Water Quality Management and Permitting on a Watershed Scale

A Vermont Perspective

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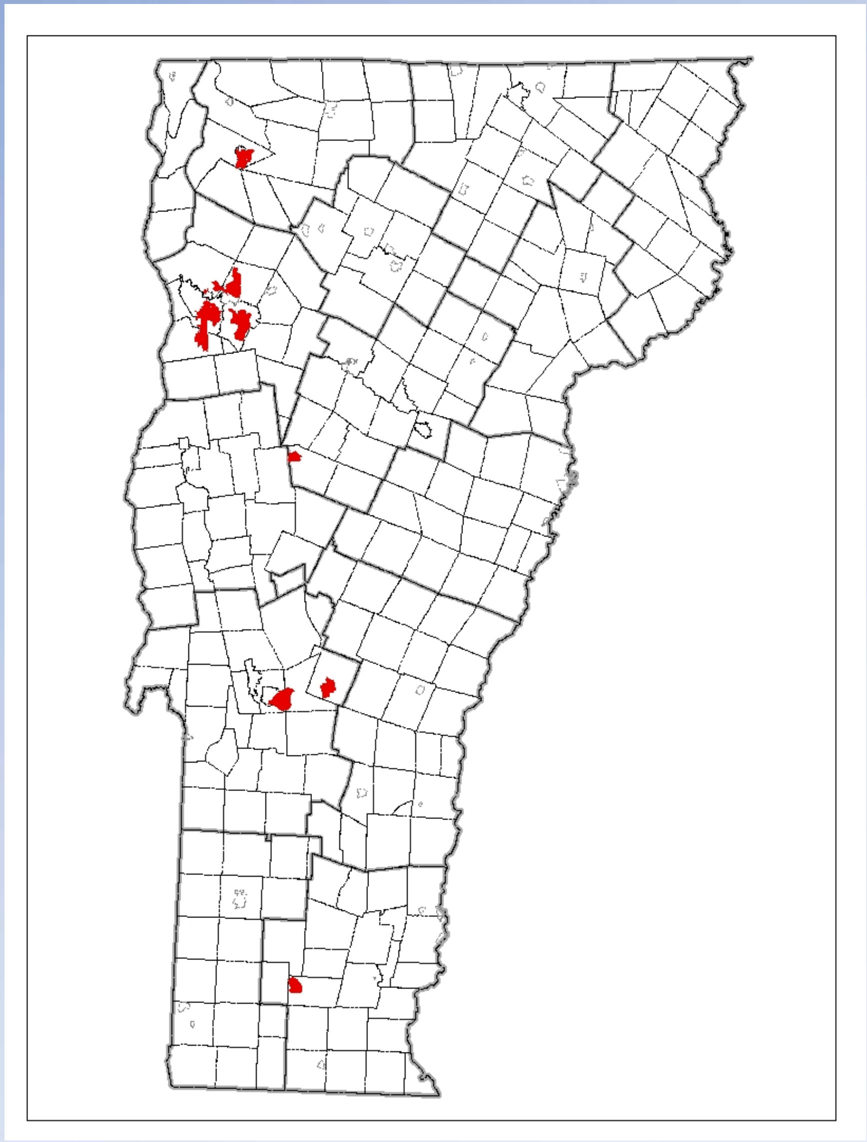
Presentation Will Cover Four Major Topics:

- Watershed TMDLs – Innovative New Concepts
- New Science behind Watershed Permitting
- Watershed Permitting to Implement TMDLs
- Future Challenges – Management of all NPS

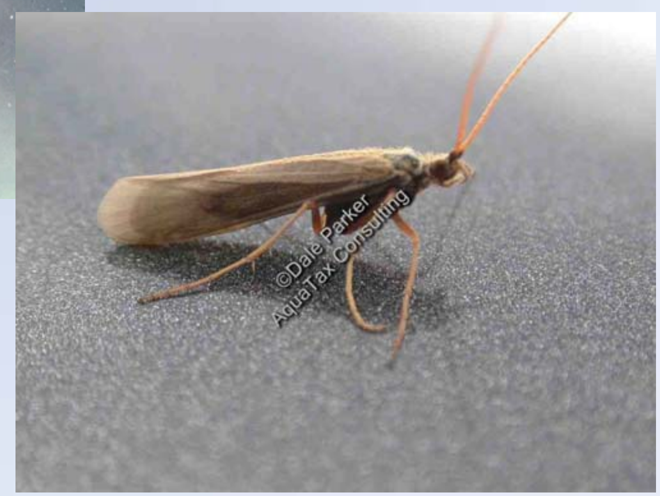
Background Information…

- VT has issued “NPDES-like” permits for runoff from impervious surfaces for ~ 27 years
- VT has 17 *303(d)* listed “urban” streams principally Impaired by stormwater runoff
- Vermont is an NPDES delegated State
- In VT, stormwater management is now a 50/50 mix of science and law



Problem Overview…

- Vermont's Water Quality impairments are measured through analysis of aquatic biota populations



Problem Overview…

- Hydrologic Effects of stormwater runoff are implicated

Stream Geomorphic Destabilization


Potash Brook – Tributary #3

Problem Overview…

- No known mathematical relationships exist between stormwater BMP improvements and instream biotic responses

Problem Overview…

- Retrofit BMPs can be logistically difficult to install, and extremely expensive as a result

Direct Use of Sediment in TMDLs is Problematic

- Washoff loads or instream sources??
  - Washoff estimates difficult:
    - Land use, topography, climate
    - Data suggests high variability
    - Sediment dynamics
  - Instream estimates difficult:
    - Bank and bed erosion
    - Complex modeling/data intensive

Hydrology is more predictable and inclusive

- Well established methods for measurement and modeling, and a history of use
- Hydrological modeling is less data intensive
- Hydrology has a direct influence on sediment generation and transport factors

Initial Challenges in Developing Watershed Remediation Plans

- No actual gage data to provide hydrologic statistics on the stormwater impaired streams
- No sub-watershed level mapping for accurately assessing stormwater contributors
- Old and potentially inaccurate measurements of contributing impervious surfaces
- No actual measurements on stream geomorphic conditions

Watershed Remediation Protocol

- 2 Phase Process - TMDLs with hydrologic targets, then watershed permits to implement necessary retrofits
- Targets will be met through stormwater retrofit and remediation projects in the watershed
- Sequence of changes expected in streams – flow response to precip, sga stability, biota
- Ongoing collection of background monitoring data to measure progress towards targets

Concepts in Hydrological TMDL Development

- Sediment/Water Imbalance is the problem
- Use of Attainment Watersheds as surrogate targets
- Targets Established as % Changes in FDC
- Use of modeling to simulate both Attainment watersheds and Impaired watersheds
- Target Setting through Watershed Comparisons of appropriate Independent Variables
- Define baseline environmental condition through data gathering
- Use Adaptive Management to refine process

Development of the underlying basis for hydrological TMDLs

- Calibration of the base watershed hydrology model on nearby and currently gaged small watersheds
- Development of predictive watershed hydrological models for both attainment and impaired watersheds
- Establishment of synthetic flow duration curves for analysis of hydrological differences
- Development of a statistical model for matching attainment and impaired watersheds
- Development of low flow enhancements to the existing P8 modeling

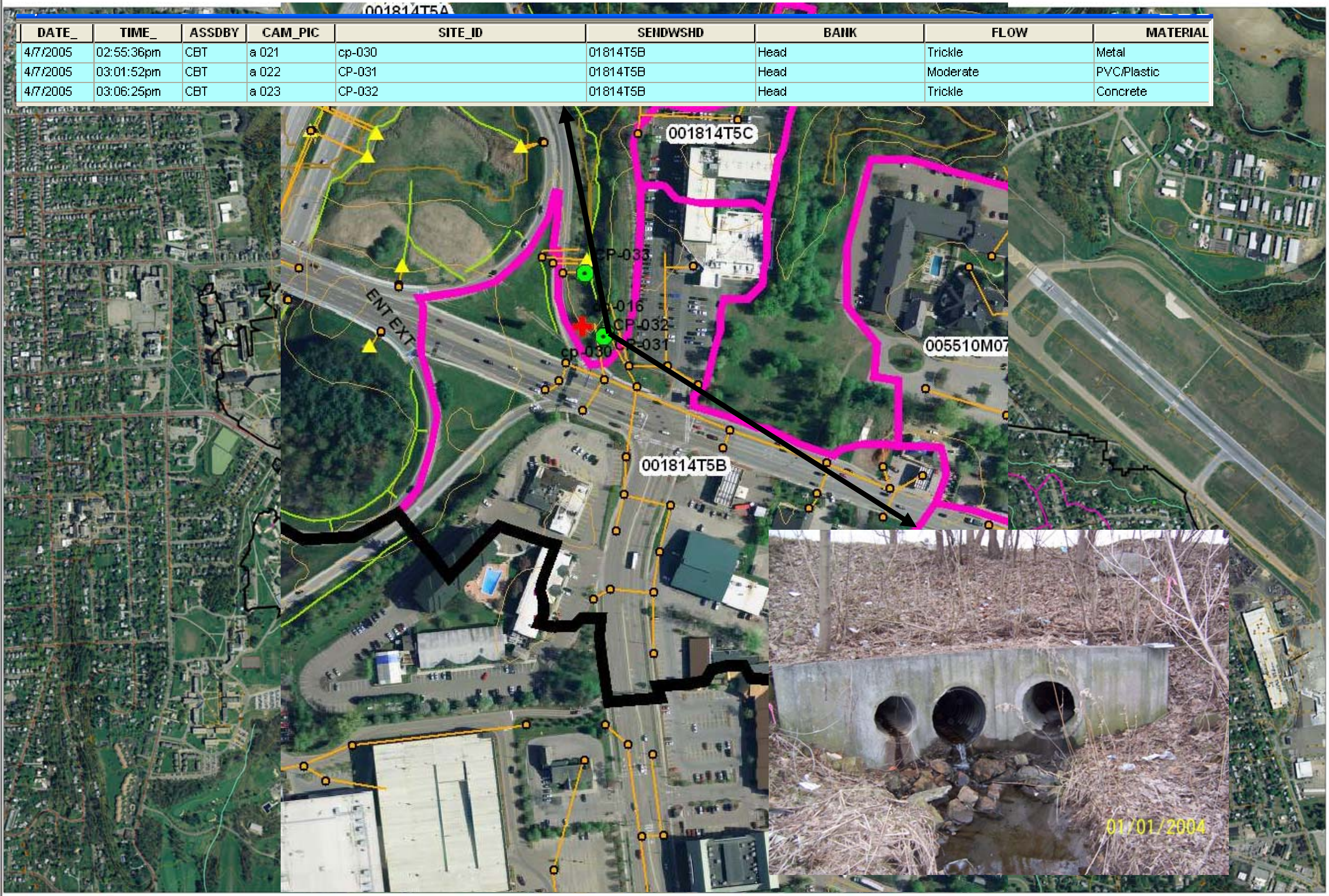
Flow Comparisons in Potash Brook Cluster

	Status	Q 0.3% (cfs/mi^2)	Q 95% (cfs/mi^2)
Potash Brook	Impaired	12.2374	0.1964
LaPlatte River	Attainment	11.5221	0.2132
Little Otter Creek	Attainment	9.0217	0.2249
Attainment streams mean flow		10.2719	0.2190
Difference between Potash and mean attainment flows		1.9655	0.0226

Development of Baseline Implementation & Opportunity Analysis Data

- Stormwater Implementation of continuous flow and precipitation monitoring for each of the impaired and attainment streams
- Production of GIS compatible databases:
  - Sub-Watershed Mapping for all discharge points
  - QuickBird Satellite Imagery for Land Use/Land Cover Determinations
  - Phase I and II Stream Geomorphic Assessments for each Stormwater Impaired Stream
  - Updated property ownership databases
- Existing BMP upgrade opportunity analysis
- 24 Months ~ $1,200,000

DATE_	TIME_	ASSDBY	CAM_PIC	SITE_ID	SENDWSHD	BANK	FLOW	MATERIAL
4/7/2005	02:55:36pm	CBT	a 021	cp-030	01814T5B	Head	Trickle	Metal
4/7/2005	03:01:52pm	CBT	a 022	CP-031	01814T5B	Head	Moderate	PVC/Plastic
4/7/2005	03:06:25pm	CBT	a 023	CP-032	01814T5B	Head	Trickle	Concrete



Subwatershed Boundary

Stormwater Outfalls (GPS)

- Closed Pipe
- Open Channel

SW Infrastructure

- Combined Sewer & Stormwater
- Stormwater
- Catchbasin/Inlet
- Flow Path
- Swale/Ditch
- Outfalls

Town Boundary

Surface Water

Watershed Boundary

Vermont Department of Environmental Conservation
Stormwater Impaired Waterbody Mapping

[redacted]

May 9, 2005

Sources: Background: CCMPO DOQs (2004); Watershed Boundary mapped by Pioneer Environmental Associates (2005); Stormwater Outfalls mapped by PEA using Trimble ProXR GPS (2005); Contours generated using HydroDEM data from VCGI (2005); Surface waters from the Vermont Hydrography Dataset from VCGI (2004); Town Boundary downloaded from VCGI (2005); Stormwater infrastructure data collected from VTrans, The City of South Burlington and the City of Burlington.

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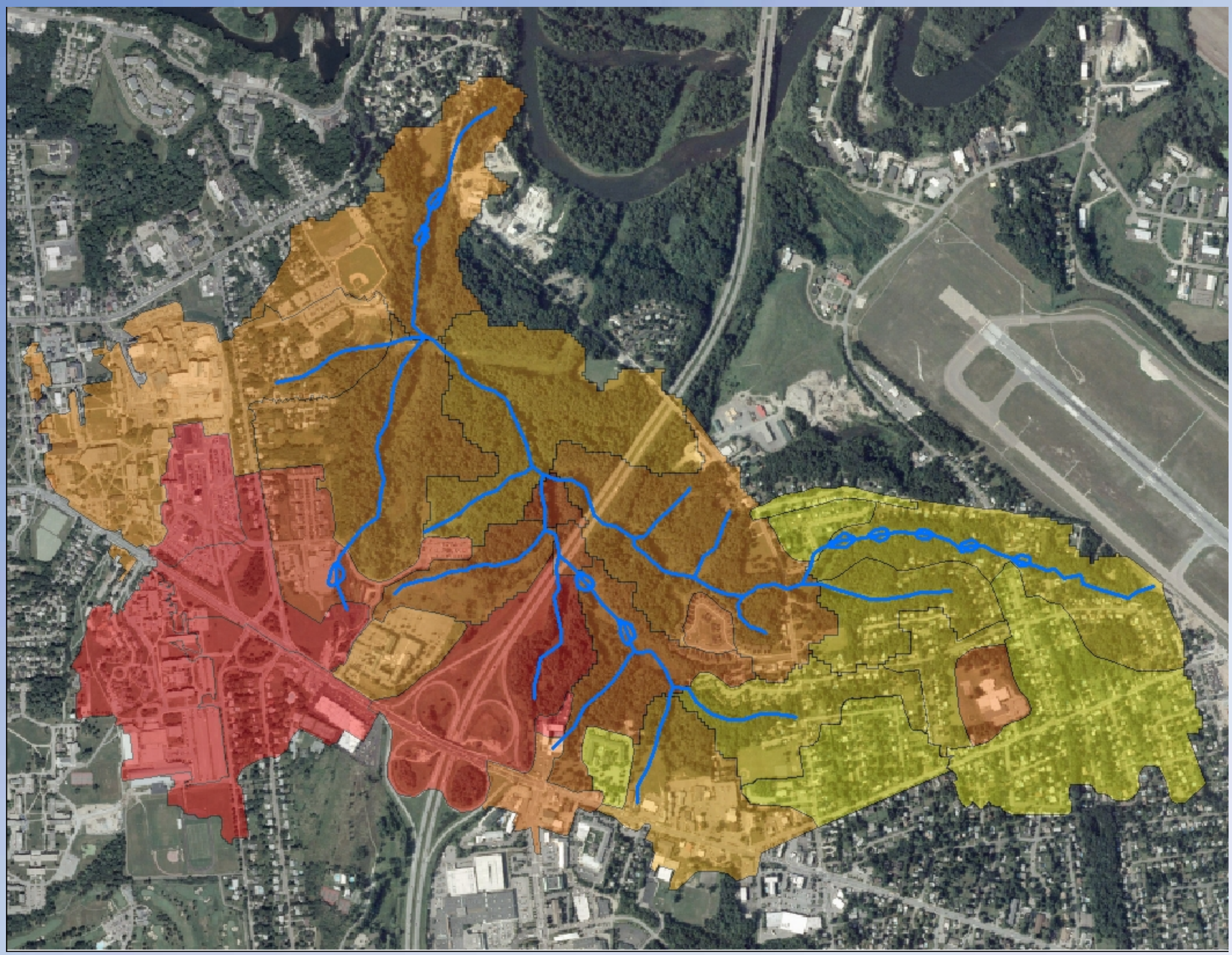
Original

Subwatersheds

Pervious Curve Number

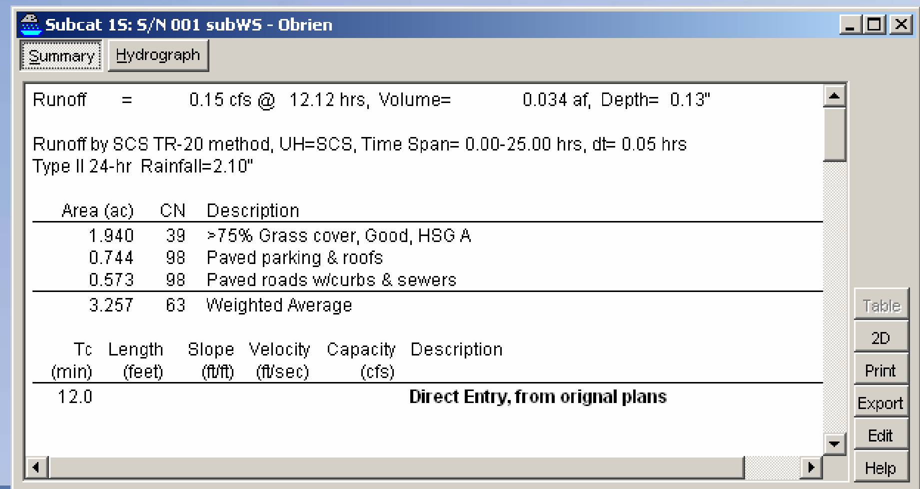


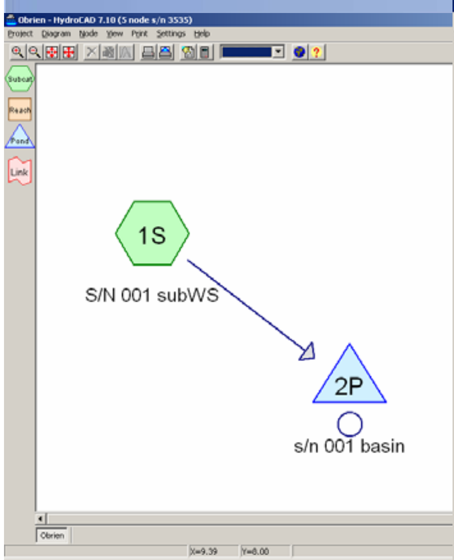
Stormwater Pond Data

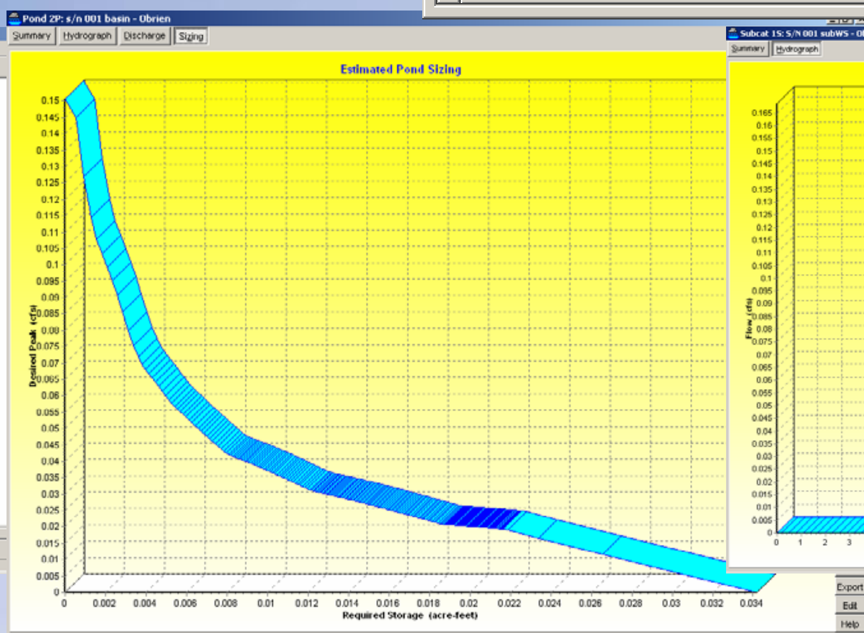
- Collected data for all permitted and existing stormwater detention structures
- Field checked all information
- Conducted limited Engineering Feasibility Analysis (EFA) - including HydroCad modeling
- Pond routing data included in P8 model

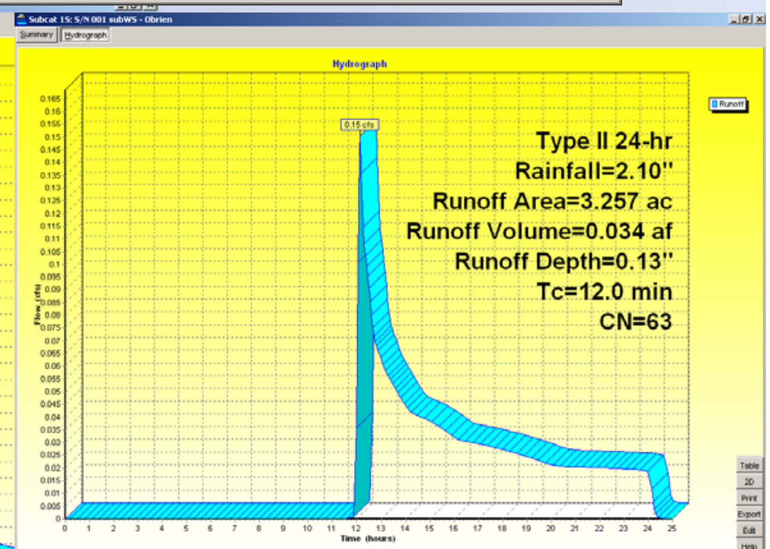
Pond Information

- Size & Volume
- Outlet Structure
- Detention Time
- Maintenance Issues

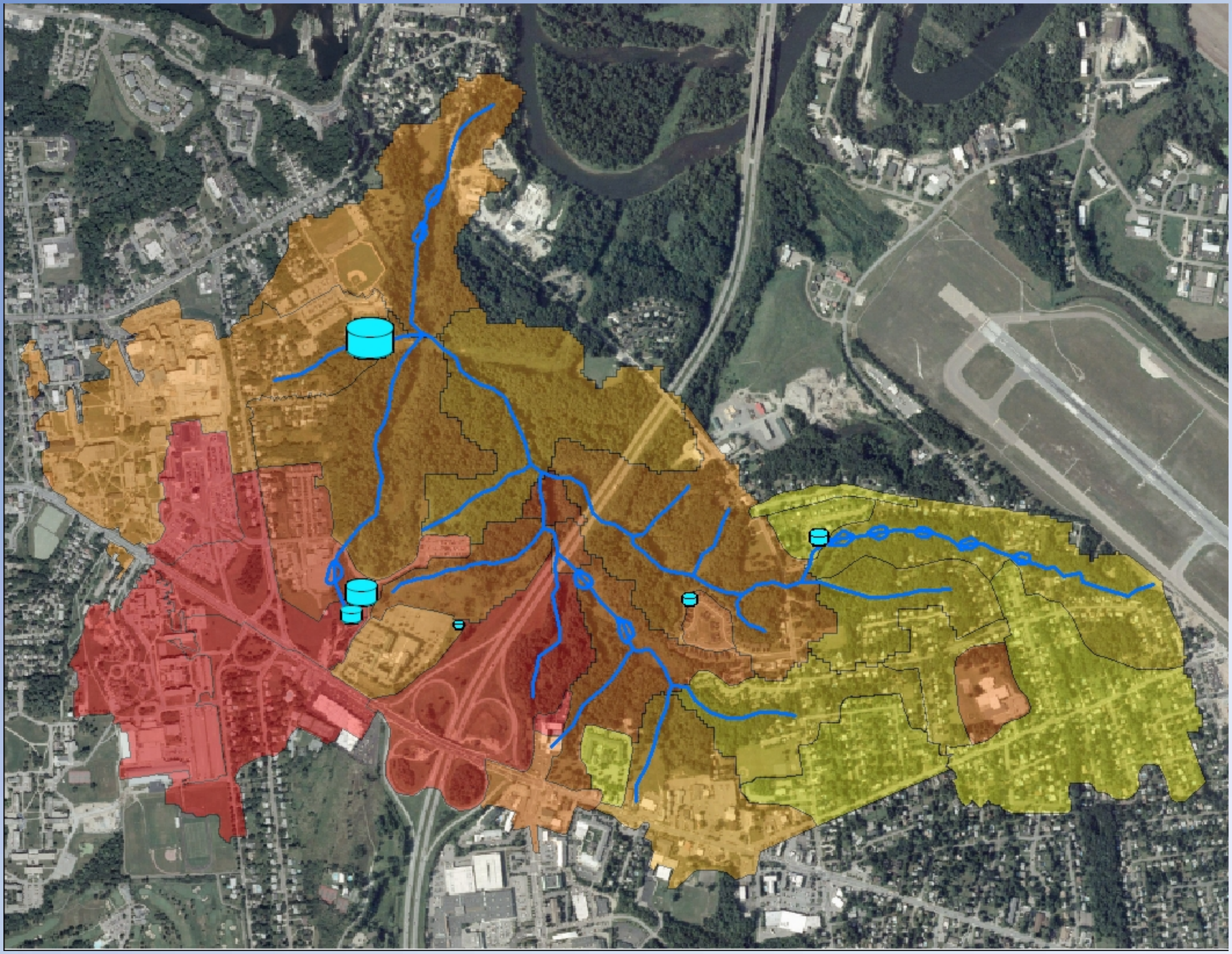






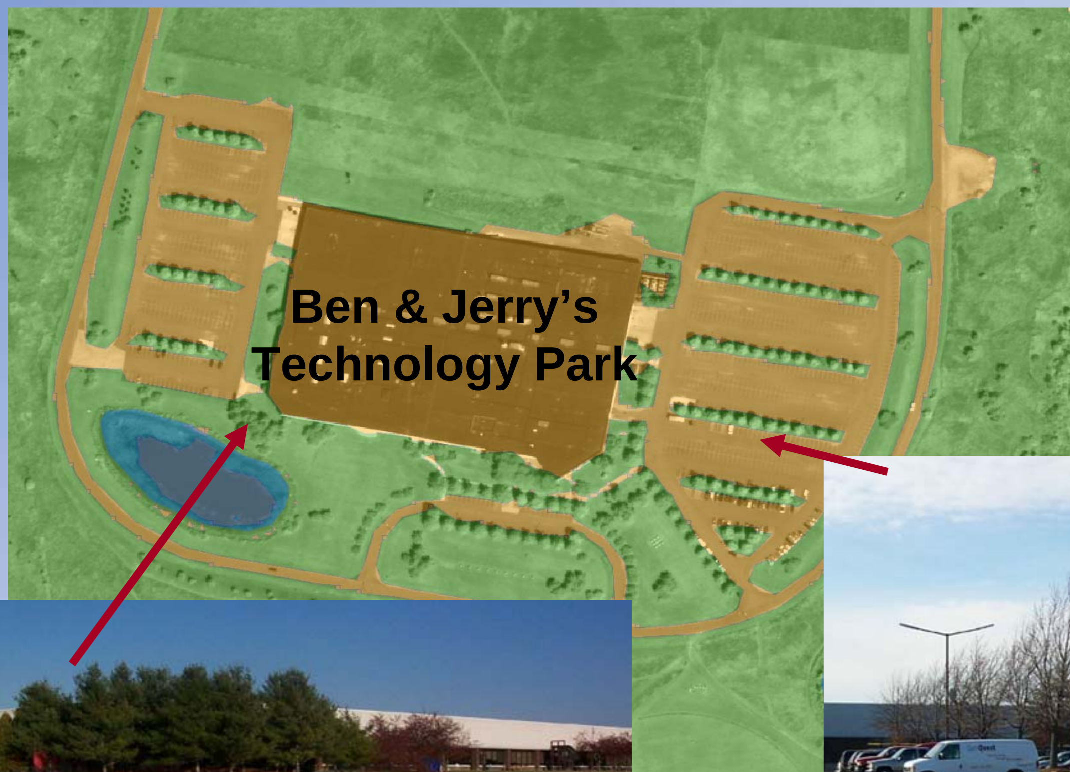


Stormwater Ponds

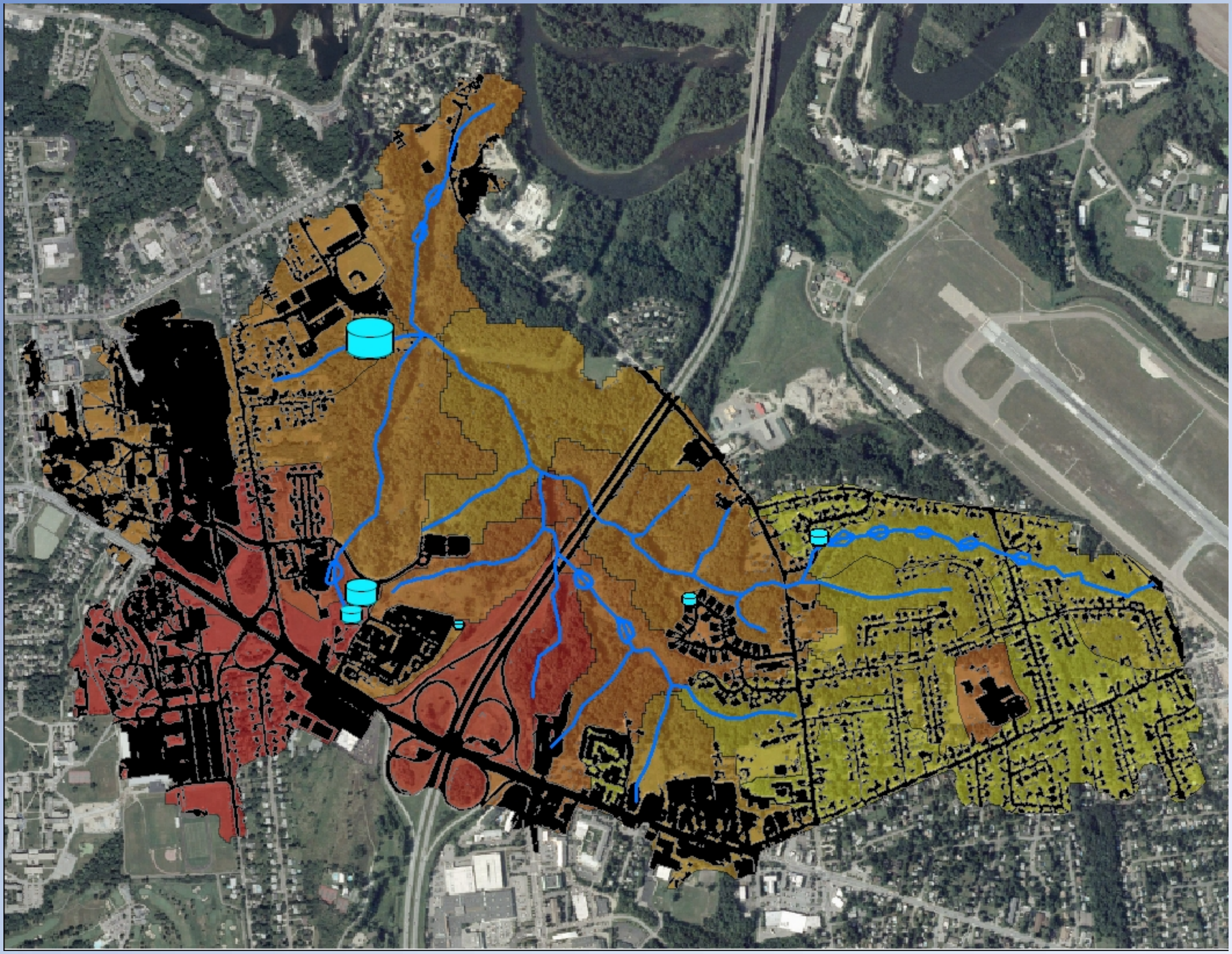


Impervious Mapping Results

Impervious
Pervious
Water



Quickbird



Three Phases of VT SGA:

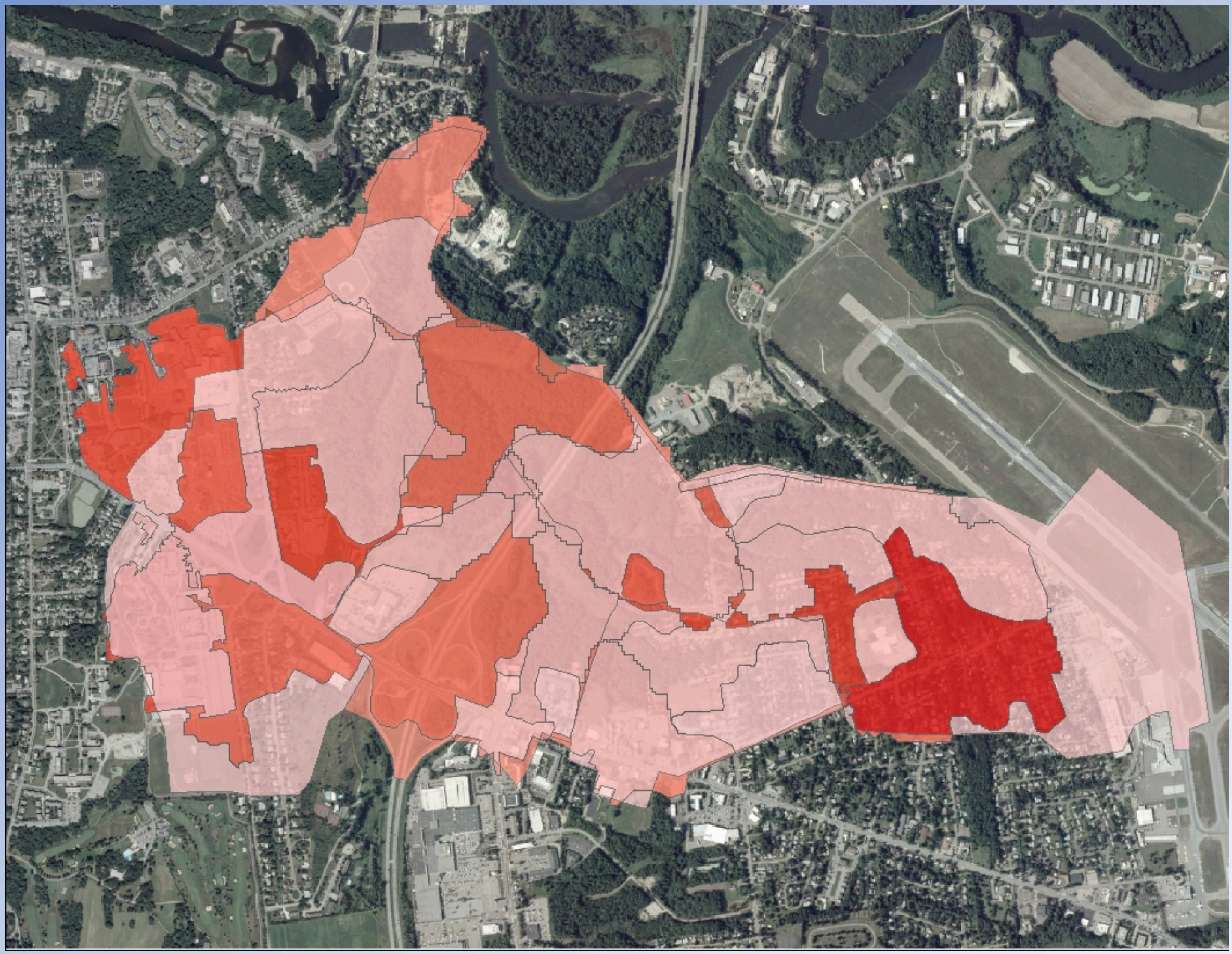
Phase I – GIS data gathering and SGAT (ArcView ext.)

Phase II – Rapid Stream Assessment (incl. RGA & RHA)

Phase III – Detailed Reach Survey for Restoration Purposes

SAWS

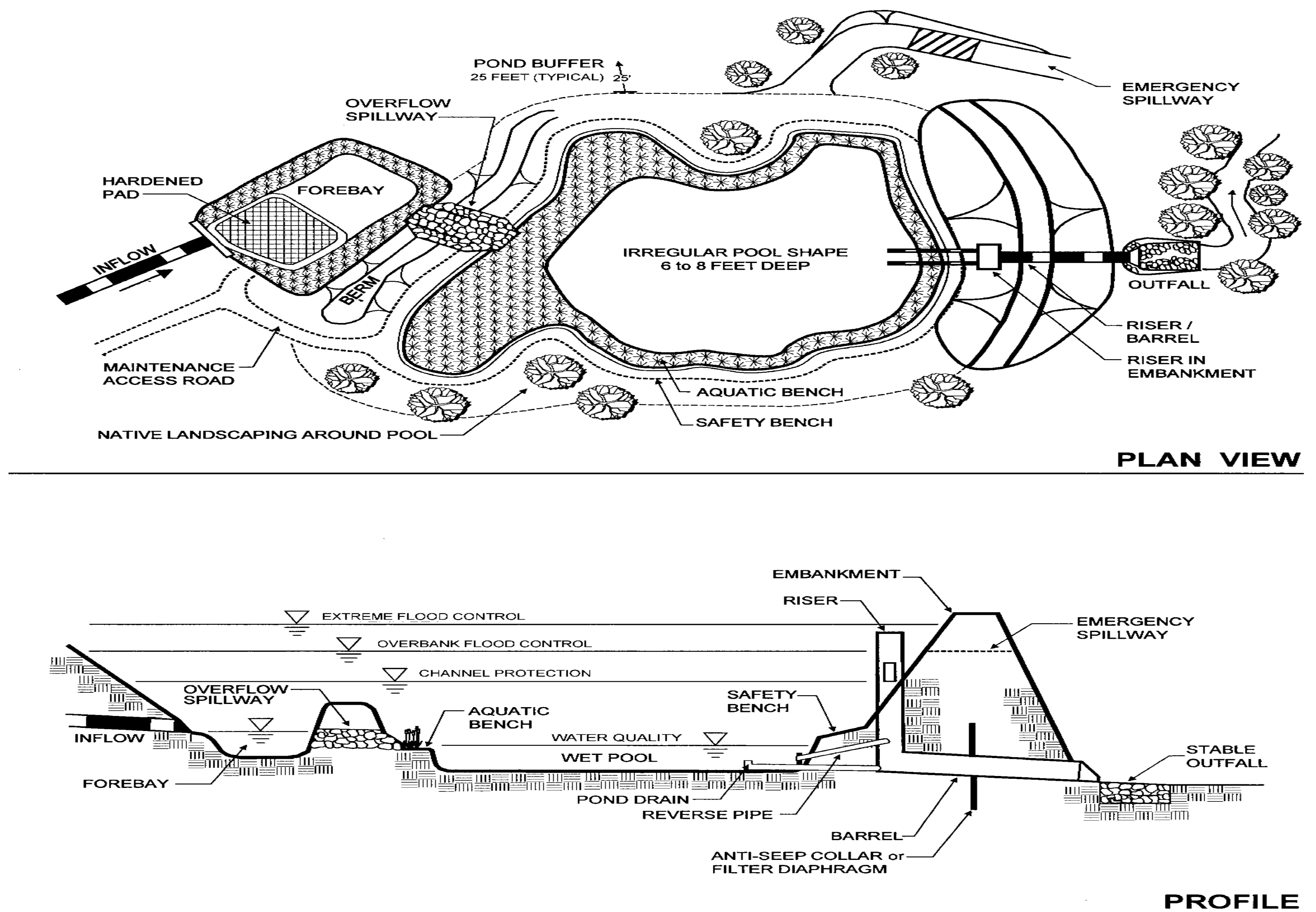
Spatial Analysis of Watershed Sensitivity



WaRP Protocol

- Stormwater remediation projects will be expensive!
- Target selection will be guided by goal of most cost-effective solution on a watershed basis
- SAWS process to isolate areas of greatest yield
- Integration of data layer analysis necessary for SAWS through use of the BMP Optimization Tool
- Development of BMP designs with presumptive performance expectations

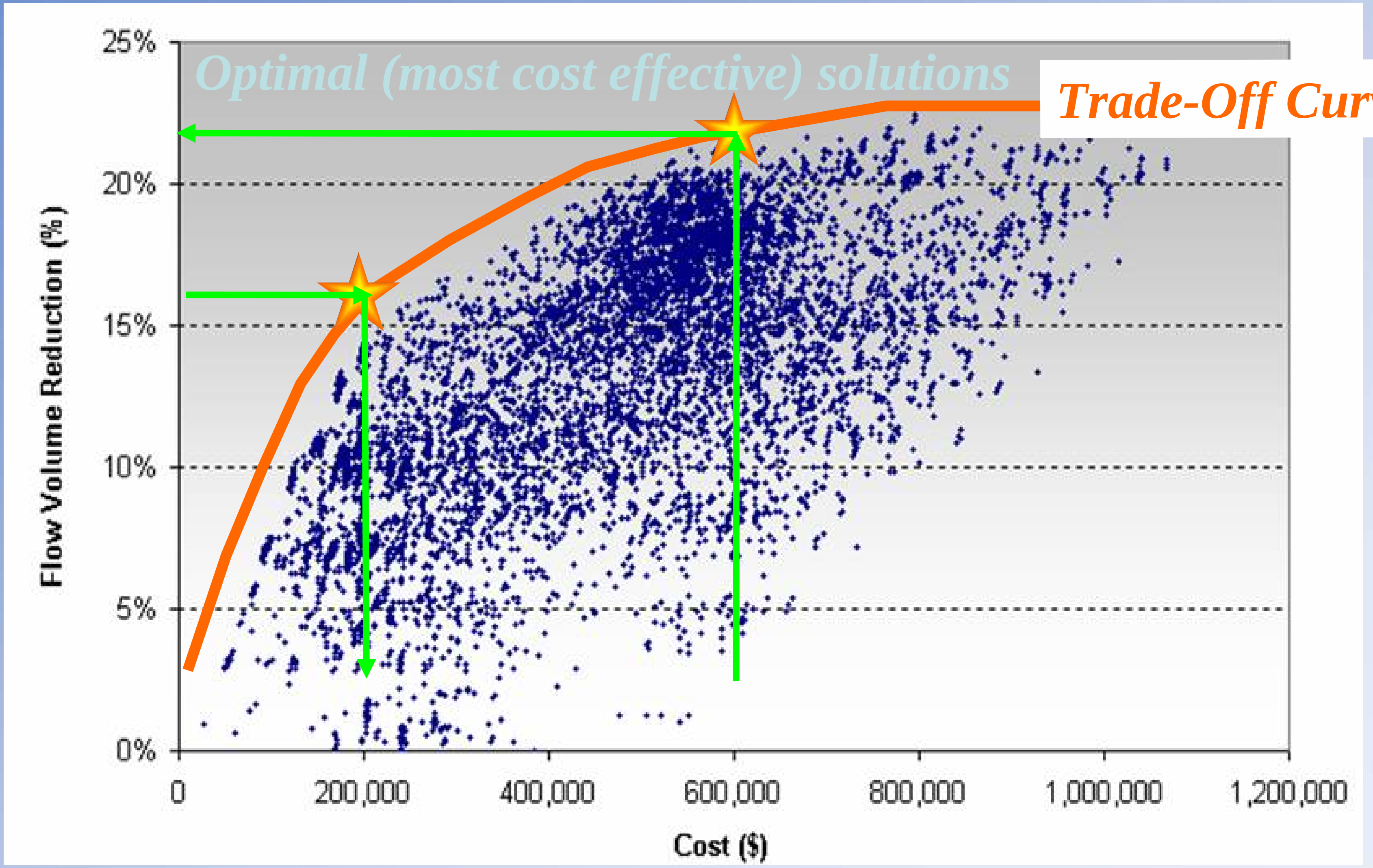
Presumptive BMP Performance Standards



BMP Optimization Tool

- Find *optimum* BMP placement and selection strategies based on pre-selected potential sites and applicable BMP types
- What is optimum? Minimize cost and/or maximize pollutant load reduction from runoff using various BMP alternatives.
- How does one measure optimum?
  - Evaluation Criteria (using continuous simulation):
    - Minimum long-term flows and pollutant loads
    - Best-fit multi-storm curve with pre-developed condition

Optimization Solutions



Take-away Messages…

- Importance of involving a ‘team’ development approach for development of Stormwater TMDLs and Permits
- Evaluation of impacts from altered hydrology on stream geomorphology – endogenous sediment production may be dwarfing wash-off loadings
- Use presumptive effluent criteria for BMPs that are built to prescriptive design standards – TMDL “building blocks”
- Learn to live with uncertainty! – scientific, legal and programmatic

Issues in Watershed Permitting

Mary Borg, Esq.

Vermont Department of Environmental Conservation

Approaches to TMDL Implementation

- NPDES Stormwater Permits
- State Stormwater Permits
- Individual Permits
- Watershed-wide General Permits

Watershed Permitting to Implement TMDLs

- What is watershed permitting?
  - Developing permits for multiple sources within a defined geographic watershed area
- Approaches to Watershed Permitting
  - Issue individual permits with synchronized expiration/reissuance dates
  - Watershed general permit – Common Sources (e.g. POTWs)
  - Watershed general permit – Collective Sources (all or subcategory of sources)
  - Watershed-based individual permit – multiple permittees

Watershed Permitting

- Advantages:
  - Considers watershed goals/holistic solution
  - Considers impact of multiple pollutant sources and stressors
  - TMDL target can be quantified across identified discharges
  - Synchronized permit conditions
  - Consideration of cost efficiencies
  - Not a bar to individual NPDES permits for construction, industrial, or other typical point source discharges
  - Administrative efficiencies
  - Allows watershed wide monitoring efforts

Watershed Improvement Permits

- Pre – TMDL Approach: Issued Watershed Improvement Permits (WIPs) in 2003
  - General permits
  - Identified "Significant Contributors" that in total contributed 50% of sediment loading to streams
  - Anticipated use of "adaptive management" approach:
    - Issue general permit
    - Implement stormwater controls
    - Monitor Stream
    - Amend WIP to Add Additional Contributors to Met VWQS
- Environmental Groups Sue, WIPS overturned

Vermont's Anticipated Approach

Issue watershed-wide general permit

- What will a watershed general permit look like?

- Federal NPDES permit or state?

Watershed Permitting

- **What will a watershed permit look like?**
  - General Permit
  - Will target all sources of impervious surface runoff necessary to reach TMDL target
  - BMPs, not numeric effluent limitations
  - BMPs may be structural or non-structural
  - Iterative, adaptive management approach
  - First round suite of BMPs
  - Monitoring
  - Second round of BMPs . . .
  - Vermont - may include “non-point sources” in a state law section

State TMDL Implementation Tools

- Vermont stormwater law = complete "tool box" for TMDL implementation:
- watershed-wide general permits and individual permits
- any size impervious surfaces to implement TMDL
- discharge need not be collected or channelized; tied to creation of impervious surfaces
- identify permittees through BMP tool
- adaptive management approach recognized

Watershed Permitting

- **Existing NPDES Tools for TMDL Permitting**
  - Construction Permits
  - Multi-Sector Permit
  - MS4 Permit
- **Advantages to These Permits**
  - They already exist; already understood
  - EPA's CGP and Multi-sector general permits specifically cite "residual designation" authority

Watershed Permitting

- **Disadvantages to Use of these 3 Permits**
  - They attack problem on a piecemeal basis
  - Hard to coordinate – expiration dates vary, conditions of permits vary
  - Not designed to permit long-term operational stormwater systems and BMPs
  - Do not cover universe of discharges – e.g. large subdivisions, shopping malls; areas outside of MS4s, construction projects less than 1 acre

Residual Designation Authority

- **Residual Designation Authority – The perfect tool for stormwater TMDLs and watershed permitting?**
  - 40 CFR 122.26(a)(1) and (9) provide 4 major categories of stormwater discharges that require a NPDES permit:
  - Discharges that had been permitted prior to February 4, 1987
  - Large and Small Construction Discharges
  - Large and Small MS4 discharges
  - Industrial Stormwater Discharges

Residual Designation Authority

- Two additional categories of discharges that may be "residually designated" (40 CFR 122.26(a)(9)) :
  - Stormwater discharges that are determined by the permitting agency to be causing or contributing to a water quality standards violation or are a significant contributor of pollutants.
  - Stormwater discharges that the permitting authority determines require stormwater controls based on wasteload allocations that are part of TMDLs that address the pollutants of concern.

Residual Designation Authority

- Under “residual designation authority” a state may on a case-by-case basis after balancing certain factors designate a stormwater discharge as requiring a NPDES permit because it contributes to a violation of a water quality standard or is a significant contributor of pollutants.

- Factors to balance (40 CFR 122.26(a)(1)(5)):
  - Location of discharge
  - Size of Discharge
  - Quantity and Nature of Pollutants
  - Other relevant factors

Residual Designation

- Environmental Defense Center, Inc. v. EPA, 344 F.3d 832 (Ninth Cir. 2003) – only federal lawsuit to date that deals with residual designation authority
- Case involved challenge to Phase II Rules
- Industry petitioners argued that EPA acted improperly in retaining authority to designate future sources of stormwater pollution for Phase II regulation
- Supported designation of discharges that do not “fall neatly into a discrete, predetermine category

Point vs. Non-Point Sources

- **Point vs. Nonpoint Discharges - A Potential Limitation to Residual Designation?**
- The NPDES permit program only regulates "point sources"
- "Point source is defined in Section 502(14) of the federal Clean Water Act:

  "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged."

- Stormwater runoff traditionally considered non-point. Must be collected or channeled in some way to be a point source.

Non-point Source – a term of the past… an anachronism

Point Sources

- Courts have broadly interpreted "point source"
  - Ditches, gullies, rills
  - Formed by natural erosion and gravity
  - Pollutants originate somewhere else but flow through a point source
- Determining what is a point source can take a lot of work
- Vermont "work-around" – Stormwater rule provides that a permit is required for any discharge from an impervious surface if necessary to meet TMDL targets

Central Legal Issues :

- Point versus Non-Point
  - This may limit permitting of discharges essential to success of TMDL – e.g. shopping centers, large residential subdivisions

- Lack of clarity on residual designation
  - When and how can it really be used
  - What constitutes “cause and contribute”?

Watershed Permitting for "Nonpoint Sources"

- "Non-point source" – an anachronism
- Watershed permitting for all "non-point" sources:
  - Impervious surface runoff
  - Agricultural discharges
  - Silvicultural discharges
  - Disturbed land discharges (e.g. construction, other)
  - Backroads
  - Developed lands (golf courses, ski trails)
- Evaluate watershed on a holistic basis to identify and rank contributing sources to water quality impairment
- Issue permits for predominant contributing sources within watershed
- Best "bang for the buck" and best for environment