



# Monthly Stakeholder Update Utilities Master Plan

April 25, 2023



DIVISION OF CAMPUS PLANNING,  
INFRASTRUCTURE, AND FACILITIES  
VIRGINIA TECH.

## 1 Status

## 2 Current Tasks

## 3 Upcoming Tasks

## 4 Schedule

## 5 NI&S/VTES Update

## 6 Action Items

# STATUS

Phase 1: Assess existing utility systems to meet current levels of services

- Engage utilities to capture and compile existing data
- Field investigate critical features and attributes
- Evaluate risk for current operations
- Identify operational/maintenance/capital options
- Existing conditions report for review



1 Status

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3 Upcoming Tasks

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## CURRENT TASKS

- Ongoing field investigation and data collection
  - Civil – sanitary sewer, water, stormwater
  - Thermal Distribution
  - Steam Condensate
  - Chilled Water
  - Telecom OSP
- Website content updated – dynamic site
- 1<sup>st</sup> Existing Conditions Workshops
  - VTES – Electrical distribution 4/10/23
  - NI&S - Telecom OSP – 4/21/23





# PROGRESS DASHBOARD

## Phase 1: Kickoff and Data Gathering

UMP Progress Dashboad	Kick Off	System/Ops Data			Condition Assesment		Capacity Assesment		Existing Conditions Report		
Thermal Generation	100%	<div><div></div></div>	50%	22	<div><div></div></div>	100%	104	0%	1	0%	1
Steam and Condensate Return	100%	<div><div></div></div>	33%	3	<div><div></div></div>	45%	269	0%	1	0%	1
Chilled Water Distribution	100%	<div><div></div></div>	67%	3	<div><div></div></div>	58%	250	0%	1	0%	1
Domestic Hot Water	100%	<div><div></div></div>	100%	1	<div><div></div></div>	40%	40	0%	1	0%	1
Electrical Distribution	100%	<div><div></div></div>	30%	10	<div><div></div></div>	100%	379	0%	1	0%	1
Telecom OSP	100%	<div><div></div></div>	100%	2	<div><div></div></div>	65%	252	0%	1	0%	1
Potable and Fire Protection	100%	<div><div></div></div>	25%	4	<div><div></div></div>	0%	45	0%	1	0%	1
Sanitary Sewer	100%	<div><div></div></div>	33%	3	<div><div></div></div>	61%	224	0%	1	0%	1
Stormwater	100%	<div><div></div></div>	33%	3	<div><div></div></div>	0%	451	0%	1	0%	1

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## UPCOMING TASKS

- Continue utility field investigations
- Coordinate VT GIS app for Stormwater systems
- VT GIS continued support of utility field investigations
- Asset Management framework with UMP
- Workshop for 5/2/23 at The Inn at Virginia Tech



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## SCHEDULE

- Civil utilities field investigations
- Coordinate VT GIS app for Stormwater systems
- Work shop May 2nd - Aligning the UMP with 2047 Beyond Boundaries and CAC Goals .



# May 2nd Workshop @ INN

**Theme:** Align Campus Utility Systems with the Beyond Boundaries Campus Plan & Sustainability goals set forth in Climate Action Commitment.

## Agenda

9:00 to 9:15 - Introductions and Background: Matt Stolte

9:15 to 10:00 - 2047 Campus Master Plan presentation: Liza Morris

10:00 to 10:10 - break

10:10 to 10:50 - Climate Action Commitment presentation: Mary-Ann Ibeziako

10:50 to 11:00 - break

11:00 to 12:00 - Working Group Q&A

## Event Information from The Inn at Virginia Tech

Date	Start Time	End Time	Event Name	Venue	AGR	Setup
5/2/2023	8:00 AM	10:00 AM	Refreshment Break	Upper Quad	55	Existing
5/2/2023	8:30 AM	10:00 AM	General Session	Solitude	55	Rounds
5/2/2023	9:30 AM	12:00 PM	Refreshment Break	Upper Quad	20	Existing
5/2/2023	10:00 AM	12:00 PM	Breakout	Duck Pond	20	U-Shape

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## VTES Conditions Workshop

- Identifying Main System Features & Attributes
- GIS Field Mapping tool increase dataset robust
- Developing priority ranking system
- Developing risk matrices for weighting three categories
  - Cosmetic grade
  - Structural grade
  - Electrical/mechanical grade





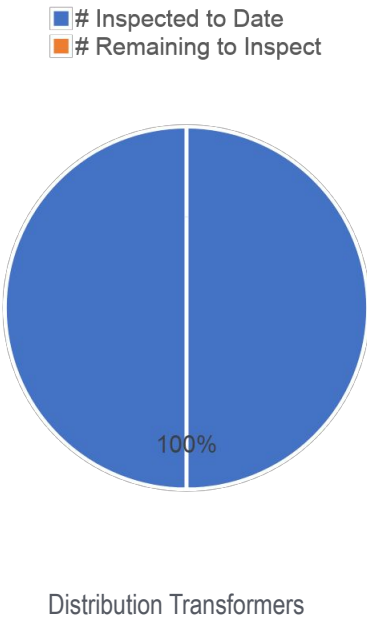
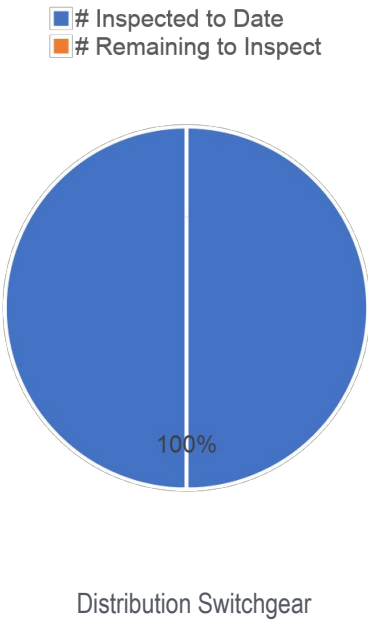
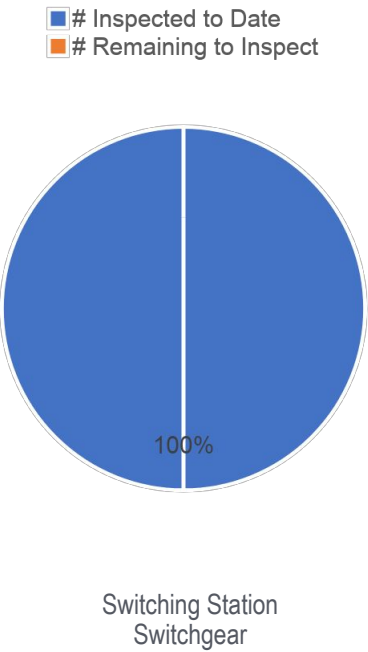


# UMP EXISTING CONDITIONS WORKSHOP - ELECTRICAL

April 10, 2023

# INSPECTION PROGRESS CHARTS

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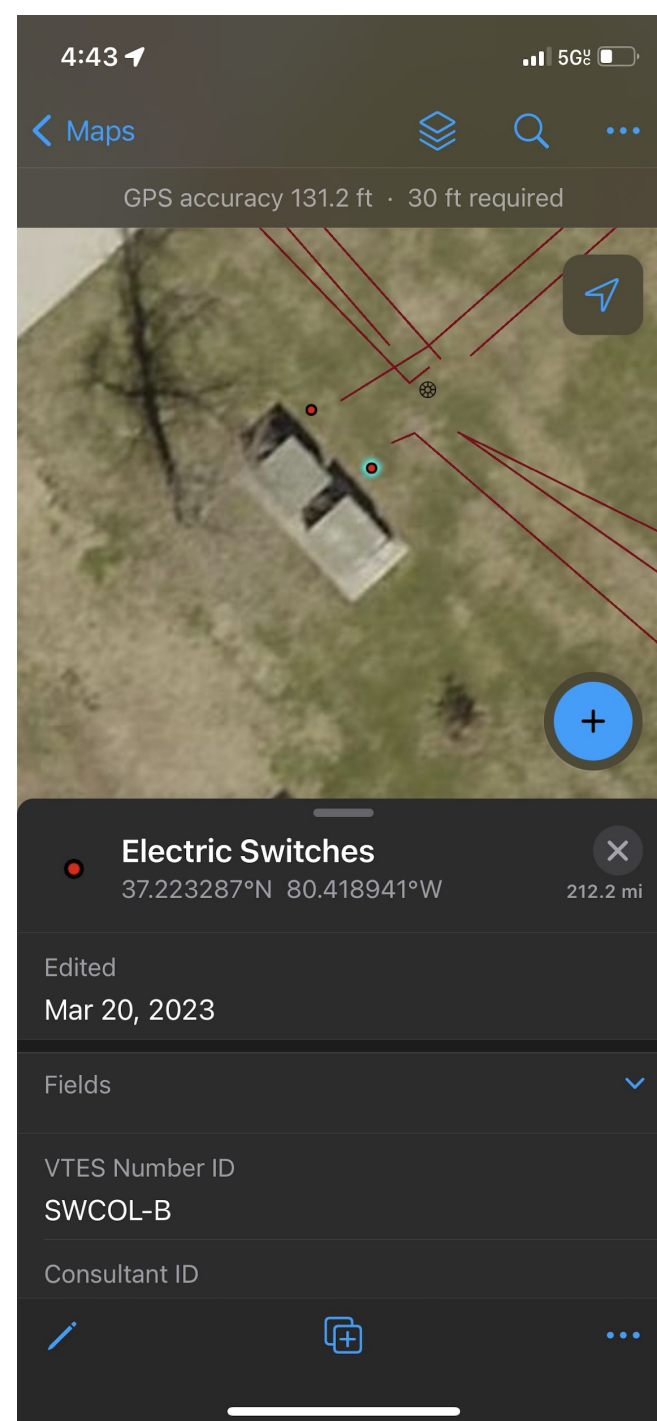
# SURVEY FORMS

SURVEY INFO		EXISTING CONDITIONS		COMPARTMENT 1		COMPARTMENT 2		COMPARTMENT 3		COMPARTMENT 4	
DESIGNATION:		EQUIPMENT GRADE:	<input checked="" type="checkbox"/>	CIRCUIT NAME:		CIRCUIT NAME:		CIRCUIT NAME:		CIRCUIT NAME:	
LOCATION:		EXTERIOR		SWITCH		SWITCH		SWITCH		SWITCH	
SURVEY BY:	<input checked="" type="checkbox"/>	PHYSICAL DAMAGE:	<input checked="" type="checkbox"/>	RATED AMPS:		RATED AMPS:		RATED AMPS:		RATED AMPS:	
SURVEY DATE:	<input checked="" type="checkbox"/>	RUST/DISCOLORATION:	<input checked="" type="checkbox"/>	MOM. ASYM:		MOM. ASYM:		MOM. ASYM:		MOM. ASYM:	
SWITCHGEAR		ANCHORAGE:	<input checked="" type="checkbox"/>	1-SEC RATING:		1-SEC RATING:		1-SEC RATING:		1-SEC RATING:	
MANUFACTURER:		ALIGNMENT:	<input checked="" type="checkbox"/>	MOTOR OPERATOR:	<input checked="" type="checkbox"/>	MOTOR OPERATOR:	<input checked="" type="checkbox"/>	MOTOR OPERATOR:	<input checked="" type="checkbox"/>	MOTOR OPERATOR:	<input checked="" type="checkbox"/>
CATALOG #:		PAD/WEEL MATERIAL:	<input checked="" type="checkbox"/>	VOLTAGE SENSORS:	<input checked="" type="checkbox"/>	VOLTAGE SENSORS:	<input checked="" type="checkbox"/>	VOLTAGE SENSORS:	<input checked="" type="checkbox"/>	VOLTAGE SENSORS:	<input checked="" type="checkbox"/>
TYPE:	<input checked="" type="checkbox"/>	FAULT INDICATOR:	<input checked="" type="checkbox"/>	FAULT INDICATOR:	<input checked="" type="checkbox"/>	FAULT INDICATOR:	<input checked="" type="checkbox"/>	FAULT INDICATOR:	<input checked="" type="checkbox"/>	FAULT INDICATOR:	<input checked="" type="checkbox"/>
MODEL #:		SURGE ARRESTERS:	<input checked="" type="checkbox"/>	SURGE ARRESTERS:	<input checked="" type="checkbox"/>	SURGE ARRESTERS:	<input checked="" type="checkbox"/>	SURGE ARRESTERS:	<input checked="" type="checkbox"/>	SURGE ARRESTERS:	<input checked="" type="checkbox"/>
SERIAL #:		PHYSICAL PROTECTION:	<input checked="" type="checkbox"/>	CT:	<input checked="" type="checkbox"/>	CT:	<input checked="" type="checkbox"/>	CT:	<input checked="" type="checkbox"/>	CT:	<input checked="" type="checkbox"/>
MANUFACTURE DATE:		INTERIOR		PHYSICAL CONDITION:		PHYSICAL CONDITION:		PHYSICAL CONDITION:		PHYSICAL CONDITION:	
RATED VOLTAGE:		WATER INGRESS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>
RATED BIL:		DIRT/WEEDS/RODENTS:	<input checked="" type="checkbox"/>	OPEN/CLOSED:	<input checked="" type="checkbox"/>	OPEN/CLOSED:	<input checked="" type="checkbox"/>	OPEN/CLOSED:	<input checked="" type="checkbox"/>	OPEN/CLOSED:	<input checked="" type="checkbox"/>
SC RATING:		INTERIOR CLEARANCES:	<input checked="" type="checkbox"/>	FUSE		FUSE		FUSE		FUSE	
CODE ISSUES		OIL/GAS LEVEL:	<input checked="" type="checkbox"/>	FUSE		FUSE		FUSE		FUSE	
DEPTH OF WORK SP:	<input checked="" type="checkbox"/>	CONNECTIONS PRESENT:	<input checked="" type="checkbox"/>	MANUFACTURER:	<input checked="" type="checkbox"/>	MANUFACTURER:	<input checked="" type="checkbox"/>	MANUFACTURER:	<input checked="" type="checkbox"/>	MANUFACTURER:	<input checked="" type="checkbox"/>
WIDTH OF WORK SP:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	TYPE / CATALOG #:	<input checked="" type="checkbox"/>	TYPE / CATALOG #:	<input checked="" type="checkbox"/>	TYPE / CATALOG #:	<input checked="" type="checkbox"/>	TYPE / CATALOG #:	<input checked="" type="checkbox"/>
HEIGHT OF WORK SP:	<input checked="" type="checkbox"/>	SOURCE TRANSFER CONTROLLER		RATED VOLTAGE:		RATED VOLTAGE:		RATED VOLTAGE:		RATED VOLTAGE:	
CLEAR SPACES:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>	RATED AMPS:	<input checked="" type="checkbox"/>	RATED AMPS:	<input checked="" type="checkbox"/>	RATED AMPS:	<input checked="" type="checkbox"/>	RATED AMPS:	<input checked="" type="checkbox"/>
ENTRANCE / EGRESS:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	MAX FUSE RATING:	<input checked="" type="checkbox"/>	MAX FUSE RATING:	<input checked="" type="checkbox"/>	MAX FUSE RATING:	<input checked="" type="checkbox"/>	MAX FUSE RATING:	<input checked="" type="checkbox"/>
ILLUMINATION:	<input checked="" type="checkbox"/>	INTERRUPT RATING:	<input checked="" type="checkbox"/>	INTERRUPT RATING:	<input checked="" type="checkbox"/>	INTERRUPT RATING:	<input checked="" type="checkbox"/>	INTERRUPT RATING:	<input checked="" type="checkbox"/>	INTERRUPT RATING:	<input checked="" type="checkbox"/>
		PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>
		BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>	BARRIERS:	<input checked="" type="checkbox"/>
		SCADA BOX PHOTO:	<input checked="" type="checkbox"/>	CONDUCTOR		CONDUCTOR		CONDUCTOR		CONDUCTOR	
SKETCH (IF NEEDED)		TYPE:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>
		VOLTAGE CLASS:	<input checked="" type="checkbox"/>	VOLTAGE CLASS:	<input checked="" type="checkbox"/>	VOLTAGE CLASS:	<input checked="" type="checkbox"/>	VOLTAGE CLASS:	<input checked="" type="checkbox"/>	VOLTAGE CLASS:	<input checked="" type="checkbox"/>
		SIZE:	<input checked="" type="checkbox"/>	SIZE:	<input checked="" type="checkbox"/>	SIZE:	<input checked="" type="checkbox"/>	SIZE:	<input checked="" type="checkbox"/>	SIZE:	<input checked="" type="checkbox"/>
		MATERIAL:	<input checked="" type="checkbox"/>	MATERIAL:	<input checked="" type="checkbox"/>	MATERIAL:	<input checked="" type="checkbox"/>	MATERIAL:	<input checked="" type="checkbox"/>	MATERIAL:	<input checked="" type="checkbox"/>
		INSULATION:	<input checked="" type="checkbox"/>	INSULATION:	<input checked="" type="checkbox"/>	INSULATION:	<input checked="" type="checkbox"/>	INSULATION:	<input checked="" type="checkbox"/>	INSULATION:	<input checked="" type="checkbox"/>
		CONDUCTOR AGE:	<input checked="" type="checkbox"/>	CONDUCTOR AGE:	<input checked="" type="checkbox"/>	CONDUCTOR AGE:	<input checked="" type="checkbox"/>	CONDUCTOR AGE:	<input checked="" type="checkbox"/>	CONDUCTOR AGE:	<input checked="" type="checkbox"/>
		SHIELD GROUNDED:	<input checked="" type="checkbox"/>	SHIELD GROUNDED:	<input checked="" type="checkbox"/>	SHIELD GROUNDED:	<input checked="" type="checkbox"/>	SHIELD GROUNDED:	<input checked="" type="checkbox"/>	SHIELD GROUNDED:	<input checked="" type="checkbox"/>
		TERMINATION TYPE:	<input checked="" type="checkbox"/>	TERMINATION TYPE:	<input checked="" type="checkbox"/>	TERMINATION TYPE:	<input checked="" type="checkbox"/>	TERMINATION TYPE:	<input checked="" type="checkbox"/>	TERMINATION TYPE:	<input checked="" type="checkbox"/>
		TERMINATION COND.:	<input checked="" type="checkbox"/>	TERMINATION COND.:	<input checked="" type="checkbox"/>	TERMINATION COND.:	<input checked="" type="checkbox"/>	TERMINATION COND.:	<input checked="" type="checkbox"/>	TERMINATION COND.:	<input checked="" type="checkbox"/>
		PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>
SETTINGS/REMARKS		SETTINGS/REMARKS		SETTINGS/REMARKS		SETTINGS/REMARKS		SETTINGS/REMARKS		SETTINGS/REMARKS	
ADDITIONAL COMMENTS		EQUIPMENT GRADE LEGEND									
		GRADE A = LIKE NEW CONDITION		MAJORITY OF USEFUL LIFE SPAN REMAINS.							
		GRADE B = GOOD CONDITION		OVER HALF OF USEFUL LIFE SPAN REMAINS.							
		GRADE C = AVERAGE CONDITION		<1/2 OF USEFUL LIFE SPAN REMAINS.							
		GRADE D = WORKABLE CONDITION		MAY BE PAST USEFUL LIFE, BUT STILL WORKS.							
		GRADE E = POOR CONDITION		PAST USEFUL LIFE. FAILURE IS NOT CRITICAL.							
		GRADE F = CRITICAL CONDITION		NEEDS IMMEDIATE ATTENTION.							

## Transformer

SURVEY INFO		GENERAL INFO		ELECTRICAL INFO	
DESIGNATION:		MANUFACTURER:	<input checked="" type="checkbox"/>	RATING (KVA):	
LOCATION:		TYPE:	<input checked="" type="checkbox"/>	IMPEDANCE (%):	
SURVEY BY:	<input checked="" type="checkbox"/>	CATALOG #:		TEMP. RISE (°C):	
SURVEY DATE:	<input checked="" type="checkbox"/>	SERIAL #:		# OF TAPS:	
EXISTING CONDITIONS		MANUFACTURE DATE:		TAP SETTING:	
EQUIPMENT GRADE:	<input checked="" type="checkbox"/>	INSULATION		PRIMARY	
EXTERIOR		LIQUID TYPE:	<input checked="" type="checkbox"/>	PRIMARY VOLTAGE:	
PHYSICAL DAMAGE:	<input checked="" type="checkbox"/>	LIQUID LEVEL:	<input checked="" type="checkbox"/>	DELTA/WYE:	
RUST/DISCOLORATION:	<input checked="" type="checkbox"/>	COOLING CLASS:	<input checked="" type="checkbox"/>	IV BIL:	
ANCHORAGE:	<input checked="" type="checkbox"/>	SURVEY TEMP:		PRIMARY CONDUCTOR	
ALIGNMENT:	<input checked="" type="checkbox"/>	MAX TEMP:		COND. MATERIAL:	<input checked="" type="checkbox"/>
PAD/WEEL MATERIAL:	<input checked="" type="checkbox"/>	PRESSURE VACUUM:	<input checked="" type="checkbox"/>	WINDING MATERIAL:	<input checked="" type="checkbox"/>
PAD/WEEL CONDITION:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	TYPE:	<input checked="" type="checkbox"/>
PHYSICAL PROTECTION:	<input checked="" type="checkbox"/>	SURGE ARRESTERS		VOLTAGE CLASS:	<input checked="" type="checkbox"/>
INTERIOR		TYPE:	<input checked="" type="checkbox"/>	SIZE:	<input checked="" type="checkbox"/>
WATER INGRESS:	<input checked="" type="checkbox"/>	PHYSICAL CONDITION:	<input checked="" type="checkbox"/>	# OF CONDUCTORS PER PHASE:	<input checked="" type="checkbox"/>
DIRT/WEEDS/RODENTS:	<input checked="" type="checkbox"/>	FOR SUBSTATION TRANSFORMERS		PRIMARY FUSES	
INTERIOR CLEARANCES:	<input checked="" type="checkbox"/>	LTC COUNTER:	<input checked="" type="checkbox"/>	MANUFACTURER:	<input checked="" type="checkbox"/>
GROUNDING		FOUNDATION CONDITION:	<input checked="" type="checkbox"/>	TYPE/CATALOG #:	<input checked="" type="checkbox"/>
CONNECTIONS PRESENT:	<input checked="" type="checkbox"/>	OIL RETENTION:	<input checked="" type="checkbox"/>	RATED VOLTAGE:	<input checked="" type="checkbox"/>
PHYSICAL CONDITION:	<input checked="" type="checkbox"/>			SECONDARY VOLTAGE:	<input checked="" type="checkbox"/>
EQUIPMENT GRADE LEGEND				DELTA/WYE:	<input checked="" type="checkbox"/>
GRADE A = LIKE NEW CONDITION		MAJORITY OF USEFUL LIFE SPAN REMAINS.		LV BIL:	<input checked="" type="checkbox"/>
GRADE B = GOOD CONDITION		OVER HALF OF USEFUL LIFE SPAN REMAINS.		WINDING MATERIAL:	<input checked="" type="checkbox"/>
GRADE C = AVERAGE CONDITION		<1/2 OF USEFUL LIFE SPAN REMAINS.		SECONDARY	
GRADE D = WORKABLE CONDITION		MAY BE PAST USEFUL LIFE, BUT STILL WORKS.		COND. MATERIAL:	<input checked="" type="checkbox"/>
GRADE E = POOR CONDITION		PAST USEFUL LIFE. FAILURE IS NOT CRITICAL.		COND. SIZE:	<input checked="" type="checkbox"/>
GRADE F = CRITICAL CONDITION		NEEDS IMMEDIATE ATTENTION.		# OF CONDUCTORS PER PHASE:	<input checked="" type="checkbox"/>
ADDITIONAL COMMENTS				TERMINATION CONDITION:	<input checked="" type="checkbox"/>
				SKETCH (IF NEEDED)	

# GIS FIELD MAPS





# SUMMARY OF FINDINGS

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## Substations

- Dirt, discoloration, rust on horizontally mounted insulators
- Foundation cracking and delamination
- Moss growth and rust at base of transformers
- Rust and poor condition of uncoated steel fence near steam plant
- Grounding of vinyl coated (PVC) fence fabric at all other locations
- Uneven/settled cable trench
- Blacksburg Substation – Bank A & B Transformers, OCBs, and Relays in-service for greater than 50 years
- Perry Street Substation – Bank C & D Transformers DGA Monitors not working
- Lane West Substation – Bank A & B Transformers do not have secondary oil containment
- Lane East Substation – Spare conduits not capped or sealed







# SUMMARY OF FINDINGS

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## Distribution Switchgear and Transformers

- Moss and rust on exterior of equipment enclosures
- Rust/corrosion around the base of equipment and within switch compartments
- Dirt and mold on termination skirts and switch insulators
- Corona discharge / surface tracking heard at some locations
- Low oil level or evidence of an oil leak in some transformers
- Cracked and delaminated equipment pads
- Working space and egress concerns at some locations





# PRELIMINARY DEFICIENCY TABLE

Virginia Tech Utilities Master Planning - Consolidated Deficiency Table				Severity of Deficiency			Criticality of Element			Ranking
				Failure is Imminent or Safety Issue - Replace Immediately	Poor Condition, but Currently Operational - Replace Within 3 years	Obsolete, in Adequate Working Condition - Replace within 5 years	Mission Critical - Renders Facility Non-Operational	Major - Disables Significant Functionality	Minor - Disables Minor Functionality	Severity x Criticality
Discipline	System	Deficiency #	Description of Deficiency	3	2	1	3	2	1	
Electrical Distribution	Substations	ESS-1	Blacksburg Substation - Dirt, discoloration, rust on horizontal insulators.							0
Electrical Distribution	Substations	ESS-2	Blacksburg Substation - Bank A transformer in-service for greater than 50 years.							0
Electrical Distribution	Substations	ESS-3	Blacksburg Substation - Bank B transformer in-service for greater than 50 years.							0
Electrical Distribution	Substations	ESS-4	Blacksburg Substation - Bank B transformer has oil in the bottom of the LTC control cabinet.							0
Electrical Distribution	Substations	ESS-5	Blacksburg Substation - Oil Circuit Breakers (OCBs) in-service for greater than 50 years.							0
Electrical Distribution	Substations	ESS-6	Blacksburg Substation - Foundation for OCB 7 has delamination/cracking.							0
Electrical Distribution	Substations	ESS-7	Blacksburg Substation - Fence on South side of station shows significant rust and at least one location where top rail is cut. Fence fabric also does not match the fabric used at the Perry Street end.							0

# ASSET CONDITION GRADING

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The final condition assessment grade for each electrical distribution asset will be based on the worst-case grade from the following condition categories:

- Cosmetic and housekeeping condition
- Structural condition
- Electrical and mechanical condition

The final grade will be added as an attribute for each location in GIS.

# COSMETIC & HOUSEKEEPING CONDITION GRADE

- Paint discoloration
- Moss or rust on exterior
- Dirty interior

		COSMETIC AND HOUSEKEEPING DEFICIENCIES		
		NONE	MINOR	SIGNIFICANT
AGE	0-10	A	B	C
	11-20	B	B	C
	21-30	C	C	C
	30+	C-	C-	D

# STRUCTURAL CONDITION GRADE

- Cracked or uneven pads
- Rusted base/flange of equipment
- Interior rust

		STRUCTURAL DEFICIENCIES		
		NONE	MINOR	SIGNIFICANT
AGE	0-10	A	B	C
	11-20	B	C	C-
	21-30	C	C-	D
	30+	C-	D	F



# ELECTRICAL & MECHANICAL CONDITION GRADE

- Corona tracking
- Signs of previous faults
- Low oil or gas levels

		ELECTRICAL AND MECHANICAL DEFICIENCIES		
		NONE	MINOR	SIGNIFICANT
AGE	0-10	A	D	F
	11-20	B	D	F
	21-30	C	D	F
	30+	C-	D	F

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## ACTION ITEMS

- Weekly Field Investigations
- Negotiating CCTV Work within the Civil Scope
- Asset Management with Analytics & Accountability
- Schedule remaining Existing Conditions Workshops
- UMP Monthly Stakeholder meeting on 5/30/2023
- Schedule 30% Review Meetings to review Existing Conditions Report with stakeholders
- Schedule CAC Workshops on Decarbonizing, Air Emissions, and Measures of Success

