City of Ventura Special Studies
Estuary Subwatershed Study

Draft Data Gaps Analysis
6/18/09

Study Component	Task	Available Data and Reference	Data Gaps
1. Estuary Water Balance	1a. Define the relevant extent of the Subwatershed and Estuary that are influenced by the VWRF discharge spatially, hydrologically, and functionally by utilizing existing studies and reports to determine how the discharge may have altered conditions over time	• Estuary bathymetry [2001], 1-ft contour (ESA 2003) • LiDAR of Estuary [2005], 1-ft resolution (Ventura County) • Estuary inundation extent from 6/2001 to present (City) • Anecdotal evidence and short-term measurements of hydraulic connectivity of Estuary and adjacent areas to the south including McGrath State Park and McGrath Lake (Swanson et al., 1990; ESA 2003; Nautilus 2005; URS 2004 & 2005)	• Spatial extent of groundwater elevation increase due to impounded water in the Estuary during closed-mouth conditions • Spatial extent of inundated area over a spring-tide tidal cycle when the mouth is open.
	1b. Quantify the average monthly inflow from all quantifiable sources including; groundwater, Santa Clara River flows, VWRF discharges, and agriculture and urban surface water runoff	• VWRF discharge (City) • Estuary inflow and outflow estimates from 1984 to present (City) • Santa Clara River flows at Montalvo (1927-2004) (USGS) • Santa Clara River Flows at Freeman Diversion (2005-2008) (VCWPD) • Santa Clara River flows at Victoria Ave (2008 to present) (VCWPD)	• Continuous groundwater elevation data adjacent to the Estuary for dry and wet seasons (i.e., longer than 1 year) • Estimates of agricultural and urban run-off between Freeman Diversion and Harbor Blvd bridge

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		• Groundwater gradients from McGrath Lake to the Estuary (URS 2004 & 2005) • Modeled watershed-scale groundwater gradient 1984-1993 (Hanson et al 2003) • Short-term groundwater and Estuary water level monitoring from 1/2004 to 1/2005 (Nautilus 2005) • Short-term Estuary water balance (Kamman H&E 2007) • Short-term well monitoring adjacent to the Estuary (Swanson et al 1990; ESA 2003) • Tidal elevation adjacent to Estuary (Stillwater Sciences 2005, Nautilus 2005)	
	1c. Define the relationship between inflows and Estuary habitat area, lagoon depth, and volume under various discharge scenarios. Evaluate how different species require varied water depths, riparian habitats, and in-stream cover within the lagoon and the impact of altering the current discharge regime might have on these species.	• Estuary bathymetry [2001], 1-ft contour (ESA 2003) • LiDAR of Estuary [2005], 1-ft resolution (Ventura County) • Estuary inundation extent from 6/2001 to present (City) • BMI bioassessment from 2003-2008 (AB&C Laboratories) • Short-term fish usage and macroinvertebrate abundance (USF&WS 1999) • Vegetation and habitat mapping within and adjacent to Estuary (Swanson et al 1990; ESA 2003,	• Estuary water depth-area relationship • Estuary water depth-volume relationship • More defined relationship between water depth and vegetation and habitat type • Contribution of VWRF discharge to monthly and annual Estuary water budget • More data on tidewater goby abundance and habitat usage • More data on southern steelhead abundance and habitat usage

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		Stillwater Sciences 2008, CDPR 2009) • Short-term tidewater goby abundance and habitat usage (Entrix 2004 and Nautilus 2008 and 2009) • Short-term southern steelhead abundance and habitat usage (Kelley 2008) • Short-term least Bell's vireo abundance and habitat usage (Labinger and Greeves 2001) • Snowy plover and Least tern annual nesting locations and population estimates (Ventura Audubon Society)	• More information on least Bell's vireo and other shorebirds abundance and habitat usage
	1d. Evaluate breaching frequency and breaching types and their effect on the lagoon, backwater habitats, water quality, and how each impacts federal and state listed species present in the Estuary. Compile historic information to identify breaching changes over time considering activities such as dredge material management practices, mining, urbanization, agriculture, and other potential influences.	• Estuary inflow and outflow estimates from 1984 to present (City) • Estuary inundation extent from 6/2001 to present (City) • Daily Estuary water level and mouth closure status from 5/2001 to 4/2002 (Nautilus 2005) • Continuous Estuary water level monitoring and mouth closure status from 1/2004 to 1/2004 (Nautilus 2005) • Mouth 'inlet stability analysis' (Nautilus 2005) • Water quality measurements in McGrath Lake (in ESA 2003)	• More defined relationship between water depth and vegetation and habitat type • Time-series of water quality parameters at several locations throughout the Estuary for open- and closed-mouth conditions • Accounts of changes in breaching dynamics • Channel/estuary dredging records • Better data on gravel mining extraction rates

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		• Water quality measurements in the Estuary from 1997-1999 (USFWS 1999) • Short term water quality measurements in the Estuary (Kelley 2008) • Water quality measurements (temp. DO, salinity, pH) in the Estuary from 2000 to present (City) • Short term continuous water quality parameters (DO, temp, pH, salinity, turbidity, Chl-a) and targeted macroalgae measurements in the Estuary (SCCWRP) • Water quality measurements in the Estuary during open- and closed-mouth conditions for 2003-2005 (Nautilus 2005) • Water column toxicity measurements for 2003-2005 (Nautilus 2005) • Known changes to river flow and sediment delivery over time (Warrick 2001, Stillwater Sciences 2005) • Aggregate mining estimates (Simons and Li 1983)	
2. Functionality of the Subwatershed and Estuary	2a. Identify alternate VWRF discharge scenarios considering flow volumes, the quality of the various inflows, and treatment wetlands	• VWRF discharge (City) • River discharge downstream from Freeman	• Better understanding of the relative contribution of each water budget component on total water volume, particularly

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	feasibility	Diversion/Montalvo, Victoria Ave. (VCWPD/USGS) • Water quality measurements in McGrath Lake (ESA 2003 and URS 2004 & 2005) • Water quality measurements in the Estuary from 1997-1999 (USF&WS 1999). • Estuary inflow and outflow estimates from 1984 to present (City) • Water quality measurements in the Estuary during open- and closed-mouth conditions for 2003-2005 (Nautilus 2005) • Water column toxicity measurements for 2003-2005 (Nautilus 2005) • Water quality measurements (temp. DO, salinity, pH) in the Estuary from 2000 to present (City) • Short term continuous water quality parameters (DO, temp, pH, salinity, turbidity, Chl-a) and targeted macroalgae	groundwater and surface water downstream of Freeman Diversion Dam • Better understanding of the relative contribution of each water budget component on seasonal and annual Estuary water quality
	2b. Analyze the system to predict how changes to the amount of the discharge could alter water quality, side stream habitat, lagoon surface area, and groundwater influences	• Estuary bathymetry [2001], 1-ft contour (ESA 2003) • LiDAR of Estuary [2005], 1-ft resolution (Ventura County) • VWRF discharge (City) • Estuary inundation extent from	• Estuary water depth-area relationship • Estuary water depth-volume relationship • More defined relationship between water depth and

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		6/2001 to present (City) • Short term water quality measurements in the Estuary (Kelley 2008) • Short-term water quality and measurements in the Estuary (USF&WS 1999). • Water quality measurements (temp. DO, salinity, pH) in the Estuary from 2000 to present (City) • Short term continuous water quality parameters (DO, temp, pH, salinity, turbidity, Chl-a) and targeted macroalgae • Short-term monitoring of relationship between Estuary water level and groundwater discharge in McGrath State Park (Nautilus 2005) • BMI bioassessment from 2003-2008 (AB&C Laboratories)	vegetation and habitat type • More knowledge on groundwater contribution to Estuary water budget • More defined relationship between Estuary water surface elevation and groundwater/surface water elevation in McGrath State Park • Knowledge of each hydrologic component's current relative contribution to Estuary water quality
	2c. Under each discharge scenario, predict changes to spatial inundation characteristics of the Estuary and McGrath State Park including depth and volume	• Estuary bathymetry [2001], 1-ft contour (ESA 2003) • LiDAR of Estuary [2005], 1-ft resolution (Ventura County) • Estuary inundation extent from 6/2001 to present (City) • Vegetation and habitat mapping within and adjacent to Estuary (Swanson et al 1990; ESA 2003, Stillwater Sciences 2008, CDPR	• Estuary water depth-area relationship • Estuary water depth-volume relationship • More defined relationship between Estuary water surface elevation and groundwater/surface water elevation in McGrath State Park • Hydraulic conductivity for soils

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		2009) • River discharge downstream from Freeman Diversion/Montalvo, Victoria Ave. (VCWPD/USGS) • Groundwater gradients from McGrath Lake to the Estuary (URS 2004 & 2005)	underlying McGrath State Beach • Spatial extent of groundwater elevation increase due to impounded VWRF water in the Estuary during closed-mouth conditions
	2d. Provide mapping of the various habitat types and their extent	• Vegetation and habitat mapping within and adjacent to Estuary (Swanson et al 1990; ESA 2003, Stillwater Sciences 2008, CDPR, 2009)	• More defined relationship between water depth and vegetation and habitat type
	2e. Identify how each scenario effects habitats for state and federally listed species including steelhead trout, tidewater goby, Western Snowy Plover, and critical habitat areas for birds such as the California least tern	• Vegetation and habitat mapping within and adjacent to Estuary (Swanson et al 1990; ESA 2003, Stillwater Sciences 2008, CDPR, 2009) • Short-term tidewater goby abundance and habitat usage (Entrix 2004 and Nautilus 2008 and 2009) • Short-term southern steelhead abundance and habitat usage (Kelley 2008) • Short-term least Bell's vireo abundance and habitat usage (Labinger and Greeves 2001) • Snowy plover and Least tern annual nesting locations and population estimates (Ventura Audubon Society)	• Estuary water depth-area relationship • Estuary water depth-volume relationship • Better understanding of habitat preference for species of interest (in particular those species with little to no information to date) • More defined relationship between water depth and vegetation and habitat type

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	2f. Investigate the role wastewater discharge plays in vegetation growth in the subwatershed and whether this factor and any changes in riverbed vegetation and sediment management practices that may have occurred over time	• VWRF discharge (City) • Water quality measurements in McGrath Lake (in ESA 2003) • Water quality measurements in the Estuary from 1997-1999 (USFWS 1999). • Water quality measurements in the Estuary during open- and closed-mouth conditions for 2003-2005 (Nautilus 2005) • Water column toxicity measurements for 2003-2005 (Nautilus 2005) • Water quality measurements (temp. DO, salinity, pH) in the Estuary from 2000 to present (City) • Short term continuous water quality parameters (DO, temp, pH, salinity, turbidity, Chl-a) and targeted macroalgae	• Better understanding of the wastewater discharge water quality and it's contribution to the seasonal and annual Estuary water quality
	2g. Identify how each VWRF discharge scenario changes breaching and those impacts on water quality and beach water quality in the area influenced by the discharge	• Estuary inflow and outflow estimates from 1984 to present (City) • Daily Estuary water level and mouth closure status from 5/2001 to 4/2002 (Nautilus 2005) • Mouth 'inlet stability analysis' (Nautilus 2005) • Continuous Estuary water level monitoring and mouth closure status from 1/2004 to 1/2004	• Relative seasonal and annual contributions of individual water budget components • More in-depth understanding of the relative seasonal and annual water budget components contribution to Estuary water quality

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		(Nautilus 2005) • Water quality measurements in McGrath Lake (in ESA 2003) • Water quality measurements in the Estuary from 1997-1999 (USFWS 1999). • Water quality measurements in the Estuary during open- and closed-mouth conditions for 2003-2005 (Nautilus 2005) • Water column toxicity measurements for 2003-2005 (Nautilus 2005) • Water quality measurements (temp. DO, salinity, pH) in the Estuary from 2000 to present (City) • Short term continuous water quality parameters (DO, temp, pH, salinity, turbidity, Chl-a) and targeted macroalgae	
	2h. Predict how groundwater quality could influence lagoon water quality under each scenario	• Water quality measurements in McGrath Lake (in ESA 2003) • Water quality measurements in the Estuary from 1997-1999 (USFWS 1999). • Water quality measurements in the Estuary during open- and closed-mouth conditions for 2003-2005 (Nautilus 2005) • Water column toxicity measurements for 2003-2005	• Measurements of groundwater quality • Better understanding of groundwater contribution to Estuary water budget • More in-depth understanding of the relative seasonal and annual water budget components contribution to Estuary water quality

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		(Nautilus 2005) • Groundwater gradients from McGrath Lake to the Estuary (URS 2004 & 2005)	
	2i. Evaluate the impacts of global warming on the potential increase on sea level elevation to the Estuary and Subwatershed area, sustainability of the system and VWRF alternatives being evaluated, and the potential impacts to the outcome of the special studies	• Estuary bathymetry [2001], 1-ft contour (ESA 2003) • LiDAR of Estuary [2005], 1-ft resolution (Ventura County) • Tidal elevation adjacent to Estuary (Stillwater Sciences 2005, Nautilus 2005)	• Current projection of increase in relative mean sea level over the next 50-100 years • More defined relationship between water depth and vegetation and habitat type
	2j. Recommend a management strategy for the VWRF discharge in order to optimize the function of the Estuary affected by the discharge to demonstrate enhancement of the Estuary, or determine that no enhancement exists	• All of the above	• All of the above