detailing elements not clearly detailed in overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Standard details and standard detail callouts • General structural notes
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present and modeled to LOD 300 • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings include: • Updates to any annotation present in 50% documents reflecting model changes. ○ All structural elements dimensioned or otherwise located • Structural framing elevations if applicable • Rebar sizes and spacing represented on drawings • Framing connection details • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present, sized per the structural engineer's final calculations, and modeled to LOD 300 • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all structural elements reflecting the design intent of the structural engineer
Substantial Completion	Model includes: • All discipline elements modeled to as-built size, type, and location.

Structural Model

Project Milestone	Project Milestone Requirements
	○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to other structural elements. ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition. • Any changes made to the proposed structural design during construction Contract drawings include: • Dimensions and annotation sufficient for the construction of all structural elements reflecting the as-built condition of the structure ○ Dimensions and annotation modified to reflect as-built conditions

Architectural Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major architectural elements represented at LOD 100 or 200
	  o Major architectural elements include but are not limited to: masonry walls (interior and exterior), roofs, doors, etc.
	
	Layout dimensions, element sizes and orientations are approximate and may change upon further model development.

PER Final	Architectural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic architectural layout. All architectural elements represented for the PER and beyond shall be modeled to LOD 300.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o If existing architectural model exists and is developed beyond current milestone, there is no need to remove or hide content for the sake of consistency.
	• Major walls sized based on standard practice
	  o Wall construction materials can be assumed to be standard masonry or actual material where known at this milestone
	• Preliminary architectural items
	  o Basic doors representing proposed size and type
	  o Basic roofs representing shape and type
	• Rooms with associated room names
	• Egress and code requirements
	
	Drawings include:

Architectural Model

Project Milestone	Project Milestone Requirements

	Consult HRSD project manager regarding the inclusion of architectural drawings for the Final PER.
	
	• Plans, Elevations, and Sections:
	  o Plans (overall and enlarged when required)
	  o Overall Elevations
	  o Overall Building Sections
	  o Refer to Paragraph IX Section F for general information about plans, elevations and sections.
	• Overall, out-to-out dimensions
	• Interior-to-interior dimensions of spaces
	  o Thicknesses of walls and floors is not required at this stage
	• Room names
	• Simple descriptions of visible architectural items

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Walls
	  o Size and composition updated to reflect architect's input
	• Doors
	  o Type and size updated to reflect architect's input
	• Ceiling Systems
	• Casework and built-in items
	• Finish and Opening Schedules
	• Life safety data including maximum travel distances, adequate exits, fire rated walls, and appropriate fire warning systems per local building code
	• Door properties entered as BIM data
	• Window and louver properties entered as BIM data
	
	Contract drawings include:
	
	• Updates to any annotation present in PER documents reflecting model changes, if applicable
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Partial sections detailing elements not clearly detailed in overall sections

Architectural Model

Project Milestone	Project Milestone Requirements
	○ Refer to Paragraph IX Section F for general information about plans and sections. • Casework and built-in items identified and detailed on drawings • Standard details and standard detail callouts • Room and opening schedules to define all finishes and materials
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • All exterior and interior wall materials updated to reflect architect's design intent • Ceiling systems updated • Roof drainage system • Toilet accessories • Furniture • ADA compliant building components • Room finish data updated • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings include: • Updates to any annotation present in 50% documents reflecting model changes • Schedules for architectural components populated by BIM data • Wall sections • Ceiling system identified and detailed • Roof, wall, and other architectural details • Interior elevations • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • All walls, ceilings, and roofs modeled to LOD 300 • All doors, windows, casework, and additional architectural items modeled to LOD 350 • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer

Architectural Model

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements shall be modeled to as-built size, type, and location.
	  ○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½".
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Any changes made to the proposed architectural design during construction
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer
	• Dimensions and annotation modified to reflect as-built conditions

HVAC Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major HVAC equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: condensing units, VAV boxes, air handling units, etc.
	
	Layout dimensions and equipment orientations are approximate and may change upon further model development.

PER Final	HVAC drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for the PER Final submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All HVAC equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed HVAC items.
	• If existing HVAC model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary HVAC equipment:
	  o Large HVAC equipment:
	  ▪ Air Handling units, Condensers, VAV Boxes, etc.
	  ▪ Pumps
	  o Layout of HVAC equipment shall accurately represent size, quantity, shape, and location.
	  o HVAC equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed.
	  ▪ When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.

HVAC Model

Project Milestone	Project Milestone Requirements
	○ Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage ○ Space allocations for small diameter piping and content related to other disciplines not shown: process mechanical piping, control panels, structural framing, etc. • Areas reserved for the future locations/routing of ductwork and HVAC equipment not shown in the HVAC model Drawings include: Consult HRSD project manager regarding the inclusion of HVAC drawings for the Final PER. • Plans and sections: ○ Plans (overall and enlarged when required) ○ Overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. ○ Basic descriptions of all HVAC equipment present in the model • Dimensions locating HVAC equipment relative to major structural or architectural walls
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Ductwork for supply and exhaust/return air • HVAC related piping 1" diameter and greater • Additional HVAC equipment: ○ Fans, unit heaters • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Plans and sections: ○ Plans (overall and enlarged when required) ○ Overall sections

HVAC Model

Project Milestone	Project Milestone Requirements
	○ Partial sections detailing elements not clearly detailed in overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Updates to any annotation present in PER documents reflecting model changes, if applicable • Descriptive tags of HVAC equipment and control equipment • Descriptive tags of HVAC ductwork including size and elevation • Size, system abbreviation and centerline elevation (CL) for all major piping • Standard details and standard detail callouts
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels located and coordinated with Electrical and Instrumentation • Duct and Pipe supports, to the extent specified by the project BIM Execution Plan, but, supports for pipe systems that experience substantial expansion and contraction during normal process, including Chilled and Hot Water • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes ○ Much of this should be automated if tags are used in lieu of simple text. • Details of unique HVAC equipment, equipment configurations or equipment connections • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • Final routing of all ductworks with all necessary fittings, control and distribution devices • Final placement of HVAC equipment modeled to LOD 350 • All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD ○ All equipment operations and maintenance data parameters are preloaded into the HRSD HVAC Revit template and will

HVAC Model

Project Milestone	Project Milestone Requirements
	automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly. o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt). • Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all HVAC equipment, ductwork, and piping
Substantial Completion	Model includes: • All discipline elements modeled to as-built size, type, and location. o All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.). o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition. • Model reflects specific equipment installed which may differ from the proposed model and drawings • Model reflects all changes made to proposed HVAC design during construction • All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD. o All operations and maintenance data parameters are populated with correct data as provided by contractor Contract drawings include: • Dimensions and annotation sufficient for the construction of HVAC equipment, ductwork, and piping o Dimensions and annotation modified to reflect as-built conditions

Plumbing Model

Project Milestone	Project Milestone Requirements
PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.

Plumbing Model

Project Milestone	Project Milestone Requirements

	Model includes:
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major plumbing equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: water heaters, sinks toilets, safety showers, etc.
	• Layout dimensions and equipment orientations are approximate and may change upon further model development

PER Final	Plumbing drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort at PER Final.
	
	The PER model and contract drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All plumbing fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed plumbing items.
	  o If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary plumbing fixtures and equipment:
	  o Large plumbing fixtures and equipment:
	  ▪ Sinks, toilets, safety showers, water heaters, etc.
	  o Layout of plumbing equipment shall accurately represent size, quantity, shape, and location
	  o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage
	  o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.
	
	Drawings include:
	
	Consult HRSD project manager regarding the inclusion of plumbing drawings for the Final PER.

Plumbing Model

Project Milestone	Project Milestone Requirements

	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible.
	  o Descriptive tags of plumbing fixtures and equipment

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Further development of plumbing fixtures, equipment, and piping:
	  o Piping 1/2" and greater diameter and all associated fittings and valves
	  o Final pipe size diameter representation requirements will vary by project. Consult with HRSD project manager for specific project requirements
	• Additional plumbing fixtures not represented in PER drawings
	• Inter-discipline coordination and conflict resolution (clash detection)
	
	Drawings Include:
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Partial sections detailing elements not clearly detailed in overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Updates to any annotation present in PER documents reflecting model changes, if applicable
	  o Much of this should be automated if tags are used in lieu of simple text.
	• Dimensions of major pipe penetrations and locations of fixtures
	• Standard details and standard detail callouts
	• Additional callouts of any additional fixtures and equipment, piping, or pipe accessories
	• Instrumentation tags for all plumbing equipment that require power

Plumbing Model

Project Milestone	Project Milestone Requirements
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Further refinement of plumbing fixtures, equipment, and piping layout as well as any related equipment representing further design • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Details of unique plumbing fixtures and equipment configurations or equipment connections. • Piping system riser diagrams • Detailed notes dictating the specifics of construction that may not be clearly represented graphically

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Final locations of plumbing fixtures and equipment
	• All process plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD plumbing Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).
	• Final routing of plumbing piping
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment, and piping

Plumbing Model

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements modeled to as-built size, type and location.
	  ○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.).
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed which may differ from the proposed model and drawings
	• Model reflects all changes made to proposed plumbing design during construction
	• All plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  ○ All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	• Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment, and piping.
	  ○ Dimensions and annotation modified to reflect as-built conditions

Electrical Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major electrical equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: generators and service entrance equipment, switchgear, switchboards, motor control centers and/or large motor controllers, etc.
	
	Layout dimensions and equipment orientations are approximate and may change upon further model development.

Final PER	Electrical model and drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort for the Final PER.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All electrical fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed electrical items.
	  o If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary electrical equipment:
	  o Layout of electrical equipment shall accurately represent size, quantity, shape, and location.
	  o Electrical equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed.
	  ▪ When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.

Electrical Model

Project Milestone	Project Milestone Requirements
	• Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage • Space considerations for placement of conduit and/or cable tray Drawings include: Consult HRSD project manager regarding the inclusion of electrical drawings for the Final PER. • Plans: o Plans (overall and enlarged when required) o Refer to Paragraph IX Section F for general information about plans • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. o Descriptive tags of electrical equipment
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Instrumentation and electrical equipment associated with electrical not included in PER model • Additional electrical equipment not in the PER • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Plans and sections: o Plans (overall and enlarged when required) o Overall sections o Partial sections detailing elements not clearly detailed in overall sections o Refer to Paragraph IX Section F for general information about plans and sections. • Updates to any annotation present in PER documents reflecting model changes, if applicable o Much of this should be automated if tags are used in lieu of simple text.

Electrical Model

Project Milestone	Project Milestone Requirements
	• Standard details and standard detail callouts • Additional callouts of any additional equipment • Instrumentation tags for all equipment (pumps, motor operated valves, sensors, etc.) that require power
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels and local control stations located and coordinated with all other required disciplines • Further refinement of electrical equipment layout as well as any related equipment representing further design • Lighting and other electrical fixtures • Inter-discipline coordination and conflict resolution (clash detection). • Conduit embedded in slabs and walls. Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Details of unique electrical equipment, equipment configurations or equipment connections. • Single line diagrams, panel schedules, riser diagrams, conduit and wire schedules lighting plans and other electrical equipment single lines

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Accurate representations of proposed electrical equipment developed to LOD 350
	• All applicable electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD electrical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).

Electrical Model

Project Milestone	Project Milestone Requirements
	• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all electrical equipment.

Substantial Completion	Model includes:
	
	• All discipline elements modeled to as-built size, type, and location.
	  o All elements shall be model to correct dimensions and positional accuracy to the nearest ½".
	  o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed which may differ from the proposed model and drawings
	• Model reflects all changes made to proposed electrical design during construction
	• All electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all electrical equipment
	• Dimensions and annotation modified to reflect as-built conditions

III. BIM Execution Plan

These requirements shall be used in conjunction with the project specific BIM Execution Plan. The BIM Execution Plan includes project specific planning including: team members and roles, software and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project LOD requirements, etc. and shall be set up by the project BIM lead in close coordination with the HRSD project manager.

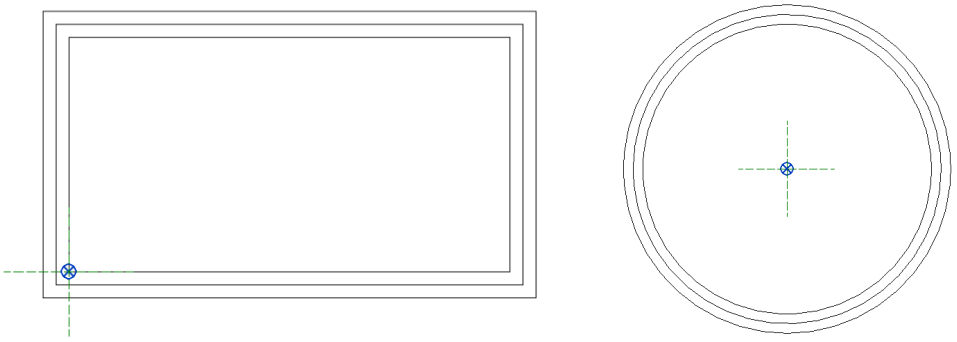
IV. Model File Creation

A. Project Templates

All HRSD project model files shall be created using HRSD's project template. Reference the BIM Execution Plan for software version requirements.

B. Orientation and Project Base Point

Project files should be modeled in the same orientation as they will be shown on contract drawing plan views. Refer to Paragraph IX Section F for more information on plan views. All project files shall be modeled such that the project base point is at the inside bottom left corner or the center of a round structure. The project base point shall be located at the finished floor elevation of the structure. The project base point must never be moved unclipped and should always be located at the project origin.



C. Revit Model Linking

All Revit models shall be linked origin to origin or by shared coordinates once shared coordinates have been established.

D. Level and Grids

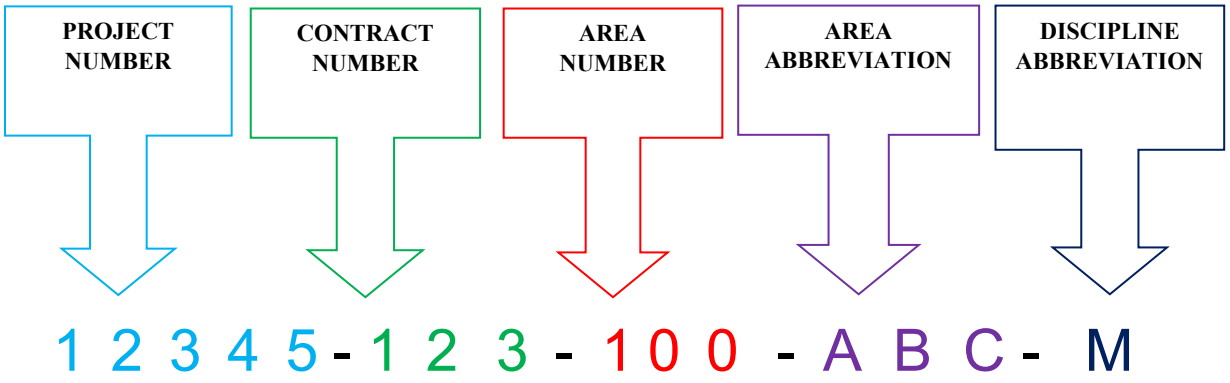
All column grids and levels associated with main floors shall be copy-monitored from the structural model.

E. Model Naming Convention

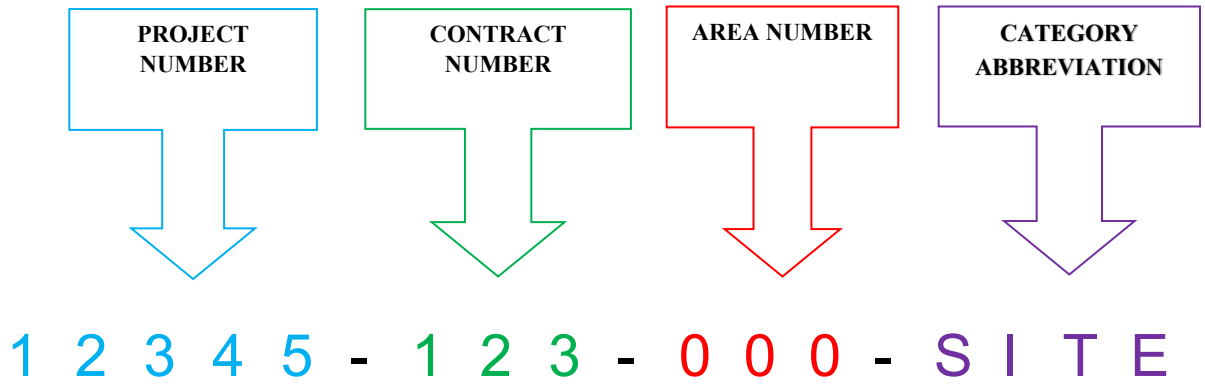
Project files names shall contain the project number, contract number, area number and category abbreviation. The “Area Number” and “Area Abbreviation” shall correspond area numbers established in the BIM Execution Plan. The following is an example of a project file name: 12345-123-100-ABC-M.rvt. In this example, the project number is “12345-123,” the area number is 100, the structure (area abbreviation) is a “ABC” and it is a Mechanical file “M” (See discipline abbreviation table below). Most Revit files should fall into one of the categories below.

Discipline Abbreviation Table	
Discipline Abbreviation	**Discipline**
C	Civil/Site
M	Process Mechanical
S	Structural
A	Architectural
H	HVAC
P	Plumbing
FP	Fire Protection
E	Electrical
I	Instrumentation

SINGLE DISCIPLINE MODEL



SITE PLANS



V. Shared Coordinates

A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier in the project life cycle per the directions specified in the Project BIM Execution Plan.

Care should be taken to ensure that all model geometry is within a 20-mile radius of the model's internal origin to ensure model accuracy. It should be noted that this requirement does not hold the location of a shared coordinate system to that 20-mile limit as this is related to the Virginia State Plane Coordinate System and is not model geometry.

A. State Plan Coordinate System

All project shared coordinates shall be based on North American Vertical Datum of 1988 (NAVD 88) and State Plane Coordinate System: VIRGINIA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NORTH AMERICAN DATUM 1983 (NAD 83) (1993) (U.S. FEET).

B. Federated Site Model

A federated site model (a single model containing all discipline models for all areas within the scope of the project linked as references) shall be created before the 50% submittal unless specified otherwise in the BIM Execution Plan. The federated site model shall include all linked files of all structures/processes for all disciplines. All discipline models shall be located per the established shared coordinate system.

VI. Family Creation

The HRSD template files contain general annotation and tags but do not contain equipment models. Equipment models created for project needs shall meet the criterial defined in this document and any criteria detailed in the Project BIM Execution Plan. All equipment families shall be created as the appropriate category type. Equipment families should never be categorized as "Generic Models" but rather as what they represent: "Mechanical Equipment", "Pipe Accessories", "Electrical Equipment", etc.

Families representing maintainable assets must be modeled in such a way that all independently maintainable assets within the family are also independently addressable. For example, a progressive cavity pump may have maintenance data requirements that differ from the electric motor attached to it. In such a case, the pump and attached motor would each need to be unique elements capable of hosting independent and different data. This is most easily accomplished by making individual maintainable assets within a family separate nested and "Shared" families.

A. Family Naming Convention

All families will be named using the following requirements:

1. Keep file names as short as possible.

2. All family names must be unique.

3. File names will use ‘title casing’.

4. When adding descriptors (e.g., “Plug Valve Flanged 4-12in”), consider the order of the descriptors and the order they will appear in the project browser. Descriptors that would appear in several similar families should be the first of the descriptors if there are more than one.

5. All family names shall adhere to the following format:

Functional Type-Subtype-Manufacturer-Descriptor1-Descriptor 2

Name Format Descriptions		
Component	**Required or optional**	**Description**
Functional Type	Required	Names the element that the part will represent. For example, MCC or Door.
Subtype	As needed	Names the part type, for example, “Flanged” on a flanged valve.
Manufacturer	As needed	Manufacturer information not necessary when dimensions are governed by an industry standard (ANSI) or when the family is a generic component.
Descriptor	As needed	Examples: Size ranges (4-12in), Material (PVC, Steel, etc.)

B. Family Level of Detail

To maintain consistency and drawing clarity families must be created using the following requirements:

1. Families shall be drawn with sufficient detail to clearly visually identify them from any view and will accurately represent overall size and key features of an object (LOD 300). Items too fine to be clearly represented when printed at a given drawing scale should not be included in a family. These items include but are not limited to bolts, buttons, hinges, etc. The inclusion of such items increases the time required to model a family without adding any needed clarity.

a. Simply put, a progressing cavity pump family should look like a progressing cavity pump when printed but should not print as an indistinct black blob on contract drawings.

2. Families should feature enough visual information to convey features that impact the design of the project. For example, access hatches or manways on equipment that must be clear from obstruction or lifting hooks that must align with a monorail.

3. Dimensions taken from manufacturers' literature should be rounded to the nearest minimum unit of measurement. See table below:

Minimum Units*	Examples
1/16"	Annotation symbols
1/4"	Small diameter pipe accessories (1" to 6"), Small equipment (occupying less than 2'-0"^{3})
1/2"	Pipe accessories greater than 6" diameter, medium size equipment (small pumps, small control panels...)
1"	Large equipment (large pumps, large equipment...)

Flanged pipe connections or any other connection size dictated by an industry standard should be drawn to the nearest .01" per the standard. This includes any connectors associated with a family of any size. Pipe fittings that adhere to an industry standard, ANSI, should be drawn to those dimensions.

VII. Shared Parameter File

The HRSD Shared Parameter file is provided as a repository for the IFC parameters present in the template as well as other standard parameters. It is not necessary for all parameters to be present in all families. The shared parameter file is provided simply to facilitate adding parameters to families as needed.

A. Shared Parameters in Models

Project needs may require the addition of shared parameters. Any project specific shared parameter file shall always start with the provided HRSD Shared Parameter file and all parameters unique to that project will be added to that file. The Project Shared Parameter file contains all family and project parameters as well as all standard HRSD parameters.

B. Shared Parameters, Equipment Data and Asset ID

The provided HRSD Shared Parameter file contains parameters relating to HRSD equipment record standards. These parameters must be included in all project files. These parameters are present in the HRSD template files

as well as the HRSD Shared Parameter.txt file. The parameters shall be applied to all equipment requiring regular maintenance. This will occur automatically, provided equipment is categorized properly and the appropriate HRSD template was used to create the project file. See paragraph VIII for more information.

All equipment requiring regular maintenance shall be assigned a unique asset ID. This asset ID shall match the asset ID found on the corresponding equipment data sheet. All data sheet information shall be applied to the corresponding equipment in the BIM model. Equipment data shall be applied to the completed as-built model prior to it being turned over to HRSD.

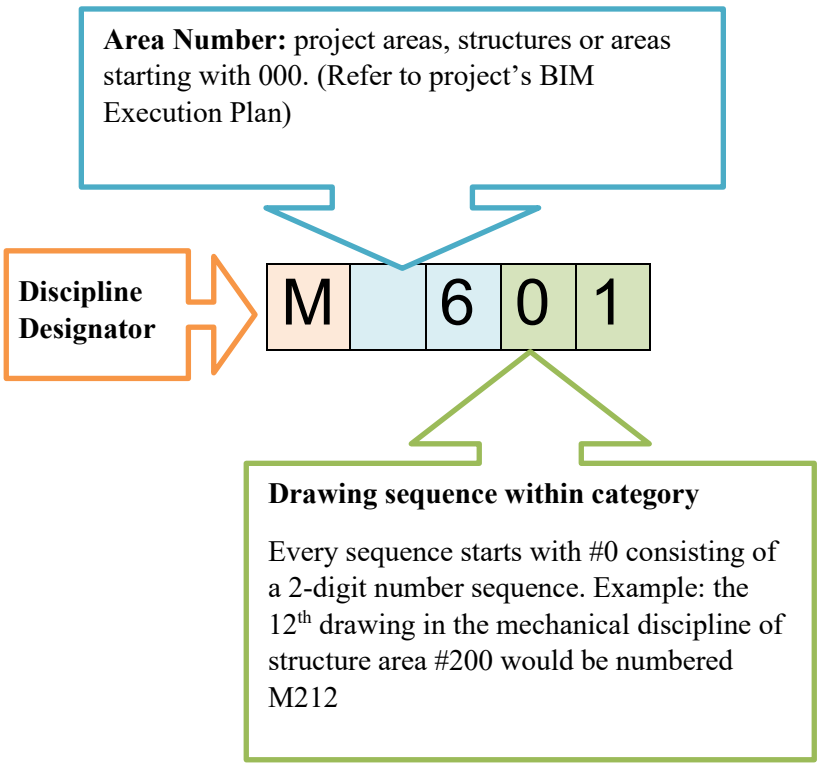
VIII. Contract Drawings

A. Sheet Size

All sheets created for HRSD shall be produced on ANSI D 22”x34” when printed full size.

B. Sheet Numbering

Sheets numbers shall consist of a discipline designator, an area number and a sequential individual sheet number as shown in the example below.



C. View Templates and Filters

View templates are predefined templates with view overrides in HRSD templates. View templates will be used in plans, section, tables, and detail views, to show consistency in all project drawings. With that in mind, understand that view templates will not do all the work for every element in every model; a good understanding of the graphic overrides that need to take place is a must. View templates should be used in all views. Presentation changes should be made in view templates, never in individual Visibility/Graphics Overrides on individual views.

A key portion of view templates are filters. Filters allow graphic overrides for elements that differ from the category in which it's modeled. Filters override elements based on different parameters, such as type name, family name, comments, etc. It is critical that all users familiarize themselves with information filters that are required to model elements properly. It is imperative that all modeling be consistent with the information that view filters require. When additional filters are required, filter names will use the following requirements:

1. All filter names must be unique.

2. Filter names will be case sensitive and use 'title casing'.

3. Keep filter names as short as possible.

D. Text and Labels

HRSD project template files contain all text styles needed for annotating drawings. All annotation shall be created using the text styles provided in the template. See the table below for text style names and uses:

HRSD Text Styles			
Text Style Name	**Actual Text Height**	**Text Font**	**Drawing Use**
HRSD-06pt	1/16"	Arial	Annotation on figures
HRSD-08pt	5/64"	Arial	Annotation on figures
HRSD-10pt	3/32"	Arial	General contract drawing text
HRSD-14pt	9/64"	Arial	Titles, room names…
HRSD-18pt	3/16"	Arial	Label text
HRSD-20pt	13/64"	Arial	Titles, tables…

All annotation shall be placed per the following requirements:

1. All leaders shall use a 15 Degree Filled Arrow

2. All text with leaders shall be left aligned with leaders coming from the top left or bottom right of text strings.

3. Labels shall be used wherever possible. “Dumb” text should only be used when the presented information cannot be pulled from the model element itself with the use of a label.

4. All labels shall adhere to the same requirements and properties as regular text.

E. Schedules

Schedules shall be created per the following requirements:

1. All tables or schedules shall use the HRSD-Schedule View Template.

2. All schedule or table data shall be generated from project BIM data when possible.

3. Unique parameters can be added for scheduling purposes. Refer to Paragraph VIII.

F. Plans, Sections and Details

Plan views presented on contract drawings shall be at a preferred scale of 1/4” = 1’-0” or 3/16” = 1’-0” if necessary. Larger structures may need to be displayed at larger scales to fit on standard ANSI D sheets. In this case, enlarged plans should be used in conjunction with overall plans. Overall plans may be displayed at the minimum scale necessary for them to fit on sheets. Plan views shall be orientated such that plan or true north point up or to the left. It is acceptable for plant or true north to point to the right when necessary. Plan views should never be oriented such that plan or true north point down the page. Use the HRSD Plan Viewport callout option when placing plan views on sheets.

All sections and details in the same project or drawing series (i.e. 100, 200, etc.) shall have unique letters (sections) or numbers (details). In other words, the mechanical drawing series for area 200 may contain sections: A, B, C, etc. and details: 1, 2, 3, etc. and the mechanical drawing series for area 300 may also contain sections: A, B, C, etc. and details: 1, 2, 3, etc., but these letters and numbers shall not repeat within a series. This rule only applies to a single discipline. For example, Architectural, Structural and Mechanical can all have a section “A” and a Detail “1” within the same drawing series. The sections and details only need to be unique per discipline and drawings series. Section letters “I” and “O” shall not be used because of their similar appearance to numbers “1” and “0.” If a drawing series exceeds the number of available letters for sections, it is correct to number sections “AA,” “BB,” etc. When sections are cut in a detail view, they are considered minor sections. Minor Sections shall be Section A-A, B-B, etc. The numbering is sheet dependent, meaning you can have a minor

section A-A on more than one sheet, but there cannot be two minor sections A-A on the same sheet.

Sections should be cut to the right or, when necessary, left. Sections should be cut looking up a page on a plan view. Sections should only be cut looking down a page only when required.

G. Drawing Submittal Format

All drawings shall be provided to HRSD as vector pdfs, printed directly to pdf, and not scanned. Drawings shall be printed full size (22x34in). Drawings shall be signed and sealed in accordance with the Commonwealth of Virginia DPOR requirements.

End of Section