
California Seawater Desalination Intake Requirements

First International Fish Impingement and Entrainment Conference

July 11-13, 2023

Liverpool, UK

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Outline

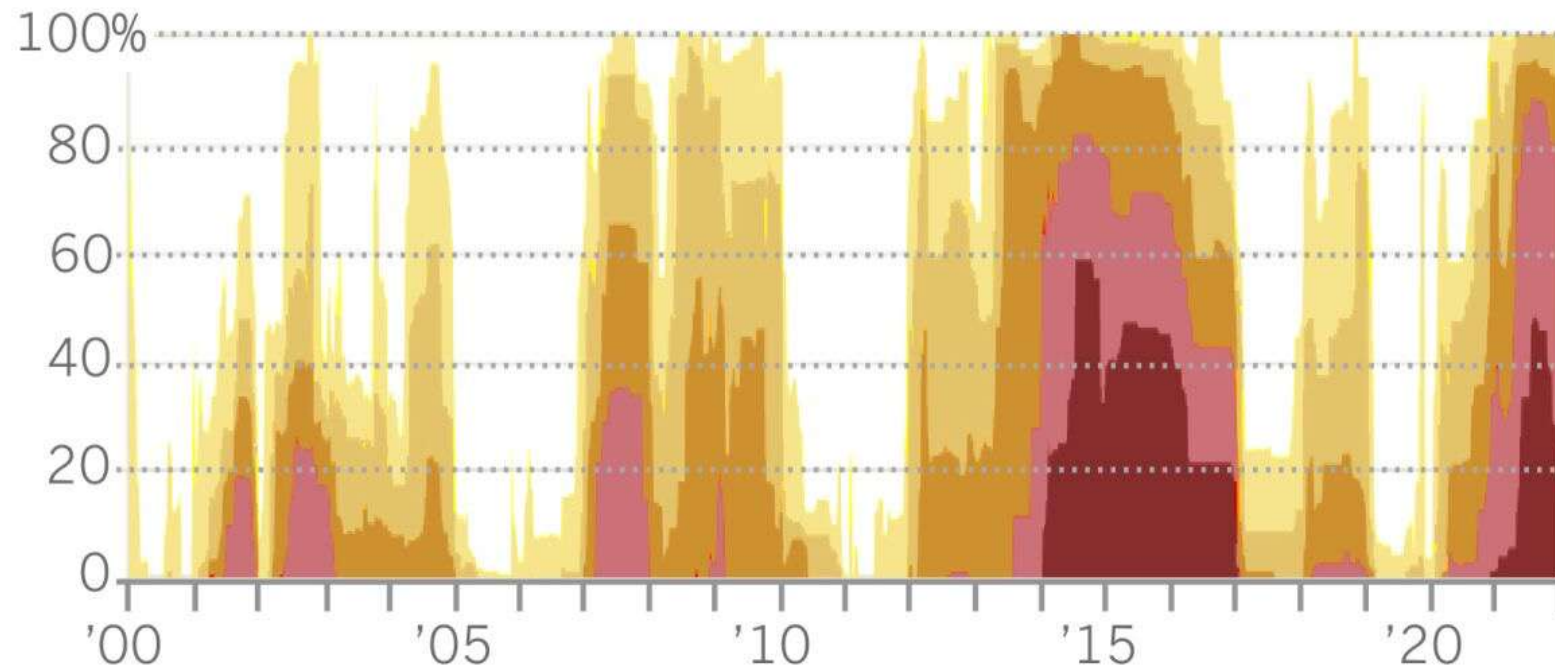
- Background
- Ocean Plan Amendment
 - Focus on intake requirements
- Case study – surface intake
- Case study – subsurface intake
- Conclusions

Once-through Cooling (OTC) Policy

- OTC Policy implements 316(b) in CA
- Adopted in 2010
- Goal of phasing out OTC intakes
- Track 1 (closed-cycle cooling)
 - Reduce flow rate by 93% at each unit
 - 0.5 ft/sec (0.15 m/sec) through-screen velocity (TSV)
- Track 2
 - Impingement – reduce IM by 90% of what Track 1 would achieve
 - Velocity approach – monthly verification of 0.5 ft/sec through-screen velocity
 - Biol monitoring approach – 36-month baseline IM study, 36-month post-installation IM study
 - Entrainment
 - Flow rate approach – monthly verification of 93% reduction of flow rate
 - Biol monitoring approach – 36-month baseline entrainment study, post-installation entrainment study

CA Drought Since 2000

Abnormally dry Moderate drought Severe drought
Extreme drought Exceptional drought



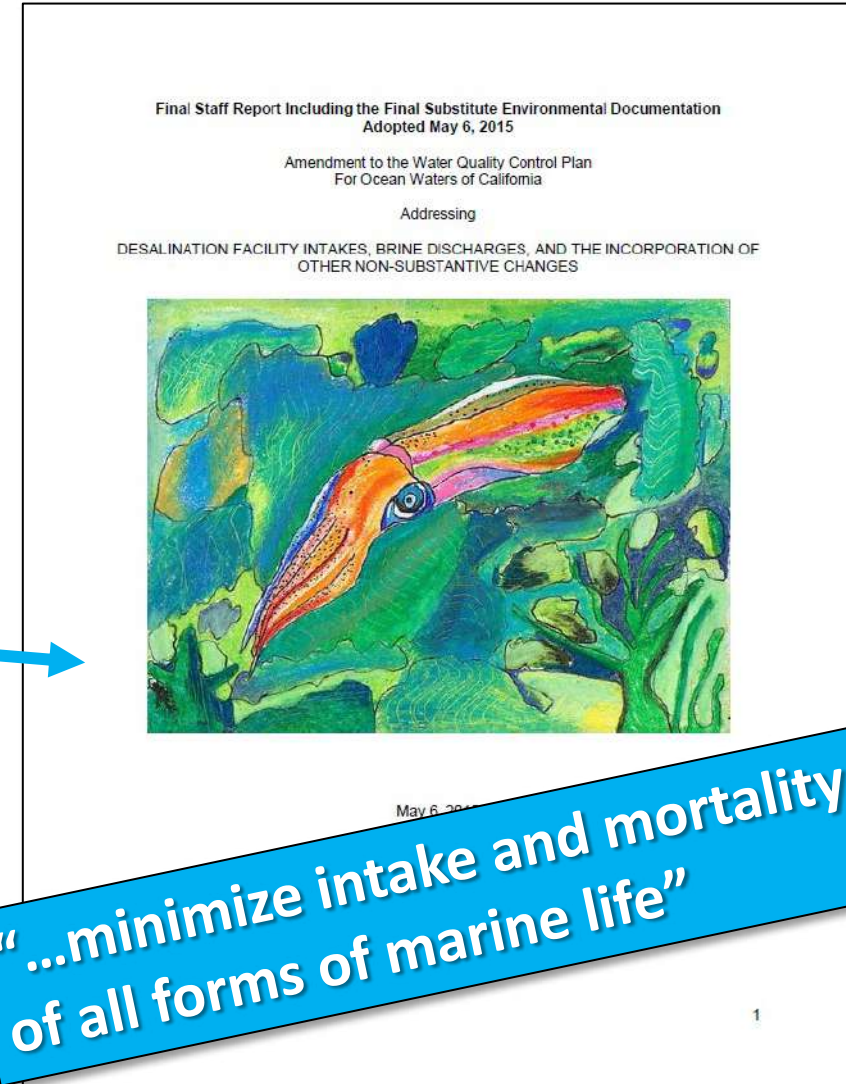
droughtmonitor.unl.edu

<https://www.latimes.com/california/story/2022-01-08/charts-show-why-california-recent-rain-wont-end-drought>



CA Ocean Plan

- Ocean Plan regulates waste discharge to ocean
- Goal is to preserve beneficial uses
- Desal not adequately covered
- So, Ocean Plan required amendment



Ocean Plan Amendment



1. Reduce impacts via careful design



2. Quantify unavoidable impacts



3. Mitigate for unavoidable impacts

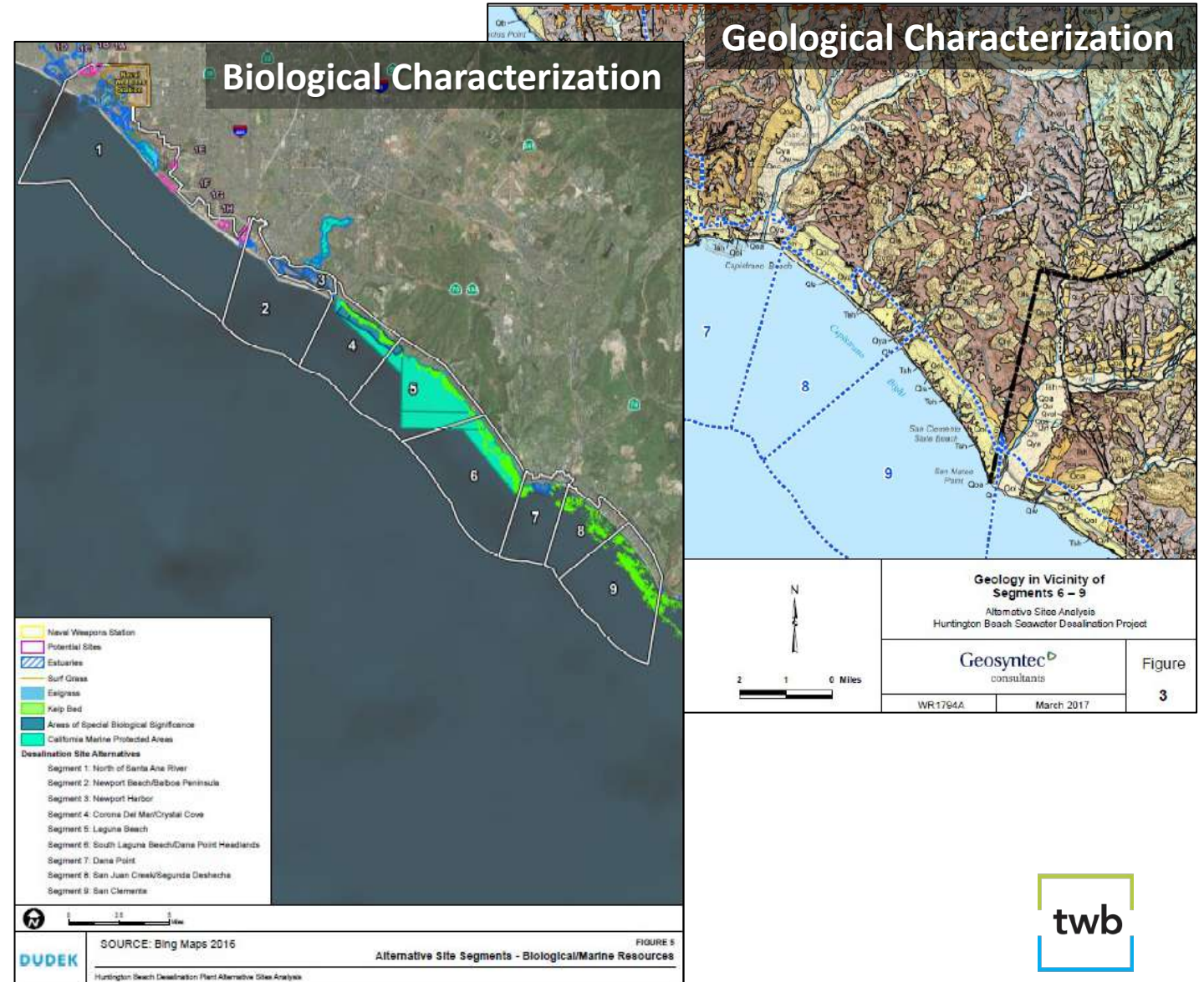
Ocean Plan Amendment

1. **Site** – offshore and onshore location
2. **Design** – size, layout, form ,function, capacity, configuration, type of infrastructure
3. **Technology** – type of equipment, materials, methods to construct an operate
4. **Mitigation** – replacement of marine life or habitat lost from construction and operation

Focus on intake

Site

- Subsurface feasibility
- Water “need”
- Avoid sensitive habitat/species
- Oceanographic/physical features to reduce impacts



Design

- Intake capacity
- Infrastructure configuration for all potential sites



https://www.waterboards.ca.gov/sandiego/board_decisions/adopted_orders/2022/r9_2022_0005.pdf

Technology

- Subsurface intake required, if feasible
- Surface intake allowed if subsurface not feasible
 - Preference for passive screening
 - 1-mm slot/mesh
 - 0.5 ft/sec (0.15 m/sec) through-screen velocity
 - Must conduct 12-month entrainment study
 - Must mitigate for entrainment



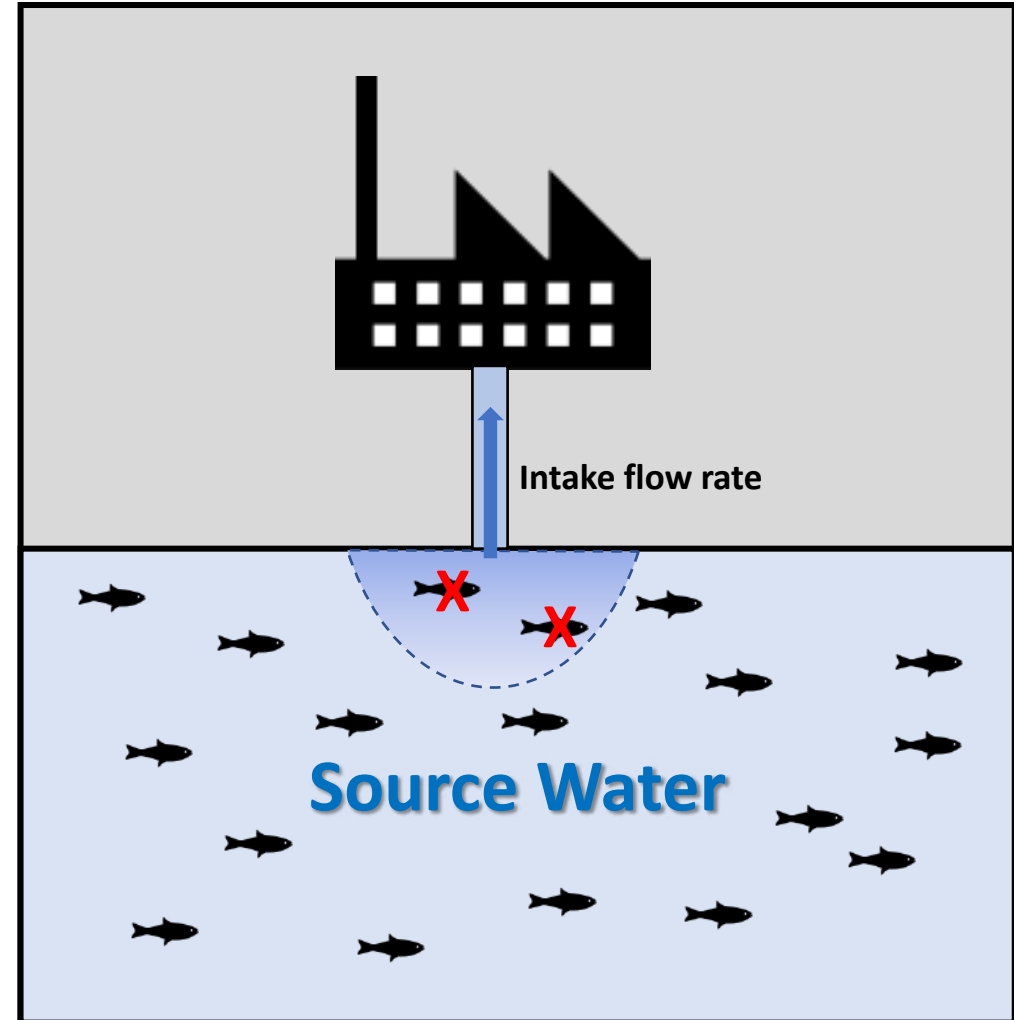
https://isi-screens.com/wp-content/uploads/2021/10/Intake-Screens-Inc_Cylinder-Screen-Brochure.pdf



<https://johnsonscreens.com/wp-content/uploads/2022/08/Max-Flow.pdf>

Mitigation

- Must estimate impacts
 - Impingement
 - Entrainment
- Empirical Transport Model
- Area of Production Foregone
- Mitigation options:
 - Wetland restoration project
 - Fee-based
- May allow a mitigation ratio



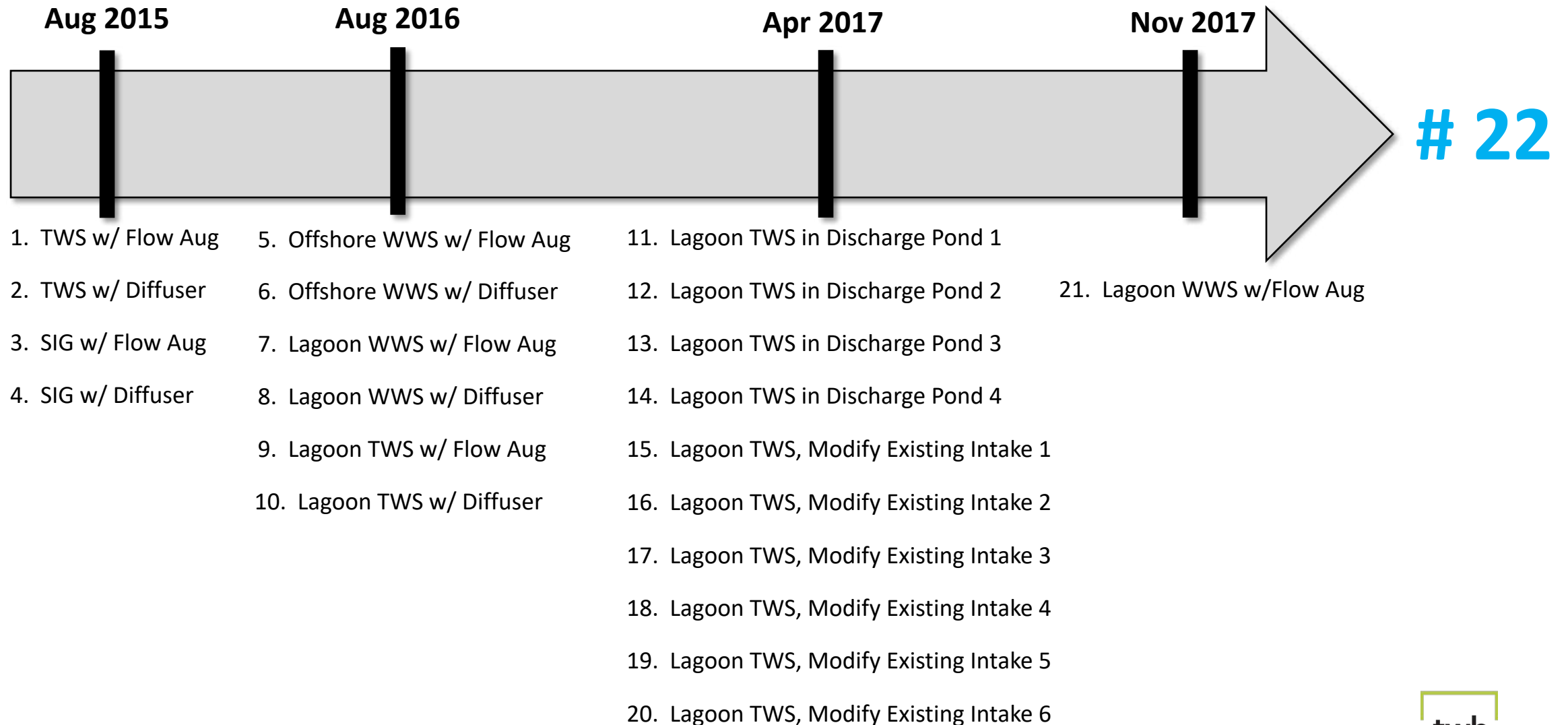
Case Study – Surface Intake: Carlsbad Desalination Plant

Background

- Originally co-located with Encina Power Station (EPS)
- Online 2015
- Production = 50 MGD (189,270 m³/day)
- Intake = 299 MGD (1,131,840 m³/day)
- EPS offline 2018
- Regs required new intake

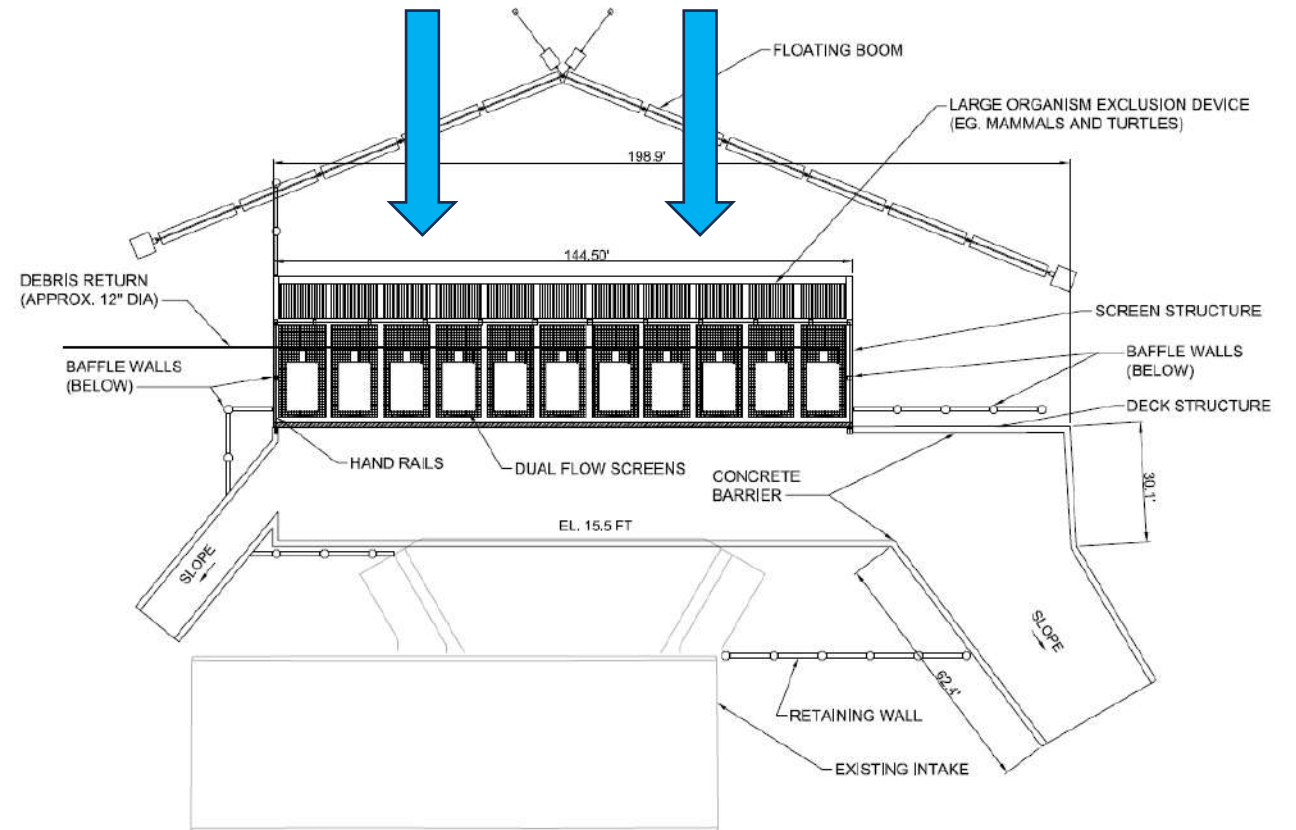


Intake Alternatives



Compliant Surface Intake

- 22 intake options
- ~ 7 years
- Subsurface not feasible
- Biofouling challenge at site
- 11 Shoreline dual flow TWS
 - 1-mm mesh
 - ≤ 0.5 ft/sec (0.15 m/sec)



<https://documents.coastal.ca.gov/reports/2022/9/Th9a/Th9a-9-2022-report.pdf>

Construction Phasing

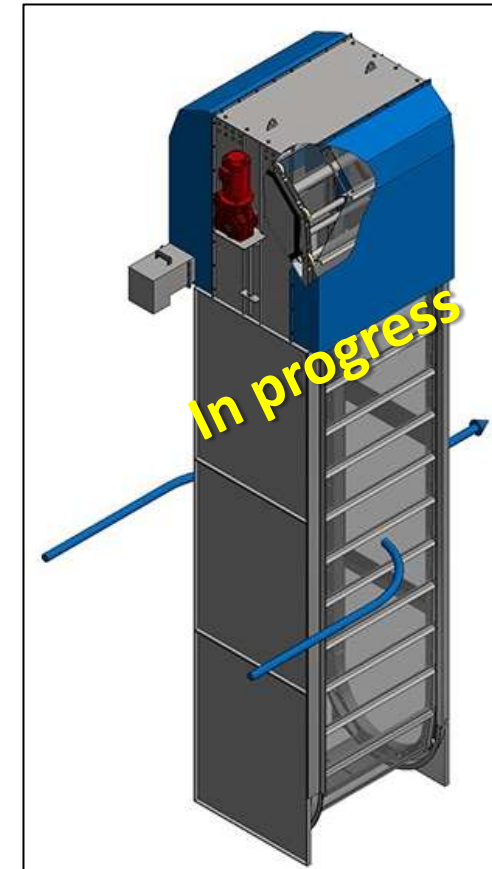
Phase 1 – interim operation with power plant circ pumps



Phase 2 – install new fish-friendly pumps

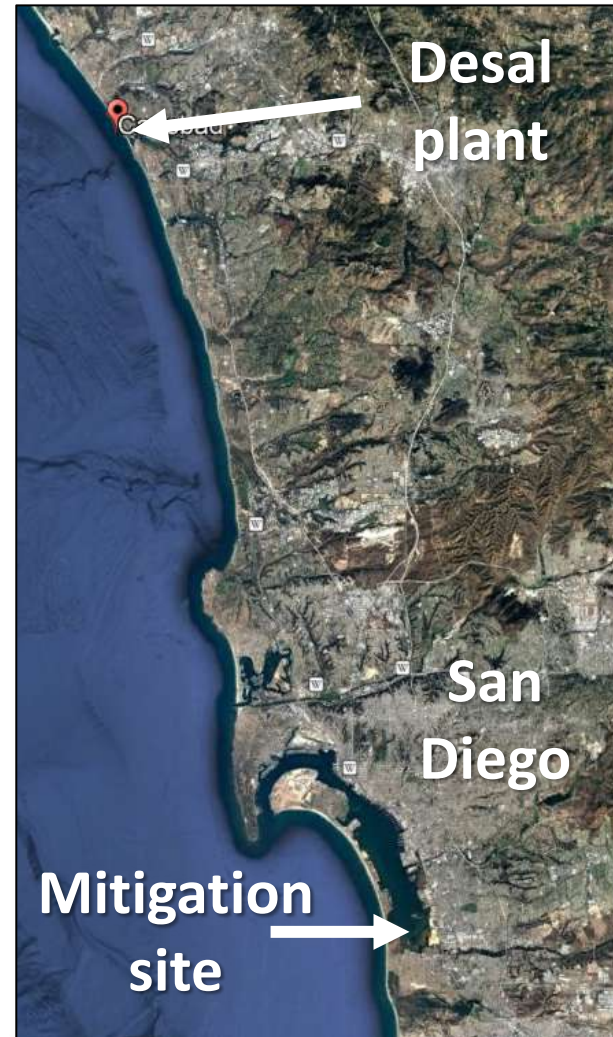


Phase 3 – install new compliant intake



Mitigation

- ETM/APF completed
- Mitigation = 66.4 ac (26.9 ha)
- Absolute and relative performance standards



<https://documents.coastal.ca.gov/reports/2019/5/th10a/th10a-5-2019-exhibits.pdf>

Case Study – Subsurface Intake: Doheny Desalination Plant

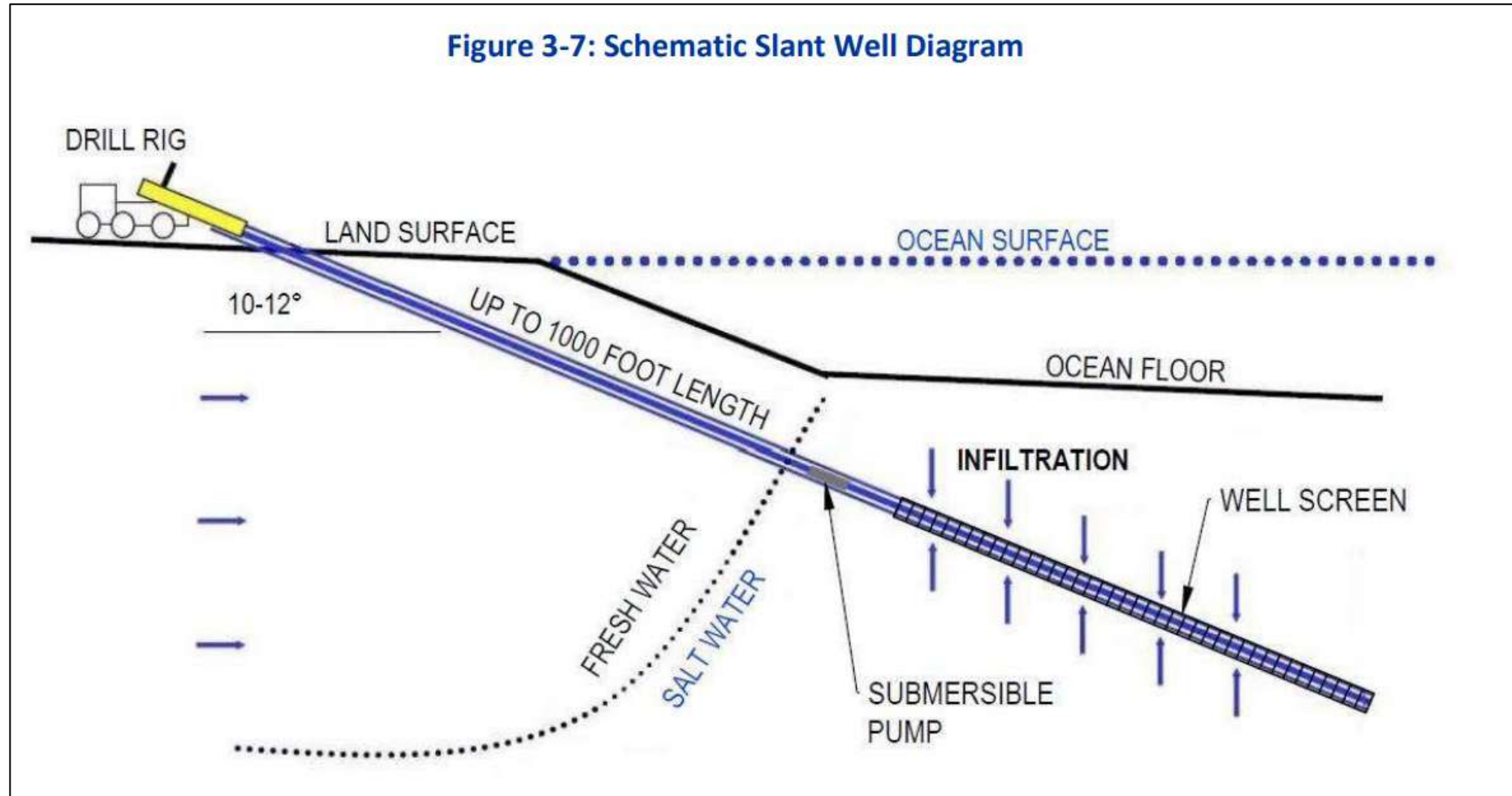
Background

- Stand-alone subsurface intake
- Co-mingled discharge with WWTP
- Has received all permits
- Scheduled to be online in 2028
- Production = 5 MGD (18,930 m³/day); expandable to 15 MGD (56,780 m³/day)
- Intake = 10 MGD (0.44 m³/sec)
- No mitigation for intake
- Mitigation required for
 - construction
 - shear-related mortality at discharge



https://www.scwd.org/about/district_projects/doheny_ocean_desalination_project/index.php

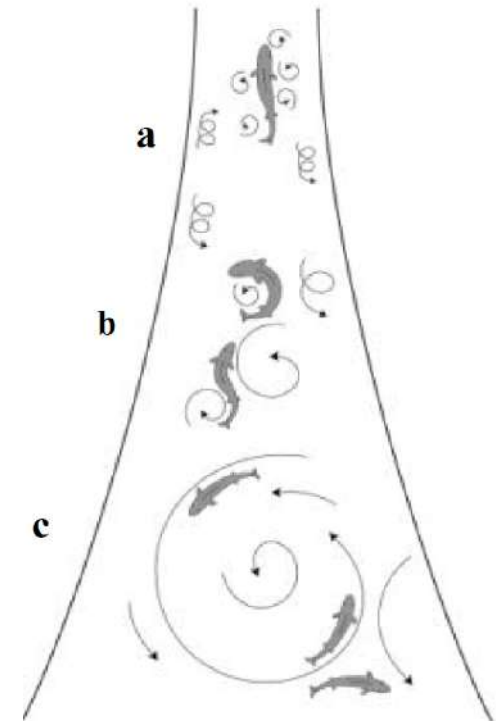
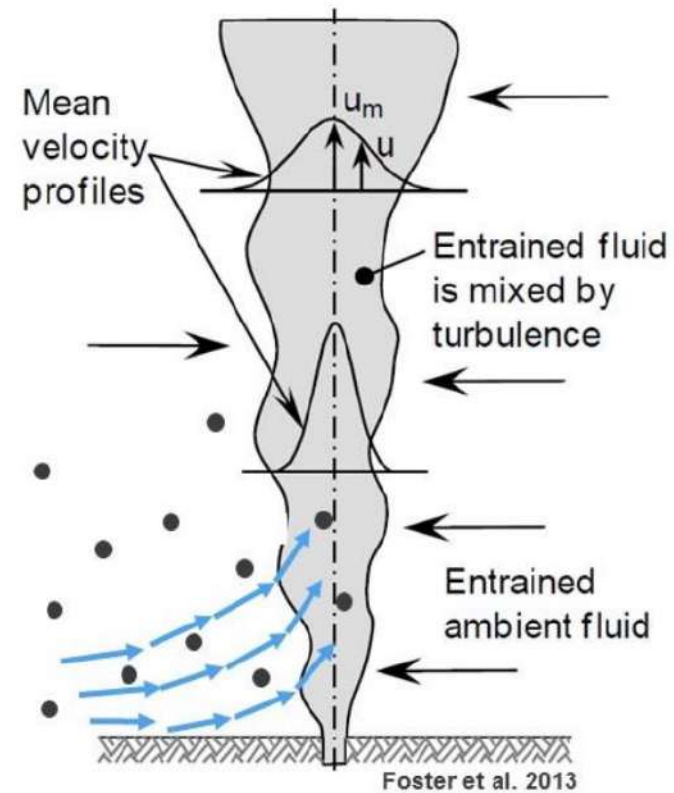
Compliant Subsurface Intake



Final EIR: https://www.scwd.org/about/district_projects/doheny_ocean_desalination_project/index.php#outer-631

Mitigation

- Entrainment....at the diffuser
- Mitigation = 7.45 ac (3 ha)



Odeh et al. 2002 – Evaluation of the effects of turbulence on the behavior of migratory fish

Conclusions

- IM&E impacts
 - Some can be avoided
 - Others can be minimized
 - All can be mitigated for
- OPA sets a high bar
 - Many industry firsts
 - Other permits are required too
 - O&M for 1-mm screens in seawater
- Balance between water need and environmental protection
 - Are all benefits of desal considered?



Questions

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