Asset and Location Hierarchy

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Tyler Byrne – US Bureau of Reclamation Scott Stukel – Whites Elm Consulting



Goals/Strategies & Business Drivers – Asset Management

"the coordinated activity of an organisation to realize value from assets." - ISO 55000, 2014 (3.3.1)

- Improve maintenance/work efficiency to free up labor to do other things such as projects, focused improvements, and/or preventive/predictive reliability initiatives (through better work planning)
- 2. Ensure maintenance effectiveness, doing the right work and eliminating work that does not add value
- 3. Maximize lifecycle of assets/equipment
- 4. Enhance equipment reliability, availability, & maintainability
- 5. Optimize resources, materials, spare parts, and tools to support efficiency improvements and control operating costs
- 6. Enhance personnel skills, knowledge, ownership



Focus Areas/Notes from BOR Users/Sites

1. "Do Meaningful Maintenance"

- a. Performing the right work on assets/equipment for the right reason and eliminating those that don't necessarily add value.
- b. Optimizing equipment maintenance plans and sustainment strategies, utilizing the appropriate mix of planned, predictive, and run to failure
- c. Understanding and assigning asset criticality and priorities to help determine where to focus efforts and resources
- 2. "Have the right materials, spare parts, and tools at the right time to support efficient completion of work"
 - a. Establish Kitting process and having the right parts and tools when needed to do the job to eliminate waste and delays
 - b. Better Inventory Management with appropriate min/max levels, storage locations, knowing where to get parts, and better coordination for ordering and receiving
 - c. Availability and ready access to spare parts to help maintenance get them when needed

3. "Leverage and share information with other USBR sites"

- a. Maintenance history of shared & similar equipment
- b. PM/Sustainment Plans to better maintain assets
- c. Asset information, history, criticality, spare parts lists, etc.
- d. Training and skills development
 - i. Carma/Maximo
 - ii. Maintenance/work practices
 - iii. Support/materials management processes
- 4. "Implement improvements & enhancements to Carma to support USBR objectives and desired outcomes"
 - a. Work order data entry and required work tracking
 - b. Compliance PMS Track when things are due and when it was done. NERC CIP WECC
 - c. Standing work orders meetings, training, admin
 - d. Operator rounds, collecting information, CBM, meter based PMs
 - e. Mobile capability in the field





Asset Management, Simplified





Best Practices for Asset Management



Facility/Asset Inventory & Organization Hierarchies Walkdowns





Asset Criticality & Condition Assessments



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Asset Needs & Lifecycle Sustainment Plans Deferred Maintenance, Capital Improvements, Funding and Annual Work Plans

What facilities & assets do we have?

What condition are they in?

What maintenance and other work do they need?

3





What is an Asset?

"An asset is an item, thing or entity that has potential or actual value to an organisation". - ISO 55000, 2014 (3.2.1)

<u>Asset Criteria</u>: To determine if something is an asset, employ the following litmus test, if the answer to both questions is "yes" then it should be tracked as an asset and entered as an ASSET record in CARMA, the questions are,

- (1) it is a singular, specific physical object or entity, "It can be touched", i.e. a pump, motor, etc., **and**
- (2) USBR desires to have institutional information stored or tracked for it, i.e. property, value, lifecycle, cost, maintenance/sustainment strategy/PM, property, etc.



Asset Information – Recommended Asset Data

Primary Data Elements	Secondary Data Elements
 Unique Asset ID Standardized Description Location Asset Classification 	 Serial # Installation Date Expected Life/Expected End of Life Purchase Cost
 Failure Class Priority/Criticality Manufacturer Model 	 Total Cost YTD Cost Current Replacement Value Spare Parts List



Identified USBR Asset Classes

Source: CARMA 2.0 – IBM Maximo FACT Cohort Notes, Draft CARMA 2.0 Application Requirements

FIST Asset Priorities for Power Facilities (Asset Classes)

Equipment	Priority	Equipment	Priority	Equipment	Priority	Equipment	Priority
Air compressors	2	Communication	3	Hoists	2	Relay, auto transfer	3
Annunciator/sequence of	2	equipment		Hydraulic turbines	4	Relay, protective	4
events recorder		Control circuits	4	IT systems and	2	Relays	3
Arresters	3	Control circuits	3	hardware		Ropes, slings, chains and	4
Auxiliary piping systems	3	Cranes and hoists	4	Meters	3	rigging hardware	
Batteries	4	Electric gates and doors	2	Motor AC induction	3	SCADA systems	3
Battery charger	4	Elevators	2	Motor AC synchronous	3	Shaft couplings	2
Bearings	3	Emergency lighting	2	Motor vehicle and heavy	2	Shop fabricated lifting	1
Bushings	3	Exciters	3	equipment		devices and rigging	
Buswork, enclosures, and	3	Fire detection and alarm	3	Motors DC	3	hardware	
insulators		systems and CO ₂	0	Outlet pipes	4	Switch, disconnect manual	3
Circuit breaker switch	4	Gates and valves	4	Packing/mechanical seals	3	Switches, disconnect – medium and high voltage	4
Circuit brookers MCC	2	Generating units	4	Penstock and fixed	Δ	Transducers	3
Circuit breakers load	3	Generator, emergency	4	wheel gates	Т	Transformer station	4
circuit breakers, load	4	Generator, portable2Potheads and	3	service			
CO ₂ systems	3	Governors	4	stresscones		Transformers	4
	-	Guard gate	3	Power cables	4	Valve and outlet works	3
				Pumps	2	Voltage regulators	3



Identified USBR Asset Classes

Source: CARMA 2.0 – IBM Maximo FACT Cohort Notes, Draft CARMA 2.0 Application Requirements

Other Non-Power Asset Classes

Equipment	Priority
Bank Metal Pipe Corrugated 24" and other sizes	3
Bead filtration systems	3
Gate Electrical Plannles (Panels?)	3
Transfer Pumps	3
Holding Tanks	3
Radial Drum Gates	3
Valves PVC	3

Equipment	Priority
Cranes	4
Pumps	4
Slide Gates & Stop Log Bays	4
Motors for Hoists and Cranes,	4
Fish Screens, Fish Viewing Tanks, Fish	4
Ladders, Injector Air SEP in Fish Bldgs	
Hydromet system, Power Control Boxes,	4



Identified USBR Asset Classes

Asset Registry – Asset Classes (Non-Power?)

Asset Regisrty Asset Classes		
Boat Ramps	PCCP	
Bridges	Pumping Plants	
Buildings	Recreation	
Conveyance Lines	Reservoirs	
Conveyance Points	Roads & Parking Lots	
Dams	Trails	
Fish Structures	Transmission	
Hydropower	Urban Canals	
Land	Water Treatment	
Levees	Wells	



Hierarchy



The Maximo Asset & Location Hierarchy

DEFINITION: A Hierarchy is a structured, intuitive, way to organize your assets.

- The Location hierarchy is where asset management begins. It serves as the structural relationship of physical and functional placeholders necessary to logically organize assets.
- It is the <u>heart of implementing Asset Management Best Practices</u> as well as being the backbone of standards such as ISO-55001.
- No two location hierarchies are exactly the same, it is critical to develop a proper structure that meets the needs of the organization and implement asset & data management processes to support the ever changing hierarchy.



The Maximo Asset & Location Hierarchy

- The word "hierarchy" in Maximo is often used to refer to both the Location Hierarchy and the Equipment Hierarchy. It is important to understand that there are distinct differences. Both Locations and Assets play their part in effective asset management, and the organization of them is crucial.
- For modern asset management in Maximo the term **"asset hierarchy"** may be used to describe the **physical and functional fundamentally parent-child relationship of nodes built within the Location application.**
- Physical equipment becomes the mostly-flat Asset Registry which is managed in the Assets application. Assets can have sub-assemblies, but should not be linked more than two or three levels and definitely not entirely from highest to lowest level of major systems or to model the whole organization/enterprise.



Benefits of a well-developed Hierarchy

- To provide an intuitive, simple means of drilling down to locate assets that may be added to work orders and use for other Maximo functions.
- To provide the ability to track lifecycle costs for functional nodes where assets reside, also to allow costs to roll-up to any level in the structure.
- To enable use of other technologies such as GIS/GPS, process functional modelling, BIM, Predictive, AI, asset health monitoring, etc.

- To facilitate functional organization of systems, subsystems, assemblies to simplify reporting, reliability, RCM/sustainability analysis, and asset management continuous improvement.
- To facilitate organizing and grouping of nodes within an organization – which could be used to represent geographic, functional, or plant/operating systems.



Benefits of a well-developed Hierarchy

 To store key values such as GL Account, Priority, Criticality, and Failure Codes for the functional location.

Assets may require different cost accounts or other information depending on where they fall within the function of a system or systems. Entering this static data once on the location record enables coding to work orders when assets in that location are applied to them, thus minimizing typing by the end-user and extra time required to change that data on assets when assets are moved to another operating system/location. To enable leveraging of Maximo rotating asset capabilities. Since a location is "fixed in space" within the hierarchy structure it will always have cost and work history tied to it.

Since assets can be removed/returned with a new asset installed in its place, it is desirable to both maintain the integrity of all costs and history for a functional location for all assets that have ever been installed in it while allowing assets to carry their asset-specific costs and history with them to other locations. This concept is critical to assets which are rotating, or "move around" from one location/system to another location (repair location, storeroom, salvage, etc.).





Functional Location Structural Convention

Relates an asset with other assets within a functional process or system (independent of physical location)





Defining the USBR Asset & Location Hierarchy



Columbia-Pacific Missouri Basin Northwest 6 Region 5 Region 9 lorth Atlantic **Great Lakes** Appalachian Region_1 **California-Great Upper Colorado** Basin Basin Region 10 Region 7 Lower Colorado Basin Region 8 South Atlantic Mississippi Basin Gulf Arkansas-Rio Region 4 **Grande-Texas Gulf** Region 6



Each Region is a site under the USBR Organization:

- **California Great Basin** • (CGB)
- Columbia Pacific Northwest (CPN)
- Lower Colorado Basin (LCB)
- Missouri Basin and Arkansas-Rio Grande-Texas Gulf (MB)
- Upper Colorado Basin (UCB)



USBR Location/ Asset Hierarchy Model



OCATIONS





USBR Location Hierarchy – Power & Pump Generating Plant





— BUREAU OF — RECLAMATION



Generator	Unit XX Generator		Upper Bracket, Lower Bracket
Brakes And Jacking System (Generator)	Brakes And Jacking System	H	YDRAULIC JACKING PUMP / MOTOR, BRAKE R SUPPLY SOLIENOID VALVE, BRAKES 1-12
Generator Cooling Water System	Generator Cooling Water System	-	GENERATOR COOLERS (each), VALVES, STRAINER, INSTRUMENTATION, PUMPS
Excitation System (Generator)	Exciter (each)	RE((A)	Power System Stabilizer (PSS), VOLTAGE GULATOR, BRIDGE RECTIFIERS, BREAKER(C & DC), POWER POTENTIAL TRANSFORME AND RELAYS
			OLLECTOR (with required sub-assets Brush Rigging. Collector Ring)
Excitation System Protection (Generator)	Excitation System Protection	-	Relays, CT's, PT's
Generator Bearing System			
Upper Guide Bearing	Upper Guide Bearing	Coo	bling System, Filtration System, Shoes/Bearin Segments/Halves, Instrumentation
Lower Guide Bearing	Lower Guide Bearing	Coo	oling System, Filtration System, Shoes/Bearin Segments/Halves, Instrumentation
Thrust Bearing	Thrust Bearing	Coo	bling System, Filtration System, Shoes/Bearin Segments/Halves, Instrumentation
Thrust Bearing High Pressure Oil System	Thrust Bearing High Pressure Oil System	Н	eader, PUMP, MOTOR, Motor Starter, FILTER ASSEMBLY, STRAINER ASSEMBLY, Instrumentation, Control Panel, Valves
Stator	Stator	H	EATERS, Winding, Frame, Laminations/Core, utral Grounding Transformer, Neutral Resisto
Rotor	Rotor	S	pider, Field, Rim, Collector/Slip Rings, Poles
Fire Protection System (Generator)	Fire Protection System (Generator)	St	Piping/Nozzles/Flex Hoses, Valves, orage(Bottles/Tanks), Controls, ALARM UNIT, RELAYS, Compressors
Generator Protection System	Generator Protection System	-	Relays, CT's, PT's, OVERSPEED SWITCHES/ SPEED HEAD, TEMPERATURE DEVICES, IGHTNING/SURGE ARRESTORS, ROTATION/ CREEP DETECTOR
Governor System	Governor		
Governor System	Governor Governor Hydraulic System	Pun Hea Kid	np Units, Motors, Sumps; Filters/Filter Systen ters, Accumulator Tank, Piping, Servo Motors ney Loop, Main Valve, Other Valves, Restorin Cable, Dashpot
Governor System	Governor Hydraulic System Governor Controls	Pun Hea Kid	np Units, Motors, Sumps: Filters/Filter System ters, Accumulator Tank, Piping, Servo Motor ney Loop, Main Valve, Orher Valves, Restorin Cable, Dashpot Controls, Electrical
Governor System	Governor Hydraulic System Governor Controls	Pun Hea Kid	np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motors ney Loop, Main Valve, Other Valves, Restorin <u>Cable, Dashpot</u> Controls, Electrical
Governor System Turbine System Auto Greasing System (Turbine)	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System		np Units, Motors, Sumps, Filters/Filter System fers, Accumulator Tank, Piping, Servo Motors Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESUME REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine)	Governor Governor Controls Turbine Auto Greasing System Turbine Air Admission System	Pun Hea Kid	np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motors Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation Iping, Valves (each individual trackable/relief ive under here), Controls, BLOWER, MOTOR,
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Guide Bearing	Pun Hea Kid	np Units, Motors, Sumps, Filters/Filter System fers, Accumulator Tank, Piping, Servo Motors Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR, ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation ping, Valves (each individual trackable/relief ping, Valves, Controls, BLOWER, MOTOR, Compressors, Receivers(pressure vessels)
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System	Governor Governor Hydraulic System Governor Controls Turbine Auto Greesing System Turbine Air Admission System Turbine Guide Bearing Turbine Bearing Oil System	Pun Head Kid	np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motors Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, instrumentation iping, Valves (each individual trackable/relief Ne under here), Controls, BLOWER, MOTOR, Compressors, Receivers/pressure vessels) Instrumentation
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Guide Bearing Turbine Bearing Oil System HeadCover		np Units, Motors, Sumps; Filters/Filter System fers, Accumulator Tank, Piping, Servo Motor- ney Loop, Main Valve, Other Valves, Restorin Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASEMBLY, CONTROLLER MANIFOLD, Instrumentation Diracon Provided And Provided Acable/relief we under here), Controls, BLOWER, MOTOR, Compressors, Receivers(pressure vessels) Instrumentation Dir Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Bairing Oil System Headcover Turbine Runner		np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motor Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR Fill TER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation (CONTROLLER MANIFOLD, Instrumentation (Control, Electrical) instrumentation Dif Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Guide Bearing Turbine Bearing Oil System Headcover Turbine Runner Petton Wheel		np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motor Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR Fil.TER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation ping, Valves (each individual trackable/relief ve under here), Controls, BLOWER, MOTOR, Compressors, Receivers(pressure vessels) Instrumentation Dil Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Guide Bearing Turbine Bearing Oil System Headcover Headcover Pelton Wheel Shift Ring		np Units, Motors, Sumps; Filters/Filter System fers, Accumulator Tank, Piping, Servo Motor Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, instrumentation ping, Valves (each individual trackable/relief ve under here), Controls, BLOWER, MOTOR, Compressors, Receivers/pressure vessels) Instrumentation DI Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Bearing Oil System Headcover Headcover Bearing Shift Ring Wicket Gates		np Units, Motors, Sumps; Filters/Filter System fers, Accumulator Tank, Piping, Servo Motor, Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, instrumentation iping, Valves (each individual trackable/reliable) (CONTROLLER MANIFOLD, instrumentation Compressors, Receivers(pressure vessels) Instrumentation 201 Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box
Governor System Turbine System Auto Greasing System (Turbine) Air Admission System (Turbine) Turbine Guide Bearing Turbine Guide Bearing Oil System Turbine Components	Governor Governor Hydraulic System Governor Controls Turbine Auto Greasing System Turbine Air Admission System Turbine Bearing Oil System Headcover Furbine Runner Petton Wheel Shift Ring Wicket Gates Servo Gate Lock		np Units, Motors, Sumps; Filters/Filter System ters, Accumulator Tank, Piping, Servo Motors Cable, Dashpot Controls, Electrical Controls, Electrical Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation Iping, Valves (each individual trackable/relief ive under here), Controls, BLOWER, MOTOR, Compressors, Receivers(pressure vessels) Instrumentation DI Cooler, Pumps, Motors, filtration system, instrumentation, Piping Valve, Vent Valve, Shaft Seal/Packing Box

Other Battery Banks/Voltage Subsystems	Each Asset/System	Chargers, Batteries, Monitoring, Protection/Relays
Test Equipment & Shared Tools	Individual Equipment Assets	
Shop Equipment	Shop Equipment/Asset (each)	Lathe, Mill, Drill Press, Shear, Shaper, Surface Grinder, Welder, Plasma Table, Water Jet, CNC
Lube Oil System	Lube Oil System	Tanks, Pumps, Motors, Valves, Piping, Purifiers (Filter sets, Dehydrators, Centrifuges, etc)
Auto Greasing System	Auto Greasing System	Piping, Valves, Controls, Pump, AIR FILTER PRESSURE REGULATOR ASSEMBLY, CONTROLLER MANIFOLD, Instrumentation
Air Systems		
High Pressure Air Systems	High Pressure Air System	Compressor set, Motor, pump, controls, Dryer, Receiver(pressure vessels), Piping
Low Pressure Air Systems (Station Service Air)	Low Pressure Air System	Compressor set, Motor, pump, controls, Dryer, Receiver(pressure vessels), Piping
l	Brake Air System	Compressor set, Molor, pump, controls, Dryer, Receiver(pressure vessels), Piping
Cranes & Hois ts	Each Crane/Hoist	Motors, Gearbox, Drums, Cable, Block, Hook/Pick, Controls & Electrical
Domestic Water Systems		
Potable Water Systems	Potable Water System	Treatment system/Assets, Tanks, Pumps, Monitoring & Control System, Piping
Non-Potable Water Systems	Non-Potable Water System	Pumps, Piping, Valves, Monitoring & Control System
Sewage/Wastewater System	Sewage/Wastewater System	Pumps, Collection System/Assets, Treatment System/Assets, Piping
Drainage & Unwatering System	Drainage & Unwatering System	Sump, Pumps, Motors, Valves, Float Controls, Skimmers, Eductors, Piping
Security Systems	EACSS/Security Systems	Readers, Cameras, Controls & Processors, Workstations, Virtual Machines, Switches, Sensors, Annunciators, Locks, Digital Video Recorders, Servers



USBR Location Hierarchy – Dams, Dikes, & Levees



LOCATIONS







USBR Location Hierarchy – Buildings & Grounds



