CITY OF VENTURA

Special STUDIES for Santa Clara River Estuary

PRESENTATION February 2011

carollo
Engineers...Working Wonders With Water®

Stillwater Sciences

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The special studies will answer …

…What is the best use of the treated water resources from the Ventura Water Reclamation Facilities to protect the health of the Santa Clara River Estuary?

Agenda for the Day

- Introduction
- Review of work to date
- Estuary Subwatershed Study-Draft Synthesis Report
  - Overview
  - Alternatives Evaluation
    - Description of alternatives
    - Comparison of alternatives
- Questions and Next Steps

Introduction

The Santa Clara River Estuary Project consists of three studies

Task Description	2009	2010	2011
	M J J A S O N D	J F M A M J J A S O N D	J F M
Estuary Subwatershed Study			
Recycled Water Study (Phase1)			
Treatment Wetlands Feasibility Study			
Stakeholder Workshops			

Previous stakeholder workshop discussions covered:

- Dec 2008 – Stakeholder Values
- July 2009 – Monitoring Plan
- Nov 2009 – Wetlands and Recycled Water
- Feb 2010 – Year One Data, Wetlands and Recycled Water
- Sept 2010 – Estuary Study Preliminary Finding
- Feb 2011 – Estuary Study Results

Estuary Subwatershed Study

Estuary Subwatershed Study Approach

Data Review and Collection

Estuary Water Balance

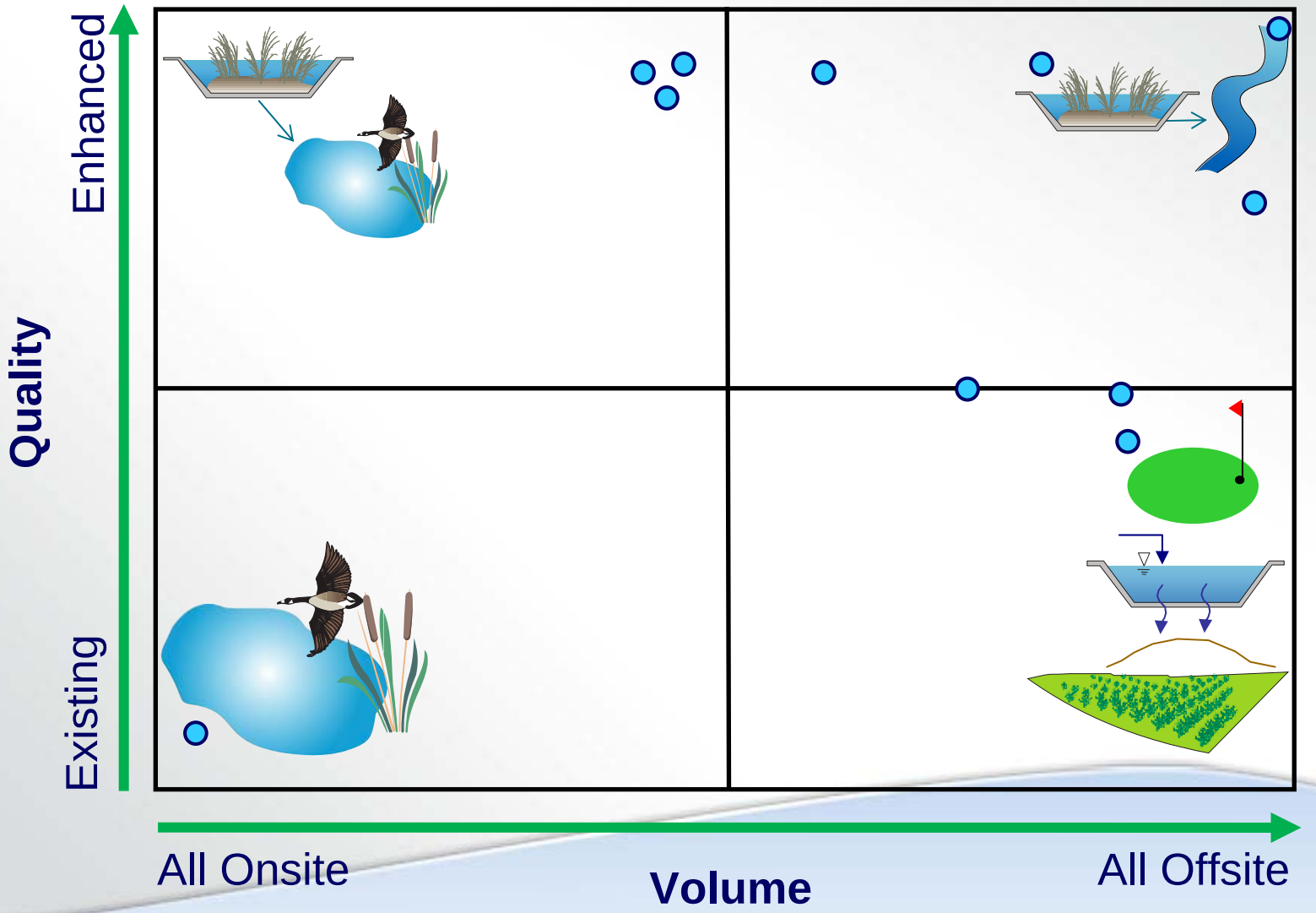
Estuary Physical/Biological Condition

Estuary Ecosystem Function

Climate Change

Develop/Optimize Discharge Scenarios

Stakeholders provided input on alternatives for recycled water and wetlands treatment



Discharge scenarios were developed based on stakeholder input

	VWRF effluent discharge			VWRF effluent WQ			
	Existing	Reduced	None	Existing	Planned upgrades	Enhanced denitrification	None
Alternative 1	✓			✓			
Alternative 2	✓				✓		
Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

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Alternative 1	✓			✓			
Alternative 2	✓				✓		
Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

Discharge scenarios were developed based on stakeholder input

Planned upgrades will reduce nitrate to below 10 mg-N/L

	VWRF effluent discharge			VWRF effluent WQ			
	Existing	Reduced	None	Existing	Planned upgrades	Enhanced denitrification	None
Alternative 1	✓			✓			
Alternative 2	✓				✓		
Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

Discharge scenarios were developed based on stakeholder input

Enhanced denitrification to 5 mg-N/L from treatment wetland or other means

	VWRF effluent discharge			VWRF effluent WQ			
	Existing	Reduced	None	Existing	Planned upgrades	Enhanced denitrification	None
Alternative 1	✓			✓			
Alternative 2	✓				✓		
Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

Discharge scenarios were developed based on stakeholder input

VWRF effluent reduction to benefit focal species and recreational opps.

	VWRF effluent discharge			VWRF effluent WQ			
	Existing	Reduced	None	Existing	Planned upgrades	Enhanced denitrification	None
Alternative 1	✓			✓			
Alternative 2	✓				✓		
Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

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Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

Discharge scenarios were developed based on stakeholder input

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Alternative 3	✓				✓	✓	
Alternative 4		✓			✓		
Alternative 5		✓			✓	✓	
Alternative 6			✓				✓

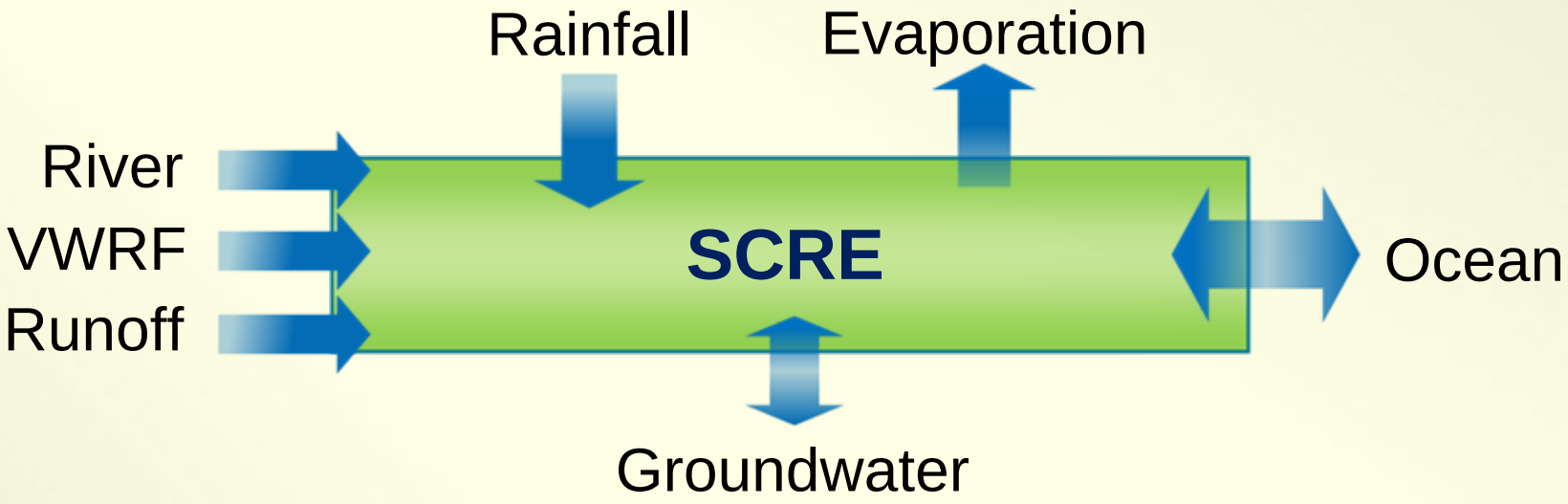
Alternatives analyzed under the following conditions…

- **Effluent-dominated**
  - Closed-mouth, low river flow
  - Late spring into fall (June through September)

- **Future climate change (ca 2050)**
  - Sea level rise: ~*1.35 ft*
  - Increase air temperature: ~*2°C*

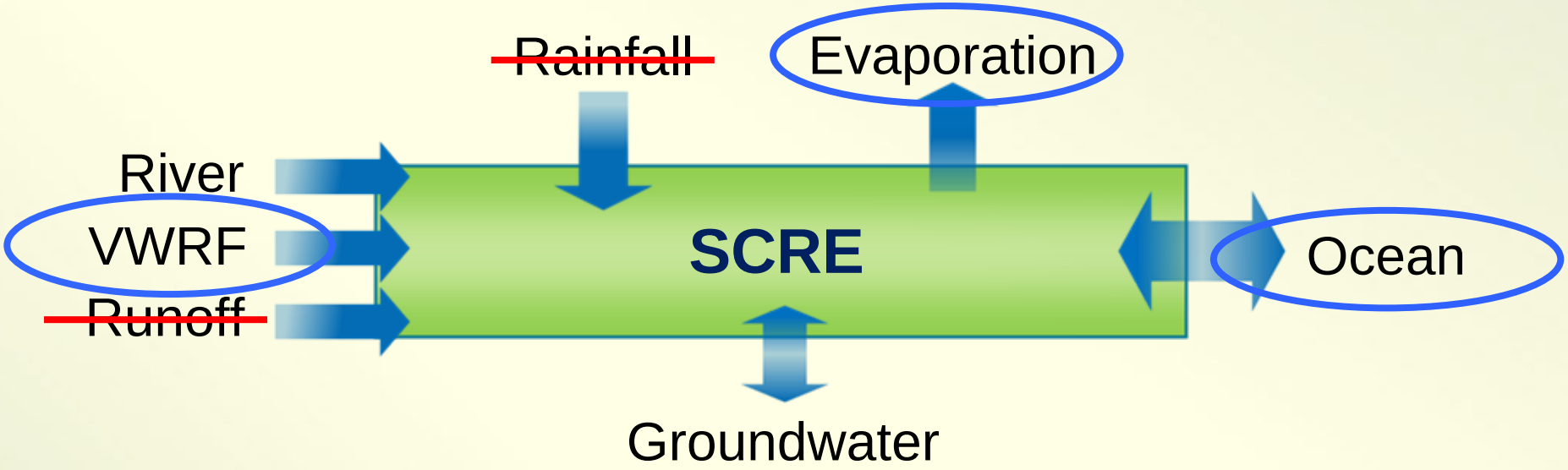
- **Current morphology and vegetation**

Estuary stage and habitat area was modeled using the water balance



$$V_{SCRE} = \text{River} + \text{VWRF} + \text{Runoff} + \text{Rain} + \text{GW(in)} + \text{Ocean(in)} - \text{GW(out)} - \text{Ocean(out)} - \text{Evaporation}$$

Estuary stage and habitat area was modeled using the water balance



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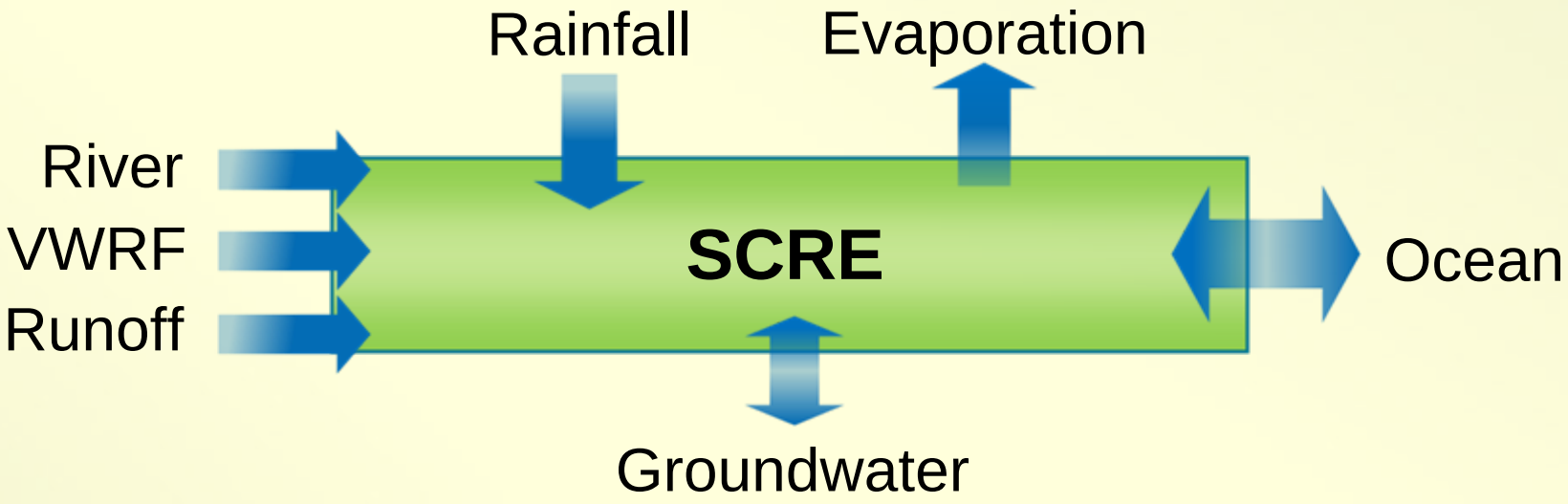

V_{SCRE} = River + VWRF + Runoff + Rain + GW(in) + Ocean(in) – GW(out) – Ocean(out) – Evaporation

V_{SCRE} converted to Estuary stage

Estuary stage converted to habitat area

Model inflow and outflow rates (MGD)

Alternatives	Santa Clara River	VWRF Discharge	Precipitation	Evaporation	Berm Outflow	Groundwater Flow Contributions		
						South Bank	VWRF ponds	North Bank and other sources
Alternatives 1 through 3	0.4	5.0	0	-0.7	-4.0	-0.2	0.9	0.4
Alternatives 4 and 5	0.4	3.5	0	-0.6	-3.1	-0.2	1.0	0.6
Alternative 6	0.4	0	0	-0.6	-2.1	-0.4	1.1	2.3

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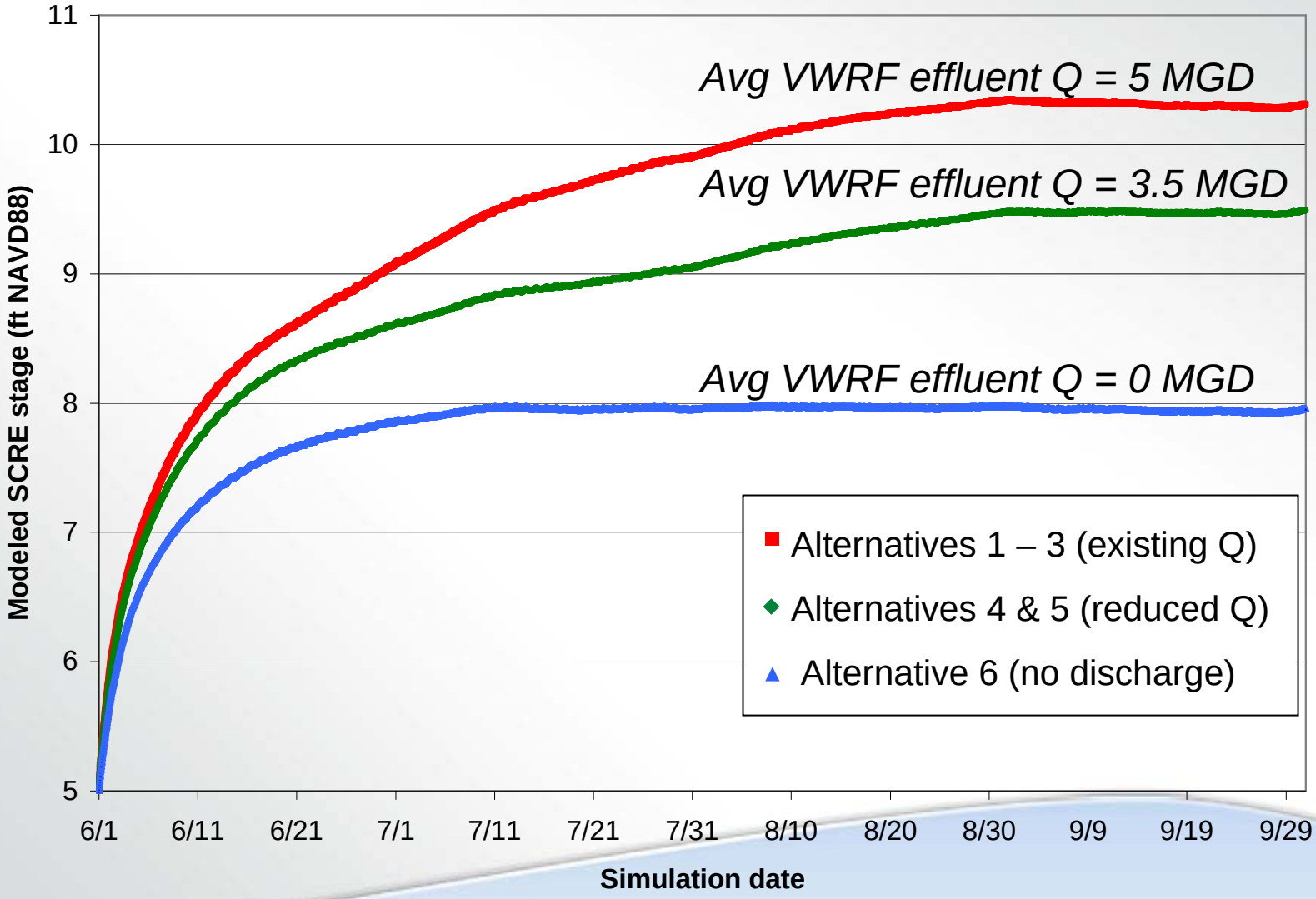
Modeled estuary stage for each alternative



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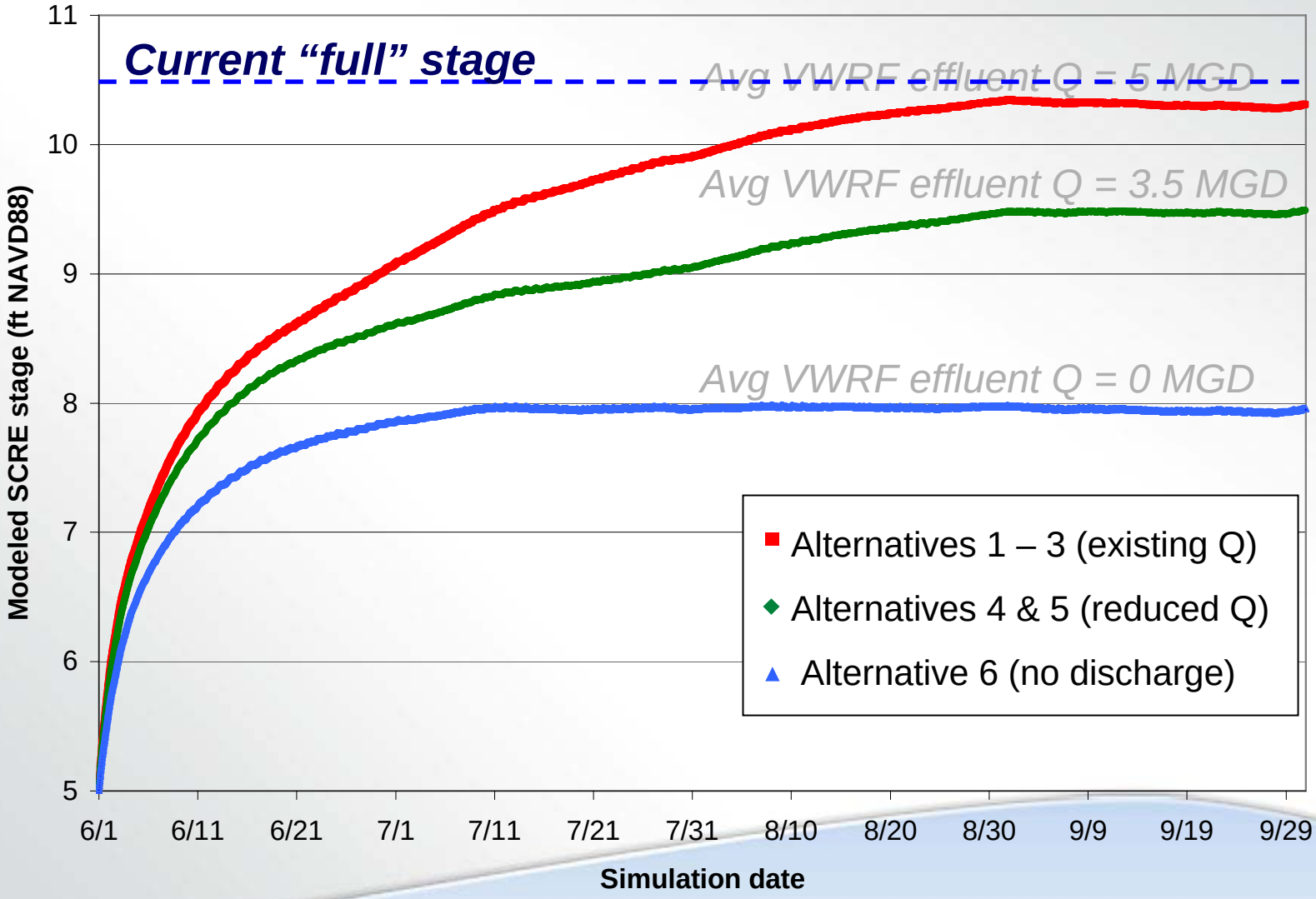


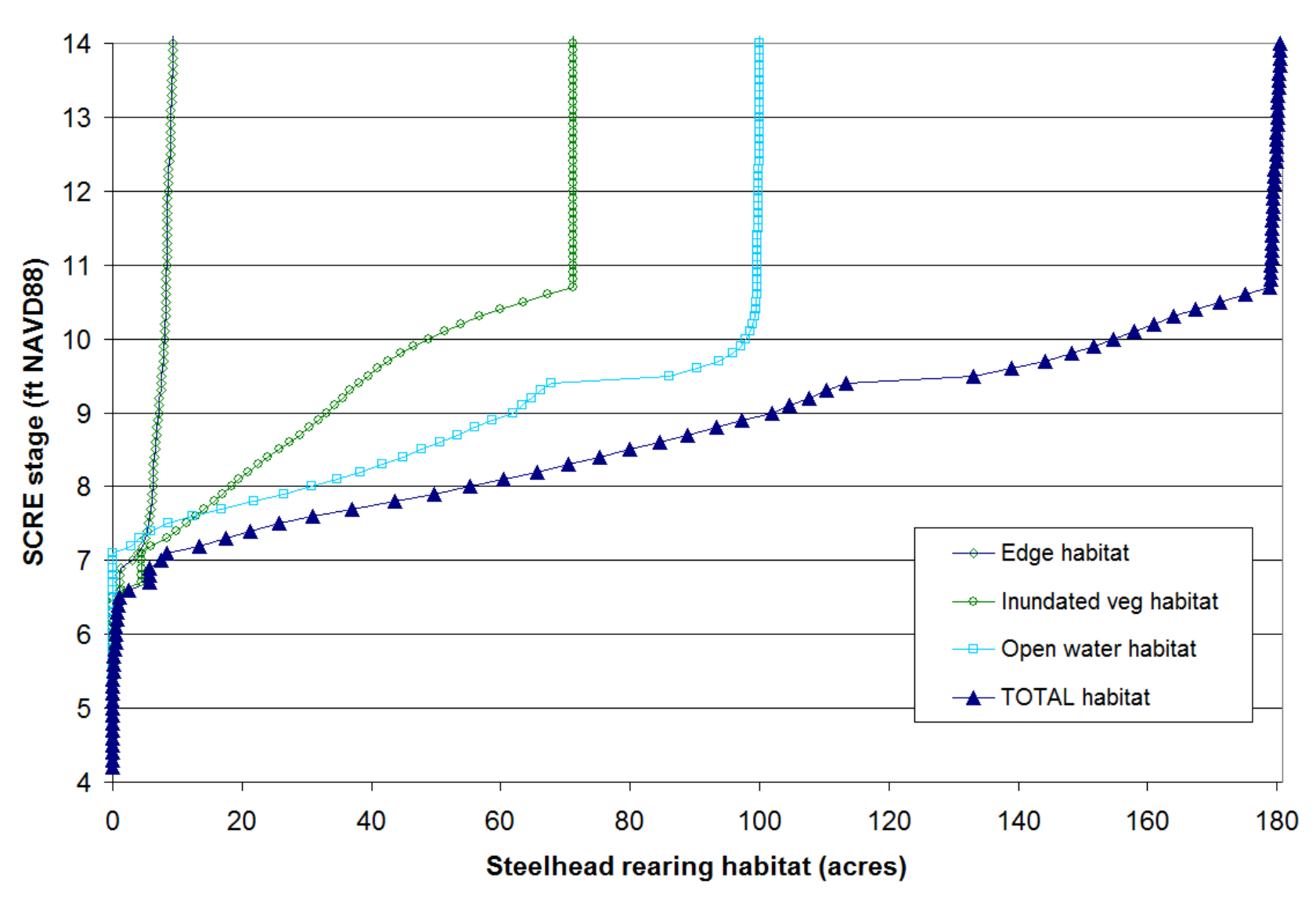
Stage-habitat relationships

- **Developed general 'rules' for determining suitable habitat as a function of stage**
  - Range of suitable depths, substrate, and cover (or vegetation) associations

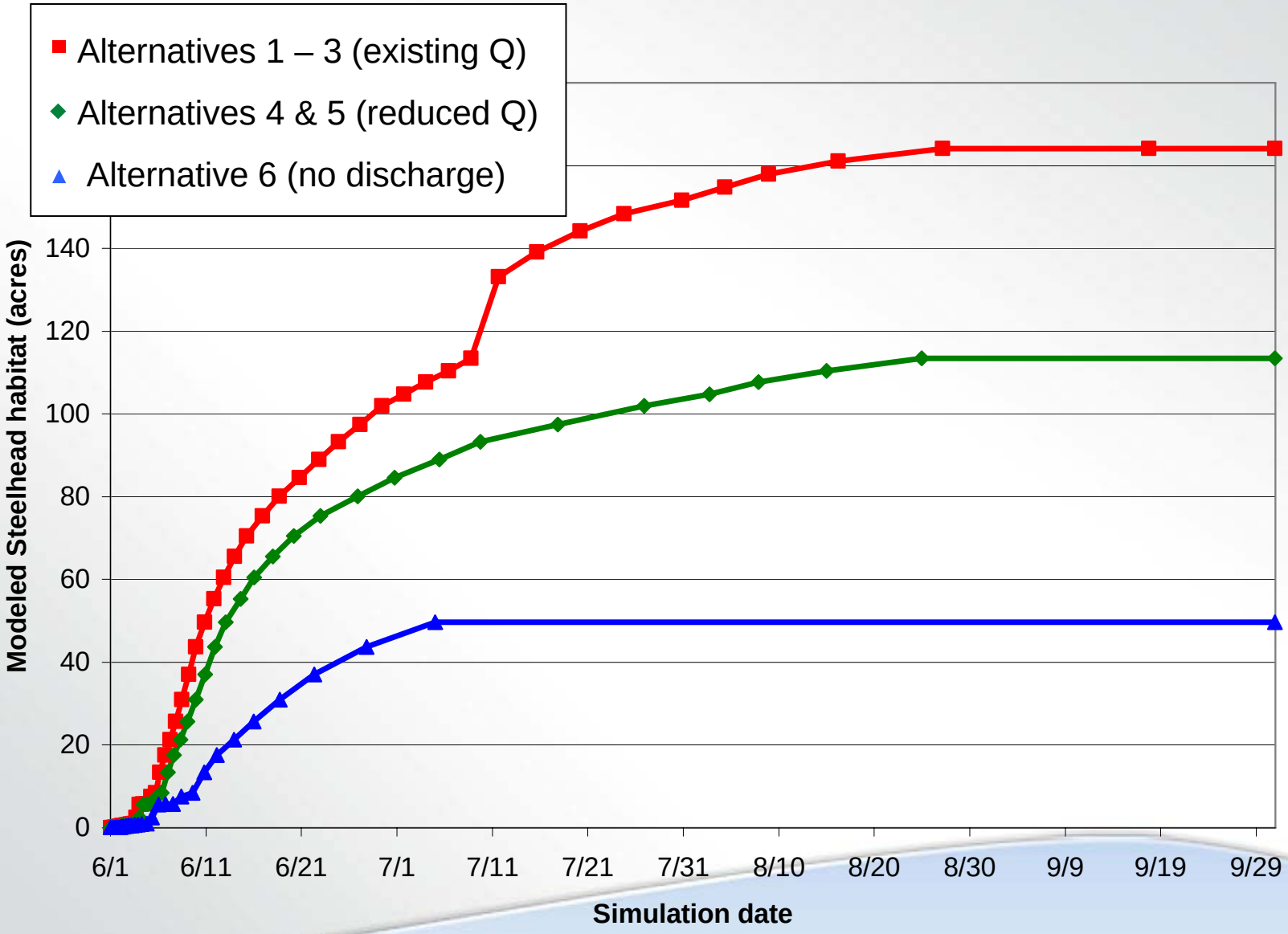
- **Steelhead & tidewater goby**
  - Water depth
  - Distance from cover

- **Western snowy plover & CA Least tern**
  - Minimum water depth
  - Vegetation density
  - Vegetation type

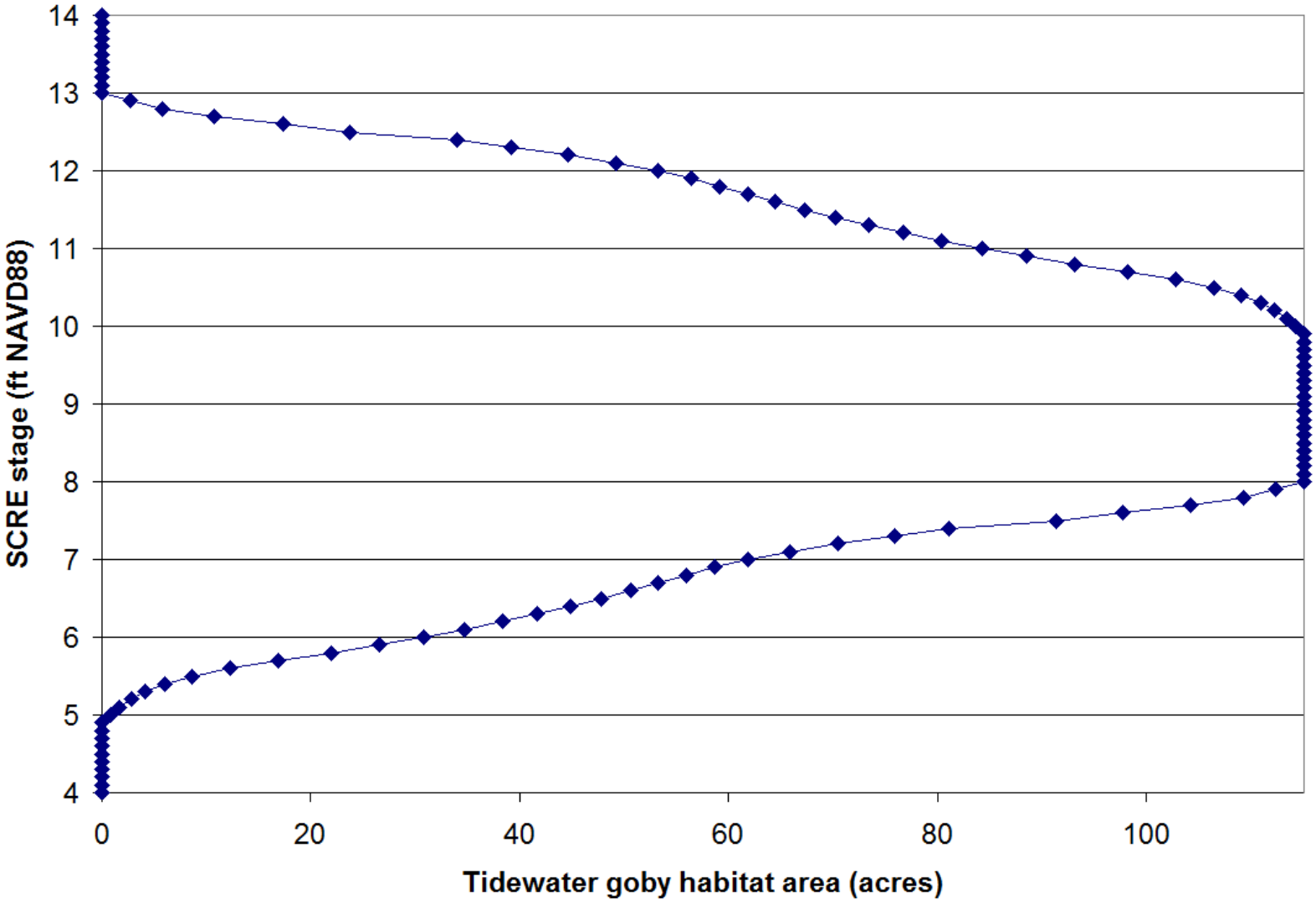
Steelhead stage-habitat relationships



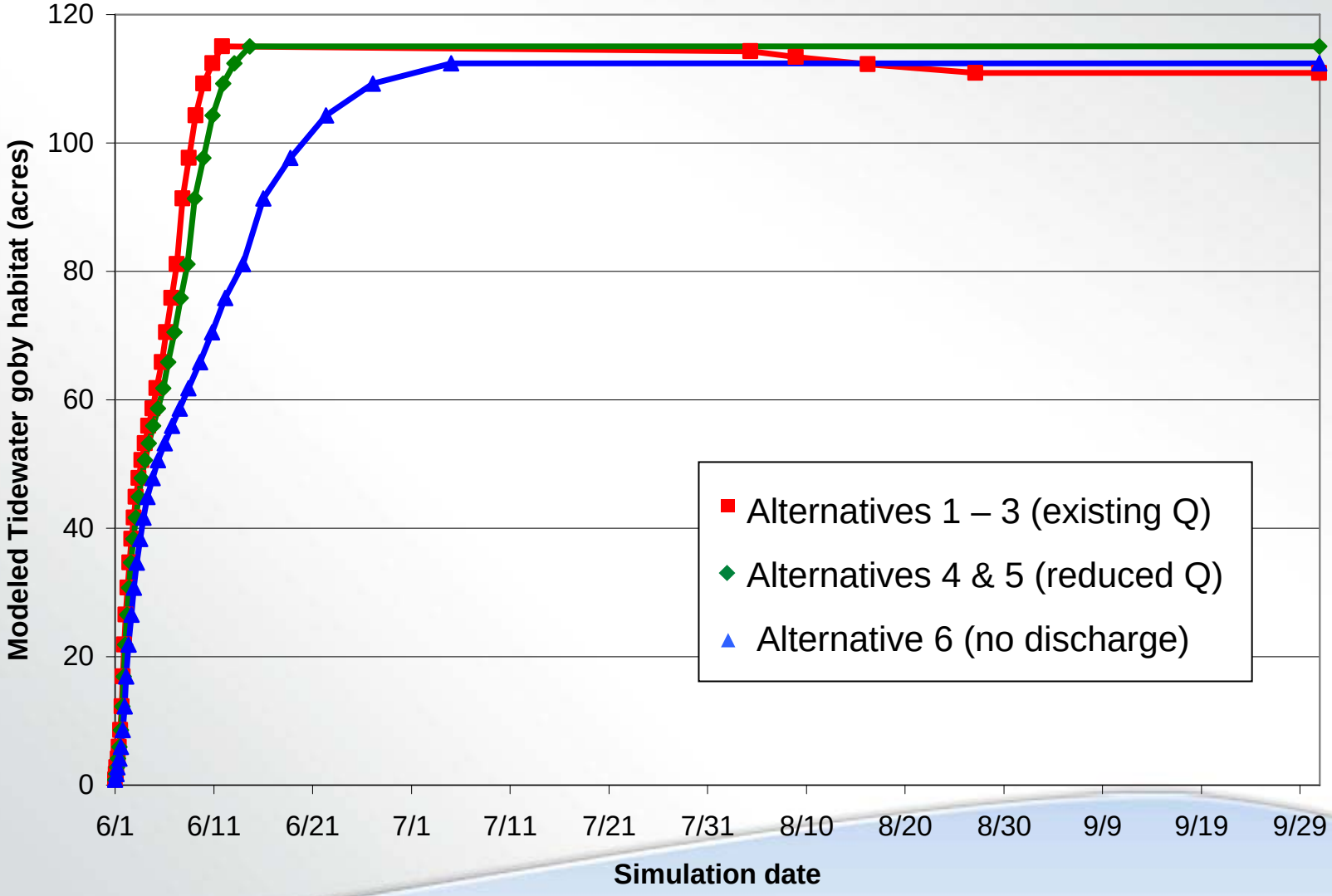
Steelhead habitat area for each alternative



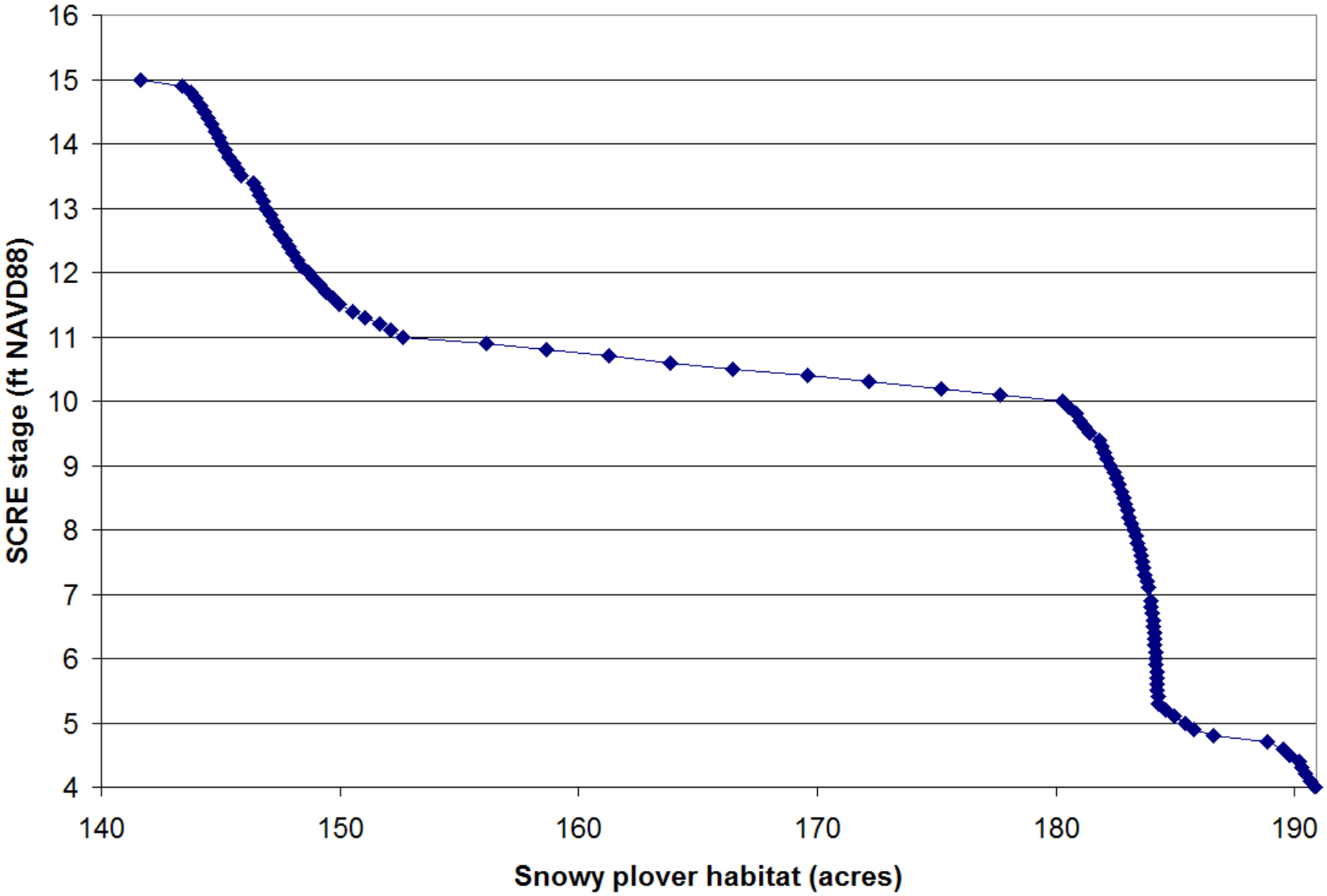
Tidewater goby stage-habitat relationship



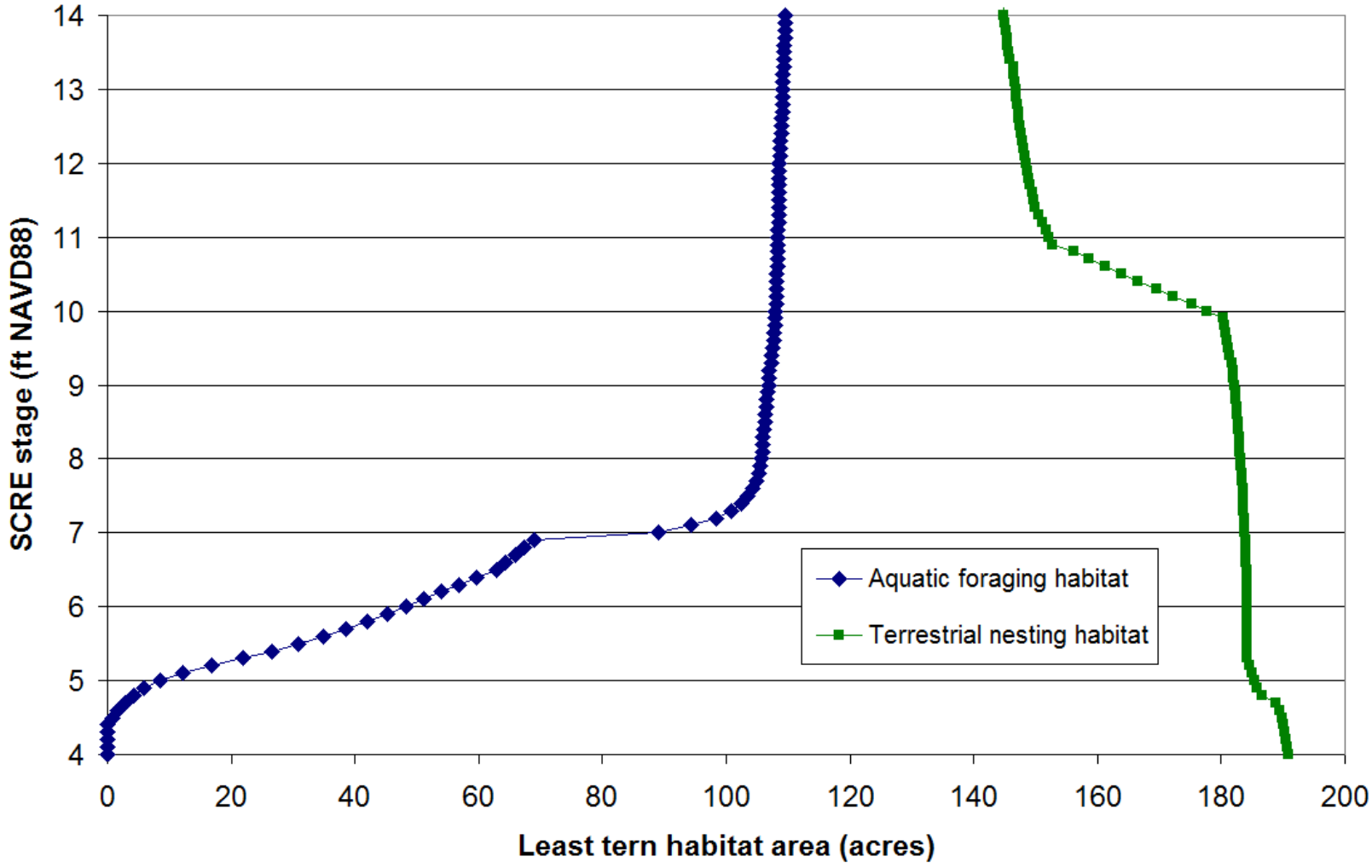
Tidewater goby habitat area for each alternative



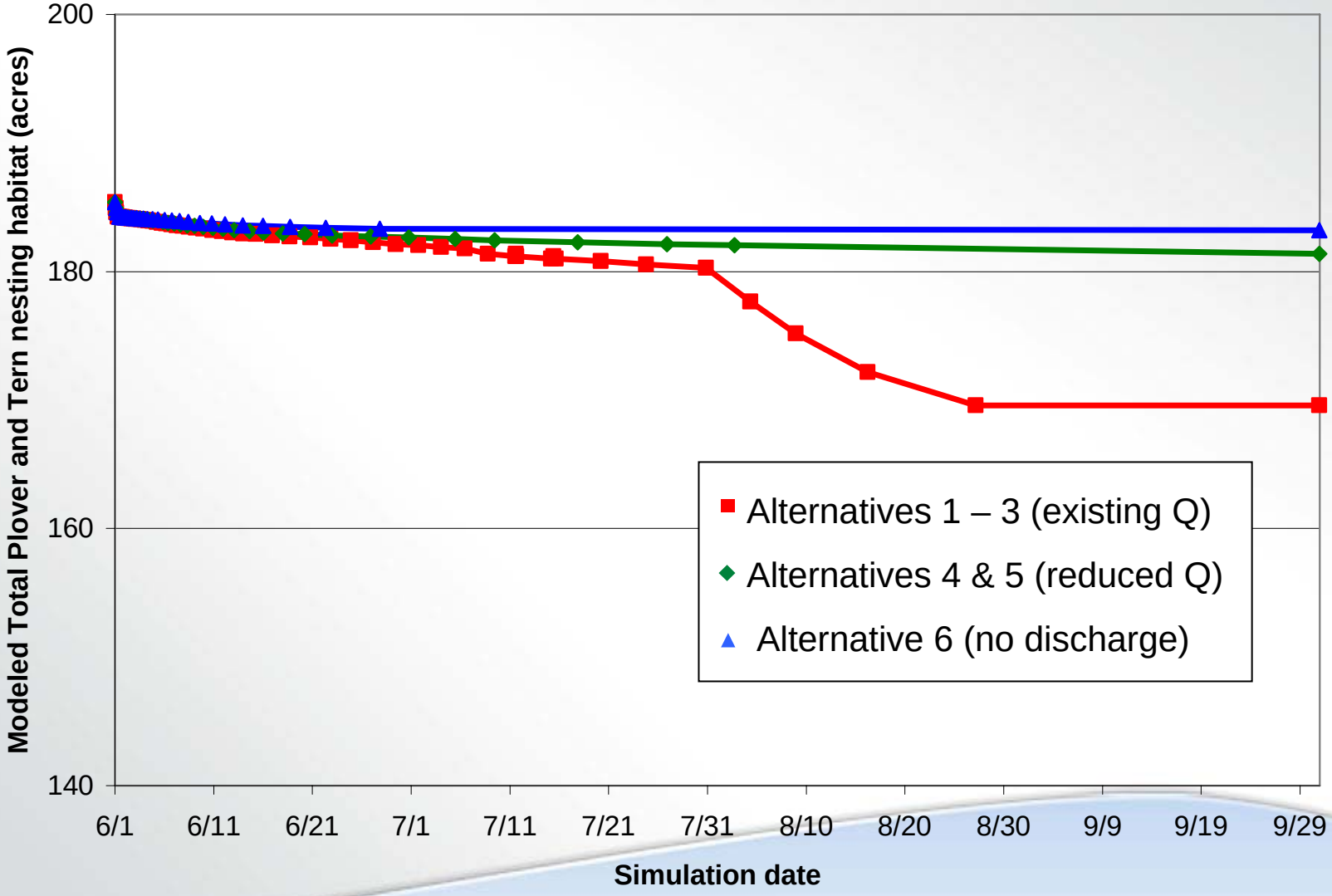
Snowy plover stage-habitat relationship



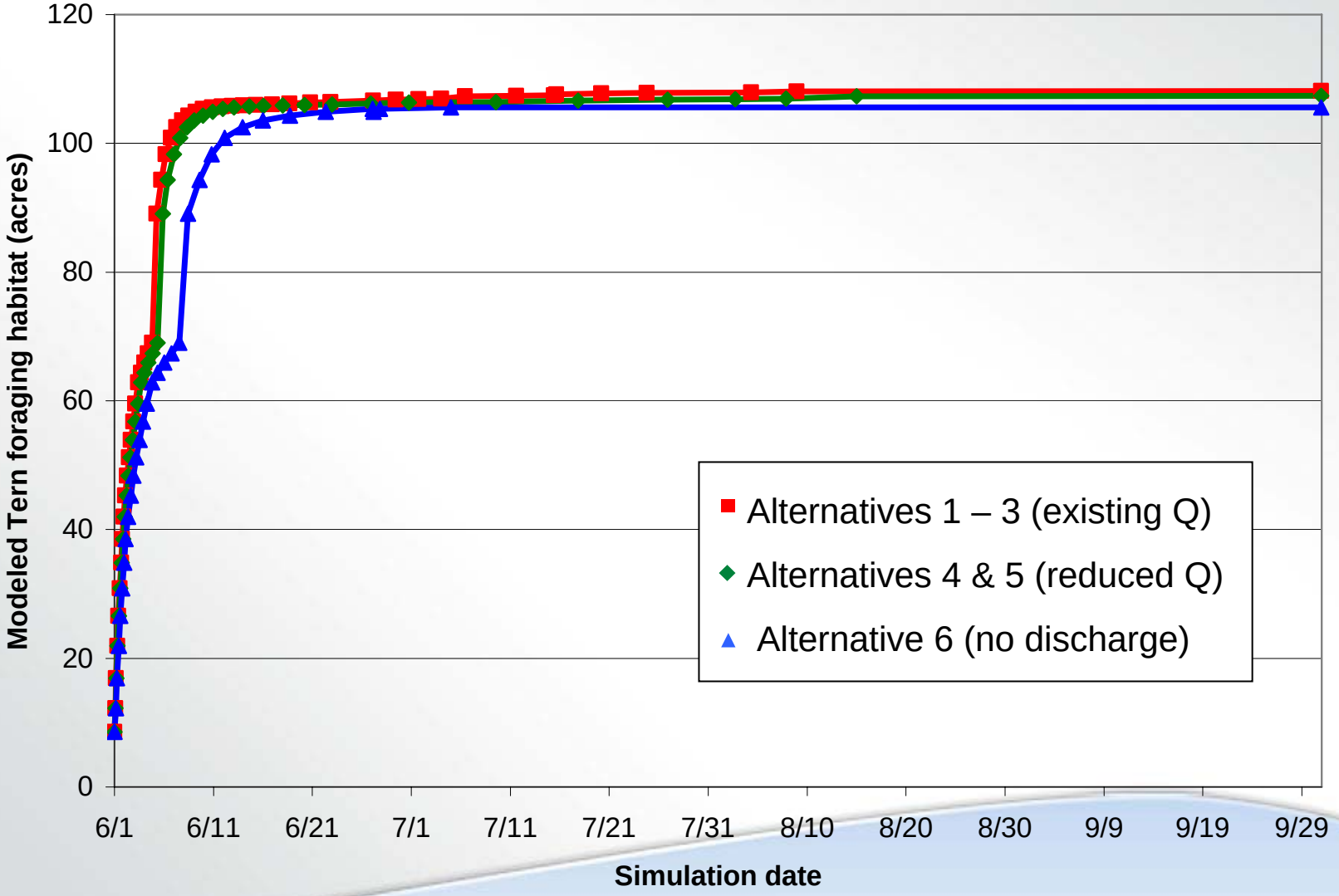
Least tern stage-habitat relationships



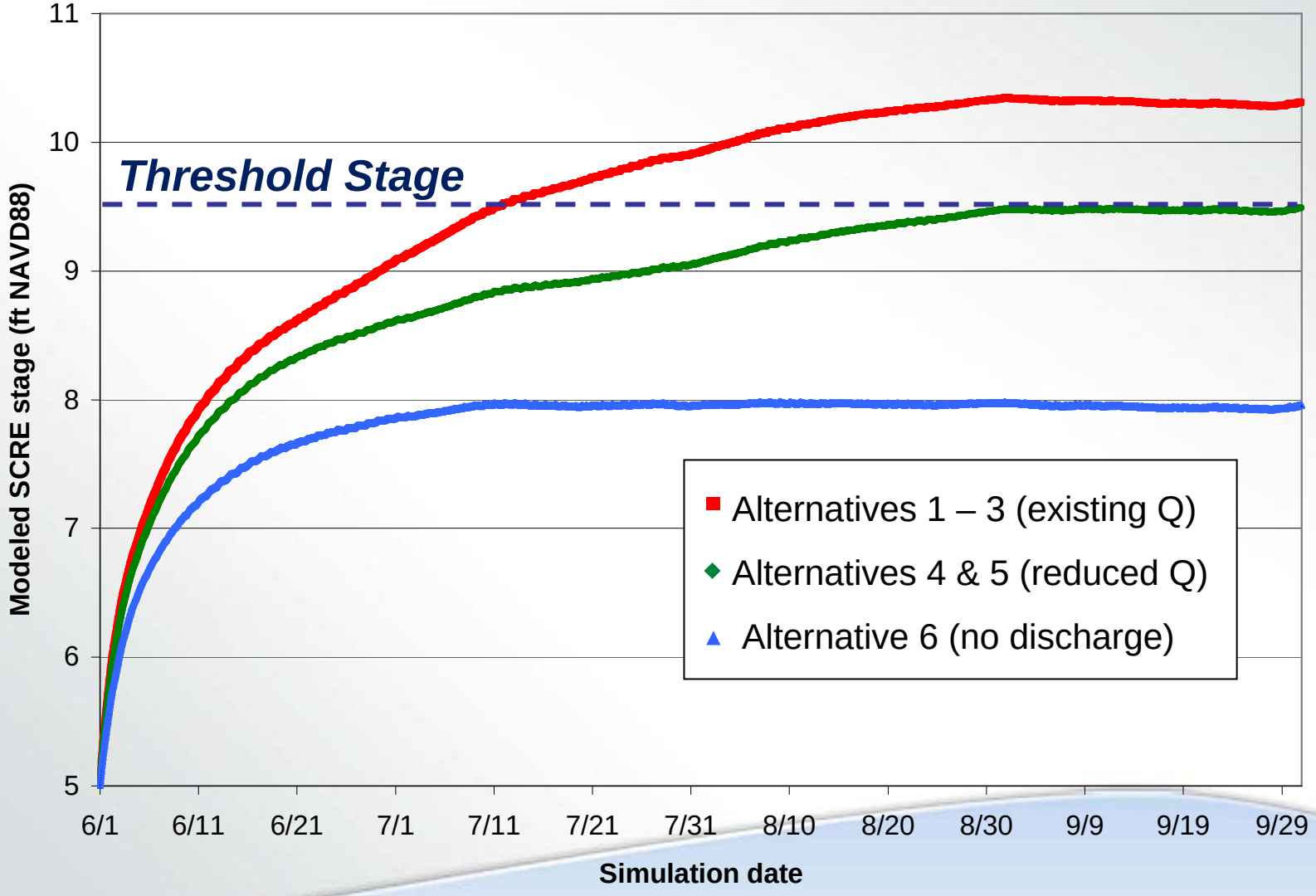
Western snowy plover/CA least tern nesting habitat area for each alternative



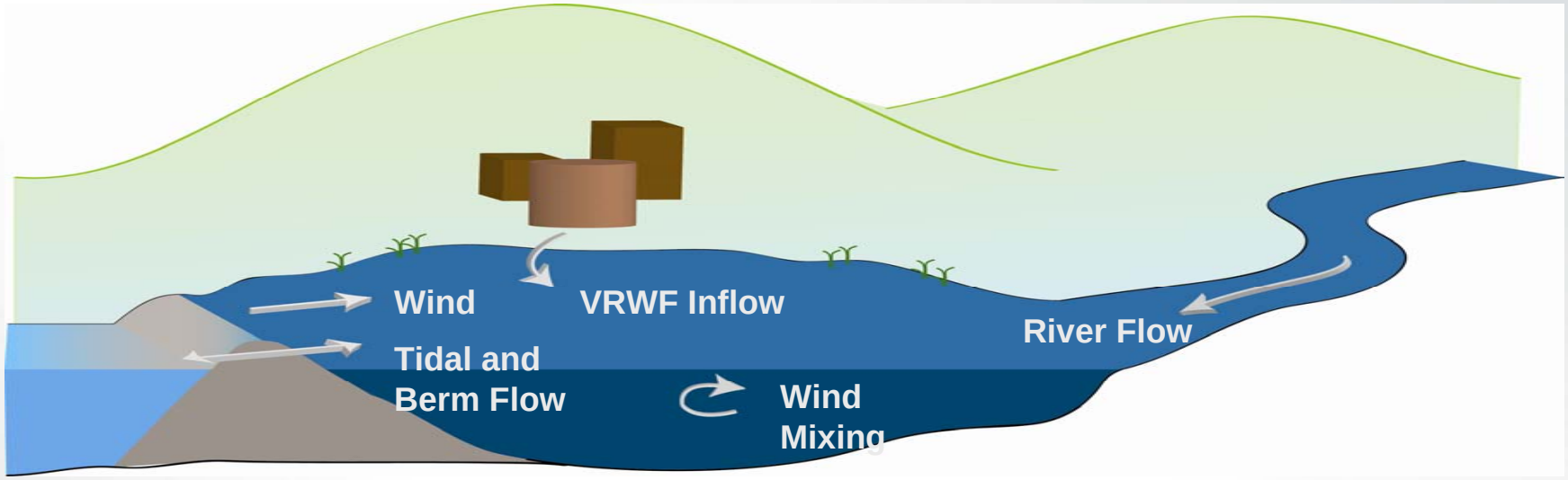
CA least tern forging habitat area for each alternative



McGrath State Beach campground flooding for each alternative

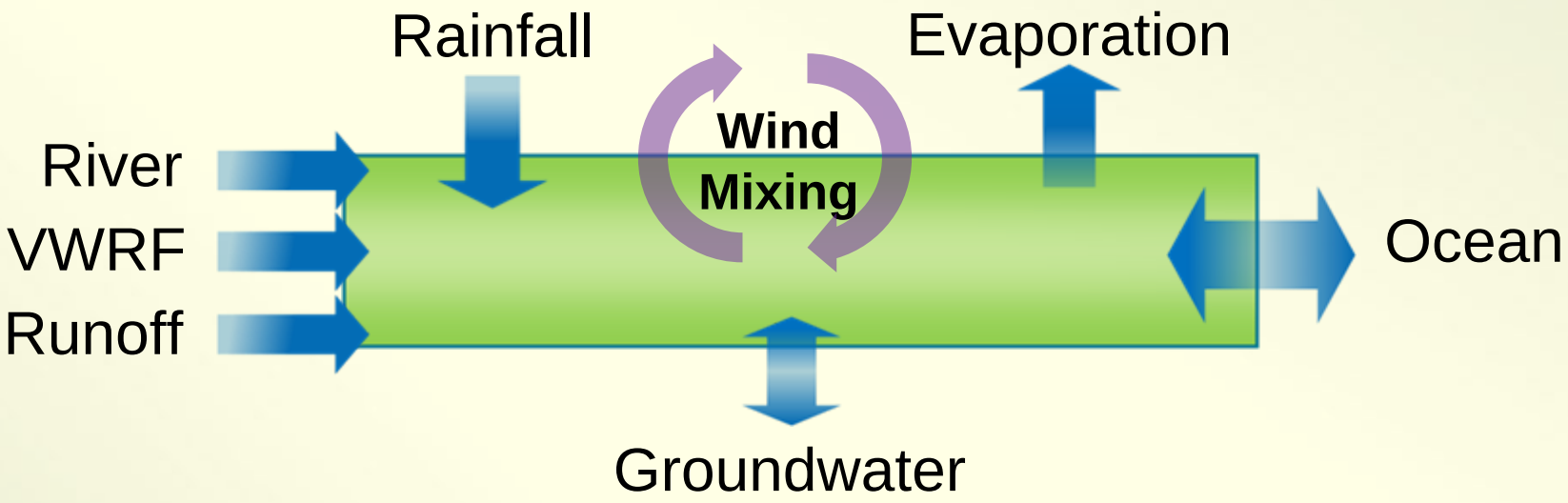


Water quality regulation



- Lagoonal System with Wind mixing
- Large Fluctuations in DO under Closed Mouth Conditions due to Algae
- Although VWRF appears as largest nutrient source, excess Nutrients (N, P) arriving from multiple sources

Water quality was estimated using the nutrient balance model



Storage = Inputs – Outputs +/- Reactions

$$\frac{dC_E V_E}{dt} = Q_R C_R + Q_{VWRF} C_{VWRF} + Q_G C_G + Q_O C_O - \left(Q_R + Q_{VWRF} + Q_G + Q_O\right) C_E - Rxn$$

$$\boxed{C_E \approx \left(\sum_{i=1}^{n} Q_i C_i - Rxn\right) \Big/ \left(\sum_{i=1}^{n} Q_i + dV/dt\right)}$$

Sources of nitrogen into the Estuary

	River, mg/l	VWRF, mg/l	Pond seepage, mg/l	Ground water, mg/l
Alternative 1	6	15	15	1
Alternative 2	6	10	10	1
Alternative 3	6	5	10	1
Alternative 4	6	10	10	1
Alternative 5	6	5	10	1
Alternative 6	6	-	10	1

Results of nutrient balance

	SCRE Area, Acres	Total N load, ppd	Natural N uptake, ppd	Estimated range of N, mg/l
Alternative 1	174	750	78 - 160	10 - 15
Alternative 2	174	500	78 - 160	4 - 9
Alternative 3	174	300	78 - 160	2 – 6
Alternative 4	151	390	68 – 140	3 – 9
Alternative 5	151	200	68 – 140	2 – 6
Alternative 6	131	30	63 - 130	2 - 6

Alternatives Assessment

	Focal Species Habitat					Recreational Opportunity
	Habitat Area				Water Quality Conditions	
	Tidewater goby	Steelhead	Plover & Tern Nesting	Tern Foraging		
Alternative 1 Existing Conditions	=	=	=	=	=	=
Alternative 2 Planned upgrades	=	=	=	=	↑	=
Alternative 3 enhanced dentirification	=	=	=	=	↑↑	=
Alternative 4 flow reduction	=	↓	↑	=	↑	↑
Alternative 5 flow reduction with enhanced dentirification	=	↓	↑	=	↑↑↑	↑
Alternative 6 Complete effluent removal	=	↓↓	↑	=	↑↑↑	↑↑

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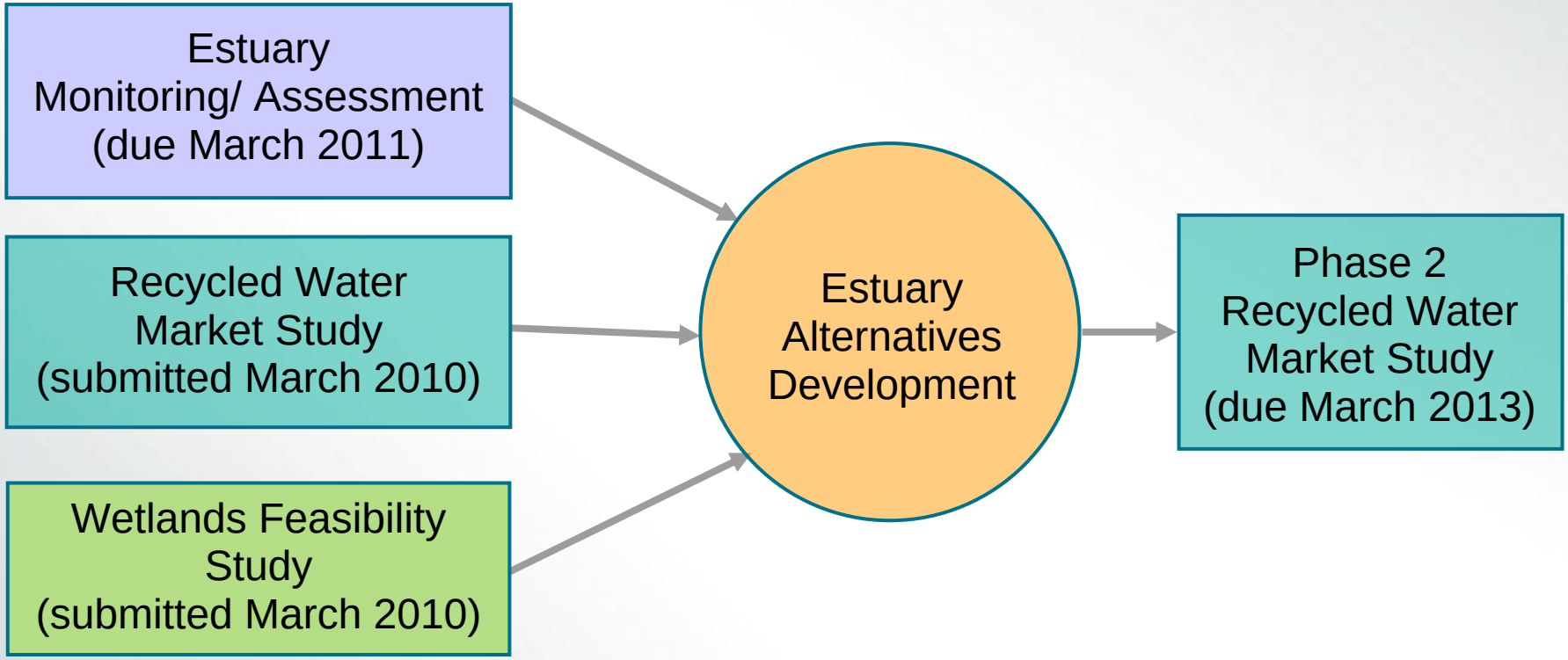
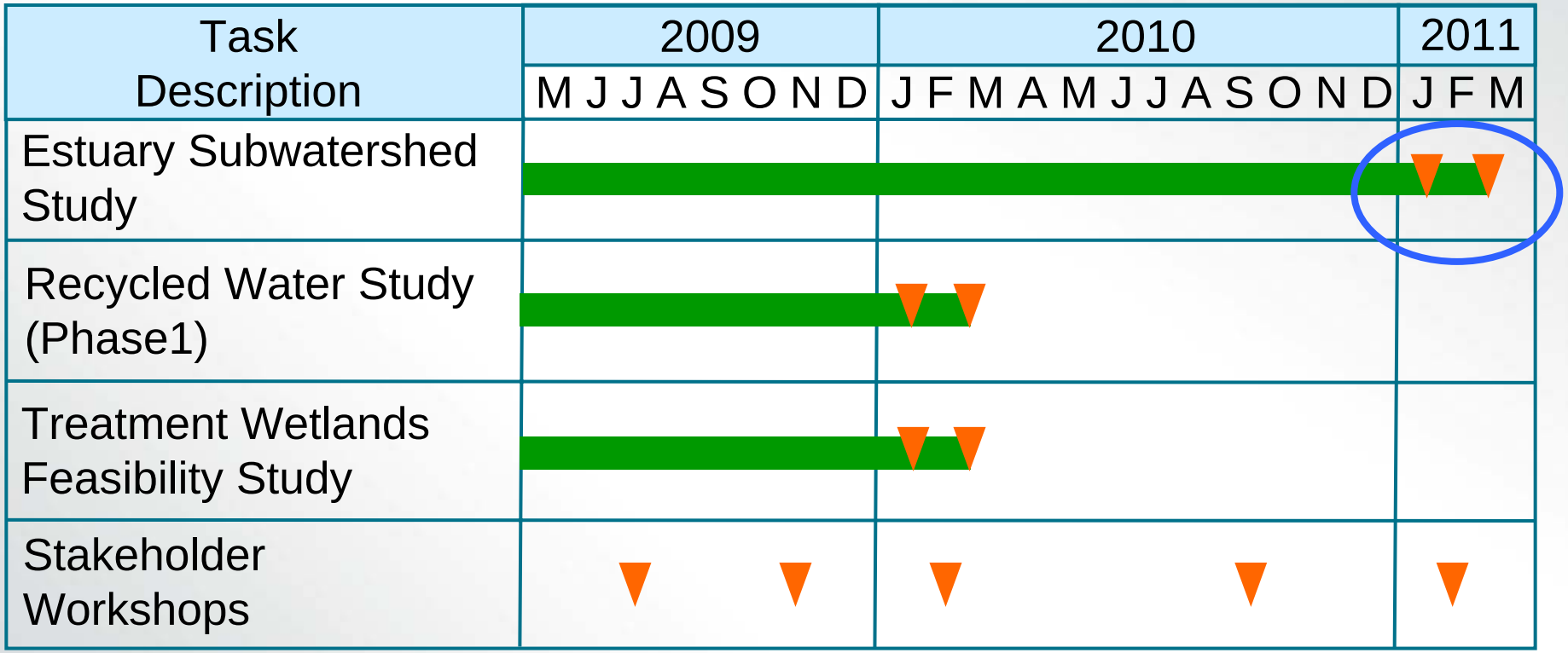
Next Steps

All three studies are connected and lead into the next step of the Phase 2 study required by the NPDES permit



Estuary Subwatershed Synthesis Report to be submitted to RWQCB on March 7th



Opportunity to comment before submittal:

- Provide comments, questions to Karen Waln at KWaln@ci.ventura.ca.us
- For incorporation into March submittal, provide comments by Feb 21, 2011
- Draft report and other documents at www.cityofventura.net/rivers