SOIL

Sampling Point: ________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
4	2.5Y 4/1		7.5YR 5/6	60	C	M	Clayey	Sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes X No ____

Remarks:

HYDROLOGY

Algal Crusts

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- X Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- X Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ________

Water Table Present? Yes ____ No X Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ________

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/0
Applicant/Owner: LA County Flood Control State: CA Sampling Point: 7a
Investigator(s): Bramlet Riefner Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Upper Basin Local relief (concave, convex, none): Convex Slope (%): 3-6
Subregion (LRR): ______ Lat: 33 59 9 13 Long: 118 27 19.43 Datum: NAD 83
Soil Map Unit Name: ______ NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ___	Is the Sampled Area within a Wetland?	Yes X No ___
Hydric Soil Present? Yes ✓ No ___		
Wetland Hydrology Present? Yes ✓ No ___		

Remarks:
Salicornia zone
12ft wide

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1. Salicornia virginica	45	Y	obl
2. Atriplex prostrata	10	Y	facw
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	45	x 1 = 45
FACW species	10	x 2 = 20
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	55 (A)	65 (B)

Prevalence Index = B/A = 1.18

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Saturated

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 4/1						Sandy silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- X Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Oxidized root channels

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ✓ No ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- X Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ____________

Water Table Present? Yes ______ No ✓ Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes X No ______ Depth (inches): ____________

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/1/20

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 7b

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): upper basin Local relief (concave, convex, none): Convex Slope (%): 3

Subregion (LRR): ______ Lat: 33 59 9.18 Long: 118 27 19.54 Datum: NAD 83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ______	Is the Sampled Area within a Wetland?	Yes X No ______
Hydric Soil Present?	Yes ✓	No ______		
Wetland Hydrology Present?	Yes ✓	No ______		

Remarks:

10 ft wide

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Schinus Molle	40	Y	Up
2.			
3.			
4.			
	______ = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	______ = Total Cover		
Herb Stratum (Plot size: ______)			
1. Atriplex trangalanis	90	Y	FacW
2. Salicornia trangulans	10	Y	obl
3.			
4.			
5.			
6.			
7.			
8.			
	______ = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	______ = Total Cover		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	67	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	10	x 1 = 10
FACW species	90	x 2 = 180
FAC species		x 3 =
FACU species		x 4 =
UPL species	40	x 5 = 200
Column Totals:	140 (A)	390 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ______ No ______

Remarks:

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 2/1		No mottles				Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- _X_ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Oxidized root channel

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___________

Depth (inches): ___________

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- _X_ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- _X_ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? **Yes** ✓ **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/10

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 7C

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Convex Slope (%): 8

Subregion (LRR): ______ Lat: 33 59 9.22 Long: 118 27 19.77 Datum: NAD 83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	Is the Sampled Area within a Wetland? Yes ___ No X
Hydric Soil Present?	Yes ___ No X	
Wetland Hydrology Present?	Yes ___ No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1. Schinus molle	30		Up
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ___)			
1. Salicornia virginica	80	Y	Obl
2. Beta vulgaris	10	Y	Facup
3. Bromus diandrus	5	Y	up
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ___ % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	80	x 1 = 80
FACW species		x 2 =
FAC species		x 3 =
FACU species	10	x 4 = 40
UPL species	35	x 5 = 175
Column Totals:	125 (A)	295 (B)

Prevalence Index = B/A = 2.36

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50% No

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
	10YR 4/2		no mottle				Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): ____________

Water Table Present? Yes _____ No X Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): ____________

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/10

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 8

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Basin + Basin slope Local relief (concave, convex, none): Convex Slope (%): 4%

Subregion (LRR): ______ Lat: 33 59 9.4 Long: 118 27 18.46 Datum: NAD 83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ______	Is the Sampled Area within a Wetland? Yes ✓ No ______
Hydric Soil Present?	Yes ✓ No ______	
Wetland Hydrology Present?	Yes ✓ No ______	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Myoporum laetum	20	Y	NI
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: ______)			
1. Salicornia virginica	85	Y	Obl
2. Atriplex prostrata	10	Y	FacW
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	85	x 1 = 85
FACW species	10	x 2 = 20
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	95 (A)	105 (B)

Prevalence Index = B/A = 1.1

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ______

Remarks:
NI species not considered in dominance test & or prevalence index

SOIL

Sampling Point: ______

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
6	10YR 4/2		none				Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ______

Remarks: oxidized rhizospheres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- X Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ______

Water Table Present? Yes ______ No ✓ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches): ______

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/10

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 9

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Slope of Basin Local relief (concave, convex, none): Convex Slope (%): 20

Subregion (LRR): ______ Lat: 33 59 8.48 Long: 118 27 14.49 Datum: NAD83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	Is the Sampled Area within a Wetland?	Yes ___ No X
Hydric Soil Present?	Yes X No ___		
Wetland Hydrology Present?	Yes X No ___		

Remarks:

Atriplex band ~8ft wide

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Myoporum laetum	20	Y	~~Facu~~ NI
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: prostrate)			
1. Atriplex triangularis	85	Y	Facw
2. Limonium perezii	10	Y	Facup
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	85	x 2 = 170
FAC species		x 3 =
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	95 (A)	210 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50% No

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

NI species not evaluated in dominance test or prevalence index

SOIL Moist ~~Mottles~~ 2030 Sampling Point: ___

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
4	7.5Y3.1		7.5 YR5/8	3%	C	M	Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ✓ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ✓ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/10
Applicant/Owner: LA County Flood Control State: CA Sampling Point: 10
Investigator(s): Bramlet Riefner Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Basin slope Local relief (concave, convex, none): Convex Slope (%): 15%
Subregion (LRR): ______ Lat: 33 59 8.19 Long: 118 27 10.43 Datum: ______
Soil Map Unit Name: ______ NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	Is the Sampled Area within a Wetland? Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	

Remarks:

Salicornia band ~ 6ft wide

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1. Myoporum laetum	15	Y	NI
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ______)			
1. Salicornia virginica	75	Y	Obl
2. Atriplex prostrata	15	Y	Facw
3.			
4.			
5.			
6.			
7.			
8.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	75	x 1 = 75
FACW species	15	x 2 = 30
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	90 (A)	105 (B)

Prevalence Index = B/A = 1.2

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

NI species not included dominance test or prevelance index

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 2/1		5YR 5/4	20	C	M	Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? Yes X No ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply) Algal crust

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- X Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- X Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ________

Water Table Present? Yes ____ No X Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ________

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

S side

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: OX ford Basin City/County: LA County Sampling Date: 6/12/10

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 11

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Basin Slope Local relief (concave, convex, none): Convex Slope (%): 25%

Subregion (LRR): ______ Lat: 33 59 7.32 Long: 118 27 16.09 Datum: NAD 83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? No Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	Is the Sampled Area within a Wetland? Yes ___ No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:
Salicornia/Limonium band ~10ft wide

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1. Myoporum laetum	30	Y	NI
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ___)			
1. Salicornia virginica	85	Y	Obl
2. Limonium perezii	10	Y	Facu
3. Polypogon monspeliensis	5	Y	Facw
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	85	x 1 = 85
FACW species	5	x 2 = 10
FAC species		x 3 =
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	100 (A)	135 (B)

Prevalence Index = B/A = 1.35

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
NI species not included in dominance test or prevalence index

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 2/1						Sandyloam	
6	Gley1 6/N							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ✓ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? Yes ✓ No ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply) Moist soil

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ✓ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): ___________

Water Table Present? Yes _____ No X Depth (inches): ___________

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): ___________

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/10

Applicant/Owner: LA County Flood Control State: CA Sampling Point: 12a

Investigator(s): Bramlet Riefner Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Basin Slope Local relief (concave, convex, none): Convex Slope (%): 20%

Subregion (LRR): ______ Lat: 33 59 4.19 Long: 118 27 22.14 Datum: NAD83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? No Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks: Salicornia band ~10ft wide

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1. Salicornia virginica	85	Y	obl
2. Spergularia marina	10	Y	obl
3. Polypogon monspeliensis	3	N	facw
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	95	x 1 = 95
FACW species	3	x 2 = 6
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	98 (A)	111 (B)

Prevalence Index = B/A = 1.13

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 4/2		5YR 6/8	20%	M	C	Sandyloam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- _✓_ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? **Yes** _✓_ **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- _✓_ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- _X_ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No _✓_ Depth (inches): ________

Water Table Present? Yes ____ No _✓_ Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No _✓_ Depth (inches): ________

Wetland Hydrology Present? **Yes** _X_ **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Oxford Basin City/County: LA County Sampling Date: 6/12/6
Applicant/Owner: ______ State: CA Sampling Point: 126
Investigator(s): Bramlet Riefner Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Basin Slope Local relief (concave, convex, none): Convex Slope (%): 20%
Subregion (LRR): ______ Lat: 33 59 4.18 Long: 118 27 22.14 Datum: NAD83
Soil Map Unit Name: ______ NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No X	Is the Sampled Area within a Wetland? Yes ______ No X
Hydric Soil Present?	Yes ______ No X	
Wetland Hydrology Present?	Yes ______ No X	

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1. Limonium perezii	80	Y	FacUp
2. Melilotus indica	5	Y	Fac
3. Bromus chandros	3	N	UP
4. Salicornia virginica	5	Y	Obl
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	5	x 1 = 5
FACW species		x 2 =
FAC species	5	x 3 = 15
FACU species	80	x 4 = 320
UPL species		x 5 =
Column Totals:	90 (A)	341 (B)

Prevalence Index = B/A = 3.9

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
__ Prevalence Index is ≤3.0[1] No
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ______ No ______

Remarks:

SOIL

Sampling Point: ______

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
6	10YR 4/2		no mottles				Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (inches): ______

Water Table Present? Yes ______ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No X Depth (inches): ______

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX C
PHOTO DOCUMENTATION
OF PROJECT SITE WETLANDS

Sample Site 1: Corps Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 2A: Corps Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 2C: Coastal Commission Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 3: Corps Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 6: Corps Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 7c: Corps Jurisdictional Wetland Area — Vegetation and Soils

Sample Site 11a: Corps Jurisdictional Wetland Area — Vegetation and Soils

ATTACHMENT F: CURRICULA VITAE

Robert A. Hamilton

President, Hamilton Biological, Inc.

Expertise

Endangered Species Surveys
General Biological Surveys
CEQA Analysis
Population Monitoring
Bird Banding
Vegetation Mapping
Noise Monitoring
Open Space Planning
Natural Lands Management

Education

1988. Bachelor of Science degree in Biological Sciences, University of California, Irvine

Professional Experience

1994 to Present. Independent Biological Consultant, Hamilton Biological, Inc.

1988 to 1994. Biologist, LSA Associates, Inc.

Permits

Federal Permit No. TE-799557 to survey for the Coastal California Gnatcatcher and Southwestern Willow Flycatcher (expires 3/5/12)

Federal Bird Banding Subpermit No. 20431 (expires 1/31/11)

MOUs with the California Dept. of Fish and Game to survey for the San Diego Cactus Wren (expires 12/31/11), and the Coastal California Gnatcatcher and SW Willow Flycatcher (expires 5/31/12)

California Scientific Collecting Permit No. SC-001107 (expires 11/5/11)

Robert A. Hamilton has been providing biological consulting services in southern California since 1988. He spent the formative years of his career at the firm of LSA Associates in Irvine, where he was a staff biologist and project manager. He has worked as a full-time independent consultant since 1994, incorporating the enterprise as Hamilton Biological, Inc., in 2009. His consultancy specializes in the practical application of environmental policies and regulations to land management and land use decisions in southern California.

A recognized authority on the status, distribution, and identification of birds in California, Mr. Hamilton is the lead author of two standard references describing aspects of the state's avifauna: *The Birds of Orange County: Status & Distribution* and *Rare Birds of California*. Mr. Hamilton has also conducted extensive studies in Baja California, and for seven years edited the Baja California Peninsula regional reports for the journal *North American Birds*. He served ten years on the editorial board of *Western Birds* and regularly publishes in peer-reviewed journals. He is a founding member of the Coastal Cactus Wren Working Group and is presently updating the Cactus Wren species account for *The Birds of North America Online*. Mr. Hamilton's expertise includes floral identification and vegetation mapping. He served for a decade as Conservation Chair for the Orange County chapter of the California Native Plant Society and has a working knowledge of native plant restoration. He is a current member of the Los Angeles County Significant Ecological Areas Technical Advisory Committee (SEATAC).

Mr. Hamilton conducts general and focused biological surveys of small and large properties as necessary to obtain various local, state, and federal permits, agreements, and clearances. He also conducts landscape-level surveys needed by land managers to monitor songbird populations. Mr. Hamilton holds the federal and state permits and MOUs listed to the left, and he is recognized by federal and state resource agencies as being highly qualified to survey for the Least Bell's Vireo. He also provides nest-monitoring services in compliance with the federal Migratory Bird Treaty Act and California Fish & Game Code Sections 3503, 3503.5 and 3513. Mr. Hamilton has the capability of monitoring noise as it relates to nesting or roosting birds using an advanced Quest SoundPro unit that can provide second-by-second logging of noise levels at the nest; this allows documentation of the varying sound pressure levels that nesting birds are exposed to during construction and evaluation of any effects associated with different levels. He is also an expert photographer, and typically provides photo-documentation and/or video documentation as part of his services.

Drawing upon a robust, multidisciplinary understanding of the natural history and ecology of his home region, Mr. Hamilton works with private and public land owners, as well as governmental agencies and interested third parties, to apply the local, state, and federal land use policies and regulations applicable to each particular situation. Mr. Hamilton has amassed extensive experience in the preparation and critical review of CEQA documents, from relatively simple Negative Declarations to complex supplemental and recirculated Environmental Impact Reports. In addition to his knowledge of CEQA and its Guidelines, Mr. Hamilton understands how each Lead Agency brings its own interpretive variations to the CEQA review process.

Representative Project Experience

From 2007 to present, have reviewed biological resources sections of CEQA documents submitted to the County of Los Angeles Department of Regional Planning. Work includes evaluating the accuracy and adequacy of consultants' biological reports, developing impact analyses and mitigation measures, and recommending findings of significance. Under the same contract, prepared a list of drought-tolerant native plants, hyperlinked to web-based information, for use in landscaping in Los Angeles County. The County later revised the list, with some loss of information, but the original list and accompanying map of seven planting zones in the county are available here and here.

In 2009, under contract to the Palos Verdes Peninsula Land Conservancy, surveyed for the California Gnatcatcher and Cactus Wren across nine habitat reserves that constitute nearly all of the Portuguese Bend Natural Preserve in coastal Los Angeles County. The services provided included mapping and classifying all cactus scrub resources in the areas surveyed.

Board Memberships, Advisory Positions, Etc.

Los Angeles County Significant Ecological Areas Technical Advisory Committee (SEATAC) (2010–present)

Coastal Cactus Wren Working Group (2008–present)

American Birding Association: Baja Calif. Peninsula Regional Editor, *North American Birds* (2000–2006)

Western Field Ornithologists: Associate Editor of *Western Birds* (1999–2008)

California Bird Records Committee (1998–2001)

Nature Reserve of Orange County: Technical Advisory Committee (1996–2001)

California Native Plant Society, Orange County Chapter: Conservation Chair (1992–2003)

Professional Affiliations

American Ornithologists' Union

Cooper Ornithological Society

Institute for Bird Populations

California Native Plant Society

Southern California Academy of Sciences

Western Foundation of Vertebrate Zoology

Insurance

$3,000,000 professional liability policy (Axis)

$2,000,000 general liability policy (The Hartford)

$1,000,000 auto liability policy (State Farm)

Other Relevant Experience

Field Ornithologist, San Diego Natural History Museum Scientific Collecting Expedition to Central and Southern Baja California, October/November 1997 and November 2003.

Field Ornithologist, Island Conservation and Ecology Group Expedition to the Tres Marías Islands, Nayarit, Mexico, 23 January to 8 February 2002.

Field Ornithologist, Algalita Marine Research Foundation neustonic plastic research voyages in the Pacific Ocean, 15 August to 4 September 1999 and 14 to 28 July 2000.

Field Assistant, Bird Banding Study, Río Ñambí Reserve, Colombia, January to March 1997.

References

Provided upon request.

Under contract to the Conservation Biology Institute in San Diego County, conducted 2008 reconnaissance of those portions of the San Dieguito River Valley that were unburned or only partially burned during the massive Witch Fire, which consumed nearly 200,000 acres in October 2007. Three-pass surveys conducted at 14 sites between Lake Hodges and the San Pasqual Valley determined the presence or absence of Cactus Wrens and California Gnatcatchers. Work products included maps of all unburned and partially burned scrub communities, maps of weed infestations, and complete lists documenting the numbers of each vertebrate wildlife species detected during the surveys.

Under contract to the City of Orange, prepared the Biological Resources section of a hybrid Supplemental EIR/Draft EIR for the 6,900-acre Santiago Hills II/East Orange Planned Community project in central Orange County. This complicated document covered one proposed development area that already had CEQA clearance, but that required updating for alterations to the previously approved plan, and a much larger area that was covered under an existing Natural Communities Conservation Plan (NCCP). The SEIR/EIR was certified in November 2005.

During the 1990s and 2000s, worked with study-design specialists and resource agency representatives to develop the long-term passerine bird monitoring program for the 37,000-acre Nature Reserve of Orange County, and directed its implementation from 1996 to 2001 with additional contract work since then. Tasks have included 1) annual monitoring of 40 California Gnatcatcher and Cactus Wren study sites, 2) oversight of up to 10 constant-effort bird banding stations from 1998 to 2003 under the Monitoring Avian Productivity and Survivorship (MAPS) program, and 3) focused surveys for the Cactus Wren, and detailed mapping of cactus scrub habitat, across the NROC's coastal reserve in 2006 and 2007.

Third-Party CEQA Review

Under contract to cities, conservation groups, homeowners' associations, and other interested parties, have reviewed EIRs and other project documentation for the following projects:

- The Ranch Plan (residential/commercial, County of Orange)

- Southern Orange County Transportation Infrastructure Improvement Project (Foothill South Toll Road, County of Orange)
- Sunset Ridge Park (proposed city park, City of Newport Beach)
- Gregory Canyon Landfill Restoration Plan (proposed mitigation, County of San Diego)
- Montebello Hills Specific Plan EIR (residential, City of Montebello)
- Cabrillo Mobile Home Park Violations (illegal wetland filling, City of Huntington Beach)
- Newport Hyatt Regency (timeshare conversion project, City of Newport Beach)
- Lower San Diego Creek "Emergency Repair Project" (flood control, County of Orange)
- Tonner Hills (residential, City of Brea)
- The Bridges at Santa Fe Units 6 and 7 (residential, County of San Diego)
- Villages of La Costa Master Plan (residential/commercial, City of Carlsbad)
- Whispering Hills (residential, City of San Juan Capistrano)
- Santiago Hills II (residential/commercial, City of Orange)
- Rancho Potrero Leadership Academy (youth detention facility/road, County of Orange)
- Saddle Creek/Saddle Crest (residential, County of Orange)
- Frank G. Bonelli Regional County Park Master Plan (County of Los Angeles)

Contact Information

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Selected Presentations

Hamilton, R. A., and Cooper, D. S. 2009-2010. Conservation & Management Plan for Marina del Rey. Twenty-minute Powerpoint presentation given to different governmental agencies and interest groups.

Hamilton, R. A. 2008. Cactus Wren Conservation Issues, Nature Reserve of Orange County. One-hour Powerpoint presentation for Sea & Sage Audubon Society, Irvine, California, 25 November 2008.

Hamilton, R. A., Miller, W. B., Mitrovich, M. J. 2008. Cactus Wren Study, Nature Reserve of Orange County. Twenty-minute Powerpoint presentation given at the Nature Reserve of Orange County's Cactus Wren Symposium, Irvine, California, 30 April 2008.

Hamilton, R. A. and K. Messer. 1999-2004 Results of Annual California Gnatcatcher and Cactus Wren Monitoring in the Nature Reserve of Orange County. Twenty-minute Powerpoint presentation given at the Partners In Flight meeting: Conservation and Management of Coastal Scrub and Chaparral Birds and Habitats, Starr Ranch Audubon Sanctuary, 21 August 2004; and at the Nature Reserve of Orange County 10th Anniversary Symposium, Irvine, California, 21 November 2006.

Hamilton, R.A. Preliminary results of reserve-wide monitoring of California Gnatcatchers in the Nature Reserve of Orange County. Twenty-minute Powerpoint presentation given at the Southern California Academy of Sciences annual meeting at California State University, Los Angeles, 5 May 2001.

Publications

Hamilton, R. A. 2008. Cactus Wrens in central & coastal Orange County: How will a worst-case scenario play out under the NCCP? *Western Tanager* 75:2–7.

Erickson, R. A., R. A. Hamilton, R. Carmona, G. Ruiz-Campos, and Z. A. Henderson. 2008. Value of perennial archiving of data received through the North American Birds regional reporting system: Examples from the Baja California Peninsula. *North American Birds* 62:2–9.

Erickson, R. A., R. A. Hamilton, and S. G. Mlodinow. 2008. Status review of Belding's Yellowthroat *Geothlypis beldingi*, and implications for its conservation. Bird Conservation International 18:219–228.

Hamilton, R. A. 2008. Fulvous Whistling-Duck (*Dendrocygna bicolor*). Pp. 68-73 *in* Shuford, W. D. and T. Gardali, eds. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate

conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, CA, and California Department of Fish and Game, Sacramento, CA.

California Bird Records Committee (R. A. Hamilton, M. A. Patten, and R. A. Erickson, editors.). 2007. Rare Birds of California. Western Field Ornithologists, Camarillo, CA.

Hamilton, R. A., R. A. Erickson, E. Palacios, and R. Carmona. 2001–2007. *North American Birds* quarterly reports for the Baja California Peninsula Region, Fall 2000 through Winter 2006/2007.

Hamilton, R. A. and P. A. Gaede. 2005. Pink-sided × Gray-headed Juncos. *Western Birds* 36:150–152.

Mlodinow, S. G. and R. A. Hamilton. 2005. Vagrancy of Painted Bunting (*Passerina ciris*) in the United States, Canada, and Bermuda. *North American Birds* 59:172–183.

Erickson, R. A., R. A. Hamilton, S. González-Guzmán, G. Ruiz-Campos. 2002. Primeros registros de anidación del Pato Friso (*Anas strepera*) en México. Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología 73(1): 67–71.

Hamilton, R. A. and J. L. Dunn. 2002. Red-naped and Red-breasted sapsuckers. *Western Birds* 33:128–130.

Hamilton, R. A. and S. N. G. Howell. 2002. Gnatcatcher sympatry near San Felipe, Baja California, with notes on other species. *Western Birds* 33:123–124.

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Hamilton, R. A. 2001. Log of bird record documentation from the Baja California Peninsula archived at the San Diego Natural History Museum. Pp. 242–253 *in* Monographs in Field Ornithology No. 3. American Birding Association, Colorado Springs, CO.

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Wurster, T. E., R. A. Erickson, R. A. Hamilton, and S. N. G. Howell. 2001. Database of selected observations: an augment to new information on migrant birds in northern and central portions of the Baja California Peninsula. Pp. 204–237 *in* Monographs in Field Ornithology No. 3. American Birding Association, Colorado Springs, CO.

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EDUCATION

B.S., Zoology (cum laude), California State Polytechnic University, Pomona, 1976.
Graduate Studies, Biology, California State University, Long Beach, Fall Semester 1976
Graduate Studies, Ecology, California State Polytechnic University, Pomona, 54 Units completed. 1977-1979.

Federal Wetland Delineation Training, 1989, 1994.

CDFG Plant Voucher Collecting Permit No. 08051

CONSULTING EXPERIENCE

April 1988 to Present

Independent Consulting Biologist
Prepare biological assessments, develop the terrestrial biology sections of EIRs and assist with the permitting requirements for several larger environmental consulting firms and for individual clients. Recent projects include:

o CH2MHill, Highway 79 Re-alignment Project
Conducted field botanical surveys for a proposed the proposed highway 79 re-alignment project, west of Hemet. Field botanical surveys were preformed to document the special status plant species found in alkali grassland, alkali playa, and vernal pool habitats over a two year period. Following the data collection, assistance was provided in reviewing the GIS maps and with developing and reviewing the draft technical report for this study

o LSA, Greenspot Botanical Surveys
Field botanist on surveys for special status plant species on a 1,650 acre parcel in the City of Highland. Surveys concentrated on areas of alluvial fan sage scrub in the Santa Ana and Mill Creek washes and in areas of Riversidian sage scrub and chaparral.

o BonTerra Consulting, Whittier Hills Vegetation Mapping and Community Classification
Prepared a vegetation map for the 3,800 acre Puente Hills Habitat Authority. A vegetation classification system was developed, and plant communities mapped within the reserve. Surveys for special status plant species were also conducted for this project.

o Keane Biological Consulting, Big Canyon Creek Restoration Project.
Described and mapped the plant communities found within the watershed of Big Canyon Creek in Upper Newport Bay. Inventoried special status plant species found in the study area, especially the salt marsh bird's beak.

o Donna O'Neill Land Conservancy, Floristic Inventory and Special Status Species Study
In association with Fred Roberts a floristic inventory of the Donna O'Neill land conservancy was performed. This project attempted to document all of the plant species found within this reserve with a herbarium specimen. In addition, a study documenting the special status plant species was also conducted within the conservancy boundaries.

o Santa Ana River, SBKR Habitat Relationships, MEC Analytical Systems.
Conducted point intercept vegetation sampling to describe SBKR habitat in alluvial fan sage scrub and other plant communities in the Santa Ana River wash.

o Recovery Plan for three southern California plant species, U.S. Fish and Wildlife Service.
Co-authored a draft recovery plan for the Munz's onion, San Jacinto Valley crownscale, and thread-leaved brodiaea. Conducted literature reviews to determine the current status of these species, and developed an action plan for the recovery of these federally listed species.

Other examples of past projects include:

o Botanical surveys in the Angeles National Forest, to document the presence of sensitive plant species within proposed project sites.

o Monitoring of plant populations of two sensitive plant species in the Angeles National Forest.

o Botanical field crew member on a project to re-locate carbonate endemic plant species in the San Bernardino National Forest.

o Special status plant species studies within a proposed SKR study corridor on the Camp Pendleton Marine Corps Base.

o Special status plant species studies within the proposed Lovell Unit wetlands development at the San Jacinto Widlife Area.

o Special status plant species studies for the MWD Inland Feeder pipeline project, Riverside and San Bernardino Counties.

o Developed a classification system for the plant communities within Orange County and assisted in mapping the plant communities found within the County. Also developed lists of special status plant species and communities in the region.

o Conducted or supervised the completion of 150 line transects within coastal sage scrub series found within Orange County. This information was used to characterized habitat for a number of sensitive animal species restricted to this community.

o Conducted botanical field surveys for special status plant species for the Eastside Reservoir in western Riverside County.

o Performed field surveys for sensitive plant surveys on tailings from old tunnel construction in the Cabazon area.

o Prepared a map of plant communities and conducted surveys for special status plant species at the Prima Deshecha landfill in Orange County.

o Conducted field botanical surveys, to supplement previous biological studies on a proposed recreational facility in the Hill Canyon area of Thousand Oaks, Ventura County.

o Field monitoring of a new trail at Lake Skinner County Park. Conducted vegetation transects, and special status species monitoring, to determine the impacts of the new trail system.

o Supplemental botanical surveys for special status plant species within the southern portion of Lake Mathews.

o Mapped alluvial fan sage scrub and upland plant communities in the Deer-Day Canyon washes. Completed a vegetation map and described the plant communities, as part of an experiment to remotely map vegetation communities using ADAR.

Wetland Delineations

o Biological Resources and Wetland Assessment, Carbon Creek Channel, Orange County
Performed wetland delineations and determined Corps and CDFG jurisdictional areas along the earthen Carbon Creek channel.

o El Sobrante Landfill Expansion, Western Riverside County
Conducted jurisdictional determinations of ephemeral and perennial drainages within the area of the landfill expansion. Described riparian plant communities

Environmental Impact Reports

o El Sobrante Landfill Expansion DEIR, Western Riverside County
Conducted supplemental botanical surveys, to update previous studies within the project site. Prepared the biological resources section and determined the potential impacts of implementing the proposed landfill expansion.

o Old Webster Quarry EIR, San Bernardino County
Conducted field surveys to describe the existing alluvial sage scrub vegetation and developed the biological resources section of the DEIR. Significant issues included

potential impacts to the Santa Ana woolly-star and slender-horned spineflower which were determined from the applicant's survey data.

o Natural Environmental Study and Biological Assessment on the I-215 improvement project, western Riverside and San Bernardino Counties.
Conducted botanical and wetland surveys to document the existing biological resources within the study corridor. Assisted in developing the potential impacts and mitigation measures of the proposed highway project.

Revegetation Planning

o Bee Canyon Landfill, County of Orange.
Developed a revegetation plan and conducted installation monitoring on a 15 acre riparian revegetation project, as part of the mitigation for the Bee Canyon Landfill in Orange County.

o Calmat San Bernardino, Sand and Gravel Mine, San Bernardino County.
Assisted in the development of two revegetation plans in the Cajon Wash and Lytle Creek. Provided information on the composition of the existing alluvial fan sage scrub communities and recommended plant species to be used in the revegetation effort. Conducted quadrat counts of shrub seedlings in the revegetated areas, to establish the success of revegetation effort.

o Upper Newport Bay Regional Park, County of Orange.
Assisted in developing the proposed planting materials for the revegetation of eroded drainages and bluffs within the park. Reviewed planting lists and conducted limited field surveys to assist the development of the revegetation program.

November 1984 to April 1988

Staff Biologist-Harmsworth Associates (formerly VTN Environmental)
Responsible for the implementation and coordination of terrestrial biology projects. Conducted or managed field studies to assess existing animal and/or plant populations. Categories of experience and projects include:

Environmental Impact Reports and Assessments

Completed the terrestrial biology sections on the following projects:

- Rialto Cactus Basin EIR
- Ontario UPS Cargo Handling Facility EIR
- Walnut Canyon Erosion Control Project EIR, Anaheim Hills
- Catalina Airport EA
- Hunt Canyon Detention Basin EIR, Pearblossom

Technical Reviews

Conducted issues scoping, review of ERs, proposals and DEIRs/DEISs of the terrestrial biology sections of fourteen oil development projects in Santa Barbara County. Assisted in the development of permit conditions to be required for each of these proposed projects. Reviewed the revegetation, erosion control and spill contingency plans on four of these projects.

November 1978 to October 1984

Staff Botanist - VTN Consolidated, Inc., Irvine CA

Responsible for botanical and plant ecology projects. Conducted vegetative mapping and inventories, sensitive species surveys and community classifications. Examples of experience include:

Baseline Surveys

Conducted field studies, including quantitative transects, to describe the existing vegetation on the following projects:

- Quartz Hill Molybdenum Mine, southeast Alaska
- Paraho Oil Shale Development, Uintah County, Utah
- Geokinetics Oil Shale Development, Uintah County, Utah
- Sohio Tar Sand Development, Uintah County, Utah
- IRI Nahcolite Solution Mine, Rio Blanco, Colorado

EIRs, EISs and EAs

Developed the vegetation sections of the following environmental reports:

- Second Border Crossing, San Diego County, EIR/EIS
- Nashua-Hudson Circumferential Highway, New Hampshire, EIS
- Quartz Hill Molybdenum Mine, Southeast Alaska, EA

Stream Surveys

Performed ocular instream habitat and channel stability surveys in the San Bernardino National Forest, California and the Malheur National Forest, Northeast Oregon.

Conducted stream flow measurements, field water quality sampling and salinity measurements, as part of long term hydrology studies for a proposed mining project in southeast Alaska.

OTHER EXPERIENCE

March 1980 to June 1984

Independent Consulting Biologist

Conducted botanical surveys for the technical appendices of four EIRs in Los Angeles (including the Cities of: Claremont and Rancho Cucamonga) and San Diego Counties. Conducted field surveys, described the existing vegetation and determined potential impacts of the proposed development projects.

April 1977 to June 1979

Lecturer, Teaching Assistant. California Polytechnic University, Pomona.

Taught laboratories for General Biology, Invertebrate Zoology and Immature Insect Identification.

PAPERS PRESENTED/PUBLISHED

Developing Requirements for Native Plant Revegetation Programs. Paper presented at the second Native Plant Revegetation Symposium, 1987.

Riversidian Alluvial Fan Sage Scrub Revegetation, San Bernardino, California. Paper presented with Martha Blane at the Society of Ecological Restoration's Fifth Annual Conference, 1993.

Boyd, S., T.S. Ross, O. Mistretta and D. Bramlet. 1995. Vascular flora of the San Mateo Canyon Wilderness Area, Cleveland National Forest, California. Aliso 14(2): 109-139.
Developed the maps of riparian plant communities and assisted with the plant community descriptions for this project.

Roberts, F.M., S.D. White, A.C. Sanders, D.E. Bramlet, and S.D. Boyd. 2004.
The vascular plants of western Riverside County: An annotated checklist. F.M. Roberts Publications, San Luis Rey, California.
Assisted with the editing the checklist, modifying the introduction, and with reviewing the references for this book.

Roberts, F.M. and D.E. Bramlet. 2007a. Vascular plants of the Donna O'Neill Land Conservancy, Rancho Mission Viejo, California. Crossosoma 33(1) 2-38.

Roberts, F.M., S.D. White, A.C. Sanders, D.E. Bramlet, and S.D. Boyd. 2007b. Additions to the Flora of western Riverside County, California. Crossosoma 33(2) 55-69.

Status and proposed conservation measures for the San Jacinto Valley crownscale (*Atriplex coronata* var. *notatior*) in western Riverside County, California. Paper presented at the CNPS Conservation Conference, 2009

COLLECTING PERMITS, MOU'S

CDFG MOU for the collection of listed plant species valid to 2008.

PROFESSIONAL AFFILIATIONS

California Native Plant Society
Ecological Society of America
Society for Ecological Restoration
Southern California Botanists
California Botanical Society
Rancho Santa Ana Botanic Garden, Research Associate

Daniel S. Cooper

President, Cooper Ecological Monitoring, Inc.

Overview

Daniel S. Cooper is an authority on California bird ecology, identification and distribution, and has a strong background in southern California ecology and natural history. Specific areas of expertise include the Ballona Wetlands, eastern Santa Monica Mountains, Santa Clara River, Puente-Chino Hills, and remnant habitat patches on the floor of the Los Angeles Basin. Mr. Cooper has designed and managed numerous field-based research projects and assessments for a wide variety of clients, including public agencies and municipalities, large consulting firms, private landowners, and nonprofit environmental organizations. He is the author of <u>Important Bird Areas of California</u> (Audubon California 2004), and he continues to publish in peer-reviewed journals.

Mr. Cooper is permitted by the U.S. Fish and Wildlife Service to perform protocol surveys for the federally-threatened California gnatcatcher, and brings more than ten years of professional experience surveying for and observing special-status species throughout California. Mr. Cooper has held a Master Station Bird Banding permit from the U.S. Geological Survey, and has completed the requirements for a scientific collecting permit for the California Dept. of Fish and Game (anticipated summer 2009). Since the mid-1990s, Mr. Cooper has also conducted original research on bird distribution in Central and northern South America, primarily for private landowners.

Areas of Expertise

- Project Management
- Environmental Compliance (CEQA/NEPA) and Monitoring
- Bird and Wildlife Surveys
- Biological Assessments
- Protocol Surveys for the California Gnatcatcher and other special-status bird species

Years of Experience

CEM, Inc.: 4 years
Audubon California: 5 years

Education

MSc. (Biogeography)/1999/UC Riverside
BA/1995/Harvard University

Certification

U.S. Fish and Wildlife Permit No. TE-100008-0 (California Gnatcatcher).
USGS Master Station Banding Permit (#23049) (2001-2004)
CDFG Scientific Collecting Permit (in review)

Project Management Experience

Griffith Park Natural History Survey and Postfire Bio-monitoring. Researched and co-authored Griffith Park Wildlife Management Plan. Supervised development of website (www.griffithparkwildlife.org; with Cartifact, Inc.). Designed and carried out first-ever study of wildlife of Griffith Park, focusing on the 2007 burn area, including breeding/wintering birds, reptiles/amphibians, and bats with two subcontractors. Coordinated survey effort of reptiles/amphibians with USGS San Diego Field Station (Dr. Robert Fisher). Wildlife Management Plan submitted to City of Los Angeles, Dept. of Recreation and Parks on January 22, 2009; other technical reports submitted include those on bats (February 20, 2009) and birds (March 2, 2009).

Coastal Cactus Wren Survey, Los Angeles County. Organized and supervise a team of more than 20 volunteers for The Nature Conservancy (ongoing), the first-ever effort to document the actual range of this bird in the County.

Puente Hills Landfill Native Habitat Preservation Authority, Whittier, CA. As the staff ecologist, I managed $2M of restoration contracts in coastal sage scrub, oak/walnut woodland, and riparian habitats in western Puente Hills. I also developed and reviewed plant palettes and restoration design, and oversaw bio-monitoring of restoration sites (2007-08).

Audubon Christmas Bird Count. Organizer and compiler for two Los Angeles-area Christmas Counts: Los Angeles (since 2008) and Santa Clarita (since 2003). These are annual events that involve coordinating assignments and processing data sheets for 50+ volunteers, part of a worldwide effort to census birds each winter.

CoffeeReserve Program. Developed in 2006 with California-based coffee importer Rogers Family Co., this program has organized bird and wildlife surveys on supplier-farms in Chiapas, Mexico and Nicaragua, developed species lists and hiking maps for several properties, and pilot-testing an ecotourism internship program at a lodge/farm complex in northern Nicaragua in 2008.

Kingston Wildlife Research Station, Kingston, RI. Managed bird-banding station for Univ. of Rhode Island; other responsibilities included training volunteers, writing grants (obtained $10,000 for habitat management), bird/amphibian surveys of local natural areas (2005-06).

California Important Bird Area Project. From 2001-2004, researched, wrote and published the Important Bird Areas of California (Audubon California 2004), a compendium of 150 sites considered most critical for bird conservation in the state. This project involved convening a team of dozens of advisors and local experts from around the state, numerous site visits, and working with photographers, a layout designer, printer, and distribution company. This book now forms a cornerstone of Audubon's conservation work in California.

CEQA/NEPA Compliance

Marina del Rey Dredging and Sand-Separation Project, Los Angeles, CA. Designed survey protocol and carried out surveys and construction monitoring for wintering population of federally-threatened western snowy plover at Dockweiler State Beach. Attend weekly construction meetings with US Army Corps of Engineering and County of Los Angeles staff and contractors (ongoing).

Vista Canyon Ranch, Santa Clarita, CA. Conducted field visits, provided consultation on special-status plant and wildlife species as part of preparation of biological assessment of large parcel along the Santa Clara River (with Forde Biological Consultants and The River Project). Attend design meetings with developer, architect and consultants (ongoing).

Landmark Village, Newhall Ranch, Santa Clarita, CA. Provided analysis of and re-wrote special-status species accounts in Biological Resources section of EIR for large residential and commercial development along Santa Clara River for Audubon California (2007) and Pacific Coast Conservation Alliance (2008).

Broad Beach, Malibu, CA. Conducted field visits and helped prepare the Biological Assessment (with Robert A. Hamilton) for Malibu Bay Company development at Broad Beach. Analyzed impacts to potential ESHA (Environmentally Sensitive Habitat Area) at site (2008).

San Gabriel River Discovery Center, South El Monte, CA. Conducted bird surveys and habitat assessment and provided mitigation recommendations for proposed nature center and office/conference facility in the Whittier Narrows Recreation Area. Final reports submitted to the Los Angeles and San Gabriel Rivers and Mountains Conservancy November 7, 2008.

Faunal/Floral Surveys (clients listed in parentheses)

Bird surveys and analysis, incl. mist-netting, point-counts, spot-mapping, and/or walking transects:

- Playa Vista Riparian Corridor, Los Angeles, CA (ongoing, for E Read Consulting, Inc.)
- Ballona Wetlands Ecological Reserve, Playa del Rey, CA (ongoing; Friends of Ballona Wetlands)
- Ballona Freshwater Marsh, Los Angeles, CA (Center for Natural Lands Management)
- Ballona Outdoor Learning and Discovery site, Playa del Rey, CA (Ballona Wetlands Foundation)
- Malibu Lagoon, Malibu, CA (Resource Conservation District of the Santa Monica Mountains)
- Nicholas Creek mouth, Malibu, CA (Wishtoyo Foundation)

Miscellaneous bird surveys:

- Kern River Preserve, Weldon, CA (incl. MAPS Station; Kern River Research Center)
- Audubon Center in Debs Park, Los Angeles (incl. MAPS Station; Audubon California)
- Western Riverside Co. (UCR/Western Riverside County Multi-Species Habitat Conservation Plan; Dartmouth College)
- Audubon Sanctuaries in Central MA (Massachusetts Audubon Society)
- Kingston Wildlife Research Station, Kingston, RI (Univ. of Rhode Island)
- Angelus Oaks Transect, San Bernardino Mountains, CA (USGS Breeding Bird Survey)
- Pasoh Forest Reserve, Malayisa (Univ. of Malaysia)
- Chequamagon National Forest, Wisconsin (Univ. of Missouri)
- Private forest reserves in Guatemala, Costa Rica, Panama and Venezuela (various owners)

Biological assessments (multi-taxa):

- Cahuenga Peak, Los Angeles, CA (ongoing; The Trust for Public Land)
- Sanford-Avalon Community Garden, Watts, CA. Conduct (ongoing; Los Angeles Community Garden Council)
- Open space parcels in Northeastern Los Angeles, CA (Mountains Recreation and Conservation Authority)
- Mission Creek, South El Monte, CA (Los Angeles Conservation Corps)
- Elephant Hill, Montecito Heights (Los Angeles), CA (Committee to Save Elephant Hill)

Experience with Special-status Species

Coastal California gnatcatcher *Polioptila californica californica*

More than 50 hours of experience conducting protocol surveys for this species in Los Angeles and Riverside counties; Discovered previously-unknown populations in western Puente Hills and northern Chino Hills (both Los Angeles Co.).

Western snowy plover *Charadrius alexandrinus nivosus*

Surveyed for and monitored this species at Dockweiler State Beach, Los Angeles; volunteer for a countywide survey in Los Angeles County (Surfrider Foundation, Pacific Coast Conservation Alliance)

Western burrowing owl *Athene cunicularia hypugaea*

Volunteered (Antelope Valley, Los Angeles Co., CA) on a statewide breeding population census for Institute for Bird Populations.

Mountain plover *Charadrius montanus*

Long-billed curlew *Numenius americanus*

Volunteered in surveys for both grassland species in agricultural fields in the Imperial Valley, CA, with researchers from the Los Angeles Co. Museum of Natural History.

Coastal cactus wren *Campylorhynchus brunneicapillus sandiegensis*

Organizing Los Angeles County portion of region-wide survey for The Nature Conservancy.

Least Bell's Vireo *Vireo bellii pusillis*

Assessed potential breeding habitat at several sites in Los Angeles and Riverside counties.

Belding's savannah sparrow *Passerculus sandwichensis beldingi*

Surveyed for this and other coastal wetland species at Ballona Freshwater Marsh and adjacent Ballona Wetlands.

Survey experience with the following additional special-status species:

BIRDS

Brant *Branta bernicla*
Cackling Canada goose *B. hutchinsii leucopareia*
Ruffed grouse *Bonasa umbellus*
California brown pelican *Pelecanus occidentalis californicus*
Double-crested cormorant *Phalacrocorax auritus*
Great egret *Ardea alba*
Great blue heron *Ardea herodias*
American bittern *Botaurus lentiginosus*
Snowy egret *Egretta thula*
Least bittern *Ixobrychus exilis*
Black-crowned night-heron *Nycticorax nycticorax*
Cooper's hawk *Accipiter cooperii*
White-tailed kite *Elanus leucurus*
Merlin *Falco columbarius*
Peregrine falcon *F. peregrinus*
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*
Southwestern willow flycatcher *Empidonax traillii extimus*
Brown-crested flycatcher *Myiarchus tyrannulus*
Loggerhead shrike *Lanius ludovicianus* (incl. *mearnsi*)
Least bell's vireo *Vireo bellii pusillus*
California horned lark *Eremophila alpestris actia*
Yellow warbler *Dendroica petechia*
Yellow-breasted chat *Icteria virens*
Southern California rufous-crowned sparrow *Aimophila ruficeps canescens*

Grasshopper sparrow *Ammodramus savannarum*
Bell's sage sparrow *Amphispiza belli belli*
Black-chinned sparrow *Spizella atrogularis*
Summer tanager *Piranga rubra*
Kern red-winged blackbird *Agelaius phoeniceus aciculatus*
Tricolored blackbird *Agelaius tricolor*
Yellow-headed blackbird *Xanthocephalus xanthocephalus*

OTHER WILDLIFE
Coast horned lizard *Phrynosoma coronatum*
Orange-throated whiptail *Aspidoscelis hyperythra*
Coastal western whiptail *Aspidoscelis tigris stejnegeri*
Ringneck snake *Diadophis punctatus*
Northern red-diamond rattlesnake *Crotalus ruber ruber*
San Diego black-tailed jackrabbit *Lepus californicus bennettii*

PLANTS
Southern California black walnut *Juglans californicus*
Hubby's Phacelia *Phacelia cicutaria* var. *hubbyi*
Catalina mariposa-lily *Calochortus catalinae*
Slender mariposa-lily *Calochortus clavatus*
Plummer's mariposa-lily *Calochortus plummerae*
Humboldt lily *Lilium humboldti*

Expert Witness/Declaration

Expert witness deposition regarding the ecological function of eucalyptus trees in the Malibu/Santa Monica Mountains area, Sidley vs. Thurman (settled out-of-court Oct. 2008).

Declaration in support of plaintiffs' motion for summary judgment in NEPA case involving stream-filling, Wishtoyo Foundation/Ventura Coastkeeper et al. vs. Francis J. Harvey, Secretary of the Army et al. and Pardee Homes. U.S. District Court, Central Coast of California (Nov. 2007).

Teaching

University of California, Los Angeles. *Instructor, UCLA Extension School*: Developed courses on conservation biology and bird monitoring, 2001 - 2003.

University of California, Riverside. *Graduate Teaching Assistant*: Geomorphology, Natural Disasters, and Astronomy, 1998-1999.

Boards/Committees

Griffith Park Postfire Recovery Team. Wildlife Team Leader, 2007-2008
California Department of Water Resources. Salton Sea Restoration Advisory Committee, 2003-2005
California Partners-in-Flight. Executive Steering Committee, 2003-2005
Los Angeles and San Gabriel Rivers and Mountains Conservancy. Tech. Advisory Board, 2002- 2005
Central Valley Habitat Joint Venture. Executive Steering Committee, 2001-2003
Friends of the Los Angeles River. Technical Advisory Board, 1989-2001

Professional Societies/Affiliations

Western Field Ornithologists
Neotropical Bird Club
Southern California Academy of Sciences
Southern California Botanists

Awards

Semifinalist honor, Interactive Media. International Science & Engineering Visualization Challenge (National Science Foundation/*Science*), for the website "Griffith Park Wildlife Management Plan", online at: www.griffithparkwildlife.org 2008.

Certificate of Appreciation, "In recognition of outstanding citizenship and activities enhancing community betterment" (City of Los Angeles), for service to the Griffith Park Postfire Recovery Team, 2008.

Audubon "ACE" Award, Debs Park Audubon Center planning team (National Audubon Society), 2001.

Education Project Award - University of California, Riverside (American Planning Association, Inland Empire Section), for the website "Understanding the Plants and Animals of the Western Riverside County Multiple Species Habitat Conservation Plan", online at www.ecoregion.ucr.edu, 2001.

Winner, Great Texas Birding Classic ("Team Wildbird", sponsored by Wildbird magazine), 1999.

Chronology

1995 - 1996	Research Associate, Kern River Research Center
1997 - 1999	Graduate Research Associate, Univ. of California, Riverside
1999 - 2001	Biologist, National Audubon Society
2001 - 2005	Dir. of Bird Conservation (California), National Audubon Soc.
2005 - 2006	Manager, Kingston Wildlife Research Station
2005 -	President, Cooper Ecological Monitoring, Inc.

Contact Information

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Los Angeles, CA 90036
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Email: dan@cooperecological.com
Website: www.cooperecological.com

Publications

Books

Cooper, D.S. 2004. Important Bird Areas of California. Audubon California, Pasadena. 286 pp.

Book sections

Cooper, D.S. 2007. "Playa del Rey/Ballona Freshwater Marsh", p. 336, *In*: A Birder's Guide to Southern California, Schram, B., American Birding Association, Colorado Springs, CO.

---------------- 2005. "Ernest E. Debs Regional Park & Audubon Center", pp. 16-17, *In:* Birding Guide to the Greater Pasadena Area, Pasadena Audubon Soc., Pasadena, CA.

Peer-reviewed papers

Mathewson, P., S. Spehar and D.S. Cooper. 2008. A preliminary large mammal survey of Griffith Park, Los Angeles, California. Bull. So. Calif. Acad. Sci. 107:57-67.

Cooper, D.S. 2008. The use of historical data in the restoration of the avifauna of the Ballona Wetlands, Los Angeles County, California. Natural Areas Journal 28:83-90.

---------------- 2006. Annotated checklist of extirpated, reestablished, and newly-colonized avian taxa of the Ballona Valley, Los Angeles County, California. Bull. So. Calif. Acad. Sci. 105:91-112.

---------------- 2006. Shorebird use of a novel habitat: the lower Los Angeles River channel. Western Birds 37:1-6.

Cooper, D.S, R. Carmona, and R.A. Erickson. 2004. State of the Region: Baja California Peninsula. North American Birds 58:605-606.

Cooper, D.S. 2003. New distributional and ecological information on birds in southwestern Guatemala. Cotinga 19:61-64.

---------------- 2002. Geographical associations of breeding bird distribution in an urban open space. Biological Conservation 104:205-210.

---------------- 2000. Breeding landbirds of a highly-threatened open space: The Puente-Chino Hills, California. Western Birds 31:213-234.

---------------- 1999. Notes on the birds of Isla Popa, western Bocas del Toro, Panama. Cotinga 11:23-26.

Cooper, D.S. and C.M. Francis. 1998. Nest predation in a lowland Malaysian rainforest. Biological Conservation 85:199-202.

Cooper, D.S. 1998. Birds of the Rio Negro Jaguar Preserve, Colonia Libertad, Costa Rica. Cotinga 8:17-22.

Rowe, S.P. and D.S. Cooper. 1997. Confirmed nesting of Lazuli Bunting with Indigo Bunting in Kern County, California. Western Birds 28:225-227.

Cooper, D.S. and D. Perlman. 1997. Conservation of biodiversity on California military bases: Implications of base closures. Fremontia 25:3-8.

Book reviews

Cooper, D.S. 2004. Review of *Birds of the Salton Sea: Status, biogeography and ecology*, by M.A. Patten, G.M. McCaskie and P. Unitt. University of California Press. Western Birds 35:114-117.

Professional reports

Ballona Wetlands

Cooper, D.S. 2008. Quarterly bird survey, Fall 2008. Playa Vista Riparian Corridor, Los Angeles, California. Prepared for E Read and Associates, Orange, California, Oct. 27, 2008.

---------------- 2008 Breeding bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for E Read and Associates, Orange, California, July 2, 2008.

---------------- 2008. 2007-08 Winter bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for E Read and Associates, Orange, California, Jan. 12, 2007.

---------------- 2007. 2007 Fall bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for E Read and Associates, Orange, California, Oct. 8, 2007.

---------------- 2007. 2007 Breeding bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, July 13, 2007.

---------------- 2007. Chapter 6: Birds of the BOLD Project Site. In: J.H. Dorsey and S. Bergquist (Eds.), "A baseline survey of the Ballona Outdoor Learning & Discovery (BOLD) Area, Ballona Wetlands, Los Angeles County, California". Report submitted to The California Coastal Conservancy and Santa Monica Bay Restoration Commission by the Ballona Wetlands Foundation, April, 2007.

---------------- 2007. 2006-07 Winter bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Jan. 20, 2007.

---------------- 2006. 2006 Fall bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Oct. 23, 2006.

---------------- 2006. 2006 Breeding bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, July 14, 2006.

---------------- 2006. 2005-06 Winter bird survey. Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Jan. 7, 2006.

---------------- 2005. 2005 Fall bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Nov. 8, 2005.

---------------- 2005. 2005 Breeding bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, July 11, 2005.

---------------- 2005. 2004-05 Winter bird survey. Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Feb. 8, 2005.

---------------- 2005. Checklist of birds of Ballona Valley, Los Angeles County, California (Online). Available: http://www.cooperecological.com/ballona_field_checklist_v.htm.

---------------- 2004. 2004 Fall bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, Nov. 2, 2004.

---------------- 2004. 2004 Breeding bird survey, Ballona Freshwater Marsh at Playa Vista, Playa del Rey, California. Prepared for the Center for Natural Lands Management, Fallbrook, California, July 25, 2004.

---------------- 2004. Ballona Wetlands Training Manual, Audubon Ballona Wetlands Program. 54 pp.

<u>Misc. Los Angeles area</u>

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---------------- 2008. Summer bird survey for San Gabriel River Discovery Center. Prepared for Los Angeles and San Gabriel Rivers and Mountains Conservancy (RMC), Azusa, Calif. Nov. 7, 2008.

---------------- 2008. Habitat Assessment for Whittier Narrows Natural Area (eastern portion). Prepared for Los Angeles and San Gabriel Rivers and Mountains Conservancy (RMC), Azusa, Calif. Nov. 7, 2008.

---------------- 2008. Biota report for La Habra Heights reservoir relocation project, La Habra Heights, Los Angeles Co., California. Prepared for Civiltec Engineering, Inc., Monrovia, California. Oct. 3, 2008.

Forde, A.M. and E. Read, with D.S. Cooper, D. Crawford, I.P. Swift and R. Francis, Jr. 2008. Biological Assessment, Vista Canyon Ranch, Los Angeles Co., California. Prepared for Vista Canyon Ranch, LLC (Valencia, Calif.) and The River Project (Studio City, Calif.), August 27, 2008.

Cooper, D.S. 2008. Protocol survey for California Gnatcatcher *Polioptila californica* at "Terraces at Hidden Hills" in Calabasas, Los Angeles County, California. Prepared for Impact Sciences, Camarillo, California. June 12, 2008.

---------------- 2008. Protocol survey for California Gnatcatcher *Polioptila californica* at "KRLA site" near Walnut/Covina, Los Angeles County, California. Prepared for Impact Sciences, Camarillo, California. June 12, 2008.

---------------- 2008. Initial Biological Assessment: Mission Creek. Prepared for Los Angeles Conservation Corps. March 31, 2008.

Hamilton, R.A., D.S. Cooper, W.R. Ferren and C.P. Sandoval. 2008. Biological Resources Assessment, 30732 Pacific Coast Hwy., Malibu, California. Prepared for Malibu Bay Company, Feb. 19, 2008.

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---------------- 2007. Protocol survey for California Gnatcatcher *Polioptila californica* at the "pit", a former quarry site adjacent to Claremont College (Los Angeles/San Bernardino counties), Spring 2007. Prepared for Impact Sciences, Camarillo, California. June 22, 2007.

---------------- 2006. Birds of Malibu Lagoon: Final Report, 2006. Prepared for the Resource Conservation District of the Santa Monica Mountains, Topanga, California, August 8, 2006.

---------------- 2005. Breeding bird survey, Nicholas Creek mouth, Malibu, California. Prepared for the Wishtoyo Foundation, Oxnard, California, June 10, 2005.

---------------- 2005. Debs Park Teacher-Naturalist Training Manual, Audubon Center at Debs Park, 45 pp.

---------------- 2004. Rapid Biological Assessment of Elephant Hill (Los Angeles/South Pasadena, CA). May 25, 2004.

---------------- 1999. Debs Park Habitat Management Plan. Audubon Center at Debs Park, 24 pp.

Scott, T.A. and D.S. Cooper. 1999. Summary of avian resources of the Puente-Chino Hills Corridor. January, 1999. Available (Online): http://www.hillsforeveryone.org/

Cooper, D.S., C. D'Agosta, K. Garrett, L. Dwyer-Hade, V. Jigour, A. Thomas, K. Bullard, S. Manion, T. Alsobrook, M. Campbell, A. Dove. 1998. Environmental review of vegetation removal in Los Angeles County rivers and streams. Mountains Recreation and Conservation Authority/EPA Region IX, San Francisco.

<u>Latin America</u>

Cooper, D.S. 2007. Ecological assessment of five coffee farms in north-central Nicaragua. Prepared for Rogers Family Companies, Apr. 28, 2007.

---------------- 2006. Ecological assessment of seven coffee farms in the Soconusco region of Chiapas, Mexico. Prepared for Rogers Family Companies, Dec. 1, 2006.

Popular articles

Los Angeles County Sensitive Bird Species Working Group (incl. Daniel S. Cooper). 2008. Los Angeles County's Sensitive Bird Species. *Western Tanager* (newsletter of Los Angeles Audubon Society) 75:E1-E11.

Cooper, D.S. 2007. Wildlife response to the Griffith Park fire. *Water Wise* (newsletter of the Los Angeles and San Gabriel Rivers Watershed Council) 11(1):10-11. Fall 2007.

---------------- 2005. A duck club in L.A.?: The near-death and slow recovery of the Ballona Wetlands. *California Waterfowl*. June/July 2005.

---------------- 2005. Birding the Ballona Wetlands. *Winging It* (newsletter of American Birding Association). 17(2):1-4.

---------------- 2000. Rediscovering the lower Arroyo Seco. *Western Tanager* 67:1-3.

---------------- 2000. ("Off the beaten path") The Huntington Library. *Western Tanager* 66:6-7.

---------------- 1999. From the front lines: a birding tour leader offers his perspective. *Wildbird*. October, 1999.

Conference Presentations

Cooper, D.S. Cactus Wrens of the Puente-Chino Hills: 1998 - 2008 (presentation). *Coastal Cactus Wren Symposium*. April 1, 2008. Irvine Ranch Water District, Irvine, CA.

---------------- Rethinking "Shade-grown" (presentation, in Spanish). *Annual meeting of Rogers Family Company coffee suppliers* (c. 50 growers from throughout Latin America). August 2, 2007. Selva Negra Lodge, Matagalpa, Nicaragua.

---------------- Wildlife of Griffith Park (presentation). *Los Angeles and San Gabriel Rivers Watershed Council Symposium*. June 20, 2007. The Autry National Center in Griffith Park, Los Angeles, CA.

---------------- Avian extirpation and colonization at the Ballona Wetlands, Los Angeles County, California (presentation). *Southern California Academy of Sciences Annual Meeting*, May 20-21, 2005, Loyola Marymount University, Los Angeles, CA.

---------------- Important Bird Areas of California (presentation). *California All-Bird Conservation Workshop*. November 15-16, 2004, Sacramento, CA.

Cooper, D.S. and E. Galicia (co-moderators). Community participation, birding trails and birding festivals – tools for IBA outreach and implementation. *Important Bird Areas Conference*, August 14, 2004. Sierra Vista, AZ.

Cooper, D.S. An exploration of the importance of the Salton Sea and associated ecosystems to birds (presentation). *California Water Dialogue*, Sept. 16, 2003. San Diego, CA.

---------------- Fall migration of shorebirds along the lower Los Angeles River (poster). *27th Annual Meeting of the Western Field Ornithologists*. October 10-13, 2002. Irvine, CA.

---------------- The use of riparian bird species as indicators of restoration success in the Los Angeles area (presentation). *Southern California Academy of Sciences Annual Meeting*, May 19-20, 2000, University of Southern California, Los Angeles, CA.

Cooper, D. and T. Scott. Patterns of breeding bird distribution in a large urban open space reserve (presentation). *4th International Urban Wildlife Conservation Symposium*. May 1-5, 1999. University of Arizona. Tucson, AZ.

Wehtje, W. and D.S. Cooper. Range expansion in the Great-tailed Grackle (poster). *North American Ornithological Conference*. April 6-12, 1998. St. Louis, MO.

Cooper, D.S. Southern California's camouflaged national parks: military reservations (presentation). *Nature's Workshop: Environmental Change in 20th Century Southern California*. Sept. 18-20, 1997. California State University, Northridge, CA.

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RECENT EMPLOYMENT & EXPERIENCE

2002-present **President**, *InnoVeyda-BioVeyda Consulting. Torrance, CA., USA*
Performing projects, and providing advice, regarding taxonomy, biodiversity assessments, research, project management, and data processing. Most recently completed project: Family-level Invertebrate Inventory of the Santa Monica Mountains Recreation Area, for the National Park Service. Pending project: Invertebrate Survey of the Madrona Marsh Preserve in Torrance, California, for the City of Torrance and the Friends of Madrona Marsh.

2002-present **Docent and Photographer**, *Friends of Madrona Marsh. Torrance, CA., USA*
Researching and photo-documenting the biodiversity at the Madrona Marsh Preserve. Educating youth on ecosystems, as well as on environmental issues in general. Planning, coordinating, and leading educational tours of one of the last remaining vernal marsh eco-systems in L.A. County.

2000-present **Docent**, *Children's Nature Institute. Los Angeles, CA., USA*
Introducing inner city and at-risk children to nature by leading hands-on educational field trips in the Santa Monica Mountains National Recreation Area and other natural areas in L.A. County.

2003-2006 **Vice-President of the Board of Directors**, *Friends of Madrona Marsh. Torrance, CA., USA*
Organizing and presiding board meetings, planning and coordination of restoration efforts, and curriculum and policy development and implementation.

2002 **Visiting Professor**, *Computer Science Department, Lamar University. Beaumont, TX., USA*
Taught graduate courses in Pattern Recognition, Image Processing, and Machine Learning.

1998-2001 **Director**, *Advanced Signal and Image Processing, IOS. Torrance, CA., USA*
Scientific research, as well as team and project management.

EDUCATION

1991 Ph.D. degree in Computer Science
minor in Mathematics, *University of Alabama in Huntsville, Huntsville, AL, USA*

1986 M.Sc. and B.Sc. equivalents in Information Science
minor in Biology with focus on Zoology and Ecology, *University of Amsterdam, The Netherlands*

SUPPLEMENTAL EDUCATION

- Environmental Restoration, *California State University, Dominguez Hills and El Camino College,* Fall 2003
- Environmental Interpretation, *California State University, Dominguez Hills and El Camino Coll.,* Spring 2004
- Wilderness Training Course, *The Los Angeles Chapter of the Sierra Club,* Winter 2006

OTHER PROFESSIONAL ACTIVITIES

- Performed thousands of taxonomic identifications, predominantly of Southern Californian invertebrates
- Taught *Entomology*, as part of the Pasadena City College course: *Zoology*, Pasadena, 2007
- Taught *Insects & other Invertebrates and their Habitats*, for the California State University, Dominguez Hills and El Camino College joint course on Environmental Restoration, September 2007
- Invited speaker and lecturer for scientific panels and short courses
- Reviewed and edited publications in a range of scientific disciplines
- Author of more than sixty scientific publications and two pending patents

LANGUAGE SKILLS

English, Dutch, German, basic French, and a dash of Hindi

Camm Churchill Swift, Ph.D.

SENIOR PROJECT BIOLOGIST

DISCIPLINE/SPECIALTY

- Ichthyology
- Fishery Biology
- Estuarine Biology

EDUCATION

- Ph.D., Department of Biology, Florida State University, Tallahassee, 1970
- M.A., Department of Zoology, University of Michigan, Ann Arbor, 1965
- A.B., Department of Zoology, University of California, Berkeley, 1963

TRAINING/CERTIFICATIONS

- California Department of Fish and Game-Resident Scientific Collecting Permit No. 801056-01 with Memoranda of Understanding covering federally listed tidewater goby, Santa Ana sucker, unarmored threespine stickleback, southern steelhead & incidental take of redlegged frog and Species of special concern arroyo chub and speckled dace.
- USFWS U. S. Fish and Wildlife Service Scientific Collecting Permit (10A) No. TE793644-5 for tidewater goby, Santa Ana sucker and unarmored three-spined stickleback
- NOAA Fisheries project specific southern steelhead handling permit

SUMMARY OF QUALIFICATIONS

Dr. Swift is one of the leading authorities on the biology, management, and conservation of the fresh and brackish water fishes of coastal southern California. He served on the Recovery Teams for the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) and tidewater goby (*Eucyclogobius newberryi*), both federally endangered species, and was an author for the recovery plans for both fish. He currently serves on the Technical Recovery Teams for tidewater goby (U. S. Fish and Wildlife Service) and southern steelhead (National Marine Fisheries Service). Dr. Swift is a member of the Desert Fishes Council.

With over 30 years of experience working in the field, Dr. Swift is one of the most knowledgeable persons in the state on the status and distribution of freshwater fishes of coastal southern California. He has a strong understanding of their biology, requirements for recovery, and habitat restoration needs to improve their conservation status. He has worked with a wide variety of public and private agencies to conserve these species and advise on habitat restoration for their benefit.

Dr. Swift also has major expeditionary experience in the fresh and estuarine waters of the southeastern United States, marine shore fishes of Pacific coastal Mexico and Costa Rica (including Cocos Island), the Indus River Delta, Pakistan, and Amazonian Peru. He has done extensive fieldwork, led field crews, conducted literature searches, and written several comprehensive reports and peer reviewed publications. He serves as an expert witness in fishery conservation issues. He also has considerable experience in identification and analysis of archaeological and fossil fish bones from the southeastern United States, southern California, and coastal Pakistan.

RELEVANT EXPERIENCE

RESEARCH EXPERTISE

Dr. Swift is a recognized expert in the biology, conservation, and paleontology of freshwater and estuarine fishes in coastal southern California, including the federally endangered brackish water species, the tidewater goby, *Eucyclogobius newberryi*, the migratory (anadromous) and federally listed steelhead (*Oncorhynchus mykiss*), and the federally threatened Santa Ana sucker (*Catostomus santaanae*). Of approximately eight species of freshwater fishes native to the Los Angeles Basin, the Santa Ana sucker, Santa Ana speckled dace (*Rhinichthys csculus ssp*.), and arroyo chub (*Gila orcutti*) are endemic in this region and have been highly impacted by man. The severe alteration of freshwater and estuarine habitat in much of California has led to most of the freshwater and brackish water species having special conservation status.

Estuarine Fishes of Ballona Marsh, Los Angeles County, California

Dr. Swift is coauthor of “Estuarine Fish Communities of Ballona Marsh [Los Angeles County]”, In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local Coastal Plan, Los Angeles Co. Dept. Regional Planning. This one year study sampled fishes monthly at 13 stations in the marsh and provided the most comprehensive study of the fish communities of the marsh to date. It continues to be followed to monitor changes to the fish community. Currently Dr. Swift serves on the Scientific Advisory Committee for the Ballona Marsh Restoration.

Study of Santa Ana Sucker Biology on the Middle Santa Ana River, Riverside, California

As part of the Santa Ana Sucker Conservation program on the Santa Ana River, Dr. Swift participated in a long-term study to assess the population size and distribution of Santa Ana Suckers in the Santa Ana River near the city of Riverside, California. The program was administered by the multi agency Santa Ana Water Projects Authority (SAWPA) in Riverside. Survey protocols included annual summer surveys employing electrofishing using three pass depletion transects at locations in the mainstem Santa Ana River near the city of Riverside. Santa Ana suckers were measured, weighed, and tagged with PIT tags if over about 80 mm standard length. Dr. Swift holds federal permits for capture, handling and PIT tagging of the suckers. In addition to the mainstem river sites, electrofishing efforts were conducted at sites in the mainstem and tributaries of the river to detect tagged suckers. Dr. Swift participated in the program from 1999-2003, which formed the beginning of a long term annual survey of population size, movements and distribution of the Santa Ana sucker in the river.

U.S. Geological Survey, National Water-Quality Assessment Program, Santa Ana River, California

Dr. Swift participated in the USGS NAWQA program, a nationwide river monitoring and quality assessment designed to assess the status and trends in the quality of freshwater streams and aquifers, and to provide a sound understanding of the natural and human factors that affect the quality of these resources. The program included a three year survey of Santa Ana suckers on the Santa Ana River. Survey protocols required electrofishing of a total of one kilometer of river in 100-meter increments at two localities on the Santa Ana River. The goal of this assessment was to characterize, in a nationally consistent manner, the broad-scale geographic and seasonal variations of water-quality related to major contaminant sources and background conditions.

California Department of Fish and Game Native Fish Surveys, San Gabriel River, California

The California Department of Fish and Game periodically assesses the status of wild trout, Santa Ana sucker, speckled dace, and arroyo chubs in the San Gabriel River system. Dr. Swift participated in four of these sampling efforts in the early 1990s. Survey protocols included electrofishing with three pass depletion of 100 meter transects in the West Fork of the San Gabriel River and its tributary Bear Creek. Fish were identified, measured and released back to the stream.

Restoration of the Santa Maria River Estuary, Santa Barbara County, California

Dr. Swift prepared a historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, California for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site, through Hagler-Bailly Inc., Boulder, Co. Fieldwork. In addition, Swift collaborated with ENTRIX biologists in surveying the estuary for tidewater gobies and preparing a report on their current status at the site.

Big Tujunga Mitigation and Restoration, Sunland, California

On behalf of the Los Angeles County Department of Public works, Dr. Camm Swift, with Dan Holland, designed and implemented the exotic removal program at Big Tujunga Wash from 2000 to 2004. Work included extensive trapping for crayfish, gill netting and snorkeling for bass, removal of bullfrog egg masses, and monitoring of the three native fish species in Haines Creek. Dr. Swift was instrumental in making recommendations with respect to the refinement of methods, equipment needs and sampling design and strategy. Effectiveness monitoring of the eradication efforts included periodic surveys of the native fishes in the streams at randomly selected transects along the 1.7 km of stream in the mitigation area.

Expert Witness Testimony Big Tujunga Wash, California

In support of the California Department of Fish and Game's Community Arbitration with Foothill Golf and Development in California State Superior Court, Los Angeles, Dr. Swift provided extensive and detailed information on the biology of Southern California Coastal Minnow and Santa Ana Sucker to support the Department's position of the extreme importance of the wash habitat for the continued existence of the native fishes and other native species in this surviving remnant fish community consisting of the Santa Ana sucker (federally threatened) and Santa Ana speckled dace and arroyo chub, both California species of special concern.

Exotic Predators on Tidewater Gobies on Marine Corps Base Camp Pendleton

Dr. Swift, working with Mr. Holland, used their extensive experience on the Base to prepare a management plan for exotic fishes and other species on Marine Corps Base Camp Pendleton. Many of these prey on tidewater gobies and this plan included methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. Since 1998, Dr. Swift has led teams of biologists to implement the exotic species removal plan at San Mateo Lagoon on the Base.

San Juan Creek Native Fish Survey – La Novia Bridge, San Juan Capistrano, California
Dr. Swift provided biological support and pre-construction monitoring for a project involving widening of the La Novia Street Bridge over San Juan Creek. The project included field surveys and monitoring, developing best management practices for fish avoidance and developing mitigation measures for post-construction planning. Species of concern included migrating southern steelhead, unarmored three-spine stickleback and arroyo chub.

Tidewater Gobies on Vandenberg Air Force Base
Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University. This contract extended for two years and comprehensively studied the biology and distribution of the tidewater gobies at five sites on Vandenberg Air Force Base. A comprehensive report detailed many aspects of needs for restoration of habitats on the Base.

Bixby Ranch Steelhead, Tidewater Goby and California Red-Legged Frog Baseline Habitat Assessment, Santa Barbara, California
Dr. Swift conducted a baseline biological assessment of the Bixby Ranch in Santa Barbara, California. The focus of this assessment was to assess aquatic habitat conditions as it pertains to steelhead, tidewater goby, California red-legged frog, and southwestern pond turtle. Terrestrial habitat was also assessed but was limited by access constraints. New populations of tidewater gobies were discovered during this assessment.

Tidewater Gobies on Marine Corps Base Camp Pendleton
Dr. Swift, working with Mr. Dan Holland, did multiple surveys from 1991 to 2000 for the tidewater gobies and other members of the estuarine fish community at seven estuaries and lagoons on Marine Corps Base Camp Pendleton, coastal southern California. They provided the first descriptions of the estuarine fish communities for several of these sites and provided recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, California for Marine Corps Base Camp Pendleton

SURVEYS OF FRESHWATER FISHES OF SOUTHERN CALIFORNIA

Dr. Swift has extensive experience surveying, researching and studying freshwater species of special concern. A representative sample of these surveys includes:

- Advised a Six Agency committee of southern California water and power purveyors, including Metropolitan Water District of Southern California] on the quality and rationale for U.S. Fish and Wildlife Service Critical Habitat designations for endangered big river fishes of the Colorado River, southwestern United States. Responsibilities included expert testimony, literature research and report writing.
- Supervised crews of three to six graduate students surveying the estuarine and freshwaters of southern California for fishes for four months and prepared report for the California Department of Fish and Game on the status and distribution of these fishes, at Natural History Museum of Los Angeles County.
- Evaluated the status of the native freshwater fishes of southern California, including the status of the estuarine tidewater goby, *Eucyclogobius newberryi*, with recommendations for preserves to maintain their existence. California Department of Fish and Game Contract FG-7455, one year. Compiled data bases on fish records collaborating with Peter Moyle, U. C. Davis, to incorporate data into the California Department of Fish and Game's Natural Heritage Data Base, at Natural History Museum of Los Angeles County.
- Participated in a Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University.

- Analyzed bottom samples from Delta Mendota Canal, central California, for invertebrate densities of the Asiatic clam, *Corbicula fluminea*, as a research assistant Zoology Department, University of California, Berkeley.
- Identified freshwater and coastal fish habitats to determine Significant Ecological Areas for Regional Planning Department, Los Angeles County, via contract to Natural History Museum of Los Angeles County.
- Co-author, U.S. Fish and Wildlife Service Recovery Plan for Endangered Unarmored Threespine Stickleback, as member of Unarmored Threespine Stickleback Endangered Species Recovery Team.
- Author, Estuarine Fish Communities of Ballona Marsh [Los Angeles County], In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local Coastal Plan, Los Angeles Co. Dept. Regional Planning.
- Served on an expert panel, habitat suitability criteria and curves for three native cyprinoid fishes (state species of special concern) of the Santa Ana River, southern Calif., EA Engineering and Technology (Lafayette, California) for Southern California Edison Company.
- Surveyed for freshwater fishes of the Los Angeles River. Field work and report writing, as part of contract from the California Department of Fish and Game to the Natural History Museum of Los Angeles County, to assess the fauna and flora of the river.
- Monitored populations of native federally endangered fish species during streambed alterations in the Santa Clara River, southern. Performed both field work and report writing.
- Surveyed for the proposed endangered fish, the tidewater goby, in coastal estuaries of Camp Pendleton Marine Base, southern California. Performed both field work and report preparation.
- Surveyed for the federally endangered tidewater goby in the estuarine Shuman Lagoon, Vandenberg Air Force Base, Santa Barbara County, California for U.S. Fish and Wildlife Service, Ventura Field Office,
- Analyzed diet of the endangered bird, the least tern, with Patricia Baird, Department of Biology, California State University, Long Beach. Under U.S. Navy contract (to P. Baird) at Long Beach, with three undergraduate research participants at Loyola Marymount University.
- Prepared draft recovery plan for tidewater goby as a member of the Tidewater Goby Technical Recovery Team, with U. S. Fish and Wildlife Service, Ecological Services, Ventura California.
- Prepared historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, California for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site. Performed field work, research and report writing in collaboration with ENTRIX, Inc., retained by UNOCAL Corporation.
- Surveyed for the endangered fish species, the tidewater goby on Marine Corps Base Camp Pendleton, coastal southern California, and provide recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, California for Marine Corps Base Camp Pendleton.
- Prepared management plan for exotic fishes on Marine Corps Base Camp Pendleton, including methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. With Dan Holland (Principal Investigator), Camp Pendleton Amphibian and Reptile Survey, Fallbrook, California.
- Surveyed for native and introduced freshwater fishes in the middle Santa Ana River in the Prado Dam vicinity with special reference to Santa Ana sucker and arroyo chub. For U. S. Army Corps of Engineers, Los Angeles California.
- Surveyed, downstream trapping, and analysis of habitat quality for the three endangered fishes (southern steelhead, tidewater goby, and unarmored threespine stickleback) in San Antonio Creek, Santa Barbara County for Vandenberg Air Force Base.

- Surveyed, downstream trapping, and food habit studies of Santa Ana suckers in the Santa Ana River to document movements into diversions and impact of exotic species on suckers. Phase II for Santa Ana Water Project Authority, Riverside, California.
- Expert witness on Southern California Minnow/sucker community for California Department of Fish and Game in their arbitration with Foothill Golf and Development, State Superior Court, Los Angeles, No. 99-0600-DW (This fish community consists of Santa Ana sucker, Santa Ana speckled dace, and arroyo chub).
- Prepared preliminary assessment of impacts of shore dredging on the fisheries of Big Bear Lake, for Big Bear Municipal Water District.
- Surveyed and estimate population sizes of endangered unarmored threespine stickleback and tidewater goby, and analyze steelhead habitat on several drainages on Vandenberg Air Force.
- Monitored population of tidewater goby in San Luis Obispo Creek Lagoon in relation to Avila Beach clean up site. For Unocal through Essex Environmental, San Luis Obispo.
- Surveyed for tidewater gobies in Santa Clara River Lagoon, Ventura County. For City of Ventura California.
- Surveyed for populations of sensitive native freshwater fish in the Santa Ana River near Colton and Loma Linda, California.
- Surveyed for populations of native fishes in the Santa Ana River in the vicinity of the Interstate 210 crossing, for Cal Trans, California.
- Monitored for Santa Ana suckers and assess effects of bridge maintenance, sand mining, and alternative bridge design on this fish. For Riverside County Transportation Department.
- Surveyed for the federally endangered tidewater goby in lower San Luis Rey River, California. with Camp Pendleton Amphibian and Reptile Survey, Fallbrook, California.
- Surveyed and monitored for the federally endangered tidewater goby in San Mateo Lagoon, Camp Pendleton Marine Corps Base with recommendations for restoration and recovery..
- Interaction of native and exotic freshwater fishes during El Nino disturbance in the Santa Margarita River, southern California. With USGS Laboratory, San Diego State University with partial support of the Nature Conservancy.
- Determined possible effects on steelhead of UNOCAL remediation of soil contamination in the vicinity of the lower Santa Maria River.
- Reviewed and assessed mitigation features for Seven Oaks Dam on the Santa Ana River in relation to populations of Santa Ana sucker downstream. For the U. S. Army Corps of Engineers.
- Review and assess mitigation plans and Biological Assessments for tidewater goby and steelhead in relation to Lower Mission Flood Control Project of U. S. Army Corps of Engineers. For City of Santa Barbara, California.
- Survey for fishes and assess possible impacts of the construction of a pipeline crossing over Dominguez Channel in Wilmington.
- Directed surveys for Santa Ana speckled dace in lower Fremont, Blackstar, and Silverado canyons, Orange County.
- Survey for native freshwater fishes and advise on mitigation for quarry operations at the mouth of Fish Canyon, near Azusa, California.
- Implement eradication plan for exotic fishes in Los Angeles County Public Works mitigation area of lower Big Tujunga Canyon-Haines Creek area. With Camp Pendleton Amphibian and Reptile Survey, Fallbrook, California, for Los Angeles County Department of Public Works.
- Identify freshwater fossil fish remains from a variety of late Pleistocene freshwater sites in Riverside County.

- Monitor, rescue, and transfer federally threatened Santa Ana suckers from diversion of Santa Ana River, Orange County. For U. S. Corps of Engineers
- Provide assessment of impacts of changes in water flow from San Bernardino Infiltration and Extraction Wastewater Treatment Facility (RIX) on populations of Santa Ana sucker. For City of San Bernardino.
- Survey for native fishes in relation to highway crossing of streams at Temecula Creek, San Diego County and Chino Creek, San Bernardino County for CalTrans.
- Provide assessment of impacts and mitigation possibilities for native sensitive fish species in lower San Juan Capistrano Creek, Orange County and lower San Mateo Creek, northern San Diego County for various alternatives of the proposed new highways. For Foothill/Eastern Transportation Corridor Agency.
- Provide expertise and fieldwork to study steelhead in Topanga Creek including snorkel surveys, habitat assessment, and up and downstream migrant trapping. With Resource Conservation District of the Santa Monica Mountains, Topanga, California.
- Prepare draft Recovery Plan for combined South Central Coast Steelhead (federally threatened) and South Coast Steelhead (federally endangered) as member of NOAA Technical Recovery Team for Southern Steelhead.

PROFESSIONAL AFFILIATIONS AND HONORS

Dr Swift has held various elected and appointive positions in the California-Nevada Chapter of the American Fisheries Society, Southern California Academy of Sciences, and American Society of Ichthyologists and Herpetologists. Secretary, Vice-president, and President of the Academy; elected President-elect, and proceeded to President, and past President of California Nevada Chapter, 1997-1999. Served on host committees for Los Angeles meetings of the American Society of Ichthyologists and Herpetologists (twice), Society of Vertebrate Paleontology, California-Nevada Chapter of the AFS, and the Southern California Academy of Sciences (three times).

Dr. Swift served as a member of the Unarmored Threespine Stickleback Endangered Species Recovery Team (1972-1995). He currently serves on the Technical Recovery Team for the Tidewater Goby (2003-present), both for U.S. Fish and Wildlife Service, and is a member of the Southern Steelhead Technical Recovery Team (2003-present) for the National Marine Fisheries Service.

Dr. Swift was elected Fellow of the Southern California Academy of Sciences in 1991 and named Emeritus Associate Curator of Fishes, Natural History Museum of Los Angeles County in 1993. He received the Award of Excellence from California Nevada Chapter of the American Fisheries Society in 1997.

Dr. Swift is an active member in numerous professional associations including: American Fisheries Society, including California Nevada Chapter, Estuarine Research Foundation, American Society of Ichthyologists and Herpetologists, Desert Fishes Council, Southeastern Fishes Council, Society of Vertebrate Paleontology, Sigma Xi (Loyola Marymount University Chapter), American Association for the Advancement of Science, Southern California Academy of Sciences, Society for Conservation Biology, Society of Systematic Biology, Biological Society of Washington, Japanese Ichthyological Society, Western Field Ornithologists, and California Native Plant Society

EMPLOYMENT HISTORY

- ENTRIX, Inc., Senior Project Scientist, Ventura, California, September, 2003 - present
- Emeritus Associate Curator, Natural History Museum of Los Angeles County, January, 1993 - present
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- Associate Curator of Fishes, Natural History Museum of Los Angles County; and Adjunct Assistant Professor of Biology, University of Southern California, 1970 - 1993

PUBLICATIONS

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- Organized one day Symposium on Tidewater Gobies for California Nevada Chapter of the American Fisheries Society Meeting, San Luis Obispo, March 30, 2006. Chaired session and presented “Annual and seasonal variations in fish populations of San Mateo Lagoon, San Diego County, California” with Dan Holland, Melissa Booker, Brian Lohstroh, and Eric Bailey.
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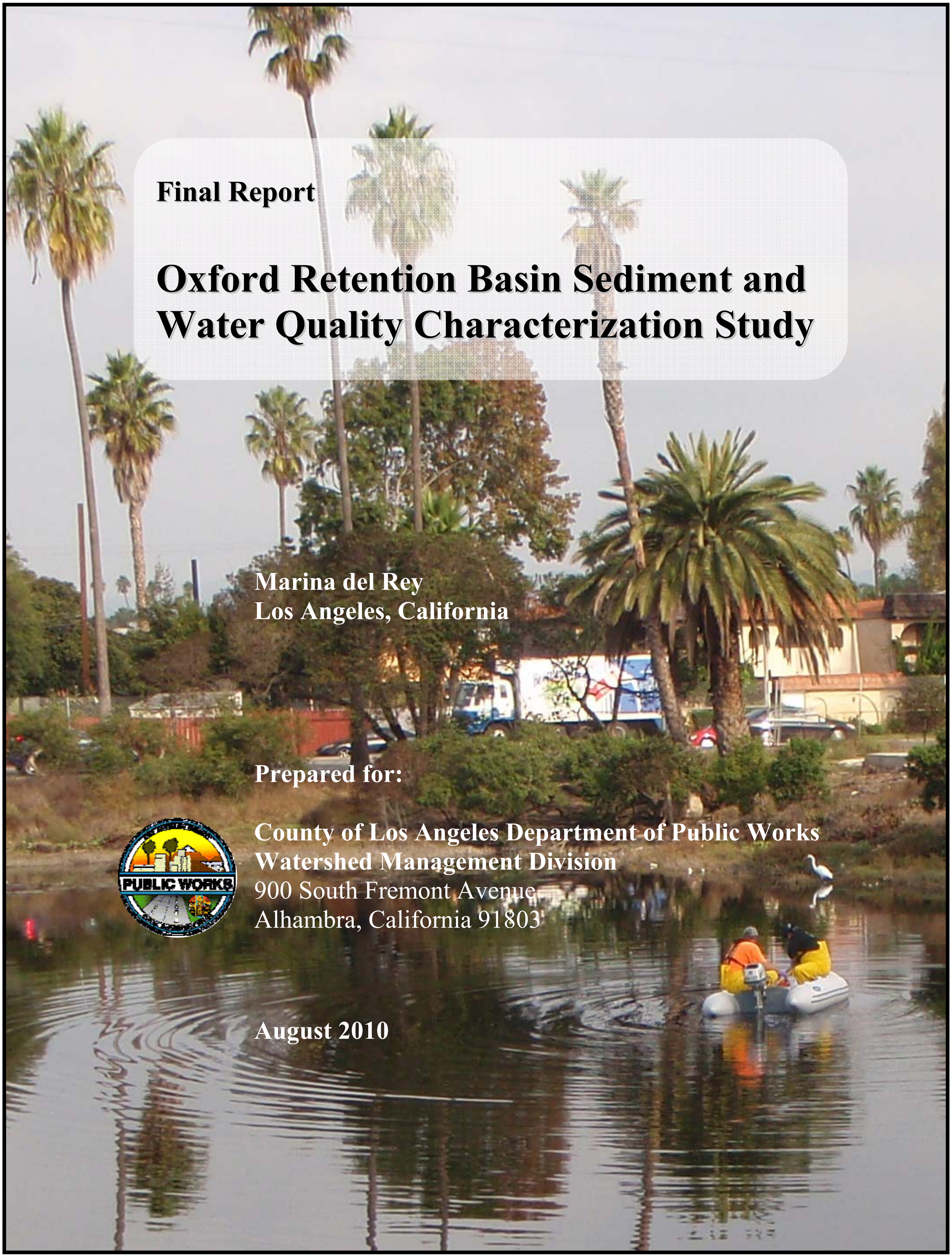

Final Report

Oxford Retention Basin Sediment and Water Quality Characterization Study

Marina del Rey
Los Angeles, California

Prepared for:

County of Los Angeles Department of Public Works
Watershed Management Division
900 South Fremont Avenue
Alhambra, California 91803

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August 2010

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ACRONYMS AND ABBREVIATIONS

Σ	sum
µg	microgram
AVS	acid volatile sulfides
BHC	hexachlorobenzene
BMP	best management practice
BOD	biochemical oxygen demand
CAM	California Assessment Manual
COC	chain of custody
COD	chemical oxygen demand
COP	California Ocean Plan
CTR	California Toxics Rule
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DOC	dissolved organic carbon
ID	identification
IDW	Inverse Distance Weighted
LARWQCB	Los Angeles Regional Water Control Board
MDL	method detection limit
MdRH	Marina del Rey Harbor
MPN	most probable number
NDMA	N-Nitrosodimethylamine
NDPA	N-Nitrosodi-n-propylamine
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated bipheynl
PCE	tetrachloroethene
pH	hydrogen ion concentration
Q-PCR	Quantitative Polymerase Chain Reaction
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SEM	Simultaneously Extracted Metal
SM	standard method
STLC	soluble threshold limit concentration
SVOC	semi-volatile organic carbon
SWRCB	State Water Resources Control Board
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSS	total suspended solids
TTLC	total threshold limit concentration
USEPA	United States Environmental Protection Agency
VOC	volatile organic carbon
WET	Waste Extraction Test
WQO	water quality objective

1.0 INTRODUCTION

1.1 Study Overview

Water and sediment samples were collected from Oxford Retention Basin and Basin E in Marina del Rey Harbor (MdRH) to characterize existing contaminant levels and to assess available options for water quality improvements and sediment disposal (Figure 1). Specifically, sediment and water quality characterizations were performed for the County of Los Angeles Department of Public Works (LADPW) for the following purposes:

- Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.
- Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.
- Determine the organic composition of the sediment to examine evaluate the feasibility of bioremediation.
- Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria Total Maximum Daily Load (TMDL) and Toxics TMDL for Basin E within MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal from Oxford Retention Basin.

The Oxford Retention Basin serves primarily as a flood control facility and is an integral part of the Marina del Rey local drainage system. The purpose of the basin is to retain urban and stormwater runoff until it can be safely discharged into Basin E of the MdRH. During storms, contaminants associated with development and street runoff are carried into Oxford Retention Basin and then into Basin E through two tide gates. The quality of the discharged water is speculated to be poor, mainly due to high recorded concentrations of bacteria and other pollutants of concern. Basin E is on the Clean Water Act (CWA) Section (§)303(d) list due to impairments caused by high concentrations of bacteria and toxic contaminants that on occasion have exceeded the water quality objectives (WQOs) contained in the California Ocean Plan (COP) (SWRCB, 2005). TMDLs for bacteria and toxics were adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) and became effective on March 18, 2004, and March 17, 2006, respectively. The current TMDL requirements call for improving water quality in the MdRH Mother's Beach and Basins D, E, and F. Because Oxford Retention Basin discharges directly into Basin E, excavation of accumulated sediments in the Oxford Retention Basin is considered a potential remediation measure to improve water quality discharged into Basin E and the MdRH.

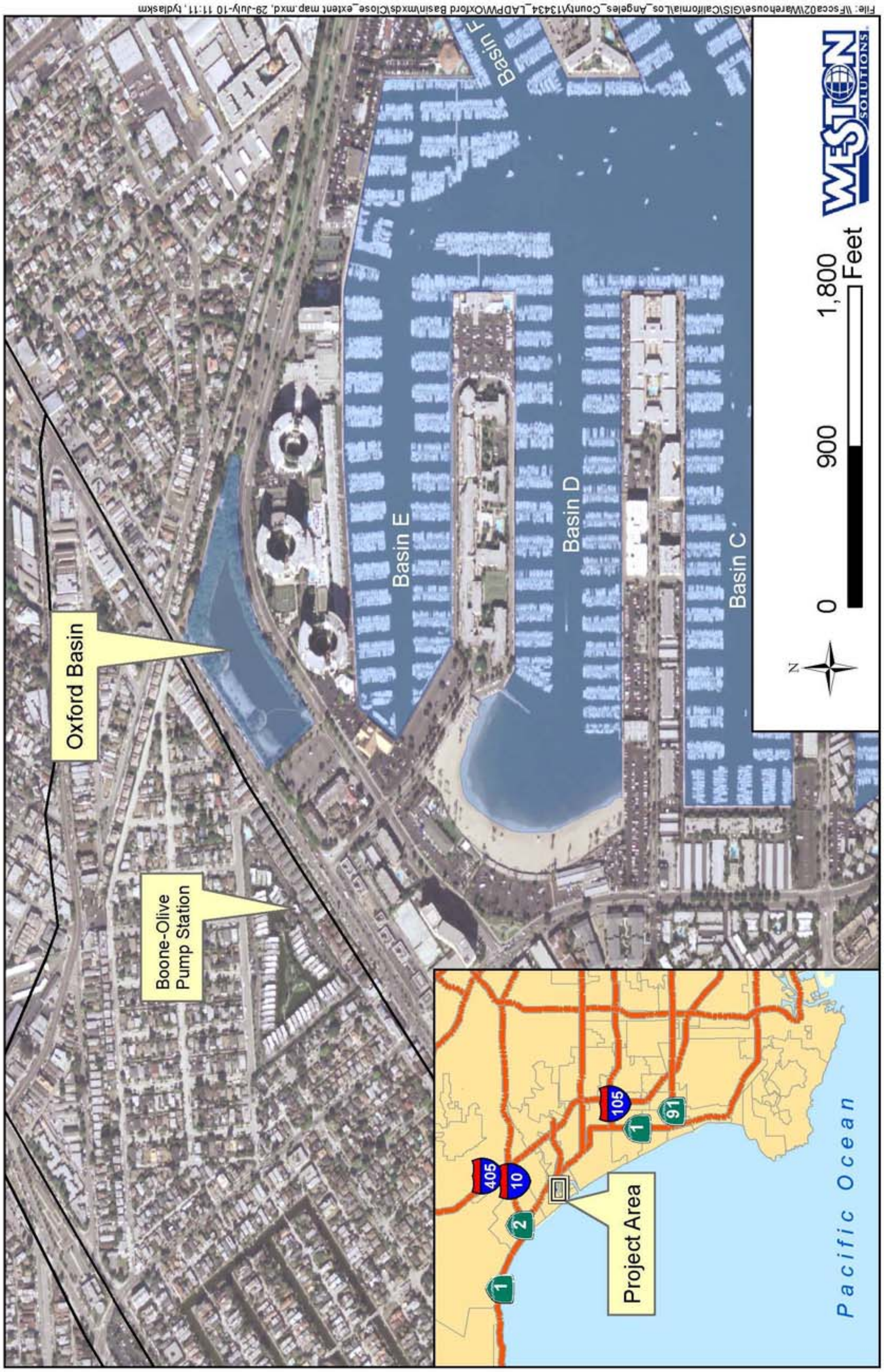

Figure 1. Project Area showing Oxford Retention Basin and Basin E in Marina del Rey Harbor and Boone Olive Pump Station

1.2 Study Objectives

Study objectives were defined for each of the three sampling components of the characterization study. The objectives of the sediment study were to define the spatial extent of sediment contamination using a scientifically defensible approach and to determine the overall organic content of the sediment so that bioremediation options could be evaluated. Specifically, the sediment study aimed to complete the following:

- Surficial sediment data were collected to determine feasibility of proposed bioremediation.
- Surficial sediment bacterial tests were conducted to determine if sediments are a likely source of bacteria.
- Surficial sediment acid volatile sulfides (AVS) / simultaneously extracted metals (SEM) analyses were conducted to determine bioavailability of metals in surface sediments.
- Sediment from the surface to the design depth was evaluated to characterize the bulk of the sediment proposed for excavation.
- Sediment at or below the design depth was evaluated to characterize what will become the new surface layer based on the proposed grading plan.

The objectives of the wet weather and dry weather water sampling were to characterize water quality in both Oxford Retention Basin and Basin E. Specifically, the water quality study aimed to complete the following:

- Understand the extent of chemical and bacterial contamination in the water column within the Oxford Retention Basin.
- Characterize water quality conditions in Oxford Retention Basin in relation to the Bacteria and Toxics TMDLs compliance requirements at Basin E within MdRH.
- Determine the relationship among contaminants found in the Oxford Retention Basin and their potential impacts to Basin E in MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal.

Analyses for sediment and water samples included semivolatile organic compounds (SVOCs), California Assessment Manual (CAM) 17 metals, organochlorine pesticides, total petroleum hydrocarbons (TPH), total organic carbon (TOC), hydrogen ion concentration (pH), nutrients, and indicator bacteria. Additional analyses for sediment samples included AVS/SEM, grain size, percent solids, total sulfides, and Toxicity Characteristic Leaching Procedure (TCLP) for metals, SVOCs, and organochlorine pesticides, whereas additional analyses for water included volatile organic compounds (VOCs), polychlorinated biphenyl (PCB) congeners, dissolved organic carbon (DOC), hardness, total dissolved solids (TDS), and total suspended solids (TSS).

1.3 Previous Studies

Results and findings from several previous studies were reviewed prior to creating a *Sampling and Analysis Plan (SAP) for the Oxford Retention Basin Sediment and Water Quality Characterization Study*. Sampling locations for this study were selected based upon information from these prior studies to provide high-resolution data regarding water quality and the vertical and horizontal distribution of sediment contamination within Oxford Retention Basin. A summary of the previous studies conducted in MdRH is presented below.

1.3.1 Mother□s Beach and Back Basins□Bacteria Total Maximum Daily Load Non-Point Source Study

The Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study was conducted to assess the bacterial sources that may potentially impact water quality at Mother's Beach and the back basins and attribute loads to these sources. A weight-of-evidence approach, including visual observations, a public questionnaire, temporal and spatial bacteria sampling studies during both wet conditions and dry conditions, an illicit boating discharge investigation, hydrologic modeling, sewerage infrastructure inspections, and a novel approach to bacterial source tracking known as the 'toolbox approach' using Quantitative Polymerase Chain Reaction (Q-PCR) and ribotyping techniques to determine the significant non-point sources of contamination continually affecting the quality of the waters within the back basins of MdRH and Mother's Beach. After completing the source identification (ID) aspect of this study, loading was assessed for the primary contributors of bacterial pollution.

Spatial and Temporal Bacterial Investigation—Circulation within MdRH is relatively poor in the back basins and limited in general. The highest concentration of fecal indicator bacteria occurred in Oxford Retention Basin and the Boone Olive Pump Station and Basin E during dry weather or wet weather monitoring events. Ribotyping analyses determined that the majority of bacteria contained in water samples collected from Basins D, E, and F during both dry weather and wet weather were avian in origin. Rodent and canine were secondary to avian sources during both dry weather and wet weather. Q-PCR analysis showed little human contamination throughout the back basins; human sources (direct human and/or sewage) were found to attribute 3% of the bacteria load for both wet weather and dry weather overall. Based on visual observation, the back basins appeared to be affected by contamination sources local to the basins themselves.

Sewerage Infrastructure Investigation—The sewerage infrastructure investigation determined that the sanitary sewer lines surrounding the back basins of MdRH did have structural defects and operational and maintenance problems.

Illicit Boat Discharge Investigation— Results based on this weight-of-evidence approach indicate that illegal discharges of sewage from boats in Basins D, E, and F were not likely a major cause of contamination. However, because illegal discharges of sewage from boat holding tanks is inherently episodic, results of this study do not rule out the potential for isolated events.

Sediment Investigation—Results from the sediment investigation conducted at Mother's Beach indicate that the surficial sediments in the inter-tidal zone and beach face were generally low in fecal indicator bacteria suggesting that it was unlikely that sediment re-suspension resulting from beach activity was contributing large amounts of bacteria to the water (Figure 2).

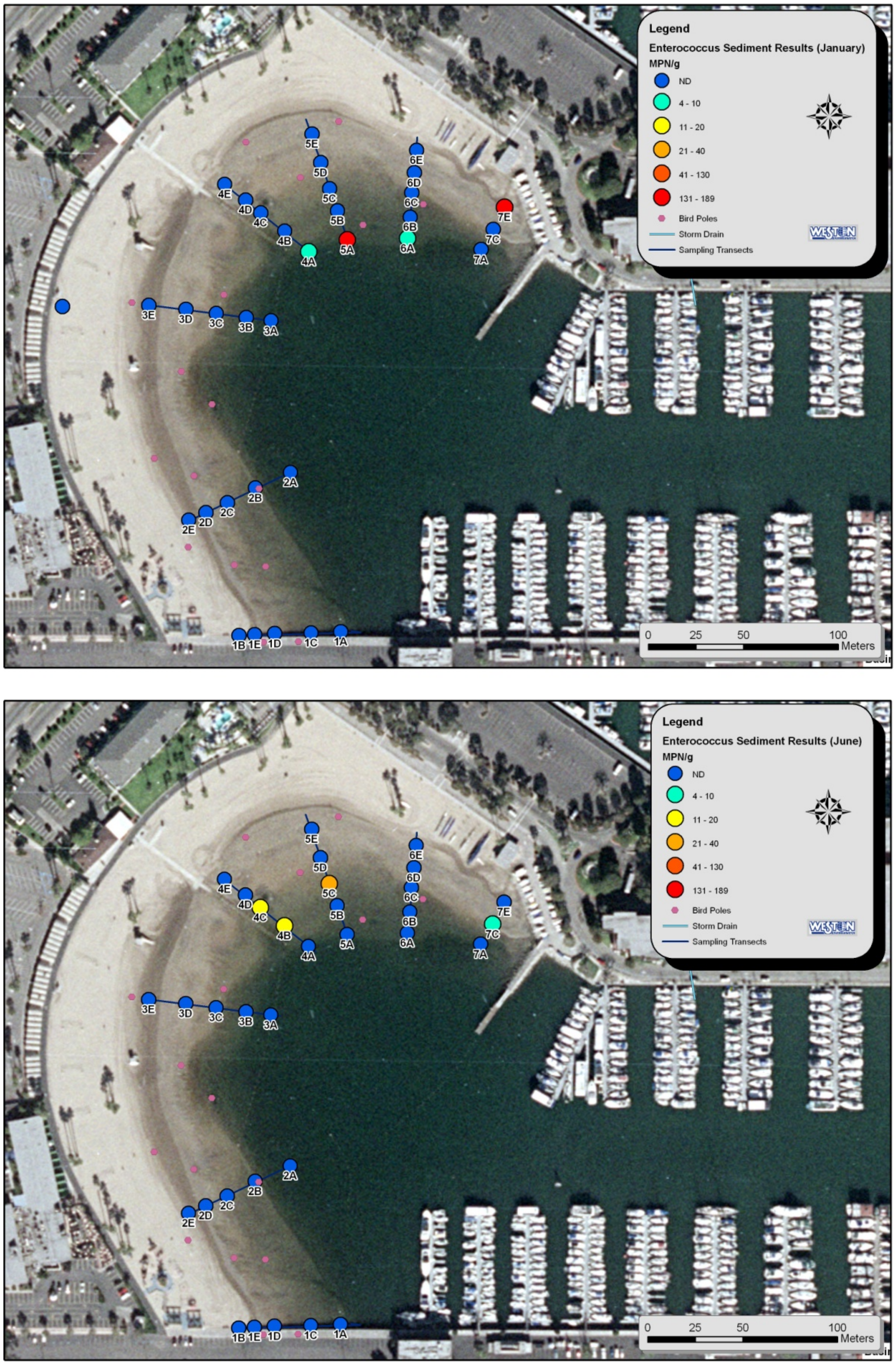

Figure 2. Sediment Results for Enterococci for January and June

Bacterial Loading Estimate—An Excel-based loading model was developed for the assessment of bacterial contributions. Because of the complexities of modeling bacteria in a tidal system, the model was limited in scope and was not designed for best management practice (BMP) development but rather as a tool for general assessment of different management actions. The bacterial results of a one-day comprehensive bacterial sampling event, coupled with the sampling of four upstream sampling locations within the MdRH watershed, was incorporated into a hydrologic mass balance model to estimate bacteria concentrations in Oxford Retention Basin and Basin E during dry weather. The model results suggested some of the greatest impacts to fecal coliform loads were attributable to effluent from Oxford Retention Basin as it drained into Basin E. Additionally, higher bacteria concentrations were measured from the Boone Olive Pump Station and were found to correlate with higher bacteria concentrations in Basin E.

Overall, the results of the Mother’s Beach and Back Basins Bacteria TMDL Non-Point Source Study suggested that the majority of the indicator bacteria in MdRH originated from direct and indirect (i.e., through storm drains) avian sources. However, in the case of Basin E, dry weather and wet weather point sources were identified as including discharges from Oxford Retention Basin and (during wet weather) the Boone Olive Pump Station. This resulted in a number of BMP recommendations, including structural bird controls and sewerage infrastructure improvements.

Recommendations were also provided for reducing bacterial densities in the back basins with a focus on illicit boat discharges, irrigation, sediment management, wash down activities, sewerage infrastructure and BMPs of Boone Olive Pump Station and Oxford Retention Basin.

1.3.2 Marina del Rey Harbor Mother’s Beach and Back Basins’ Indicator Bacteria Total Maximum Daily Load Compliance Study

The MdRH Mother’s Beach and Back Basins’ Indicator Bacteria TMDL Compliance Study provided an analysis of compliance data collected in response to the MdRH Mother’s Beach and Back Basins’ Indicator Bacterial TMDL. Eight months of TMDL compliance monitoring indicator bacteria data were analyzed for compliance with TMDL goals, and sampling stations were assessed for the applicability of CWA §303(d) listing status based on historic data from ten years of sampling. The study also assessed differences between geometric mean calculation methods and how they affect TMDL compliance, as well as a comparison of bacterial levels before and after BMP implementation. The following findings were made during this study:

- TMDL compliance targets were mostly met with the exception of compliance monitoring stations during summer dry weather sampling events.

Station Type	% within TMDL Compliance Targets		
	Summer Dry Weather	Winter Dry Weather	Wet Weather
Compliance monitoring	22%	89%	78%
Ambient monitoring	80%	100%	100%

- Analysis of historical data showed that all stations exceeded the TMDL single sample compliance targets, although only four stations would have met the criteria for State Water Resources Control Board (SWRCB) §303(d) listing. Due to this difference in assessment methodology, the TMDL compliance targets are expected to be more difficult to achieve than meeting the SWRCB §303(d) listing policy.

- Data collected for TMDL and historical monitoring were used to evaluate differences between conditions before and after BMP implementation in Basins D, E, and F. Receiving water data in Basin E showed no significant difference between bacterial levels pre and post BMP implementation. Receiving water data in Basin D showed significantly higher levels of total coliforms and enterococci after BMP implementation when compared to pre-implementation levels. Receiving water data in Basin F showed significantly higher levels of enterococci after sewer lining was completed. Bacterial levels during days following mechanical circulation of water at Mothers Beach compared to bacterial levels on days when no mechanical circulation occurred showed no significant difference.

1.3.3 Marina del Rey Sediment Characterization

The MdRH Sediment Characterization Study was completed in April 2008 in compliance with the *Requirement of Submit Information* letter from the LA RWQCB regarding sediment contamination in MdRH (WESTON, 2008a). The letter specified that the responsible agencies were to design a study plan to assess the areal extent of sediment contamination in the harbor for constituents listed in the Toxics TMDL, including total PCBs, chlordane, copper, lead, and zinc.

In this study, 23 sites were assessed with the collection of sediment cores, with samples collected at the surface, top (0–10 cm) and bottom (11 cm and deeper). Sixteen predetermined sampling locations were assessed by removal of surface sediments and sediment cores. Pore water was collected from five of the 23 sites. Sediment samples were analyzed for benthic infauna, toxicity and physical/chemical composition with regard to sediment grain size, total organic content (TOC), metals, organochlorine pesticides, and PCBs.

Results from the surface sediment analyses indicated that chlordane distribution was most highly concentrated at the mouth of the main channel (Figure 3). Copper (Figure 4), lead (Figure 5), zinc, and PCB (Figure 6) concentrations were highest in the mouths of each Back Basin and in the main channel.

Metals were found to be higher in the main channel and the mouths of each Back Basin compared with concentrations further into the Back Basins (Figure 4 and Figure 5).

These results are consistent with those of the MdRH Annual Report, which suggests influences external to the harbor for higher concentrations of chlordane and PCBs at the mouth of the harbor.

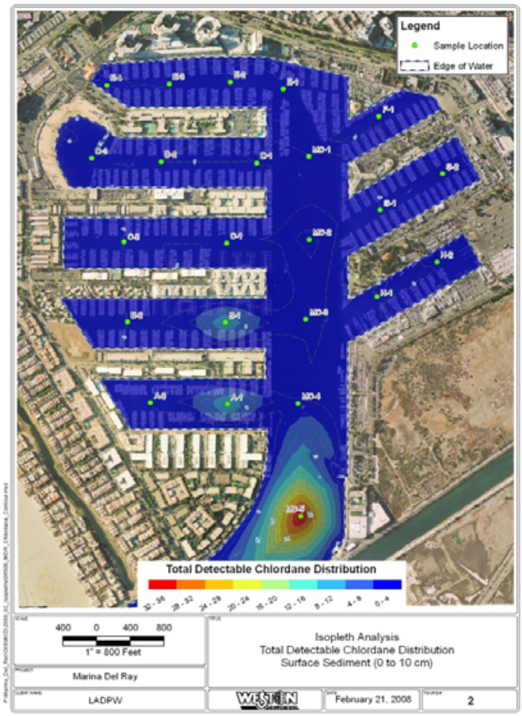

Figure 3. Distribution of Total Chlordane in Surface Sediment in Marina del Rey Harbor

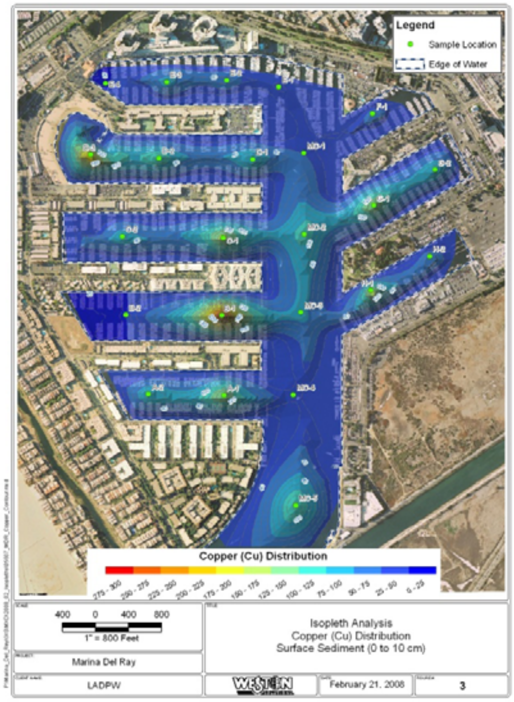

Figure 4. Distribution of Copper in Surface Sediment in Marina del Rey Harbor

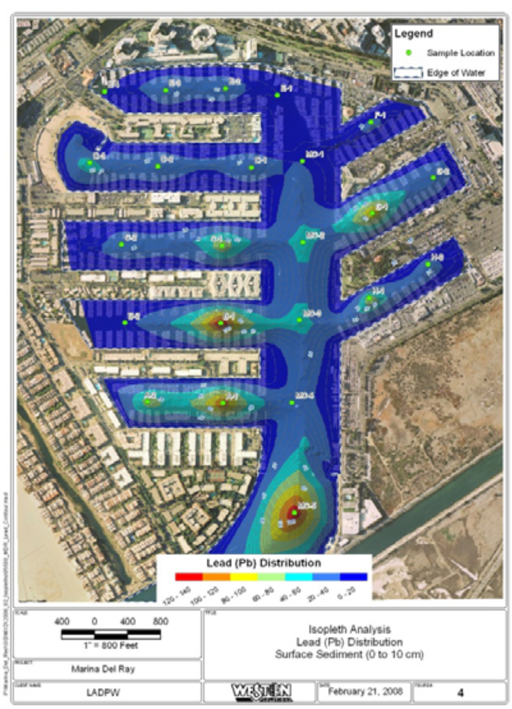

Figure 5. Distribution of Lead in Surface Sediment in Marina del Rey Harbor

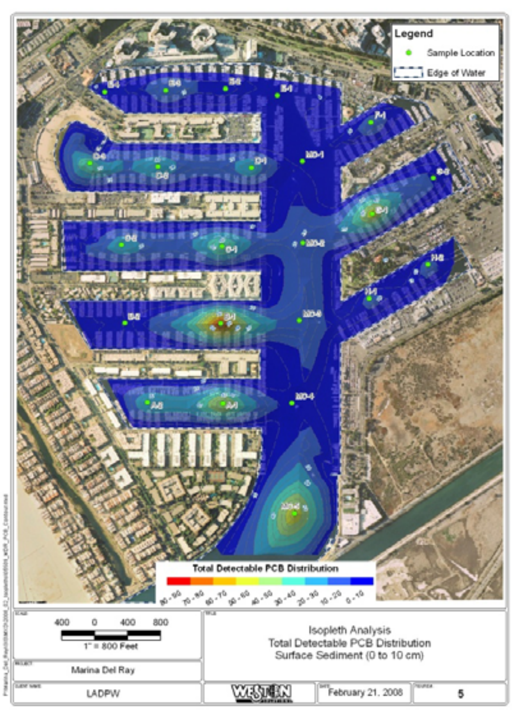

Figure 6. Distribution of Total Polychlorinated Biphenyls in Surface Sediment in Marina del Rey Harbor

2.0 MATERIALS AND METHODS

Water and sediment samples were collected from MdRH and Oxford Retention Basin between October 2009 and March 2010 as part of a sediment and water quality characterization study for the LADPW. Details of each of these monitoring components are provided below.

2.1 Sampling Locations and Sample Nomenclature

Sampling locations for wet weather and dry weather water samples were located in Oxford Retention Basin, Basin E, and Boone Olive Pump Station while sediment sampling was confined to Oxford Retention Basin. All station locations were pre-planned.

2.1.1 Sediment Sampling

Sediment cores were collected at all ten stations within the Oxford Retention Basin (Figure 7). Cores extended through recently deposited (unconsolidated) sediments and into the consolidated sediment layer at seven of the ten stations. At three stations, the consolidated layer was not encountered due to refusal. Once collected, the cores were delivered to an on-site processing station where a certified California geologist characterized the vertical stratification of cores. The targeted sampling latitude and longitude coordinates and targeted core lengths are provided in the approved SAP.

Multiple cores per location were collected to ensure an adequate volume of material (approximately 2 L) for all required testing and archival. Based on sediment stratification, the cores were split into vertical segments to assess the vertical resolution of potential chemical contamination. Since multiple samples were collected from each core, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., EL represents sediment from the excavation layer and NL represents sediment from the consolidated layer). Figure 8 illustrates the derivation of the sample IDs relative to the station ID and sample point for the sediment sampling event.

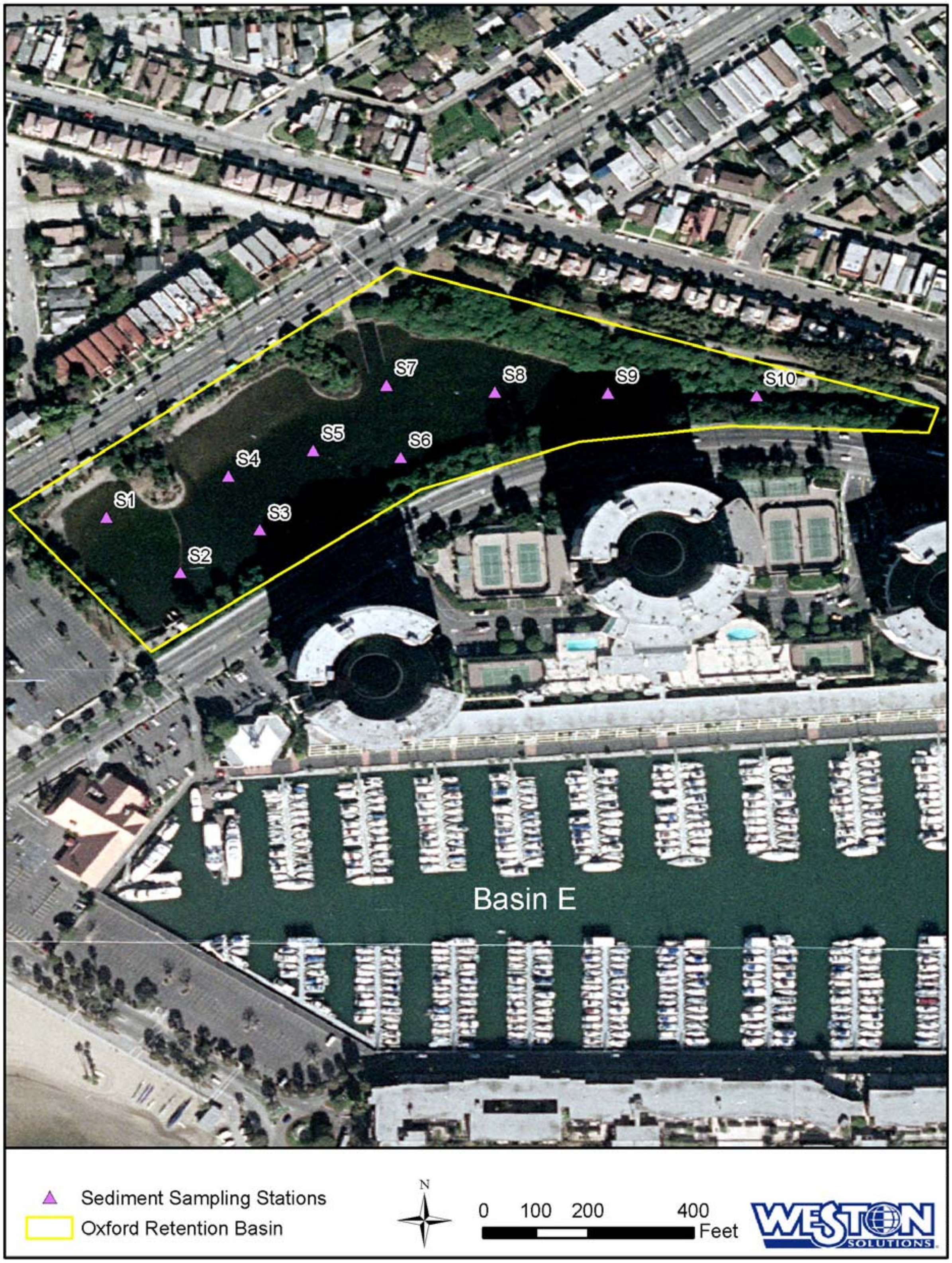

Figure 7. Sediment Sampling Stations within Oxford Retention Basin

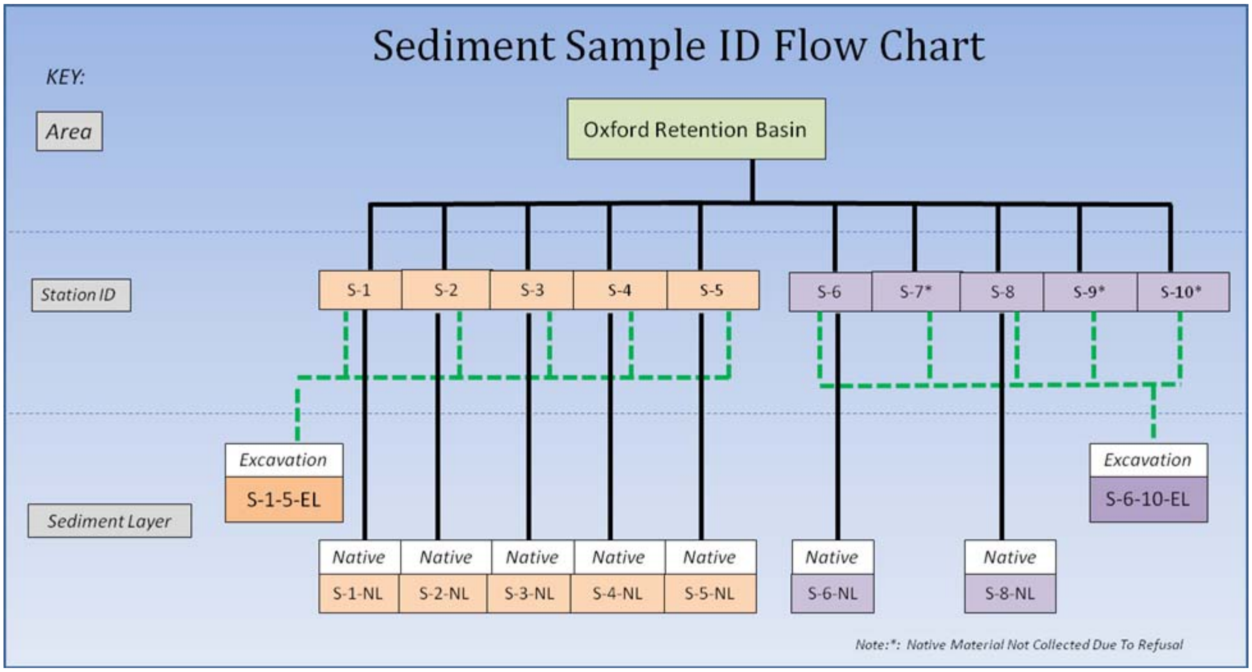

Figure 8. Sediment Quality Sample Identification Flow Chart

2.1.2 Water Sampling Wet Weather

The sampling stations for the wet weather component of the water quality sampling are shown on Figure 9. Due to extremely shallow water during low tide, Station ORB-E was moved approximately 40 meters southwest of the proposed location as described in the SAP. The relocation of Station ORB-E to an area slightly deeper allowed for water collection without the draft of the inflatable boat disturbing the sediment layer during water sample collection. The targeted sampling latitude and longitude coordinates and targeted core lengths are provided in the approved SAP.

As the goal of these sampling events was to characterize the baseline wet weather water quality conditions in the two basins, water samples were collected from a number of locations and composited together to more accurately represent water quality conditions in each basin (Figure 10). In Oxford Retention Basin, water was collected from five sample locations and composited to represent one sample for analysis. Basin E samples were collected from three sample locations and composited into one sample for laboratory analysis. Three of the constituents from the analyte list were not conducive to composite analysis. Thus, for VOCs, TPH, and fecal indicator bacteria analysis, samples were collected from a single sample location (Station ORB-C in Oxford Retention Basin and Station E-C in Basin E) that was determined to best represent the basin water quality as a whole.

In addition to the samples collected in Oxford Retention Basin and Basin E, samples were also collected from Boone Olive Pump Station. During dry weather conditions, runoff entering Boone Olive Pump Station is diverted to the sanitary sewer system. However, during storm conditions the sanitary sewer diversion is shut off, and stormwater flows freely to Basin E, approximately 90 meters south of the Oxford Retention Basin outfall.

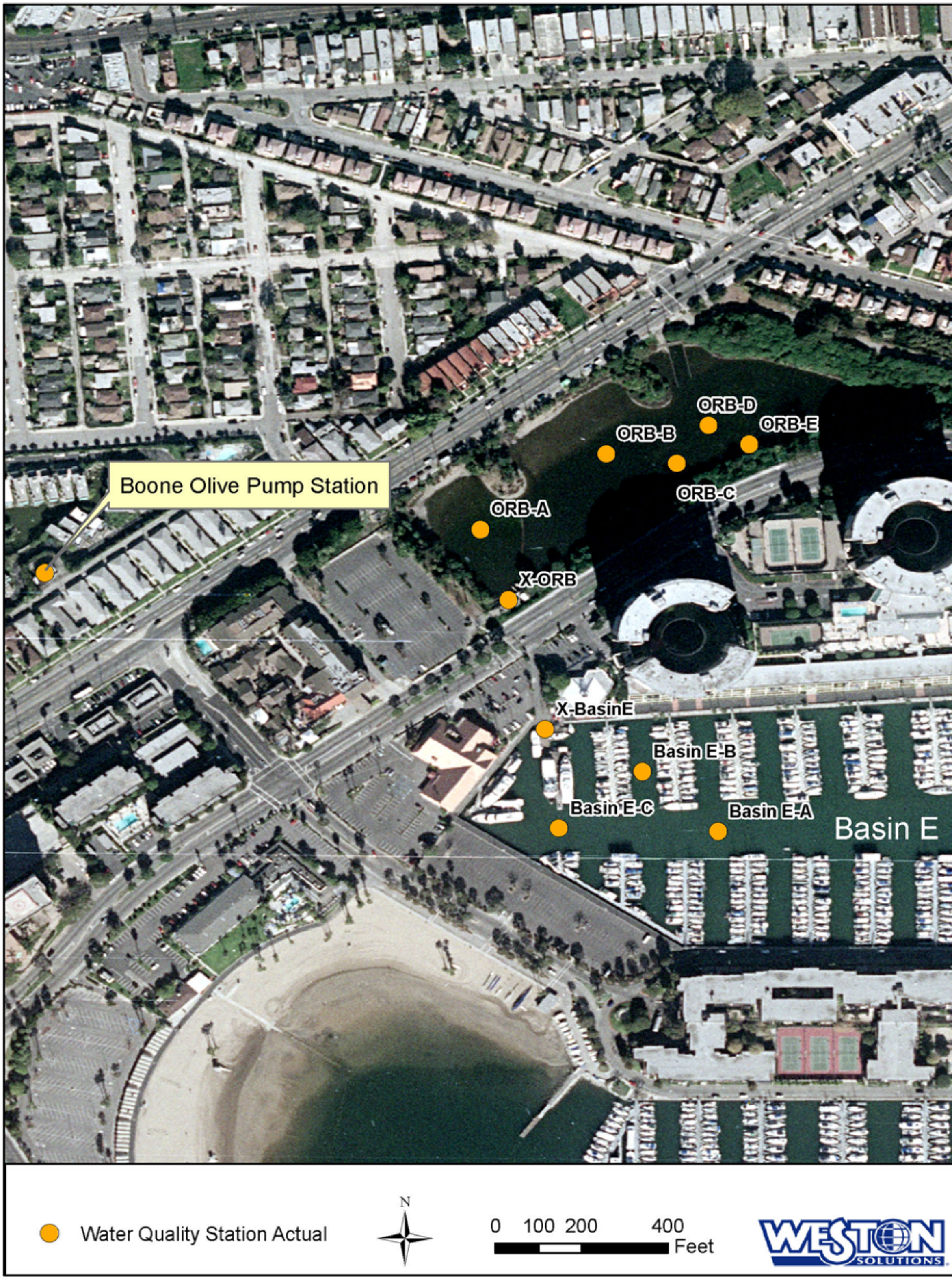

Figure 9. Water Quality Sampling Stations within Oxford Retention Basin, Basin E, and Boone Olive Pump Station

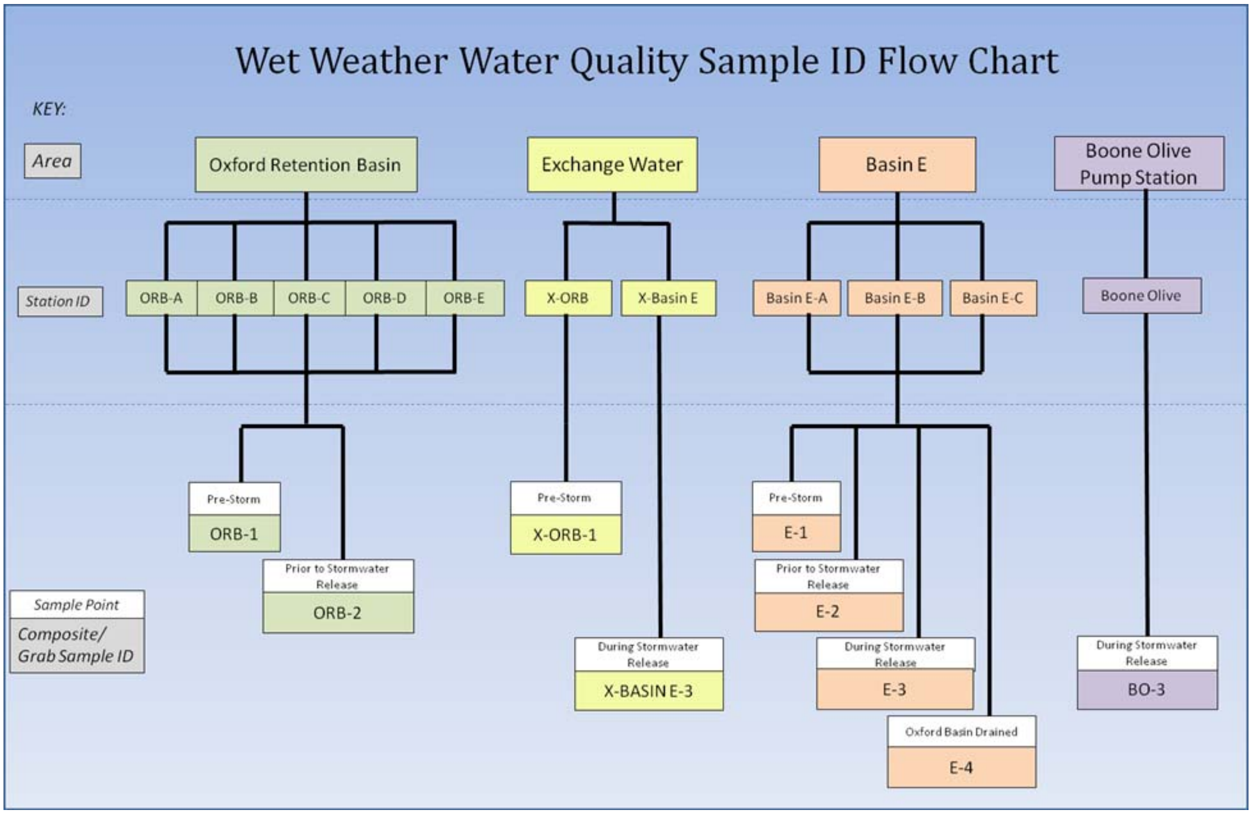

Figure 10. Wet Weather Water Quality Sample Identification Flow Chart

During the wet weather survey, an additional set of water quality grab samples were collected from Oxford Retention Basin and the Exchange water between Oxford Retention Basin and Basin E. These samples were collected for use in understanding the potential feasibility of bioremediation techniques on existing sediment within Oxford Retention Basin.

For the wet weather water sampling, Exchange water samples were collected on the Oxford Retention Basin side prior to the storm and on the Basin E side of the culverts during drainage of Oxford Retention Basin.

During the wet weather event, multiple samples were collected at each station representing each sampling period relative to the storm, therefore, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., ‘1’ represents prior to the storm, ‘2’ represents after the storm but before drainage of Oxford Retention Basin, ‘3’ represents during the drainage of Oxford Retention Basin, and ‘4’ represents conditions after Oxford Retention Basin had been completely drained). Figure 10 illustrates the derivation of the sample IDs relative to the station ID and sample point for the wet weather event.

2.1.3 Water Sampling Dry Weather

The sampling stations for the dry weather component of the water quality sampling are shown on Figure 9. Due to extremely shallow water during low tide, Station ORB-E was moved approximately 40 meters southwest of the proposed location as described in the SAP. The relocation of Station ORB-E to an area slightly deeper allowed for water collection without the draft of the inflatable boat disturbing the sediment layer during water sample collection.

As the goal of these sampling events was to characterize the baseline dry weather water quality conditions in the two basins, water samples were collected from a number of locations and composited together to more accurately represent water quality conditions in each basin (Figure 11). In Oxford Retention Basin, water was collected from five sample locations and composited to represent one sample for analysis. Basin E samples were collected from three sample locations and composited into one sample for laboratory analysis. Three of the constituents from the analyte list are not conducive to composite analysis. Thus, for VOC, TPH, and fecal indicator bacteria analysis, samples were collected from a single sample location (Station ORB-C in Oxford Retention Basin and Station E-C in Basin E) that was determined to best represent the basin water quality as a whole.

In addition to the samples collected in Oxford Retention Basin and Basin E, samples were also collected from Boone Olive Pump Station. During dry weather conditions, runoff entering Boone Olive Pump Station is diverted to the sanitary sewer system.

For the dry weather water sampling, Exchange water samples were collected on the Basin E side of the culverts during flood tide and on the Oxford Retention Basin side during ebb tide.

During the dry weather sampling event, multiple samples were collected at each station representing different tidal stages, therefore, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., 1 represents ebb tide and 2 represents flood tide). Figure 11 illustrates the derivation of the sample IDs relative to the station ID and sample point for the dry weather event.

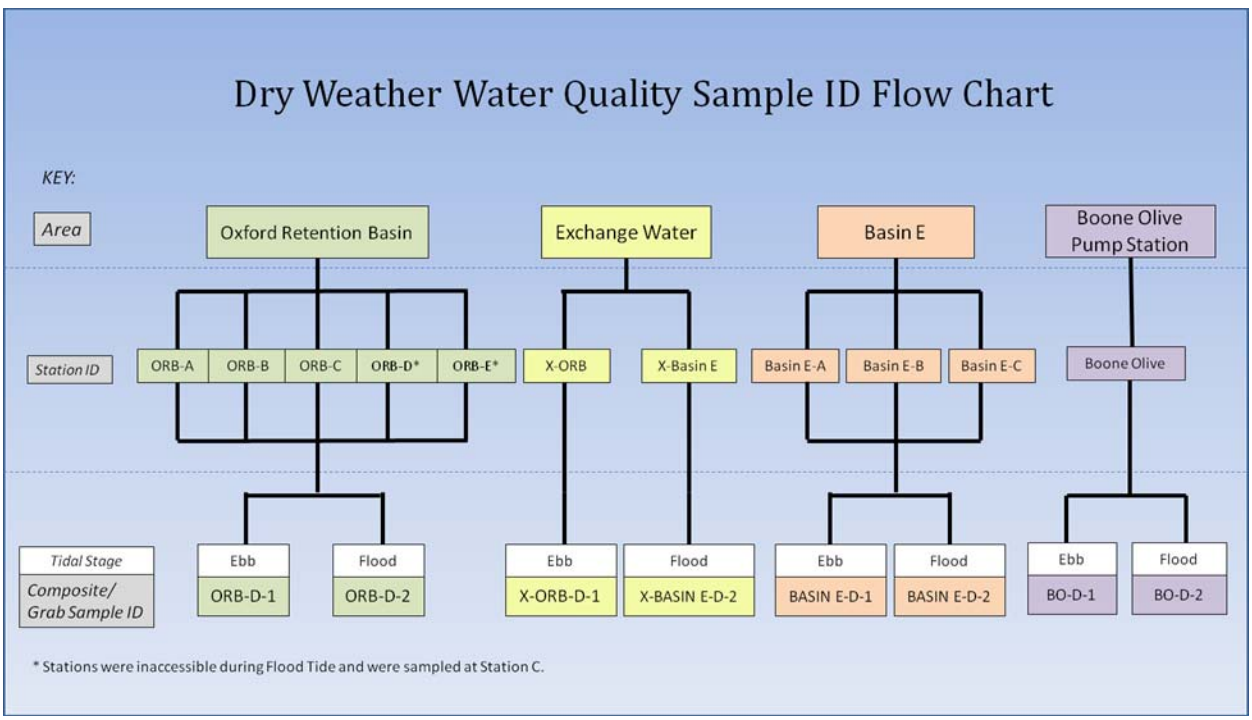

Figure 11. Dry Weather Water Quality Sample Identification Flow Chart

2.2 Navigation

Stations were located using a Garmin Wide Area Augmentation System (WAAS) enabled global positioning system (GPS) device. The system uses corrections provided by the Federal Aviation Administration (FAA) and is accurate to within 15 ft. All final station locations were recorded in the field using positions from the GPS.

2.3 Sampling Methods

2.3.1 Sediment Sampling

Figure 12. Piston Core Sampling

Sediment cores were collected at all stations using a piston core (Figure 12). The piston core was deployed from an inflatable vessel and was the preferred sampling device for areas inaccessible to larger vessels such as the Oxford Retention Basin. The piston core was equipped with a 3-inch outer diameter polycarbonate tube. Piston coring is the process of obtaining continuous well-preserved sediment core samples from water saturated, unconsolidated sediments. Penetration of the polycarbonate core tube was achieved by manually pushing the tube into the sediment via application of downward pressure on aluminum extensions attached to the piston core. To prevent compaction of the core during penetration, a plunger within the tube was set at the sediment water interface and maintained static pressure ensuring core integrity. To increase penetration, a hammering device was utilized to drive the core deeper into sediments. To eliminate the possibility of cross contamination between stations, a new polycarbonate tube was used at each station.

Following sampling, the piston core was retrieved to the deck of the boat and the liner with sediment removed from the piston device and placed in a core tray for processing. At the on-site processing station, the tube was placed vertically in a rack for 20 minutes to allow settling and then the tube was cut vertically along the length of the core to expose the sediment for processing. A certified geologist examined and classified the sediment as well as photographed the sediment core (Appendix A). The core stratigraphy, sediment grain-size distribution, color, texture, and other pertinent sediment characteristics were logged according to the Unified Soil Classification System (USCS). The station ID, actual latitude and longitude coordinates, and core lengths were also documented in the sample core logs (Appendix B).

At all stations, cores did not penetrate sediment to the anticipated target core length (based on existing bathymetry and planned design drawings). Refusal was encountered at shallower depths than expected. Refusal was defined as less than 2 inches of penetration per minute. Each time refusal was encountered, the vessel or sampling point was moved slightly and a second core attempted. If refusal was encountered again, additional cores were attempted until a sufficient amount of sample was collected. In cases where sediment cores with consolidated layers were insufficient to collect a full sample set, sample volume was reduced.

2.3.1.1 Sample Processing and Storage

Sediment cores were vertically subsampled to determine the vertical extent of sediment contamination and assess the presence of distinct layers of sedimentation. Each core was vertically segmented into two sections, representing the proposed excavation material in the upper section and the consolidated material in the lower section. No residual layers were found to be present in the sediment cores.

Once collected, subsamples from each of the ten cores were taken from the upper 6 inches of the excavation layer to be analyzed for grain size and indicator bacteria (i.e., total coliforms, fecal coliforms, enterococci, and *Escherichia coli*). The remaining sediment from the excavation layer was combined into two composite samples; Composite 1 was comprised of sediment from sites S1 through S5, and Composite 2 was comprised of sediment from sites S6 through S10. Consolidated sediment from each of the cores was analyzed separately.

All cores were processed on site, and the sediment samples homogenized to a uniform consistency using a stainless-steel mixing apparatus. Subsamples representing the distinct layers were placed in appropriate containers for all analyses. All samples were labeled (with project name, date, sampler ID, analysis, and preservative where applicable), logged into a field chain-of-custody (COC) form, and placed into a cooler. Samples were stored in the dark on ice or at 4°C until shipped or delivered to the appropriate analytical laboratory.

2.3.1.2 Decontamination of Field and Laboratory Equipment

All sampling equipment was cleaned prior to sampling. Between stations, the piston core was rinsed and a new polycarbonate tube used at each sample location. Before homogenizing each core segment, all stainless-steel utensils (i.e., stainless-steel bowls, spoons, spatulas, mixers, and other utensils) were cleaned with soapy water, rinsed with tap water, and then rinsed three times with deionized water.

2.3.2 Water Sampling –Wet Weather and Dry Weather

Water quality samples in Oxford Retention Basin and Basin E for both wet weather and dry weather sampling events were collected from an inflatable boat in Oxford Retention Basin and from a kayak in Basin E. The latitude and longitude, as well as station depth, depth of saltwater lens (if present), and physical water quality measurements, were recorded at the five locations within Oxford Retention Basin and three locations within Basin E. The physical water quality measurements that were recorded at each station were temperature, pH, specific conductivity, dissolved oxygen (DO), and turbidity.

During the wet weather and dry weather events, one water quality sample was collected from the Boone Olive Pump Station sump. The samples were collected using a telescoping sample pole with appropriate analyte sample containers. Physical water quality measurements, depth, and presence/depth of the saltwater lens were recorded as well.

At each water quality sample location, salinity measurements were collected to determine if any freshwater lenses or layers were present. If a freshwater lens was present, the depth of the lens at that location was recorded. Water quality samples for were collected from below the freshwater lens, if detected. During the course of this study, one field duplicate and one field blank sample were collected for quality assurance (QA) purposes.

Field scientists wearing clean, disposable gloves collected water grab samples in sterile, glass containers. Water to be tested for conventional analytes was collected from beneath the water surface to a depth of 6 inches (or below the freshwater lens, if determined present). The bottle was submerged open-end down approximately 6 inches below the water’s surface. The bottle was then turned face-up and allowed to fill. Care was taken to avoid contaminating the sample with debris and/or disturbed sediment.

2.3.2.1 Sample Processing and Storage

The composite water samples were collected directly into new 2-L glass jars and composited into 19-L borosilicate glass jugs. The composite sample was then partitioned from the glass jug into separate, appropriate analyte containers as needed.

The grab samples that were not conducive to composite sampling, as well as the Exchange water sites and additional analytes samples were collected in the field directly into the appropriate lab containers for each respective analyte.

After samples were partitioned to the appropriate analyte containers they were immediately placed in coolers on ice. The samples were kept in accordance with strict COC procedures until relinquished to laboratory couriers.

2.3.2.2 Decontamination of Field and Laboratory Equipment

All sampling equipment was cleaned prior to sampling. Water samples collected for composite analysis samples were collected in new lab certified precleaned 2-L jars. The composite samples were then poured into lab-cleaned 19-L borosilicate jars, and then homogenized and partitioned into appropriate containers for laboratory analysis.

Grab samples were collected in the field directly into the appropriate lab containers for analytes that were not conducive to composite sampling, such as oil and grease, and also for the Exchange water samples.

2.3.3 Shipping

Prior to delivery of samples to the various chemistry laboratories, sample containers were securely packed inside the cooler with ice. Then, COC forms were filled out, and the original signed COC forms were inserted in a sealable plastic bag and placed inside the cooler. The cooler lids were securely taped shut. Samples were delivered to the analytical laboratories listed in Table 1.

Table 1. Analytical Laboratories, Point-of-Contact Information, and Shipping Information

Laboratory	Analyses Performed	Point-of-Contact	Shipping Information
CRG Marine Laboratories, Inc.	Sediment and water chemistry	Mr. Eugene Chae (310) 533-5190 or Mr. Joseph Doak (310) 533-5190	CRG Marine Laboratories, Inc. 2020 Del Amo Blvd. Torrance, CA 90501

2.3.4 Chain-of-Custody Procedures

Samples were considered to be in custody if they were (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession were COC records, field log books, and field tracking forms. COC procedures were used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures were initiated during sample collection. A COC record was provided with each sample or sample group. Each person who had custody of the samples signed the form and ensured that the samples were not left unattended unless properly secured. Minimum documentation of sample handling and custody included the following:

- Sample ID.
- Sample collection date and time.
- Any special notations on sample characteristics.
- Initials of the person collecting the sample.
- Date the sample was sent to the laboratory.
- Shipping company and waybill information.

The completed COC form was placed in a sealable plastic envelope that traveled inside the ice chest containing the listed samples. The COC form was signed by the person transferring the custody of the samples. The condition of the samples was recorded by the receiver. COC records were included in the final analytical report prepared by the laboratory, and were considered an integral part of that report.

2.4 Sample Analyses

All chemical analyses were conducted in accordance with United States Environmental Protection Agency (USEPA) or Standard Methods (SMs) approved methods.

2.4.1 Sediment Samples

A total of ten sediment samples were submitted for laboratory analysis for the following list of analytes. Subsamples from each of the ten cores were taken from the upper six inches of the excavation layer to test for indicator bacteria (i.e., total coliforms, fecal coliforms, enterococci, and *E. coli*) and grain-size analyses. The remaining sediment from the excavation layer was combined into two composite samples. Composite 1 was comprised of sediment from stations S1 through S5, whereas Composite 2 was comprised of sediment from S6 through S10. The two composite samples were analyzed for the following parameters:

- General chemistry (i.e., TOC, pH, ammonia, nitrate, nitrite, percent solids, and total sulfides).
- SVOCs (i.e., polycyclic aromatic hydrocarbons (PAHs), base/neutral-extractables, phthalates, and acid extractables (phenols)).
- CAM 17 metals.
- AVS/SEM for TMDL-listed metals (i.e., copper, lead, and zinc).
- Organochlorine Pesticides (i.e., aroclor PCBs and PCB congeners).
- TPH (C6-C44).
- TCLP for metals, SVOCs, and organochlorine pesticides.
- Grain size.
- Organophosphorus pesticides.

Consolidated sediment from each of seven cores was analyzed separately (at three sites consolidated material was not sampled due to refusal). Sediment from the consolidated layer was analyzed for the same parameters as listed above for the composite samples with the exception of AVS/SEM for TMDL listed metals. A residual layer (i.e., in cases where the proposed grading depth was shallower than the consolidated layer) was not identified; therefore, no residual layer samples were collected. The compositing scheme and list of analyses performed on sediment samples is provided in Table 2.

To understand the potential feasibility of bioremediation techniques on existing sediment, Weston Solutions, Inc. (WESTON®), in consultation with Anderson Environmental, conducted the additional analysis of organophosphorus pesticides on the composite sediment samples.

Table 2. Analyses Performed on Oxford Retention Basin Sediment Samples

Sample Matrix	Sample Description		Number of Samples	Bacteria	Grain Size	Total Metals	Organochlorine Pesticides and PCBs	SVOCs	Organophosphorus pesticides	General Chemistry	TCLP Analyses: Metals	TCLP Analyses: SVOCs	TCLP Analyses: Organochlorine Pesticides
Sediment	Excavation layer	Subsamples from upper 6 inches	10	x	x								
	Excavation layer	Entire excavation layer (composites)	2		x	x	x	x	x	x	x	x	x
	Consolidated layer		7		x	x	x	x	x	x	x	x	x

The sediment chemistry results were compared to the total threshold limit concentration (TTLC) and ten times the soluble threshold limit concentration (STLC) values. Briefly, TTLC and STLC values are published in Title 22 of the State of California Code of Regulations and are the benchmark for determining whether a solid, or its leachate, respectively, exhibits the characteristics of toxicity, thereby causing it to be classified as hazardous. If bulk chemistry values exceed ten times the STLC, it does not definitively classify the material as hazardous; rather, it suggests those analytes have the potential to exceed the STLC after conducting the Waste Extraction Test (WET). Sediment was also subjected to TCLP tests. Briefly, the TCLP values are published in the Code of Federal Regulations (40 CFR §261.24) and are the federal benchmark for determining whether the leachate from a solid would be classified as toxic and, therefore, hazardous.

2.4.2 Water Samples —Wet Weather

A total of 14 water samples plus one field duplicate and one blank were collected and analyzed during this project. Each water sample was analyzed for the following:

- VOCs.
- SVOCs.
- CAM 17 metals (total and dissolved).
- Chlorinated pesticides.
- TPH (C6-C44).
- PCBs.
- TOC.
- DOC.
- pH.
- Hardness.
- TDS.
- TSS.
- Indicator bacteria (i.e., total coliforms, fecal coliforms, *E. coli*, and enterococci) (not composited).
- Nutrients (i.e., ammonia, total Kjeldahl nitrogen (TKN), nitrate, nitrite, and orthophosphate).
- Sulfides.

Total and dissolved metals were also analyzed and ultra-low detection limits (0.1 ng/L) for PCB analysis were used to satisfy established TMDL requirements.

To understand the potential feasibility of bioremediation techniques on existing sediment, WESTON, in consultation with Anderson Environmental, collected an additional volume of water from Oxford Retention Basin and at the discharge point just prior to discharge to Basin E following the wet weather event. The following additional analyses on the composite water samples were performed:

- Oil and grease.
- Cyanide.
- Biochemical oxygen demand (BOD).
- Chemical oxygen demand (COD).
- Chloride.
- Organophosphorus pesticides.

The wet weather water quality results were compared to criteria presented in either the COP or the California Toxics Rule (CTR), as appropriate.

2.4.3 Water Samples – Dry Weather

A total of seven samples, plus one field duplicate and one field blank were collected and analyzed during this project. Each water sample was analyzed for the following:

- pH.
- TOC.
- DOC.
- Hardness.
- TDS.
- TSS.
- Nutrients (i.e., ammonia, TKN, nitrate, and nitrite)
- Indicator bacteria (i.e., total coliforms, fecal coliforms, *E. coli*, and enterococci) (not composited).
- CAM 17 metals (total and dissolved).
- SVOCs.
- TPH (C6-C44).
- Chlorinated pesticides.
- PCBs.
- VOCs.

Total and dissolved metals were also analyzed and ultra-low detection limits (0.1 ng/L) for PCB analysis were used to satisfy established TMDL requirements.

The dry weather water quality results were compared to criteria presented in either the COP or the CTR, as appropriate.

2.5 Quality Assurance – Quality Control Procedures

All data were reviewed and verified by participating team laboratories to determine that all data quality objectives were met and that appropriate corrective actions were taken when necessary. Analytical laboratories provided a QA / quality control (QC) narrative that described the results of the standard QA/QC protocols that accompanied analysis of field samples. All hard copies of results are maintained in the project file at WESTON in Carlsbad and included in this report. In addition, back-up copies of results generated by each laboratory are maintained at their respective facilities. At a minimum, the laboratory reports contained results of the laboratory analysis, QA/QC results, all protocols and any deviations from the project SAP, and a case narrative of COC details.

3.0 RESULTS AND DISCUSSION

3.1 Sediment Sampling Results

3.1.1 Field Results

Piston core sampling was conducted between October 19, 2009, and October 20, 2009, at ten stations located within the Oxford Retention Basin. All ten stations were successfully sampled, although consolidated material from stations S7, S9, and S10 was not recovered due to refusal. Field coordinates, number of cores per station, depth of core penetration, final core length (i.e., recovery length), and thickness of the consolidated and unconsolidated layers are summarized in Table 3.

3.1.2 Excavation Layer Results

3.1.2.1 Physical and Conventional Parameters

Results of the physical and conventional parameter analyses for sediments collected within the excavation layer of the Oxford Retention Basin are presented in Table 4 (the complete laboratory analytical data report for sediment samples is included in Appendix C). The composite sample S-1-5-EL consisted of 82.8% fine-grained material (47.5% silt and 35.3% clay); and 17.2% coarse-grained material (1.4% gravel and 15.8% sand). The composite sample S-6-10-EL consisted of 49.1% fine-grained material (30.8 silt and 18.3% clay); and 50.9% coarse-grained material (4.7% gravel and 46.2% sand). The ammonia-N concentrations reported for S-1-5-EL and S-6-10-EL were 19.61 mg/kg and 8.5 mg/kg, respectively. TKN results ranged from 732 mg/kg to 1130 mg/kg. TOC levels for both samples ranged from 4.07–5.62%, and percent solids ranged from 57.8–65.9%. Total sulfides and AVS ranged from 4.76 mg/kg to 5.02 mg/kg. TPH-CC ranged from 160 mg/kg to 200 mg/kg, and pH ranged from 8.3 to 8.4 for both excavation layer composite samples.

3.1.2.2 Chemical Analyses

Results of the bulk chemical analyses for sediments collected within the Oxford Retention Basin are presented in Table 4. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

<u>**Trace Metals**</u>
Chromium and lead were the only metals to exceed the screening level assessment of ten times the STLC values (50 microgram per gram (µg/g)) in the proposed excavation layer composite samples. The chromium concentrations reported for S-1-5-EL and S-6-10-EL were 66.28 µg/g) and 52.11 µg/g, respectively. The lead concentrations reported for S-1-5-EL and S-6-10-EL were 306.3 µg/g) and 359.6 µg/g, respectively. All other metals listed in Table 4 were reported below the TTLC values, and none exceeded the federal TCLP criteria.

Table 3. Field Coordinates, Sample Depths, and Piston Core Recoveries for Samples Collected in the Oxford Retention Basin

Station ID	Attempt	Latitude (WGS 84)	Longitude (WGS 84)	Water Depth (ft)	Target Core Length (ft)	Actual Depth Sampled (ft)	Penetration (ft)	Final Core Length (ft)	Thickness of Consolidated Layer (ft)	Thickness of Un-consolidated Layer (ft)	Comments
S1	1	33.984971°	-118.456618°	3.9	8	6.4	2.5	0.3	0	0.3	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.984971°	-118.456618°	3.9	8	6.4	2.5	1	0.5	0.5	
	3	33.984971°	-118.456618°	3.9	8	6.4	2.5	1.5	1	0.5	
S2	1	33.984679°	-118.456232°	3.9	8	6.4	2.5	0.3	0.15	0.15	Refusal encountered in consolidated layer due to sediment composition/compaction
	2	33.984679°	-118.456232°	3.9	8	6.9	3	0.7	0.2	0.5	
	3	33.984679°	-118.456232°	3.9	8	6.9	3	0.7	0	0.7	
	4	33.984679°	-118.456232°	3.9	8	NA	NA	NA	0	NA	
	5	33.984679°	-118.456232°	3.9	8	NA	NA	NA	0	NA	
	6	33.984679°	-118.456232°	3.9	8	6.9	3	1.5	0.3	1.2	
	7	33.984679°	-118.456232°	3.9	8	6.9	3	2.6	0.4	2.2	
S3	1	33.984904°	-118.455816°	3.9	8	6.4	2.5	0.7	0.4	0.3	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.984904°	-118.455816°	3.9	8	6.9	3	1.4	0.3	1.1	
	3	33.984904°	-118.455816°	3.9	8	6.9	3	1.3	0	1.3	
	4	33.984904°	-118.455816°	3.9	8	6.9	3	1.1	0.3	0.8	
	5	33.984904°	-118.455816°	3.9	8	6.9	3	1.4	0	1.4	
S4	1	33.985186°	-118.455979°	3.9	8	6.4	2.5	1.5	0.3	1.2	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985186°	-118.455979°	3.9	8	6.4	2.5	1.4	0.8	0.6	
S5	1	33.985321°	-118.455536°	3.9	8	6.4	2.5	1.6	0.5	1.1	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985321°	-118.455536°	3.9	8	6.4	2.5	1.6	0	1.6	
	3	33.985321°	-118.455536°	3.9	8	6.9	3	2.2	0.3	1.9	
S6	1	33.985286°	-118.455077°	3.3	8	4.3	1	0.5	0	0.5	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985286°	-118.455077°	3.3	8	4.8	1.5	1	0.2	0.8	
	3	33.985286°	-118.455077°	3.3	8	6.3	3	2.1	0.4	1.7	
S7	1	33.985664°	-118.455151°	3.3	8	4.8	1.5	0.6	0	0.6	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap
	2	33.985664°	-118.455151°	3.3	8	4.8	1.5	0.6	0	0.6	
S8	1	33.985627°	-118.454585°	2.6	8	5.6	3	1.2	0.6	0.6	Refusal encountered in consolidated layer due to sediment composition and/or compaction
S9	1	33.985624°	-118.453995°	3.3	8	6.3	3	1.3	0	1.3	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap
	2	33.985624°	-118.453995°	3.3	8	5.8	2.5	1	0	1	
	3	33.985624°	-118.453995°	3.3	8	5.8	2.5	1.5	0	1.5	
S10	1	33.985609°	-118.453217°	3.3	8	6.3	3	2.3	0	2.3	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Grain Size												
Gravel	□			1.4	4.7	0.4	2.0	2.5	1.5	2.2	2.6	2.0
Sand	□			15.8	46.2	23.4	47.5	35.8	29.0	37.1	47.5	39.9
Silt	□			47.5	30.8	51.0	35.0	39.8	41.4	35.7	31.4	35.3
Clay	□			35.3	18.3	25.3	15.6	21.9	28.0	25.0	18.5	22.8
General Chemistry												
Ammonia-N	mg/dry kg			19.61	8.5	3.41	22.82	8.27	6.96	11.6	9.25	8.66
Total sulfides	mg/dry kg			4.8	5	<0.2	5.3	<0.2	<0.2	<0.2	<0.2	1.7
AVS	mg/dry kg			4.76	5.02	<0.05	5.31	<0.05	<0.05	<0.05	<0.05	1.67
TKN	mg/kg			1,130	732	333	239	310	301	345	182	217
TOC	% Dry weight			4.07	5.62	0.54	0.63	0.56	1.15	0.76	0.33	0.86
TPH-CC (C6-C44)	mg/kg			160	200	150	22	12	<4.8	59	<4.8	<4.8
pH	pH units			8.3	8.4	9.3	8.9	8.8	9	8.9	9.3	9.2
Percent solids	Percent			57.8	65.9	76.2	77.1	81.9	80.9	78.9	88.5	76.8
Trace Metals												
Antimony (Sb)	µg/dry g	500	150	1.57	2.002	0.925	1.009	0.593	1.198	0.772	0.564	0.893
Arsenic (As)	µg/dry g	500	50	15.17	10.51	7.952	32.51	6.23	12.77	7.998	5.09	8.854
Barium (Ba)	µg/dry g	10,000	1,000	162	140	219.7	194	167.1	183.2	176.3	68.44	209.2
Beryllium (Be)	µg/dry g	75	7.5	0.653	0.398	0.676	0.701	0.559	0.673	0.512	0.416	0.581
Cadmium (Cd)	µg/dry g	100	10	2.842	3.093	0.533	1.217	0.303	0.775	0.673	0.658	0.5
Chromium (Cr)	µg/dry g	2,500	50	66.28	52.11	49.34	56.84	35.75	51.93	37.46	25.27	45.97
Cobalt (Co)	µg/dry g	8,000	800	12.05	8.36	10.14	13.06	8.441	12.79	9.22	9.608	8.775
Copper (Cu)	µg/dry g	2,500	250	157.7	101.9	33.91	39.8	26.09	33.74	31.35	18.06	31.58
Lead (Pb)	µg/dry g	1,000	50	306.3	359.6	5.987	36.16	10.88	13.78	28.49	7.026	30.22
Mercury (Hg)	µg/dry g	20	2	0.37	0.28	0.03	0.07	0.04	0.04	0.06	0.04	0.04
Molybdenum (Mo)	µg/dry g	3,500	3,500	6.367	6.046	1.935	2.215	1.445	2.845	1.761	1.847	3.092
Nickel (Ni)	µg/dry g	2,000	200	39.41	30.26	36.87	39.8	25.59	36.57	25.12	19.31	27.3
Selenium (Se)	µg/dry g	100	10	1.088	0.79	1.807	0.577	1.996	1.768	1.204	1.139	0.37
Silver (Ag)	µg/dry g	500	50	1.978	1.059	0.598	0.52	0.47	0.674	0.668	0.58	0.72
Thallium (Tl)	µg/dry g	700	70	0.329	0.187	0.277	0.288	0.185	0.276	0.198	0.155	0.218
Vanadium (V)	µg/dry g	2,400	240	95.5	60.9	107.2	110.7	74.05	103.7	73.8	51.06	93.29
Zinc (Zn)	µg/dry g	5,000	2,500	481.2	459.2	72.06	107.8	76.65	98	105.1	51.02	86.82
AVS/SEM												
Cadmium (Cd) – SEM	µmol/dry g			<0.0018	0.0022J	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018
Copper (Cu) – SEM	µmol/dry g			<0.0062	<0.0062	0.0102J	<0.0062	0.0085J	0.007J	0.0065J	0.0116J	<0.0062
Lead (Pb) – SEM	µmol/dry g			0.147	0.2691	0.0015	0.0847	0.007	0.0029	0.0121	0.0101	0.0198
Nickel (Ni) – SEM	µmol/dry g			0.0167	0.0325	0.007	0.0142	0.0098	0.013	0.0119	0.015	0.0089
Silver (Ag) – SEM	µmol/dry g			<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047
Zinc (Zn) – SEM	µmol/dry g			0.7977	1.5269	0.008	0.2	0.0884	0.0348	0.106	0.0797	0.0826
ΣSEM[1]	µmol/dry g			0.967	1.835	0.029	0.304	0.116	0.060	0.139	0.118	0.116
AVS	µmol/dry g			0.148	0.157	0.001	0.166	0.001	0.001	0.001	0.001	0.052
ΣSEM:AVS	ratio			6.511	11.72	36.91	1.836	148.5	76.67	177.7	152.0	2.236
Polynuclear Aromatic Hydrocarbons												

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
1-Methylnaphthalene	ng/dry g			2.4J	3.4J	<1	<1	<1	<1	<1	<1	<1
1-Methylphenanthrene	ng/dry g			4.4J	<1	<1	<1	<1	<1	<1	<1	<1
2,3,5-Trimethylnaphthalene	ng/dry g			1.8J	1.9J	<1	<1	<1	<1	<1	<1	<1
2,6-Dimethylnaphthalene	ng/dry g			32.9	21.4	<1	1.1J	<1	<1	<1	<1	<1
2-Methylnaphthalene	ng/dry g			5.9	11.3	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	ng/dry g			2.6J	4J	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	ng/dry g			3.6J	4.6J	<1	<1	<1	<1	2J	<1	<1
Anthracene	ng/dry g			18.9	30.7	<1	1J	<1	<1	2.8J	<1	1J
Benz[a]anthracene	ng/dry g			105.5	198.5	<1	6.1	1.2J	<1	14	11.1	4.2J
Benzo[a]pyrene	ng/dry g			231	275	32.1	11.6	5.9	1.6J	22.3	11	5.4
Benzo[b]fluoranthene	ng/dry g			254.5	361.3	<1	8.6	<1	<1	14.7	11	4.4J
Benzo[e]pyrene	ng/dry g			215.3	285.6	8.8	9.2	3.2J	<1	13.2	8.8	5
Benzo[g,h,i]perylene	ng/dry g			265.5	353.2	7.5	11.1	3.1J	<1	16.1	10.6	5.8
Benzo[k]fluoranthene	ng/dry g			95.8	148.1	<1	3.6J	<1	<1	4.5J	6	1.9J
Biphenyl	ng/dry g			2.4J	7.5	<1	<1	<1	<1	<1	<1	<1
Chrysene	ng/dry g			154.4	267.1	11.8	8	2.9J	<1	21.1	14.8	5.9
Dibenz[a,h]anthracene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	ng/dry g			<1	7.6	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	ng/dry g			169.6	493.3	5.2	9.8	2.8J	<1	22.8	25.5	6.7
Fluorene	ng/dry g			4.6J	7.8	<1	<1	<1	<1	<1	<1	<1
Indeno[1,2,3-c,d]pyrene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	ng/dry g			5.7	10.3	<1	1J	<1	<1	1.8J	<1	<1
Perylene	ng/dry g			113.7	99	59.1	3.8J	4J	3.5J	19.2	3.6J	2.9J
Phenanthrene	ng/dry g			42.7	80.3	<1	3J	1.5J	<1	12.2	5	5.1
Pyrene	ng/dry g			362.9	671.3	12.6	18.6	5.6	1.1J	32.2	27.3	11.9
Total detectable PAHs	ng/dry g			2,096.1	3,343.2	137.1	96.5	30.2	6.2	198.9	134.7	60.2
Base Neutral-Extractable Compounds												
1,2,4-Trichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Benzidine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Hexachlorobutadiene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
N-Nitrosodi-n-propylamine (NDPA)	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
N-Nitrosodimethylamine (NDMA)	mg/kg			<0.3	<0.26	<0.33	<0.28	<0.27	<0.3	<0.31	<0.3	<0.29
N-Nitrosodiphenylamine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Phthalates												
bis(2-Ethylhexyl) phthalate	ng/dry g			4773	6158	<100	168	<100	<100	158	149	<100
Butylbenzyl phthalate	ng/dry g			344	460	<25	<25	<25	<25	<25	<25	<25
Di-n-butyl phthalate	ng/dry g			<75	<75	<75	<75	<75	<75	<75	<75	<75
Di-n-octyl phthalate	ng/dry g			<10	60	<10	<10	<10	<10	<10	<10	<10
Diethyl phthalate	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Dimethyl phthalate	ng/dry g			222	271	<50	<50	<50	<50	<50	<50	<50
Acid-Extractable Compounds												
2,4,6-Trichlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/dry g	17,000	17,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Phenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Organochlorine Pesticides												
2,4'-DDD	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/dry g			9.9	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/dry g	1,000	1,000	<1	44.8	<1	<1	<1	<1	<1	<1	1J
4,4'-DDE	ng/dry g	1,000	1,000	<1	3.8	<1	2.3	<1	<1	<1	<1	<1
4,4'-DDT	ng/dry g	1,000	1,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/dry g			9.9	48.6	<1	2.3	<1	<1	<1	<1	1
Aldrin	ng/dry g	1,400	1,400	<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/dry g			17.9	34.3	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/dry g			28.5	50	<1	1.6J	<1	<1	1.1J	<1	1J
Total detectable chlordane (a,g)	ng/dry g			46.4	84.3	<1	1.6	<1	<1	1.1	<1	1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
DCPA (dacthal)	ng/dry g			<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Dieldrin	ng/dry g	8,000	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/dry g	200	200	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin aldehyde	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/dry g	4,700	4,700	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/dry g	100,000	100,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-Nonachlor	ng/dry g			<1	15	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/dry g			15.5	24.8	<1	<1	<1	<1	<1	<1	<1
Oxychlordane	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/dry g			<5	<5	<5	<5	<5	<5	<5	<5	<5
Toxaphene	ng/dry g	5,000	5,000	61.29	168.71	<10	<10	<10	<10	<10	<10	<10
Aroclor PCBs												
Aroclor 1016	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	ng/dry g	50,000	50,000	137	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	ng/dry g	50,000	50,000	110	199	<10	20	<10	<10	<10	<10	16J
Aroclor 1260	ng/dry g	50,000	50,000	<10	148	<10	38	<10	<10	<10	<10	<10
Total Aroclor	ng/dry g			247	347	<10	58	<10	<10	<10	<10	16
PCB Congeners												
PCB003	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB008	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB018	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB028	ng/dry g			11	<1	<1	<1	<1	<1	<1	<1	<1
PCB031	ng/dry g			4.8	<1	<1	<1	<1	<1	<1	<1	<1
PCB033	ng/dry g			10.4	<1	<1	<1	<1	<1	<1	<1	<1
PCB037	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB044	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	1J
PCB049	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	1.1J
PCB052	ng/dry g			<1	11.4	<1	<1	<1	<1	<1	<1	<1
PCB056/060	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB066	ng/dry g			7.1	4.2	<1	<1	<1	<1	<1	<1	<1
PCB070	ng/dry g			5.8	32	<1	<1	<1	<1	<1	<1	1J
PCB074	ng/dry g			<1	11.4	<1	<1	<1	<1	<1	<1	<1
PCB077	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
PCB081	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB087	ng/dry g			6.2	4.2	<1	<1	<1	<1	<1	<1	<1
PCB095	ng/dry g			6.9	15.8	<1	1.3J	<1	<1	1.1J	<1	<1
PCB097	ng/dry g			<1	7.4	<1	<1	<1	<1	<1	<1	<1
PCB099	ng/dry g			6.2	8.4	<1	1.1J	<1	<1	<1	<1	<1
PCB101	ng/dry g			18	30.3	<1	2.7	<1	<1	<1	<1	1.5J
PCB105	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB110	ng/dry g			13.5	24.3	<1	2.4	<1	<1	<1	<1	2
PCB114	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB118	ng/dry g			<1	22.1	<1	<1	<1	<1	<1	<1	<1
PCB119	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB123	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB126	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB128	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB138	ng/dry g			<1	13	<1	3	<1	<1	<1	<1	1J
PCB141	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB149	ng/dry g			14.3	16.8	<1	1.6J	<1	<1	<1	<1	<1
PCB151	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB153	ng/dry g			<1	12.2	<1	1.4J	<1	<1	<1	<1	1.3J
PCB156	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB157	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB158	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB167	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB168+132	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB169	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB170	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB174	ng/dry g			<1	4.4	<1	<1	<1	<1	<1	<1	<1
PCB177	ng/dry g			<1	1.1J	<1	<1	<1	<1	<1	<1	<1
PCB180	ng/dry g			8.3	9	<1	3	<1	<1	<1	<1	<1
PCB183	ng/dry g			<1	2.2	<1	<1	<1	<1	<1	<1	<1
PCB187	ng/dry g			4.9	8.3	<1	3	<1	<1	<1	<1	<1
PCB189	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB194	ng/dry g			<1	18.5	<1	4.7	<1	<1	<1	<1	<1
PCB195	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB200	ng/dry g			1.3J	<1	<1	1J	<1	<1	<1	<1	<1
PCB201	ng/dry g			<1	6.6	<1	8.2	<1	<1	<1	<1	<1
PCB203	ng/dry g			<1	2.3	<1	6.9	<1	<1	<1	<1	<1
PCB206	ng/dry g			<1	3.9	<1	9.5	<1	<1	1J	<1	<1
PCB209	ng/dry g			<1	<1	<1	2.9	<1	<1	1.7J	<1	<1
Total PCBs	ng/dry g			118.7	269.8	<1	52.7	<1	<1	3.8	<1	8.9
Organophophorus Pesticides												
Azinphos methyl	ng/dry g			<50	<50							
Bolstar (sulprofos)	ng/dry g			<10	<10							

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Chlorpyrifos	ng/dry g			<5	<5							
Demeton	ng/dry g			<10	<10							
Diazinon	ng/dry g			<5	<5							
Dichlorvos	ng/dry g			<10	<10							
Dimethoate	ng/dry g			<5	<5							
Disulfoton	ng/dry g			<10	<10							
Ethoprop (ethoprofos)	ng/dry g			<10	<10							
Ethyl parathion	ng/dry g			<10	<10							
Fenchlorphos (ronnel)	ng/dry g			<10	<10							
Fenitrothion	ng/dry g			<10	<10							
Fensulfothion	ng/dry g			<10	<10							
Fenthion	ng/dry g			<10	<10							
Malathion	ng/dry g			<5	<5							
Merphos	ng/dry g			<10	<10							
Methamidophos (monitor)	ng/dry g			<50	<50							
Methidathion	ng/dry g			<10	<10							
Methyl parathion	ng/dry g			<10	<10							
Mevinphos (phosdrin)	ng/dry g			<10	<10							
Phorate	ng/dry g			<10	<10							
Phosmet	ng/dry g			<50	<50							
Tetrachlorvinphos (stirofos)	ng/dry g			<10	<10							
Tokuthion	ng/dry g			<10	<10							
Trichloronate	ng/dry g			<10	<10							

<	Less than the method detection limit (MDL).
J	Estimated value less than the reporting limit but greater than the MDL.
1	ΣSEM = sum (Cd + Cu + Pb + Ni + (Ag/2) + Zn); if ND, then 1/2 MDL used.
(yellow)	ΣSEM:AVS = >1, indicating potential for metal toxicity due to excess ΣSEM.
BHC	Hexachlorobenzene.
Σ	Sum.
DDD	Dichlorodiphenyldichloroethane.
DDE	Dichlorodiphenyldichloroethylene.
DDT	Dichlorodiphenyltrichloroethane.

The aforementioned data for chromium and lead suggested the potential for leachate from the excavation layer composite samples to exhibit the characteristics of toxicity. Further analyses of these samples (Table 5) using the WET showed that chromium and lead results (4.4 mg/L and 2.4 mg/L, respectively) for sample S-1-5-EL did not exceed STLC criteria (5 mg/L for both metals) and was therefore classified as non-hazardous material. On the other hand, the WET confirmed that chromium and lead results (5.5 mg/L and 5.3 mg/L, respectively) for sample S-6-10-EL, collected from the excavation layer, exceeded STLC criteria for both metals and was therefore classified as hazardous material as defined by the State of California.

Table 5. Oxford Retention Basin Sediment Chemistry – Soluble Threshold Limit Concentration Results

Parameter	Units	Criteria	Excavation Layer	
		STLC	S-1-5-EL	S-6-10-EL
Trace Metals				
Chromium (Cr)	mg/L	**5**	4.4	5.5
Lead (Pb)	mg/L	**5**	2.4	5.3

Simultaneously Extracted Metals – Acid-Volatile Sulfides

The SEM/AVS method was used to determine the potential toxicity of metals in a sediment sample. This method is based on the theory that AVS, comprised primarily of iron monosulfides in sediments, bind to divalent cationic metals and form metal-sulfide complexes. Because these metal-sulfide complexes have low solubility, metal bioavailability and toxicity to benthic organisms is therefore affected by the amount of AVS in sediment. Thus, to determine the potential toxicity of metals in a sediment sample, the ratio of SEM to the concentration of AVS in a sample is evaluated. If SEM is higher than AVS, or SEM:AVS more than 1, then some portion of the metals are not bound up by AVS and therefore are bioavailable and potentially toxic. If SEM is less than AVS, or SEM:AVS is less than 1, then the metals are bound to AVS in the sediment sample are likely not toxic to benthic organisms.

It should be emphasized that this approach works specifically with divalent metals, including cadmium, copper, lead, nickel, and zinc (McGrath et al., 2002). Further research has suggested that silver may also bind with AVS; however, unlike the one to one relationship of the each of the other metals to AVS, one mole of SEM silver reacts with two moles of AVS (Berry et al., 1999; USEPA, 2000).

In addition, results should be interpreted in light of other environmental factors (e.g., DO and salinity), which, at their extremes, may interfere with the determination of this ratio (Long et al., 1988). However, a number of studies have demonstrated the usefulness of this method to predict the toxicity of metals in sediments (Di Toro et al., 1991; Ankley et al., 1991, Casas and Crecelius, 1994).

Table 4 presents the SEM results for the six divalent metals that are likely to bind AVS and the concentration of AVS for each sample. The table also presents the sum (Σ) of the SEM metals and the ratio of the ΣSEM to AVS. Stations with a ΣSEM:AVS ratio greater than one have been highlighted. All of the station samples that were analyzed using the SEM:AVS method had ΣSEM:AVS ratios greater than one. Ratios ranged from 6.511 in the S-1-5-EL sample to 11.72 in the S-6-10-EL sample. This indicates that the concentration of SEM was higher than the concentration of AVS in the sediment sample, suggesting that not all of the metals in the sediment samples were bound up by AVS and therefore may be bioavailable and potentially toxic to benthic organisms. Although the ratios for each station were greater than one, suggesting the potential for metal toxicity from excess ΣSEM to AVS, the calculated ratios for the samples were within a range of 2 to 40, making the prediction of effects uncertain (McGrath et al., 2002). Therefore, these results should be interpreted in the context of toxicity test results and other chemical/physical measurements.

Organic Sediment Constituents

The results of the organic constituents analyses are summarized in Table 4. Several PAH compounds were detected in the sample composites representing the excavation layer. Total detectable PAHs were calculated (low + high molecular weight) at concentrations of 2,096.1 µg/kg and 3,343.2 µg/kg for S-1-5-EL and S-6-10-EL, respectively.

Base/neutral-extractable compounds, acid-extractable compounds, and organophosphorus pesticides were not detected in both excavation layer composite samples. Three phthalates compounds were detected in S-1-5-EL, ranging from 222 ng/g to 4,773 ng/g. Four phthalate compounds were detected in S-6-10-EL, ranging from 60–6,158 ng/g.

Although seven organochlorine pesticide analytes were detected in low concentrations in sample S-1-5-EL and nine organochlorine pesticide analytes were detected in low concentrations in sample S-6-10-EL, none exceeded their respective TTLC or ten times STLC values. The value reported for 4,4'-DDD, in sample S-6-10-EL was 3.8 ng/g, significantly below the ten times STLC value of 1,000 ng/g. The values reported for toxaphene ranged from 61.29 ng/g to 168.71 ng/g for both excavation layer samples, significantly below the ten times STLC value of 50,000 ng/g. Total detectable chlordane ranged from 46.4 ng/g to 84.3 ng/g.

Fourteen individual PCB congeners were detected in sample S-1-5-EL and 21 individual PCB congeners were detected in sample S-6-10-EL. Aroclor 1242 and Aroclor 1254 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 137 µg/kg and 110.0 µg/kg, respectively. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 199 µg/kg and 148 µg/kg, respectively. Total detectable PCBs were calculated at a concentration of 247 µg/kg for S-1-5-EL and at a concentration of 347 µg/kg for S-6-10-EL. All reported PCB results for the excavation layer samples were significantly below the ten times STLC criteria value of 50,000 ng/g.

3.1.2.3 Sediment Chemistry using Toxicity Characteristic Leaching Procedure

Results of the TCLP analyses are presented in Table 6. Briefly, the TCLP values are published in the Code of Federal Regulations (40 CFR §261.24) and are the federal benchmark for determining whether the leachate from a solid would be classified as toxic and, therefore, hazardous. Results of TCLP analyses of project sediments from the excavation layer indicated no metals were reported above the TCLP criteria.

All base/neutral-extractable compounds, acid-extractable compounds, and organochlorine pesticides were reported less than the reporting limit, with the exception of N-Nitrosodimethylamine (NDMA). NDMA values ranged from 7,600 ng/L to 24,000 ng/L. As shown in Table 6, all analytes were reported below the TCLP values.

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Trace Metals											
Antimony (Sb)	µg/L		1.3	4.5	1.7	1.1	1	2	1.5	0.9	1
Arsenic (As)	µg/L	5,000	178	94.5	11.7	24.7	10.3	9.5	18.8	8.5	35.2
Barium (Ba)	µg/L	100,000	406.2	393.5	546.4	620.4	586.8	461.2	512.5	628.1	456.2
Beryllium (Be)	µg/L		3.7	2.9	6.8	5.6	5.2	5.3	4.6	3	3.4
Cadmium (Cd)	µg/L	1,000	24.7	17.7	3.8	6.8	7.3	7.5	6	6.7	4.1
Chromium (Cr)	µg/L	5,000	11.6	9	6.6	4.5	1.6	2.2	2.6	1.5	2.6
Cobalt (Co)	µg/L		26.5	37.3	56.8	66.6	67.8	73.2	75.5	78.9	48.6
Copper (Cu)	µg/L		13.2	7.6	8.5	1.7	35	14.9	7	31.9	5.9
Lead (Pb)	µg/L	5,000	942.71	744.51	8.97	36.17	16.53	14.91	12.23	3.93	21.43
Mercury (Hg)	µg/L	200	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	µg/L		0.7	0.8	0.4J	0.3J	<0.2	0.2J	0.2J	<0.2	0.3J
Nickel (Ni)	µg/L		63.3	98.1	107.7	109.8	111.6	110.7	104.6	114.5	77
Selenium (Se)	µg/L	1,000	<0.2	<0.2	0.8	0.4J	3.4	6.5	5.4	19.6	0.3J
Silver (Ag)	µg/L	5,000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium (Tl)	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium (V)	µg/L		128.2	77.4	227.6	190	83.3	106.3	128.6	142.5	111.1
Zinc (Zn)	µg/L		6,187.9	5,215.9	432.3	766.7	879.8	642.6	620.6	301.3	384.2
Base/Neutral-Extractable Compounds											
1,2,4-Trichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Benzidine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
NDPA	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
NDMA	ng/L		7,600	24,000	4,500	6,800	5,400	7,200	7,300	6,500	8,200
N-Nitrosodiphenylamine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Acid-Extractable Compounds											
2,4,6-Trichlorophenol	ng/L	2,000,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/L	100,000,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Phenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
Organochlorine Pesticides											
2,4'-DDD	ng/L	10,000,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Aldrin	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/L	400,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable chlordane (a,g)	ng/L	30,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
DCPA (dacthal)	ng/L		<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Dieldrin	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/L	20,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin aldehyde	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/L	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/L	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/L	10,000,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-Nonachlor	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Oxychlordane	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/L		<5	<5	<5	<5	<5	<5	<5	<5	<5
Toxaphene	ng/L	500,000	<10	<10	<10	<10	<10	<10	<10	<10	<10

< Less than the MDL.
J Estimated value less than the reporting limit but greater than the MDL.

3.1.2.4 Microbiological Characteristics of Sediment

Results of the sediment bacterial analyses are provided in Table 7. Currently, no sediment quality criteria have been established for indicator bacteria, therefore, these results should be interpreted based on an understanding of the behavior and natural occurrence of these parameters in the environment. Preliminary review of these data suggest the total coliform concentrations were likely indicative of nutrient rich sediment and may be influenced by recent activities in the Oxford Retention Basin to control algae. The fecal coliform, *E. coli*, and enterococcus concentrations are considered indicative of natural sediment background levels. None of the indicator bacteria concentrations suggested anthropogenic sources that required abatement.

Table 7. Indicator Bacterial Concentrations in Oxford Retention Basin Sediment

Parameter	Units	EXCAVATION LAYER									
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Total coliforms	MPN/dry gram	218	451	435	278	591	2,174	21,782	14,953	1,110	5,693
Fecal coliforms	MPN/dry gram	10	34	33	18	81	625	554	935	236	436
E. coli	MPN/dry gram	11*	58*	66*	530*	640*	106	146	5851*	140	407
Enterococci	MPN/dry gram	3	58	59	10	81	<5	8	32	32	133

*Although *E. coli* is a subgroup of fecal coliforms, some values may be higher due to differences in methodology, the sample's matrix (sediment), or statistical range.

MPN = most probable number.

3.1.3 Consolidated Layer Results

3.1.3.1 Physical and Conventional Parameters

Results of the physical and conventional parameter analyses for sediments collected within consolidated layer of the Oxford Retention Basin are presented in Table 4. The individuals sediment samples (S-1-NL through S-6-NL, and S-8-NL) ranged from 23.8–50.1% in coarse-grained material (gravel and sand); and 49.9–76.3% in fine-grained material (silt and clay). The ammonia-N concentrations reported for the consolidated layer samples ranged from 3.41 mg/kg to 22.82 mg/kg. TKN results ranged from 182 mg/kg to 345 mg/kg. TOC levels ranged from 0.33–1.15%, and the percent solids ranged from 76.2–88.5%. Total sulfides and AVS ranged from non-detected (value reported under the method detection limit (MDL)) to 5.31 mg/kg. TPH-CC ranged from non-detected to 150 mg/kg, and pH ranged from 8.8 to 9.3 for all individual consolidated layer sediment samples.

3.1.3.2 Chemical Analyses

Results of the bulk chemical analyses for sediments collected within the Oxford Retention Basin are presented in Table 4. Similar to the excavation layer sediment results, these results were compared to the TTLC and ten times the STLC values. The consolidated layer sediment was also subjected to TCLP tests. Results of the TCLP analyses are presented in Table 6.

Trace Metals

Chromium was the only metal to minimally exceed the screening level assessment of ten times STLC value (50 µg/g) in the consolidated layer individual sediment samples. The chromium concentrations reported for S-2-NL and S-4-NL were 56.84 µg/g and 51.93 µg/g, respectively. All metals, including chromium, were reported significantly below their respective TTLC values.

Simultaneously Extracted Metals □Acid-Volatile Sulfides

Table 4 presents the SEM results for the six divalent metals that are likely to bind AVS and the concentration of AVS for each sample. The table also presents the sum (Σ) of the SEM metals and the ratio of the ΣSEM to AVS. Stations with a ΣSEM:AVS ratio greater than one have been highlighted. All of the station samples that were analyzed using the SEM:AVS method had ΣSEM:AVS ratios greater than one. Ratios ranged from 1.836 in the S-2-NL sample to 177.7 in the S-5-NL sample. This indicates that the concentration of SEM was higher than the concentration of AVS in the sediment sample, suggesting that not all of the metals in the sediment samples were bound up by AVS and therefore may be bioavailable and potentially toxic to benthic organisms. It should be noted that although the ratios for each station were greater than one, suggesting the potential for metal toxicity from excess ΣSEM to AVS, the calculated ratios for the samples, S-1-NL, S-2-NL, and S-8-NL were within a range of 2 to 40, making the prediction of effects uncertain (McGrath et al., 2002). Therefore, these results should be interpreted in the context of toxicity test results and other chemical/physical measurements.

Organic Sediment Constituents

The results of the organic constituents analyses are summarized in Table 4. Several PAH compounds were detected in the sample composites representing the excavation layer. Total detectable PAHs were calculated (low + high molecular weight) at concentrations ranging from 6.2 µg/kg and 198.9 µg/kg for consolidated layer samples.

Base/neutral-extractable compounds and acid-extractable compounds were not detected in the individual consolidated layer sediment samples. One phthalate compound (bis[2-Ethylhexyl] phthalate) was detected in S-2-NL, S-5-NL and S-6-NL, ranging from 149 ng/g to 168 ng/g.

Three organochlorine pesticide analytes were detected in low concentrations in sample S-2-NL, one organochlorine pesticide analyte was detected in sample S-5-NL, and two organochlorine pesticide analytes were detected in low concentrations in sample S-8-NL. The value reported for 4,4'-DDE, in sample S-2-NL was 2.3/g, significantly below the ten times STLC value of 1,000 ng/g. Total detectable chlordane ranged from non-detected to 1.6 ng/g. Organophosphorus pesticides were not tested for in the individual consolidated layer sediment samples.

Eleven individual PCB congeners were detected in sample S-2-NL, one individual PCB congener was detected in sample S-5-NL and two individual PCB congeners were detected in sample S-8-NL. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 137 µg/kg and 110.0 µg/kg, respectively. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-2-NL with a concentration of 20 µg/kg and 30 µg/kg, respectively. Total detectable PCBs were calculated at a concentration of 58 µg/kg for S-2-NL and at a concentration of 16 µg/kg for S-8-NL. All reported PCB results for the excavation layer samples were significantly below the ten times STLC criteria value of 50,000 ng/g.

3.1.3.3 Sediment Chemistry using Toxicity Characteristic Leaching Procedure

Results of the TCLP analyses are presented in Table 6. All base/neutral-extractable compounds, acid-extractable compounds, and organochlorine pesticides were reported less than the reporting limit, with the exception of NDMA. NDMA values ranged from 4,500 ng/L to 8,200 ng/L. As shown in Table 6, all analytes, including trace metals were reported significantly below the TCLP values.

3.2 Water Sampling Results □Wet Weather

3.2.1 Sample Collection

The wet weather water quality field sampling program was completed on January 12–13, 2010, in accordance with the approved SAP. Four sampling efforts were conducted during the sampling event. Table 8 presents the station locations where samples were collected during each sampling round.

The first sampling effort was conducted prior to the onset of rain (termed ‘pre-storm’) during the low tide. This pre-storm sampling effort was conducted to assess water quality during dry weather conditions. Samples were collected from the Oxford Retention Basin (sample ORB-1), from the Exchange Area between Oxford Retention Basin and Basin E, from the Oxford Retention Basin side of the Exchange, (X-ORB-1), and from Basin E (E-1).

The second sampling effort (termed ‘prior to stormwater release’) was conducted after the storm had passed, and Oxford Retention Basin had filled with stormwater runoff (with the tide gates closed). This sampling effort was collected to assess stormwater quality entering Oxford Retention Basin via the associated storm drain system. During this sampling effort, samples were also collected from within Basin E, and represent water quality within Basin E prior to the release of stormwater runoff from Oxford Retention Basin into Basin E. Samples were also collected during this sampling effort for the additional list of analytes listed at the end of Subsection 2.4.2. These additional analyte samples were collected from Oxford Retention Basin as well as the Exchange water between the two basins.

The third sampling effort (termed ‘during stormwater release’) was conducted after the tide gate between Oxford Retention Basin and Basin E was opened. During this sampling effort, samples were collected from the Exchange water (i.e., discharge from Oxford Retention Basin to Basin E), Basin E, and Boone Olive Pump Station.

The fourth sampling effort was collected after Oxford Retention Basin had completely discharged (termed ‘Oxford Retention Basin drained’). Samples were collected from Basin E only during this sampling effort.

Table 8. Station Identification and Latitude and Longitude Coordinates for Water Samples Collected within the Oxford Retention Basin, Basin E, and Boone Olive Pump Station

Area□Basin	Station ID	Latitude	Longitude
Oxford Retention Basin	**ORB-A**	33.98482°	-118.45650°
	ORB-B	33.98530°	-118.45570°
	ORB-C	33.98524°	-118.45525°
	ORB-D	33.98548°	-118.45505°
	ORB-E	33.98536°	-118.45479°
Exchange Area	**X-ORB**	33.98437°	-118.45632°
	X-Basin E	33.98355°	-118.45609°
Basin E	**Basin E-A**	33.98290°	-118.45499°
	Basin E-B	33.98328°	-118.45547°
	Basin E-C	33.98292°	-118.45600°
Boone Olive Pump Station	**Boone Olive**	33.98461°	-118.45928°

3.2.2 Pre-Storm Results

3.2.2.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 12, 2010, to represent the pre-storm conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Water depth varied between the stations from 0.4 ft at ORB-E to 1.0 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 20.76 mS (ORB-E) to 28.91 mS (ORB-A). Turbidity ranged from 5.0 nephelometric turbidity units (NTU) (ORB-A) to 31.7 NTU (ORB-E). DO was relatively consistent among the five stations, ranging from 6.6 mg/L to 12.4 mg/L. pH ranged from 8.23 to 8.50. Temperature was consistent among the five stations monitored, ranging from 15.38ºC to 16.59ºC.

Exchange Water
Field observations and measurements were only taken at one station, X-ORB to represent the Exchange Area water. Water depth was measured at 4.16-ft deep, and temperature was reported at 14.64ºC. Conductivity was 54.16 mS and turbidity was measured at 1.0 NTU. DO was measured at 14.60 mg/L, and ph was measured at 7.94 at station X-ORB.

Basin E
Water depth varied between the stations from 12.5 ft at Basin E-B to 18.6 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.15 mS to 50.82 mS. Turbidity was also consistent among the stations ranging from -0.3 NTU to -0.5 NTU. DO ranged from 7.96 mg/L to 8.03 mg/L. pH ranged from 8.02 to 8.04. Temperature was consistent among the three stations monitored, ranging from 14.79ºC to 14.82ºC.

3.2.2.2 Analytical Chemistry Results

Results of the wet weather (i.e., pre-storm) water quality sampling are presented in Table 10 (the complete laboratory analytical data report for wet weather water quality samples is included in Appendix D). The results from composite sample ORB-1 represent the Oxford Retention Basin, the results from the composite sample X-ORB-1 represent the Exchange Area, and the results from the composite sample E-1 represents Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Concentrations of ammonia in all three samples, ORB-1, X-ORB-1, and E-1were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at ORB-1 (0.34 mg/L). TKN was only detected in the sample, ORB-1, at 2.62 mg/L. Orthophosphate results ranged from 0.02 mg/L (ORB-1) to 0.04 mg/L (X-ORB-1). DOC and TOC were only detected in the ORB-1 sample, reported at 3.0 mg/L and 4.9 mg/L, respectively. TDS ranged from 15,840 mg/L (ORB-1) to 33,380 mg/L (X-ORB-1). TSS were only detected in sample ORB-1, reported at 29.3 mg/L.

Table 9. Field Observations of Water Quality during Wet Weather Monitoring Event at Oxford Retention Basin

Parameter	Unit	Pre Storm										
		Oxford Basin					Exchange Water		Basin E			Boone Olive Pump Station
		ORB-A	ORB-B	ORB-C	ORB-D	ORB-E	X-ORB	X-Basin E	Basin E-A	Basin E-B	Basin E-C	Boone Olive
Date		1.12.10	1.12.10	1.12.10	1.12.10	1.12.10	1.12.10		1.12.10	1.12.10	1.12.10	
Time		2040	2040	2040	2040	2040	2210		2310	2310	2310	
pH		8.31	8.37	8.50	8.38	8.23	7.94		8.03	8.04	8.02	
Conductivity	mS	28.91	27.29	27.34	25.39	20.76	54.16		50.69	50.15	50.82	
Turbidity	NTU	5.0	9.5	5.7	18.3	31.7	1		-0.4	-0.3	-0.5	
Dissolved Oxygen	mg/L	12.4	9.44	11.55	8.36	6.6	7.45		7.96	8.22	8.03	
Temperature	°C	16.48	16.59	15.97	15.46	15.38	14.64		14.8	14.79	14.82	
Color		slight yellow	slight yellow	slight yellow	slight yellow	yellow	None		None	None	None	
Odor		None	None	sulfide	sulfide	sufide	None		None	None	None	
Clarity		Clear	Clear	Clear	Clear	Opaque	Clear		Clear	Clear	Clear	
Water Depth (Total)	feet	1.0	0.9	0.6	0.6	0.4	4.16		14	12.5	18.6	
Fresh Water Lens Depth	feet	0	0	0	0	0	0		0	0	0	
Prior to Stormwater Release												
Date		1.13.10	1.13.10	1.13.10	1.13.10	1.13.10	1.13.10		1.13.10	1.13.10	1.13.10	
Time		1010	1010	1010	1010	1010	1130		1150	1150	1150	
pH		7.9	8.02	7.93	7.94	7.99	7.87		7.94	7.92	7.69	
Conductivity	mS	46.2	36.25	45.55	44.52	42.99	51.06		51.00	50.95	50.81	
Turbidity	NTU	5.6	9.2	5.2	6.4	9.8	1.4		-0.2	-0.2	-0.3	
Dissolved Oxygen	mg/L	7.70	7.77	7.23	7.09	7.12	7.98		7.54	7.53	7.69	
Temperature	°C	14.91	15.0	15.0	15.08	15.15	16.04		14.87	14.96	14.84	
Color		None	None	None	None	None	None		None	None	None	
Odor		None	None	None	None	None	None		None	None	None	
Clarity		Clear	Clear	Clear	Clear	Clear	Clear		Clear	Clear	Clear	
Water Depth (Total)	feet	3.5	2.25	2.4	1.8	2.0	5.8		12.5	11.2	15.5	
Fresh Water Lens Depth	feet	1.3	2.0	1.66	1.5	1.5	0		<0.3	0	0	
During Stormwater Release												
Date								1.13.10	1.13.10	1.13.10	1.13.10	1.13.10
Time								1400	1425	1425	1425	1500
pH								8.02	7.83	7.86	7.81	7.69
Conductivity	mS							32.53	50.04	50.41	50.58	N/A
Turbidity	NTU							12.5	1.1	1.0	1.7	34.8
Dissolved Oxygen	mg/L							7.48	7.62	7.91	7.45	7.36
Temperature	°C							18.36	15.2	15.25	15.04	16.56
Color								slight yellow	None	None	None	slight yellow
Odor								None	None	None	None	None
Clarity								Clear	Clear	Clear	Clear	Clear
Water Depth (Total)	feet							6.75	10.5	9.5	13.0	1.0
Fresh Water Lens Depth	feet							0	<0.3	<0.3	<0.3	N/A
Oxford Basin Drained												
Date									1.13.10	1.13.10	1.13.10	
Time									1600	1600	1600	
pH									7.91	7.93	7.81	
Conductivity	mS								50.7	51.28	50.85	
Turbidity	NTU								1.3	0.3	5.3	
Dissolved Oxygen	mg/L								7.79	7.84	6.33	
Temperature	°C								15.22	15.17	15.14	
Color									None	None	None	
Odor									None	None	None	
Clarity									Clear	Clear	Clear	
Water Depth (Total)	feet								11.3	9.9	13.0	
Fresh Water Lens Depth	feet								<0.3	<0.3	<0.3	

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
General Chemistry													
Ammonia-N	mg/L	6			0.34B	<0.03	0.05B	0.33B	0.05B	0.05B	0.13B	0.08B	0.69B
DOC	mg/L				3	2.9	<0.1	4.6	<0.1	<0.1	2.9	1.4J	11.3
Nitrate-N	mg/L				1.23	0.42	0.07	0.52	0.13	0.21	0.36	0.17	
Nitrate-N by IC	mg/L												1.98
Nitrite-N	mg/L				0.06	0.03J	0.01J	0.05	0.01J	0.01J	0.03J	0.01J	0.08
pH	pH Units				8H	7.4H	7.5H	7.2H	7.4H	7.3H	7.1H	7.2H	7.1H
TDS	mg/L				15,840	24,980	33,380	19,000	31,660	31,320	27,400	29,420	1,106
Total hardness as CaCO3	mg/L				3,097.9	4,688.4	6,035.6	3,676.0	5,856.8	5,735.5	5,075.4	5,616.3	276.9
TKN	mg/L				2.62	1.088	<0.456	1.862	<0.456	<0.456	0.872J	0.586J	2.06
TOC	mg/L				4.9	4.2	0.6J	8.2	0.1J	0.4J	4.3	6.3	15.4
Total orthophosphate as P	mg/L				0.02	0.03	0.04	0.1	0.03	0.06	0.08	0.04	0.69
Total sulfides	mg/L				0.01J,H	0.01J,H	<0.01	0.02J,H	<0.01	0.01J,H	0.01J,H	0.01J,H	0.04J,H
TSS	mg/L				29.3	20.8	3.3J	17.5	2J	5	9.8	5	39.3
Indicator Bacteria													
Enterococci	MPN/100mL	104			10	6,867	10	1,664	10	246	6,131	19,863	>241,960
Fecal coliforms	MPN/100mL	400			130	30,000	40	24,000	70	300	50,000	13,000	17,000
Total coliforms	MPN/100mL	10,000			1,100	50,000	70	50,000	300	2,400	220,000	24,000	240,000
Acid-Extractable Compounds													
2,4,6-Trichlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/L		(a)	13,000	988	<50	<50	951	<50	<50	<50	<50	1203
Phenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
Total chlorinated phenolics	ng/L	10,000			<100	<100	<100	<100	<100	<100	<100	<100	<100
Total non-chlorinated phenolics	ng/L	300,000			988	<100	<100	951	<100	<100	<100	<100	1203
Base/Neutral-Extractable Compounds													
1,2,4-Trichlorobenzene	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Benzidine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Butylbenzyl Phthalate	ng/L				117	504	<25	593	35J	47J	347	132	450
Di-n-butyl Phthalate	ng/L				340	116	<75	182	84J	<75	274	<75	217
Di-n-octyl Phthalate	ng/L				79	113	<10	151	<10	12J	121	27	267
Diethyl Phthalate	ng/L				144	116J	<100	208	<100	<100	179	<100	234
Dimethyl Phthalate	ng/L				<50	97	<50	179	<50	<50	148	<50	89
Hexachlorobenzene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
NDPA	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
NDMA	ng/L				<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	2.7
N-Nitrosodiphenylamine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Ethylhexyl) Phthalate	ng/L				860	999	<100	1124	146	237	625	257	1983
Chlorinated Pesticides													
2,4'-DDD	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	ng/L		1,100	130	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Aldrin	ng/L		3,000	1,300	<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/L		950	160	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable BHC	ng/L	12			<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
DCPA (dacthal)	ng/L				<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Dieldrin	ng/L		240	710	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/L	6	83	37	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Endrin aldehyde	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Oxychlordane	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/L				<5	<5	<5	<5	<5	<5	<5	<5	<5
Total detectable chlordane	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Toxaphene	ng/L		730	210	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-Nonachlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Aroclor PCBs													
Aroclor 1016	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1260	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aroclor	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB Congeners													
PCB1	ng/L				0.0111	0.0071	0.0052	<0.0045	0.0047	<0.0066	<0.0044	<0.0036	<0.0065
PCB2	ng/L				0.0057	<0.0039	<0.0038	<0.0048	<0.0035	<0.0068	<0.0045	<0.0037	<0.0053
PCB3	ng/L				<0.0087	0.0074	0.0043	0.0066	0.0036	<0.0067	0.0066	0.0057	0.0136
PCB4	ng/L				0.038	0.0376	0.0424	0.021	0.035	0.025	0.0273	0.0227	0.0249
PCB5	ng/L				<0.0065	<0.0053	<0.0083	<0.0059	<0.0052	<0.0067	<0.0034	<0.0042	<0.0049
PCB6	ng/L				0.0187	0.0143	<0.015	0.0099	0.0146	<0.0091	0.0091	<0.0084	0.0117
PCB7	ng/L				<0.0064	<0.0053	<0.0082	<0.0067	<0.0051	<0.0076	<0.0038	<0.0048	<0.0056
PCB8	ng/L				0.086	0.0748	0.0753	0.0563	0.0744	0.0545	0.0523	0.0602	0.082
PCB9	ng/L				0.0064	<0.0049	<0.0077	<0.0061	<0.0048	<0.007	<0.0035	<0.0044	<0.0051
PCB10	ng/L				<0.02	<0.013	<0.014	<0.012	<0.014	<0.018	<0.011	<0.012	<0.0053
PCB11	ng/L				0.12	0.13	0.0444	0.141	0.0243	0.0341	0.0857	0.0522	0.248
PCB12+13	ng/L				0.0076	<0.0061	<0.0079	<0.0068	0.0069	<0.0078	<0.0039	<0.0048	0.0063
PCB14	ng/L				<0.0059	<0.0048	<0.0075	<0.0064	<0.0047	<0.0073	<0.0037	<0.0046	<0.0054
PCB15	ng/L				0.045	0.0393	0.041	0.0243	0.0407	0.022	0.0254	0.0242	0.0346
PCB16	ng/L				0.036	0.048	<0.039	0.036	0.037	0.03	<0.031	0.038	0.043
PCB17	ng/L				0.045	0.055	0.049	0.027	0.043	0.024	<0.024	0.0255	0.0267
PCB18+30	ng/L				0.102	0.119	0.102	0.0665	0.083	<0.047	0.0572	0.0556	0.0556
PCB19	ng/L				<0.012	0.0138	<0.012	<0.0086	0.0153	0.0109	0.0098	0.0116	0.0087
PCB20+28	ng/L				0.159	0.14	0.178	0.0883	0.122	0.0853	0.0885	0.091	0.0911
PCB21+33	ng/L				0.0893	0.0837	0.091	0.052	0.069	0.047	0.0471	0.0482	0.0577

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB22	ng/L				0.0533	0.0544	0.056	0.0335	0.0418	0.0291	0.0311	0.0295	0.0381
PCB23	ng/L				<0.0038	<0.0019	<0.0023	<0.0067	<0.0043	<0.0042	<0.0032	<0.003	<0.0035
PCB24	ng/L				<0.016	<0.01	<0.0097	<0.0074	<0.012	<0.0078	<0.0058	<0.0065	<0.0054
PCB25	ng/L				<0.011	0.011	0.0123	0.0076	<0.0085	0.0068	0.0076	<0.0062	0.0067
PCB26+29	ng/L				0.0271	0.0245	0.0251	0.015	0.0204	0.0142	<0.015	0.015	0.0153
PCB27	ng/L				<0.012	0.0088	0.0104	<0.0081	<0.009	<0.0085	<0.0058	<0.0071	<0.0059
PCB31	ng/L				0.138	0.122	0.132	0.0841	0.0912	0.063	0.0722	0.0711	0.0807
PCB32	ng/L				0.03	0.0355	0.0389	0.0206	0.0304	0.0197	0.0205	0.021	<0.016
PCB34	ng/L				<0.0035	<0.0017	<0.0021	<0.006	<0.0039	<0.0037	<0.0029	<0.0027	<0.0031
PCB35	ng/L				0.0055	<0.0058	<0.0022	0.0064	<0.0041	<0.0038	<0.0029	<0.0028	0.0099
PCB36	ng/L				<0.0032	<0.0016	<0.002	<0.0054	<0.0037	<0.0034	<0.0026	<0.0025	<0.0029
PCB37	ng/L				0.0365	0.0372	0.0446	0.0229	0.0254	0.0167	0.0198	0.0181	0.0341
PCB38	ng/L				<0.0036	<0.0018	<0.0022	<0.0062	<0.0041	<0.0039	<0.003	<0.0028	<0.0033
PCB39	ng/L				<0.0034	<0.0017	<0.0021	<0.0058	<0.0039	<0.0037	<0.0028	<0.0026	<0.0031
PCB40+41+71	ng/L				<0.073	0.0925	0.066	0.0854	0.0451	0.0319	0.0563	<0.038	0.045
PCB42	ng/L				0.042	0.0458	0.0414	0.0379	0.026	0.0191	0.0284	0.0243	<0.017
PCB43	ng/L				<0.01	<0.0081	<0.0057	<0.01	<0.0059	<0.011	<0.0065	<0.0092	<0.008
PCB44+47+65	ng/L				0.173	0.301	0.138	0.38	0.093	0.0774	0.191	0.118	0.0801
PCB45+51	ng/L				<0.022	0.0314	0.0229	0.0211	<0.017	<0.012	0.0169	0.0172	<0.013
PCB46	ng/L				<0.011	<0.0091	0.0092	0.0098	0.0071	<0.01	<0.006	<0.0086	<0.0075
PCB48	ng/L				0.0306	0.0364	0.0278	0.0254	0.0197	0.0132	<0.016	0.0159	<0.013
PCB49+69	ng/L				0.104	0.159	0.1	0.175	0.0606	0.0526	0.0992	0.0721	0.0427
PCB50+53	ng/L				0.0259	0.031	0.0226	0.0314	0.0182	<0.014	0.0218	0.021	<0.0092
PCB52	ng/L				0.298	0.558	0.16	0.791	0.103	0.0867	0.363	0.167	0.107
PCB54	ng/L				<0.013	<0.008	<0.008	<0.0088	<0.0089	<0.0097	<0.0077	<0.0097	<0.01
PCB55	ng/L				<0.0041	<0.0031	<0.003	<0.0051	<0.0023	<0.0051	<0.0024	<0.0047	<0.0049
PCB56	ng/L				<0.043	0.0512	0.0391	0.0644	0.0167	0.0175	0.0333	0.0266	0.0386
PCB57	ng/L				<0.0037	<0.0028	<0.0028	<0.0048	<0.0021	<0.0049	<0.0023	<0.0044	<0.0047
PCB58	ng/L				<0.0041	<0.0031	<0.003	0.0262	<0.0023	<0.0049	<0.0087	<0.0044	<0.0047
PCB59+62+75	ng/L				0.012	0.0136	0.0136	0.0115	<0.0076	<0.0067	0.0102	0.0084	0.0068
PCB60	ng/L				0.0257	0.0276	0.0232	0.024	0.0091	<0.0093	0.0163	0.0121	0.0194
PCB61+70+74+76	ng/L				0.256	0.406	0.188	0.552	0.077	0.0817	0.271	0.14	0.141
PCB63	ng/L				0.0051	0.005	0.004	0.0061	0.0021	<0.0046	0.0034	<0.0042	<0.0044
PCB64	ng/L				<0.06	0.0924	0.0523	0.108	0.0315	0.0275	<0.054	0.0371	0.0341
PCB66	ng/L				0.115	0.118	0.105	0.149	0.047	0.0557	0.0936	0.0709	0.071
PCB67	ng/L				<0.0034	<0.0032	0.0029	<0.0046	<0.0019	<0.0047	<0.0022	<0.0043	<0.0045
PCB68	ng/L				<0.0038	<0.0029	<0.0028	<0.0047	<0.0021	<0.0048	<0.0023	<0.0043	<0.0046
PCB72	ng/L				<0.0037	<0.0028	<0.0027	<0.0047	<0.0021	<0.0048	<0.0023	<0.0044	<0.0046
PCB73	ng/L				<0.0075	<0.0059	<0.0042	<0.0065	<0.0043	<0.007	<0.0041	<0.0059	<0.0051
PCB77	ng/L				0.0196	0.0266	0.0084	0.0373	0.0046	<0.0061	0.018	0.0083	0.0293
PCB78	ng/L				<0.0038	<0.0029	<0.0028	<0.0047	<0.0022	<0.0048	<0.0023	<0.0044	<0.0046
PCB79	ng/L				<0.0034	0.0037	<0.0025	<0.0052	<0.0019	<0.0043	0.0037	<0.0039	<0.0042

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB80	ng/L				<0.0034	<0.0026	<0.0026	<0.0043	<0.0019	<0.0043	<0.0021	<0.0039	<0.0042
PCB81	ng/L				<0.0052	<0.0039	<0.0039	<0.006	<0.0029	<0.006	<0.0029	<0.0055	<0.0058
PCB82	ng/L				0.042	0.0697	<0.011	0.102	<0.0048	<0.008	0.0452	0.019	0.0273
PCB83+99	ng/L				0.16	0.319	0.113	0.423	0.0427	0.0476	0.197	0.0947	0.0854
PCB84	ng/L				0.086	0.223	0.0331	0.339	0.0211	0.0185	0.142	0.0532	0.0524
PCB85+116+117	ng/L				0.0516	0.0896	0.0308	0.113	0.0117	<0.007	0.0492	0.0241	0.0291
PCB86+87+97+109+119+125	ng/L				0.23	0.469	0.105	0.649	0.0467	0.0541	0.29	0.119	0.165
PCB88+91	ng/L				0.047	<0.089	0.0229	0.144	0.0123	0.0091	0.0623	0.0269	0.0213
PCB89	ng/L				<0.0097	<0.0074	<0.0053	0.0101	<0.0042	<0.0077	<0.0053	<0.0048	<0.0065
PCB90+101+113	ng/L				0.334	0.722	0.205	0.94	0.0866	0.106	0.439	0.195	0.261
PCB92	ng/L				0.0585	0.119	0.0337	0.168	0.0143	0.0185	0.0746	0.0366	0.0405
PCB93+98+100+102	ng/L				<0.0093	0.0247	0.0083	0.0362	<0.0041	<0.0073	0.0162	0.0066	<0.0062
PCB94	ng/L				<0.0097	<0.0074	<0.0053	<0.0076	<0.0042	<0.0079	<0.0054	<0.0049	<0.0067
PCB95	ng/L				0.25	0.628	0.11	0.979	0.0685	0.0726	0.41	0.163	0.193
PCB96	ng/L				<0.012	<0.013	<0.022	<0.0086	<0.015	<0.014	<0.0073	<0.012	<0.011
PCB103	ng/L				<0.0082	<0.0063	<0.0044	<0.0061	<0.0036	<0.0064	<0.0043	<0.004	<0.0054
PCB104	ng/L				<0.0049	<0.0052	<0.0091	<0.0054	<0.006	<0.0085	<0.0046	<0.0075	<0.0066
PCB105	ng/L				0.126	0.177	0.0445	0.237	0.0196	0.025	0.113	0.0496	0.102
PCB106	ng/L				<0.0033	<0.0025	<0.0022	<0.0048	<0.0028	<0.0056	<0.0024	<0.0031	<0.0026
PCB107	ng/L				0.0181	0.0279	0.0106	0.0376	<0.0025	<0.005	0.0181	0.0104	0.0158
PCB108+124	ng/L				0.0108	0.0189	0.0053	0.0256	<0.0026	<0.0054	0.0115	0.0054	0.0103
PCB110+115	ng/L				0.379	0.742	0.188	1.06	0.0806	0.0944	0.492	0.206	0.305
PCB111	ng/L				<0.0068	<0.0052	<0.0037	<0.0052	<0.003	<0.0054	<0.0037	<0.0034	<0.0046
PCB112	ng/L				<0.0074	<0.0057	<0.004	<0.0053	<0.0032	<0.0056	<0.0038	<0.0035	<0.0047
PCB114	ng/L				0.0052	0.0103	0.0029	0.0125	<0.0032	<0.0061	0.0047	<0.0033	0.0056
PCB118	ng/L				0.282	0.445	0.144	0.583	0.0516	0.0688	0.29	0.132	0.215
PCB120	ng/L				<0.0066	<0.0051	<0.0036	<0.005	<0.0029	<0.0052	<0.0035	<0.0032	<0.0044
PCB121	ng/L				<0.0068	<0.0053	<0.0037	<0.0052	<0.003	<0.0054	<0.0037	<0.0034	<0.0046
PCB122	ng/L				<0.0033	0.0041	<0.0022	<0.0055	<0.0028	<0.0057	<0.0025	<0.0031	<0.0027
PCB123	ng/L				<0.0048	0.0093	0.0032	0.0106	<0.0032	<0.0061	0.0047	<0.0033	<0.0029
PCB126	ng/L				<0.0052	<0.0058	<0.0024	0.0095	<0.0031	<0.006	0.0043	<0.0033	<0.0063
PCB127	ng/L				<0.003	<0.0023	<0.002	<0.0044	<0.0026	<0.0052	<0.0022	<0.0028	<0.0024
PCB128+166	ng/L				<0.07	<0.081	0.0222	0.144	<0.0086	0.015	0.0655	0.0281	0.0654
PCB129+138+163	ng/L				0.467	0.589	0.191	0.816	0.0791	0.11	0.377	0.171	0.458
PCB130	ng/L				0.028	0.037	0.0106	0.061	<0.011	<0.014	0.0245	0.0105	<0.022
PCB131	ng/L				<0.02	<0.013	<0.0078	0.017	<0.011	<0.014	<0.0073	<0.009	<0.01
PCB132	ng/L				0.16	0.233	0.051	0.341	0.024	0.036	0.146	0.058	0.143
PCB133	ng/L				<0.018	<0.012	<0.0072	<0.015	<0.01	<0.013	<0.0067	<0.0082	<0.0095
PCB134+143	ng/L				0.024	0.038	0.0082	0.05	<0.011	<0.014	0.0216	0.0117	0.019
PCB135+151	ng/L				<0.095	0.196	0.067	<0.2	0.03	0.04	0.098	0.053	0.12
PCB136	ng/L				0.052	0.097	0.022	<0.11	<0.016	<0.014	0.0557	0.025	0.0521
PCB137	ng/L				0.023	<0.022	<0.0073	0.046	<0.01	<0.013	0.0175	<0.0082	0.0121

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB139+140	ng/L				<0.017	0.012	<0.0068	0.018	<0.0094	<0.012	0.0086	<0.0078	<0.009
PCB141	ng/L				0.072	0.1	0.0348	0.136	0.0107	0.014	0.0555	0.0298	0.0815
PCB142	ng/L				<0.019	<0.012	<0.0075	<0.016	<0.01	<0.013	<0.007	<0.0086	<0.01
PCB144	ng/L				0.023	<0.025	<0.013	0.032	<0.02	<0.016	0.015	<0.013	0.02
PCB145	ng/L				<0.016	<0.014	<0.011	<0.014	<0.017	<0.013	<0.009	<0.011	<0.01
PCB146	ng/L				<0.05	<0.061	0.0263	0.092	0.011	0.014	0.0468	0.0256	0.0604
PCB147+149	ng/L				0.329	0.464	0.142	0.582	0.0643	0.082	0.265	0.134	0.32
PCB148	ng/L				<0.02	<0.018	<0.014	<0.017	<0.022	<0.016	<0.011	<0.013	<0.012
PCB150	ng/L				<0.015	<0.013	<0.011	<0.013	<0.016	<0.012	<0.0084	<0.01	<0.0094
PCB152	ng/L				<0.015	<0.013	<0.011	<0.013	<0.016	<0.012	<0.0084	<0.01	<0.0094
PCB153+168	ng/L				0.316	0.413	0.186	0.5	0.0657	0.0907	0.247	0.138	0.325
PCB154	ng/L				<0.018	<0.016	<0.012	<0.015	<0.019	<0.015	<0.01	<0.012	<0.011
PCB155	ng/L				<0.007	<0.0061	<0.0049	<0.0087	<0.0074	<0.0085	<0.0058	<0.0069	<0.0065
PCB156+157	ng/L				0.049	0.0624	0.0171	0.087	0.0063	0.0105	<0.04	<0.015	0.0518
PCB158	ng/L				0.043	0.059	<0.013	0.081	<0.007	<0.009	0.0348	0.0156	0.0449
PCB159	ng/L				<0.0069	<0.0038	<0.0034	<0.0091	<0.0037	<0.0066	<0.0033	<0.004	<0.0049
PCB160	ng/L				<0.014	<0.0095	<0.0057	<0.012	<0.0079	<0.01	<0.0053	<0.0065	<0.0076
PCB161	ng/L				<0.013	<0.0088	<0.0053	<0.011	<0.0073	<0.0093	<0.0049	<0.006	<0.007
PCB162	ng/L				<0.0072	<0.0039	<0.0035	<0.0095	<0.0038	<0.0069	<0.0035	<0.0042	<0.0052
PCB164	ng/L				0.029	0.0401	0.0113	0.053	<0.0076	<0.0096	0.0245	0.0123	0.0335
PCB165	ng/L				<0.015	<0.0098	<0.0059	<0.013	<0.0081	<0.01	<0.0055	<0.0067	<0.0078
PCB167	ng/L				0.0171	0.021	0.0062	0.033	<0.0047	<0.008	0.0151	0.007	0.0207
PCB169	ng/L				<0.0089	<0.0049	<0.0043	<0.011	<0.0048	<0.0082	<0.0041	<0.005	<0.0062
PCB170	ng/L				0.066	0.068	0.0346	0.085	0.0125	0.021	0.0445	0.028	0.131
PCB171+173	ng/L				<0.019	0.022	0.013	0.029	<0.0085	<0.018	<0.013	<0.012	<0.031
PCB172	ng/L				<0.019	<0.013	<0.0087	<0.016	<0.0085	<0.018	<0.01	<0.012	0.021
PCB174	ng/L				0.078	0.078	<0.036	0.074	0.019	0.023	0.041	0.026	0.103
PCB175	ng/L				<0.021	<0.011	<0.0096	<0.015	<0.0095	<0.014	<0.0067	<0.0097	<0.012
PCB176	ng/L				<0.016	0.0109	<0.0075	<0.012	<0.0074	<0.011	<0.0053	<0.0077	<0.011
PCB177	ng/L				0.042	0.04	<0.021	0.044	0.0099	<0.018	<0.022	0.015	0.065
PCB178	ng/L				<0.022	<0.015	<0.0099	<0.016	<0.0098	<0.015	0.01	<0.01	<0.022
PCB179	ng/L				0.039	0.0395	0.0206	<0.037	0.0116	0.012	0.022	0.0146	0.0368
PCB180+193	ng/L				0.142	0.125	0.0745	0.148	0.0269	<0.039	0.0802	0.0467	0.247
PCB181	ng/L				<0.019	<0.013	<0.0085	<0.015	<0.0083	<0.017	<0.0096	<0.011	<0.01
PCB182	ng/L				<0.021	<0.011	<0.0098	<0.015	<0.0097	<0.014	<0.0068	<0.0099	<0.012
PCB183	ng/L				0.038	0.038	0.0257	0.048	0.0113	<0.018	<0.022	0.021	0.078
PCB184	ng/L				<0.016	<0.0081	<0.0073	<0.011	<0.0072	<0.011	<0.0051	<0.0073	<0.0088
PCB185	ng/L				<0.02	<0.013	<0.009	<0.015	<0.0087	<0.017	<0.0096	<0.011	<0.01
PCB186	ng/L				<0.017	<0.0086	<0.0078	<0.012	<0.0077	<0.011	<0.0055	<0.0079	<0.0095
PCB187	ng/L				<0.095	0.099	0.0579	0.094	<0.026	0.032	0.0522	<0.034	0.127
PCB188	ng/L				<0.012	<0.0062	<0.0056	<0.011	<0.0055	<0.011	<0.0052	<0.0075	<0.0089
PCB189	ng/L				<0.013	<0.0091	<0.0043	<0.02	<0.0065	<0.0094	<0.012	<0.0078	<0.0081

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB190	ng/L				<0.015	<0.012	0.0077	0.017	<0.0066	<0.014	0.0084	<0.009	<0.019
PCB191	ng/L				<0.014	<0.0093	<0.0063	<0.012	<0.0061	<0.014	<0.0079	<0.009	<0.0086
PCB192	ng/L				<0.015	<0.01	<0.007	<0.013	<0.0068	<0.015	<0.0084	<0.0096	<0.0091
PCB194	ng/L				0.031	<0.018	<0.0088	<0.025	<0.0079	<0.017	<0.014	<0.012	0.061
PCB195	ng/L				<0.024	<0.016	<0.0083	<0.021	<0.0084	<0.018	<0.015	<0.012	<0.02
PCB196	ng/L				<0.03	<0.023	<0.016	<0.027	<0.011	<0.023	<0.018	<0.016	0.035
PCB197	ng/L				<0.024	<0.019	<0.013	<0.02	<0.0088	<0.017	<0.014	<0.012	<0.016
PCB198+199	ng/L				<0.041	0.038	0.016	0.039	<0.011	<0.023	0.022	0.016	0.069
PCB200	ng/L				<0.021	<0.017	<0.011	<0.019	<0.0077	<0.016	<0.013	<0.011	<0.015
PCB201	ng/L				<0.023	<0.018	<0.012	<0.019	<0.0082	<0.017	<0.013	<0.011	<0.016
PCB202	ng/L				<0.021	<0.017	<0.011	<0.021	<0.0077	<0.018	<0.014	<0.012	0.018
PCB203	ng/L				<0.028	<0.022	<0.015	<0.024	<0.01	<0.021	<0.017	<0.014	0.038
PCB204	ng/L				<0.022	<0.017	<0.012	<0.019	<0.0081	<0.016	<0.013	<0.011	<0.016
PCB205	ng/L				<0.023	<0.015	<0.0078	<0.018	<0.008	<0.016	<0.013	<0.011	<0.011
PCB206	ng/L				<0.046	<0.025	<0.014	<0.032	<0.016	<0.023	<0.025	<0.021	0.044
PCB207	ng/L				<0.04	<0.022	<0.012	<0.027	<0.014	<0.02	<0.022	<0.018	<0.012
PCB208	ng/L				<0.047	<0.026	<0.015	<0.033	<0.016	<0.024	<0.026	<0.022	<0.014
PCB209	ng/L				<0.048	<0.028	<0.014	<0.039	<0.017	<0.047	<0.019	<0.029	0.028
Total PCBs	ng/L				6.3154	10.081	4.0823	12.8006	2.1814	1.9604	6.2485	3.3569	5.9616
PAHs													
1-Methylnaphthalene	ng/L				3J	<1	<1	2.6J	<1	<1	1.8J	1.1J	28.7
1-Methylphenanthrene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	26.5
2,3,5-Trimethylnaphthalene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	7.2
2,6-Dimethylnaphthalene	ng/L				38.5	5.4	<1	7.3	<1	<1	3.3J	1.5J	21.4
2-Methylnaphthalene	ng/L				3.8J	1.5J	<1	4.1J	<1	<1	3.1J	1.1J	54.8
Acenaphthene	ng/L				<1	<1	<1	<1	<1	<1	3.1J	<1	7.1
Acenaphthylene	ng/L				3.2J	2.7J	<1	1.6J	<1	<1	5	2.6J	5.6
Anthracene	ng/L				4.1J	7.9	<1	6.1	<1	<1	1.9J	3.8J	12.5
Benz[a]anthracene	ng/L				7.4	9.5	<1	6.6	<1	<1	4.6J	2.1J	20.3
Benzo[a]pyrene	ng/L				7.7	9	<1	9.8	<1	<1	6.2	4.1J	26.5
Benzo[b]fluoranthene	ng/L				13.1	11.9	<1	12.3	<1	5.1	8.5	6.1	39
Benzo[e]pyrene	ng/L				13.8	17.2	<1	14.1	<1	3.2J	7.4	4.9J	69.8
Benzo[g,h,i]perylene	ng/L				6.9	3.3J	<1	4.9J	<1	<1	<1	<1	38.5
Benzo[k]fluoranthene	ng/L				6.9	65	<1	8.4	<1	3.1J	6.7	2.6J	18.3
Biphenyl	ng/L				6.3	3.9J	<1	5.5	<1	<1	2.6J	2.8J	11
Chrysene	ng/L				20.2	34.2	<1	27.3	<1	4.1J	16.5	6.9	97.7
Dibenz[a,h]anthracene	ng/L				3.3J	<1	<1	5.5	<1	<1	<1	<1	8.6
Dibenzothiophene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	18.5
Fluoranthene	ng/L				26.6	40.9	<1	32.6	<1	7.5	17.2	7.4	89.5
Fluorene	ng/L				<1	3J	<1	5.2	<1	<1	3.3J	1.6J	14.8
Indeno[1,2,3-c,d]pyrene	ng/L				12.2	10.6	<1	17.4	<1	<1	2J	<1	19
Perylene	ng/L				2.1J	4.4J	<1	4.3J	<1	<1	4J	6.5	37.4

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Phenanthrene	ng/L				11	15.7	<1	12.9	<1	5.5	9.8	4.6J	90.4
Pyrene	ng/L				29.7	35.5	<1	32.1	<1	6.8	20.7	7.5	94.7
Total detectable PAHs	ng/L				219.8	281.6	<1	220.6	<1	35.3	127.7	67.2	857.8
TPH-CC													
C6	ug/L				<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
C7	ug/L				<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1
C8	ug/L				<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
C9-C10	ug/L				<13	<13	<13	<13	<13	<13	<13	<13	<13
C11-C12	ug/L				<14	<14	<14	<14	<14	<14	<14	<14	<14
C13-C14	ug/L				<16	<16	<16	16	<16	<16	<16	<16	28
C15-C16	ug/L				<17	<17	<17	18	<17	<17	<17	<17	49
C17-C18	ug/L				<17	<17	<17	24	<17	<17	<17	<17	57
C19-C20	ug/L				<18	<18	<18	23	<18	<18	<18	<18	64
C21-C22	ug/L				<18	<18	<18	28	<18	<18	<18	<18	75
C23-C24	ug/L				<18	<18	<18	32	<18	<18	<18	<18	93
C25-C28	ug/L				<16	<16	<16	34	<16	<16	17	19	130
C29-C32	ug/L				15	20	<8.5	41	<8.5	<8.5	18	18	190
C33-C36	ug/L				<7.9	12	<7.9	21	<7.9	<7.9	8.5	8	140
C37-C40	ug/L				<6.8	<6.8	<6.8	21	<6.8	<6.8	<6.8	<6.8	130
C41-C44	ug/L				9	<6.6	<6.6	11	<6.6	<6.6	<6.6	<6.6	66
C6-C44 Total	ug/L				<47	<47	<47	270	<47	<47	<47	<47	1000
Dissolved Metals													
Antimony (Sb)	µg/L				0.38B	0.4B	0.14B	0.62B	0.23B	0.26B	0.5B	0.34B	<0.1
Arsenic (As)	µg/L		0.34 (b)	69	0.91B	1.45B	2.02B	1.36B	2.17B	2.24B	1.55B	1.59B	<0.2
Barium (Ba)	µg/L				43	21.3	10.6	25.9	12.5	12.9	16.5	12.9	34.4
Beryllium (Be)	µg/L				0.032	0.034	0.025	0.032	0.024	0.038	0.026	0.02	<0.2
Cadmium (Cd)	µg/L		(c)	42	0.015	0.067	0.108	0.048	0.112	0.123	0.105	0.107	<0.2
Chromium (Cr)	µg/L		(c)	1100	1.671B	0.701B	0.198B	0.859B	0.481B	0.256B	0.461B	0.303B	<0.1
Cobalt (Co)	µg/L				0.291B	0.203B	0.189B	0.237B	0.215B	0.198B	0.204B	0.183B	<0.1
Copper (Cu)	µg/L		(c)	4.8	1.46B	3.52B	10.74B	3.88B	12.11B	9.59B	7.02B	9.94B	<0.4
Lead (Pb)	µg/L		(c)	210	0.078	0.158	0.207	0.188	0.147	0.107	0.17	0.144	<0.05
Mercury (Hg)	µg/L				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	µg/L				8.044	7.408	7.995	6.667	8.135	8.598	7.197	7.943	<0.2
Nickel (Ni)	µg/L		(c)	74	1.019B	1.02B	0.572B	1.341B	0.629B	0.667B	0.959B	0.742B	<0.2
Selenium (Se)	µg/L			290	0.01J	0.03	0.02	0.04	0.02	0.03	0.02	0.03	<0.2
Silver (Ag)	µg/L		(c)	1.9	0.09B	0.07B	0.11B	0.06B	0.08B	0.09B	0.07B	0.07B	<0.5
Thallium (Tl)	µg/L				<0.005	<0.005	0.011	<0.005	0.012	0.01	0.007J	0.01	<0.1
Vanadium (V)	µg/L				3.08	2.01	1.89	2.32	2.17	1.97	2.09	1.92	<0.2
Zinc (Zn)	µg/L		(c)	90	10.22B	52.44B	89.5B	48.91B	84.59B	77.79B	66.53B	74.18B	<0.1
Total Metals													
Antimony (Sb)	µg/L				0.5B	0.55B	0.24B	0.76B	0.15B	0.26B	0.47B	0.34B	2.2B
Arsenic (As)	µg/L	80			1.11B	1.52B	2.07B	1.5B	2.24B	1.92B	1.72B	2.16B	3.6B

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Barium (Ba)	µg/L				49.3	26.3	11.9	37.8	13	15	20.4	15.1	43.9
Beryllium (Be)	µg/L				0.046	0.048	0.033	0.046	0.03	0.04	0.035	0.037	<0.2
Cadmium (Cd)	µg/L	10			0.368	0.132	0.108	0.141	0.107	0.181	0.114	0.105	0.3J
Chromium (Cr)	µg/L	20			4.116B	1.951B	0.347B	2.169B	0.51B	0.463B	1.028B	0.676B	1.9B
Cobalt (Co)	µg/L				0.377B	0.308B	0.2B	0.324B	0.208B	0.204B	0.244B	0.208B	0.5B
Copper (Cu)	µg/L	30			10.6B	14.75B	14.03B	16.51B	14.14B	13.44B	15.04B	14.41B	21.6B
Lead (Pb)	µg/L	20			3.504B	3.255B	0.56B	3.659B	0.332B	0.767B	1.748B	0.92B	7.38B
Mercury (Hg)	µg/L	0.4			0.01J	0.01J	<0.01	0.01J	<0.01	<0.01	<0.01	<0.01	0.01J
Molybdenum (Mo)	µg/L				6.707	5.279	7.423	4.912	8.093	7.072	5.636	6.71	5.3
Nickel (Ni)	µg/L	50			1.596B	1.464B	0.63B	1.861B	0.617B	0.702B	1.284B	0.85B	3.9B
Selenium (Se)	µg/L	150			0.04	0.04	0.02	0.04	0.03	0.03	0.04	0.03	2.3
Silver (Ag)	µg/L	7			0.09B	0.07B	0.11B	0.07B	0.08B	0.08B	0.06B	0.08B	<0.5
Thallium (Tl)	µg/L				<0.005	0.007J	0.012	0.006J	0.012	0.01	0.009J	0.01	<0.1
Vanadium (V)	µg/L				5.01	3.19	2.13	3.45	2.14	2.26	2.55	2.37	5.4
Zinc (Zn)	µg/L	200			50.35B	79.66B	91.85B	80.32B	67.43B	82.14B	77.5B	78.15B	89.7B
VOCs													
1,1,1-Trichloroethane (TCA)	µg/L				<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365
1,1,2,2-Tetrachloroethane	µg/L				<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228
1,1,2-Trichloroethane	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	1.2	<0.031	<0.031	<0.031
1,1-Dichloroethane	µg/L				<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076
1,1-Dichloroethene	µg/L				<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177
1,2-Dichlorobenzene	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
1,2-Dichloroethane (EDC)	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
1,2-Dichloropropane	µg/L				<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266
1,3-Dichlorobenzene	µg/L				<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283
1,4-Dichlorobenzene	µg/L				0.1J,B	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
2-Chloroethyl vinyl ether (2-CVE)	µg/L				<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
Acrolein	µg/L				<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217
Acrylonitrile	µg/L				<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401
Benzene	µg/L				<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118
Bromodichloromethane	µg/L				<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281
Bromoform	µg/L				<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347
Bromomethane (methyl bromide)	µg/L				0.4J,B	0.3J,B	0.5B	0.3J,B	0.3J,B	0.4J,B	0.3J,B	0.2J	0.2J
Carbon Tetrachloride	µg/L				<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323
Chlorobenzene	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Chloroethane (ethyl chloride)	µg/L				<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583
Chloroform	µg/L				<0.1795	<0.1795	<0.1795	0.2J	<0.1795	<0.1795	<0.1795	<0.1795	<0.1795
Chloromethane (methyl chloride)	µg/L				0.4J,B	0.3J,B	0.4J,B	0.3J,B	0.4J,B	0.3J,B	0.2J	0.2J	0.2J
Dibromochloromethane	µg/L				<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Dichlorodifluoromethane (F12)	µg/L				0.3J,B	0.2J,B	0.2J,B	0.2J,B	0.2J,B	0.3J,B	0.2J,B	0.2J,B	0.2J,B
Ethylbenzene	µg/L				0.1J	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156
Methyl-t-butyl ether (MTBE)	µg/L				<0.1318	<0.1318	0.2J	<0.1318	0.2J	0.2J	<0.1318	<0.1318	<0.1318

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Methylene chloride (dichloromethane)	µg/L				1.5B	2.2B	1.3B	2.9B	2B	2.9B	2.3B	1.8B	0.3J,B
Tetrachloroethene (PCE)	µg/L				0.1J	<0.0167	<0.0167	<0.0167	<0.0167	<0.0167	0.1J	0.4J	10.7
Toluene	µg/L				0.2J,B	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Trichloroethene (TCE)	µg/L				0.1J	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	0.4J
Trichlorofluoromethane (F11)	µg/L				<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	0.1J
Vinyl Chloride	µg/L				0.1J	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983
c-1,2-Dichloroethene	µg/L				<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	0.3J
c-1,3-Dichloropropene	µg/L				<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198
o-Xylene	µg/L				<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152
p/m-Xylene	µg/L				<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201
t-1,2-Dichloroethene	µg/L				<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403
t-1,3-Dichloropropene	µg/L				<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218

CVE = chloroethyl vinyl ether.
EDC = dichloroethane.
F11 = trichlorofluoromethane.

Organic Constituents Results

Acid-extractable compounds were not detected in samples X-ORB-1 and E-1. Total non-chlorinated phenolics (i.e., pentachlorophenol) were reported at 988 ng/L in sample ORB-1, which is below the CTR value of 13,000 ng/L and the COP value of 300,000 ng/L. Five base/neutral-extractable compounds were detected in sample ORB-1, and one base/neutral-extractable compound was detected in sample E-1.

There were no chlorinated pesticides detected during the pre-storm event in all three composite samples.

Aroclor PCBs were not detected in the three samples. Although, 59 individual PCB congeners were detected in sample ORB-1, 63 individual PCB congeners were detected in sample X-ORB-1, and 52 individual PCB congeners were detected in sample E-1, total detectable PCBs were calculated at low concentrations of 6.32 ng/L for ORB-1, 4.08 ng/L for X-ORB-1, and 2.1814 ng/L for E-1.

Several PAH compounds were detected only in sample ORB-1. Total detectable PAHs were calculated (low + high molecular weight) at a concentration 219.8 µg/L.

Two TPH-CC analytes were detected in sample ORB-1. C29-C32 was reported at 15.0 ug/L, and C41-C44 was reported at 9.0 ug/L.

One VOC (methylene chloride) was detected in sample ORB-1 at 1.5 µg/kg, two VOCs (bromomethane and methylene chloride) were detected in X-ORB-1, at 0.5 µg/kg and 1.3 µg/kg, respectively; and one VOC (methylene chloride) was detected in E-1 at 2.0 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/L) in samples X-ORB-1 (10.74 µg/L) and E-1 (12.11 µg/L). There were no other exceedances reported for dissolved metals in all three samples. In addition, there were no observed exceedances for total metals in all three composite samples.

3.2.2.3 Microbiology Results

The indicator bacteria monitored during the pre-storm event—representing the Oxford Retention Basin, Exchange Area, and Basin E—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 10 MPN/100 mL for all three samples, which is significantly below the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 40 MPN/100 mL (X-ORB-1) and 130 MPN/100 mL (ORB-1), which is below the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 70 MPN/100 mL (X-ORB-1) and 1,100 MPN/100 mL (ORB-1), which is also significantly below the COP values of 10,000 MPN/100mL.

3.2.3 Prior to Stormwater Release

3.2.3.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions prior to stormwater release. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin

Water depth varied between the stations from 1.3 ft at ORB-A to 2.0 ft at ORB-B. Conductivity, a measure of the dissolved solutes in the water, ranged from 36.25 mS (ORB-B) to 46.2 mS (ORB-A). Turbidity ranged from 5.2 NTU (ORB-C) to 9.8 NTU (ORB-E). DO was relatively consistent among the five stations, ranging from 7.09 mg/L to 7.77 mg/L. pH ranged from 7.90 to 8.02. Temperature was consistent among the five stations monitored, ranging from 14.91ºC to 15.15ºC.

Exchange Water

Field observations and measurements were only taken at one station, X-ORB, to represent the Exchange Area water. Water depth was measured at 5.8-ft deep, and temperature was reported at 16.04ºC. Conductivity was 51.06 mS and turbidity was measured at 1.4 NTU. DO was measured at 7.98 mg/L, and ph was measured at 7.87 at station X-ORB.

Basin E

Water depth varied between the stations from 11.2 ft at Basin E-B to 15.5 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.81 mS to 51.00 mS. Turbidity was also consistent among the stations ranging from -0.2 NTU to -0.3 NTU. DO ranged from 7.53 mg/L to 7.69 mg/L. pH ranged from 7.69 to 7.94. Temperature was consistent among the three stations monitored, ranging from 14.84ºC to 14.96ºC.

3.2.3.2 Analytical Chemistry Results

Results of the wet weather (i.e., prior to stormwater release) water quality sampling are presented in Table 10. The results from composite sample ORB-2 represent the Oxford Retention Basin, and the results from the composite sample E-2 represents Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry

Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia was only detected in sample E-2, at 0.05 mg/L; significantly less than the COP water quality criteria of 6.0 mg/L. TKN was only detected in the sample, ORB-2, at 1.088 mg/L. Orthophosphate results ranged from 0.03 mg/L (ORB-2) to 0.06 mg/L (E-2). DOC and TOC were only detected in the ORB-2 sample, reported at 2.9 mg/L and 4.2 mg/L, respectively. TSS ranged from 24,980 mg/L (ORB-2) to 31,320 mg/L (E-2). TSS were ranged from 5.0 mg/L (E-2) to 17.5 mg/L (ORB-2).

Organic Constituents Results

Acid-extractable compounds were not detected in samples X-ORB-2 and E-2. Five base/neutral-extractable compounds were detected in sample ORB-2, and one base/neutral-extractable compound was detected in sample E-2.

There were no chlorinated pesticides detected prior to the stormwater release in both composite samples.

Aroclor PCBs were not detected in both samples. Although 77 individual PCB congeners were detected in sample ORB-2, and 48 individual PCB congeners were detected in sample E-2, total detectable PCBs were calculated at low concentrations of 10.08 ng/L and 1.96 ng/L for E-2.

Several PAH compounds were detected only in both samples. Total detectable PAHs were calculated (low + high molecular weight) at a concentration 281.6 µg/L for ORB-2 and 35.3 µg/L for E-2.

Two TPH-CC analytes were detected in sample ORB-2. C29-C32 was reported at 20 µg/L, and C33-C36 was reported at 12.0 µg/L.

One VOC (methylene chloride) was detected in sample ORB-2 at 2.2 µg/kg, two VOCs (1,1,2-trichloroethane and methylene chloride) were detected in E-2, at 1.2 µg/kg and 2.9 µg/kg, respectively.

Total and Dissolved Metals
The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-2, reported at 9.59 µg/L. There were no other observed exceedances for dissolved metals in the two composite samples. In addition, there were no observed exceedances for total metals in both composite samples.

3.2.3.3 Microbiology Results

The indicator bacteria monitored prior to the stormwater release—representing the Oxford Retention Basin and Basin E—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 6,867 for sample ORB-2 and 246 MPN/100 mL for sample E-2, which exceeds the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 300 MPN/100 mL (E-2) and 30,000 MPN/100 mL (ORB-2). This concentration reported for ORB-2 exceeds the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 2,400 MPN/100 mL (E-2) and 50,000 MPN/100 mL. This concentration reported for sample ORB-2 exceeds the COP value of 10,000 MPN/100mL.

3.2.3.4 Additional Analytes Results

Additional analytes were collected prior to the stormwater release for the composite samples ORB-Add-2 and X-ORB-Add-2. General chemistry (i.e., BOD, COD, chloride, cyanide, and oil and grease) and organophosphorus pesticides results are presented in Table 11. These additional analytes will be used for the bioremediation study.

BOD ranged from not-detected (X-ORB-Add-2) to 6.9 mg/L for ORB-Add-2. COD ranged from 119 mg/L (ORB-Add-2) to 161 mg/L (X-ORB-Add-2). Chloride ranged from 15,143.34 mg/L (ORB-Add-2) to 17,594.57 mg/L (X-ORB-Add-2). Cyanide and oil and grease were not detected in both samples. There were no detected organophosphorus pesticides reported in the two composite samples.

Table 11. Summary of Additional Analytes Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater	
					Oxford Retention Basin	Exchange
					ORB-Add-2	X-ORB-Add-2
					01/13/2010	01/13/2010
General Chemistry						
BOD	mg/L				6.9	<2
COD	mg/L				119	161
Chloride by IC	mg/L				15143.34	17594.57
Cyanide	mg/L	0.01		0.001*	<0.005	<0.005
Oil & grease	mg/L				1.7J	1.6J
Organophosphorus Pesticides						
Azinphos methyl	ng/L				<10	<10
Bolstar (sulprofos)	ng/L				<2	<2
Chlorpyrifos	ng/L				<1	<1
Demeton	ng/L				<1	<1
Diazinon	ng/L				<2	<2
Dichlorvos	ng/L				<3	<3
Dimethoate	ng/L				<3	<3
Disulfoton	ng/L				<1	<1
Ethoprop (ethoprofos)	ng/L				<1	<1
Ethyl parathion	ng/L				<10	<10
Fenchlorphos (ronnel)	ng/L				<2	<2
Fenitrothion	ng/L				<10	<10
Fensulfothion	ng/L				<1	<1
Fenthion	ng/L				<2	<2
Malathion	ng/L				<3	<3
Merphos	ng/L				<1	<1
Methamidophos (monitor)	ng/L				<50	<50
Methidathion	ng/L				<10	<10
Methyl parathion	ng/L				<1	<1
Mevinphos (phosdrin)	ng/L				<8	<8
Phorate	ng/L				<6	<6
Phosmet	ng/L				<50	<50
Tetrachlorvinphos (stirofos)	ng/L				<2	<2
Tokuthion	ng/L				<3	<3
Trichloronate	ng/L				<1	<1

< = Results are less than the MDL.
J = Analyte was detected at a concentration below the reporting limit and above the laboratory MDL. Reported value is estimated.
*MDL is above WQO.

3.2.4 During Stormwater Release

3.2.4.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions during stormwater release. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Physical parameter measurements were not taken in the field during the stormwater release event in the Oxford Retention Basin.

Exchange Water
Field observations and measurements were only taken at one station, X-Basin E, to represent the Exchange Area water. Water depth was measured at 6.75 ft, and temperature was reported at 18.36ºC. Conductivity was 32.53 mS and turbidity was measured at 12.5 NTU. DO was measured at 7.48 mg/L and ph was measured at 8.02 at station X-Basin E.

Basin E
Water depth varied between the stations from 9.5 ft at Basin E-B to 13.0 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.04 mS to 50.58 mS. Turbidity was also consistent among the stations ranging from 1.0 NTU to 1.7 NTU. DO ranged from 7.53 mg/L to 7.69 mg/L. pH ranged from 7.45 to 7.91. Temperature was consistent among the three stations monitored, ranging from 15.04ºC to 15.25ºC.

Boone Olive Pump Station
Field observations and measurements were only taken at one station (i.e., Boone Olive) to represent the Boone Olive Pump Station. Water depth was measured at 1.0 ft, and temperature was reported at 16.56ºC. Turbidity was relatively high, measured at 34.8 NTU. DO was measured at 7.36 mg/L, and ph was measured at 7.69 at the Boone Olive Pump Station.

3.2.4.2 Analytical Chemistry Results

Results of the wet weather (i.e., during stormwater release) water quality sampling are presented in Table 10. The results from composite sample X-BasinE-3 represent the Exchange Area, the results from the composite sample E-3 represents Basin E, and the results from the composite sample BO-3 represents Boone Olive Pump Station. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia ranged from 0.13 mg/L in sample E-3, to 0.69 mg/L in sample BO-3; significantly less than the COP water quality criteria of 6.0 mg/L. TKN ranged from 0.872 mg/L (E-3) to 2.06 mg/L (B)-3). Orthophosphate results ranged from 0.08 mg/L (E-3) to 0.69 mg/L (BO-3). DOC results ranged from 2.9 mg/L (E-3) to 11.3 mg/L (BO-3). TOC results ranged from 4.3 mg/L (E-3) to 15.4 mg/L (BO-3). TDS ranged from 1,106 mg/L (BO-3) to 27,400 mg/L (E-3). TSS were ranged from 9.8 mg/L (E-3) to 39.3 mg/L (BO-3).

Organic Constituents Results

Acid-extractable compounds were not detected in samples E-3. Pentachlorophenol was reported at 951 ng/L in sample X-BasinE-3 and 1203 ng/L in sample BO-3, thus the total non-chlorinated phenolics were calculated at 951 ng/L and 1203 ng/L, respectively. These values are significantly below the COP value of 300,000 ng/L. Six base/neutral-extractable compounds were detected in sample X-Basin E-3, six compounds were detected in sample E-3, and seven compounds were detected in sample BO-3.

There were no chlorinated pesticides detected during the stormwater release in all three composite samples.

Aroclor PCBs were not detected in all three samples. Although 78 individual PCB congeners were detected in sample X-BasinE-3, 72 individual PCB congeners were detected in sample E-3, and 73 individual PCB congeners were detected in sample BO-3, total detectable PCBs were calculated at low concentrations of 12.8006 ng/L for sample X-BasinE-3, 6.2486 ng/L for sample E-3, and 5.9616 ng/L for BO-3.

Several PAH compounds were detected only in both samples. Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 220.6 µg/L for X-Basin-E-3, 127.7 ng/L for sample E-3, and 857.8 µg/L for BO-3.

Eleven TPH-CC analytes were detected in sample X-BasinE-3, and the total C6-C44 TPH-CC was calculated at 270 µg/L. Two TPH-CC analytes were detected in sample E-3, and C29-C32 was reported at 18.0 µg/L and C33-36 was reported at 8.5 µg/L. Eleven TPH-CC analytes were detected in sample BO-3, and the total C6-C44 TPH-CC was calculated at 1,000 µg/L.

One VOC (methylene chloride) was detected in sample X-BasinE-3 at 2.9 µg/kg, one VOC (methylene chloride) was detected in E-3, at 2.3 µg/kg and one VOC (tetrachloroethene (PCE)) was detected 10.7 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the stormwater release event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-3, reported at 7.02 µg/L. There were no other observed exceedances reported for dissolved metals in the three composite samples. Additionally, there were no observed exceedances reported for total metals in all three composite samples.

3.2.4.3 Microbiology Results

The indicator bacteria monitored during the stormwater release—representing the Exchange Area, and Basin E, and the Boone Olive Pump Station—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 1,664 MPN/100 mL for sample X-BasinE-3, 6,131 MPN/100 mL for sample E-3, and greater than 241,960 MPN/100 mL for sample BO-3, which exceed the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 17,000 MPN/100 mL (BO-3) and 50,000 MPN/100 mL (E-3). All three station results exceed the COP values of 400 MPN/100 mL for fecal coliforms. The total coliform concentrations ranged between 50,000 MPN/100 mL (X-BasinE-3) and 240,000 MPN/100 mL (BO-3). All three station results exceed the COP values of 10,000 MPN/100 mL for total coliforms.

3.2.5 Oxford Retention Basin Drained

3.2.5.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions while the Oxford Retention Basin was drained. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Physical parameter measurements were not taken in the field during the event while the Oxford Retention Basin was drained.

Exchange Water
Physical parameter measurements were not taken in the field in the Exchange Area Water for the event conducted while the Oxford Retention Basin was drained.

Basin E
Water depth varied between the stations from 9.9 ft at Basin E-B to 13.0 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.7 mS to 51.28 mS. Turbidity ranged among the stations from 0.3 NTU to 5.3 NTU. DO ranged from 6.33 mg/L to 7.84 mg/L. pH ranged from 7.81 to 7.93. Temperature was consistent among the three stations monitored, ranging from 15.14ºC to 15.22ºC.

Boone Olive Pump Station
Physical parameter measurements were not taken in the field at the Boone Olive Pump Station for the event conducted while the Oxford Retention Basin was drained.

3.2.5.2 Analytical Chemistry Results

Results of the wet weather (i.e., Oxford Retention Basin drained) water quality sampling are presented in Table 10. The results from the composite sample E-4 represent Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia was reported at 0.08 mg/L in sample E-4, significantly less than the COP water quality criteria of 6.0 mg/L. TKN was reported at 0.586 mg/L. Orthophosphate was reported at 0.04 mg/L. DOC was reported as not detected TOC was 6.3 mg/L. TDS were 29,420 mg/L, and TSS was 5.0 mg/L.

Organic Constituents Results
Acid-extractable compounds were not detected in samples E-4. Three base/neutral-extractable compounds were detected in sample E-4.

There were no chlorinated pesticides detected during the Oxford Retention Basin drainage event in composite sample E-4.

Aroclor PCBs were not detected in all three samples. Although 65 individual PCB congeners were detected in sample E-4, total detectable PCBs were calculated at a low concentration of 5.96 ng/L.

Several PAH compounds were detected only in sample E-4. Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 857.8 µg/L sample E-4.

Three TPH-CC analytes were detected in sample E-4. C25-C28 was reported at 19 µg/L, C29-C32 was reported at 18 µg/L and C33-C36 µg/L in sample E-4. One VOC (methylene chloride) was detected in sample E-4 at 1.8 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the stormwater release event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-4, reported at 9.94 µg/L. There were no other observed exceedances reported for dissolved metals in the three composite samples. Additionally, there were no observed exceedances reported for total metals in all three composite samples.

3.2.5.3 Microbiology Results

The indicator bacteria monitored while the Oxford Retention Basin was drained—representing Basin E (composite sample E-4)—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 19,863 MPN/100 mL for sample E-3, which exceeds the COP value of 104 MPN/100 mL (Table 10). The fecal coliform concentrations were 13,000 MPN/100 mL, which exceeds the COP value of 400 MPN/100 mL for fecal coliforms. The total coliform concentrations were measured at 24,000 MPN/100 mL, which exceeds the COP value of 10,000 MPN/100 mL for total coliforms.

3.3 Water Sampling Results Dry Weather

3.3.1 Sample Collection

The dry weather water quality field sampling program was completed on March 11, 2010, in accordance with the approved SAP. Two rounds of sampling were conducted during the sampling event, once during the ebbing tide and once during flooding tide. Table 8 presents the station locations where samples were collected during each sampling round. Boone Olive Pump Station was only sampled during the ebb tide.

The first round of sampling was conducted after the high tide peak, while the tide was receding (termed ‘ebb tide’). The ebb tide sampling round was conducted to evaluate how water discharged from Oxford Retention Basin and Boone Olive Pump Station may affect water quality in Basin E. Samples were collected from Oxford Retention Basin (with the tide gates closed), the Exchange water from the Oxford Retention Basin side of the tide gate, the Boone Olive Pump Station, and Basin E.

The second round of sampling was conducted after the low tide nadir, while the tide was filling in (termed ‘flood tide’). The flood tide sampling round was conducted to evaluate how flood water from Basin E may affect water quality in Oxford Retention Basin. Samples were collected from Basin E, the Exchange water from the Basin E side of the tide gate, and Oxford Retention Basin. All samples were taken after the tide gate between Oxford Retention Basin and Basin E was opened.

Due to extremely low water levels in Oxford Retention Basin during the flood tide sampling round, samples could not be taken at Station ORB-D or Station ORB-E. A strong current was created in Oxford Retention Basin while the tide gate was open. Water being discharged from Oxford Retention Basin to Basin E had significantly dropped the water level in the east end of the basin, leaving it inaccessible for sampling. Samples ORB-D and ORB-E were collected at Station ORB-C, where water levels were sufficient enough for sampling. These samples were processed following the procedure described in Subsection 2.3.2.

3.3.2 Ebbing Tide

3.3.2.1 Field Data Results

Physical parameter measurements were taken in the field during the dry weather event of March 11, 2010. The following results were taken on March 11, 2010, to represent the ebbing tide conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 12.

Oxford Retention Basin
Water depth varied between the stations from 1.5 ft (ORB-C, ORB-D, and ORB-E) to 2.0 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 43.27 mS (ORB-E) to 45.65 mS (ORB-D). Turbidity ranged from 0.3 NTU (ORB-A) to 2.6 NTU (ORB-D). DO was relatively consistent among the five stations, ranging from 2.65 mg/L to 6.77 mg/L. pH ranged from 7.66 to 7.91. Temperature ranged from 14.59ºC to 17.29ºC among all five stations.

Exchange Water
Field observations and measurements were only taken at one station, X-Basin E to represent the Exchange Area water. Water depth was measured at 5.5-ft deep, and temperature was reported at 17.61ºC. Conductivity was 33.81 mS, and turbidity was measured at 2.9 NTU. DO was measured at 6.33 mg/L, and ph was measured at 7.93 at station X-Basin E.

Basin E
Water depth varied between the stations from 11.1 ft at Basin E-B to 14.7 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 52.45 mS to 52.66 mS. Turbidity was also consistent among the stations ranging from 0.0 NTU to 1.4 NTU. DO ranged from 7.15 mg/L to 7.27 mg/L. pH ranged from 7.91 to 7.92. Temperature was consistent among the three stations monitored, ranging from 16.05ºC to 16.23ºC.

Boone Olive Pump Station
Field observations and measurements were only taken at one station, to represent the Boone Olive Pump Station. Water depth was measured at 2.4-ft deep, and temperature was reported at 18.41ºC. Conductivity was 7.51 mS and turbidity was measured at 0.4 NTU. DO was measured at 7.11 mg/L and ph was measured at 7.62 at the Boone Olive Pump Station.

3.3.2.2 Analytical Chemistry Results

Results of the dry weather (ebbing tide) water quality sampling are presented in Table 13 (the complete laboratory analytical data report for dry weather water quality samples is included in Appendix E). The results from Composite sample Basin E-D-1 represent Basin E, the results from the composite sample ORB-D-1 represent the Oxford Retention Basin, the results from the composite sample X-ORB-D-1 represents the Exchange Area, and the results from the composite sample BO-D-1represents The Boone Olive Pump Station. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 13). Of these, a water quality benchmark is available for

ammonia. Concentrations of ammonia in all four samples, Basin E-D-1, ORB-D-1, X-ORB-D-2, and BO-D-1 were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at X-ORB-D-1 (0.07 mg/L). TKN was recorded as not-detected in all four samples. Orthophosphate results ranged from 0.03 mg/L (Basin E-D-1) to 0.18 mg/L (BO-D-1).

DOC carbon results ranged from 2.6 mg/L (BO-D-1) to 7.4 mg/L (Basin E-D-1), and TOC results ranged from 2.0 mg/L (ORB-D-1) to 3.0 mg/L (X-ORB-D-1). DOC was not detected in sample ORB-D-1, and TOC was not detected in sample Basin E-D-1. TDS ranged from 3,944 mg/L (BO-D-1) to 32,760 mg/L (Basin E-D-1). TSS were not-detected in all four samples.

Organic Constituents Results

Acid-extractable compounds were not detected in all four composite samples. Base/neutral-extractable compounds were not detected in sample Basin E-D-1. Two base/neutral-extractable compounds were detected in sample ORB-D-1, three base/neutral-extractable compounds were detected in sample X-ORB-D-1, and one base/neutral-extractable compound was detected in sample BO-D-1.

There were no chlorinated pesticides detected during the dry weather, ebbing tide event in all four composite samples.

Aroclor PCBs were not detected in the four composite samples. No individual PCB congeners were detected in samples Basin E-D-1 and BO-D-1; only two individual PCB congeners were detected in sample ORB-D-1, and four individual PCB congeners were detected in sample X-ORB-D-1. Total detectable PCBs were calculated at a concentration of 2.0599 ng/L for ORB-D-1, and 2.3804 ng/L for X-ORB-D-1.

Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 7.4 µg/L for Basin E-D-1, 90.1 ng/L for sample ORB-D-1, 37.8 ng/L for sample ORB-D-1, and 48.3 µg/L for BO-D-1.

Five TPH-CC analytes were detected in sample ORB-D-1 and the Total C6-C44 was reported at 110 µg/L. Four TPH-CC analytes were detected in sample X-ORB-D-1 and the Total C6-C44 was reported at 96 µg/L.

No VOCs were detected in sample Basin E-D-1 and sample X-ORB-D-1. One VOC (methyl bromide) was detected in sample ORB-D-1 at 0.5 µg/kg, two VOCs (methylene chloride and PCE) were detected in BO-D-1, at 1.0 µg/kg and 8.8 µg/kg, respectively.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/L) in sample Basin E-D-1 (5.1 µg/L). There were no other exceedances reported for dissolved metals in all four samples. In addition, there were no observed exceedances for total metals in all four composite samples.

Table 12. Field Observations of Water Quality during Dry Weather Event

Parameter	Unit	Oxford Basin					Exchange Water	Basin E			Pump Station
		ORB-A	ORB-B	ORB-C	ORB-D	ORB-E	X-Basin E	Basin E-A	Basin E-B	Basin E-C	Boone Olive
Flood Tide											
Date		3/11/2010	3/11/2010	3/11/2010	Stations ORB-D and ORB-E were inaccessible due to low water levels; physical parameter measurements and samples collected at station ORB-C.		3/11/2010	3/11/2010	3/11/2010	3/11/2010	
Time		1245	1245	1245			1200	1400	1400	1400	
pH		7.77	7.88	7.91			7.70	7.85	7.27	7.82	
Conductivity	mS	37.65	25.42	26.06			46.04	52.37	52.31	53.32	
Turbidity	NTU	2.7	1.3	11.7			0.3	-0.3	0.1	0.0	
Dissolved Oxygen	mg/L	7.79	9.68	10.3			5.87	7.38	7.87	7.3	
Temperature	°C	19.74	20.75	20.87			16.73	16.71	16.46	16.55	
Color		None	None	Light Brown			None	None	None	None	
Odor		None	None	Organic			None	None	None	None	
Clarity		Clear	Clear	Slightly Turbid			Clear	Clear	Clear	Clear	
Water Depth (Total)	feet	1.7	0.41	0.41			7.4	10.8	9.7	12.5	
Fresh Water Lens Depth	feet	1.5	None	None			None	2.5	2.8	2.7	
Ebb Tide											
Date		3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010
Time		0800	0800	0800	0800	0800	1055	1015	1015	1015	0930
pH		7.91	7.83	7.88	7.66	7.87	7.93	7.92	7.91	7.91	7.62
Conductivity	mS	43.48	44.5	45.4	45.65	43.27	33.81	52.66	52.46	52.45	7.52
Turbidity	NTU	0.3	1.7	1.8	2.6	1.4	2.9	1.4	0.0	0.0	0.4
Dissolved Oxygen	mg/L	6.77	4.21	5.23	2.65	4.66	6.33	7.23	7.15	7.27	7.11
Temperature	°C	14.59	16.1	15.8	17.29	15.7	17.61	16.23	16.05	16.08	18.41
Color		None	None	None	None	None	None	None	None	None	None
Odor		Sulfide	None	None	Sulfide	Sulfide	None	None	None	None	Sulfide/ Anaerobic
Clarity		Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Water Depth (Total)	feet	3.3	2.2	1.6	1.7	1.6	5.5	12.5	11.1	14.7	2.4
Fresh Water Lens Depth	feet	2.0	1.9	1.5	1.5	1.5	None	None	None	None	N/A

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
General Chemistry												
pH	SM 4500 H+	pH Units				7.8 H	7.9 H	7.5 H	7.5 H	7.9 H	7.7 H	7 H
Total hardness as CaCO3	SM 2340 B	mg/L				5,778.30	5,050	4,836.50	5,094.20	2,852.50	3,651.60	899.9
TDS	SM 2540 C	mg/L				32,760	28,480	27,780	28,640	15,900	19,800	3,944
TSS	SM 2540 D	mg/L				3.8 J	3.2 J	4.2 J	4.5 J	23	3.5 J	1.3 J
DOC	SM 5310 B	mg/L				7.4	0.9 J	2.2	1.3 J	1.7 J	4	2.6
TOC	SM 5310 B	mg/L				0.8 J	1 J	3.1	2	2.1	3	2.7
Ammonia-N	SM 4500-NH3 F	mg/L	6			<0.03	0.07	0.11	0.16	0.14	0.15	0.03 J
Nitrite-N	SM 4500-NO2 B	mg/L				<0.01	0.02 J	0.03 J	0.04 J	0.05	0.07	0.01 J
Nitrate-N	SM 4500-NO3 E	mg/L				0.09	0.51	0.5	0.46	2.8	1.67	4.73
TKN	SM 4500-N D	mg/L				<0.456	<0.456	0.458 J	0.586 J	0.642 J	0.632 J	<0.456
Total orthophosphate as P	SM 4500-P E	mg/L				0.03	0.05	0.06	0.06	0.14	0.08	0.18
Total sulfides	SM 4500-S2 D	mg/L				<0.01	<0.01	<0.01	<0.01	0.02 J	<0.01	0.01 J
Indicator Bacteria												
E. coli	Colilert	MPN/100mL				30	10	<10	10	63	<10	20
Enterococci	Enterolert	MPN/100mL	104			20	20	<10	30	195	30	63
Fecal coliforms	SM 9221E	MPN/100mL	400			40	<20	<20	<20	230	<20	20
Total coliforms	SM 9221B	MPN/100mL	10,000			220	70	40	220	1400*	220	1,100
Total Metals												
Antimony (Sb)	EPA 1640m/EPA 200.8m	µg/L				0.21 B	0.45 B	0.52 B	0.47 B	0.76 B	0.86 B	0.4 J
Arsenic (As)	EPA 1640m/EPA 200.8m	µg/L	80			2.84	2.08	2.49	1.84	1.7	1.67	11.1
Barium (Ba)	EPA 200.8m	µg/L				11.2	17.6	21	19.8	38.6	32.5	56.3
Beryllium (Be)	EPA 1640m/EPA 200.8m	µg/L				0.042 B	0.031 B	0.041 B	0.036 B	0.052 B	0.04 B	<0.2
Cadmium (Cd)	EPA 1640m/EPA 200.8m	µg/L	10			0.076	0.089	0.066	0.067	0.123	0.06	<0.2
Chromium (Cr)	EPA 1640m/EPA 200.8m	µg/L	20			0.358	1.363	1.684	1.533	9.161	3.728	1.1
Cobalt (Co)	EPA 1640m/EPA 200.8m	µg/L				0.355 B	0.396 B	0.39 B	0.461 B	0.593 B	0.51	0.3 J
Copper (Cu)	EPA 1640m/EPA 200.8m	µg/L	30			6.99 B	5.92 B	3.98 B	4.78 B	8.82 B	3.81 B	0.9
Lead (Pb)	EPA 1640m/EPA 200.8m	µg/L	20			0.689 B	0.944 B	1.122 B	1.508	5.987 B	1.162 B	<0.05
Mercury (Hg)	EPA 245.7m	µg/L	0.4			<0.01	<0.01	<0.01	<0.01	0.01 J	<0.01	0.01 J
Molybdenum (Mo)	EPA 1640m/EPA 200.8m	µg/L				10.33 B	10.83 B	10.14 B	10.2 B	10.4 B	9.732 B	19.6
Nickel (Ni)	EPA 1640m/EPA 200.8m	µg/L	50			0.494 B	0.685 B	0.787 B	0.814 B	1.547 B	1.021 B	2.7
Selenium (Se)	EPA 1640m/EPA 200.8m	µg/L	150			0.02	0.05	0.05	0.04	0.07	0.05	4.4
Silver (Ag)	EPA 1640m/EPA 200.8m	µg/L	7			0.68 B	0.68 B	0.65 B	0.61 B	0.64 B	0.64 B	<0.5
Thallium (Tl)	EPA 1640m/EPA 200.8m	µg/L				0.009 J	0.007 J	<0.005	<0.005	0.005 J	<0.005	<0.1
Vanadium (V)	EPA 1640m/EPA 200.8m	µg/L				2.05	2.3	2.09	1.9	4.22	2.57	3.6
Zinc (Zn)	EPA 1640m/EPA 200.8m	µg/L	200			30.14 B	27.79 B	25.27 B	28.01 B	42.21 B	22.97 B	5.2 B
Dissolved Metals												
Antimony (Sb)	EPA 1640m/EPA 200.8m	µg/L				0.26 B	0.44 B	0.7 B	0.52 B	0.82 B	0.79 B	0.5
Arsenic (As)	EPA 1640m/EPA 200.8m	µg/L		340 (a)	69	2.26 B	1.7 B	1.29 B	1.75 B	1.34 B	1.49 B	12.6
Barium (Ba)	EPA 200.8m	µg/L				9.1	17.5	20.5	19.8	37.4	30.6	53.3
Beryllium (Be)	EPA 1640m/EPA 200.8m	µg/L				0.03 B	0.032 B	0.029 B	0.033 B	0.038 B	0.04 B	<0.2
Cadmium (Cd)	EPA 1640m/EPA 200.8m	µg/L		(b)	42	0.074 B	0.073 B	0.057 B	0.038 B	0.028 B	0.047 B	0.2 J

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Chromium (Cr)	EPA 1640m/EPA 200.8m	µg/L		(b)	1100	0.17	0.874	0.792	0.578	4.902	2.625	1
Cobalt (Co)	EPA 1640m/EPA 200.8m	µg/L				0.374 B	0.502 B	0.415 B	0.4 B	0.442 B	0.46 B	0.4 J
Copper (Cu)	EPA 1640m/EPA 200.8m	µg/L		(b)	4.8	5.1 B	3.82 B	1.58 B	1.09 B	0.76 B	1.89 B	1.5
Lead (Pb)	EPA 1640m/EPA 200.8m	µg/L		(b)	210	0.131	0.051	0.032	0.025	0.077	0.057	0.12
Mercury (Hg)	EPA 245.7m	µg/L				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	EPA 1640m/EPA 200.8m	µg/L				10.1	10.42	10.06	9.914	10.32	9.686	21
Nickel (Ni)	EPA 1640m/EPA 200.8m	µg/L		(b)	74	0.445 B	0.613 B	0.719 B	0.674 B	0.986 B	0.972 B	2.8
Selenium (Se)	EPA 1640m/EPA 200.8m	µg/L			290	0.02	0.04	0.04	0.04	0.07	0.03	5.6
Silver (Ag)	EPA 1640m/EPA 200.8m	µg/L		(b)	1.9	0.63 B	0.66 B	0.63 B	0.58 B	0.64 B	0.64 B	1.2
Thallium (Tl)	EPA 1640m/EPA 200.8m	µg/L				0.012	0.006 J	<0.005	<0.005	<0.005	<0.005	<0.1
Vanadium (V)	EPA 1640m/EPA 200.8m	µg/L				1.75	1.85	1.58	1.32	3.05	2.26	3.4
Zinc (Zn)	EPA 1640m/EPA 200.8m	µg/L		(b)	90	29.26 B	23.73 B	20.33 B	18.79 B	6.111 B	15.48 B	5.5
Acid-Extractable Compounds												
2,3,4,6-Tetrachlorophenol	EPA 625m	ng/L										<50
2,4,5-Trichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4,6-Trichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2,6-Dichlorophenol	EPA 625m	ng/L										<50
2-Chlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2-Methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
3+4-Methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Benzoic Acid	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	EPA 625m	ng/L		(c)	13000	<50	<50	<50	<50	<50	<50	<50
Phenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Total chlorinated phenolics	Calculations	ng/L	10000			<100	<100	<100	<100	<100	<100	<100
Total non-chlorinated phenolics	Calculations	ng/L	300000			<100	<100	<100	<100	<100	<100	<100
Base Neutral-Extractable Compounds												
1,2,4-Trichlorobenzene	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Azobenzene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Benzidine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Butylbenzyl phthalate	EPA 625m	ng/L				40 J	44 J	41 J	57	58	58	60
Di-n-butyl phthalate	EPA 625m	ng/L				<75	<75	<75	91 J	98 J	<75	<75
Di-n-octyl phthalate	EPA 625m	ng/L				<10	<10	<10	17 J	58	<10	<10
Diethyl phthalate	EPA 625m	ng/L				<100	<100	<100	<100	115 J	167	<100
Dimethyl phthalate	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Isophorone	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
NDPA	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
N-Nitrosodimethylamine	EPA 1625M	ng/L				<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	2.5
N-Nitrosodiphenylamine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Ethylhexyl) Phthalate	EPA 625m	ng/L				<100	178	<100	276	1118	148	<100
PAHs												
1-Methylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	1.7 J	2.3 J	1.2 J
1-Methylphenanthrene	EPA 625m	ng/L				<1	<1	<1	<1	3.1 J	<1	<1
2,3,5-Trimethylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,6-Dimethylnaphthalene	EPA 625m	ng/L				1 J	<1	1.2 J	5.1	15.7	3.3 J	<1
2-Methylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	4.7 J	3.3 J	1.9 J
Acenaphthene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	EPA 625m	ng/L				<1	<1	<1	<1	2.4 J	1.1 J	<1
Anthracene	EPA 625m	ng/L				<1	<1	<1	<1	3.5 J	<1	1.7 J
Benz[a]anthracene	EPA 625m	ng/L				<1	<1	<1	4.7 J	9.6	<1	<1
Benzo[a]pyrene	EPA 625m	ng/L				<1	<1	<1	3.3 J	11.9	<1	<1
Benzo[b]fluoranthene	EPA 625m	ng/L				<1	<1	<1	6.3	23.7	<1	<1
Benzo[e]pyrene	EPA 625m	ng/L				<1	<1	<1	3.4 J	21.2	<1	<1
Benzo[g,h,i]perylene	EPA 625m	ng/L				<1	<1	<1	13.3	21.2	<1	<1
Benzo[k]fluoranthene	EPA 625m	ng/L				<1	<1	<1	1.6 J	6.5	<1	<1
Biphenyl	EPA 625m	ng/L				1.6 J	1.6 J	2.1 J	2.3 J	5.1	3.6 J	2.2 J
Chrysene	EPA 625m	ng/L				<1	<1	3.8 J	11	28.2	1.8 J	5.7
Dibenz[a,h]anthracene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Fluoranthene	EPA 625m	ng/L				1.2 J	4.2 J	5.5	16.4	46.6	5.5	9.6
Fluorene	EPA 625m	ng/L				<1	<1	<1	<1	4.9 J	2.9 J	1.7 J
Indeno[1,2,3-c,d]pyrene	EPA 625m	ng/L				<1	<1	<1	<1	14.3	<1	<1
Naphthalene	EPA 625m	ng/L				2.2 J, B	3 J, B	3.1 J, B	3.4 J, B	9.7 B	5.1 B	6.8 B
Perylene	EPA 625m	ng/L				<1	<1	<1	<1	5.8	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Phenanthrene	EPA 625m	ng/L				<1	2 J	3 J	4.6 J	20.1	5.1	10.2
Pyrene	EPA 625m	ng/L				1.4 J	3.4 J	4 J	14.7	38.7	3.8 J	7.3
Total detectable PAHs	Calculations	ng/L				7.4	14.2	22.7	90.1	298.6	37.8	48.3
TPH-CC												
C6	EPA 8015B (M)	ug/L				<1.4	<1.4	<1.4	<1.4	<2.8	<1.4	<1.4
C7	EPA 8015B (M)	ug/L				<6.1	<6.1	<6.1	<6.1	<12	<6.1	<6.1
C8	EPA 8015B (M)	ug/L				<9.9	<9.9	<9.9	<9.9	<20	<9.9	<9.9
C9-C10	EPA 8015B (M)	ug/L				<13	<13	<13	<13	<26	<13	<13
C11-C12	EPA 8015B (M)	ug/L				<14	<14	<14	<14	<29	<14	<14
C13-C14	EPA 8015B (M)	ug/L				<16	<16	<16	<16	<31	<16	<16
C15-C16	EPA 8015B (M)	ug/L				<17	<17	<17	<17	<34	<17	<17
C17-C18	EPA 8015B (M)	ug/L				<17	<17	<17	<17	<35	<17	<17
C19-C20	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C21-C22	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C23-C24	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C25-C28	EPA 8015B (M)	ug/L				<16	<16	<16	21	<31	24	<16
C29-C32	EPA 8015B (M)	ug/L				<8.5	<8.5	16	29	37	31	<8.5
C33-C36	EPA 8015B (M)	ug/L				<7.9	<7.9	14	25	30	25	<7.9
C37-C40	EPA 8015B (M)	ug/L				<6.8	8.2	14	20	28	16	<6.8
C41-C44	EPA 8015B (M)	ug/L				<6.6	<6.6	<6.6	20	19	<6.6	<6.6
C6-C44 Total	EPA 8015B (M)	ug/L				<47	<47	<47	110	110	96	<47
Chlorinated Pesticides												
2,4'-DDD	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	EPA 625m	ng/L		1100	130	<1	<1	<1	<1	<1	<1	<1
Aldrin	EPA 625m	ng/L		3000	1300	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-beta	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-delta	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-gamma	EPA 625m	ng/L		950	160	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	EPA 625m	ng/L				<1	<1	<1	<1	3.3 J	<1	<1
Chlordane-gamma	EPA 625m	ng/L				<1	<1	<1	1.6 J	2.1 J	<1	<1
DCPA (dacthal)	EPA 625m	ng/L				<5	<5	<5	<5	<5	<5	<5
Dicofol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Dieldrin	EPA 625m	ng/L		240	710	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	EPA 625m	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	EPA 625m	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1
Endrin	EPA 625m	ng/L	6	83	37	<1	<1	<1	<1	<1	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Endrin aldehyde	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Endrin ketone	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Heptachlor	EPA 625m	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	EPA 625m	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Mirex	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Oxychlordane	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Perthane	EPA 625m	ng/L				<5	<5	<5	<5	<5	<5	<5
cis-Nonachlor	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	EPA 625m	ng/L				<1	<1	<1	<1	1.1 J	<1	<1
Toxaphene	EPA 625mNCI	ng/L		730	210	<10	<10	<10	<10	<10	<10	<10
Total detectable BHC	Calculations	ng/L	12			<1	<1	<1	<1	<1	<1	<1
Total detectable chlordane	Calculations	ng/L				<1	<1	<1	1.6	6.5	<1	<1
Total detectable DDTs	Calculations	ng/L				<1	<1	<1	<1	<1	<1	<1
Aroclor PCBs												
Aroclor 1016	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1260	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Total aroclor	Calculations	ng/L				<10	<10	<10	<10	<10	<10	<10
PCB Congeners												
PCB003	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB008	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB018	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB028	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB031	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB033	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB037	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB044	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB049	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB052	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB056/060	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB066	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB070	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB074	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB077	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB081	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB087	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB095	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB097	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB099	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB101	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB105	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB110	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB114	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB118	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB119	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB123	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB126	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB128	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB138	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB141	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB149	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB151	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB153	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB156	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB157	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB158	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB167	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB168+132	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB169	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB170	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB174	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB177	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB180	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB183	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB187	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB189	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB194	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB195	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB200	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB201	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB203	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB206	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB209	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Total PCBs for EPA 625m	Calculations	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB1	EPA 1668A	ng/L				<0.019	<0.056	<0.03	<0.0082	<0.017	<0.017	<0.014
PCB10	EPA 1668A	ng/L				<0.042	<0.074	<0.028	<0.022	<0.016	<0.019	<0.024
PCB103	EPA 1668A	ng/L				<0.0066	<0.006	<0.0075	<0.0075	<0.0069	<0.0068	<0.0043
PCB104	EPA 1668A	ng/L				<0.0055	<0.012	<0.0074	<0.0093	<0.01	<0.0076	<0.005
PCB105	EPA 1668A	ng/L				0.0151 J	<0.024	0.0371 J	0.0492 J	0.26	0.0463 J	<0.0066

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB106	EPA 1668A	ng/L				<0.0041	<0.0063	<0.0051	<0.0065	<0.0074	<0.0064	<0.0041
PCB107	EPA 1668A	ng/L				<0.0044	<0.0068	0.0084 J	0.0079 J	0.0484 J	0.0099 J	<0.0044
PCB108+124	EPA 1668A	ng/L				<0.0044	<0.0067	<0.0054	<0.0068	0.0228 J	<0.0067	<0.0043
PCB11	EPA 1668A	ng/L				0.057 J	0.1	0.1 J	0.1	0.21	0.13	<0.06
PCB110+115	EPA 1668A	ng/L				0.0696 J	0.105 J	0.143 J	0.178 J	1	0.18 J	0.0336 J
PCB111	EPA 1668A	ng/L				<0.0059	<0.0054	<0.0067	<0.0067	<0.0062	<0.0061	<0.0038
PCB112	EPA 1668A	ng/L				<0.0057	<0.0052	<0.0065	<0.0064	<0.0059	<0.0059	<0.0037
PCB114	EPA 1668A	ng/L				<0.005	<0.0076	<0.0061	<0.0077	0.0137 J	<0.0077	<0.0049
PCB118	EPA 1668A	ng/L				0.0473 J	0.068 J	0.0994 J	0.11	0.6	0.12	0.0218 J
PCB12+13	EPA 1668A	ng/L				<0.019	<0.02	<0.019	<0.0059	<0.015	<0.012	<0.0093
PCB120	EPA 1668A	ng/L				<0.0057	<0.0052	<0.0065	<0.0065	<0.006	<0.0059	<0.0037
PCB121	EPA 1668A	ng/L				<0.0059	<0.0054	<0.0067	<0.0067	<0.0062	<0.0061	<0.0038
PCB122	EPA 1668A	ng/L				<0.0048	<0.0073	<0.0059	<0.0075	<0.0086	<0.0074	<0.0047
PCB123	EPA 1668A	ng/L				<0.005	<0.0077	<0.0062	<0.0079	0.0129 J	<0.0078	<0.005
PCB126	EPA 1668A	ng/L				<0.0049	<0.0075	<0.006	<0.0077	0.0112 J	<0.0076	<0.0048
PCB127	EPA 1668A	ng/L				<0.0042	<0.0065	<0.0052	<0.0066	<0.0076	<0.0065	<0.0042
PCB128+166	EPA 1668A	ng/L				<0.011	<0.013	0.02 J	<0.023	0.153 J	0.027 J	<0.0082
PCB129+138+163	EPA 1668A	ng/L				0.066 J	0.099 J	0.13 J	0.162 J	0.85	0.161 J	0.041 J
PCB130	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	0.053 J	<0.02	<0.0097
PCB131	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	<0.013	<0.019	<0.0095
PCB132	EPA 1668A	ng/L				0.017 J	0.027 J	0.036 J	0.05 J	0.27	0.05 J	0.0113 J
PCB133	EPA 1668A	ng/L				<0.012	<0.013	<0.014	<0.011	<0.012	<0.018	<0.0089
PCB134+143	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	0.033 J	<0.02	<0.0096
PCB135+151	EPA 1668A	ng/L				<0.017	0.022 J	0.028 J	<0.027	0.146 J	0.042 J	<0.012
PCB136	EPA 1668A	ng/L				<0.0077	<0.015	<0.011	<0.014	0.066 J	0.0151 J	<0.0085
PCB137	EPA 1668A	ng/L				<0.014	<0.015	<0.016	<0.013	<0.035	<0.021	<0.01
PCB139+140	EPA 1668A	ng/L				<0.012	<0.012	<0.013	<0.011	0.014 J	<0.018	<0.0086
PCB14	EPA 1668A	ng/L				<0.018	<0.018	<0.018	<0.0055	<0.014	<0.011	<0.0087
PCB141	EPA 1668A	ng/L				<0.012	<0.013	<0.015	0.024 J	0.13	0.023 J	<0.0087
PCB142	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	<0.013	<0.02	<0.0097
PCB144	EPA 1668A	ng/L				<0.0096	<0.018	<0.013	<0.018	0.021 J	<0.012	<0.011
PCB145	EPA 1668A	ng/L				<0.008	<0.015	<0.011	<0.015	<0.013	<0.01	<0.0088
PCB146	EPA 1668A	ng/L				<0.011	<0.012	<0.014	0.018 J	0.095 J	0.02 J	<0.0083
PCB147+149	EPA 1668A	ng/L				0.044 J	0.063 J	0.079 J	0.095 J	0.46	0.104 J	0.0312 J
PCB148	EPA 1668A	ng/L				<0.0095	<0.018	<0.013	<0.017	<0.015	<0.012	<0.01
PCB15	EPA 1668A	ng/L				<0.026	<0.027	<0.026	<0.0082	<0.021	<0.016	<0.013
PCB150	EPA 1668A	ng/L				<0.008	<0.015	<0.011	<0.015	<0.013	<0.01	<0.0088
PCB152	EPA 1668A	ng/L				<0.0065	<0.012	<0.009	<0.012	<0.01	<0.0081	<0.0071
PCB153+168	EPA 1668A	ng/L				0.054 J	0.075 J	<0.086	0.111 J	0.54	0.128 J	0.0342 J
PCB154	EPA 1668A	ng/L				<0.0088	<0.017	<0.012	<0.016	<0.014	<0.011	<0.0097
PCB155	EPA 1668A	ng/L				<0.0065	<0.012	<0.009	<0.012	<0.01	<0.0081	<0.0071
PCB156+157	EPA 1668A	ng/L				0.0062 J	<0.01	0.0141 J	0.015 J	0.093 J	0.017 J	<0.0087

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB158	EPA 1668A	ng/L				<0.0094	<0.01	<0.011	<0.015	0.0889 J	<0.014	<0.0069
PCB159	EPA 1668A	ng/L				<0.0054	<0.0093	<0.0088	<0.009	<0.0089	<0.0097	<0.0077
PCB16	EPA 1668A	ng/L				<0.018	<0.056	<0.025	<0.019	<0.022	<0.019	<0.02
PCB160	EPA 1668A	ng/L				<0.011	<0.011	<0.012	<0.0097	<0.01	<0.016	<0.0077
PCB161	EPA 1668A	ng/L				<0.0097	<0.01	<0.011	<0.009	<0.0095	<0.015	<0.0071
PCB162	EPA 1668A	ng/L				<0.0055	<0.0094	<0.009	<0.0092	<0.0091	<0.0099	<0.0078
PCB164	EPA 1668A	ng/L				<0.0094	<0.01	<0.011	0.0148 J	0.0652 J	<0.014	<0.0069
PCB165	EPA 1668A	ng/L				<0.011	<0.011	<0.012	<0.0098	<0.01	<0.016	<0.0078
PCB167	EPA 1668A	ng/L				<0.0059	<0.01	<0.0097	<0.01	0.033 J	<0.011	<0.0085
PCB169	EPA 1668A	ng/L				<0.0062	<0.011	<0.01	<0.01	<0.01	<0.011	<0.0088
PCB17	EPA 1668A	ng/L				<0.015	<0.048	<0.021	<0.017	<0.019	<0.016	<0.017
PCB170	EPA 1668A	ng/L				0.0127 J	0.013 J	0.0199 J	0.028 J	0.13	0.032 J	0.0126 J
PCB171+173	EPA 1668A	ng/L				<0.009	<0.01	<0.0094	<0.013	0.038 J	<0.014	<0.0096
PCB172	EPA 1668A	ng/L				<0.0092	<0.01	<0.0096	<0.013	<0.021	<0.014	<0.0098
PCB174	EPA 1668A	ng/L				<0.0086	<0.0096	0.0162 J	<0.023	0.12	0.028 J	<0.0092
PCB175	EPA 1668A	ng/L				<0.008	<0.013	<0.01	<0.013	<0.011	<0.015	<0.0065
PCB176	EPA 1668A	ng/L				<0.0064	<0.01	<0.008	<0.01	0.0103 J	<0.012	<0.0052
PCB177	EPA 1668A	ng/L				<0.0088	<0.0099	<0.0093	<0.012	0.067 J	0.017 J	<0.0094
PCB178	EPA 1668A	ng/L				<0.008	<0.013	<0.01	<0.013	0.019 J	<0.015	<0.0065
PCB179	EPA 1668A	ng/L				0.0069 J	<0.01	<0.0077	<0.0099	<0.032	0.013 J	0.0059 J
PCB18+30	EPA 1668A	ng/L				0.014 J	<0.039	<0.018	<0.014	0.042 J	0.027 J	<0.014
PCB180+193	EPA 1668A	ng/L				0.0235 J	0.0263 J	0.0445 J	0.049 J	0.24	0.065 J	<0.02
PCB181	EPA 1668A	ng/L				<0.0087	<0.0097	<0.0091	<0.012	<0.011	<0.013	<0.0093
PCB182	EPA 1668A	ng/L				<0.0084	<0.014	<0.01	<0.014	<0.011	<0.015	<0.0068
PCB183	EPA 1668A	ng/L				0.0085 J	0.0092 J	0.0121 J	0.017 J	0.0668 J	0.02 J	<0.0081
PCB184	EPA 1668A	ng/L				<0.0062	<0.01	<0.0077	<0.0099	<0.0082	<0.011	<0.005
PCB185	EPA 1668A	ng/L				<0.009	<0.01	<0.0095	<0.013	<0.011	<0.014	<0.0097
PCB186	EPA 1668A	ng/L				<0.0062	<0.0099	<0.0077	<0.0099	<0.0082	<0.011	<0.005
PCB187	EPA 1668A	ng/L				0.0147 J	0.019 J	0.027 J	0.031 J	0.12	0.032 J	<0.011
PCB188	EPA 1668A	ng/L				<0.007	<0.011	<0.0087	<0.011	<0.0093	<0.013	<0.0057
PCB189	EPA 1668A	ng/L				<0.0068	<0.0079	<0.01	<0.01	<0.012	<0.0077	<0.0085
PCB19	EPA 1668A	ng/L				<0.014	<0.043	<0.019	<0.015	<0.017	<0.015	<0.016
PCB190	EPA 1668A	ng/L				<0.0072	<0.008	<0.0076	<0.01	0.0261 J	<0.011	<0.0077
PCB191	EPA 1668A	ng/L				<0.0072	<0.0081	<0.0076	<0.01	<0.0089	<0.011	<0.0077
PCB192	EPA 1668A	ng/L				<0.0077	<0.0085	<0.008	<0.011	<0.0094	<0.012	<0.0082
PCB194	EPA 1668A	ng/L				<0.012	<0.012	<0.015	<0.015	0.058 J	<0.019	<0.01
PCB195	EPA 1668A	ng/L				<0.013	<0.012	<0.015	<0.016	0.023 J	<0.02	<0.011
PCB196	EPA 1668A	ng/L				<0.012	<0.013	<0.015	<0.016	<0.024	<0.015	<0.0074
PCB197	EPA 1668A	ng/L				<0.01	<0.011	<0.013	<0.013	<0.013	<0.013	<0.0061
PCB198+199	EPA 1668A	ng/L				<0.012	<0.013	<0.016	0.016 J	0.067 J	<0.015	<0.0074
PCB2	EPA 1668A	ng/L				<0.019	<0.058	<0.031	<0.0086	<0.018	<0.018	<0.015
PCB20+28	EPA 1668A	ng/L				0.0261 J	0.03 J	0.0278 J	0.0286 J	0.0724 J	0.0386 J	0.0126 J

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB200	EPA 1668A	ng/L				<0.0093	<0.0096	<0.012	<0.012	<0.012	<0.012	<0.0056
PCB201	EPA 1668A	ng/L				<0.0096	<0.0099	<0.012	<0.012	<0.012	<0.012	<0.0057
PCB202	EPA 1668A	ng/L				<0.011	<0.011	<0.014	<0.014	<0.015	<0.014	<0.0066
PCB203	EPA 1668A	ng/L				<0.012	<0.012	<0.015	<0.015	0.038 J	<0.015	<0.007
PCB204	EPA 1668A	ng/L				<0.0099	<0.01	<0.012	<0.013	<0.013	<0.012	<0.0059
PCB205	EPA 1668A	ng/L				<0.011	<0.01	<0.013	<0.013	<0.013	<0.017	<0.0092
PCB206	EPA 1668A	ng/L				<0.012	<0.018	<0.013	<0.017	<0.042	<0.017	<0.013
PCB207	EPA 1668A	ng/L				<0.011	<0.015	<0.011	<0.014	<0.023	<0.015	<0.011
PCB208	EPA 1668A	ng/L				<0.013	<0.019	<0.014	<0.017	<0.028	<0.018	<0.014
PCB209	EPA 1668A	ng/L				<0.013	<0.04	<0.021	<0.032	0.042 J	<0.023	<0.01
PCB21+33	EPA 1668A	ng/L				<0.0075	<0.012	0.0085 J	0.009 J	0.0253 J	0.0162 J	<0.0047
PCB22	EPA 1668A	ng/L				<0.0055	<0.013	0.0071 J	0.007 J	0.0225 J	0.0113 J	<0.005
PCB23	EPA 1668A	ng/L				<0.0052	<0.013	<0.0067	<0.0061	<0.0062	<0.007	<0.0049
PCB24	EPA 1668A	ng/L				<0.012	<0.038	<0.017	<0.013	<0.015	<0.013	<0.014
PCB25	EPA 1668A	ng/L				<0.0046	<0.011	<0.0059	<0.0054	<0.0055	<0.0062	<0.0043
PCB26+29	EPA 1668A	ng/L				<0.0048	<0.012	<0.0062	<0.0056	0.0114 J	<0.0065	<0.0046
PCB27	EPA 1668A	ng/L				<0.012	<0.036	<0.016	<0.012	<0.014	<0.012	<0.013
PCB3	EPA 1668A	ng/L				<0.019	<0.056	<0.03	<0.0083	<0.017	<0.017	<0.014
PCB31	EPA 1668A	ng/L				0.0157 J	0.017 J	0.0201 J	<0.02	0.0667 J	0.0309 J	0.0127 J
PCB32	EPA 1668A	ng/L				<0.011	<0.033	<0.015	<0.011	0.016 J	<0.011	<0.012
PCB34	EPA 1668A	ng/L				<0.0049	<0.012	<0.0063	<0.0057	<0.0059	<0.0066	<0.0046
PCB35	EPA 1668A	ng/L				<0.0049	<0.012	<0.0063	<0.0058	<0.0059	<0.0066	<0.0047
PCB36	EPA 1668A	ng/L				<0.0044	<0.011	<0.0057	<0.0052	<0.0053	<0.0059	<0.0042
PCB37	EPA 1668A	ng/L				<0.0062	<0.015	<0.008	<0.0073	0.0218 J	0.0118 J	<0.0059
PCB38	EPA 1668A	ng/L				<0.005	<0.012	<0.0064	<0.0058	<0.006	<0.0067	<0.0047
PCB39	EPA 1668A	ng/L				<0.0047	<0.012	<0.0061	<0.0056	<0.0057	<0.0064	<0.0045
PCB4	EPA 1668A	ng/L				<0.04	<0.071	<0.026	<0.021	<0.027	<0.018	<0.023
PCB40+41+71	EPA 1668A	ng/L				0.0159 J	<0.015	0.0165 J	0.02 J	<0.065	<0.022	<0.0086
PCB42	EPA 1668A	ng/L				0.0079 J	<0.012	<0.0093	<0.011	<0.032	0.0128 J	<0.0089
PCB43	EPA 1668A	ng/L				<0.0086	<0.013	<0.011	<0.013	<0.011	<0.01	<0.01
PCB44+47+65	EPA 1668A	ng/L				0.0432 J	0.042 J	0.051 J	0.0821 J	0.263 J	0.07 J	0.012 J
PCB45+51	EPA 1668A	ng/L				<0.0068	<0.011	<0.0085	<0.01	<0.016	<0.0081	<0.0082
PCB46	EPA 1668A	ng/L				<0.0078	<0.012	<0.0098	<0.012	<0.01	<0.0093	<0.0094
PCB48	EPA 1668A	ng/L				<0.007	<0.011	<0.0088	<0.01	<0.018	0.0095 J	<0.0084
PCB49+69	EPA 1668A	ng/L				<0.025	0.0266 J	0.0338 J	0.0402 J	0.146 J	<0.036	<0.0072
PCB5	EPA 1668A	ng/L				<0.02	<0.021	<0.02	<0.0062	<0.016	<0.012	<0.0098
PCB50+53	EPA 1668A	ng/L				0.0084 J	<0.01	<0.0082	<0.0098	0.0239 J	0.0082 J	<0.0079
PCB52	EPA 1668A	ng/L				0.0515 J	0.068 J	0.0953 J	0.12	0.57	0.14	0.0156 J
PCB54	EPA 1668A	ng/L				<0.012	<0.039	<0.015	<0.02	<0.021	<0.019	<0.0095
PCB55	EPA 1668A	ng/L				<0.0063	<0.0095	<0.0094	<0.0096	<0.0073	<0.01	<0.011
PCB56	EPA 1668A	ng/L				0.0113 J	0.0156 J	0.0121 J	<0.013	0.0568 J	0.0194 J	<0.01
PCB57	EPA 1668A	ng/L				<0.0054	<0.0082	<0.0081	<0.0083	<0.0063	<0.0088	<0.0093

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB58	EPA 1668A	ng/L				<0.0056	<0.0085	<0.0084	<0.0085	<0.0065	<0.0091	<0.0096
PCB59+62+75	EPA 1668A	ng/L				<0.0056	<0.0086	<0.007	<0.0083	<0.0071	<0.0066	<0.0067
PCB6	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0056	<0.015	<0.011	<0.0089
PCB60	EPA 1668A	ng/L				<0.006	<0.0091	<0.009	<0.0092	0.0312 J	<0.011	<0.01
PCB61+70+74+76	EPA 1668A	ng/L				0.0388 J	0.059 J	0.0707 J	0.0839 J	0.399 J	0.0951 J	0.019 J
PCB63	EPA 1668A	ng/L				<0.0052	<0.0079	<0.0078	<0.008	<0.0061	<0.0085	<0.009
PCB64	EPA 1668A	ng/L				0.0136 J	0.0142 J	0.0176 J	0.0207 J	0.0896 J	0.0231 J	<0.0066
PCB66	EPA 1668A	ng/L				0.0296 J	0.0425 J	0.0353 J	0.0433 J	0.14	0.0414 J	<0.0094
PCB67	EPA 1668A	ng/L				<0.0051	<0.0078	<0.0077	<0.0079	<0.006	<0.0084	<0.0088
PCB68	EPA 1668A	ng/L				<0.0051	<0.0078	<0.0077	<0.0079	<0.006	<0.0084	<0.0088
PCB7	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0057	<0.015	<0.011	<0.009
PCB72	EPA 1668A	ng/L				<0.0052	<0.0079	<0.0078	<0.008	<0.0061	<0.0085	<0.009
PCB73	EPA 1668A	ng/L				<0.0055	<0.0085	<0.0068	<0.0082	<0.007	<0.0065	<0.0066
PCB77	EPA 1668A	ng/L				<0.0074	<0.011	<0.011	<0.011	0.0385 J	<0.012	<0.013
PCB78	EPA 1668A	ng/L				<0.0056	<0.0085	<0.0084	<0.0086	<0.0065	<0.0091	<0.0096
PCB79	EPA 1668A	ng/L				<0.0048	<0.0073	<0.0072	<0.0074	0.007 J	<0.0078	<0.0083
PCB8	EPA 1668A	ng/L				<0.017	<0.018	<0.017	<0.0053	0.02 J	<0.011	<0.0084
PCB80	EPA 1668A	ng/L				<0.005	<0.0075	<0.0074	<0.0076	<0.0058	<0.0081	<0.0085
PCB81	EPA 1668A	ng/L				<0.0074	<0.011	<0.011	<0.011	<0.0086	<0.012	<0.013
PCB82	EPA 1668A	ng/L				<0.0084	<0.0076	<0.0095	0.0161 J	0.0839 J	0.0172 J	<0.0054
PCB83+99	EPA 1668A	ng/L				0.0424 J	0.0502 J	0.0669 J	0.0767 J	0.38	0.0676 J	0.0206 J
PCB84	EPA 1668A	ng/L				0.0137 J	<0.017	0.0286 J	0.0353 J	0.2	0.0407 J	<0.0054
PCB85+116+117	EPA 1668A	ng/L				0.0073 J	0.007 J	0.015 J	0.0194 J	0.0923 J	0.0201 J	<0.0039
PCB86+87+97+109+119+125	EPA 1668A	ng/L				0.0435 J	0.0578 J	0.0816 J	0.1 J	0.498 J	0.0984 J	0.0281 J
PCB88+91	EPA 1668A	ng/L				<0.0073	<0.0087	0.0147 J	0.0175 J	0.0932 J	0.0164 J	<0.0047
PCB89	EPA 1668A	ng/L				<0.0078	<0.0071	<0.0088	<0.0088	<0.0081	<0.0081	<0.005
PCB9	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0057	<0.015	<0.011	<0.009
PCB90+101+113	EPA 1668A	ng/L				0.0666 J	0.0887 J	0.124 J	0.127 J	0.66	0.138 J	0.0329 J
PCB92	EPA 1668A	ng/L				<0.011	<0.017	0.0231 J	0.0272 J	0.12	0.0264 J	<0.0052
PCB93+98+100+102	EPA 1668A	ng/L				<0.0074	<0.0067	<0.0084	<0.0083	0.0243 J	<0.0076	<0.0048
PCB94	EPA 1668A	ng/L				<0.008	<0.0073	<0.0091	<0.009	<0.0083	<0.0083	<0.0052
PCB95	EPA 1668A	ng/L				0.0513 J	0.063 J	0.0866 J	0.11	0.58	0.12	0.0235 J
PCB96	EPA 1668A	ng/L				<0.0071	<0.016	<0.0097	<0.012	<0.014	<0.0098	<0.0065
Total PCBs for EPA1668A	Calculation	ng/L				0.9433	1.2081	1.651	2.0599	11.1501	2.3804	0.3686
VOCs												
1,1,1-TCA	EPA 624	µg/L				<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365
1,1,2,2-Tetrachloroethane	EPA 624	µg/L				<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228
1,1,2-Trichloroethane	EPA 624	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
1,1-Dichloroethane	EPA 624	µg/L				<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076
1,1-Dichloroethene	EPA 624	µg/L				<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177
1,2-Dichlorobenzene	EPA 624	µg/L				<0.019	<0.019	<0.019	0.1 J	<0.019	<0.019	<0.019
1,2-Dichloroethane (EDC)	EPA 624	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
1,2-Dichloropropane	EPA 624	µg/L				<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266
1,3-Dichlorobenzene	EPA 624	µg/L				<0.0283	<0.0283	<0.0283	0.1 J	<0.0283	<0.0283	<0.0283
1,4-Dichlorobenzene	EPA 624	µg/L				<0.031	<0.031	<0.031	0.2 J	<0.031	<0.031	<0.031
2-Chloroethyl vinyl ether (2-CVE)	EPA 624	µg/L				<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
Acrolein	EPA 624	µg/L				<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217
Acrylonitrile	EPA 624	µg/L				<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401
Benzene	EPA 624	µg/L				<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118
Bromodichloromethane	EPA 624	µg/L				<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281
Bromoform	EPA 624	µg/L				<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347
Bromomethane (methyl bromide)	EPA 624	µg/L				0.3 J, B	0.2 J, B	0.3 J, B	0.5 B	0.2 J, B	0.4 J, B	0.4 J, B
Carbon Tetrachloride	EPA 624	µg/L				<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323
Chlorobenzene	EPA 624	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Chloroethane (ethyl chloride)	EPA 624	µg/L				<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583
Chloroform	EPA 624	µg/L				<0.1795	<0.1795	<0.1795	<0.1795	0.2 J	<0.1795	<0.1795
Chloromethane (methyl chloride)	EPA 624	µg/L				<0.0763 J	<0.0763	<0.0763	<0.0763 J	<0.0763	<0.0763 J	<0.0763 J
Dibromochloromethane	EPA 624	µg/L				<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Dichlorodifluoromethane (F12)	EPA 624	µg/L				<0.0654	<0.0654	<0.0654	<0.0654	<0.0654	<0.0654	<0.0654
Ethylbenzene	EPA 624	µg/L				<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156
MTBE	EPA 624	µg/L				<0.1318	<0.1318	<0.1318	<0.1318	<0.1318	<0.1318	<0.1318
Methylene chloride	EPA 624	µg/L				0.6 J	0.4 J	0.6 J	0.6 J	0.5 J	0.5 J	1
PCE	EPA 624	µg/L				<0.0167	0.3 J	<0.0167	<0.0167	0.2 J	0.1 J	8.8
Toluene	EPA 624	µg/L				<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
TCE	EPA 624	µg/L				<0.0277	<0.0277	<0.0277	<0.0277	0.2 J	0.1 J	0.3 J
Trichlorofluoromethane (F11)	EPA 624	µg/L				<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312
Vinyl chloride	EPA 624	µg/L				<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983
c-1,2-Dichloroethene	EPA 624	µg/L				<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	0.3 J
c-1,3-Dichloropropene	EPA 624	µg/L				<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198
o-Xylene	EPA 624	µg/L				<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152
p/m-Xylene	EPA 624	µg/L				<0.0201	<0.0201	<0.0201	0.1 J	<0.0201	<0.0201	<0.0201
t-1,2-Dichloroethene	EPA 624	µg/L				<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403
t-1,3-Dichloropropene	EPA 624	µg/L				<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218

< = Results less than the MDL.
B = Analyte was detected in the associated method blank.
H = Samples received and/or analyzed past the recommended holding time.
J = Analyte was detected at a concentration below the reporting limit and above the MDL. Reported value is an estimate.
*Fecal coliforms : total coliforms ratio exceeds 0.1, therefore total coliform criterion becomes 1,000 MPN/100 mL.
(a) = Water quality benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(b) = Water quality benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The criterion maximum concentration (CMC) was used.
(c) = Water quality benchmark for Pentachlorophenol is based on pH as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The CMC was used.

3.3.2.3 Microbiology Results

A total of seven samples were collected from the Oxford Retention Basin, Basin E, and Boone Olive Pump Station. The indicator bacteria monitored during the dry weather, ebbing tide event—representing the Basin E, Oxford Retention Basin, Oxford Retention Basin Exchange Area, and Boone Olive Pump Station—included *E. coli*, enterococci, fecal coliforms, and total coliforms.

E. coli was not detected in the X-ORB-D-1 sample, and ranged from 10 MPN/100 mL (ORB-D-1) to 30 MPN/100 mL (Basin E-D-1) for the other three samples. Enterococcus concentrations ranged from at 20 MPN/100 mL (Basin E-D-1) to 63 MPN/100 mL (BO-D-1), which is significantly below the COP values of 104 MPN/100 mL (Table 13). The fecal coliform concentrations ranged between 20 MPN/100 mL (BO-D-1) and 40 MPN/100 mL (Basin E-D-1), which is significantly below the COP values of 400 MPN/100 mL. Fecal coliforms were not detected in samples ORB-D-1 and X-ORB-D-1. The total coliform concentrations ranged between 220 MPN/100 mL (basins E-D-1, ORB-D-1, and X-ORB-D-1) and 1,100 MPN/100 mL (BO-D-1), which is also significantly below the COP values of 10,000 MPN/100mL.

3.3.3 Flooding Tide

3.3.3.1 Field Data Results

Physical parameter measurements were taken in the field during the dry weather event of March 11, 2010. The following results were taken on March 11, 2010, to represent the flooding tide conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 12.

Oxford Retention Basin
Water depth varied between the stations from 0.41 ft at ORB-B and ORB-C to 1.7 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 25.42 mS (ORB-B) to 37.65 mS (ORB-A). Turbidity ranged from 2.7 NTU (ORB-A) to 11.7 NTU (ORB-C). DO was relatively consistent among the three stations, ranging from 7.79 mg/L to 10.3 mg/L. pH ranged from 7.77 to 7.91. Temperature was consistent among the three stations monitored, ranging from 19.74ºC to 20.87ºC.

Exchange Water
Field observations and measurements were only taken at one station, X-Basin E to represent the Exchange Area water. Water depth was measured at 7.4-ft deep, and temperature was reported at 16.73ºC. Conductivity was 46.04 mS, and turbidity was measured at 0.3 NTU. DO was measured at 5.87 mg/L and ph was measured at 7.70 at station X-Basin E.

Basin E
Water depth varied between the stations from 9.7 ft at Basin E-B to 12.5 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 52.31 mS to 53.32 mS. Turbidity was also consistent among the stations ranging from -0.3 NTU to 0.1 NTU. DO ranged from 7.30 mg/L to 7.87 mg/L. pH ranged from 7.27 to 7.85. Temperature was consistent among the three stations monitored, ranging from 16.46ºC to 16.71ºC.

Boone Olive Pump Station
Field observations and measurements were not taken at the Boone Olive Pump Station during the flooding tide event.

3.3.3.2 Analytical Chemistry Results

Results of the dry weather (i.e., flooding tide) water quality sampling are presented in Table 13. The results from the composite sample Basin E-D-2 represent the Basin E, the results from the composite sample X-Basin E-D-2 represent the Basin E Exchange Area, and the results from the composite sample ORB-D-2 represent Oxford Retention Basin. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry

Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 13). Of these, a water quality benchmark is available for ammonia. Concentrations of ammonia in all three samples, Basin E-D-2, X-Basin E-D-2, and ORB-D-2 were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at ORB-D-2 (0.14 mg/L). TKN was recorded as not-detected in all three samples. Orthophosphate results ranged from 0.05 mg/L (Basin E-D-2) to 0.14 mg/L (ORB-D-2). DOC was only detected in sample X-Basin E-D-2 at 2.2 mg/L, and TOC results ranged from 2.1 mg/L (ORB-D-2) to 3.1 mg/L (X-Basin E-D-2). TOC was not detected in sample Basin E-D-2. TDS ranged from 15,900 mg/L (ORB-D-2) to 28,480 mg/L (Basin E-D-2). TSS were not-detected in samples Basin E-D-2 and X-Basin E-D-2. TSS was reported as 23.0 mg/L for sample ORB-D-2.

Organic Constituents Results

Acid-extractable compounds were not detected in all three composite samples. Base/neutral-extractable compounds were not detected in sample Basin E-D-1. One base/neutral-extractable compound was detected in sample Basin E-D-2, no base/neutral-extractable compounds were detected in sample X-Basin E-D-2, and three base/neutral-extractable compounds were detected in sample ORB-D-2. Bis(2-Ethylhexyl) Phthalate was recorded at 1,118 ng/L in sample ORB-D-2.

There were no chlorinated pesticides detected during the dry weather, flooding tide event in all three composite samples.

Aroclor PCBs were not detected in the three composite samples. No individual PCB congeners were detected in sample X-Basin E-D-2; only one individual PCB congener was detected in sample Basin E-D-2 and 29 individual PCB congeners were detected in sample ORB-D-2. Total detectable PCBs were calculated at a concentration of 1.2081 ng/L for Basin E-D-2 and at a concentration of 11.1501 ng/L for ORB-D-2.

Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 7.4 µg/L for Basin E-D-1, 90.1 ng/L for sample ORB-D-1, 37.8 ng/L for sample ORB-D-1, and 48.3 µg/L for BO-D-1.

One TPH-CC analyte (C37-C40) was detected in sample Basin E-D-2 and reported at 8.2 µg/L. Three TPH-CC analytes (C29-C32, C33-C36, C37-C40) were detected in sample X-Basin E-D-2 and reported at 16.0 µg/L, 14.0 µg/L, and 14.0 µg/L, respectively. Four TPH-CC analytes were detected in Sample ORB-D-1 and the total C6-C44 was reported at 110.0 µg/L.

No VOCs were detected in all three composite samples.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. There were no exceedances reported for dissolved metals in all three composite samples. In addition, there were no observed exceedances for total metals in all three composite samples.

3.3.3.3 Microbiology Results

A total of seven samples were collected from the Oxford Retention Basin, Basin E, and Boone Olive Pump Station. The indicator bacteria monitored during the dry weather, ebbing tide event—representing the Basin E, Oxford Retention Basin, Oxford Retention Basin Exchange Area, and Boone Olive Pump Station—included *E. coli*, enterococci, fecal coliforms, and total coliforms.

E. coli was not detected in the sample X-Basin-D-2 and ranged from 10 MPN/100 mL (Basin E-D-2) to 63 MPN/100 mL (ORB-D-2). Enterococcus concentrations were not detected in sample X-Basin E-D-2 and ranged from 20 MPN/100 mL (Basin E-D-2) to 195 MPN/100 mL (ORB-D-2). The results for ORB-D-2 exceed the COP values of 104 MPN/100 mL (Table 13). Fecal coliform concentrations were not detected in sample Basin E-D-2 and X-Basin E-D-2. The fecal coliform concentrations for sample ORB-D-2 were reported at 230 MPN/100 mL, which is below the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 40 MPN/100 mL (X-Basin E-D-2) and 1,400 MPN/100 mL (ORB-D-2). The fecal coliform : total coliform ratio exceeded 0.1, thus the total coliform criterion became 1,000 MPN/100 mL, and the sample ORB-D-2 exceeded the COP criteria.

3.4 Quality Assurance Quality Control

A complete review of analytical results is provided in Appendix F.

4.0 DISCUSSION AND CONCLUSIONS

As stated in the study objectives, water and sediment samples were collected from Oxford Retention Basin and Basin E in MdRH to characterize existing contaminant levels and to assess available options for water quality improvements and sediment disposal. Specifically, sediment and water quality characterizations were performed for the LADPW for the following purposes:

- Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.
- Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.
- Determine the organic composition of the sediment to examine evaluate the feasibility of bioremediation.
- Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria and Toxics TMDLs for Basin E within MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal from Oxford Retention Basin.

This section reviews each of these five main project objectives and discusses the data collected in this study relative to these objectives.

4.1 Objective 1

Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.

Subsection 3.1 (Sediment Sampling Results) presented a detailed characterization of sediments contained with Oxford Retention Basin. In summary, sediments in Oxford Retention Basin are comprised of the following two distinct layers:

- Unconsolidated sediments made up of recently deposited sediments, generally higher in organics and nutrients.
- Consolidated sediments made up of an artificial cap placed over an historical landfill that lies beneath the Oxford Retention Basin.

Sediments within Oxford Retention Basin are generally finer grained towards the discharge into Basin E and are generally coarser grained in the areas closer to the storm drain input. This characterization suggests that any management of sediments should focus on finer-grained sediments that pose the potential to transport constituents out into the MdRH.

Sediment characterization of unconsolidated layers suggests that Oxford Retention Basin contains sediments that exceed the Toxics TMDL compliance targets for metals and PCBs (Objective 4). If left undisturbed, these sediments may not impact compliance in Basin E. However, disturbance or flushing of these sediments has the potential to impact Basin E. Analysis of sediments suggests that excavation could be done in compliance with disposal regulations under the classification of hazardous material (per the State of California), specifically for chromium and lead (Objective 5). However, under federal guidelines, this material would not be classified as hazardous.

With regard to bacteria concentrations, sediments were not found to be a reservoir for bacteria and therefore removal and disposal of sediments would not appear to provide a management solution for compliance with the Bacteria TMDL targets.

Sediment management can therefore be approached in the following four ways:

1. Excavation can be implemented to remove unconsolidated sediments that may contribute to non-compliance with Toxics TMDL targets at the risk of disturbing finer grains and allowing further transport out into Basin E. Excavation of the consolidated layer is not recommended.
2. Unconsolidated sediments can be left undisturbed, and improved circulation can be implemented to reduce environmental fluctuations (which may cause bacterial growth) at the risk of allowing sediments to be resuspended and transported into Basin E.
3. Bioremediation (i.e., uptake of contaminants into bacteria, algae, or emergent vegetation) can be investigated (Subsection 4.3).
4. Leave the system as it is and allow sediments to remain undisturbed while assuming a risk of increased bacterial concentrations from a fluctuating environment.

4.2 Objective 2

Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.

A number of water quality and sediment quality studies have been undertaken in both Oxford Retention Basin and Marina del Rey's Back Basins providing directly comparable data for this study.

The studies used in comparison include the following:

- *Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study* (WESTON, 2007).
- *Marina del Rey Harbor Sediment Characterization Study* (WESTON, 2008a).
- *Marina del Rey Annual Reports* (LADPW, 2008).

In this section, results of those previous studies are compared to the results of this study to address the objective stated above.

4.2.1 Sediment Conditions

Sediment collected with Oxford Retention Basin became increasingly finer-grained closer to the Exchange with Basin E, whereas the eastern portion of Oxford Retention Basin contained coarser-grained material. These results are consistent with the sediment grain-size data collected in the Marina del Rey Annual Reports, which found increasing grain size towards the centre of the main channels and finer grains sizes in those area of the MdRH with low flows and longer retention times. The grain-size analysis in the Oxford Retention Basin, comprising predominantly silts and clays, is consistent with these findings and suggest that deposition of finer grains towards the Exchange with Basin E is attributable to lower flows and longer retention times from the storm drain inputs.

Total metals were detected in all samples, with chromium and lead exceeding the STLC criteria in the excavation layer in the eastern portion of Oxford Retention Basin (Table 14). These results are consistent with the *Marina del Rey Sediment Characterization Study* (WESTON, 2008a), which used Isopleth mapping to assess pollutant distribution in sediments. The results showed that copper concentrations were higher in the main channel and Mother's Beach than in Basin E, suggesting that Oxford Retention Basin was not a source of copper. Analysis of lead in MdRH sediments found that the highest concentrations were at the mouths of the main channel and each Back Basin, with concentrations decreasing towards the further reaches of the basins. Basin E was found to have lower lead concentrations in comparison to other basins in this study, which was undertaken in 2007–2008. These results suggest that, while Oxford

Retention Basin may be a reservoir for some metals (e.g., chromium and lead), concentrations of most metals are higher outside of the Oxford Retention Basin and suggest an external source. previous studies have hypothesized that those sources may include maritime activities such as boat hull paints, storm drain discharges and inputs from outside the MdRH. Ballona Creek has been identified as a potentially significant external source for metal contamination.

Table 14. Summary of Results

	Sediment Quality	Wet Weather Water Quality	Dry Weather Water Quality
Boone Olive Pump Station	Not Applicable	Appears to be a source of total metals though dissolved metals were not detected. All dissolved values below the CTR. Appears to be a contributing source of bacteria at the Exchange and in Basin E. This site exceeded the WQO for bacteria stated in the TMDL	Boone Olive Pump station does not pump to Basin E during dry weather and concentrations of total and dissolved metals were below WQOs. Boone Olive Pump Station does not pump to Basin E during dry weather and concentrations of bacteria in the pump station were below WQOs.
Oxford Retention Basin	Total metals detected throughout Oxford Retention Basin; only chromium and lead exceeded STLC. No TTLC or TCLP exceedances. Trace amounts of semivolatile compounds, chlorinated pesticides and PCBs at some locations. Bacteria indicative of nutrient rich sediments.	Both total and dissolved metals were detected though all dissolved values below CTR. Appears to receive bacterial pollution from tributary storm drains and contribute bacteria to the Exchange and Basin E. Stormwater within Oxford Retention Basin exceeded the WQO for bacteria stated in the TMDL.	Both total and dissolved metals were detected though all dissolved values were below the CTR. Dry weather flows are diverted from Oxford Retention Basin. May be a reservoir for bacteria. One exceedance at ORB D-2 for total coliform and enterococcus exceeded the WQO for bacteria stated in the TMDL.
Exchange	Not Applicable	Both total and dissolved metals were detected and dissolved copper values were above the CTR. Appears to receive bacterial pollution from Oxford Retention Basin and contribute bacteria to Basin E. These sites exceed the WQO for bacteria stated in the TMDL.	Both total and dissolved metals were detected though all dissolved values were below the CTR. May receive bacterial pollution from the Oxford Retention Basin if conditions for bacteria regrowth in Oxford Retention Basin are optimal; though concentrations of bacteria in the exchange were below WQOs.
Basin E	Not Applicable	Both total and dissolved metals were detected and dissolved copper values were above the CTR. Appears to receive bacteria from the Exchange. These sites	Both total and dissolved metals were detected though all dissolved values were below the CTR with exception of dissolved copper at E-D-1. May receive bacterial

Table 14. Summary of Results

	Sediment Quality	Wet Weather Water Quality	Dry Weather Water Quality
		exceed the WQO for bacteria stated in the TMDL.	pollution from the Exchange if conditions for bacteria regrowth in the Oxford Retention Basin are optimal; though concentrations of bacteria in the Basin E were below WQOs.

Trace amounts of SVOCs (i.e., PAHs, base/neutrals, phthalates, and acid extractables), and chlorinated pesticides were found in the unconsolidated layer in the Oxford Retention Basin. Again, these results are consistent with those of the Marina del Rey Sediment Characterization Study, which found that concentrations of chlordane and PCBs were highest at the mouth of the Main Channel and were found only in very low concentrations in Basin E. Again, it has been postulated that a key source (e.g., Ballona Creek) is responsible for the majority of chlordane and PCBs in the main channel of the MdRH.

Indicator bacteria concentrations found in Oxford Retention Basin sediments in this study were comparable to those found in sediments at Mother's Beach during the *Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study* (WESTON, 2007). This study showed that enterococcus concentrations in sediments within Mother's Beach were generally low (the majority of samples were at the MDLs) and were not a significant source of contamination to the receiving water. However, at the deeper sediment depths, where nutrients and organics are higher and sediment is constantly below the water line, concentrations of enterococci were found to increase at Mother's Beach. These results are consistent with the results found within the Excavation Layer of the Oxford Retention Basin sediments where enterococcus concentrations were between 3 MPN/gram and 133 MPN/gram. The results suggest that sediments within the Oxford Retention Basin are not a significant source of indicator bacteria.

4.2.2 Water Column Conditions

4.2.2.1 Wet Weather Monitoring Conditions

During wet weather monitoring, four conditions were monitored within Oxford Retention Basin, including 1) pre-storm, 2) post-storm but immediately prior to stormwater discharges from Oxford Retention Basin, 3) during stormwater discharges from Oxford Retention Basin, and 4) after Oxford Retention Basin had been completely drained of stormwater (Table 14). Prior to the storm, physical observations and measurements indicated a freshwater lens was not present in either Oxford Retention Basin or Basin E. After the storm, a freshwater lens appeared in Oxford Retention Basin, but Basin E still appeared well mixed. A shallow freshwater lens developed in Basin E during the discharge of stormwater from Oxford Retention Basin and persisted for at least two hours post-discharge.

Prior to the storm event, all indicator bacteria were below TMDL WQOs (Table 14). However, during the storm events, all indicator bacteria were detected at levels that exceeded WQOs within Oxford Retention Basin and at the tidal Exchange. Although bacterial concentrations were elevated, there was no difference between the concentrations observed at each of the monitoring locations, with the exception of enterococcus concentrations at the Boone Olive Pump Station. Enterococcus concentrations at this site were one to two orders of magnitude higher than those observed within the Oxford Retention Basin, Exchange and Basin E. These results suggest that Boone Olive Pump Station may be a contributing source of fecal indicator bacteria during wet weather. These results are consistent with observations from the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study, which identified the Boone Olive Pump Station as a potential source of bacteria.

Nutrients and general chemistry were within expected ranges with no exceedances of COP objectives. As noted in the subsection below, the low nutrient concentrations may have been a causal link to the low bacterial concentrations observed in the water column.

There were detections for nearly all total and dissolved metals. There were exceedances of the WQO for one metal (i.e., dissolved copper at the tidal Exchange and in Basin E), which could contribute to concentrations of dissolved copper in Oxford Retention Basin.

PAHs, PCBs, TPH, VOCs, and base/neutral-extractable compounds (phthalates) were detected at low levels below WQO. Acid-extractable compounds and chlorinated pesticides were not detected in stormwater samples.

4.2.2.2 Dry Weather Monitoring Conditions

During dry weather monitoring, two conditions were monitored within Oxford Retention Basin (i.e., 1) ebbing tide and 2) flooding tide). During the ebbing tide, a freshwater lens was present within Oxford Retention Basin, but this lens was not apparent in Basin E. During the flooding tide, a freshwater lens was only apparent in the western portion of Oxford Retention Basin (Station ORB-A); a freshwater lens had also developed in Basin E. In both cases (i.e., Oxford Retention Basin during ebbing tide and Basin E during flooding tide), it was assumed the freshwater lens was from nuisance flow, but this study's results regarding nuisance flow origin (i.e., either from Oxford Retention Basin or Basin E) and potential transport mechanisms were inconclusive. Note that construction of the Washington/Thatcher low flow diversion and Marina del Rey low flow diversion systems was completed at the two primary stormwater conveyances in Oxford Retention Basin in January 2007 and January 2010, respectively. The Marina del Rey low flow diversion system was completed prior to the wet weather and dry weather monitoring events conducted as part of this study.

During both ebbing and flooding tide sampling events, all indicator bacterial concentrations during dry weather were low relative to the wet weather event and were near detection limits with the exception of one sample in Oxford Retention Basin during the flooding tide (Table 14). Total coliforms and enterococci in this sample exceeded WQOs. Analysis results of the Exchange water and Boone Olive Pump Station water quality showed bacteria concentrations below WQOs. These results are not consistent with observations from the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study, which showed dry weather indicator bacteria concentrations consistently exceeding WQOs. Although it is difficult to draw conclusions from only one monitoring event, this may due to the completion of the dry weather diversion in Oxford Retention Basin.

Nutrients and general chemistry were within expected ranges with no exceedances of COP objectives. As noted in the subsection below, the low nutrient concentrations may have been a causal link to the low bacterial concentrations observed in the water column.

With the exception of one sample, all total and dissolved metals were detected at concentrations below COP WQOs. There were no exceedances of WQOs for total and dissolved metals within the Oxford Retention Basin. Dissolved copper exceeded WQOs in one sample collected from Basin E at concentrations five times higher than those from the Oxford Retention Basin. These results suggest that Oxford Retention Basin is not a contributing source of metals during dry weather.

PAHs, PCBs, TPH, VOCs, base/neutral-extractable compounds (phthalates), and chlorinated pesticides were detected at low levels below WQO. Acid-extractable compounds were not detected in dry weather samples.

4.2.2.3 Overall Summary of Water Quality Conditions

With the exception of fecal indicator bacteria, sediment and water quality results are comparable to other studies conducted in MdRH, and demonstrate that Oxford Retention Basin and the Boone Olive Pump Station are not contributors of metals and toxics during dry weather and wet weather.

Contrary to the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study conducted in 2007, this study did not find higher concentrations of fecal indicator bacteria in the Oxford Retention Basin compared to concentrations in Basin E during wet weather. The 2007 study was conducted with temporally and spatially intensive sampling during dry weather and wet weather and provides a robust dataset for comparison. The study concluded that, due to low flushing, bacterial contamination was site specific within MdRH, and each basin was found to have its own local sources of bacteria. Basin E was identified as having the most complex contamination issues with both direct and in-direct sources, including birds, irrigation, the influence of Oxford Retention Basin and the Boone Olive Pump Station. A significant emphasis was placed on the impact of the Oxford Retention Basin and Boone Olive Pump Station with most bacterial exceedances occurring in direct proximity to the discharge point from Oxford Retention Basin. In addition, a rudimentary Excel-based model was prepared, which calculated potential bacterial load transfer between Oxford Retention Basin and Basin E. Overall, the 2007 study identified Oxford Retention Basin as a key contributing source of bacteria.

In contrast, this present study found lower than expected bacterial concentrations in the water column and sediments as well as unconsolidated sediments and low nutrients. These conditions suggest that bacterial survival and growth in Oxford Retention Basin was nutrient-limited at the time of sampling. The impact of nutrients, freshwater inputs and circulation can have significant repercussions on bacterial survival. The discrepancy in results may be explained in part by the temporal and spatial characteristics impacting indicator bacteria growth. Conditions within the Oxford Retention Basin on the day of sampling do not suggest the presence of a large reservoir within the water column. However, seasonal and spatial effects can change very rapidly with increases in nutrients, algae and decreases in UV penetration causing increases in bacterial growth. In addition, the completion of the Washington/Thatcher low flow diversion system and Marina del Rey low flow diversion system may assist in reducing inputs of indicator bacteria during dry weather.

To better control season and spatial fluctuations in bacterial growth, a increased circulation within the Oxford Retention Basin may be implemented. Increased circulation has the benefit of introducing more oxygen into the water column, maintaining an aerobic sediment structure and reducing algal growth. All these factors can assist in providing a steady state, rather than a fluctuating, environment that would reduce the risk of bacterial proliferation.

4.3 Objective 3

Determine the organic composition of sediment to examine and evaluate the feasibility of bioremediation.

Samples collected from the unconsolidated layer of sediment contained 58–66% solids, 4.1–5.6% TOC, and 724–1,110 mg/kg total organic nitrogen (TON) (calculated as TKN – ammonia-N).

There are several operational parameters that need to be considered with use of bioremediation as a treatment strategy for decreasing the organic carbon load of the Oxford Retention Basin. After discussions regarding the goodness-of-fit of microbial augmentation with Pro-Act Biotech (Warren, Rhode Island) and AquaBio Environmental Technologies, Inc. (Marina del Rey, California), TOC, DO, BOD, nutrients (i.e., ammonia, nitrate, phosphorus, etc.), vertical depth of the targeted sediments, overlying water depth, and operation of flow-control structures must be considered during an evaluation of this technology as a treatment option. If bioremediation successfully decreased all the available carbon within the excavatable layers, only a 3% decrease in mass would be realized. In other words, as a technology to solely decrease sediment mass in this basin, there would not be much 'bang for the buck.' However, addition of the right microorganism blend to this system would out-compete resident algae and bacteria populations for available nutrients in the sediments and stormwater influent and subsequently decrease their potential to be a nuisance to water quality in Oxford Retention Basin and Basin E.

Additional benefits to this system from bioaugmentation include but are not limited to decreased nutrient loads, increased oxygen concentrations in overlying waters, decreased odors, and a small increase in storage capacity. Algae fix carbon, using available oxygen to respire carbon dioxide into the water column and during eutrophic conditions can deplete oxygen concentrations below potentially harmful thresholds to resident biota within a confined basin. Introduction of microorganisms (that do not fix carbon dioxide) to the basin twice a year would suppress potential algae blooms and decrease the potential of oxygen depletion in the system. Additionally, without a large die-off of algae biomass in the fall/winter providing a pulse of carbon for decay, associated odors (due to ammonia, hydrogen sulfide, and methane) would decrease. If microorganisms were used for algae control in this system, chlorophyll concentrations could be monitored over time to measure treatment performance. Addition of this type of microorganism blend does not require additional supplements and or operational changes (e.g., discharge gate closure, and aeration) to the system and could be applied by current personnel with minimal training and health and safety concerns.

Stormwater contaminants (i.e., PCBs, chlordane, copper, lead, zinc, and nutrients) transported to the Oxford Retention Basin may be sequestered within the basin's sediments via sedimentation, precipitation, adsorption, and absorption and other transfers and transformations. Within a natural engineered treatment system, these contaminants may be simultaneously transferred to basin sediments and vegetation and/or transformed to less mobile chemical species. Adsorption to natural organic matter (NOM) and organic carbon is expected to be the primary transfer pathway of PCBs, organochlorine pesticides, and metals from the stormwater to sediments of this treatment system. Metals (e.g., copper, lead, and zinc) have a lithic biogeochemical cycle and have a predisposition to return to freshwater and marine sediments, especially when organic material is available for adsorption. Metals may also be absorbed by resident biota (e.g., hyperaccumulaters) and/or precipitate from the water to sediments depending on the hydrodynamics and ionic strength of the engineered system. If not utilized, sedimentation will also facilitate transfer of nutrients (N and P) to basin sediments. However, low concentrations of nitrogen and phosphorus flushing into this system should be quickly used by algae, bacteria, and floating vegetation in the system.

Speciation or a change in the oxidation state of dissolved metals is the primary transformation facilitated in a potential treatment system designed for stormwater mitigation. PCBs and organochlorine pesticides will biodegrade, but typically this transformation process occurs over the course of several years. Overall, several characteristics (i.e., pH, hardness, redox, and alkalinity) within the basin must be stabilized and maintained in order for these transfers and transformations to initially occur and be sustainable over time.

As previously discussed in Section 3 (Results), the SEM:AVS method is often used to determine the potential toxicity and speciation of divalent metals (i.e., copper, lead, and zinc) in a sediment sample. This method is based on the theory that AVS binds to divalent cationic metals and forms metal-sulfide complexes. Because these metal-sulfide complexes have low water solubility, they will subsequently precipitate to the sediments of the treatment system. Therefore, the ratio of SEM to the concentration of AVS in a sample may be measured to determine the metal speciation occurring within the basin's sediments. If SEM is higher than AVS (SEM:AVS ratio greater than 1), then some portion of the metals are not bound by AVS and probably in their ionic (i.e., dissolved) form. If SEM is less than AVS (i.e., SEM:AVS ratio is less than 1), then metal concentrations are bound to AVS within the sediments and in their precipitated form (i.e., salt or chelation).

The results from this study indicate that the current basin system is not engineered to maintain the chemical characteristics necessary to facilitate these desired transfers and transformations for the stormwater contaminants of concern. Neither the Oxford Retention Basin (excavated and consolidated sediments) nor Basin E had organic carbon (i.e., DOC and TOC) concentrations required for both adsorption and sufficient bacterial activity to decrease the system's redox for subsequent AVS production.

Confirmation of these results were indicated by SEM:AVS ratios greater than one in both excavation and consolidated sediment layers throughout the basin system. Remember, ratios greater than one indicate that AVS concentrations are insufficient for chelation of total metal concentrations and thus dissolved metal species are likely within the engineered system. Additionally, a significant increase in metals, PAHs, organochlorine pesticides, PCBs, and other hydrophobic contaminants concentrations were measured in the excavated layers of these basin sediments compared to consolidated sediments due to significantly higher organic material loads.

There are several factors to consider in the design of a natural engineered treatment system for these potential stormwater contaminants, as follows:

- Redox within the Oxford Retention Basin is probably positive due to tidal flushing and unpredictable stormwater events, thus a consistent overlying water depth is not maintained.
- Inputs of organic material are lost from the basin during daily, tidal flushing events.
- Hydraulic retention time and other hydrodynamic characteristics of these stormwater events have not been sufficiently modeled and correlated with the desired fate processes of these contaminants.
- The contaminants of concern have a predisposition to adsorb to organic matter, thus are transported with the organic materials out of the retention basin during these tidal events.
- Although native biota are present within the basin, these species may be antagonistic to the desired sediment characteristics required for this treatment system and its fate processes. Additionally, vegetation absorbs nutrients and other contaminants at varying rates depending on life-stage of the population. An appropriate operation and maintenance program should be designed and implemented to maintain optimal removal performance.

Recommendations to be considered include:

- Perform a cost–benefit analysis of bioaugmentation for algae control compared to other chemical treatment options and request proposals from qualified vendors.
- Review the literature for natural engineered treatment systems located in tidally influenced areas that mitigate comparable contaminants.
- Model the potential fate processes (i.e., transfers and transformations) of the contaminants of concern and prioritize those processes that are synergistic for this system.
- Quantify and model the treatment system for mass loading of organic material compared to contaminants.
- Review the hydrodynamics of the treatment system compared to the desired water and sediment quality characteristics.
- Inventory native vegetation species and perform a literature review for species that will facilitate desired water and sediment quality characteristics as well as potential hyperaccumulaters.

4.4 Objective 4

Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria and Toxics TMDLs for Basin E within MdRH.

4.4.1 Bacteria Total Maximum Daily Load

The MdRH Marina Beach and Back Basins' Bacteria TMDL established bacterial compliance targets and waste load allocations (WLAs) based on the numeric targets set under the Assembly Bill 411 health standards. The TMDL WLAs are expressed as allowable exceedance days or the maximum number of days where sampling results can surpass the established Assembly Bill 411 standards without exceeding the limits in the Bacteria TMDL. The indicator bacteria standards for the TMDL are presented in Table 15.

Table 15. Total Maximum Daily Load Compliance Limits

	Rolling 30-Day Geometric Mean Limit*	Single Sample Limit
Total coliforms	1,000 MPN/ 100 mL	1,000 MPN/ 100 mL if fecal > 10% of total, or 10,000 MPN/100 mL**
Fecal coliforms	200 MPN/100 mL	400 MPN/100 mL
Enterococci	35 MPN/100 mL	104 MPN/100 mL

*30-day limit is based on the geometric mean of 30 sample days. For days without sampling, the result for that day is applied to the remaining days of the week until the next sample event (excluding wet weather days).
**The total coliform single sample limit of 10,000 MPN decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value.

The Bacteria TMDL is divided into the following three defined seasons:

- *Summer Dry* – April 1 to October 3.
- *Winter Dry* – November 1 to March 31.
- *Wet Weather* – Year-round wet weather (defined as days of 0.1 inch of rain or more plus three days following the rain event).

Each season has its own compliance dates, requirements, and limits as provided in Table 16.

Table 16. Total Maximum Daily Load Compliance Targets

Compliance Categories	Compliance Dates	Compliance Days Year
Summer dry weather	April 1–October 31	0 days per year (daily and weekly sampling)
Winter dry weather	November 1–March 31	3 days per year (daily sampling) 0 days per year (weekly sampling)
Wet weather	Rain event ≥ 0.1 inch at LAX rain gage, and three days following the end of the rain event	17 days per year (daily sampling) 3 days per year (weekly sampling)

In this study, bacteria samples were collected during both winter dry conditions (March 2010) and wet conditions (January 2010).

During wet weather, six of the nine bacterial water samples collected exceeded the Bacteria TMDL compliance targets. Compliance points for the TMDL are located in Basin E, where four samples were