Watsonville Sloughs Hydrology Study

Technical Advisory Committee Update

May 31, 2012

Balance Hydrologics, Inc.®

Environmental Data Solutions

and with assistance from Jonathan Lear, CHg

Meeting Agenda

- Overview and introductions
- Monitoring program update
- Summary of the survey work
- Revised preliminary water balance
- Overview of hydrologic and hydraulic modeling
- Outstanding questions and data gaps
- Next steps

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Monitoring Program Update

- Successful installation of all components of the data collection plan (with the normal "adjustments" along the way)
- Measuring water surface elevations at 9 locations
- Measuring specific conductance & temperature at 6 locations
- Measuring shallow groundwater elevations at 4 locations
- Measuring rainfall at 2 locations
- Real-time data access via the web for 2 of the stations
- Initial field calibrations as well flow records at 10 locations (eventually)

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211131 Watsonville Slough.mxd

Figure 1. Existing hydrologic monitoring stations

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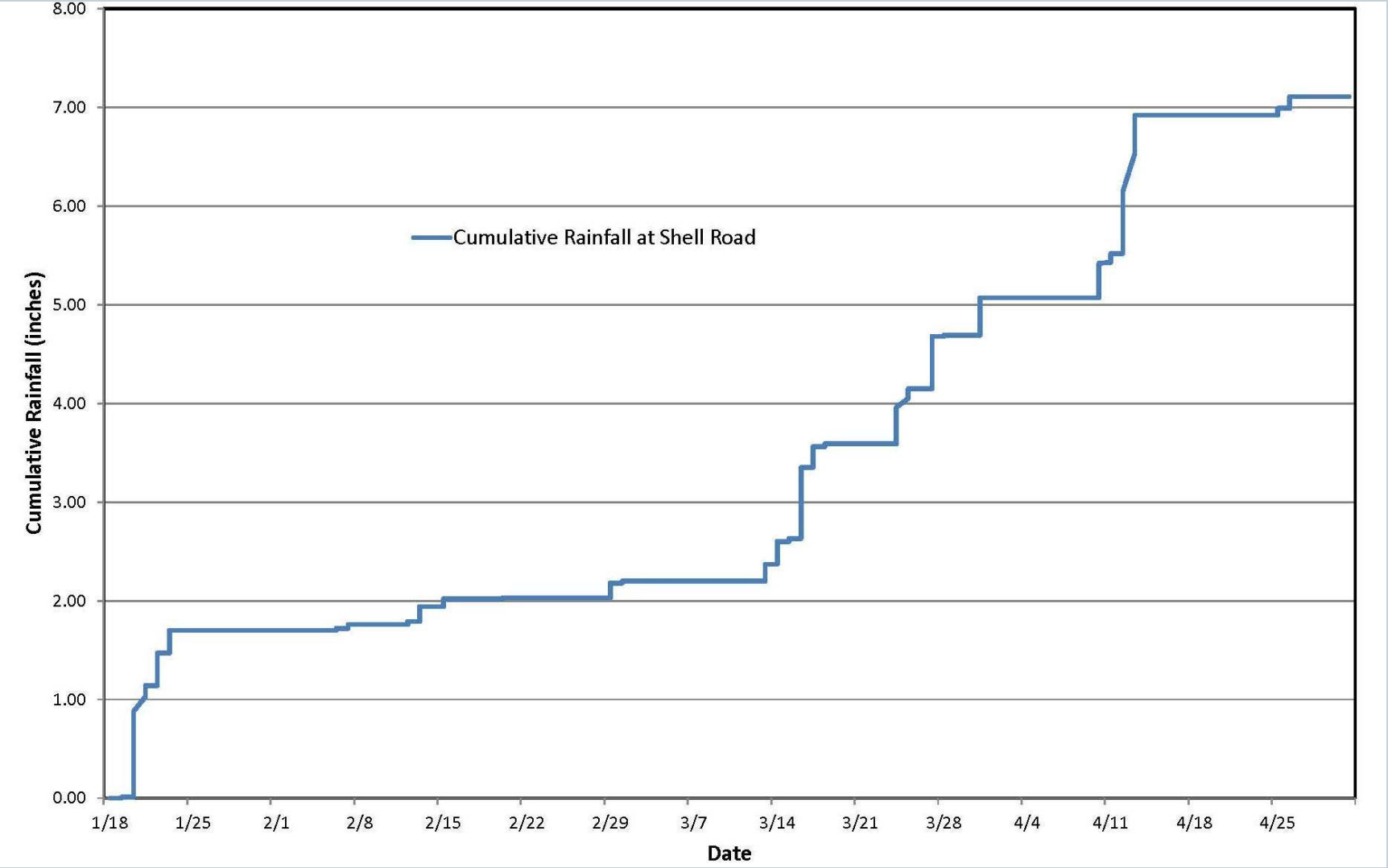
- It rained!! … well, at least a little



- Overview of preliminary data by station

- Watershed areas at selected stations:
  - Harkins Slough at Buena Vista 2,720 acres
  - Watsonville Slough at Highway 1 1,470 acres
  - Gallighan Slough 1,240 acres
  - East Struve at Main 840 acres
  - West Struve at High School 380 acres
  - Harkins Slough Tributary at Manfre 250 acres

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Summary of Survey Work

Summary of Survey Work

- Reference elevations at 10 staff plates
- Top of pipe elevations at 6 groundwater piezometers
- 109 channel invert points along lower Watsonville and Harkins Sloughs
- 67 water surface elevations along lower Watsonville and Harkins Sloughs
- 1,300 points along 30 cross-sections that cover the inundated and heavily vegetated portions of the study area
- Invert elevations and other measurements characterizing 10 channel crossings along lower Watsonville and Harkins Sloughs
- Permanent benchmark placement at multiple locations within the study area

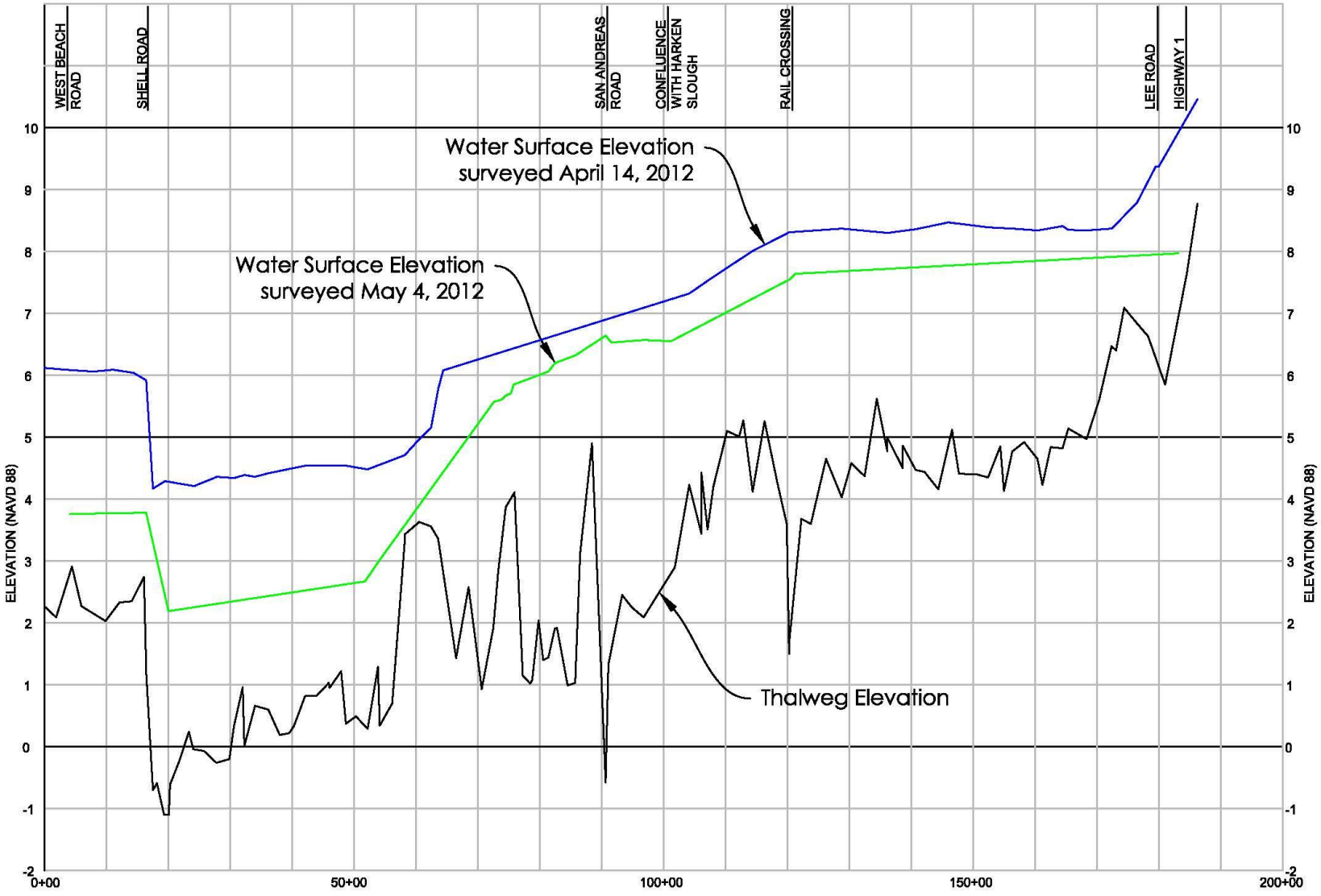

Figure 4: Watsonville Slough Profile

SCALE: 1" = 2000' VERTICAL: X1000

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W:\CADPROJECTS\211131 WATSONVILLE SLOUGH\211131 PROFILE 5-16-12.DWG

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Revised Preliminary Water Balance

- Update to the water budget analysis presented in the Water Resources Management Plan for Watsonville Sloughs (Questa Engineering Corporation, 1995).
- Calculational methodologies and system boundaries were kept the same
- Update uses the same types of inflow and outflow (e.g. rainfall, irrigation, evapotranspiration, etc.) as in the original water budget
- Uses monthly time steps based on average conditions
- Three independent watershed areas: 1) Harkins Slough excluding Gallighan Slough, 2) Gallighan Slough, and 3) Watsonville Slough excluding the former two
- Results are compiled and tabulated for two areas: 1) the Harkins Slough watershed to the confluence with Watsonville Slough and 2) the overall Watsonville Sloughs watershed to Shell Road
- Focus on characterizing how changes in land use and management practices affect the values of the various fluxes in the overall water balance

Table 1. Summary of land use changes between 1992 and 2011 in the Watsonville Slough Watershed

	Gallighan Slough			Harkins Slough			Watsonville Slough		
	1992	2011	Delta	1992	2011	Delta	1992	2011	Delta
	acres	acres	acres	acres	acres	acres	acres	acres	acres
Open Space	1095	1075	-20	3902	3745	-157	1044	966	-78
Agriculture	350	348	-2	1086	1177	91	1012	811	-201
Urban	69	91	22	362	428	66	1808	2087	279

	Gallighan Slough			Harkins Slough			Watsonville Slough		
	1992	2011	Delta	1992	2011	Delta	1992	2011	Delta
	%	%		%	%		%	%	
Open Space	72	71	-1	73	70	-3	27	25	-2
Agriculture	23	23	0	20	22	2	26	21	-5
Urban	5	6	1	7	8	1	47	54	7

Note: Harkin Slough excudes the area from Gallighan Slough and Watsonville Slough excludes the areas from Harkin Slough

Table 2. Summary of water balance results for Harkin Slough

1995 Questa Water Balance Summary

Month	Precip	Precip	Runoff	GW Seepage Lost	Loss to Deep GW	Return Shallow GW	Septic Return	AG Return	ET Loss From Wetlands	Pumping from Harkin Slough	Outflow from Slough System
	inches	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*
Sep	0.30	176	3	6	0	-177	3	38	8	0	36
Oct	1.10	646	10	6	0	-89	3	23	4	0	32
Nov	3.25	1,908	94	6	193	-2	3	0	0	0	97
Dec	3.25	1,908	340	6	259	68	3	0	0	0	404
Jan	4.50	2,642	507	6	442	212	3	0	0	0	716
Feb	3.75	2,202	514	6	162	385	3	0	0	0	896
Mar	4.50	2,642	507	6	158	423	3	0	0	0	927
Apr	1.50	881	155	6	0	262	3	26	0	0	440
May	0.40	235	35	6	0	73	3	31	29	0	107
Jun	0.00	0	0	6	0	-43	3	45	28	0	21
Jul	0.00	0	0	6	0	-50	3	44	27	0	20
Aug	0.00	0	0	6	0	-77	3	6	13	0	-4
Total	**22.55**	**13,241**	**2,162**	**72**	**1,215**	**984**	**36**	**213**	**109**	**0**	**3,690**

Updated Water Balance Summary

Month	Precip	Precip	Runoff	GW Seepage Lost	Loss to Deep GW	Return Shallow GW	Septic Return	AG Return	ET Loss From Wetlands	Pumping from Harkin Slough	Outflow from Slough System
	inches	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*
Sep	0.30	172	3	6	0	-177	3	38	59	0	-15
Oct	1.10	629	12	6	0	-89	3	23	42	0	-4
Nov	3.25	1,859	101	6	193	-3	3	0	27	0	77
Dec	3.25	1,859	346	6	259	57	3	0	22	0	384
Jan	4.50	2,574	515	6	442	207	3	0	25	116	584
Feb	3.75	2,145	521	6	162	378	3	0	43	199	661
Mar	4.50	2,574	515	6	158	416	3	0	71	189	674
Apr	1.50	858	158	6	0	254	3	26	79	120	242
May	0.40	229	35	6	0	67	3	31	82	53	0
Jun	0.00	0	0	6	0	-45	3	45	77	0	-29
Jul	0.00	0	0	6	0	-50	3	44	80	0	-33
Aug	0.00	0	0	6	0	-96	3	6	71	0	-62
Total	**22.55**	**12,899**	**2,206**	**72**	**1,215**	**918**	**36**	**213**	**678**	**678**	**2,478**

Table 3. Summary of water balance results for Watsonville Slough

1995 Questa Water Balance Summary

Month	Precip	Precip	Runoff	GW Seepage Lost	Loss to Deep GW	Return Shallow GW	Septic Return	AG Return	ET Loss From Wetlands	Pumping from Harkin Slough	Outflow from Slough System
	inches	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*
Sep	0.30	273	28	0	0	0	3	188	44	0	175
Oct	1.10	1,000	101	0	0	0	3	117	22	0	199
Nov	3.25	2,955	429	0	193	0	3	0	0	0	432
Dec	3.25	2,955	768	6	275	140	3	0	0	0	904
Jan	4.50	4,091	1,107	6	469	295	3	0	0	0	1,399
Feb	3.75	3,409	1,075	6	170	547	3	0	0	0	1,619
Mar	4.50	4,091	1,107	6	166	599	3	0	0	0	1,703
Apr	1.50	1,364	343	6	0	339	3	131	0	0	810
May	0.40	364	68	6	0	32	3	155	161	0	90
Jun	0.00	0	0	0	0	0	3	227	157	0	73
Jul	0.00	0	0	0	0	0	3	219	153	0	69
Aug	0.00	0	0	0	0	0	3	107	72	0	38
Total	**22.55**	**20,502**	**5,024**	**36**	**1,274**	**1,951**	**36**	**1,144**	**609**	**0**	**7,510**

Updated Water Balance Summary

Month	Precip	Precip	Runoff	GW Seepage Lost	Loss to Deep GW	Return Shallow GW	Septic Return	AG Return	ET Loss From Wetlands	Pumping from Harkin Slough	Outflow from Slough System
	inches	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*	*ac-ft*
Sep	0.30	268	32	0	0	0	3	188	107	0	115
Oct	1.10	983	117	0	0	0	3	117	77	0	160
Nov	3.25	2,906	467	0	193	0	3	0	50	0	421
Dec	3.25	2,906	791	6	270	78	3	0	40	0	833
Jan	4.50	4,023	1,138	6	459	282	3	0	46	116	1,262
Feb	3.75	3,353	1,100	6	168	532	3	0	77	199	1,359
Mar	4.50	4,023	1,138	6	164	586	3	0	128	189	1,410
Apr	1.50	1,341	354	6	0	332	3	131	143	120	557
May	0.40	358	73	6	0	27	3	155	149	53	55
Jun	0.00	0	0	0	0	0	3	227	140	0	90
Jul	0.00	0	0	0	0	0	3	219	145	0	77
Aug	0.00	0	0	0	0	0	3	107	128	0	-18
Total	**22.55**	**20,160**	**5,212**	**36**	**1,254**	**1,838**	**36**	**1,144**	**1,231**	**678**	**6,320**

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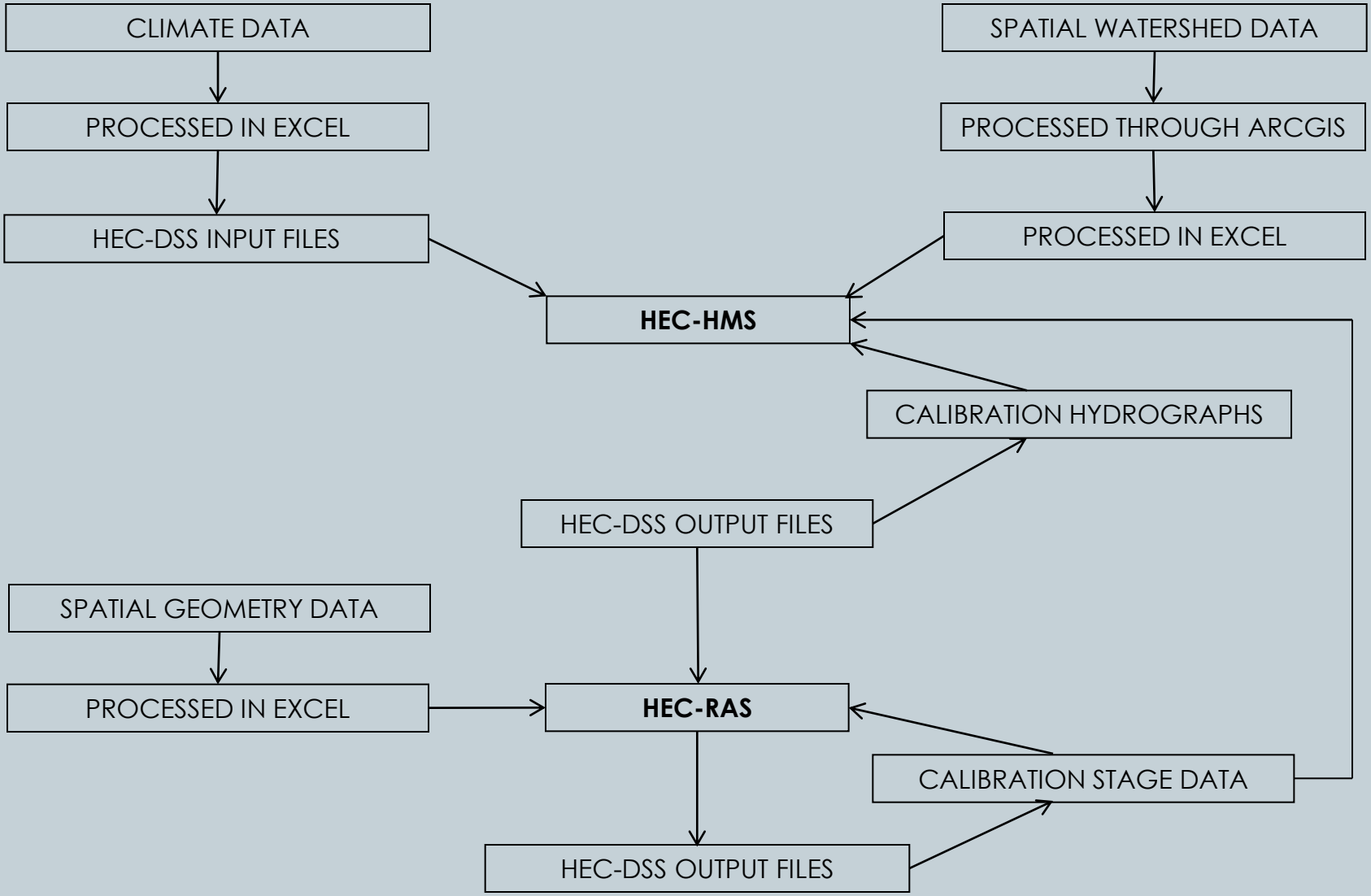
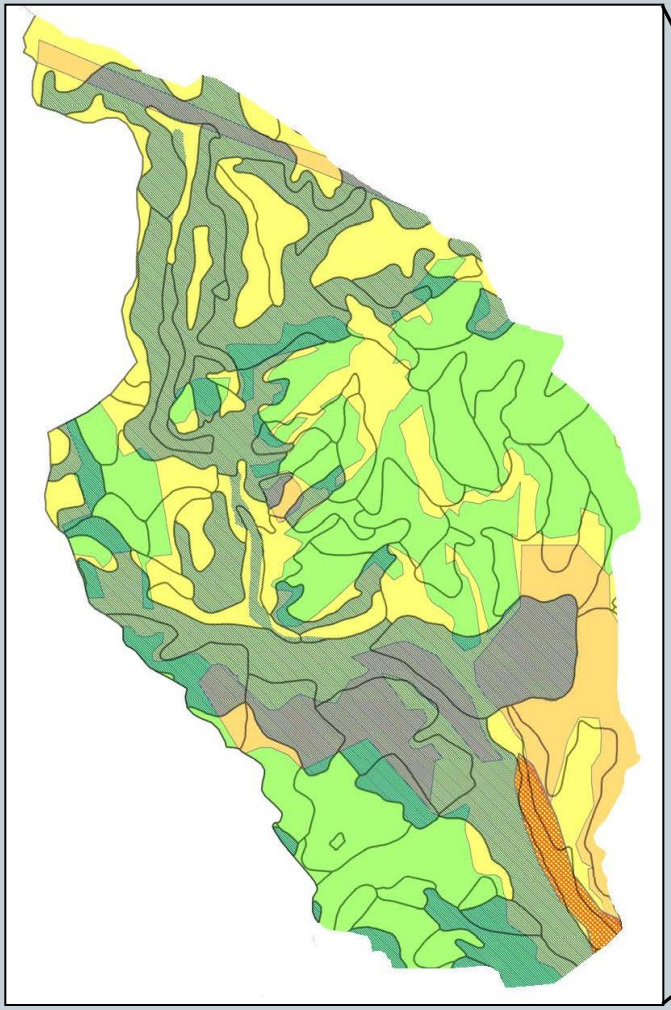
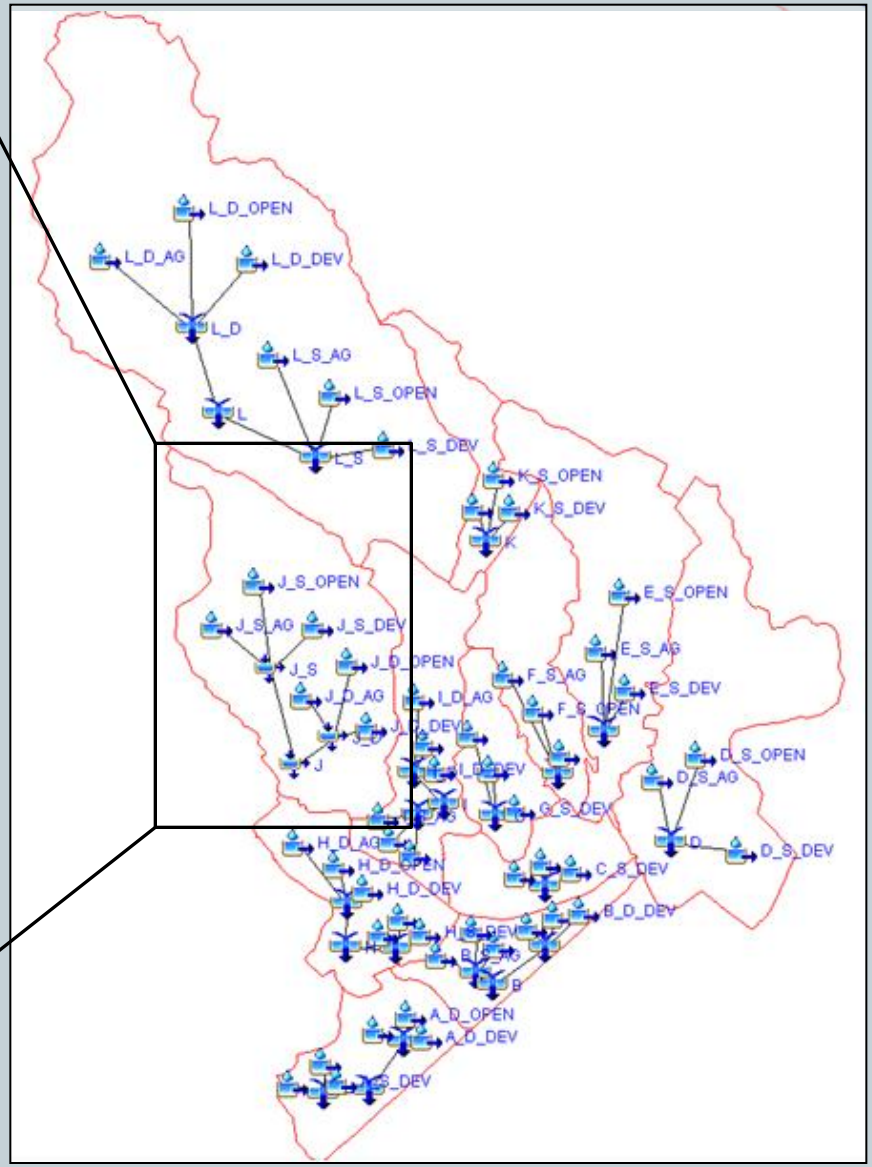
Overview of Modeling

Modeling Overview Schematic

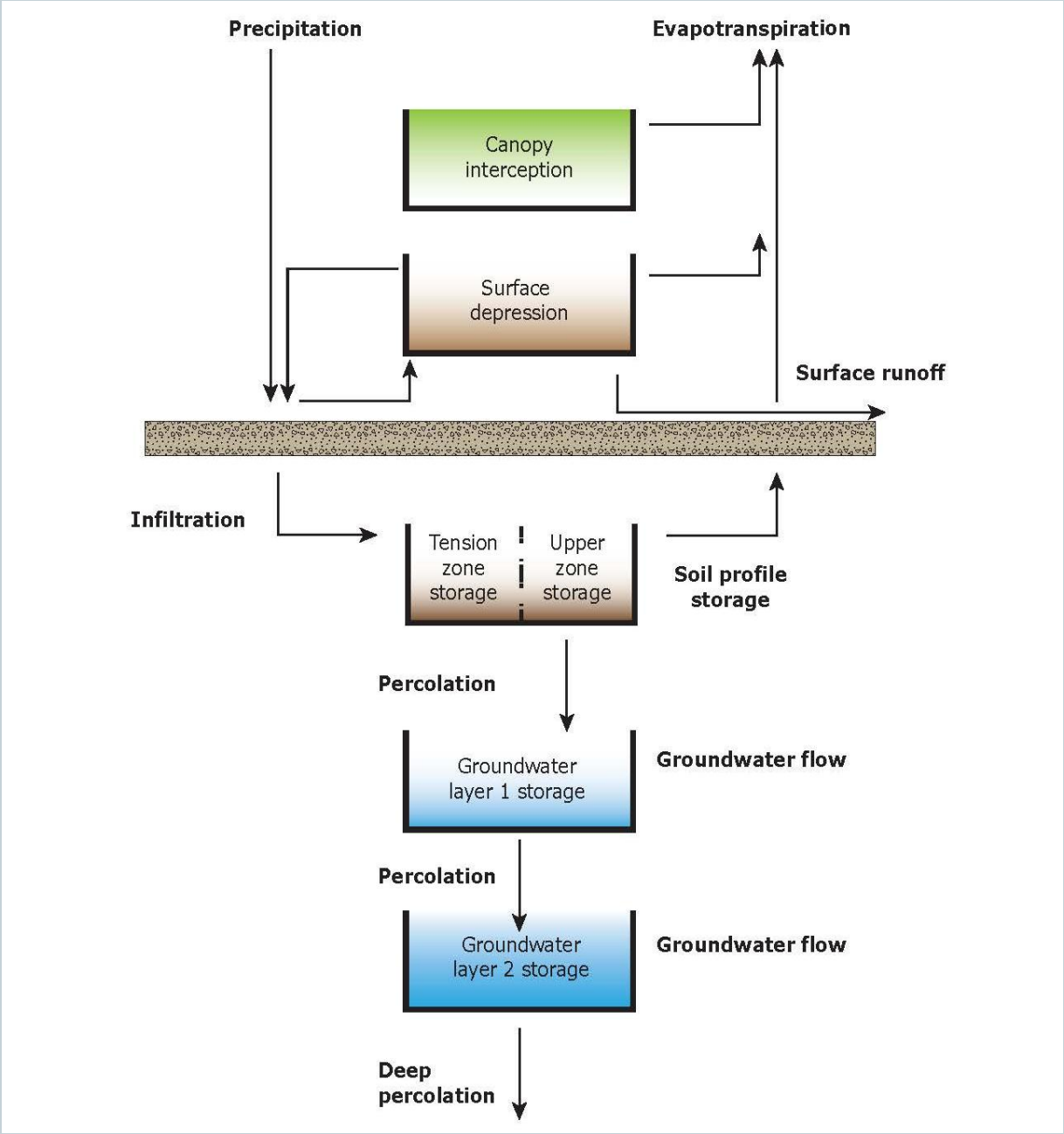


Hydrologic Modeling Framework





Hydrologic Calculation Methodology



Hydraulic Modeling Framework

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Questions and Next Steps

Outstanding Questions and Next Steps

Questions:

- Real-time data feeds
- Completeness of monitoring network
- Modeling complexity
- Others?

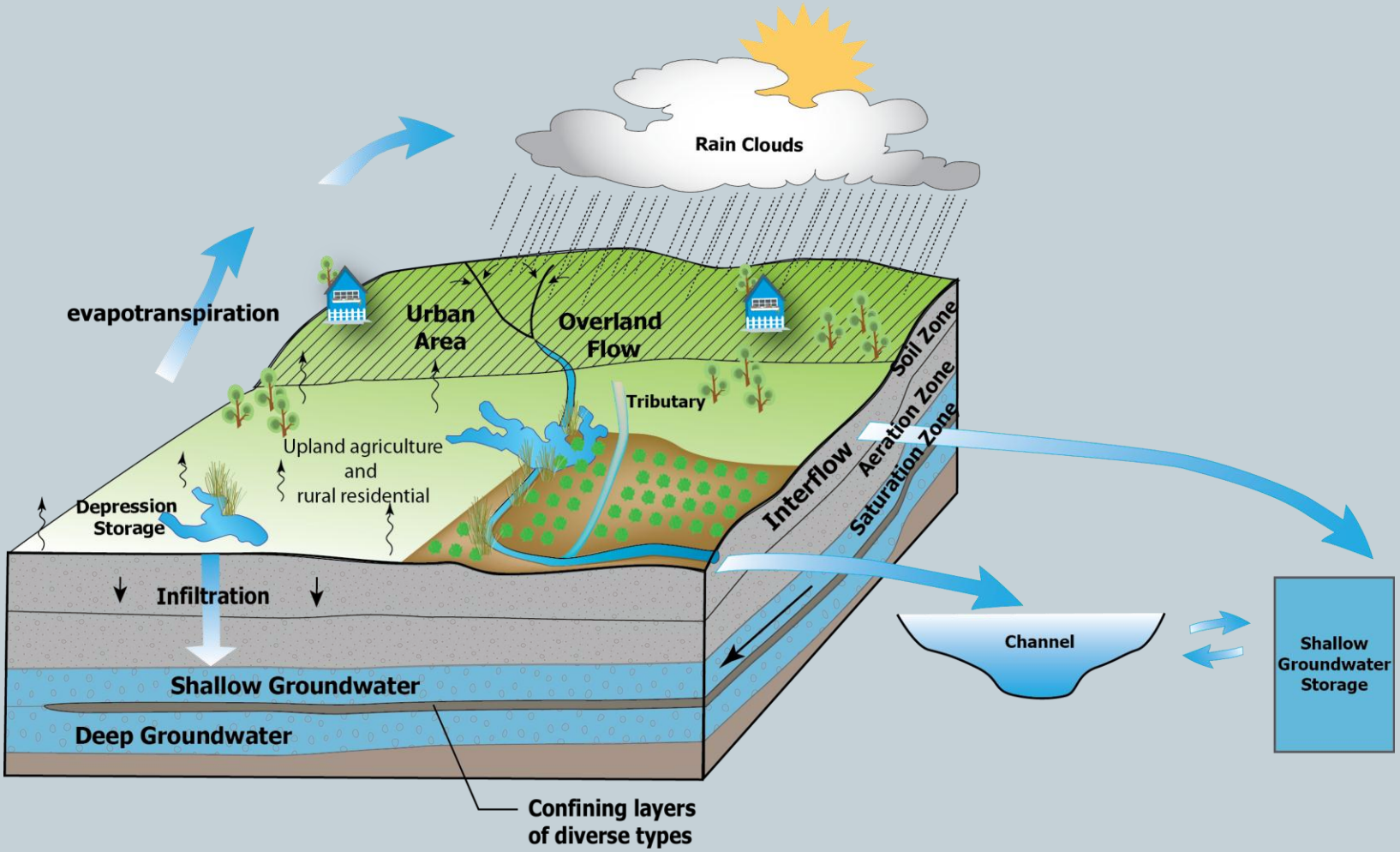
Next Steps:

- Complete hydrologic modeling including preliminary calibrations
- Complete preliminary hydraulic modeling and run to inform upcoming monitoring season work
- Download and maintain monitoring network
- Schedule next TAC meeting (modeling review)

PHOTOS – WATSONVILLE SLOUGH D/S FROM SAN ANDREAS

PHOTOS – WATSONVILLE SLOUGH D/S FROM R.R.

Hydrologic Modeling Overview



The Bigger Picture