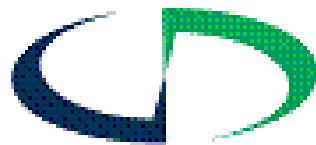


Wetland and Stream Restoration Techniques Following Emergency Response Actions to the Line 6B Oil Leak in Marshall, Michigan



- Ecological Consulting • Native Plant Nursery •
- Restoration Services • Cultural Resource Management •



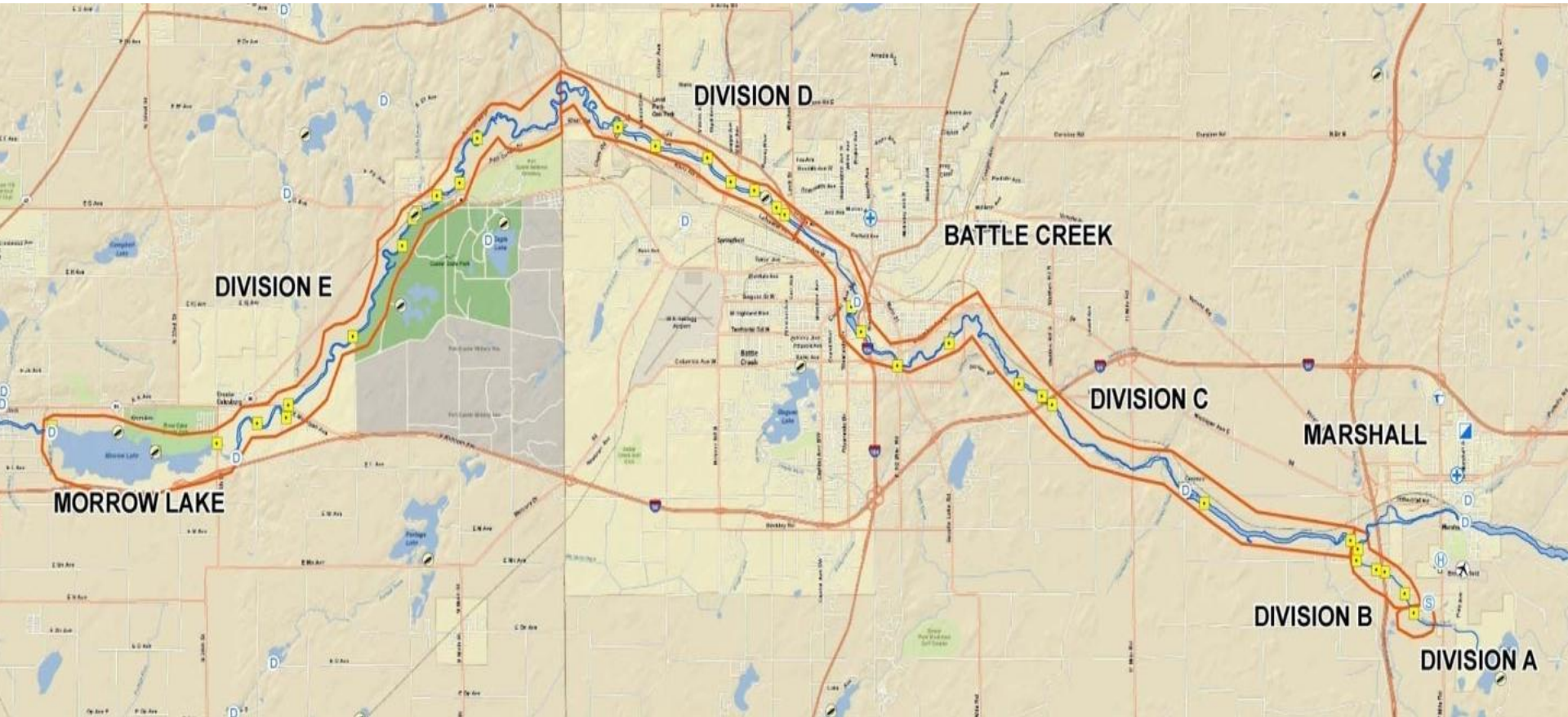
Cardno
JFNew

Background

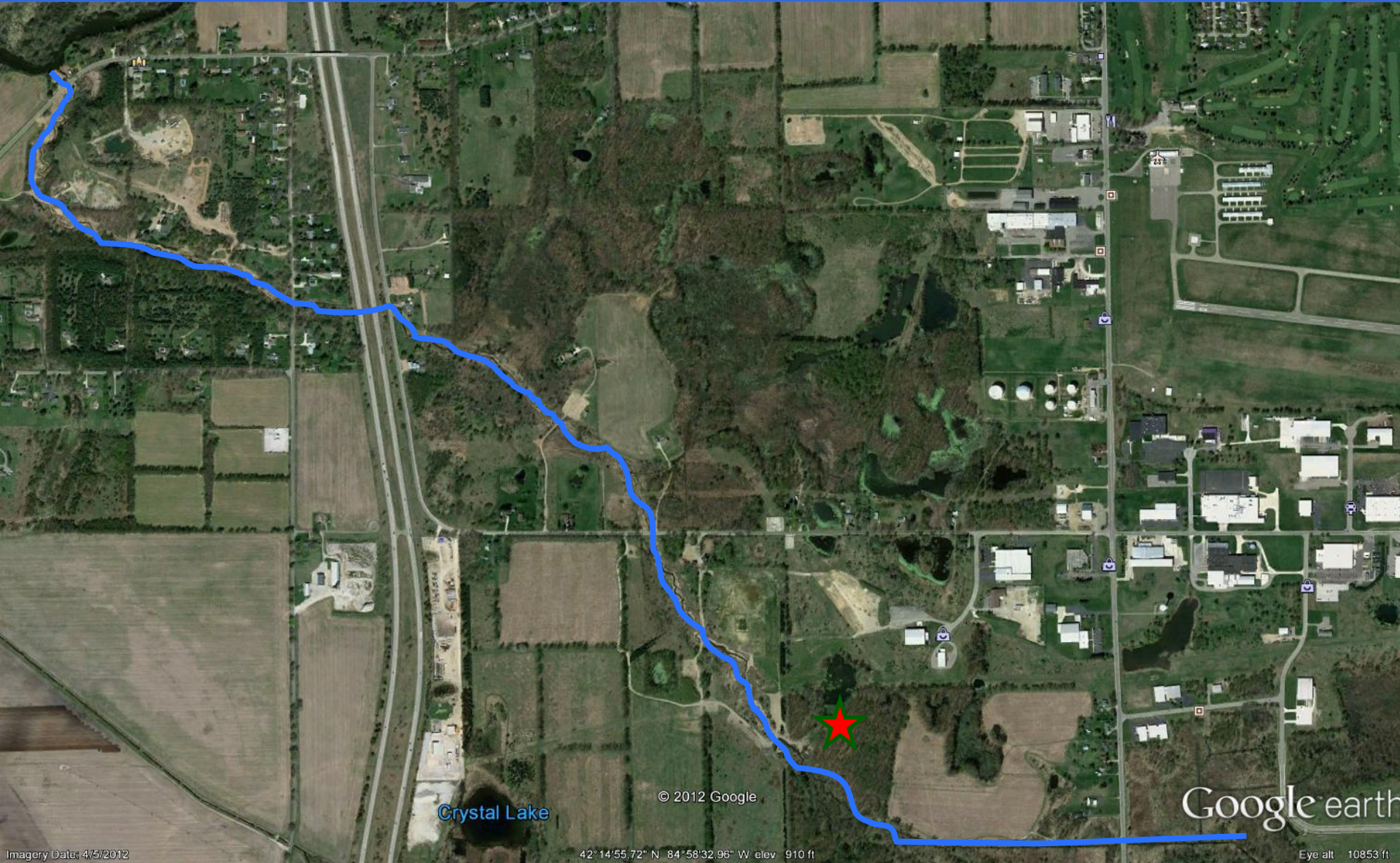
- Failure of approximately 5 feet of 30" steel pipe
- On July 26th Enbridge's Line 6B released approximately 843,000 gallons of Canadian crude oil; approximately 337,000 gallons reached Talmadge Creek and the Kalamazoo River
- Both watercourses were at flood stage at the time of the incident, pushing oil into the contiguous floodplains and wetlands



Incident/Project Area



Talmadge Creek



Crystal Lake

© 2012 Google

Google earth

Timeline



★ AUGUST 2010

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	★ 24	★ 25	26	27	28
29	30	31				

JFNew Contacted

JFNew Site Visit

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★ Line 6B release: July 26

SEPTEMBER 2010

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1	2	3	4
5	6	★ 7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	★ 27	28	29	30		

September Holidays
Labor Day - 6
First Day of Autumn - 22

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Begin restoration

Target restoration date (EPA order)

End of July 2010



September 2010



September 2010



September 2010



October 2010



Design Concepts

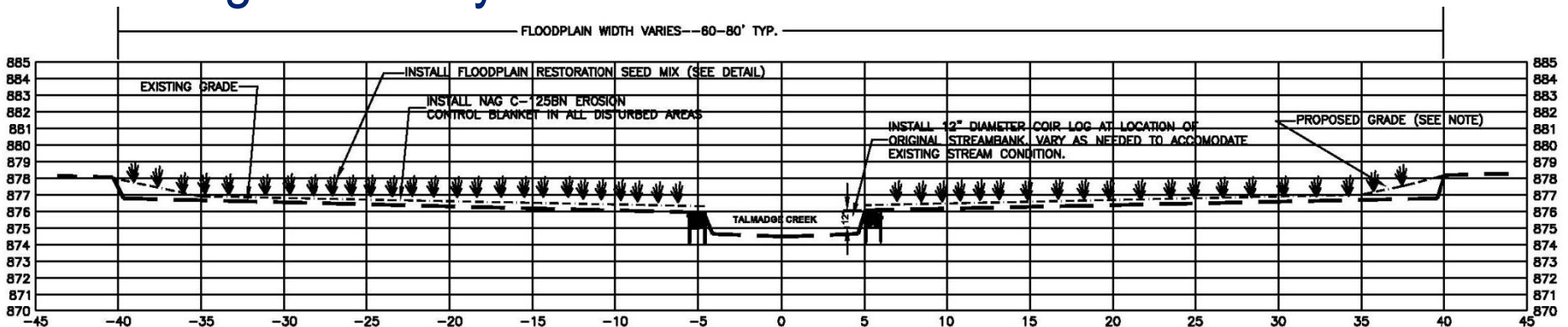
- Created representative cross sections
- Calculated shear stresses throughout stream (0.7-1.5 lbs/sf) at flood stage
- Assess and match soils
- Assess plant communities and create appropriate native seed mixes
- Considered market availability of materials, construction sequencing, and ability to rapidly install



Design Concept



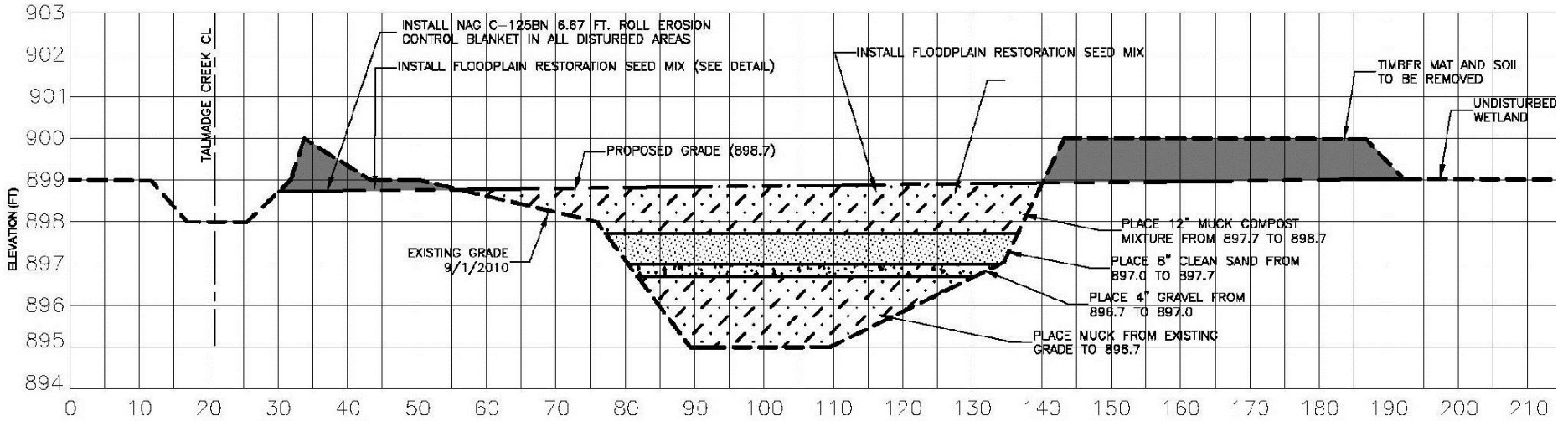
- Coir logs
- Backfill
- Seed
- NAG C-125BN
- Have surveyors stake pre-remediation bankfull mark based on original survey



TYPICAL PROPOSED CROSS SECTION—SECTION A5/A6 RESTORATION

Design Concept – Soils

B



Controlling Flow/Sediment Transport



Creek Flume
("creek in a bag")



Inverted weir

Implementation



Implementation



Implementation



Implementation



Implementation



Talmadge Creek



Implementation



Talmadge Creek



Implementation



Post-restoration



Post-restoration



Post-restoration





Post-restoration

Summer 2011

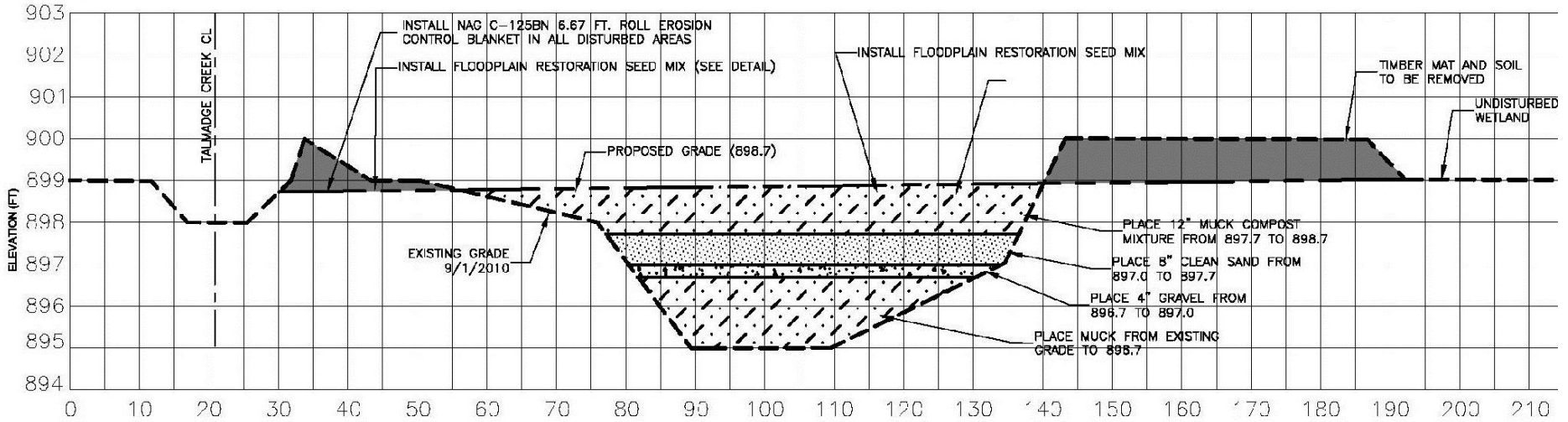


Fall 2010



Design Concept – Soils

B



Post-restoration (Open areas)



Aug 2010



Post-restoration (Open areas)

Nov 2010



Post-restoration (Open areas)

July 2011



Post-restoration (Open areas)



Aug 2010



Post-restoration (Open areas)

Nov 2010



Post-restoration (Open areas)



July 2011



Groundwater



**Indirectly – subsurface
discharging into creek**

**Directly discharging
into creek**



Unique Techniques



- Required to address unique situations

Heavy
groundwater
flows

Unconsolidated
soils



Rock Chutes



Early Spring 2011



Fall 2010

Rock Chutes



July 2011



Nov. 2010



Vegetative Mats



Proposed 2012
(if necessary)



Rock Ramps

- Creates riffles
- Increases habitat diversity
- Enables deposition on upstream ends of culverts



Wildlife Habitat Structures



Fall 2010

Fall 2010



Wildlife Habitat Structures



July 2011

Nov. 2010





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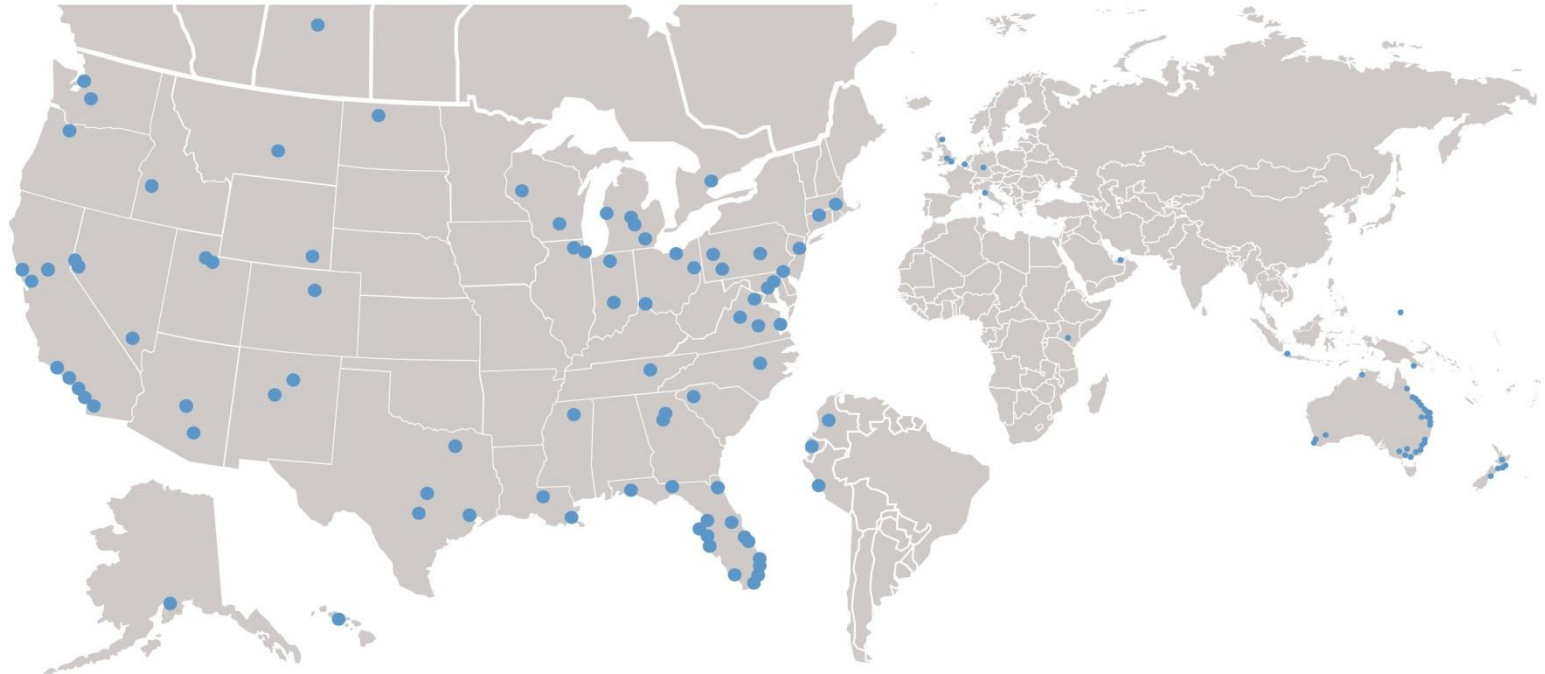


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No. of Staff

