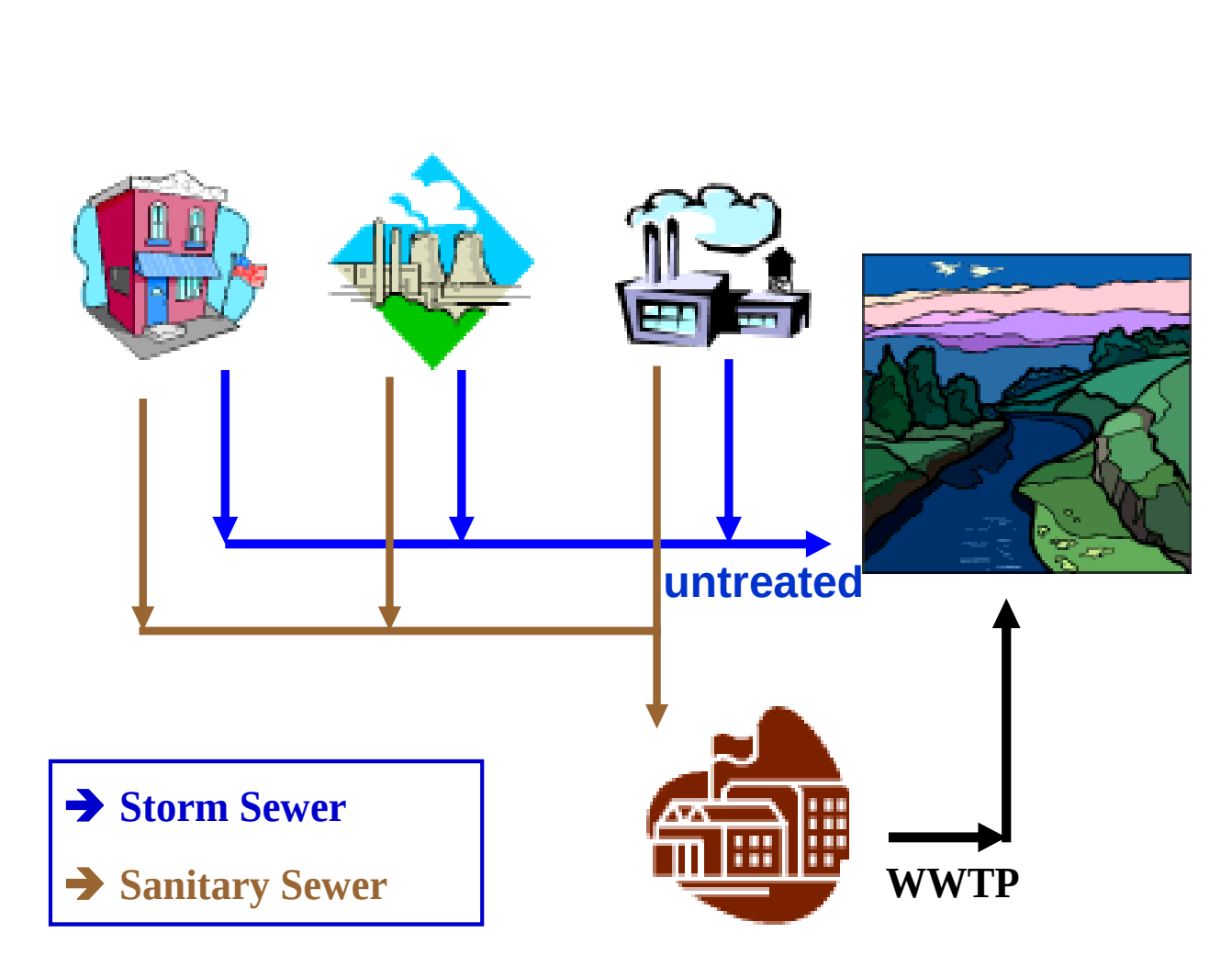
Overview of CSO Control in Michigan and within the Saginaw River Watershed

Acronyms

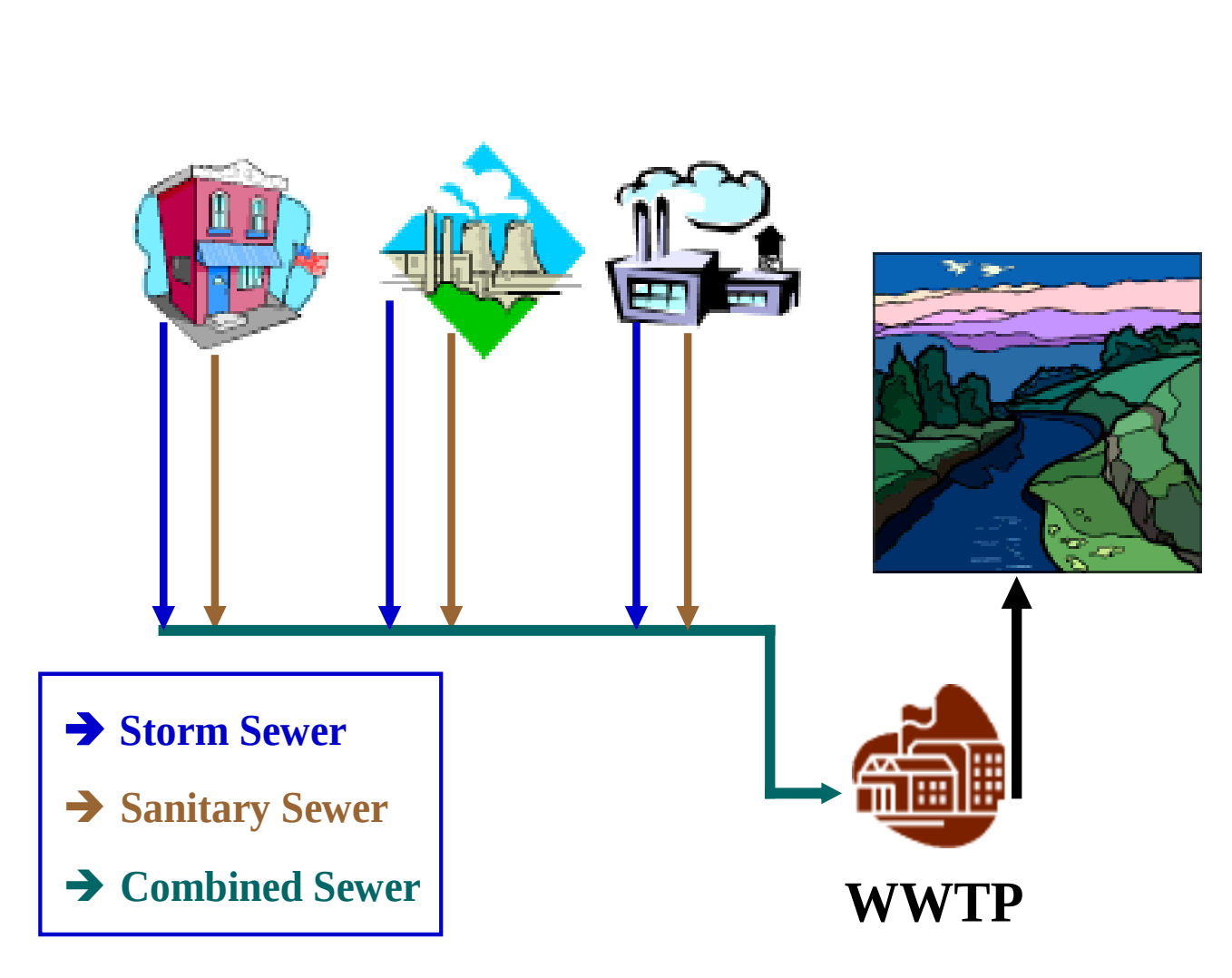
- CSO – combined sewer overflow
- SSO - sanitary sewer overflow
- RTB – retention and treatment basin
- WWTP – wastewater treatment plant
- WWSL – wastewater stabilization lagoon
- SFR – state revolving fund (provides loans)
- NPDES – National Pollutant Discharge Elimination System (wastewater discharge permits)
- WQS – water quality standards

Separate Sanitary Sewers

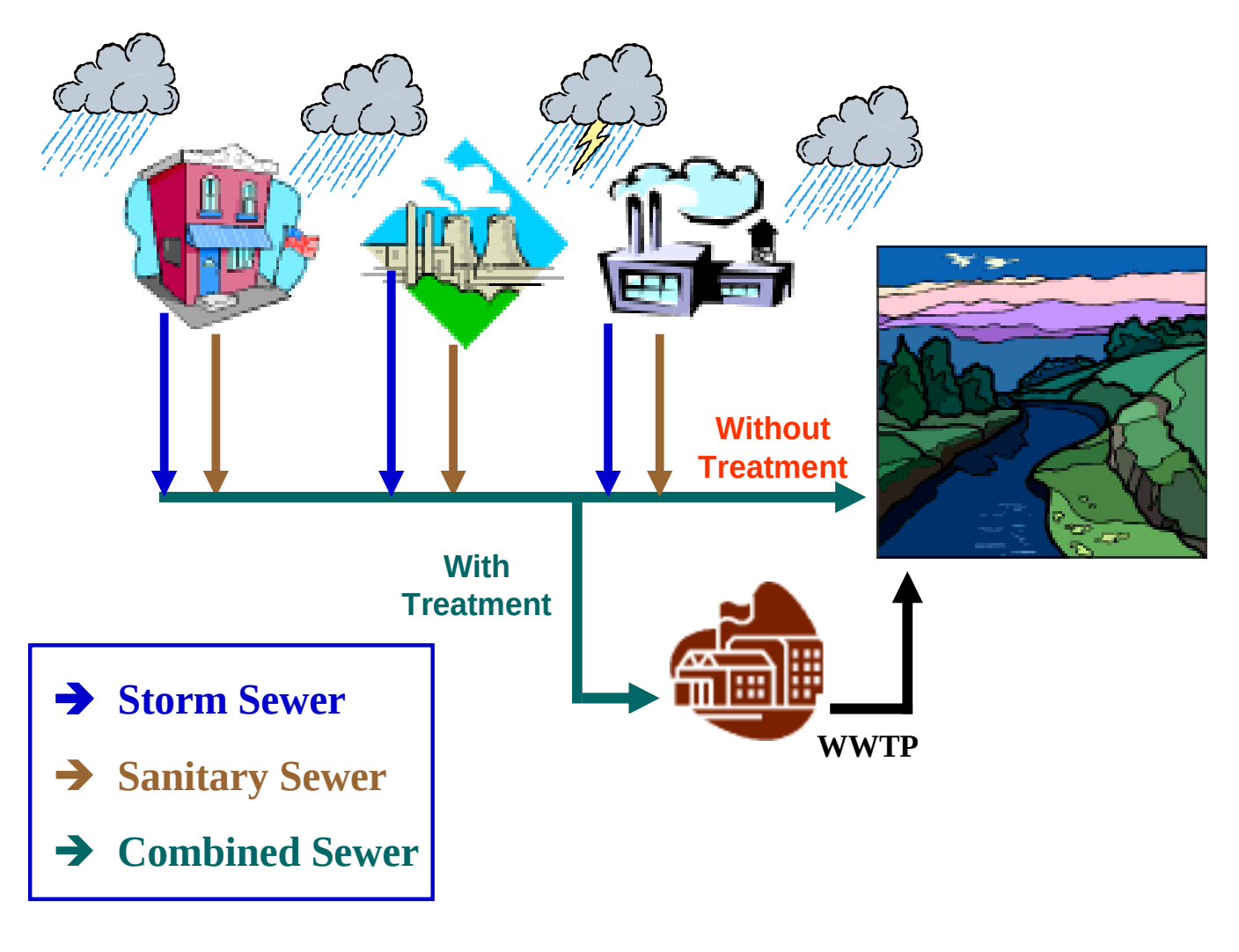


Combined Sewers - Dry Weather

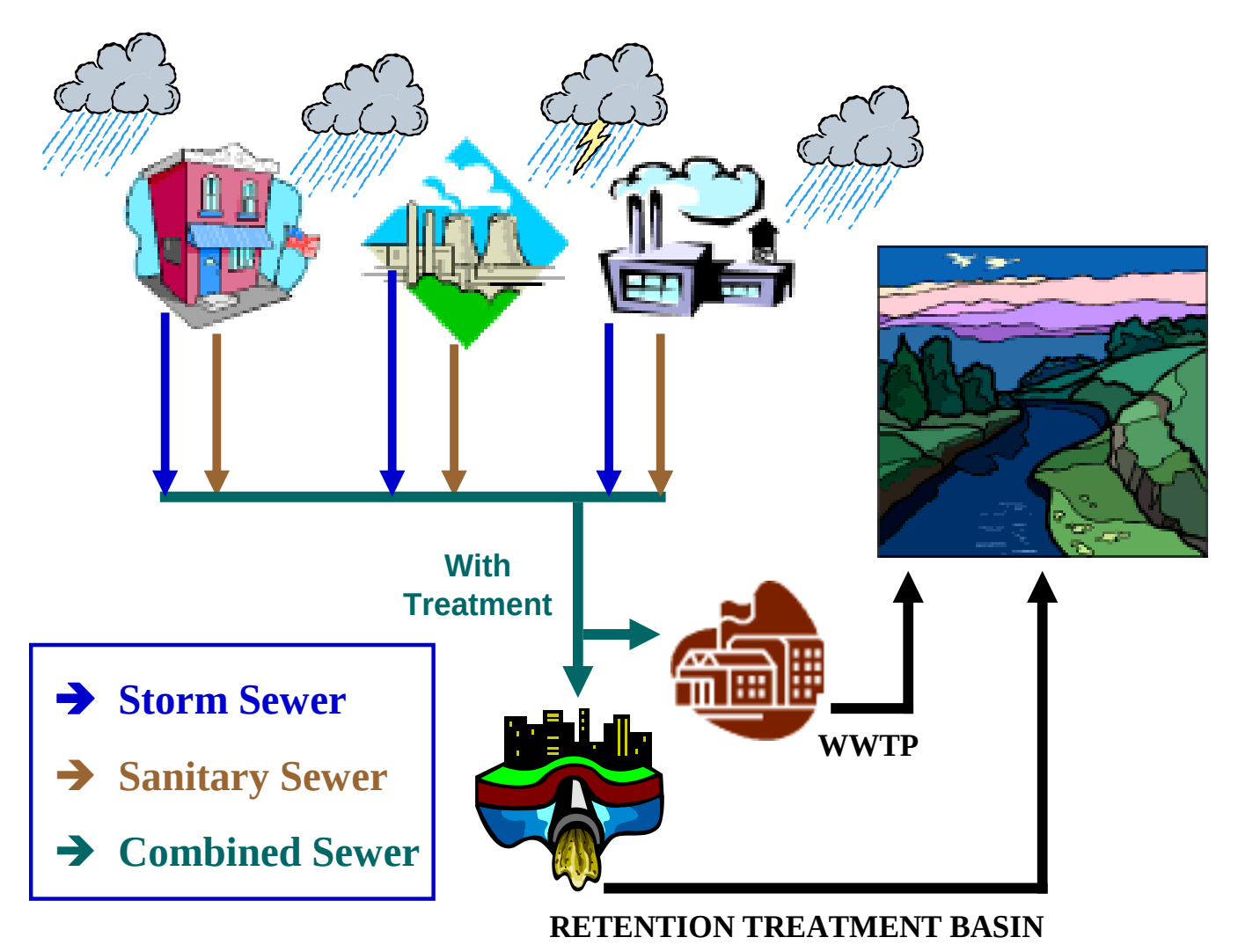
(and small rain events)



Combined Sewers – Wet Weather

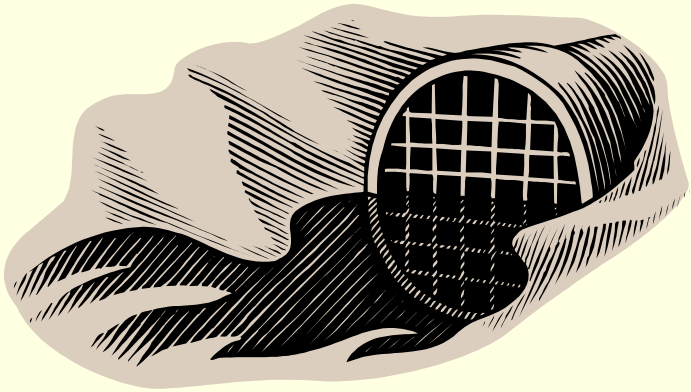


Combined Sewers with RTB



CSO Water Quality

- Vast percentage of CSO volume is storm water
- Storm water - typically untreated
  - TSS
  - E. coli & Fecal Coliform
  - Other pollutants (phosphorus, oils, metals, etc.)
- Secondary (biological) treatment not practicable
  - high flows/volumes
  - too dilute
  - therefore not required by EPA



NPDES Permits for the Discharge of Treated Human Wastewater

- 3 types of permitted discharges for human sewage:
  - WWTPs
  - WWSLs
  - RTBs (to control untreated CSOs)
- All have established national levels of control which based on what technology can achieve
- In Michigan, all wastewater treatment systems must meet state water quality standards (we don’t classify streams based on the type discharges they receive)

Fecal Coliform Limits in Permits

- WWTP: 200 cfu/100 ml as a monthly average, 400 cfu/100 ml as a 7-day average, sampling is done daily
- RTB: 200 cfu/100 ml as a monthly average, 400 cfu/100 ml as a daily max

Combined Sewer Overflow (CSO) Control - History

- **1960's** Most municipalities stopped building combined sewer systems.

- **1966** Unlawful pollution is defined in law.

  323.6(2) "The discharge of any raw sewage of human origin, directly or indirectly into any of the waters of the state shall be considered prima facie evidence of a violation of this act by the municipality in which the discharge originated unless the discharge shall have been permitted by an order or rule of the commission."

- **1972** The federal Clean Water Act established the NPDES permit program which addressed wastewater discharges

- **1974 – 1987** Several Michigan municipalities with combined systems implemented separation programs or first stages of retention and treatment, including Bay City and Saginaw.

- **1987** CSO controls were added to NPDES permits

  Lansing, Port Huron and Belding

  Permittees fought these efforts

CSO Control - History

- **1988** In the fall of 1988, the stalemate over CSO control requirements ends because:

  A major storm hits Grand Rapids following a long drought, which resulted in large **untreated** CSOs causing water quality impacts as far downstream as Grand Haven.

  The Department subsequently issued a letter to all Michigan CSO communities advising them that long term CSO controls would be required in NPDES permits, and public notifications of overflows would be required.

- **1988** Bond proposal passes and launches state match for state revolving fund used to provide loans for wastewater pollution control

- **1989** The Department's 1989 CSO Control Policy

- **1989** National CSO Control Strategy

CSO Control - History

- **1990 Michigan's State-Wide CSO Permitting Strategy**

  Based on the Department's 1989 CSO Policy, the Water Resources Commission approved Michigan's State-Wide CSO Permitting Strategy on January 15, 1990, which was based upon the Department's CSO Policy and the approach followed in the Grand Rapids permit and Rouge River RAP. Michigan's CSO Permitting Strategy stated that the following level of CSO treatment would be considered adequate treatment:

  - retention for transportation and treatment at the WWTP, of combined sewage flows generated during storms up to the one-year, one hour storm;
  - primary treatment of combined sewage flows generated during storms up to the ten-year, one-hour storm (thirty minutes detention or equivalent for settling, skimming and disinfection), and
  - treatment of combined sewage flows generated in storms in excess of the ten-year, one-hour storm to the extent possible with facilities designed for lesser flows.

  Also very importantly, the Strategy provided that the permittee could demonstrate that other control methods would provide adequate treatment and meet water quality standards at the time of discharge.

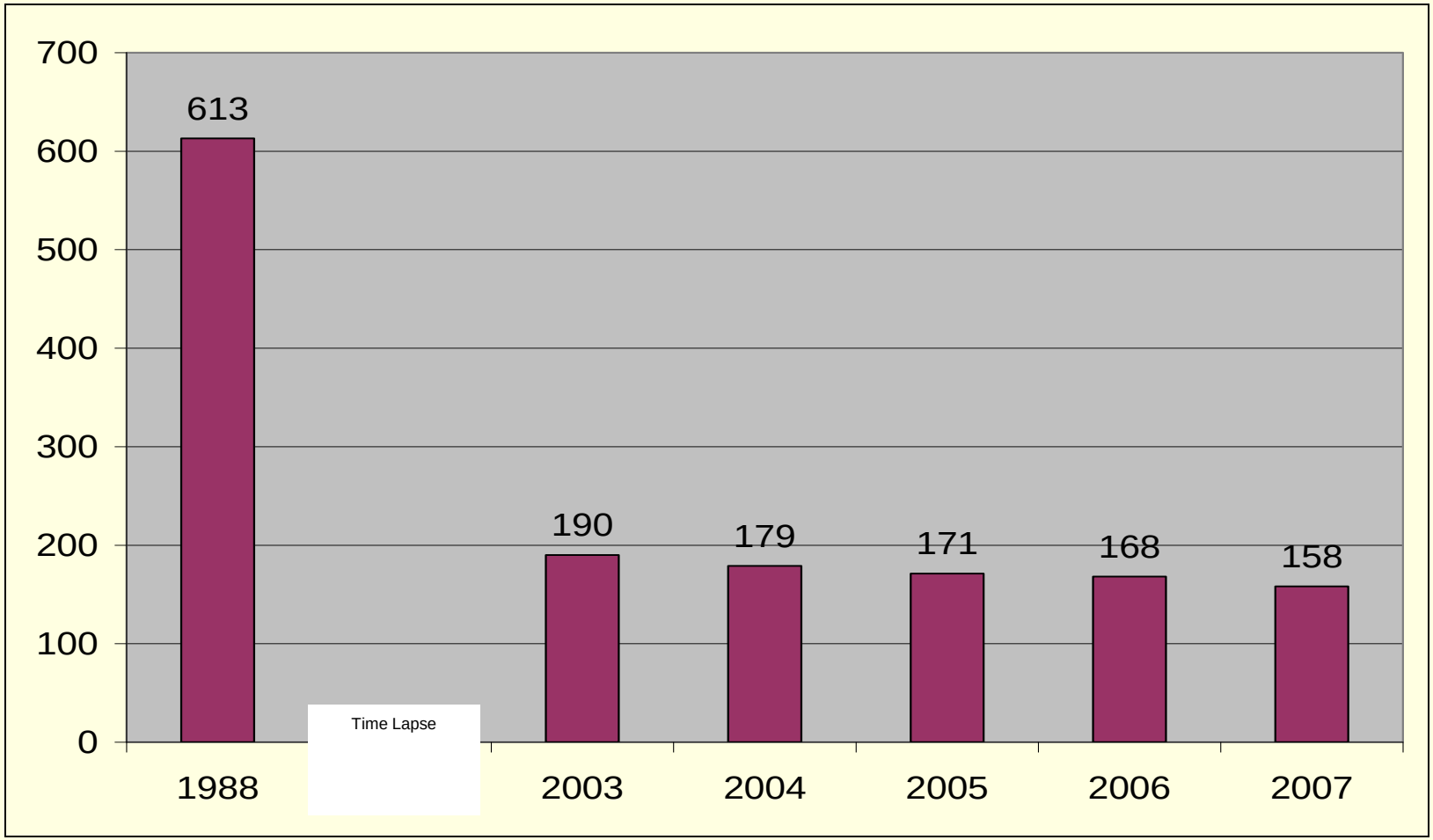
CSO Control - History

- **1992 National Policy Formulated**
- **1994 The Federal Government Adopted a CSO Policy**

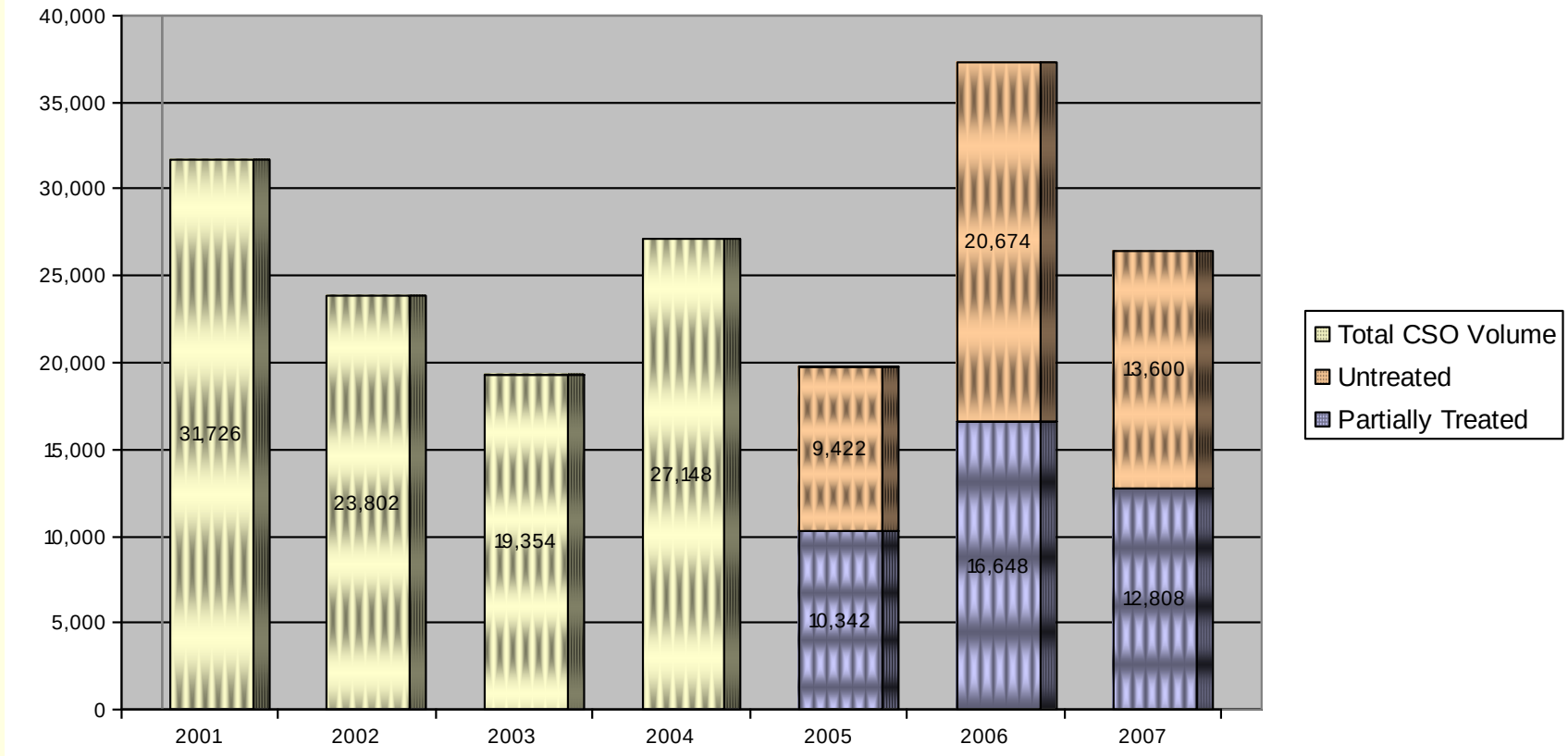
EPA's CSO Control Policy, published April 19, 1994, is the national framework for control of CSOs. The Policy provides guidance on how communities with combined sewer systems can meet Clean Water Act goals in as flexible and cost-effective a manner as possible. EPA's Report to Congress on implementation of the CSO Control Policy assesses the progress made by EPA, states, and municipalities in implementing and enforcing the CSO Control Policy. The CSO Policy was published April 19, 1994, at 59 Fed. Reg. 18688.

Since the Department was involved in formulating the national policy, the national policy somewhat mimics Michigan's program and includes the concept of treatment; but the national policy falls short of adopting Michigan's concept of adequate treatment by definition.

Elimination of **Untreated** CSO Outfalls in Michigan



Statewide Summary: Untreated CSOs vs. Treated RTB Discharges



CSO Controls

Treatment Technology: meet 9 minimum controls and submit Long-term Control Plan

- Proper operation and regular maintenance programs for the sewer system and the CSOs
- Maximum use of the collection system for storage
- Review and modification of pretreatment requirements to assure CSO impacts are minimized
- Maximization of flow to the publicly owned treatment works for treatment
- Prohibition of CSOs during dry weather
- Control of solid and floatable materials in CSOs
- Pollution prevention
- Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts
- Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls

CSO Long-Term Control

- Options for long-term control are sewer separation and/or provide treatment
- Decision is often driven by economics, but also includes political considerations and feasibility of project
- If financing is needed and provided by the state through a loan from SRF program, then the most cost effective option must be pursued.

CSO LTCP - Presumptive

EPA	DEQ
no more than 4 annual average overflows/year from system that do not meet primary clarification, or	retention for transportation and treatment at the WWTP of combined sewage flows generated during storm events up to the 1-year, 1-hour storm, and
eliminate for capture and primary clarification 85% of annual wet weather flow in system.	primary treatment of combined sewage flows generated during storm events up to the 10-year, 1-hour storm (thirty minutes detention or equivalent for settling, skimming, and disinfection), and
also, must meet state WQS (i.e. MI WQS that require disinfection under Part 4 rule 62, etc.)	control alternatives not meeting the presumptive criteria, but demonstrated to provide adequate treatment to meet MI WQS at times of discharge. **Note: all waters in state protected the same**

Combined Sewer RTBs Design & Operational Standard

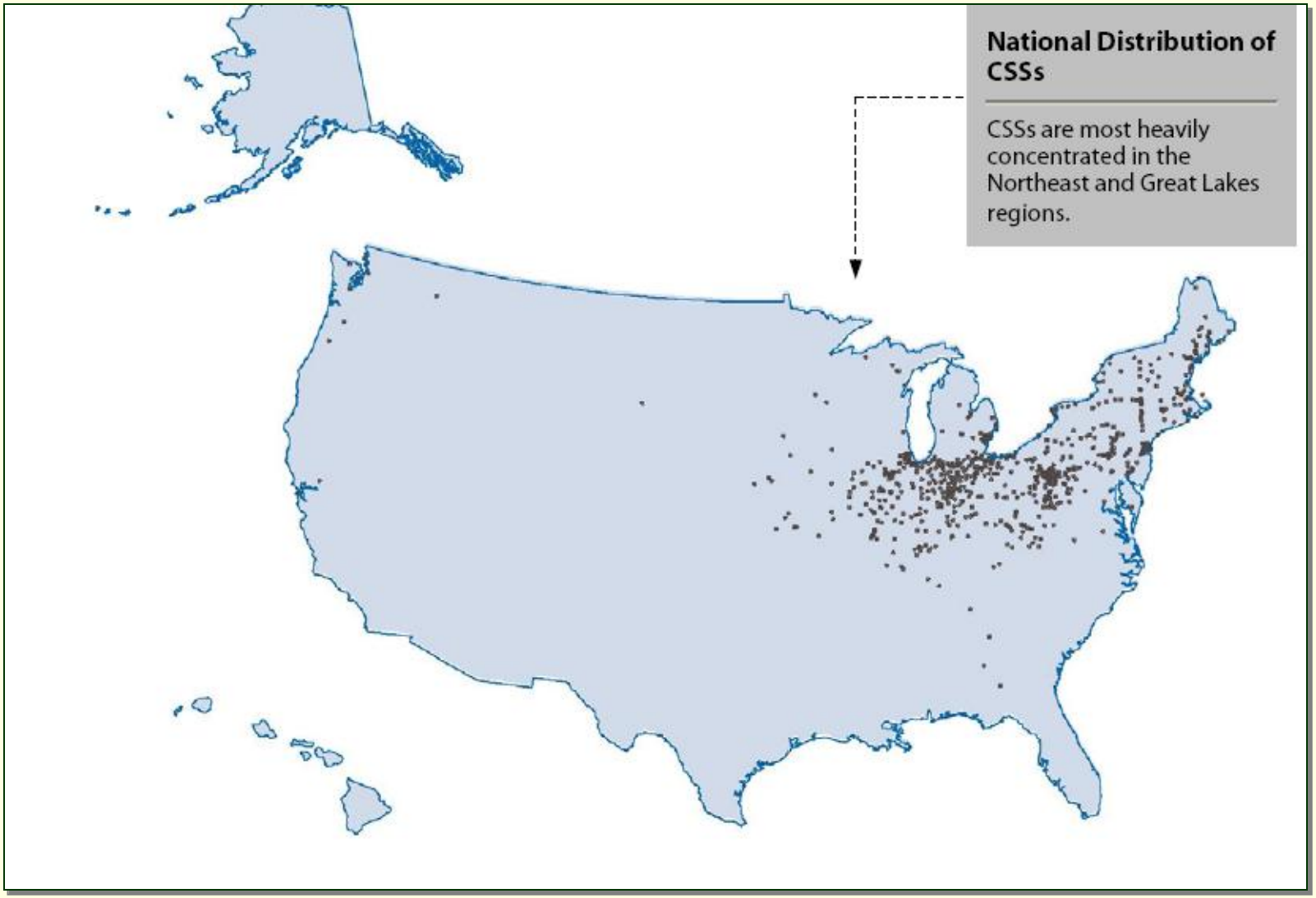
- Retention and Treatment Basins (RTBs) utilized for storage and treatment prior to discharge

- 1 year, 1 hour storm event
  - 0.82” precipitation
  - capture and return to WWTP
- 10 year, 1 hour storm event
  - 1.43” precipitation
  - primary treatment (settling/skimming & disinfection)

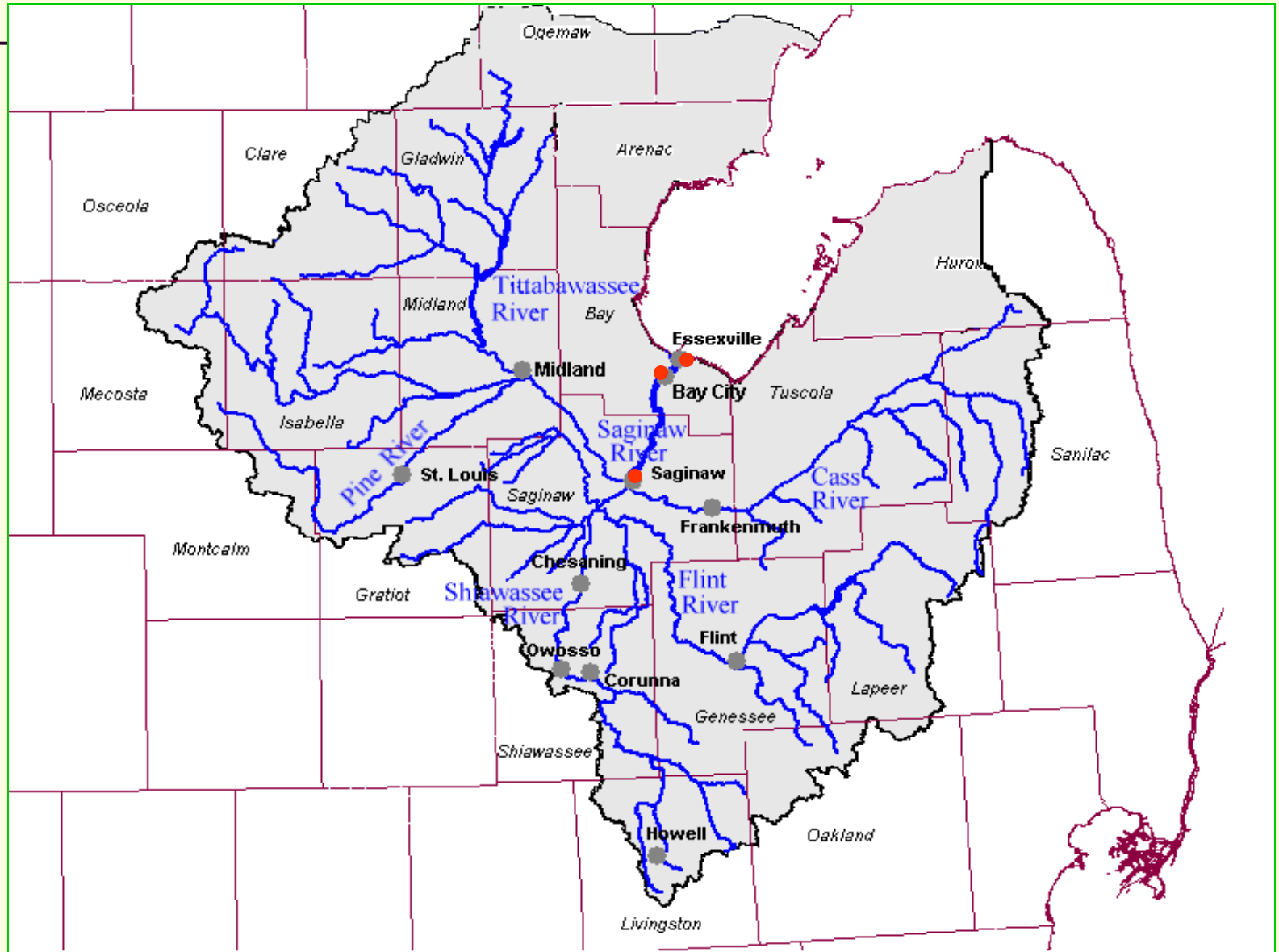
Combined Sewer RTBs

- used in high flow/volume events
  - large storms
  - series of back-to-back smaller storms
  - prevents catastrophic flooding of WWTP & collection system (basement backups)
- designed to bleed back collected water to WWTP as flow diminish
- if there is a discharge, then primary treatment with disinfection is required
  - must meet NPDES permit requirements (fecal coliform)

Distribution of CSOs



RTB Locations in Saginaw River



CSO Control Efforts – Saginaw River

3 municipalities that had untreated CSOs, now have Retention and Treatment Basins

- Saginaw
- Bay City
- Essexville

Review:

- What have they done
- How are they performing

Saginaw CSO Control Efforts

- Built 1 RTB in ’80’s
- SRF Assistance: 2/28/91 - 5/25/99 (Construction of 6 more RTBs, plus system improvements, in-line storage, computerized system, etc.)
- 10 Loans, Total: $106,135,000
- 1988 Outfalls: 42 Untreated; 1 RTB (Hancock RTB)
- 2007 Outfalls: 7 Retention Treatment Basins
- Saginaw – Major WWTP improvement just put in place, now more capacity to handle flows that would have been discharged from the RTBs in prior years
- Basins are currently being studied using the Demonstrative approach. Once the study is completed, any additional improvements to comply with the permit will be undertaken

Saginaw RTBs

- 7 CSO Basins
  - Return flows to WWTP
  - Primary Treatment with Disinfection if discharge
- 1998 EPA National First Place CSO Control Award Winner
- Other engineering awards

City of Saginaw RTBs

Saginaw RTBs 2006-2008

- 26 days of discharge in 3 years (1095 days), less than 1 day per month
- 22 events in 3 years (back to back days counted as one event), 0.6 events per months
- Fecal coliform concentrations:
  - range <40 to 5300 cfu/100 ml
  - 9 of 91 values over 200
  - five values exceeded 400 cfu/100 ml.
- 1206 million gallons of RTB discharge
- 4474 million gallons of RTB influent
- 19908 million gallons of WWTP discharge

Bay City CSO Control Efforts

- $65,000,000 in Federal grants to build 5 RTBs
- SRF Assistance: 3/12/01 (WWTP & RTB Upgrades, computerized system) – loans of $6,763,130
- Additional $12,000,000 Corrections from Revenue Bonds for I/I
- Prior to 1988 (perhaps prior to 1982) Outfalls: 5 Untreated
- 2007 Outfalls: 5 Retention Treatment Basins
- Bay City – Basins were designed using the Presumptive approach. All basins are in compliance and exceed the design requirements for CSO Basins. No further work is needed.
- By this fall, the City will have spent up to $20 million for sewer repairs. The City has also spent $45 million to upgrade their WWTP

Bay City

Bay City RTBs 2007-2008

- 21 days of discharge in 2 years (730 days), less than 1 day per month
- 9 events in 2 years, 0.38 events per months
- Fecal coliform concentrations:
  - ranged from 0 to 6000 cfu/100 ml
  - 2 of 56 values over 200
  - 1 value exceeded 400 cfu/100 ml.
- 246 million gallons of RTB discharge
- 381 million gallons of RTB influent
- 5828 million gallons of WWTP discharge

Essexville CSO Control Efforts

- SRF Assistance: 2/27/97 (WWTP Improvements, Expand RTB) Amount: $238,800
- Other costs funded by City
- 1988 Outfalls: 1 Untreated
- 2007 Outfalls: 1 Retention/Treatment Basins
- Basins were designed using the Presumptive approach.
- Additional work on the basin and treatment system has been put on hold due to Essexville in process of redirecting it's wastewater to West Bay County wastewater treatment facility

Essexville RTB 2006-2008

- 40 days of discharge in 3 years (1095 days), about 1.1 days per month
- 25 events in 3 years, 0.7 events per month
- Fecal coliform concentrations ranged from 0 to 216 cfu/100 ml
- 62.8 million gallons of RTB discharge
- 94.1 million gallons of RTB influent
- 835 million gallons of WWTP discharge

Sources of Fecal Coliform & E. coli

Direct & Indirect Discharges to Surface Water

- Illicit Discharges - Illegal Connections to Drains and Storm Sewers
- Failed Septic Systems
- Agriculture (CAFOs and AFOs)
- Wildlife (animals, birds)
- Municipal Storm Water discharges
- SSOs
- Untreated CSOs
- **Retention & Treatment Basins**
- **WWTPs and WWSLs**

Inventory of Point Sources by Watershed

	Pine	Flint	Saginaw	Cass	Shiawassee	Tittabaw.	Totals
WWTPs	5	6	5	6	9	8	39
WWSLs	4	15	2	6	16	8	51
CAFOs	5	0	0	4	6	1	16
MS4	0	19	15	1	6	3	44
Industrial SW	35	127	97	34	85	44	422
NCCW	1	5	1	5	2	1	15
HPTW	0	2	1	0	0	0	3
Sand and Gravel	0	1	0	4	1	2	8
Swimming Pool	0	1	0	0	0	0	1
WTP	0	7	0	1	4	2	14
GWCU	2	6	1	2	2	1	14
superfund	0	0	0	0	2	1	3
Others (industry)	3	6	4	2	5	6	26
Totals	**55**	**195**	**126**	**65**	**138**	**77**	**656**

Saginaw River Watershed

- 2008 Municipal WWTP flows = 49,787 million gallons
- 2008 CSO flows (4 systems) = 1,252 million gallons
  - 2.5% of the flow from Municipal WWTPs

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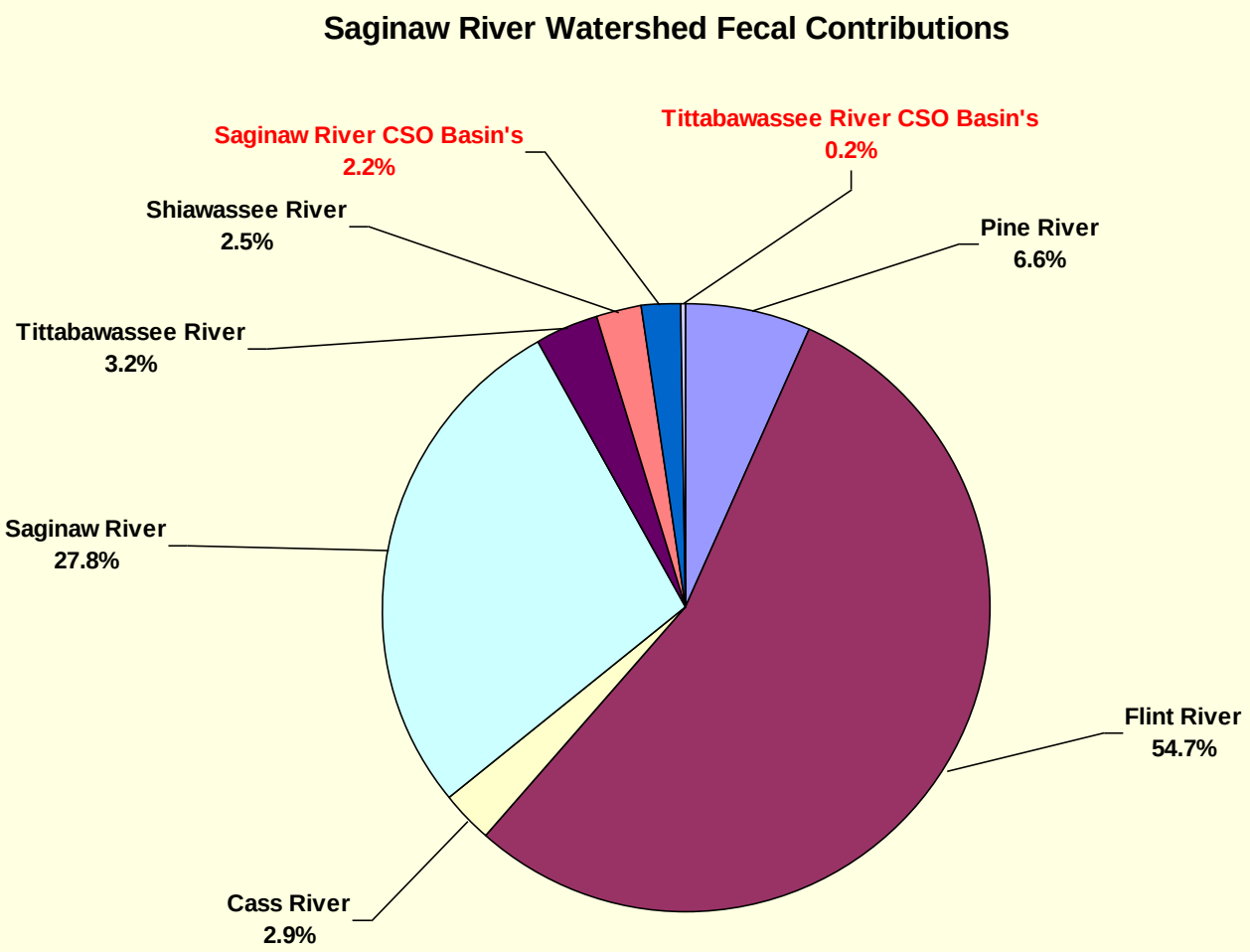
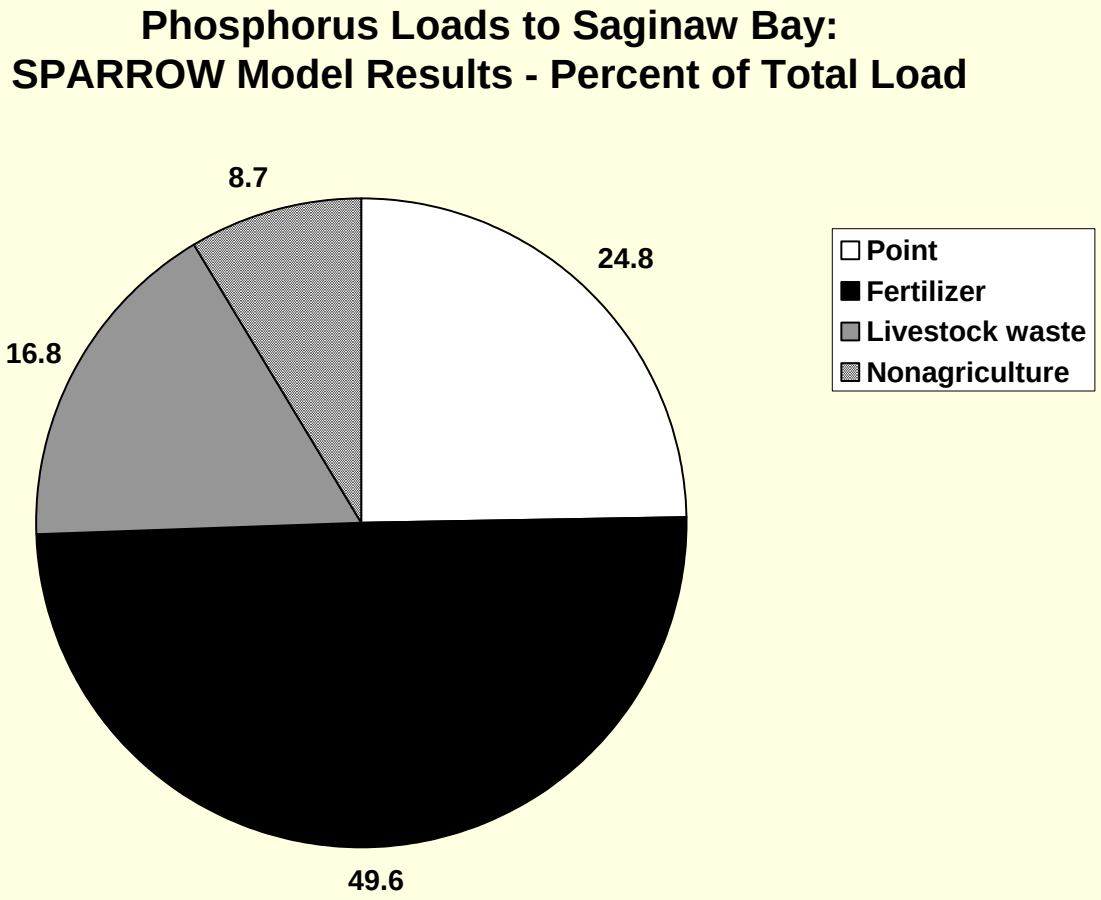
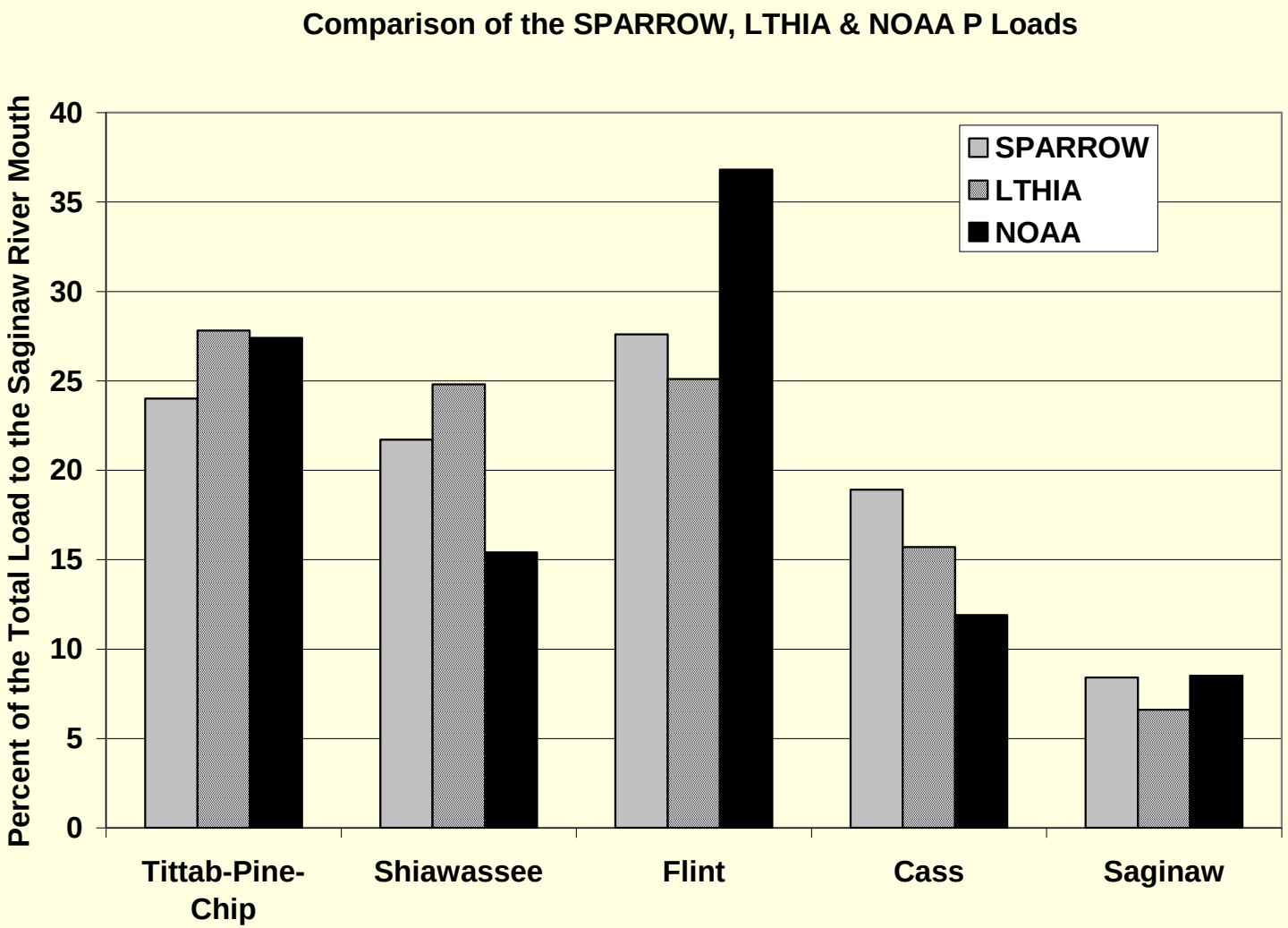
Fecal Coliform
Relative % from RTBs vs. WWTPs



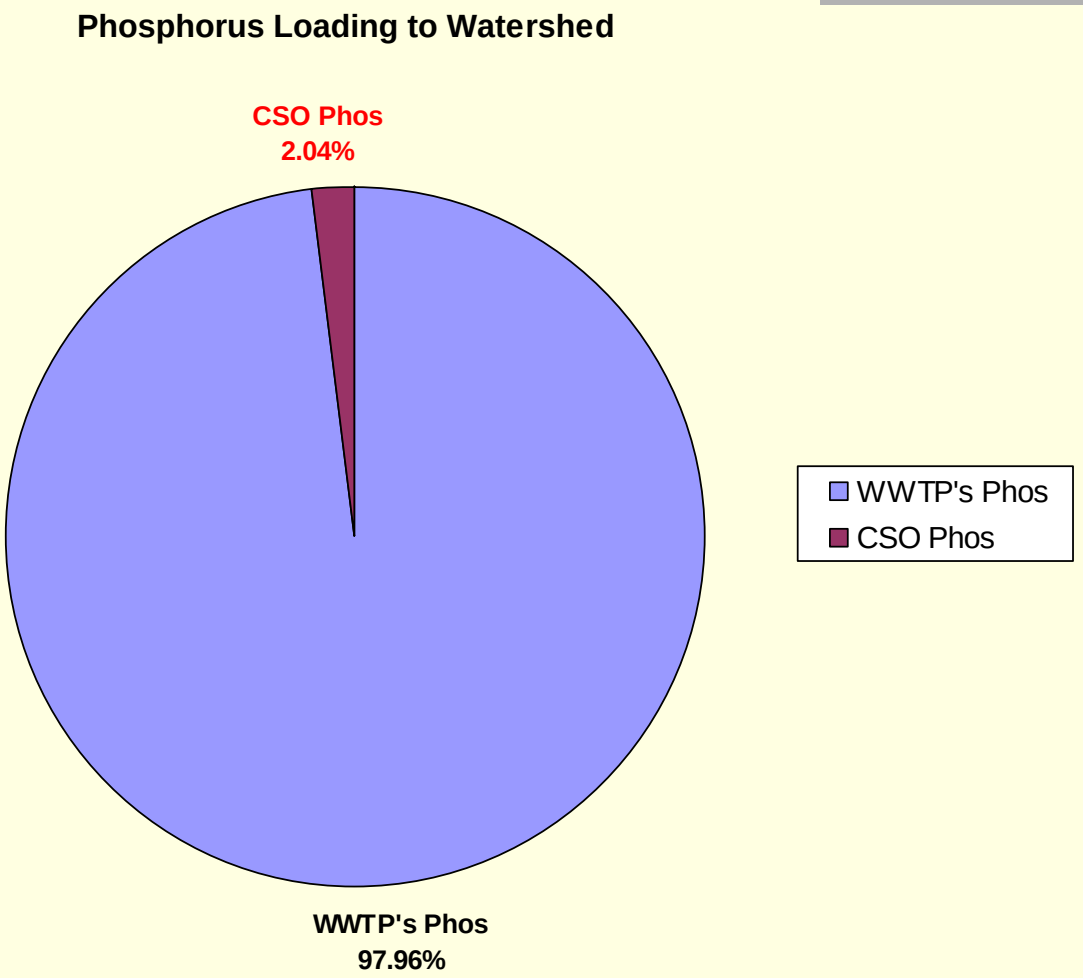
Phosphorus – PS & NPS Contributions



Comparison of Modeled Phos Loads



Total Phosphorus Loading from RTBs vs. WWTPs



Review of CSO Control Efforts and Results

- Untreated combined sewer overflows into Saginaw River have been **eliminated**
- Discharges from RTBs have permit limits and monitoring requirements and must meet WQS
- Relative Impacts from RTBs
  - Fecal coliform
  - Phosphorus

What's Next for CSO Workgroup?

- Town hall style meetings planned to discuss issues
- Identify the public's concerns and why these are held
- Identify education needs
- Discuss changing press coverage – RTB discharges are treated like discharges of raw sewage
- Determine how the CSO discussion fits into the rest of the SBCI efforts
- What's the best use of limited $ resources