

ADDENDUM NO. 1
March 4, 2022

DLH Runway 3-21 Lighting and Signage Replacement
City of Duluth No. 21-4401
AIP No. 3-27-0024-072-2022
Duluth International Airport (DLH)
Duluth Airport Authority

SEH No. DULAI 164242

From: Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110-3507
651.490.2000

To: Document Holders

DOCUMENT HOLDERS on the above-named project are hereby notified that this document shall be appended to, take precedence over and become part of the original bidding documents dated February 15, 2022 and February 16, 2022 for this work. Bids submitted for the construction of this work shall conform to this document.

This addendum consists of 2 pages and attached Pre-Bid Meeting Minutes and Video Recording Link, addition of an alternate bid scope of work and bid schedule, revised project drawings, revised Section No. L-108 – Underground Power Cable for Airports, revised Section No. L-110 Airport Underground Electrical Duct Banks Conduits, and revised Section No. L-125 – Installation of Airport Lighting Systems.

Changes to Bidding Requirements:

1. Document 00 21 13 – Instructions to Bidders: Article 6 “Pre-Bid conference.” See the attached Pre-Bid Meeting minutes and video recording transcript link: [DLH Runway 3 21 Lighting and Signage Replacement - Pre-Bid Meeting-20220222 130154-Meeting Recording.mp4](#).
2. An Alternate Bid Schedule has been added to the the bidding documents. The contract shall be awarded on the solely on the pricing of the base bid schedule which corresponds to the original scope of work in the bidding documents. However, if the bid pricing is favorable and additional funding is available, the alternate bid schedule scope shall be awarded to the contractor at the discretion of the Duluth Airport Authority (DAA). Otherwise, the DAA may elect to only award the base bid scope and schedule. The base bid schedule and alternate bid schedule items are appropriately distinguished on the updated bid form in Bid Express.
3. Document 00 41 00 – Bid Form: A new bid form adding the alternate bid schedule and updating the quantities of the base bid schedule items will be uploaded on [BidExpress](#).

Changes to Specifications: (Section No. and Title, Article and Paragraph, Page No., Describe Change)

4. Section No. L-108 – Underground Power Cable for Airports: REPLACE with attached Section L-108 – Underground Power Cable for Airports. The bid alternate pay items and scope have been added to the specification.
5. Section No. L-110– Installation of Airport Lighting Systems: REPLACE with attached Section No. L-125 – Installation of Airport Lighting Systems. The bid alternate pay items and scope have been added to the specification.
6. Section No. L-125 – Installation of Airport Lighting Systems: REPLACE with attached Section No. L-125 – Installation of Airport Lighting Systems. The ALCMS Reprogramming pay item and scope have been removed from the specification. The bid alternate pay items and scope have been added to the specification.

Changes to Drawings:

7. Drawing ED-101 Electrical Demolition Plan 1 – Updated keyed note #1. Existing REIL equipment shall be turned over to the FAA.
8. Drawing E-100 Proposed Signage Plan – Bid Alternate Sign Schedule Added. If the Bid Alternate is awarded this signage schedule shall apply. If the Bid Alternate is not awarded, only the Airfield Sign Schedule – Base Bid shall apply.
9. Drawing E-101 Electrical New Work Plan 1 – Bid Alternate Sign Schedule Added. Signs affected by alternate bid sign schedule are identified in the Electrical New Work Plan and notes have been updated.
10. Drawing E-102 Electrical New Work Plan 2 – Bid Alternate Sign Schedule Added. Signs affected by alternate bid sign schedule are identified in the Electrical New Work Plan and notes have been updated.
11. Drawing E-105 Electrical New Work Plan 5 – Bid Alternate Sign Schedule Added. Signs affected by alternate bid sign schedule are identified in the Electrical New Work Plan and notes have been updated.
12. Drawing E-106 Electrical New Work Plan 6 – Bid Alternate Sign Schedule Added. Signs affected by alternate bid sign schedule are identified in the Electrical New Work Plan and notes have been updated.
13. Drawing E-107 Electrical New Work Plan 7 – Bid Alternate Sign Schedule Added. Signs affected by alternate bid sign schedule are identified in the Electrical New Work Plan and notes have been updated.
14. Drawing E-108 – Electrical New Work Plan – Bid Alternate: ADD drawing E-108 Electrical New Work Plan – Bid Alternate, which outlines the new work associated with the bid alternate scope. This sheet shall be constructed if the bid alternate is awarded.

Note: Receipt of this Addendum No.1, dated March 4, 2022 shall be acknowledged on [BidExpress](#). Failure to do so will not allow Bidder to submit Bid.

END OF ADDENDUM



Building a Better World
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PRE-BID MEETING MINUTES

RE: Runway 3-21 Lighting and Signage
Replacement
Duluth International Airport (DLH)

Date of Meeting: Tuesday, February 22, 2022

Project Manager: Clint Sciacca

Time of Meeting: 2:00 p.m.

SEH No.: DULAI 164242 16.00

Location of Meeting: Virtual MS Teams

Attendees: See attached attendance roster
SEH – Clint, Lindsay, Adinda, Allison
BCMD – Derek, Mark
Duluth Airport Authority - Mark
City of Duluth - Patti
Contractors -

The following items are to be discussed at the above referenced meeting:

I. Project Representatives

- A. Owner Representatives – Duluth Airport Authority
 - 1. Mark Papko – DAA, Director of Operations
 - 2. Ryan Welch – DAA, Airside Manager
- B. Engineer Representative – Short Elliott Hendrickson, Inc.
 - 1. Shawn McMahon, PE – SEH, Project Principal, 651.925.7541
 - 2. Clint Sciacca, PE (CO) – SEH, Project Manager, 480.686.0979
 - 3. Allison Andrashko, EIT – SEH, Project Engineer, 507.261.7617
 - 4. Andy Loftus, PE (MO), LEED AP – Burns & McDonnell, Electrical Project Manager
 - 5. Mark Giddings, PE (MO, KS) – Burns & McDonnell, Civil Engineer
 - 6. Derek Bruemmer, EIT – Burns & McDonnell

II. Project Information

- A. Project Documents: Bidding Documents are available to view and download at no cost as www.bidexpress.com. Bidders must create a free account with Bid Express®; and login to search for city projects (search by “City of Duluth” or bid number). Bids will only be received electronically through Bid Express®.
 - 1. [Mandatory Items to Submit Bid \(warning will be provided by Bid Express if something is missed by the contractor\)](#)
 - a. [Bid Bond](#)
 - b. [Authority to Conduct Business in MN](#)
 - c. [Declaration of Non-Collusion](#)
 - d. [DBE Certification](#)
 - e. [Responsible Contractor Verification](#)
 - f. [Subcontractors List](#)

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 3535 Vadnais Center Drive, St. Paul, MN 55110-3507
651.490.2000 | 800.325.2055 | 888.908.8166 fax | sehinc.com

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- B. Major Items of Work Include: 26,500 LF L-824 Cable, 16,100 SY 2-inch PVC, 2,315 LF 2-inch directional bored HDPE, 49 Medium Intensity Runway Edge Lights, 16 Medium Intensity Runway Threshold Lights, 11 Hold Short Signs, 7 Runway distance remaining signs, 2 sets of REILs, and turf restoration.
- C. Anticipated Project Schedule:
 - 1. Receive Bids: March 8, 2022
 - 2. Anticipated Contract Award: March 2022
 - 3. Anticipated Start of Construction: July 19, 2022 (37 Calendar Days)
 - a. After DLH Airshow
 - 4. Anticipated Substantial Completion: August 25, 2022
- D. Phasing:
 - 1. Phase A: Install Lighting and Signage on Runway 3-21 outside of Runway 9-27 Runway Safety Area (30 Calendar Days)
 - 2. Phase B: Install Lighting and Signage inside Runway 9-27 Runway Safety Area (Nightwork, 7 Calendar Days).
 - a. Nightwork shall commence each night after last scheduled commercial flight on Runway 9-27 and shall conclude prior to first scheduled departure on Runway 9-27 (Approx. 11pm to 6am). Final schedule to be determined 7 days prior to the start of construction.

[See CSPP sheets in Plans](#)
- E. Airport Security:
 - 1. Bidders must thoroughly examine Project Documents for security related requirements.
 - 2. Airport shall remain in full operation during construction except where required for project specific closures
 - 3. Airfield Safety and Security Training will be held at scheduled times, where the following topics will be discussed:
 - a. Project Signage for Haul Routes and Site Access
 - b. Procedure for Receipt of Deliveries
 - c. Airfield and Site Security
 - d. Badging Requirements
 - 4. Failure to comply with safety and phasing plans that results in a runway incursion or vehicle deviation will result in a penalty of \$1,000. Security violations could result in a penalty of up to \$10,000 per occurrence.
 - 5. Contractor is required to hire a third-party Professional Security Firm.
- F. Access and Haul Routes
 - 1. [See CSPP Sheets in Plans](#)
- G. Staging and Storage
 - 1. [See CSPP Sheets in Plans](#)

III. Contract Requirements

- A. Construction Staking – Contractor's Responsibility
 - 1. [Survey Control established by SEH](#)
- B. Disadvantaged Business Enterprise
- C. Wage Rates
 - 1. Equal Employment Opportunity (EEO)

2. State and Federal prevailing wage rate requirements

D. Buy American Certification

E. Permits

1. City of Duluth Stormwater Permit to be paid for by the contractor.

IV. **Project Work**

A. General Scope

1. Installation of Traffic Control Devices/Signage and Barricades
2. Covering of existing airfield taxiway and runway signs
3. Erosion Control BMP installation

B. Electrical Scope

1. Removal of existing lighting and signage
2. Existing utilities – locate, flag, protect
 - a. Hydro excavation around FAA utility
 - b. [Specific Bid Item for this – will need to coordinate with FAA tech ops](#)
3. Installation of new lighting, signage, and circuitry.
4. Routing of new homerun conductors in existing duct bank. Pull back, protect, and reconnect existing cable.
5. ALCMS Programming Updates
 - a. To be removed from project in Addendum No. 1
6. [Most pavement shoulder work will need to be performed in the critical 7 day night work period](#)

C. Restoration

1. Locations: disturbed areas, storage areas, haul roads
2. Restored to equal or better conditions

D. [Adjacent Project Coordination](#)

1. [Taxiway A Reconstruction – Phase 1](#)
 - a. [Consists of reconstruction of Taxiway A from RSA west of Runway 3-21 to Taxiway A5](#)
2. [Projects will be under construction at the same time and share boundaries](#)
3. [Contractors will need to coordinate with the adjacent project to be successful.](#)

V. **Addendum**

A. [Addendum 1](#)

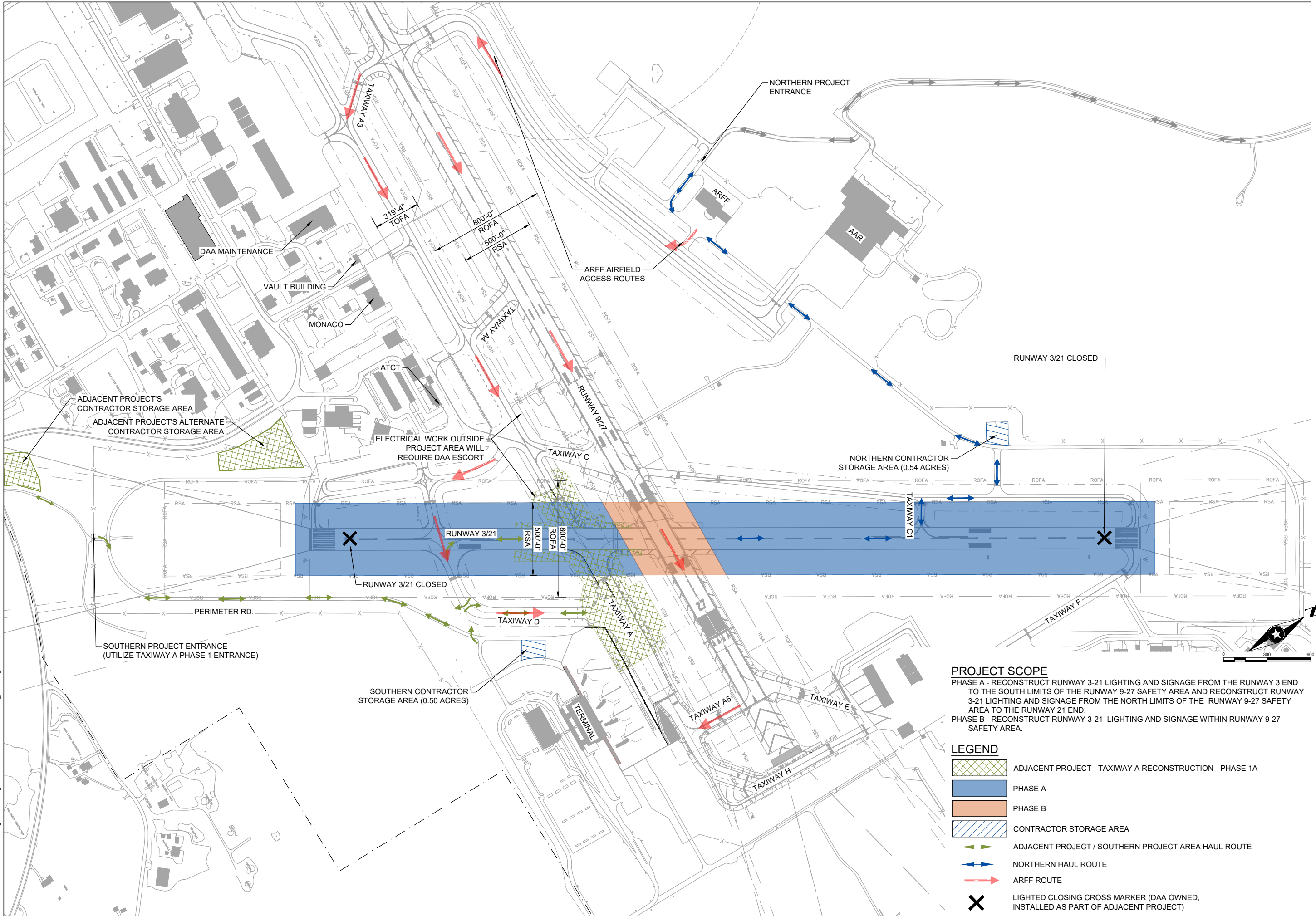
1. [Pre-bid Meeting minutes](#)
2. [ALCMS Programming updated removed from this project](#)
3. [Taxiway nomenclature edits possibly included in this addendum. This change is still awaiting FAA Approval.](#)

VI. **Questions**

SEH believes that this document accurately reflects the business transacted during the meeting. If any attendee believes that there are any inconsistencies, omissions or errors in the minutes, they should notify the writer at once. Unless objections are raised within seven (7) days, we will consider this account accurate and acceptable to all.

If there are errors contained in this document, or if relevant information has been omitted, please contact Clint Sciacca at 480.686.0979.

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ST PAUL, MN 55110
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FAX: 651.480.7160
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HEREBY CERTIFY THAT THIS PLAN SPECIFICATION OR
DRAWING WAS PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY LICENSED
PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE
OF MINNESOTA

Shawn T. McLaughlin, PE
DATE: FEB 15, 2022 LICENSE NO.: 48858

DULUTH INTERNATIONAL AIRPORT (DLH)
2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT
DULUTH, MINNESOTA

MARK	DATE	DESCRIPTION
		REVISIONS

SHEET TITLE
CONSTRUCTION SAFETY
PLAN

SHEET
G0.02

SEH FILE NO. DULAI 164242
STATE PROJECT NO. A6901-204
ISSUE DATE FEB 15, 2022
DESIGNED BY CS
DRAWN BY AA
Shawn T. McLaughlin, Inc. © (SEH)
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for All of Us®

PRE-BID ATTENDANCE ROSTER

RE: Runway 3-21 Lighting and Signage
Replacement
Duluth International Airport (DLH)

Project Manager: Clint Sciacca

Date of Meeting: Tuesday, February 22, 2022

Time of Meeting: 2:00 p.m.

Location: Virtual

SEH No.: DULAI 164242 16.00

Please Print

Name: Clint Sciacca _____
Representing: SEH _____
Address: _____

Phone: _____
Mobile: 480.686.0979 _____
Email: csciacca@sehinc.com _____

Name: Allison Andrashko _____
Representing: SEH _____
Address: _____

Phone: _____
Mobile: 507.261.7617 _____
Email: aandrashko@sehinc.com _____

Name: Lindsay Reidt _____
Representing: SEH _____
Address: _____

Phone: _____
Mobile: _____
Email: lreidt@sehinc.com _____

Name: Patti Stalvig _____
Representing: City of Duluth _____
Address: _____

Phone: 218.730.5002 _____
Mobile: _____
Email: pstalvig@duluthmn.gov _____

Name: Mark Papko _____
Representing: DAA _____
Address: _____

Phone: _____
Mobile: _____
Email: Mpapko@duluthairport.com _____

Name: Ryan Welch _____
Representing: DAA _____
Address: _____

Phone: _____
Mobile: _____
Email: Rwelch@duluthairport.com _____

Name: Andy Loftus _____
Representing: Burns & McDonnell _____
Address: _____

Phone: _____
Mobile: _____
Email: aloftus@burnsmcd.com _____

Name: Mark Giddings _____
Representing: Burns & McDonnell _____
Address: _____

Phone: _____
Mobile: _____
Email: mgiddings@burnsmcd.com _____

Engineers | Architects | Planners | Scientists

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Name: Adinda Van Espen _____
Representing: _____
Address: _____

Phone: _____
Mobile: _____
Email: avanespen@sehinc.com _____

Name: _____
Representing: _____
Address: _____

Phone: _____
Mobile: _____
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Name: _____
Representing: _____
Address: _____

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Email: _____

Name: Derek Bruemmer _____
Representing: Burns & McDonnell _____
Address: _____

Phone: _____
Mobile: _____
Email: dbruemmer@burnsmcd.com _____

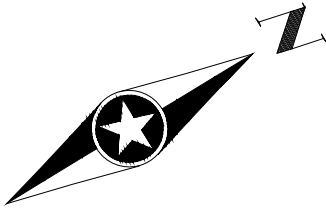
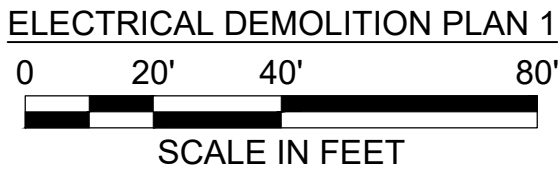
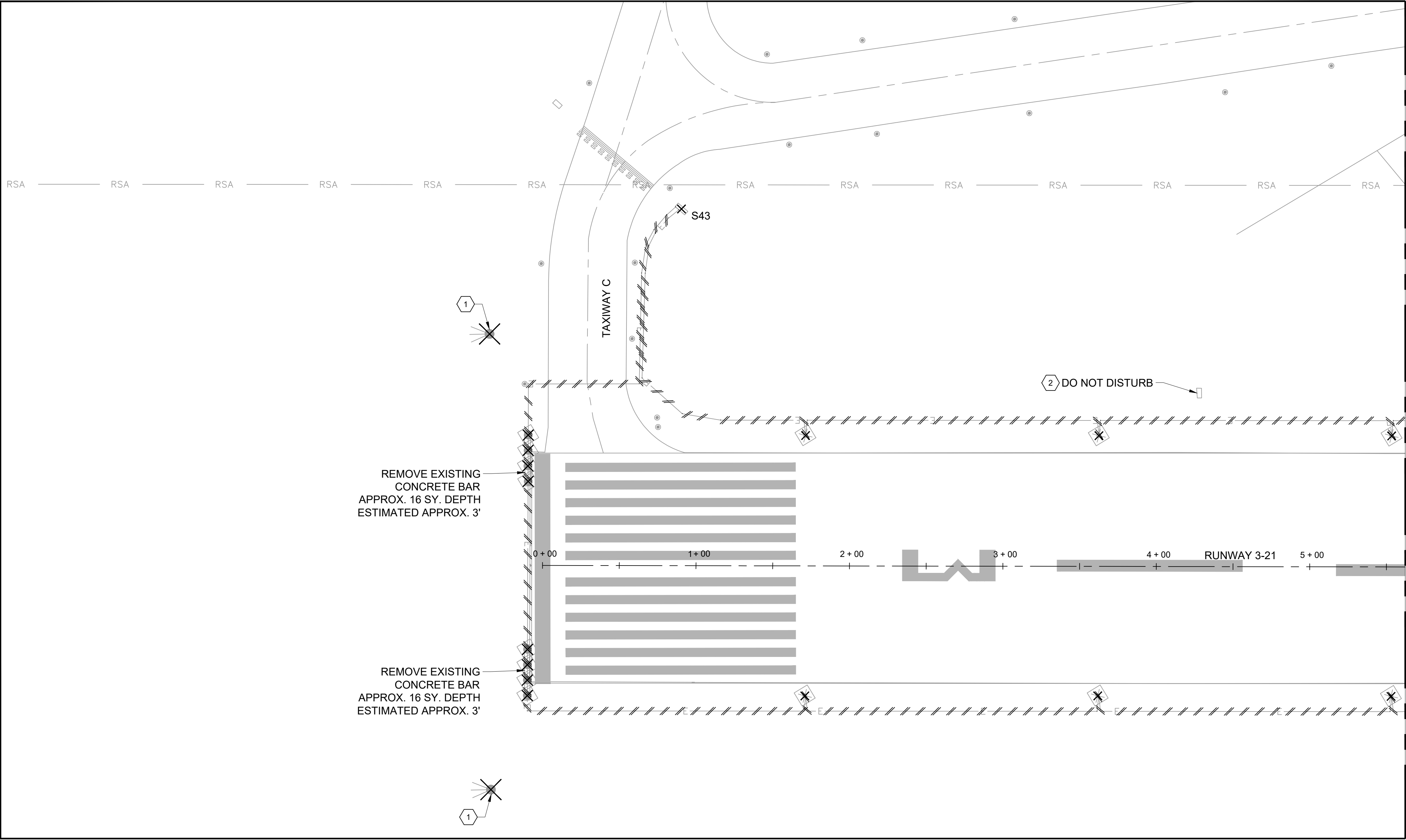
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NOTES:

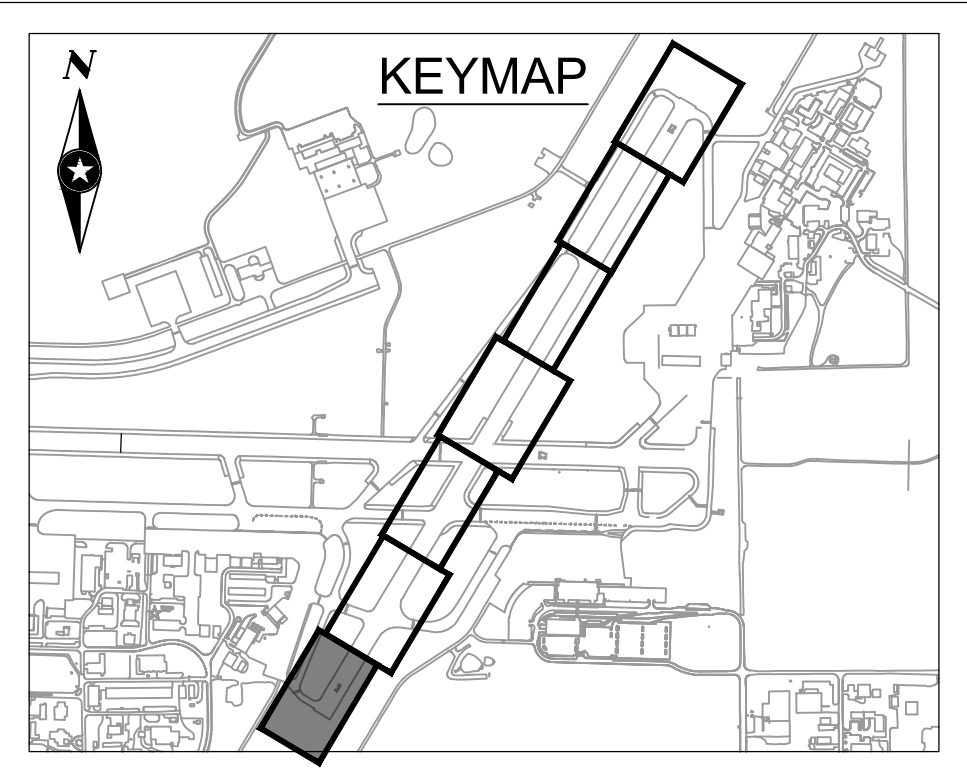
1. CONTRACTOR SHALL PROTECT ALL AIRFIELD LIGHTING, ELECTRICAL CIRCUITRY, COMPONENTS AND NAVAIDS TO REMAIN. PLACE REFLECTIVE CONE OVER TAXIWAY LIGHTS TO ENHANCE VISIBILITY AND PROTECTION. ANY DAMAGE CAUSED TO AIRFIELD LIGHTING OR NAVAIDS BY THE CONTRACTOR SHALL BE REPAIRED TO ORIGINAL CONDITION OR BETTER AT NO ADDITIONAL COSTS.
2. SUBSURFACE UTILITIES NOT NOTED FOR REMOVAL, INCLUDING SANITARY SEWER AND ELECTRICAL DUCTS TO BE PROTECTED BY CONTRACTOR. ANY DAMAGED UTILITIES TO BE REPAIRED BY CONTRACTOR AT NO COST TO OWNER. NOT ALL UTILITIES MAY BE SHOWN ON THE PLAN. CONTRACTOR IS REQUIRED TO COMPLETE LOCATE PRIOR TO REMOVALS.
3. ALL PAVEMENT REMOVED SHALL BE PERFORMED SUCH THAT NO DAMAGE IS DONE TO ADJACENT PAVEMENTS AND/OR UNDERLYING BASE LAYERS. DAMAGE TO PAVEMENTS AND UNDERLYING BASE LAYERS TO REMAIN CAUSED BY CONTRACTOR SHALL BE REPAIRED AT THE DIRECTION OF THE ENGINEER AT NO ADDITIONAL COST.
4. ALL SURFACES (PAVEMENT, TURF, OR OTHERS) SHALL BE RESTORED TO THEIR PRECONSTRUCTION CONDITION OR BETTER TO THE SATISFACTION OF THE ENGINEER AT NO ADDITIONAL COST.
5. ALL PAVEMENT MATERIAL REMOVED SHALL BE DISPOSED OF OFF SITE.
6. SEE SHEETS E-001 AND E-002 FOR DEMOLITION NOTES.

KEYED NOTES:

- 1

COORDINATE WITH LOCAL FAA ON WHERE TO DISCONNECT POWER FOR EXISTING REILs, LOCATION OF EXISTING CIRCUITS, AND EXTENT OF REMOVAL. LOCATE AND REMOVE EXISTING FAA CURRENT SENSOR WIRE. EXISTING REIL EQUIPMENT SHALL BE TURNED OVER TO FAA. SHOULD THE FAA REFUSE THE EQUIPMENT, THE CONTRACTOR SHALL DISPOSE OF AT CONTRACTOR'S EXPENSE.
- 2

LOCATE AND PROTECT EXISTING CIRCUITRY FROM TAXIWAY CHARLIE TO EXISTING SIGN.



SHEET TITLE
ELECTRICAL
DEMOLITION PLAN 1

SHEET

ED101

SEH FILE NO. DULAI 164242
STATE PROJECT NO. AR6901-204
ISSUE DATE FEB 14, 2022
DESIGNED BY DSB
DRAWN BY JTM

MARK	DATE	DESCRIPTION
1	03-04-2022	ADDENDUM 1
		REVISIONS

DULUTH INTERNATIONAL AIRPORT (DLH)

2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT

DULUTH, MINNESOTA

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR SUPPLEMENTARY SHEET WAS PREPARED BY ME OR UNDER MY CLOSE PERSONAL SUPERVISION AND THAT I AM A LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SHAWN M. WHALEN

DATE FEB 14, 2022 LICENSE NO. 23984

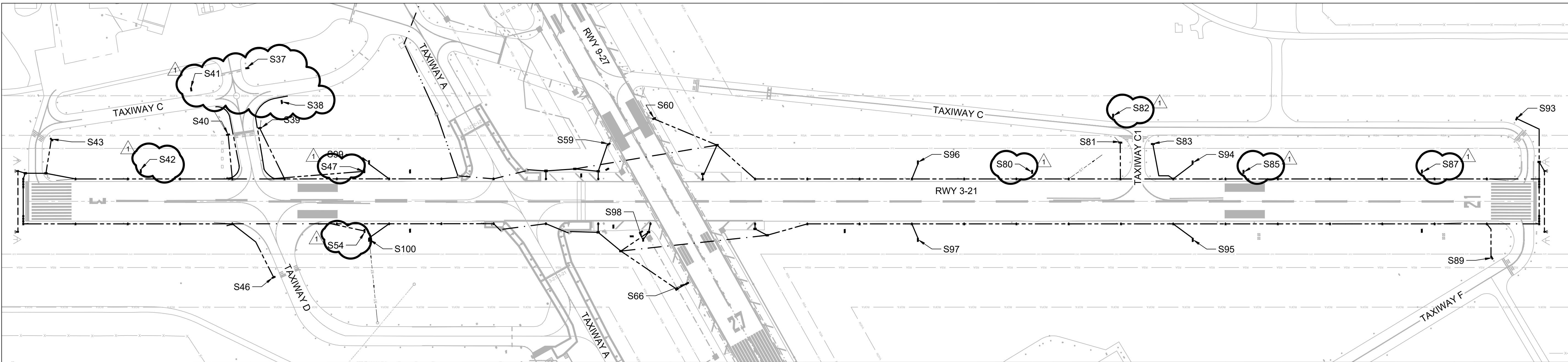


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PROJECT 126027 - AIR OPERATOR 816-333-4469

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NOTES:

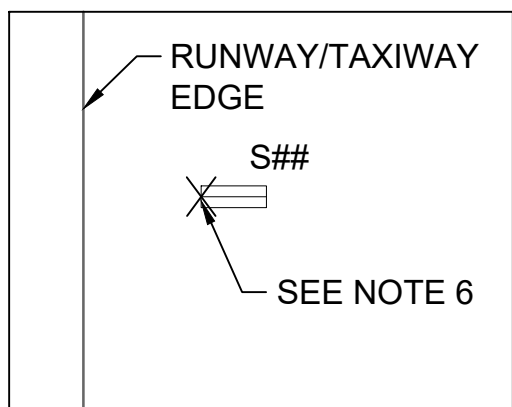
1. SIGN PANEL TYPES:

TYPE	ABBRV.	PURPOSE	LEGEND COLOR	BACKGROUND COLOR	i.e.
L-858Y	Y	DIRECTION, DESTINATION & BOUNDARY	BLACK	YELLOW	A
L-858R	R	MANDATORY	WHITE w/ BLACK OUTLINE	RED	3 - 21
L-858L	L	RUNWAY / TAXIWAY LOCATION	YELLOW	BLACK w/ YELLOW BORDER	Y
L-858B	B	RUNWAY DISTANCE REMAINING	WHITE w/ BLACK OUTLINE	BLACK	7

2. SIGN LENGTHS AND INSTALLATION PADS:

THE NUMBER OF MODULES INDICATED IS AN ESTIMATE ONLY FOR BID PURPOSES. ACTUAL NUMBER OF MODULES/WIDTH TO BE USED FOR EACH SIGN MUST BE DETERMINED BY THE SIGN MANUFACTURER.

SIGN LENGTHS	
NUMBER OF MODULES	APPROXIMATE LENGTH (FEET)
1	8'
2	12'
3	15'
4	18'



SIGN LENGTH NOTES:

- SIGN LENGTHS MAY VARY BASED ON MANUFACTURER.
- CONFIRM LENGTH WITH MANUFACTURER PRIOR TO BID AND ADJUST FOUNDATION ACCORDINGLY.
- SIGNAGE CONCRETE BASE TO BE APPROPRIATELY SIZED. SEE DETAIL 1 ON DRAWING EA502.

3. TRANSFORMERS:

PROVIDE APPROPRIATELY SIZED ISOLATION TRANSFORMER AS RECOMMENDED BY SIGN MANUFACTURER.

4. CIRCUIT TYPE CONVERSION KITS:

PROVIDE CONVERSION KIT TO ENSURE PROPER OPERATION WHEN CONNECTED TO A STYLE 3 (5 STEP) CIRCUIT. COORDINATE WITH MANUFACTURER PRIOR TO ORDERING. ILS CRITICAL AREA BOUNDARY PER FIGURE 9(b) OF AC 150/5340-18.

5. RSA/OFFZ BOUNDARY PER FIGURE 9(a) OF AC 150/53040-18.

6. SIGN COORDINATES ARE FROM MIDPOINT OF EDGE OF SIGN WHICH IS CLOSEST TO THE ADJACENT PAVEMENT EDGE. SEE NEW WORK SHEETS FOR SIGN LOCATION COORDINATES.

7. SEE PLAN SHEETS FOR ORIENTATION OF SIGNS.

8. THE SIGN LEGEND TABLE ON THIS DRAWING IS FOR NEW SIGNS OR REVISIONS TO EXISTING SIGNS ONLY.

9. COVER OR DISCONNECT ALL TAXIWAY LIGHTS AND GUIDANCE SIGNS WITHIN THE CLOSURE AREA.

10. NEW BASE CAN AND SIGN LOCATIONS MUST BE STAKED OUT BY A REGISTERED SURVEYOR.

11. SEE SHEET EA001 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND NOTES.

12. ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR MUST VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.

13. CONTRACTOR SHALL REPLACE, AT NO ADDITIONAL COST, ANY LIGHT FIXTURE, BASE CAN, ISOLATION TRANSFORMER, OR CABLE DAMAGED BY THE CONTRACTOR.

14. THIS SIGN LEGEND IS INTENDED TO BE PRINTED IN COLOR.

15. "FRONT" OF A SIGN FIXTURE REFERS TO THE SIGN FACE AS PILOT APPROACHES SIGN AND FACE IS ON PILOT'S LEFT-HAND SIDE. "BACK" OF SIGN REFERS TO THE OPPOSITE SIDE.

16. ALL SIGNS SHALL BE LED. SIGNS TO BE MODIFIED AS PART OF THE BID ALTERNATE SHALL BE CONVERTED TO LED.

PROPOSED SIGNAGE PLAN



AIRFIELD SIGN SCHEDULE - BASE BID																		
SIGN ID	SIGN LEGEND (NOTE 15)								TYPE (NOTE 1)		SIZE	STYLE	MODULES SEE (NOTE 2)	ISOLATION TRANSFORMER SIZE (NOTE 3)	WORK DESCRIPTION	CIRCUIT INFORMATION		
	FRONT (LEFT TO RIGHT)				BACK (LEFT TO RIGHT)											STEPS	DESCRIPTION	
	1	2	3	4	1	2	3	4										
S39	D	21 - 3			FFFF	D			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S40	D	←	C	→	21 - 3	D			L/Y	R/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S43	C	3			FFFF	C			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S46	D	3 - 21			FFFF	D			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S59	↖	C			21 - 3				Y	R	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S60	21 - 3				C	↘			R	Y	2	2	2	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S66	3 - 21								R	BLANK	2	2	2	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S81	←	C	→	C1	21 - 3	C1			Y/L	R/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S83	C1	3 - 21			FFFF	C1			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S89	F	21			FFFF	F			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S93	C	C 21			FFFF	C			L/R	Y/L	2	2	3	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S94	1				4				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S95	4				1				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S96	2				3				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S97	3				2				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S98	2				3				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S99	4				1				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	
S100	1				4				B	B	4	2	1	100W	NEW SIGN ON NEW FOUNDATION	3	RUNWAY 3-21	

AIRFIELD SIGN SCHEDULE - BID ALTERNATE																	
SIGN ID	SIGN LEGEND (NOTE 15)								TYPE (NOTE 1)		SIZE	STYLE	MODULES (SEE NOTE 2)	ISOLATION TRANSFORMER SIZE (NOTE 3)	WORK DESCRIPTION	CIRCUIT INFORMATION	
	FRONT (LEFT TO RIGHT)				BACK (LEFT TO RIGHT)											STEPS	DESCRIPTION
	1	2	3	4	1	2	3	4	FRONT	BACK							
S39	C3	21 - 3			FFFF	C3			L/R	Y/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S40	C3	←	C	→	21 - 3	C3			L/Y	R/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S43	C4	3			FFFF	C4			L/R	Y/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S46	D1	3 - 21			FFFF	D1			L/R	Y/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S81	←	C	→	C2	21 - 3	C2			Y/L	R/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S83	C2	3 - 21			FFFF	C2			L/R	Y/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S93	C1	21			FFFF	C1			L/R	Y/L	2	2	3	100W	BASE BID SIGN WITH UPDATED SIGN PANEL	3	RUNWAY 3-21
S37	C3	←	C	→	APRON	↑			L/Y	Y	1	2	1	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S38	C	←	C3	→	C				L/Y	L	1	2	4	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S41	C				C	←	C3	→	L	L/Y	1	2	4	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S42	C4	→							L/Y	BLANK	1	2	4	100W	NEW SIGN ON NEW FOUNDATION	3	TW C-SOUTH
S47	D1	→							L/Y	BLANK	1	2	4	100W	NEW SIGN ON NEW FOUNDATION	3	TW C-SOUTH
S54	↖	D1							L/Y	BLANK	1	2	4	100W	NEW SIGN ON NEW FOUNDATION	3	TW C-SOUTH
S80	←	C2							L/Y	BLANK	1	2	4	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S82	C	C2	→		C				L/Y	L	1	2	4	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S85	C2	→							L/Y	BLANK	1	2	4	100W	NEW SIGN PANEL ON EXISTING SIGN	3	TW C-SOUTH
S87	←	C1							L/Y	BLANK	1	2	4	100W	NEW SIGN ON NEW FOUNDATION	3	TW C-SOUTH

3535 VADAMS CENTER DR
ST PAUL, MN 55110
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PROJECT 126027 - AIR OPERATOR 216-335-4469

DULUTH INTERNATIONAL AIRPORT

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR CONTRACT DOCUMENTS WERE PREPARED BY ME OR UNDER MY CLOSE PERSONAL SUPERVISION AND THAT I AM A DULUTH LICENSED PROFESSIONAL ENGINEER WORKING UNDER THE LAWS OF THE STATE OF MINNESOTA

SHAWN M. WHALEN
DATE FEB 14, 2022 LICENSE NO. 23984

DULUTH INTERNATIONAL AIRPORT (DLH)

2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT

DULUTH, MINNESOTA

03-04-2022 APPENDUM 1

MARK DATE DESCRIPTION REVISIONS

SEH FILE NO. DULAI 164242

STATE PROJECT NO. AR6901-204

ISSUE DATE FEB 14, 2022

DESIGNED BY DSB

DRAWN BY JTM

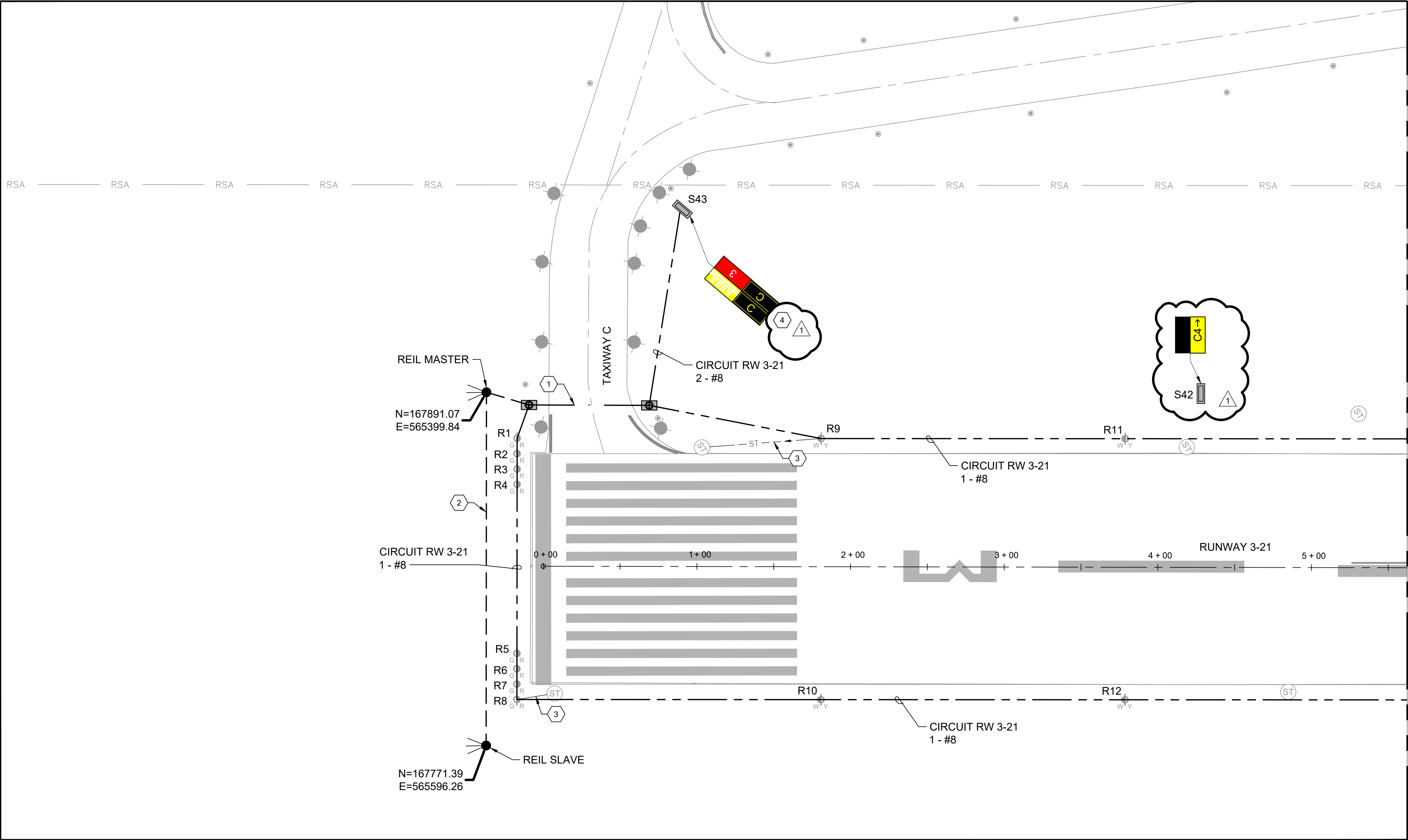
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PROPOSED SIGNAGE PLAN

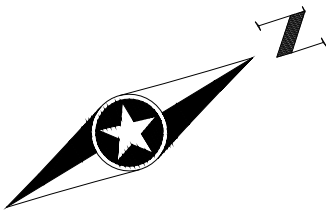
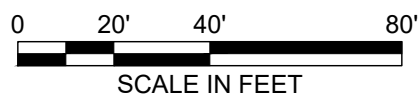
SHEET

E-100

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ELECTRICAL NEW WORK PLAN 1



NOTES:

- SEE SHEETS E-001 AND E-002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
- SEE SIGN SCHEDULE ON SHEET E-100 FOR SIGN CONFIGURATION.
- ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.
- COVER OR DISCONNECT ALL TAXIWAY LIGHTS AND GUIDANCE SIGNS WITHIN THE CLOSURE AREA.
- NEW BASE CAN AND SIGN LOCATIONS SHALL BE STAKED OUT BY A REGISTERED SURVEYOR.
- CONTRACTOR SHALL REPLACE, AT NO ADDITIONAL COST, ANY LIGHT FIXTURE, BASE CAN, ISOLATION TRANSFORMER, OR CABLE DAMAGED BY THE CONTRACTOR.
- ALL CONDUITS SHALL BE INSTALLED TO ENSURE THAT WATER MAY DRAIN FROM ANY GIVEN BASE CAN. CONTRACTOR SHALL COORDINATE IN THE FIELD AND DOCUMENT ON AS-BUILT REDLINE DRAWINGS WHICH WAY CONDUITS DRAIN.
- ALL NEW LIGHTING FIXTURE DRAIN CONDUITS SHALL BE INCIDENTAL TO FIXTURE INSTALLATION. STRUCTURE DRAINS INDICATED SHALL BE COORDINATED WITH CIVIL DRAWINGS. WHERE SHOULDERS ARE NOT BEING REPAIRED, CONTRACTOR SHALL SAW CUT EXISTING PAVEMENT AND PATCH, WHICH SHALL BE INCIDENTAL TO DRAIN INSTALLATION.

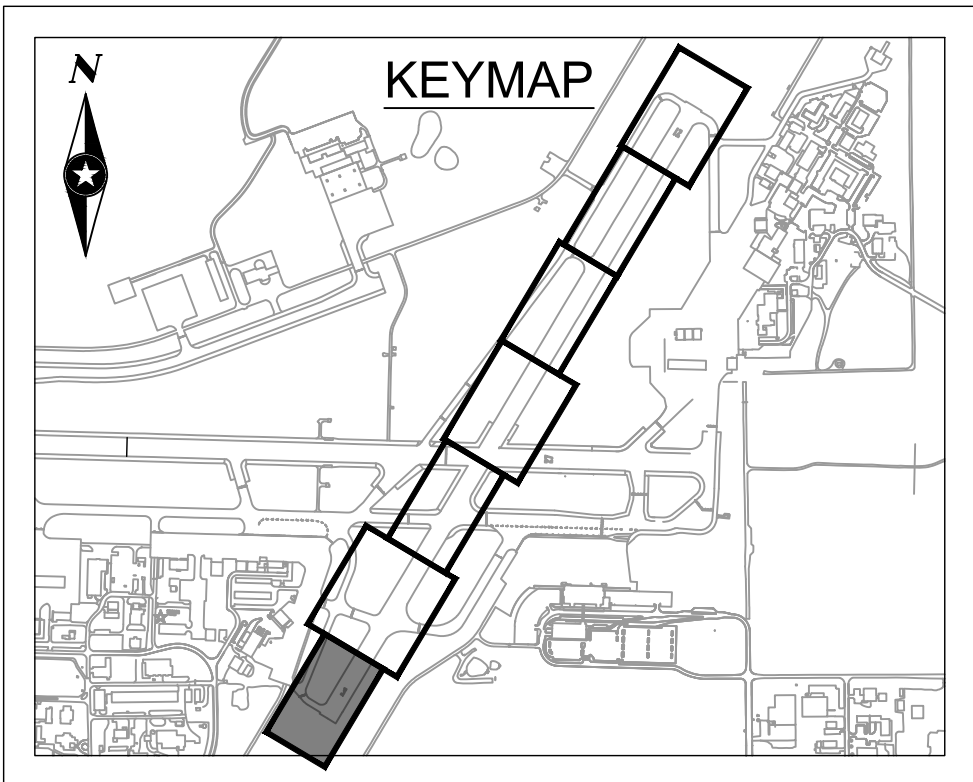
9. SEE SHEET E-100 FOR PROPOSED SIGNAGE MODIFICATIONS.

KEYED NOTES:

- 1 PROVIDE DIRECTIONAL BORE UNDER EXISTING TAXIWAY PAVEMENT.
- 2 PROVIDE CONTROL WIRE PER REIL MANUFACTURER'S RECOMMENDATIONS IN 2" CONDUIT.
- 3 INSTALL 2" PVC DRAINAGE CONDUIT SLOPED TO DRAIN FROM PROPOSED BASE CAN TO EXISTING STORM DRAIN STRUCTURE PER DETAIL 3 ON E-502. CONNECTION AT EXISTING STORM DRAIN STRUCTURE PER L-110.
- 4 IF THE ALTERNATE BID IS AWARDED THIS SIGN SHALL APPEAR AS DEPICTED IN THE BID ALTERNATE SIGN SCHEDULE ON SHEET E-100.

RUNWAY LIGHT FIXTURE LOCATIONS			
LIGHT FIXTURE	NORTHING	EASTING	CIRCUIT
R1	167892.54	565435.87	RUNWAY 3-21
R2	167887.34	565444.41	RUNWAY 3-21
R3	167882.14	565452.94	RUNWAY 3-21
R4	167876.94	565461.47	RUNWAY 3-21
R5	167819.68	565555.44	RUNWAY 3-21
R6	167814.48	565563.98	RUNWAY 3-21
R7	167809.28	565572.51	RUNWAY 3-21
R8	167804.08	565581.04	RUNWAY 3-21
R9	168061.57	565538.80	RUNWAY 3-21
R10	167973.12	565683.95	RUNWAY 3-21
R11	168230.59	565641.73	RUNWAY 3-21
R12	168142.16	565786.86	RUNWAY 3-21

RUNWAY SIGN LOCATIONS			
SIGN	NORTHING	EASTING	CIRCUIT
S42	168287.93	565642.23	RUNWAY 3-21
S43	168061.94	565364.33	RUNWAY 3-21



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BURNS & MCDONNELL
PROJECT 126027 - NEW AIRPORT 616-335-4400



I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR CONTRACT DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULUTH LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

SHAWN M. WHALEN
DATE FEB 14, 2022 LICENSE NO. 23984

DULUTH INTERNATIONAL AIRPORT (DLH)

2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT
DULUTH, MINNESOTA

MARK	DATE	DESCRIPTION
1	03-04-2022	APPENDUM 1
		REVISIONS

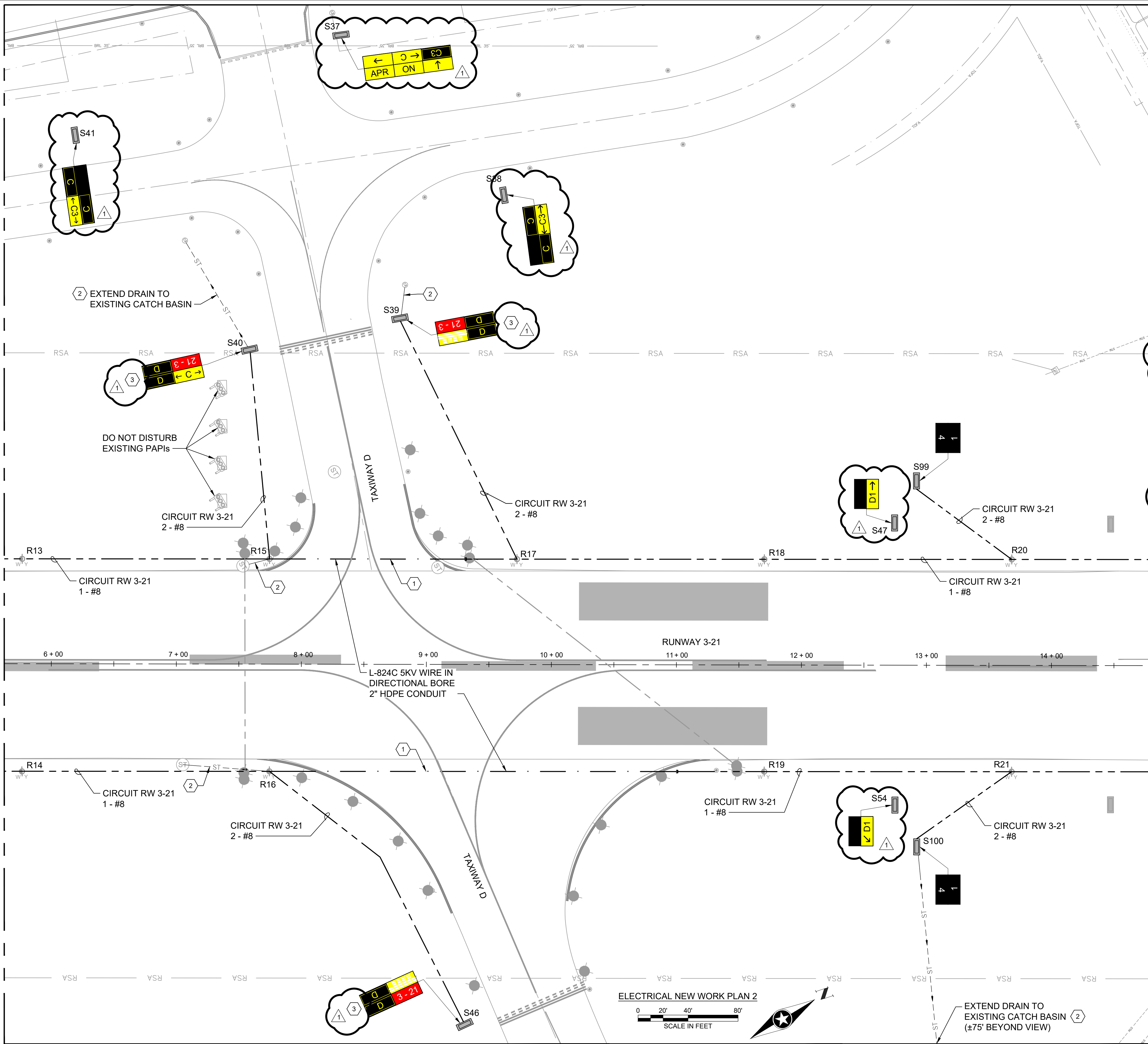
SEH FILE NO. DULAI164242
STATE PROJECT NO. AR6901-204
ISSUE DATE FEB 14, 2022 DSB
DESIGNED BY JTM
DRAWN BY

SHEET TITLE
ELECTRICAL NEW WORK
PLAN 1

SHEET
E-101

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MATCHLINE - SEE DRAWING E-101 FOR CONTINUATION



NOTES:

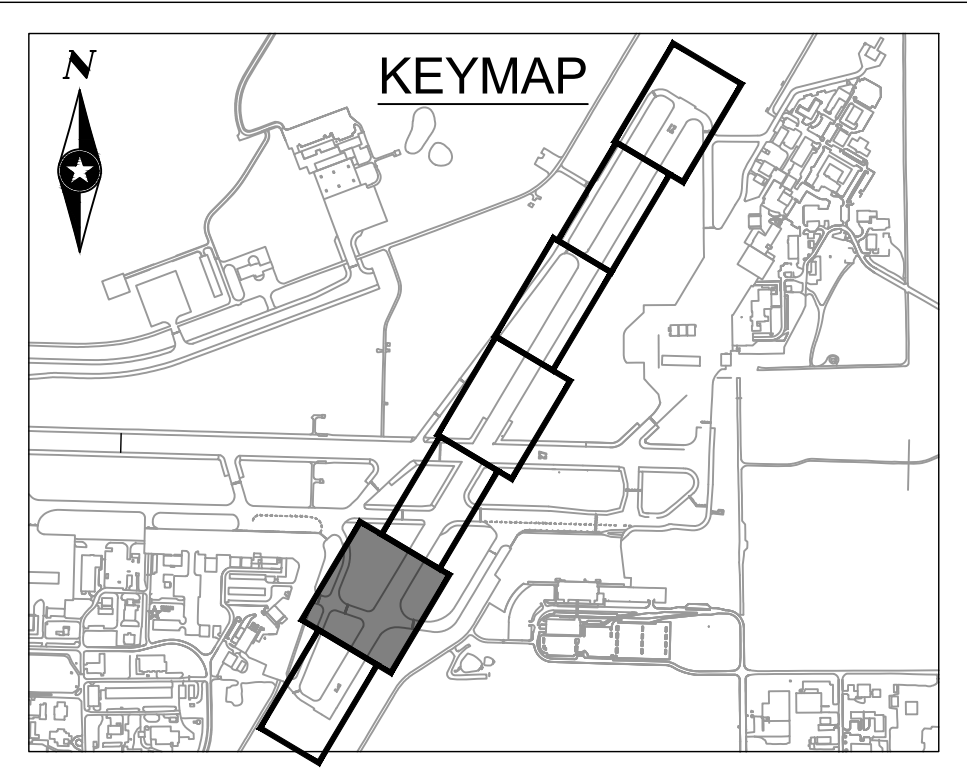
- SEE SHEETS E001 AND E002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
- SEE SIGN SCHEDULE ON SHEET E-100 FOR SIGN CONFIGURATION.
- ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.
- COVER OR DISCONNECT ALL TAXIWAY LIGHTS AND GUIDANCE SIGNS WITHIN THE CLOSURE AREA.
- NEW BASE CAN AND SIGN LOCATIONS SHALL BE STAKED OUT BY A REGISTERED SURVEYOR.
- CONTRACTOR SHALL REPLACE, AT NO ADDITIONAL COST, ANY LIGHT FIXTURE, BASE CAN, ISOLATION TRANSFORMER, OR CABLE DAMAGED BY THE CONTRACTOR.
- ALL CONDUITS SHALL BE INSTALLED TO ENSURE THAT WATER MAY DRAIN FROM ANY GIVEN BASE CAN. CONTRACTOR SHALL COORDINATE IN THE FIELD AND DOCUMENT ON AS-BUILT REDLINE DRAWINGS WHICH WAY CONDUITS DRAIN.
- ALL NEW LIGHTING FIXTURE DRAIN CONDUITS SHALL BE INCIDENTAL TO FIXTURE INSTALLATION. STRUCTURE DRAINS INDICATED SHALL BE COORDINATED WITH CIVIL DRAWINGS. WHERE SHOULDERS ARE NOT BEING REPAIRED, CONTRACTOR SHALL SAW CUT EXISTING PAVEMENT AND PATCH, WHICH SHALL BE INCIDENTAL TO DRAIN INSTALLATION.
- SEE SHEET E-100 FOR PROPOSED SIGNAGE MODIFICATIONS.
- SEE SHEET E-108 FOR TAXIWAY BID ALTERNATE MODIFICATIONS.

KEYED NOTES:

- PROVIDE DIRECTIONAL BORE UNDER EXISTING TAXIWAY PAVEMENT.
- INSTALL 2" PVC DRAINAGE CONDUIT SLOPED TO DRAIN FROM PROPOSED BASE CAN TO EXISTING STORM DRAIN STRUCTURE PER DETAIL 3 ON E-502. CONNECTION AT EXISTING STORM DRAIN STRUCTURE PER L-110.
- IF THE ALTERNATE BID IS AWARDED THIS SIGN SHALL APPEAR AS DEPICTED IN THE BID ALTERNATE SIGN SCHEDULE ON SHEET E-100.

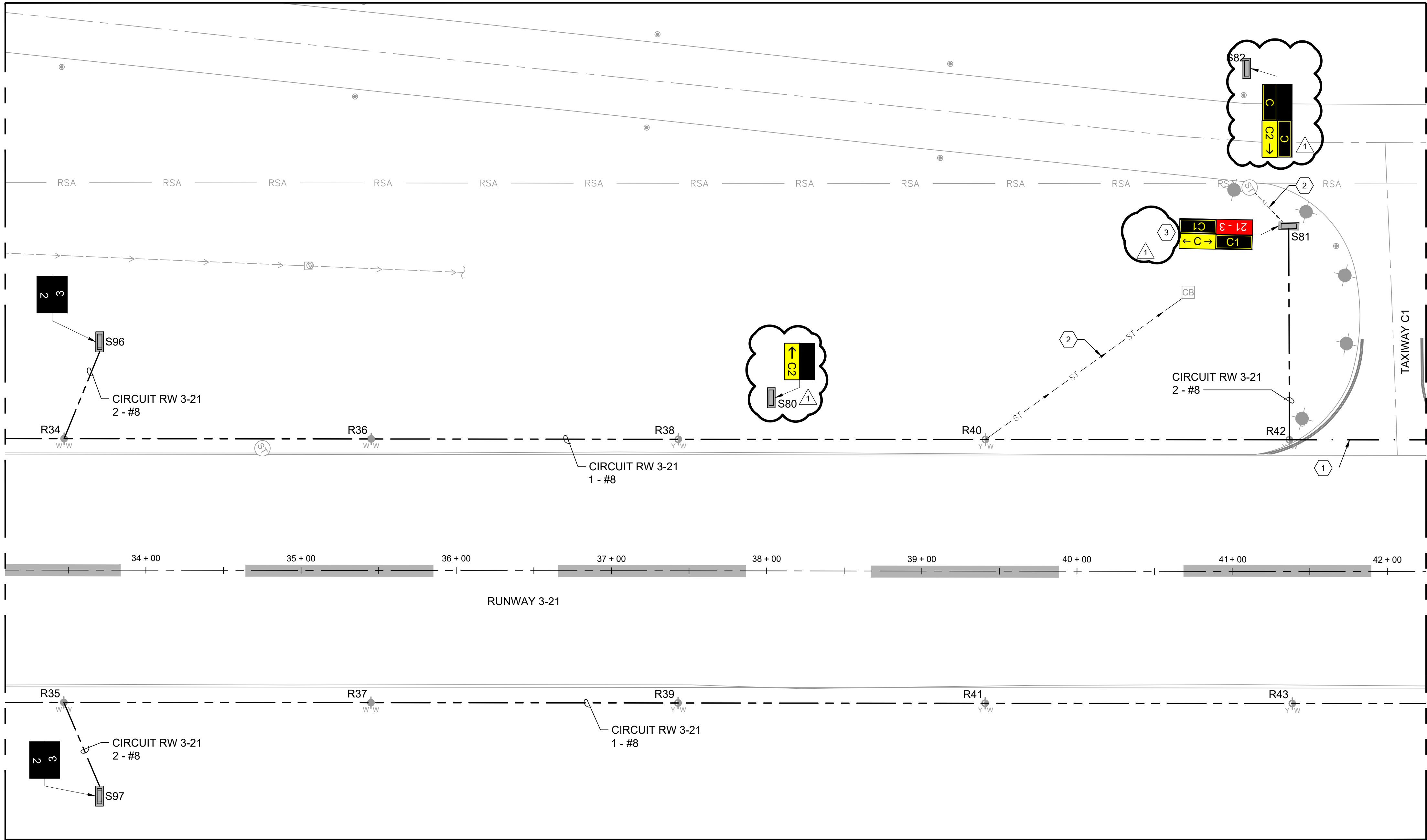
RUNWAY LIGHT FIXTURE LOCATIONS			
LIGHT FIXTURE	NORTHING	EASTING	CIRCUIT
R13	168399.62	565744.66	RUNWAY 3-21
R14	168311.14	565889.86	RUNWAY 3-21
R15	168568.66	565847.57	RUNWAY 3-21
R16	168480.24	565992.67	RUNWAY 3-21
R17	168737.67	565950.53	RUNWAY 3-21
R18	168906.69	566053.46	RUNWAY 3-21
R19	168818.32	566198.48	RUNWAY 3-21
R20	169075.72	566156.39	RUNWAY 3-21
R21	168987.36	566301.39	RUNWAY 3-21

RUNWAY SIGN LOCATIONS			
SIGN	NORTHING	EASTING	CIRCUIT
S39	168757.83	565737.24	RUNWAY 3-21
S40	168642.01	565696.13	RUNWAY 3-21
S41	168612.04	565477.06	RUNWAY 3-21
S46	168508.56	566246.94	RUNWAY 3-21
S47	169003.70	566094.15	CHARLIE SOUTH
S54	168899.40	566265.70	DELTA
S99	168643.25	566665.09	RUNWAY 3-21
S100	168891.24	566313.33	RUNWAY 3-21

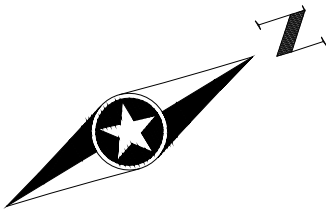


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MATCHLINE - SEE DRAWING E-104 FOR CONTINUATION



ELECTRICAL NEW WORK PLAN 5



NOTES:

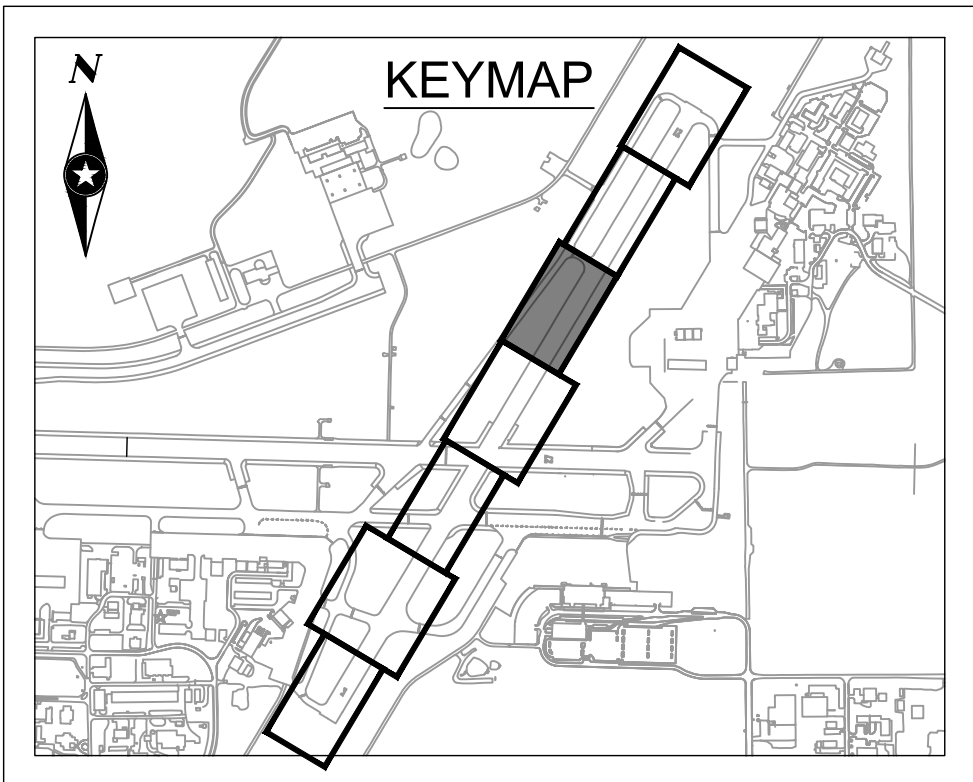
- SEE SHEETS E-001 AND E-002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
- SEE SIGN SCHEDULE ON SHEET E-100 FOR SIGN CONFIGURATION.
- ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.
- COVER OR DISCONNECT ALL TAXIWAY LIGHTS AND GUIDANCE SIGNS WITHIN THE CLOSURE AREA.
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- CONTRACTOR SHALL REPLACE, AT NO ADDITIONAL COST, ANY LIGHT FIXTURE, BASE CAN, ISOLATION TRANSFORMER, OR CABLE DAMAGED BY THE CONTRACTOR.
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- SEE SHEET E-100 FOR PROPOSED SIGNAGE MODIFICATIONS.

KEYED NOTES:

- 1 PROVIDE DIRECTIONAL BORE UNDER EXISTING TAXIWAY PAVEMENT.
- 2 INSTALL 2" PVC DRAINAGE CONDUIT SLOPED TO DRAIN FROM PROPOSED BASE CAN TO EXISTING STORM DRAIN STRUCTURE PER DETAIL 3 ON E-502. CONNECTION AT EXISTING STORM DRAIN STRUCTURE PER L-110.
- 3 IF THE ALTERNATE BID IS AWARDED THIS SIGN SHALL APPEAR AS DEPICTED IN THE BID ALTERNATE SIGN SCHEDULE ON SHEET E-100.

RUNWAY LIGHT FIXTURE LOCATIONS			
LIGHT FIXTURE	NORTHING	EASTING	CIRCUIT
R34	170765.48	567186.51	RUNWAY 3-21
R35	170677.02	567331.68	RUNWAY 3-21
R36	170934.48	567289.49	RUNWAY 3-21
R37	170846.02	567434.66	RUNWAY 3-21
R38	171103.47	567392.46	RUNWAY 3-21
R39	171015.01	567537.64	RUNWAY 3-21
R40	171272.47	567495.44	RUNWAY 3-21
R41	171184.01	567640.61	RUNWAY 3-21
R42	171439.76	567597.38	RUNWAY 3-21
R43	171353.01	567743.59	RUNWAY 3-21

RUNWAY SIGN LOCATIONS			
SIGN	NORTHING	EASTING	CIRCUIT
S81	171511.07	567479.48	RUNWAY 3-21
S96	170817.49	567145.06	RUNWAY 3-21
S97	170665.26	567395.20	RUNWAY 3-21



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DULUTH INTERNATIONAL AIRPORT

2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT

DULUTH, MINNESOTA

1

HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR SUPPLEMENTARY SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULUTH LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

SHAWN M. WHALEN

FEB 14, 2022

23984

LICENSE NO.

SEH FILE NO. DULAI164242
STATE PROJECT NO. AR6901-204
ISSUE DATE FEB 14, 2022
DESIGNED BY DSB
DRAWN BY JTM

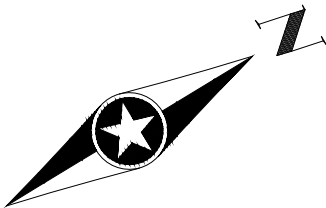
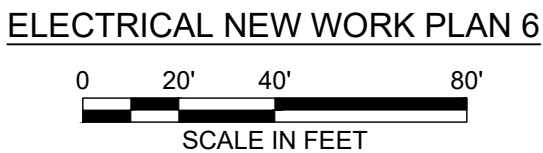
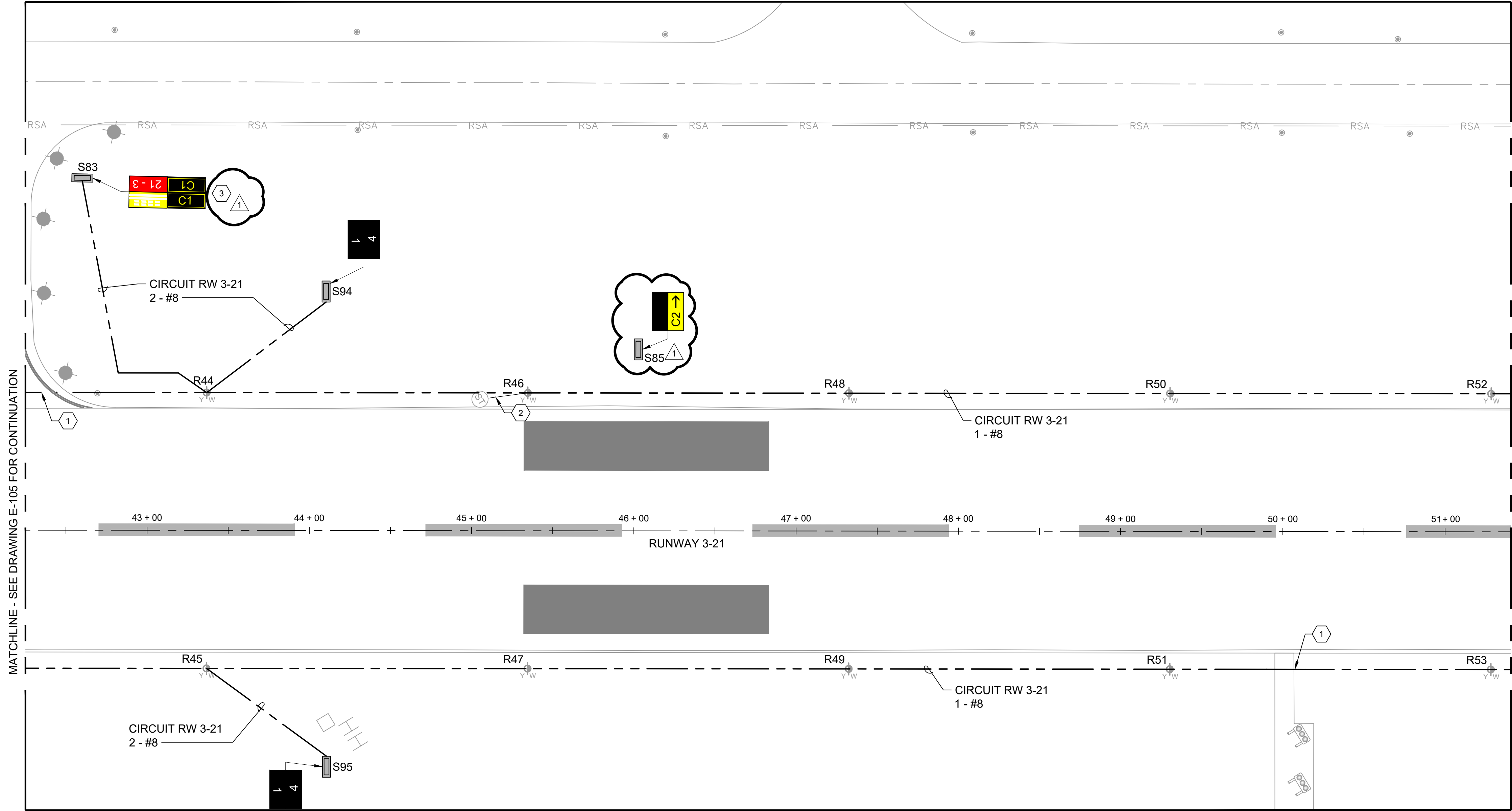
SHEET TITLE

ELECTRICAL NEW WORK
PLAN 5

SHEET

E-105

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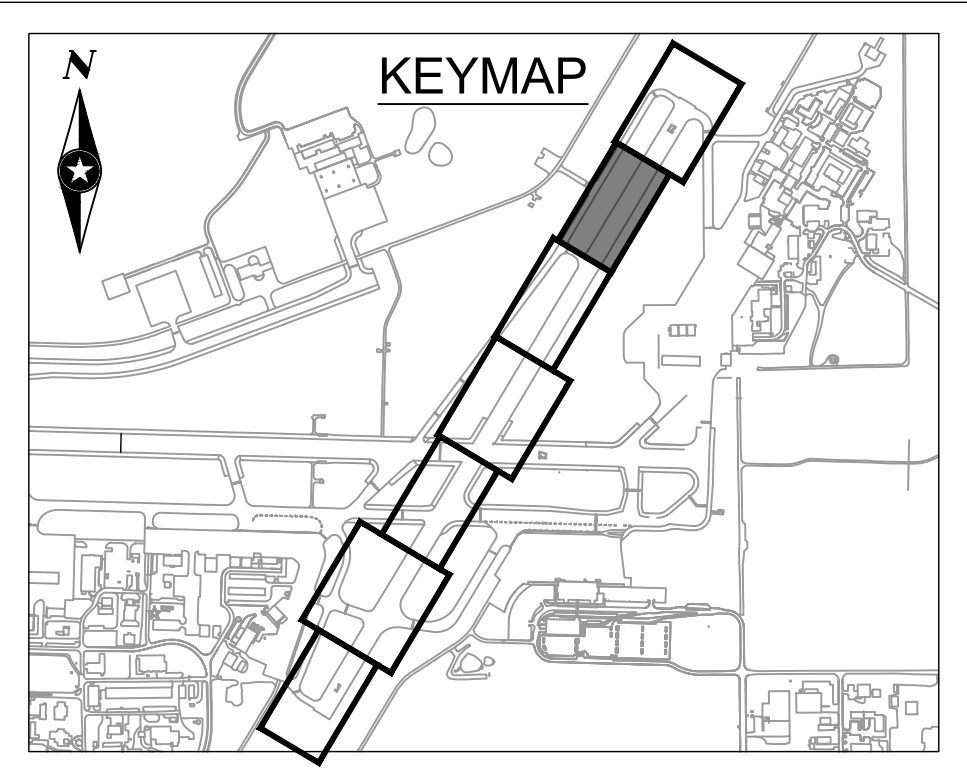
- SEE SHEETS E-001 AND E-002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
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KEYED NOTES:

- PROVIDE DIRECTIONAL BORE UNDER EXISTING PAVEMENT.
- INSTALL 2" PVC DRAINAGE CONDUIT SLOPED TO DRAIN FROM PROPOSED BASE CAN TO EXISTING STORM DRAIN STRUCTURE PER DETAIL 3 ON E-502. CONNECTION AT EXISTING STORM DRAIN STRUCTURE PER L-110.
- IF THE ALTERNATE BID IS AWARDED THIS SIGN SHALL APPEAR AS DEPICTED IN THE BID ALTERNATE SIGN SCHEDULE ON SHEET E-100.

RUNWAY LIGHT FIXTURE LOCATIONS			
LIGHT FIXTURE	NORTHING	EASTING	CIRCUIT
R44	171610.46	567701.40	RUNWAY 3-21
R45	171522.00	567846.57	RUNWAY 3-21
R46	171779.46	567804.38	RUNWAY 3-21
R47	171691.00	567949.55	RUNWAY 3-21
R48	171948.46	567907.36	RUNWAY 3-21
R49	171859.99	568052.53	RUNWAY 3-21
R50	172117.45	568010.34	RUNWAY 3-21
R51	172028.99	568155.51	RUNWAY 3-21
R52	172286.45	568113.32	RUNWAY 3-21
R53	172197.99	568258.49	RUNWAY 3-21

RUNWAY SIGN LOCATIONS			
SIGN	NORTHING	EASTING	CIRCUIT
S83	171613.73	567548.48	RUNWAY 3-21
S94	171705.70	567686.37	RUNWAY 3-21
S95	171553.69	567936.84	RUNWAY 3-21



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ST PAUL, MN 55110
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PROJECT 12607 - NEW AIRPORT 216-335-4400



I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR CONTRACT DOCUMENT WAS PREPARED BY ME OR UNDER MY CLOSE PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

SHAWN M. WHALEN
FEB 14, 2022
23984

DULUTH INTERNATIONAL AIRPORT (DLH)

2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT

DULUTH, MINNESOTA

1	03-04-2022 APPENDUM 1	
	DATE	DESCRIPTION
MARK	DATE	REVISIONS

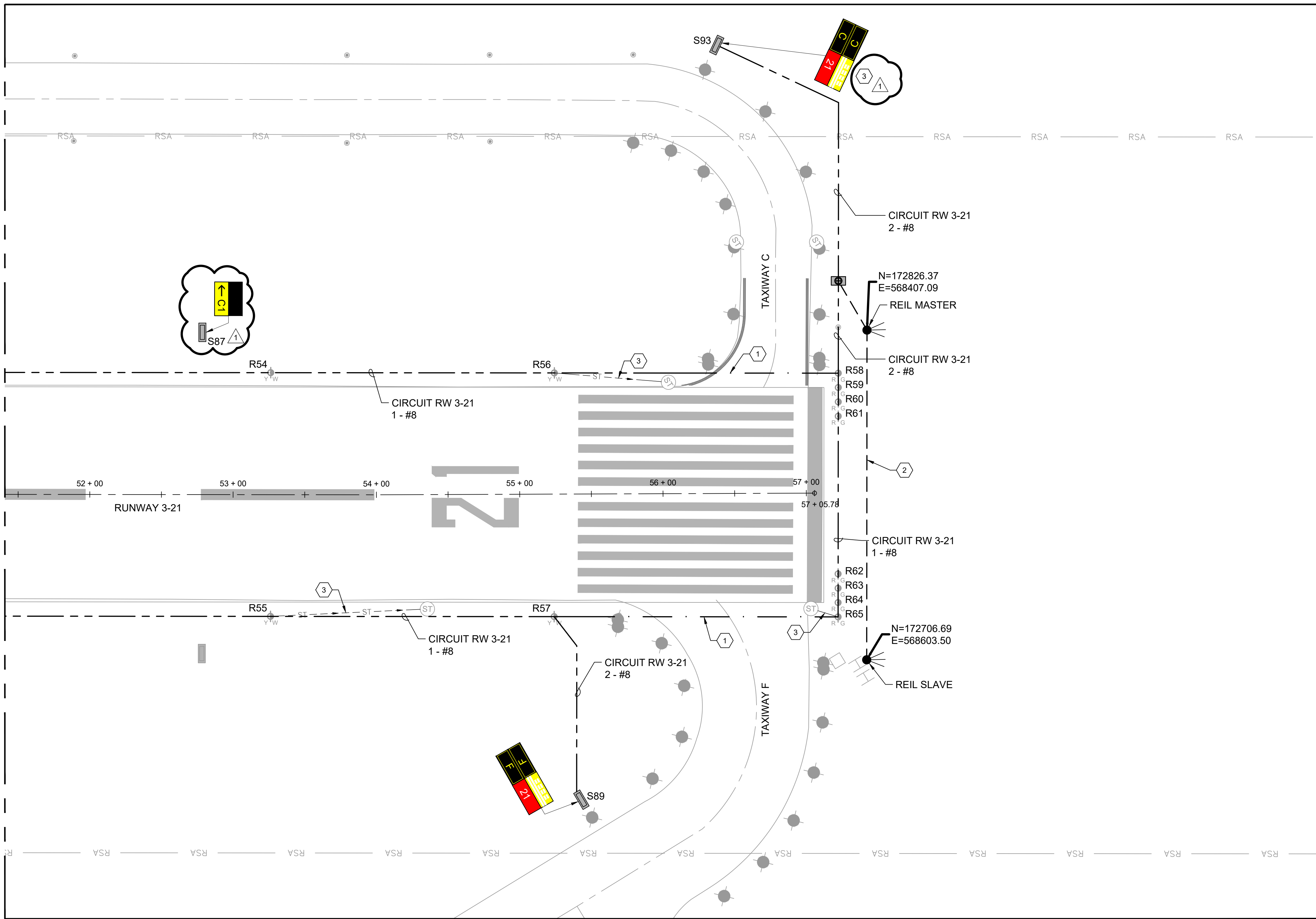
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STATE PROJECT NO. AR6901-204
ISSUE DATE FEB 14, 2022 DSB
DESIGNED BY JTM
DRAWN BY

SHEET TITLE
ELECTRICAL NEW WORK
PLAN 6

SHEET
E-106

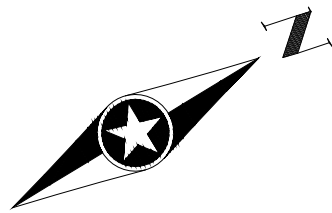
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MATCHLINE - SEE DRAWING E-106 FOR CONTINUATION



ELECTRICAL NEW WORK PLAN 7

0 20' 40' 80'
SCALE IN FEET



NOTES:

- SEE SHEETS E-001 AND E-002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
- SEE SIGN SCHEDULE ON SHEET E-100 FOR SIGN CONFIGURATION.
- ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.
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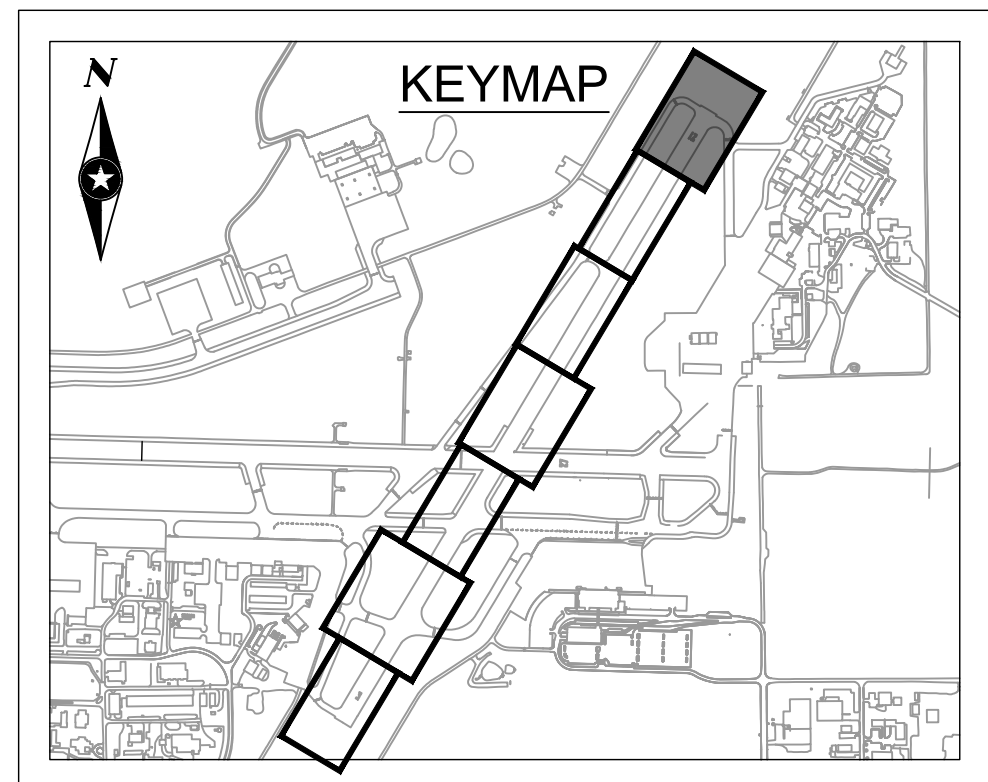
9. SEE SHEET E-100 FOR PROPOSED SIGNAGE MODIFICATIONS.

KEYED NOTES:

- 1 PROVIDE DIRECTIONAL BORE UNDER EXISTING TAXIWAY PAVEMENT.
- 2 PROVIDE CONTROL WIRE PER REIL MANUFACTURER'S RECOMMENDATIONS IN 2" CONDUIT.
- 3 INSTALL 2" PVC DRAINAGE CONDUIT SLOPED TO DRAIN FROM PROPOSED BASE CAN TO EXISTING STORM DRAIN STRUCTURE PER DETAIL 3 ON E-502. CONNECTION AT EXISTING STORM DRAIN STRUCTURE PER L-110.
- 4 IF THE ALTERNATE BID IS AWARDED THIS SIGN SHALL APPEAR AS DEPICTED IN THE BID ALTERNATE SIGN SCHEDULE ON SHEET E-100.

RUNWAY LIGHT FIXTURE LOCATIONS			
LIGHT FIXTURE	NORTHING	EASTING	CIRCUIT
R54	172455.44	568216.29	RUNWAY 3-21
R55	172366.98	568361.47	RUNWAY 3-21
R56	172624.44	568319.27	RUNWAY 3-21
R57	172535.98	568464.44	RUNWAY 3-21
R58	172793.64	568422.37	RUNWAY 3-21
R59	172788.43	568430.91	RUNWAY 3-21
R60	172783.23	568439.45	RUNWAY 3-21
R61	172778.03	568447.99	RUNWAY 3-21
R62	172720.79	568541.93	RUNWAY 3-21
R63	172715.58	568550.46	RUNWAY 3-21
R64	172710.38	568559.00	RUNWAY 3-21
R65	172705.18	568567.54	RUNWAY 3-21

RUNWAY SIGN LOCATIONS			
SIGN	NORTHING	EASTING	CIRCUIT
S87	172422.46	568178.68	RUNWAY 3-21
S89	172485.61	568383.41	RUNWAY 3-21
S93	172840.08	568182.76	RUNWAY 3-21



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PROJECT 12607 - NEW DRAINAGE AT E-107



I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR SUPPLEMENTARY SHEET WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SHAWN M. WHALEN
DATE FEB 14, 2022 LICENSE NO. 23984

DULUTH INTERNATIONAL AIRPORT (DLH)

2021 RUNWAY 3-21 LIGHTING AND SIGNAGE REPLACEMENT

DULUTH, MINNESOTA

1	03-04-2022 APPENDUM 1		DESCRIPTION
	DATE	REVISIONS	

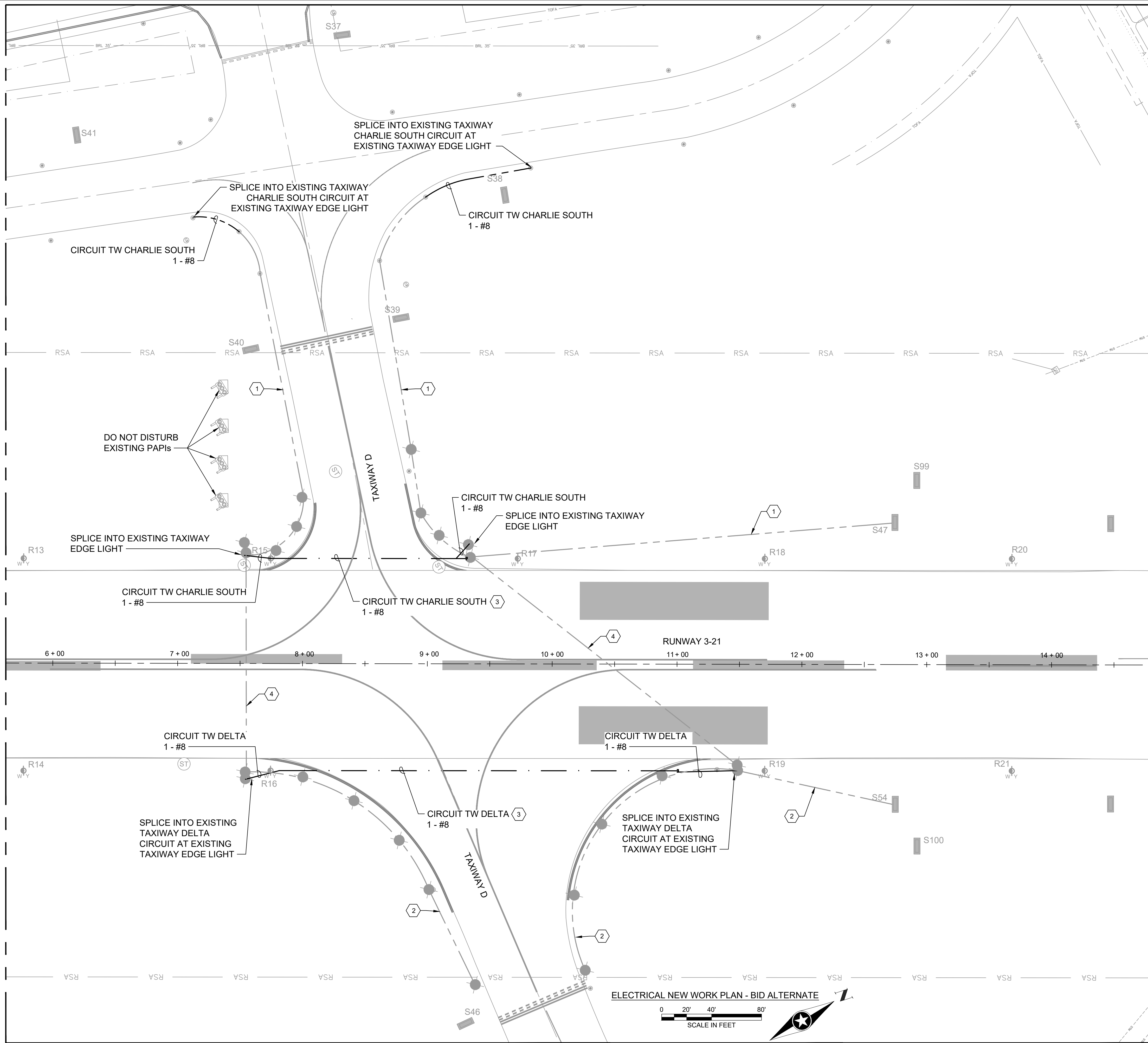
SEH FILE NO. DULAI164242
STATE PROJECT NO. AR6901-204
ISSUE DATE FEB 14, 2022 DSB
DESIGNED BY JTM
DRAWN BY

SHEET TITLE
**ELECTRICAL NEW WORK
PLAN 7**

SHEET
E-107

Z:\Clients\ANF\DuluthMN\DLH\139320_RW321ELEC\Design\Civil\Sheets\139320_E-101_3/4/2022 10:50 AM dbruemmer

MATCHLINE - SEE DRAWING E-101 FOR CONTINUATION



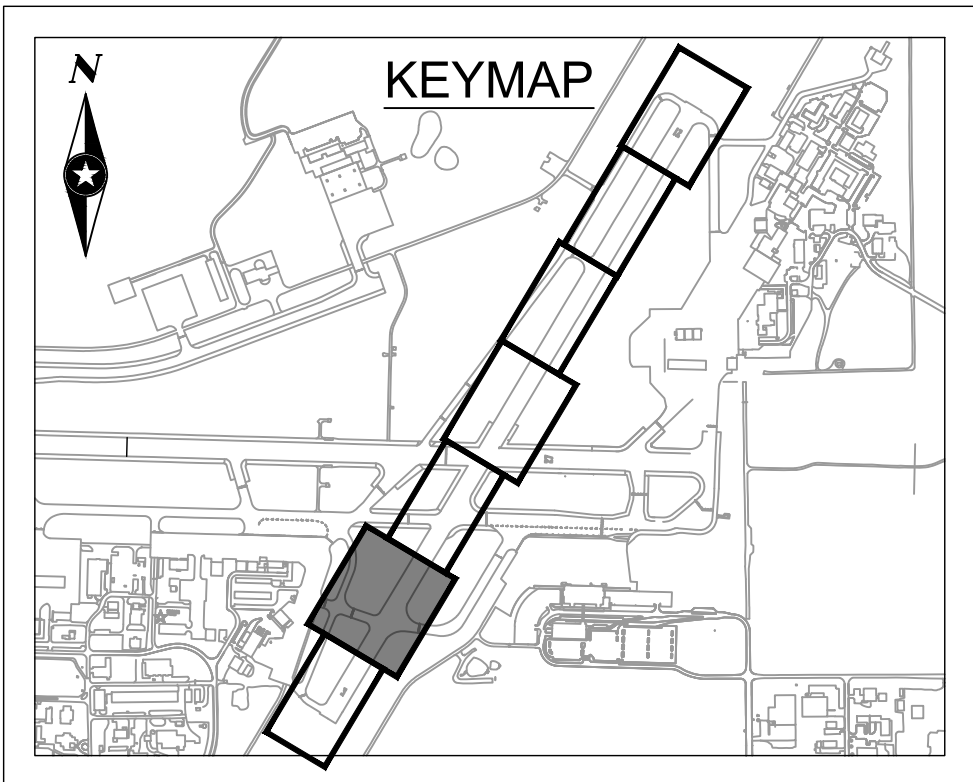
MATCHLINE - SEE DRAWING E-103 FOR CONTINUATION

NOTES:

1. SEE SHEETS E001 AND E002 FOR LEGEND, ABBREVIATIONS, INFORMATION ON CIRCUITS, AND GENERAL NOTES.
2. SEE SIGN SCHEDULE ON SHEET E-100 FOR SIGN CONFIGURATION.
3. ALL EXISTING UTILITIES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION.
4. COVER OR DISCONNECT ALL TAXIWAY LIGHTS AND GUIDANCE SIGNS WITHIN THE CLOSURE AREA.
5. NEW BASE CAN AND SIGN LOCATIONS SHALL BE STAKED OUT BY A REGISTERED SURVEYOR.
6. CONTRACTOR SHALL REPLACE, AT NO ADDITIONAL COST, ANY LIGHT FIXTURE, BASE CAN, ISOLATION TRANSFORMER, OR CABLE DAMAGED BY THE CONTRACTOR.
7. ALL CONDUITS SHALL BE INSTALLED TO ENSURE THAT WATER MAY DRAIN FROM ANY GIVEN BASE CAN. CONTRACTOR SHALL COORDINATE IN THE FIELD AND DOCUMENT ON AS-BUILT REDLINE DRAWINGS WHICH WAY CONDUITS DRAIN.
8. ALL NEW LIGHTING FIXTURE DRAIN CONDUITS SHALL BE INCIDENTAL TO FIXTURE INSTALLATION. STRUCTURE DRAINS INDICATED SHALL BE COORDINATED WITH CIVIL DRAWINGS. WHERE SHOULDERS ARE NOT BEING REPAIRED, CONTRACTOR SHALL SAW CUT EXISTING PAVEMENT AND PATCH, WHICH SHALL BE INCIDENTAL

KEYED NOTES:

- 1 EXISTING TAXIWAY DELTA CIRCUITRY SHALL REMAIN BETWEEN EXISTING LIGHTS/SIGNS AND BE REUSED AS TW CHARLIE SOUTH CIRCUITRY.
- 2 EXISTING TAXIWAY DELTA CIRCUITRY SHALL REMAIN BETWEEN LIGHTS AND BE REUSED AS TW DELTA CIRCUITRY.
- 3 ROUTE WIRE THROUGH BASE BID DIRECTIONAL BORE CONDUIT.
- 4 ABANDON EXISTING TAXIWAY DELTA CIRCUITRY UNDER RUNWAY.



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PROJECT 12607 - NEW AIRPORT 616-331-9400



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SHAWN M. WHALEN
FEB 14, 2022
DATE LICENSE NO. 23984

DULUTH INTERNATIONAL AIRPORT (DLH)
2021 RUNWAY 3-21 LIGHTING
AND SIGNAGE REPLACEMENT
DULUTH, MINNESOTA

MARK	DATE	DESCRIPTION	REVISIONS
1	03-04-2022	APPENDUM 1	

SEH FILE NO. DULAI 164242
STATE PROJECT NO. AR6901-204
ISSUE DATE, FEB 14, 2022
DESIGNED BY DSB
DRAWN BY JTM

SHEET TITLE
ELECTRICAL NEW WORK
PLAN - BID ALTERNATE

SHEET
E-108

Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the RPR. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities. Requirements and payment for trenching and backfilling for the installation of underground conduit and duct banks are in Item L-110, Airport Underground Electrical Duct Banks and Conduits.

It shall be noted that locations of existing underground wiring, conduits, duct banks and other utilities have been gathered from previous plans and site visits. It shall be the Contractor's responsibility to confirm all information prior to start of construction. Any discrepancies shall be brought to the attention of the Owner and RPR. Any cable, conduit, or duct banks damaged by the Contractor shall be immediately repaired, at the Contractor's expense and shall be repaired to the satisfaction of the Owner and RPR.

EQUIPMENT AND MATERIALS

108-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the RPR.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in electronically submitted in pdf format. The RPR reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and Buy American equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in accordance with AC 150/5340-26, *Maintenance Airport Visual Aid Facilities*, paragraph 5.1.3.1, Insulation Resistance Test.

108-2.2 Cable. Underground cable for airfield lighting facilities (runway and taxiway lights and signs) shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits latest edition. Conductors for use on 6.6 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #8 American wire gauge (AWG), L-824 Type C, 5,000 volts, non-shielded, with cross-linked polyethylene insulation. L-824 conductors for use on the L-830 secondary of airfield lighting series circuits shall be sized in accordance with the manufacturer's recommendations. All other conductors shall comply with FAA and National Electric Code (NEC) requirements. Conductor sizes noted above shall not apply to leads furnished by manufacturers on airfield lighting transformers and fixtures.

Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Commercial Item Description A-A-59544A and shall be type THWN-2, 75°C for installation in conduit and RHW-2, 75°C for direct burial installations. Conductors for parallel (voltage) circuits shall be type and size and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600-volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600-volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for grounding bond wire per ASTM B3 and ASTM B8, and shall be bare copper wire. For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.

Ground rods shall be copper-clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 3/4 in diameter.

108-2.4 Cable connections. In-line connections or splices of underground primary cables shall be of the type called for on the plans, and shall be one of the types listed below. No separate payment will be made for cable connections.

a. The cast splice. A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by 3M™ Company, “Scotchcast” Kit No. 82-B, or an approved equivalent, used for potting the splice is acceptable.

b. The field-attached plug-in splice. Field attached plug-in splices shall be installed as shown on the plans. The Contractor shall determine the outside diameter of the cable to be spliced and furnish appropriately sized connector kits and/or adapters. Tape or heat shrink tubing with integral sealant shall be in accordance with the manufacturer’s requirements. Primary Connector Kits manufactured by Amerace, "Super Kit", Integro "Complete Kit", or approved equal is acceptable.

c. The factory-molded plug-in splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

d. The taped or heat-shrink splice. Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D4388 and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits that are designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made per the manufacturer’s recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. All exothermic connections shall be made per the manufacturer’s recommendations and listings.

108-2.5 Splicer qualifications. Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the RPR proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

108-2.7 Flowable backfill. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

108-2.8 Cable identification tags. Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.9 Tape. Electrical tapes shall be Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch (50 mm) wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, or an approved equivalent.

108-2.11 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the existing circuit's insulation resistance shall be tested, in the presence of the RPR. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the RPR. Test results and weather conditions shall be noted. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual. No separate payment will be made for testing.

108-2.12 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend tape shall be polyethylene film with a metalized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item. Detectable warning tape for communication cables shall be orange. Detectable warning tape color code shall comply with the APWA Uniform Color Code.

CONSTRUCTION METHODS

108-3.1 General. The Contractor shall install the specified cable at the approximate locations indicated on the plans. Unless otherwise shown on the plans, all cable required to cross under pavements expected to carry aircraft loads shall be installed in concrete encased duct banks. Cable shall be run without splices, from fixture to fixture.

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections unless otherwise authorized in writing by the RPR or shown on the plans.

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed and on both sides of slack loops where a future connector would be installed.

Provide not less than 3 feet (1 m) of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot (30 cm) vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the RPR. Provide not less than 10 feet (3.3 m) of cable slack in all manholes.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans. Cable and counterpoise slack is considered incidental to this item and is included in the Contractor's unit price. No separate measurement or payment will be made for cable or counterpoise slack.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

The cable shall be installed in a manner that prevents harmful stretching of the conductor, damage to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing before pulling into the conduit and it shall be left sealed until connections are made. Where more than one cable is to be installed in a conduit, all cable shall be pulled in the conduit at the same time. The pulling of a cable through duct banks or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer's recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the RPR prior to any cable installation. If required by the RPR, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the RPR. Cable pull tensions shall be recorded by the Contractor and reviewed by the RPR. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor's expense.

The manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the RPR, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or use other appropriate means to prevent abrasion to the cable jacket.

108-3.3 Installation of direct-buried cable in trenches. Not used

108-3.4 Cable markers for direct-buried cable. Not used

108-3.5 Splicing. Connections of the type shown on the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

a. Cast splices. These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured per the manufacturer's instructions and to the satisfaction of the RPR.

b. Field-attached plug-in splices. These shall be assembled per the manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by one of the following methods: (1) wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint or (3) On connector kits equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

c. Factory-molded plug-in splices. These shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by one of the following methods: (1) Wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint. (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint. or (3) On connector kits so equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

d. Taped or heat-shrink splices. Shall not be used.

e. Assembly. Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer's recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.

108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables.

a. Equipotential. The counterpoise size is as shown on the plans. The equipotential method is applicable to all airfield lighting systems; i.e. runway, taxiway, apron – touchdown zone, centerline, edge, threshold and approach lighting systems. The equipotential method is also successfully applied to provide lightning protection for power, signal and communication systems. The light bases, counterpoise, etc – all components - are bonded together and bonded to the vault power system ground loop/electrode.

Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. The counterpoise is centered over the cable/conduit/duct to be protected.

The counterpoise conductor shall be installed no less than 8 inches (200 mm) minimum or 12 inches (300 mm) maximum above the raceway or cable to be protected, except as permitted below:

(1) The minimum counterpoise conductor height above the raceway or cable to be protected shall be permitted to be adjusted subject to coordination with the airfield lighting and pavement designs.

(2) The counterpoise conductor height above the protected raceway(s) or cable(s) shall be calculated to ensure that the raceway or cable is within a 45-degree area of protection, (45 degrees on each side of vertical creating a 90 degree angle).

Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, external to the raceway or sleeve.

The counterpoise conductor shall be bonded to each metallic light base, mounting stake, and metallic airfield lighting component.

All metallic airfield lighting components in the field circuit on the output side of the constant current regulator (CCR) or other power source shall be bonded to the airfield lighting counterpoise system.

All components rise and fall at the same potential; with no potential difference, no damaging arcing and no damaging current flow.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) apart around the entire circuit. The counterpoise system shall be continuous and terminate outside the transformer vault.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

b. Isolation – used in areas where lightning strikes are not common. Counterpoise size is selected by the RPR. The isolation method is an alternate method for use only with edge lights installed in turf and stabilized soils and raceways installed parallel to and adjacent to the edge of the pavement. NFPA 780 uses 15 feet to define “adjacent to”.

The counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable being protected.

The counterpoise conductor shall be installed 8 inches (203 mm) minimum below grade. The counterpoise is not connected to the light base or mounting stake. An additional grounding electrode is required at each light base or mounting stake. The grounding electrode is bonded to the light base or mounting stake with a 6 AWG solid copper conductor.

See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Isolation Method of lightning protection.

Reference FAA STD-019E, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7.

c. Common Installation requirements. When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor. Grounding electrodes may be rods, ground dissipation plates, radials, or other electrodes listed in the NFPA 70 (NEC) or NFPA 780.

Grounding electrodes may be rods, ground dissipation plates, radials, or other electrodes listed in the NFPA 70 (NEC) or NFPA 780.

Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, external to the raceway or sleeve.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) apart around the entire circuit. The counterpoise system shall be

continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

d. Parallel Voltage Systems. Provide grounding and bonding in accordance with NFPA 70, National Electrical Code.

108-3.7 Counterpoise installation above multiple conduits and duct banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete area of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete area of protection measured 45 degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

108-3.8 Counterpoise installation at existing duct banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.9 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the RPR, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor shall perform all tests in the presence of the RPR. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the RPR. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

a. Earth resistance testing methods shall be submitted to the RPR for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the RPR. All such testing shall be at the sole expense of the Contractor.

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance

ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The RPR shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the RPR the following:

- c. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.
- d. That all affected circuits (existing and new) are free from unspecified grounds.
- e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than should recommend 50 megohms. Verify continuity of all series airfield lighting circuits prior to energization.
- f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 100 megohms.
- g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.
- h. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.
- i. That the impedance to ground of each ground rod does not exceed **25** ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the RPR prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the RPR. Where connecting new cable to existing cable, insulation resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved “repair” procedures for items that have failed testing other than complete replacement.

METHOD OF MEASUREMENT

108-4.1 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. Cable and counterpoise slack is considered incidental to this item and is included in the Contractor’s unit price. No separate measurement or payment will be made for cable or counterpoise slack.

108-4.2 No separate payment will be made for ground rods.

BASIS OF PAYMENT

108-5.1 Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and

incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108-5.1	NO. 8 AWG, 5 KV, L-824, TYPE C CABLE, INSTALLED IN DUCT BANK OR CONDUIT - PER LINEAR FOOT
Item L-108-5.2	NO. 6 AWG, SOLID, BARE COUNTERPOISE WIRE, INSTALLED IN TRENCH, ABOVE THE DUCT BANK OR CONDUIT, INCLUDING CONNECTIONS/TERMINATIONS, GROUND RODS AND GROUND CONNECTORS. COUNTERPOISE SLACK IS CONSIDERED INCIDENTAL TO THIS ITEM AND IS INCLUDED IN THE CONTRACTOR'S UNIT PRICE. NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE FOR COUNTERPOISE SLACK.
Item L-108-5.3	NO. 8 AWG, 5 KV, L-824, TYPE C CABLE, INSTALLED IN DUCT BANK OR CONDUIT [BID ALTERNATE] - PER LINEAR FOOT
Item L-108-5.4	NO. 6 AWG, SOLID, BARE COUNTERPOISE WIRE, INSTALLED IN TRENCH, ABOVE THE DUCT BANK OR CONDUIT, INCLUDING CONNECTIONS/TERMINATIONS, GROUND RODS AND GROUND CONNECTORS [BID ALTERNATE] – PER LINEAR FOOT

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-53	Airport Lighting Equipment Certification Program

Commercial Item Description

A-A-59544A	Cable and Wire, Electrical (Power, Fixed Installation)
A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

ASTM International (ASTM)

ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

ASTM D4388	Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes
Mil Spec	
MIL-PRF-23586F	Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive
National Fire Protection Association (NFPA)	
NFPA-70	National Electrical Code (NEC)
NFPA-780	Standard for the Installation of Lightning Protection Systems
American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)	
ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
Federal Aviation Administration Standard	
FAA STD-019E	Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM L-108

Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

110-1.1 This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits and removal of existing duct banks. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification. Any existing ducts found to be damaged or collapsed shall be immediately brought to the attention of the Owner and Engineer.

It shall be noted that locations of existing underground wiring, conduits, duct banks and other utilities have been gathered from previous plans and site visits. It shall be the Contractor's responsibility to confirm all information prior to start of construction. Any discrepancies shall be brought to the attention of the Owner and Engineer. Any cable, conduit, or duct banks damaged by the Contractor shall be immediately repaired, at the Contractor's expense and shall be repaired to the satisfaction of the Owner and Engineer.

All field verified existing conduit locations discovered during the course of this project shall be recorded clearly on the Contractors red-lined drawing set for later inclusion in the Conforming to Construction Records. Information shall include, size, depth, and system (if known) .

EQUIPMENT AND MATERIALS

110-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the RPR and replaced with materials, that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be

made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be electronically submitted in pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

110-2.2 Steel conduit. Not Used.

110-2.3 Plastic conduit. Plastic conduit and fittings shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high-density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

a. Type I–Schedule 40 and Schedule 80 PVC suitable for underground use either direct-buried or encased in concrete.

b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.

d. Type III –HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement shall be as recommended by the conduit/fitting manufacturer.

110-2.4 Split conduit. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

110-2.5 Conduit spacers. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads. They shall be designed to accept No. 4 reinforcing bars installed vertically.

110-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

110-2.7 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program. Precast concrete structures shall conform to ASTM C478.

110-2.8 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

110-2.9 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches (50 mm) inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches (75 mm) per 100 feet (30 m). On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. Under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches (0.5 m) below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (6 mm) smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill may alternatively be used

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the RPR. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

Unless otherwise specified, excavated materials that are deemed by the RPR to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the RPR and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

- a.** Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

- b.** Trenching, etc., in cable areas shall then proceed with approval of the RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the RPR shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the RPR.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch (6.3 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

110-3.4 Markers. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4 - 6 inches (100 - 150 mm) thick extending approximately one inch (25 mm) above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

The Contractor shall impress the word "DUCT" or "CONDUIT" on each marker slab. Impression of letters shall be done in a manner, approved by the RPR, for a neat, professional appearance. All letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-visibility orange paint, as approved by the RPR. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the RPR. The letters shall be 4 inches (100 mm) high and 3 inches (75 mm) wide with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include sodding and seeding shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

110-3.8 Drain Line Connections. Install 2" drainage conduit sloped to drain from proposed base can to existing concrete storm drain structure at locations depicted in the plans. Excavate with care to make connection to existing structure. Penetration of structure shall be made by coring, sawcutting, or other method agreeable to the Contractor and approved by the Engineer. Secure the drain line in place and patch the structure penetration with non-shrink grout. Backfill excavation immediately around the drain line connection with excavated soils and compact to match undisturbed ground. Contractor shall have the option to backfill immediately around the drain line connection with controlled low strength material per P-153.

110-3.9 Ownership of removed cable. The Airport shall retain ownership of all removed cable, unless otherwise directed. Cable shall be coiled and bound by Contractor in a manner acceptable to the Airport. Contractor shall deliver coiled and bound removed cable to location on the Airport as directed.

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and restoration, and for drain lines, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

110-4.2 Drain line connections to existing storm structures shall be measured by each connection made and accepted. This shall include excavation, penetration of the existing concrete structure, securing the drain line at the structure, patching around the structure penetration, and backfill.

110-4.3 All markers are incidental to the cable or duct pay item.

110-4.4 Clearing existing duct is incidental to the cable installation pay item.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for removal and disposal of existing duct banks and conduits as shown on the plans, furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

110-5.2 Payment will be made at the contract unit price for each drain line connection to existing storm structure. This price shall be full compensation for excavation, penetration of the existing concrete structure, securing the drain line at the structure, patching around the structure penetration, and backfill, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

Payment will be made under:

Item L-110-5.1	NON-CONCRETE ENCASED, ELECTRICAL CONDUIT, 1-WAY 2-INCH, PVC SCH 40 – PER LINEAR FOOT
Item L-110-5.2	DIRECTIONAL BORED, ELECTRICAL CONDUIT, 1-WAY 2-INCH, HDPE SCH 80 – PER LINEAR FOOT
Item L-110-5-3	DRAIN LINE CONNECTION TO EXISTING STORM STRUCTURE
Item L-110-5-4	NON-CONCRETE ENCASED, ELECTRICAL CONDUIT, 1-WAY 2-INCH, PVC SCH 40 [BID ALTERNATE] – PER LINEAR FOOT

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circular (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program

ASTM International (ASTM)

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
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National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
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Underwriters Laboratories (UL)

UL Standard 6	Electrical Rigid Metal Conduit - Steel
UL Standard 514B	Conduit, Tubing, and Cable Fittings
UL Standard 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL Standard 1242	Electrical Intermediate Metal Conduit Steel

UL Standard 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110

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Item L-125 Installation of Airport Lighting Systems

DESCRIPTION

125-1.1 This item shall consist of airport lighting systems furnished and installed in accordance with this specification, the referenced specifications, and the applicable advisory circulars (ACs). The systems shall be installed at the locations and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the RPR.

125-1.2 The Contractor shall ascertain that all lighting system components furnished are compatible in all respects with each other and the remainder of the new/existing system. Any non-compatible components furnished by the Contractor shall be replaced at no additional cost to the airport sponsor with a similar unit, approved by the RPR (different model or different manufacturer) that is compatible with the remainder of the airport lighting system.

125-1.3 The Contractor is responsible for using the latest editions of the referenced FAA Advisory Circulars, including any changes, in effect at the time of bidding. The advisory circulars may be obtained free of charge on the internet at the following address:

http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

EQUIPMENT AND MATERIALS

125-2.1 General.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified under the Airport Lighting Equipment Certification Program in accordance with AC 150/5345-53, current version. FAA certified airfield lighting shall be compatible with each other to perform in compliance with FAA criteria and the intended operation. If the Contractor provides equipment that does not perform as intended because of incompatibility with the system, the Contractor assumes all costs to correct the system for to operate properly.

b. Manufacturer's certifications shall not relieve the Contractor of their responsibility to provide materials in accordance with these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the RPR and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

c. All materials and equipment used shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be clearly made with arrows or circles (highlighting is not acceptable). The Contractor shall be responsible for delays in the project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted in electronic PDF format, tabbed by specification section. The RPR reserves the right to reject any or all equipment, materials or procedures, which, in the RPR's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. All LED light fixtures must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics.

125-2.2 Conduit/Duct. Conduit shall conform to Specification Item L-110 Airport Underground Electrical Duct Banks and Conduits.

125-2.3 Cable and Counterpoise. Cable and Counterpoise shall conform to Item L-108 Underground Power Cable for Airports.

125-2.4 Tape. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88 respectively, as manufactured by 3M Company or an approved equal.

125-2.5 Cable Connections. Cable Connections shall conform to Item L-108 Installation of Underground Cable for Airports.

125-2.6 Retroreflective Markers. Not used.

125-2.7 Runway Lights. Runway lights shall conform to the requirements of AC 150/5345-46. Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors conforming to the specification for the light concerned or to the standard referenced.

Lights

Type	Class	Mode	Option	Base	Filter	Transformer	Notes
L-861(L)	2	2	4	L-867B		L-830	Runway 3-21 Edge Lights
L-861E(L)	2	2	4	L-867B		L-830	Runway 3-21 Threshold Lights

125-2.8 Runway and Taxiway Signs. Runway and Taxiway Guidance Signs should conform to the requirements of AC 150/5345-44.

Signs

Type	Size	Style	Class	Mode	Notes
L-858R(L)	2	2	2	2	Hold Sign
L-858B(L)	4	2	2	2	Runway Distance Remaining Sign

125-2.9 Runway End Identifier Light (REIL). The REIL fixtures shall meet the requirements of AC 150/5345-51, current version, Type L-849I(LED), Style E and be listed in the current version of Appendix 3 to AC 150/5345-53, current version. Provide with runway current sensor and baffles.

125-2.10 Precision Approach Path Indicator (PAPI). Not used.

125-2.11 Circuit Selector Cabinet. Not used.

125-2.12 Light Base and Transformer Housings. Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases shall be Type L-867 and L-868, and shall be provided as indicated on drawings or as required to accommodate the fixture or device installed thereon. Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures.

125-2.13 Isolation Transformers. Isolation Transformers shall be Type L-830 size as required for each installation. Transformer shall conform to AC 150/5345-47.

125-2.14 Constant Current Regulator (CCR). The constant current regulator shall be a Type L-829 conforming to the requirements of AC 150/5345-10. The regulator(s) shall be of the size and steps indicated on drawings, CCR(s) shall be floor mounted but capable of stacking vertically with other CCR's. CCR(s) shall include meggering option and shall be compatible with existing DLH ALCMS. Contractor shall coordinate existing system prior to procurement of CCR. Input shall be single phase with output of 6.6A maximum current at 60 Hz. Lightning protection shall be provided on the input and output of the regulator. The regulator shall have an integrated digital ammeter indicating the output current. Control voltage shall be coordinated with existing ALCMS currently installed. All necessary program and additional wiring to connect the new CCR into the existing ALCMS and airfield vault infrastructure (power, control, etc.) shall be incidental to the CCR.

INSTALLATION

125-3.1 Installation. The Contractor shall furnish, install, connect and test all equipment, accessories, conduit, cables, wires, buses, grounds and support items necessary to ensure a complete and operable airport lighting system as specified here and shown in the plans.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and state and local code agencies having jurisdiction.

The Contractor shall install the specified equipment in accordance with the applicable advisory circulars and the details shown on the plans.

The Contractor shall provide core-drilling as required to install the new in-pavement runway lighting fixture and shall be incidental to the installation. Contractor shall coordinate locations with RPR prior to

work and provide all necessary labor and equipment for a fully functioning system. Should in-pavement fixtures fall within a close enough proximity to pavement jointing, lighting fixture block outs shall be provided as shown on drawings.

125-3.2 Testing. All lights shall be fully tested by continuous operation for not less than 24 hours as a completed system prior to acceptance. The test shall include operating the constant current regulator in each step not less than 10 times at the beginning and end of the 24-hour test. The fixtures shall illuminate properly during each portion of the test.

125-3.3 Shipping and Storage. Equipment shall be shipped in suitable packing material to prevent damage during shipping. Store and maintain equipment and materials in areas protected from weather and physical damage. Any equipment and materials, in the opinion of the RPR, damaged during construction or storage shall be replaced by the Contractor at no additional cost to the owner. Painted or galvanized surfaces that are damaged shall be repaired in accordance with the manufacturer's recommendations.

125-3.4 Elevated and In-pavement Lights. Water, debris, and other foreign substances shall be removed prior to installing fixture base and light.

A jig or holding device shall be used when installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Light fixtures shall be oriented with the light beams parallel to the runway or taxiway centerline and facing in the required direction. The outermost edge of fixture shall be level with the surrounding pavement. Surplus sealant or flexible embedding material shall be removed. The holding device shall remain in place until sealant has reached its initial set.

125-3.5 CCR Installation. Proposed CCR shall be installed in the Airfield Vault and programmed to interface with existing ALCMS. Branch circuit conductor and conduit to power new CCRs shall be incidental to the CCR installation.

METHOD OF MEASUREMENT

125-4.1 Base cans and junction plazas will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the RPR.

125-4.2 Runway lights will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the RPR.

125-4.3 Guidance signs will be measured by the number of each type and size installed as completed units, in place, ready for operation, and accepted by the RPR.

125-4.4 Removal and salvage of airfield lighting fixtures and signs will be measured with lump sum and accepted by the RPR.

125-4.5 Constant Current Regulators will be measured by the number of each type and size installed as completed units, in place, ready for operation, and accepted by the RPR.

BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete runway light, guidance sign, or runway end identification light, installed by the Contractor and accepted by the Engineer. This payment will be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

- | | |
|-----------------|---|
| Item L-125-5.1 | REMOVAL OF EXISTING RUNWAY EDGE LIGHT FIXTURES AND SIGNS, INCLUDING BASE CAN, ISOLATION TRANSFORMER, SIGN FOUNDATION, CONDUIT, AND WIRE – PER LUMP SUM. |
| Item L-125-5.2 | L-861(L) MEDIUM INTENSITY RUNWAY EDGE LIGHT (WITHOUT ARCTIC KIT), WHITE LENS OR WHITE/YELLOW LENS INSTALLED ON NEW L-867-B GALVANIZED BASE CAN (INCLUDES FIXTURES, TRANSFORMER, AND BASE CAN) – PER EA. |
| Item L-125-5.3 | L-861E(L) MEDIUM INTENSITY RUNWAY THRESHOLD LIGHT, (WITHOUT ARCTIC KIT), RED/GREEN LENS INSTALLED ON L-867-B GALVANIZED BASE CAN (INCLUDES FIXTURES, TRANSFORMER, AND BASE CAN) |
| Item L-125-5.4 | L-858R(L) HOLD SIGN, SIZE 2, INCLUDING FOUNDATION, ISOLATION TRANSFORMER, WIRE, BASE CAN, AND CONDUIT – PER EA. |
| Item L-125-5.5 | L-858B(L) RUNWAY DISTANCE REMAINING SIGN, SIZE 4, INCLUDING FOUNDATION, ISOLATION TRANSFORMER, WIRE, BASE CAN, AND CONDUIT – PER EA. |
| Item L-125-5.6 | L-829 7.5KW CONSTANT CURRENT REGULATOR – PER EA. |
| Item L-125-5.7 | L-849(L) REIL (2 UNIT) – PER EA. |
| Item L-125-5.8 | NOT USED |
| Item L-125-5.9 | NEW BLANK STEEL COVER ON EXISTING BASE CAN – PER EA. |
| Item L-125-5.10 | REMOVE BID ALTERNATE SIGNS INCLUDING FOUNDATIONS [BID ALTERNATE] – PER EACH |
| Item L-125-5.11 | REPLACEMENT SIGN PANELS ON EXISTING SIGN, INCLUDING LED UPGRADE KIT AND ISOLATION TRANSFORMER [BID ALTERNATE] |

Item L-125-5.12 L-858(L) AIRFIELD GUIDANCE SIGN, SIZE 2, INCLUDING FOUNDATION, ISOLATION TRANSFORMER, WIRE, BASE CAN, AND CONDUIT [BID ALTERNATE] – PER EACH

MATERIAL REQUIREMENTS

AC 150/5345-5	Circuit Selector Switch
AC 150/5345-26	L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
AC 150/5345-42	Airport Light Bases, Transformer Houses, Junction Boxes and Accessories
AC 150/5345-44	Taxiway and Runway Signs
AC 150/5345-46	Runway and Taxiway Light Fixtures
AC 150/5345-47	Isolation Transformers for Airport Lighting Systems
AC 150/5345-51	Discharge-Type Flasher Equipment

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5340-18	Standards for Airport Sign Systems
AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
AC 150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-44	Specification for Runway and Taxiway Signs
AC 150/5345-46	Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47	Specification for Series to Series Isolation Transformers for Airport Lighting Systems
AC 150/5345-51	Specification for Discharge-Type Flashing Light Equipment
AC 150/5345-53	Airport Lighting Equipment Certification Program

Engineering Brief (EB)

EB No. 67

Light Sources Other than Incandescent and Xenon for Airport and
Obstruction Lighting Fixtures

END OF ITEM L-125