COLE ENGINEERING

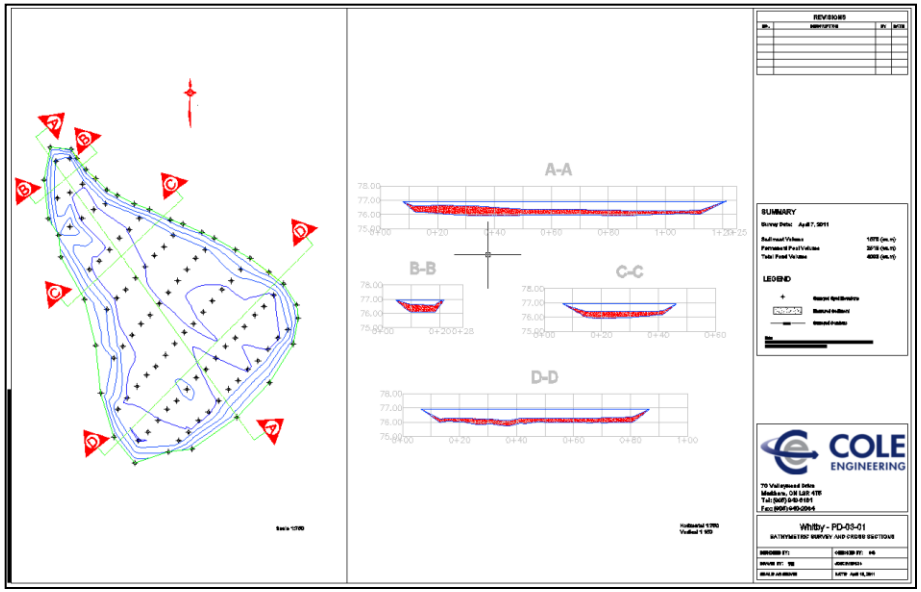
Experience Enhancing Excellence

Storm Water Management Operations & Maintenance Software (SWMSoft)

MARKHAM VAUGHAN BRAMPTON Flower City Town of East Gwillimbury TOWN OF CALEDON TOWN OF WHITCHURCH–STOUFFVILLE

SWMF Operation and Maintenance

1. Maintenance Objectives
2. Initial Plan
3. Plan Integration
4. Using the Plan



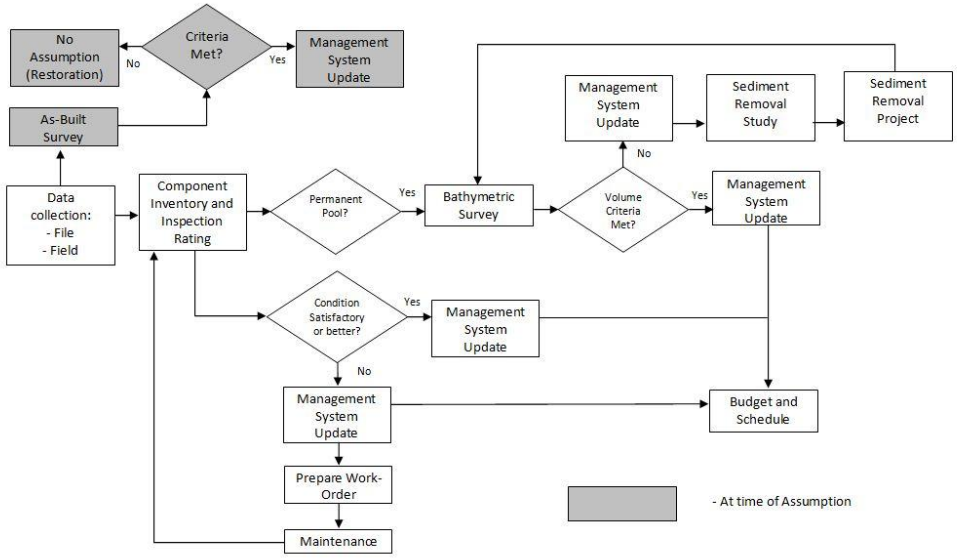
Maintenance Objectives

- A comprehensive inventory of all the SWM assets owned by municipality
- Develop plans to maintain all components within each asset to minimize liability and costs:
    - Capital expenditures
    - Operational costs

Methodology

1. Data Collection
   - Field
   - File

2. Organize and store all data in easily accessible GIS-Database (SWMSoft)



3. Create comprehensive Assumption and O&M Master Plan

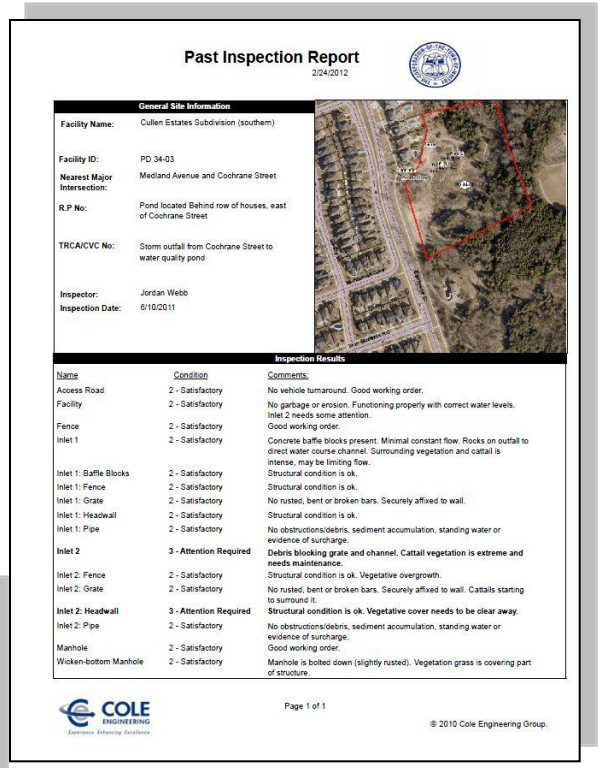
Data Collection

Existing File Data Collection:

- Collect design and as-built drawings and reports
- Review files and data extraction
- Component
  - Identification
  - Information entry into O&M system
- Create field inspection forms

Comprehensive Field Inspections:

- Visit all facilities and supply all necessary equipment
- Identify and locate components
- Populate all inspection forms
- Photographic Records
- Bathymetric Survey



Past Inspection Report

2/24/2012

General Site Information

Facility Name:	Cullen Estates Subdivision (southern)
Facility ID:	PD 34-03
Nearest Major Intersection:	Medland Avenue and Cochrane Street
R.P No:	Pond located Behind row of houses, east of Cochrane Street
TRCA/CVC No:	Storm outfall from Cochrane Street to water quality pond
Inspector:	Jordan Webb
Inspection Date:	6/10/2011

Inspection Results

Name	Condition	Comments:
Access Road	2 - Satisfactory	No vehicle turnaround. Good working order.
Facility	2 - Satisfactory	No garbage or erosion. Functioning properly with correct water levels. Inlet 2 needs some attention.
Fence	2 - Satisfactory	Good working order.
Inlet 1	2 - Satisfactory	Concrete baffle blocks present. Minimal constant flow. Rocks on outfall to direct water course channel. Surrounding vegetation and cattail is intense, may be limiting flow.
Inlet 1: Baffle Blocks	2 - Satisfactory	Structural condition is ok.
Inlet 1: Fence	2 - Satisfactory	Structural condition is ok.
Inlet 1: Grate	2 - Satisfactory	No rusted, bent or broken bars. Securely affixed to wall.
Inlet 1: Headwall	2 - Satisfactory	Structural condition is ok.
Inlet 1: Pipe	2 - Satisfactory	No obstructions/debris, sediment accumulation, standing water or evidence of surcharge.
Inlet 2	**3 - Attention Required**	**Debris blocking grate and channel. Cattail vegetation is extreme and needs maintenance.**
Inlet 2: Fence	2 - Satisfactory	Structural condition is ok. Vegetative overgrowth.
Inlet 2: Grate	2 - Satisfactory	No rusted, bent or broken bars. Securely affixed to wall. Cattails starting to surround it.
Inlet 2: Headwall	**3 - Attention Required**	**Structural condition is ok. Vegetative cover needs to be clear away.**
Inlet 2: Pipe	2 - Satisfactory	No obstructions/debris, sediment accumulation, standing water or evidence of surcharge.
Manhole	2 - Satisfactory	Good working order.
Wicken-bottom Manhole	2 - Satisfactory	Manhole is bolted down (slightly rusted). Vegetation grass is covering part of structure.

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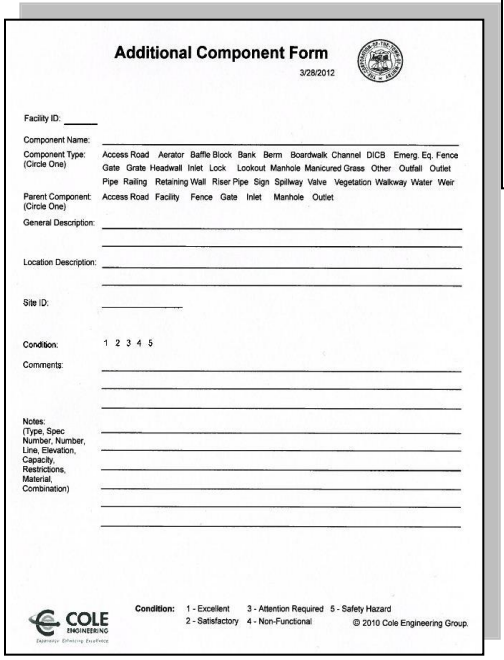

Additional Component Form

3/28/2012

Facility ID: _____

Component Name: _____

Component Type: (Circle One) Access Road Aerator Baffle Block Bank Berm Boardwalk Channel DICB Emerg. Eq. Fence Gate Grate Headwall Inlet Lock Lookout Manhole Manicured Grass Other Outfall Outlet Pipe Railing Retaining Wall Riser Pipe Sign Spillway Valve Vegetation Walkway Water Weir

Parent Component: (Circle One) Access Road Facility Fence Gate Inlet Manhole Outlet

General Description: _____

Location Description: _____

Site ID: _____

Condition: 1 2 3 4 5

Comments: _____

Notes: (Type, Spec Number, Number, Line, Elevation, Capacity, Restrictions, Material, Combination) _____

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Condition: 1 - Excellent 3 - Attention Required 5 - Safety Hazard 2 - Satisfactory 4 - Non-Functional

Component Categories

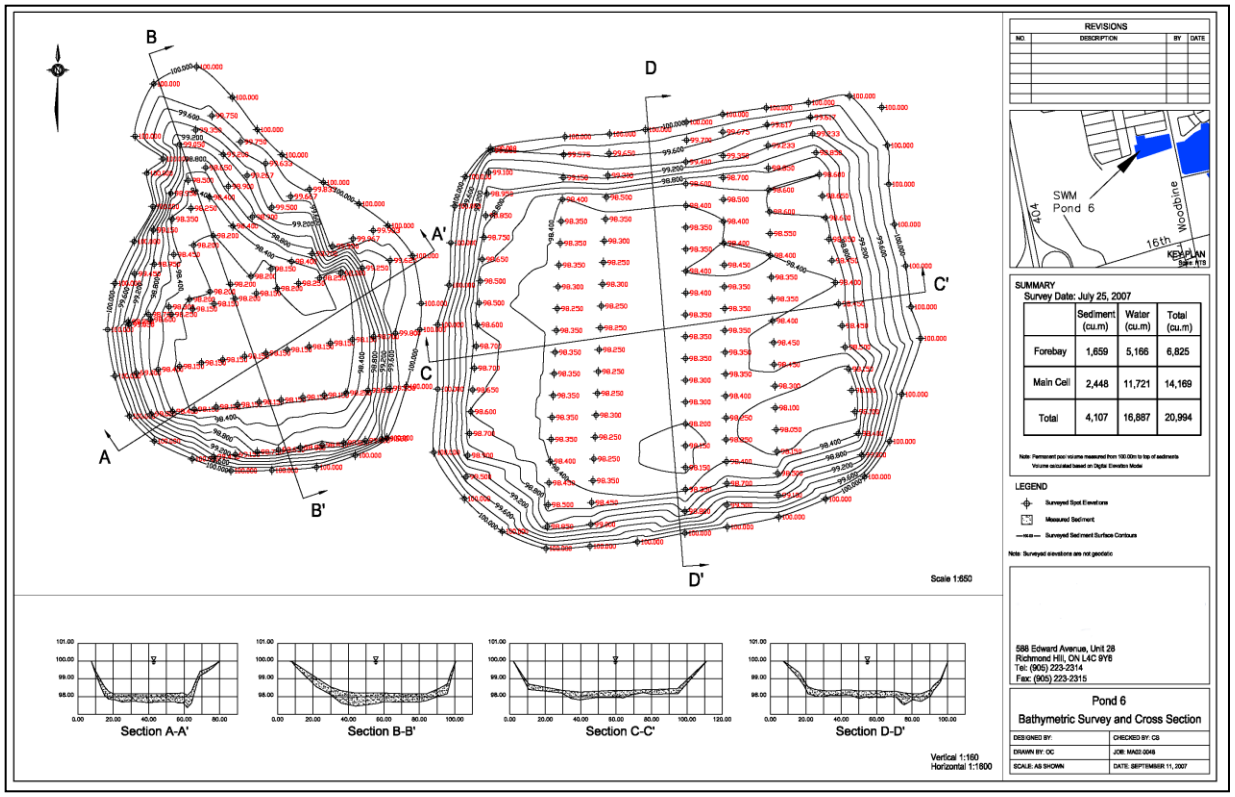
Name	Description
Access Road	Check for surface integrity, vegetation cover, erosion.
Aerator	Ensure visible bubbling, lack of algae in pond.
Baffle Block	Check for structural condition (cracking, flaking, broken, separating, leaning).
Bank	Check for evidence of animal burrows, unstable slopes, and erosion.
Bench Mark	Make sure to record any offset from the actual bench mark
Berm	Check slope stability, vegetation cover condition, erosion reels.
Boardwalk	Check for surface integrity, moss (slippery), weeds.
Channel	Check for standing water, structural integrity and in-stream erosion.
DICB	Check for obstructions/debris built-up around structure, sediment accumulation at the bottom, standing water, slope stability, water quality at the surface (colour, smell), vegetation cover.
Emergency Equip.	Check for presence and functionality of necessary equipment
Facility	Check for garbage, erosion, proper functioning and correct water levels
Fence	Check for structural condition (broken, leaning).
Gate	Check for structural condition (broken, leaning), lock, hinges, grease.
Grate	Check grate bars for rust, bent, broken, open/closed, lock.
Headwall	Check for structural condition (cracking, flaking, broken, separating, leaning).
Inlet	Check for obstructions/debris built-up around structure, sediment accumulation at the bottom, aesthetic conditions (grafiti, etc.), slope stability, water quality at the surface (colour, smell), vegetation cover.
Lock	Check for structural condition (broken, rust), grease.

Component Categories

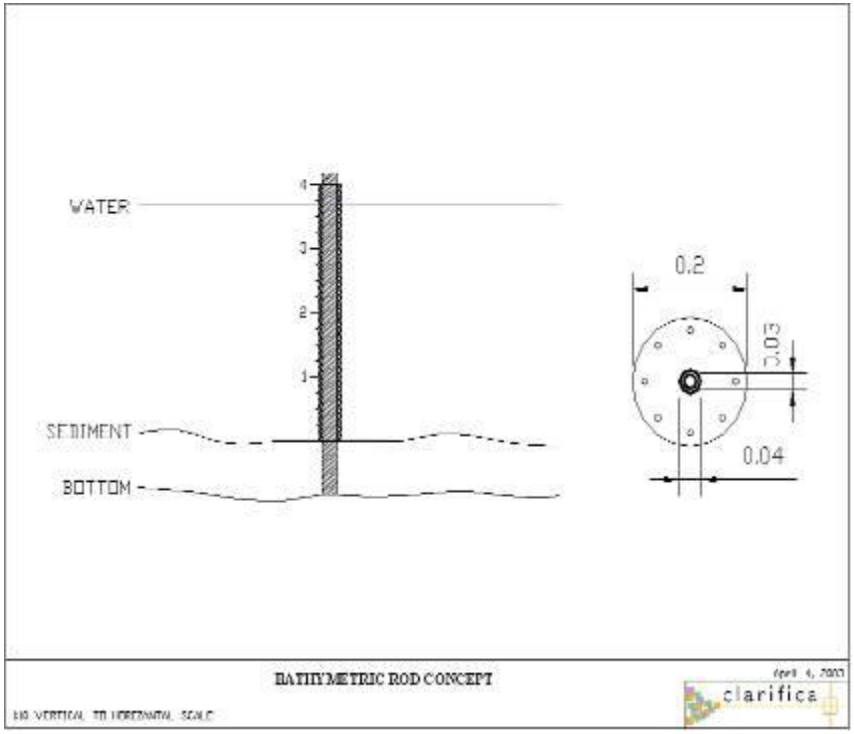
Name	Description
Lookout	Check interpretation signs.
Manhole	Check integrity of cover (rust, bent, broken, open/closed, lock-bolts), settling around, erosion.
Manicured Grass	Approximate manicured area
Other	Check structural condition and function
Outfall	Check for obstructions/debris built-up around structure, sediment accumulation at the bottom, aesthetic conditions (grafiti, etc.), slope stability, water quality at the surface (colour, smell), vegetation cover.
Outlet	Check for obstructions/debris built-up around structure, sediment accumulation at the bottom, aesthetic conditions (grafiti, etc.), slope stability, water quality at the surface (colour, smell), vegetation cover.
Pipe	Check for obstructions/debris built-up, sediment accumulation at the bottom, standing water, evidence of surcharge, vegetation cover.
Railing	Check for structural condition (broken, leaning).
Retaining Wall	Check for structural condition (cracking, flaking, broken, separating, leaning).
Riser Pipe	Check for structural condition (cracking, flaking, broken, separating, leaning), clogging.
Signage	Check for legibility, integrity and accuracy of signs
Spillway	Check for structural condition (cracking, flaking, broken, separating, leaning), obstructions.
Valve	Check functionality, rust, grease, leaks.
Vegetation	Check for general cover condition (eg. grass height), sick trees, noxious weeds.
Walkway	Check for surface integrity, vegetation cover, erosion.
Water	Check water level (not higher or lower than design permanent pool level), oily sheen, algae growth or abnormal colour or odour.
Weir	Check for structural condition (cracking, flaking, broken, separating, leaning), obstructions.

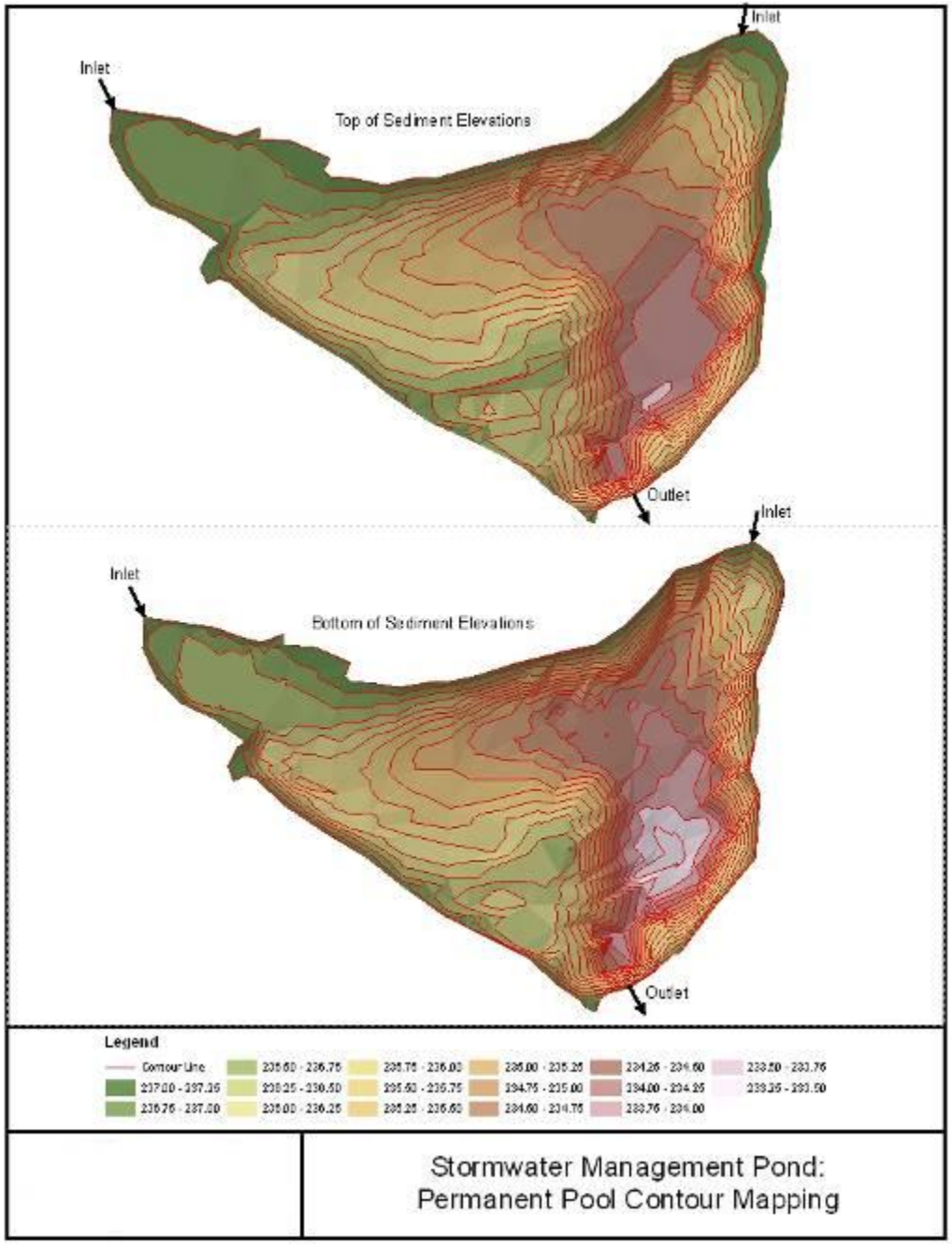
Bathymetric Survey

- Survey completed by taking 50 -100 points of both sediment and bottom layer of pond
- Sediment and water volumes calculated using CAD or GIS and compared with minimum active volume requirements



Dual Measurement Bathymetric Survey

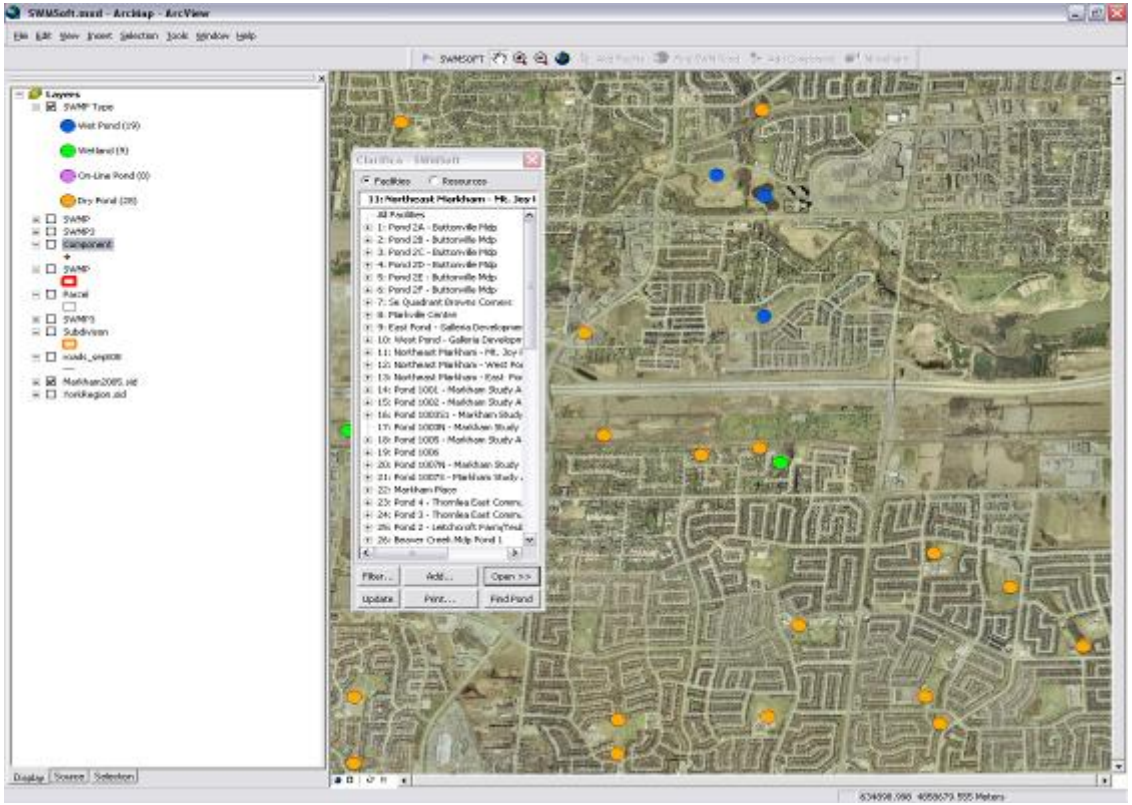




SWMSoft

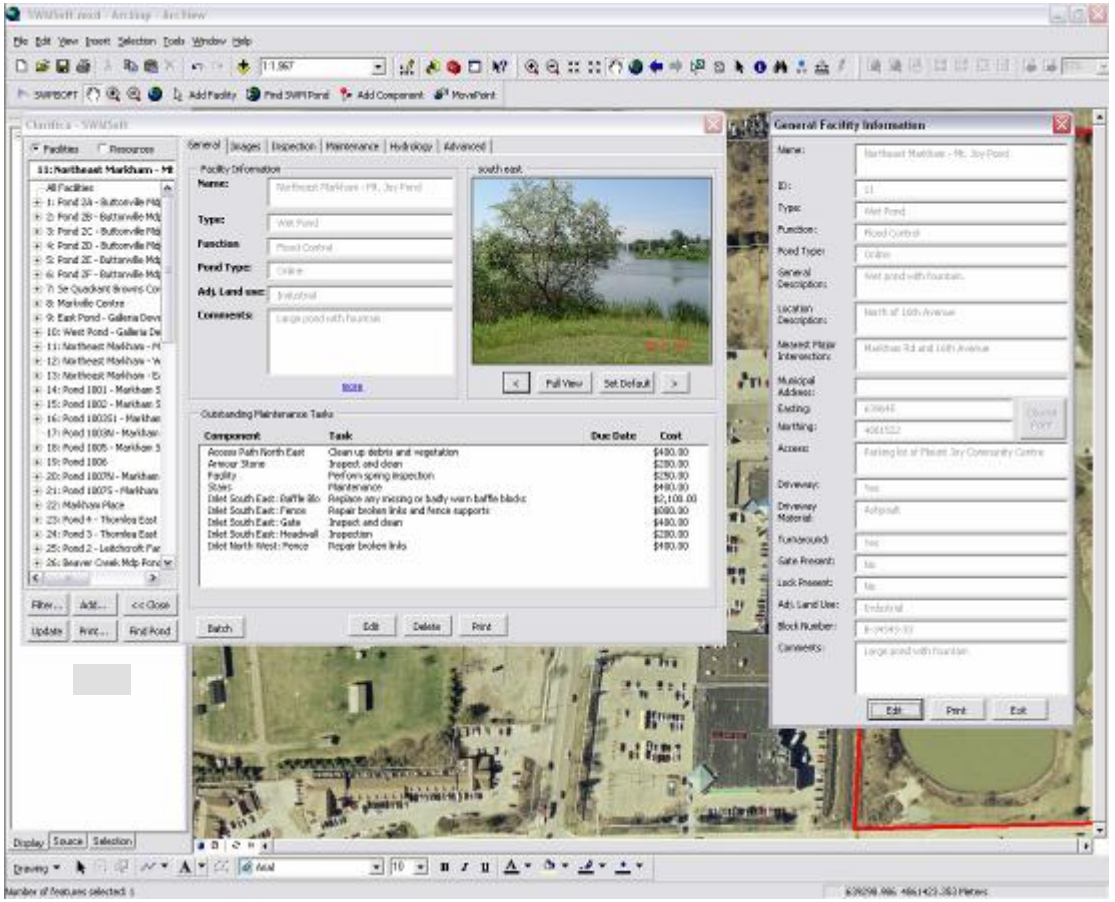
SWMSoft = Centralized Repository of all SWM Information

- SWM Reports
- Drawings
- Inspection results
- Maintenance (completed and recommended)
- Photographs
- Sediment accumulation and forecasting



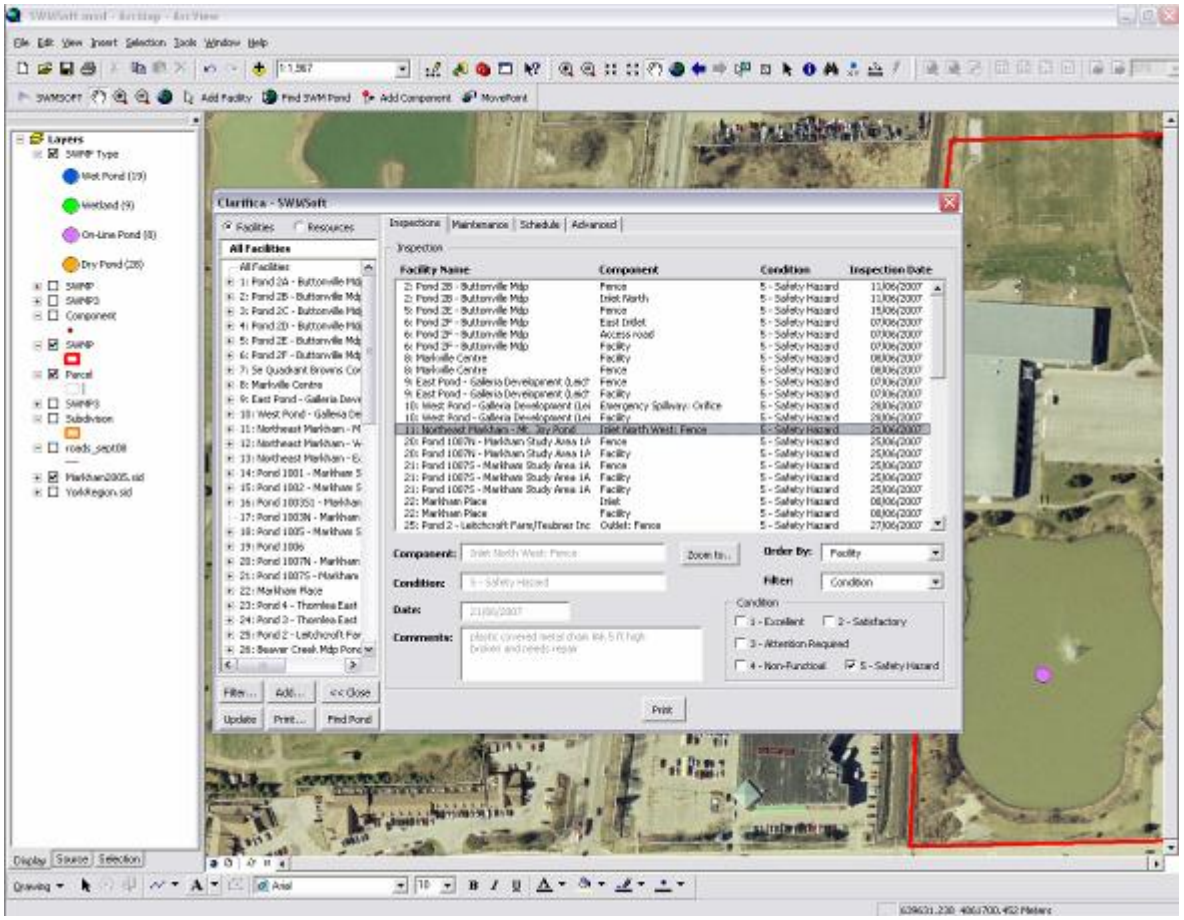
Facility Information

- Provides general information about facilities including:
  - Name and ID
  - Type
  - Location
  - Access
  - Maintenance tasks
  - Comments
- Facility status and general inspection forms can be printed directly from this screen



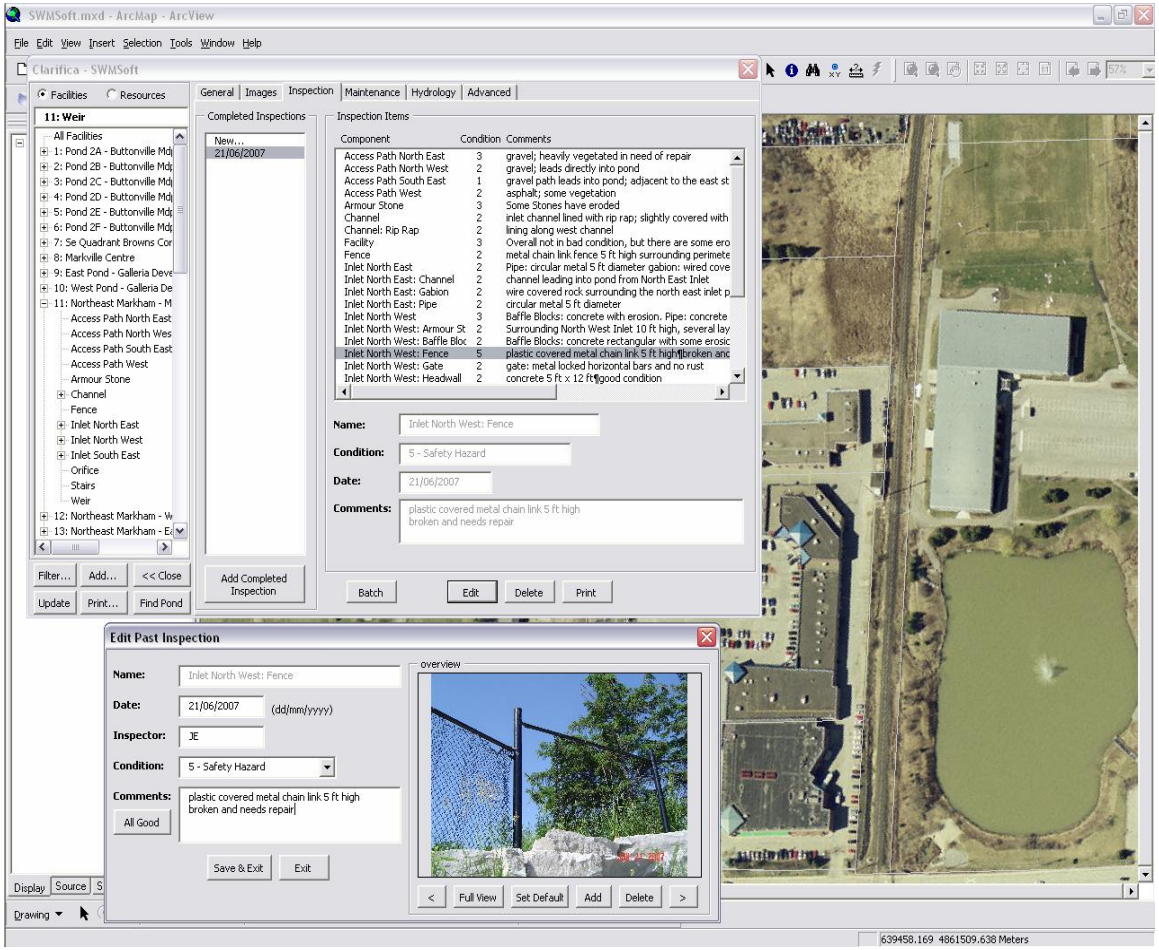
Inspection Summary

- Lists all components and their current condition
- Filters:
  - Condition
  - Type (wet ponds)
- Sorting:
  - Facility
  - Component
  - Condition
  - Inspection date



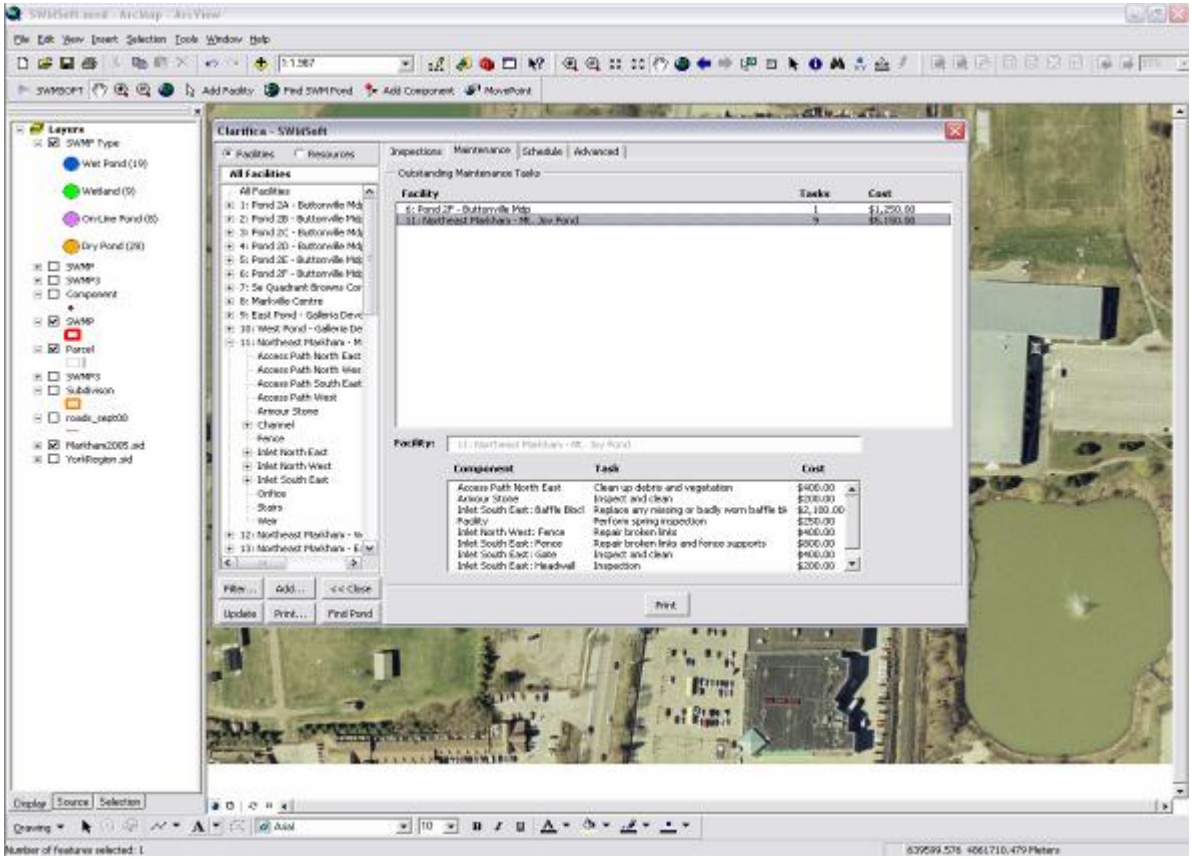
Inspections Details

- Provides access to:
  - Inspection results
  - New inspection forms
- Lists all components associated with a facility including:
  - Inlet and outlet structures and pipes
  - Fences
  - Access roads
  - Weirs and other controls
  - Structural elements
- Reports condition and comments by:
  - Overall facility
  - Component
  - Inspection date



Maintenance Summary

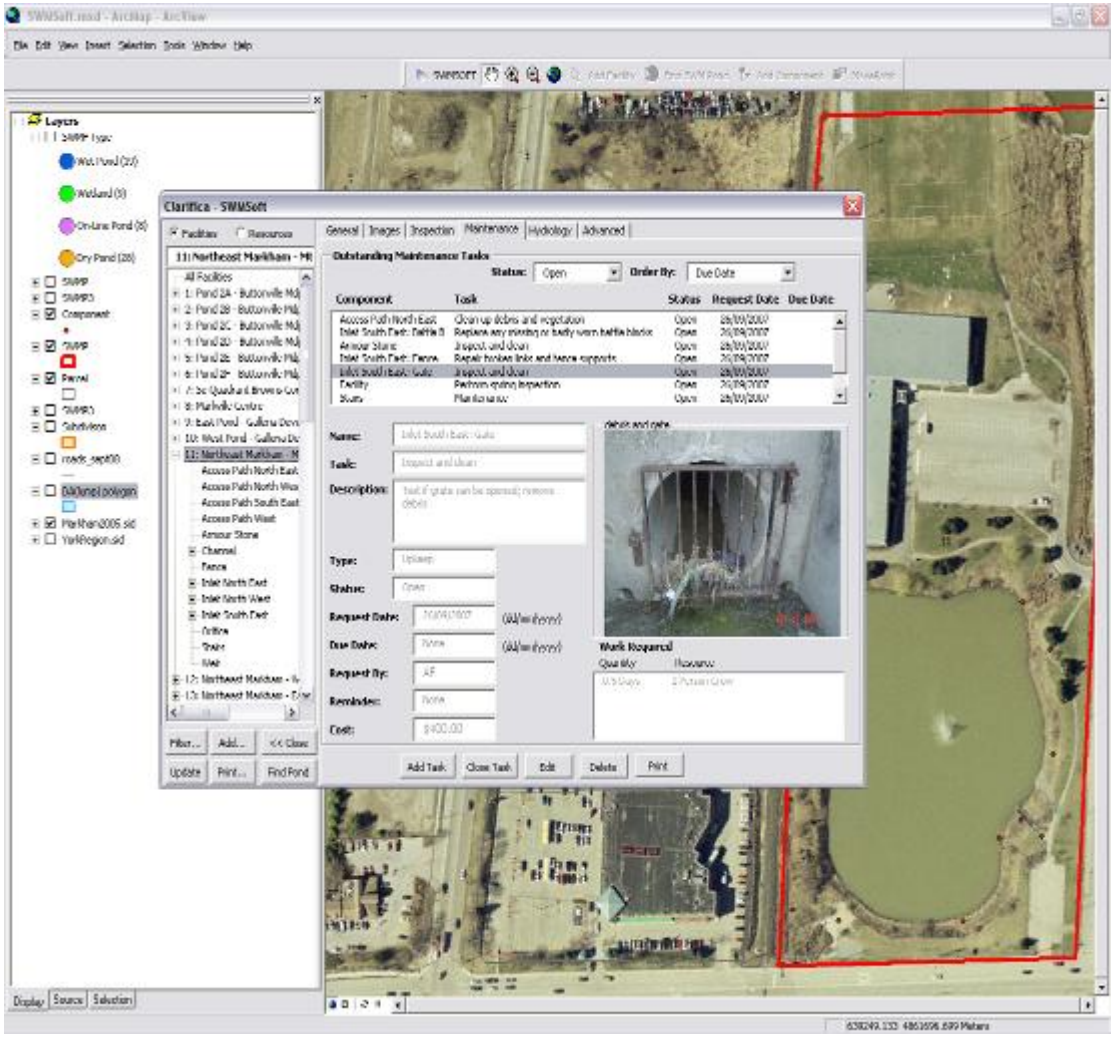
- Detailed breakdown of cost for each maintenance task



Maintenance Details

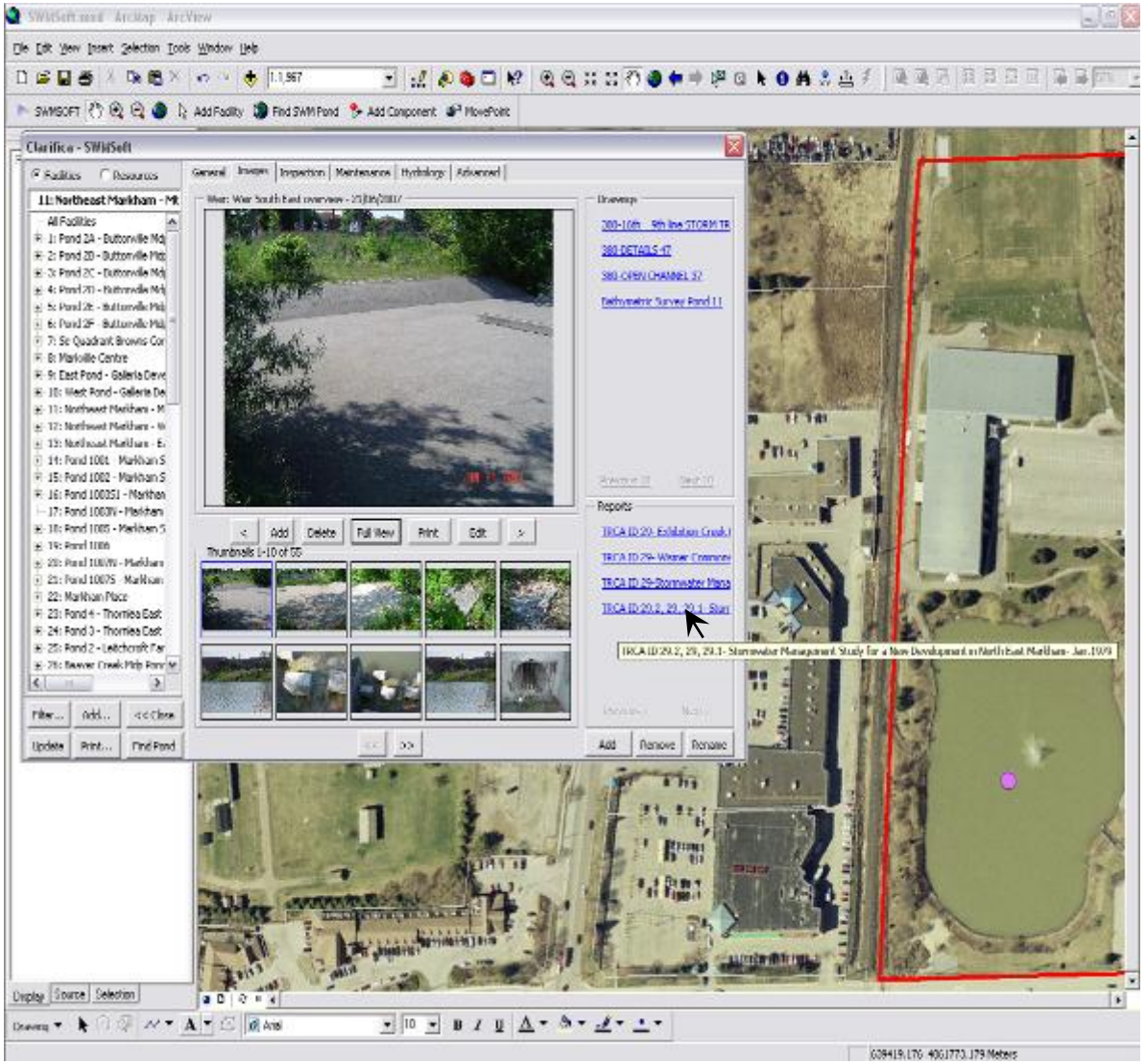
For each facility, identifies recommended maintenance tasks including:

- Component to be maintained
- Description of task
- Work order status
- Request date and due date
- Resources required (staff, time, and equipment)



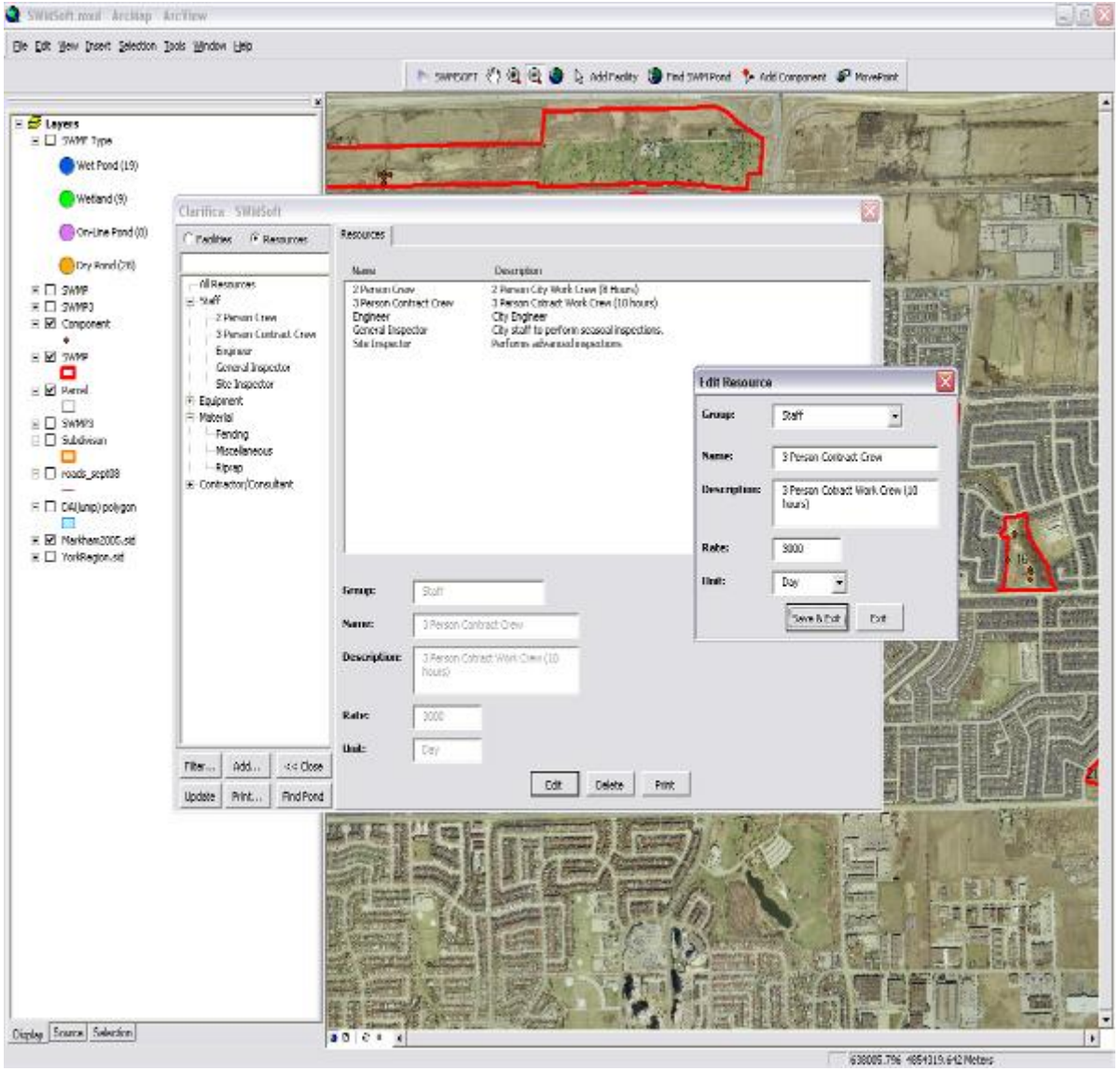
Central Data Reference

- Provides access to:
  - Drawings
  - Bathymetric surveys
  - SWM reports
  - Photographs



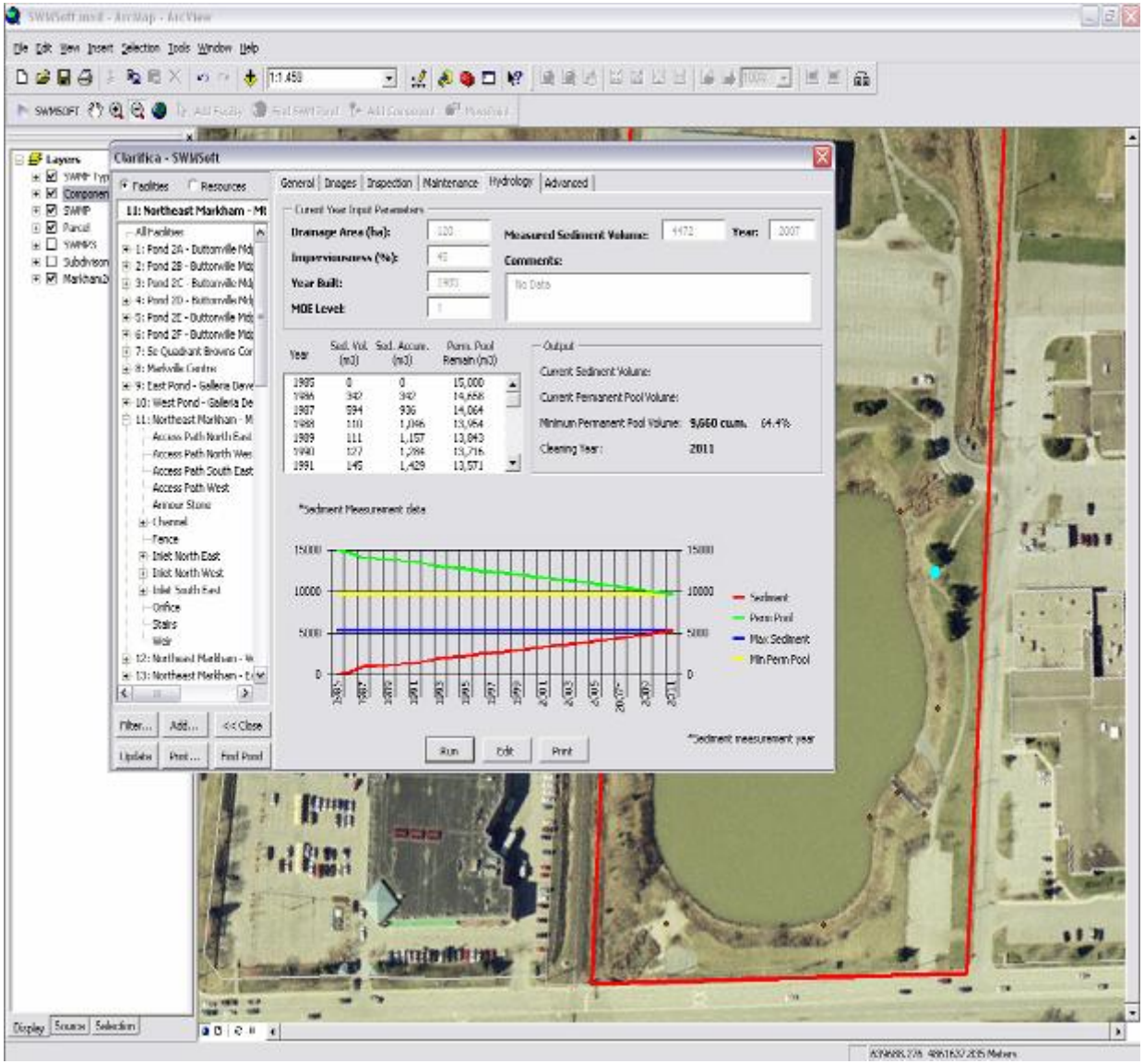
Resources & Costs

- Unit rates and staff times
- Equipment and material costs



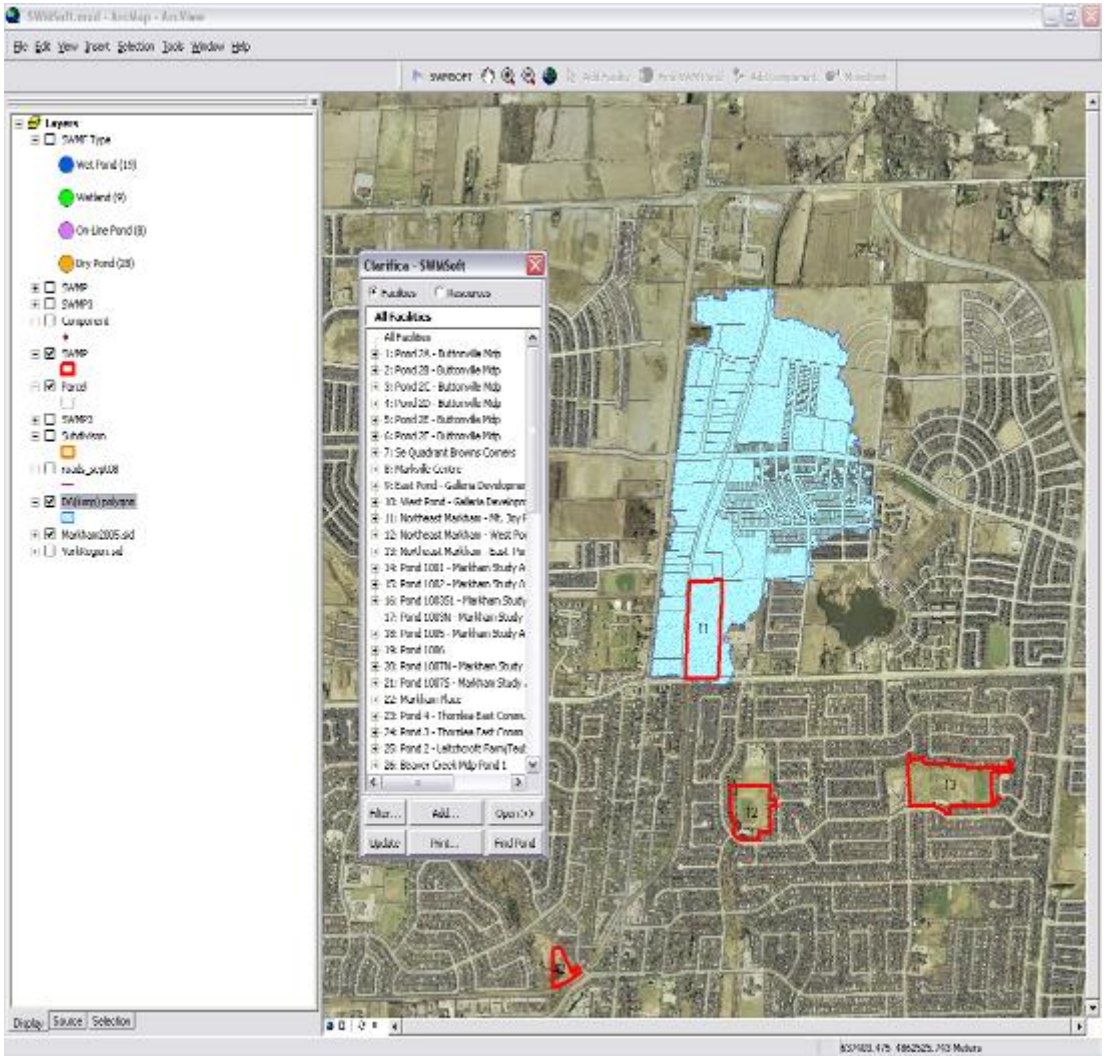
Hydrology, Water Quality, Environmental Management

- Integrated SWMM model to forecast sediment accumulation
- Estimates based on drainage area, past surveys, and age
- Pollutant build-up and wash-off function included for estimates



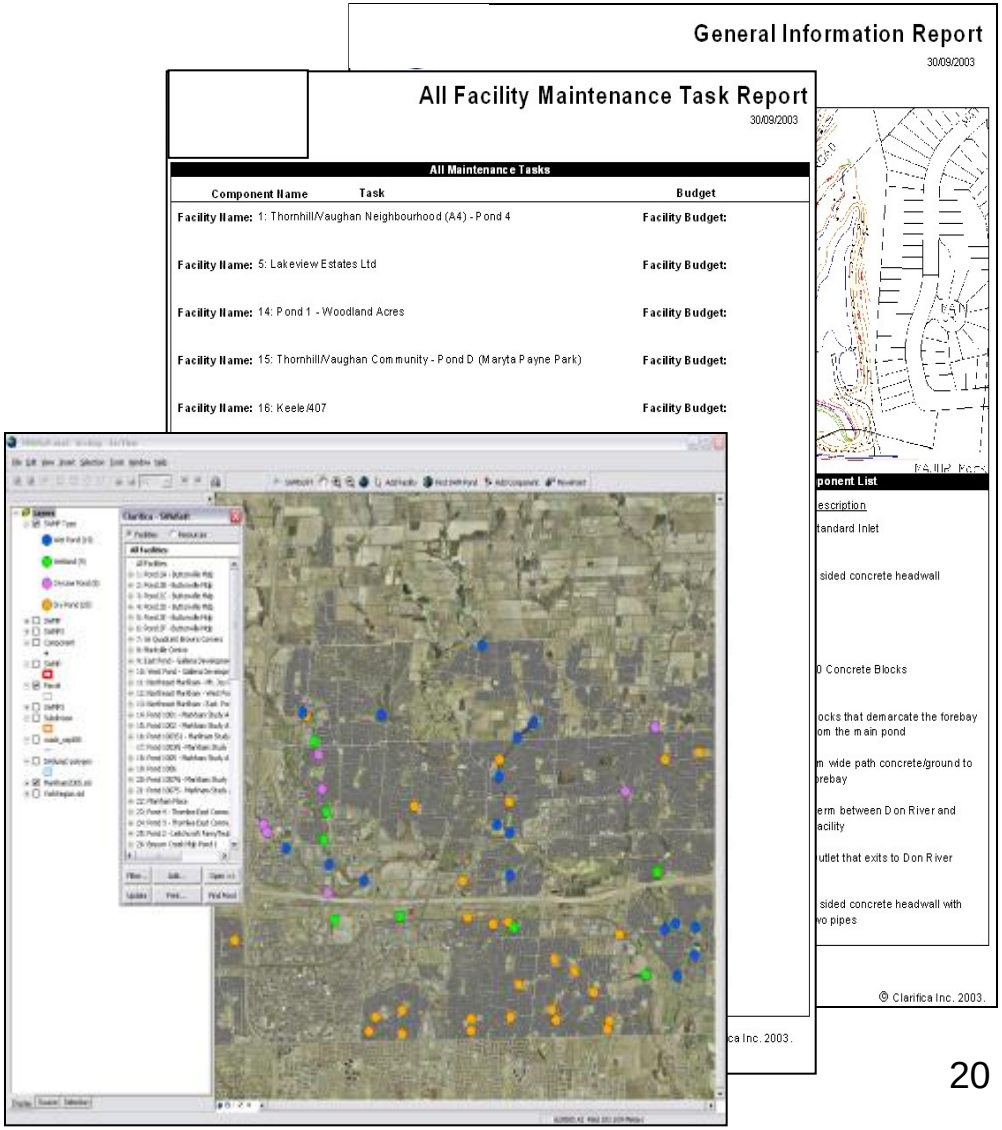
Drainage Area

- Drainage area delineation:
  - Spill response
  - New or infill development SWM criteria
  - Development charges
- Major and minor system drainage area



Other Useful Functions

- Facility Index Map
- Detailed SWM Facility information binders
- Maintenance priority listing and detailed costing

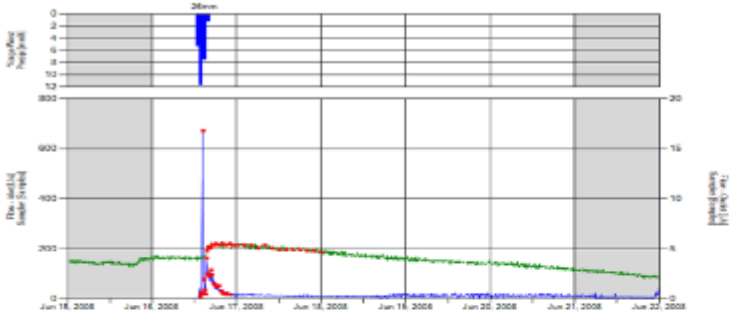


SWM Monitoring Records

Pond Monitoring and Sample Analysis

Clarifica Automated Data Analysis System

Project: Yonge West Environmental Monitoring
Site: Pond A



Event Statistics

Owner: Chris Stebbing Drainage Area: 62 ha Time of Concentration (T_C): 17 min

Event Date	2008-06-16
Total Precipitation	26 mm
Peak Precipitation Intensity	11.8 mm/hr
Peak Precipitation Intensity over Tc	8.9 mm/45min
Volumetric Runoff Coefficient	0.58
Peak Runoff Coefficient	0.12
Inlet Sample #	24
Outlet Sample #	24
Inlet Peak Flow	678 L/s
Outlet Peak Flow	6.5 L/s
Design Outlet Peak Flow	12 L/s
Total Inlet Flow	1323 cu.m.
Total Outlet Flow	1145 cu.m.
Peak Inlet Temperature	21 °C
Peak Outlet Temperature	17 °C

Parameter	Unit	Inlet	Outlet	Guideline
TSS	mg/L	1360	140	80%
pH		7.33	7.05	6.5-8.5
Nitrate	mg/L	1.72	0.17	
Nitrite	mg/L	<0.05	<0.05	
Total Phosphorus	mg/L	**0.11**	**0.06**	0.03
Turbidity	NTU	30	11	
Iron	mg/L	0.27	0.11	0.3
CBOD	mg/L	11	10	
Electrical Conductivity	uS/cm	507	482	
Ammonia	mg/L	0.15	0.11	
Phosphate	mg/L	<0.10	<0.10	
Aluminum	mg/L	**0.128**	0.023	0.075
Arsenic	mg/L	<0.003	<0.003	0.003
Cadmium	mg/L	0.004	<0.001	0.001

Legend
- Precipitation
- Outlet
- Inlet
- Sample

Setup

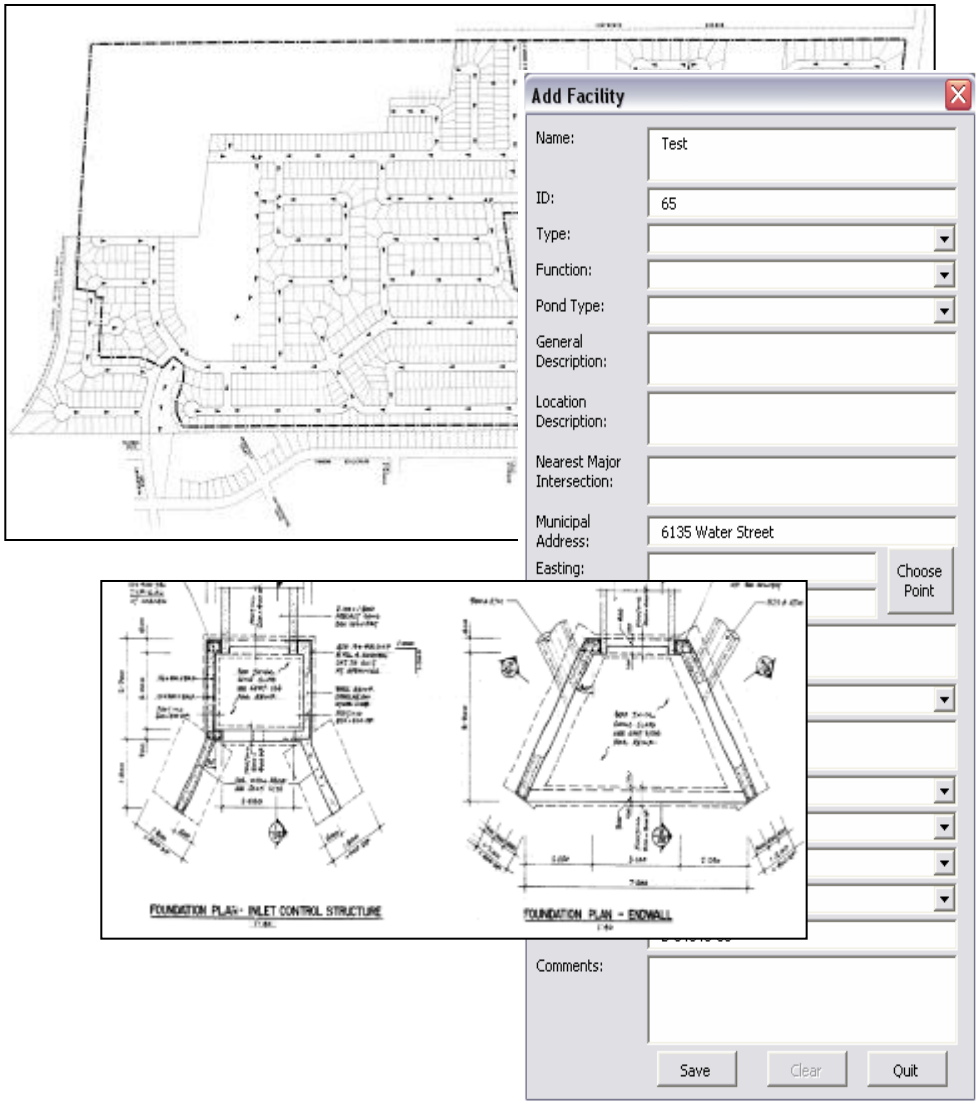
Project
Site
Flow Sensor
Rain Gauge
Tc
Drainage Area

Event Date
June 16, 2008
August 19, 2005
June 16, 2008

Start: 2008-06-15 00:00:00
End: 2008-06-22 23:59:59
Inter-event dry period: 48 hours
Go

Pond Assumption Protocols

- Developers provide information and consistent QA/QC surveys prior to assumption
- New facilities added via standard forms

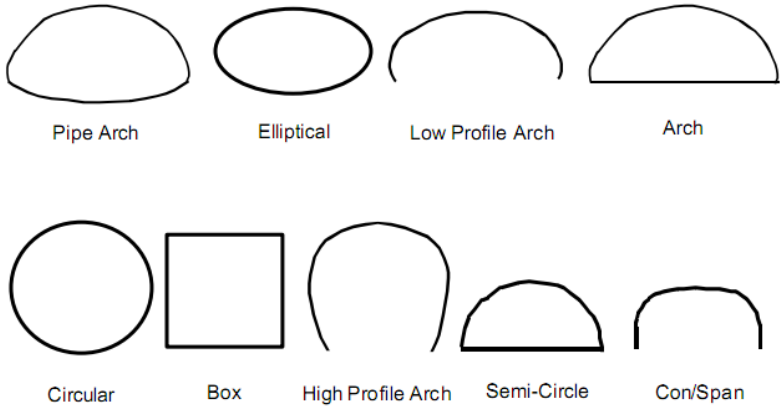


Crossings (Culvert, Bridges…)

- Similar to ponds, location, type, inspection, maintenance requirements, etc. available through system
- Specialized cross-related components included
- All HEC-RAS information stored

Crossings (Culvert, Bridges…)

- Crossings types:
  - Single Pipe
  - Multi-Pipe
  - Box
  - Bridges
- Specialized components include:
  - Piers including drag coefficient and size
  - Wing walls
  - Slope
  - Size and shape of openings
  - Material



Questions?