


Hoffman Park & Crystal Springs Stream Restoration Projects Monitoring Project Success



Kathy Hale, Principal Watershed Protection Specialist
New Jersey Water Supply Authority
May 21, 2008

Stream Restoration Monitoring

- Implementation monitoring to ensure proper construction
- Performance monitoring to monitor effectiveness and success of project



Why Monitor Stream Restoration Projects?

Pre-construction:

- Design needs, modeling (baseline conditions)
- Permitting needs
- Grant requirements

Post-construction:

- Grant requirements
- Permit requirements - e.g. newly adopted NJDEP Flood Hazard Area regulations
- Demonstrate project is meeting permit conditions
- Evaluate need for additional maintenance or adaptive management
- Evaluate success of project – what worked & what didn't



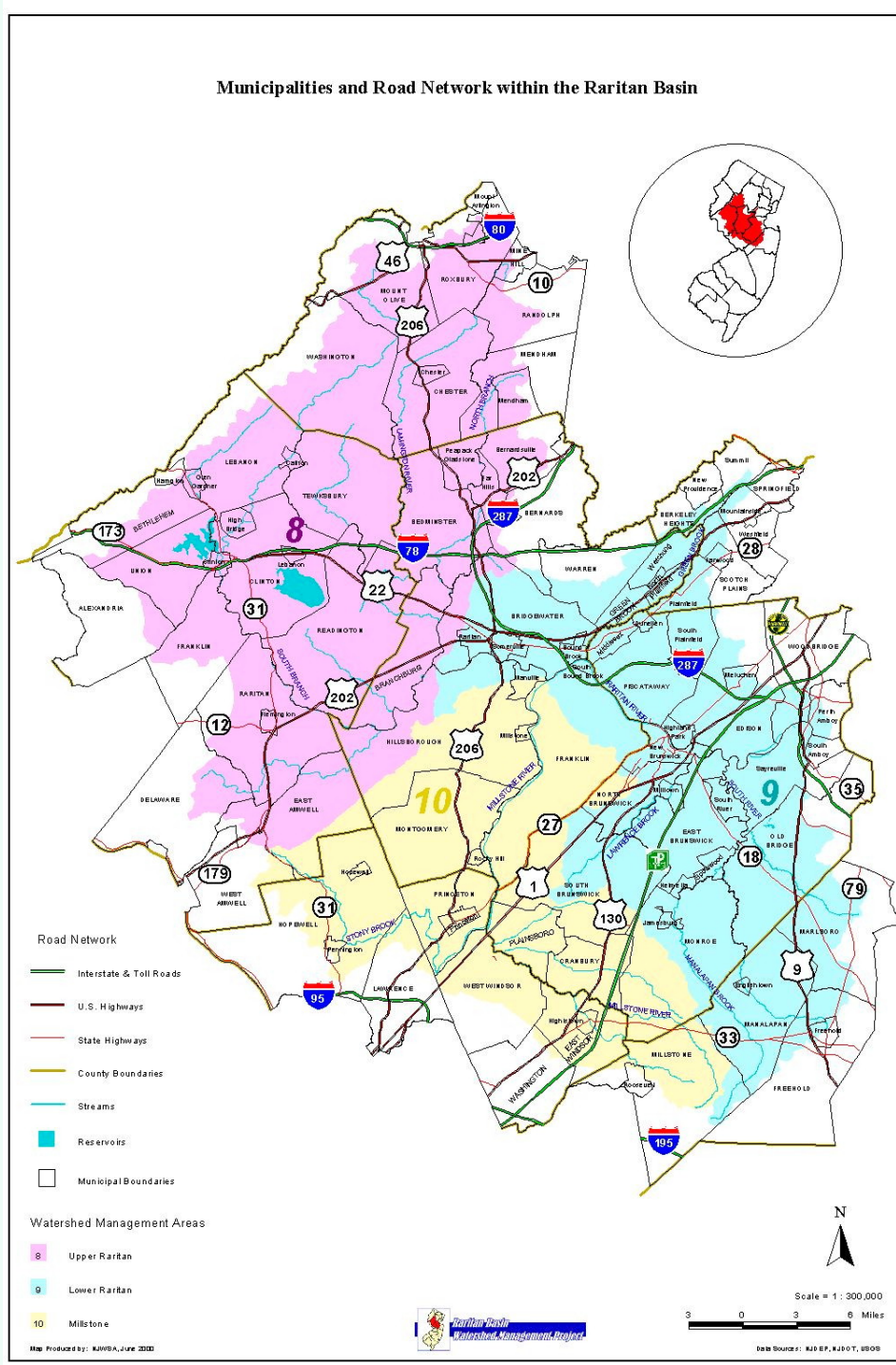
Types of Monitoring

- Photo-monitoring
- Visual observation
- Macroinvertebrate sampling
- Fish sampling
- Habitat sampling
- Vegetation surveys
- Geomorphology surveys



The Raritan Basin

- Largest river basin entirely within NJ
- 1,100 mi²
- Parts of 7 counties & 100 municipalities
- Water supply for 1.5+ million people
- 2003 Targeted Watershed Grant



Stream Restoration Through Targeted Watershed Grant

Mulhockaway Creek:

- Old Farm Road
- Hoffman Park

Spruce Run:

- Crystal Springs





Monitoring the Hoffman Park & Crystal Springs Projects

Pre-Construction:

- Photomonitoring/Visual Observations – Frequent
- Macroinvertebrate Sampling - 3x/year
- Habitat Assessment – 1x/year
- Geomorphology Survey – once

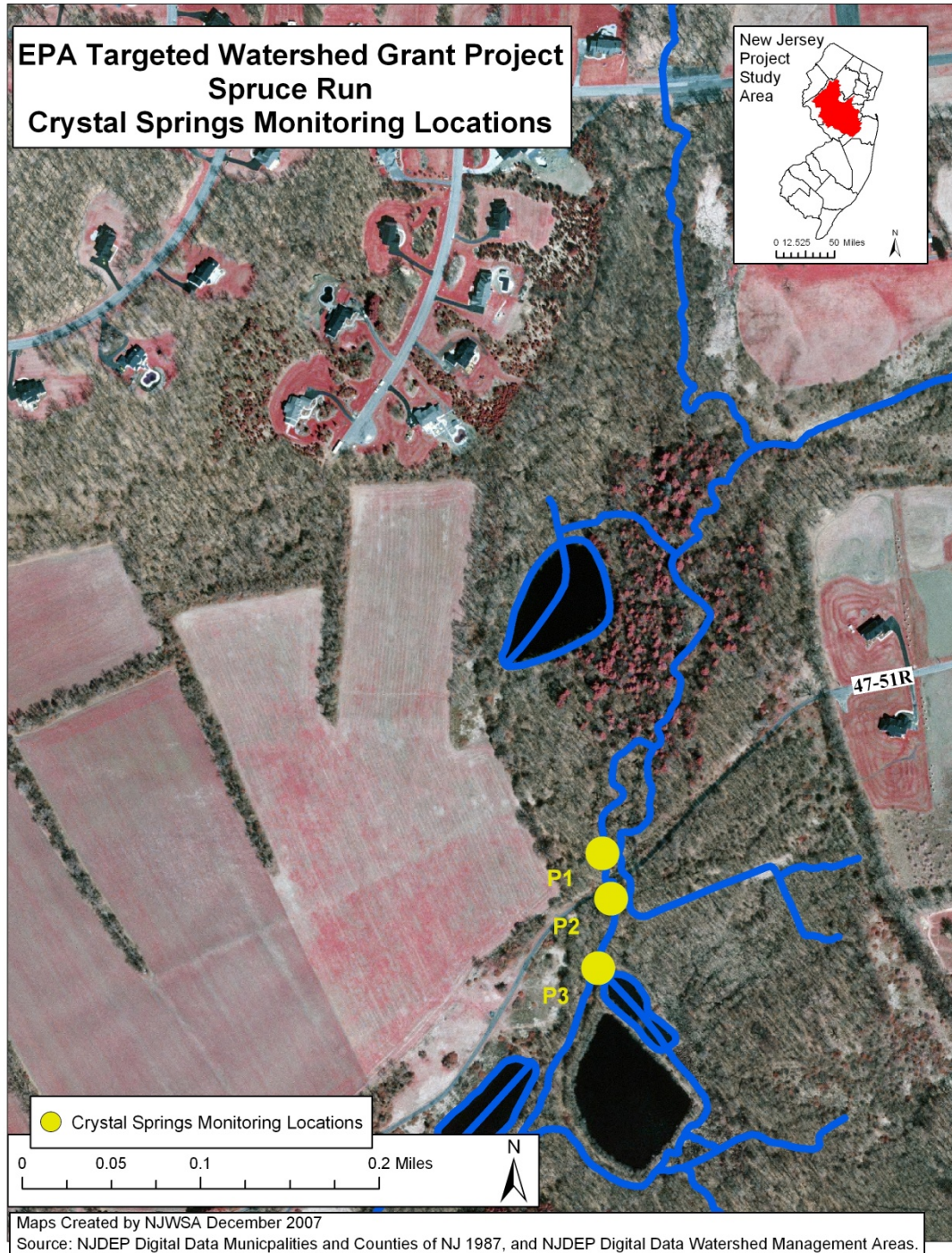
Post-Construction:

- Photomonitoring/Visual observations – Frequent
- Macroinvertebrate Sampling – 3x/year to end of grant period, 1-2x/year thereafter
- Habitat Assessment – 1x/year
- Geomorphology Survey – 1x/year, additional if flows or visual observations indicated need
- Vegetation Monitoring – 1x/year at HP





Crystal Springs Project Location & Monitoring Locations





Spruce Run at Crystal Springs Pre-Construction

- Deteriorated culvert
- Lack of pool/riffle morphology



Crystal Springs

Objectives:

- Improve sediment conveyance
- Improve flow conveyance
- Improve fish passage
- Improve structural/traffic safety features



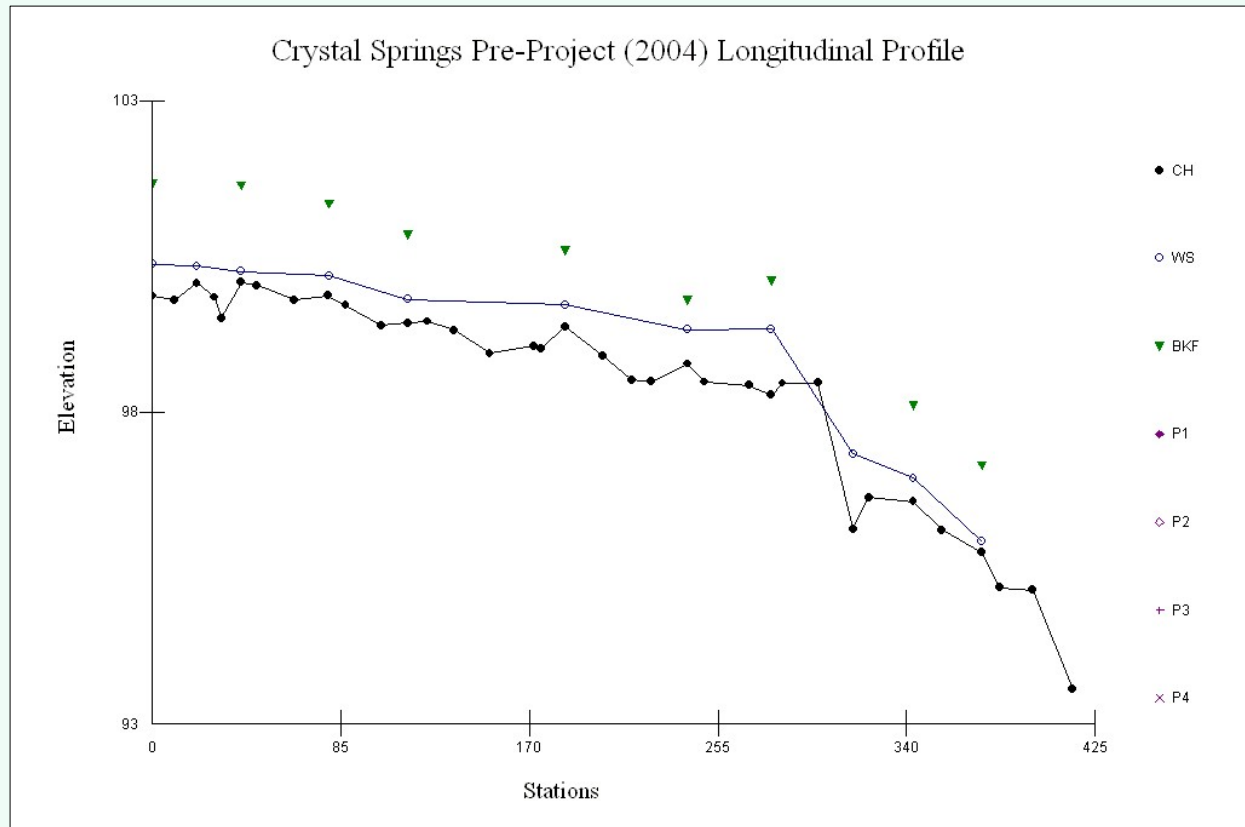
Crystal Springs

Summary of Monitoring

Macroinvertebrates	Habitat	Geo-morphology	Substrate Analysis
Pre-Project Monitoring			
Summer 2004 Fall 2004 Spring 2005 Summer 2005 Fall 2005 Spring 2006	October 2004 Fall 2004 Fall 2005	June 2004	June 2004 February 2005
Post-Project Monitoring			
Fall 2006 Spring 2007 Summer 2007 Fall 2007 Summer 2008 (planned)	Fall 2007 Summer 2008 (planned)	March 2007 April 2008	November 2007



Crystal Springs Pre-Construction Longitudinal Profile



CH – thalweg WS – water surface elevation LBKF/RBKF – left/right bankfull depth

LTOB/RTOB – left/right top of bank P1 – P4 – Other features (see Appendix X for details)

Crystal Springs Post-Construction



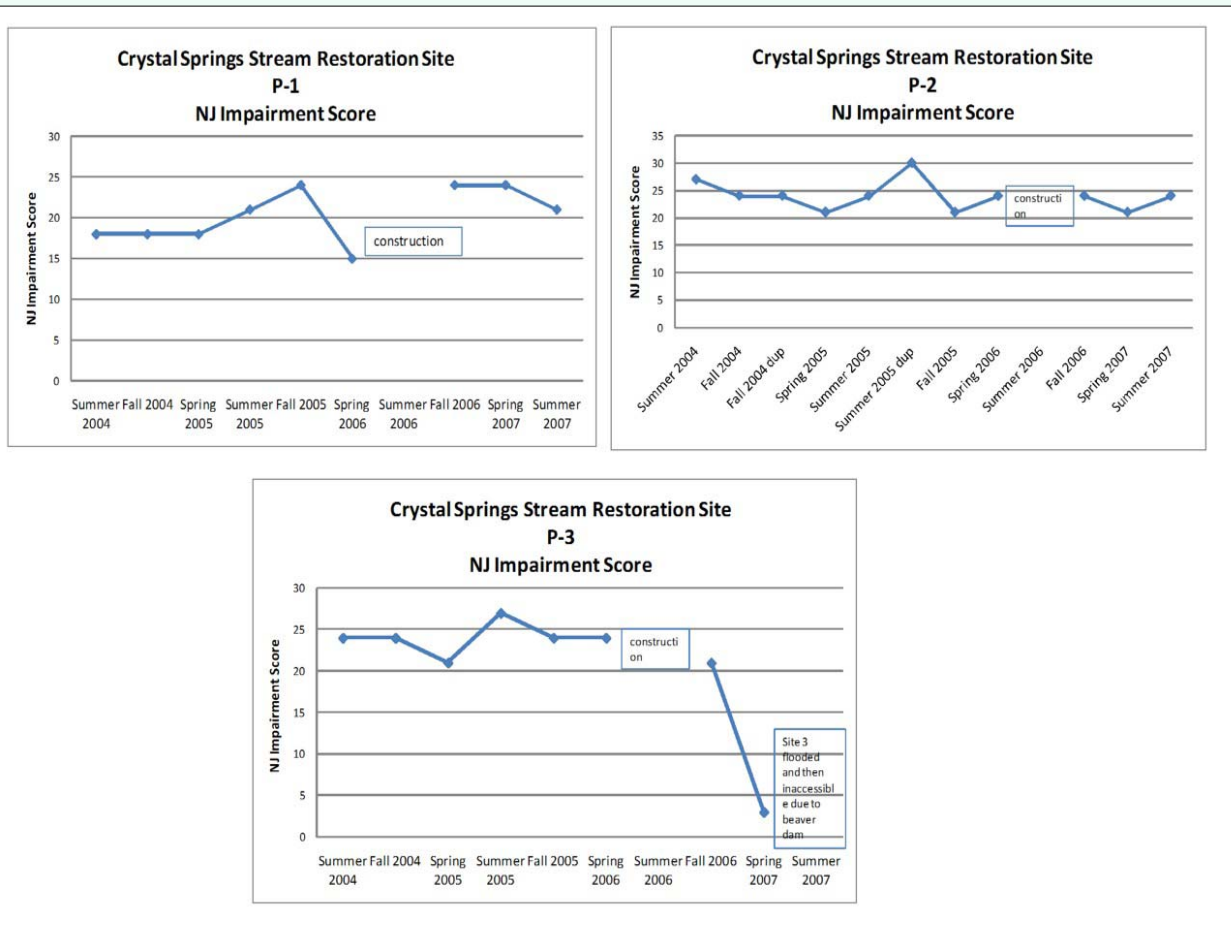
Crystal Springs Post-Construction



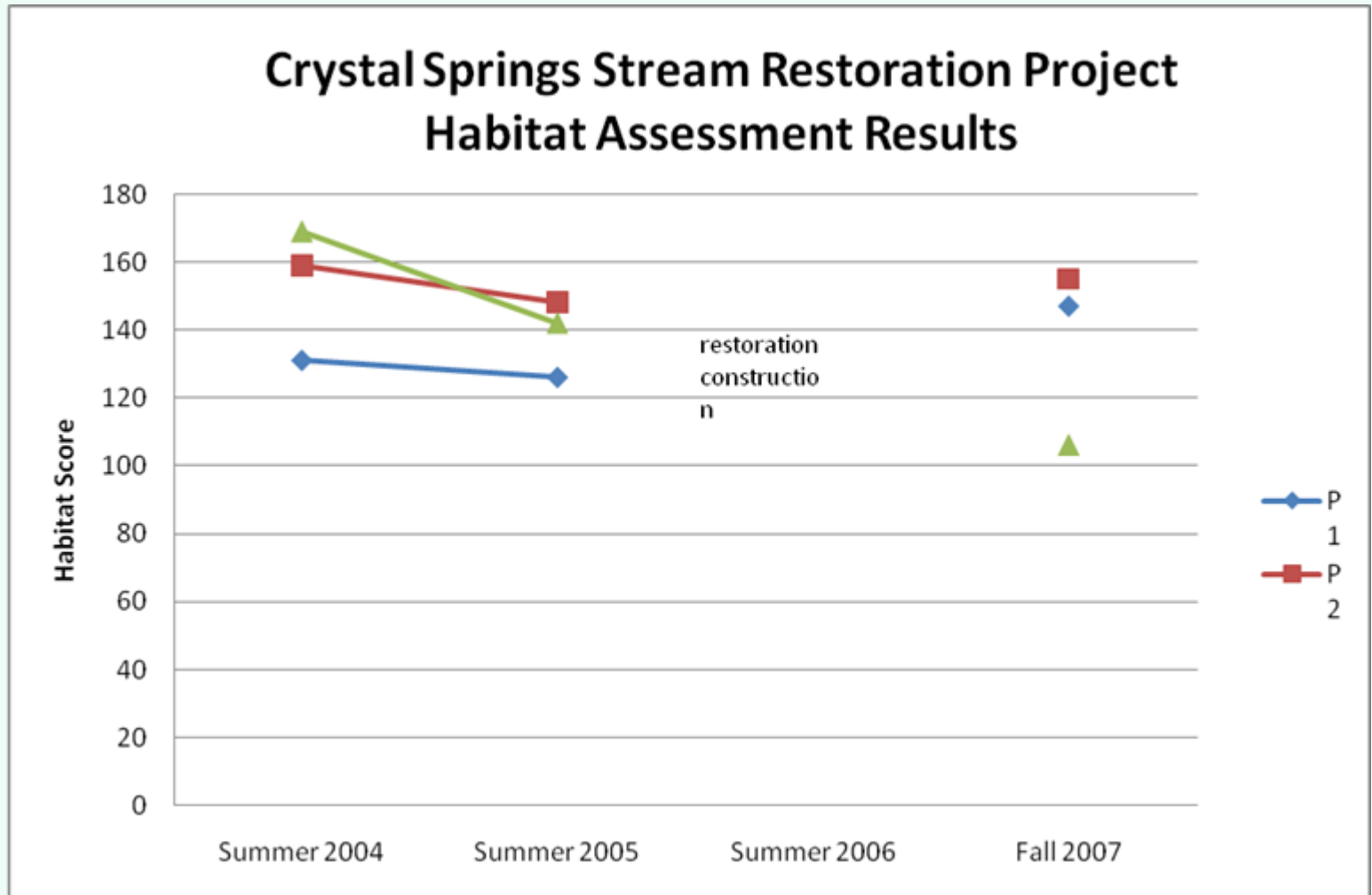
Photograph: Microsoft Earth



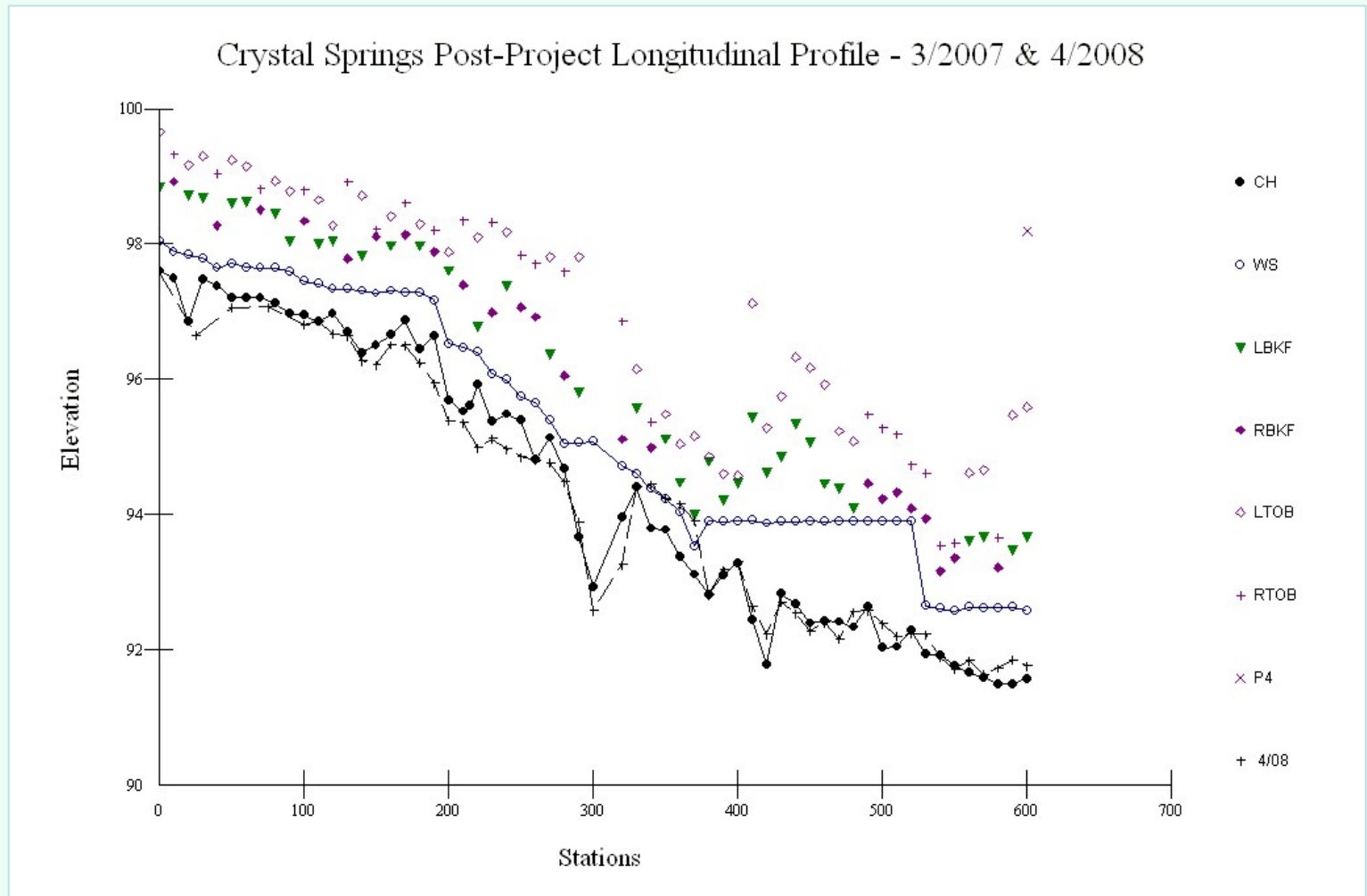
Crystal Springs Macroinvertebrate Sampling Results



Crystal Springs Habitat Assessment



Crystal Springs Post-Construction Longitudinal Profile



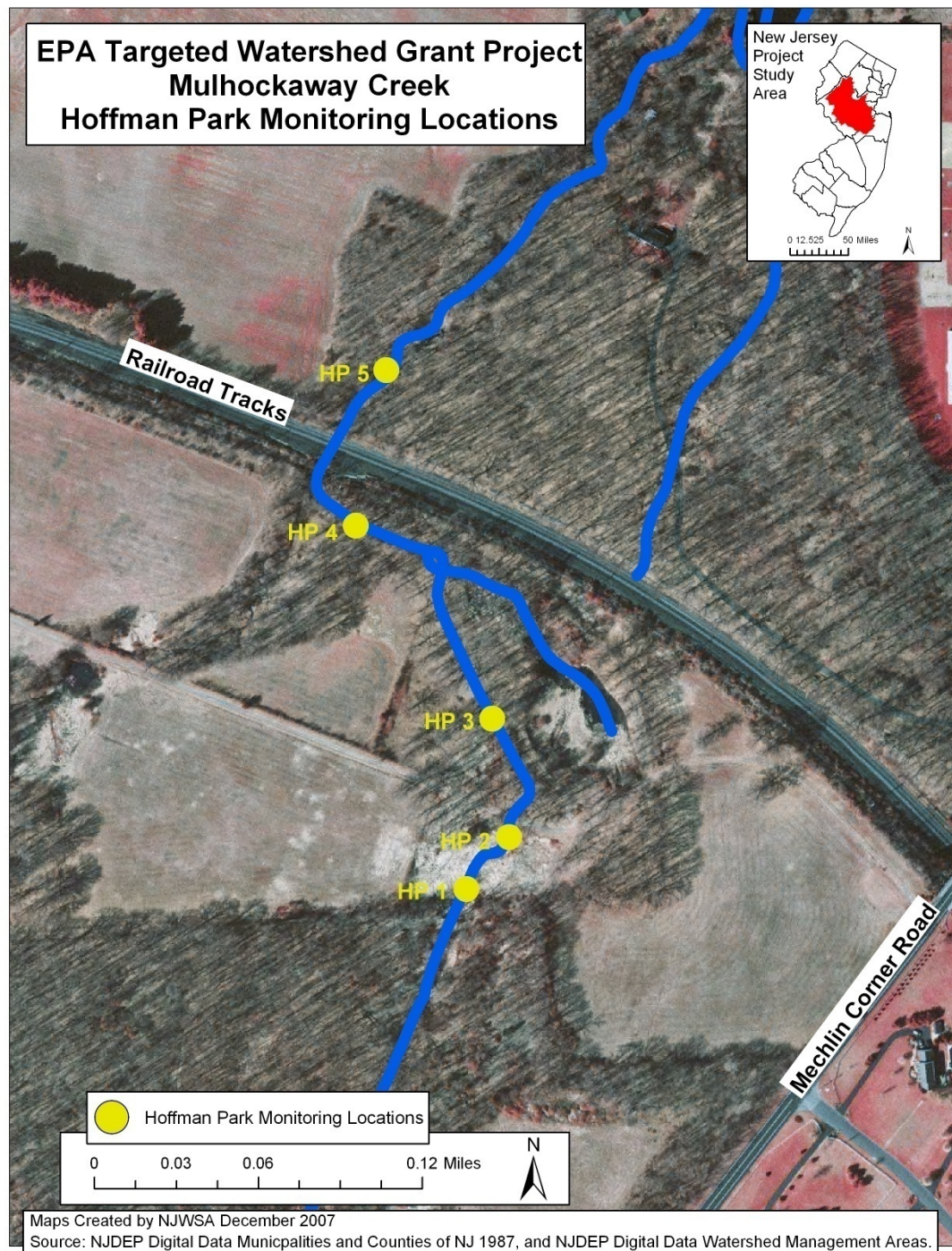
What have we learned from the Crystal Springs monitoring data?

- No significant changes to NJ Impairment score at P-1 and P-2*
- Habitat scores increased slightly at P-1 and P-2*
- More natural riffle-pool sequence being re-established upstream of culvert
- No adaptive management necessary
- No additional restoration necessary at this time

* P-3 affected by beaver dam



Hoffman Park Project Location & Monitoring Locations



Hoffman Park Pre-Construction



- Eroded/failing banks
- Stream lacked access to floodplain
- Deeply incised channel
- Deteriorated culvert system

Hoffman Park

Goals & Objectives

Goals:

- Correct severe environmental degradation caused by the channel instabilities;
- Prevent further degradation from occurring;
- Protect and enhance water quality within this reach designated as FW2-TP(C1) (public potable water supply, trout production, category 1); and
- Protect and enhance aquatic, riparian, and wetland habitat.

Objectives:

- Create a stable stream channel and accessible bankfull benches for flood stage flows;
- Manage headcuts, or vertical breaks in slope, that threaten to destroy habitat or divert their hydrologic sources;
- Reduce stream bed and bank erosion;
- Improve flow and sediment conveyance and fish passage;
- Improve water quality; and
- Improve park access.



Hoffman Park Project Components

- Install precast arch bridge
 - Adjust sinuosity and slope
 - Create bankfull bench
 - Install instream structures – rock vanes, cross vanes, root wads, log vanes
 - Stabilize headcut with floodplain interceptor
 - Establish riparian buffer
- 1st stream restoration project to receive Highlands
Preservation Area Approval



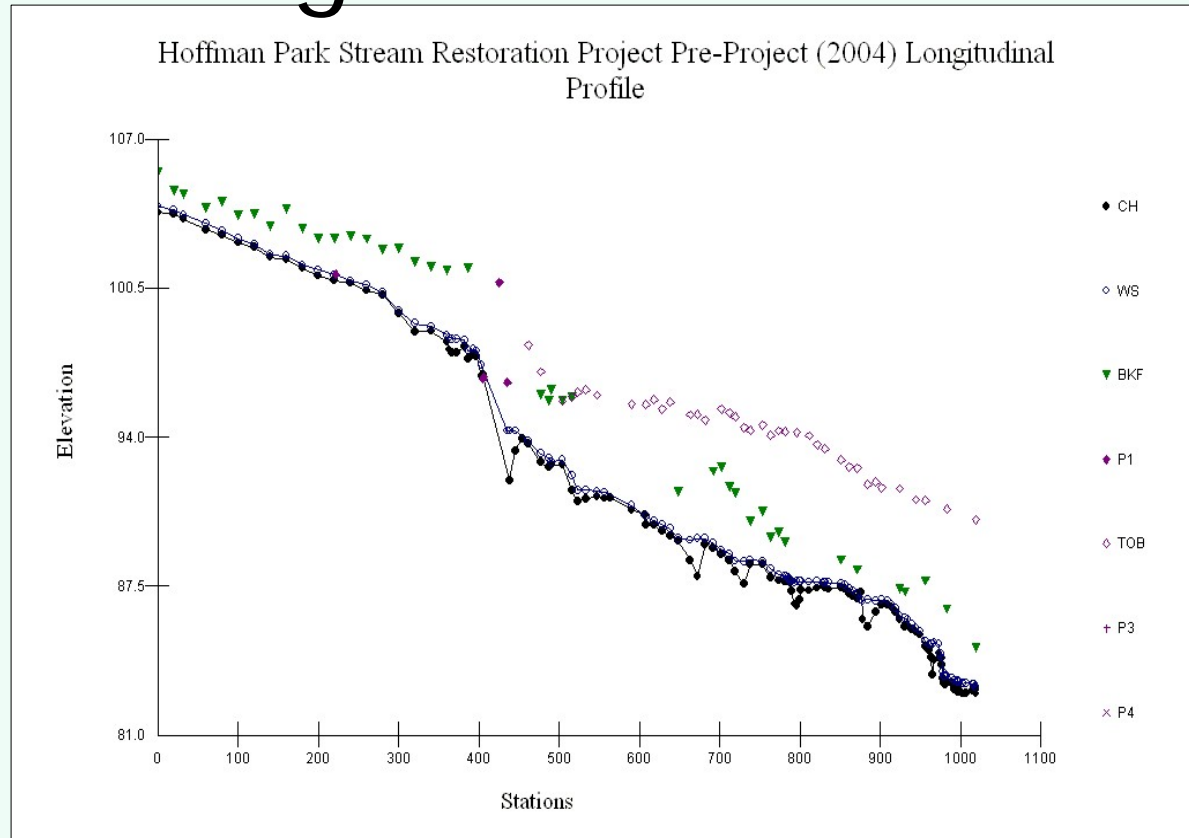
Hoffman Park

Summary of Monitoring

Macroinvertebrates	Habitat	Geo-morphology	Substrate Analysis
Pre-Project Monitoring			
Summer 2004 Fall 2004 Spring 2005 Summer 2005 Fall 2005 Spring 2006	Summer 2004 Fall 2004 Summer 2005	July 2004	July 2004 September 2004
Post-Project Monitoring			
Fall 2006 Spring 2007 Summer 2007 Fall 2007 Summer 2008 (planned)	Fall 2007 Summer 2008 (planned)	November 2006 January 2007 May 2007 April 2008	November 2006 November 2007



Hoffman Park Pre-Construction Longitudinal Profile

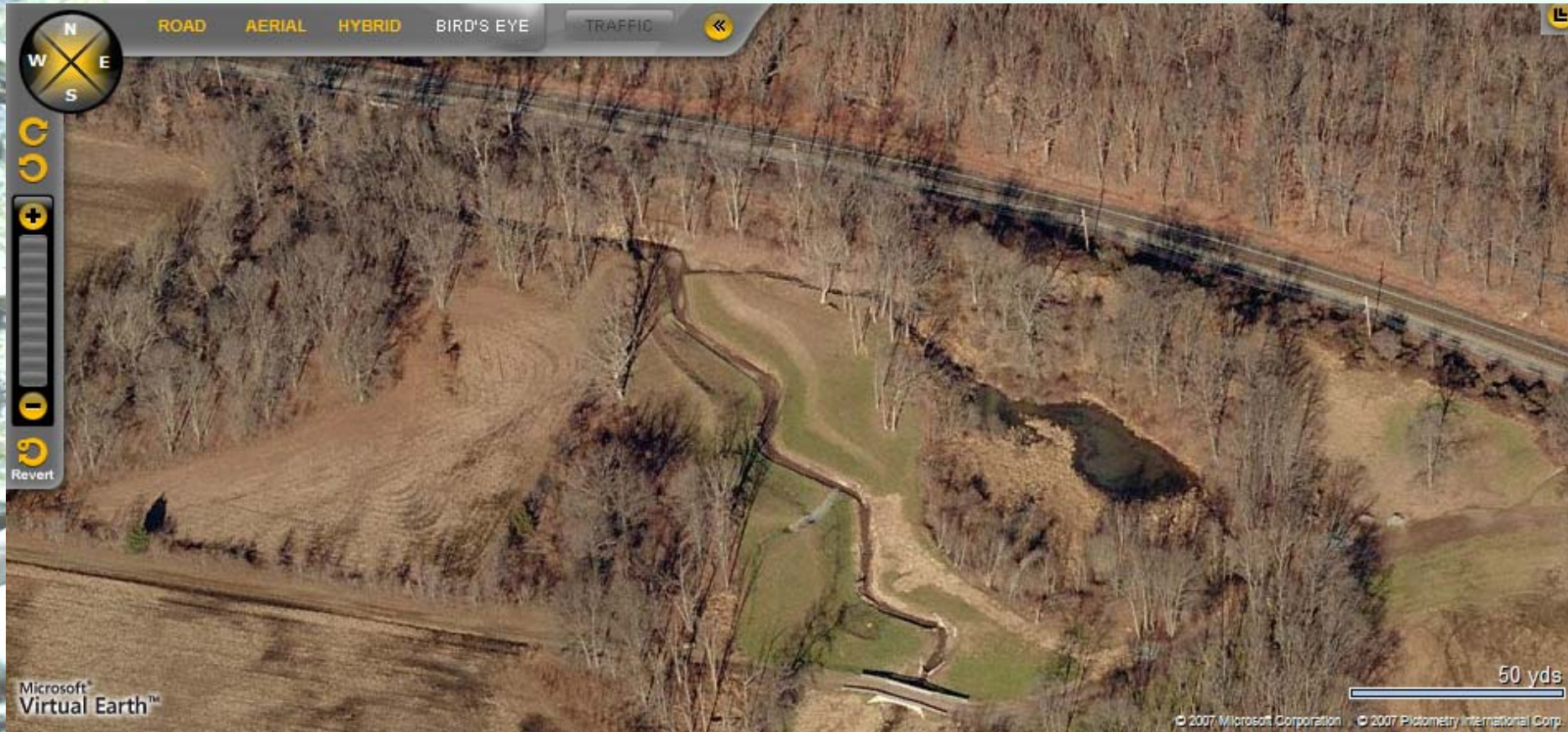


CH – thalweg WS – water surface elevation LBKF/RBKF – left/right bankfull depth
LTOB/RTOB – left/right top of bank P1 – P4 – Other features (see Appendix X for details)

Hoffman Park Post-Construction



Hoffman Park Post-Construction



Photograph: Microsoft Earth

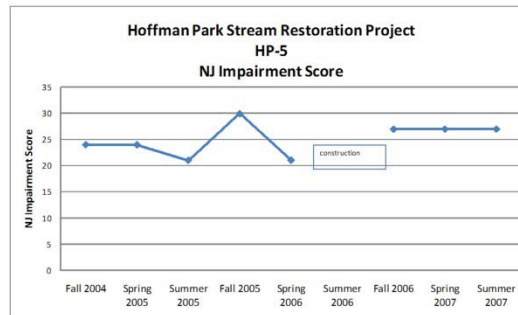
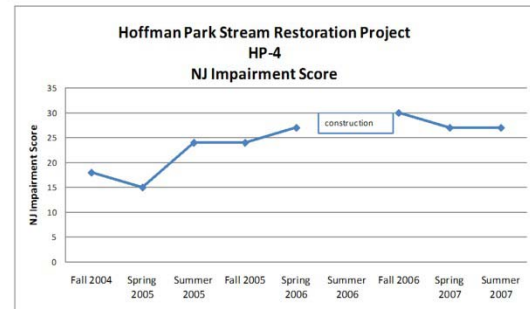
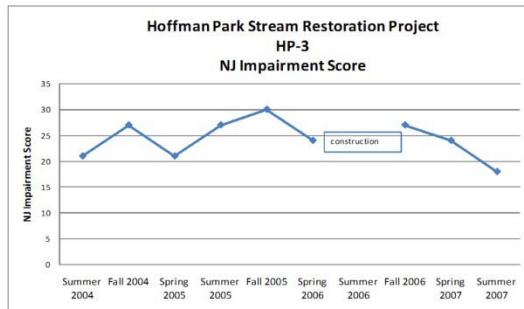
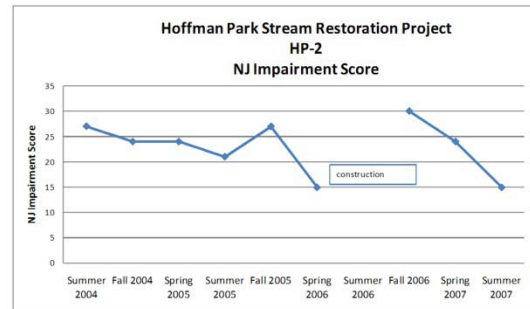
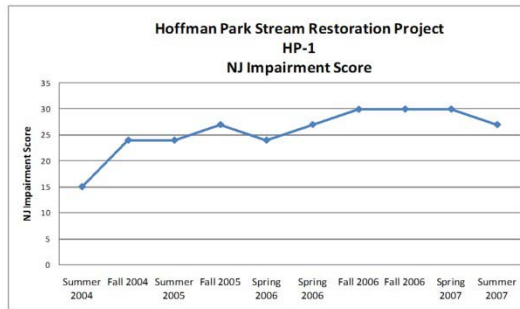
Hoffman Park Post-Construction



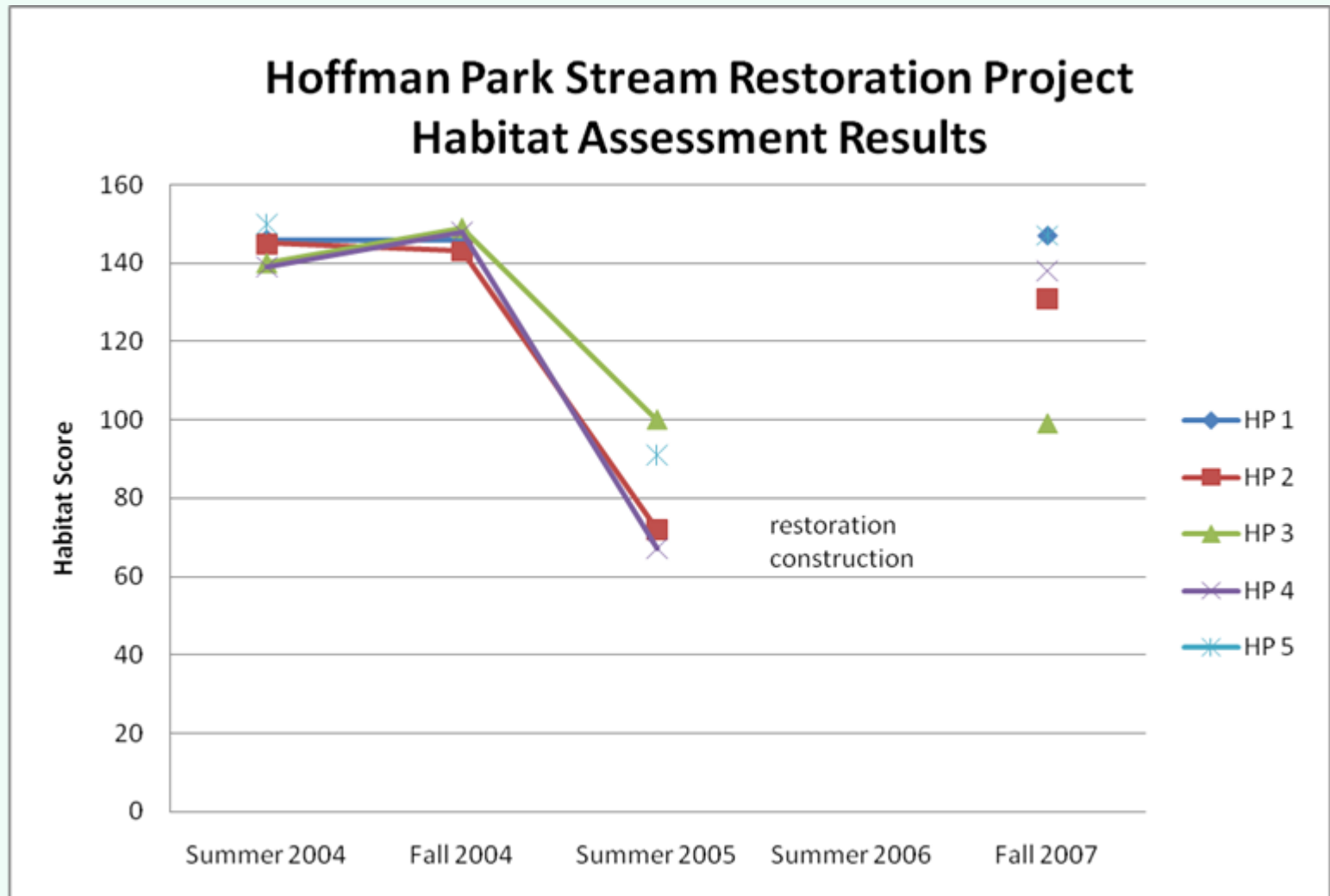
Photograph: Microsoft Earth

Hoffman Park

Macroinvertebrate Monitoring

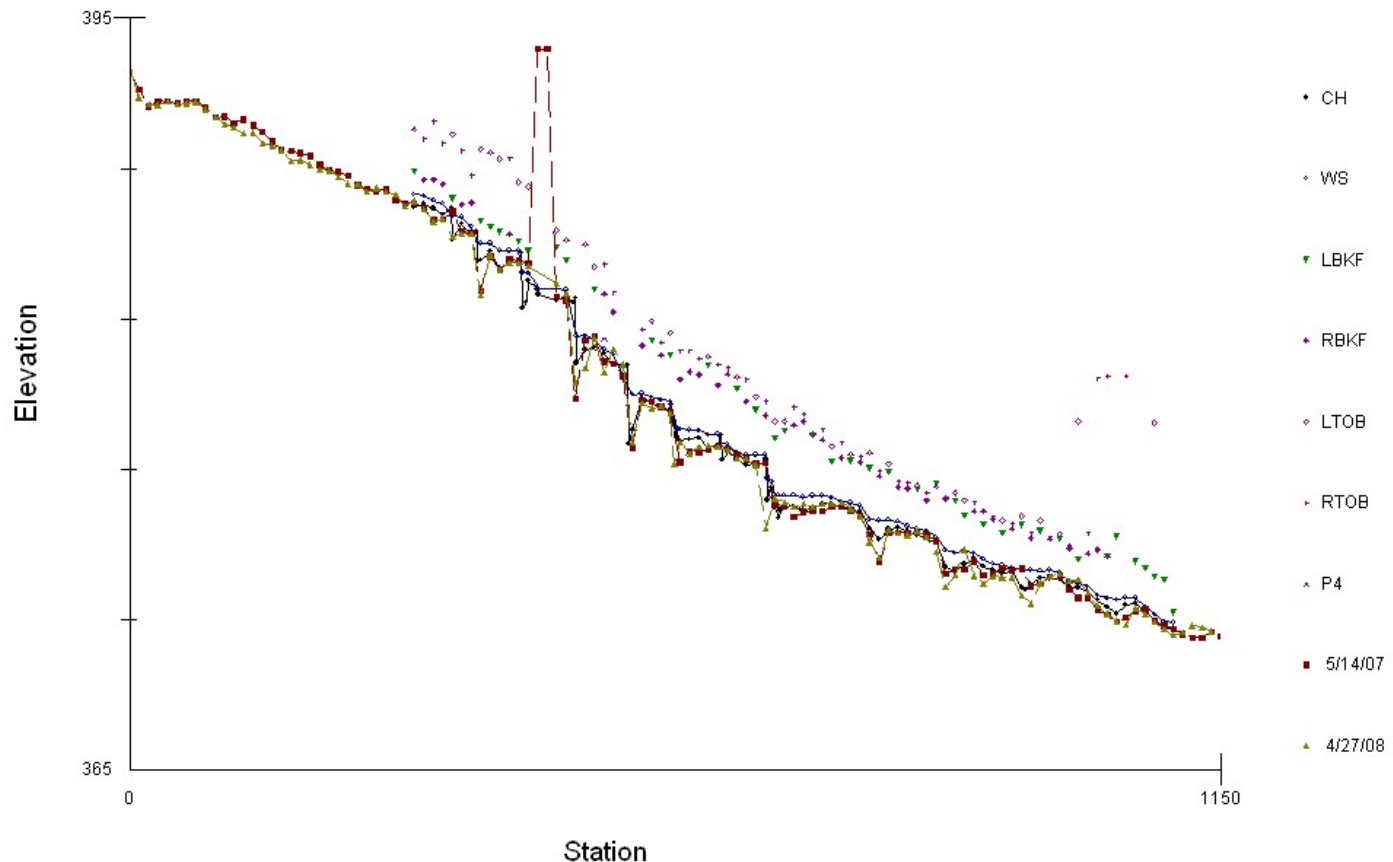


Hoffman Park Habitat Assessment

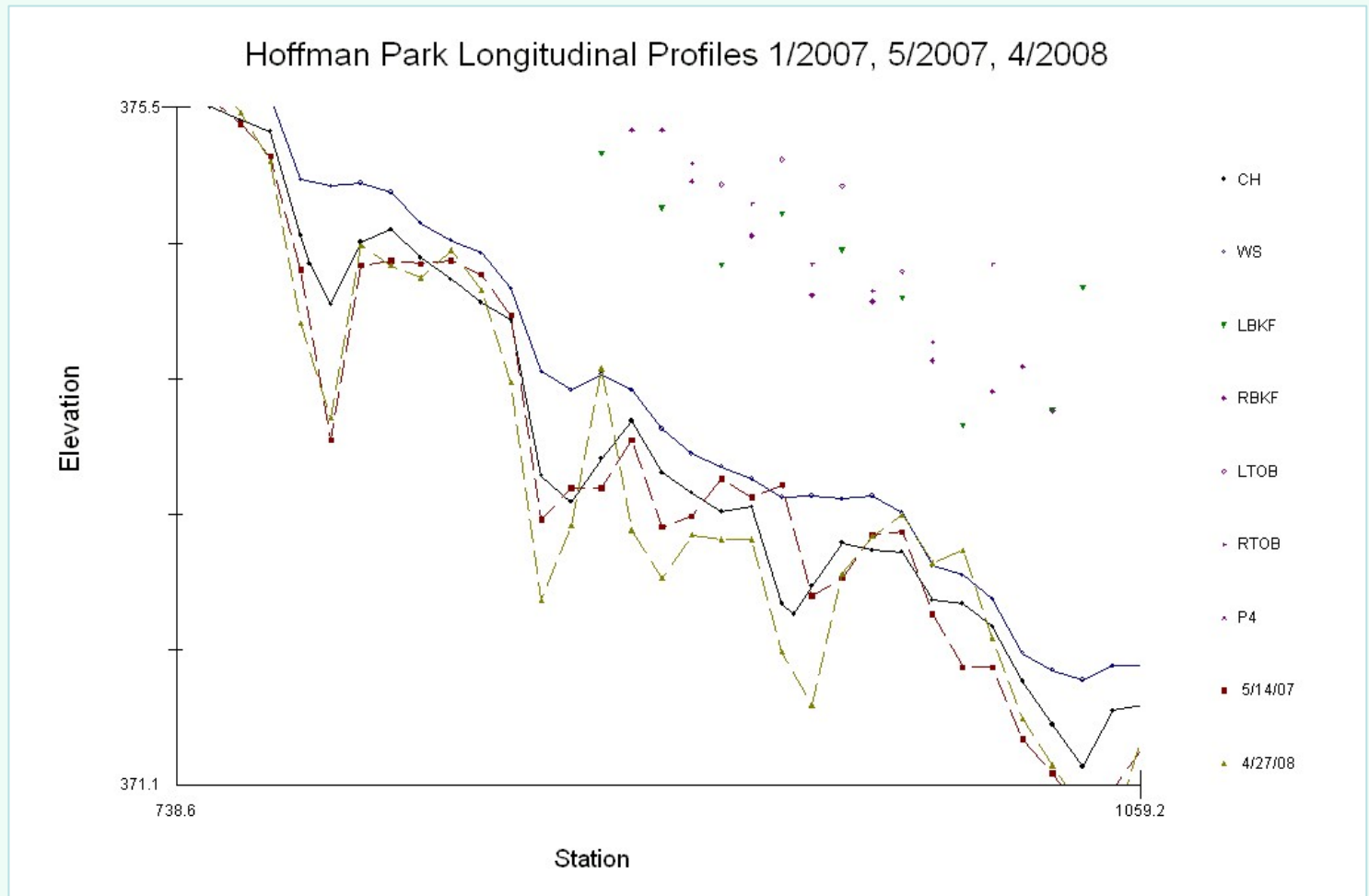


Hoffman Park Post-Construction Longitudinal Profile

Hoffman Park Longitudinal Profiles 1/2007, 5/2007, 4/2008



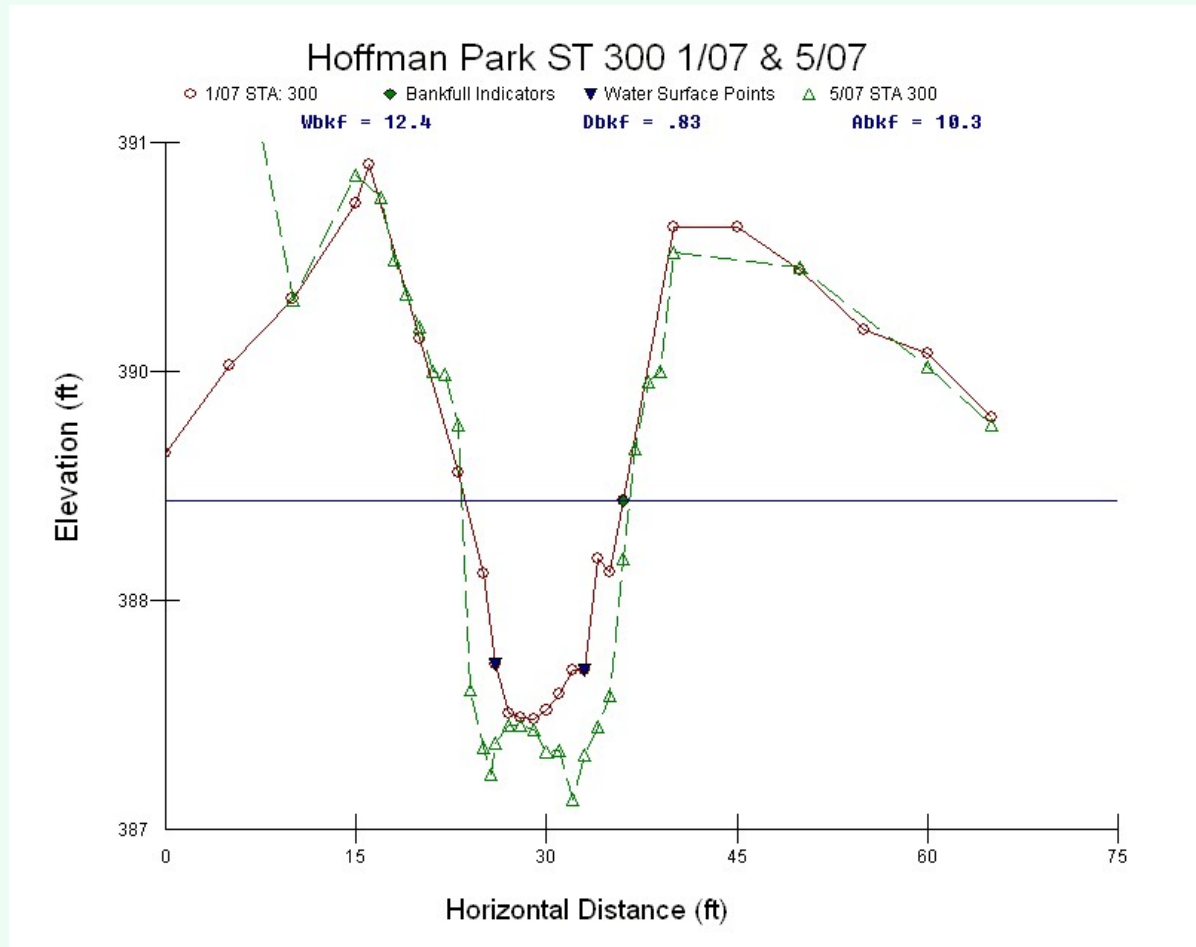
Hoffman Park Post-Construction Longitudinal Profile



Hoffman Park

Post-Construction Cross Section

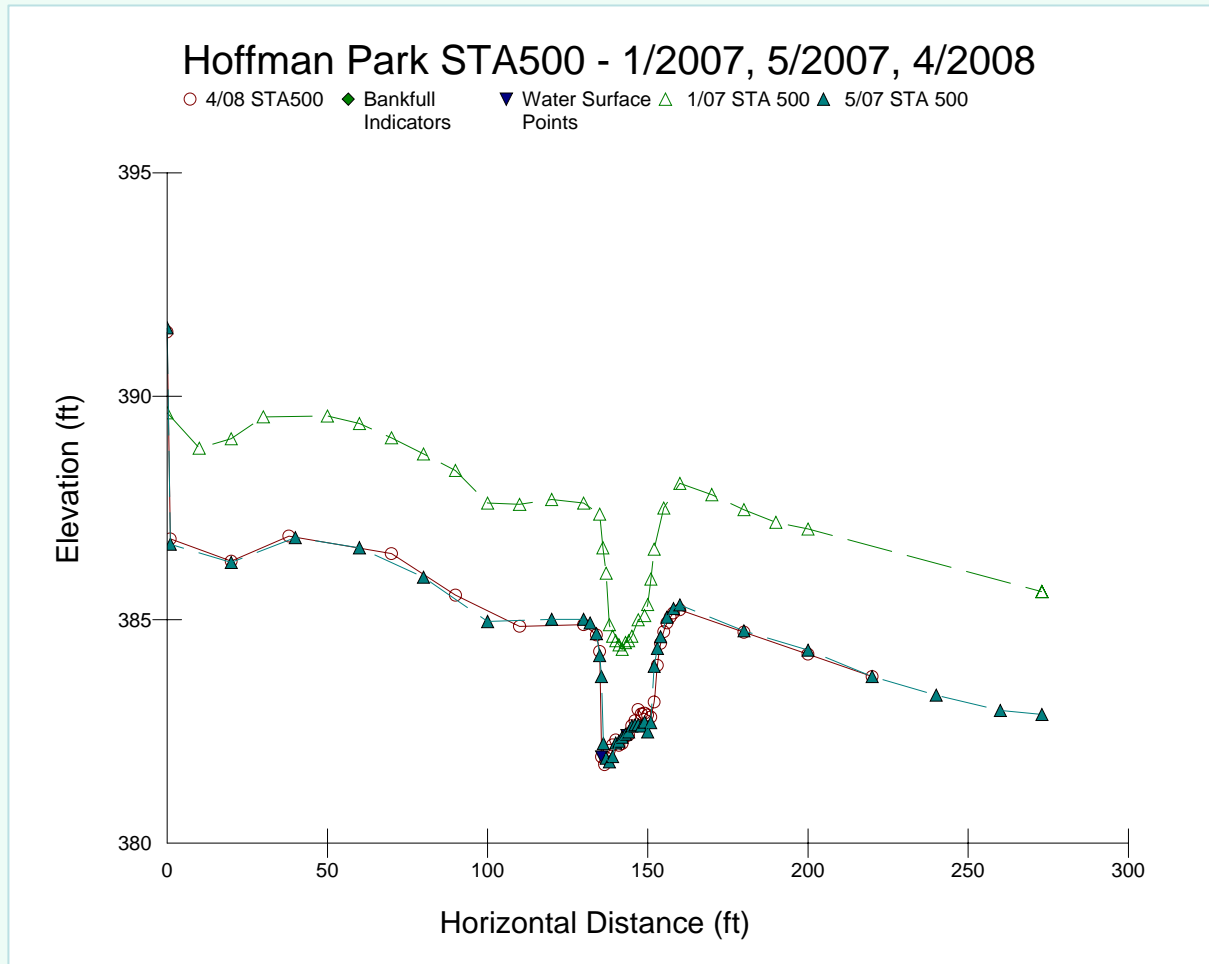
ST 300



Hoffman Park

Post-Construction Cross Section

ST 500

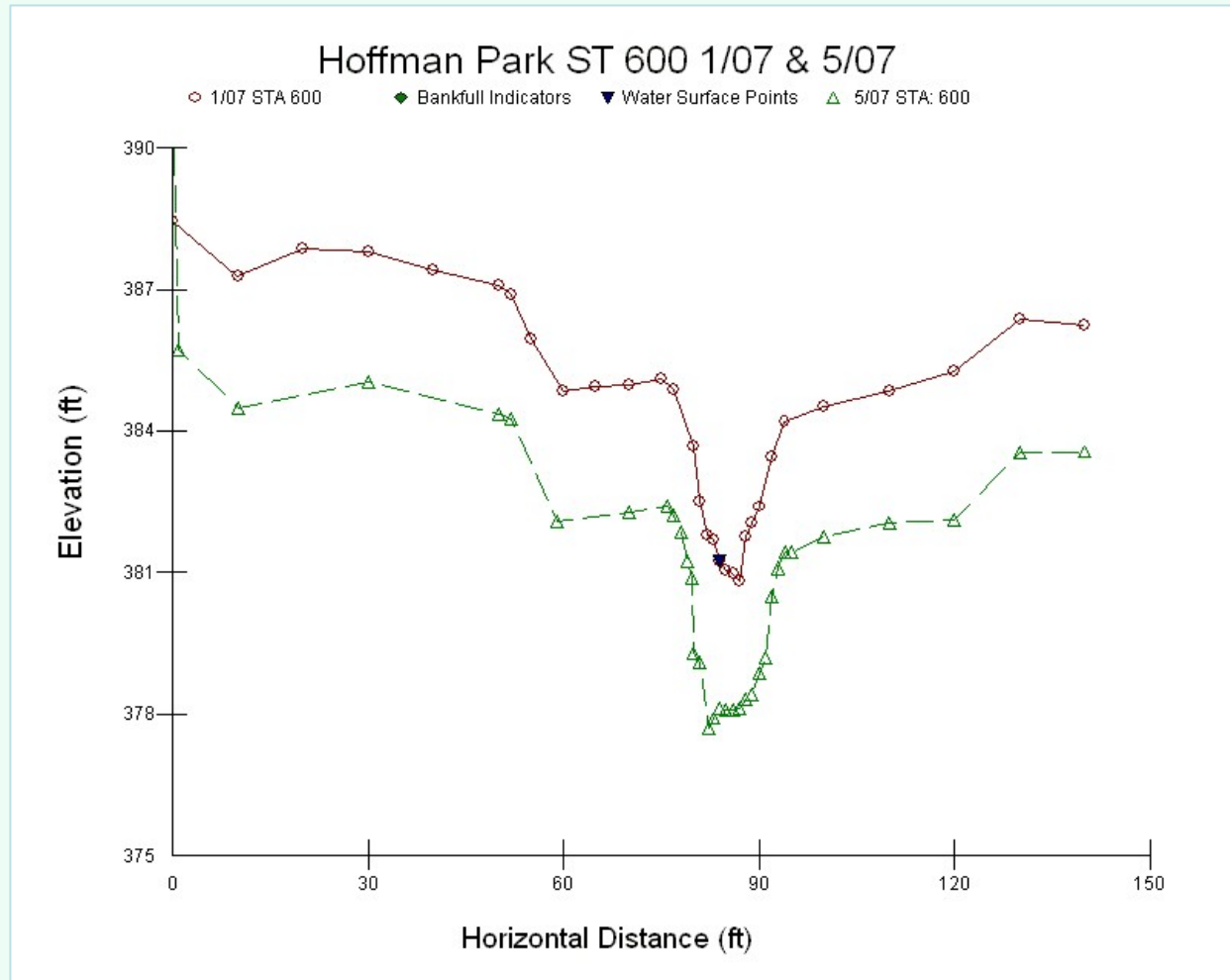


Note that cross-section shape is similar, but there is a benchmark error

Hoffman Park

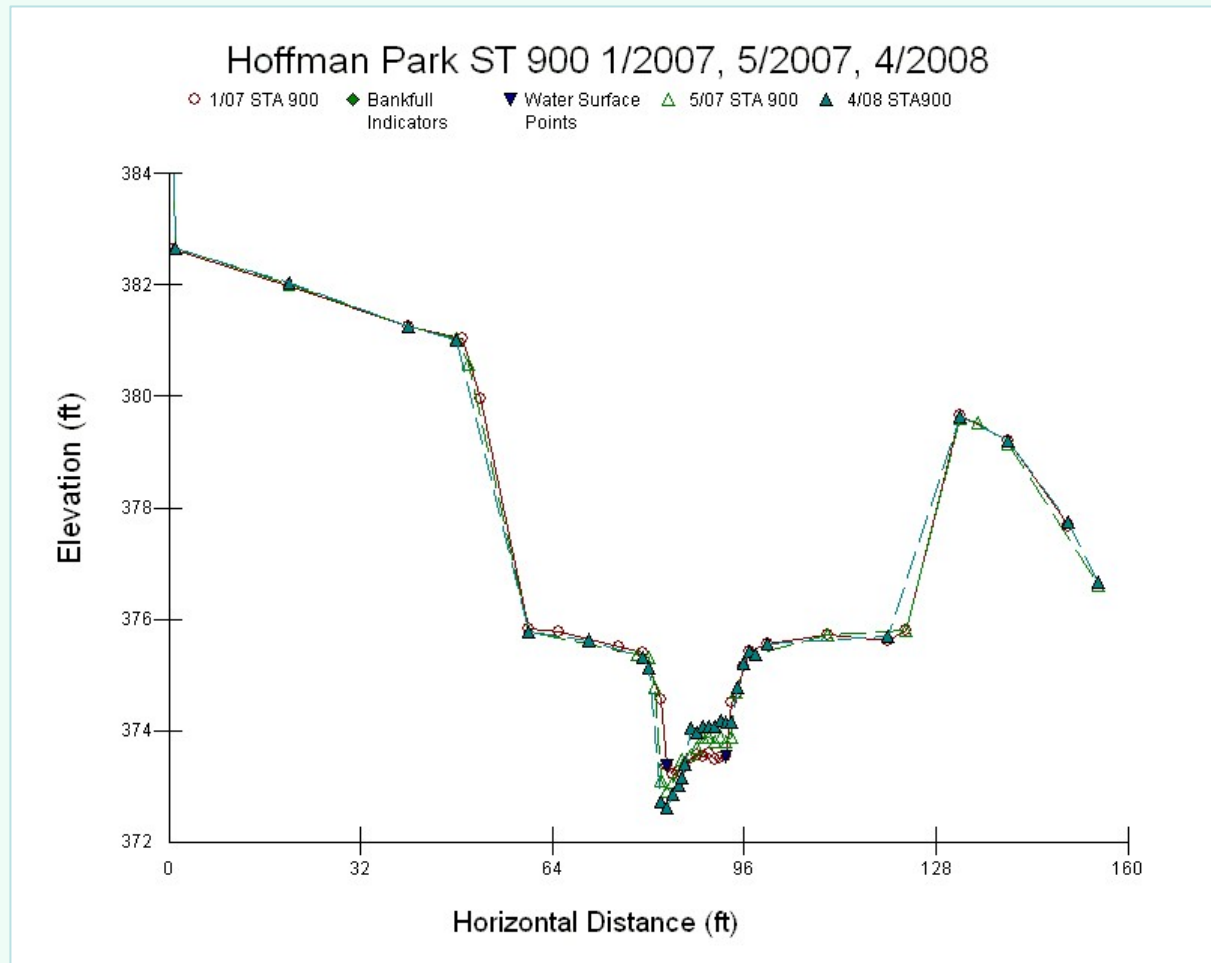
Post-Construction Cross Section

ST 600

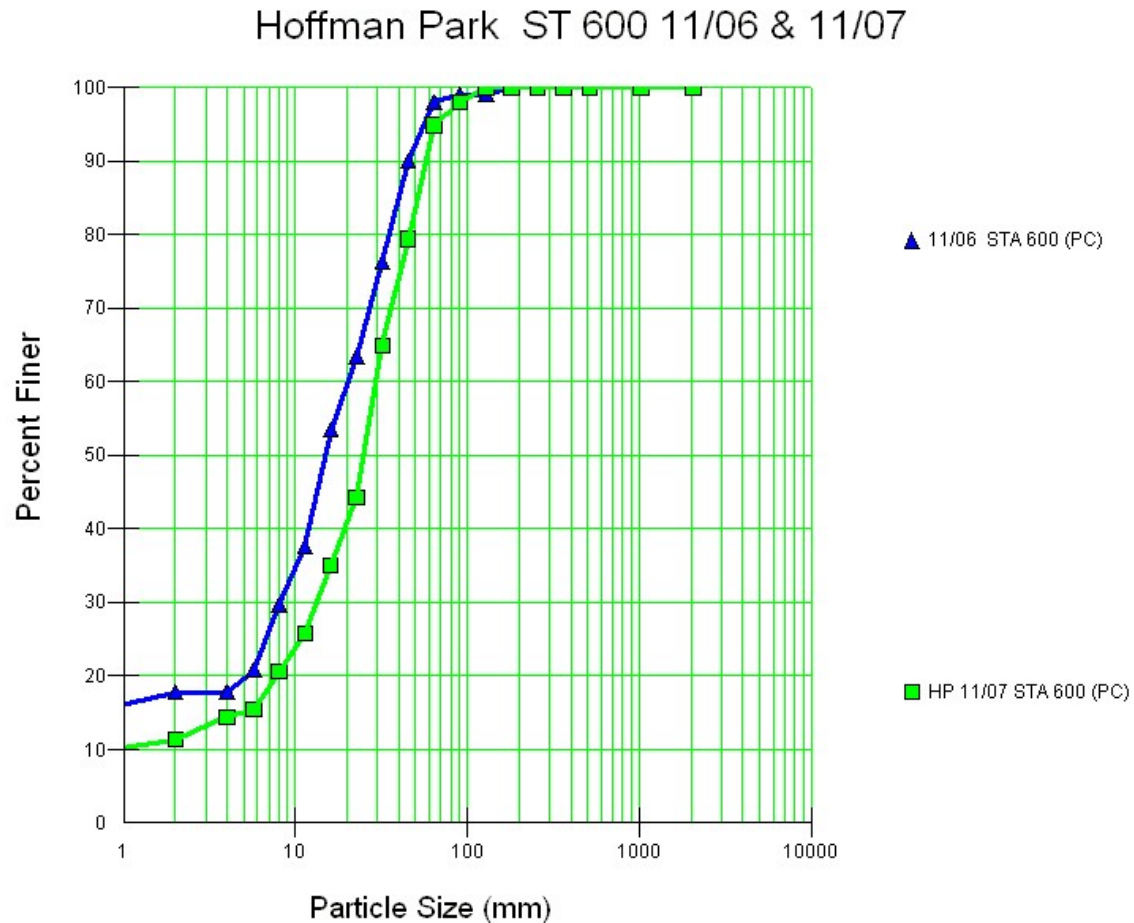


Note that cross-section shape is similar, but there is a benchmark error

Hoffman Park Post-Construction Cross Section ST 900



Hoffman Park Post-Construction Substrate Analysis



Hoffman Park Design Criteria & Monitoring Data

Parameter	Design Criteria	Monitoring Data
Slope	0.025 – 0.034	0.0204
D50	14-23	16-30.24



Hoffman Park Photomonitoring



Problems with
structures – need for
adaptive
management

Hoffman Park Photomonitoring

March 2007 – Problem with structure



July 2007 – Structure healed itself



Hoffman Park Photomonitoring



August
2006



November
2006



July
2007



March
2008

What have we learned from the Hoffman Park monitoring data?

- No significant changes to NJ Impairment score overall, NJIS decreased slightly at HP-2 and HP-3, within project reach where most disturbance occurred
- Habitat assessment scores increased slightly
- Geomorphology surveys show gradual dissipation of slope through reach
- USGS flow data – high flow events
- Stream is no longer incised
- Photodocumentation is key
- Need for adaptive management



Now What? & Lessons Learned

- Stream restoration is tough!
- Define goals & objectives
- Budget for monitoring, maintenance and adaptive management
- Develop QAPP/SOP
- Establish stations and stick to them
- Visual & photomonitoring provide valuable information
- Continue to assess whether projects are within design criteria
- Continue to evaluate need for adaptive management
- Keep monitoring!





New Jersey Water Supply Authority Watershed Protection Programs Unit

908-685-0315 x228

Khale@raritanbasin.org

www.raritanbasin.org and
www.njwsa.org/wpu

Thank you to:

Tara Petti, NJWSA and all NJWSA field staff

The Louis Berger Group (design consultant)