Identification

Sewer Exfiltration to Storm Drain Systems

SCAP
SOUTHERN CALIFORNIA ALLIANCE OF PUBLICLY OWNED TREATMENT WORKS

REUSE
WASTE
TREATMENT
BRINGING WATER FULL CIRCLE

DUDEK

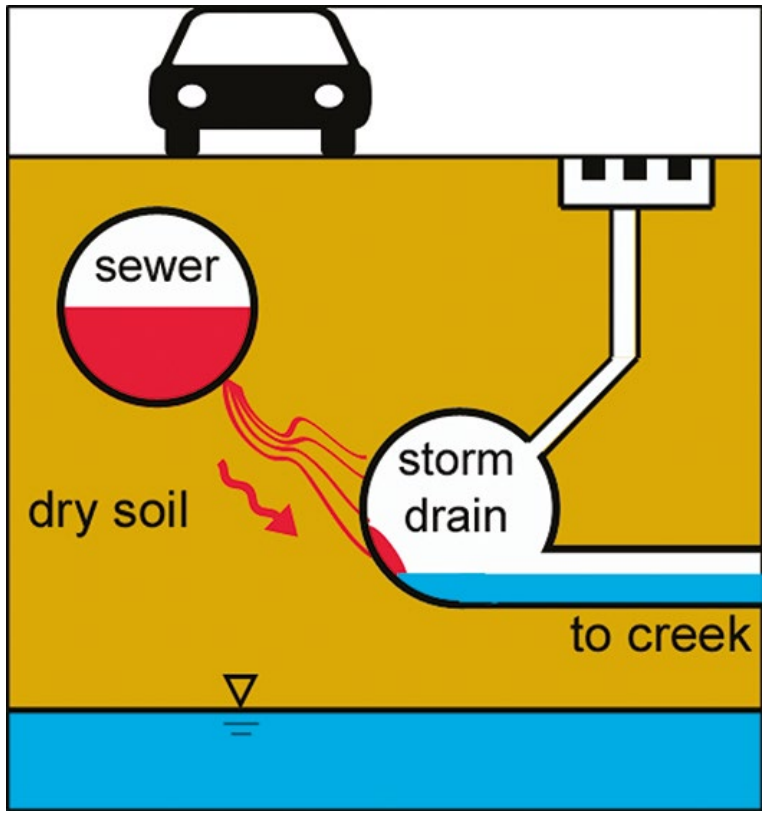
October 1, 2018

Outline

- Exfiltration Evaluation
- Regulatory Framework Connections
- Next Steps

Sewer/MS4 Exfiltration/Infiltration

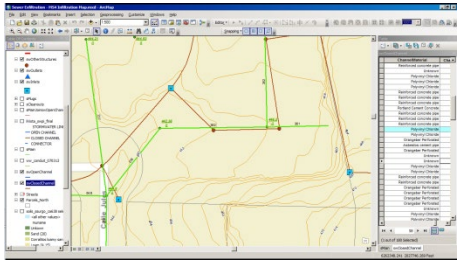
- **Identify- Potential areas:**
  - Underground
  - Numerous variables
  - Extensive geographic area
- **Quantify- Estimate:**
  - Flows
  - Transfer through soil/media
  - Pipe defect(s)
  - Soil microbial action?
- **Synthesize**
  - RWQCB requirements
  - Operations



(Sercu et al. 2011, ES&T)

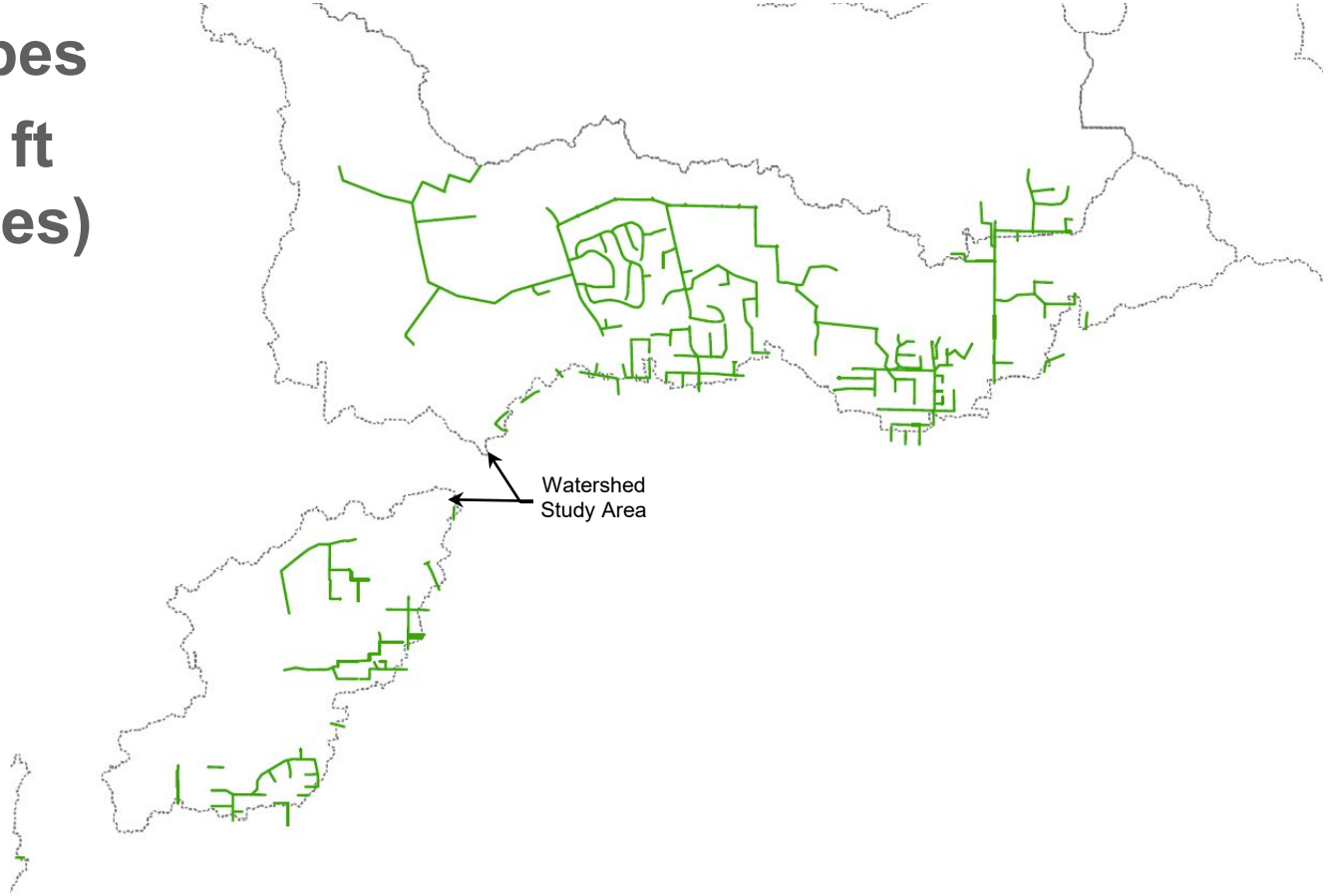
Phased Pilot Approach

- **Phase I – "Desktop" Study**
  - GIS data
  - Record drawings
  - CCTV)
- **Phase II – Field Investigation (CCTV Storm Drains)**
- **Phase III – Field Testing (dye, soil, sampling)**
- **Phase IV – Pipe Rehab**



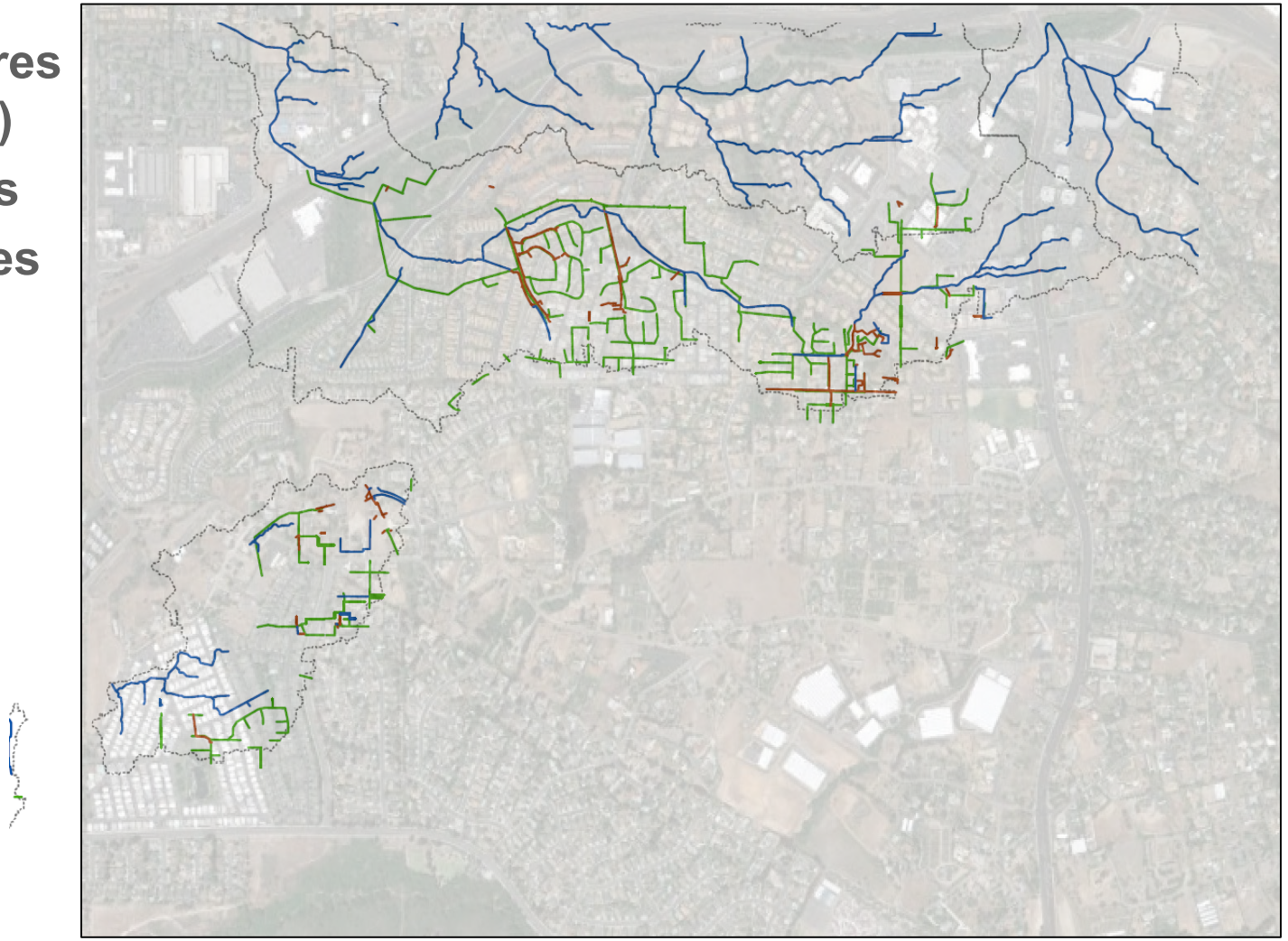
Sewer Collection System

- 507 pipes
- 93,000 ft (18 miles)

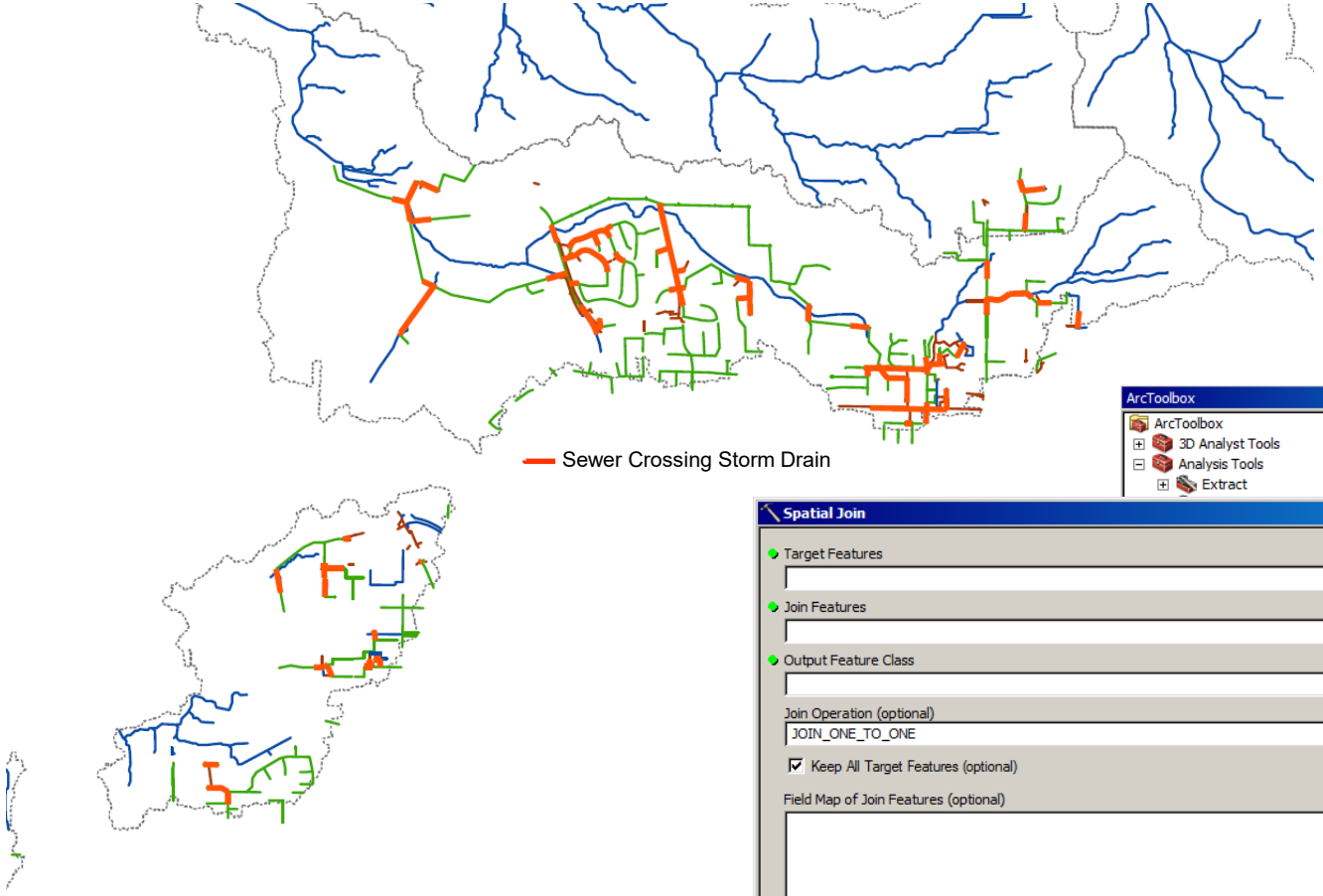


Sewer and Storm Drain System

- 3,200 acres (5 sq.mi)
- Channels
- MS4 pipes



Sewer/Storm Drain Crossings



Desktop Investigation

- Contributing Factors
  - Pipe Crossings
  - Vertical Separation
  - Sewer Pipe Condition
  - Storm Drain Mat'l/Size
  - Soil Type

Scoring Matrix

- 5 Categories, 12 sub categories
  - Spatial relationship (horizontal/vert distance)
  - Sewer pipe flow
  - Sewer pipe material and age
  - Sewer condition scores (CCTV)
  - Soil type
  - Storm drain pipe material and age
  - Groundwater level
- Weighted scoring

	Storm Drain Pipe Priority Rating					
Value	SD size	Mat'l	Age	**Average**	**Weight**	**Score**
1	<12"	HDPE	< 15 yrs			
2	15" to 24"	PVC, RCP, etc	15 to 40 yrs			
3	30" to 48"	CMP	> 40 yrs			
4	54" to 96"	Perf, Natr'l				
5	> 96"					
Score	**2**	**5**	**2**	**3.0**	**1.0**	**3.0**
	Soil Priority Rating					
Value	Soil Permeability (in/hr)			**Average**	**Weight**	**Score**
1	<.63					
2	.63 to 2					
3	2 to 6.3					
4	6.3 to 20					
5	> 20					
Score	**1**			**1.0**	**2.0**	**2.0**
Total						**19.0**

Priority Ratings

- **Scoring matrix-based**
  - **19** of 507 (4%) sewer pipes **above storm drain**
  - **12** of 19 (2%) also **cross storm drain**
  - **6** of 12 (1%) also have **defect**
  - **2** of 6 (0.3%) also in **sandy soil** → **highest rating**
- **Unaccounted variables/factors**

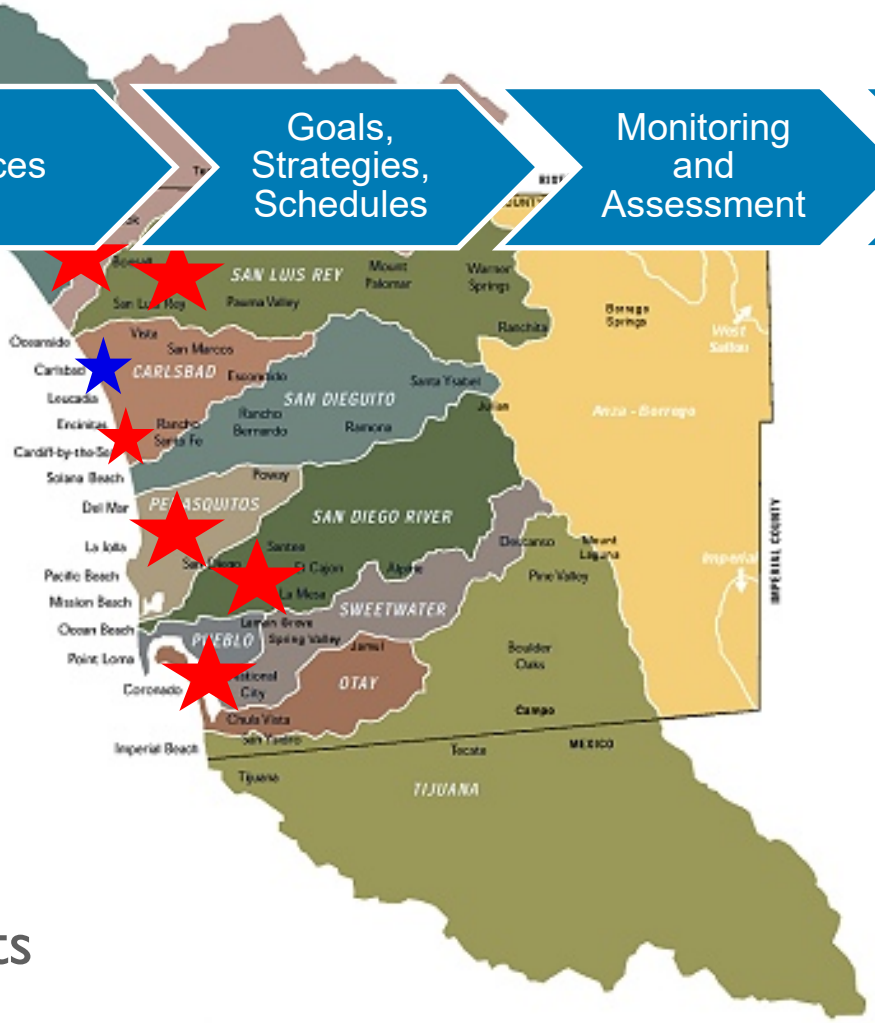
Site ID	Spatial Relationship				Ground Water					Sewer Pipe Priority Rating					Storm Drain Pipe Priority Rating					Soil Priority Rating			FINAL	Rank
	Vert. Dist.	Horz. Dist	Avg	Total	In Valley?	Swr Depth	Vert. Dist.	Avg	Total	Flow Depth	Defect	EMA	Avg	Total	SD Mat'l	Size	Age	Avg	Total	Perm. (in/hr)	Avg	Total	SCORE	
116	5	1	3.0	**9.0**	3	3	5	3.7	**3.7**	1	0	0	0.3	**1.7**	2	3	2	2.3	**2.3**	3	3.0	**6.0**	22.7	8
176	5	3	4.0	**12.0**	3	2	5	3.3	**3.3**	2	2	0	1.3	**6.7**	2	5	2	3.0	**3.0**	1	1.0	**2.0**	27.0	3
223	5	3	4.0	**12.0**	3	1	5	3.0	**3.0**	1	0	0	0.3	**1.7**	2	5	2	3.0	**3.0**	1	1.0	**2.0**	21.7	10
225	5	2	3.5	**10.5**	3	2	5	3.3	**3.3**	2	0	0	0.7	**3.3**	2	5	2	3.0	**3.0**	1	1.0	**2.0**	22.2	9
257	4	3	3.5	**10.5**	3	1	5	3.0	**3.0**	1	2	0	1.0	**5.0**	3	3	2	2.7	**2.7**	1	1.0	**2.0**	23.2	7
277	5	3	4.0	**12.0**	3	1	5	3.0	**3.0**	1	2	0	1.0	**5.0**	2	3	2	2.3	**2.3**	1	1.0	**2.0**	24.3	5
302	5	3	4.0	**12.0**	1	1	5	2.3	**2.3**	0	3	0	1.0	**5.0**	2	2	2	2.0	**2.0**	1	1.0	**2.0**	23.3	6
333	5	3	4.0	**12.0**	3	2	5	3.3	**3.3**	2	4	0	2.0	**10.0**	3	4	3	3.3	**3.3**	3	3.0	**6.0**	34.7	1
368	5	1	3.0	**9.0**	3	2	5	3.3	**3.3**	1	4	0	1.7	**8.3**	4	1	3	2.7	**2.7**	1	1.0	**2.0**	25.3	4
590	4	3	3.5	**10.5**	1	1	5	2.3	**2.3**	1	3	1	1.7	**8.3**	3	2	2	2.3	**2.3**	3	3.0	**6.0**	29.5	2

Outline

- Exfiltration Evaluation- Case Studies
- **Regulatory Framework Connections**
- Next Steps

Watershed-based Planning

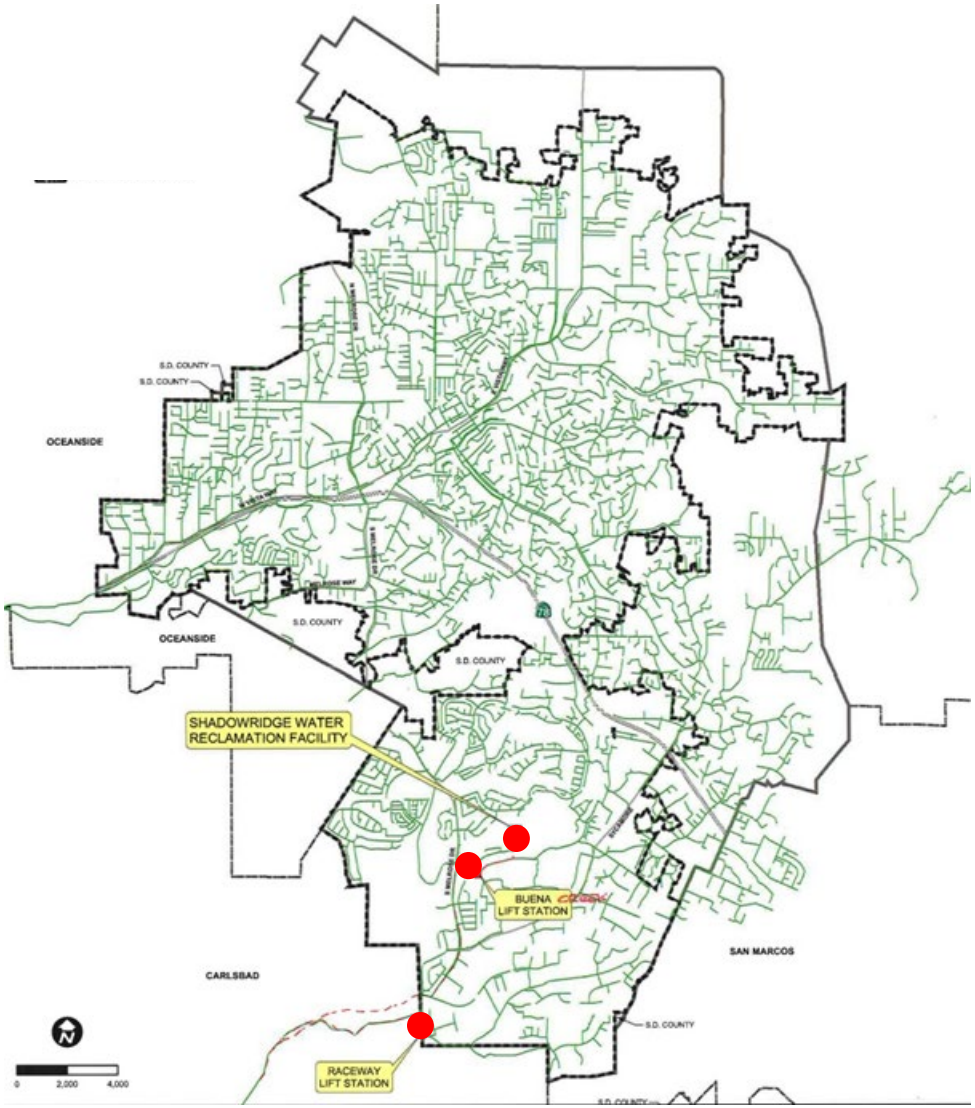
Priority Water Quality Conditions → Sources → Goals, Strategies, Schedules → Monitoring and Assessment → Adaptive Management Process



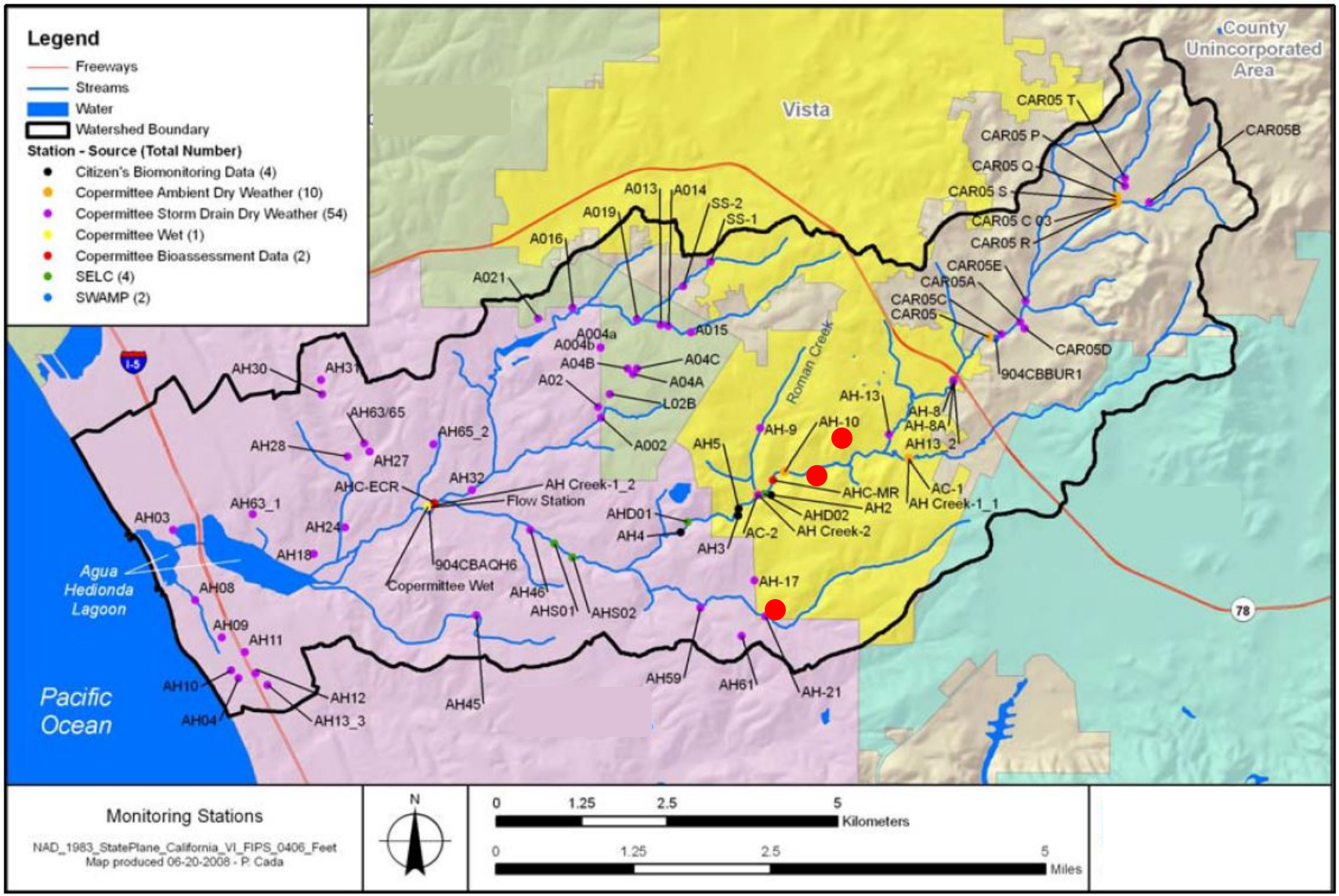
★ Priority= Bacteria

★ Priority= Nutrients

Collection System Overview



Infrastructure/Monitoring Connection



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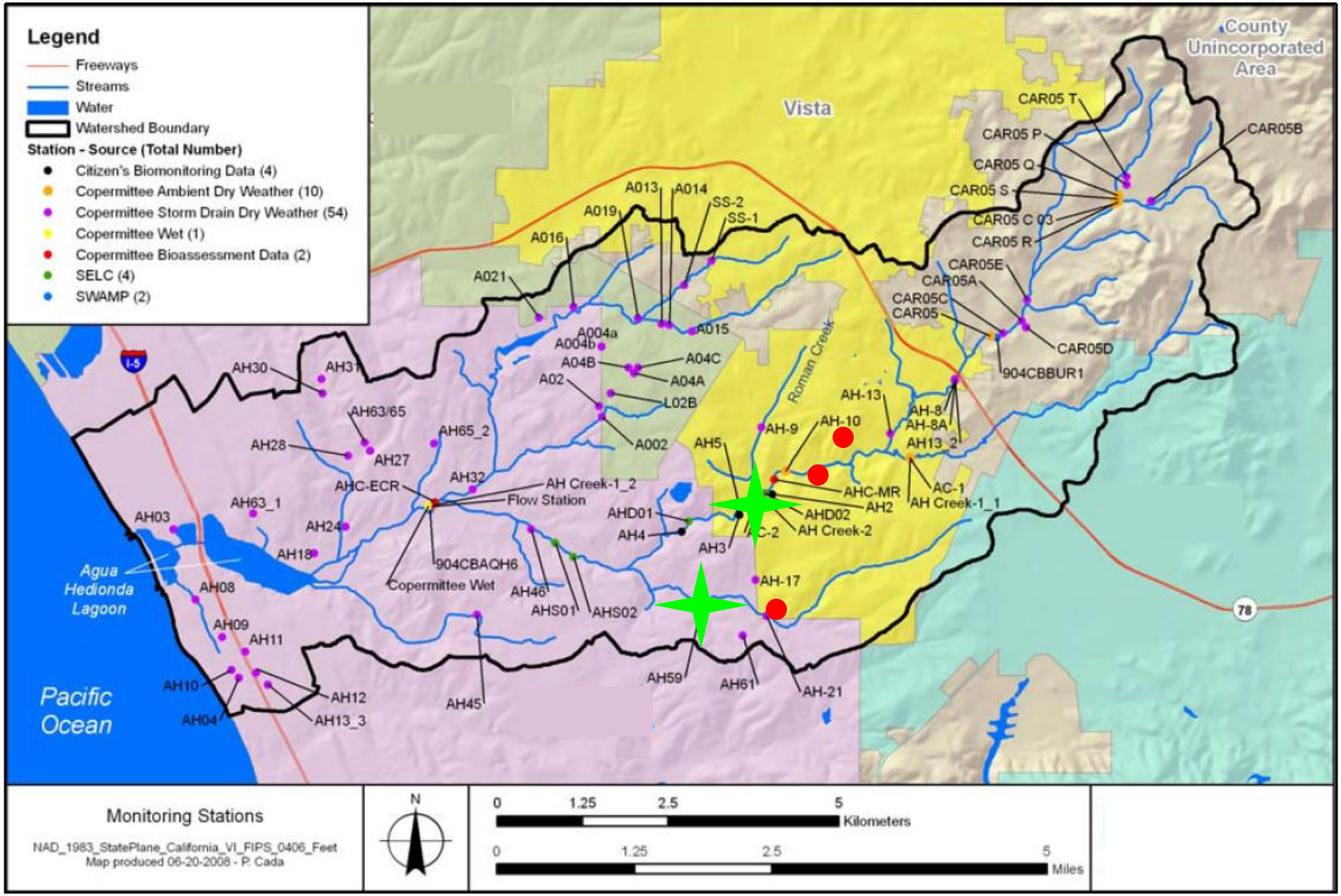

Case Study- Typical Monitoring Data

Carlsbad WMA 2011-2012 Dry Weather MS4 Summary

WMA	Carlsbad Watershed Management Area								
HA	Buena Vista Creek (904.20)			BVC-TWAS-1 Summary		Agua Hedionda (904.30)			
Subwatershed	El Salto (904.21)		Vista (904.22)			Los Monos (904.31)		Buena (904.32)	
Analyte	n	% > Criteria	NA	n	% > Criteria	n	% > Criteria	n	% > Criteria
pH	0	NA	NA	0	NA	0	NA	1*	0%
Nitrate as N	0	NA	NA	0	NA	0	NA	1*	100%
Nitrate/Nitrite as N	5	0%	NA	3	0%	3	0%	1*	100%
Nitrite as N	0	NA	NA	0	NA	0	NA	1*	0%
Total Nitrogen (cal	5	80%	NA	3	67%	3	67%	1*	100%
Total Phosphorus	5	100%	NA	3	100%	3	100%	1*	100%
Dissolved Phospho	0	NA	NA	0	NA	0	NA	0	NA
Total Suspended So	5	0%	NA	3	0%	5	20%	1*	0%
Total Dissolved So	2	100%	NA	2	100%	5	100%	1*	100%
Fecal Coliform	5	60%	NA	3	100%	5	80%	1*	100%
Enterococcus	5	100%	NA	3	100%	5	60%	1*	100%
Ammonia as N	0	NA	NA	0	NA	0	NA	0	NA

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Potential for Proactive Evaluation

- Desktop assessment to identify potential priority sewer exfiltration/MS4 infiltration locations
- Coordinated with regional/local MS4 monitoring programs
  - Source ID- areas with high bacteriological concentrations
  - Human DNA marker/other studies
- Strategic coordination with CIP/pipe rehab
  - Potential to align desktop priority locations with ongoing projects to inform comprehensive asset management approach

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