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SECTION 01 32 19

MILESTONE COMPLETION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the requirements for completing designated project milestones, verifying milestone completion, and administering milestone-based payments.

B. Related activities include progress documentation, inspection, and the submission of milestone-related deliverables.

1.2 RELATED SECTIONS

A. Drawings, General and Supplementary Conditions, Contract Agreements, and other Specification Sections apply to this Section.

B. Section 01 31 00 – Project Management and Coordination

C. Section 01 32 20 – Construction Progress Schedule

D. Section 01 29 00 – Payment Procedures

1.3 DEFINITIONS

Milestone: A specific, measurable event or deliverable in the project schedule that marks significant progress.

Substantial Completion of Milestone: The stage at which the Work (or a designated portion thereof) required by a specific milestone has been completed in accordance with the Contract Documents, and the Work is fit for its intended use by the Owner.

Milestone Completion Certificate (MCC): A written document issued by the Owner's Representative confirming that a particular milestone is deemed substantially complete.

CSX Operation Use: ***The point in time at which the work on the relevant rail bridge, or a portion thereof, has progressed to a stage where the structure is sufficiently complete and structurally capable of supporting CSX rail traffic, and the bridge is ready for CSX to install track infrastructure in preparation for commencement of rail operations.***

Any remaining construction activities in the vicinity of the bridge, such as demolition of existing abutments or work occurring beneath the bridge span, must not interfere with CSX's access, safety, or ability to perform their work and maintain rail operations. ~~The point in time at which the work for the relevant rail bridge or a portion thereof has progressed such that the bridge or a portion thereof is structurally able to carry ongoing rail traffic while construction continues.~~

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling

1. Milestones shall be clearly identified in the Construction Progress Schedule (Section 01 32 20).
2. Each milestone shall be assigned a logical duration, start date, and completion date.
3. The Contractor is responsible for updating milestone status in each schedule update.

B. Coordination

1. The Contractor shall coordinate milestone-related activities (e.g., inspections, tests, deliveries) to achieve timely completion.
2. Sub-tier contractors or suppliers with milestone-critical activities shall be notified in writing of their obligations to maintain the milestone dates.

1.5 SUBMITTALS

A. Milestone Completion Notice

1. Contractor shall provide written notice to the Owner's Representative at least five (5) business days in advance of anticipated milestone completion.

B. Milestone Completion Documentation

1. Provide all required submittals supporting each milestone, including but not limited to test reports, inspection certificates, photos, operation and maintenance manuals, warranties, or other deliverables specified in the Contract Documents.
2. Include any punch-list items and related documentation confirming that deficiencies have been addressed.
3. For each milestone involving CSX bridge infrastructure, the Contractor shall submit as-built drawings and associated documentation for review by CSX. These submittals shall be provided within 30 calendar days of the respective bridge being placed into CSX ***operation.*** ~~operational use~~. Submittals shall be complete, accurate, and clearly reflect the constructed condition of the Work.

1.6 QUALITY ASSURANCE

A. Inspection

1. The Owner's Representative shall conduct an inspection to verify that the Work pertaining to a milestone is complete and in compliance with the Contract Documents.
2. Any deficiencies discovered during inspection shall be documented in writing and provided to the Contractor for prompt correction.

B. Re-Inspection

1. Upon correction of deficiencies, the Contractor shall submit a request for re-inspection.
2. If corrective work is satisfactory, the Owner's Representative shall issue the Milestone Completion Certificate.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 MILESTONE COMPLETION REQUIREMENTS

A. General

1. The Contractor shall complete each milestone by the date specified in the Contract Documents or as otherwise authorized in writing by the Owner.
   a. CSX Operation Use of East Bridges no later than February 26, 2027
   b. CSX Operation Use of West Bridges no later than August 11, 2027

2. Milestone completion is a condition precedent for issuance of associated payments as defined in Section 01 29 00, "Payment Procedures".

B. Substantial Completion of Each Milestone

1. Substantial Completion is achieved when:

a. All Work assigned to that milestone is complete and compliant with the Contract Documents.

b. The Owner's Representative has inspected the Work and confirmed that all punch-list items are resolved or scheduled for prompt completion acceptable to the Owner's Representative.

c. All required deliverables (e.g., test data, product warranties, O&M manuals) are submitted.

C. Liquidated Damages for Milestone Non-Compliance

1. In the event the Contractor fails to complete any of the milestones listed above by the respective Milestone Completion Date, the Contractor shall be liable to the Owner for liquidated damages in the amount of $10,224 per calendar day, per milestone, for each day the milestone remains incomplete.

2. These amounts are agreed upon as a reasonable estimate of the damages the Owner will incur due to delay in milestone completion, including but not limited to impacts on third-party coordination, public inconvenience, administrative and inspection costs, and loss of anticipated benefits. These liquidated damages are not a penalty but shall be assessed in addition to any liquidated damages associated with overall Substantial or Final Completion of the Project.

3. Assessment of liquidated damages shall begin on the calendar day immediately following the milestone completion date and continue until a Milestone Completion Certificate is issued by the Owner's Representative in accordance with this Section.

3.2 CLOSEOUT ACTIVITIES

A. Final Completion

1. Closeout of the entire project requires completion of all milestones, final inspections, submission of as-built documents, warranties, and final payment application, as outlined in Section 01 77 00, "Closeout Procedures."

END OF SECTION

SECTION 01 35 14

ALEXANDRIA CORRIDOR COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for coordinating construction operations with other Owners and Contractors working on concurrent projects as part of the Alexandria Corridor Transforming Rail in Virginia Program (Alexandria Corridor), including, but not limited to, the following:

1. Alexandria Corridor Concurrent Projects Coordination Requirements
2. Alexandria Corridor Phasing and Coordination Requirements
3. Shared Use of Corridor Requirements
4. Maintenance of Rail Requirements
5. Exhibit A – Alexandria Corridor Projects Phasing Diagrams***, dated June 2025***
6. Exhibit B – Alexandria Station and King & Commonwealth Bridges Replacement Suggested Phasing Diagrams***, Sheets 4 and 7 at Rev. No. 1***
7. Exhibit C – Crystal City Station Improvements Suggested Phasing Diagrams
8. Exhibit D – CSX Standard Specification Section 010010 Part 1.1.A

1.2 RELATED SECTIONS

A. Section 01 24 00 – Value Engineering

B. Section 01 31 00 – Project Management and Coordination

C. Section 01 31 33 – Project Meetings

D. Section 01 32 20 – Construction Progress Schedule

E. Section 01 33 00 – Submittal Procedures

F. Section 01 35 13 – Host Railroad Coordination

G. Section 01 73 00 – Execution of Work

1.3 ALEXANDRIA CORRIDOR CONCURRENT PROJECTS COORDINATION REQUIREMENTS

A. The Contractor shall coordinate construction operations with the other contractors working on concurrent contracts in the Alexandria Corridor projects listed below as required by this Section and Section 01 73 00 – Execution of Work. The Contractor shall cooperate with the other contractors in the phasing and performance of the work so as not to delay, interrupt, or hinder the progress or completion of work being performed by the other contractors.

1. Alexandria Fourth Track (CSX)

   The Alexandria Fourth Track project constructs railroad track and related infrastructure in a 6-mile rail corridor in Arlington and Alexandria, VA. The project extends from the

southern end of the existing Long Bridge to the AF interlocking just south of Telegraph Road and will add one additional track to the existing three-track segment.

Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the project area, the maintenance of rail traffic through the Washington, DC to Richmond, VA corridor, grading, and track/civil construction.
The Alexandria Fourth Track project is an overlapping project in the Alexandria Corridor. All projects in the Alexandria Corridor are anticipated to be under construction simultaneously, and close coordination between the projects and Contractors will be required as detailed in this Section.

2. VRE Crystal City Station Improvements (VRE)

   The project will construct an island platform to allow simultaneous boarding of two eight-car train sets and the planned fourth track at and around the station. The station is designed to be constructed immediately north of the separate Amtrak Crystal City Station project. The shared stair and elevator tower at the confluence of these two projects is also designed to be connected to a future Crystal City to Ronald Reagan National Airport (CC2DCA) pedestrian bridge being designed by Arlington County. The VRE project will include a new underpass pedestrian tunnel at the northern end of the platform, running beneath Track 5 to connect with Crystal Drive. Track 5 in the station's vicinity will be removed by the Alexandria Fourth Track project, prior to the station construction within the right of way. Track 5's replacement will be funded and constructed through the Crystal City Station Improvement project

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the project area, maintenance of rail traffic through the Washington DC to Richmond VA corridor, maintaining passenger station operations during construction, grading, pedestrian bridge construction, pedestrian underpass construction, station platform construction, and elevator construction.

   The VRE Crystal City Station Improvements project is an overlapping project in the Alexandria Corridor. All projects in the Alexandria Corridor are anticipated to be under construction simultaneously, and close coordination between the projects and Contractors will be required as detailed in this Section.

3. Amtrak Crystal City Station Improvements (Amtrak)

   The project will construct an island platform to allow simultaneous boarding of two train sets and the planned fourth track at and around the station. The station is designed to be constructed immediately south of the separate VRE Crystal City Station Improvements project. The shared stair and elevator tower at the confluence of these two projects is also designed to be connected to a future CC2DCA pedestrian bridge being designed by Arlington County.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the project area, maintenance of rail traffic through the Washington DC to Richmond VA corridor, grading, station platform construction, and escalator construction.

   The Amtrak Crystal City Station project is an overlapping project in the Alexandria Corridor. All projects in the Alexandria Corridor are anticipated to be under construction simultaneously, and close coordination between the projects and Contractors will be required as detailed in this Section.

4. Long Bridge Project, South Package (VPRA)

   The Long Bridge Project, South Package will construct a new, two-track railroad bridge next to the existing Long Bridge, creating a four-track corridor. The project will construct an additional track at the RO interlocking and generally overlap the north end of the Alexandria Fourth Track project.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the project area, maintenance of rail traffic through the Washington, DC to Richmond, VA corridor, grading, drainage construction, and bridge construction.

   The Contractor shall be aware that the Long Bridge Project, South Package is anticipated to be under construction at the same time as this Contract, and close coordination of staging, phasing, and scheduling will be required.

5. Long Bridge Project, North Package (VPRA)

   The Long Bridge Project, North Package will connect the new two-track bridge over the Potomac to the existing three-track corridor and new fourth track at L'Enfant in Washington, DC, including a new bridge over I-395 and WMATA, and replacement of existing two-track bridges with four-track bridges over Ohio Drive SW, Washington Channel, and Maine Avenue.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the Washington, DC to Richmond, VA corridor.

   The Contractor shall be aware that the Long Bridge Project, North Package, is anticipated to be under construction at the same time as this Contract.

6. L’Enfant Station Improvements & Fourth Track (VRE)

   The L’Enfant Station Improvements & Fourth Track project will expand VRE's busiest station. It will also construct an additional mainline track between the Virginia (VA) and L'Enfant (LE) interlockings in Washington, DC. The expanded station will enable simultaneous boarding of two full-length trains.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the Washington, DC to Richmond, VA corridor and maintaining passenger station operations during construction.

   The Contractor shall be aware that the L'Enfant Station Improvements & Fourth Track project is anticipated to be under construction at the same time as this Contract.

7. Franconia-Lorton Third Track (CSX)

   The Franconia to Lorton Third Track will increase rail capacity and alleviate congestion for passenger and freight services by adding a third mainline track along one of the most heavily traveled rail sections between DC and Richmond. This additional 6 miles of mainline third track from Franconia to Lorton will create a continuous three-track corridor between Alexandria and Lorton. In addition, the project will construct railroad bridges over Newington Road and Lorton Road, as well as other infrastructure to accommodate the additional third track.

   Critical items affecting this Contract include Maintenance of rail traffic through the Washington, DC to Richmond, VA corridor.

The Contractor shall be aware that the Franconia-Lorton Third Track project is anticipated to be under construction at the same time as this Contract.

8. Franconia-Springfield Bypass (VPRA)

   Franconia-Springfield Bypass, located just south of Franconia-Springfield station, is a rail bridge allowing passenger trains to cross over the freight trains. This is necessary because the passenger rail stations south of the bypass are located on the east side of the railroad tracks, and the passenger rail stations north of the bypass are on the west side. Currently, an interlocking allows passenger trains to switch sides with the freight trains. However, this creates a bottleneck and significant delays. The bridge structure will eliminate the conflict, reduce congestion, and improve reliability for freight and passenger trains.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the Washington, DC to Richmond, VA corridor.

   The Contractor shall be aware that the Franconia-Springfield Bypass project is anticipated to be under construction at the same time as this Contract.

9. Franconia-Springfield Station Improvements (VRE)

   The Franconia-Springfield Station Improvements will extend the existing platforms to allow simultaneous boarding of two eight-car train sets. A new pedestrian ramp and underpass tunnel will be constructed from the eastern platform to Barry Road to accommodate the third track to be constructed under the Franconia-Lorton Third Track project.

   Critical items affecting this Contract include (but are not limited to): Maintenance of rail traffic through the project area, maintenance of rail traffic through the Washington DC to Richmond VA corridor, maintenance of passenger station operations, maintenance of pedestrian access to the adjacent WMATA station, grading, pedestrian underpass construction, and station platform construction.

   The Contractor shall be aware that the Franconia-Springfield Station Improvements project is anticipated to be under construction at the same time as this Contract.

1.4 ALEXANDRIA CORRIDOR PROJECTS PHASING AND COORDINATION REQUIREMENTS

A. The Alexandria Corridor Phasing Diagrams appended at the end of this Section have been collaboratively developed for the Alexandria Corridor Projects (Alexandria 4th Track, Alexandria Station and King & Commonwealth Bridges Replacement, and Crystal City Station Improvements). Phase milestones are provided for reference below and do not take precedence over contractual milestones. Phase milestones shall be included in the Contractor's "CPM Construction Schedule" per Section 01 32 20 – Construction Progress Schedule.

   1. Completion of Phase 1 by 03/10/2026
   2. Completion of Phase 2 by ~~11/15/2026~~ ***11/12/2026***
   3. Completion of Phase 3 by 05/20/2027
   4. Completion of Phase 4 by 10/06/2027
   5. Complete Phase 5 by 12/31/2027

B. The Contractor shall maintain the number of available tracks and boarding edges identified in each phase of the Alexandria Corridor Phasing Diagrams. Alexandria Corridor Phasing may be changed only by the consensus of CSX, VRE, and VPRA (collectively, the "Owners") and their respective contractors for the Alexandria Corridor Projects. The Contractor may propose changes in accordance with Section 01 24 00 – Value Engineering.

C. No work requiring track outages may occur from November 15th to January 15th of any year, and the maximum number of tracks identified in the Suggested Phasing Plans must be available for railroad traffic. Modifications to track outages will not be considered during this period.

D. The Contractor shall identify all work items requiring coordination for the Alexandria Corridor Projects (Alexandria 4th Track, Alexandria Station and King & Commonwealth Bridges Replacement, and Crystal City Station Improvements) and the other concurrent projects listed in Section 1.03 above (including critical items listed in each project description) and coordinate the sequence and timing of their execution and completion with the other contractors. The Contractor shall include these work items in the Contractor's "CPM Construction Schedule" per Section 01 32 20 – Construction Progress Schedule. Failure to consider the sequence and timing of interfacing activities from the Alexandria Corridor Concurrent Projects is not a basis for additional compensation or time.

E. The Contractor shall submit a duplicate copy of the "CPM Construction Schedule" to the CM for VPRA's Enterprise P6 Cloud Tool. The Contractor shall coordinate with the contractors for the Alexandria Corridor Projects (Alexandria 4th Track, Alexandria Station and King & Commonwealth Bridges Replacement, and Crystal City Station Improvements) to resolve conflicts as required by this Section and Section 01 73 00 – Execution of Work.

F. The Contractor shall participate in bi-weekly corridor coordination meetings for the Alexandria Corridor Projects (Alexandria 4th Track, Alexandria Station and King & Commonwealth Bridges Replacement, and Crystal City Station Improvements) per Section 01 31 33 – Project Meetings requirements. Bi-weekly corridor coordination meetings shall be scheduled by VPRA and include the owners of each project and their respective contractors and representatives. The meeting shall generally cover topics such as corridor-level scheduling, sequencing and conflicts, discussion of any proposed changes to the phasing plan, overall use of the corridor during construction, and maintenance of railroad traffic. Contractor's from the other concurrent projects listed in Section 1.03 above may participate at the Owner's discretion.

1.5 SHARED USE OF CORRIDOR REQUIREMENTS

A. When necessary for the proper prosecution of work, the Contractor shall permit the other Alexandria Corridor Owners and Contractors access through the overlapping construction areas and use any access or haul roads constructed by others.

B. When necessary for the proper prosecution of work, the Contractor shall permit the other Alexandria Corridor Owners and Contractors access to work within predetermined areas of overlapping construction work areas for a predetermined duration. The Contractor working within the adjacent overlapping construction work areas will be responsible for cleaning the work area upon completion and leaving the work area in a suitable condition, including application of temporary erosion control measures as required, to the satisfaction of both Engineers. Examples of work requiring occupation of overlapping work areas include (but are not limited to) earth excavation/grading, landscaping, maintenance of erosion control items, and ballast and track installation.

C. Any damages resulting from the shared use of access facilities or overlapping work areas shall be repaired by the Contractor that caused the damage at its own expense, and no additional cost to the Contract.

1.6 MAINTENANCE OF RAIL TRAFFIC REQUIREMENTS

A. The Contractor shall maintain the specified number of tracks for the work's duration per the CSX Standard Specification Section 010010 Part 1.1 requirements, incorporated as an appendix to this Section. Work on projects across the Alexandria Corridor and larger Washington-Richmond corridor must be coordinated to maintain rail traffic. The CMs shall facilitate such coordination, and the Contractor shall attend meetings in support of this effort at the direction of the CMs.

END OF SECTION

Exhibit A

Alexandria Corridor Projects Phasing Diagrams *dated June 2025*

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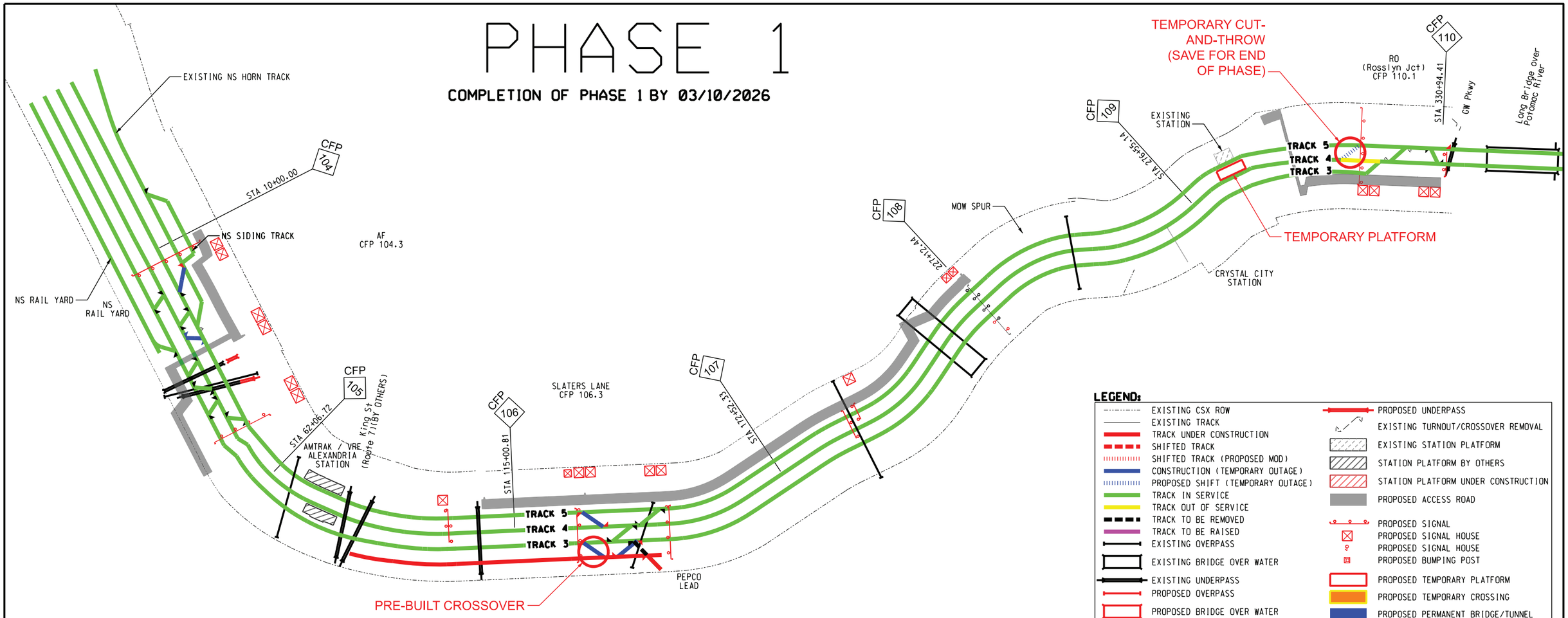
PHASE 1

COMPLETION OF PHASE 1 BY 03/10/2026



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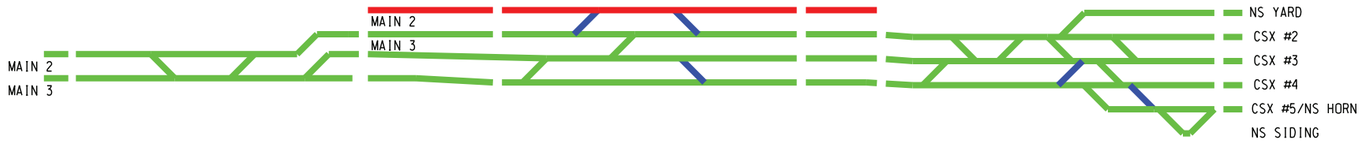
← L'ENFANT RO (CFP 110.1/STA. 325+00) SLATER'S LANE (CFP 106.3/STA 130+00) AF (CFP 104.3/STA. 25+00) FRANCONIA →



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WORK ELEMENT	PHYSICAL ENTITY	CONTRACT DESIGNATOR	LINE ITEM	COST ELEMENT	PROJECT NUMBER

LEVEL #

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY TWKII
DRAWN BY TWKII
CHECKED BY MJK
APPROVED BY MJK
DATE JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

Michael Baker INTERNATIONAL

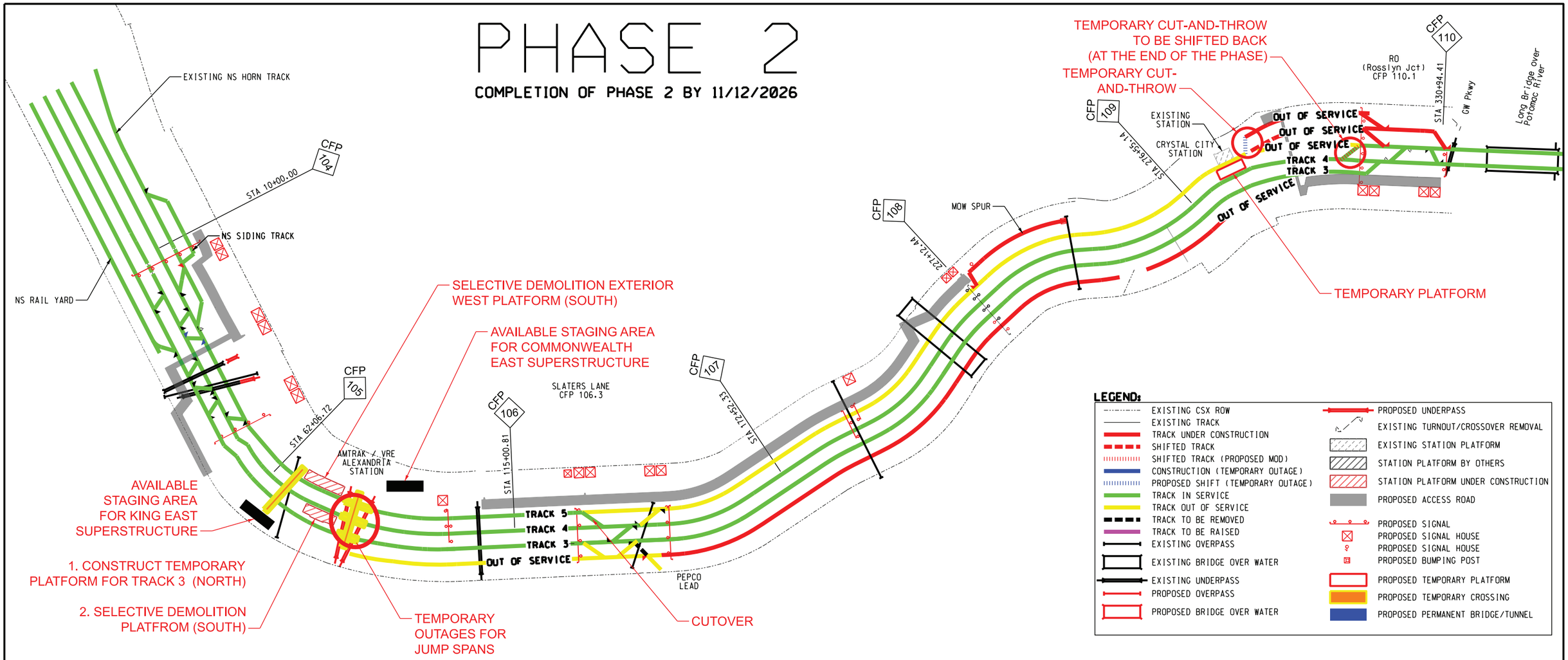
VAL. SEC.

PROJECT NO. 188957
DRAWING NO. SD-01
REVISION 0
SHEET NO. 1 OF 10
SCALE N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 2

COMPLETION OF PHASE 2 BY 11/12/2026



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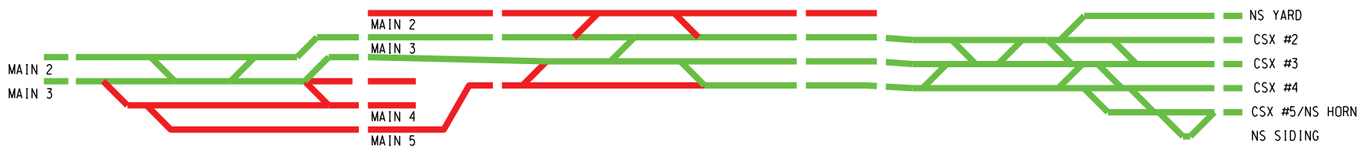

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ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

[CSX]

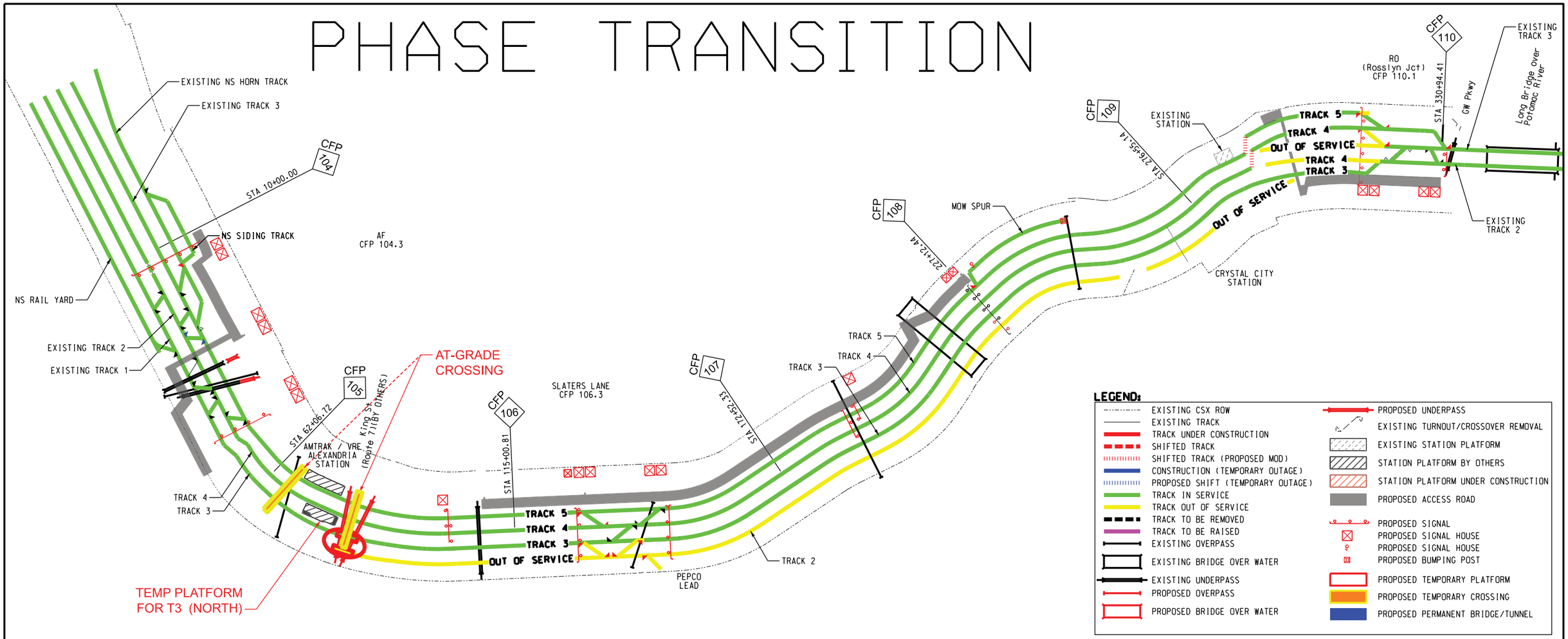
Michael Baker INTERNATIONAL

VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-02
REVISION	0
SHEET NO.	2 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE TRANSITION



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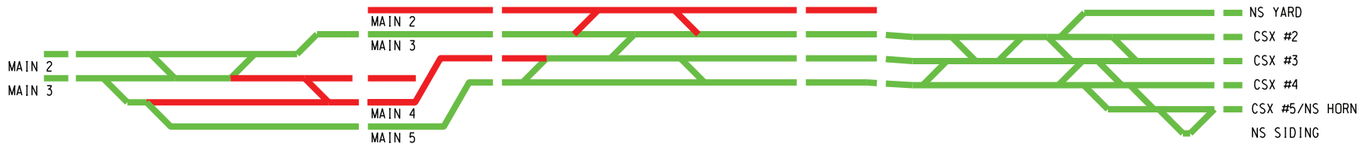

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DATE	JUNE 2025

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ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

Michael Baker INTERNATIONAL

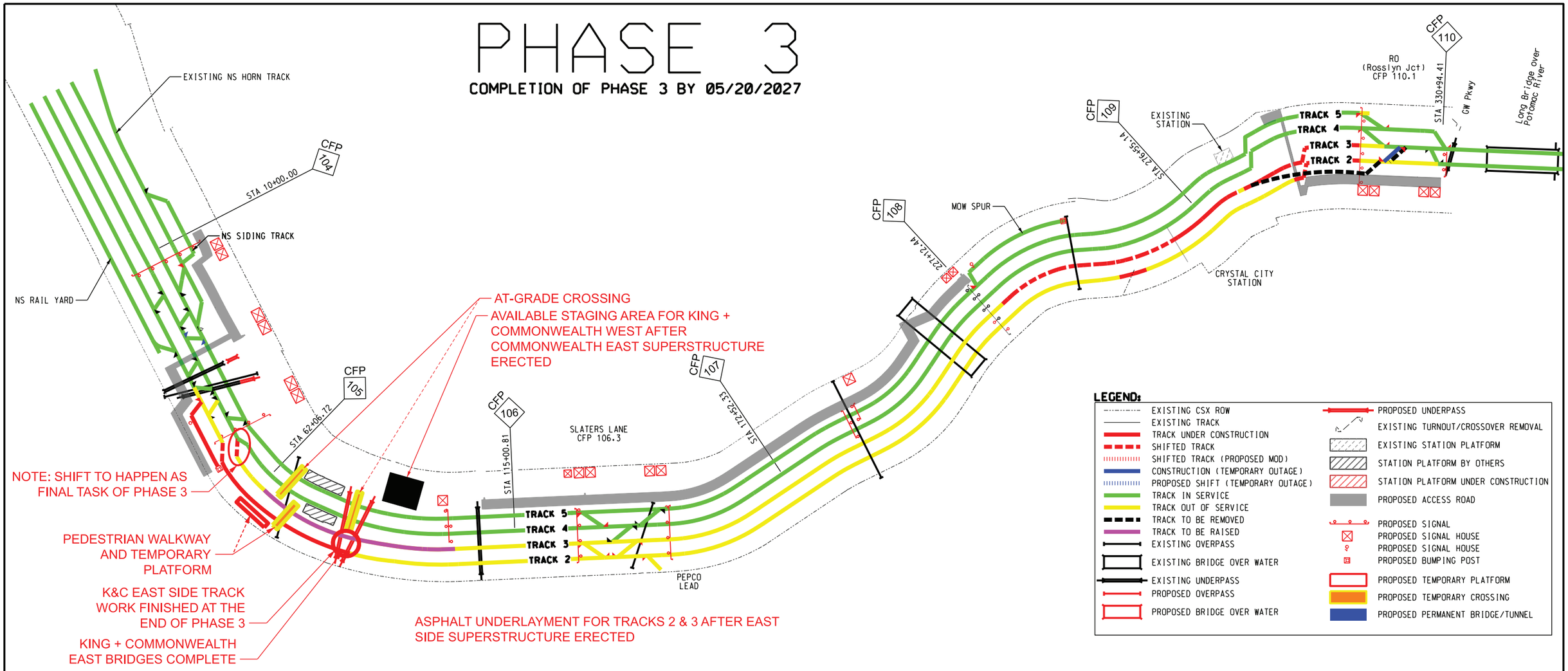
VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-03
REVISION	0
SHEET NO.	3 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 3

COMPLETION OF PHASE 3 BY 05/20/2027



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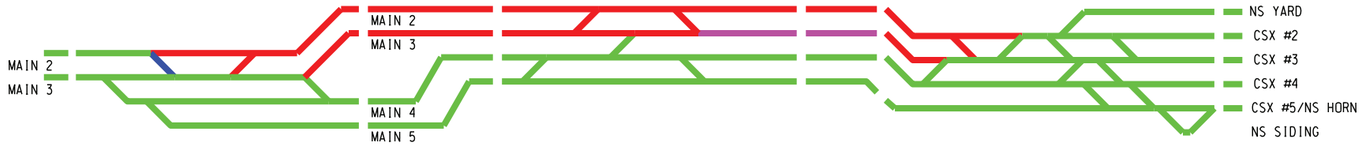


Pen Table File
$TIME$
$DATE$

PROJECT NUMBER	COST ELEMENT	LINE ITEM	CONTRACT DESIGNATOR	PHYSICAL ENTITY	WORK ELEMENT

LEVEL #

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

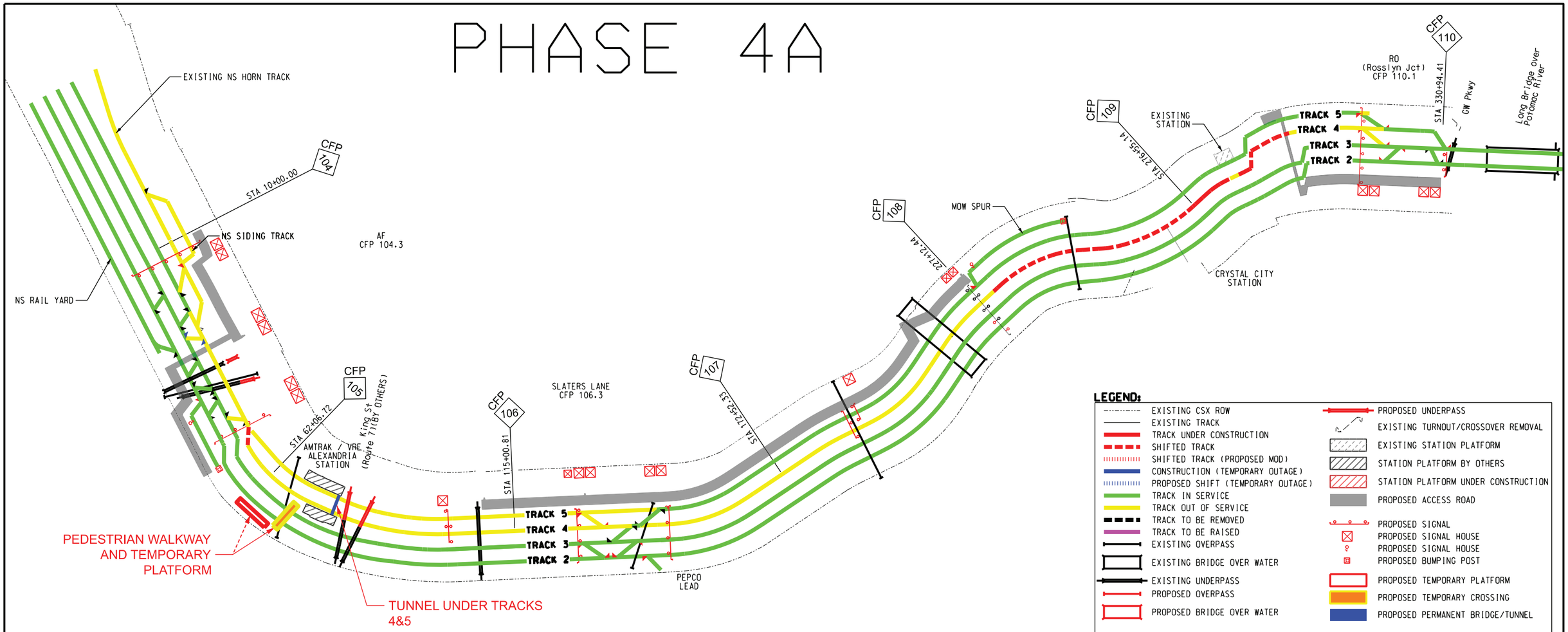
Michael Baker INTERNATIONAL

VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-04
REVISION	0
SHEET NO.	4 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

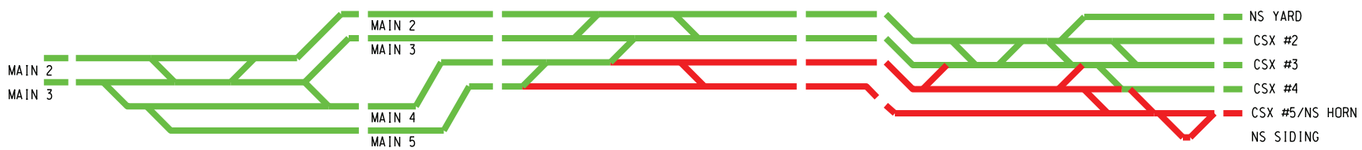
PHASE 4A



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
- PROPOSED SHIFT (TEMPORARY OUTAGE)
- TRACK IN SERVICE
- TRACK OUT OF SERVICE
- TRACK TO BE REMOVED
- TRACK TO BE RAISED
- EXISTING OVERPASS
- EXISTING BRIDGE OVER WATER
- EXISTING UNDERPASS
- PROPOSED OVERPASS
- PROPOSED BRIDGE OVER WATER
- PROPOSED UNDERPASS
- EXISTING TURNOUT/CROSSOVER REMOVAL
- EXISTING STATION PLATFORM
- STATION PLATFORM BY OTHERS
- STATION PLATFORM UNDER CONSTRUCTION
- PROPOSED ACCESS ROAD
- PROPOSED SIGNAL
- PROPOSED SIGNAL HOUSE
- PROPOSED SIGNAL HOUSE
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

← L'ENFANT RO (CFP 110.1/STA. 325+00) SLATER'S LANE (CFP 106.3/STA 130+00) AF (CFP 104.3/STA. 25+00) FRANCONIA →



Pen Table File
$TIME$
$DATE$

WORK ELEMENT	PHYSICAL ENTITY	CONTRACT DESIGNATOR	LINE ITEM	COST ELEMENT	PROJECT NUMBER

REV	DATE	DESCRIPTION	BY / SUB	APP
		LEVEL #		

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

[CSX]

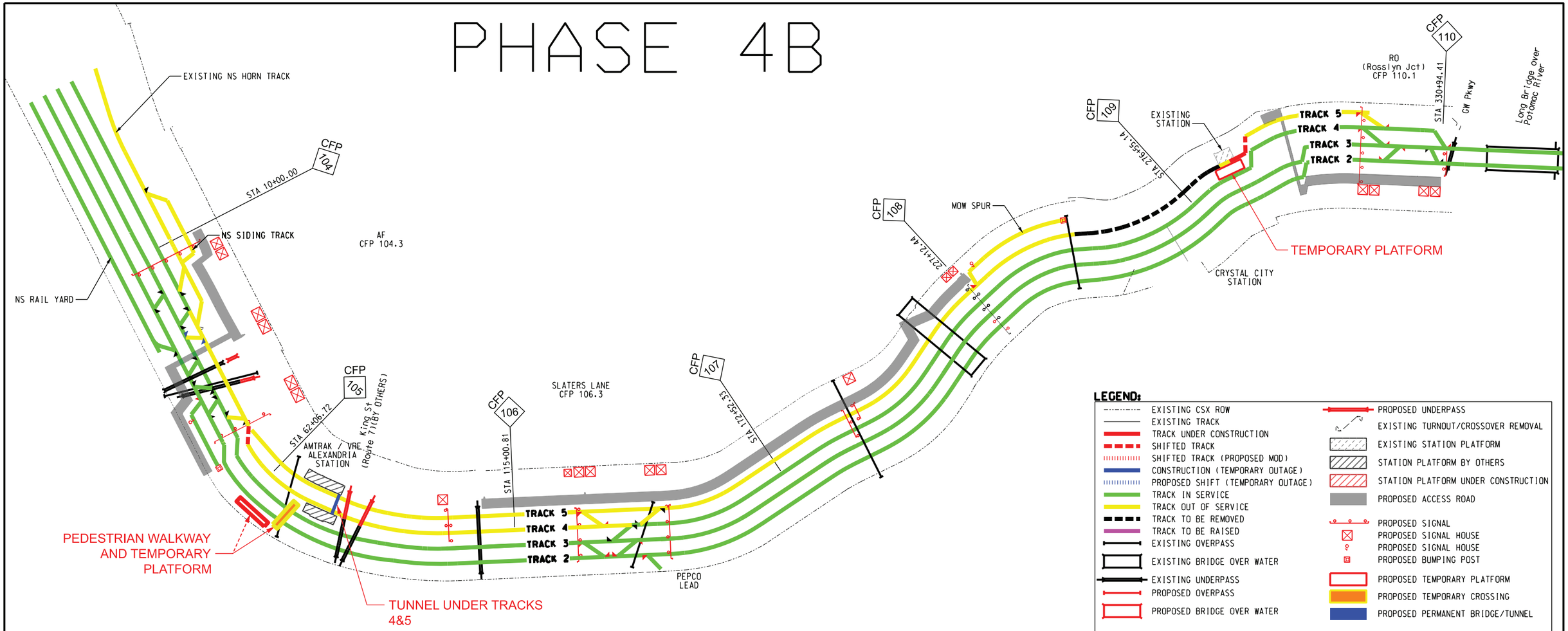
Michael Baker INTERNATIONAL

VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-05
REVISION	0
SHEET NO.	5 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

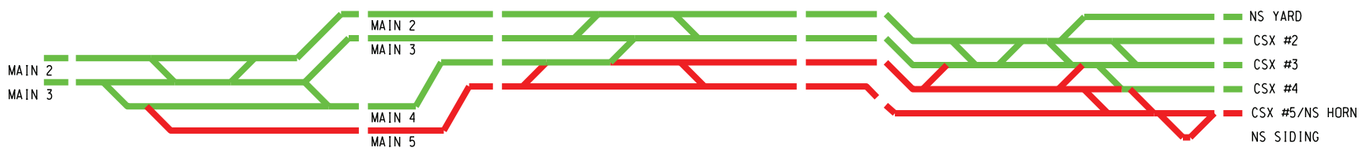
PHASE 4B



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
- PROPOSED SHIFT (TEMPORARY OUTAGE)
- TRACK IN SERVICE
- TRACK OUT OF SERVICE
- TRACK TO BE REMOVED
- TRACK TO BE RAISED
- EXISTING OVERPASS
- EXISTING BRIDGE OVER WATER
- EXISTING UNDERPASS
- PROPOSED OVERPASS
- PROPOSED BRIDGE OVER WATER
- PROPOSED UNDERPASS
- EXISTING TURNOUT/CROSSOVER REMOVAL
- EXISTING STATION PLATFORM
- STATION PLATFORM BY OTHERS
- STATION PLATFORM UNDER CONSTRUCTION
- PROPOSED ACCESS ROAD
- PROPOSED SIGNAL
- PROPOSED SIGNAL HOUSE
- PROPOSED SIGNAL HOUSE
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

← L'ENFANT RO (CFP 110.1/STA. 325+00) SLATER'S LANE (CFP 106.3/STA 130+00) AF (CFP 104.3/STA. 25+00) FRANCONIA →



Pen Table File
$TIME$
$DATE$

WORK ELEMENT	PHYSICAL ENTITY	CONTRACT DESIGNATOR	LINE ITEM	COST ELEMENT	PROJECT NUMBER

REV	DATE	DESCRIPTION	BY / SUB	APP
		LEVEL #		

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

[CSX]

Michael Baker INTERNATIONAL

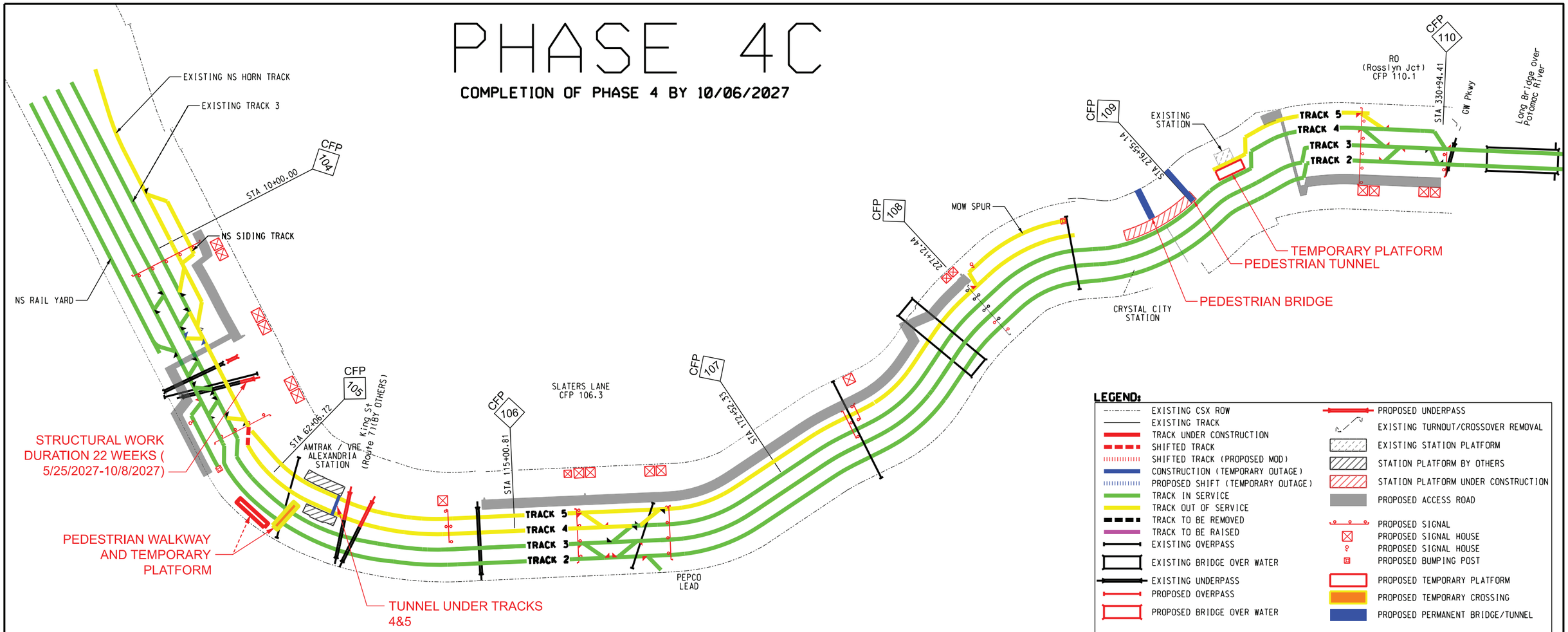
VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-06
REVISION	0
SHEET NO.	6 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 4C

COMPLETION OF PHASE 4 BY 10/06/2027



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
- PROPOSED SHIFT (TEMPORARY OUTAGE)
- TRACK IN SERVICE
- TRACK OUT OF SERVICE
- TRACK TO BE REMOVED
- TRACK TO BE RAISED
- EXISTING OVERPASS
- EXISTING BRIDGE OVER WATER
- EXISTING UNDERPASS
- PROPOSED OVERPASS
- PROPOSED BRIDGE OVER WATER
- PROPOSED UNDERPASS
- EXISTING TURNOUT/CROSSOVER REMOVAL
- EXISTING STATION PLATFORM
- STATION PLATFORM BY OTHERS
- STATION PLATFORM UNDER CONSTRUCTION
- PROPOSED ACCESS ROAD
- PROPOSED SIGNAL
- PROPOSED SIGNAL HOUSE
- PROPOSED SIGNAL HOUSE
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

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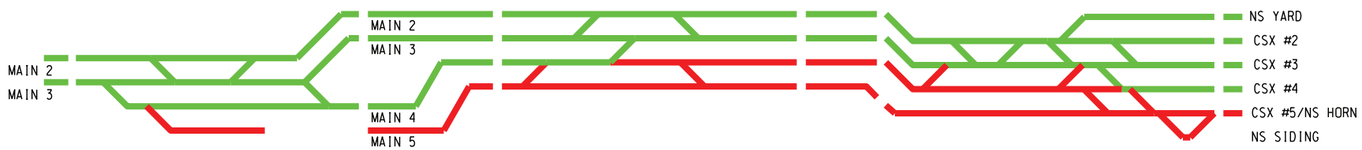


Pen Table File
$TIME$
$DATE$

WORK ELEMENT	PHYSICAL ENTITY	CONTRACT DESIGNATOR	LINE ITEM	COST ELEMENT	PROJECT NUMBER

REV	DATE	DESCRIPTION	BY / SUB	APP
		LEVEL #		

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

[CSX]

Michael Baker INTERNATIONAL

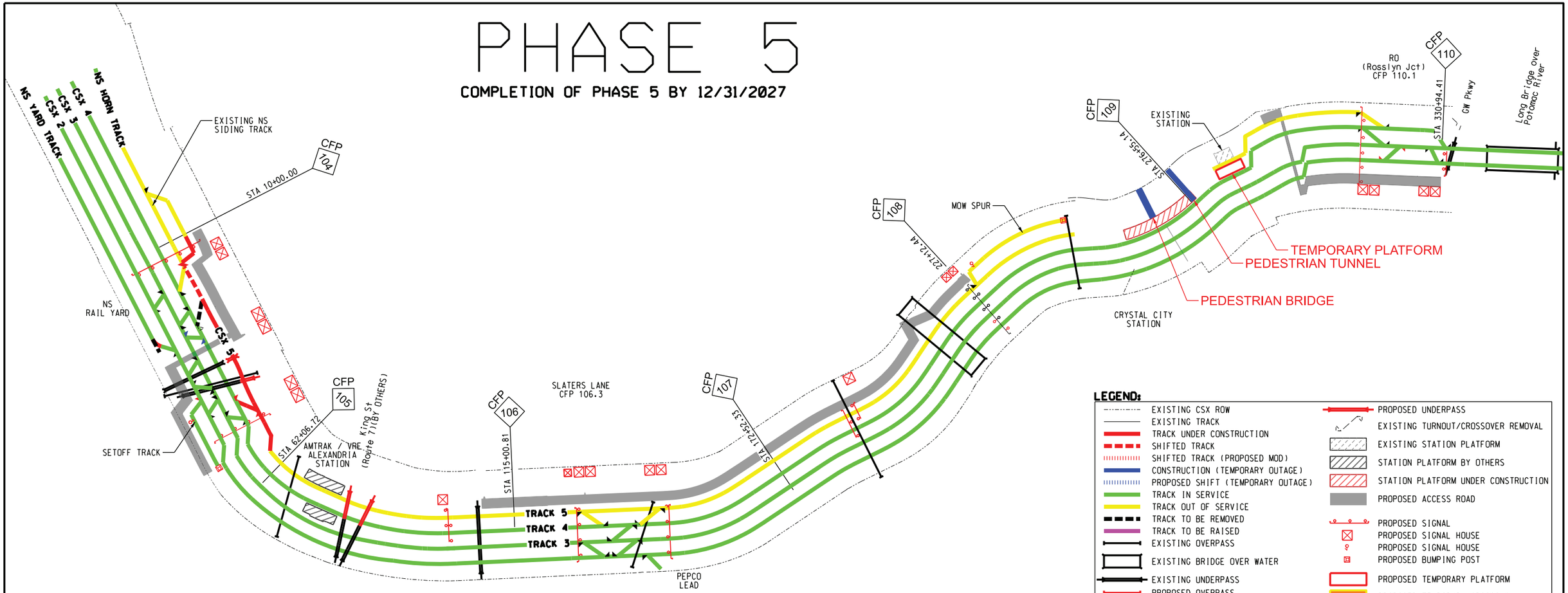
VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-07
REVISION	0
SHEET NO.	7 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 5

COMPLETION OF PHASE 5 BY 12/31/2027



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
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- TRACK IN SERVICE
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- PROPOSED BRIDGE OVER WATER
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- PROPOSED SIGNAL
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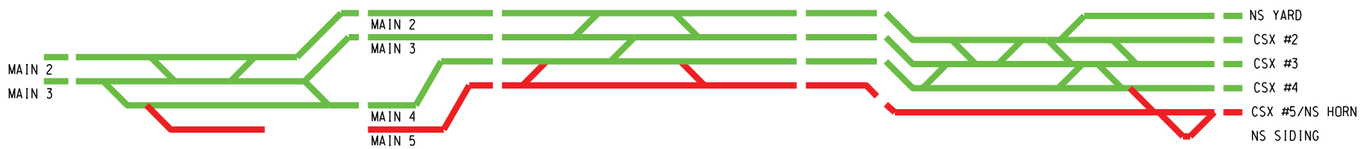
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

← L'ENFANT | RO (CFP 110.1/STA. 325+00) | SLATER'S LANE (CFP 106.3/STA 130+00) | AF (CFP 104.3/STA. 25+00) | FRANCONIA →



Pen Table File
$TIME$
$DATE$

WORK ELEMENT	PHYSICAL ENTITY	CONTRACT DESIGNATOR	LINE ITEM	COST ELEMENT	PROJECT NUMBER

LEVEL #

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

Michael Baker INTERNATIONAL

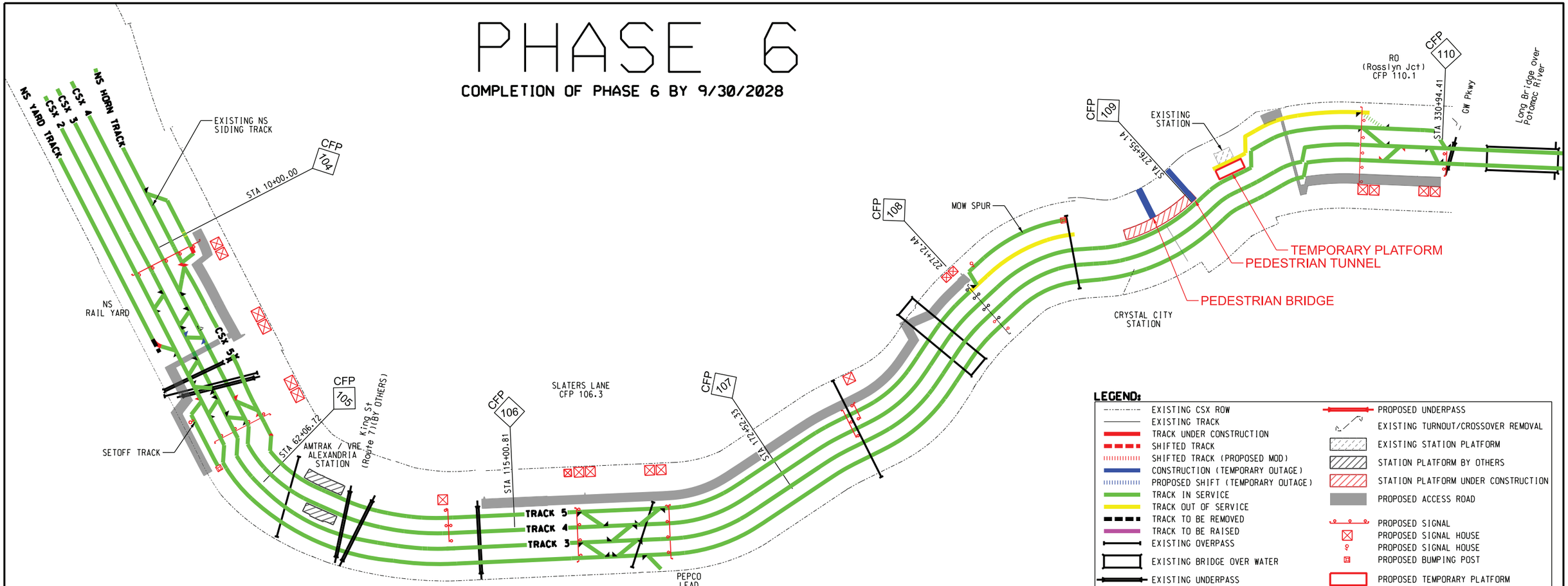
VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-08
REVISION	0
SHEET NO.	8 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 6

COMPLETION OF PHASE 6 BY 9/30/2028



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
- PROPOSED SHIFT (TEMPORARY OUTAGE)
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- STATION PLATFORM BY OTHERS
- STATION PLATFORM UNDER CONSTRUCTION
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- PROPOSED SIGNAL HOUSE
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

← L'ENFANT | RO (CFP 110.1/STA. 325+00) | SLATER'S LANE (CFP 106.3/STA 130+00) | AF (CFP 104.3/STA. 25+00) | FRANCONIA →

Pen Table File
$TIME$
$DATE$

PROJECT NUMBER	COST ELEMENT	LINE ITEM	CONTRACT DESIGNATOR	PHYSICAL ENTITY	WORK ELEMENT

REV	DATE	DESCRIPTION	BY / SUB	APP
		LEVEL #		

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

Michael Baker INTERNATIONAL

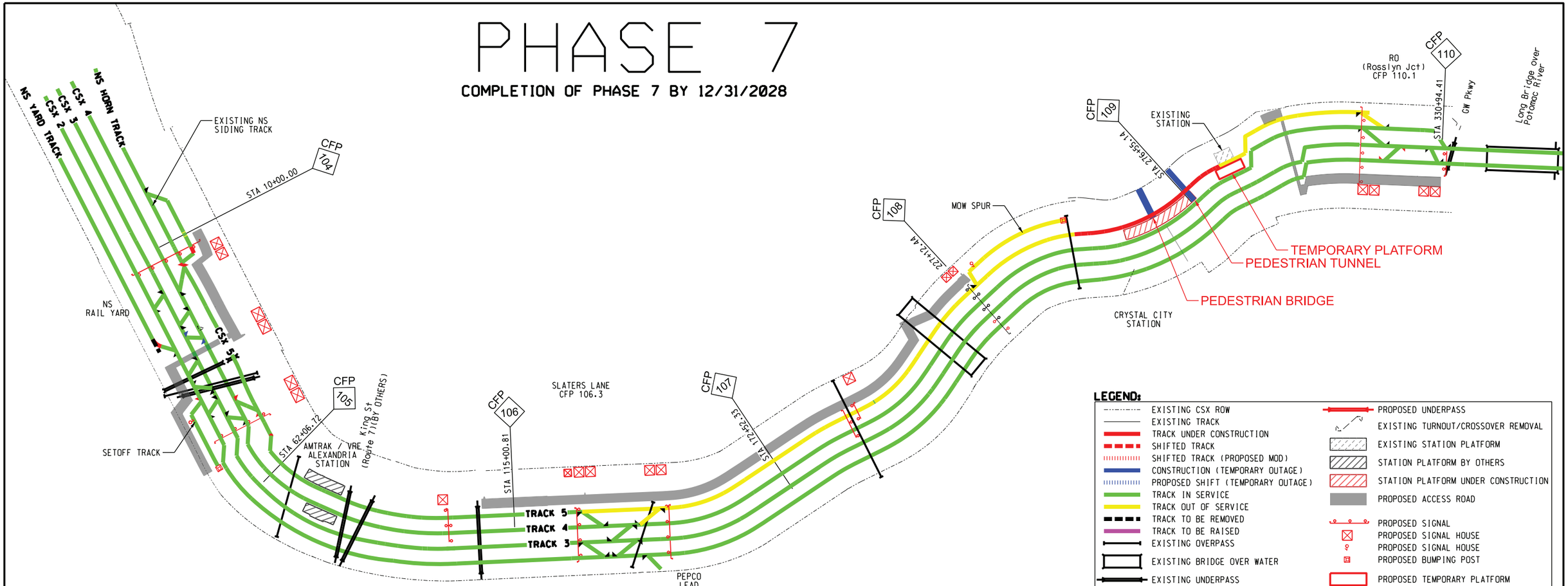
VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-09
REVISION	0
SHEET NO.	9 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

PHASE 7

COMPLETION OF PHASE 7 BY 12/31/2028



LEGEND:

- EXISTING CSX ROW
- EXISTING TRACK
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- SHIFTED TRACK (PROPOSED MOD)
- CONSTRUCTION (TEMPORARY OUTAGE)
- PROPOSED SHIFT (TEMPORARY OUTAGE)
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- PROPOSED BRIDGE OVER WATER
- PROPOSED UNDERPASS
- EXISTING TURNOUT/CROSSOVER REMOVAL
- EXISTING STATION PLATFORM
- STATION PLATFORM BY OTHERS
- STATION PLATFORM UNDER CONSTRUCTION
- PROPOSED ACCESS ROAD
- PROPOSED SIGNAL
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- PROPOSED SIGNAL HOUSE
- PROPOSED BUMPING POST
- PROPOSED TEMPORARY PLATFORM
- PROPOSED TEMPORARY CROSSING
- PROPOSED PERMANENT BRIDGE/TUNNEL

← L'ENFANT RO (CFP 110.1/STA. 325+00) SLATER'S LANE (CFP 106.3/STA 130+00) AF (CFP 104.3/STA. 25+00) FRANCONIA →

Pen Table File
$TIME$
$DATE$

PROJECT NUMBER	COST ELEMENT	LINE ITEM	CONTRACT DESIGNATOR	PHYSICAL ENTITY	WORK ELEMENT

REV	DATE	DESCRIPTION	BY / SUB	APP
		LEVEL #		

DESIGNED BY	TWKII
DRAWN BY	TWKII
CHECKED BY	MJK
APPROVED BY	MJK
DATE	JUNE 2025

CSX TRANSPORTATION, INC.
ENGINEERING DEPARTMENT
DESIGN & CONSTRUCTION
JACKSONVILLE, FLORIDA

Michael Baker INTERNATIONAL

VAL. SEC.

CONTRACT NO.	188957
DRAWING NO.	SD-10
REVISION	0
SHEET NO.	10 OF 10
SCALE	N.T.S.

ALEXANDRIA FOURTH TRACK PROJECT
ALEXANDRIA & ROSSLYN
ARLINGTON AND FAIRFAX COUNTIES, VIRGINIA
SUBDIVISION: RF&P ZONE: CENTRAL

Exhibit B

VRE Alexandria Station and King & Commonwealth Bridges Suggested Phasing Diagrams
Sheets 4 and 7 at Rev. No. 1

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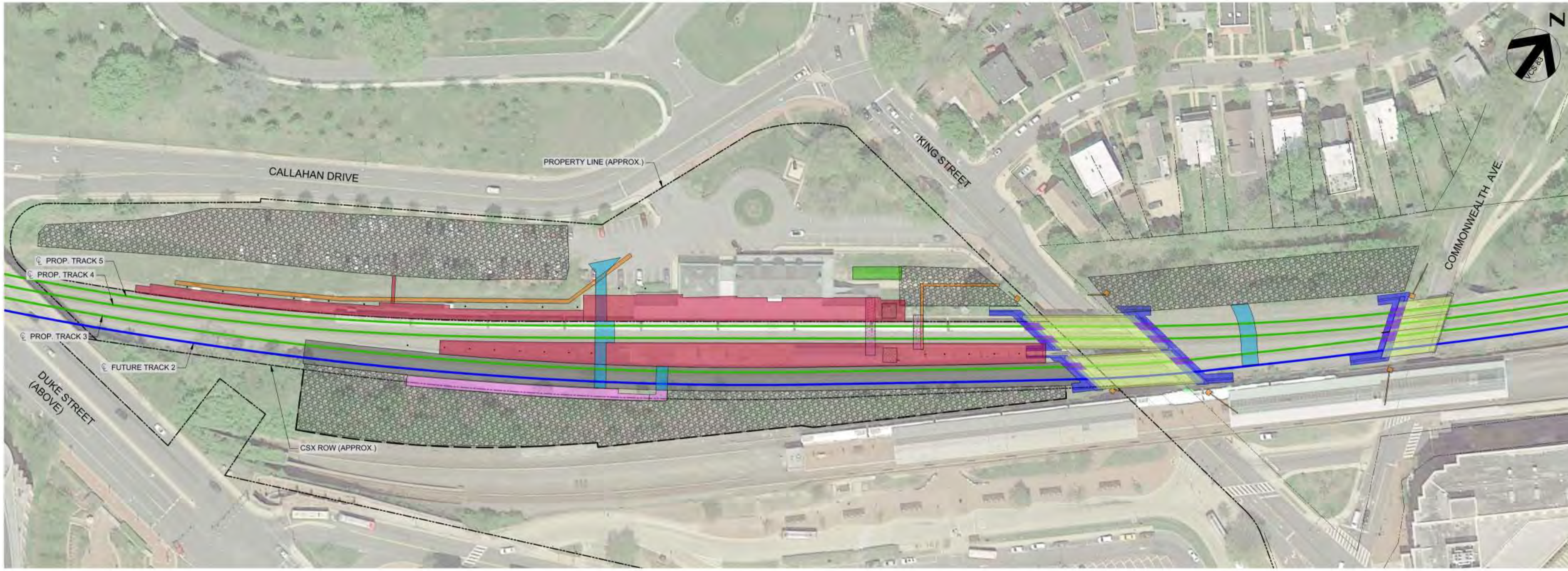


OVERVIEW OF SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

SCHEDULING SEQUENCE – CSX	SCHEDULING SEQUENCE – VRE	OVERVIEW ACTIVITIES
NTP / PRE-CONSTRUCTION; PHASE 1	NTP PRE-CONSTRUCTION	1) CSX INSTALLS TWO TEMPORARY CONSTRUCTION AT-GRADE CROSSINGS
PHASE 2 & PEAK SEASON	PHASE 1 STAGE 1	1) PREPARATION TO CONSTRUCT BRIDGE SUBSTRUCTURES 2) STATION SITEWORK
	PHASE 1 STAGE 2	1) COMPLETION OF BRIDGE SUBSTRUCTURES 2) PREPARATION AND CONSTRUCTION OF TEMPORARY AND EAST PLATFORMS 3) OFFLINE CONSTRUCTION OF SUPERSTRUCTURES FOR EAST BRIDGES

SCHEDULING SEQUENCE – CSX	SCHEDULING SEQUENCE – VRE	OVERVIEW ACTIVITIES
PHASE 3	PHASE 1 STAGE 3	1) COMPLETION OF EAST BRIDGES 2) COMPLETION OF TEMPORARY AND EAST PLATFORMS 3) PREPARATION AND FOUNDATIONS FOR EAST ELEVATOR 4) CSX REMOVES AT-GRADE CROSSINGS FROM 5) CSX RELOCATES PEDESTRIAN CROSSING ACROSS PROPOSED TRACKS 4 AND 5
PHASE 4	PHASE 2 STAGE 1	1) OFFLINE CONSTRUCTION OF SUPERSTRUCTURES FOR WEST BRIDGES 2) PREPARATION AND CONSTRUCTION OF WEST SIDE OF ISLAND PLATFORM
PHASE 4 / PHASE 5	PHASE 2 STAGE 2	1) COMPLETION OF WEST BRIDGES 2) COMPLETION OF WEST PLATFORMS 3) COMPLETION OF EAST AND WEST ELEVATORS 4) COMPLETION OF TUNNEL AND UTILITIES 5) CSX REMOVES TEMPORARY CONSTRUCTION CROSSING BETWEEN KING STREET AND COMMONWEALTH AVENUE
	PHASE 3	1) REMOVAL OF TEMPORARY EAST PLATFORM 2) CSX REMOVES ALL REMAINING AT-GRADE CROSSINGS WITHIN PROJECT LIMITS

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- TRACK IN SERVICE
- FUTURE TRACK

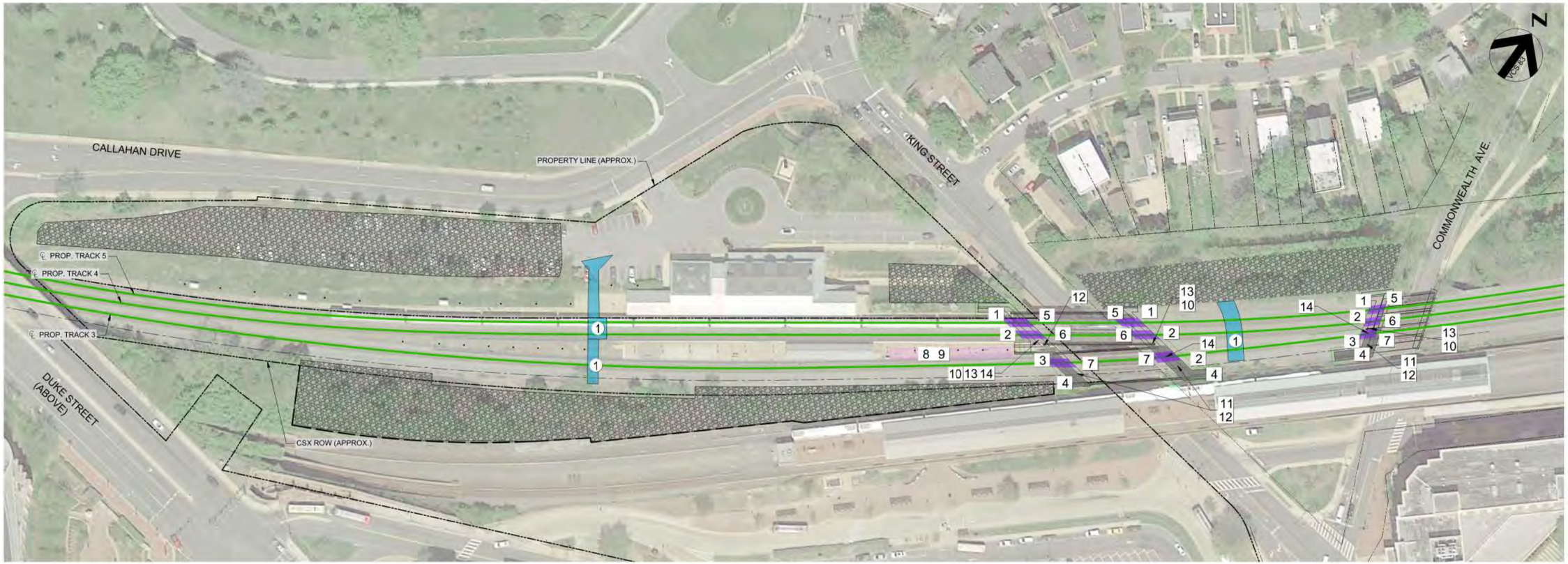
NOTE:

1) THE PURPOSE OF VRE PHASE 1:
   a. PREPARE AND INSTALL THE TWO BRIDGES SUBSTRUCTURE
   b. CONSTRUCT THE PART OF THE ISLAND PLATFORM ADJACENT TO PROPOSED TRACK 3
   c. CONSTRUCT THE EAST BRIDGES SUPERSTRUCTURE
2) THE PURPOSE OF VRE PHASE 2:
   a. CONSTRUCT THE SIDE OF THE PLATFORM ADJACENT TO PROPOSED TRACK 4 AND 5
   b. CONSTRUCT THE WEST BRIDGE
   c. CONSTRUCT THE ELEVATOR AND PLATFORM TUNNEL
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS	DATE: 05/22/2025
	SCALE: 1" = 60'
CONSTRUCTION PHASING OVERVIEW	SHEET NO: 01 OF 07



SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
NTP / PRE-CONSTRUCTION	NTP PRE-CONSTRUCTION	1) INSTALLS TWO TEMPORARY CONSTRUCTION AT-GRADE CROSSINGS ACROSS ALL THREE EXISTING TRACKS - CSX INSTALLS CROSSINGS ON EXISTING TRACKS TIES - CONTRACTOR WILL LAYDOWN FILTER FABRIC ON BALLAST AND INSTALL ASPHALT BETWEEN CROSSING SURFACES AND ON BOTH FIELD SIDES OF TRACKS
PHASE 1		
PHASE 2 & PEAK SEASON	PHASE 1 STAGE 1	1) INSTALL SOE DURING PROPOSED TRACK 5 OUTAGE 2) INSTALL SOE DURING PROPOSED TRACK 4 OUTAGE 3) INSTALL SOE DURING PROPOSED TRACK 3 OUTAGE 4) INSTALL SOE FOR FUTURE TRACK 2 5) INSTALL JUMP SPANS DURING TRACK 5 OUTAGE 6) INSTALL JUMP SPANS DURING TRACK 4 OUTAGE 7) INSTALL JUMP SPANS DURING TRACK 3 OUTAGE 8) GRADING FOR TEMPORARY PLATFORM TRACK 3 9) INSTALL TEMPORARY PLATFORM AT PROPOSED TRACK 3 10) EXCAVATE FOR PROPOSED TRACKS 5, 4, AND 3 BRIDGE FOUNDATIONS 11) EXCAVATE FOR FUTURE TRACK 2 BRIDGE FOUNDATIONS 12) INSTALL MICROPILES FOR FUTURE TRACK 2 13) INSTALL MICROPILES FOR PROPOSED TRACKS 3, 4, AND 5 14) FORM, INSTALL REBAR, AND POUR MONOLITHIC FOUNDATION
	PHASE 1 STAGE 2	

OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 4 3) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) WEST PLATFORM 3) EAST PLATFORM 4) WEST BRIDGE 5) EAST BRIDGE 6) NORTH STAIRS AT EAST PLATFORM 7) CENTER STAIRS AT EAST PLATFORM
OUT OF SERVICE		
CONSTRUCTION ACTIVITIES	1) TEMPORARY OUTAGES OF TRACKS 3, 4, AND 5 TO INSTALL SOE AND JUMP SPANS	
OPERATION STATUS	TRACK (AFTER STAGE)	STATION (AFTER STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 4 3) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 3) WEST BRIDGE 4) EAST BRIDGE 5) TEMPORARY PLATFORM TRACK 3
OUT OF SERVICE		1) SOUTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 2) NORTH STAIRS TO EAST PLATFORM

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- (1) CSX ACTIVITY
- [1] VRE ACTIVITY
- TRACK IN SERVICE
- TRACK OUT OF SERVICE

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE: 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

NTP / PRE-CONSTRUCTION AND PHASE 1 - STAGE 1

DATE: 05/22/2025

SCALE: 1" = 60'

SHEET NO: 02 OF 07

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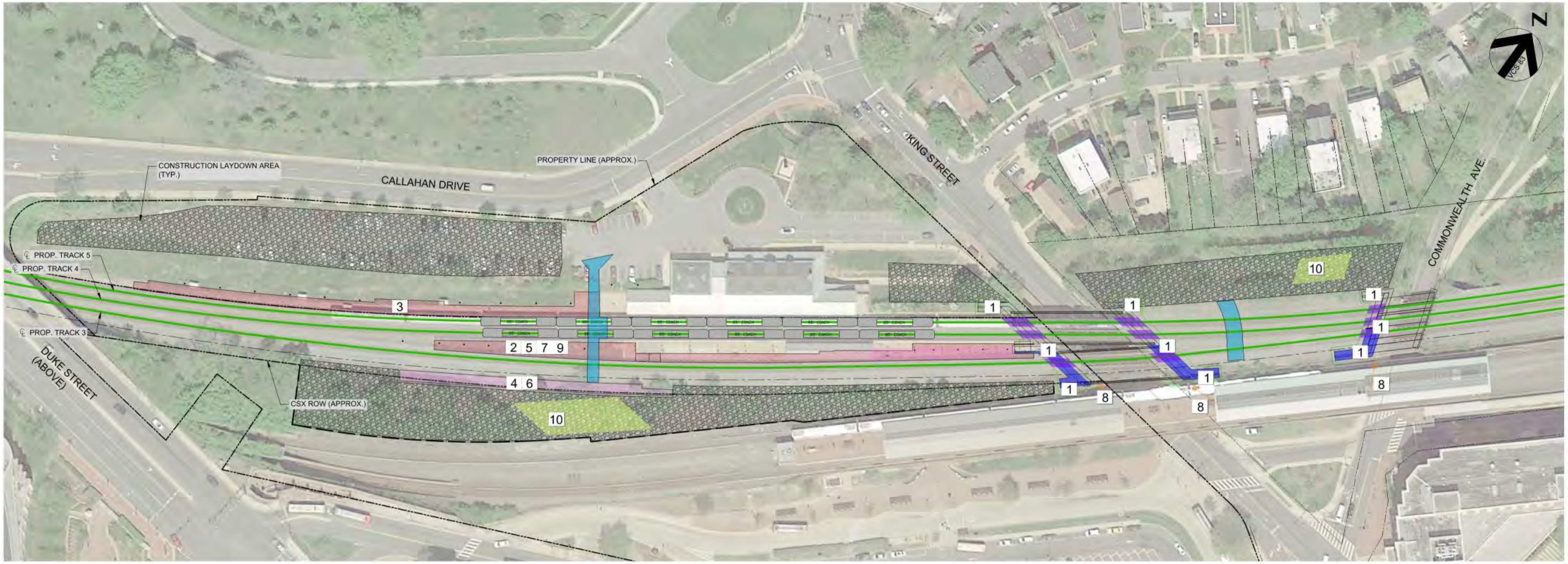


SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

SCHEDULING SEQUENCE CSX	SCHEDULING SEQUENCE VRE	SEQUENCE ACTIVITIES
PHASE 2 & PEAK SEASON	PHASE 1 STAGE 1	
	PHASE 1 STAGE 2	1) FORM, INSTALL REBAR, AND POUR ABUTMENT AND WING WALLS 2) SELECTIVE DEMOLITION OF EXISTING PLATFORM ADJACENT TO PROPOSED TRACK 3 3) SELECTIVE DEMOLITION OF EXISTING PLATFORM ADJACENT TO TRACK 5 4) GRADING FOR TEMPORARY PLATFORM AT PROPOSED TRACK 2 5) GRADING FOR PLATFORM AT PROPOSED TRACK 3 6) INSTALL DRAINAGE AND UTILITIES FOR TEMPORARY PLATFORM AT PROPOSED TRACK 2 7) INSTALL DRAINAGE AND UTILITIES FOR PLATFORM AT PROPOSED TRACK 3 8) INSTALL DRAINAGE AT EAST ABUTMENTS 9) FORM, INSTALL REBAR, AND POUR EAST PLATFORM AT PROPOSED TRACK 3 10) CONSTRUCT EAST BRIDGE SUPERSTRUCTURES OFFLINE

OPERATION / STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 4 3) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 3) WEST BRIDGE 4) EAST BRIDGE 5) CENTER STAIRS AT EAST PLATFORM
OUT OF SERVICE		1) SOUTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 2) NORTH STAIRS AT EAST PLATFORM
CONSTRUCTION ACTIVITIES		

OPERATION / STATUS	TRACK (AFTER STAGE)	STATION (AFTER STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 4 3) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 3) WEST BRIDGE 4) EAST BRIDGE 5) TEMPORARY PLATFORM TRACK 3
OUT OF SERVICE		1) SOUTH ENDS OF WEST PLATFORM 2) DEMOLISHED AREAS OF EAST PLATFORM 3) NORTH STAIRS TO EAST PLATFORM

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- REMOVED PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- (1) CSX ACTIVITY
- [1] VRE ACTIVITY
- TRACK IN SERVICE

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE 1"=60'

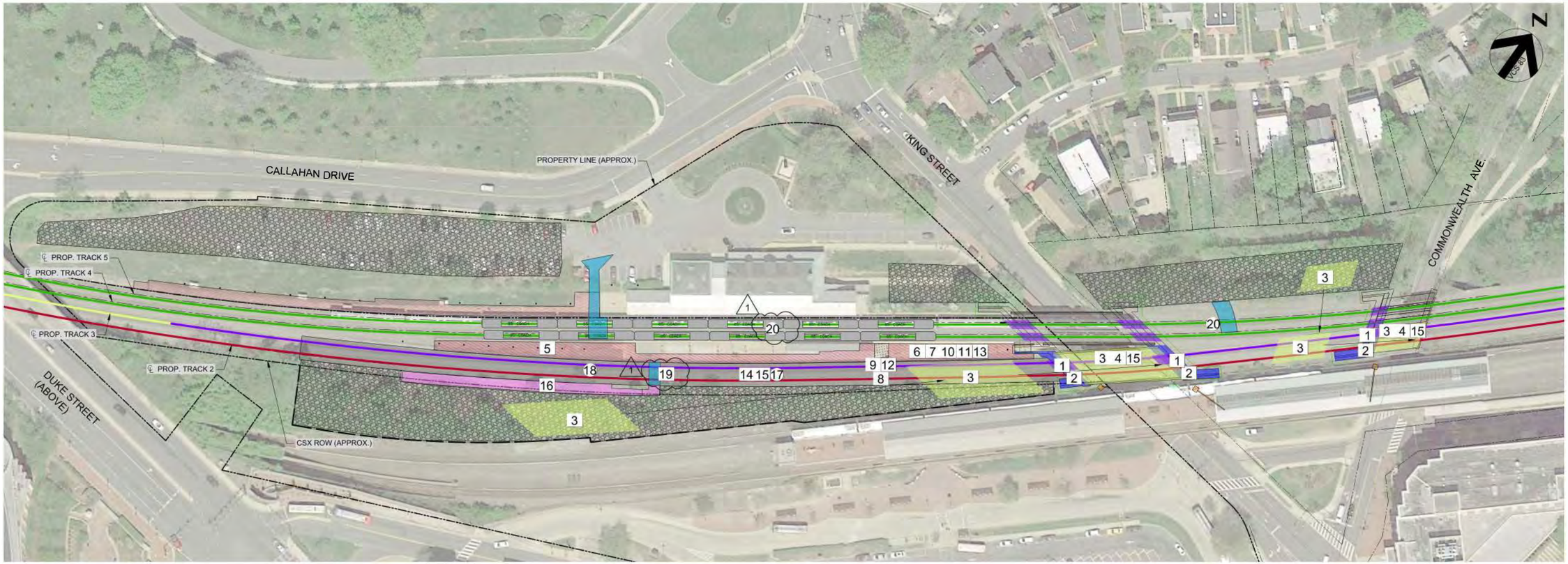
ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

PHASE 1 STAGE 2

DATE: 05/22/2025

SCALE: 1" = 60'

SHEET NO: 03 OF 07



SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

1

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASE 3	PHASE 1 STAGE 3	1) REMOVE JUMP SPANS AS SOON AS TRACK 3 IS REMOVED A. CSX TO REMOVE TRACK FROM JUMP SPANS, BRIDGE SUPERSTRUCTURE, AND ASPHALT UNDERLAYMENT AREA. 2) INSTALL PRECAST BACKWALL FOR TRACKS 2 AND 3 3) MOVE SUPERSTRUCTURES OF EAST BRIDGES ONTO SUBSTRUCTURES 4) COMPLETE SUPERSTRUCTURE CONSTRUCTION 5) CONSTRUCT CANOPIES, LIGHTING, SECURITY, AND PIMS ON EAST PLATFORMS 6) REMOVE TEMPORARY PLATFORM AT TRACK 3 7) SELECTIVE DEMOLITION OF EXISTING PLATFORM ADJACENT TO PROPOSED TRACK 3 8) INSTALL SOE FOR EAST ELEVATOR 9) EXCAVATE FOR EAST ELEVATOR 10) GRADING FOR PLATFORM AT TRACK PROPOSED TRACK 3 11) INSTALL DRAINAGE AND UTILITIES FOR PLATFORM AT PROPOSED TRACK 3 12) FORM, INSTALL REBAR, AND POUR FOUNDATION FOR EAST ELEVATOR 13) FORM, INSTALL REBAR, AND POUR EAST PLATFORM AT PROPOSED TRACK 3 14) INSTALL ASPHALT UNDERLAYMENT FOR PROPOSED TRACKS 2 AND 3 15) INSTALL 6" OF BALLAST ON UNDERLAYMENT AND SUPERSTRUCTURES 16) INSTALL TEMPORARY PLATFORM AT PROPOSED TRACK 2 17) CSX INSTALLS TRACKS 2 AND 3 TO FINAL ALIGNMENT AND PROFILE 18) CSX REMOVES CONSTRUCTION AT-GRADE CROSSING FROM TRACK 3 19) INSTALL WOOD TEMPORARY PEDESTRIAN CROSSING ACROSS PROPOSED TRACKS 2 AND 3 20) CSX REMOVES CONSTRUCTION AND PEDESTRIAN AT-GRADE CROSSING FROM PROPOSED TRACKS 4 AND 5

OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 4 3) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH ENDS OF EAST AND WEST PLATFORMS AFTER INSTALLING AT-GRADE CROSSINGS 3) WEST BRIDGE 4) EAST BRIDGE 5) CENTER STAIRS AT EAST PLATFORM
OUT OF SERVICE		1) SOUTH END OF WEST PLATFORM 2) DEMOLISHED AREAS OF EAST PLATFORM 3) NORTH STAIRS TO EAST PLATFORM
CONSTRUCTION ACTIVITIES	1) TEMPORARY OUTAGES OF TRACKS 3, 4, AND 5 TO MOVE EAST BRIDGE SUPERSTRUCTURE IN PLACE 2) TEMPORARY OUTAGE OF ROADWAY UNDERNEATH BRIDGES WHILE DISASSEMBLING EXISTING EAST BRIDGES	
OPERATION STATUS	TRACK (AFTER STAGE)	STATION (AFTER STAGE)
IN SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH END OF WEST PLATFORM 3) WEST BRIDGE
OUT OF SERVICE	1) PROPOSED TRACK 3	1) SOUTH END OF WEST PLATFORM 2) DEMOLISHED AREAS OF EAST PLATFORM 3) EAST BRIDGE 4) NORTH STAIRS TO EAST PLATFORM

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- REMOVED PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- (1) CSX ACTIVITY
- [1] VRE ACTIVITY
- TRACK IN SERVICE
- TRACK OUT OF SERVICE
- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

PHASE 1
STAGE 3

REV. NO.	DATE:	DESCRIPTION
1	08/18/2025	ADDENDUM NO. 7
DATE:	05/22/2025	
SCALE:	1" = 60'	
SHEET NO:	04 OF 07	

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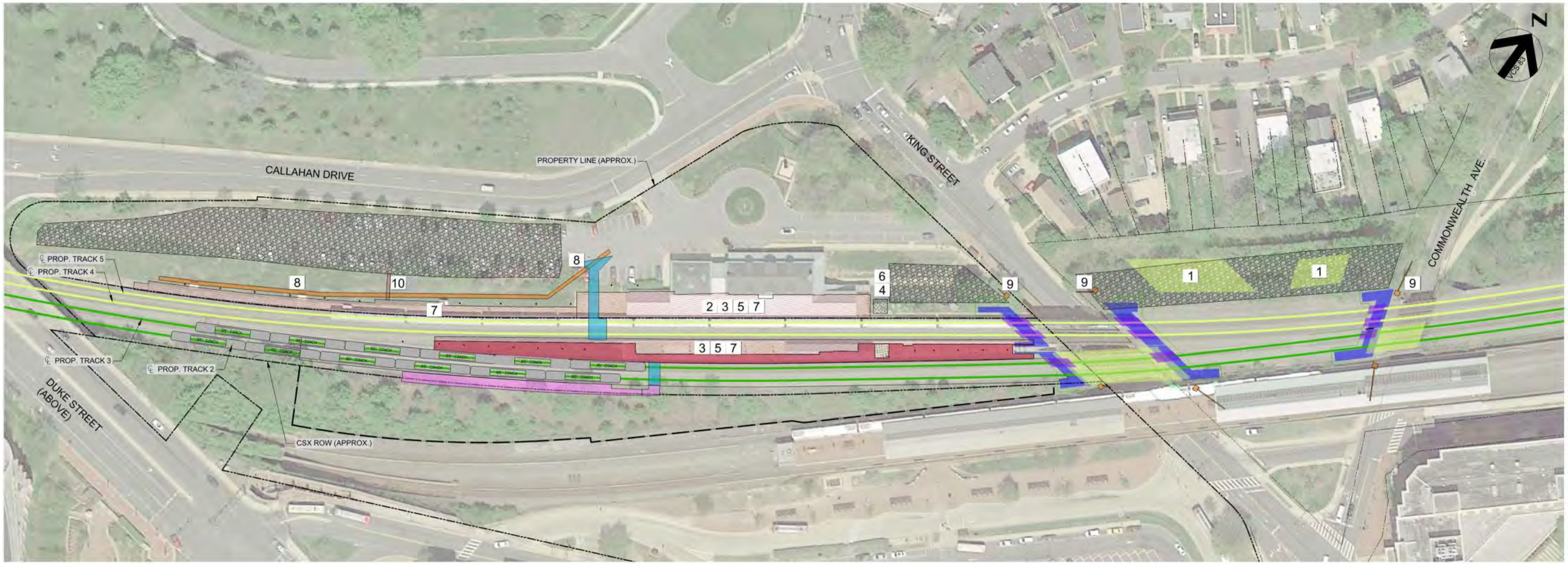

SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASE 4	PHASE 2 STAGE 1	1) OFFLINE CONSTRUCTION OF SUPERSTRUCTURES FOR WEST BRIDGES 2) DEMOLITION OF WEST PLATFORMS ADJACENT TO PROPOSED TRACKS 4 AND 5 3) GRADING FOR WEST PLATFORMS 4) INSTALL SOE FOR WEST ELEVATOR 5) INSTALL DRAINAGE AND UTILITIES FOR WEST PLATFORMS 6) FORM, INSTALL REBAR, AND POUR FOUNDATION FOR WEST ELEVATOR 7) FORM, INSTALL REBAR, AND POUR WEST PLATFORMS 8) INSTALL DRAINAGE AND BMPS SOUTH OF STATION 9) INSTALL DRAINAGE AT WEST ABUTMENTS 10) INSTALL SOUTH STAIRS FROM WEST PLATFORM TO PARKING AREA
	PHASE 2 STAGE 2	

OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) PLATFORM TUNNEL 2) NORTH END OF WEST PLATFORM 3) WEST BRIDGE 4) CENTER STAIRS AT EAST PLATFORM
OUT OF SERVICE	1) PROPOSED TRACK 3	1) SOUTH END OF WEST PLATFORM 2) DEMOLISHED AREAS OF EAST PLATFORM 3) EAST BRIDGE 4) NORTH STAIRS TO EAST PLATFORM
CONSTRUCTION ACTIVITIES		
OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 2	1) SOUTH END OF EAST PLATFORM 2) TEMPORARY PLATFORM 3) EAST BRIDGE
OUT OF SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) NORTH ENDS OF WEST AND EAST PLATFORMS 2) WEST BRIDGE 3) NORTH STAIRS TO EAST PLATFORM 4) CENTER STAIRS TO EAST PLATFORM 5) PLATFORM TUNNEL

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- (1) CSX ACTIVITY
- [1] VRE ACTIVITY
- TRACK IN SERVICE
- TRACK OUT OF SERVICE

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE: 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

PHASE 2
STAGE 1

DATE: 05/22/2025
SCALE: 1" = 60'
SHEET NO: 05 OF 07

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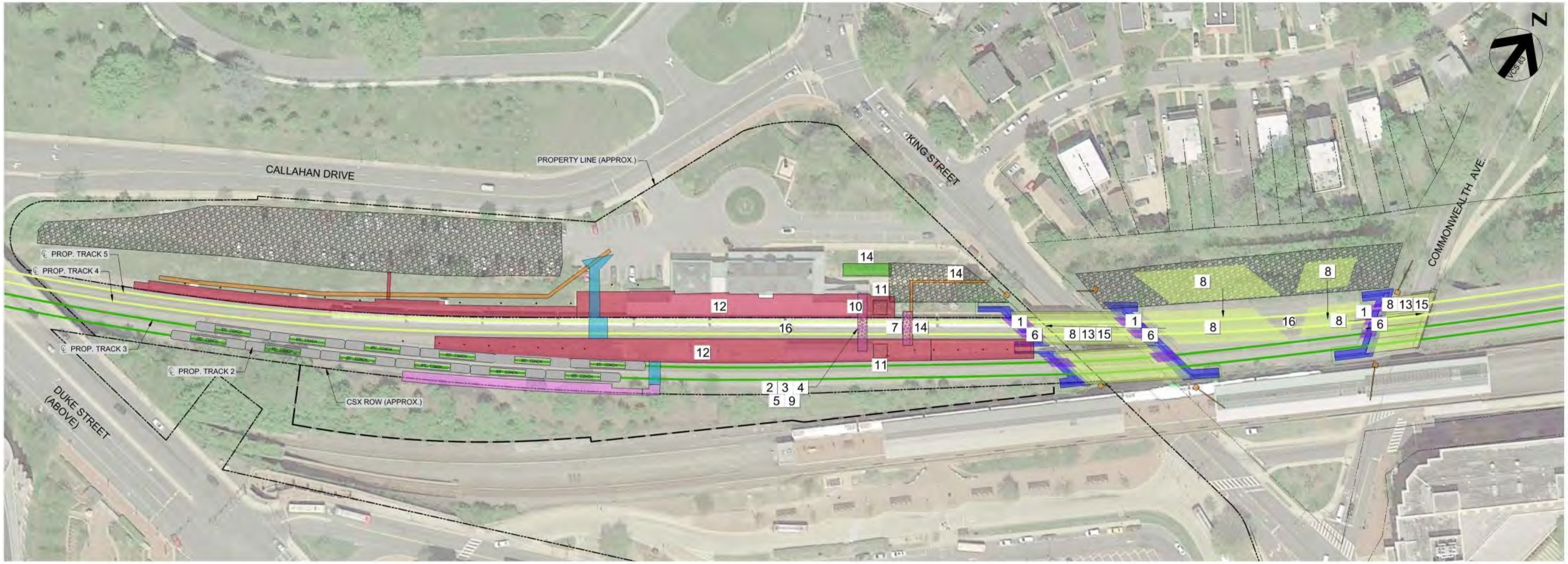


SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'–0"

SCHEDULING SEQUENCE CSX	SCHEDULING SEQUENCE VRE	SEQUENCE ACTIVITIES
PHASE 4	PHASE 2 STAGE 1	
PHASE 4	PHASE 2 STAGE 2	1) REMOVE JUMP SPANS WHILE TRACK 4 AND 5 ARE OUT OF SERVICE 2) INSTALL SOE FOR TUNNEL CONSTRUCTION 3) INSTALL SOE FOR UTILITIES 4) INSTALL PRECAST BOX SEGMENTS FOR TUNNEL 5) INSTALL TUNNEL CONCRETE CLOSURE POURS 6) INSTALL PRECAST BACKWALL FOR TRACK 4 AND 5 7) INSTALL CASING AND CARRIER PIPES FOR UTILITIES 8) MOVE SUPERSTRUCTURES OF WEST BRIDGES ONTO SUBSTRUCTURES 9) BACKFILL TUNNEL AND UTILITIES 10) COMPLETE PLATFORM CONSTRUCTION AT THE TUNNEL 11) COMPLETE CONSTRUCTION OF EAST AND WEST ELEVATORS 12) CONSTRUCT CANOPIES, LIGHTING, SECURITY, AND PIMS ON WEST PLATFORM 13) COMPLETE SUPERSTRUCTURE CONSTRUCTION 14) COMPLETE SITE DRAINAGE AND UTILITY CONSTRUCTION 15) INSTALL 6" OF BALLAST ON SUPERSTRUCTURES AND TO RAISED TRACK LIMITS INDICATED 16) CSX INSTALLS TRACKS 4 AND 5 TO FINAL ALIGNMENT AND PROFILE
PHASE 5	PHASE 3	

OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 2	1) SOUTH END OF EAST PLATFORM 2) TEMPORARY PLATFORM 3) EAST BRIDGE
OUT OF SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) NORTH ENDS OF WEST AND EAST PLATFORMS 2) WEST BRIDGE 3) NORTH STAIRS TO EAST PLATFORM 4) CENTER STAIRS TO EAST PLATFORM 5) PLATFORM TUNNEL
CONSTRUCTION ACTIVITIES	1) TEMPORARY OUTAGES OF TRACKS 3, 4, AND 5 TO MOVE EAST BRIDGE SUPERSTRUCTURE IN PLACE 2) TEMPORARY OUTAGE OF ROADWAY UNDERNEATH BRIDGES WHILE DISASSEMBLING EXISTING EAST BRIDGE	

OPERATION STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 2	1) SOUTH END OF EAST PLATFORM 2) TEMPORARY PLATFORM 3) EAST BRIDGE
OUT OF SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) NORTH ENDS OF WEST AND EAST PLATFORMS 2) WEST BRIDGE 3) NORTH STAIRS TO EAST PLATFORM 4) CENTER STAIRS TO EAST PLATFORM 5) PLATFORM TUNNEL

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- (1) CSX ACTIVITY
- [1] VRE ACTIVITY
- TRACK IN SERVICE
- TRACK OUT OF SERVICE

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

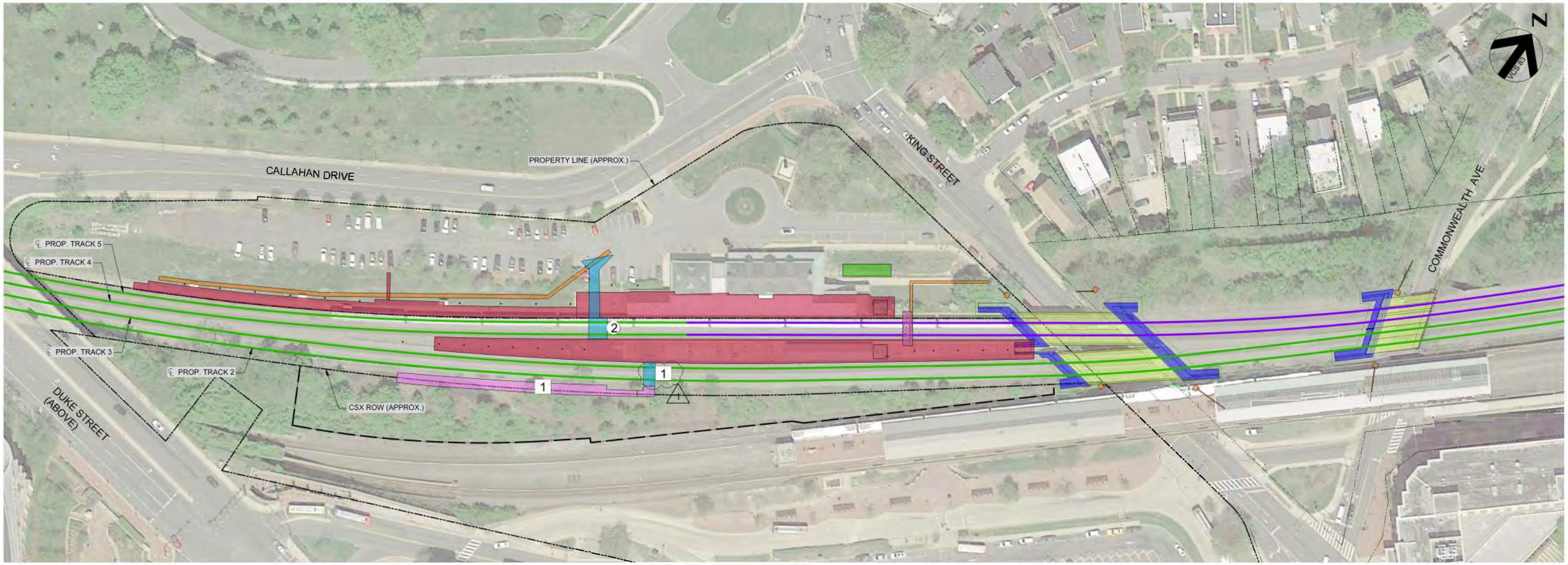
CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

PHASE 2 STAGE 2

DATE: 05/22/2025
SCALE: 1" = 60'
SHEET NO: 06 OF 07



SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES

1"=60'-0"

△1

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASE 5	PHASE 3	1) REMOVE TEMPORARY EAST PLATFORM AND TEMPORARY WOOD CROSSING 2) CSX REMOVES ALL OF THE REMAINING AT-GRADE CROSSINGS WITHIN PROJECT LIMITS

OPERATION / STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 3 2) PROPOSED TRACK 2	1) SOUTH ENDS OF EAST 2) TEMPORARY PLATFORM 3) EAST BRIDGE
OUT OF SERVICE	1) PROPOSED TRACK 4 2) PROPOSED TRACK 5	1) NORTH ENDS OF WEST AND EAST PLATFORM 2) WEST BRIDGE 3) NORTH STAIRS AT EAST PLATFORM 4) CENTER STAIRS AT EAST PLATFORM 5) PLATFORM TUNNEL
CONSTRUCTION ACTIVITIES		

OPERATION / STATUS	TRACK (BEFORE STAGE)	STATION (BEFORE STAGE)
IN SERVICE	1) PROPOSED TRACK 2 2) PROPOSED TRACK 3 3) PROPOSED TRACK 4 4) PROPOSED TRACK 5	1) EAST PLATFORM 2) WEST PLATFORM 3) EAST BRIDGE 4) WEST BRIDGE 3) ALL STAIRS TO PLATFORMS 4) BOTH ELEVATORS 5) PLATFORM TUNNEL
OUT OF SERVICE		1) TEMPORARY PLATFORM

LEGEND:

- ASPHALT UNDERLAY
- AT-GRADE CROSSING
- CONSTRUCTION LAYDOWN AREA
- DRAINAGE
- ELEVATOR
- GENERATOR ENCLOSURE
- TUNNEL & UTILITIES
- JUMP SPAN
- PLATFORM
- SUBSTRUCTURE
- SUPERSTRUCTURE
- TEMPORARY PLATFORM
- CSX ACTIVITY
- 1 VRE ACTIVITY
- TRACK IN SERVICE
- SHIFTED TRACK

NOTE:

1) THIS IS A SUGGESTED SEQUENCE OF CONSTRUCTION ACTIVITIES AND IS NOT A DIVISION OF WORK.
2) DIAGRAM DOES NOT CONVEY FINAL CONDITIONS.
3) TRACK NUMBERING WILL CHANGE AT SOME TIME DURING CONSTRUCTION AS FOLLOW:

CURRENT NO.	PROPOSED NO.
0	2
1	3
2	4
3	5

0 30' 60' 120'
HORIZONTAL SCALE 1"=60'

ALEXANDRIA STATION AND BRIDGE IMPROVEMENTS

PHASE 3

REV. NO.	DATE:	DESCRIPTION
1	08/18/2025	ADDENDUM NO. 7
DATE:	05/22/2025	
SCALE:	1" = 60'	
SHEET NO:	07 OF 07	

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Exhibit C

VRE Crystal City Station Suggested Phasing Diagrams

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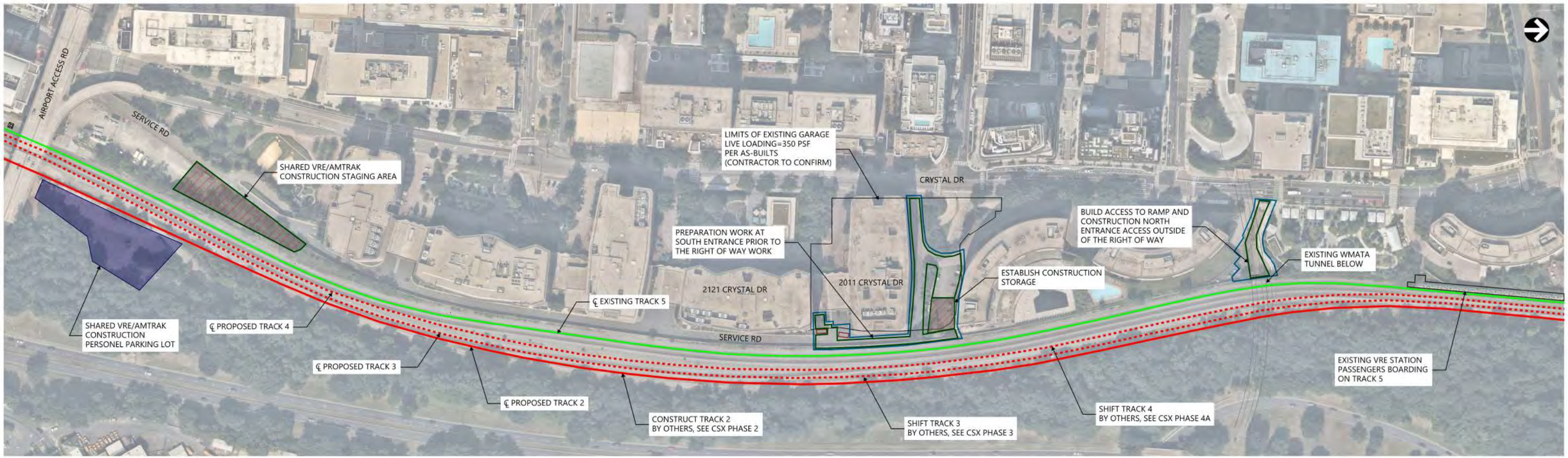


SUGGESTED CONSTRUCTION SEQUENCE PLAN - PHASE 1

SCALE: 1" = 120'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASES 2-4A		1) ALEXANDRIA 4TH TRACK WORK BEGINS; TRACK 0 (FUTURE TRACK 2) INSTALLED, TRACKS 1 AND 2 (FUTURE TRACKS 3 AND 4) SHIFTED (BY CSX AND A4T PROJECT)
	PHASE 1	2) VRE CCV PROJECT MOBILIZATION BEGINS. 3) NORTH AND SOUTH ENTRANCE ROW CONSTRUCTION ACCESS CONSTRUCTED OUTSIDE OF THE RIGHT OF WAY

LEGEND

- TRACK UNDER CONSTRUCTION
- SHIFTED TRACK
- TRACK IN SERVICE
- LIMITS OF WORK (LOW)
- CONSTRUCTION ACCESS
- UNDERGROUND FUEL TANKS

NOTES

1. CONSTRUCTION SEQUENCING SHOWN IS NOT INTENDED TO DETAIL THE DIVISION OF WORK BETWEEN VRE AND CSXT.
2. SEE CSX DIAGRAMS FOR ACTUAL STAGING OF TRACKS 2, 3, & 4.

0 40 80 160 Feet

NOT FOR CONSTRUCTION

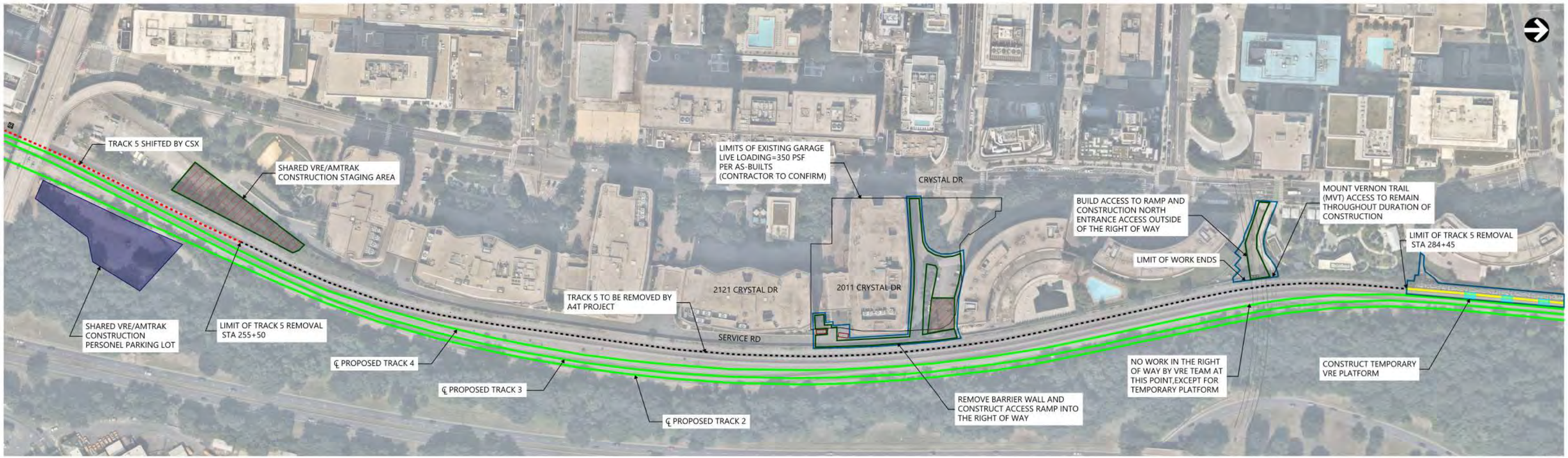
REV. NO.	DATE	BY	APP BY	DESCRIPTION

DESIGNED BY: D. KULAKOVA
DRAWN BY: D. KULAKOVA
CHECKED BY: A. MACPHERSON
DATE:

CRYSTAL CITY STATION IMPROVEMENTS

SUGGESTED CONSTRUCTION SEQUENCING (1 OF 5)

IFB NO.: XXX-XXX
DRAWING NO.: G-101
SCALE: 1" = 120'-0"
SHEET NO: 7 OF 214



SUGGESTED CONSTRUCTION SEQUENCE PLAN - PHASE 2

SCALE: 1" = 120'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASE 4B	PHASE 2	1) REMOVE/SHIFT TRACK 5 (BY CSX AND A4T PROJECT) 2) CONSTRUCT TEMPORARY PLATFORM 3) CONSTRUCTION OF THE TEMPORARY PLATFORM IS TO OCCUR STARTING AFTER THE LAST SCHEDULED VRE TRAIN LEAVES ON FRIDAY NIGHT AND PRIOR TO THE FIRST SCHEDULED TRAIN ON MONDAY MORNING 4) AFTER REMOVAL/SHIFTING OF TRACK 5 REMOVE BARRIER WALL FOR CONSTRUCTION ACCESS AND DEVELOP ACCESS AT SOUTHERN STAGING AREA.

LEGEND

- TRACK IN SERVICE
- REMOVE TRACK
- SHIFT TRACK AS NEEDED
- TRACK OUT OF SERVICE
- LIMITS OF WORK (LOW)
- CONSTRUCTION ACCESS
- TEMPORARY PLATFORM (IN USE)
- UNDERGROUND FUEL TANKS

NOTES

1. CONSTRUCTION SEQUENCING SHOWN IS NOT INTENDED TO DETAIL THE DIVISION OF WORK BETWEEN VRE AND CSXT.
2. SEE CSX DIAGRAMS FOR ACTUAL STAGING OF TRACKS 2, 3, & 4.

NOT FOR CONSTRUCTION

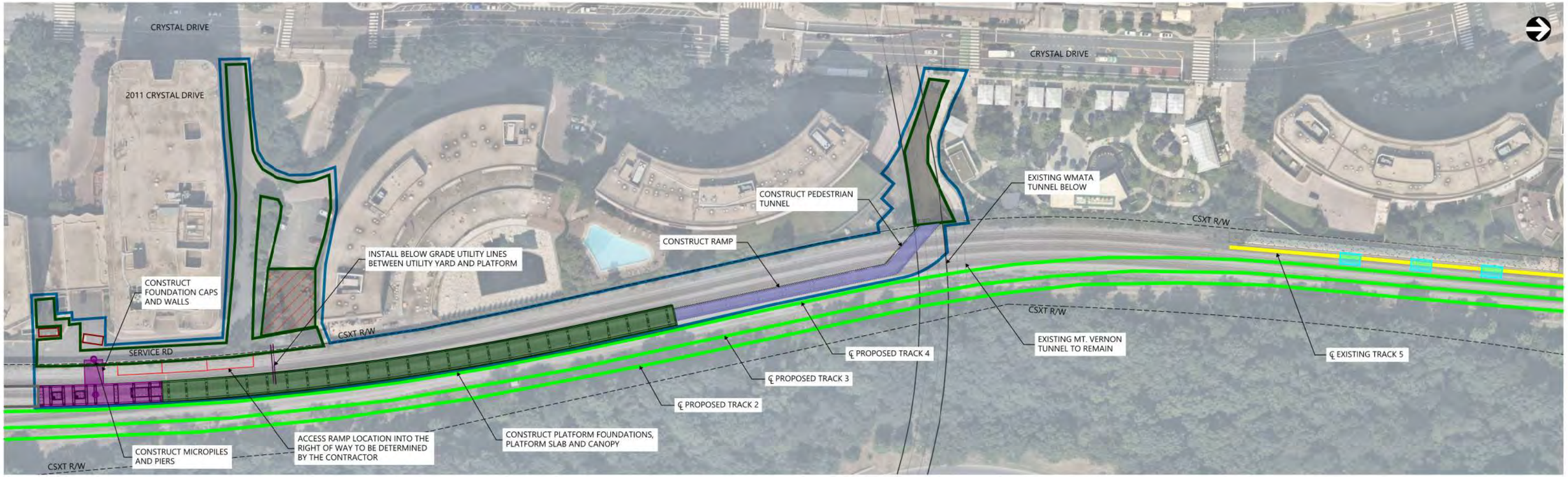
REV. NO.	DATE	BY	APP BY	DESCRIPTION

DESIGNED BY: D. KULAKOVA
DRAWN BY: D. KULAKOVA
CHECKED BY: A. MACPHERSON
DATE:

CRYSTAL CITY STATION IMPROVEMENTS

SUGGESTED CONSTRUCTION SEQUENCING (2 OF 5)

IFB NO.: XXX-XXX
DRAWING NO.: G-102
SCALE: 1" = 120'-0"
SHEET NO: 8 OF 214



SUGGESTED CONSTRUCTION SEQUENCE PLAN - PHASE 3

SCALE: 1" = 60'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
PHASE 4C-5	PHASE 3	1) SITE PREPARATION WORK AND LEVELING 2) ESTABLISH CONSTRUCTION ACCESS INTO THE RIGHT OF WAY 3A) INSTALL SHORING AND EXCAVATE TUNNEL AND RAMP 3B) CONSTRUCT MEZZANINE AND BRIDGE FOUNDATIONS 3C) INSTALL BELOW GRADE UTILITY CONDUITS BETWEEN UTILITY YARD AND PLATFORM 4) CONSTRUCT RAMP AND TUNNEL 5) CONSTRUCT MEZZANINE LEVEL AND PEDESTRIAN BRIDGE 6) CONSTRUCT PLATFORM AND CANOPIES 7) INSTALL MEP, COMMS AND FINISHES
A4T PROJECT COMPLETE		

LEGEND

- TRACK IN SERVICE
- TRACK OUT OF SERVICE
- LIMITS OF WORK (LOW)
- TEMPORARY PLATFORM (IN USE)
- PLATFORM CONSTRUCTION
- RAMP/TUNNEL CONSTRUCTION
- MEZZANINE/BRIDGE CONSTRUCTION
- CONSTRUCTION ACCESS
- CONSTRUCTION STORAGE
- UNDERGROUND FUEL TANKS

NOTES

1. CONSTRUCTION SEQUENCING SHOWN IS NOT INTENDED TO DETAIL THE DIVISION OF WORK BETWEEN VRE AND CSXT.
2. ALL ACTIVITY IN THE RIGHT OF WAY SHALL BE COORDINATED WITH THE POTENTIAL AMTRAK STATION.

0 40 80 160 Feet

NOT FOR CONSTRUCTION

REV. NO.	DATE	BY	APP BY	DESCRIPTION

DESIGNED BY: D. KULAKOVA
DRAWN BY: D. KULAKOVA
CHECKED BY: A. MACPHERSON
DATE:

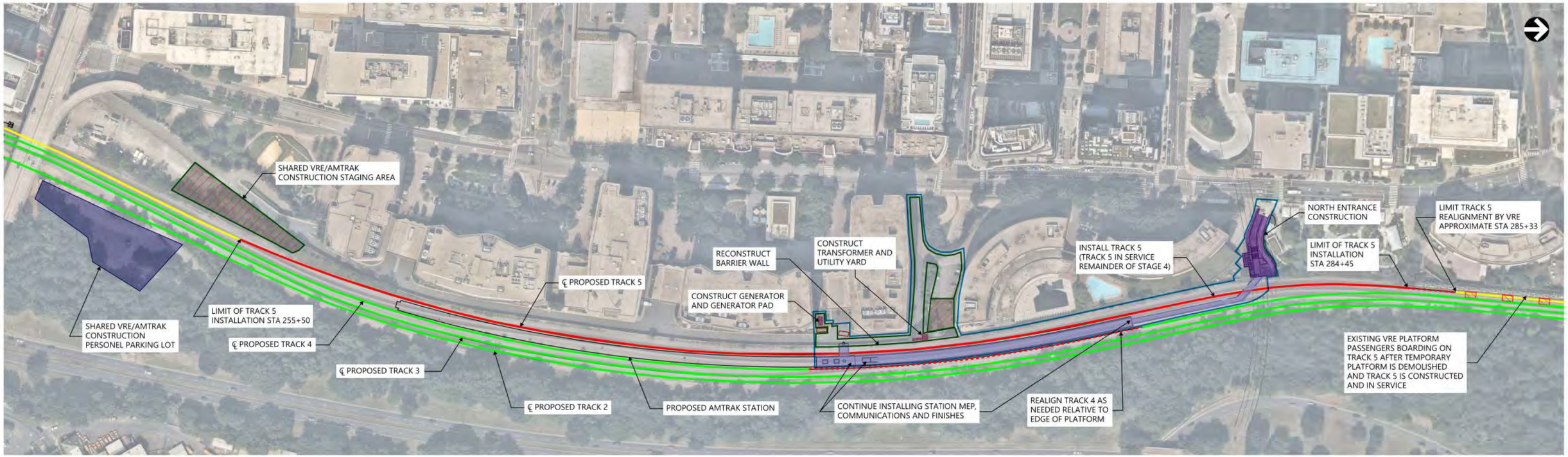
vhb

VRE

CRYSTAL CITY STATION IMPROVEMENTS

SUGGESTED CONSTRUCTION SEQUENCING (3 OF 5)

IFB NO.: XXX-XXX
DRAWING NO.: G-103
SCALE: 1" = 60'-0"
SHEET NO.: 9 OF 214



SUGGESTED CONSTRUCTION SEQUENCE PLAN - PHASE 4

SCALE: 1" = 120'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
A4T PROJECT COMPLETE	PHASE 4	1A) DEMOLISH TEMPORARY PLATFORM 1B) INSTALL, GRADE AND COMPACT SUB-BALLAST AND 8" BALLAST MAT FOR THE TIES 1C) INSTALL TRACK 5 UTILIZING CSX FORCES (COORDINATED AND FUNDED BY VRE CCV PROJECT) 1D) REALIGN TRACK 4 AS NEEDED RELATIVE TO EDGE OF PLATFORM. 1E) ACTIVITIES 1A -1D SHALL BE COORDINATED TO MAINTAIN VRE OPERATIONS WHETHER VIA TEMPORARY PLATFORM OR EXISTING PLATFORM. PLATFORM REMOVAL TO OCCUR EITHER OVERNIGHT OF OVER WEEKEND 2) CONTINUE INSTALLING MEP, COMMS AND FINISHES (WORK BEING DONE BETWEEN ACTIVE TRACKS) 3) RECONSTRUCT BARRIER WALL 4) CONSTRUCT TRANSFORMER PAD AND TRANSFORMER 5) CONSTRUCT GENERATOR PAD AND GENERATOR 6) INSTALL NORTH ENTRANCE

LEGEND

- TRACK OUT OF SERVICE
- TRACK UNDER CONSTRUCTION
- REALIGN TRACK AS NEEDED
- TRACK IN SERVICE
- TEMPORARY PLATFORM DEMOLITION
- CONSTRUCT STAIRS AND ELEVATOR
- CONSTRUCT GENERATOR AND TRANSFORMER
- NORTH ENTRANCE CONSTRUCTION
- LIMITS OF WORK (LOW)
- CONSTRUCTION ACCESS
- CONSTRUCTION STORAGE
- UNDERGROUND FUEL TANKS

NOTES

1. CONSTRUCTION SEQUENCING SHOWN IS NOT INTENDED TO DETAIL THE DIVISION OF WORK BETWEEN VRE AND CSXT.
2. ALL ACTIVITY IN THE RIGHT OF WAY SHALL BE COORDINATED WITH THE POTENTIAL AMTRAK STATION.

0 40 80 160 Feet

NOT FOR CONSTRUCTION

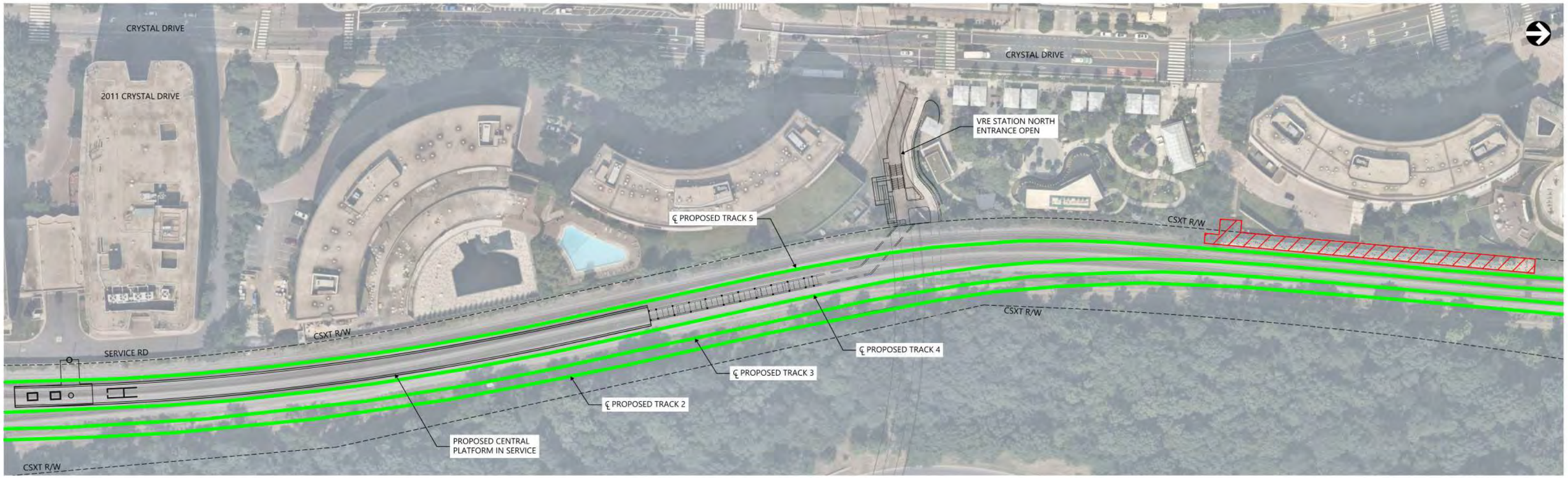
REV. NO.	DATE	BY	APP BY	DESCRIPTION

DESIGNED BY: D. KULAKOVA
DRAWN BY: D. KULAKOVA
CHECKED BY: A. MACPHERSON
DATE:

CRYSTAL CITY STATION IMPROVEMENTS

SUGGESTED CONSTRUCTION SEQUENCING (4 OF 5)

IFB NO.: XXX-XXX
DRAWING NO.: G-104
SCALE: 1" = 120'-0"
SHEET NO: 10 OF 214



SUGGESTED CONSTRUCTION SEQUENCE PLAN - PHASE 5

SCALE: 1" = 60'-0"

SCHEDULING SEQUENCE		SEQUENCE ACTIVITIES
CSX	VRE	
A4T PROJECT COMPLETE	PHASE 5	1) PLATFORM IN SERVICE ON TRACKS 4 & 5 2) PERFORM PLATFORM FINISH WORK (CLOSE OUT ITEMS): WORK BEING DONE BETWEEN TWO ACTIVE TRACKS 3) DEMOLISH EXISTING PLATFORM 4) DEMOBILIZE THE SITE

LEGEND

- TRACK IN SERVICE
- EXISTING PLATFORM DEMOLITION

NOTES

1. CONSTRUCTION SEQUENCING SHOWN IS NOT INTENDED TO DETAIL THE DIVISION OF WORK BETWEEN VRE AND CSXT

0 40 80 160 Feet

NOT FOR CONSTRUCTION

REV. NO.	DATE	BY	APP BY	DESCRIPTION

DESIGNED BY: D. KULAKOVA
DRAWN BY: D. KULAKOVA
CHECKED BY: A. MACPHERSON
DATE:

CRYSTAL CITY STATION IMPROVEMENTS

SUGGESTED CONSTRUCTION SEQUENCING (5 OF 5)

IFB NO.: XXX-XXX
DRAWING NO.: G-105
SCALE: 1" = 60'-0"
SHEET NO: 11 OF 214

NO TEXT ON THIS PAGE

Exhibit D

CSX Standard Specification Section 010010 Part 1.1.B

B. Flagging will be provided by RAILROAD at no expense to CONTRACTOR on track time arranged by ENGINEER. Rail traffic scheduling takes precedence over any and all work. Work may be interrupted at any time for rail traffic. No Additional payment will be made to CONTRACTOR for wait time due to rail traffic.

SECTION 03 45 00

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Precast coping, curbing and other precast site elements.

B. Furnish labor, materials, tools, equipment, and services for Architectural Precast Concrete (APC) in accordance with provisions of Contract Documents.

C. Completely coordinate with work of other trades.

1.2 REFERENCES

A. Reference Standards:

1. ASTM:

a. ASTM C33/C33M Concrete Aggregates

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units including:

a. Member locations, plans, elevations, dimensions, shapes, and cross sections.

b. Details at joints, reveals, and surface finish.

c. Locations of dry joints if two-stage casting is proposed.

d. Identification mark on each panel.

e. Relationship of architectural precast concrete units to adjacent materials.

C. Samples:

1. Three, 12 x 12 x 2 inches 300 x 300 x 50 mm, samples, replicating each of the colors and textures indicated, approval of appearance.

a. Provide samples for each color/texture combination.

b. Label samples to indicate name of project; fabricator; finish; type, color and source of cement and aggregate.

2. Mock-up Panel on-site: As shown on drawings.

D. Project Information:

1. Test reports signed by certified testing agency.

2. Design Mixes: For each concrete mix including compressive strength and water absorption tests.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications:

1. *Firm experienced in producing architectural precast concrete units similar to those indicated and with a record of successful performance.*
2. *Capacity to produce required units without delaying Work.*
3. *Assume responsibility for engineering of APC units to comply with Building Code requirements as locally adopted.*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Architectural Precast Concrete (APC):

1. *Base:*
   a. *Coreslab Structures Inc.*
2. *Optional:*
   a. *Shockey*
   b. *Enterprise Precast Concrete.*
   c. *Smith-Midland*

2.2 DESIGN CRITERIA

A. Comply with ACI 318 and the design recommendations of PCI MNL120 applicable to types of architectural precast concrete units indicated.

B. Design units and connections to satisfy requirements of building codes.

C. Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. *Include effect from adjacent attached construction.*
2. *Wind pressure*
3. *Live Loads.*
4. *Dead load of unit plus superimposed loads.*
5. *Handling, transportation, and erection forces.*
6. *Temperature stresses appropriate for project site and conditions.*
7. *Shrinkage stresses.*

2.3 REINFORCING MATERIALS

A. Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and wire in place.

B. Use products with Corrosion Resistant Coatings of type indicated below when concrete cover on exterior face is less than 1-1/2 inches 38 mm or interior face is less than 3/4 inches 19 mm. Otherwise, uncoated reinforcing may be used.

C. Reinforcing Bars:

1. *Welded bars: ASTM A706.*
2. *Non-welded: ASTM A615 Grade 60, deformed.*

D. Welded Wire Reinforcement:

1. Galvanized and chromate wash treated.

2. Plain: ASTM A185, flat sheet.

2.4 CONCRETE MATERIALS

A. Portland Cement:

1. ASTM C150, Type I

2. Same type, brand, and mill source throughout production.

3. Cement Color:

a. Match existing

B. Supplementary Cementitious Materials:

1. Metakaolin Admixture: ASTM C618, Class N.

C. Normal Weight Aggregates:

1. Comply with ASTM C33 except as modified by PCI MNL 117:

a. Employ coarse aggregates complying with Class 5S.

2. Stockpile fine and coarse aggregates for each type of exposed finish from a single source for entire project.

3. Face Mix Coarse Aggregates:

a. Selected, hard, and durable; free of material that reacts with cement or causes staining.

b. Color: To match selected Design Reference Sample.

c. Gradation:

1) To match selected Design Reference Sample.

4. Face Mix Fine Aggregates:

a. Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.

b. Color: To match selected Design Reference Sample.

D. Coloring Admixture:

1. Pigment: As required by Design Reference Sample.

2. ASTM C979, synthetic or natural mineral oxide pigments or colored water reducing admixtures, temperature stable and non-fading.

3. Lime and alkali resistant.

4. Limit type and amount used so as not to reduce quality of concrete.

E. Water:

1. Potable, clean, fresh, free from oil, acid, organic matter, or other deleterious substances that may affect color, stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Accessories:

1. Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.5 CONCRETE MIX DESIGN

A. Normal Weight Concrete Face and Backup Mixes:

1. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal weight concrete with the following properties:

a. Minimum Compressive Strength (28 Days): 3000 psi 34.5 MPa.

b. Maximum Water-Cementitious Materials Ratio: 0.45.

2.6 MOLD FABRICATION

A. Molds:

1. Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes and for prestressing and de-tensioning operations.

2. Coat contact surfaces of molds with release agent before reinforcement is placed.

3. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Form Liners:

1. Place form liners accurately to provide finished surface texture indicated.

2. Provide solid backing and supports to maintain stability of liners during placing of concrete.

3. Coat form liner with form-release agent.

C. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

D. Form joints are not permitted on faces exposed to view in the finished work.

2.7 PANEL FABRICATION

A. Mark each unit for identification and date of casting.

B. Locate holes, inserts and other lifting mechanisms in non-finished surfaces.

C. Panel Edge and Corner Treatment:

1. Uniformly chamfered or as otherwise indicated.

D. Reinforcement:

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.

a. When damage to epoxy coated reinforcing exceeds limits specified ASTM A775 repair with patching material compatible with coating material and epoxy coat bar ends after cutting.

2. *Accurately position, support and secure reinforcement during concrete placement and consolidation operations.*
    a. *Completely conceal support devices to prevent exposure on finished surfaces.*
3. *Install welded wire reinforcement in lengths as long as practicable.*
    a. *Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design.*
    b. *Offset laps of adjoining widths to prevent continuous laps in either direction.*

2.8 FABRICATION TOLERANCES

A. *Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true.*
    1. *Finished units comply with PCI MNL117 product tolerances as well as position tolerances for cast-in items.*
    2. *Architectural trim and site furnishing comply with PCI MNL135.*

2.9 FINISHES

A. *Panel faces shall be free of joint marks, grain, and other obvious defects.*
B. *Corners, including false joints shall be uniform, straight, and sharp.*
C. *Exposed Face and Edge Surfaces:*
    1. *Match colors and textures of existing site elements*

2.10 SOURCE QUALITY CONTROL

A. *Quality Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.*
    1. *If using self-consolidating concrete: Also test and inspect according to PCI Guidelines for the Use of Self-Consolidating Concrete.*
B. *Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.*
C. *Testing:*
    1. *If there is evidence that the concrete strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, APC Fabricator will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.*
    2. *Procedural Requirements:*
        a. *A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.*
        b. *Cores will be tested in an air dry condition.*
        c. *Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85% of the 28 day design compressive strength and no single core is less than 75% of the 28 day design compressive strength.*

d. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator.

3. Reports:

a. Test reports will include the following:

1) Project identification name and number.

2) Date when tests were performed.

3) Name of precast concrete fabricator.

4) Name of concrete testing agency.

5) Identification letter, name, and type of precast concrete units or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length/diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Defective Work:

1. The Architect reserves the right to reject any unit if it does not match the accepted samples and visual mock-up.

2. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

2. Start of installation constitutes acceptance of surfaces and conditions.

B. Do not install precast concrete units until structure is structurally ready to receive loads from precast.

3.2 ERECTION

A. Perform erection under supervision of qualified superintendent.

B. Employ only skilled and experienced personnel and equipment capable of properly installing units.

C. Erect architectural precast concrete level, plumb and square within the specified allowable tolerances.

D. Grouting Connections:

1. Grout connections where required or indicated.

2. Retain grout in place until hard enough to support itself.

3. Pack spaces with stiff grout material, tamping until voids are completely filled.

4. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.

5. *Promptly remove grout material from exposed surfaces before it affects finishes or hardens.*

3.3 JOINT SEALANTS

A. Seal architectural precast concrete work as specified in Section 07 92 13.

3.4 CLEANING

A. Clean surfaces of precast concrete to be exposed to view prior to shipping.

B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. *Protect other work from staining or damage due to cleaning operations.*
2. *Coordinate cleaning of precast units with cleaning of glass and other work.*
3. *Pre-clean soiled surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water.*
4. *Perform cleaning procedures using product specified in Section 04 05 10 or as otherwise recommended by precast concrete fabricator.*
    a. *Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.*
5. *Start at top of building and proceed downward.*
6. *Leave precast units clean, free of traces of cleaning compound and with joints watertight.*

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 04 05 13

MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar.
2. Masonry grout.
3. Integral water repellent admixture.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 22 00 - Concrete Masonry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   b. C144, Standard Specification for Aggregate for Masonry Mortar.
   c. C150/C150M, Standard Specification for Portland Cement.
   d. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   e. C270, Standard Specification for Mortar for Unit Masonry.
   f. C404, Standard Specification for Aggregates for Masonry Grout.
   g. C476, Standard Specification for Grout for Masonry.
   h. C1019, Standard Test Method for Sampling and Testing Grout.
   i. C1093, Standard Practice for Accreditation of Testing Agencies for Masonry.
   j. C1384, Standard Specification for Admixtures for Masonry Mortars.
2. The Masonry Society (TMS):
   a. 602, Specification for Masonry Structures.

B. Qualifications:

1. Preconstruction Testing Laboratory shall be an independent agency qualified in accordance with ASTM C1093 for performing the testing indicated.
   a. Testing Laboratory shall have a minimum of 10 years of experience in the testing of mortar and grout.
   b. Technician conducting tests shall have minimum of five years of experience in the testing of mortar and grout.

C. Mock-Ups:

1. Provide mortar and grout for mock-up specified in Specification Section 04 21 13.

1.3 DEFINITIONS

A. Coarse grout and fine grout are defined by the aggregate size used in accordance with ASTM C476.

B. Coarse aggregate and fine aggregate are defined in ASTM C404, Table 1.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. General:

1) Product data for cementitious materials.

2) Source or producer of aggregates and gradation.

3) Integral water repellent manufacturer's dosage rate.

c. Proposed mortar mix design:

d. Proposed masonry grout mix design.

2. Test results:

a. Preconstruction mortar test results.

b. Preconstruction masonry grout test results.

B. Informational Submittals:

1. Qualifications of testing lab and technician.

2. Test results and inspection reports per Specification Section 01 45 00.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location.

1. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mixes in moisture-resistant containers.

1. Store preblended, dry mixes in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

D. Material shall not be delivered to the site before the time of installation.

E. Delivery of materials shall be in sufficient quantities to allow continuity of the work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement:

1. ASTM C150/C150M, Type I or II.

2. No air entrainment.
3. Natural color.
4. Maximum percent of alkalis: 0.60 in accordance with ASTM C150/C150M, Table 2.

B. Hydrated Lime:
1. ASTM C207, Type S.
2. Type SA not acceptable.
3. Lime substitutes are not acceptable.

C. Mortar Aggregate: ASTM C144, free of gypsum.

D. Grout Aggregate: ASTM C404.

E. Water: Potable.

F. Integral Water Repellent Admixture:
1. Liquid polymeric admixture: ASTM C1384.
2. Verify compatibility with liquid water repellent admixture being used in the fabrication of concrete masonry units.

2.2 MIXES

A. Mortar and grout shall comply with TMS 602 and building code.

B. Type "S" mortar shall be used:
1. Comply with ASTM C270, Table No. 1, Cement-Lime Mortar.
a. Do not use masonry cement or mortar cement.
b. No fly ash additives will be accepted.
2. Mix materials minimum of three minutes and maximum of five minutes.
3. Adjust consistency to satisfaction of mason.
4. Do not use admixtures unless otherwise indicated.
5. Provide integral water repellent admixture in mortar used for:
a. Exterior concrete masonry work.
b. Interior concrete masonry work in wet areas.
6. Do not use integral water repellent admixture in mortar for brick.

C. Masonry Grout:
1. ASTM C476.
a. Minimum 28-day compressive strength: ~~2,000~~ ***3,000*** psi.
b. Slump: 8 to 11 inches.
2. Mix 5 minutes minimum.
3. No admixtures allowed.
4. At Contractor's option, premixed or preblended grout meeting the above minimum requirements may be used.

2.3 SOURCE QUALITY CONTROL

A. Perform preconstruction laboratory tests on proposed masonry mortar and grout prior to start of masonry work.

1. Perform tests far enough in advance so that any necessary retesting can be accomplished before masonry construction begins.

a. Test mortar per ASTM C270.

b. Test grout per ASTM C1019.

B. Source Limitations for Mortar Materials:

1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and TMS 602.

B. Mortar:

1. If standard gray mortar begins to stiffen, it may be retempered by adding water and remixing unless prohibited by water repellent admixture manufacturer.

a. Standard gray mortar shall not be retempered more than one time.

2. All mortar must be used within 2-1/2 hours maximum after initial mixing per TMS 602.

3. Mortar shall be well driven and compacted into joints and finished with an approved pointing tool.

4. Mortar shall be added in lifts no greater than ¼ IN or 3/8 IN, which allows for the mortar to bond to the surrounding masonry and minimizes shrinkage. Once the morar has reached thumbprint hardness, a second lift can be added.

5. Engineer reserves right to alter mix design based on initial rate of absorption of masonry units.

a. Rake mortar from joint as recommended by the unit manufacturer.

b. Tuckpoint raked joints using pointing grout.

1) Install pointing grout in accordance with ANSI A108.10 and masonry unit manufacturer’s published instructions.

2) Tuckpointing shall not be done when the surface temperature of the masonry is below 40 DEGF or ambient temperatures below 32 DEGF are predicted within 24 hours of work.

3) Use polymer modified sanded pointing grout for joints in:

a) Exterior masonry.

b) Interior dry areas.

4) Use epoxy pointing grout for joints in interior areas subject to exposure to corrosive or caustic chemicals.

C. Masonry Grout:

1. Use grout within 1-1/2 hours maximum after initial mixing.
2. Use no grout after it has begun to set.
3. Do not retemper grout after initial mixing.
4. Place grout in lifts not exceeding feet.
5. Use coarse grout in spaces with least dimension over 2 inches.
6. Consolidate all grout while installing.
    a. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.
    b. Consolidate grout pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

3.2 FIELD QUALITY CONTROL

A. Masonry Mortar and Grout Testing and Inspection:

1. Testing and inspection services will be provided by the Owner's special masonry inspector.
    a. Do not include in the bid price the cost of these services.
2. Testing and inspection shall include, but is not limited to:
    a. Observe proportions of site-prepared mortar and grout.
    b. Observe grout space prior to grouting.
    c. Grout compressive strength sampling, testing and reporting per ASTM C1019.
        1) One strength test shall be the average of three specimens from the same sample, tested at 28 days.
    d. Grout slump test sampling, testing, and reporting per ASTM C143/C143M.
    e. Frequency of sampling: One sample (three specimens) collected each grouting operation during masonry construction.
3. Reporting: Special inspector to submit test results and inspection reports per City of Alexandria requirements for Special Inspections.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 04 42 00

DIMENSION STONE CLADDING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Dimension Stone Cladding, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Materials, Anchors and Installation Standards:

1. Marble Institute standards and recommendations.
2. Indiana Limestone Institute standards.
3. Installer; Company specializing in installing cut stone approved by the manufacturer.
4. Provide Dimension Stone Cladding engineered to support dead, live, and lateral (wind or seismic) loads indicated.
   a. Comply with Section 01 33 00, Submittal Procedure ***R~~r~~eq**u*irements.
   b. Design anchors and connection hardware for dead load, wind load and seismic load in accordance with applicable building codes.
   c. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.
5. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

B. Mock Up:

1. As indicated in ***the Architectural Contract D~~d~~***rawings.
2. Accepted mockup may remain part of building.

1.3 SUBMITTALS

A. Shop Drawings:

1. Setting drawings.
2. Indicate on shop drawings layout, pertinent dimensions, anchorages, and jointing methods.

B. ***Calculations:***

1. Calculations signed and sealed by a Virginia state licensed Professional Engineer confirming the size and configuration of all stone anchorages. Submittal shall be concurrent with the shop drawings submittal.

C. Samples:

1. Coordinate with VRE to obtain a source sample of the existing stone for use in sourcing the matching replication stone sample. Submit source sample with the

replication sample to the Architect for approval. Sample shall be a minimum of 4 IN high X 6 IN long.

2. Minimum ~~12~~ ***4*** IN ***X 6 IN*** ~~300 MM square~~ ***replication*** samples of each type of material proposed for use.

   a. Submit samples in sufficient quantity to show extreme variation which may reasonably occur in each kind of stone, regarding color, texture and quality.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Base:

1. Cold Spring Granite.

B. Optional:

1. Polycor Stone_____.

C. Other manufacturers desiring approval comply with Section 01 25 00.

2.2 MATERIALS

A. Granite:_____.

1. Granite name: ____~~Crema Montana~~***Match existing building stone***_____.
2. Color: _____~~Brown & Purple~~***Match existing building stone***_____.
3. ~~Opalescent,~~ ***S***~~s~~ound and free from defects which would materially impair strength, durability or appearance.
4. Uniform in texture, free from freak colorations.
5. Non-absorbent, free from reads, rifts, seams, spalls, chips and minerals which by weathering would tend to discolor, deteriorate, streak or stratify.
6. ~~Split Face finish exposed surfaces.~~***Surface finish shall match existing building stone.***
7. Thickness***:*** 2 IN ~~22 MM~~, or as indicated.

B. Mortars and grout: See Section 04 05 13.

C. Anchors and similar items:

1. Material for all anchor types: -Type 304 or 316 Stainless Steel unless otherwise noted.
2. Anchors for general use:
   a. Of sufficient length to anchor to backing.
   b. Of sufficient size and configuration for support of stone and applicable superimposed loads.
3. Cramps:
   a. 3/16 x 1 x 8 IN ~~5 x 25 x 200 MM~~ long after ends are turned up 1-1/2 IN ~~38 MM~~.
   b. Where doweling is required in addition to cramping, form cramps with dowel welded to underside of cramp.
4. Suspension anchorage or bolt hangers:

a. Minimum Diameter: 3/4 IN ~~19 MM~~ min.

b. Lewis or Cinch anchor type with sufficient depth of anchorage in stone to develop hanger strength.

5. Use special anchors as approved for projecting pieces of stone or for anchorage to structural steel.

6. Dowels: ~~-~~***As required per delegated design. See Paragraph 1.3.b of this Section.***~~Size and length as required~~.

7. Spacing: ~~Provide 1 anchor per 1.77 SQFT 0.16 m2 or wall area.~~***As required per delegated design. See Paragraph 1.3.b of this Section.***

8. Bolts, nuts, and washers: Stainless steel type 304.

D. Sealant:

1. Exterior: See Section 07 92 13.

2. Interior: See Section 07 92 16.

2.3 FABRICATION

A. Make arises sharp and true with edges slightly eased.

B. Perform cutting, dressing, drilling, fitting, and other preparations of stone.

1. Include work as required to accommodate or fit work of other trades, such as cutting and fitting for pipes, conduits, structural work, etc.

2. Do not cut stone until shop drawings are approved.

C. Completely cut and finish before delivery to site except as necessary for fitting.

D. Cut accurately to shape and dimensions with joints as indicated.

1. Lay stone with 3/16 IN ~~5 MM~~ face joints.

2. Form exposed faces true and without wind.

3. Make beds and joints straight, at right angles to face.

E. Saw or dress backs parallel to wall face.

1. Where bonding occurs, arrange backs to fit lay of masonry backing.

2. Shape beds for stone resting on structural work to fit support.

3. Do not impair strength or stone bearing capacity.

F. Cut stone to set on its natural bed.

G. Cut holes and sinkage's in stone for anchors, dowels or cramps specified or required to execute work properly.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrates to accept installation of stone work.

B. Start of installation constitutes acceptance of substrate conditions and responsibility for performance.

3.2 PREPARATION

A. Prior to setting, waterproof back of stone using non-staining material approved for use by manufacturer and satisfactory to Architect.

B. When ready for setting, clean stones, removing dirt or foreign matter from edges and surfaces.

C. Do not use wire brushes.

3.3 INSTALLATION

A. Erect stone in accordance with stone supplier's instructions and erection drawings.

B. Arrange stone pattern to provide a consistent joint width of 1/4 IN ~~6 MM~~ throughout.

C. Provide setting bed and pointing mortar in accordance with Section 04 05 13.

D. Place setting buttons and set stone in full mortar setting bed to support stone over full bearing surface and to establish joint dimensions.

E. Shore and maintain panel in position without movement for seven days after setting.

F. Fill dowel, clevis, and lifting holes with mortar.

G. Rake joints 5/8 to 3/4 IN ~~16 MM x 19 MM~~ and brush mortar joint clean to accommodate pointing mortar.

H. Fill Joints with pointing mortar.

I. Tool surface to a concave joint.

J. Install flashings of longest practical length, lap end joint minimum 6 IN ~~150 MM~~ and seal watertight to back-up.

3.4 TOLERANCES

A. Positioning of elements: Maximum 1/4 IN ~~6 MM~~ from true position.

B. Maximum variation from plan of wall: 1/4 IN ~~6mm~~ in 10 FT ~~3 m~~; 1/2 IN ~~13 MM~~ in 50 FT ~~15 m~~.

C. Maximum variation between face planes of adjacent panels: 1/16 IN ~~1.5 MM~~.

D. Maximum variation from plumb: 1/4 IN per story non-cumulative; 1/2 IN ~~25 MM~~ in any two stories.

E. Maximum variation from level coursing: 1/8 IN ~~1.5 MM~~ in 3 FT ~~1 m~~; in 1/4 IN ~~6 MM~~ in 10 FT ~~3 m~~; 1/2 IN ~~25 MM~~ maximum.

F. Maximum variation of joint thickness 1/8 IN ~~3 MM~~ in 3 FT ~~1 M~~ or 1/4 the joint width, whichever is less.

3.5 PROTECTION AND CLEANING

A. Box and maintain projecting stone sills and stonework.

B. Just before project is completed, remove boxing and clean with fiber brushes, mild detergent and water.

C. Remove and replace units having stains which cannot be removed by cleaning.

D. Remove and replace units requiring patching or repairing.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 07 19 16

SILANE WATER REPELLENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Silane Water Repellent, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. Seal following concrete surfaces:

~~1. Concrete surfaces within parking structure except columns.~~

~~2. Exterior structural driveway slab.~~

1. Cast-in-Place (CIP) concrete.

1.2 QUALITY ASSURANCE

A. Installer qualifications: Licensee of manufacturer or approved by manufacturer in writing.

B. National Cooperative Highway Research Program:

1. NCHRP 244 Series II cube test.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturers' product data sheets indicating product used to be in compliance with specifications.

B. Water Repellent application process.

C. Certifications:

1. Water Repellent certifications.

D. Contract Closeout Information:

1. Warranty.

1.4 WARRANTY

A. Written five (5) year warranty signed by installer, agreeing to repair or replace work performed under this section which fails.

1. Failure includes but not limited to, defects in materials, workmanship, waterproof integrity and chloride ion protection, or other defect which affects waterproof integrity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Silane Water Repellent:

1. Base:

a. BASF Master Builders Solutions.

2. Optional:

a. Dayton Superior.
b. Tnemec Industrial Coatings.
c. L&M Construction Chemicals.
d. Nox-Crete Chemicals.
e. ProSoCo.
f. SpecChem, LLC

B. Other manufacturers desiring approval comply with Section 01 25 00.

2.2 MATERIALS

A. Water-based Penetrating Silane Solution.
1. VOC compliant.
2. Water weight gain: 85 PCT reduction when tested in accordance with NCHRP 244.
3. Chloride absorption: 85 PCT reduction when tested in accordance with NCHRP 244.
4. Average Penetration: 0.2 IN 5 MM minimum.
5. Vapor permeable.
6. Base Product: MasterProtect H 400.

B. Water repellent material shall consist of a silane based, one part liquid penetrating sealer, in accordance with AREMA Chapter 8, Part 1 and in conformance with applicable ASTM designations.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify substrates are clean and dry.

B. Treat efflorescence or alkali deposits with neutralizing compound recommended by manufacturer of substrate.

C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 HANDLING & STORAGE

A. Material shall be handled and stored according to manufacturer's recommendations.

3.3 INSTALLATION

A. Surface preparation and application shall be in accordance with AREMA Chapter 8, Part 1.

B. Install in accordance with Manufacturer's instructions.

C. Water repellent shall be applied to the top of the deck, curbs and sides of all deck slabs prior to installation, as well as concrete bent caps and top and sides of wing walls. In the case that slabs are set prior to concrete curing, water repellent will be applied to only those areas accessible after 28 days.

D. Allow concrete to cure at least 72 HRS prior to application.

E. Verify caulking and sealant work has cured a minimum of 12 HRS prior to application.

F. Protect adjacent areas from water repellant materials.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 10 14 23

SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services required for fabrication and installation of Signs as indicated in the drawings.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. 2010 ADA Standards for Accessible Design.

B. American National Standards Institute, ICC/ANSI A117.1.

1.3 SUBMITTALS

A. Shop drawings

1. For each sign type: showing sign's graphic layout; structure and assembly and height above grade, rail, platform or finish floor (as applicable).

B. Samples:

1. Color and font samples for approval.

2. On material substrate of intended sign.

3. Note sign type name on back of each sample

4. Min. samples size 4"x4"

1.4 WARRANTY

A. Manufacturer shall warrant workmanship and materials for a period of two (2) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

1. Signs:
   a. Base:
      1) Poblocki Sign Company.
   b. Optional:
      1) Mohawk Sign Systems.
      2) ASI Sign Systems.
      3) Best Manufacturing Sign Systems.
      4) Innerface Architectural Signage.
      5) InPro Corporation.
2. Other manufacturers desiring approval comply with Section 01 25 00.

2.2 MATERIALS

A. Signs:

1. ~~1.~~ ***See drawings for sign details, lettering and materials.*** ~~Three-ply plastic laminate, 1-1/2 IN 38 MM wide x length required for script.~~
2. ***Reference VRE and Amtrak signage guidelines.***
3. ~~Nominal letter height: 3/4 IN 19 MM.~~
4. ~~Letters and numbers: Raised 1/32 IN 0.8 MM.~~
5. ~~Uppercase.~~
6. ~~Letter style: Sans serif.~~
7. ~~Color: As selected.~~
   a. ~~Characters: Dark.~~
   b. ~~Background: Light.~~
8. ~~Finish: Nonglare.~~
9. Bevel edges.
10. Letters shall conform to following proportional standard:
    a. The font width of uppercase letter “O” shall be 55 PCT minimum and 110 PCT maximum height of uppercase letter “I”.
    b. Stroke thickness of uppercase letter "I" shall be 10 PCT minimum and 30 PCT maximum height of character.
11. Tactile lettering shall conform to following standards:
    a. Character height measured vertically from the baseline of character shall be 5/8 IN minimum and 2 IN 50 MM maximum based on height of uppercase letter “I”.
    b. Stroke thickness of uppercase letter "I" shall be 15 PCT maximum height of character.
    c. The font width of uppercase letter “O” shall be 55 PCT minimum and 110 PCT maximum height of uppercase letter “I”.
    d. Maintain minimum 1/8 IN 3 MM font separation between characters.
12. Braille characters shall conform to the following standard:
    a. Braille characters shall be separated from adjacent raised characters or symbols 1/2 IN.
    b. Grade 2 Braille translation to be provided by identification device manufacturer.

B. Directional and identification signs for communications systems: International symbols.

C. Adhesive: 3M double-coated urethane foam tape.

1. 4032 for smooth surfaces.
2. 4016 for rough surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location:

1. Single doors: Install on wall adjacent to latch side of door.
2. Double doors: Install on nearest adjacent wall.

B. Mount 5 FT above finish floor to centerline of sign.

C. Mount using adhesive tape.

3.2 SCHEDULE

A. Provide signs as follows:

1. "Stair" at each floor, each stair.
2. "Mechanical Room" at each mechanical space door.
3. "Men" at each men's toilet.
4. "Women" at each women's toilet.
5. "Janitor" at each janitor’s closet.
6. "Electrical" at each electrical closet.

B. Provide signs at elevator call stations directing use of stairs: See ASME-A17.1, Appendix H.

C. Provide stair identification sign in enclosed stairs connecting three or more stories.

1. See both IBC and NFPA for features of sign.

D. Provide international accessibility symbols at:

1. Accessible entrance.
2. Accessible exit.
3. Accessible toilets.
4. At inaccessible elements, provide directional signage to indicate route to nearest accessible element.

E. Provide directional and identification signs for:

1. Assistance listening systems.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 10 82 13

EXTERIOR GRILLES AND SCREENS

PART 1 -

GENERAL 1.1

SUMMARY A. Furnish labor, materials, tools, equipment, and services for Mechanical Unit Enclosures, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum five (5) years' experience producing systems specified in this section.

B. ASTM International (ASTM):

1. ASTM B221 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes

C. American Society of Civil Engineers (ASCE):

1. ASCE 7-95 Minimum Design Loads for Buildings and Other Structures

D. Aluminum Association Incorporated (AA):

1. AA ADM-1516166 Aluminum Design Manual

1.3 SUBMITTALS

A. Product Data:

B. For each type of material and accessory. Shop Drawings

C. Samples:

1. Three 6 inches square samples, of each panel type and finish specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Exterior Screen Enclosures:

1. Base:

a. CityScapes Incorporated

2. Optional:

a. Palm Shield

b. Eclipse Screen Systems.

c. Berridge.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Form to sizes and shapes indicated.

B. Fabricate units to support a minimum loading greater of 200 psf or 150 PLF without permanent deflection.

C. Include stiffeners, brackets, plates and straps.

D. Include supports for piping, conduit, heating and cooling elements as an integral part of enclosure.

E. Coordinate and locate openings for louvers and grilles.

F. Incorporate blind knockouts for electrical outlets, controls or other openings.

G. Provide operable or removable components for access to critical elements of unit.

H. Locate fixed sections to occur at window mullions and ends of runs.

I. Shop-assemble units to greatest extent possible to minimize mechanical joints, splicing and field assembly.

2.3 MATERIALS

A. Screen Panels:

1. Extruded aluminum sheet.

2. Thickness: 3/16 inches 18 mm minimum.

3. Style:

a. Vertical.

4. Design:

a. Louver.

5. Color as selected by Architect from manufacturers full palette of colors.

B. Trim and Closers:

1. 24 GA metal.

2. Top Profile:

a. Band.

C. Framing:

1. Aluminum plate, shapes and bar:

a. ASTM B 221, alloy 6005-T5 or 6063-T5.

D. Fasteners:

1. Stainless steel.

E. Hardware:

1. Manufacturer's standard hardware.

2. Finish: Powder coat to match framing.

3. Hardware Set:

a. Hinges.

b. Self-closing gravity hinges.

c. Hold Open pipe hinges.

d. Pull.

e. Hasp.

f. Gate latch.

g. Cane bolt on inactive leaf.

F. Finishes:

1. Aluminum framing:

a. Powder coat.

b. Color: As selected by Architect from manufacturer's full palette.

2. Panel coating:

a. Manufacturer standard coating system.

b. Color:

1) As selected by Architect from manufacturer's full palette.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which units are to be installed.

B. Field-verify dimensions prior to fabrication.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Set unit enclosures plumb and level.

B. Anchor securely using concealed fasteners.

C. Form joints with exposed connections tightly fit.

D. Clean and treat ferrous metal.

E. Remove protective coverings from finished metal surfaces after units have been installed.

F. Do not finish aluminum or plastic surfaces.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 28 20 01

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The Section includes a video surveillance system consisting of cameras, data transmission wiring, and its associated equipment. IP cameras, mounts, and connections to communications closets and rooms are included. VRE shall provide switches, routers, remote monitoring, and recording of cameras installed in this Project.

B. Related Specification Sections but not necessarily limited to:

1. Section 27 10 00 - Structured Cabling.

1.2 REFERENCES

A. Reference Standards: Standards referenced in this section include, but are not necessarily limited to the following:

1. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA).

a. ANSI/TIA--569-E – Telecommunications Pathways and Spaces.

2. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC).

3. UL Solutions. (UL).

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet Protocol.

G. LAN: Local area network.

H. MPEG: Moving Picture Experts Group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers:

a. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

2. Installers:

a. Comply with ANSI/NFPA 70 – National Electric Code.

b. Comply with ANSI/TIA-569E Standard and the BICSI Telecommunications Distribution Methods Manual (TDMM) for the installation of Communication Pathways.

1.5 SUBMITTALS

A. Action Submittals

1. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

2. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other Work.

3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

4. Functional Block Diagram: Show single-line interconnections between signal transmission and control components. Show cable types and sizes.

5. Dimensioned plan and elevations of equipment racks. Show access and workspace requirements.

6. Wiring Diagrams: For power, signal, and control wiring.

7. Design Data: Include an equipment list of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add a pretesting record of each piece of equipment, listing the name of the person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

B. Informational Submittals

1. Field quality-control reports.

2. Product Warranty: Sample of special warranty.

C. Closeout Submittals

1. Operation and Maintenance Data: Cameras should be included in emergency, operation, and maintenance manuals.

2. Provide 2(Two) licenses for each camera

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments, shall be rated for continuous operation in ambient temperatures of 36 to 122 °F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.

B. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 °F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250 Type 4 enclosures.

C. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. The rate for constant operation when exposed to rain, as specified in NEMA 250, winds up to 85 mph, and snow cover up to 24 inches thick. Use NEMA 250 Type 4 enclosures.

1.7 WARRANTY

A. Special Warranty: The manufacturer's standard form is in which the manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fails in materials or workmanship within the specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The video-signal format shall comply with the NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

B. Surge Protection: Protect components from voltage surges from external to the equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for the external wiring of each conductor's entry connection to components.

1. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 26 24 16 "Panelboards" as the manufacturer recommends for the type of protected line.

2. Provide PoE+ in-line surge protection on all circuits from the exterior of the building. Comply with the system PoE power ratings and bandwidth. Ground unit to ground bus.

C. Tamper Protection: Tamper switches on enclosures shall initiate a tamper-alarm signal when the unit is opened or partially disassembled. The control station and control-unit alarm display shall identify tamper alarms and indicate their locations.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NECA 1.

C. Comply with NFPA 70.

2.3 CAMERA-SUPPORTING EQUIPMENT

A. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

2.4 IP VIDEO SYSTEMS

A. Avigilon shall manufacture products, and specific model numbers for cameras are identified on the drawings as required by VRE. The cameras shall integrate with systems provided by

VRE. Work must be performed in conjunction with VRE to adjust proper settings and integration.

B. Description:

1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. The system shall seamlessly integrate all video surveillance and control functions.
3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2- 2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discrete sensor inputs, and control system outputs.
5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
7. Encoder/decoder combinations shall place video, audio, and data network streams that can be managed from multiple workstations on the user's LAN or WAN.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP networks before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING

A. Wiring Method: Install cables in raceways unless otherwise indicated.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding the manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. For communication wiring, comply with the following:

1. Section 27 10 00 "Structured Cabling."

D. Grounding: Provide independent-signal circuit grounding, as recommended in the manufacturer's writing.

3.3 INSTALLATION

A. Install the camera's level and plumb.

B. Install cameras with a 96-inch minimum clear space below cameras and their mountings—change mounting type to achieve required clearance. Keep it as high as possible in covered areas without obstructing views to avoid tampering.

C. Set the pan unit and pan-and-tilt unit stops to suit the final camera position and to obtain the field of view required for the camera. Connect all controls and alarms, and adjust.

D. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures, and mounted in self-protected, inconspicuous positions.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: The ~~Engineer and CM~~ ***Contractor*** will engage an independent, qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Schedule and coordinate programming, testing, integration, and inspections with the Engineer and CM for remote monitoring and recording equipment.

2. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

3. Pretesting: Align and adjust the system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

a. Prepare the equipment list described in the “Informational Submittals" Article.

b. Verify operation of auto-iris lenses.

c. Set back-focus of fixed focal length lenses. At the focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until the image is in focus with and without the filter.

d. Set back-focus of zoom lenses. At the focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set Zoom to full wide angle and aim the camera at an object 50 to 75 feet away. Adjust until the image is in focus from full wide angle to full telephoto, with the filter in place.

e. Set and name all preset positions; consult Owner's personnel.

f. Set the sensitivity of motion detection.

g. Connect and verify responses to alarms.

h. Verify operation of control-station equipment.

4. Test Schedule: Schedule tests after pretesting has been completed and the system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of the test schedule.

5. Operational Tests: Perform operational system tests to verify that the system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. A video surveillance system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 CLEANING

A. Clean installed items using methods and materials recommended in writing by the manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION

~~SECTION 31 22 00~~

~~SITE GRADING~~

PART 1 - GENERAL

~~1.1 SUMMARY~~

~~A. Section Includes:~~

~~1. Earthwork - site excavation, grading, compaction, disposal of waste and surplus materials, construction of berms, dewatering and other Earthwork related work.~~

~~B. Related Requirements: Include but are not necessarily limited to:~~

~~1. Section 31 23 16 - Excavation and Backfill.~~

~~1.2 REFERENCES~~

~~A. Terminology:~~

~~1. Terms indicated in this provision are not defined terms indicated with initial capital letters, but when used in this Section have the meaning indicated in this provision.~~

~~2. "Excavation" consists of removal of materials encountered to subgrade or rough grade elevations required or indicated. Excavation includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.~~

~~3. "Geotechnical engineer" means the independent geotechnical specialist, licensed and registered as a professional engineer in the same jurisdiction as the Site, retained by Owner or Engineer, with responsibility for observing required field quality control activities and determining acceptability of results of required field quality control activities, in accordance with the Contract Documents. Where geotechnical engineer is not the same person who sealed and signed this Section and related Drawings, geotechnical engineer has not authority to approve or accept the Work or to modify the Contract Documents on behalf of Engineer.~~

~~4. "Non-structural fill" and "non-structural backfill" mean excavated materials placed and compacted to achieve finish grade elevations and do not support foundations, slabs, pavement, other flatwork, or carry imposed loads.~~

~~5. "Finish grade" means layer of soil or other acceptable material immediately below the Site's surfacing material (such as landscaping, pavement, and other surfaces).~~

~~6. "Rough grade" means layer of soil or other acceptable material immediately below the finish grade.~~

~~7. "Subgrade" means soil or other suitable material immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil.~~

~~8. "Unauthorized excavation" means removal of native material (a) beyond subgrade elevation or dimensions shown or indicated I the Contract Documents, and (b) outside of payment limits for Unit Price Work shown or indicated in the Contract Documents, without Engineer's authorization or an appropriate Contract modification. Unauthorized excavation and all Work necessary to remedy unauthorized excavation in accordance with the Contract Documents are ineligible for payment, and Contractor is ineligible for additional Contract Price or additional Contract Time therefor.~~

9. ~~"Unsuitable material" and "unsuitable soil material" means materials, including soil, encountered at the Site, at or below subgrade elevation, and of insufficient strength, stiffness, and bearing capacity to support the completed Work, as determined by Engineer.~~

~~B. Referenced Standards:~~

~~1. ASTM International (ASTM):~~

~~a. C33, Standard Specification for Concrete Aggregates.~~

~~b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/CUFT).~~

~~c. D1241, Standard Specification for Material for Soil-Aggregate Subbase, Base, and Surface Courses.~~

~~d. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 feet-LBF/CUFT (2,700 kN-M/M)).~~

~~e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).~~

~~f. D3786, Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.~~

~~g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.~~

~~h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.~~

~~i. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.~~

~~2. American Association of State Highway and Transportation Officials (AASHTO)~~

~~a. M 43, Standard Specification for Sizes of Aggregate for Road and Bridge Construction.~~

~~b. M 57, Standard Specification for Materials for Embankment and Subgrades.~~

~~c. M 147, Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.~~

~~1.3 SUBMITTALS~~

~~A. Action Submittals: Submit the following:~~

~~1. Product Data:~~

~~a. Written indication of each source of materials to be used for site grading Work. Where materials from the Site will be used, so indicate in the Submittal.~~

~~b. Where materials not native to the Site will be used, indicate borrow source, location, and sufficient information to indicate to Engineer's satisfaction that proposed materials are appropriate and comply with the Contract Documents and are do not constitute a Hazardous Environmental Condition. Where borrow materials contain one or more Constituents of Concern, submit acceptable laboratory analysis results of~~

representative samples sufficient to demonstrate such materials will not constitute a Hazardous Environmental Conditions when installed at the Site.

c. Regardless of source, submit:

1) Results and certification of gradation and material of aggregate fill.

2) Results of representative sampling and testing of material for gradation (as applicable) and material content.

3) Contractor's written certification that materials proposed comply with the Contract Documents, including applicable reference standards.

2. Samples:

a. Coordinate with Engineer and geotechnical engineer locations of Samples and testing of borrow materials.

B. Informational Submittals: Submit the following:

1. Supplier's Installation instructions: Written instructions on handling, storing, and installing materials from offsite sources.

2. Field Quality Control Results:

a. Results of required field quality control activities, including installed material density and moisture tests.

b. One optimum moisture-maximum density curve for each type of material encountered.

c. Report of actual unconfined compressive strength or results of bearing tests of each strata tested.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fill:

1. Selected, suitable material from the Site excavation or from suitable offsite borrow approved by Engineer.

2. Structural Fill:

a. May be low volume change cohesive or granular soil at Contractor's option.

b. Free of organic matter, frozen material and debris.

c. Low volume change cohesive soil:

1) ASTM D2487 classification: CL-ML, ML or CL.

2) Liquid limit: Less than 35.

3) Maximum plasticity index: 15.

d. Granular soil:

1) ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.

3. Non-Structural Fill:

a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML, ML or CL.

b. Liquid limit: Less than 35.

c. Maximum plasticity index: 15.

B. Aggregate Base:

1. Granular Fill Material:

a. Clean, Granular material.

b. Less than 5% fines passing the No. 200 sieve.

c. ASTM D1241/AASHTO M147 Grading "B" or other material acceptable to Engineer.

d. Virginia Department of Transportation (VDOT) 2020 Road and Bridge Specifications:

C. Geotextile Filter Fabric:

1. Nonwoven type.

2. Equivalent opening size: 50 - 100 (U.S. Standard Sieve).

3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.

4. Grab strength: 90 pounds minimum in either direction in accordance with ASTM D4632 requirements.

5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.

2. Conduct work to minimize erosion of site. Remove eroded material washed off site.

a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.

2. Protect and maintain benchmarks, monuments or other established reference points and property corners.

a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.

3. Verify location of utilities.

a. Omission or inclusion of utility items does not constitute nonexistence or definite location.

b. Secure and examine local utility records for location data.

c. Take necessary precautions to protect existing utilities from damage due to any construction activity.

1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.

3) Obtain Owner's approval prior to disconnecting any utility service.

d. Repair damages to utility items at own expense.

e. In case of damage, notify Engineer at once so required protective measures may be taken.

4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.

a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.

c. All repairs to be made and paid for by Contractor.

5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on site or on adjoining property.

7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

C. Protection of trees to remain:

1. Perform excavation by hand within dripline of large trees designated on Drawings to remain. Protect root systems from damage or dryout to the greatest extent possible.

a. Maintain moist condition for root system and cover exposed roots with moistened burlap.

3.2 SITE EXCAVATION AND GRADING

A. The site excavation and grading work includes the offsite disposition of all material:

1. That exceed quantities required for earthwork on the project.

2. That the Geotechnical engineer classifies as unclassified excavation.

3. That the Geotechnical engineer classifies as unacceptable.

4. That the Geotechnical engineer classifies as potentially contaminated.

B. Excavation and Grading:

1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
    a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
    b. Perform other layout work required.
    c. Replace property corner markers to original location if disturbed or destroyed.
2. Preparation of ground surface for embankments or fills:
    a. Before fill is started, scarify to a minimum depth of 6 inches in all proposed embankment and fill areas.
    b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
3. Protection of finish grade:
    a. During construction, shape and drain embankment and excavations.
    b. Maintain ditches and drains to provide drainage at all times.
    c. Protect graded areas against action of elements prior to acceptance of work.
    d. Reestablish grade where settlement or erosion occurs.

C. Borrow:
1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
2. Include cost of all borrow material in original proposal.
3. Fill material to be approved by Engineer prior to placement.

D. Construct embankments and fills as required by the Drawings:
1. Construct embankments and fills at locations and to lines of grade indicated.
    a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 inches.
    a. Ensure stones larger than 4 inches are not placed in upper 6 inches of fill or embankment.
    b. Do not place material in layers greater than 8 inches loose thickness.
    c. Place layers horizontally and compact each layer prior to placing additional fill.
3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
    a. In general, compact cohesive soils by sheepsfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
    b. Control moisture for each layer necessary to meet requirements of compaction.

E. Grading Tolerances: As shown on Drawings.

3.3 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Engineer.

E. Assure by results of testing that compaction densities comply with the following requirements:

1. Sitework:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Subgrade:		
Cohesive soils	95% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	95% per ASTM D698	-2 to +3% of optimum
Rough Grade:		
Cohesive soils	95% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	95% of ASTM D698	-2 to +3% of optimum
Finish Grade:		
Cohesive soils	95% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	95% of ASTM D698	-2 to +3% of optimum

3.4 FIELD QUALITY CONTROL

A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

B. Special Inspection and testing:

1. Special inspections shall comply with the City of Alexandria requirements for Special Inspections.

C. A Special Inspector shall inspect and test piles for compliance with the Specification Section.

1. Special Inspector shall be an independent geotechnical testing agency, acceptable to the Owner.

D. Contractor provides sufficient notification and access so inspection and testing can be accomplished.

E. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

~~F. Responsibilities of Special Inspector:~~

~~1. Review proposed materials for fill and backfill around structures.~~

~~2. All testing, observation and work indicated as being performed by geotechnical engineer in this Section .~~

~~3. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.~~

~~4. Moisture density relations, to be established by Engineer required for all materials to be compacted.~~

~~5. Extent of compaction testing will be as necessary to assure compliance with specifications.~~

~~6. Make at least one field density test on subgrade and each compacted fill layer for every 2000 SQFT.~~

~~7. Prepare and submit inspection and test reports to Engineer.~~

~~a. Coordinate such work with other Special Inspectors.~~

~~8. Test reports to include the following:~~

~~a. Report and certification of aggregate fill and drainage fill.~~

~~b. Test reports on borrow material.~~

~~c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.~~

~~d. Field reports; in-place soil density and moisture tests.~~

~~e. One optimum moisture-maximum density curve for each type of soil encountered.~~

~~f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.~~

~~g. Other documentation necessary for Engineer to accept earthwork.~~

~~h. Assist Engineer to determine corrective measures necessary for defective work.~~

~~G. Give minimum of 24 hours' advance notice to Engineer and geotechnical engineer when ready for compaction or subgrade testing and inspection.~~

~~H. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary, at no additional expense to Owner.~~

~~I. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.~~

~~J. Responsibilities of Testing Agency for Site Excavation and Grading:~~

~~1. Testing, observation, and services indicated as performed by geotechnical engineer in other than Article 3.5 of this Specification Section.~~

~~2. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.~~

~~3. Moisture density relations, to be established by Engineer required for all materials to be compacted.~~

~~4. Extent of compaction testing will be as necessary to assure compliance with specifications.~~

~~END OF SECTION~~

NO TEXT ON THIS PAGE.

SECTION 31 23 16

EXCAVATION

PART 1 -

GENERAL 1.1

SUMMARYSection Includes:

1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving, and parking areas.
4. Excavating for slabs on grade.
5. Excavating for site structures.
6. Excavating for landscaping.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 31 22 00 - Site Grading.
4. Section 33 10 10 - Outside Utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Excavating Soil Materials:

1. Basis of Measurement: By CU YD.
2. Basis of Payment: Includes general excavating to required elevations, loading and removing from site. Over Excavating: Payment will not be made for over excavated work nor for replacement materials.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. Local utility standards when working within 24 inches of utility lines.

B. Perform Work in accordance with Municipality of __City of Alexandria___ standard.

C. Maintain 3 copies of each document on site.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.5 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Virginia.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION) PART 3 - EXECUTION

3.1 PREPARATION

A. Call Local Utility Line Information service at City of Alexandria not less than two working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade paving and site structures, and construction operations.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 33.

D. Slope banks with machine.

E. Do not interfere with 45 DEG bearing splay of foundations.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Trim excavation. Remove loose matter.

H. Notify Architect of unexpected subsurface conditions.

I. Correct areas over excavated with structural fill specified in Section 31 23 33.

J. Remove excess and unsuitable material from site.

K. Repair or replace items indicated to remain damaged by excavation.

3.3 FIELD QUALITY CONTROL

A. Section 01 45 00: Field inspecting, testing, adjusting, and balancing.

B. Request inspection of excavation and controlled fill operations in accordance with applicable code.

C. Request visual inspection of bearing surfaces by VRE Representative before installing subsequent work.

~~**3.4 PROTECTION**~~

~~A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.~~

~~B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.~~

~~C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.~~

~~**END OF SECTION**~~

NO TEXT ON THIS PAGE.

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dewatering system.
2. Surface water control system.
3. Water disposal.

B. Related Specification Sections include but are not necessarily limited to:

~~1. Site Grading.~~

~~2. Section 31 23 16 - Excavation~~

~~3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.~~

2. Section 31 10 00 - Site Clearing.

3. Section 31 23 00 Earthwork.

1.2 PRECONSTRUCTION MEETINGS

A. Preinstallation Conference:

1. Conduct conference at the location and time determined by the County Inspector.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installer:
   a. An experienced installer that has specialized in dewatering work.
2. Delegated Design Engineer:
   a. A professional engineer who is legally qualified to practice in the Commonwealth of Virginia where Project is located and who is experienced in providing engineering services of the type indicated.
3. Land Surveyor:
   a. A professional land surveyor who is legally qualified to practice in Commonwealth of Virginia where Project is located.

B. Permits:

1. Obtain and pay respective fees for all local, state, and federal permits required for the withdrawal, treatment, and disposal/discharge of water from the dewatering operation, prior to start of work.

1.4 DEFINITIONS

A. Dewatering:

1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering excavations, trenches, and shafts.
2. Disposing of removed water.

B. Surface Water Control:

1. Removal of surface water within open excavations.

C. Foundations:

1. Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

1.5 SUBMITTALS

A. Shop Drawings:

1. Dewatering plan design data and Drawings including the following:
   a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.
   b. Arrangement, locations, and depths of system components.
   c. Pipe sizes and capacities.
   d. Filter types and sizes.
   e. Water disposal method and location.
   f. Surface water control devices.
   g. System operation, monitoring, and maintenance procedures.
   h. Method of monitoring water quality.
   i. Analysis data.
   j. Prepared by or under the supervision of a qualified professional engineer.
   k. Signed and sealed by the qualified professional engineer.
2. Product technical data including:
   a. Dewatering pump data including the following:
      1) Size, capacity, and means of operation of engine and motor.
   b. Pumping equipment for control of surface water within excavation.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.6 PROJECT CONDITIONS

A. Survey Work:

1. Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements.
2. Establish exact elevations at fixed points to act as benchmarks.
3. Clearly identify benchmarks and record existing elevations.

B. Site Information:

1. Data in subsurface investigation reports was used for the basis of the design.
   a. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings.
   b. The Owner or Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.
2. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option.
   a. However, no change in the Contract Sum will be authorized for such additional exploration.
3. Site data provided is not contractual and shall be considered "for information only".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design:

1. Engage a qualified professional engineer, to design dewatering system.
2. ***All plans and specifications shall be submitted to the Owner, Engineer, and CM for approval prior to the commencement of dewatering activities.***
3. ***Dewatering system design shall include a process for monitoring track or structures for any settlement.***

B. Dewatering Performance:

1. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of groundwater and permit excavation and construction to proceed on dry, stable subgrades.

C. Regulatory Requirements:

1. Comply with governing EPA notification regulations before beginning dewatering.
2. Comply with water- and debris-disposal regulations of authorities having jurisdiction.
3. Comply with Virginia DEQ Construction General Permit dewatering requirements and monitoring.

2.2 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

B. ***Equipment of sufficient capacity to handle the flow shall be maintained on site provided the Contractor has approval from the CM to operate the equipment.***

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. See Specification Section 31 10 00 - Site Clearing.

2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
    a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.
4. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 31 10 00 - Site Clearing, during dewatering operations.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Install monitoring system for track and structures to monitor any settlement prior to operating any dewatering equipment.

2. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.

3. Protect and maintain bench marks, monuments or other established reference points and property corners.
    a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.

4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
    a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
    b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
    c. All repairs to be made and paid for by Contractor.

5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

6. Provide temporary grading to facilitate dewatering and control of surface water.

3.2 DEWATERING

A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

B. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
1. Employ dewatering specialist for selecting and operating dewatering system.
2. Groundwater shall be maintained at least 3 feet below the bottom of any excavation.
3. Install groundwater monitoring wells as necessary.
4. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.

5. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

C. Place dewatering system into operation to lower water to specified levels before excavating below groundwater level.

D. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

E. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

F. Operation:

1. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

2. ***Pumps in operation shall be constantly attended until the operation may be safely ended in the sole judgement of the CM.***

3. Operate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades.

4. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

a. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

b. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

c. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

G. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.

1. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

2. Discharge water into settling basins.

H. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.3 SURFACE WATER CONTROL SYSTEMS

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Specification Section 31 10 00.

B. Divert surface water and seepage water within excavation areas into sumps and pump water in accordance with requirements of the agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, trenching, backfilling and compacting for all underground utilities.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
4. Division 26 - Electrical.
5. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C33/C33M, Standard Specification for Concrete Aggregates.
   b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LBF/FT^3 (600 kN-M/M^3)).
   c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.

3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.

4. Submit sieve analysis reports on all granular materials.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Trench shield (trench box) certification if employed:

a. Specific to Project conditions.

b. Re-certified if members become distressed.

c. Certification by registered professional structural engineer, registered in the state where the Project is located.

d. Engineer is not responsible to, and will not, review and approve.

3. Trench Safety Plan and/or trench shoring drawing:

a. Trench Safety Plan and/or trench shoring drawings submittal is required only as evidence that plans and drawings have been prepared if required by Authorities Having Jurisdiction.

1) Engineer is not responsible to, and will not, review and approve.

4. Submit test reports and fully document each with specific location or stationing information, date, and other pertinent information.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.

1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:

1. As approved by Engineer.

a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.

b. Moisture content at time of placement: ±3 PCT of optimum moisture content as specified in accordance with ASTM D698.

2. Gravel trench backfill materials:

a. ASTM C33/C33M gradation size No. 67, 3/4 IN to No. 4 or other material acceptable to Geotechnical Engineer.

B. Filter Fabric:

1. For Placement with Subgrade Drains: The filter fabric shall be non-woven needle punched polyester or polypropylene material conforming to the following minimum average requirements:

ITEM	MINIMUM AVERAGE REQUIREMENTS	TEST
Weight	5.3 ounces per square yard	ASTM D 1910
Apparent opening size	70 Standard sieve	ASTM D 4751
Grab tensile Strength	150 pounds	ASTM D 4632
Burst strength	300 pounds per square inch	ASTM D 3786
Max. elongation @ failure	40% - 60%	ASTM D 4632
Permeability	0.2 cm / second	ASTM D 4410
Trapezoidal tear	65 pounds	ASTM D 4533
Puncture strength	80 pounds	ASTM D 4833

C. Bedding Materials:

1. As approved by the Geotechnical Engineer.

2. Granular bedding materials:

a. ASTM D2321 Class 1B.

1) Well-graded crushed stone.

b. The SOURCE QUALITY CONTROL Article is used to address Factory tests, inspections, and certifications required to be performed at the shop prior to shipment to site.

PART 3 - EXECUTION 3.1

GENERAL

A. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer to an offsite location in a legal manner.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Geotechnical Engineer.

B. Excavation for Appurtenances:

1. 12 IN (minimum) clear distance between outer surface and embankment.

2. See Specification Section 31 23 00 for applicable requirements.

C. Groundwater Dewatering:

1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
    a. Employ dewatering specialist for selecting and operating dewatering system.
4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be compensated at the unit price for Bid Item Groundwater Dewatering.

D. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
    a. Support existing utility lines where proposed work crosses at a lower elevation.
        1) Stabilize excavation to prevent undermining of existing utility .
    b. The trenches shall be excavated to a tolerance of plus or minus 0.1 feet of the invert elevation shown on the plans.
2. Open trench outside buildings, units, and structures:
    a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
    b. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
    a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened and remains idle for seven calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
    a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
    a. Trench size:

1) Excavate width to accommodate free working space.

2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.

4) Keep trenches free of surface water runoff.

a) Include cost in Bid.

b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.

2. Modify for electrical installations as follows:

a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.

b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.

c. Do not over excavate trench.

d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.

e. See Division 26 for additional requirements.

F. Flowable Fill:

1. Flowable fill shall be:

a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.

b. Placed in 4 FT maximum lifts to the elevations indicated.

1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.

2) Place flowable fill lifts in such a manner as to prevent flotation of the pipe.

2. Flowable fill shall not be placed on frozen ground.

3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.

4. Conform to appropriate requirements of Specification Section 31 23 00.

5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DEGF and rising.
6. At the time of placement, flowable fill must have a temperature of at least 40 DEGF.
7. Mixing and placing shall stop when the air temperature is 38 DEGF or less and falling.
8. Each filling stage shall be as continuous an operation as is practicable.
9. Prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over Excavation:

1. Backfill and compact to 95 PCT of maximum dry density per ASTM D698.
2. Backfill with granular bedding material as option.
3. Bedding material shall be granular backfill identical to subballast, or a well graded crushed stone or gravel. If crushed stone or gravel is to be used, it shall conform to ASTM designation C 33, Gradation 67. Or approved by Geotechnical Engineer.
   a. This material shall be placed according to the typical section and compacted in layers not exceeding six (6) inches.
   b. The layers are to be alternately placed to keep the same elevation on both sides of the culvert at all times.
   c. Compaction under the haunches shall be accomplished by utilizing a pole or 2" x 4" timber in the small areas.
   d. Hand tampers shall weigh not less than 20 pounds and have a tamping face not larger than 6" x 6". Mechanical tampers and rollers shall be used in bringing the backfill up to at least 3 feet above the culvert. They shall not strike the culverts while tamping. Smooth rollers will not be allowed in compacting fills around or over culverts.

B. Subgrade Stabilization:

1. Stabilize the subgrade when directed by the Owner.
2. Observe the following requirements when unstable trench bottom materials are encountered.
   a. Notify Owner when unstable materials are encountered.
      1) Define by drawing station locations and limits.
   b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
      1) Replace with subgrade stabilization with no additional compensation.

C. Filter Fabric Placement for Subgrade Drains:

1. The filter fabric shall be placed at the locations shown on the plans or as directed by the ENGINEER. The surface to receive the fabric shall be prepared to a relatively smooth

condition, free of obstructions, depressions, debris and soft or low density pockets of material. All holes, rips, or flaws made in the fabric shall be repaired by placing a piece of fabric, which is 1.5 feet larger than the hole in the fabric in all directions, directly over the hole before stone is placed on the fabric. The fabric shall be laid smooth and free of wrinkles, folds, or creases. The use of securing pins will not be permitted. The fabric shall be secured, if necessary, by placing large stones or bags of soil on the fabric section. All damage to the fabric during its installation or during placement of the backfill shall be replaced or repaired by the CONTRACTOR at no cost to the railroad. The fabric shall be protected from sunlight, ultra violet light, high temperatures, dirt and debris at all times prior to installation. The filter material shall be placed on the fabric, as specified herein or as shown on the plans, immediately after fabric placement.

2. Initial placement of the fabric shall be at lowest trench grade with the succeeding strips being placed at successively higher grades. Longitudinal overlaps shall be a minimum of 12 inches.

3. Trenches to be lined with fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat, but not stretched on the soil, with sides folded back and secured large stones to allow for the placement of stone backfill. The backfill shall be placed and compacted to the depth shown on the plans. The filter fabric sides shall be folded across the top of the backfill with a minimum of 12 inches of overlap.

4. The fabric shall be placed, lining the drain trenches, in accordance with the lines and grades shown on the plans.

3.4 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

B. Carefully Compacted Backfill:

1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.

2. Comply with the following:

a. Place backfill in lifts not exceeding six (6) inches or as directed by ENGINEER.

b. The layers are to be alternately placed to keep the same elevation on both sides of the culvert at all times and densely compacted.

c. Compaction under the haunches shall be accomplished by utilizing a pole or 2” x 4” timber in the small areas.

d. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.

1) Hand tampers shall weigh not less than 20 pounds and have a tamping face not larger than 6” x 6”.

2) Mechanical tampers and rollers shall be used in bringing the backfill up to at least 3 feet above the culvert. They shall not strike the culverts while tamping.

3) Smooth rollers will not be allowed in compacting fills around or over culverts.

e. Observe specific manufacturer's recommendations regarding backfilling and compaction.

f. Compact each lift to specified requirements.

C. Common Trench Backfill:

1. Perform in accordance with the following:

a. Place backfill in lift thicknesses capable of being compacted to densities specified.

b. Observe specific manufacturer's recommendations regarding backfilling and compaction.

c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

CI. Water flushing for consolidation is not permitted.

CII. Backfilling for Electrical Installations:

1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.

2. Modify for electrical installation as follows:

a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.

2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:

1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.

a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	95 PCT of ASTM D698

b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95 PCT of maximum dry density by ASTM D698
	Cohesionless soils	95 PCT of ASTM D698

c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95 PCT of maximum dry density by ASTM D698
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	95 PCT of maximum dry density by ATM D698

3.6 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 31 25 00

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil erosion and sediment control.
2. Surface debris.
3. Maintain and remove erosion control devices.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 31 10 00 - Clearing and Grubbing
4. Section 31 23 00 - Earthwork
5. Section 31 23 33 - Trenching for Utilities
6. Section 32 92 00 - Seeding, Sodding and Landscape

1.2 QUALITY ASSURANCE

A. Conform to rules and regulations of the Erosion Control Laws of Virginia, specifically the Sediment Pollution Control Act of 1973 (G.S. 113A) as amended, and the local jurisdiction where the project is located.

B. Post a copy of the approved erosion control permit, furnished by Owner, at the site prior to starting work. Maintain a copy of the approved erosion control plan at the site.

C. Provide permanent ground cover as soon as possible, and no later than the number of days after completion of work in accordance with section 32 92 00, Lawns and Grasses.

1.3 REFERENCED STANDARDS:

A. Virginia Department of Environmental Quality (VDEQ) Erosion And Sediment Control Handbook.

B. VDEQ Esc Technical Bulletins.

C. VDEQ Esc Minimum Standards.

1.4 WARRANTY

A. Contractor is liable for damages to public and private property and fines as may be placed on the Project by the governing agencies due to failure to provide erosion control devices in accordance with approved erosion control plan.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See plans for materials and standard details with material designations.

~~**PART 3 – EXECUTION**~~

~~**3.1 GENERAL**~~

~~A. See Construction Documents for Construction Sequence..~~

~~**END OF SECTION**~~

SECTION 31 40 00

SHORING AND UNDERPINNING

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers design, construction, maintenance and removal of cofferdams for marine construction and/or for structure excavation, along with other types of braced excavation.

B. General conditions for this work are in accordance with Division 1 of these Specifications.

1.2 RELATED SECTIONS

A. Sections which directly relate to the work of this Section include:

1. Section 03 05 05 – CONCRETE TESTING AND INSPECTION
2. Section 03 09 00 – CONCRETE
3. Section 03 31 30 – CONCRETE, MATERIALS AND PROPORTIONING
4. Section 03 21 00 – REINFORCEMENT
5. Section 05 12 00 – STRUCTURAL STEEL

1.3 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Contractor who specializes in installation of earth retention systems such as that proposed.

2. Minimum five years of experience in earth retention system installation.

3. Employ or retain services of a Specialty Structural Engineer with knowledge in earth retention system design and a minimum of five years of experience in systems as proposed for this project.

B. Assume complete responsibility for design, installation, and maintenance in addition to damage resulting from installation or performance of earth retention system.

C. Engineer Qualifications:

1. Comply with Section 01 33 00, Submittal Procedure requirements.

D. Carefully examine site and verify elevations of existing footings of adjacent buildings and invert elevations of underground utility lines.

E. Standards:

1. Post Tensioning Institute (PTI):

a. Guide specification for post tensioning materials.

b. Recommendation for prestressed rock and soil anchors.

2. American Institute of Steel Construction (AISC):

a. Specifications for design, fabrication and erection of structural steel for buildings.

b. Code of standard practice for steel buildings.

3. American Welding Society (AWS):

a. AWS D1.1, structural welding code - steel.

4. ASTM International (ASTM): Standards indicated.

5. Structural Steel Painting Council (SSPC): Standards indicated.

6. American Wood Preservers Association (AWPA).

F. Design Criteria:

1. Provide earth retention system which will safely withstand earth pressures and limit settlement of surrounding structures to maximum 1/4 inches [PH1]vertically and laterally.

2. Earth retention systems shall utilize effectively prestressed tie backs or earth anchors to minimize lateral earth deflection.

3. Earth pressures used for the design of the earth retention system shall be determined by recognized principles of soils mechanics and shall be acceptable to the Owner's Geotechnical Engineer.

4. Design, installation and grouting of earth retention system to follow recommendations of Post Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors".

5. Consider long term effects, including creep and relaxation in anchor design such that lateral movement of finished wall is less than 1/4 inches [PH2]during service life of structure.

6. Global Earth Stability:

a. The earth retention design engineer shall evaluate the excavation for global slope stability.

b. Demonstrate by calculation that an appropriate factor of safety will exist or be provided by the earth retention system for all conditions or imposed loads.

c. Appropriate soil properties to be used for the analysis shall be determined by the project Geotechnical Engineer.

d. Analysis shall conform to the US Army Corps of Engineers Engineer Manual 1110-2-1902

G. Testing:

1. Proof test tie-back anchors in accordance with Post Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors" to verify their load carrying capabilities.

2. Ten percent of permanent anchors shall be performance tested to at least 1.5 times design working load; and 10% of temporary anchors to at least 1.35 times design working load in accordance with referenced PTI standard.

H. Monitoring:

1. Contractor shall employ a qualified geotechnical consultant familiar with soil conditions at the site who shall install three-dimensional survey monitoring instrumentation as required to observe movement of earth retention system and adjacent structures.

a. CSX track shall be continuously monitored. If track movement occurs, work must stop, and the ENGINEER shall be notified immediately. The Contractor must propose an alternate procedure for ENGINEER approval before proceeding.

2. Geotechnical consultant shall report measured movements of earth retention system, CSX track, and adjacent structures to Contractor, Owner, and CM on a weekly basis until monitoring systems are no longer necessary as deemed acceptable by Geotechnical consultant.

3. If movements are recorded that are larger than anticipated or projected, provide necessary support to reduce movements to acceptable level.

I. Inspection:

1. Specialty Structural Engineer shall observe work in progress to see that design is being followed and design criteria are being met.

2. After construction of earth retention system is complete, Specialty Structural Engineer shall verify correctness of installation and inform Architect.

1.4 SUBMITTALS

A. The CONTRACTOR shall prepare and deliver technical submittals for review and approval of the ENGINEER. All submittals must be approved before related work may begin. Listed below are submittals required for this item of work, additional submittals may be required due to site conditions or the nature of the work. In order to maintain correspondence records each submittal shall be assigned a submittal number and transmittal number for use by the CONTRACTOR and the ENGINEER.

1. Temporary Waterway Diversion Structure, if applicable;

2. Design calculations for the cofferdam and or other braced excavation, and any temporary waterway diversion structure required for the work, signed and sealed by a Professional Engineer licensed in the Commonwealth, District, State or Province where work is to be performed. Shoring for railway Live Load shall be designed to resist a vertical live load surcharge of 1800 lbs. per square foot, in addition to active earth pressure. The surcharge shall be assumed to act on a continuous strip, 8’-6” wide. Lateral pressures due to surcharge shall be computed using the strip load formula shown in the AREMA MRE. Allowable stresses in materials shall be in accordance with AREMA recommendations.

3. Erection drawings and construction procedure detailing the proposed method of cofferdam and/or braced excavation construction and other details not fully shown in the Contract Drawings. Such drawings shall be signed and sealed by a Professional Engineer licensed in the Commonwealth, District, State or Province where work is to be performed, and approved by the ENGINEER before construction is started.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new materials meeting the requirements of the related sections listed above.

B. Any used material proposed shall be in good condition, free of section loss, or other defects and approved by the ENGINEER.

2.2 HANDLING AND STORING MATERIALS

A. All materials shall be handled and stored according to manufacturer’s recommendation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Preferred protection is the cofferdam type that completely encloses the excavation. Where dictated by conditions, partial cofferdams with open sides away from the track may be used. Cofferdams shall be constructed using steel sheet piling or steel soldier beams with timber lagging. Wales and struts shall be provided as needed.

B. Safety railing meeting the requirements of 29 CFR 1910.23 shall be installed when temporary shoring is within 12 feet of track, or depth is greater than 6 feet.

C. A minimum distance of 10 feet from centerline of the track to face of nearest point of shoring shall be maintained.

D. Cofferdams shall be constructed to keep the excavations free from earth, water, ice, or snow, and to permit excavations to be carried to the depths indicated on the plans. Additional bracing may be required to satisfactorily perform excavation, dewatering, and other required construction operations. Permanent sheeting system shall be returned to its intended condition after all cofferdam equipment and material, including any additional bracing, has been removed.

E. Cofferdams shall be designed, inspected daily, and maintained in compliance with the applicable requirements of 29 CFR 1926.651, 1926.652, and 1926.802.

F. Shoring protection shall be provided when excavating adjacent to an active railroad track, except as noted below. Shoring will not be required if both the following conditions are satisfied:

1. Excavation does not encroach upon a 1 horizontal: 1 vertical theoretical slope line starting at the bottom of the near end of the tie (approximately 4’-3” from centerline of the track).

2. Track is on level ground or in a cut section and on stable soil.

G. Dewatering equipment and any additional bracing shall be of adequate quality and capacity and shall be so arranged as to permit their proper functioning in connection with the cofferdam. Dewatering equipment and bracing shall be so located to permit construction of the structure in accordance with the plans.

H. All damage caused by the failure of a cofferdam to perform its proper functions shall be the responsibility of the CONTRACTOR. It shall also be the CONTRACTOR’s responsibility to protect all stream banks from erosion by reason of restriction of the channel caused by the erection of the cofferdam to limits greater than that shown on the plans for the CONTRACTOR’s own convenience. In that situation, bank restoration shall be at the CONTRACTOR’ own expense. The ENGINEER shall approve all repair methods proposed by the CONTRACTOR prior to the CONTRACTOR beginning any remedial activities for which they are liable.

I. It shall be the CONTRACTOR’s responsibility to place the cofferdam so that it will not interfere with any substructure components.

J. CONTRACTOR shall provide and maintain COFFERDAM access.

K. The CONTRACTOR shall establish and maintain a sediment removal area(s) to retain the discharge for a sufficient period of time using equivalent best management practices as approved by the ENGINEER, in order that any discharge entering the stream will be as clear as the flowing stream.

L. The CONTRACTOR shall fully remove cofferdam installation or the waterway diversion structure, including anchor spuds if used, after such time that it is determined by the ENGINEER to be no longer necessary. The removal shall be sequenced to minimize turbidity and the discharge of materials into the waterway. Additional temporary erosion control measures, as determined by the ENGINEER, may need to be employed to facilitate removal.

END OF SECTION

NO TEXT ON THIS PAGE.

SECTION 31 50 00

EARTH RETENTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Earth Retention Systems, as indicated, in accordance with provisions of Contract Documents.

B. Subsurface soils investigations have been made at project site.

1. Soils information was obtained for use in preparing foundation design.

2. Location of soils report is included in specifications.

3. Examine site and soils report and determine character of materials to be encountered.

C. Definitions:

1. Geotechnical Engineer: Soils Engineer or Representative of Foundation Consultant employed by Owner, empowered to conduct inspections and make approvals.

2. Design Engineer: Structural or Civil Engineer responsible for the earth retention system design.

3. Temporary earth retention system: System required to function only during construction period, up until which time excavation can safely be backfilled and retention system is no longer required.

4. Permanent earth retention system: System required to function throughout service life of structure.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Contractor who specializes in installation of earth retention systems such as that proposed.

2. Minimum five years experience in earth retention system installation.

3. Employ or retain services of a Specialty Structural Engineer with knowledge in earth retention system design and minimum five years experience in systems as proposed for this project.

B. Assume complete responsibility for design, installation, and maintenance in addition to damage resulting from installation or performance of earth retention system.

C. Engineer Qualifications:

1. Comply with Section 01 33 00, Submittal Procedure requirements.

D. Carefully examine site and verify elevations of existing footings of adjacent buildings and invert elevations of underground utility lines.

E. Standards:

1. Post Tensioning Institute (PTI):

a. Guide specification for post tensioning materials.

b. Recommendation for prestressed rock and soil anchors.

2. American Institute of Steel Construction (AISC):

a. Specifications for design, fabrication and erection of structural steel for buildings.

b. Code of standard practice for steel buildings.

3. American Welding Society (AWS):

a. AWS D1.1, structural welding code - steel.

4. ASTM International (ASTM): Standards indicated.

5. Structural Steel Painting Council (SSPC): Standards indicated.

6. American Wood Preservers Association (AWPA).

F. Design Criteria:

1. Provide earth retention system which will safely withstand earth pressures and limit settlement of surrounding structures to maximum 1/4 inches vertically and laterally.

2. Earth retention system shall utilize effectively prestressed tie backs or earth anchors to minimize lateral earth deflection.

3. Earth pressures used for the design of the earth retention system shall be determined by recognized principles of soils mechanics and shall be acceptable to the Owner's Geotechnical Engineer.

4. Design, installation and grouting of earth retention system to follow recommendations of Post Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors".

5. Consider long term effects, including creep and relaxation in anchor design such that lateral movement of finished wall is less than 1/4 inches during service life of structure.

6. Global Earth Stability

a. The earth retention design engineer shall evaluate the excavation for global slope stability.

b. Demonstrate by calculation that an appropriate factor of safety will exist or be provided by the earth retention system for all conditions or imposed loads.

c. Appropriate soil properties to be used for the analysis shall be determined by the project Geotechnical Engineer.

d. Analysis shall conform the US Army Corps of Engineers Engineer Manual 1110-2-1902

G. Testing:

1. Proof test tie back anchors in accordance with Post Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors" to verify their load carrying capabilities.

2. Ten percent of permanent anchors shall be performance tested to at least 1.5 times design working load; and 10% of temporary anchors to at least 1.35 times design working load in accordance with referenced PTI standard.

H. Monitoring:

1. Owner shall employ a qualified geotechnical consultant familiar with soil conditions at site who shall install three-dimensional survey monitoring instrumentation as required to observe movement of earth retention system and adjacent structures.

   a. CSX track shall be continuously monitored. If track movement occurs, work must stop, and the ENGINEER shall be notified immediately. The Contractor must propose an alternate procedure for ENGINEER approval before proceeding.

2. Geotechnical consultant shall report measured movements of earth retention system, CSX track, and adjacent structures to contractor, Owner, and Architect on a weekly basis until monitoring systems are no longer necessary as deemed acceptable by Geotechnical consultant.

3. If movements are recorded that are larger than anticipated or projected, provide necessary support to reduce movements to acceptable level.

I. Inspection:

1. Specialty Structural Engineer shall observe work in progress to see that design is being followed and design criteria are being met.

2. After construction of earth retention system is complete, Specialty Structural Engineer shall verify correctness of installation and inform Architect.

1.3 SUBMITTALS

A. Project Information:

1. Drawings and Specifications signed and sealed by Specialty Structural Engineer including:

   a. Description of system proposed.

   b. Provide plan layout of proposed system including dimensions, section cuts and details for stage of construction.

   c. Coordinate plan layout and details with building construction drawings and site conditions.

   d. Shop drawings shall be in sufficient detail to permit installation without reference to contract documents

   e. Include specific descriptions of required field quality control.

   f. Anchor (tiebacks), Lagging, and Internal Bracing.

      1) Type.

      2) Corrosion protection.

      3) Stressing procedure.

      4) Grout and grouting method.

   g. Proposed method of providing for utility penetrations

   h. Crack survey of existing structures protected by earth retention system.

   i. Tie-back proof test results.

j. Design calculations signed and sealed by Specialty Structural Engineer.

1.4 JOB CONDITIONS

A. Carefully maintain bench marks, monuments, and other reference points.

B. Replace if disturbed or destroyed.

C. Protect active utilities from damage.

D. Provide protective barriers around excavation as required by governing agencies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Anchor Materials:

1. Either single or multiple elements of wires conforming to ASTM A421; or strands conforming to ASTM A416; or steel bars conforming to ASTM A722.

2. Minimum protective coating (except over bond length): Double corrosion protection system consisting of a plastic sheathing and grease over tendon in addition to grouting.

3. Take extra care to ensure complete and uninterrupted continuity of protective coating.

B. Structural Steel:

1. New rolled shapes or plates of structural grade steel conforming to ASTM A36 or ASTM A992, Grade 50.

2. Deformations, imperfections, camber and sweep of piles not more than allowed by ASTM A6.

3. Pile lengths necessary to reach required depths shall be determined by Contractor.

4. Soldier pile: Coated with coal tar epoxy, with predrilled holes to prevent damage to corrosion protection system (for permanent structures).

C. Protective Coatings (For Permanent Structures):

1. Corrosion protection material which is not detrimental to prestressing steel, with following properties:

a. Free from cracks and not brittle or fluid over entire anticipated range of temperatures.

b. Chemically stable for life of tendon.

c. Nonreactive with surrounding materials such as concrete, tendons or sheathing.

d. Corrosion inhibiting.

e. Impervious to moisture.

2. Coal tar epoxy: Tnemec Tneme-Tar 46-413, minimum 8 mils.

3. Grease: Specially compounded for post tensioning.

D. Timber lagging:

1. Size and strength to support loads imposed on it; pressure treated in accordance with AWPA standards to preserve capacity of element for service life of structure.

~~PART 3 - EXECUTION~~

~~3.1 PREPARATION~~

~~A. Do not start work nor purchase materials required until description and calculations for proposed earth retention system and details have been examined for compliance with the specifications.~~

~~3.2 EXCAVATION~~

~~A. Install earth retention system to dimensions and elevations indicated, allowing additional space as required for construction operations and inspection of foundations.~~

~~B. Excavate and remove existing concrete encountered.~~

~~C. Do not perform blasting.~~

~~D. Remove old foundations, building construction, and other materials concealed beneath present grade, as required to execute work, and as indicated.~~

~~E. Properly level off bottoms of excavations.~~

~~F. Control grading around building.~~

~~G. Pitch earth to prevent water from running into excavated areas or damaging structure.~~

~~H. Provide pumping required to keep excavated spaces clear of water.~~

~~I. If springs or running water are encountered, notify Architect and Engineer, provide free discharge of water by trenches or pumps, and drain to appropriate point of disposal as directed.~~

~~J. Maintain earth retention system from time of installation until completion of backfilling around building.~~

~~END OF SECTION~~

NO TEXT ON THIS PAGE.

SECTION 31 66 15

HELICAL SCREW FOUNDATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. The purpose of this specification is to detail the furnishing of all designs, materials, tools, equipment, labor and supervision, and installation techniques necessary to install HELICAL SCREW FOUNDATIONS (HSF), also known as helical piles, as detailed on the drawings, including connection details. This shall include provisions for load testing that may be part of the scope of work. The basis of the design assumes the use of HSF as manufactured by A. B. Chance. However, this specification prescribes performance requirements that will apply to any HSF chosen by the contractor that also meets the design requirements.

B. Scope of Work

1. This work consists of furnishing all necessary, supervision, labor, tools, materials, and equipment to perform all work necessary to install the HELICAL SCREW FOUNDATIONS as per the specifications described herein, and as shown on the drawings. The Contractor shall install a helical screw foundation that will develop the load capacities as detailed on the drawings.

1.2 REFERENCED CODES AND STANDARDS

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. In case of conflict, the particular requirements of this specification shall prevail. The latest publication as of the issue of this specification shall govern, unless indicated otherwise.

B. American Society for Testing and Materials (ASTM):

1. ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.
2. ASTM A36/A36M Structural Steel.
3. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
4. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
5. ASTM A252 Welded and Seamless Steel Pipe Piles.
6. ASTM A775 Electrostatic Epoxy Coating
7. ASTM A193/A193M Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
8. ASTM A320/A320M Alloy-Steel Bolting Materials for Low Temperature Service.
9. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
10. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality.
11. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.

12. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.
13. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.
14. ASTM D1143 Method of Testing Piles Under Static Axial Compressive Load.
15. ASTM D3689 Method of Testing Individual Piles Under Static Axial Tensile Load.

C. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code – Steel.
2. AWS D1.2 Structural Welding Code – Reinforcing Steel.

D. American Society of Civil Engineers (ASCE):

1. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations.

E. Deep Foundations Institute (DFI):

1. Guide to Drafting a Specification for High Capacity Drilled and Grouted Micropiles for Structural Support, 1st Edition, Copyright 2001 by the Deep Foundation Institute (DFI).

F. Post Tensioning Institute (PTI):

1. *Recommendations for Prestressed Rock and Soil Anchors*, Third Edition, Copyright 1996 By the Post-Tensioning Institute.

G. Society of Automotive Engineers (SAE):

1. SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners.

1.3 SUBMITTALS

A. Construction Submittals

1. The Contractor shall submit a detailed description of the construction procedures proposed for use to the Owner for review. This shall include a list of major equipment to be used.
2. The technical submittal shall include the following:
3. 3.1.2.a Helical Screw Foundation number, location and pattern by assigned identification number
4. 3.2.2.b HSF design load
5. 3.1.2.c Type and size of central steel shaft
6. 3.1.2.d Helix configuration (number and diameter of helix plates)
7. 3.1.2.e Minimum effective installation torque
8. 3.1.2.f HSF attachment to structure relative to grade beam, column pad, pile cap, etc.
9. The Contractor shall submit shop drawings for all HSF components including pile top attachment to the Owner for review and approval. This includes HSF lead and extension section identification (manufacturer's catalog numbers).

10. Work shall not begin until all the submittals have been received and approved by the Owner.

B. Installation Records

1. The Contractor shall provide the Owner copies of HSF installation records within 24 hours after each installation is completed. Formal copies shall be submitted on a weekly basis. These installation records shall include, but are not limited to, the following information.

   a. Name of project and Contractor

   b. Name of Contractor's supervisor during installation

   c. Date and time of installation

   d. Name and model of installation equipment

   e. Type of torque indicator used

   f. Location of HSF by assigned identification number

   g. Actual HSF type and configuration – including lead section (number and size of helix plates), number and type of extension sections (manufacturer's SKU numbers)

   h. HSF installation duration and observations

   i. Total length of installed HSF

   j. Cut-off elevation

   k. Inclination of HSF

   l. Installation torque at one-foot intervals for the final 10 feet

   m. Comments pertaining to interruptions, obstructions, or other relevant information

   n. Rated load capacities

1.4 QUALITY ASSURANCE

A. Helical screw foundations shall be installed by a contractor certified by the manufacturer and/or their authorized representatives.

B. The Contractor shall employ an adequate number of skilled workers who are experienced in the necessary crafts and who are familiar with the specified requirements and methods needed for proper performance of the work of this specification.

C. All HSFs shall be installed in the presence of a designated representative of the Owner unless said representative informs the Contractor otherwise. The designated representative shall have the right to access to any and all field installation records and test reports.

D. Screw foundation components as specified therein shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements. Certificates of Registration denoting ISO Standards Number shall be presented upon request to the Owner or their representative.

E. Qualifications of the Helical Screw Foundation Contractor

1. The HSF Contractor shall be experienced in performing design and construction of helical screw foundations and shall furnish all materials, labor, and supervision to

perform the work. The Contractor shall be certified by the manufacturer and/or their authorized representatives in the proper methods of design and installation of helical screw foundations.

2. The HSF Contractor shall not sublet the whole or any part of the contract without the express written permission of the Owner.

1.5 GROUND CONDITIONS

A. The Geotechnical Report(s), including logs of soil borings as shown on the boring location plan, shall be considered to representative of the in-situ subsurface conditions likely to be encountered on the project site. As required for the design, additional subsurface investigations shall be performed and documented in a supplementary geotechnical report. These Geotechnical Report(s) shall be used as the basis for helical screw foundation design using generally accepted engineering judgement and methods.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA:

A. Allowable Tolerances

1. Centerline of helical screw foundations shall not be more than 3 inches from indicated plan location.
2. Helical screw foundation plumbness shall be within 5° of design alignment.
3. Top elevation of helical screw foundation shall be within +1 inch to –2 inches of the design vertical elevation.

2.2 PRODUCTS AND MATERIALS

A. Central Steel Shaft:

1. The central steel shaft, consisting of lead sections, helical extensions, and plain extensions, shall be Type SS or HS or a combination of the two (SS to HS Combo Pile) as manufactured by the A. B. Chance Company (Centralia, MO), or approved equal.
   a. *SS5 1-1/2" Material*: Shall be hot rolled Round-Cornered-Square (RCS) solid steel bars meeting dimensional and workmanship requirements of ASTM A29. The bar shall be modified medium carbon steel grade (similar to AISI 1044) with improved strength due to fine grain size.
      1) Torsional strength rating = 5,500 ft-lb
      2) Minimum yield strength = 70 ksi
   b. *SS150 1-1/2"; SS175 1-3/4; SS200 2"; SS225 2-1/4" Material*: Shall be hot rolled Round-Cornered-Square (RCS) solid steel bars meeting the dimensional and workmanship requirements of ASTM A29. The bar shall be High Strength Low Alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size.
      1) Torsional strength rating: SS150 = 7,000 ft-lb; SS175 = 10,000 ft-lb; SS200 = 15,000 ft-lb; SS225 = 20,000 ft-lb
      2) Minimum yield strength = 90 ksi

c. *HS 3-1/2" OD Material*: Shall be structural steel tube or pipe, seamless or straight-seam welded, per ASTM A53, A252, ASTM A500, or ASTM A618. Wall thickness is 0.300" (schedule 80).

1) strength rating = 11,000 ft-lb

2) Minimum yield strength = 50 ksi

d. *Type RS2875 2-7/8" OD Material*: Structural steel tube or pipe, welded or seamless, in compliance with ASTM A500 or A513. Wall thickness is 0.165", 0.203" or 0.262".

1) Torque strength rating: RS2875.165 = 4,500 ft-lb; RS2875.203 = 5,500 ft-lb; RS2875.262 = 7,500 ft-lb.

2) Minimum yield strength = 50 ksi

e. *SS to HS Combo Pile Material*: Shall be Type SS and HS material as described above with a welded adapter for the transition from SS to HS.

B. Helix Bearing Plate:

1. Shall be hot rolled carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape and uniform pitch. Bearing plate material shall conform to the following ASTM specifications.

a. *SS5 Material*: Per ASTM A572, or A1018, or A656 with minimum yield strength of 50 ksi. Plate thickness is 3/8".

b. *SS150 and SS175 Material*: Per ASTM A656 or A1018 with minimum yield strength of 80 ksi. Plate thickness is 3/8".

c. *SS200 and SS225 Material*: Per ASTM A656 or A1018 with minimum yield strength of 80 ksi. Plate thickness is ½".

d. *HS Material*: Per ASTM A36, or A572, or A1018, or A656 depending on helix diameter, per the minimum yield strength requirements cited above. Plate thickness is 3/8".

e. *RS2875 Material*: Per ASTM A36, or A572, with minimum yield strength of 36 ksi. Plate thickness is 3/8" or ½".

C. Bolts:

1. The size and type of bolts used to connect the central steel shaft sections together shall conform to the following ASTM specifications.

a. *SS5 and SS150 1-1/2" Material*: 3/4" diameter bolt per ASTM A320 Grade L7.

b. *SS175 1-3/4" Material*: 7/8" diameter bolt per ASTM A193 Grade B7.

c. *SS200 2" Material*: 1-1/8" diameter bolt per ASTM A193 Grade B7.

d. *SS225 2-1/4" Material*: 1-1/4" diameter bolt per ASTM A193 Grade B7.

e. *HS 3-1/2" OD Material*: ¾" diameter bolts (3 per coupling) per SAE J429 Grade 5.

f. *RS2875 2-7/8" OD Material*: ¾" diameter bolts (2 or 4 per coupling) per SAE J429 Grade 5 or 8.

D. Couplings:

1. Shall be formed as integral part of the plain and helical extension material. For Type HS material, the couplings shall be hot forge expanded sockets.

E. Plates, Shapes, or Pier Caps:

1. Structural steel plates and shapes for HSF top attachments shall conform to ASTM A36 or ASTM A572 Grade 50.

F. Corrosion Protection

1. Galvanization: All A. B. Chance Type HS material shall be hot-dipped galvanized in accordance with ASTM A123 after fabrication.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Prior to commencing helical screw foundation installation, the Contractor shall inspect the work of all other trades and verify that all said work is completed to the point where HSFs may commence without restriction.

B. The Contractor shall verify that all HSFs may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

C. In the event of a discrepancy, the Contractor shall notify the Owner. The Contractor shall not proceed with HSF installation in areas of discrepancies until said discrepancies have been resolved. All costs associated with unresolved discrepancies shall be the responsibility of the Owner.

3.2 INSTALLATION EQUIPMENT

A. Shall be rotary type, hydraulic power driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

B. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper HSF alignment.

3.3 INSTALLATION TOOLING

A. Shall consist of a Kelly Bar Adapter (KBA) and Type SS or HS drive tool as manufactured by A. B. Chance Company, or approved equal, and used in accordance with the manufacturers written installation instructions.

B. A torque indicator shall be used during HSF installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.

1. Shall be capable of providing continuous measurement of applied torque throughout the installation.

2. Shall be capable of torque measurements in increments of at most 500 ft-lb

3. Shall be calibrated prior to pre-production testing or start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.

4. Shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements.

3.4 INSTALLATION PROCEDURES

A. Central Steel Shaft: (Lead and Extension Sections)

1. The HSF installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

2. The lead section shall be positioned at the location as shown on the working drawings. Battered HSFs can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. The HSF sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 40 ft-lb.

3. Sufficient down pressure shall be applied to uniformly advance the HSF sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

3.5 TERMINATION CRITERIA

A. The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.

B. The minimum installation torque, minimum overall length criteria, or suitable bearing (helix not advancing with proper downpressure) as shown on the technical submittal shall be satisfied prior to terminating the helical screw foundation installation.

C. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

1. Terminate the installation at the depth obtained subject to the review and acceptance of the Owner, or:

2. Remove the existing HSF and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new HSF shall be terminated at least (3) three feet beyond the terminating depth of the original HSF.

D. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:

1. Install the HSF deeper using additional extension sections, or:

2. Remove the existing HSF and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the

Owner. If re-installing in the same location, the top-most helix of the new HSF shall be terminated at least (3) three feet beyond the terminating depth of the original HSF.

3. De-rate the load capacity of the HSF and install additional helical screw foundation(s). The de-rated capacity and additional helical screw foundation location shall be subject to the review and acceptance of the Owner.

E. If the HSF is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the HSF re-installed. If the obstruction can't be removed, the HSF shall be installed at an adjacent location, subject to review and acceptance of the Owner.

F. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the helical screw foundation to facilitate extension removal.

G. The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.

3.6 HELICAL SCREW FOUNDATION LOAD TESTS

A. Use the ASTM D1143A section 5.6 "Quick Load"

B. Load Test Equipment

1. The load test equipment shall be capable of increasing or decreasing the applied load incrementally. The incremental control shall allow for small adjustments, which may be necessary to maintain the applied load for a sustained, hold period.

2. The reaction system shall be designed to have sufficient strength and capacity to distribute the test loads to the ground. It should also be designed to minimize its movement under load and to prevent applying an eccentric load to the pile head. Test loads are normally higher than the design loads on the structure. The direction of the applied load shall be collinear with the HSF at all times.

3. Dial gauge(s) shall be used to measure HSF movement. The dial gauge shall have an accuracy of at least +/-0.001-in. and a minimum travel sufficient to measure all HSF movements without requiring resetting the gauge. The dial gauge shall be positioned so its stem is parallel with the axis of the HSF. The stem may rest on a smooth plate located at the pile head. Said plate shall be positioned perpendicular to the axis of the HSF. The dial gauge shall be supported by a reference apparatus to provide an independent fixed reference point. Said reference apparatus shall be independent of the reaction system and shall not be affected by any movement of the reaction system.

4. The load test equipment shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the load or deflection measurements.

C. Testing Program

1. The hydraulic jack shall be positioned at the beginning of the test such that the unloading and repositioning of the jack during the test shall not be required. The jack shall also be positioned co-axial with respect to the pile-head so as to minimize eccentric loading. The hydraulic jack shall be capable of applying a load not less than two times the proposed design load (DL). The pressure gauge shall be graduated in 100 psi increments or less. The stroke of the jack shall not be less than the theoretical elastic shortening of the total HSF length at the maximum test load.

2. An alignment load (AL) shall be applied to the HSF prior to setting the deflection measuring equipment to zero or a reference position. The AL shall be no more than 10% of the design load (i.e., 0.1 DL). After AL is applied, the test set-up shall be inspected carefully to ensure it is safe to proceed.

3. Axial compression or tension load tests shall be conducted by loading the HSF in step-wise fashion as shown in Table-3 to the extent practical. Pile-head deflection shall be recorded at the beginning of each step and after the end of the hold time. The beginning of the hold time shall be defined as the moment when the load equipment achieves the required load step.

4. Test loads shall be applied until continuous jacking is required to maintain the load step or until the test load increment equals 200% of the design load (DL) (i.e., 2.0 DL), whichever occurs first. The observation period for this last load increment shall be 10 minutes. Displacement readings shall be recorded at 1, 2, 3, 4, 5 and 10 minutes (load increment maxima only).

5. The applied test load shall be removed in four approximately equal decrements per the schedule in Table-3. The hold time for these load decrements shall be 1 minute, except for the last decrement, which shall be held for 5 minutes.

Table-3. Steps for Pre-Production Load Testing

LOAD STEP	HOLD TIME (MINUTES)
AL	2.5 Min.
0.20 DL	2.5 Min.
0.40 DL	2.5 Min.
0.50 DL	2.5 Min.
0.20 DL	1.0 Min.
AL	1.0 Min.
0.40 DL	1.0 Min.
0.60 DL	2.5 Min.
0.80 DL	2.5 Min.
1.0 DL	2.5 Min.
0.5 DL	1.0 Min.
0.2 DL	1.0 Min.
AL	1.0 Min.
0.5 DL	1.0 Min.
1.0 DL	1.0 Min.
1.2 DL	2.5 Min.
1.4 DL	2.5 Min.

LOAD STEP	HOLD TIME (MINUTES)
1.6 DL	2.5 Min.
1.8 DL	2.5 Min.
2.0 DL	10 Min.
1.5 DL	1.0 Min
1.0 DL	1.0 Min
0.5 DL	1.0 Min
AL	5.0 Min

AL = Alignment Load; DL = Design Load

D. Acceptance Criteria for HSF Verification Load Tests

1. Both of the following criteria must be met for approval:

   a. The HSF shall sustain the compression and tension design capacities (1.0 DL) with no more than ~~____ in. (mm)~~***1/4"*** total vertical movement of the pile-head as measured relative to the top of the HSF prior to the start of testing.

   b. Failure does not occur at the 2.0 DL maximum compression and tension test loads. The failure load shall be defined by one of the following definitions – whichever results in the lesser load:

      1) The point at which the Helical Pile tip exceeds the elastic compression/tension of the pile shaft by 0.1B, where B is defined as the average helix diameter.

      2) The point at which the slope of the load versus deflection (at end of increment) curve exceeds 0.05 inches/kip.

   c. The Contractor shall provide the Owner copies of field test reports confirming HSF configuration and construction details within 24 hours after completion of the load tests. Formal copies shall be submitted as per Section 3.3. This written documentation will either confirm the load capacity as required on the working drawings or propose changes based upon the results of the pre-production tests.

   d. When a HSF fails to meet the acceptance criteria, modifications shall be made to the design, the construction procedures, or both. These modifications include, but are not limited to, de-rating the HSF load capacity, modifying the installation methods and equipment, increasing the minimum effective installation torque, changing the helix configuration, or changing the HSF material (i.e., central steel shaft). Modifications that require changes to the structure shall have prior review and acceptance of the Owner. The cause for any modifications of design or construction procedures shall be decided in order to determine any additional cost implications.

END OF SPECIFICATION

APPENDIX

TABLE-1

MECHANICAL STRENGTH RATINGS – HELICAL SCREW FOUNDATIONS

RATING TYPE	**CENTRAL STEEL SHAFT FAMILY**					
	SS5 1-1/2" RCS	**SS150 1-1/2" RCS**	**SS175 1-3/4" RCS**	**SS200 2" RCS**	**SS225 2-1/4" RCS**	**HS 3-1/2" O.D Pipe**
Torsional Strength Rating (ft-lb)	5,500	7,000	10,000	15,000	20,000	11,000
Ultimate Capacity Per Helix (kip) (Tension/Compression)	*40	*40	*50	60	60	50
Allowable Capacity Per Helix w/ 2.0 Safety Factor (kip) (Tension/Compression)	20	20	25	30	30	25
Ultimate Tension Capacity for Axially Loaded Pile (kip)	70	70	100	150	200	100

*** For 14" Dia. Helix Plates, Reduce the Ultimate Capacity by 20%**

NOTE: Actual installed capacities are dependent on existing soil conditions.

TABLE-1B

MECHANICAL STRENGTH RATINGS – Type RS HELICAL PILES

RATING TYPE	**CENTRAL STEEL SHAFT PRODUCT FAMILY**				
	RS2875.165 2-7/8" OD Pipe Shaft	**RS2875.203 2-7/8" OD Pipe Shaft**	**RS2875.262 2-7/8" OD Pipe Shaft**	**RS3500.300 2-7/8" OD Pipe Shaft**	**RS4500.337 4-1/2" OD Pipe Shaft**
Torque Strength Rating (ft-lb)	4,500	5,500	7,500	13,000	23,000
Ultimate Strength Per Helix (kip) (Tension/Compression)	*40	*40	*40	50	60
Uplift/Compression Capacity Limit[1] (kip)	36	44	60	91	138
Ultimate Tension Strength[2] (kip)	50	60	100	120	140

*** For 14" Dia. 3/8" Thick Helix Plates, Reduce the Ultimate Capacity by 20%**

1 - Based on torque rating – Uplift/Compression Capacity Limit = Torque Rating x Kt

"Default" Kt for Type RS2875 Series = 8, for Type RS3500.300 = 7, for Type RS4500.337 = 6

SECTION 33 05 07.23

UTILITY BORING AND JACKING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish material necessary to install solid wall steel pipe culvert by the JACK AND BORE method in the locations and to the elevations shown on the plans. The solid wall steel pipe may be supplied by the CSXT, or may be furnished by the CONTRACTOR, as specified in the Contract Documents.

B. General conditions for this work are in accordance with Division 1 of these Specifications.

1.2 GENERAL

A. Hydraulic Design – Shall be based on the 100-year/24-hour storm event leaving minimum 2 feet of freeboard between the water surface elevation and bottom of rail, or a headwater surface no more than 1.5 times opening height of culvert, unless otherwise approved by the ENGINEER. Calculating the capacity of an existing or proposed drainage structure should be completed per AREMA recommendation.

B. Minimum pipe size is 36 inch diameter.

C. Adjacent pipes of dissimilar sizes and shapes shall have the same invert elevation.

D. Multiple pipes shall be spaced at no more than 2 pipe diameters apart, center to center.

E. Pipes shall be installed with headwalls, parapets, wingwalls, and apron if required for hydraulics, scour prevention, or right-of-way reasons.

F. For pipe abandonment refer to Section 33 05 07 - HORIZONTAL DIRECTIONAL DRILLING.

1.3 SUBMITTALS

A. The CONTRACTOR shall prepare and deliver technical submittals for review and approval of the ENGINEER. All submittals must be approved before related work may begin.

PART 2 - PRODUCTS

2.1 GENERAL

A. Steel Pipe:

1. The pipe shall be ASTM A139, Grade B with minimum yield strength of 35,000psi.
2. Minimum wall thickness shall be in accordance with AREMA Table 1-5-5, or as specified by the Engineer.
3. Joints in pipe sections shall be field welded with full penetration single 'V' groove butt weld, all around. Welding shall be per AWS D1.1.
4. Metal end sections consisting of pipe reducers or end walls/head walls, if required, shall consist of ASTM A36 steel plate with minimum wall thickness of ½ inch. End sections shall be welded all around with minimum ¼ inch fillet to the host pipe with per AWS D1.1.

B. Non-Shrink Structural Grout (For Grouting Pipe Annulus)

1. Shall be mixture of cement, sand, water, and admixtures.
2. Shall be highly flowable.
3. Shall have minimum 28-day unconfined compressive strength of 2,000 psi, unless otherwise indicated on the plans.

2.2 HANDLING AND STORING MATERIALS

A. Materials shall be handled and stored according to manufacturer's recommendations.

B. CONTRACTOR shall handle and store materials only in approved areas.

PART 3 – EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall prepare and deliver the following technical submittals for review and approval of the ENGINEER. All submittals must be approved before related work may begin. Listed below are submittals required for this item of work, additional submittals may be required due to site conditions or the nature of the work.

1. Installation details and arrangement to be used;
2. Shoring plans and calculations sealed by licensed professional engineer, if required;
3. Steel certifications unless steel is supplied by CSXT;
4. Non-shrink structural grout mix design.

3.2 INSTALLATION

A. The jack-and-bore CONTRACTOR shall be prepared to perform the installation on a 24-hour, continuous basis if directed by the ENGINEER. If the boring is halted within a distance of 25 feet of centerline of track, the heading of the bore shall be shored immediately.

B. The jack-and-bore shall be in accordance with the current AREMA recommendations, Earth Boring and Jacking Culvert Pipe Through Fills." (Chapter 1, Manual of Railway Engineering). This operation shall be conducted without hand mining ahead of the pipe and without the use of any type of boring, auguring, or drilling.

C. Jack-and-bore installations shall have a bore hole not exceeding the outside diameter of the pipe by more than ½ inch.

D. Boring and/or receiving pits shall be properly shored and dewatered. Shoring shall be designed for live load from construction equipment and/or rail as required. OSHA regulations apply to all worksite excavations.

E. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited.

F. If, during installation, an obstruction is encountered which prevents installation of the pipe, notify the ENGINEER immediately and, if directed by the ENGINEER, abandon the pipe in-place and immediately fill with grout or non-excavatable flowable fill (refer to Section 31 23 24 Flowable Fill). A new installation procedure and revised plans must be approved by the ENGINEER before work can resume.

G. The track shall be continuously monitored during boring within the live load influence zone. If track movement occurs, work must stop, the heading shall be bulk headed, and the

~~ENGINEER shall be notified immediately. The Contractor must propose an alternate procedure for ENGINEER approval before pr~~oceeding.

~~H. Bracing and backstops shall be designed for continuous, non-stop usage.~~

~~I. The front of the pipe shall be provided with mechanical arrangements or devices that will prevent the auger from leading the pipe.~~

~~J. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered.~~

~~K. The auger head shall not advance more than 18 inches ahead of the casing pipe.~~

~~L. The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of soft or poor material.~~

~~M. If voids develop around the pipe, the CONTRACTOR shall pressure grout (using non-shrink structural grout) all voids surrounding the pipe through grout port holes installed in top and sides of pipe. A minimum of 4 holes per grout location (transverse to pipe alignment) with longitudinal spacing of 10-feet center to center of grout location shall be required, unless otherwise approved by ENGINEER.~~

~~N. Any method that employs simultaneous boring and jacking that does not have the above approved arrangement will not be permitted.~~

~~O. CONTRACTOR shall remove and dispose of all material and supplies in accordance with local, State, Federal, and CSXT policy leaving work site clear of any and all debris.~~

~~END OF SECTION~~

NO TEXT ON THIS PAGE.