

Virginia's Dams

A Status Report

Dams Cease to Be

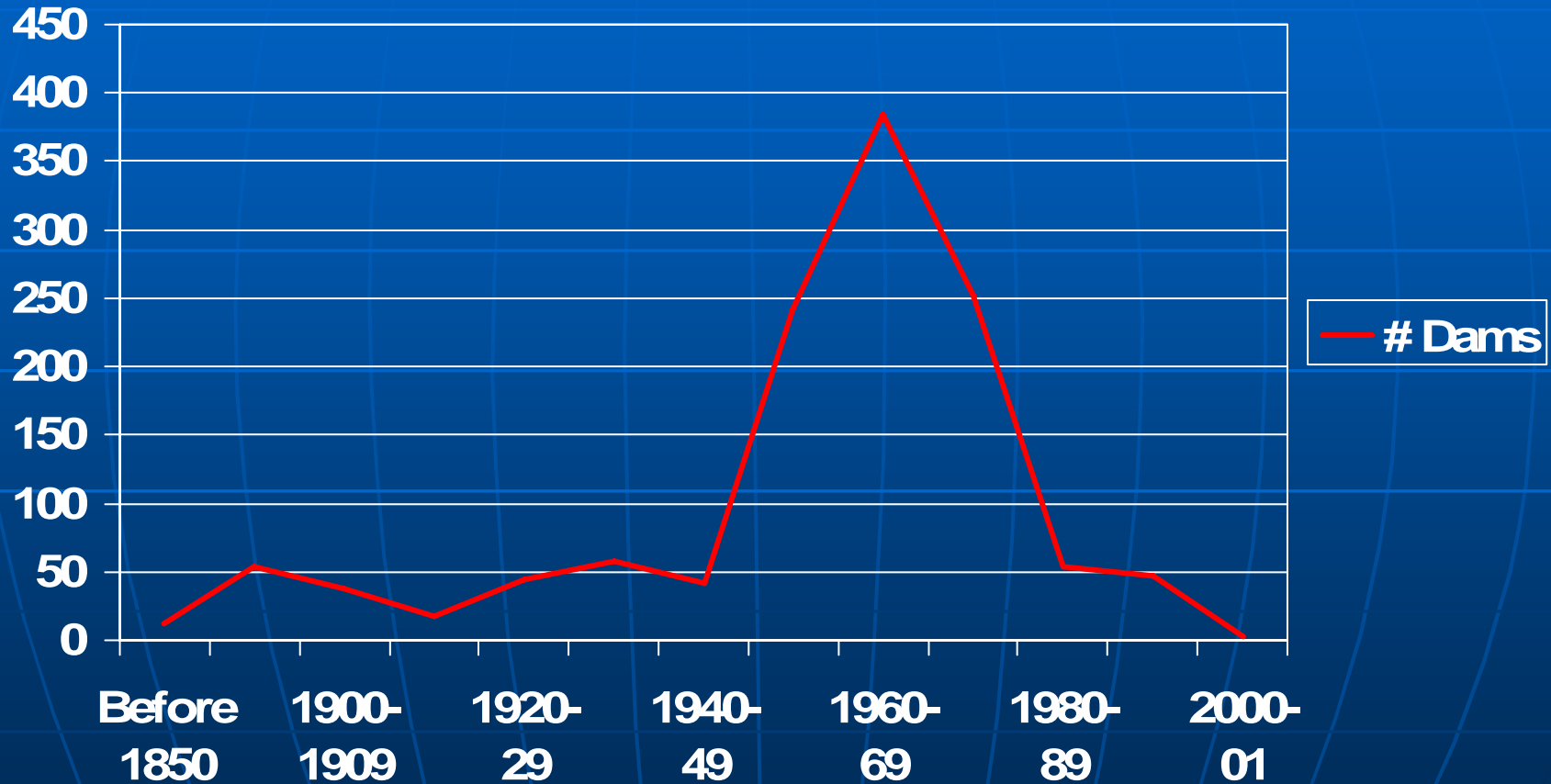
- When they fail
- When they are removed

Typical Design Life

- Dams are typically designed for 50 years of useful life.

Age of Dams in Virginia

(From Virginia's Inventory of Dams – May 2006)



Causes of Dam Failure

- Lack of attention and maintenance
- Days of rain + weakened dam
- Inadequate Spillway Size
- Extreme event (precip, seismic)

Other means

- Unqualified contractor error
- Equipment malfunction

Recognizing Problems

- Hidden problems
 - Non-working valves
- Problems that require training to recognize
 - Voids
 - Piping
 - Sinkholes



Maintenance Issues

- Pipes and Valves
 - Age and Deterioration
 - About 80% of dams in Virginia have non-working valves
- Internal Erosion
 - Leaks
 - Parallel Ports
 - Voids
 - Sinkholes
- Plants and Animals
- Unqualified Contractors or Engineers

Pipes and Valves



Gate frame
as removed



Leaking
CMP

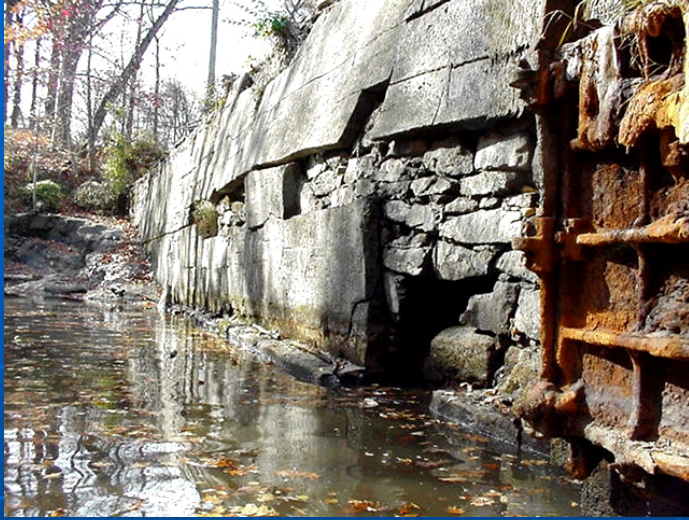


Gate as
removed



Gate
structure
with no
fasteners

Leaks



The Leak that "Couldn't Be Fixed"



- Five hundred feet into the dam through a 4' X 4' box culvert.
- Oxygen level 14%

Internal Erosion – Parallel Ports



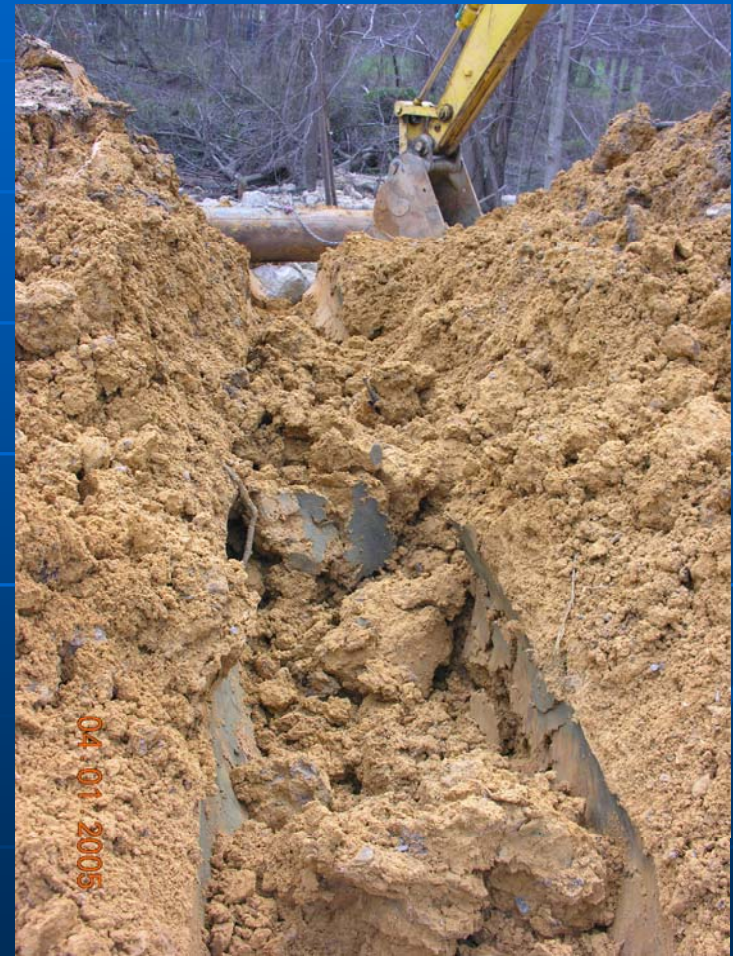
- Perceived by dam owners as not serious
- Is a serious sign that a parallel port exists along the outside of these structures
- Is a common failure mechanism for earthen dams

Internal Erosion - Voids

- Common under concrete spillways.
- Difficult to detect unless trained to look (and listen) for signs
- Will lead to loss of pool if not repaired



Internal Erosion - Piping



Piping – Near Failure



Internal Erosion - Sinkholes

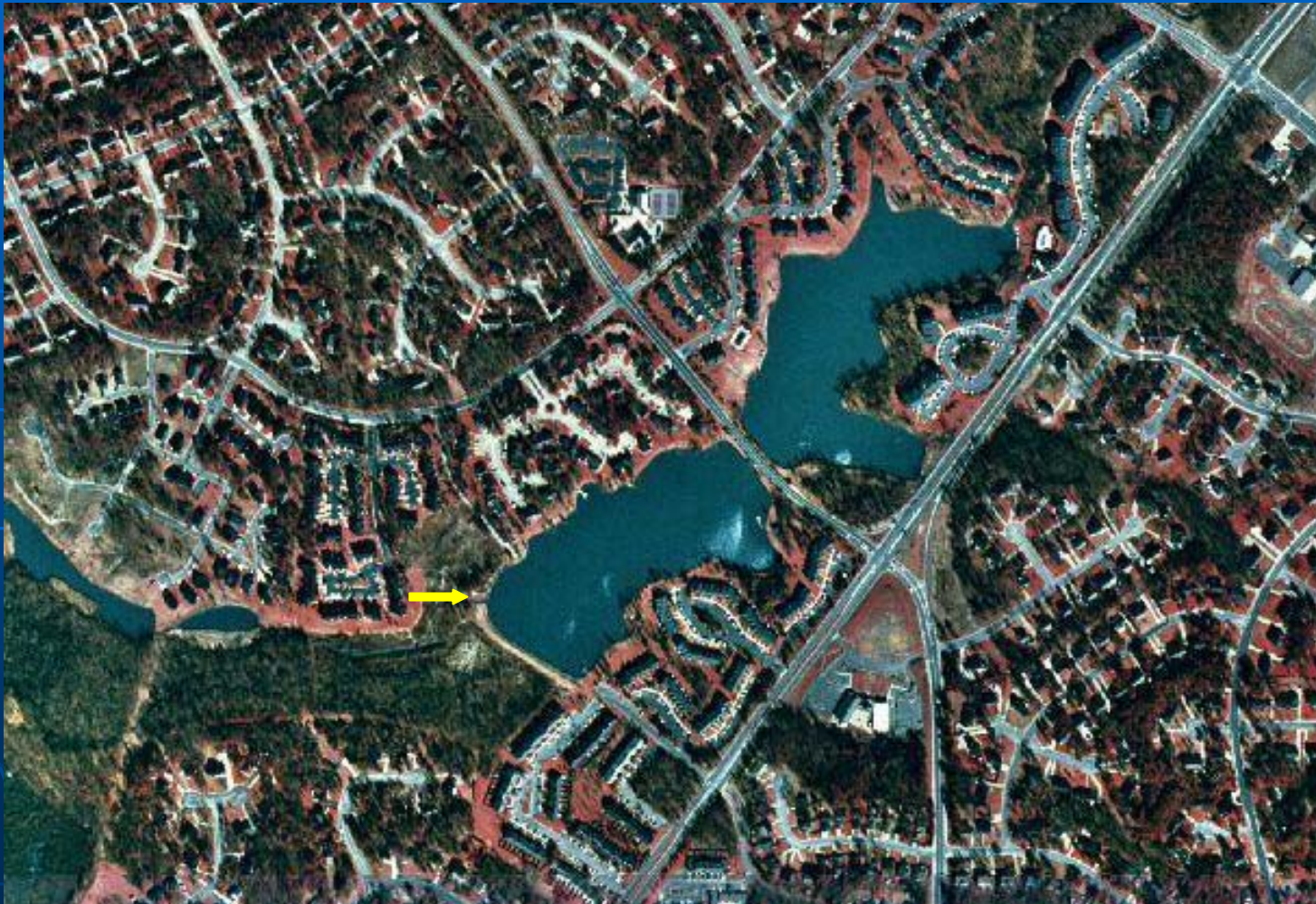
- Sinkholes are one eventuality of a parallel port



Inadequate Spillway



Inadequate Spillway



Inadequate Spillway - Overtopping



Plants and Animals



- Earthen dam failed and soil was washed away to reveal the penetration of tree root

Ground hog burrow with a yard stick for comparison



Plants and Animals

- Beaver debris around a riser
- Prevented gate from operating
- Difficult to detect



Tree Blew Down



- Large tree blew down in Hurricane Floyd
- Dam was overtopped
- Resulting erosion left this near failure
- Contractor finished it off

Contractor Errors



Fasteners of dissimilar metal with no cathodic protection



Contractor walked away



Contractor put large equipment on hydrated slope





Dredging Contractor got stuck and used the valve operator to pull himself out. Closed the gate by sticking a tree in the mud. Left the scene.



Engineer Errors

- An RCC dam has a gushing port in the groin.
- Engineer is a structural engineer specializing in skyscrapers
- Isn't concerned about port because he isn't knowledgeable about dams
- Copying the last report and sending it in without looking at the dam

Dams Not on Inventory



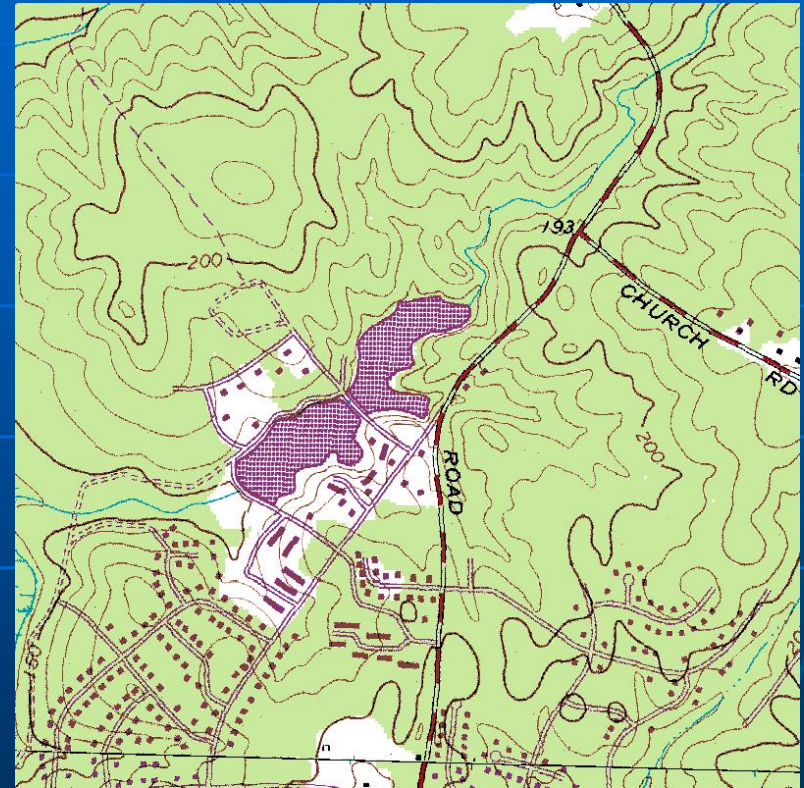
Dam Laws Changed in 2002

- Most known dam owners haven't been told
- Newly regulated dams haven't been identified even on a preliminary basis
- Four years later...

Use New On-Line Tools



Arial Photographs

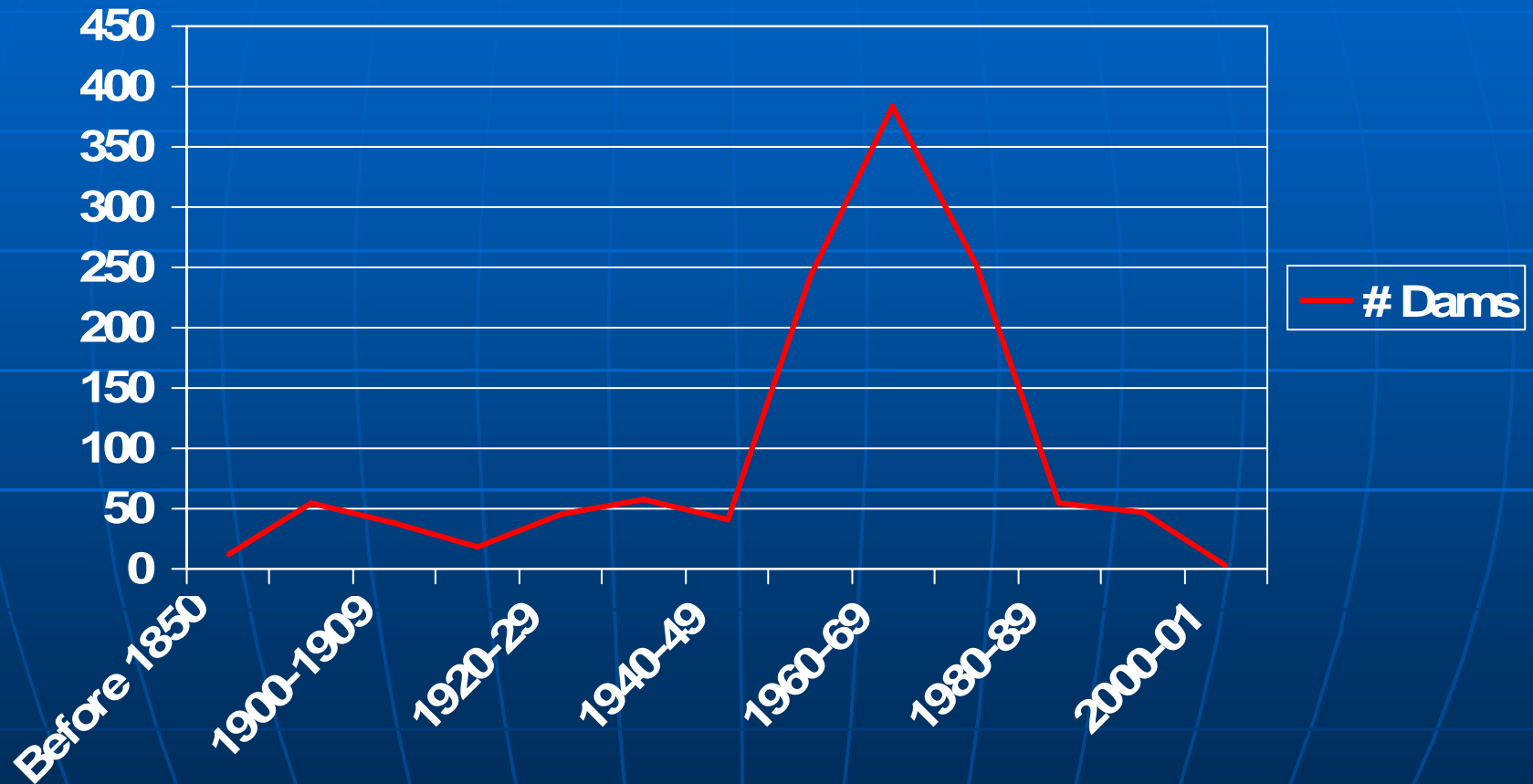


Topo

There is a 1 in 3 chance
I will get cancer in my
lifetime.

Age of Dams in Virginia

(From Virginia's Inventory of Dams – May 2006)



Average “Lifetime” of a Dam

- Average age of dams in Virginia is 48.9 years
- Dams typically exist for 100-200 years
- Average lifetime of a dam is 150 years

Probability (%) Indicated Design Flood Will Be Exceeded During Specified Planning Periods

Avg Return Period of Design Flood (yr)	Length of Planning Period (yrs)				
	1	25	50	100	200
25	4	64	87	98	100
50	2	40	64	87	98
100	1	22	39	63	87
200	0.5	12	22	39	63
1,000	0.1	3	5	10	20
10,000	0.01	0.25	0.5	1	2
100,000	0.001	0.025	0.05	0.1	0.2
1 mil.	0.0001	0.002	0.002	0.01	0.02

In A Dam's Life...

1 in 5 dams will experience a 1,000 year flood or greater (20% chance)

1 in 50 dams will experience a 10,000 year flood or greater (2% chance)

We have perhaps 3,000 dams in Virginia

The One Percent Doctrine

Subject: Major Terrorist Attacks in U.S. such as dirty bomb, etc.

- VP Cheney says, "If there is a even a 1% chance that these **low probability, high impact** events could occur, we have to treat them as a certainty."

Questions?