2018 MN Power Systems Conference

Spill Prevention Control and Countermeasures (SPCC) - Planning & Development for Substations

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Spill Prevention Control & Countermeasures (SPCC) Regulation

Prevent "Oil" Release to "Navigable" Waters of the U.S.

1973 Federal Regulation
40 CFR 112

SPCC Applicability Criteria

1. Total volume of "oil" in "storage containers" at a "facility" ≥ 1320 gallons.
2. "Reasonable likelihood" oil discharge will reach navigable **"Water of the U.S." (WOTUS)**

SPCC History & Substations

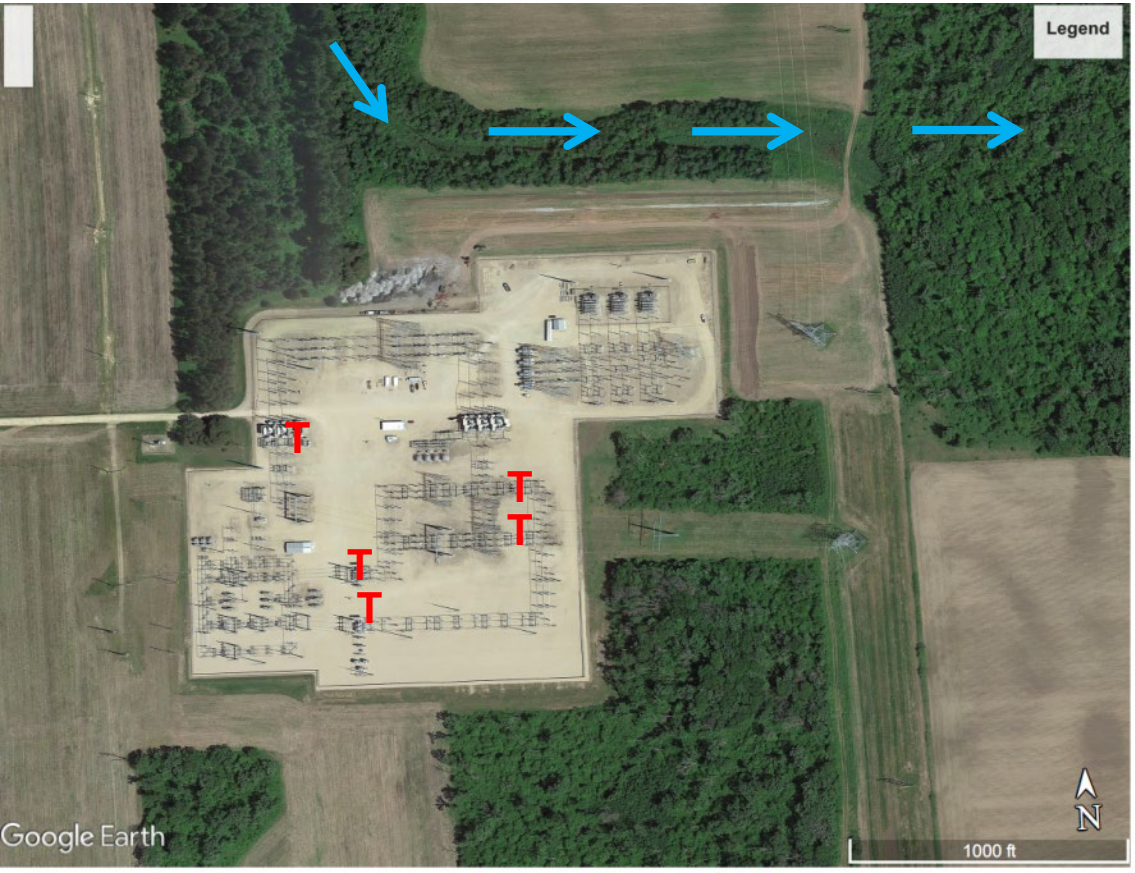
- Does transformer = "Oil Storage Container" ??
- 1991 EPA proposes including transformers
- Proposed rules 2002 – 2009, final 2011
- USWAG* lobbied EPA to shape final rule

**Utilities Solid Waste Activities Group*

2011 SPCC Amendments

- Added "Oil-Filled Operating Equipment" (OFOE)
  - ≥ 55 gal. capacity
  - Transformers, generators…
- Definition of "Facility" flexibility
  - Can split by operational oversite
  - Allows multi-facility SPCC plans

2011 Amendment - OFOE Containment



- "General Containment"
  - *vs sized & impermeable*
  - Oil release must not reach WOTUS
  - May consider gravel bed, topography, groundcover…

2011 Amendment - OFOE Containment

- **May adopt**
  "Alternative Requirements"
  - Clean discharge history,
  - Inspection program (PE approved),
  - Written contingency plan (per 40 CFR 109),
  - Senior management certification.

Option is selected instead of ensuring general containment

Utilities Response to SPCC Amendments

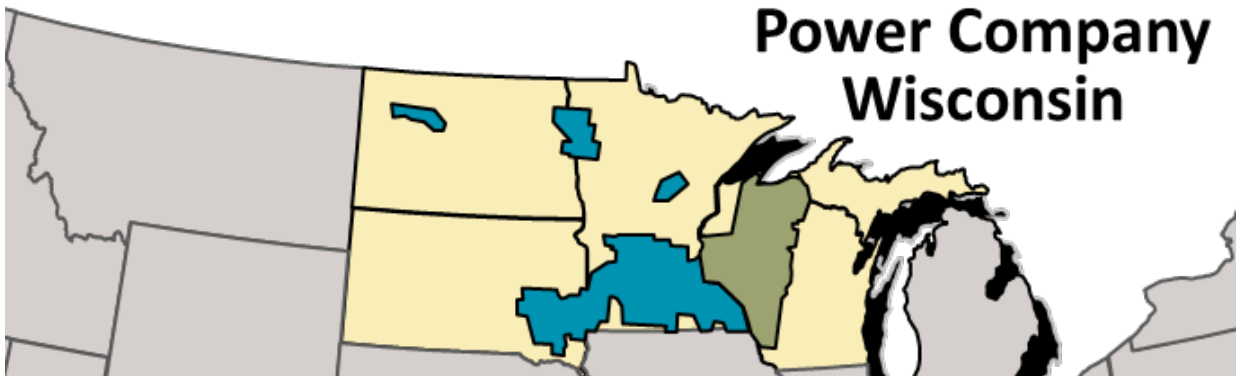
Containment All Subs	Site Specific Risk	Alternative Requirements
Low	**Risk Tolerance**	**High**
Available	**Resources $$**	**Limited**

NSP Substations History

Environmental & Substation Engineering Collaboration

- 1980's start SPCC plans/containment at risky sites
- 2008 Began site-specific evaluations using EPRI software – *(mostly w/o site visits) – Phase I*
- 2009 Began containment retrofits
- 2012 Evaluations redone w/site visits – Phase II
- 2020 Containment retrofits completed

2012 NSP Substation Evaluations



Over 500 Substations

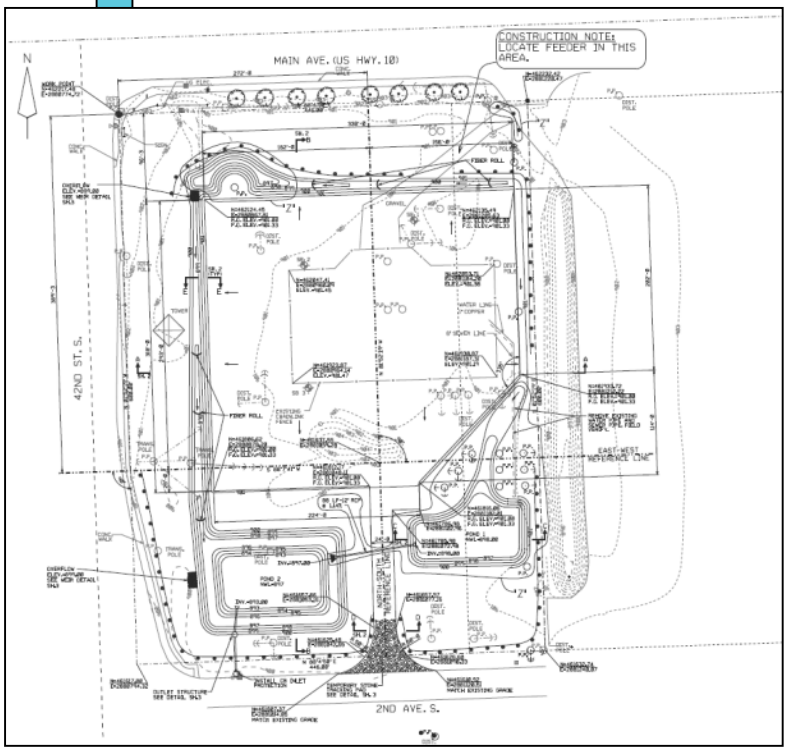
Environmental Services staff, interns & contractors

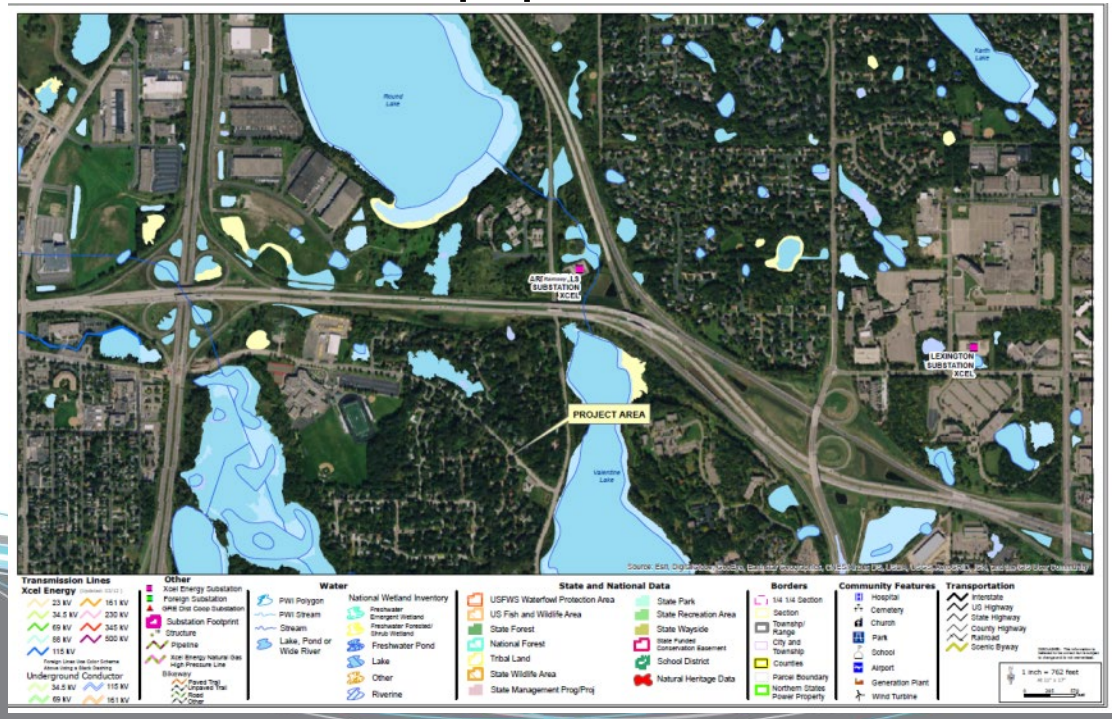
Substation SPCC Evaluation Process

- Gather Information
- Site Visit
- Determine discharge to WOTUS likelihood
- Document results
- Peer/ SME review

Gather Information

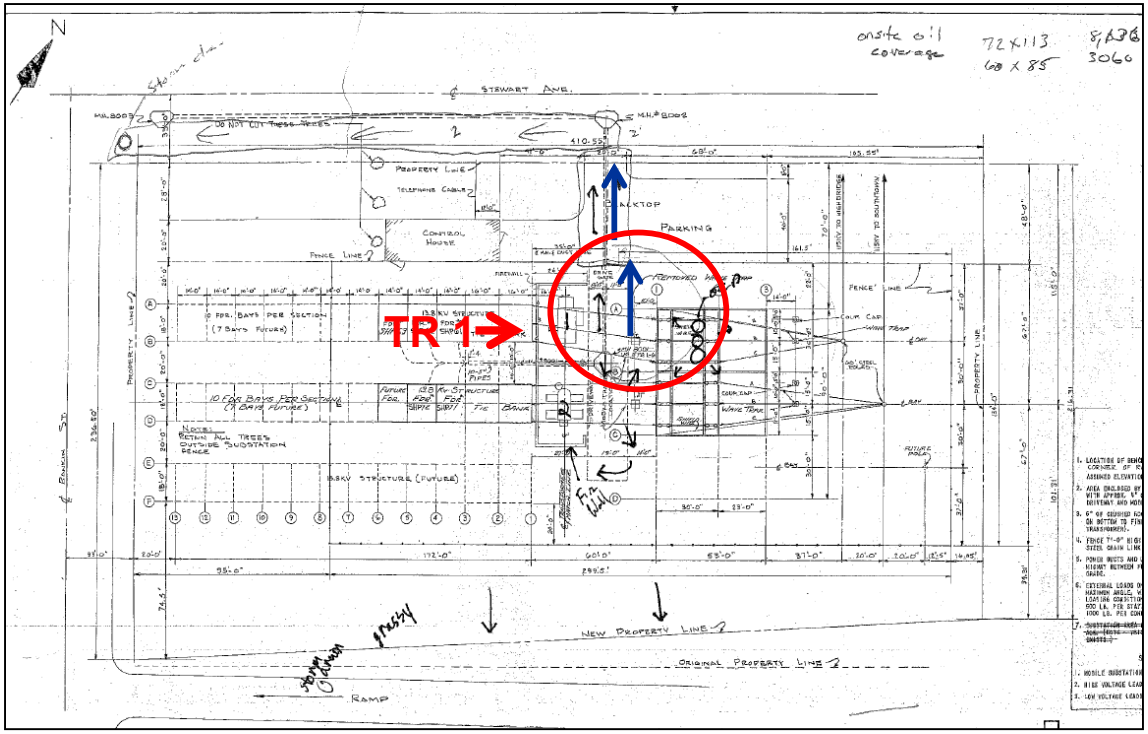
- Site engineering drawings
- Aerial & Topo maps
- State water/ wetland maps
- Stormwater system maps
- Previous equipment inventories



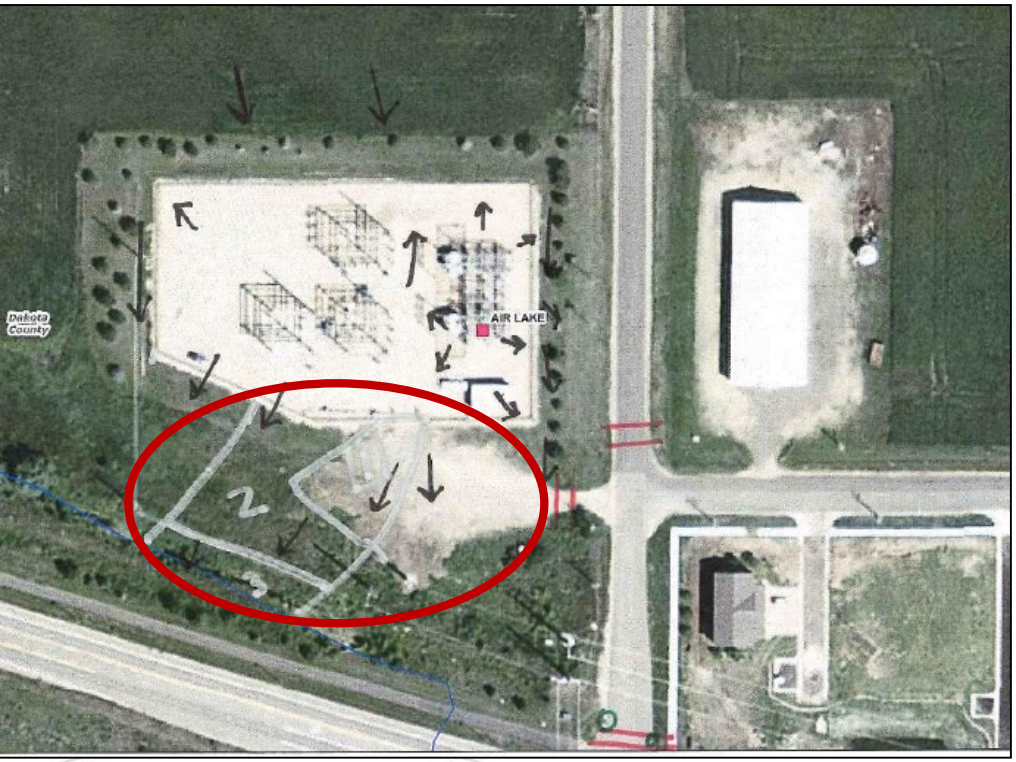


Site Visit Documentation - Substation

- Equipment inventory
- Sub drainage
- ID TR for modeling
- Estimate oil discharge coverage
- Surface cover



Site Visit Documentation - Offsite



- Quantify offsite Sections
  - From Substation to water (WOTUS)
  - Similar characteristics: surface cover, slope, soil

Site Visit Documentation - Offsite

- End-Point WOTUS
  - Lakes, rivers
  - Tributaries to WOTUS
  - Storm drains to WOTUS
  - Wetlands & stormwater ponds connected to WOTUS

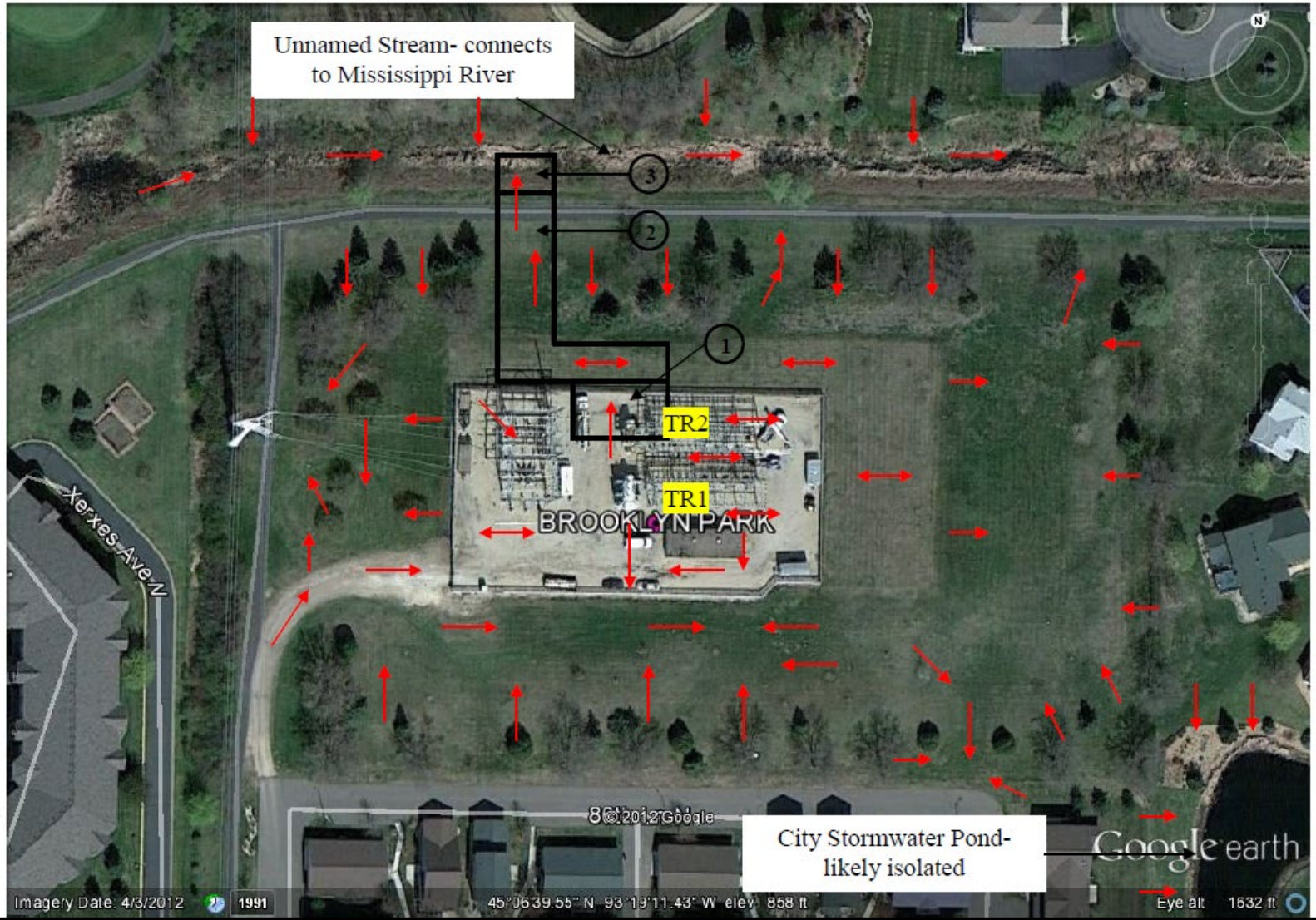
Site Visit Documentation

Site Visit Documentation

Key

- Runoff
- Storm Drain
- Culvert
- Buffer
- R.R.
- Man-Made Structures
- Distance

1. Footprint Area ~ 1,800 ft2, Slope ~1%
2. Moses Section 1, ~240'x 25', Grass, Slope 1%
3. Moses Section 2, ~20'x 25', Dense Weeds/Water Plants, Slope 2%



Site Visit Documentation

Key

- Runoff
- Storm Drain
- Culvert
- Buffer
- R.R.
- Man-Made Structures
- Distance

(1) Footprint Area~1,350 ft2, Slope ~1%

(2) Discussion Section 1 ~200'x 20', Tall Grass/Weeds/ Brush, Slope ~5%

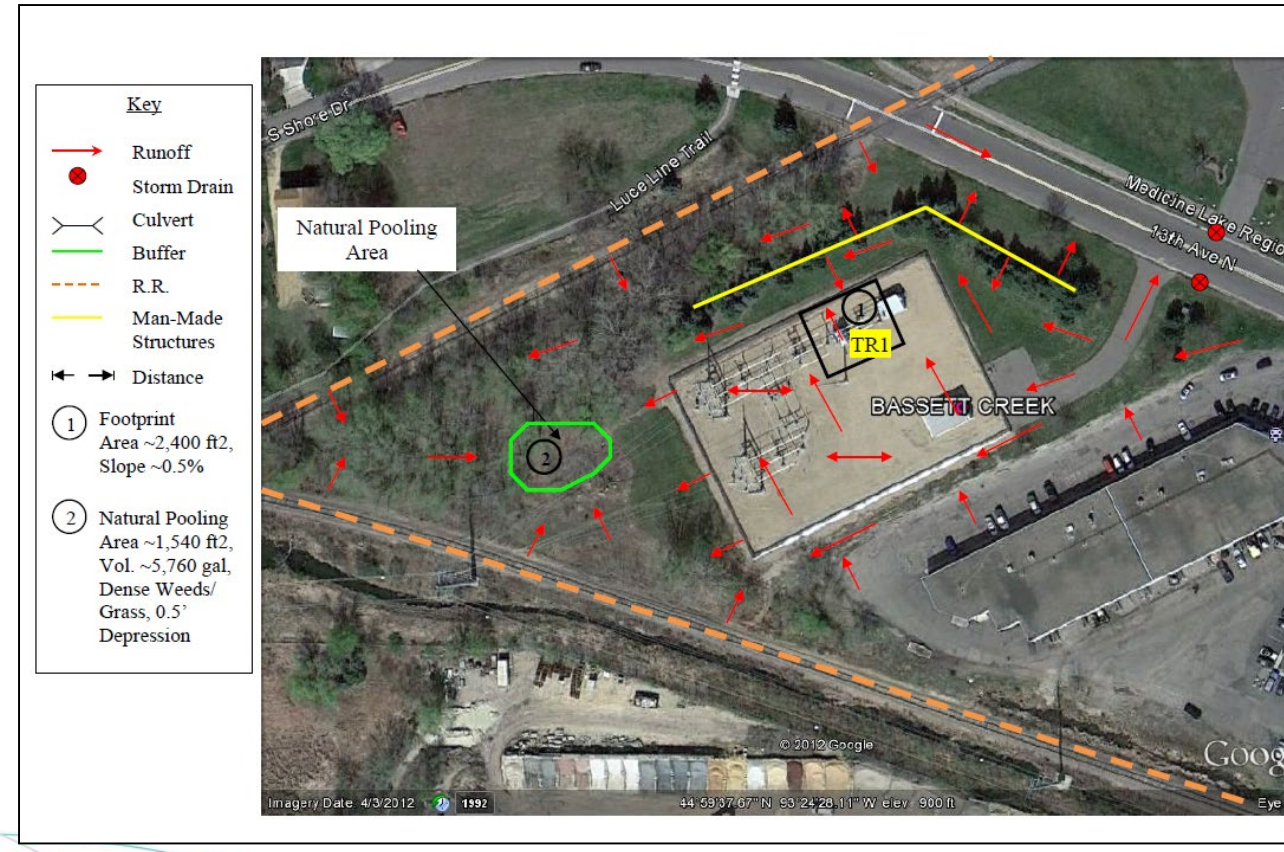
(3) Natural Pooling Area ~2,940 ft2, Vol. ~87,970 gal, Pond/Weeds ~4' Deep

Discharge to WOTUS Likelihood

- Obvious **Yes/ No**

  OR

- EPRI Mineral Oil Spill Evaluation System (MOSES) program

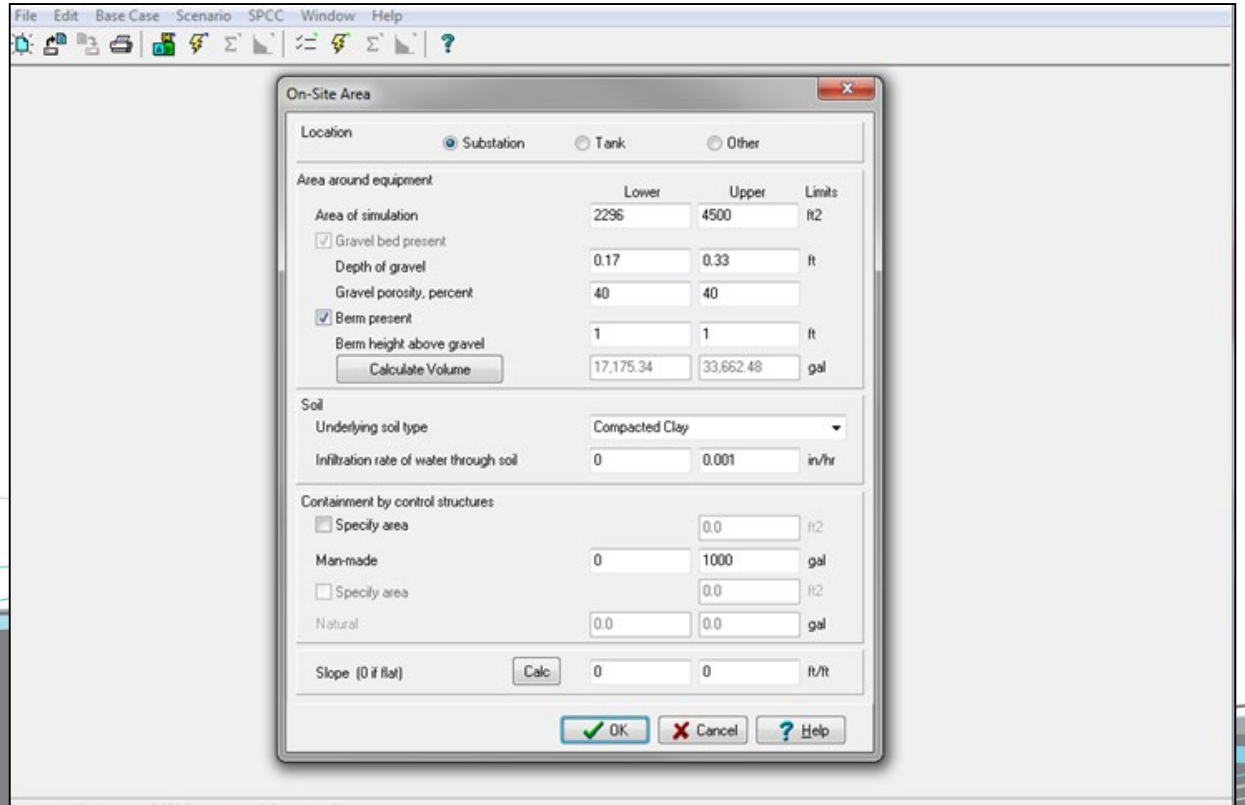


EPRI MOSES Model Inputs

- Oil volume - 100% of largest/ highest risk TR
- Oil coverage area and characteristics
- Distance to water…
- Soils & frozen days/year
- Precipitation
  - Average annual
  - Days rain/ yr
  - 25 year max
- Cannot consider manmade features
  - For SPCC coverage
  - Dikes & ditches
  - Stormwater ponds

EPRI MOSES Modelling

- Model runs simulations w/ combinations of weather/climate & input ranges
- Used 20,000 runs per EPRI



MOSES Output Report

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                MOSES-MP
            Overland Flow - Base Case

Setup - General

Substation Name:                Air Lake
Substation Location:            MN
Minimum reportable quantity:    1                gal
More Setup information is located at end of input data.

On-Site Area

Location
        (X) Substation          ( ) Tank                ( ) Other
Area around equipment, tank, or spill        Lower          Upper
        Area of simulation:                  12000          13000          ft2
        (X) Gravel bed present
        Depth of gravel:                     0.17           0.33           ft
        Gravel porosity, %:                  40             40
        ( ) Berm present
        Berm height above gravel             NA             NA             ft
Soil
        Underlying soil type:                Sandy Loam
        Infiltration of water through soil:  0.3            0.7            in/hr
Containment by control structures
        Man-made:                            0              0
        Natural:                             NA             NA
Slope:                                       0.01           0.012


Off-Site Section Description, Section 1 of 3

Dimensions                                          Lower          Up
        Total distance to surface water or drain:   220            24
        Length of section in flow direction:        60             65
        Section Type  ( ) Close pipe  (X) Open channel
        Width of potential channel:
                ( ) Automatic  (X) Manual           60             65
Containment by control structures
        Manmade:                                    0              0
        Natural:                                    0              0
Soil
        Underlying soil type:                       Sandy Loam
        Infiltration rate of water through soil:    0.3            0.
        Land slope:                                 0.01           0.

        Cover type:                                 Gravel
        Manning's n:                                0.015          0.
        Gravel depth, in: 0.2                       Porosity:      0.
```

- Lists all inputs
- Output - probability oil reaches end-point WOTUS

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Summary of Results for Base Case

General

Calculated Probability                          Initial        Recalculated
        Probability of spill occuring:          1.0            1
        Spill remaining on gravel bed:          0              0

        Number          All                     Probability of Spill Reaching
        of Days         Conditions              Surface Water
        Dry             14003                   1              1
        Wet             5997                    1              1
        All             20000                   1              1

        Probabilties include frozen conditions

        Number          Frozen
        of Days         Conditions
        Dry             4563
        Wet             2002
        All             6565

Spill contained on land
        Maximum distance travelled:                    NA              ft
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Evaluation Challenges/ Discoveries

- Substation drainage
- Contain. For multiple TR's in Sub:
  - All based on worst case
  - Where appropriate model individual TR's
- Complex path to WOTUS
  - Long distances
  - Through numerous wetlands/ waters before reach WOTUS
- Used conservative values when in doubt

Discharge Evaluation Results & Company Risk Management

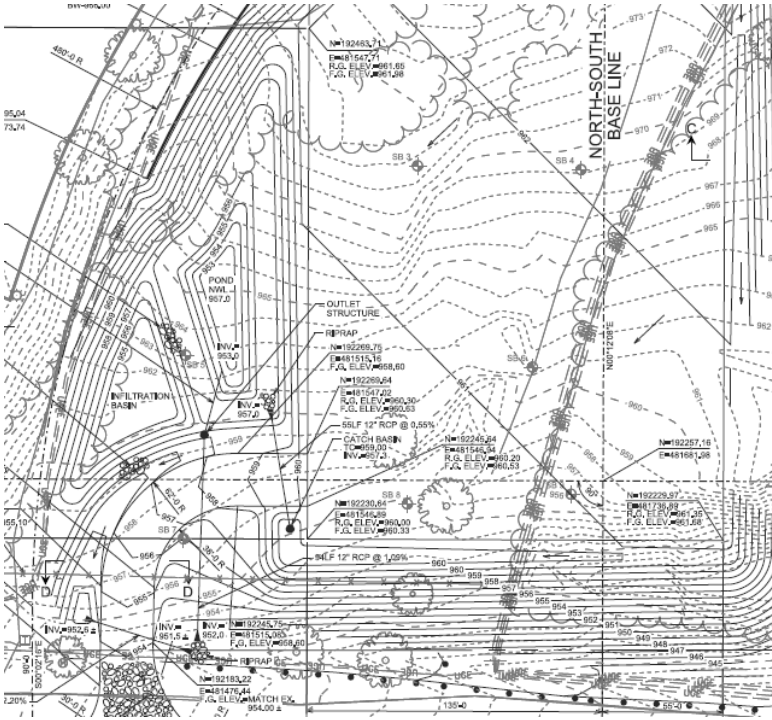
- Management/ Legal set MOSES threshold for SPCC coverage
- Also set threshold for requiring containment
- Substation Engineering coordinates retrofits

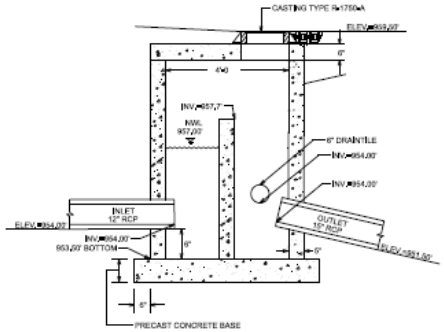
Containment Options

- Concrete dike – *most common*
- Fiberglass walls – *if limitations*

Containment Options

- Clay berms or ditches
- Pond w/ controlled outlet
  - Often required at new sub
- UG vaults in XE Colorado





POND OUTLET STRUCTURE DETAIL

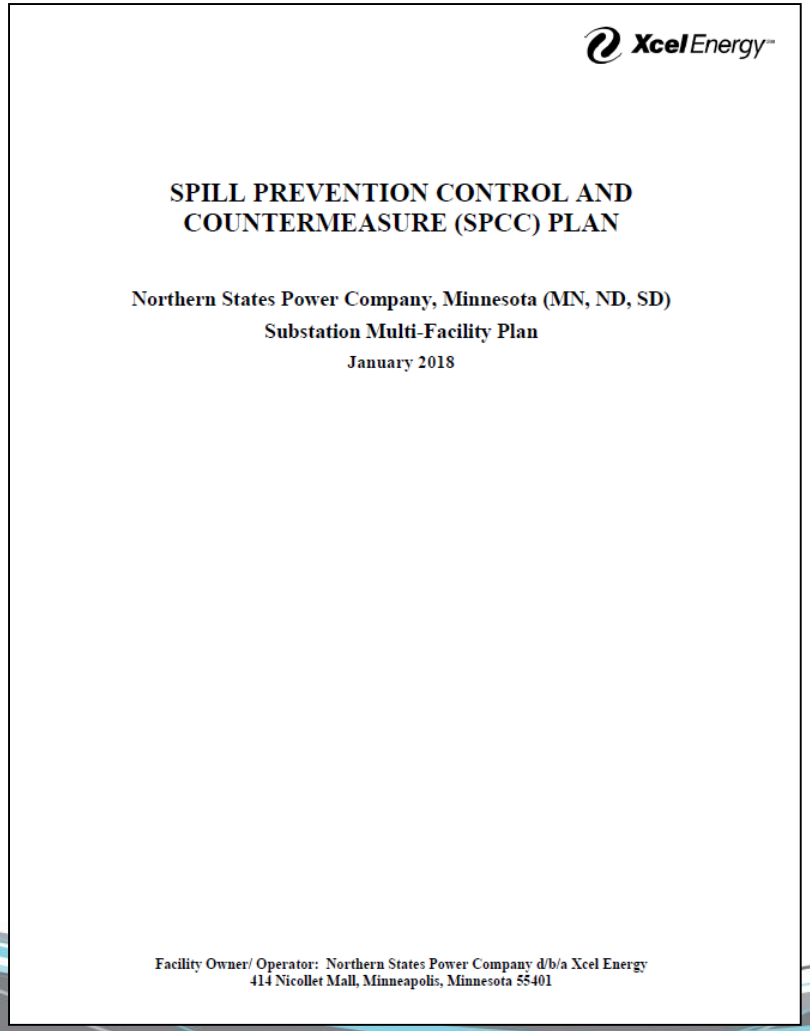
SCALE: NONE

NSP Evaluation Results

- ~ 400 evaluations performed
- ~180 Subs identified as subject to SPCC
- SPCC Substations Multi-facility plans
  - NSP MN
  - NSP WI
- 25 Subs under co-located plant SPCC plan

SPCC Multi-Facility Plan

- Lists covered subs
- Evaluation process
- Site documents location (SharePoint)
- Prevention measures
- Inspections program
- Oil release response
- Training



Xcel Energy

SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC) PLAN

Northern States Power Company, Minnesota (MN, ND, SD)
Substation Multi-Facility Plan
January 2018

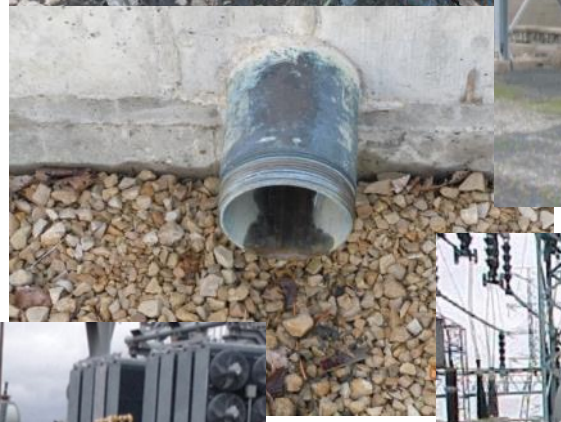
Facility Owner/ Operator: Northern States Power Company d/b/a Xcel Energy
414 Nicollet Mall, Minneapolis, Minnesota 55401

Substation Construction/ Modification SPCC Evaluation

- <u>Required whenever</u>
  - Designing new substations,
  - Adding transformers/ oil-filled equipment,
  - Replacing existing TRs/ oil-filled equipment
- Sub Engineering requests evaluation by Environmental Services.
- Documented in Project Design Guide

SPCC O&M Issues

- Containment maintenance
- Stormwater discharge
- Temp tank containment



Questions/Discussion

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