# ATC PLANNING UPDATE

## Zone 2
## Transmission Business Briefing
## November 7, 2006


**Brett French**
**Senior Regional Manager**
**Customer Relations**

**Steve Feak**
**Principal Engineer**
**ATC Planning Zone 2**

# Planning Topics

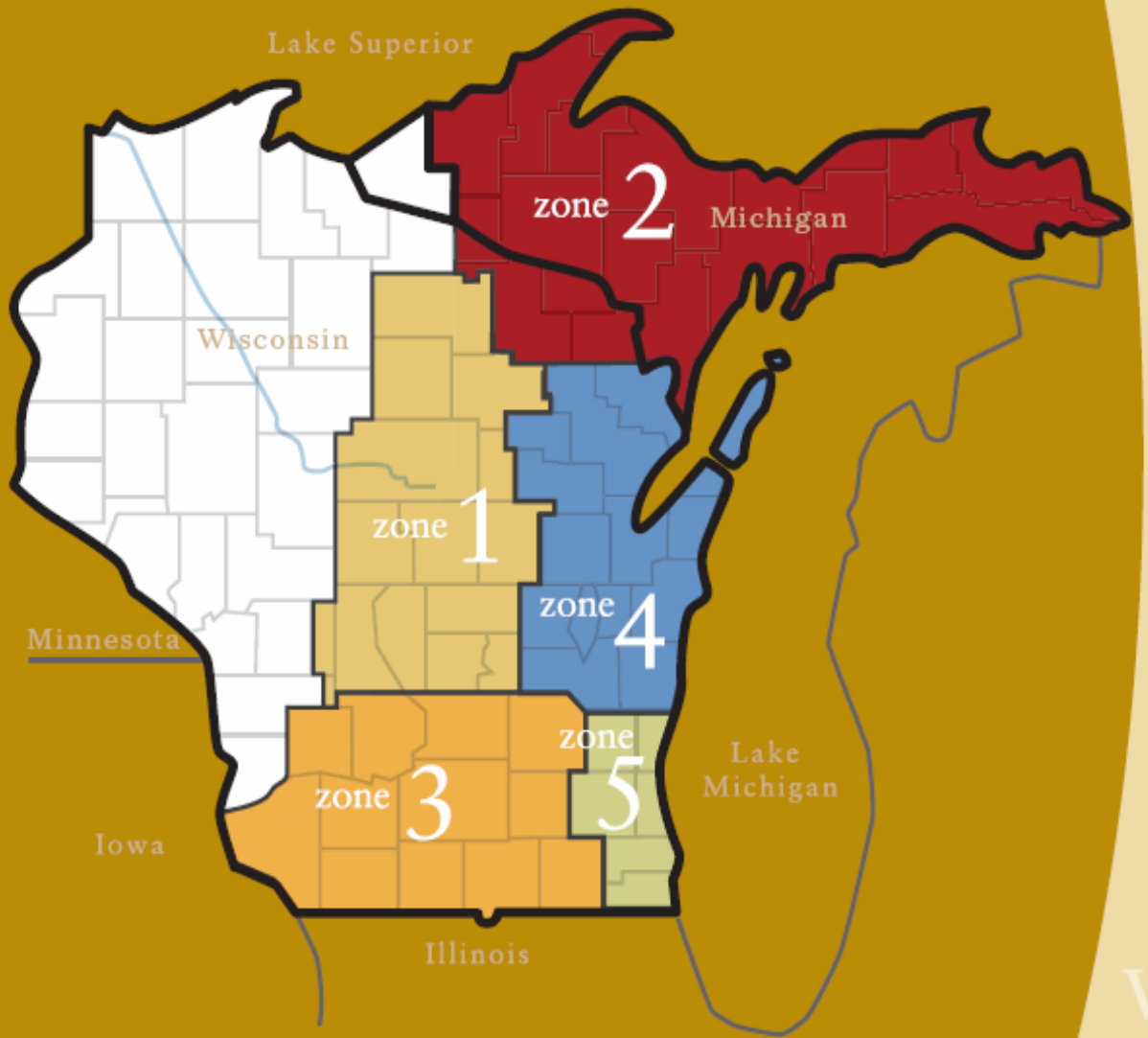
- **10 Year Assessment**
  - **Zone 2 Update**

- **Eastern Upper Peninsula**
  - **Asset Renewal**
  - **Local Load Serving**
  - **Loop Flow**

# 10 Year Assessment

- **ATC Planning processes are:**
  - **Continuous**
  - **Iterative**
  - **Transparent**
  - **Effectively performed at “Regional & Local” levels**
- **Annual Report posted in Fall**
  - **Full Report Posted on ATC Website November 8th**
    - **www.atcllc.com**
    - **Zone 2 Summary (see handout)**
- **Update posted in Spring**

# ATC Planning Zones

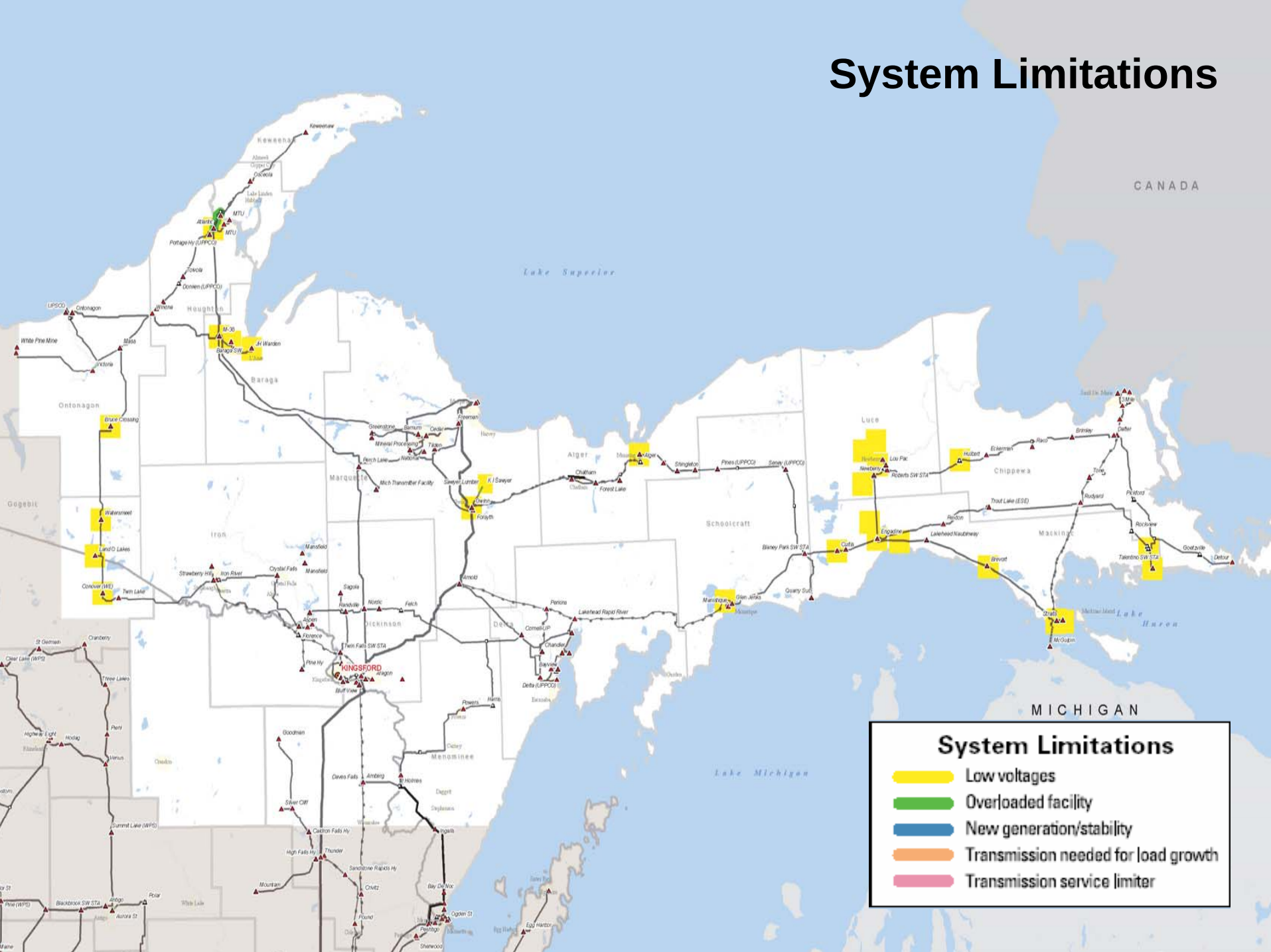



## ATC at a glance

- Formed in 2001 as the first multi-state, **transmission-only utility.**
- Owner and operator of approximately **8,900 miles of transmission line** and **460 substations.**
- Meeting electric needs of approximately **five million people.**
- Transmission facilities in **66 counties** in Wisconsin, Michigan and Illinois.
- **$1.3 billion** in total assets.
- **Seven offices** in the communities of Cottage Grove, De Pere, Madison, Waukesha and Wausau, Wis.; Kingsford, Mich.; and Washington DC.

www.atcllc.com

# System Limitations



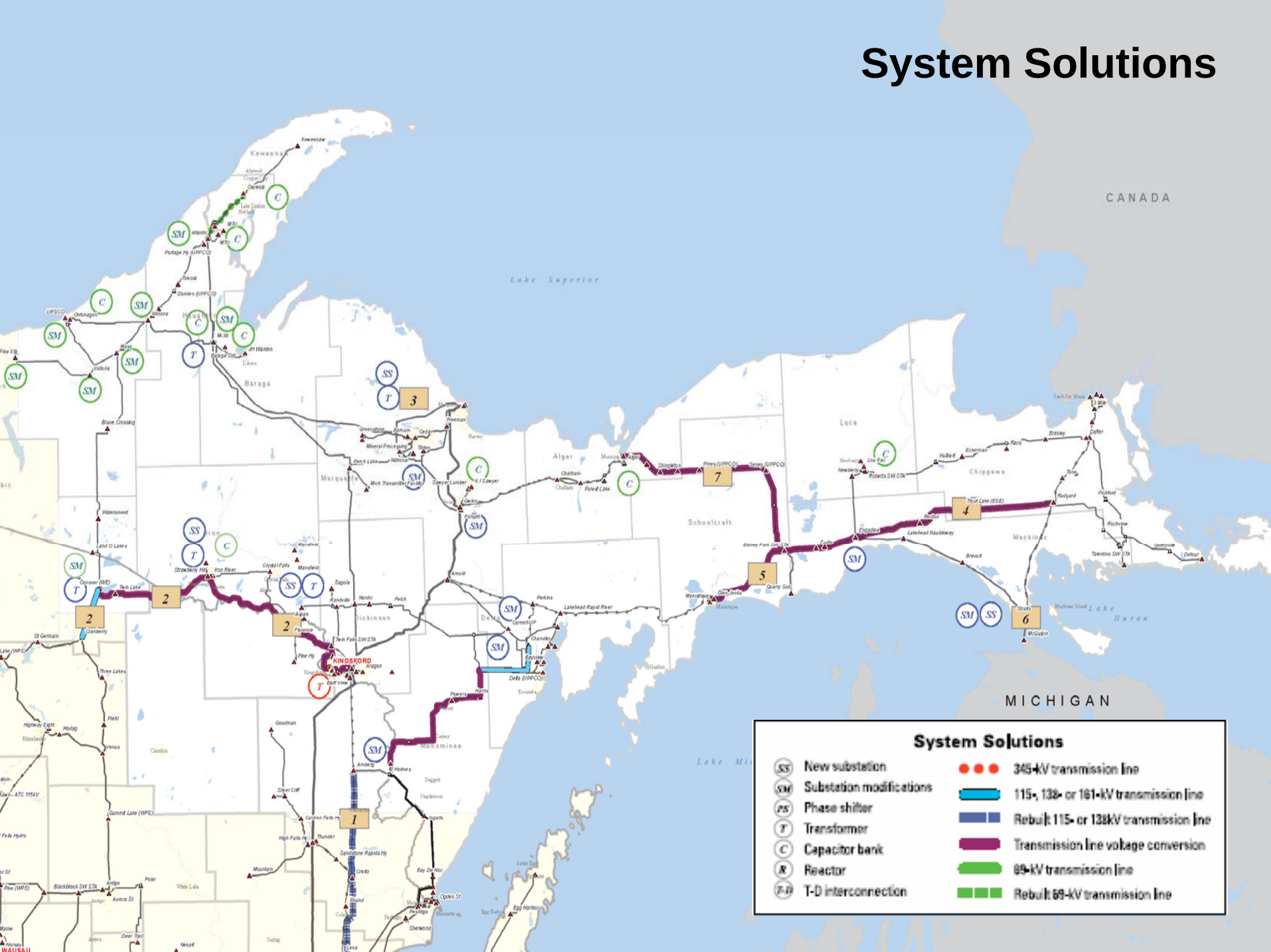
# ATC Project Categories

| Planned | Proposed | Provisional |
|---|---|---|
| Studies complete | Studies not complete | Studies not complete |
| Application pending or issued | None | None |
| Project in construction planning phase or under construction | Project identified as preferred alternative | Placeholder project; not necessarily a preferred project alternative |

# Zone 2 Summary Projects

| | Project description | In-service year | Need driver |
|---|---|---|---|
| | **Planned projects** | | |
| 1 | Stiles-Amberg double-circuit 138-kV line rebuild | 2006 | Improves reliability, helps increase import capability, reduces reliance on operating guides, lowers system losses |
| 2 | Cranberry-Conover 115-kV line and Conover-Iron River-Plains rebuild & conversion to 138 kV | 2008 | Part of Cranberry-Conover project (Zone 1) for Rhinelander Loop, improves voltage profile in the area, addresses aging facilities with condition issues |
| | **Proposed projects** | | |
| 3 | Relocate Cedar Substation (North Lake) | 2008 | Improves reliability in the area, addresses aging facilities in poor condition |
| 4 | Hiawatha-Pine River 69-kV line rebuild & conversion to 138 kV | 2009 | Addresses potential overloads of existing lines in the area, addresses aging facilities in poor condition, improves voltage profile in the area, accommodates future expansion in the area |
| | **Provisional projects** | | |
| 5 | Convert Hiawatha-Indian Lake double-circuit 69-kV line to 138-kV operation | TBD | Addresses chronic transmission service limitation, improves voltage profiles in the area, enhances value of another provisional project |
| 6 | Replace the existing Straits Substation (Mackinac) | TBD | Improves reliability in eastern UP, addresses substation facilities in poor condition, provides for future expansion |
| 7 | Blaney Park-Munising 69-kV line rebuild & conversion to 138 kV | 2012 | Addresses low voltages in the area, improves stability of Presque Isle generation, addresses aging facilities in poor condition |

# System Solutions



# Eastern U. P. Issues

- **Asset Renewal (Age & Condition)**
  - **Pine River Substation**
  - **Hiawatha – Pine River 69 kV circuit**
- **Local Load Serving (low voltage & overloads)**
  - **Case 1: Loss of Hiawatha – Straits 138 kV circuit**
  - **Case 2: Loss of Straits – McGulpin circuits**
  - **Loss of ESE hydro output (anchor ice)**
  - **High Voltage at Straits**
- **Loop Flow (voltage & overloads)**
  - **Case 3: Heavy West >> East flow**
  - **Case 4: System Split due to Heavy Flow**

# Case 1
# Loss of Hiawatha – Straits Circuit

## ISSUES:

- **Marginal Eastern U.P. system voltages (pre-contingency)**
- **Unacceptable voltages for loss of Hiawatha – Straits circuit**
- **Voltage issues exacerbated by heavy East >> West flows**
- **System split to manage heavy East >> West flow**

## SOLUTIONS:

- **Improved performance with the addition of:**
  - **Capacitors at Perkins, Indian Lake and Hiawatha substations**
  - **Construction of 138 kV substation at Hiawatha**
  - **Indian Lake – Hiawatha double circuit operated at 138 kV**
- **Splitting of system may still be required to manage heavy flows**

# Case 1
# Loss of Hiawatha – Straits Circuit

- **Segment 1:**
  - **2013 System Peak – no solutions applied**
    - **Marginal Eastern U.P. voltages**
    - **Outage of Hiawatha – Straits 138 kV circuit = inadequate voltages**
- **Segment 2:**
  - **Add H-IL double circuit 138 kV & Hiawatha 138 kV substation**
    - **Marginal Eastern U.P. voltages**
    - **Outage of Hiawatha – Straits 138 kV circuit = marginal voltages**
- **Segment 3:**
  - **Add 138 kV capacitors at Perkins, Indian Lake and Hiawatha**
    - **Marginal Eastern U.P. voltages**
    - **Outage of Hiawatha – Straits 138 kV circuit = marginal voltages**
- **Segment 4:**
  - **Add 138 kV capacitors, H – IL double circuit 138 kV & Hiawatha 138 kV SS**
    - **Acceptable Eastern U.P. voltages**
    - **Outage of Hiawatha – Straits 138 kV circuit = acceptable voltages**

# Case 2
# Loss of Straits – McGulpin Circuits

## ISSUES:

- **Voltage collapse occurs in Eastern U.P. for loss of both circuits**
- **Increased exposure risk when one circuit has been removed from service for repair/maintenance (late summer/fall 2006)**
- **Loss of both circuits has not occurred to date**

## SOLUTIONS:

- **Improved performance with the addition of:**
  - **Capacitors at Perkins, Indian Lake and Hiawatha substations**
  - **Construction of 138 kV substation at Hiawatha**
  - **Indian Lake – Hiawatha double circuit operated at 138 kV**

# Case 2
# Loss of Straits – McGulpin Circuits

- **Segment 1:**
  - **2013 System Peak – no solutions applied**
    - **Outage of Straits – McGulpin circuits = SYSTEM COLLAPSE**
- **Segment 2:**
  - **Add H-IL double circuit 138 kV & Hiawatha 138 kV substation**
    - **Outage of Straits – McGulpin circuits = inadequate voltages**
- **Segment 3:**
  - **Add 138 kV capacitors at Perkins, Indian Lake and Hiawatha**
    - **Outage of Straits – McGulpin circuits = inadequate voltages**
- **Segment 4:**
  - **Add 138 kV capacitors, H – IL double circuit 138 kV & Hiawatha 138 kV SS**
    - **Outage of Straits – McGulpin circuits = acceptable voltages**

# Case 3
# Heavy West >> East Flow

## ISSUES:

- Inadequate voltages at Perkins and Indian Lake
- Overloaded 138/69 kV Transformer at Indian Lake
- Overloaded Hiawatha – Indian Lake 69 kV circuit 6913
- Transfer Capacity limited to 113 MW at Indian Lake
- System split to manage heavy West >> East flow

## SOLUTIONS:

- Improved performance with the addition of:
  - Capacitors at Perkins, Indian Lake and Hiawatha substations
  - Construction of 138 kV substation at Hiawatha
  - Indian Lake – Hiawatha double circuit line operated at 138 kV
- Splitting of system may still be required to manage heavy flows

# Case 3
# Heavy West >> East Flow

- **Segment 1:**
  - 2013 System Peak – no solutions applied
    - Imports to LP cause heavy West >> East flow = inadequate voltages
- **Segment 2:**
  - Add 138 kV capacitors at Perkins, Indian Lake and Hiawatha
    - West >> East transfer capacity at Indian Lake = 113 MW
    - Outage of Indian Lake transformer No. 1 = overload of transformer No. 2
- **Segment 3:**
  - Add 138 kV capacitors at Perkins, Indian Lake and Hiawatha
    - West >> East transfer capacity at Indian Lake = 113 MW
    - Outage of H – IL circuit 6912 = overload of H – IL circuit 6913
- **Segment 4:**
  - Add 138 kV capacitors, H – IL double circuit 138 kV & Hiawatha 138 kV SS
    - West >> East transfer capacity at Indian Lake = 160 MW
    - Loss of Hiawatha – Straits 138 kV circuit = marginally acceptable loading on Pine River – Straits 69 kV circuit

# Case 4
# System Split due to Heavy Flow

## ISSUES:

- **Inadequate Eastern U.P. voltage for loss of Hiawatha – Straits 138 kV circuit when system is split**
- **System split to manage heavy West >> East or East >> West flow**
- **Occurring with increasing regularity and severity due to evolving system conditions**

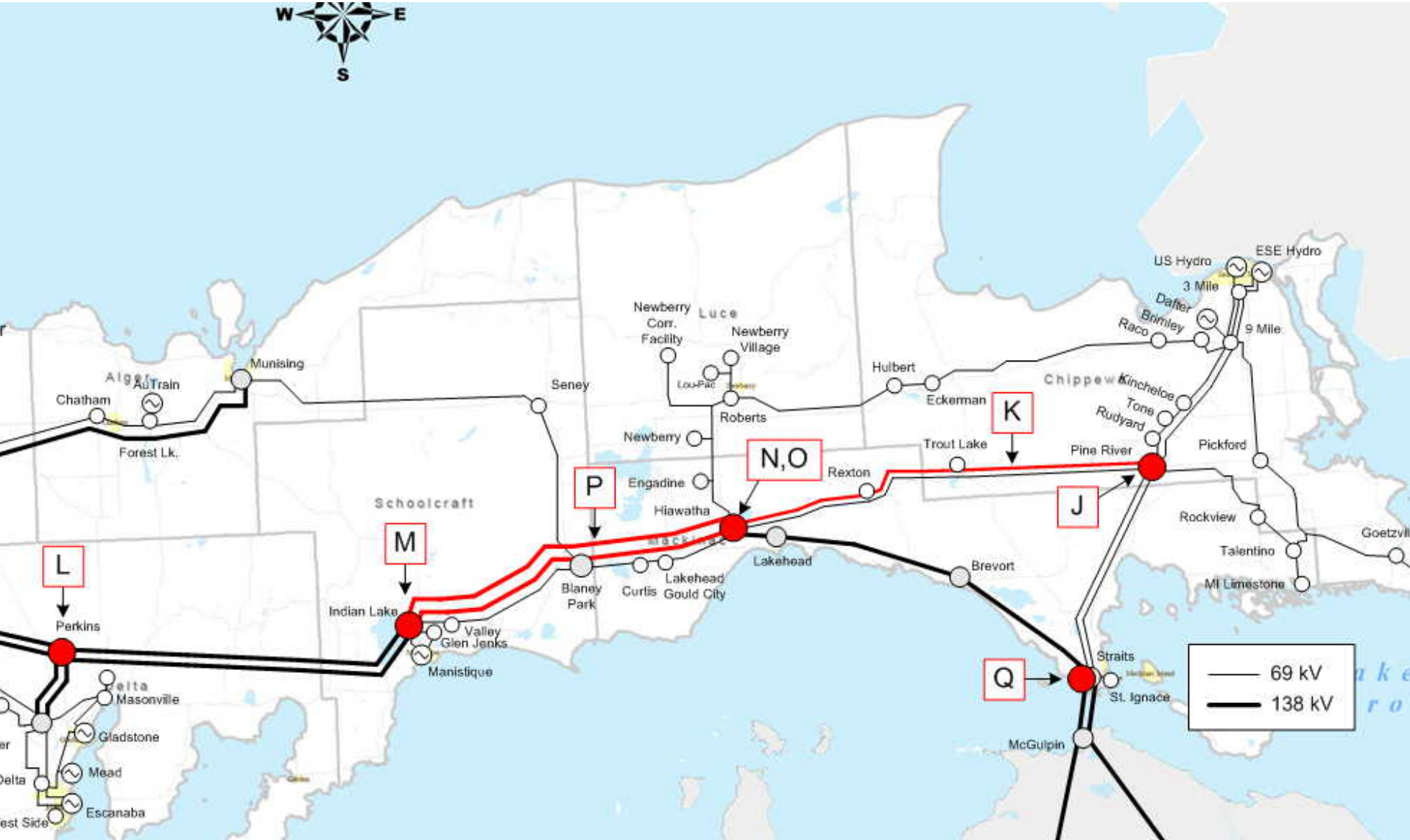
## SOLUTIONS:

- **Improved performance achieved with the addition of capacitors at Perkins, Indian Lake and Hiawatha substations**

# Case 4
# System Split due to Heavy Flow

- **Segment 1:**
  - **2013 System Peak – no solutions applied**
    - **Marginal Eastern U. P. voltages**
    - **Eastern U.P. system split (6912 @ Indian Lake and 6913 @ Hiawatha)**
    - **Outage of Hiawatha – Straits 138 kV circuit = inadequate voltages**
- **Segment 2:**
  - **Add 138 kV capacitors at Perkins, Indian Lake and Hiawatha**
    - **Acceptable Eastern U. P. voltages**
    - **Outage of Hiawatha – Straits 138 kV circuit = acceptable voltages**

# Eastern U. P. Solutions



# Eastern U. P. Summary

| Project Name | Key Need Drivers | Projected In-Service Date | Projected Cost | Status |
|---|---|---|---|---|
| **J**: Rebuild Pine River SS | Age & Condition | 3rd Quarter 2008 | ~ $5 M | Currently in "Pre-Approval" and Development to define project scope, cost and schedule |
| **K**: Rebuild Hiawatha – Pine River 69 kV Line | Age & Condition | 2010 | ~ $60 M | Will start "Pre-Approval" and Development to define project scope, cost and schedule in January 2007 |
| **L**: 138 kV CAP at Perkins SS | Low system voltages | TBD | TBD | "Proposed" - Studies Complete, Under Review |
| **M**: 138 kV CAP at Indian Lake SS | Low system voltages | TBD | TBD | "Proposed" - Studies Complete, Under Review |
| **N:** 138 CAP at Hiawatha SS | Low system voltages | TBD | TBD | "Proposed" - Studies Complete, Under Review |
| **O:** New Hiawatha 138 kV SS | Required for 138 kV line terminations and installation of 138 kV CAP | TBD | TBD | "Proposed" - Studies Complete, Under Review |
| **P:** Operate Hiawatha – Indian Lake double circuit at 138 kV | High equipment loadings; low voltages; limited transfer capability | TBD | TBD | "Proposed" - Studies Complete, Under Review |
| **Q:** New Mackinac 138/69 kV SS, install 138 kV Reactor | High voltage, System Protection, Age & Condition, Reliability | TBD | TBD | "Proposed" - Studies Complete, Under Review |

# Management of Heavy Flow

- **Proposed solutions won't resolve all "futures"**
  - Load reductions at Tilden or Empire Mines
  - Unit retirements at Presque Isle Power Plant
  - Increased imports to Lower Peninsula
  - Additional generation proposed at Escanaba
  - New generation proposed at Rogers City
  - Reduced ESE hydro output ("anchor ice" condition)
  - These "futures" exacerbate heavy flows

- **Continue to manage flow with "Operational" Solution**
  - Impact on Customers
    - MISO Day 2 Market
    - System Losses
    - Reliability
    - Access to Resources

- **Installation of "Flow Control" equipment**
  - Phase Shifter (Approximate cost: ~ $10 – $20M)
  - High Voltage DC Control (Approximate cost: ~ $20+M)
  - Management of flow reduces "system losses"

# FEEDBACK & QUESTIONS