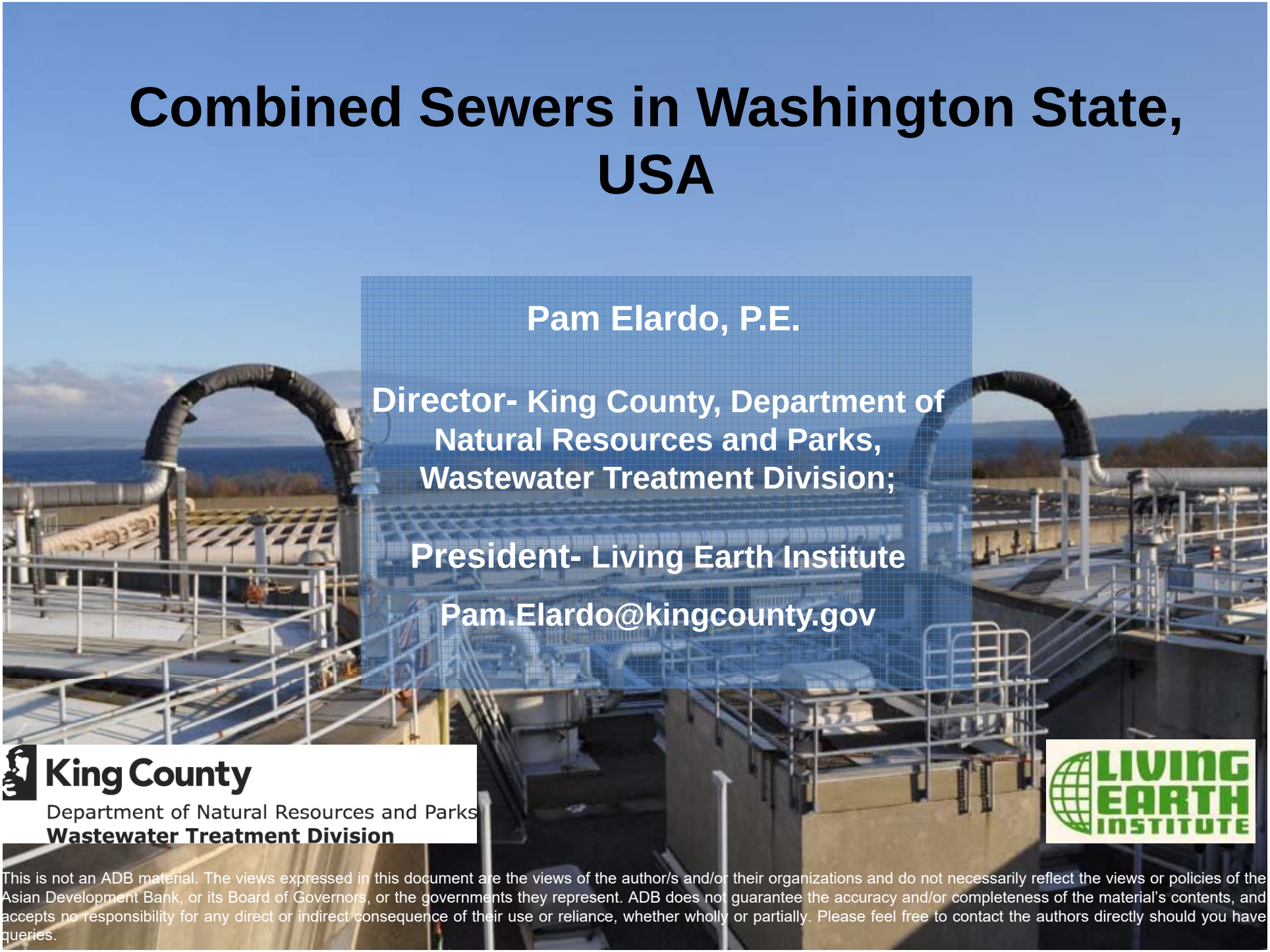
Combined Sewers in Washington State, USA



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Department of Natural Resources and Parks
Wastewater Treatment Division

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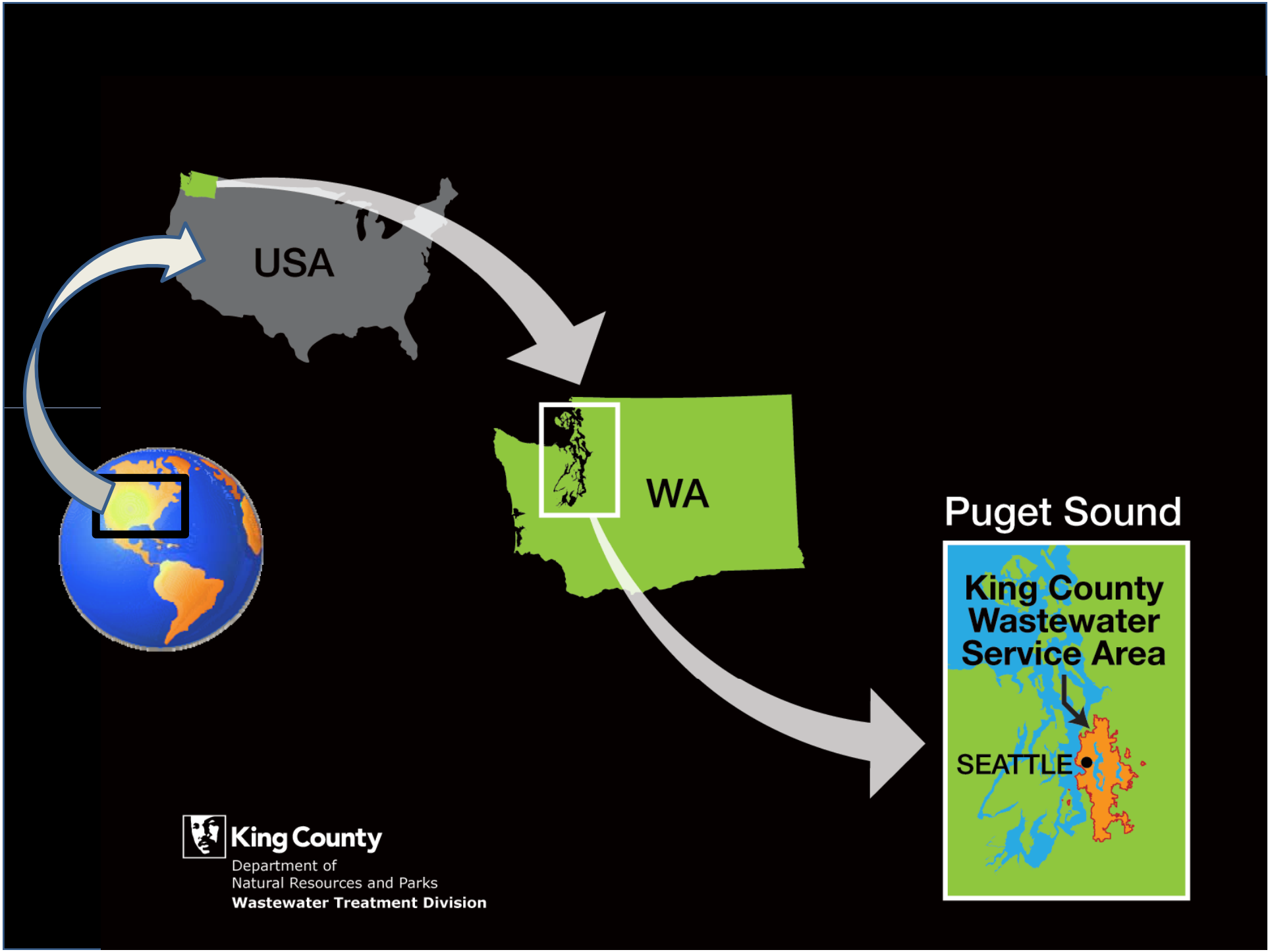
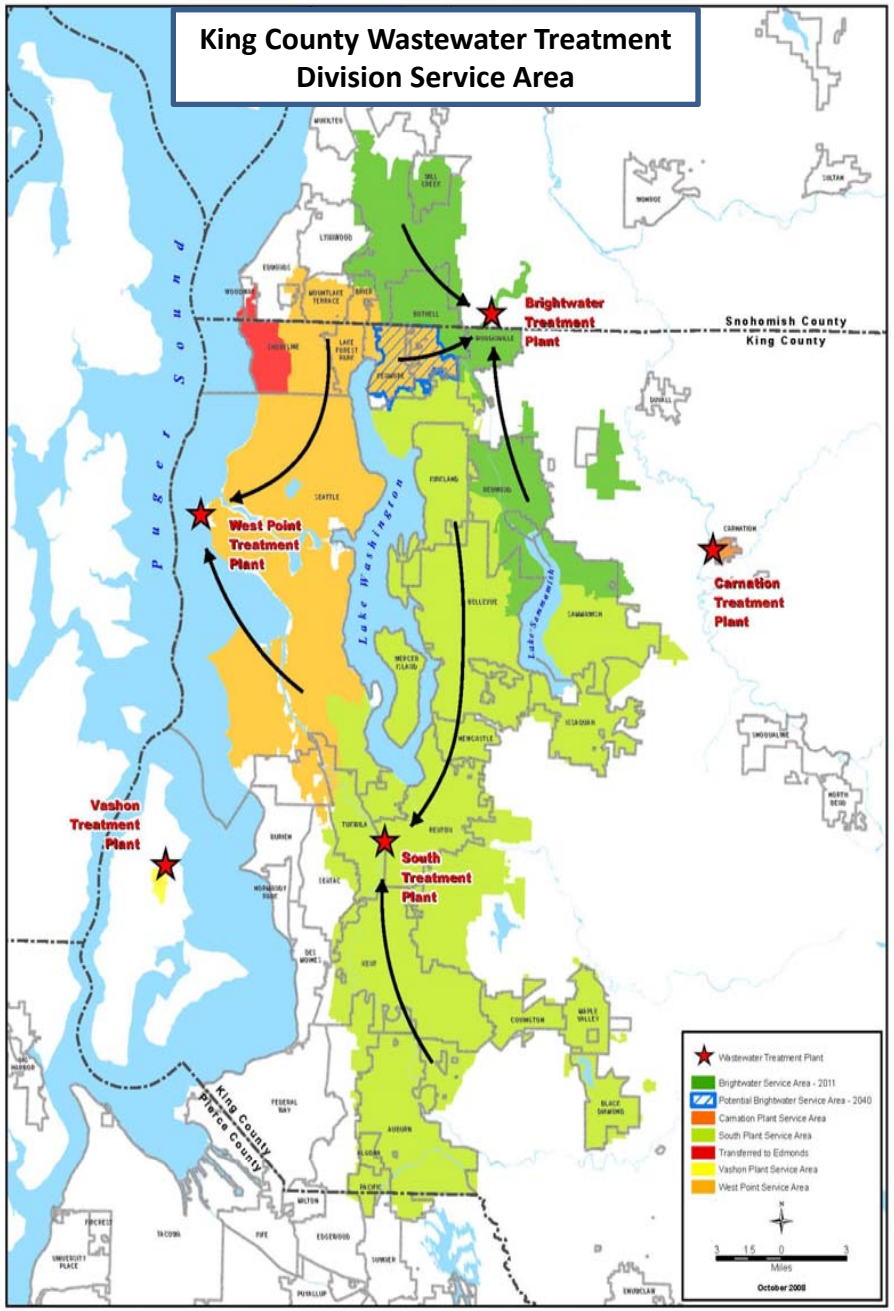

USA
WA
Puget Sound
King County
Wastewater
Service Area
SEATTLE
King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

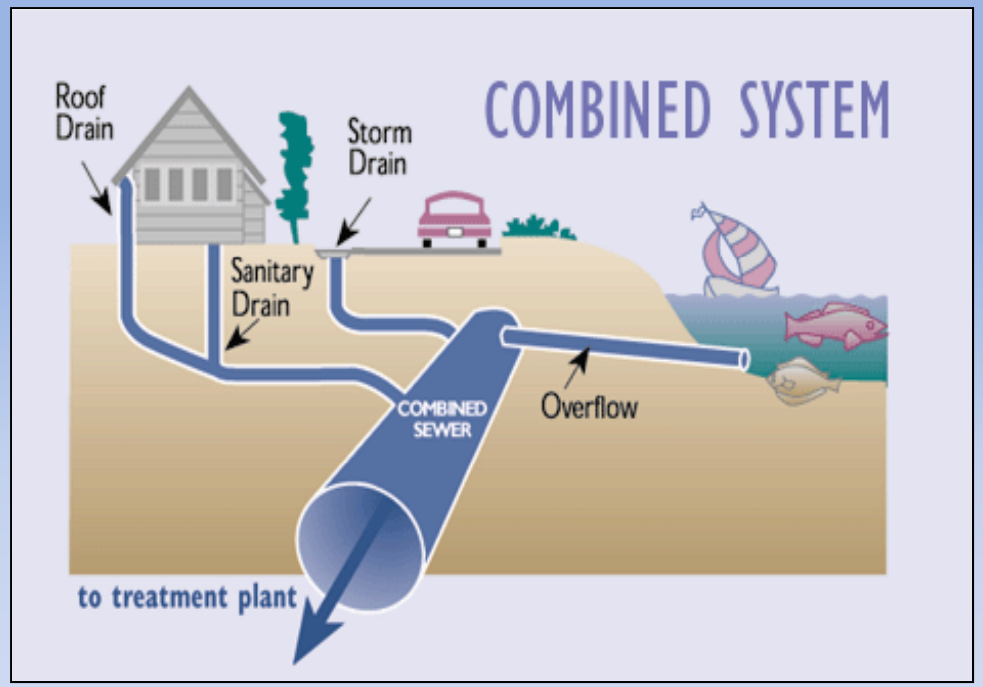


Regional Service

- 1.5 Million customers
- 600 employees
- 350 miles (540 km) conveyance pipelines
- 5 treatment plants
- 43 pumping,19 regulator stations
- Resources created:
  - Fertilizer (biosolids)
  - Energy (biogas)
  - Reclaimed water
- Flows:

  220 MGD (0.8 Mm3/d) base flow to 840 MGD peak flow (3.2 Mm3/d)

What are Combined Sewer Overflows?

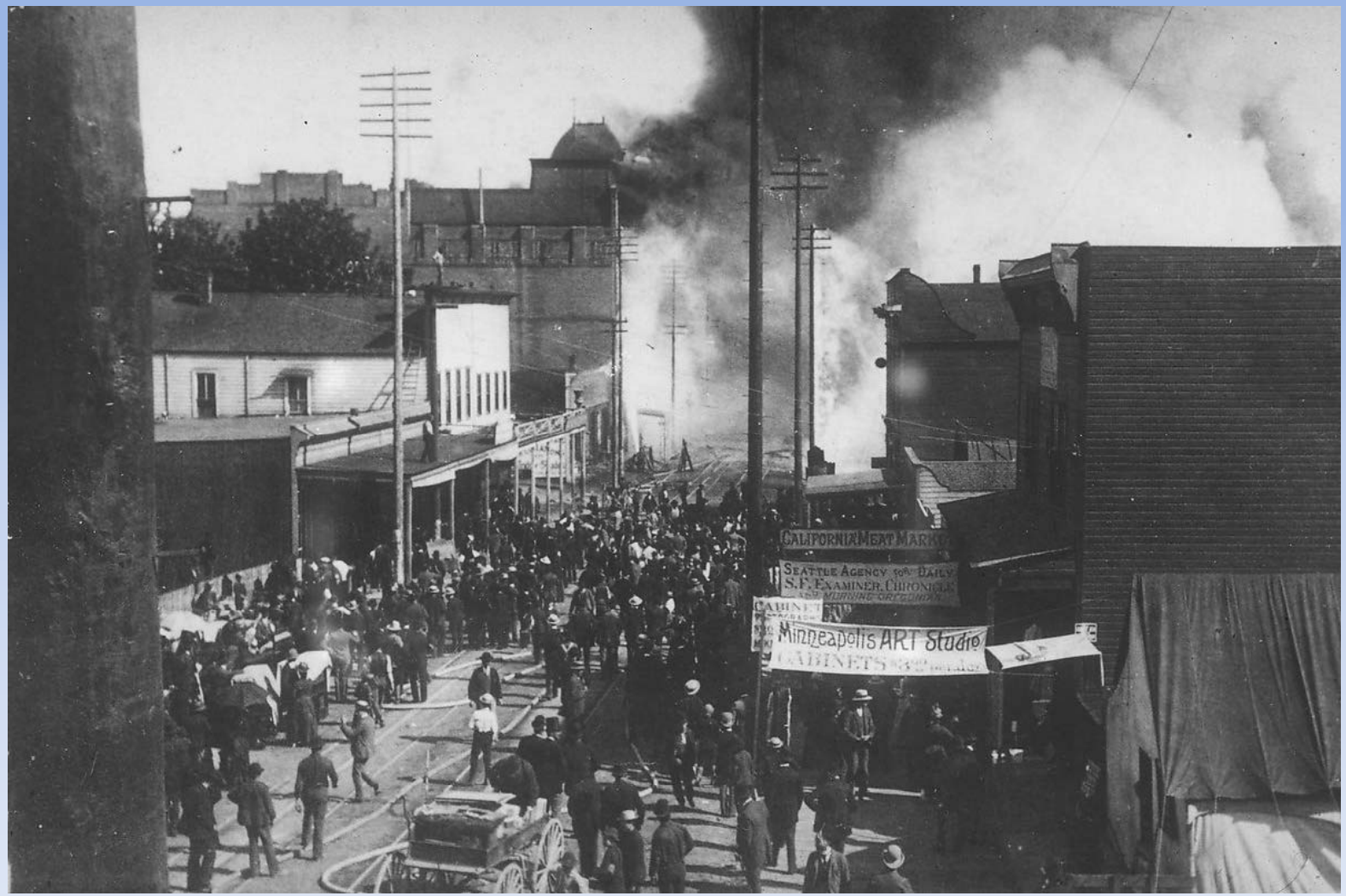


- In older cities, sewage and stormwater flow in the same combined sewer pipe
- Only Seattle has a combined system in the County's service area
- CSOs are designed relief points that allow untreated discharges during heavy rains

Separate vs Combined

- Late 1800's
  - Seattle's population grew from 300 – 5,000
  - Sanitation was a concern; public sewer system debated and started in 1885
  - Great Seattle Fire 1889
    - Quickly rebuild the city
    - Separated system lacked enough capacity
    - Use combined sewers to convey sanitary & stormwater

Great Seattle Fire 1889



Separate vs Combined

- 1890 Seattle Chartered as a City and Washington becomes a State

- 1891 construction began on combined sewer system
- 1891 – 1900

45.5 miles (73.2 Km) of pipe constructed

Overloaded Sewers

1927 – City engineers argued for separated sewer systems

1949 – Water conditions near popular beach areas not satisfactory

1955 - Improvements to sewer system and charges a monthly rate ($1.00/month)

1958 - Voters approve taxes for metropolitan system

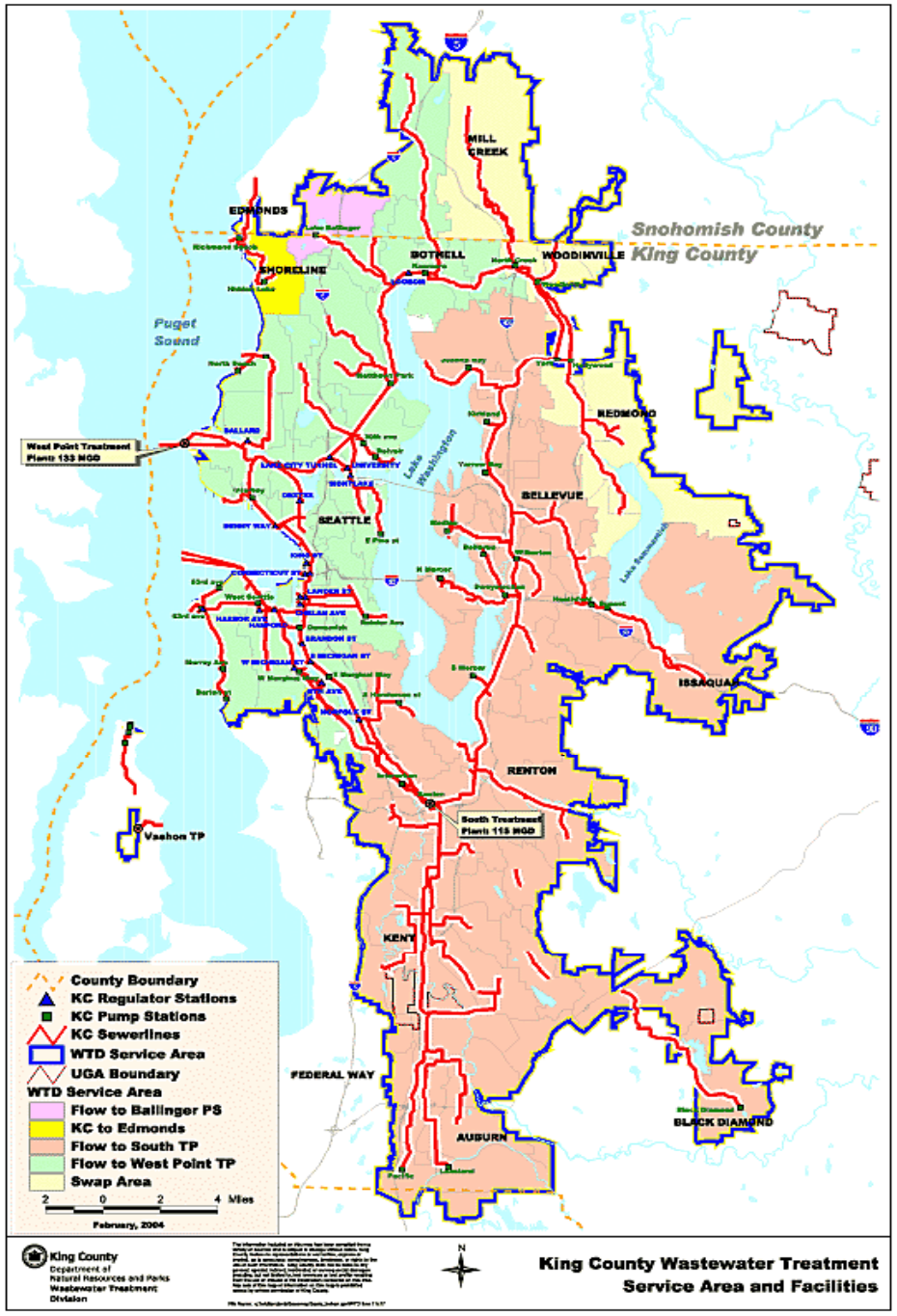
1967 - Over 20 small treatment plants and multiple direct discharge pipes replaced

Regional Wastewater Management System

- Clean up Puget Sound and Lake Washington
- Close 29 smaller treatment plants
- Regional network of pipes to convey flow to regional treatment plants

Provide wholesale wastewater service to 34 local agencies

- **collects** the water in our interceptors
- **conveys** the wastewater to plants for treatment and discharge to Puget Sound
- **recycles** by-products



Our Treatment Plants Today

West Point 1966/1995

Brightwater 2011

South Plant 1966/1987

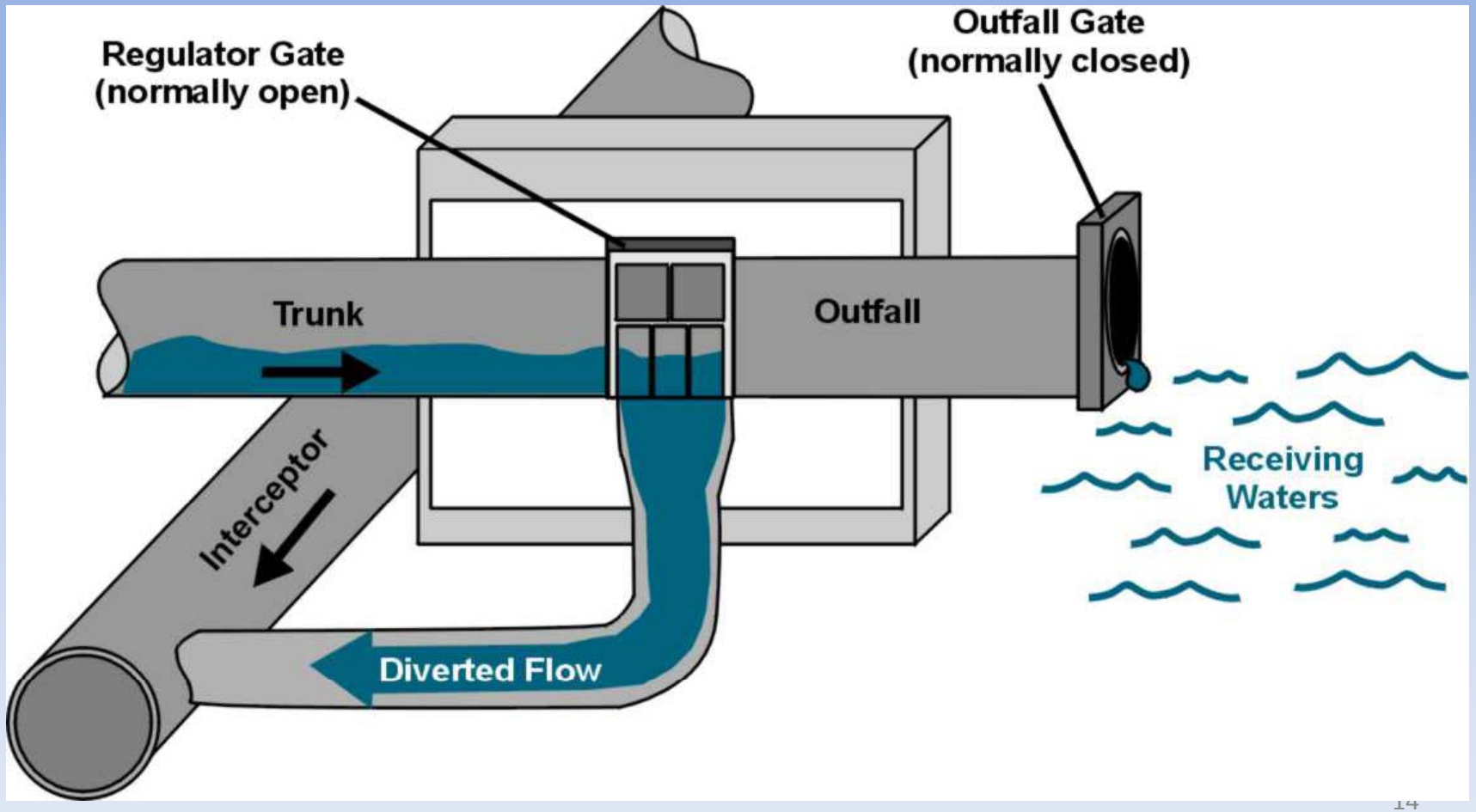
Vashon

Carnation

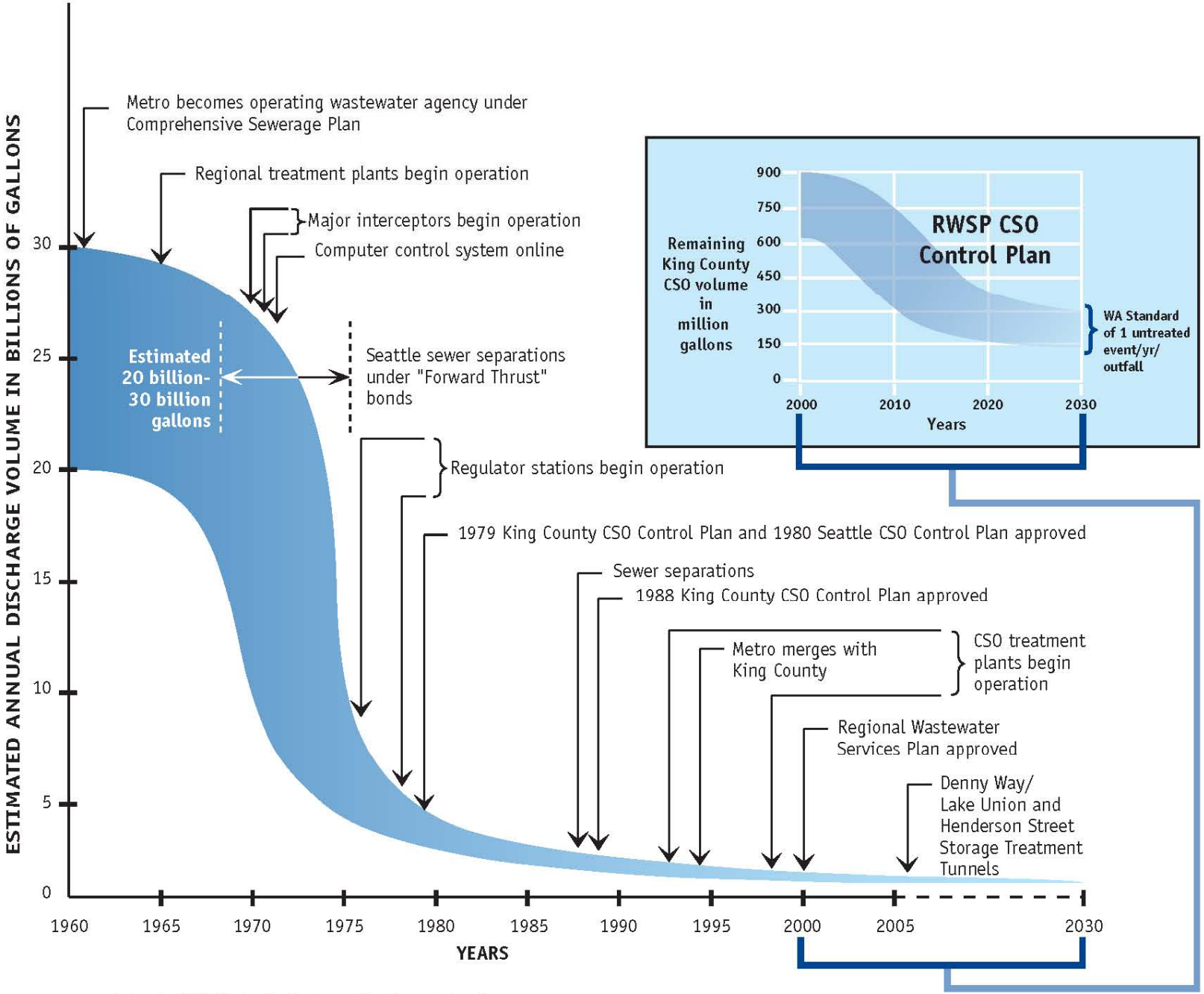
Region Made Decisions on Sizing the New System

- Sizing pipes to manage wastewater and stormwater is complex
- Design to capture major flow volumes while preventing back-ups into homes and streets
- Must meet standards for operations

Typical Constructed CSO (Regulator Station)




Puget Sound
Carkeek CSO Plant
(046)
North Beach (048)
Matthews Park (018)
Ballard (003)
11th Ave W (004)
Green Lake
30th Ave NE (049)
West Point Treatment Plant
Canal St (007)
Belvoir (012)
3rd Ave W (008)
Portage Bay
Lake Union
Montlake (014)
University (015)
Lake Washington
Dexter Ave (009)
Magnolia (006)
Elliott West Facility
Denny Way (027)
E Pine St (011)
Elliott Bay
King St (028)
Connecticut St (029)
53rd St (053)
Lander St (030)
Hanford #2 (032)
Alki CSO Plant
(051)
Chelan Ave (036)
Rainier Ave (033)
63rd St (054)
Harbor Ave (037)
Hanford #1 (031)
SW Alaska St (055)
Duwamish W (034)
Duwamish E (035)
Brandon St
Terminal 115 (038)
Michigan (039)
Murray St (056)
East Marginal (043)
West Michigan (042)
8th Ave (040)
Barton St (057)
Henderson St (045)
MLK Way (013)
SEATTLE CITY LIMITS
Henderson/ MLK Facility
Puget Sound
Norfolk (044)
522
99
5
520
90
509



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King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Cost Control Measures

- Combined projects
- Analyze technologies to reduce size of treatment facilities
- Green Stormwater Infrastructure to reduce project size and cost - not yet counted
- Working closely with Seattle
- Identify less costly properties

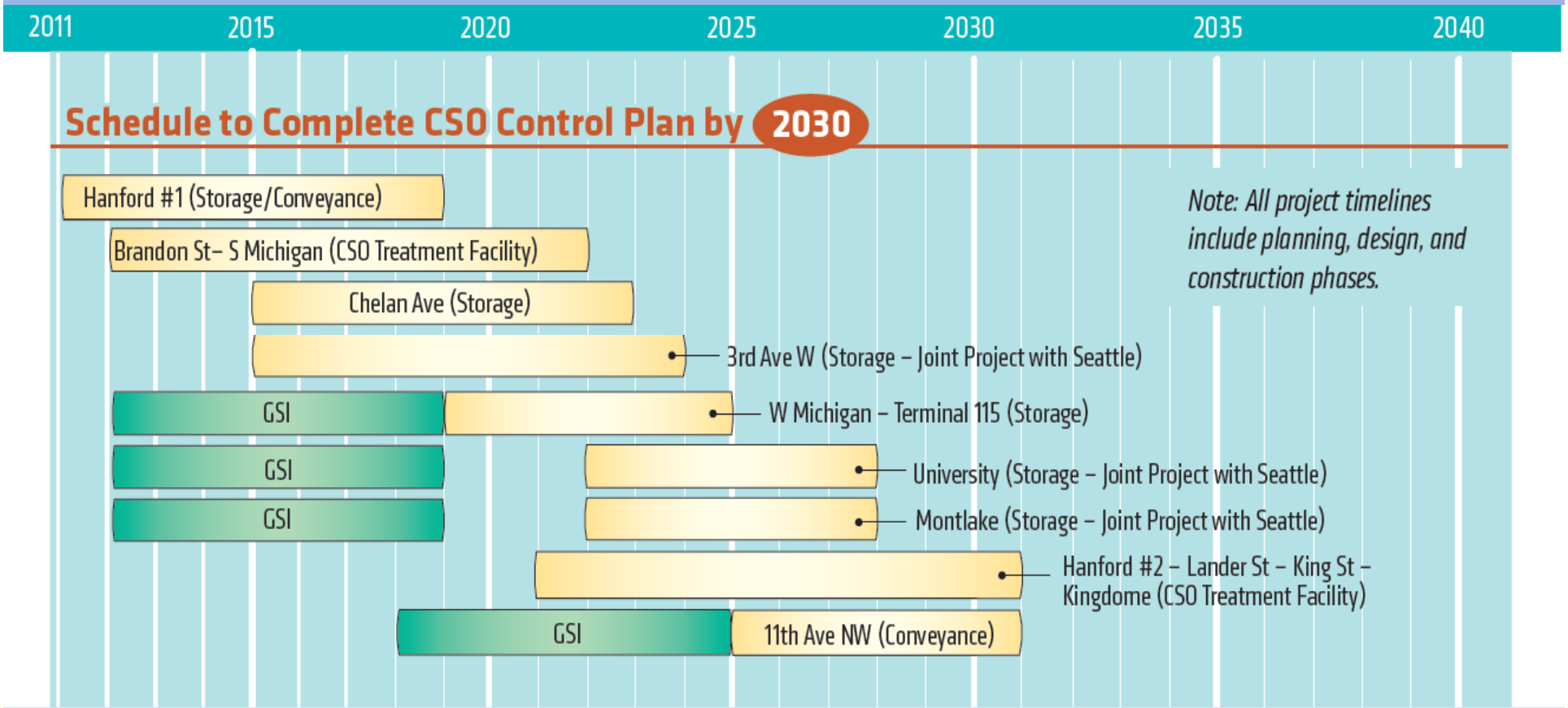
Public Involvement is Key

- Public trust and acceptance are essential to the conveyance and treatment of wastewater.
- Public involvement professionals educate the public and work to create trust and support.
- Public involvement builds support for new programs, avoids entrenched opposition and supports policy decisions.
- It can help projects stay on time and within budget.

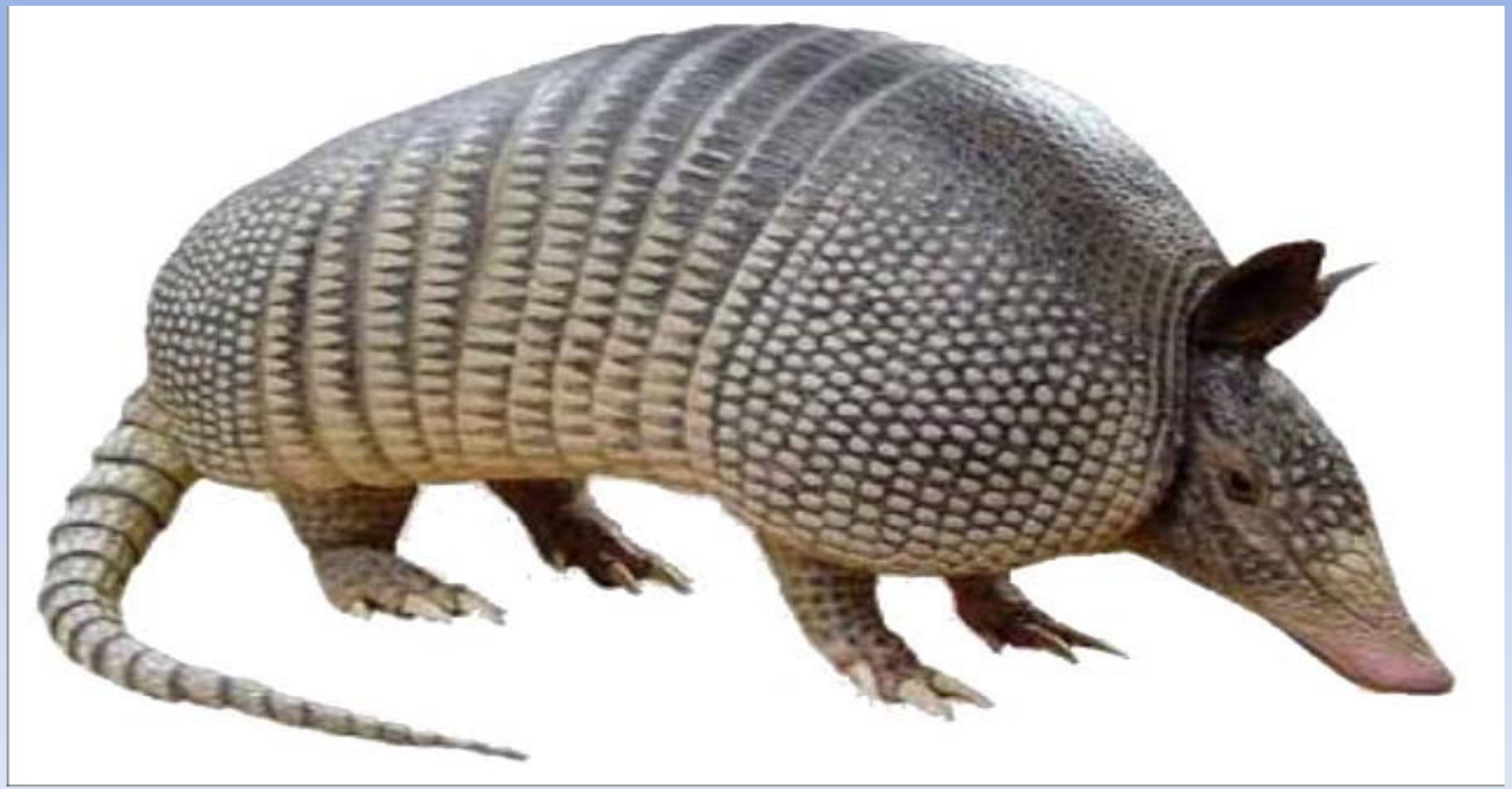
Prioritization of Projects - Science

Environmental Priority	CSO Control Area Priority Status			
	Duwamish River/ Elliott Bay Priority	Lake Washington Ship Canal Priority	Montlake Cut Priority	Same Impact
Public Health				
Pathogens				✓
Chemicals	☑			
Environment				
Water Quality				✓
Sediment Quality	☑			
Threatened and Endangered Species	☑			
Climate Change				✓

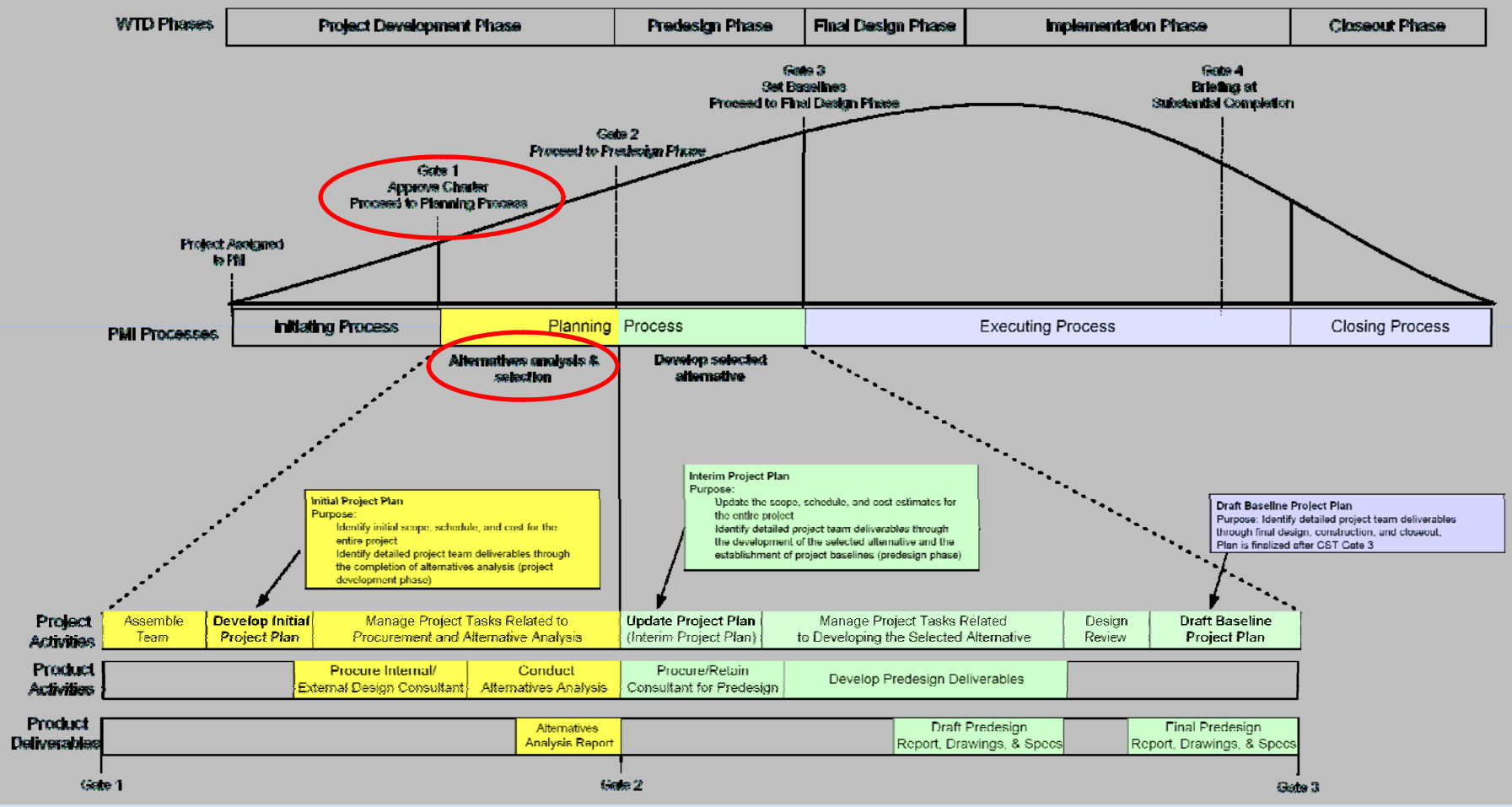
Implementation Schedule



WTD “Armadillo”: Framework for Project Management



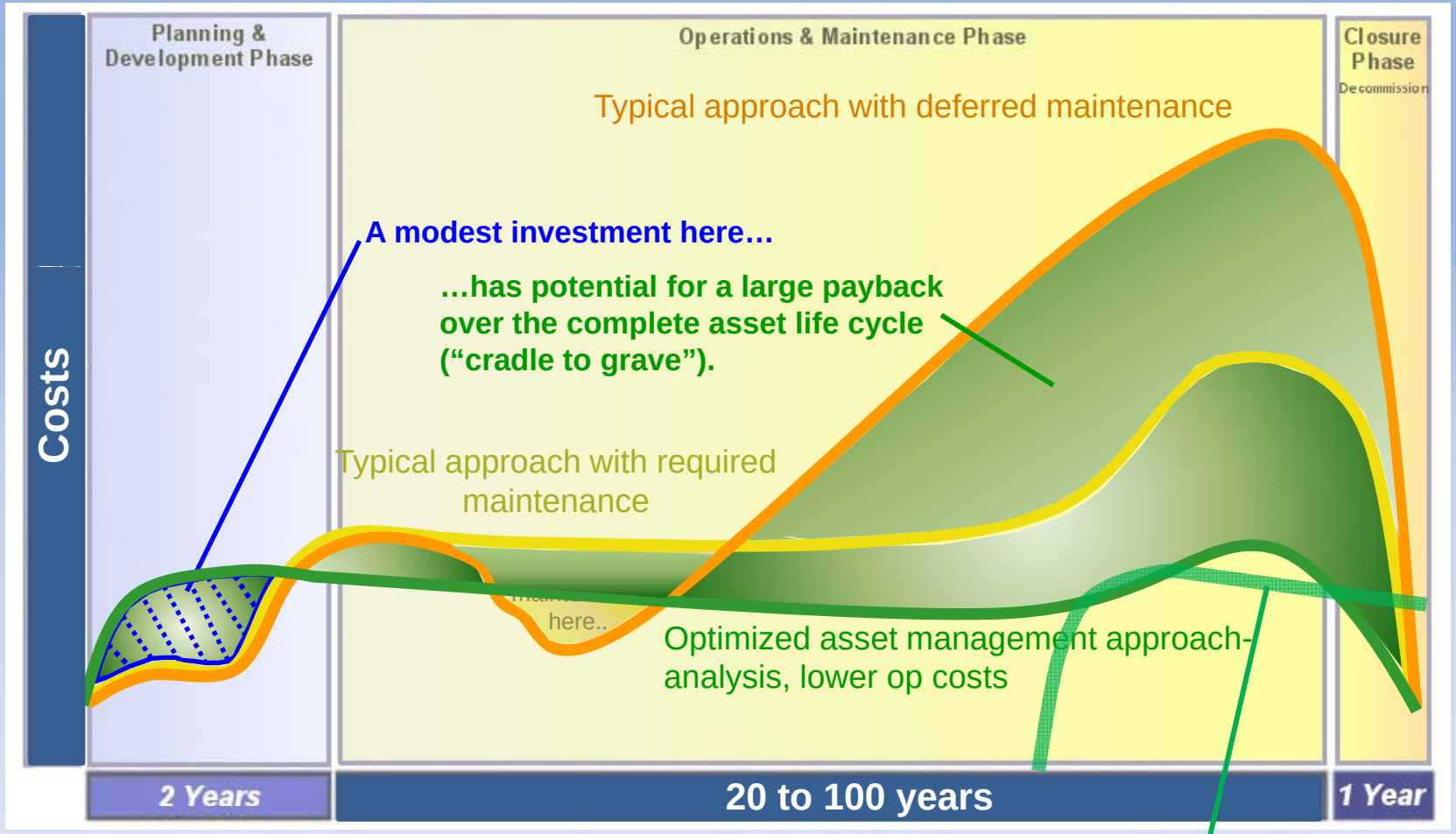
Proposed WTD Planning Process

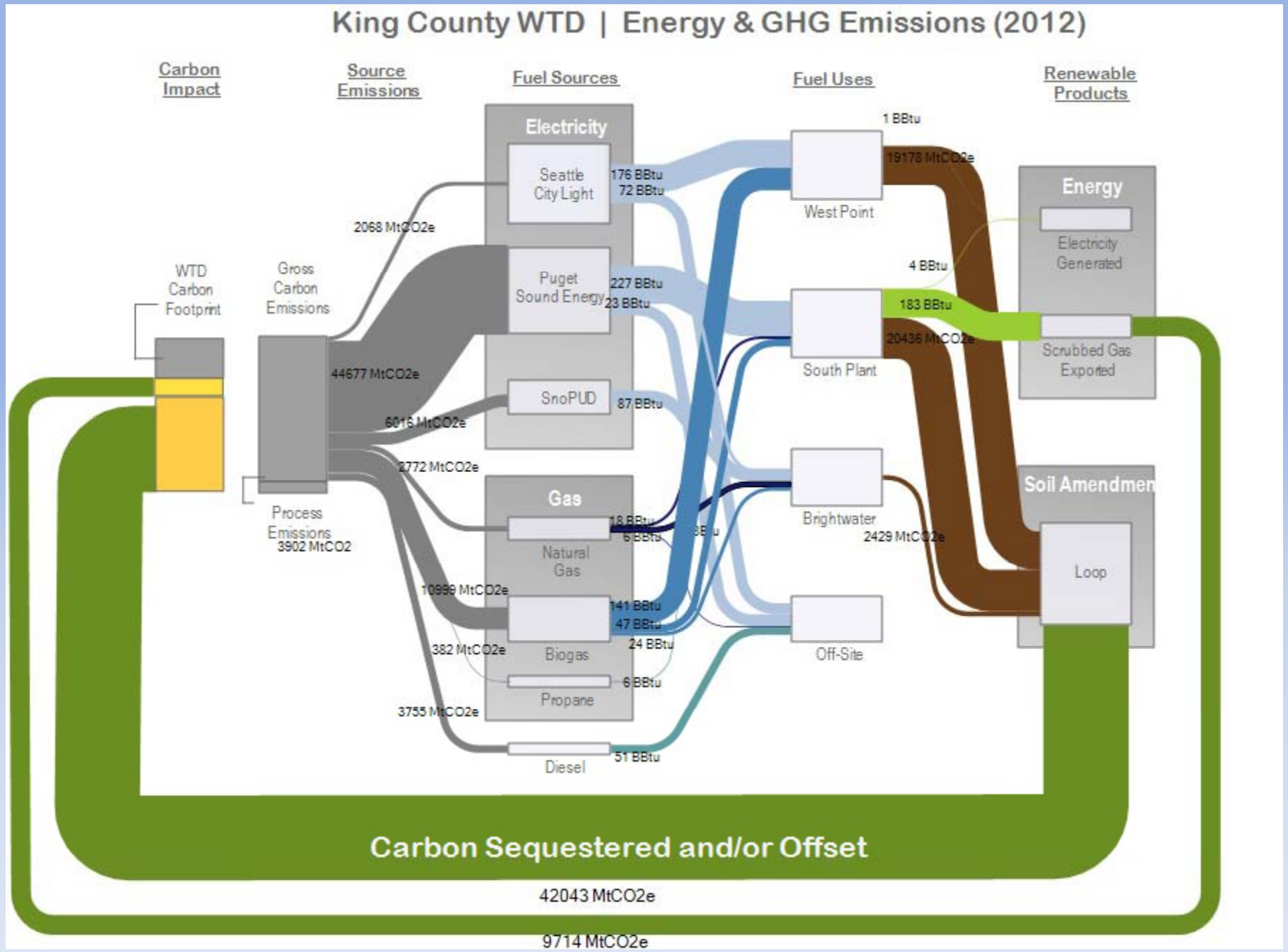


Asset management is essential for sustainability

- understand the **full economic cost** of service.
- understand the long-term capital funding needs (20 to 100 years)
- institute pricing and financing strategies that ensure sustainability
- monitor the condition and performance of assets.
- Select the assets based on performance, **maintainability, operability**, and the customers **ability to pay.**

Asset Management
Life Cycle Costs




King County WTD | Energy & GHG Emissions (2012)
Carbon Impact
Source Emissions
Fuel Sources
Fuel Uses
Renewable Products
WTD Carbon Footprint
Gross Carbon Emissions
Process Emissions
3902 MtCO2
Electricity
Seattle City Light
Puget Sound Energy
SnoPUD
Gas
Natural Gas
Biogas
Propane
Diesel
2068 MtCO2e
44677 MtCO2e
6016 MtCO2e
2772 MtCO2e
10999 MtCO2e
382 MtCO2e
3755 MtCO2e
176 BBtu
72 BBtu
227 BBtu
23 BBtu
87 BBtu
18 BBtu
6 BBtu
141 BBtu
47 BBtu
24 BBtu
6 BBtu
51 BBtu
West Point
South Plant
Brightwater
Off-Site
1 BBtu
19178 MtCO2e
4 BBtu
183 BBtu
20436 MtCO2e
2429 MtCO2e
Energy
Electricity Generated
Scrubbed Gas Exported
Soil Amendmen
Loop
Carbon Sequestered and/or Offset
42043 MtCO2e
9714 MtCO2e