Outline

- Expert Panel Introduction
- NPDES Permit Overview
- BMP Strategies
- Questions of Interest:
  1. What has recent water quality been like?
  2. What is SSFL doing to improve water quality?
  3. How are the BMPs working?
  4. What’s causing the remaining NPDES exceedances?
Expert Panel Introduction

- Dr. Bob Gearheart, Humboldt State University
- Jon Jones, Wright Water Engineers
- Dr. Michael Josselyn, WRA Consultants
- Dr. Bob Pitt, University of Alabama
- Dr. Michael Stenstrom, Univ. California, Los Angeles
- Panel consultant: Geosyntec (Brandon Steets, Megan Otto)
Expert Panel Introduction

- **Independent Expert Panel** was engaged with Regional Board consent to oversee stormwater BMP planning, as well as provide input on monitoring, source removal, and various NPDES permit issues.

- **Mission**: Improve stormwater quality at outfalls site-wide.

- **Additional responsibilities**: Oversee scientific studies and interface with the Regional Board and public on risk and science communication.
Panel’s On-Going Role and Scope

- Review NPDES compliance and BMP performance monitoring data
- Make recommendations for new BMPs or improvements to existing BMPs
- Review Stormwater Human Health Risk Assessment (HHRA)
- Investigate stormwater pollutant sources in OF009 watershed
- Public outreach
Stormwater discharges at SSFL are regulated by the LARWQCB through an individual NPDES permit, which requires:

- Composite sampling at outfalls during storms, and
- Compliance with Numeric Effluent Limits (NELs) – protective of both human health and aquatic life

- NELs for a wide range of constituents, including:
  - Dioxins (TCDD TEQ): 0.000000028 µg/L (ppb)
  - Total Copper: 14 µg/L (ppb)
  - Total Lead: 5.2 µg/L (ppb)
Monitored Parameters

32-44 parameters are analyzed at every surface water outfall during every storm that produces runoff.

Over 250 parameters are analyzed at every outfall at least once annually.
Unlike other outfalls, “end of pipe” stormwater treatment was not possible here without constructing environmentally-intrusive dams. So instead a distributed, watershed-based approach was implemented. Emphases were:

- **008**: source removal, erosion control, and restoration
- **009**: the same, plus distributed treatment controls

**Additional elements of this approach:**

- **Iterative & adaptive** – Each year new recommendations are made based on evaluation of new monitoring data
- **Low Maintenance** – Prioritized solutions that require minimal long-term maintenance
- **Redundancy** – Multipronged approach provides redundancy and is expected to be more effective
008/009 Multi-Pronged Approach

- **Source Controls**
  - ISRA soil removal
  - Pavement and building removal

- **Erosion/Sediment Controls and Restoration**
  - Hydroseed/mulch, plantings, etc.
  - Dirt road controls
  - Channel stabilization controls

- **Treatment Controls**
  - Flow-through media filters
  - Culvert modifications
  - B1, Upper Lot media filters
  - Sedimentation basin and biofilter
  - ELV treatment BMP
  - Detention bioswales
  - Temporary sedimentation areas (LOX, helipad)
Boeing Demo Areas

Excerpt From 2011 Demolition Public Tour
Hosted on July 14, 2011
CTL3 - Before and After
CTL3 - Yesterday (3/20/17)
008/009 Treated Areas
Example 009 BMPs

11 Culvert Modifications

Sedimentation Basin and Biofilter

Expendable Launch Vehicle (ELV) Treatment BMP
Recent Stormwater Quality
Historical Overview – NPDES

Sampling: All SSFL Outfalls

<table>
<thead>
<tr>
<th>Year</th>
<th>Current Season</th>
<th>Results</th>
<th>Pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009/2010</td>
<td>50</td>
<td>40</td>
<td></td>
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<tr>
<td>2010/2011</td>
<td>60</td>
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<tr>
<td>2015/2016</td>
<td>110</td>
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<td>90</td>
</tr>
<tr>
<td>2016/2017</td>
<td>120</td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

Legend:
- Grey: Number of NPDES Outfall 008/009 Samples
- Dark Grey: Number of NPDES Other Outfall Samples
- Yellow: Number of NPDES Outfall 008/009 Exceedances
- Brown: Number of NPDES Other Outfall Exceedances
- Blue: Annual Rainfall (in)
- Cyan Dotted: Average Annual Rainfall (in)
December 22-27, 2016

- Total rainfall = 1.99-in
- Outfall 009 only flowed
  - Sampled December 24th and 25th (grab and composite)
  - No exceedances

![Bar chart showing daily rainfall for December 20-25, 2016]
January 4-13, 2017

- Total rainfall = 2.74-in
- Outfall 009 only flowed
  - Sampled January 9\textsuperscript{th} and 10\textsuperscript{th} (grab and composite)
  - No exceedances
January 18-23, 2017

- Total rainfall = 5.70-in
- Outfalls 001, 002, 006, 008, 009, 011, and 018 flowed
- Only Outfall 008 and 009 results available/validated

Outfall 009
- Sampled January 19-21 (grab and composite)
- No exceedances

Outfall 008
- Sampled January 20-21 (grab and composite)
- One exceedance: Field pH = 6.2

Bar chart showing daily rainfall from 1/17 to 1/23.
Recent Activities
Existing BMPs in 008 and 009 Watersheds
Most Recently Installed BMPs

- **Media filter** recommended in 2016; more data being collected
- **Upper lot media filter materials ordered; construction pending drier weather**
- **Sandbag berm to send runoff to CM-1**
- **CM-3 road runoff diversion partially constructed; to be completed during drier weather**
- **Admin area inlet filters planned/ordered**
- **Upper lot media filter materials ordered; construction pending drier weather**

Legend:
- Drainage
- Storm Drain
- Completed ISRA Area
- Erosion/Sediment Controls
- Demolition
- Hydroseed
- Asphalt Removal
- Treatment BMPs

Treatment BMP Drainage Area:
- Upper Lot Media Filter
- Admin Area Inlet
- B1 Media Filter and Detention Basin
- Biofilter
- Culvert Modifications (11)
- Detention Bioswales and Biofilter
- ELV Treatment BMP
- Helipad Berms and Pump
- LOX Berm and Slope Drains
Detention Bioswales

**During construction**

**After construction/vegetation growth**
Detention Bioswales

Concept: Hold runoff from upper lot until lower lot runoff is treated, then slowly release for downstream treatment by biofilter.

How it works:
1. Stormwater enters the bioswale and ponds on the surface.
2. Stormwater infiltrates into the soil and stone reservoir and chambers below.
3. When water ponding exceeds the height of the risers, stormwater flows directly into subsurface chambers.
4. The chambers slowly drain to the storm drain and lower lot biofilter.
Administration Area Inlet Filters

Drop Inlet Filters filled with Site Media (Sand, GAC, Zeolite)

Weighted Wattle filled with proprietary media (Perlite, GAC, Zeolite)

Sandbag berm to increase settling of solids
Upper Parking Lot Media Filter

Before Construction

During Construction

4" D50 CRUSHED STONE OR CORBLE (INSTALLED ADJACENT TO STORMWATER INLETS INTO EXISTING SUMP)

4" GRAVEL

NOT TRUE EXIST. GRADE APPROXIMATE LINWORK SHOWN FOR CLARITY. GRAVEL AND FILTER MEDIA INSTALLED WITHIN EXIST. GRADE (NO EXCAVATION REQUIRED)

RISER OVERFLOW STRUCTURE FOR TRUE SIZING DETAIL

PROTECT EXIST. ELECTRICAL POLE (APPROXIMATE LOCATION AND DIAMETER SHOWN)

PROP 36"x 36" CONCRETE FOUNDATION SEE CONSTRUCTION NOTE 1, SHEET 3

APPROX. ELEV. = 1892.0'

APPROX. ELEV. = 1887.0 FEET

APPROX. ELEV. = 190.5 FEET

6" DIA WELL SCREEN UNDERDRAIN SEE NOTE 1

12" DRAINAGE LAYER

0.5" CRUSHED STONE
New Road Runoff Inlet to CM-3

Currently under construction; completion pending extended period of dry weather
BMP Performance
BMP Performance: Dioxins

Dioxin concentrations are being significantly reduced for all BMP types.

<table>
<thead>
<tr>
<th>Average % reduction</th>
<th>95%</th>
<th>94%</th>
<th>79%</th>
<th>99%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median effluent concentration (µg/L)</td>
<td>6.1e-8</td>
<td>3.1e-10</td>
<td>3.2e-10</td>
<td>2.6e-8</td>
</tr>
</tbody>
</table>
BMP Performance: Lead

Lead concentrations are being significantly reduced for all BMP types.

- **CM Sites**
  - Influent: 100 µg/L
  - Effluent: 2.4 µg/L
- **Lower Lot Biofilter**
  - Influent: 100 µg/L
  - Effluent: 3.3 µg/L
- **ELV Treatment BMP**
  - Influent: 100 µg/L
  - Effluent: 2.0 µg/L
- **Detention Bioswales**
  - Influent: 100 µg/L
  - Effluent: 1.9 µg/L

**Average % reduction**
- CM Sites: 42%
- Lower Lot Biofilter: 22%
- ELV Treatment BMP: 53%
- Detention Bioswales: 76%

**Median effluent concentration (µg/L)**
- CM Sites: 2.4 µg/L
- Lower Lot Biofilter: 3.3 µg/L
- ELV Treatment BMP: 2.0 µg/L
- Detention Bioswales: 1.9 µg/L
Lower Lot Biofilter Diversion

The diversion to the biofilter prevented half of all small, frequent storms from discharging to the Northern Drainage through evapotranspiration in the BMP.
Remaining Stormwater Pollutant Sources
Panel is Leading a Study to Investigate Sources of OF009 Exceedances

Study acknowledges and is complementary to ongoing efforts to characterize and remediate soils, including ongoing work in shooting range.

Study Objectives:

- Where (spatially) are dioxins and lead in stormwater predominantly coming from within 009 watershed?

- What are the predominant pollutant sources to the paved subareas? E.g.,
  - pavement (weathered or newly resurfaced)
  - vehicles
  - soils near treated wood (including utility poles)
  - atmospheric deposition
  - drainage sediments
  - upland soils
Initial results indicate potential contributors to OF009 stormwater exceedances:

- **Dioxins:**
  - Soils near treated wood
  - Fine solids from all pavement types (e.g., weathered, newly resurfaced, high/low traffic)

- **Lead:**
  - Atmospheric deposition
  - Fine solids from higher traffic roads
Summary

**Q1:** What has recent water quality been like?

**A:** NPDES exceedances were infrequent during recent drought years. This season’s results are still coming in so we’ll know more soon, but initial results have been very good in light of heavy rains.

**Q2:** What is SSFL doing to improve water quality?

**A:** Recent BMP efforts have been significant and reflect the best available technology.

2013 Outstanding Stormwater BMP Award from California Stormwater Quality Association (CASQA)
Q3: How are the BMPs working?
A: Significant performance data have been collected, and all BMPs are highly effective at reducing their targeted pollutants.

Q4: What's causing the remaining NPDES exceedances?
A: Potential contributors include impacted soils and “urban background” sources, such as treated wood and pavement. We continue to address both through BMPs.

2013 Outstanding Stormwater BMP Award from California Stormwater Quality Association (CASQA)
Questions

THANK YOU!!

Additional Information (e.g., NPDES Permit, Panel Presentations, and Technical Reports):
www.boeing.com/principles/environment/santa_susana