City of Milwaukee Department of Public Works

Street Lighting Program

February, 2014

Existing Street Lighting Facilities

DPW Street Lighting Program

February, 2014

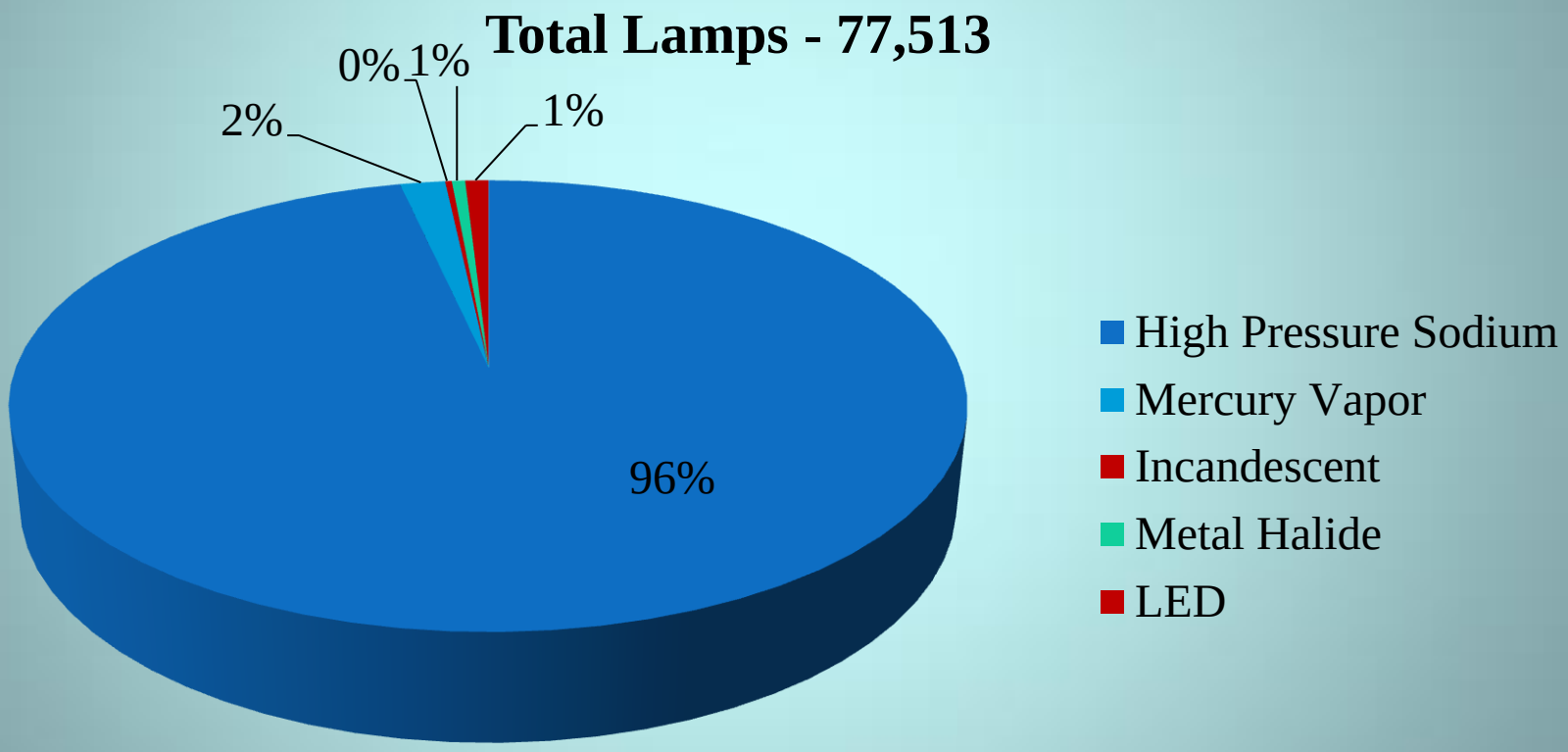
Street Lighting Facilities

(As of January 1, 2014)

- 1,291 Miles of Lighted Streets
- 251 Substations and Enclosures
- 68,540 Street Lights
  - 26,532 “Series” Lights
  - 41,597 “Multiple” Lights
- 8,815 Alley Lights
- 569 Specialty Lights
- 77,513 Total Lights Maintained by DPW

Street and Alley Light Lamp Types

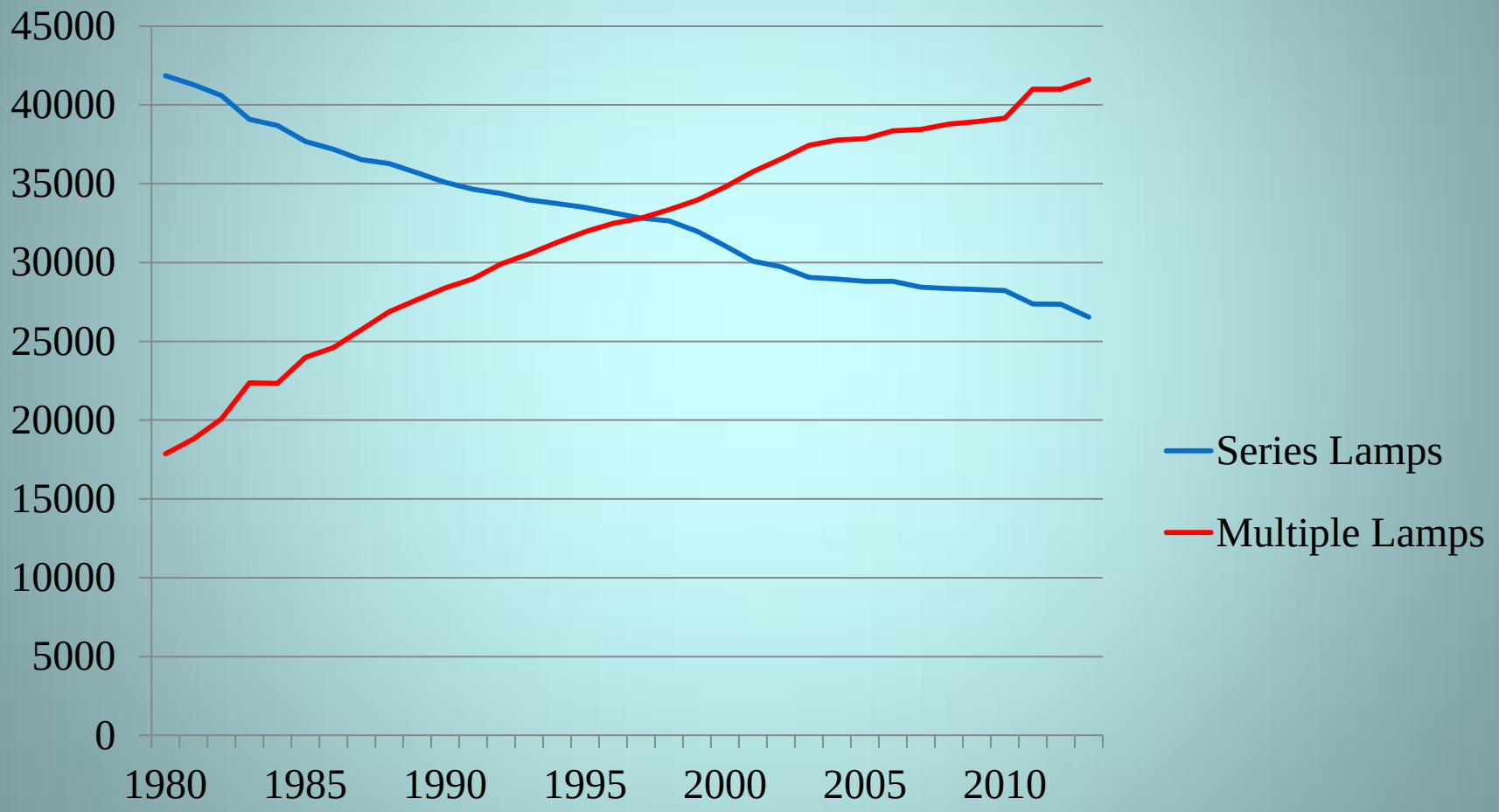
(As of January 1, 2014)



DPW Street Lighting Program February, 2014

Comparison of Number of Lamps on Series and Multiple Circuits

1980 through 2013



DPW Street Lighting Program February, 2013

LED Lighting

- Current LED Lighting Units in Service
  - Historic Third Ward Lighting Fixtures Retrofit with LED Lights
  - LED Lights Installed in the Westlawn Area in Conjunction with Area Redevelopment
  - LED Light Fixtures Installed on Test Segments of S. Indiana Avenue and on S. 97th Street
- LED Harp Light Retrofits from Several Manufacturers Currently Being Tested on N. Market Street

Capital Improvement Program Elements

DPW Street Lighting Program February, 2013

Paving Related Improvements

DPW Street Lighting Program

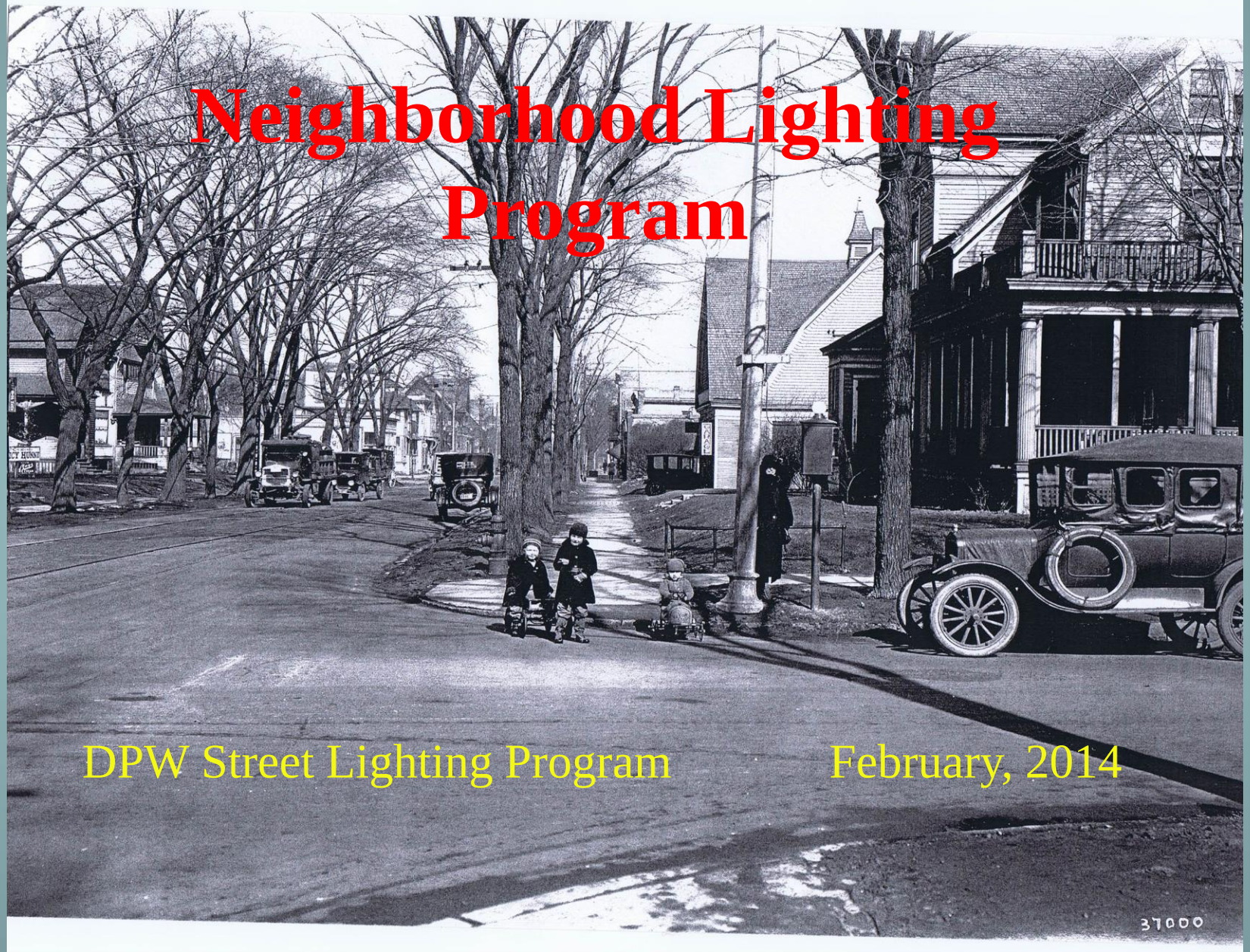
February, 2014

Paving Related Functions

- Cable and Other Underground Equipment Typically Damaged During Curb Removal on Paving Projects

- Work Performed During Paving
  - Place Cable and Other Facilities Overhead Prior To Paving to Maintain Lighting Operation During Construction
  - Protect and Adjust Facilities as Necessary for Equipment Remaining in Place
  - Restore/Upgrade Facilities During Various Stages of a Paving Project

Neighborhood Lighting Program



DPW Street Lighting Program February, 2014

Neighborhood Lighting Program

DPW Street Lighting Program

February, 2014

Street and Alley Light Upgrades

DPW Street Lighting Program February, 2014

Street and Alley Lighting Upgrades

- Provide New or Additional Alley Lights Based on City Lighting Standards Where Inadequate Lighting Exists

- Ongoing Program to Replace Mercury Vapor Lamps with High Pressure Sodium Lights

Series Circuit Replacement

DPW Street Lighting Program

February, 2014

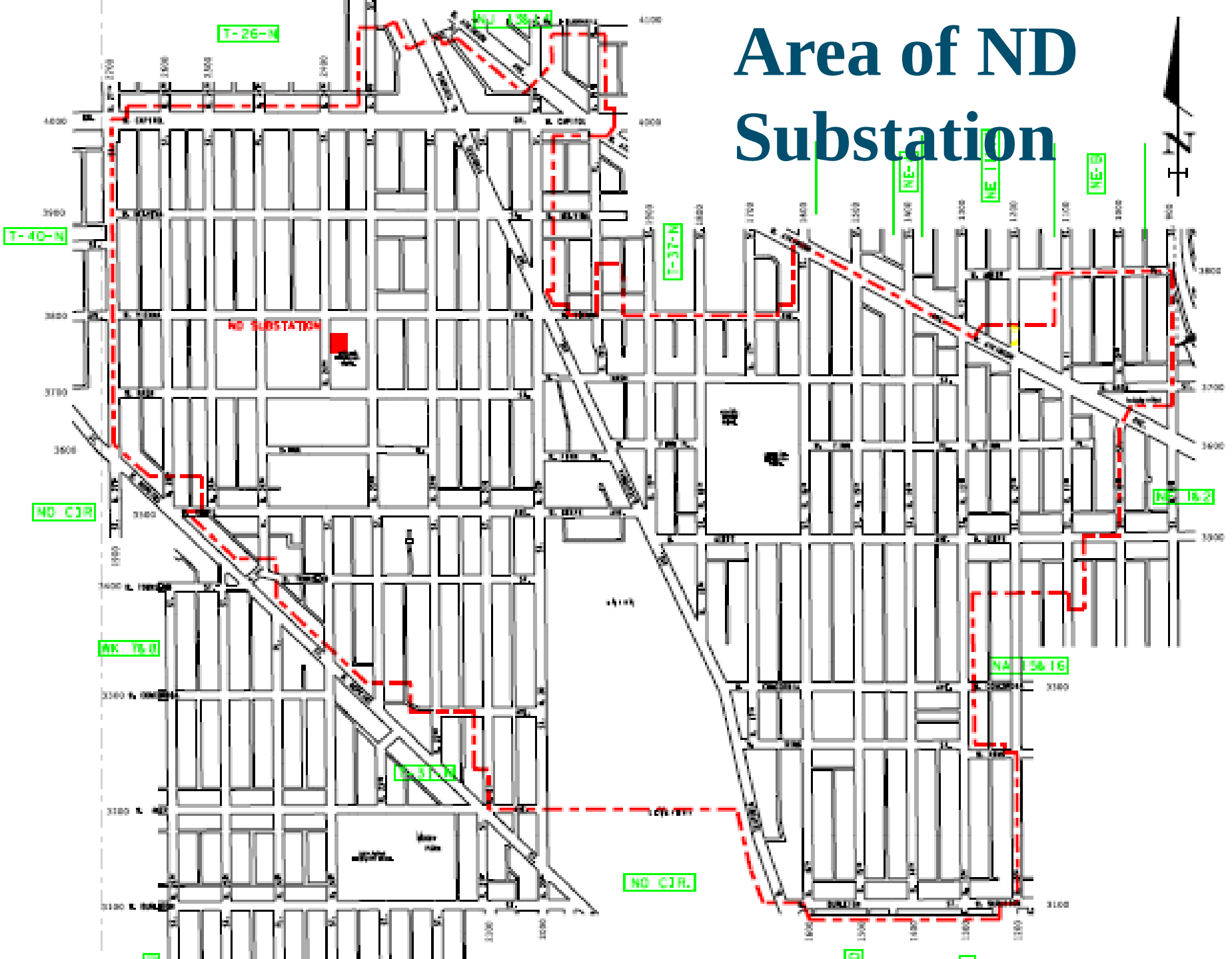
Series Circuit Replacement

- Outdated Technology Used Initially in the late 1910's and Early 1920's
- Designed Primarily for Use with Incandescent Lighting
- High Voltage System
- Aging Cable Plant Prone to Failure
- Transition Began to More Modern Multiple Circuitry in the 1950's
- Approximately 60% of Street Lights Currently Operating on Multiple Circuitry

Series Circuit Replacement

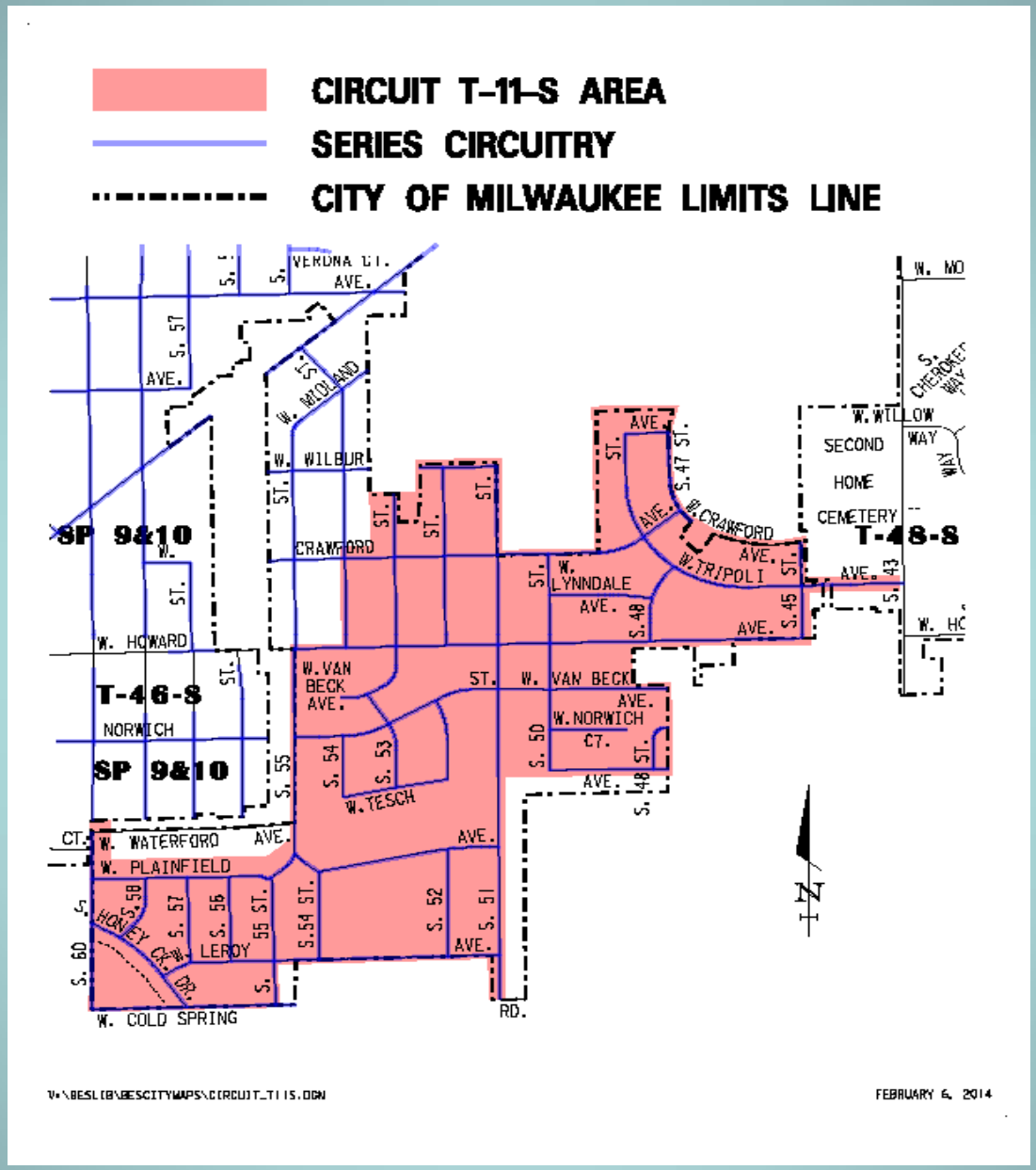
- Replacement of 22 Series Circuits from “ND” Substation Located at Vienna and 24th Was Completed In 2013
- 743 Street Lights converted from Series to Multiple Under this Multi-Year Conversion Project

Area of ND Substation



Series Circuit Replacement
(Cont.)

- Replacement of Series Circuits from the "T11S" Enclosure Located at 51st and Plainfield to be Designed and Constructed in 2014
- Provides Electrical Energy to 330 Street Lights
- 239 Outages from January 1, 2009 through December 31, 2013


CIRCUIT T-11-S AREA
SERIES CIRCUITRY
CITY OF MILWAUKEE LIMITS LINE
SP 9&10
T-46-S
NORWICH
SP 9&10
T-48-S
W. HOWARD
W. WILBUR
W. MIDLAND
CRAWFORD
W. LYNNDALE
W. TRIPOLI
W. VAN BECK
W. NORWICH
W. YESCH
W. WATERFORD
W. PLAINFIELD
W. COLD SPRING
LEROY
HONEY CK.
SECOND HOME CEMETERY
W. WILLOW WAY
S. CHEROKEE
VERONA CT.
AVE.
ST.
RD.
CT.
FEBRUARY 6, 2014

Series Circuit Replacement
(Cont.)

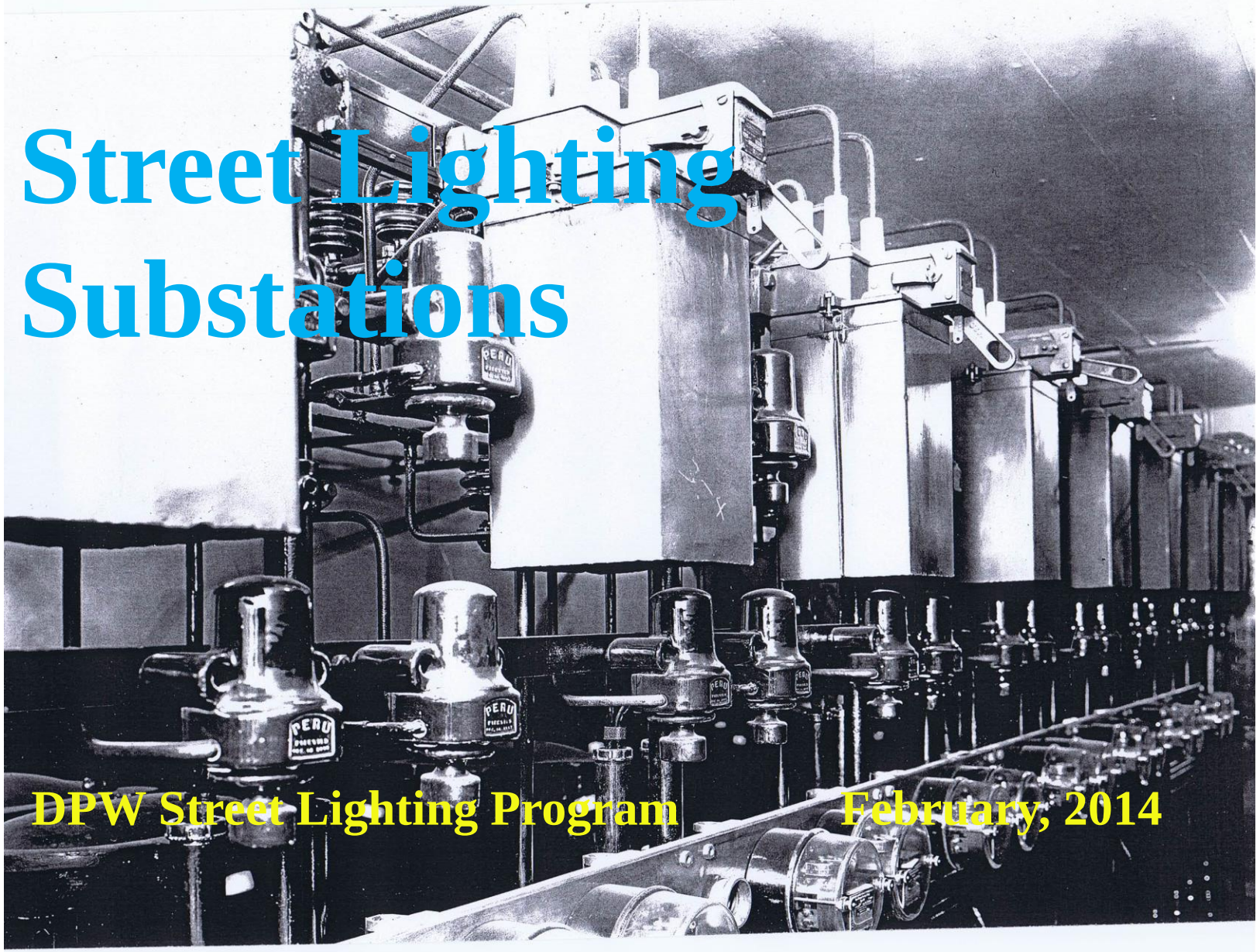
- Prior to 2014, Circuits Selected for Conversion Based on Failures from Substation/Enclosures
- Beginning in 2014, Circuits Chosen for Conversion Based on Performance of Individual Circuits

Summary of Circuit Outage Frequency

January 1, 2013 through December 31, 2013

Circuit Failures Jan 1, 2013 to Dec 31, 2013		
Station	Circuit	Frequency
T13C	E	25
SP	7	23
T1NW	4	17
SP	8	13
SR	15	13
NJ	10	13
T21S	ALL	13
SB	1&2	13
ND	7	13
NSM#20	B	13
SG	9	12
SG	11	12
NJ	8	12
T11S	2	12
SR	7	11
SP	2	11

Street Lighting Substations



DPW Street Lighting Program February, 2014

Substation Repair and Enclosure Maintenance

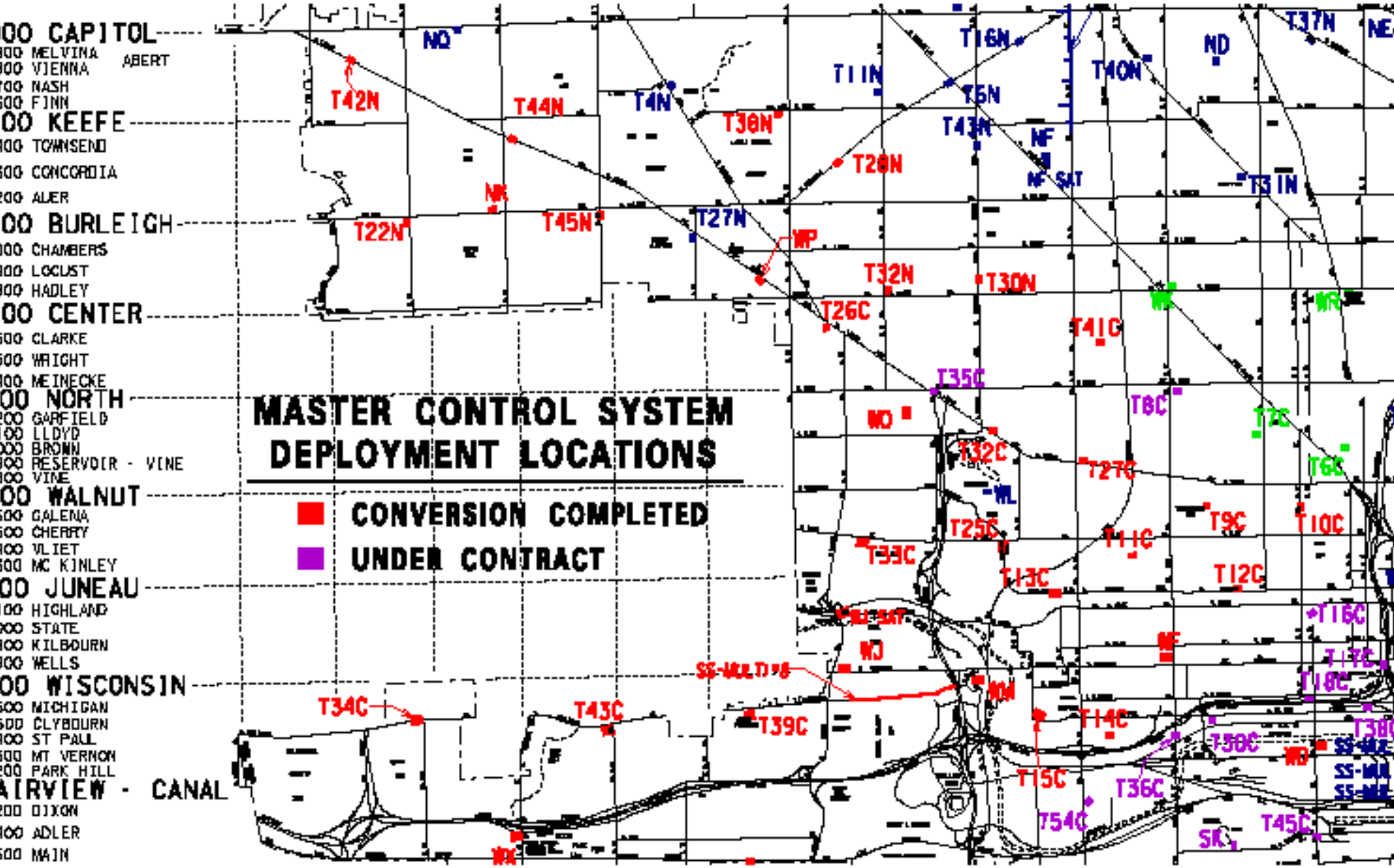
- Replace Deteriorated Enclosures
  - Necessary due to deterioration from Weather and Environmental Conditions
- Replace or Upgrade Major Electrical Components

Master Control System Replacement

- Advanced Computer Based Master Control System Currently Being Deployed
  - Utilizes Radio Communications System
  - Controls Street Light On and Off Times
  - Fail Safe System at Each Enclosure to Turn Lights On and Off if Communications System Fails
  - Monitor Operation of Each Street Lighting Circuit
    - Detect Circuit Failures as They Occur
    - Reduce Response Times to Re-light a Circuit
    - Aids in Trouble shooting of Electrical Problems

Master Control System Replacement (Cont.)

- Advanced Computer Based Master Control System Currently Being Deployed
  - Operational at 62 Stations
  - Design of an Additional 13 Stations to be completed in 2014, and Let to Contract in Late 2014 or Early 2015
  - System Anticipated to be Fully Operational in 2018 Based on Proposed Six Year Capital Improvement Program


00 CAPITOL
00 MELVINA
00 VIENNA
00 NASH
00 FINN
ABERT
00 KEEFE
00 TOWNSEND
00 CONCORDIA
00 ALER
00 BURLEIGH
00 CHAMBERS
00 LOCUST
00 HADLEY
00 CENTER
00 CLARKE
00 WRIGHT
00 MEINECKE
00 NORTH
00 GARFIELD
00 LLOYD
00 BROWN
00 RESERVOIR - VINE
00 VINE
00 WALNUT
00 GALENA
00 CHERRY
00 VLIET
00 MC KINLEY
00 JUNEAU
00 HIGHLAND
00 STATE
00 KILBOURN
00 WELLS
00 WISCONSIN
00 MICHIGAN
00 CLYBOURN
00 ST PAUL
00 MT VERNON
00 PARK HILL
AIRVIEW - CANAL
00 DIXON
00 ADLER
00 MAIN
MASTER CONTROL SYSTEM
DEPLOYMENT LOCATIONS
CONVERSION COMPLETED
UNDER CONTRACT
T42N
T44N
T4N
T11N
T16N
T40N
T37N
T5N
T43N
T30N
T28N
T31N
T22N
T45N
T27N
T32N
T30N
T26C
T41C
T35C
T6C
T7C
T32C
T27C
T25C
T9C
T10C
T33C
T11C
T13C
T12C
T16C
T17C
T18C
T34C
T43C
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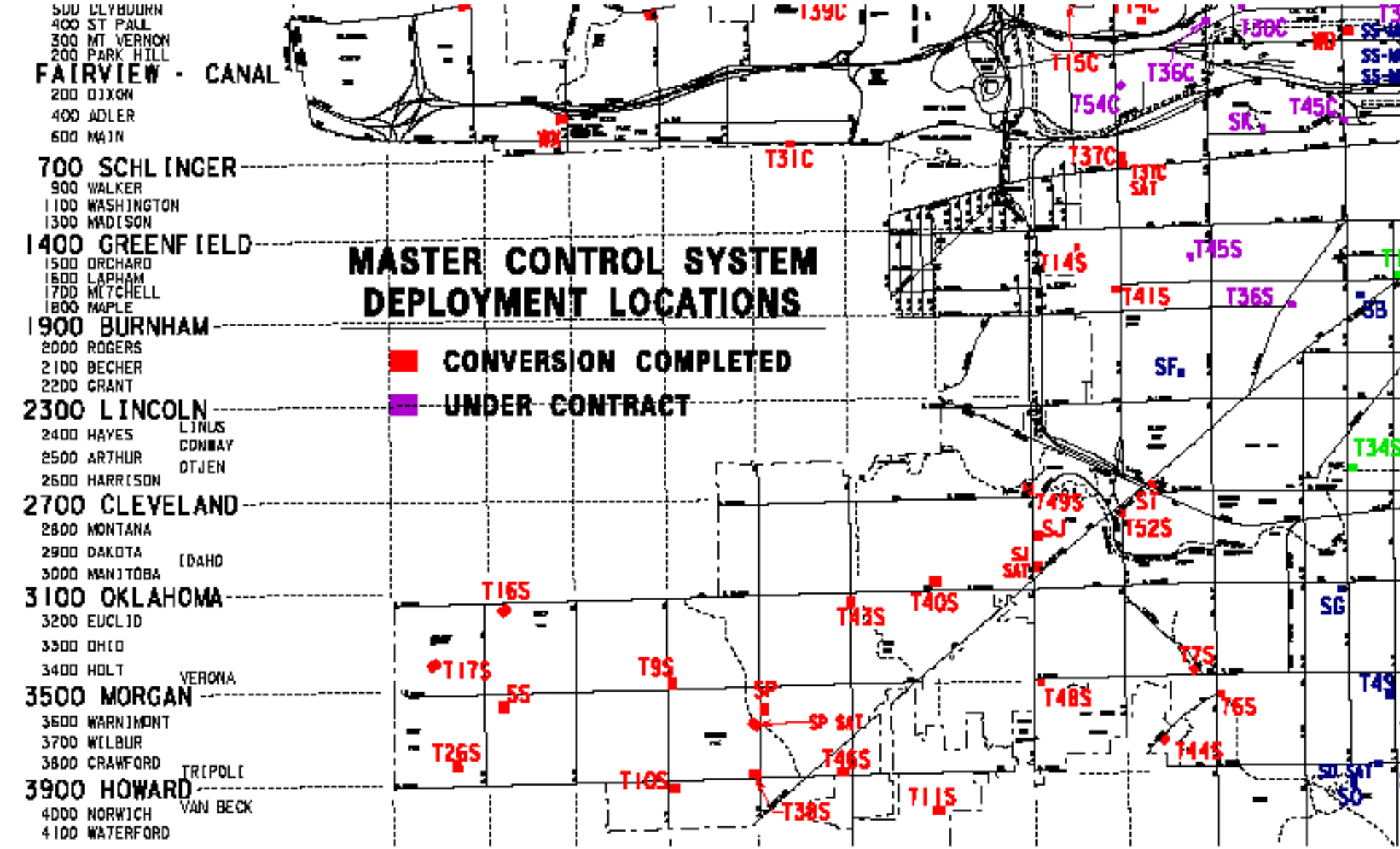
T14C
T38C
T15C
T36C
T54C
T45C


500 CLYBOURN
400 ST PAUL
300 MT VERNON
200 PARK HILL
FAIRVIEW - CANAL
200 DIXON
400 ADLER
600 MAIN
700 SCHLINGER
900 WALKER
1100 WASHINGTON
1300 MADISON
1400 GREENFIELD
1500 ORCHARD
1600 LAPHAM
1700 MITCHELL
1800 MAPLE
1900 BURNHAM
2000 ROGERS
2100 BECHER
2200 GRANT
2300 LINCOLN
2400 HAYES
2500 ARTHUR
2600 HARRISON
LINUS
CONWAY
OTJEN
2700 CLEVELAND
2800 MONTANA
2900 DAKOTA
3000 MANITOBA
IDAHO
3100 OKLAHOMA
3200 EUCLID
3300 OHIO
3400 HOLT
VERONA
3500 MORGAN
3600 WARNIMONT
3700 WILBUR
3800 CRAWFORD
TRIPOLI
3900 HOWARD
4000 NORWICH
4100 WATERFORD
VAN BECK
MASTER CONTROL SYSTEM
DEPLOYMENT LOCATIONS
CONVERSION COMPLETED
UNDER CONTRACT
T39C
T30C
T15C
T36C
T54C
T45C
T31C
T37C
T31C SAT
T14S
T45S
T41S
T36S
SF
T34S
T49S
SJ
T52S
SJ SAT
T16S
T40S
T48S
SG
T17S
T9S
T7S
SP
SS
SP SAT
T48S
T6S
T26S
T46S
T44S
T10S
T11S
T38S
SO

Other Pole, Cable and Equipment Upgrades

DPW Street Lighting Program February, 2014

Other Pole, Cable and Equipment Upgrades

- Provides Funding to Address Needs Not Funded Under Other Budget Elements
- Replace Deteriorated Poles
- Replace Failing Cable

Other Pole, Cable and Equipment Upgrades

- **Replacement of Deteriorated Decorative Steel Poles**
  - First Failures Occurred in Late 2007
  - Poles Inspected Every Year
  - Group Replacement to begin in 2014 on Shepherds Crook Style Lighting Fixtures if Capital Funds are Available

Corroded Steel Pole Bases

Other Pole, Cable and Equipment Upgrades

- **Replace Failed Double Harp Arms on Wisconsin Avenue**
  - Failure due to Corroded Aluminum Castings Found in Late Fall, 2012
  - Replacement of Corroded Arms Completed in 2013
  - Total Cost of Replacement was $545,000

Corroded Double Harp Arm

Uncollectable Knockdowns

DPW Street Lighting Program February, 2014

Uncollectable Pole and Equipment Knockdowns

- Applied to the Cost of Equipment Replacement Resulting From Traffic Accidents, Vandalism or Other Damage when Costs Cannot be Recovered from Parties Responsible For Damage
- First Included in Capital Program in 2004
- Total Expenditures of $370,000 for this Purpose for 2013 to Date ($468,000 in 2012)