A Case For the Formation of a Subcommittee to Develop a NAPL* Management Approach under Act 2

*LNAPL – light non-aqueous phase liquid, e.g., gasoline

New Understanding Should Move LNAPL Projects Forward

- LNAPL Technology is redefining the understanding of the problems and leading to possible new solutions
- Regulations have not kept up with the new technical understanding
- Many attitudes based upon old beliefs impair the ability to make progress on sites
- Several states and EPA are working toward new approaches to managing LNAPL.

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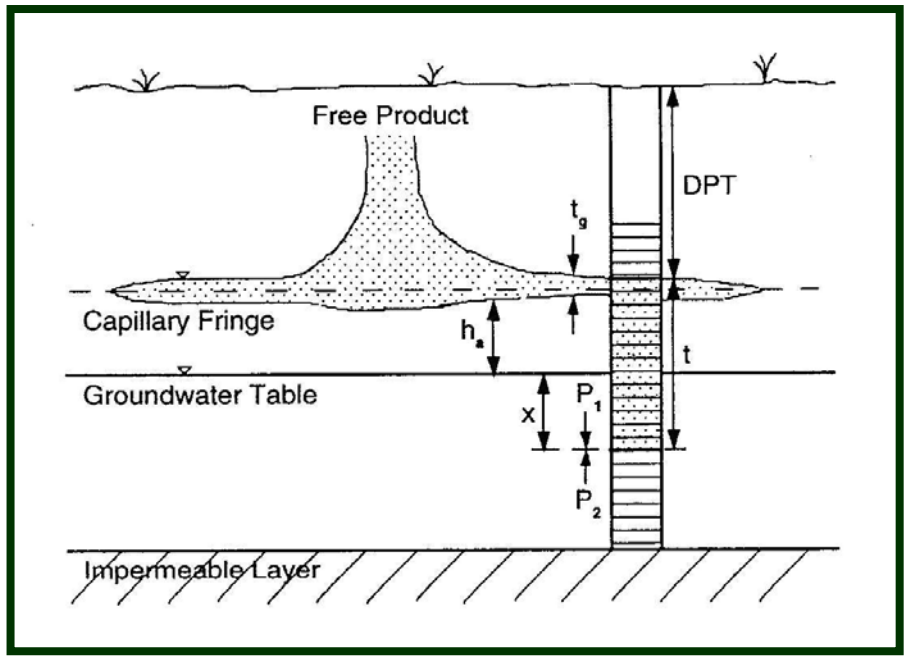
LNAPL in Porous Media
The Classical Conceptual Model – "The Pancake"

- LNAPL floats on the WT or Capillary fringe (Van Dam, 1967)
- LNAPL does not penetrate below the water-table
- LNAPL forms a pancake like lens of uniformly high saturation
- Thickness of gas in a well is 2-3 (4)times that in the dirt (Kramer 1982)
- If you see LNAPL in a well it is mobile and migrating
- Our LNAPL problem is completely analogous to petroleum engineering



From: Ballestero et al, 1994

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There is a New Paradigm for LNAPL

- The LNAPL pancake is the exception – not the rule
- LNAPL saturation and it's volume can be understood and quantified
- The conductivity of LNAPL: can be calculated
- The hydraulic recovery of LNAPL can be predicted
- This requires an understanding of the science, common sense, and good judgment
- So – what does this mean??

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It Means:

- We have a much improved understanding of the sites:
  - LNAPL distribution
  - LNAPL saturations and volumes
  - LNAPL movement
  - LNAPL recovery
- We can have discussions based upon good science
- This is helpful in setting expectations for LNAPL recovery

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What is Going On?

- Technical Advances are continuing
- ASTM is developing a standard for LNAPL Evaluation
- Training materials are under review by State and Federal technical and regulatory experts and should be available this year
- EPA and State programs are:
  - Developing approaches consistent with their current regulations and stakeholder desires to develop LNAPL management plans that make sense to all
  - Some states are considering regulatory change

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Historical Regulatory Perspectives on NAPL

The general regulatory view:

- Recover NAPL to the maximum extent practicable….
- Remove principle threat wastes…

Experience:

- When finished? What are the specific objectives?
- Minimal NAPL characterization
- Ineffective technology application
- Delayed closures & backlogs
- Over-allocation of limited resources

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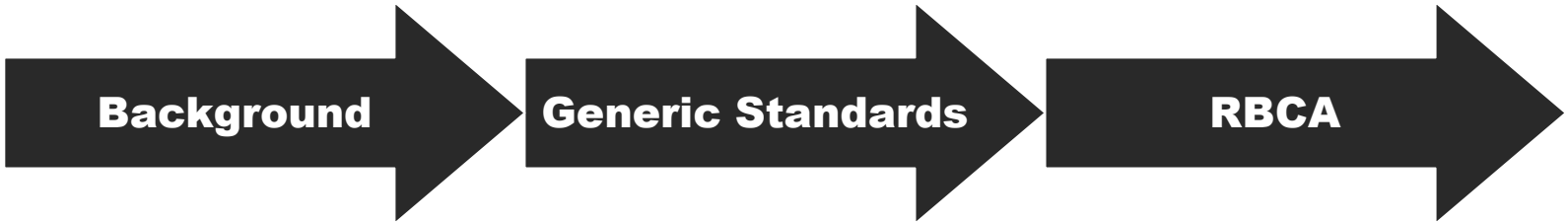
Tyner & Clarke, TCEQ, 2004

The NAPL Disconnect

Corrective Action Strategy Evolution



NAPL Strategy Evolution

KEY POINT: Shouldn't the NAPL strategy reflect the corrective action strategy?

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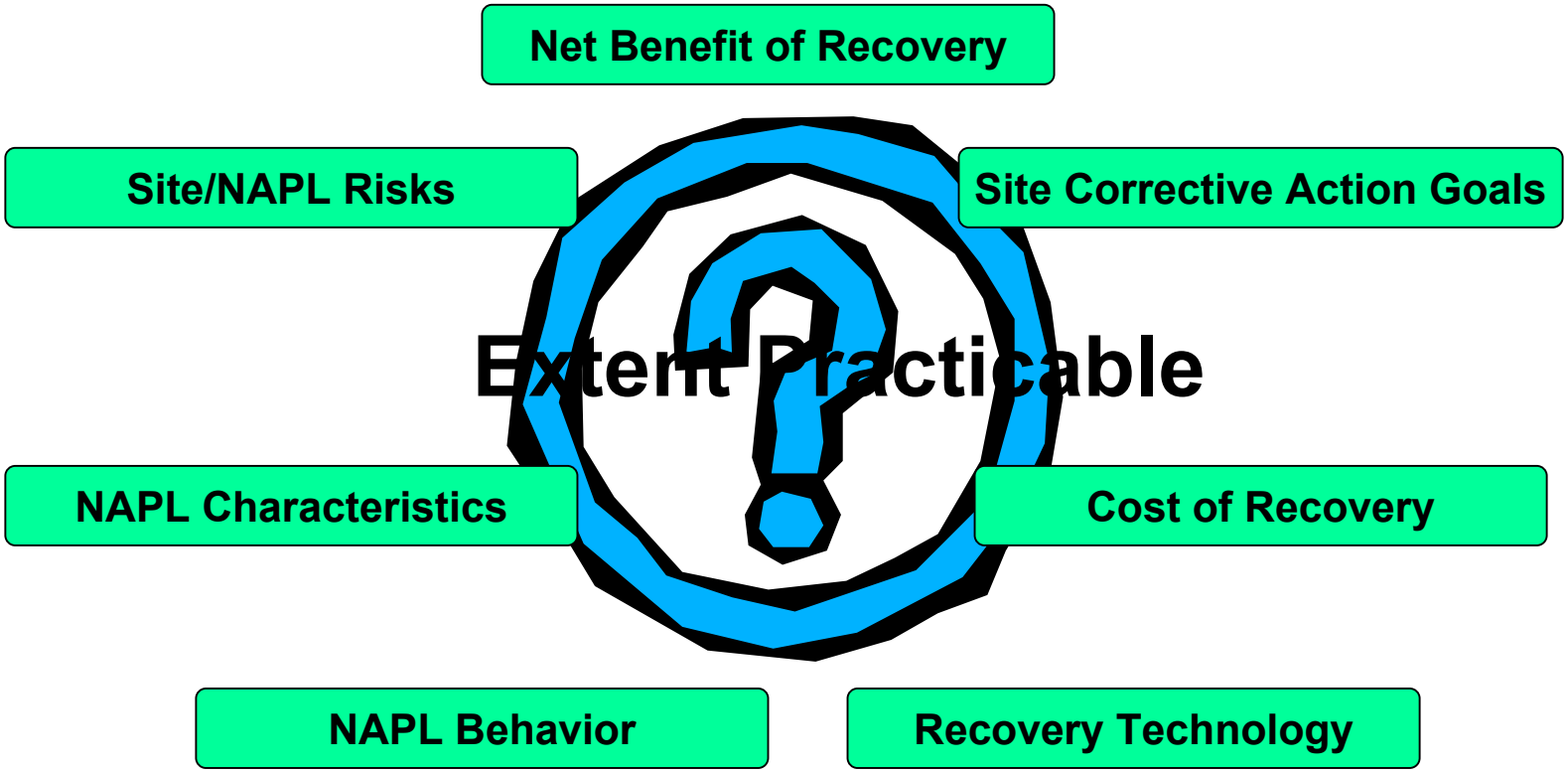
Tyner & Clarke, TCEQ, 2004

The Big Mystery



KEY POINT: *Extent Practicable* is performance-based terminology, should fit well with RBCA strategy.

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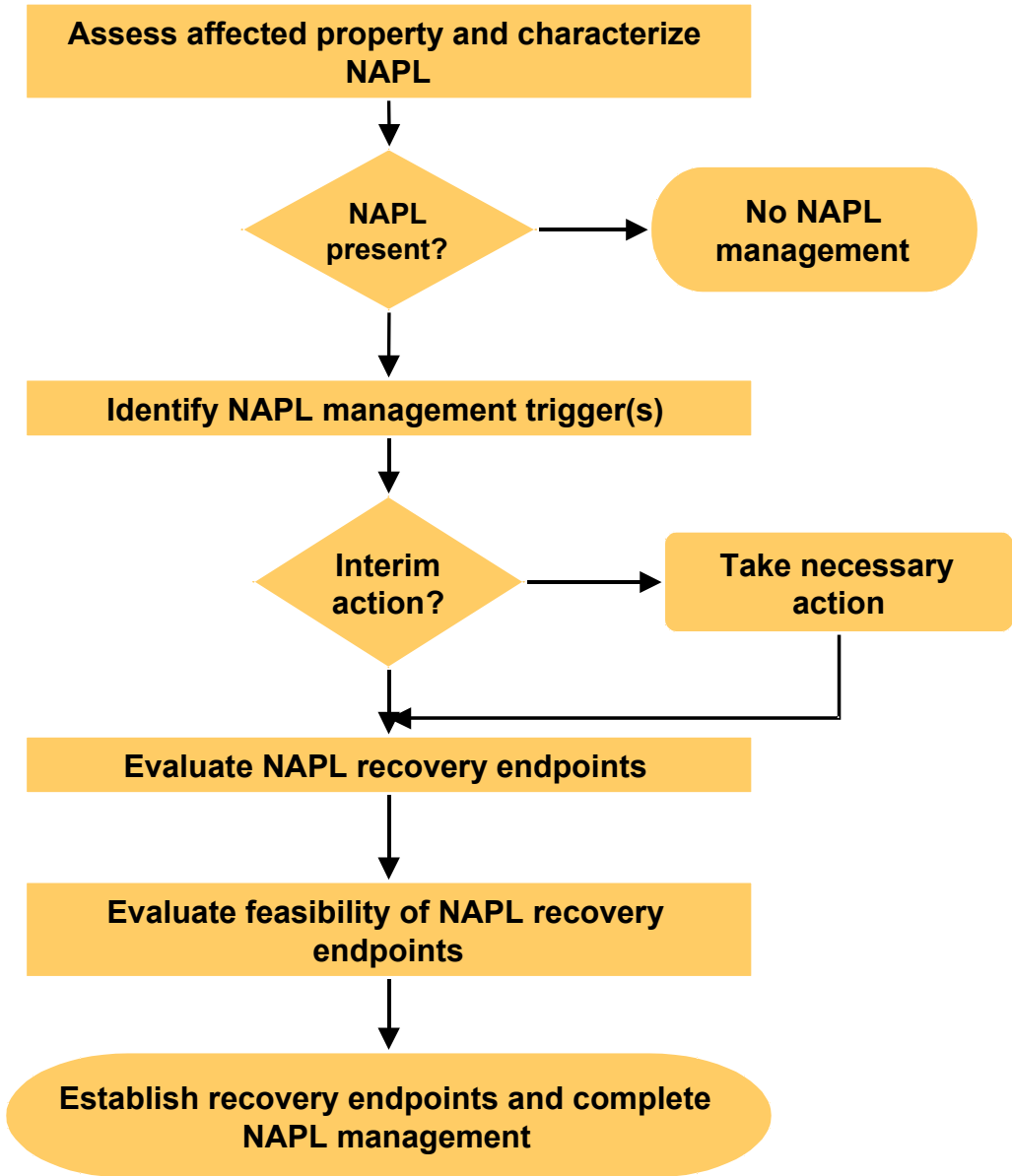
Tyner & Clarke, TCEQ, 2004

NAPL Management –
recovery or control of NAPL

NAPL recovery –
removal or decontamination



Texas Risk Reduction Program

RBCA regulation for:

LUST

Hazardous Waste

Superfund

Voluntary Cleanup

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Tyner & Clarke, TCEQ, 2004

LNAPL Cleanup Alliance RTDF

- Currently an EPA TIO, EPA OSW, EPA Region 8, Wyoming, and Industry initiative, but recent participation by many states and EPA Regions.
- Develop LNAPL Management Plan
  - Develop a process to determine Reasonable and Practical Endpoints
  - Meet needs of all stakeholders
- Train regulators and consultants in LNAPL technology
- Test Innovative Technologies: Steam, Surfactants, etc.

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A Decision-Making Framework for Cleanup of Sites Impacted with LNAPL

1. Goals: Owner, Regulator, Stakeholders
2. Regulatory Structure
3. LNAPL History and Current Situation – Sources, type, extent, recovery, EI Status, geology, regulatory and community setting
4. Expected Facility Future Land Use
5. Existing and Future Potential Receptors
6. Technologies considered and proposed – costs, satisfaction of aspirations, others.
7. Proposed endpoints and how they result in managing risk – plume longevity, mobility reduction, vapor issues, points of compliance, etc.
8. Long Term Site Management
   - > Institutional and engineering controls
   - > Schedule and time frame
   - > Land and groundwater uses
   - > Monitor compliance and performance

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Example: LNAPL Management Plan; EPA Region 8 and Wyoming

- **RCRA site 250 acres underlain by residual hydrocarbons**
- **Local community and city desire reuse**
- **180 acres of LNAPL may migrate**
- **Remedy Decision: LNAPL recovery is required**
  - Where LNAPL with the potential to migrate exists within 300 ft of downgradient boundary
  - Where LNAPL is a source of benzene to groundwater
- **Hydraulic conductivities 240-350 ft/day**
- **DTW 8-12 ft**
- **Gasoline, diesel, lube oil, and composite**
- **Currently, 300,000 gal per year of recovery**

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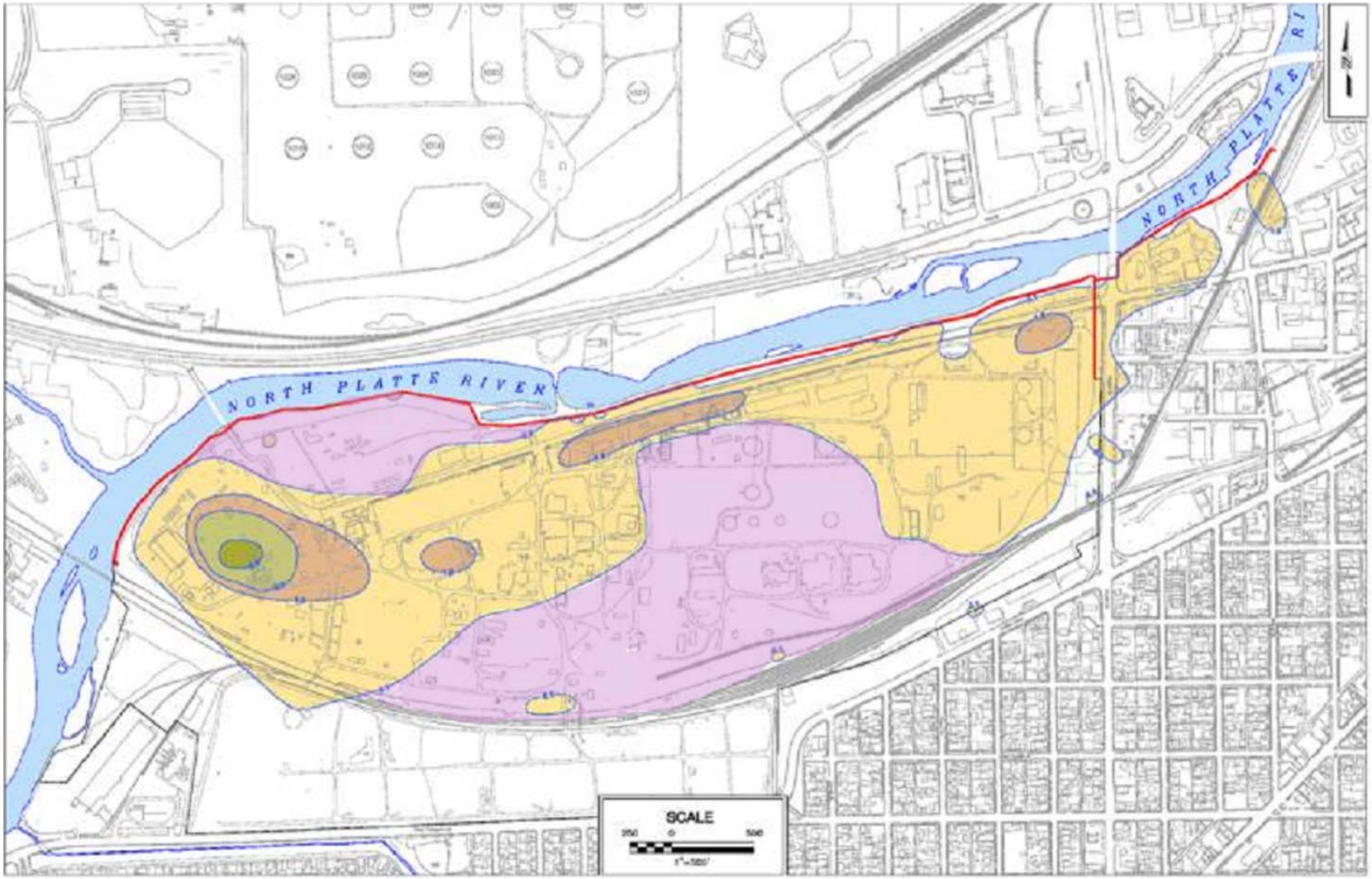
Original LNAPL Site Map



Comparison of Results

Figure 5 NAPL Saturation Log for NMS-09 (Gasoline-Like NAPL)

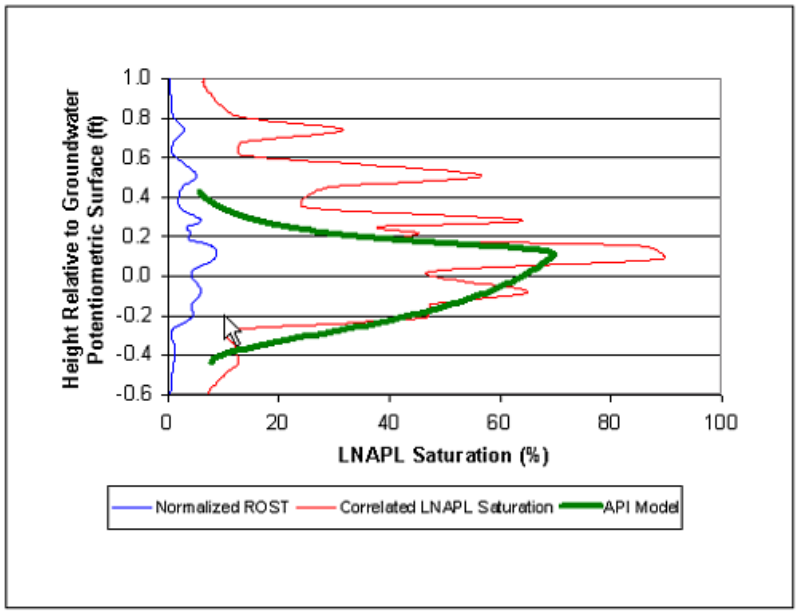
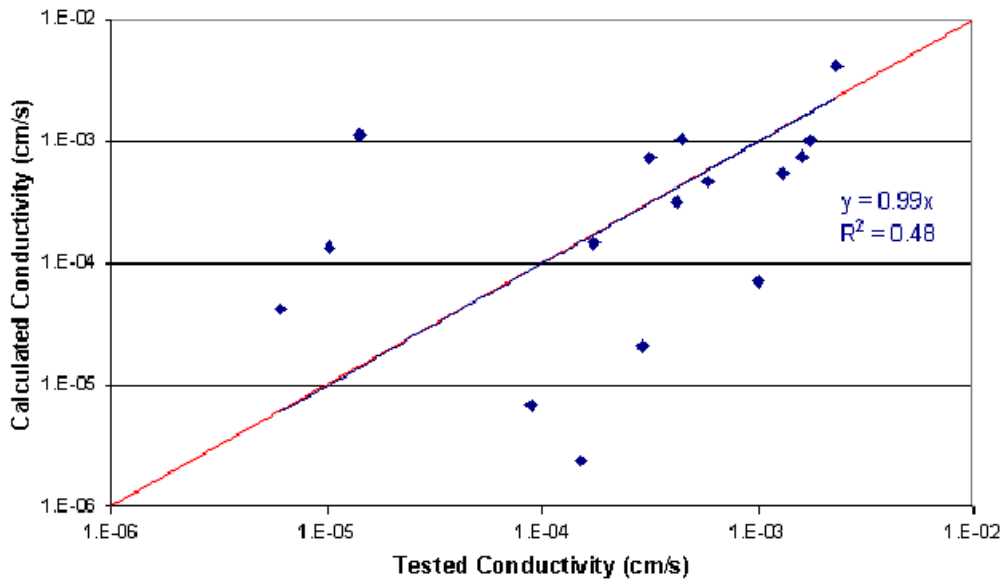


Figure 6 Comparison of Tested Versus Calculated NAPL Conductivities



Correlate ROST, capillary data, and saturation with API spreadsheets

Make saturation and conductivity predictions and validate versus field data

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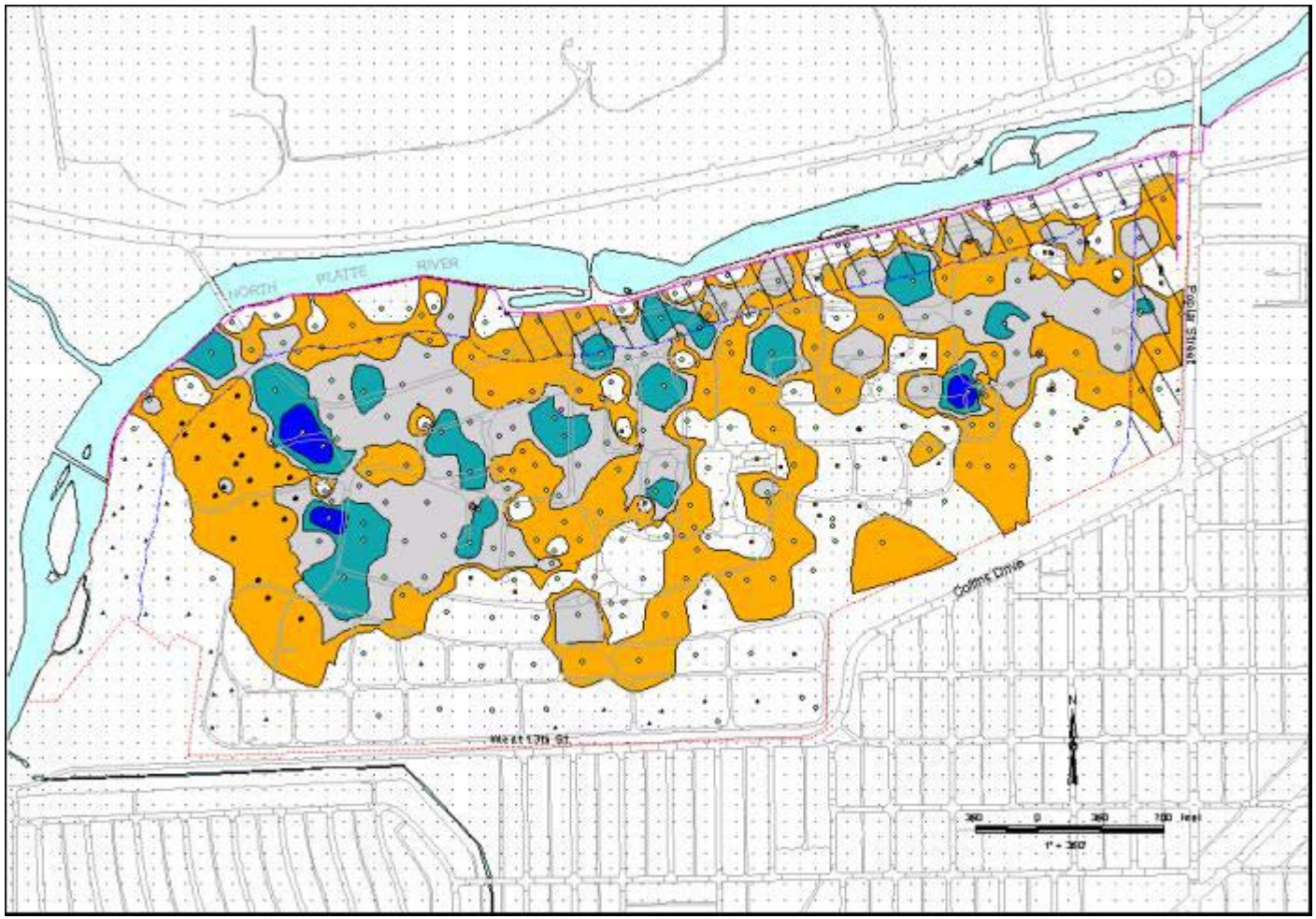
LNAPL Conductivity Distribution



Blue = >10^{-2} cm^2/sec (2.5 acres) Teal = >10^{-3} cm^2/sec (23 acres)
Grey = >10^{-4} cm^2/sec (82 acres) Brown = > 10^{-5} cm^2/sec (179 acres)

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Results

- LNAPL recovery will only be implemented within areas that contain benzene impacted LNAPL at an initial conductivity greater than 10^{-4} cm^2/sec
  - Corresponds to 0.15 ft thickness with gasoline type product
  - Approximately 46 acres (180 acres previously)
- Theory helped estimate optimum groundwater pumping rates and operating periods with recovery rate estimates
- Site is being redeveloped into a golf course and recreation area.

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