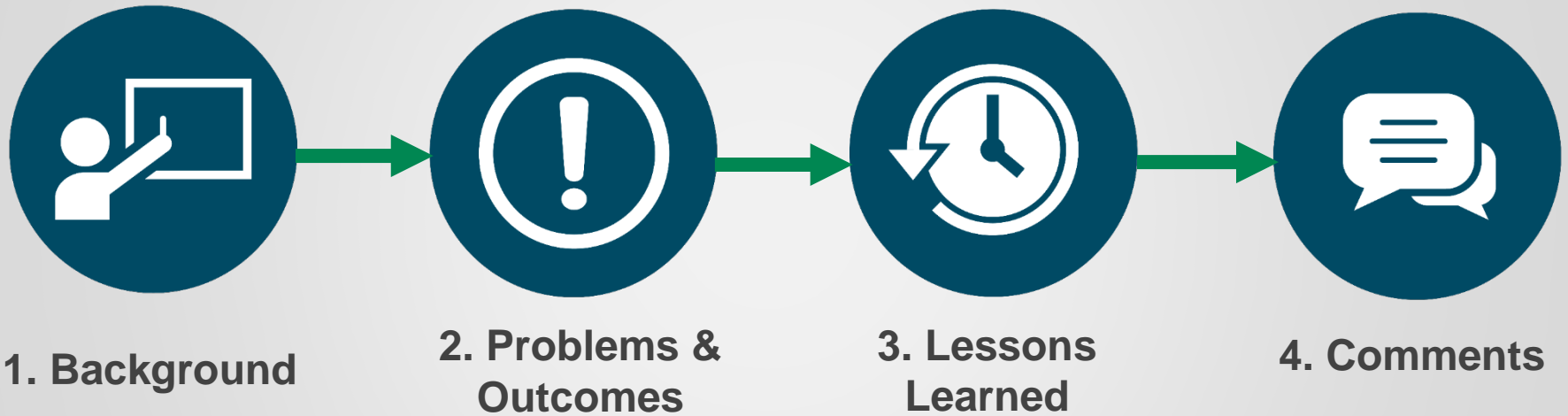


A Case Study

Dan Harpstead
Kleinfelder

Presentation Agenda



Background



GBA member provided:



+



+



Contract #1
Geotechnical
Engineering

Contract #2
Retaining Wall
Design

Contract #3
Construction
Monitoring

Background



About one week after the big-box store opened, a portion of the **Lock + Load™** Retaining Wall fell onto an adjacent homeowner's property.



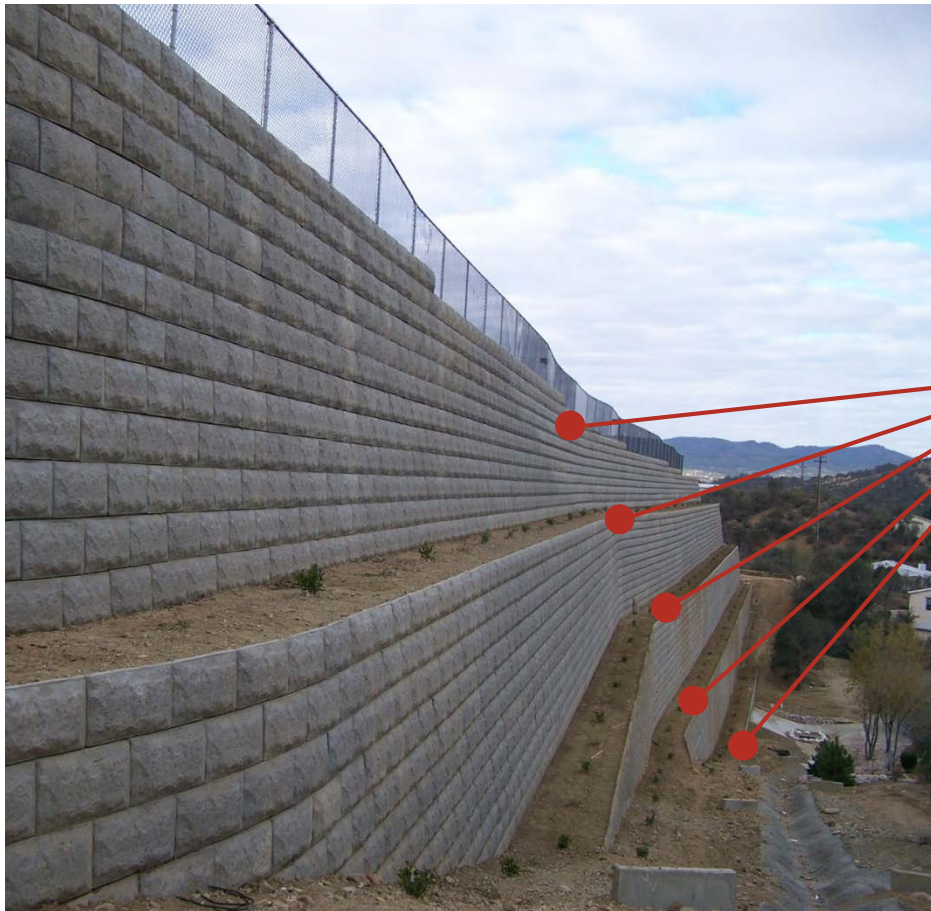
Background



The client selected the
Lock+Load™ Retaining
Wall System



Background



Comprised of
5 Walls

making it one of the
tallest **Lock+Load™**
walls ever built

Background



Background



1



**Next day
response**

2



**Team of experts
assembled**

3



**Contract extension
obtained**

4



**Inclinometers
installed**

5



**Provided 10
repair options**

6

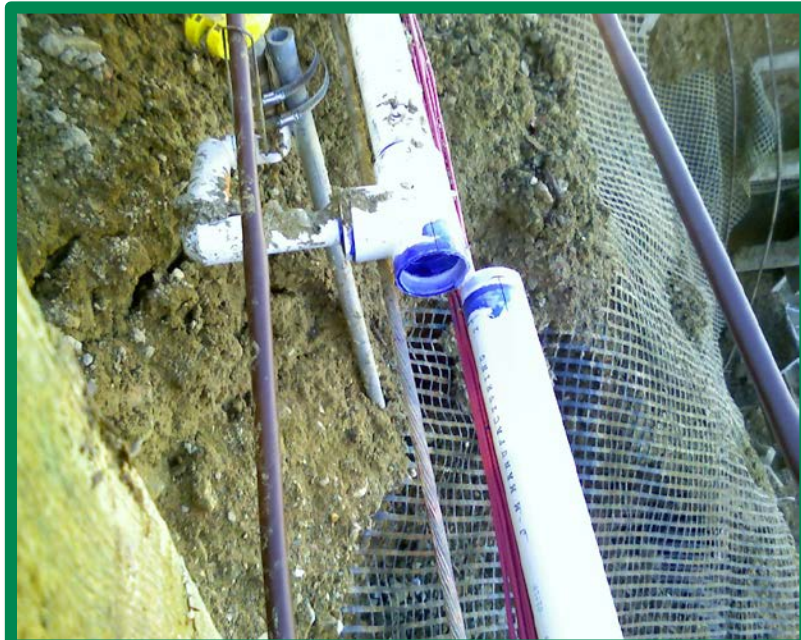


**1 Million in
investigation &
repair fees**

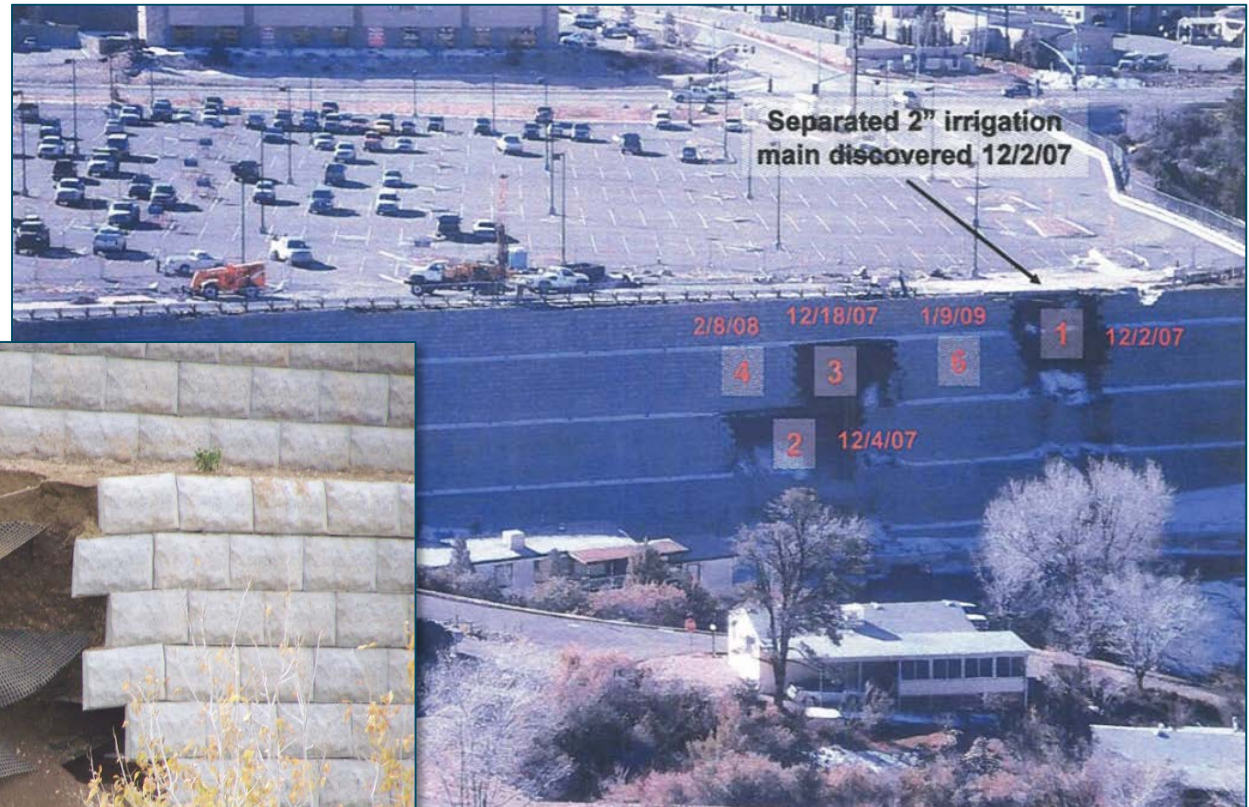
Problems



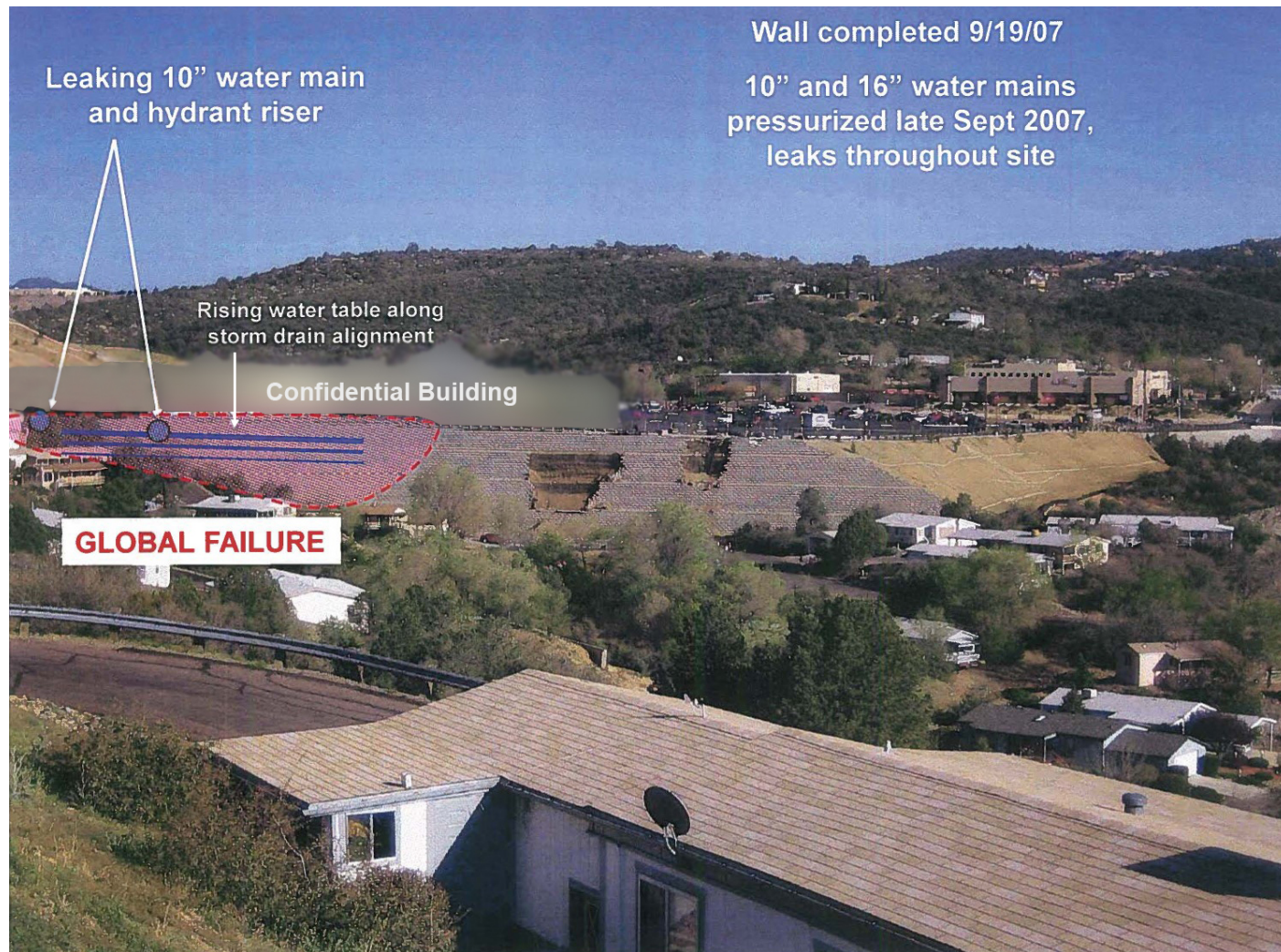
Problems



Problems



Problems



Problems



Problems



GBA Member Problems



PM's 1st time designing retaining wall



Three separate work contracts

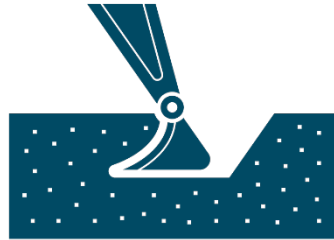


Wall staff engineer was an EIT



Peer reviewer did not really provide a proper review

GBA Member Problems



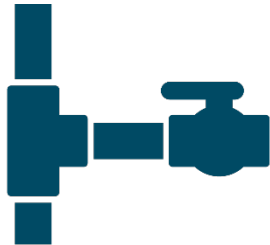
**Client and Contractor
changed to on-site soil**



**Contract extension
provided**



**An incorrect factor
of safety calculation**



**Member firm monitor
water line installation**



**Member firm witness
water line pressure test**

Outcomes



**GBA Member ceased
to provide services to
client**

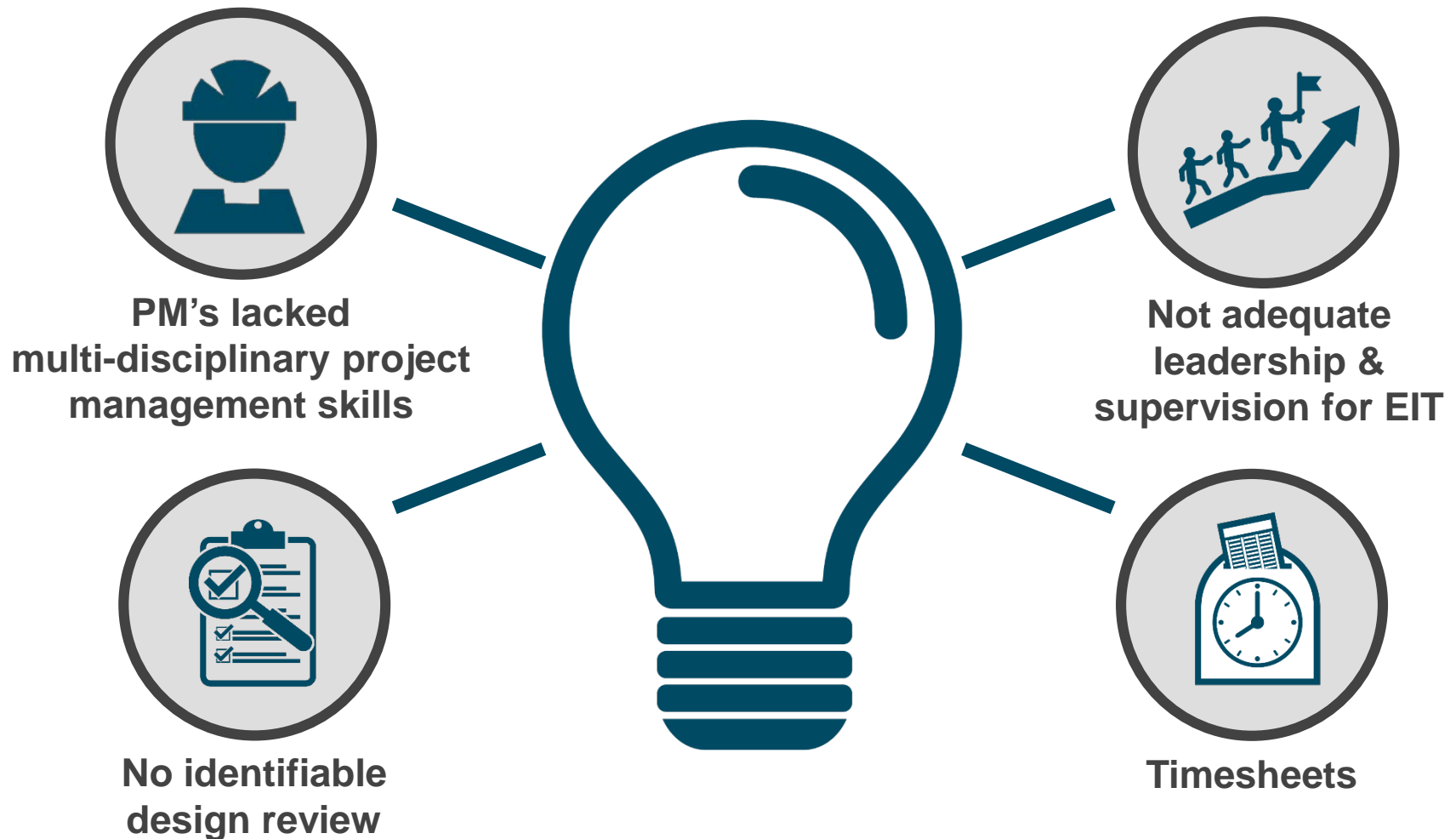


**Member firm was paid
for consulting services
after wall collapse**



**Member firm settled a
multi-million dollar
settlement**

Lessons Learned – Recognize Risk



Lessons Learned – Client Accommodation



Client selected
the wall type



One of the tallest
Lock+Load™
installations ever



Vendor provided
the calculation
software



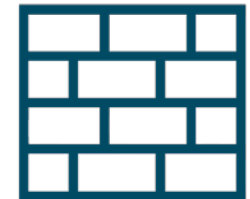
Client changed
material types in
backfill to save money



Fines content
increased
significantly



Geogrid lengths
were changed in
redesign



Overall design
concept did not
change

Lessons Learned – Contracts



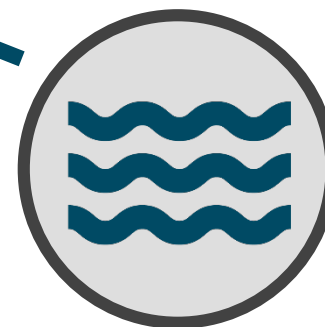
Three contracts, client argued layered Limitations of Liability



No “one project” mentality

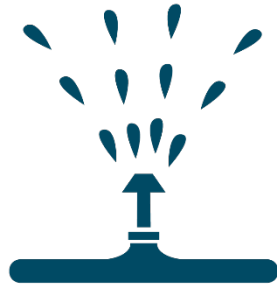


Continuity from design decisions to field work



Construction services lacked understanding of the significance of water impacts on wall design

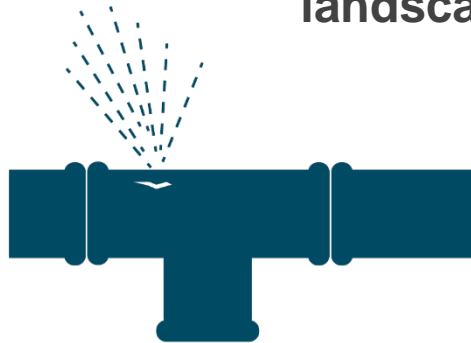
Lessons Learned – Design Vulnerabilities



Irrigation system for
landscaping



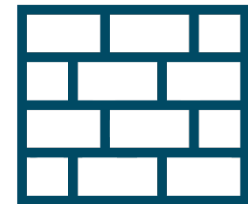
Fire and Potable
water design



Civil Engineer -leaking
stormwater system due
to pipe material selection

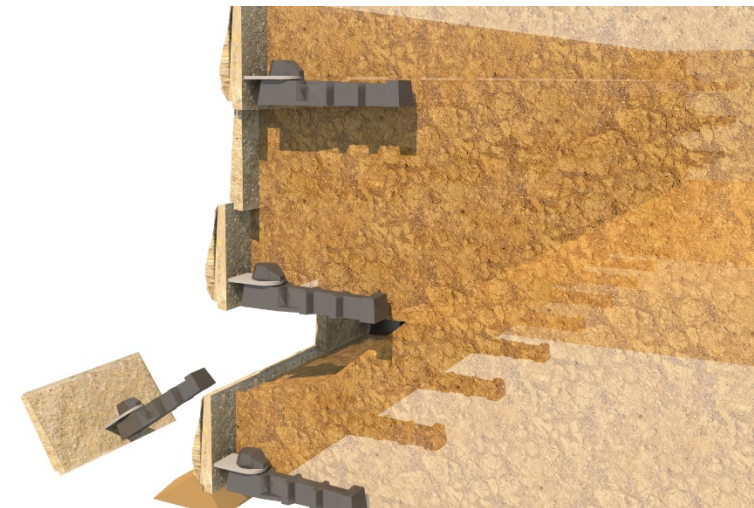
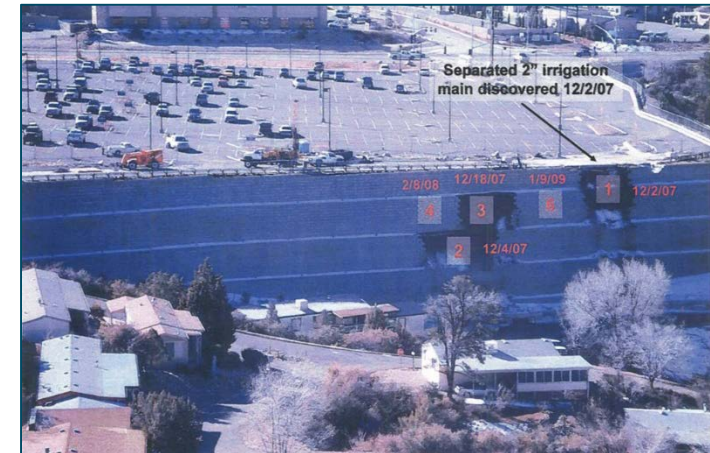
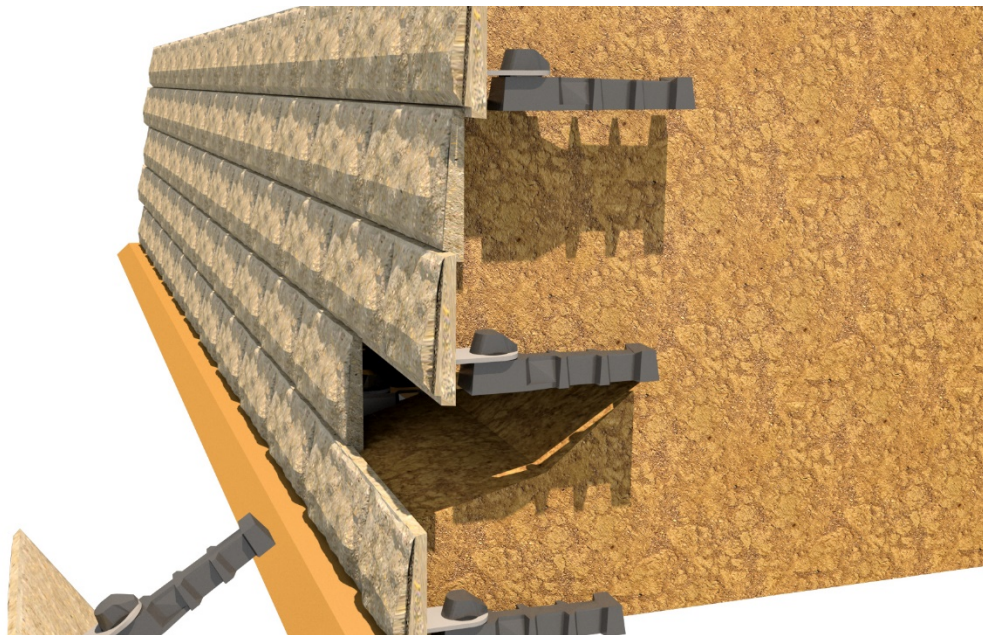


Contractors



Flaw in **Lock+Load™**
design logic

Side Bar - Lock + Load Design Vulnerability





Lessons Learned – Real World



All sites have potential sources of water behind constructed walls



Pipes are not always installed so they will never leak



Landscaping would look good on the open terraces designed into the wall



Everything you say in an email will come back during the discovery phase



Timesheets are part of the discovery process

Comments from GBA Member





Quality

- ✓ Start with selection of technical staffing
- ✓ Stay within the standard of care
- ✓ Take time to question assumptions
- ✓ Conduct the reviews that you say you do
- ✓ Consider the big picture
- ✓ Investigate the products you use – there was documentation of a previous significant **Lock+Load™** wall failure in the literature
- ✓ Design coordination with other consultants is part of the project and you need to budget for it



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