Resilient Wastewater Solutions: Building for the Future

NOWRA 2021

Onsite Wastewater Mega-Conference

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NOWRA
National Onsite Wastewater Recycling Association

NPCA
Precast ... The Concrete Solution

Disclaimer

Please Note:

The materials being presented represent the speaker's opinions and do not reflect the opinions of NOWRA.

National Precast Concrete Association (NPCA)

- **What:**
  - Not-for-profit trade association dedicated to expanding the use of quality precast concrete products
- **Who:**
  - Producers, Associates, Professional Members, Students
- **How:**
  - Technical services and resources, extensive member and industry education, networking, advocacy

Learning Objectives

- Explain ***what resilience is*** and why resilient construction has become a focal point in wastewater projects.
- Describe ***what factors contribute*** to resilience.
- Describe how resilient decentralized onsite wastewater treatment solutions can ***improve safety, reduce construction time, reduce costs, and extend service life***.


TRIVIA
TIME

Question #1

1. **How many publicly-owned wastewater treatment systems are there in the U.S.?**
   a) 14,000
   b) 15,000
   c) 16,000

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https://infrastructurereportcard.org/wp-content/uploads/2020/12/Wastewater-2021.pdf

Question #2

What percentage of the U.S. population relies on onsite wastewater treatment systems?

a) 11%

b) 21%

c) 31%

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Question #3

Across all sizes of wastewater treatment plants, systems are operating at an average of ____% of their design capacity.

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b) 75%

c) 81%

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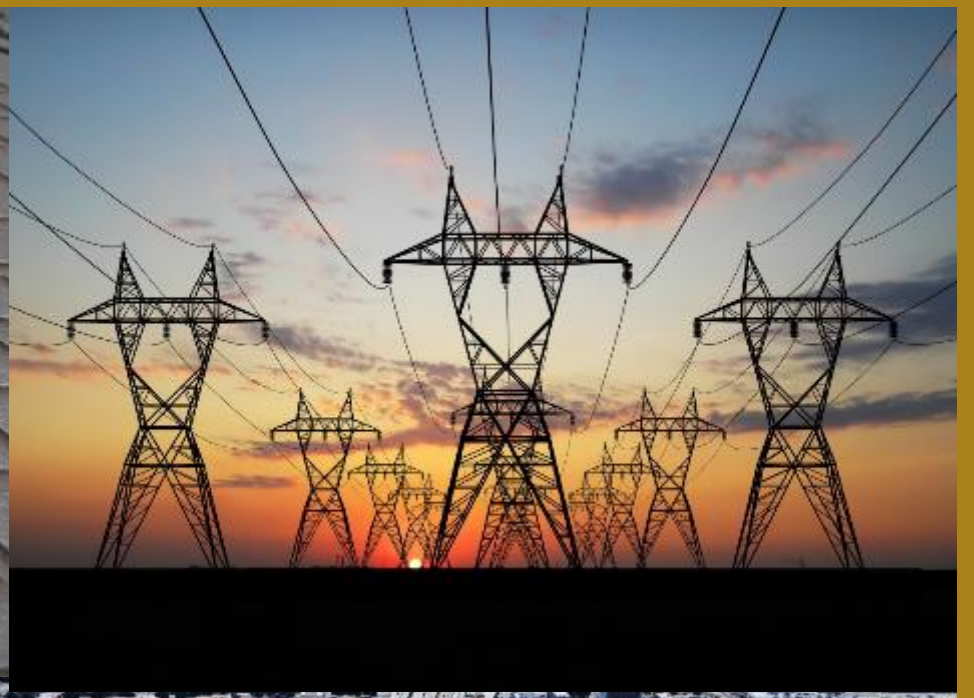
https://infrastructurereportcard.org/cat-item/wastewater/

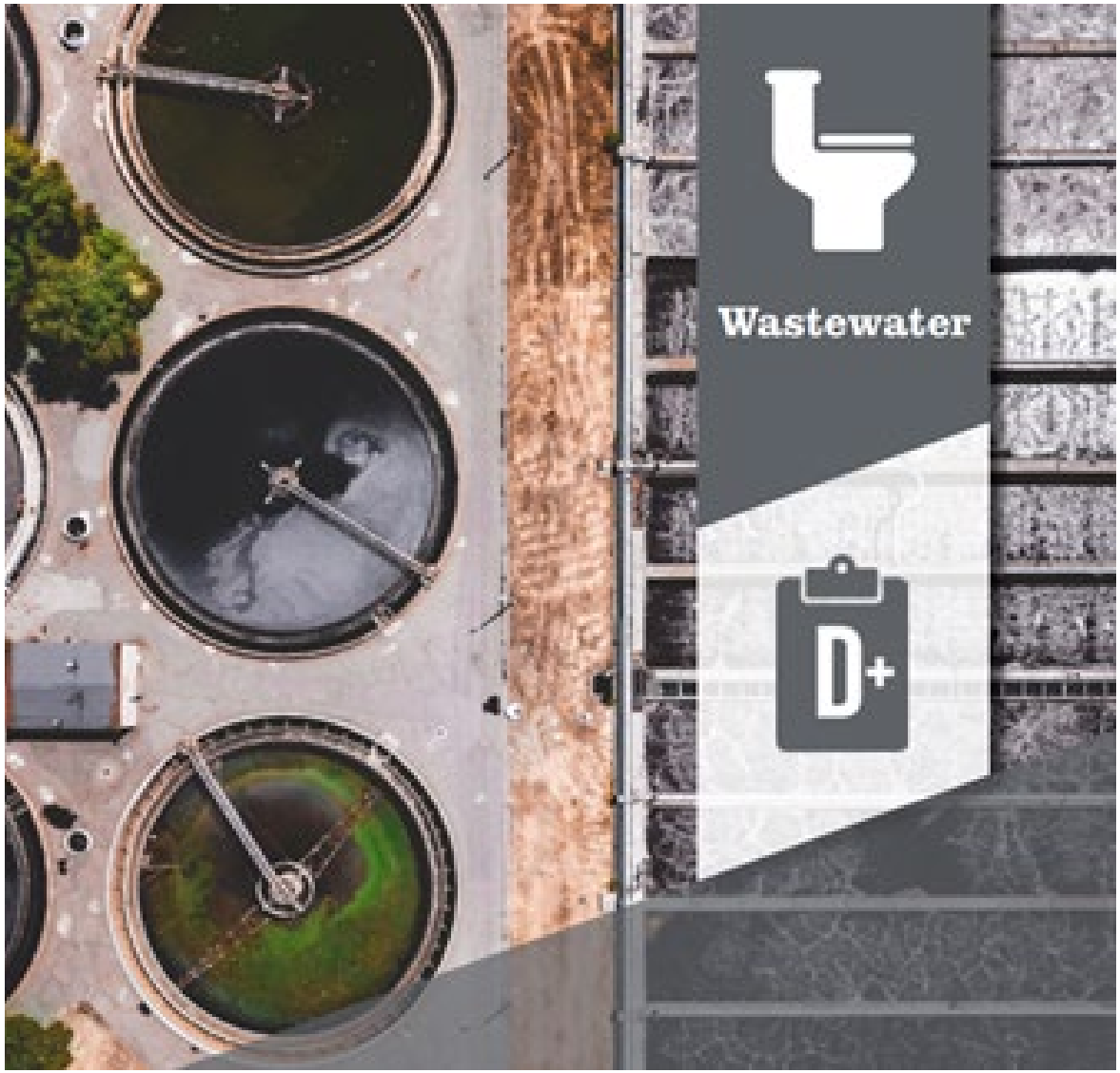

SEWER



ASCE Infrastructure Report Card

https://infrastructurereportcard.org/

ASCE Infrastructure Report Card



What's in the grade?

- ***Capacity*:** Does the infrastructure's capacity meet current and future demands?
- ***Condition*:** What is the infrastructure's existing and near-future physical condition?
- ***Funding*:** What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?
- ***Future Need*:** What is the cost to improve the infrastructure? Will future funding prospects address the need?
- ***Operation and Maintenance*:** What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?
- ***Public Safety*:** To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?
- ***Resilience*:** What is the infrastructure system's capability to prevent or protect against significant multi-hazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?
- ***Innovation*:** What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?

Wastewater Infrastructure By Numbers

- By 2032 it is expected that ***56 million*** more people will attempt to connect to centralized treatment plants – a ***23% increase*** in demand.
- Wastewater infrastructure need exceeds ***$271 billion***.
- Clean Water Act is turning 50 in 2022. ***Why does that matter?***

Resilience

https://commons.wikimedia.org/wiki/File:FEMA_-_17187_-_Photograph_by_John_Fleck_taken_on_10-04-2005_in_Mississippi.jpg

Resilience – What is it?

- **Ability to:**
  - Absorb or avoid damage without suffering complete failure
  - Rebuild or repair faster and for less cost
  - Adapt to changing needs
- **Protection against natural disasters and man-made disasters**
  - Fires, hurricanes, floods, tornadoes, earthquakes, extreme heat, terrorist attacks

Resilience – What is it?

- **Resilience is the capacity to *adapt* to changing conditions and to *maintain or regain* functionality and vitality in the face of stress or disturbance and the capacity to *bounce back* after a disturbance or interruption.**
  - Building durable, so structures withstand these events
  - Building so that when these events do occur, we can bounce back faster, easier, for less cost, and with less disruption

https://www.resilientdesign.org/defining-resilient-design/

What is it?

- **Failure should:**
  - Be predictive
  - Not be catastrophic
  - Not be disproportionate to the cause

Combination of sustainability and durability

How can it be achieved?

- Goal of design, maintenance, and restoration for individual structures, infrastructure systems, and communities
- Begins with comprehensive planning, including stricter codes and standards that produce robust structures and systems with long service lives

https://www.cement.org/cement-concrete/resilient-construction

Why does it matter?

- Infrastructure is ***aging***
- Limited resources to ***rehabilitate*** or ***replace*** current infrastructure, and limited resources to ***build new*** infrastructure to meet changing needs of society
- ***Natural disasters*** are increasing in number and severity

If only…

Why does it matter?

Money

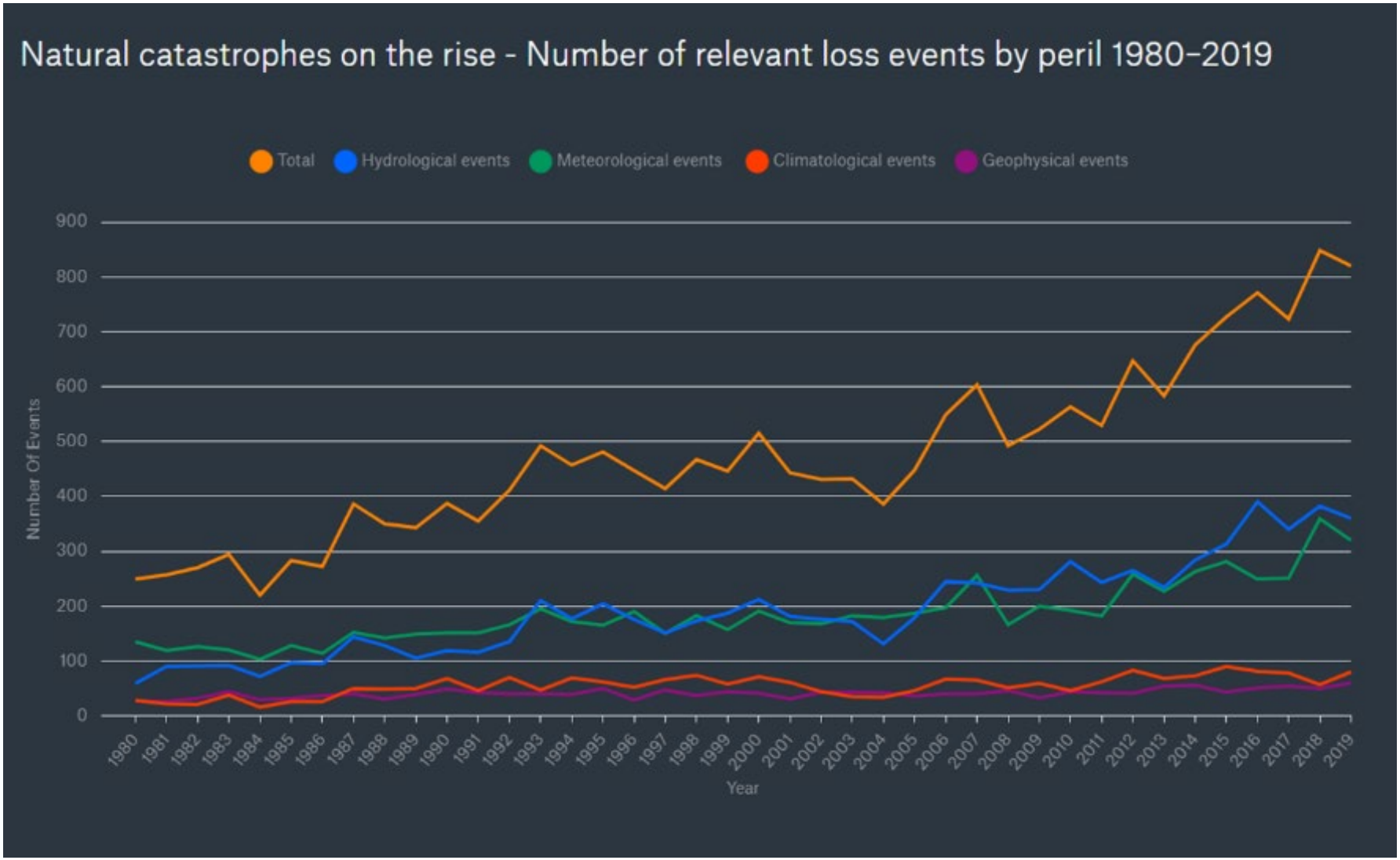
Time

Materials

Manpower

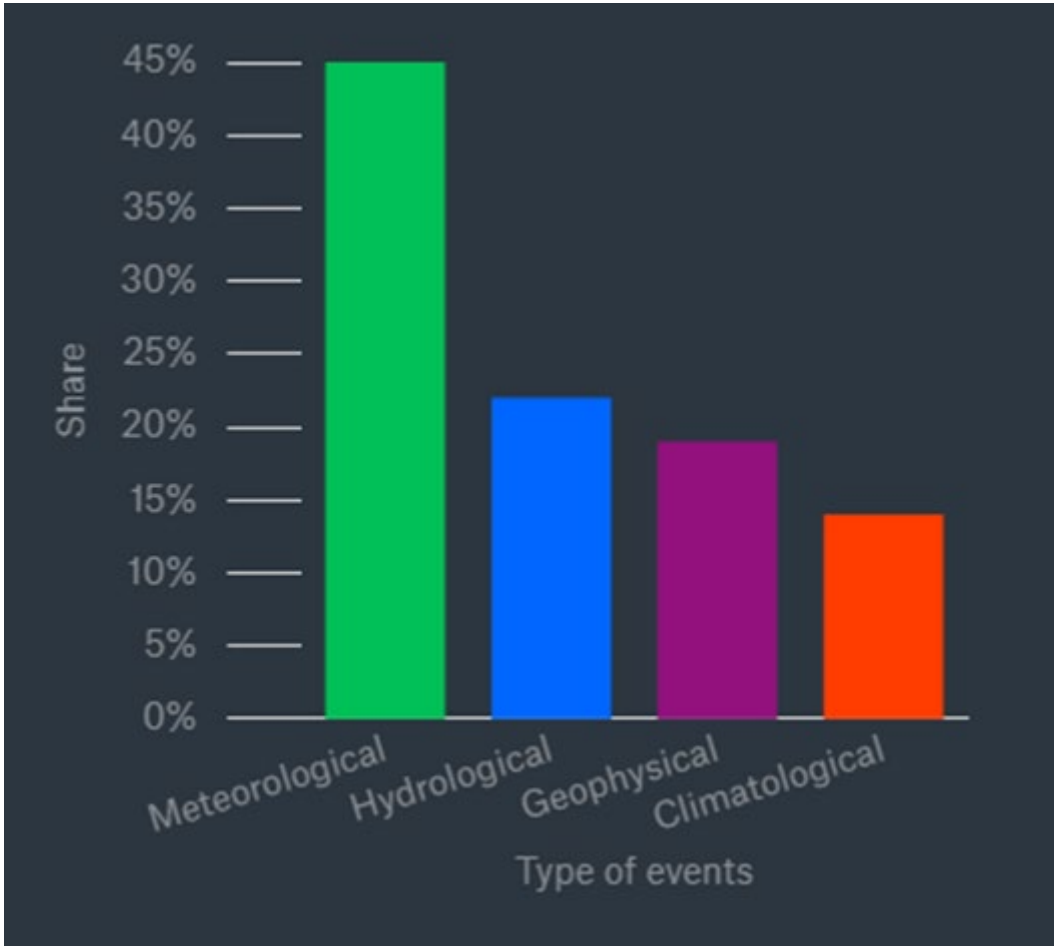
Need to do as much as we can while conserving resources while also making it last for generations to come

Why does it matter?



https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards.html

Breakdown of Natural Disaster Losses Since 1980



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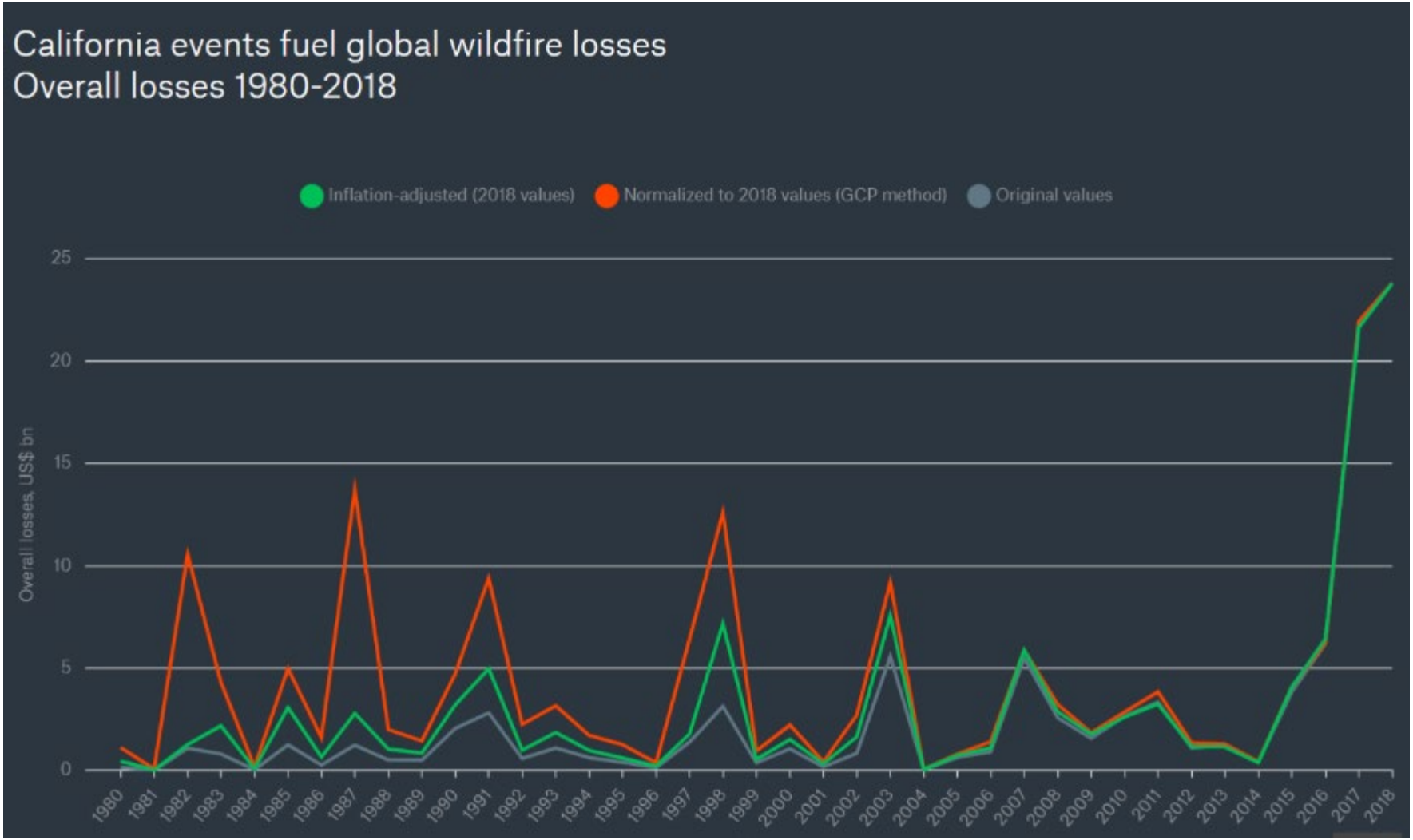
Wildfires

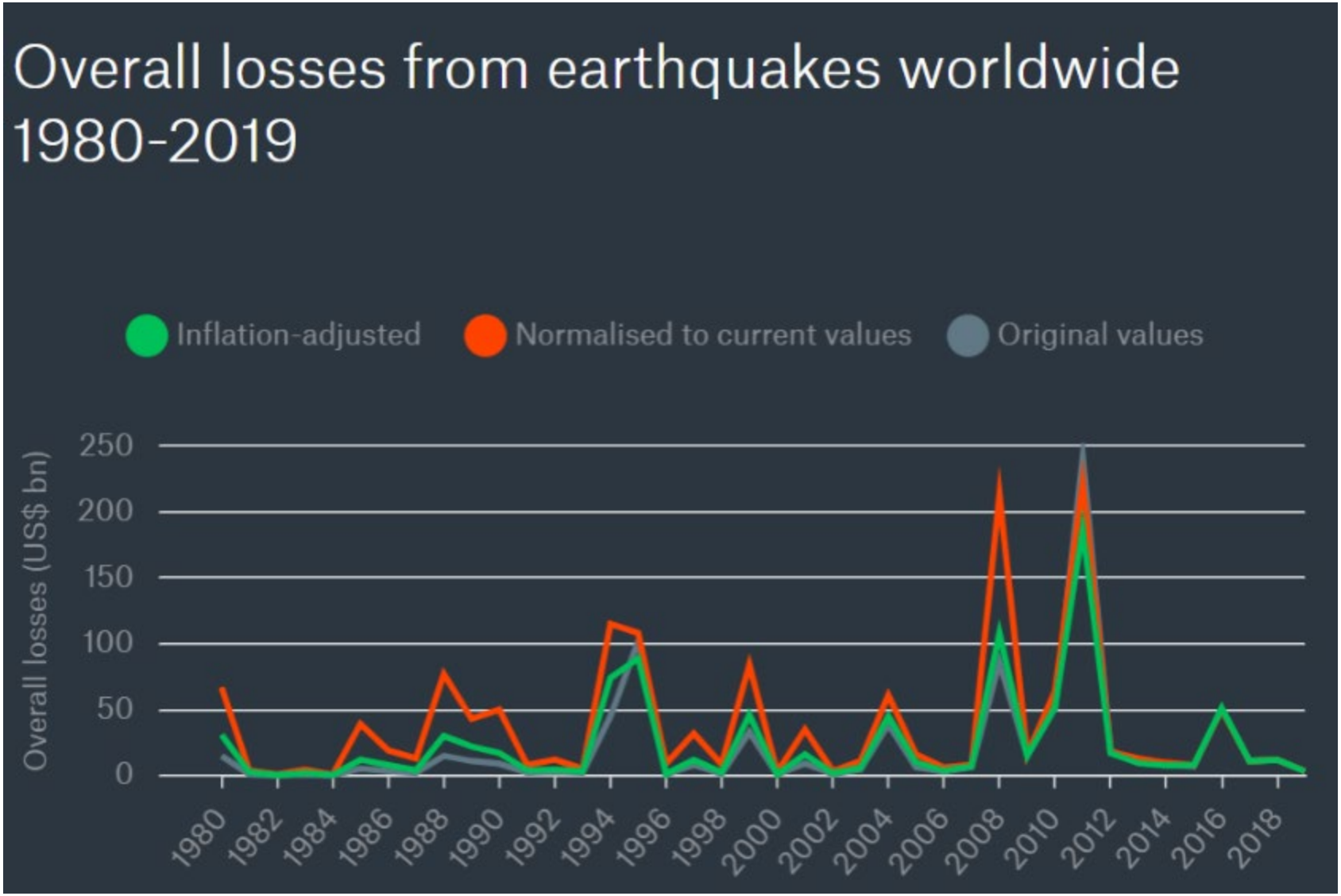
Wildfires



https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards/wildfires-as-the-climate-changes-so-do-the-risks.html

Earthquakes

Earthquakes



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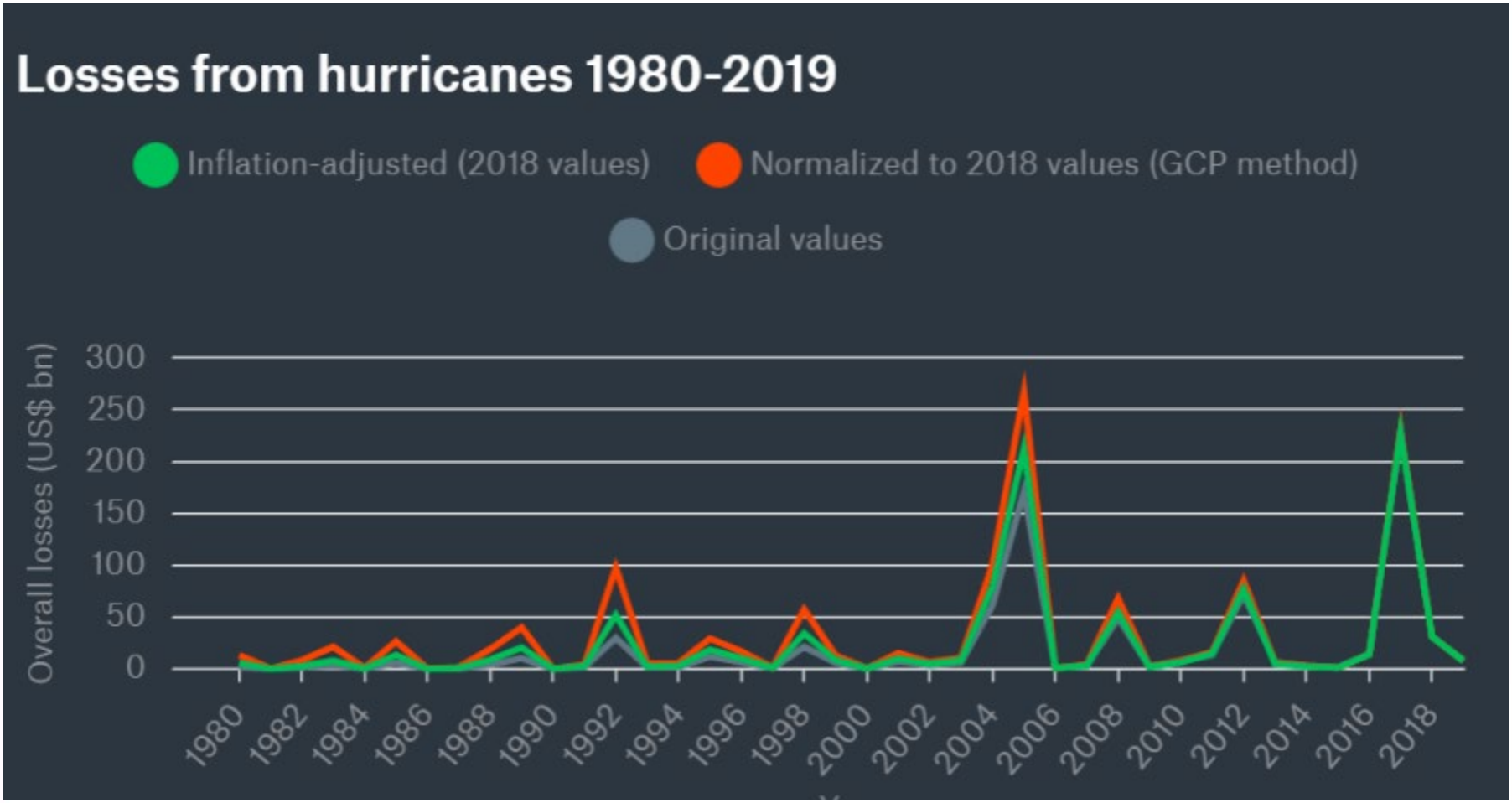
Hurricanes

Hurricanes



https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards/hurricanes-typhoons-cyclones.html

What factors contribute to resilience?

- Material selection
- Design
- Manufacturing
- Installation
- Maintenance

Resilient Design Principles
(from the Resilient Design Institute)

1. Resilience transcends scales.
2. Resilient systems provide for basic human needs.
3. Diverse and redundant systems are inherently more resilient.
4. Simple, passive, and flexible systems are more resilient.
5. Durability strengthens resilience.
6. Locally available, renewable, or reclaimed resources are more resilient.
7. Resilience anticipates interruptions and a dynamic future.
8. Find and promote resilience in nature.
9. Social equity and community contribute to resilience.
10. Resilience is not absolute

https://www.resilientdesign.org/the-resilient-design-principles/

Material Selection

- **Material selection:**
  - Durability
  - Sustainability and environmental impact

Material Selection - Durability

- **Resistance to:**
  - Freeze-thaw cycles
  - Abrasion
  - Chemical attack
  - Thermal fluctuations
  - Impact

Material Selection - Sustainability

- Natural
- Man-made
- Recycled
- Energy-intensity of manufacturing process
- Local availability of materials

Design

- **Design:**
  - Strength
  - Capacity
  - Anti-buoyancy
  - Maintenance
  - Safety
  - Modularity & Ease of Installation
  - Future need
  - Cost
  - Service life

Design - Strength

- **Select design options that will withstand the anticipated loads in service *AND* be prepared for outliers**
  - Depth of bury
  - Soil loads
  - Hydrostatic loads
  - Traffic loads
  - Impact loads

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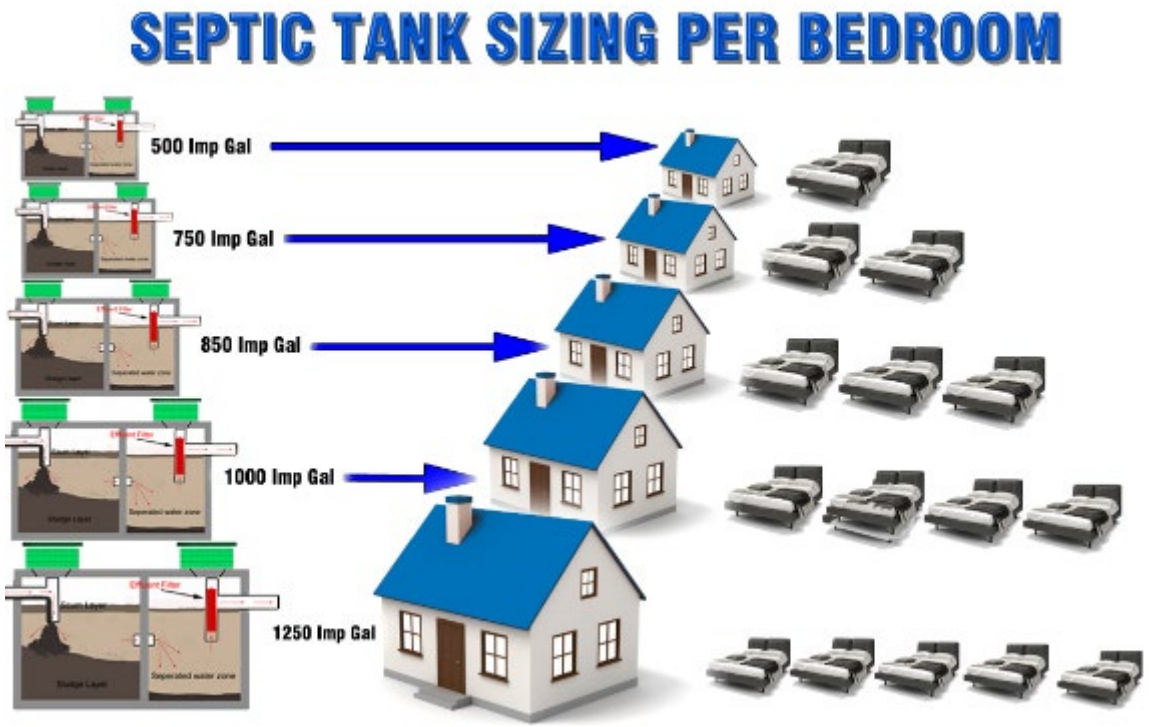
  - Depth of bury
  - Soil loads
  - Hydrostatic loads
  - Traffic loads
  - Impact loads
  - **Prepare for the unexpected**

Design - Capacity

– Abide by sizing regulations
– Select design options that meet current needs and can accommodate future needs/ growth

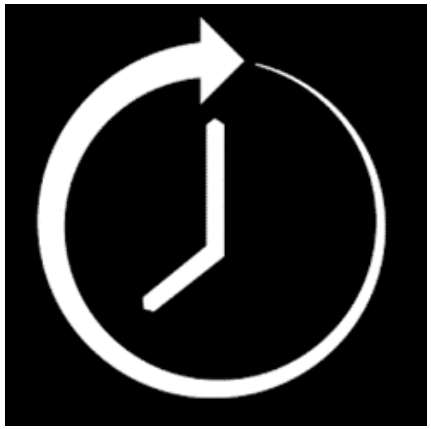


Design - Anti-Buoyancy

- **Select design options that:**
  - Provide fail-safe resistance to buoyant forces
  - Can withstand buoyant forces that would arise in certain “out of the norm” conditions

Design - Maintenance

- **Select design options that:**
  - are low maintenance (strong, durable, resistant to harsh environments, don't need routine work to keep the design operable)
  - have low maintenance costs
  - have a long service life



Design - Safety

- **Select design options that:**
  - Provide a sufficient factor of safety
  - Offer redundant safety features
  - Will withstand extreme or “out of the norm” conditions
  - If they fail, they will fail predictively and give a warning before they do

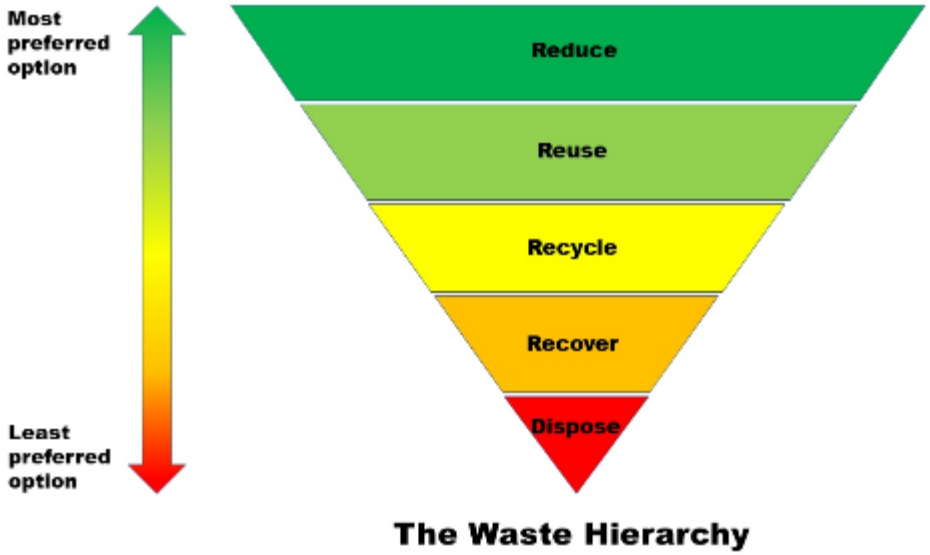
Design – Modularity & Ease of Installation

- **Select design options that:**
  - Can be assembled quickly and easily on-site
  - Are modular
  - Arrive on the jobsite with components already installed

Design - Future Need

- **Select design options that:**
  - Are lean
  - Can accommodate future needs
  - Are adaptable
  - Can be retrofitted

Pinterest



Design - Cost

- Consider not only the up-front cost of the system or solution, but also account for the costs ***"below the water line"***
- Think cradle to grave, not cradle to gate

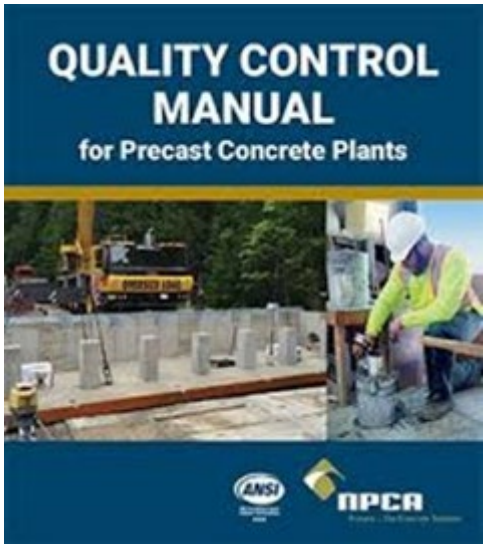
Design - Service Life

- **Select design options that:**
  - Will offer LONG service lives
  - Stand the test of time
  - Will not just serve the immediate need, but will serve the need for the next generation and beyond

Manufacturing

- **Manufacturing:**
  - Production processes
  - Manufacturing duration
  - Quality assurance and quality control
  - Testing

QA	QC
Process-oriented	Product-oriented
Defect prevention	Defect identification
Proactive strategy	Reactive strategy



Installation

- **Installation:**
  - Follow best practices
  - Bedding and foundation
  - Construction time
  - Transport distance
  - Handling and setting
  - Connections
  - Backfill
  - Inspections

Maintenance

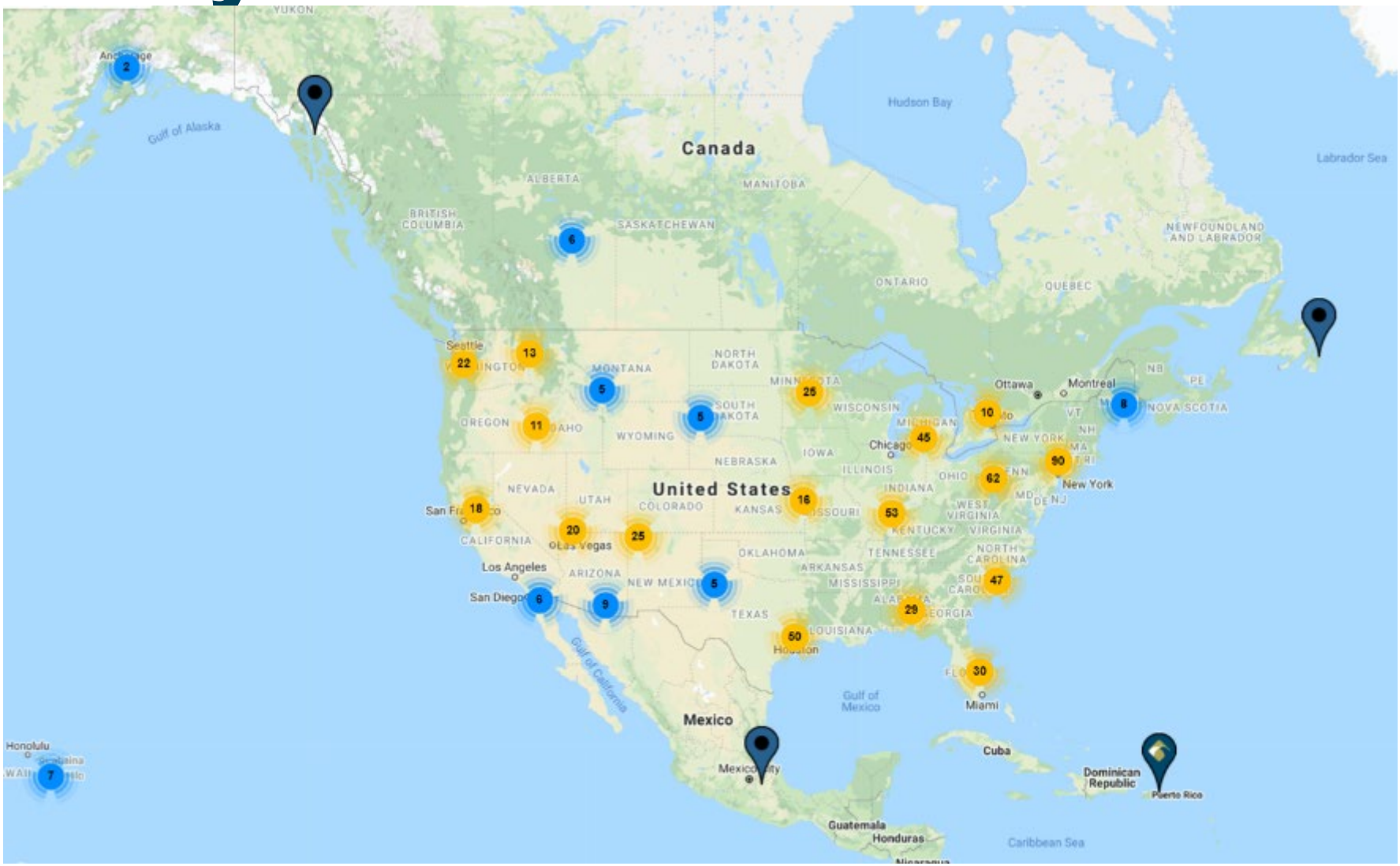
- **Inspections and maintenance:**
  - Routine, scheduled, proactive inspections
  - Timely maintenance with proper repair materials and procedures

Well-informed Stakeholders

NOWRA
National Onsite Wastewater Recycling Association

TEXAS ON-SITE WASTEWATER ASSOCIATION
TOWA
"PROTECTING TEXAS & TEXANS"
Est. 1992

Rely on Your Local Producers!



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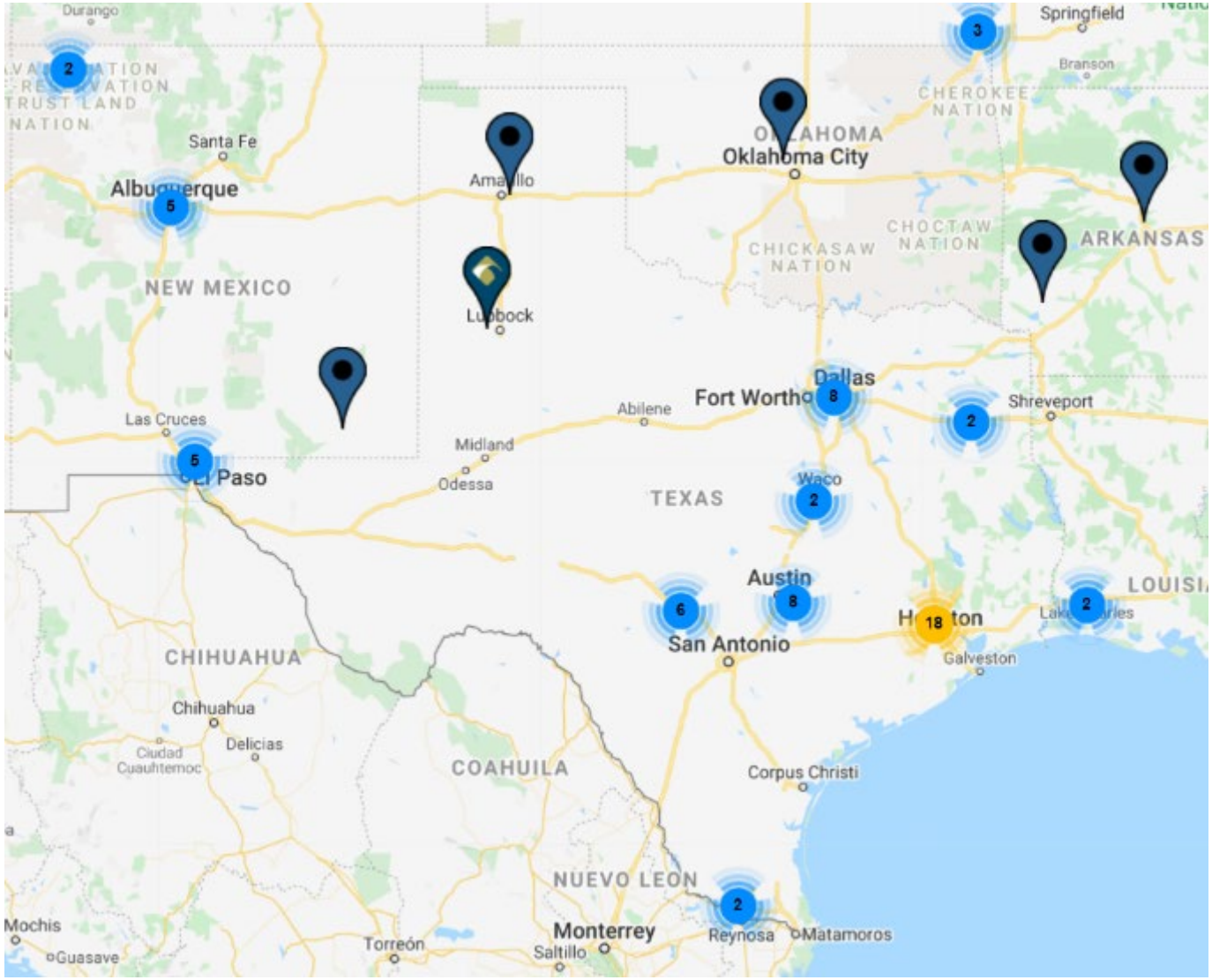

Rely on Your Local Producers!

FIND PRECAST

PRODUCTS & SUPPLIES

- www.precast.org
- www.precast.org/find

Additional Free Resources

- **NPCA website: www.precast.org**
  - NPCA Quality Control Manual
  - Onsite Wastewater Homeowner Manual
  - Onsite Wastewater Best Practices Manual
  - Gravity Grease Interceptor Design Guide
  - Gravity Grease Interceptor Design White Paper
  - Grease Interceptor O&M Manual
  - Buoyancy White Paper
  - Webinars
- **Kayla Hanson, P.E.**
  - (800) 366-7731
  - khanson@precast.org


I WANT YOU
To Lead the Way with
Resilient WW Solutions!

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