STORMWATER TREATMENT PLANNING FOR AN INDUSTRIAL PERMIT WITH NUMERIC LIMITS

CASQA Conference, September 28, 2011

Brandon M. Steets, PE, Geosyntec Consultants
Jonathan E. Jones, PE, Wright Water Engineers
Michael K. Stenstrom, PE, University of California Los Angeles
Robert Pitt, PE, University of Alabama

Geosyntec consultants

Acknowledgements

Independent Expert Panel

- Dr. Robert A. Gearheart, PE, Humboldt State University
- Jonathan E. Jones, PE, Wright Water Engineers
- Dr. Michael Josselyn, WRA Consultants
- Dr. Robert Pitt, PE, University of Alabama
- Dr. Michael K. Stenstrom, PE, Univ. California, Los Angeles

The Boeing Company

- Paul Costa
- Debbie Taege
- Lori Blair

Geosyntec Consultants

- Eric Strecker, PE
- Megan Patterson, PE
- Many others!



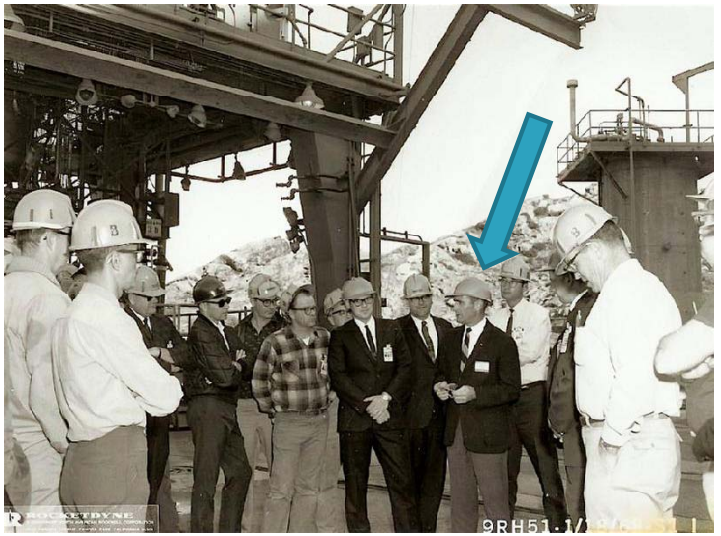

Outline

- Background
- Management Approach
- Site Ranking Method
- Lessons learned

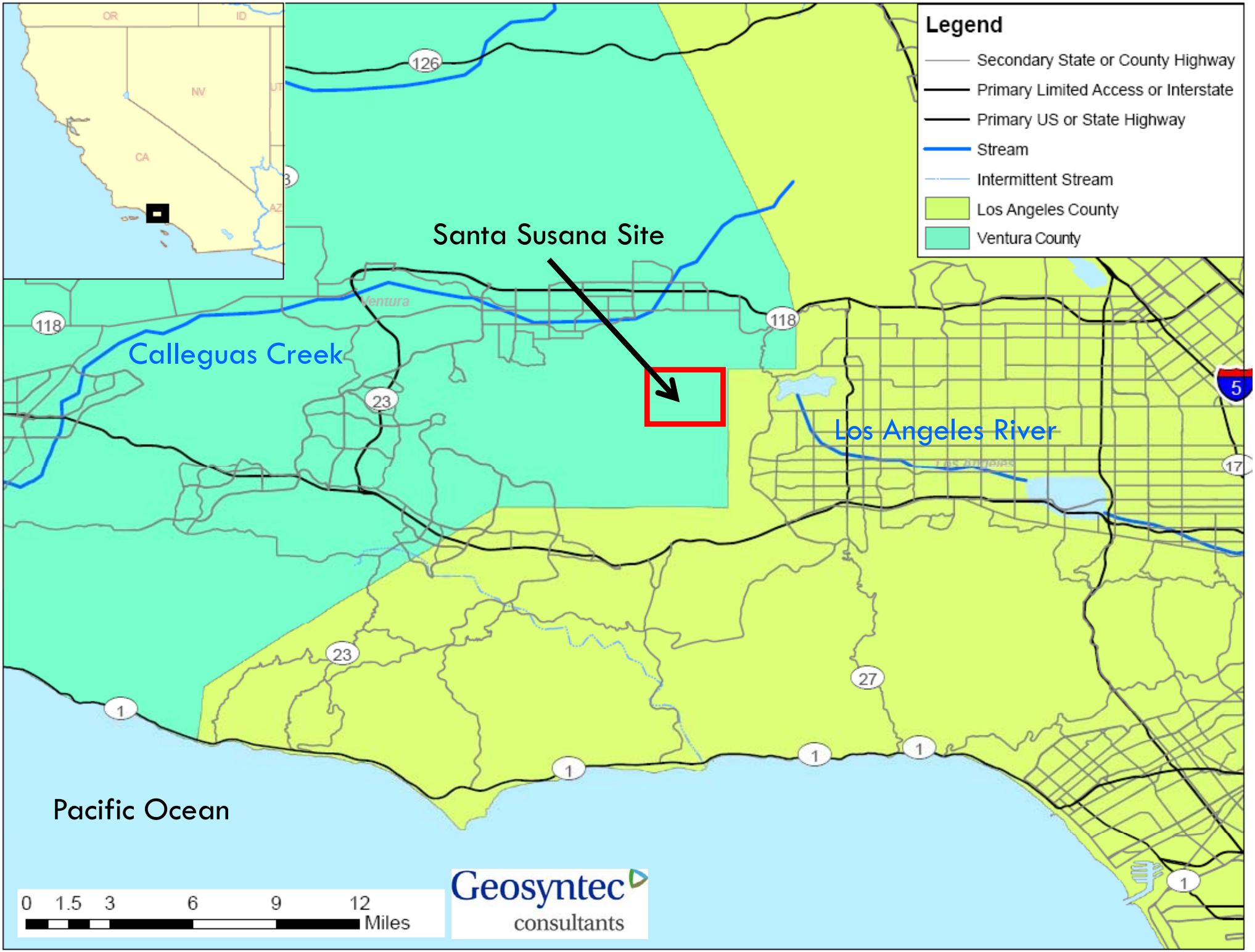
Vegetation regrowth in Watershed 008

Background – Santa Susana Field Laboratory (SSFL)

- 2800-acre former federal government rocket engine testing and energy research facility
- Located in the Santa Susana mountains of eastern Ventura County
- Owned by the Boeing Company (post-1966) and the U.S. Government
- Future parkland and open space
- Activities currently limited to demolition, remediation, and restoration
- Operated rocket testing and energy research 1950 - 1988

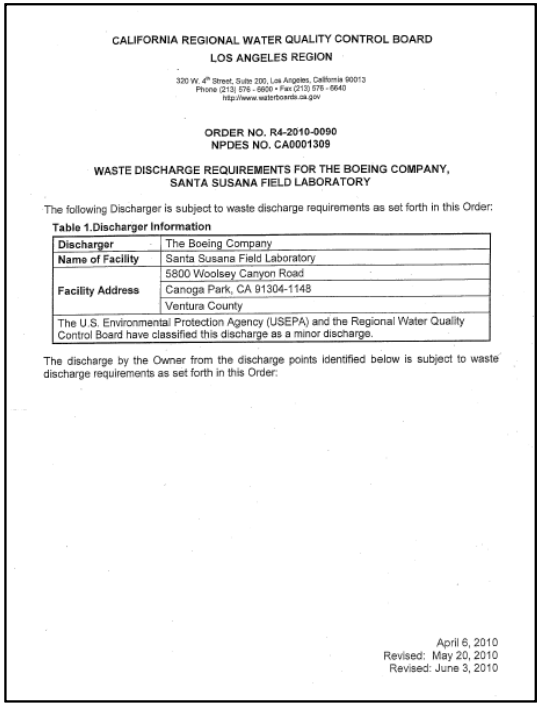


Astronaut Buzz Aldrin at SSFL
(Ref: Rocketdyne Archives)


Legend
Secondary State or County Highway
Primary Limited Access or Interstate
Primary US or State Highway
Stream
Intermittent Stream
Los Angeles County
Ventura County
Santa Susana Site
Calleguas Creek
Los Angeles River
Pacific Ocean
OR
ID
NV
UT
CA
AZ
126
118
23
27
1
5
17
0 1.5 3 6 9 12
Miles
Geosyntec
consultants

Regulation of SSFL Stormwater

- Stormwater discharges are regulated by the LARWQCB through an individual NPDES permit, which requires:
  - Composite discharge sampling during storm events, and
  - Compliance with very protective Numeric Effluent Limits (NELs)
- NELs for a wide range of constituents including:
  - Dioxins (TCDD TEQ): 2.8×10^{-8} µg/L
  - Total Copper: 14 µg/L
  - Total Lead: 5.2 µg/L



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576 - 6600 • Fax (213) 576 - 6640
http://www.waterboards.ca.gov

ORDER NO. R4-2010-0090
NPDES NO. CA0001309

WASTE DISCHARGE REQUIREMENTS FOR THE BOEING COMPANY,
SANTA SUSANA FIELD LABORATORY

The following Discharger is subject to waste discharge requirements as set forth in this Order:

Table 1.Discharger Information

Discharger	The Boeing Company
Name of Facility	Santa Susana Field Laboratory
Facility Address	5800 Woolsey Canyon Road
	Canoga Park, CA 91304-1148
	Ventura County
The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified this discharge as a minor discharge.	

The discharge by the Owner from the discharge points identified below is subject to waste discharge requirements as set forth in this Order:

April 6, 2010
Revised: May 20, 2010
Revised: June 3, 2010

Industrial General Permit NAL/NELs

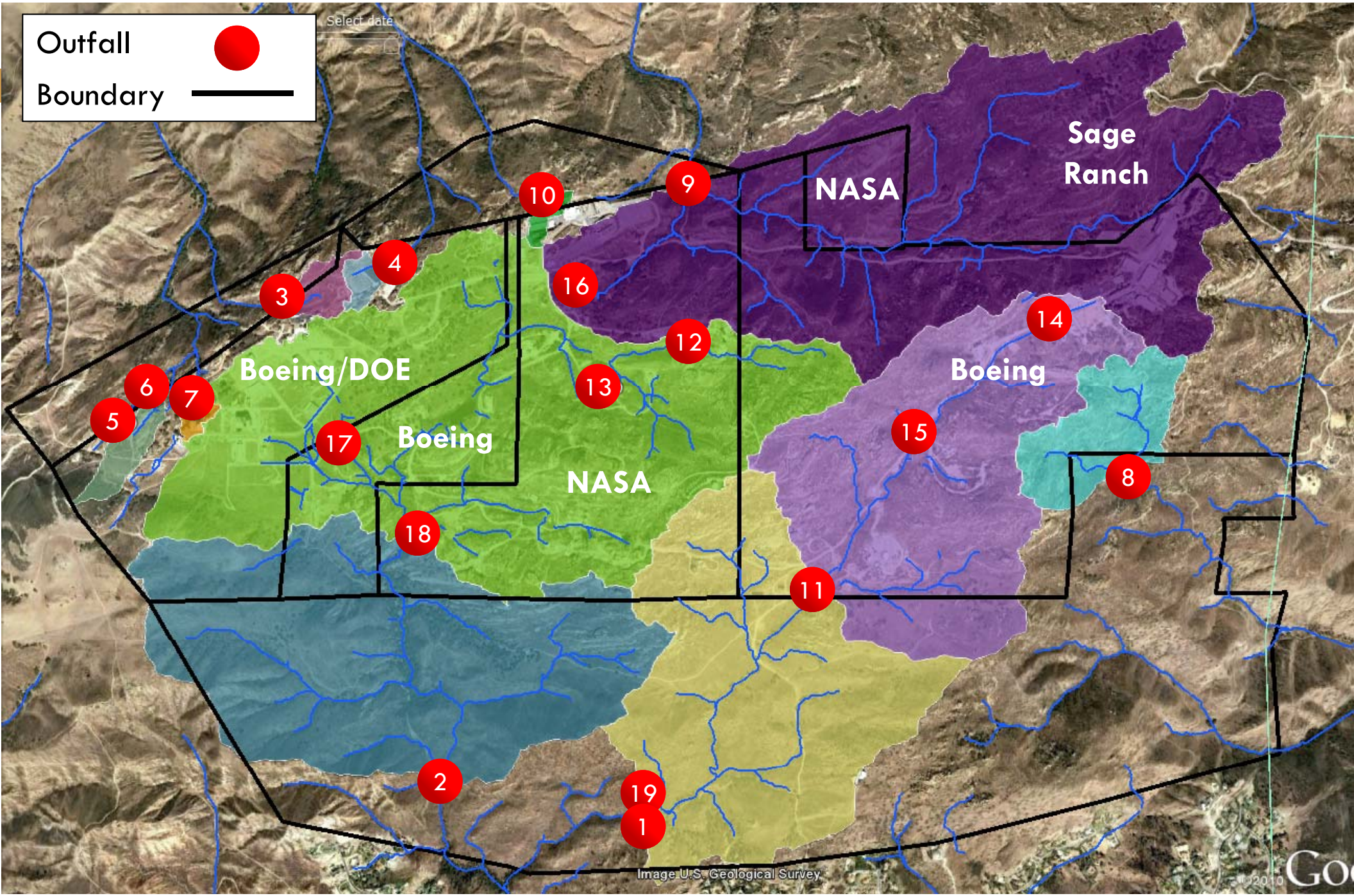
- For direct dischargers and metals impaired watersheds, metal NALs vary with receiving water hardness
- IGP dischargers may soon experience similar treatment control planning as SSFL has

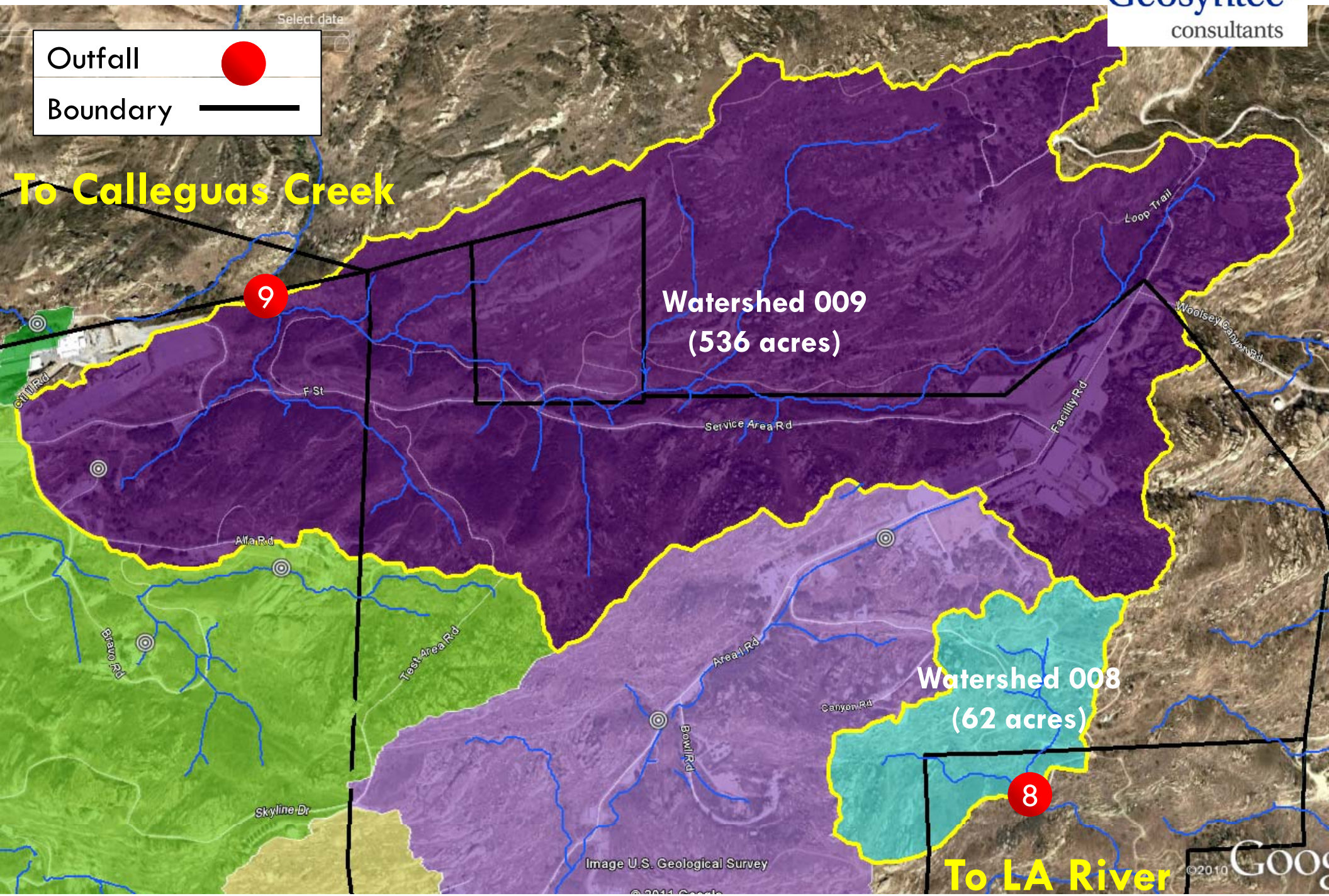
All Units mg/L	NAL/NEL Values (mg/L, total)					
	Cadmium	Copper	Lead	Nickel	Silver	Zinc
0-25 mg/L	0.0005	0.0038	0.014	0.15	0.0007	0.04
25-50 mg/L	0.0008	0.0056	0.023	0.20	0.0007	0.05
50-75 mg/L	0.0013	0.0090	0.045	0.32	0.0017	0.08
75-100 mg/L	0.0018	0.0123	0.069	0.42	0.0030	0.11
100-125 mg/L	0.0023	0.0156	0.095	0.52	0.0046	0.13
125-150 mg/L	0.0029	0.0189	0.122	0.61	0.0065	0.16
150-175 mg/L	0.0034	0.0221	0.151	0.71	0.0087	0.18
175-200 mg/L	0.0039	0.0253	0.182	0.80	0.0112	0.20
200-225 mg/L	0.0045	0.0285	0.213	0.89	0.0138	0.23
225-250 mg/L	0.0050	0.0316	0.246	0.98	0.0168	0.25
250+ mg/L	0.0053	0.0332	0.262	1.02	0.0183	0.26

Table from previous Draft IGP

SSFL Outfalls and Property Boundaries

Geosyntec consultants




Outfall
Boundary
To Calleguas Creek
9
Watershed 009
(536 acres)
Watershed 008
(62 acres)
8
To LA River
F St
Service Area Rd
Facility Rd
Loop Trail
Woolsey Canyon Rd
Alfa Rd
Test Area Rd
Area 1 Rd
Bowl Rd
Canyon Rd
Bravo Rd
Skyline Dr
Image U.S. Geological Survey

Expert Panel Scope of Work

- **Independent Expert Panel** was engaged with Regional Board consent to oversee stormwater planning and design work, as well as provide input on monitoring, source removal activities, and various NPDES permit issues
- **Mission:** Improve stormwater quality at NPDES Outfalls 008 and 009
- Additional responsibilities include overseeing scientific studies and interfacing with the public on risk and science communication.

Site Constraints

- "End-of-pipe" stormwater controls are not feasible at Outfalls 008 & 009 due to severe site constraints including:
  - Steep terrain
  - Space constraints
  - Existing infrastructure limitations

Outfall 008

Outfall 009

Site Constraints

- While treatment controls are employed at other outfalls with smaller watersheds, similar controls at 008 & 009 would result in very large dams and significant environmental impacts.
- Additionally, natural background soils have been found to contribute to Permit Limit exceedances.

Management Approach

- Use sediment and treatment controls that:
  - Replicate natural processes and
  - Are distributed throughout the watersheds to capture the contaminants of concern (COCs)
- Integrate ongoing site management activities, including pavement removal, impacted surface soil removal, erosions control, and stream channel restoration

BMP Selection and Siting

- Iterative approach - continue to implement BMPs as necessary while taking into account water quality impact of existing BMPs
- Prioritize potential BMP locations based on site specific performance monitoring data using a BMP subarea ranking methodology

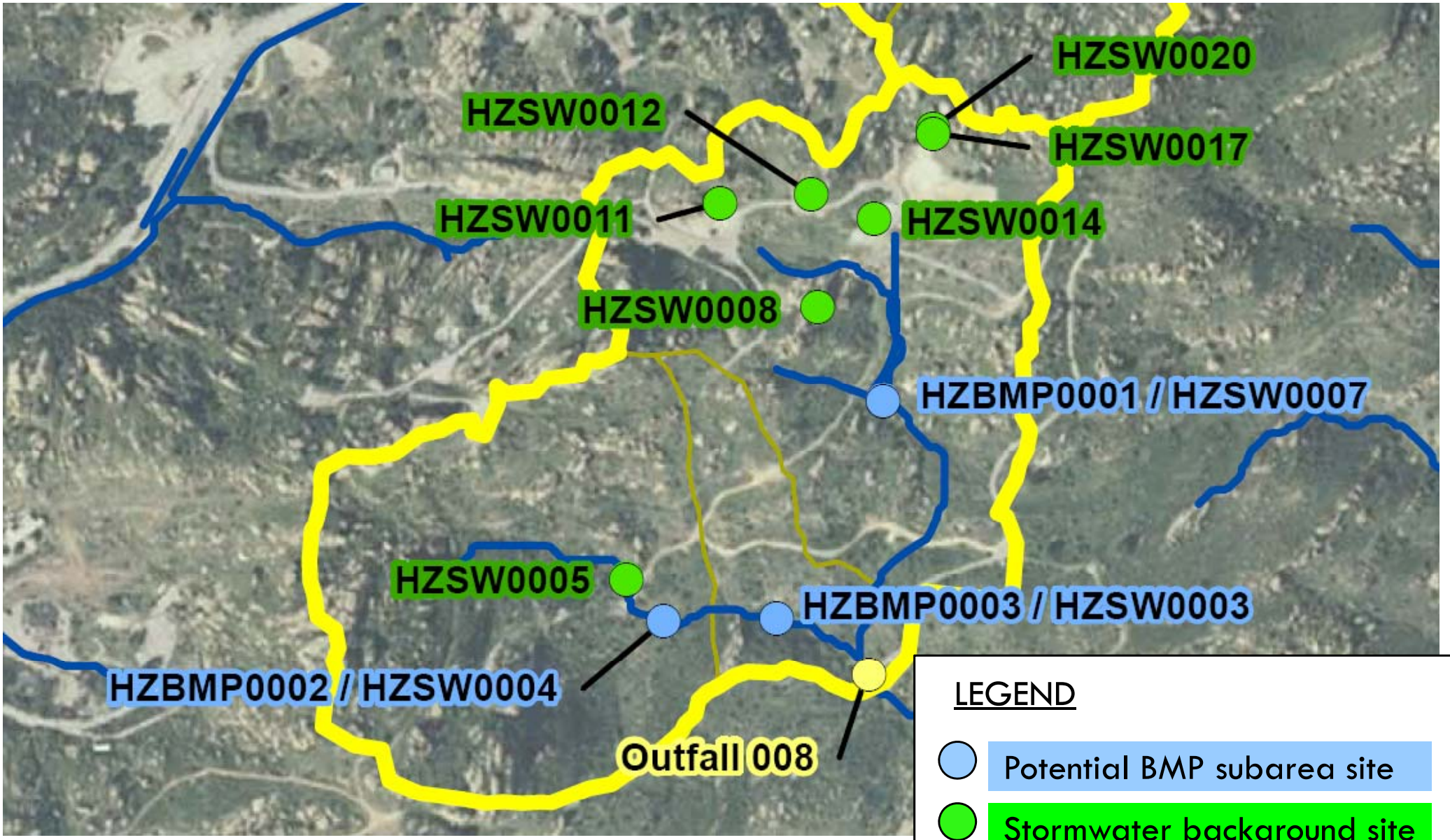
BMP Subarea Ranking Methodology

- Innovative, statistically rigorous approach
- Rank potential BMP subarea monitoring sites based on comparisons of:
  - Stormwater background concentrations with NPDES permit limits
  - Stormwater "particulate strengths" with stormwater background particulate strengths
- Monitoring locations were scored based on number and percent of samples above permit limits and/or background concentrations
- Locations then ranked based on scores, and top locations identified
- Process to be repeated annually through 2014

Previous Approaches Considered

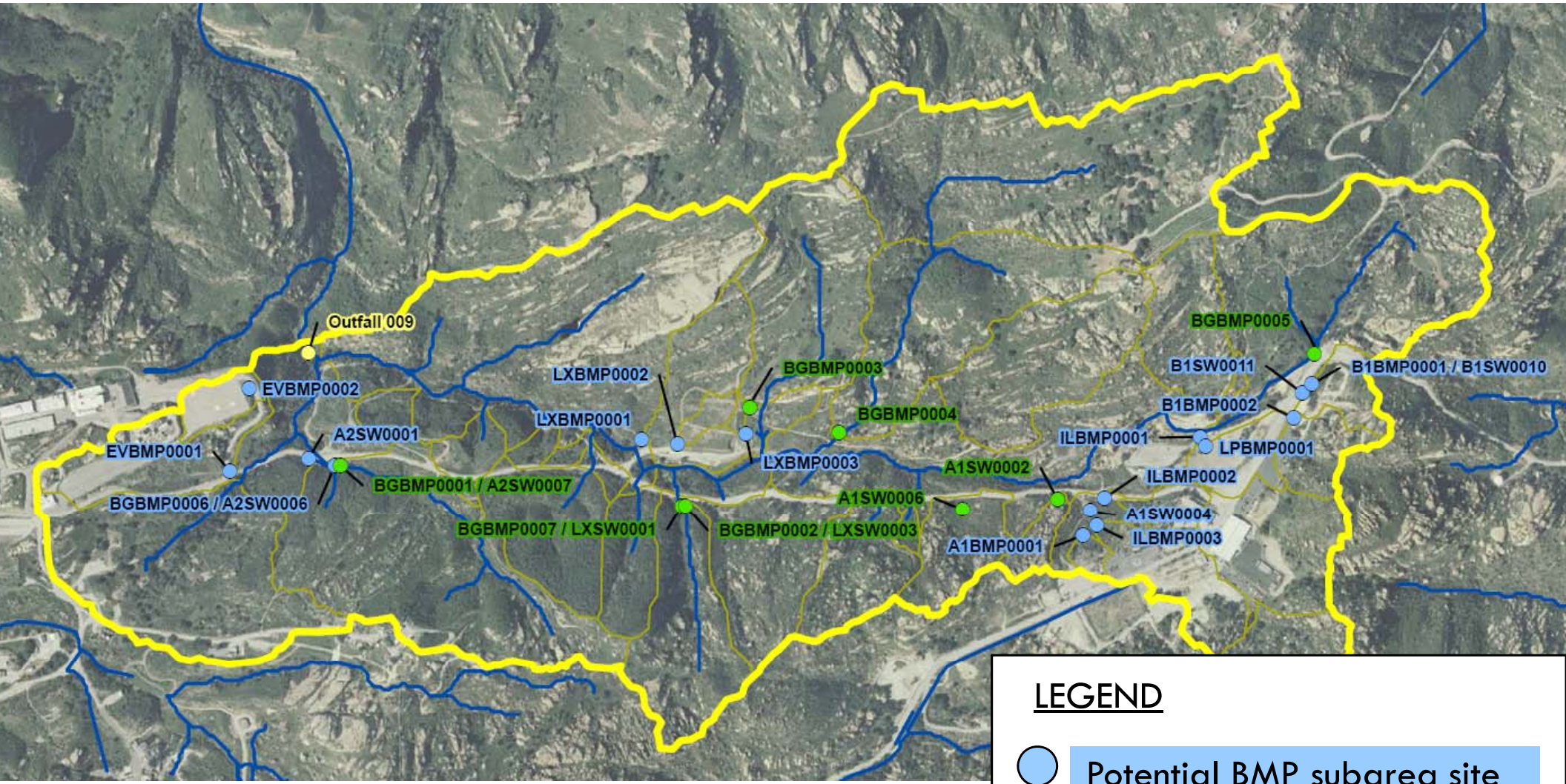
- Earlier approaches compared subarea monitoring results to fixed thresholds:
  - 75th percentile background
  - 95th percentile background
  - Permit limit
  - 75th percentile background & Permit limit
  - 95th percentile background & Permit limit
- Data were generally robust -- regardless of specific approach, the same subareas tended to be ranked the highest
- Ultimately Panel preferred:
  - Rigorous statistical analysis, and
  - Best professional judgment used to improve rankings by taking into account constructability and site specific problems.

Subarea Monitoring Sites
Watershed 008 - 62 acres



Subarea Monitoring Sites
Watershed 009 - 536 acres

Geosyntec consultants



Data Summary – SW Background Sites

Pollutant of Concern	# samples	# NDs	# DNQ	Min	Median	95th Percentile	Max	Permit limit for OF008 & OF009
TSS - 008	9	0	4	2.0	28	74	76	NA
TSS - 009	41	5	21	< 1.0	5.0	55	750	NA
TSS - all	50	5	25	< 1.0	6.5	73	750	NA
Cadmium	19	16	3	< 0.10	< 0.10	0.32	0.87	4
Copper	23	0	10	1.0	2.3	7.4	19	14
Lead	35	5	17	< 0.20	0.74	14.6	64	5.2
Mercury	19	19	0	< 0.10	< 0.10	<0.10	< 0.10	0.13
TCDD TEQ	37	10	NA	< 1.0E-10	6.0E-10	2.4E-07	8.5E-07	2.80E-08
2,3,7,8-TCDD	37	37	0	< 5.0E-08	< 8.7E-07	< 4.8E-06	< 5.4E-06	NA

= Permit limit exceeded

Concentrations (mg/L for TSS, µg/L otherwise)

Geosyntec consultants

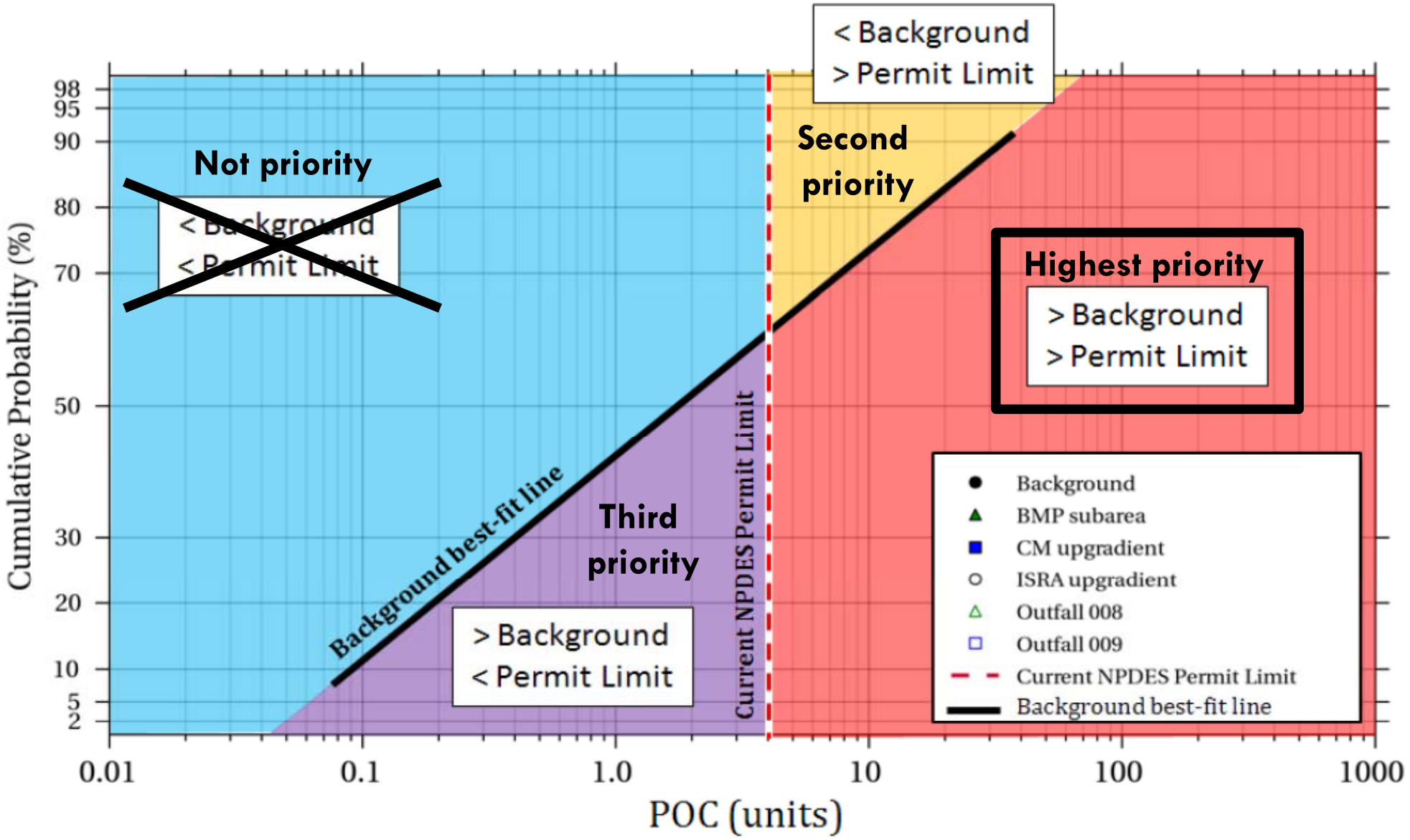
Data Summary – Potential BMP Sites

Pollutant of Concern	# samples	# NDs	# DNQ	Min	Median	95th Percentile	Max	Permit limit for OF008 & OF009
TSS - 008	27	4	7	< 1.0	15	300	840	NA
TSS - 009	70	6	22	< 1.0	12.5	260	890	NA
TSS - all	97	10	29	< 1.0	13	280	890	NA
Cadmium	70	31	39	< 0.1	0.13	0.51	0.96	4
Copper	85	0	10	0.6	4.1	14	27	14
Lead	99	19	30	< 0.2	1.2	15	55	5.2
Mercury	69	66	2	< 0.1	< 0.1	< 0.1	0.98	0.13
TCDD TEQ	91	21	NA	< 1.0E-10	3.8E-09	3.3E-06	1.4E-05	2.80E-08
2,3,7,8-TCDD	91	89	2	< 2.0E-08	< 1.0E-06	<6.5E-06	2.30E-06	NA

= Permit limit exceeded

Concentrations (mg/L for TSS, µg/L otherwise)

Basic Approach (example)



BMP Subarea Ranking Methodology

- Statistical methodology developed to rank the sites based on threshold comparisons while accounting for the number of usable data available at each site
  - Modified binomial distribution (see table) for **small** data sets (observations <= 15 and critical values <= 14)
  - Unadjusted value of the cumulative distribution function of a binomial distribution with p = 0.5 for **large** data sets (observations > 15 and critical values > 14)

BMP Subarea Ranking Methodology

- "Weighting factors" were calculated for each site for metals (cadmium, copper, and lead), dioxins (TCDD TEQ and 2,3,7,8-TCDD), and TSS.
- Multi-pollutant "score" was produced from metals and dioxin weighting factors to allow for relative ranking amongst potential BMP sites.

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Calculate Particulate Strength concentrations (A)

PS = (total-diss.)/TSS

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

Geosyntec consultants

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate PS concentrations (B)

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

NPDES Permit Limits (D)

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

Geosyntec consultants

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs)

Average max metal and

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

BMP Site Ranking Analysis Approach

Geosyntec consultants

Assemble **background** results from ISRA and BMP monitoring datasets

Assemble **potential BMP subarea site** monitoring results (concentrations in water, C)

Calculate Particulate Strength concentrations (A)
PS = (total-diss.)/TSS

Calculate PS concentrations (B)

NPDES Permit Limits (D)

Compare:
- Potential BMP site PSs (B) with background PSs (A), and
- Potential BMP site concentrations (C) with NPDES permit limits (D)

Determine pollutant-specific weighting factors (WFs) based on number of samples and percent above both critical thresholds.

Average max metal and max dioxin WFs to determine multi-pollutant "score" for each site.

Rank potential BMP subarea monitoring sites by multi-pollutant score. Rank potential BMP subarea monitoring sites by TSS WFs.

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

Geosyntec consultants

Evaluate highest ranked sites for suitability of new erosion and/or treatment controls, while utilizing best professional judgment to consider multi-pollutant and TSS scores, status of ISRA soil removal, demolition plans, existing or planned BMPs, and other pertinent factors.

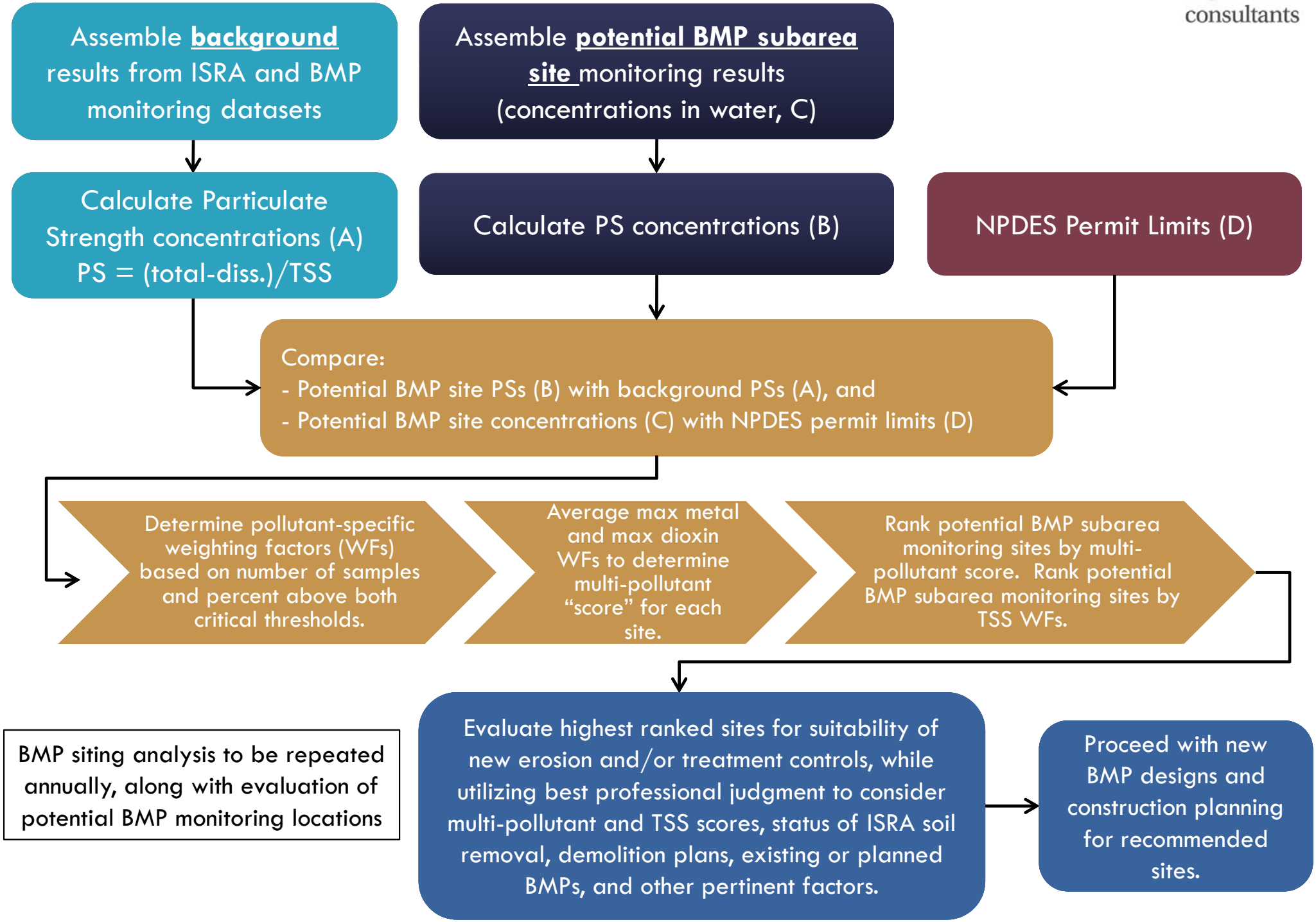
→

Proceed with new BMP designs and construction planning for recommended sites.

BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

BMP Site Ranking Analysis Approach

Geosyntec consultants



BMP siting analysis to be repeated annually, along with evaluation of potential BMP monitoring locations

Example:

Site A: n = 10, m = 7 → $Weight_A$ = 0.83

Site B: n = 14, m = 2 → $Weight_B$ = 0.01

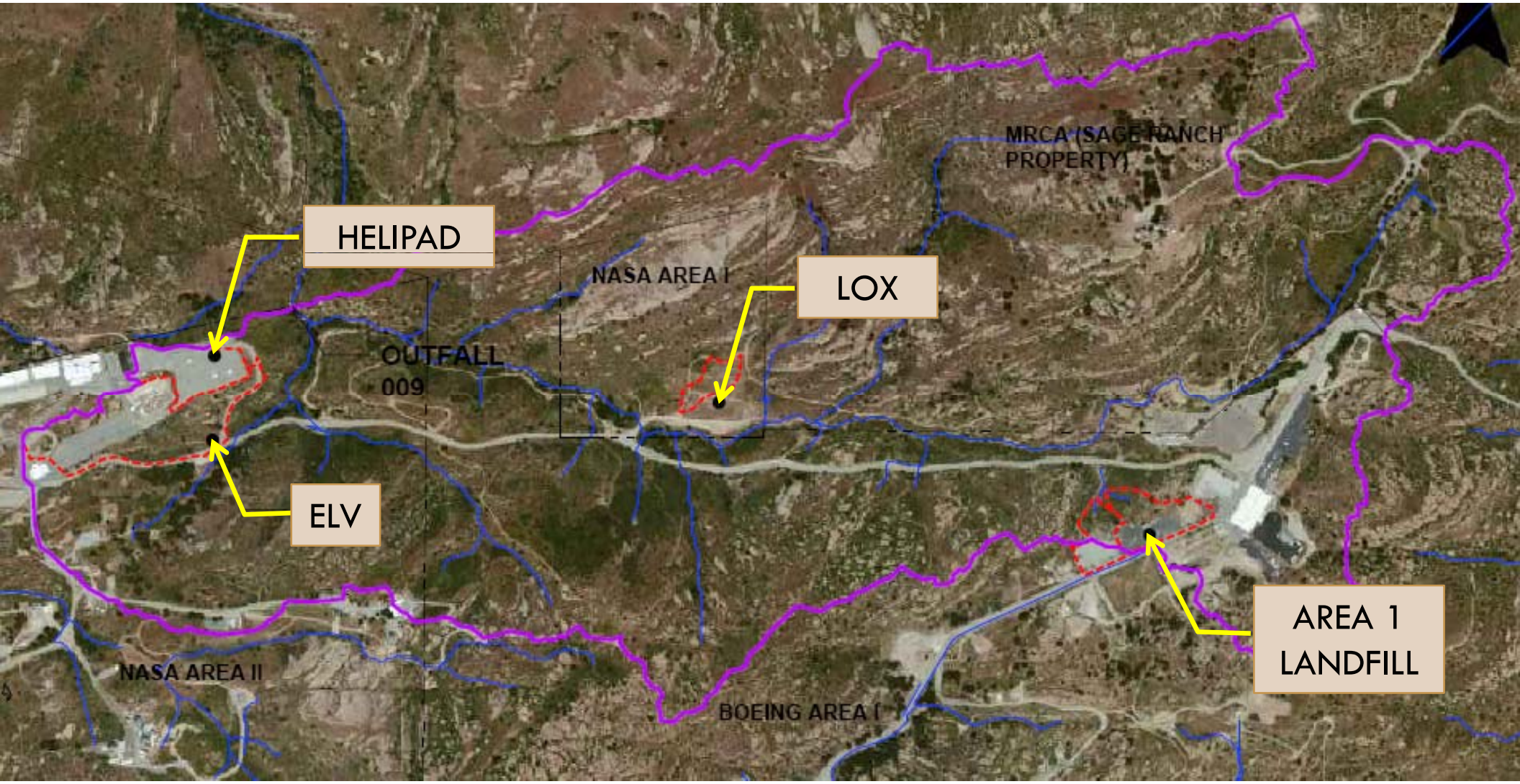
Based on weight alone, Site A would be prioritized over Site B.

Total Number of Observations (n)	Total Number of Critical Values in Data Set (m)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	50													
2	50													
3	50		87											
4	31		69	94										
5	19		50	81	97									
6	11		50	66	89	98								
7	6		50	50	77	94								
8	4		36	50	64	86		99						
9	2		25	50	50	75		98	99					
10							83	95	99	99				
11	1		11	27	50	50	73	89	97	99	99			
12	0		7	19	39	50	63	81	93	98	99	99		
13	0		5	13	29	50	50	71	87	95	99	99	99	
14		1	3	9	21	40	50	61	79	91	97	99	99	99
15	0	0	2	6	15	30	50	50	70	85	94	98	99	99

BMP Subarea Ranking Analysis

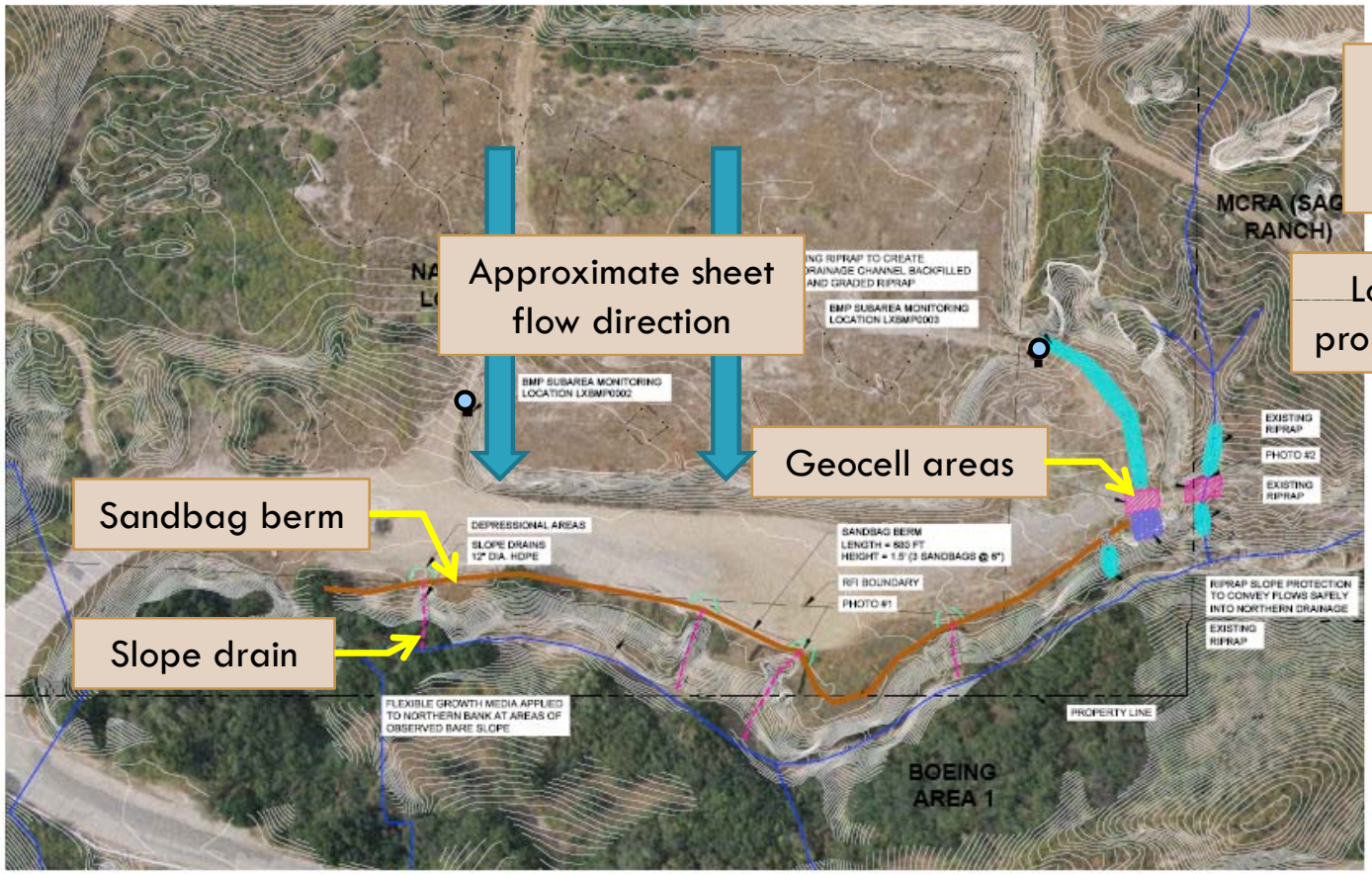
Rank from Averaged Weights	Potential BMP Subarea (Co-location)	Watershed	Description	Approximate Upgradient DA (ac)	Multi-Pollutant Score	Rank from Maximum Metal Weighting	Rank from Maximum Dioxin Weighting
1	**EVBMP0002**	Outfall 009	Helipad spillway	~4.0	0.66	6	1
2	**ILBMP0001***	Outfall 009	Lower parking lot 24" stormdrain	23	0.5	1	2
2	LPBMP0001*	Outfall 009	Soil stockpile sheetflow	5.1	0.5	1	2
4	**A2SW0001**	Outfall 009	CM1 upgradient west (also ELV area and Area I road)	~13	0.45	5	2
5	LXBMP0002	Outfall 009	LOX mid	1.5	0.31	7	6
6	B1BMP0001* (B1SW0010)	Outfall 009	B1 culvert inlet	4.4	0.30	1	8
7	**A1BMP0001**	Outfall 009	A1LF downgradient	1.2	0.28	1	9
8	**B1SW0011***	Outfall 009	B1 paved roadside ditch	<1	0.25	15	2
9	**B1BMP0002**	Outfall 009	B1 parking lot culvert inlet	5.3	0.13	8	7
10	LXBMP0003	Outfall 009	LOX east (Sage Ranch tributary)	~24	0.03	10	9
11	HZBMP0001 (HZSW0007)	Outfall 008	HV downgradient	<29	0.02	9	13
12	**BGBMP0006** (A2SW0006)	Outfall 009	CM1 upgradient east	41	0.02	11	11
13	**HZBMP0003** (HZSW0003)	Outfall 008	DRG downgradient 2	<33	0.005	11	15
13	**A1SW0004**	Outfall 009	CM9 upgradient	14	0.0012	14	12
13	**Outfall 008****	Outfall 008	NPDES outfall 008	62	0.0003	13	15
16	EVBMP0001	Outfall 009	Helipad Road/ELV culvert inlet	unknown/small	0	16	15
16	ILBMP0002	Outfall 009	Road runoff to CM9	14	0	16	15
16	**Outfall 009****	Outfall 009	NPDES outfall 009	536	0	15	14
16	LXBMP0001	Outfall 009	LOX West	unknown/small	0	16	15
16	ILBMP0003	Outfall 009	A1LF parking lot	9.5	0	16	15
16	HZBMP0002 (HZSW0004)	Outfall 008	DRG downgradient	26	0	16	15

New BMP Recommendation Locations



Example Conceptual Design

Geosyntec consultants



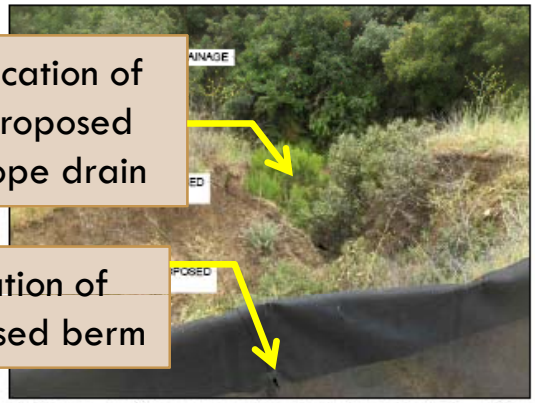


PHOTO #1: LOOKING DOWN GULLY FROM TOP OF SLOPE. SEE MAP.

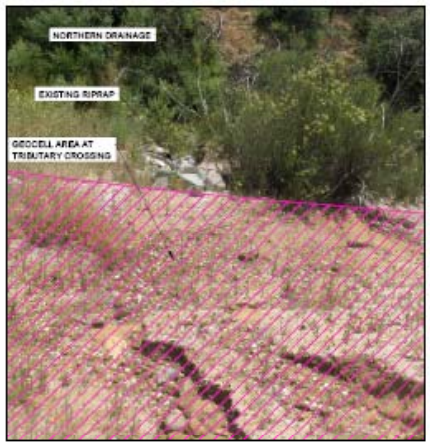


PHOTO #2: ACCESS ROAD LOOKING TOWARD SOUTH. SITE OF PROPOSED GEOCELL SHALLOW CROSSING. SEE MAP.

100 50 0 100 200

SCALE IN FEET

NORTH

DRAFT CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

NOTES:

- PROPOSED DESIGN FEATURES WERE PRELIMINARILY SIZED AND ARE APPROXIMATE. FINAL BMP DESIGN DETAILS AND SIZES WILL BE CONFIRMED BASED ON SITE VISIT AND ENGINEERING DESIGN JUDGMENT AND ANALYSIS. FINAL DESIGNS WILL BE SUBJECT TO ENGINEERING FEASIBILITY ASSESSMENT, PERMITTING CONSTRAINTS (IE., REGULATORY AGENCY REQUIREMENTS), AND EXPERT PANEL AND PROPERTY OWNER REVIEW AND APPROVAL.
- SLOPE DRAINS SHOULD BE KEYED IN TO THE SAND BAG BERM SO THAT WATER FLOW AROUND THE PIPE IS PREVENTED.
- GRADED DITCH SHOULD BE CONSTRUCTED ON UPSLOPE SIDE OF BERM TO ENSURE PROPER DRAINAGE TOWARDS SLOPE DRAIN INLETS, UNLESS EXISTING GRADE ALREADY ALLOWS FOR THIS.
- ALL EXISTING RIPRAP SHOULD BE REINSTALLED WITH FILTERED ROCK BEDDING, AND PROPOSED RIPRAP SHOULD BE SIMILARLY INSTALLED WITH FILTERED ROCK BEDDING.
- GEOCELL TRIBUTARY CROSSINGS SHOULD BE SHAPED INTO A CHANNEL TO ALLOW FOR CONVEYANCE OF CONCENTRATED FLOWS ACROSS THEM.

SITE PHOTOS

TITLE: 39 LOX AREA BMPS	PREPARED BY: Geosyntec consultants, 924 ANACAPA STREET, SUITE 4A, SANTA BARBARA, CA 93101, PHONE: 805.897.3800	PREPARED FOR: BOEING, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA	PROJECT: STORMWATER TREATMENT BMP CONCEPT DESIGNS, BOEING SSFL WATERSHED 009	DESIGNED BY: JC	REVIEWED BY: DHB	DATE: SEPT 2011	DRAWING: 5
				DRAWN BY: JC	APPROVED BY: BS	PROJ. NO.: SB0363R	

Lessons Learned

- Given 008 and 009 physical constraints, a watershed-based, distributed stormwater management approach is more appropriate than implementing "end-of-the-pipe" treatment systems.
- New BMPs and stormwater controls have been, and will continue to be (as necessary), implemented each year upon re-examination of new monitoring data.
- Integration of new BMPs with ongoing activities can further enhance BMP effectiveness.

Lessons Learned

- This approach could be applied to other large NPDES permittees (e.g., MS4s, industrial field laboratories, or landfills) that are in need of siting distributed stormwater treatment controls to meet strict NELs and have constructability constraints at the compliance monitoring locations.
- This approach has potential TMDL implementation planning implications, as it could help with structural BMP and source control planning based on monitoring or land use-based data, by accounting for the number of samples and percent of samples above both background and water quality standards thresholds.
- Acknowledge that 100% NEL compliance may not be achievable due to background sources and/or natural variability.

Questions?