



Surface Water and Riparian Areas of the Raritan Basin:

**A Technical Report for the
Raritan Basin
Watershed Management Project**

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NJ Water Supply Authority

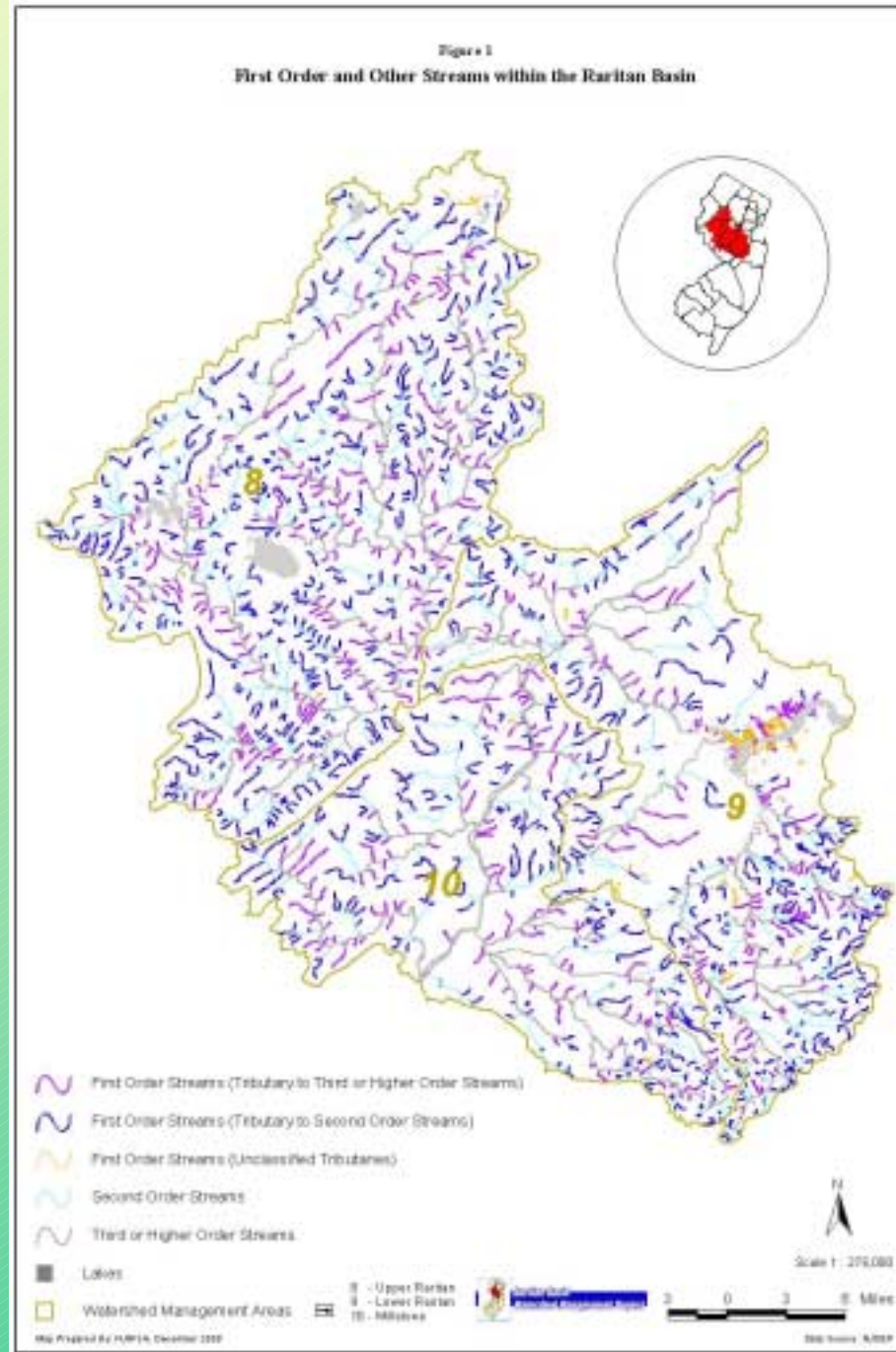
Photo of Beden Brook – Millstone Watershed Management Area

Overview of Report

- Focuses on Ecological Health of the Surface Waters and Riparian Areas of the Basin
- Provides summary of existing regulations and plans that protect surface waters and riparian areas
- Recommendations for further study (critical needs)

1st Order Streams

- Smallest streams without tributaries – majority of streams in the Basin
- “Upper” 1st order streams – join to form a 2nd order stream
- “ Lower” 1st order – flow directly into other streams such as 3rd order & above.
- 1st order streams ~52% of Basin stream miles
- “Upper” 1st order ~34% of Basin stream miles

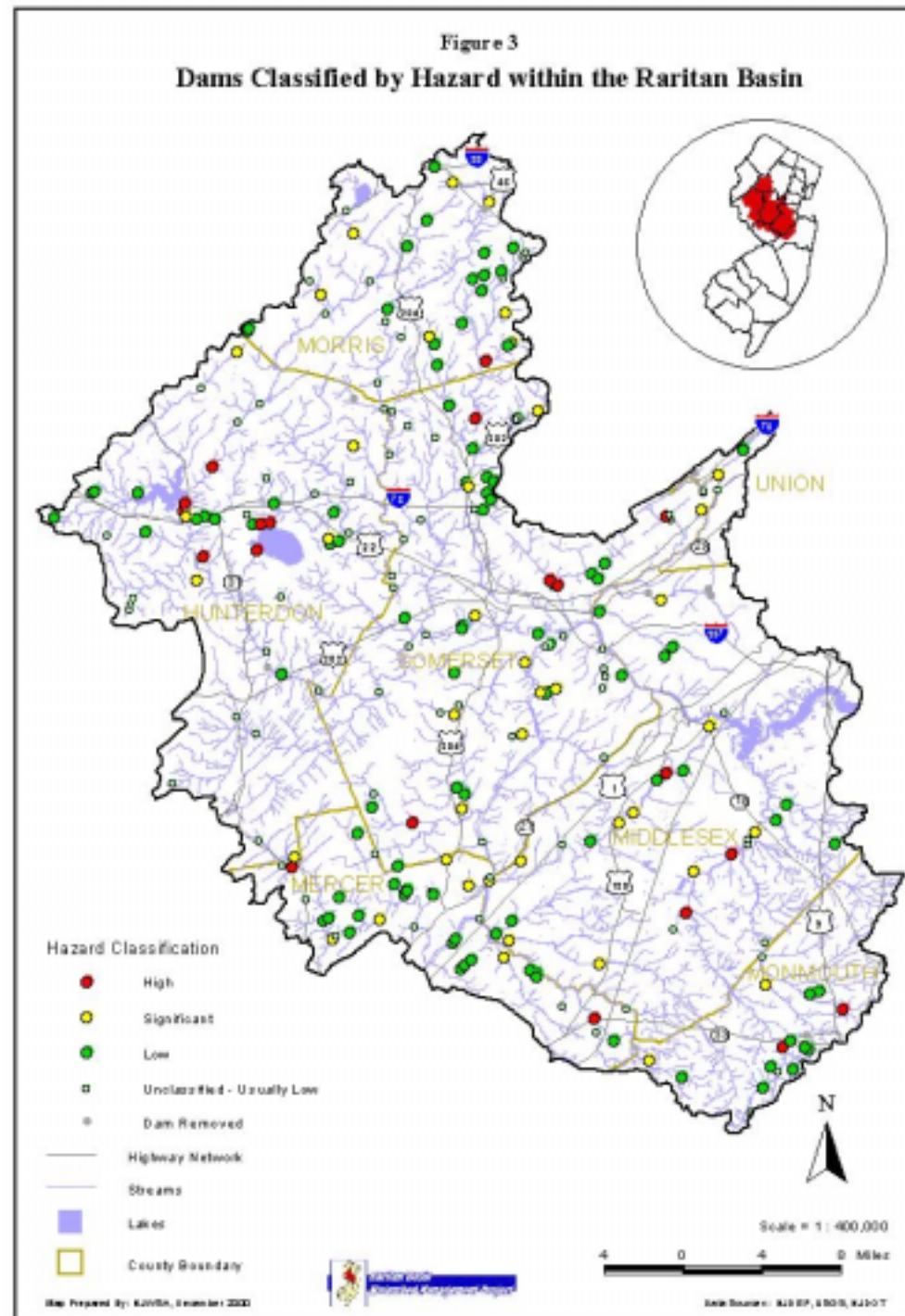


Low Flows in the Basin

- 7-Day 10-Year (MA7CD10) Low Flow Data through 1993
- Many MA7CD10 reflective of 1960's drought
- USGS has proposal to NJDEP to update low flow data (2-3 yr project)
- Some low flows based on geology, others based on human impact
- Difficult to assess trends
- For Final Report – Look at Geology, Compare Flows with Minimum Passing Flows for Gauging Stations.

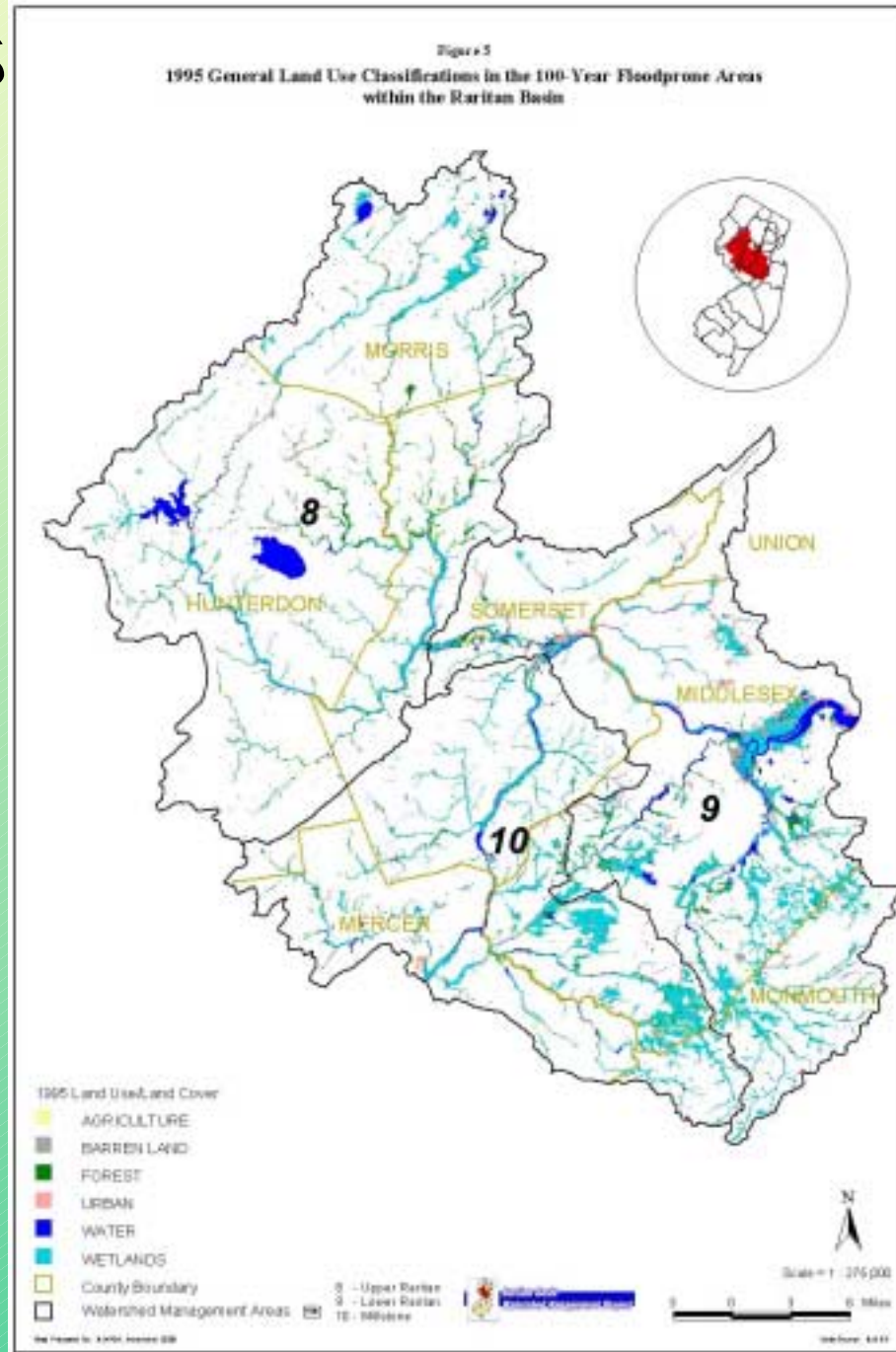
Dams of the Basin

- 256 Dams in the Basin
- Classified by Height and Hazard
- NJDEP Dam Safety Dams Database



Flood Prone Areas

- FEMA & NJDEP 100-year Flood Prone Areas (associated with frequent flood events)
- FP Areas do not extend much beyond wetland boundaries
- Significant areas prone to flooding include: mainstem of the Raritan River, tidal portions of the Raritan R., and areas in the Lower Raritan and Millstone WMAs.
- Existing Land Uses Within Flood Prone Areas



Ecological Health – Surface Waters

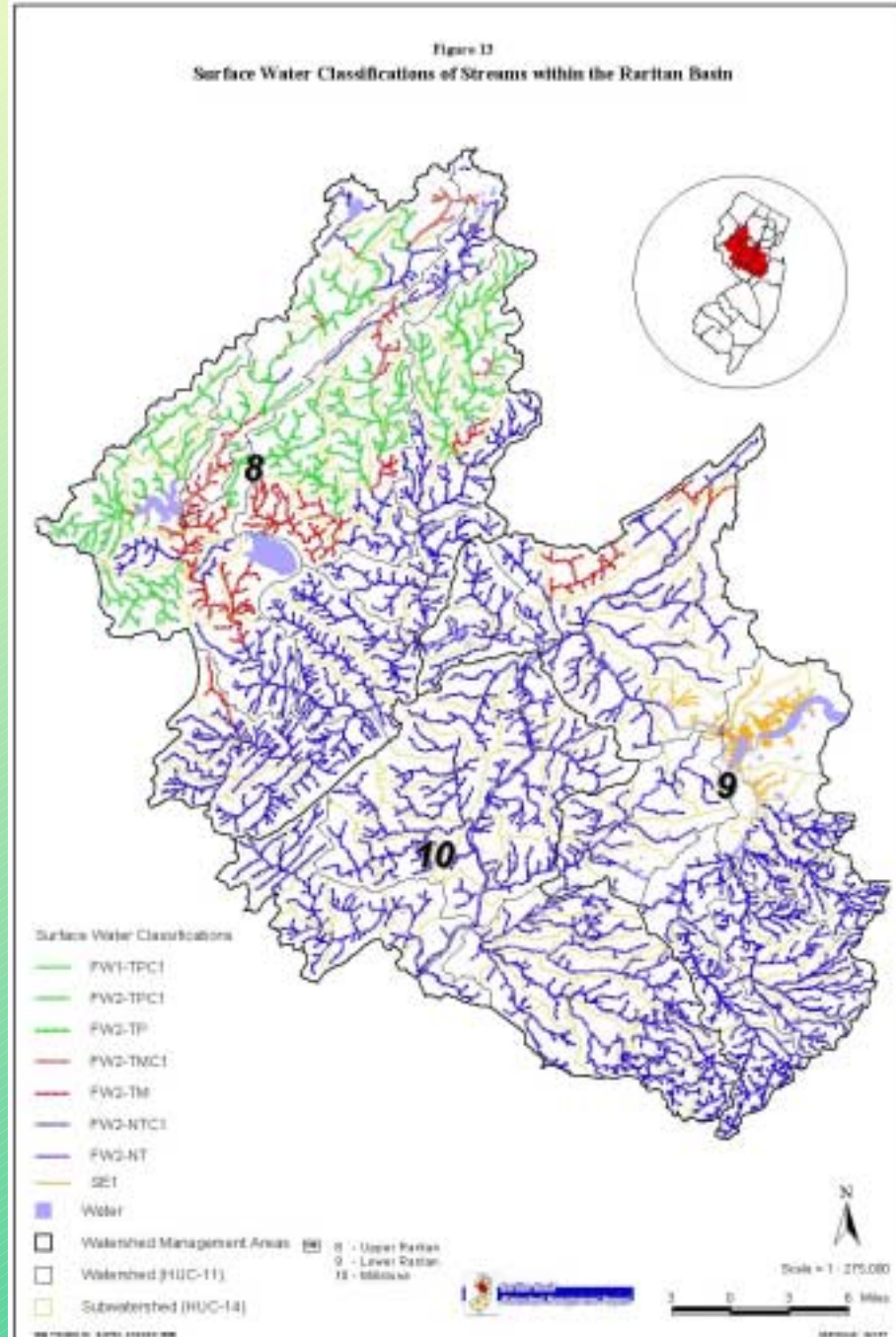
- **NJDEP Ambient Biomonitoring Network (AMNET) Data**
 - 1993-94 Results (144 sites):
 - 37.5% non-impaired
 - 56.9% moderately impaired
 - 5.6% severely impaired
 - 1999 Results (150 sites):
 - 37.3% non-impaired
 - 54.7% moderately impaired
 - 8.0% severely impaired
 - Comparison shows:
 - Significant improvement at 7 sites, significant decline at 3 sites in the Lower Raritan WMA.
 - Significant improvement at 3 sites, significant decline at 6 sites in the Millstone WMA.

Ecological Health – Surface Waters cont.

- Stony Brook-Millstone Watershed Association
 - Sampling program established 1996
 - Monitor 8 sites along tribs to the Millstone R.
 - 1999 – 2 Non. sites, 4 Mod. Sites, 1 Sev. site
 - 2000 – 1 Non. sites, 5 Mod. sites, 1 Sev. site
- Upper Raritan Watershed Association
 - Sampling program established 1999
 - Monitor 16 sites along the So. Branch Rockaway Creek
 - 1999 – 13 Non. sites, 3 Mod. Sites
 - 2000 – 10 Non. sites, 6 Mod. Sites
- Declines in health between 1999 and 2000 attributed to 1999 drought, then flood

Stream Classifications

- NJDEP Surface Water Classifications (provide basis for water quality and uses of surface waters)
- Upper Raritan WMA – Trout Maintenance, Trout Production and Nontrout
- Lower Raritan WMA – Trout Maintenance Nontrout Saline Estuarine
- Millstone WMA – Nontrout

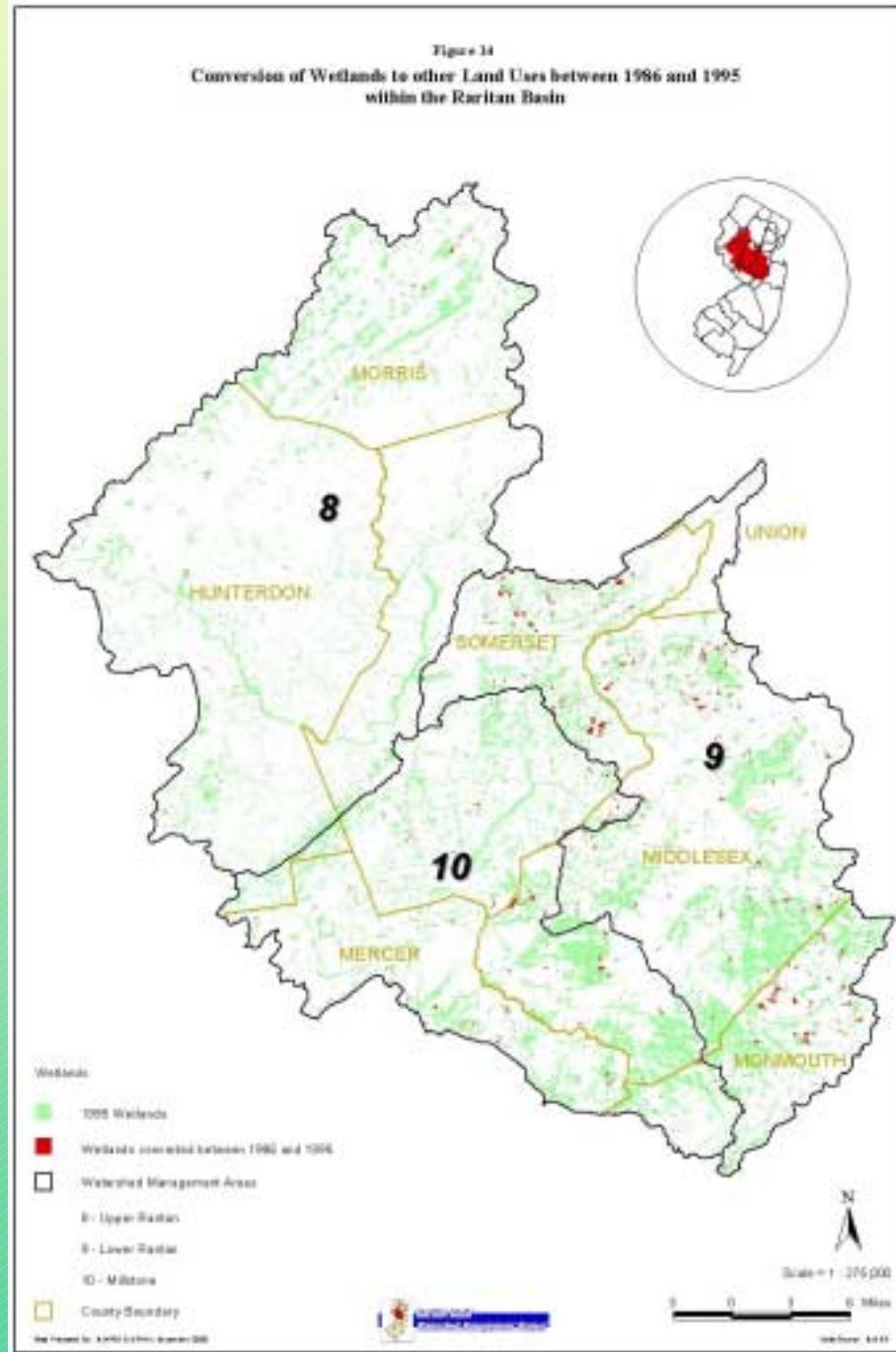


Eutrophication

- Excessive nutrients (phosphorus, nitrates) in a stream that lead to an overgrowth of algae and aquatic plants
- Problems in the Basin:
 - Lower Raritan River and Raritan Bay
 - Millstone River (Plainsboro & Carnegie Lake)
 - Stretches of Beden Br, Rock Br & Pike Run)
 - Pockets along the So. & No. Branches Raritan River
 - South River near Route 535
 - Spruce Run Reservoir

Conversion of Wetlands to Other Land Uses

- Conversions of wetlands to urban, water, barren land, agriculture and forest 1986 - 1995
- Basin-wide:
 - 4,400 acres (92.7%) converted to urban
 - 36 acres (0.8%) converted to agricultural land



Hydrologic Unit Map of the Basin

- Way of identifying sub-watersheds of the Basin by USGS hydrologic units (14-digit codes)
- For use with Riparian Area figures of the report



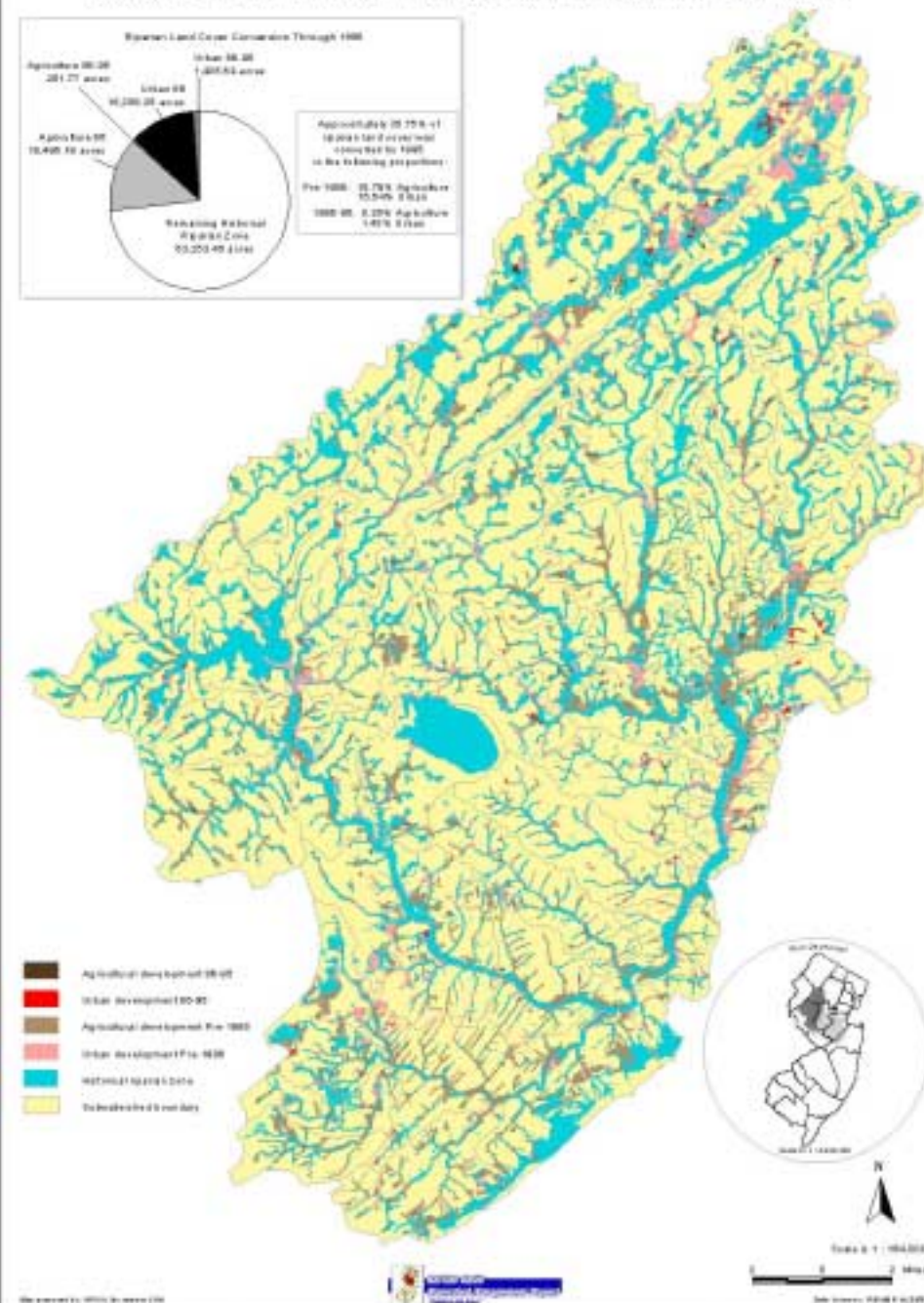
Riparian Areas of the Basin

- Used Methodology developed by Raritan Basin Characterization Committee (June 2000) – 100-yr FP Areas, Soils w/ SHWT within 18 inches, streamside wetlands and wetland transition areas, 150 ft or 300 ft wildlife passage corridor
- Report looks at conversion of Riparian Areas in the Basin to other land cover types historically and between 1986-1995
- Maps by WMA and Basin
- Tables in Appendix lists percentages by Sub-watershed (HUC-14)

Riparian Area Conversion in the Upper Raritan WMA

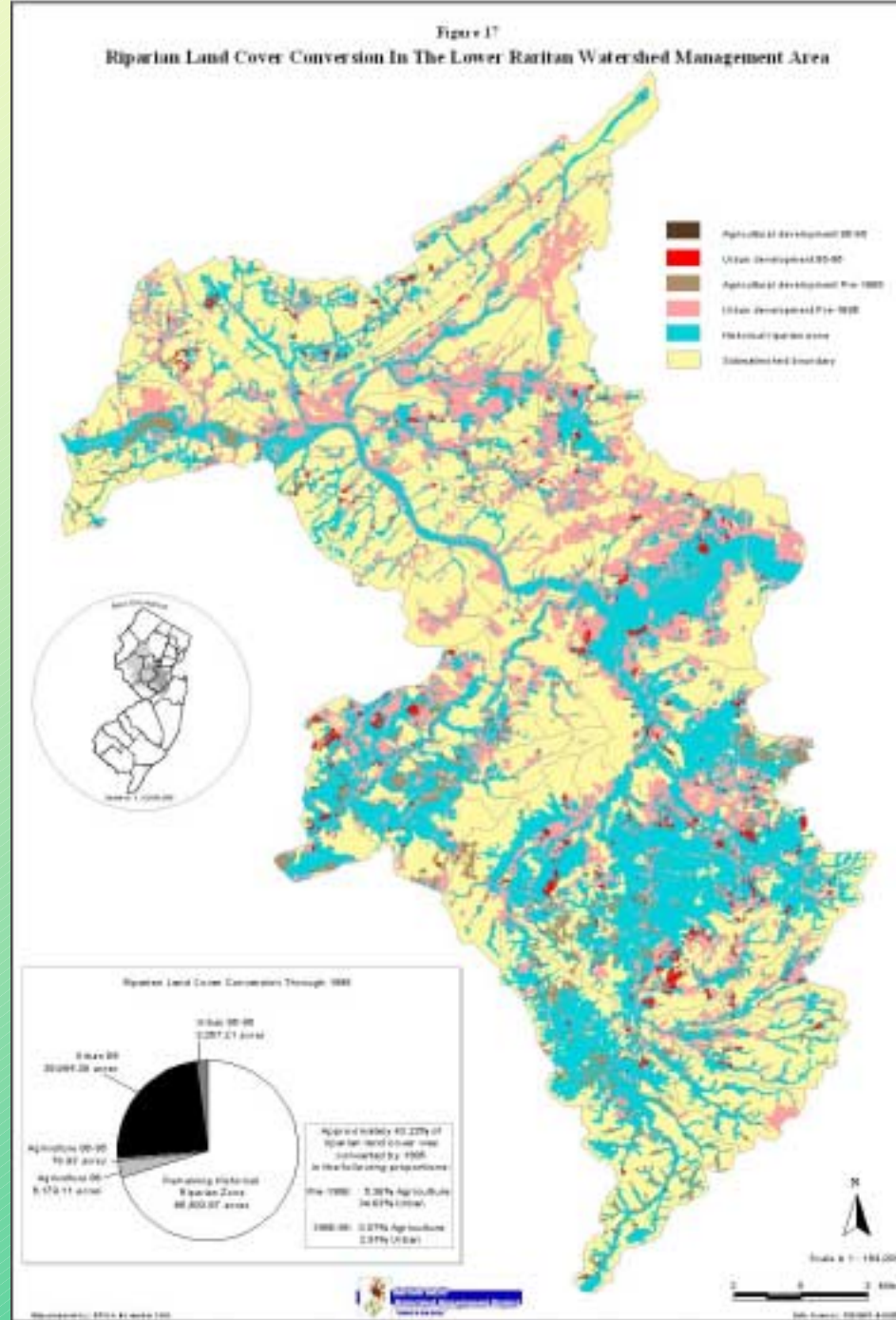
- Represents what historical riparian area may have looked like
- Historical Conversion:
18.8% to Ag
16.5% to Urban
- Between 1986-95:
0.25% to Ag
1.4% to Urban

Figure 16
Riparian Land Cover Conversion In The Upper Raritan Watershed Management Area



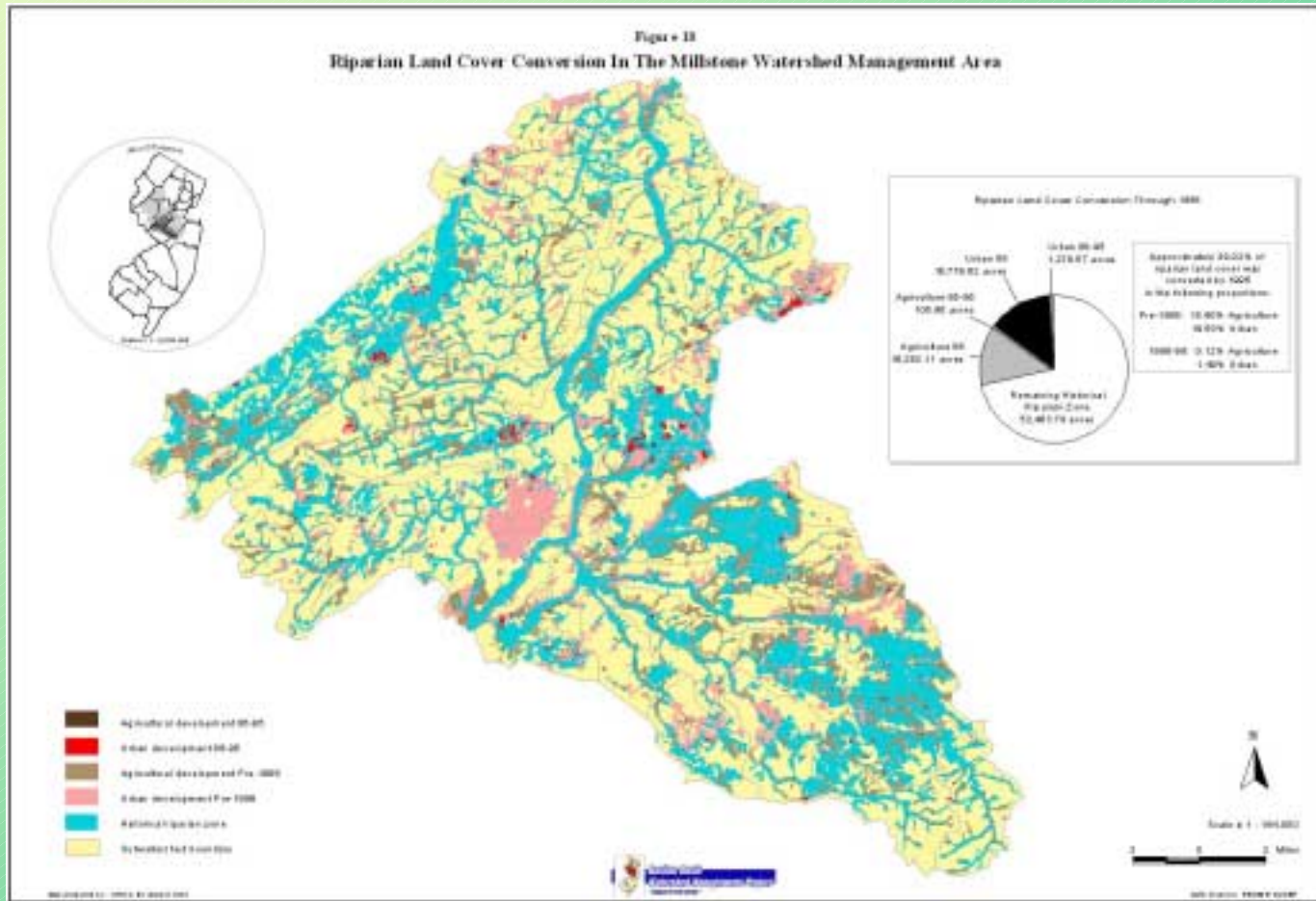
Riparian Area Conversion in the Lower Raritan WMA

- Historical Conversion:
 - 5.4% to Ag
 - 34.6% to Urban
- Between 1986-95:
 - 0.07% to Ag
 - 2.9% to Urban



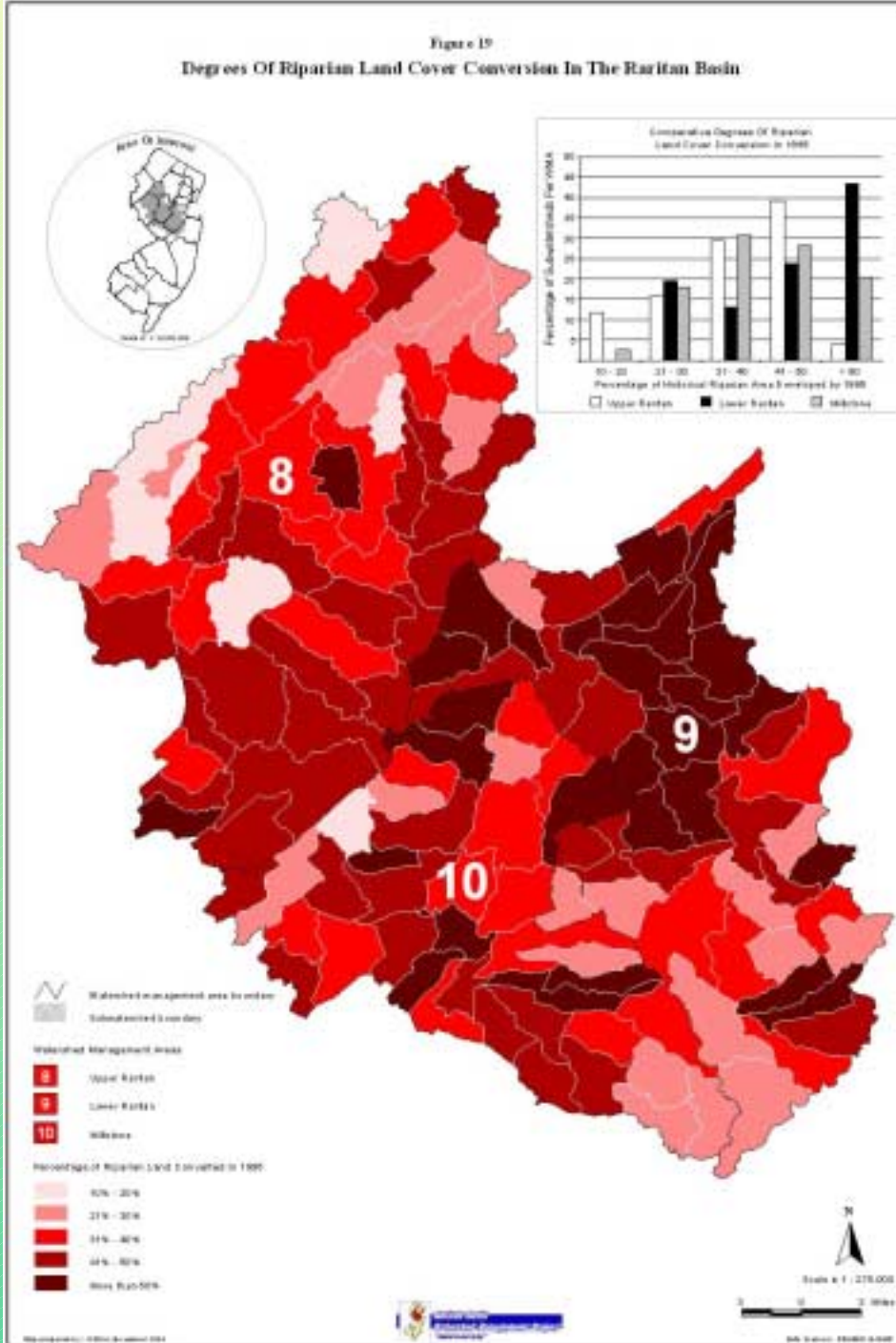
Riparian Area Conversion in the Millstone WMA

- Historical Conversion:
18.9% to Ag
19.5% to Urban
- Between 1986-95:
0.12% to Ag
1.5% to Urban



Riparian Area Conversions in the Basin

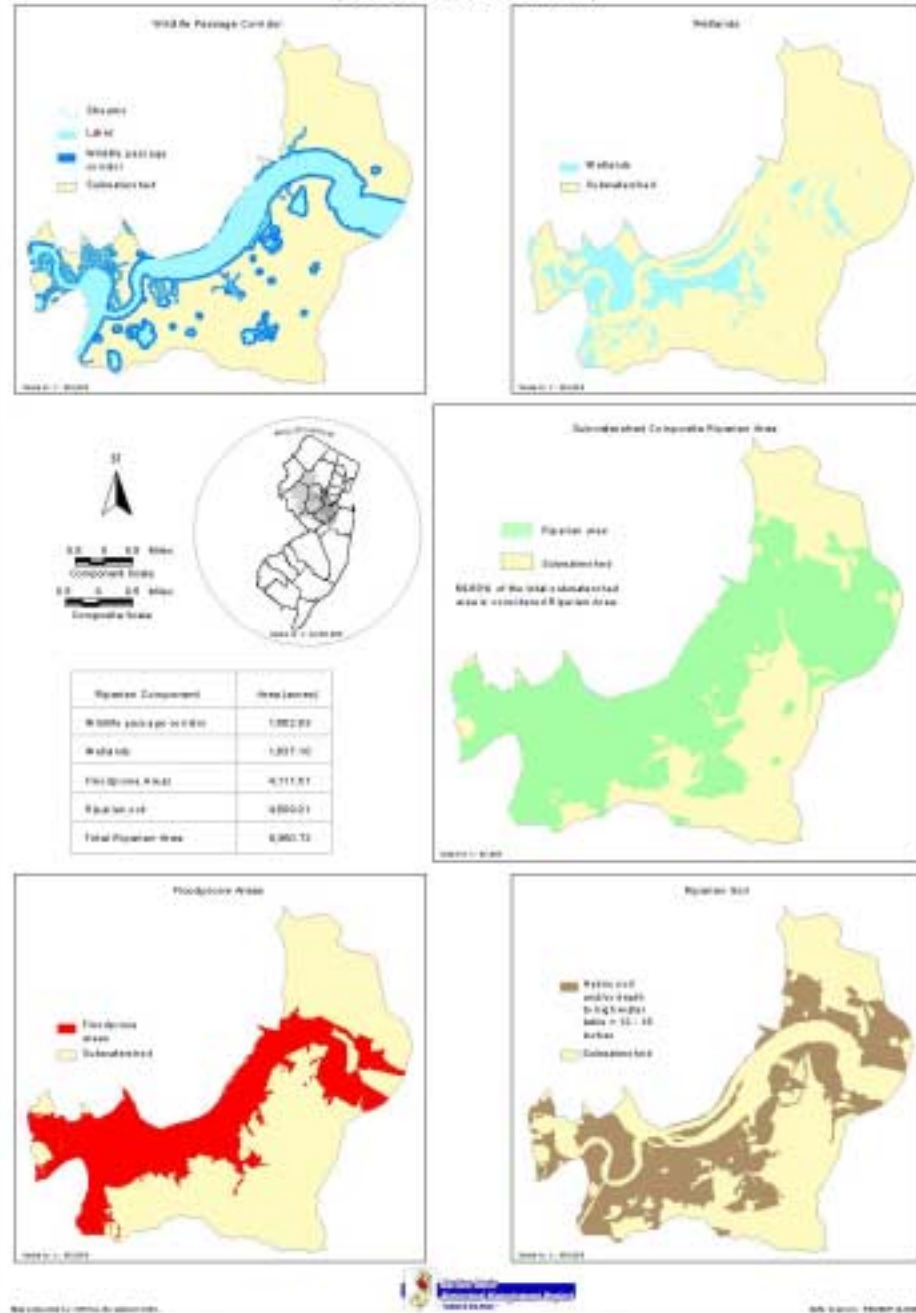
- Bar chart – Compares sub-watershed status by Management Area
- Lighter color; less conversion
- Areas with greatest conversion:
 - Tewksbury Twp.
 - Neshanic R.
 - Bridgewater area
 - New Brunswick/Edison
 - Marlboro Twp.
 - Hillsborough Twp
 - Cranbury/Plainsboro Twp



Riparian Area Components in a Subwatershed of the Lower Raritan WMA

- Assessment must consider how much of HUC originally consisted of riparian area.
- Approximately 64% of this sub-watershed was historic riparian land
- Another sub-watershed (in the Upper Raritan WMA) was only 24% historic riparian land

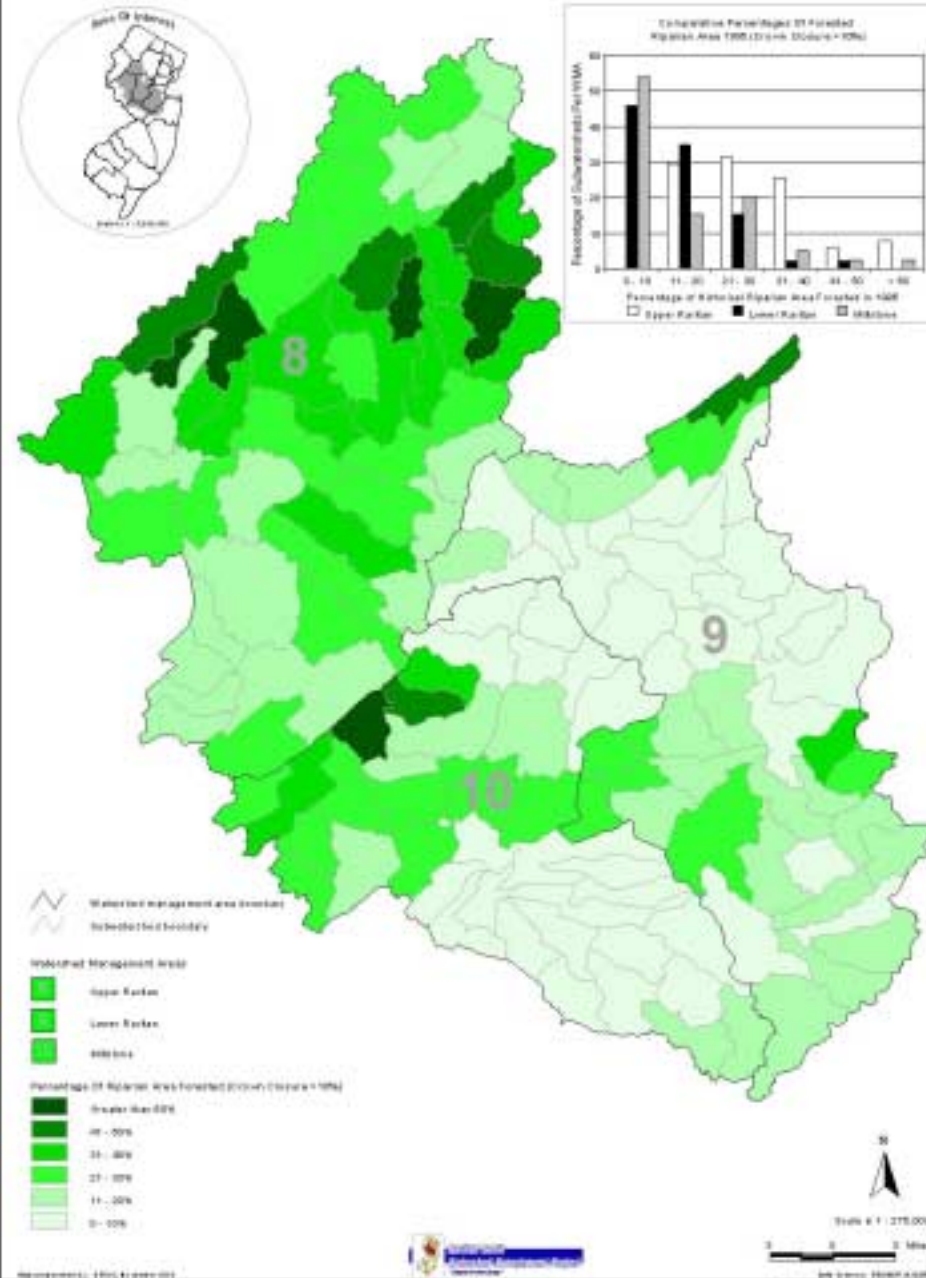
Figure 21
Riparian Area Components In A Subwatershed Of The Lower Raritan Watershed Management Area (HUC14 No. 02030105160100)



Forested Riparian Area in 1995 (% Crown Closure)

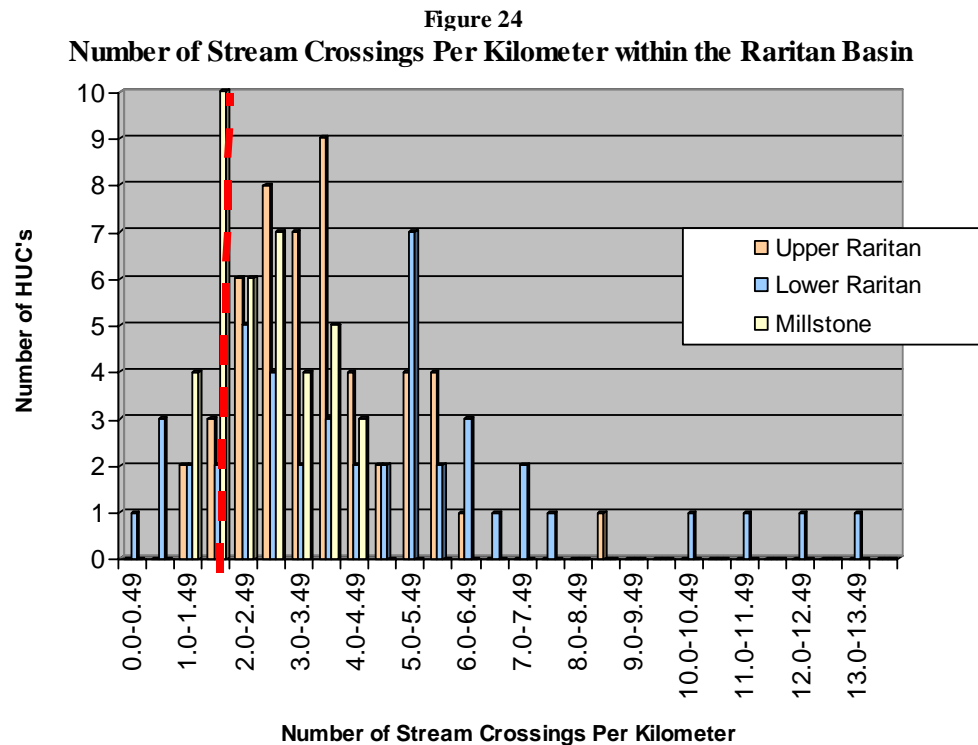
- Percentage of forested area within the riparian area by sub-watershed
- Areas with crown closure greater than 10%
- Darker colors; areas with greater % crown closure

Figure 23
Forested Riparian Area In The Raritan Basin 1995



Stream Crossings Per Km in the Basin

- Recommended 2 crossings/km to maintain a nearly continuous riparian corridor
- Lower Raritan WMA (13) has greatest # of crossings/km, followed by Upper Raritan WMA (9) and then Lower Raritan WMA (5)



Critical Needs

For the Next Revision of this Report:

- Photographs of stream morphological characteristics
- Comparison of low flow data with minimum passing flows for gaging stations of the Basin
- Comparison of benthic macroinvertebrate data with conversion of riparian areas to other land cover types
- Results of the “Great Raritan Flood Project” prepared by the Rutgers University Geography Department

Critical Needs

In Time For the Management Plan:

- Updated Low Flow Data
- Determination of stream behavior and channel conditions in the Basin
- Mapping of Floyd-flooded areas
- Revised FEMA maps
- Effects of Pre and Post-Development on Floods
- Effects of impervious surfaces on watersheds of the Basin
- Updated Surface Water Quality Inventory Results for 2000 - 305b Report

Conclusions

- Need a better assessment of the impacts of the 256 dams in the Basin.
- Slight decline in the # of non-impaired sites; increase in the # of severely impaired sites b/t 1994 and 1999.
- Overall decline between 1999 and 2000; due to drought then flood.
- Need to establish base trends.

Conclusions cont.

- Eutrophication problems – determine causes.
- Approximately 40% of the Basin's historical riparian areas converted to other land cover.
- Evidence that existing regulations are not enough to protect areas.
- Need more stringent regulations and/or better planning to guide future growth.