

West Point Treatment Plant  
Electrical Improvements Project  
PRISM Number 113777  
Scope Definition Technical Memorandum

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Prepared for  
King County Department of Natural Resources and Parks  
Wastewater Treatment Division  
July 20, 2020

**Wastewater Treatment Division  
Project Formulation Program**

**Work Order No. 37  
Project Number 1137059**

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Document Revision History				
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## List of Abbreviations

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A	amp(s)
ATS	automatic transfer switch
County	King County
COVID	Corona virus disease
DB	design- build
DBB	design-bid-build
DNRP	King County Department of Natural Resources and Parks
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GC/CM	general contractor/construction manager
kV	kilovolt(s)
kVA	kilovolt-ampere(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
MCC	motor control center
O&M	operations and maintenance
PS	pump station
RCW	Revised Code of Washington
SCL	Seattle City Light
SEPA	State Environmental Policy Act
TM	technical memorandum
TSG	temporary switchgear
V	volt
WAC	Washington Administrative Code
WPTP	West Point Treatment Plant
WTD	King County Department of Natural Resources and Parks, Wastewater Treatment Division

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## Section 1

# Objectives

The purpose of this Technical Memorandum (TM) is to facilitate the development of a preliminary project scope for the replacement of existing electrical assets at the West Point Treatment Plant (WPTP). This TM was developed under the King County Wastewater Treatment Division (WTD) Project Formulation Program. The objective of this program is to provide King County leadership with the information necessary to initiate the projects proposed by the WTD through the Capital Systems Team Gate 1 charter.

The WPTP was originally constructed in the early 1960s and underwent a major expansion during the 1991 Secondary Treatment Facilities project. As such, WPTP electrical assets from the Secondary Treatment Facilities project are over 20 years in age and are reaching the end of their life cycle, and assets installed during earlier WPTP construction are beyond the end of their life cycle. The County has initiated the replacement of aging electrical assets in conjunction with ongoing capital projects undertaken at the WPTP, taking advantage of efficiencies afforded by such opportunities. However, the scope and scale of the remaining electrical asset replacements may merit a standalone capital project to maintain safe and reliable plant operation.

Electrical equipment identified for replacement under this work order is listed in Appendix A and generally includes:

- 13.8kV main switchgear (MSG)
- 480V unit substations (US)
- 480V switchgear (SWGR)
- 480V motor control centers (MCC)
- 480V and lower distribution panels (DPP) and switchboards
- A subset of 480V MCC equipment located in below-grade gallery areas, designated for relocation to an above grade location
- Cabling, junction boxes, transformers, and switches associated with distribution to the above loads

This TM describes the project background, summarizes options for the proposed electrical equipment replacement, and discusses major risks issues and opportunities to consider for scoping and project execution.

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## Section 2

# Background

The WPTP is located on WTD-owned properties adjacent to Discovery Park in the Magnolia neighborhood of Seattle, as shown in Figure 1. The electrical equipment considered in Work Order 37 is widely distributed across process and non-process facilities and touches nearly all levels of the WPTP electrical infrastructure from 13.8kV plant-wide distribution down to 208V and 125V local distribution panels. In all, the Work Order 37 equipment list encompasses 150 total assets, with:

- 123 assets identified for replacement
- 9 assets identified for relocation, from existing gallery locations that could potentially be subject to inundation/water damage
- 18 assets identified for no current action, based on further consideration of age, condition and function, or replacement under another current capital project

The County's analysis has also considered potential opportunities to perform the asset replacement in conjunction with other planned capital projects. Therefore, the equipment list identifies other capital projects that could potentially take-on certain elements of the electrical replacement work. The final scope of Work Order 37 and the potential to coordinate replacements with other capital projects should be refined as the project progresses into design.

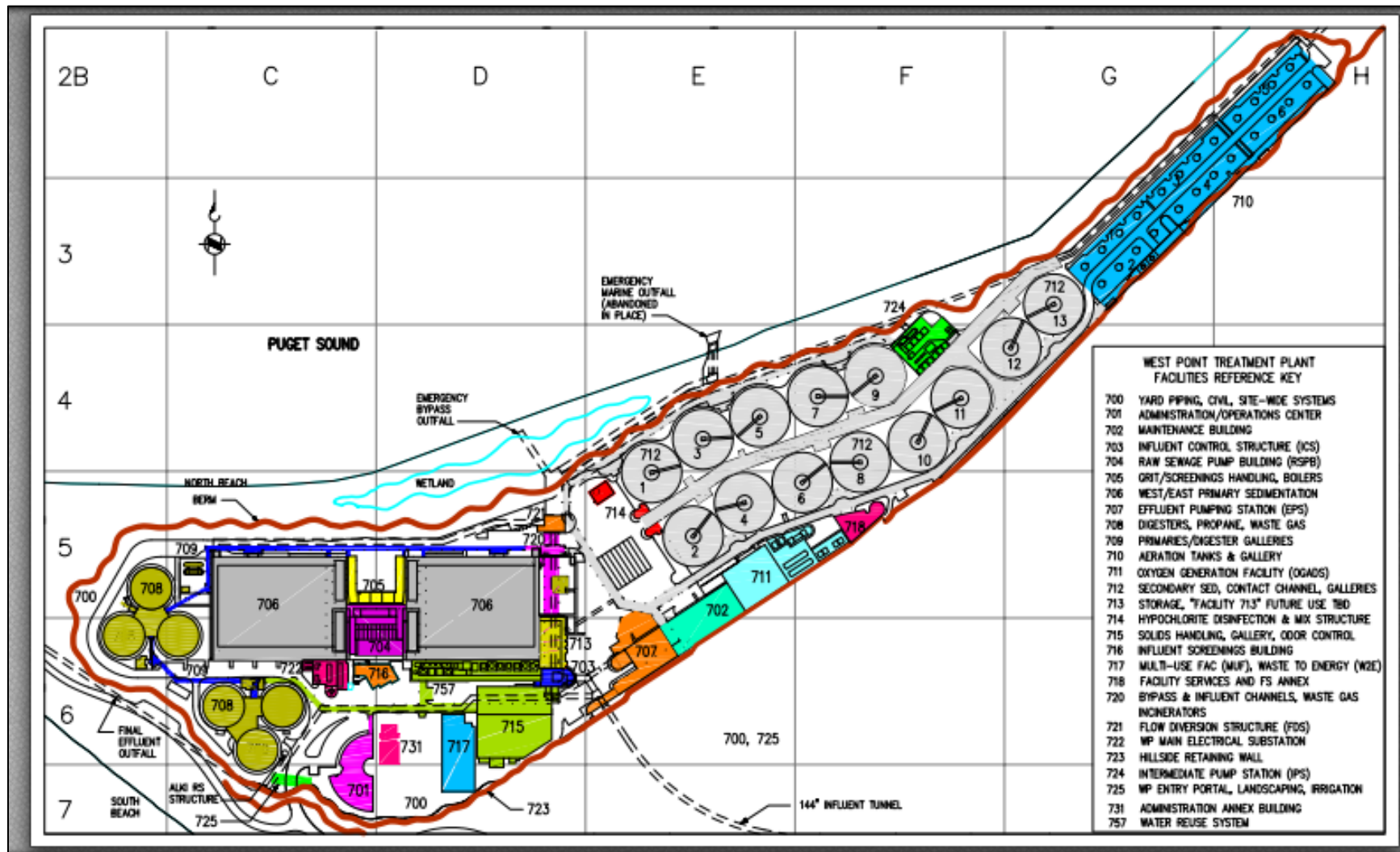


Figure 1. West Point Treatment Plant Site Overview

## Section 3

# Options Development

Work Order 37 and this Scope Definition TM were developed using a multi-step process as summarized below:

- A County-prepared draft equipment list was reviewed alongside the WPTP electrical one-line diagram for general completeness. The project team met and refined the equipment list, validating the anticipated asset replacements, and as well identifying a subset of relatively new assets proposed for relocation due to their potential exposure to water damage in an emergency event. Appendix A presents the equipment list on which the scope of this project is based.
- Typical conceptual arrangements were developed for the various gear replacements and communicated to representative equipment vendors, so that they could provide planning level pricing and estimates of lead time for fabrication and delivery.
- Project constraints and representative work sequences were developed to establish a representative framework for project implementation and to inform the development of the cost estimate and schedule.
- Two workshops were conducted with the project team to validate the equipment list, establish general requirements for the equipment replacement work, discuss potential options for project delivery, and receive input on the project constraints and representative work sequences.

The following sections of this TM provide an overview of the general project requirements and options developed using the above-described approach.

### 3.1 General Project Requirements

Prior to investigating project options, the project team identified general requirements that would be broadly applicable to the project, summarized as follows:

- Due to condition, age, and reliability considerations, electrical gear will be replaced with current equipment of new manufacture, rather than refurbished or reconditioned
- Equipment will comply with WTD guide specifications applicable to the work (such as 26 05 00 Common Work Results for Electrical, 26 05 13 Medium Voltage Cables, 26 11 16 Substation Transformers, 26 13 23 Medium Voltage Switchgear, 26 24 19 Motor Control Centers, 26 36 23 Automatic Transfer Switches, 26 50 01 Lighting Control Panels, 26 22 00 Low-Voltage Transformers, etc.)
- New electrical equipment will match the footprints and arrangements of existing gear lineups, wherever possible
- New equipment will match the electrical ratings of existing equipment (e.g., same fault ratings and interrupting capacities)
- No new ancillary equipment, beyond items included in the equipment list will be provided (e.g., active harmonic filters will not be added to new equipment lineups)
- Motor control centers will comply with WTD standards for data communications (e.g. smart starters with Tesys T and DeviceNet)
- Conductors feeding the equipment replaced under the project will be replaced with new conductors.

- The WPTP fiberoptic network will be expanded to serve all switchgear
- New work will comply with relevant codes (Seattle Electrical Code, Seattle Building Code, Seattle Mechanical Code, Seattle Energy Code, etc.); however, existing WPTP area classifications shall remain unchanged
- The project will include an allowance for Ovation integration work
- Corrosion resistant, stainless steel enclosures will be provided for exterior unit substation equipment to provide longevity in the WPTP marine air environment. It is important to note that stainless steel enclosures are not readily available in the unit substation market and could necessitate custom fabrication work. Material options should be evaluated and selected during design.

## **3.2 Development of Options**

The project primarily involves the in-kind replacement of assets within existing facilities, using existing raceways, thereby placing significant limitations on the size and configuration of the replacement gear. In general, the new electrical equipment will be required to match existing footprints, with provisions to align pull spaces and conductor terminations with existing raceways. As a result of these factors, there is a limited number of project options in terms of the type, configuration and size of the replacement gear. Instead, the options revolve primarily around how the project will be organized and structured for implementation during design and construction, as summarized in the following sections.

## **3.3 Project Implementation Options**

The project team met and discussed potential options for project delivery, including traditional design-bid-build (DBB), and alternative delivery by general contractor/construction manager (GC/CM) or design-build (DB) approaches. As a result of these discussions, traditional DBB delivery has been assumed at this early level of project definition. The County's recent South Treatment Plant Raw Sewage Pump Medium Voltage Switchgear Replacement Project was successfully completed using traditional DBB delivery under a single lump sum bid construction contract, supporting the efficacy of DBB as a representative and appropriate approach. Alternative delivery, using GC/CM or DB was not evaluated in detail at this time, given the efficacy of traditional DBB delivery, and since GC/CM and DB are less established means of project implementation for the County.

Discussions also identified the possibility of implementation using a project-specific job order or work order contract that could potentially be awarded on the basis of proposals considering qualifications and costs. While this approach was not evaluated in detail, it may merit further consideration as the project progresses into design. Consideration should be given to the cost limitations on job order contracts presented in the Revised Code of Washington (RCW) 39.10.420 through 39.10.460, which limit the total value of a job order contract to \$6 million per year for a period of up to three years, with individual work orders limited to \$500,000. Given the cost magnitude of Work Order 37, these limits may prove overly constraining.

Within the traditional DBB realm, there are several options or sub-options for project delivery, as summarized in Table 1.

Table 1. Work Order 37 Comparison of Project Delivery Options		
Implementation Option or Sub-option	Advantages	Disadvantages
Single lump sum DBB construction contract	<ul style="list-style-type: none"> <li>Least cost approach</li> <li>Least amount of construction-phase bidding, contract coordination and administration</li> </ul>	<ul style="list-style-type: none"> <li>Large size of contract may limit the number of bidders and competition</li> <li>Project costs may not align with available WTD cash flow</li> </ul>
Multiple lump sum DBB construction contracts	<ul style="list-style-type: none"> <li>May allow project costs to better align with available WTD cash flow</li> <li>Could increase competition by attracting a greater number of bidders</li> </ul>	<ul style="list-style-type: none"> <li>Increased construction and non-construction costs relative to single DBB contract</li> <li>Increased bidding, construction contract coordination and administration</li> </ul>
County preselection of electrical equipment	<ul style="list-style-type: none"> <li>Provides design certainty around specific pieces of equipment, while retaining competitive pricing and selection</li> <li>Retains equipment procurement by construction contractor</li> <li>Can potentially accelerate contractor procurement of long-lead items</li> </ul>	<ul style="list-style-type: none"> <li>Requires preselection process early in design phase</li> <li>May not provide significant benefits where multiple manufacturers can provide similar equipment that meets specifications</li> <li>If preselected supplier fails to perform, Owner may take on increased risk</li> </ul>
County prepurchase of electrical equipment	<ul style="list-style-type: none"> <li>Possible acceleration of long-lead equipment</li> <li>Provides design certainty around specific pieces of equipment</li> </ul>	<ul style="list-style-type: none"> <li>Transfers risk of delays and change orders to the Owner</li> <li>Storage and maintenance of equipment prior to installation can pose challenges and risks</li> </ul>

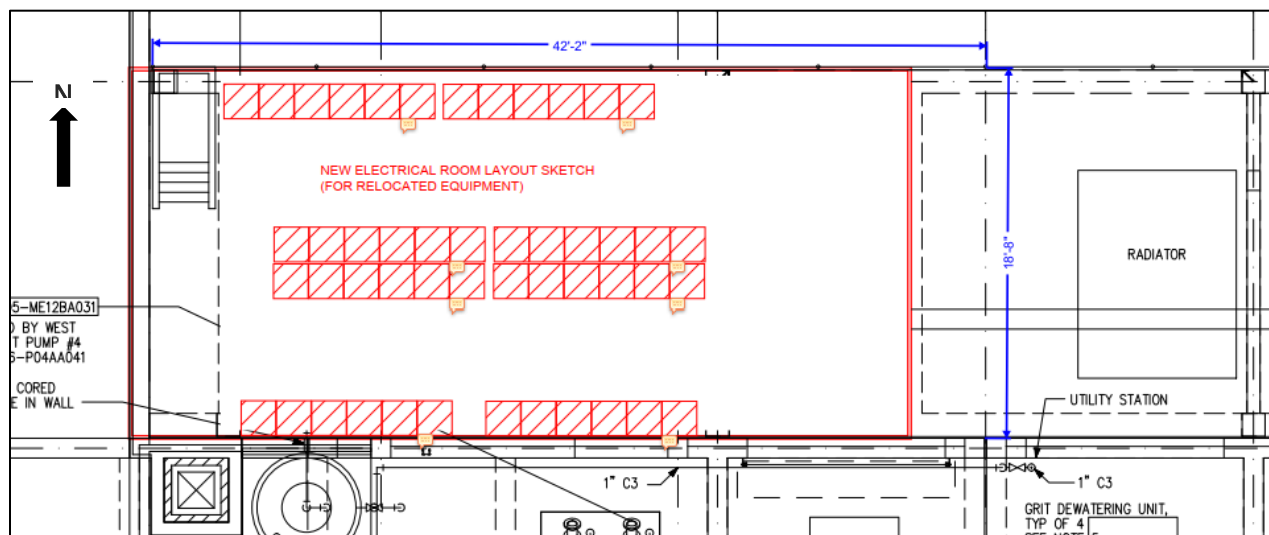
For purposes of Work Order 37, DBB using a single lump sum construction contract has been assumed, since it is a proven and representative means of project delivery. As the project progresses into design, the various options and sub-options should be given further consideration. That said, County prepurchase of electrical equipment appears to have significant risks and disadvantages that outweigh potential advantages. It is assumed that this sub-option would not be pursued unless a compelling reason is identified, for example, unanticipated failure of existing electrical gear that necessitates expedited procurement of a replacement.

### 3.4 Relocated Equipment Options

Another potential project option involves the relocation of existing below-grade gallery electrical equipment to an above-grade electrical room that will protect the equipment from potential inundation or water damage. For purposes of Work Order 37, an existing, unused mezzanine caged enclosure space in the 705 Grit area was assumed as a representative location for new electrical room to house the relocated equipment, as shown in Figure 2.

As the project progresses into design, other alternative locations may be identified and they should be evaluated giving consideration to the following general factors:

- Footprint of approximately 600 to 800 square feet, depending on the shape of the room, ingress/egress considerations, space allotted to future equipment, and utilities/amenities provided
- Proximity to gallery electrical loads and power feeds
- Located outside of Shoreline Zone, if possible, to minimize City of Seattle permits and approvals
- Given existing space constraints at WPTP, evaluate electrical room needs in coordination with other capital projects that may require a footprint for other new or relocated equipment



**Figure 2. Conceptual Electrical Room Layout for Relocated Equipment**  
*705 Grit mezzanine at location of existing cage enclosure*



## Section 4

# General Issues, Risks, Opportunities and Future Recommendations

### 4.1 General Issues and Risks

The following general issues and risks were identified during development of Work Order 37. They should be considered as the project progresses into scoping and design, and factored into the work as applicable:

- **Market considerations and competition.** Work Order 37 involves a large, complex and costly scope of work, and will involve significant construction risks due to potential plant disruptions and other factors. As such, there may be a limited number of firms who could serve as prime contractor and obtain the bonding and insurance necessary for the work. As the project progresses through design, a market assessment should be performed, contacting major regional electrical contractors and gauging their interest in bidding the work.
- **Seattle land use and zoning considerations.** While the work involves asset replacement activities that are normal and customary at an operating treatment plant, the location and zoning of WPTP may necessitate land use permits and approvals, in particular related to the new electrical room contemplated at Area 705 Grit.
- **Construction contractor staging.** The WPTP site is highly constrained and has limited area for construction contractor staging. The project should evaluate the available staging area, and the potential need for off-site storage of construction materials and equipment.
- **Coordination with other concurrent work.** WPTP is a large, complex facility that may have multiple construction contractors working on-site at any given time. Work Order 37 should be carefully coordinated with other concurrent construction activities to minimize site utilization conflicts.
- **Risk of plant interruptions and bypass.** Work Order 37 involves complex and challenging work across the entire WPTP site and could be highly disruptive to plant operations if not carefully planned and executed. The project should develop comprehensive, project-specific specifications addressing work constraints, sequences, outage requests, construction work planning, contingency planning, etc. to minimize the risk of plant interruptions and bypasses.
- **Code-driven scope changes.** Work Order 37 will be designed under future electrical, building and energy codes that will be adopted over time by the Seattle Department of Construction and Inspections. The future codes could require portions of the existing WPTP to be modified for compliance with new codes, depending on the scope and scale of the replacement work.
- **Retrofit risks.** Retrofits like the Work Order 37 electrical equipment replacement involve different risks than new, greenfield design and construction projects. Retrofit risks could include field conditions that differ from available record drawing information; presence of undetected hazardous materials such as lead paint, asbestos and PCBs; discovery of deteriorated raceways or other ancillaries requiring replacement; etc.

- **COVID-19 Pandemic.** The full impact of the current COVID-19 pandemic is not fully known at this time. The schedule and cost estimate prepared for the work are based on typical project delivery estimates and assumptions without taking into consideration any schedule or cost impacts resulting from any COVID-19 federal, state or local restrictions or guidelines. Any schedule delays or cost impacts resulting from COVID-19 restrictions should be assessed during alternatives analysis.

## 4.2 Opportunities

Work Order 37 involves a large-scale, long duration replacement of electrical assets at the WPTP. As such, it may offer the County opportunities to perform similar or related work at an economical cost. During the development of Work Order 37, a number of potential opportunities were identified for future consideration, as summarized below:

- The Work Order 37 construction duration has been conservatively estimated at approximately 5 years, given the complexities of the WPTP, seasonal constraints, staging and coordination needs, challenges posed by long-lead equipment, and other challenges associated with the work. That said, it may be possible to complete the work in a shorter duration, lessening the duration of plant disruptions and potentially reducing the construction cost. The possibility for a reduced construction duration should be further evaluated during design.
- Nine 480V MCCs located in gallery areas have been identified for relocation under Work Order 37, to protect this important equipment from potential inundation and water damage. It is possible that the Federal Emergency Management Agency (FEMA) may provide funding for the relocation work. The County has submitted an application for FEMA funding to cover the potential relocation of up to 35 MCCs presently installed in flood-prone areas of the WPTP. As this project proceeds into implementation, other gallery-mounted MCCs should be reviewed to assess whether they merit relocation along with equipment already included in Work Order 37. If relocation is warranted, FEMA funding may provide a cost-saving opportunity.
- The 13.8 kV transformers that power the 707 effluent pumps and 724 intermediate pumps have not been identified for replacement at the present time, based on evaluation and testing performed during the County's Power Monitoring Project. Since Work Order 37 will involve a large volume of complex electrical work, it may offer an economical opportunity to replace these and other 13.8 kV transformers if further analysis determines that a change out is warranted.

## 4.3 Recommended Additional Studies and Investigations

In addition to the County's typical design development documents, the age of certain WPTP facilities and nature of the anticipated work indicate that hazardous materials assessments should be performed for areas where evaluations and/or abatement work has not been completed. In addition, if ground disturbing work will be performed, a Cultural Resources Assessment should be completed along with Archaeological Monitoring and Inadvertent Discovery Plans, as required.

## Section 5

# Potential Permits and Approvals

The project is anticipated to require a range of permits and approvals, with the City of Seattle, Department of Construction and Inspections serving as the authority having jurisdiction.

Potential permits and approvals identified at this time are listed below:

- City of Seattle, Construction Permit, for new electrical room to house equipment relocated from the galleries.
- City of Seattle, Mechanical Permit, for heating, ventilation and other mechanical work associated with the new electrical room at Area 705 Grit to house equipment relocated from the galleries.
- City of Seattle Electrical Permit (construction contractor-obtained).
- City of Seattle, Master Use or Shoreline Permit. Portions of the project may be exempt as a normal maintenance and repair activity. However, careful attention should be given to the new electrical room at Area 705 Grit, which could potentially require land-use reviews or approvals involving a significant lead time.
- SEPA Review (County to determine). The project may be categorically exempt under WAC 197-11-800-(3) as a repair, remodeling and maintenance activity.

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## Section 6

# Supplemental Materials

- King County. 2020, Work Order 37, 1137771 Equipment List
- King County, 2018, South Treatment Plant, Raw Sewage Pumps Medium Voltage Switchgear Replacement, Contract C01293C18
- King County, 2017, West Point Treatment Plant, Electrical One Line Diagram
- King County Guide Specifications (various)

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**Appendix A: Equipment List**

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# Appendix A. Equipment List

Table A-1. Equipment List					
WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
701-EDPP01	ADM-ESSENT DIST PNL ADM BLDG	480V	Replace		
701-MCC01	ADM-BLDG MTR CONTROL CENTER 1	480V	Replace		
701-MTS01	ADM-SWITCH, TRANSFER FOR 701-SWBD01	480V	Replace		
701-SW1	ADM-SWITCH, TRANSFER PRIMARY SIDE OF 701-XFMR01	13.8kV	Replace		Transformer in the same enclosure
701-SW2	ADM-SWITCH, POWER TO 701-MTS01	480V	Replace		
701-SWBD01	ADM-BLDG MAIN SWITCHBOARD	480V	Replace		
701-XFMR01	ADM-TRANSFORMER FOR ADMIN BLDG 13.8kV TO 480V	13.8kV	Replace		
702-DPP01	MAINT-BLDG DIST. PANEL	480V	Replace		
702-MCC01	MAINT-BLDG MTR CTL CENTER 1	480V	Replace		
702-MCC02	MAINT-BLDG MTR CTL CENTER 2	480V	Replace		
703-EDPP01	ICS-DIST. PANEL	480V	Replace		
704-DPP02	RSP-BLDG. DISTRIBUTION PANEL	480V	Replace		
704-DPP03	RSP Bldg Distribution Panel	480V	Replace		
704-DPP05	704 DPP05 DISTRIBUTION PANEL 4	480V	Replace		
704-EDPL01	RSP-DISTRIBUTION PANEL, EMERGENCY	208V	Replace		
704-EDPP01	RSP-DISTRIBUTION PANEL	480V	Replace		
704-EDPP02	RSP Bldg Emergency Dist Panel	480V	Replace		
704-EMCC01	RSPB Emergency Motor Control	480V	No Action		Replaced in 704 Electrical Upgrade
704-ESWGR01	RSP-EMER GEN 401 SWITCHGEAR	480V	Replace		
704-MCC01	RSP-BLDG MTR CONTROL CENTER 1	480V	Replace		
704-MCC02	RSP-BLDG MTR CONTROL CENTER 2	480V	Replace		
704-MCC03	704-RSP BLDG MOTOR CONTROL CEN	480V	No Action		Replaced in 704 Electrical Upgrade
704-MCC04	704-RSP BLDG MOTOR CONTROL CEN	480V	No Action		Replaced in 704 Electrical Upgrade
704-PDB-400-DC	RSP-DISTRIBUTION PANEL, DIRECT CURRENT	125VDC	Replace	1134069	Dependent on RSP Replacement Project
705-DPP01	Grit Area Distribution Panel	480V	Replace		

Table A-1. Equipment List WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
705-DPP02	Power Distribution Panel	480V	Replace		
705-EMCC01	Grit Area Emergency Motor Cont	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MCC01	GRIT-AREA MTR CONTROL CENTER 1	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MCC02	GRIT-AREA MTR CONTROL CENTER 2	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MCC03	RSP WST HT RAD 1 MTR CTRL CNTR	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MCC04	SECTION 2 MOTOR CONTROL CENTER	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MCC05	705-GRIT/SCREENINGS MOTOR CONT	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
705-MTS01	HYDRAULIC BACK-UP POWER TRANSFER SWITCH	480V	Relocate		Replaced in 2017 flood, relocate above flood zone. May not be needed anymore. Verify during design
706-DPP01	Digester Cleaning Power Distri	480V	Replace		
706-DPP02	SED-PRI SED AREA DIST. PANEL	480V	Replace		
706-DPP03	SED-PRI SED AREA DISTR.PANEL	480V	Replace		
706-MCC01	SED-PRI SED MTR CTL CENTER 1	480V	Replace		
706-MCC02	SED-PRI SED MTR CTL CENTER 2	480V	Replace		
706-MCC03	SED-PRI SED MTR CTL CENTER 3	480V	Replace		
706-MCC04	SED-PRI SED MTR CTL CENTER 4	480V	Replace		
706-MCC05	SED-SCUM AREA MTR CTL CENTER 5	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
706-MCC06	SED-SCUM AREA MTR CTL CENTER 6	480V	Relocate		Replaced in 2017 flood, relocate above flood zone
707-DPP01	EPS-DISTRIBUTION PANEL	480V	Replace		
707-DPP02	EPS-DISTRIBUTION PANEL	480V	Replace		
707-DPP03	EPS-DISTRIBUTION PANEL	480V	Replace		
707-MCC01	EPS-MCC 1 FAC 707	480V	Replace		
707-MCC02	EPS-MCC 2 FAC707	480V	Replace		
707-MSG01	EPS-15-KV SWITCHGEAR	13.8kV	No Action	1134063	Replace under Power Monitoring Upgrade
707-SWGR01	EPS-480 VOLT SWITCHGEAR	480V	Replace		
707-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 707-SWGR01	13.8kV	Replace		
707-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 707-SWGR01	13.8kV	Replace		
708-MCC01	DIG-MOTOR CONTROL CENTER 1	480V	Replace		

Table A-1. Equipment List					
WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
708-MCC02	DIG-MOTOR CONTROL CENTER 2	480V	Replace		
708-MCC03	DIG-MOTOR CONTROL CENTER 3	480V	Replace		
708-MCC04	DIG-MOTOR CONTROL CENTER 4	480V	Replace		
708-MCC05	DIG-MTR CTL CTR 5 (MCC800-10)	480V	Replace		
708-MCC06	DIG-MTR CTL CTR 6 (MCC800-11)	480V	Replace		
708-SW1A	DIG-SWITCH, LOAD INTERRUPTER A-SIDE	13.8kV	Replace		
708-SW1B	DIG-SWITCH, LOAD INTERRUPTER B-SIDE	13.8kV	Replace		
708-US01	DIG-UNIT SUBSTATION	480V	Replace		
708-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 708-US01	13.8kV	Replace		
708-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 708-US01	13.8kV	Replace		
710-DPP01	AER-DISTRIBUTION PANEL	480V	Replace		
710-DPP02	Aeration Distribution Panel	480V	Replace		
710-MCC01	Aerator Motor Control Center 01	480V	No Action		Replaced in Aeration Mixer Replacement (OGADS)
710-MCC02	AER-MOTOR CONTROL CENTER 2	480V	No Action		Replaced in Aeration Mixer Replacement (OGADS)
710-MCC03	AER-MOTOR CONTROL CENTER 3	480V	No Action		Replaced in Aeration Mixer Replacement (OGADS)
710-MCC05	AER-MOTOR CONTROL CENTER 5	480V	Replace		
710-MCC06	AER-MOTOR CONTROL CENTER 6	480V	Replace		
710-SW1A	AER-SWITCH, LOAD INTERRUPTER A-SIDE	13.8kV	Replace		
710-SW1B	AER-SWITCH, LOAD INTERRUPTER B-SIDE	13.8kV	Replace		
710-SWGR01	AER-480 VOLT SWITCHGEAR	480V	Replace		
710-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 710-SWGR01	13.8kV	Replace		
710-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 710-SWGR01	13.8kV	Replace		
711-MCC01	OGADS-02 MTR CTL CENTER 1	480V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-MCC02	OGADS-02 MTR CTL CENTER 2	480V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-MCC03	OGADS-02 MTR CTL CENTER 3	480V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-MCC04	OGADS-02 MTR CTL CENTER 4	480V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-MCC05	OGADS-MOTOR CONTROL CENTER, 4160V FOR 711-MTR11CA111	4160V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project

Table A-1. Equipment List					
WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
711-MCC06	OGADS-MOTOR CONTROL CENTER, 4160V FOR 711-MTR11CA211	4160V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-MSG01	OGADS-MAIN SWITCHGEAR 4160V FOR VACUUM PUMP BLOWERS	4160V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
711-SWGR01	OGADS-O2 PRODION SWITCHGEAR	480V	Replace	1116798	Possible OGADS Replacement; coordinate with OGADS project
712-DPP01	SEC-DISTRIBUTION PANEL	480V	Replace		
712-DPP02	SEC-DISTRIBUTION PANEL	480V	Replace		
712-DPP03	SEC-DISTRIBUTION PANEL	480V	Replace		
712-DPP04	SEC-DISTRIBUTION PANEL	480V	Replace		
712-MCC01	SEC-MCC 1 FAC 712	480V	Replace		
712-MCC02	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-MCC03	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-MCC04	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-MCC05	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-MCC06	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-MCC07	SEC-MOTOR CONTROL CENTER	480V	Replace		
712-SW1A	SEC-SWITCH, LOAD INTERRUPTER A-SIDE	13.8kV	Replace		
712-SW1B	SEC-SWITCH, LOAD INTERRUPTER B-SIDE	13.8kV	Replace		
712-US01	SEC-SED UNIT SUBSTATION	480V	Replace		
712-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 712-US01	13.8kV	Replace		
712-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 712-US01	13.8kV	Replace		
713-DPP01	CL2-DISTRIBUTION PANEL	480V	Replace		
713-EMCC01	CL2-EMERGENCY MTR CTL CENTER 1	480V	Replace		
713-MCC01	CL2-MOTOR CONTROL CENTER 1	480V	Replace		
713-MCC02	CL2-MOTOR CONTROL CENTER 2	480V	Replace		
714-EDPP01	NAOCL 480V POWER PANEL	480V	Replace		
715-DPP01	SOLIDS-BLDG DIST.PANEL	480V	Replace		
715-DPP02	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-DPP03	SOLIDS-BLDG DIST. PANEL	480V	Replace		

Table A-1. Equipment List					
WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
715-DPP04	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-DPP05	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-DPP06	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-DPP07	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-DPP08	SOLIDS-BLDG DIST. PANEL	480V	Replace		
715-EDPP01	SOLIDS-BLDG EMER DISTPANEL	480V	Replace		
715-MCC01	SOLIDS-MOTOR CONTROL CENTER 1	480V	Replace		
715-MCC02	SOLIDS-MOTOR CONTROL CENTER 2	480V	Replace		
715-MCC03	SOLIDS-MOTOR CONTROL CENTER 3	480V	Replace		
715-MCC04	SOLIDS-MOTOR CONTROL CENTER 4	480V	Replace		
715-MCC05	SOLIDS-MOTOR CONTROL CENTER 5	480V	Replace		
715-MCC06	SOLIDS-MOTOR CONTROL CENTER 6	480V	Replace		
715-MCC07	SOLIDS-MOTOR CONTROL CENTER 7	480V	Replace		
715-MCC08	SOLIDS-MOTOR CONTROL CENTER 8	480V	Replace		
715-SW1A	SOLIDS-SWITCH, LOAD INTERRUPTER A-SIDE	13.8kV	Replace		
715-SW1B	SOLIDS-SWITCH, LOAD INTERRUPTER B-SIDE	13.8kV	Replace		
715-SWGR01	SOLIDS-SWITCHGEAR 480 VOLT	480V	Replace		
715-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 715-SWGR01	13.8kV	Replace		
715-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 715-SWGR01	13.8kV	Replace		
716-MCC01	MOTOR CONTROL CENTER #1	480V	No Action		Installed during Screenings Building Construction
716-MCC02	MOTOR CONTROL CENTER #2	480V	No Action		Installed during Screenings Building Construction
717-DPP01	POWER DISTRIBUTION PANEL 717-01	480V	No Action		Installed during W2E Install
717-DPP02	POWER DISTRIBUTION PANEL 717-02	480V	No Action		Installed during W2E Install
717-MCC01	MOTOR CONTROL CENTER 717-01	480V	No Action		Installed during W2E Install
717-MCC02	MOTOR CONTROL CENTER 717-02	480V	No Action		Installed during W2E Install
717-MCC03	MOTOR CONTROL CENTER 717-03	480V	No Action		Installed during W2E Install
717-MSG01	13.8KV COGENERATION SWITCHGEAR	13.8kV	No Action		Installed during W2E Install
717-SWBD1	SWITCHBOARD 717-1	480V	No Action		Installed during W2E Install

Table A-1. Equipment List					
WTD Project Formulation Program, Work Order 37, West Point Treatment Plant Electrical Improvements, Revised February 14, 2020					
Asset No.	Description	Voltage	Task	Related Project(s), PRISM No.	Notes
718-MCC01	FS-MOTOR CONTROL CENTER	480V	Replace		
719-DPP01	C1-C2 POWER DIST. PANEL	480V	Replace		
722-DPP01	SUB-STATION DIST. PANEL	480V	Replace		
722-DPP02	SUB-STATION DIST. PANEL	125VDC	Replace		
722-MSG01	SUB-15KV MEDIUM VOLTAGE SWGR	13.8kV	Replace		***Main Plant Substation***
722-SWGR01	SWITCHGEAR, RSPs, SCREENINGS, PRIMARY ELECTRICAL FEED	480V	No Action		Installed during 704 Electrical Upgrade
724-DPP01	IPS-DISTRIBUTION PANEL	480V	Replace		
724-MCC01	IPS-MOTOR CONTROL CENTER	480V	Replace		
724-MCC02	IPS-MOTOR CONTROL CENTER	480V	Replace		
724-MCC03	IPS-MOTOR CONTROL CENTER	480V	Replace		
724-MSG01	IPS-15KV SWITCH GEAR	13.8kV	No Action	1134063	Replace under Power Monitoring Upgrade
724-SWGR01	IPS-480 VOLT SWITCHGEAR	480V	Replace		
724-XFMR01A	IPS-TRANSFORMER 13.8kV TO 480V, A-SIDE TO 724-SWGR01	13.8kV	Replace		
724-XFMR01B	IPS-TRANSFORMER 13.8kV TO 480V, B-SIDE TO 724-SWGR01	13.8kV	Replace		
Distribution cables		13.8kV	Replace		Involves multiple cable assets/runs feeding the various replaced gear
Distribution cables		480V	Replace		Involves multiple cable assets/runs feeding the various replaced gear



## **Appendix B: Constraints and Sequence Assumptions**

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# Appendix B. Constraints and Sequence Assumptions

## B.1 Introduction

During development of Work Order 37, a series of representative constraints and sequence assumptions were developed by the project team to provide a guiding framework and aid development of the cost loaded schedule and cost estimate. The constraints and sequence assumptions should be considered conceptual in nature, and critically revisited and refined as the project progresses into design.

Reference the equipment list provided in Appendix A for an inventory of equipment included in the sequence narratives by asset number, name, and function.

## B.2 General Assumptions, Applicable to All Work

- The project will be implemented by traditional design-bid-build delivery, with typical lead times allowed for design consultant and construction contractor procurement.
- Seasonal constraints, definition of dry and wet seasons:
  - Dry season: 5-month period, May through September
  - Wet season: 7-month period, October through April
- Construction sequences and constraints will require extensive engagement of County's WPTP staff, engineering staff, and construction management (CM), and will be established during design. For purposes of this analysis, a series of representative scenarios and constraints is assumed in the following sections of this narrative, as developed through initial discussions with the County.
- Any activity that poses a risk of disruption to plant hydraulics (e.g., main switchgear 722-MSG01 and work associated with areas 704/RSP, 707/EPS and 724/IPS) will be restricted to the dry season. This assumption may be relaxed as a result of future detailed design and analysis, potentially allowing off-season work where temporary switchgear that provides full plant capabilities is utilized.
- During the work, the following minimum number of pumps will be maintained in service:

Facility/Pumps	Number Installed	Number to Maintain in Service
704 Raw Sewage Pumps (RSP)	4 at 110 MGD ea	3 (330 MGD)
724 Intermediate Pump Station (IPS)	3 at 164 MGD ea	2 (328 MGD)
707 Effluent Pump Station (EPS)	4 at 144 MGD ea	3 (432 MGD)

- Other than distribution panels replacements, work shall be limited to one process area at a time.
- Following construction contractor Notice to Proceed, and ahead of field construction activities, a Construction Planning period will be conducted per Specifications 01 31 11 and 01 14 00. The anticipated duration is 4 months. During Construction Planning, the construction contractor will develop schedules, outage plans and other supporting information to document how the WPTP will be maintained in operation for the duration of the electrical improvements work. Treatment process interruptions shall only be allowed in accordance with the approved Construction Planning documents, and with 14 days minimum prior notification to the County on basic work, and longer lead time on more complex work.

- Equipment procurement lead times will dictate the sequence of early construction, with distribution panels anticipated to arrive first, and main switchgear and unit substations arriving last. Typical lead times have been requested and provided by equipment vendors to help inform the construction schedule. Work will not be started within a given process area until all required long-lead materials have been delivered to the project site and reviewed for conformance and acceptability.
- For process areas served by A side/B side MCCs, only one side can be out of service at any given time.
- Temporary equipment, such as switchgear or motor control center in a Conex (weatherproof) enclosure, will consist of new contractor-procured equipment, and is anticipated to include 1 each unit for the main switchgear, 480V switchgear, and MCC. Photographs of temporary gear used on the County's recent South Treatment Plant, Raw Sewage Pump Station Medium Voltage Switchgear Replacement Project is presented below for illustrative purposes.



### **B.3 Typical Replacement Scenarios and Sequences by Process Area**

#### **B.3.1 13.8 kV Main Switchgear, 722-MSG01**

- Procure new 722-MSG01 equipment including any required factory testing
- Procure Conex mounted 13.8kV temporary switchgear (TSG) capable of powering both A and B side of MSG concurrently, including non-looped loads. The TSG will include connection of cogeneration with associated relays and, SCL metering equipment; SCL revenue metering for the main plant and cogeneration; and Ovation interface
- Install TSG in vicinity of 722
- Rough-in temporary conductors from SCL "A side" Transformer, secondary side, to TSG A side
- Test TSG, confirm ready to accept loads
- Connect 722-MSG01 loads to TSG. For all looped circuits, only a single circuit will be connected, loads will be looped at the destination equipment. Facility 701 Administration could be cut over on a weekend, or a temporary generator could be used to power it during the transfer
- Install new 722-MSG01. Remove and replace with new 13.8kV conductors from SCL "B side" transformer to 722-MSG01 B side, test and terminate. Testing shall include all revenue metering, protective relays, Ovation interface and any communications between 722-MSG01 and SCL
- Remove and replace 13.8kV deenergized conductors (B side conductors that were connected to 722-MSG01), test and terminate in 722-MSG01 Connect cogeneration to 722-MSG01, test, and enable cogeneration to be back on-line. Testing shall include all revenue metering, protective relays, Ovation interface and any communications between 722-MSG01 and SCL

- Connect site to new 722-MSG01. As Contractor replaces the downstream transformers/switches they will pull new all the way back to 722-MSG01, in the interim, if needed splice the existing conductor in a vault adjacent to TSG and route conductors back to 722-MSG01 for final termination
- Remove and replace 13.8kV any non-double ended conductors/circuits fed from TSG back to 722-MSG01, test, terminate and re-energize
- Remove and replace remaining 13.8kV conductors fed from TSG back to 722-MSG01, test, terminate and re-energize
- De-energize TSG, remove 13.8kV conductors to SCL A side transformer
- Install new 13.8kV conductors from SCL transformer "A side secondary to 722-MSG01, test, terminate and re-energize. Testing shall include all revenue metering, protective relays, Ovation interface and any communications between 722-MSG01 and SCL
- Redeploy TSG to serve 707-MSG01 or 724-MSG01

**B.3.2 480V Switchgear and Unit Substations including Associated Transformers (e.g., 701/Administration, 715-SWGR01, 715-SW1A, 715-SW1B, 715-XFMR01A, 715-XFMR01B, unit substations 708-US01, 708-XFRMR01A, 708-XFRMR01B)**

- Procure new switchgear equipment including any required factory testing
- Procure Conex mounted temporary 480-volt Temporary Switchgear (TSG) capable of powering all of the substation loads (This assumes looped loads will be single ended and radial loads will be connected to TSG)
- Install TSG in vicinity of unit substation
- Single end the switchgear/unit substation so all loads are fed from the B side (including existing B side transformer)
- Open A side primary switch and remove connection from the A side transformer to the switchgear/unit substation
- Rough-in temporary conductors from the A side transformer secondary to the TSG main breaker
- Energize and test TSG
- Temporary connect all the existing A side feeders to TSG, and non-looped B side feeders.
- Disconnect the B side main, deenergize the 13.8kV feeder to the B side, remove the B side primary switch, transformer and the switchgear/unit substation up to the A side transformer connection
- Connect and test the switchgear/unit substation now being fed from the B side
- Transfer the loads from TSG to the new switchgear/unit substation, using new conductors
- Disconnect TSG, remove and replace the A side transformer and primary switch. Connect the A side transformer to the 13.8kV feeder, test, reconnect to the A side of the switchgear/unit substation
- Test all metering and Ovation
- Redeploy TSG to serve the next location

**B.3.3 480V and 4,160V Motor Control Centers (e.g., 701-MCC01, 711-MCC05)**

- Procure new MCC equipment including any required factory testing
- Procure Conex mounted temporary 480 and 4,160 V MCC (TMCC) capable of powering largest MCC to be replaced

- Install TMCC in vicinity of process area
- Rough-in temporary conductors to MCC loads
- Provide power to TMCC from area switchgear
- Disconnect existing MCC
- Disconnect loads/conductors and temporarily circuit to TMCC
- Remove and replace conductors feeding MCC
- Install new MCC
- Disconnect temporary circuiting. Recircuit loads to new MCC along with power monitoring and Ovation
- Test new MCC
- Repeat for other MCCs in process area

**B.3.4 208 V, 480 V and 125 VDC Distribution Panels (e.g. 701-EDPP01, 702-DPP01, 703-EDPP01, etc.)**

- Procure new panel equipment
- Perform replacement in Administration and Maintenance Buildings on weekend or after normal work hours. Replacements in other areas may be performed during normal work hours with approved outage request
- Provide temporary power to 125 VDC systems and any other distribution panel essential loads identified in work planning
- Disconnect existing panel and loads/conductors
- Install new feed conductors to panel from source
- Install new panel and re-terminate existing conductors
- Test new panel
- Repeat for other panels in these areas
- Note: Emerson Ovation® panels have both normal and UPS power and are not anticipated to require special temporary power provisions that would add significant cost or time to the project

**B.3.5 Relocated Equipment (e.g., 705-EMCC01, 705-MCC01 through 05, 705-MTS01, 706-MCC05, 706-MCC05)**

- Note: Approach assumes that the relatively new 705 MCC and MTS and 706-MCC gear will be relocated to a new at-grade electrical room, constructed at north side of Area 709/Grit. The following narrative is written in the context of 705-MCC relocations but also applies to the relocated 706-MCC equipment.
- Construct new electrical room at existing mezzanine area at area 709/Grit, complete with lighting and HVAC
- Install TMCC in vicinity of 705/709 process area
- Rough-in temporary conductors to 705 MCC loads
- Provide power to TMCC from area switchgear or 705 MCC feed
- Disconnect existing 705 MCCs and MTS
- Disconnect 705 MCC loads/conductors and temporarily circuit to TMCC
- Relocate existing 705 MCCs and MTS to new electrical room

- Install new conductors feeding relocated 705 MCC, MTS, and MCC loads. The relocated MCCs will be fed from 722-SWBD01, using a spare circuit breaker, then reusing the existing MCC feeder breakers
- Disconnect temporary circuiting. Recircuit 705 MCC loads to the relocated MCCs along with power monitoring and Ovation
- Test relocated MCCs

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