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Regulatory Considerations for New Fish Passage Technologies

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Richland, WA

Hydropower Needs New Technology

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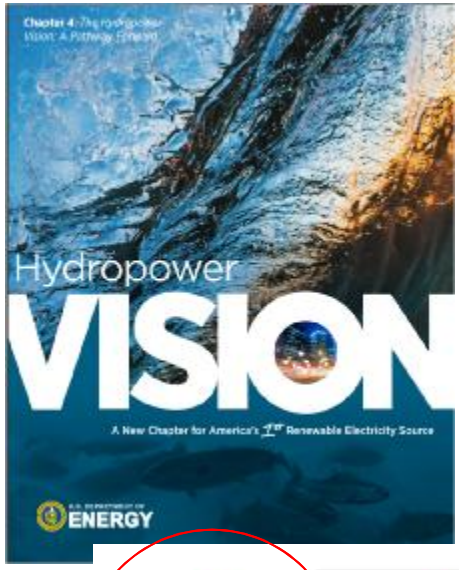
- Increased demand for renewable energies to reduce carbon footprint
- Hydropower is an important piece in the renewable energy portfolio
  - Predictable
  - Balances intermittent renewables
  - Low cost per GWH
- Development of new hydropower is constrained by entry cost and negative public perception
  - Can be reduced by improved fish passage



New Technologies are Not Easily Adopted

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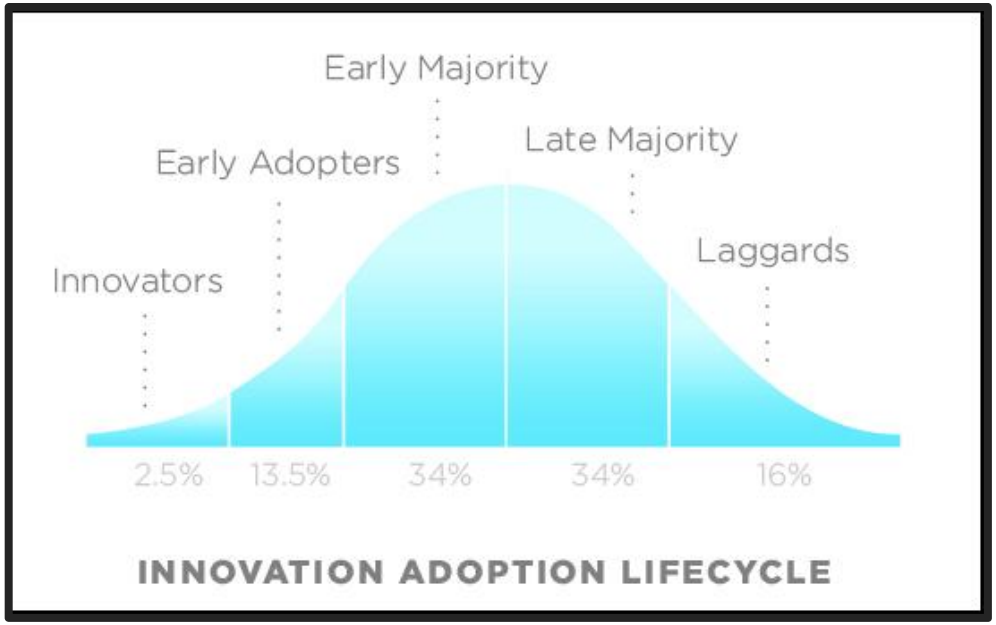
- Adopters follow “bell curve” distribution
- Bigger hill to climb for Disruptive Innovations
  - Chasm between Innovators/Early Adopters and Early Majority
  - Usually produced by outsiders and entrepreneurs
  - Have most value to emerging markets



Source: en.wikipedia.org/wiki/Technology_adoption_life_cycle

- Market adoption quickens when strong network of peers & colleagues value technology.

Status Quo is Hard to Overcome

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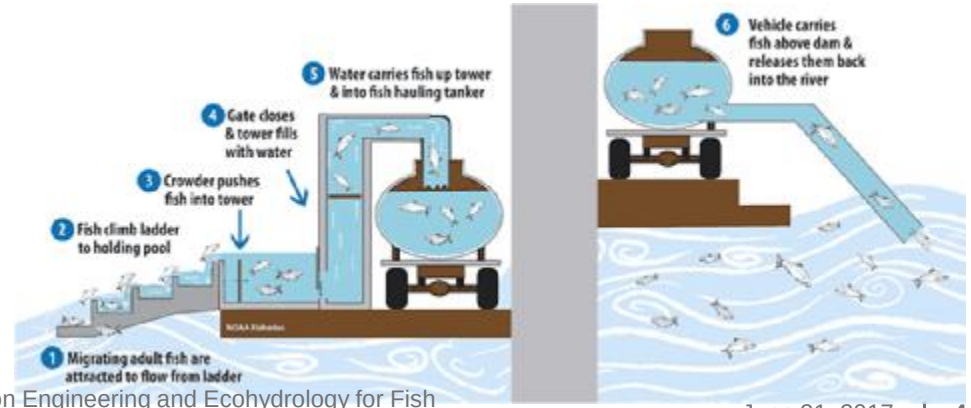
- Conventional technologies (e.g., fish ladders, trap-and-haul) are:
  - Effective
  - Fine-tuned
  - Widely accepted
- However, not appropriate for all species and situations:
  - Developed initially for migratory anadromous salmon
  - Other species present unique challenges (e.g., eels, lamprey, sturgeon, potamodromous fishes)
  - May not be feasible for all projects (e.g., Grand Coulee Dam)



Experimental Acceptance Criteria, but Ambiguity Clouds Path Forward

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- NOAA “5 steps”
  - Earlier Research
  - Study Plan
  - Lab Research
  - Prototype in Field
  - Study Results
- USFWS “3 steps” must prove that new technology is:
  - Safe
  - Timely
  - Effective

  - If yes, still requires monitoring, as with conventional technologies

Constraints for Acceptance of New Technologies

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Regulators

- Standardizing acceptance criteria is difficult
- Prioritizing review is encumbered by agency work backlog
- Accepting risk of 'poor technology' is complicated by litigation potential
- Overturning 'status quo' threatens those invested in conventional technology

Developers

- Quick commercialization of technology is required to get return on investment
- Nuances of fish passage issues may not be clearly known
- Application space for technology may be ambitious

New Fish Passage Technologies Working Toward Broad Acceptance

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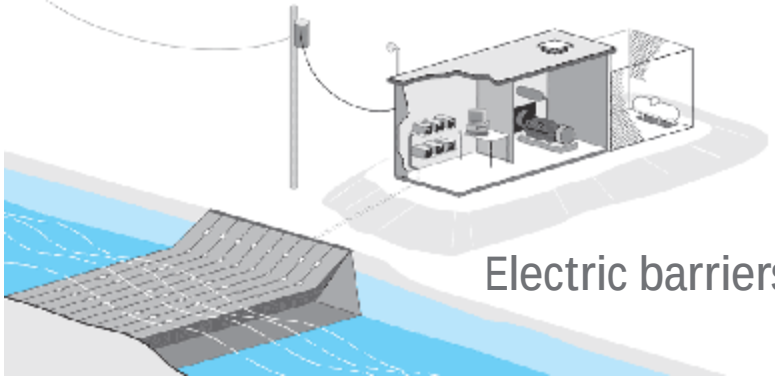
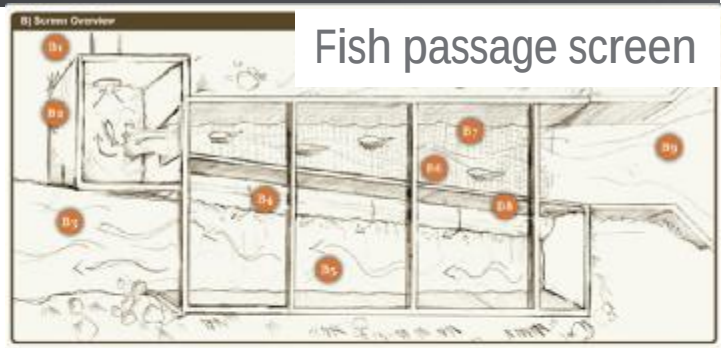
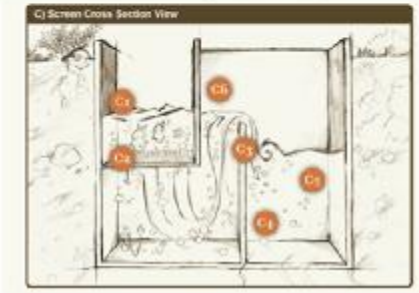


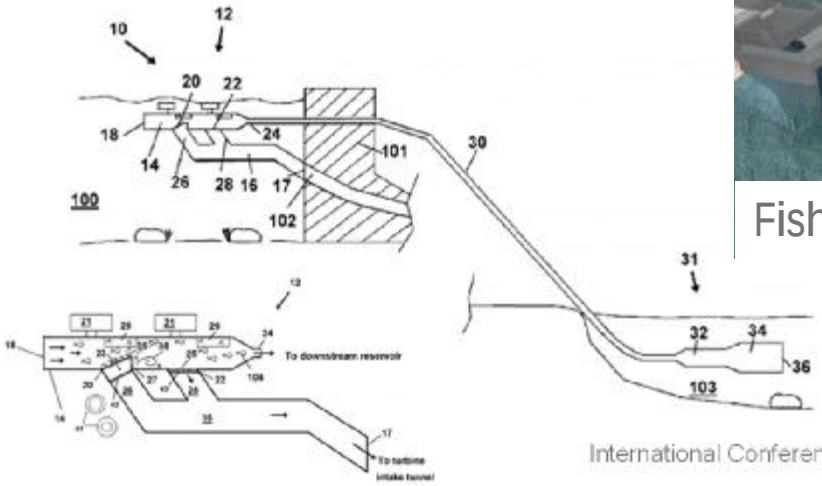
Electric barriers

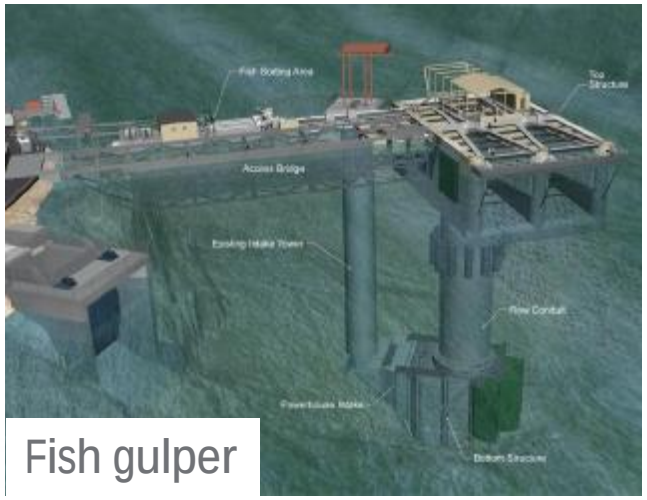


Fish passage screen



Jensen bypass





Fish gulper

Corrugated fish screen

New Fish Passage Technologies Working Toward Broad Acceptance

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Whooshh Fish Transport System

Case Study: Whooshh Fish Transport System

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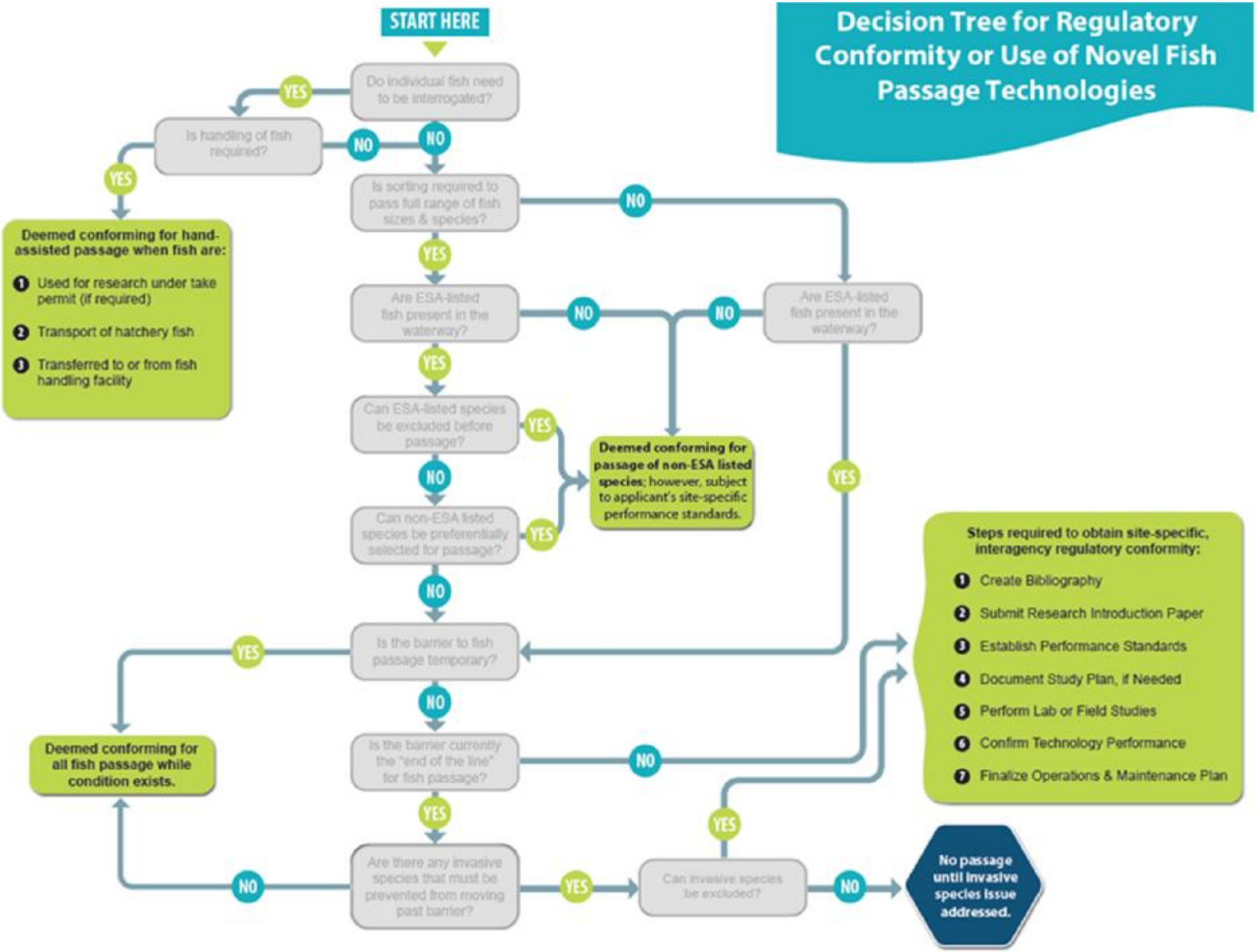
- Novel fish passage technology that uses flexible tube and pressure differentials to move fish around barriers
- Over 17 studies conducted since 2011 to evaluate effects of system on fish
  - All focused on hand loading system
- Has potential to be used where conventional fish passage options are not viable or at new projects

Decision Tree for Regulatory Conformity or Use of Novel Fish Passage Technologies



2017 Study Plans

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- Work with regulatory agencies to determine the data needed to evaluate the WFTS for passage of Endangered Species Act-Listed fish at operational hydropower facilities
- Design and execute a study that evaluates the effects of passage through the WFTS and meets the defined requirements of the regulatory agencies' fish passage acceptance criteria

2017 Study Plans – Field Evaluation

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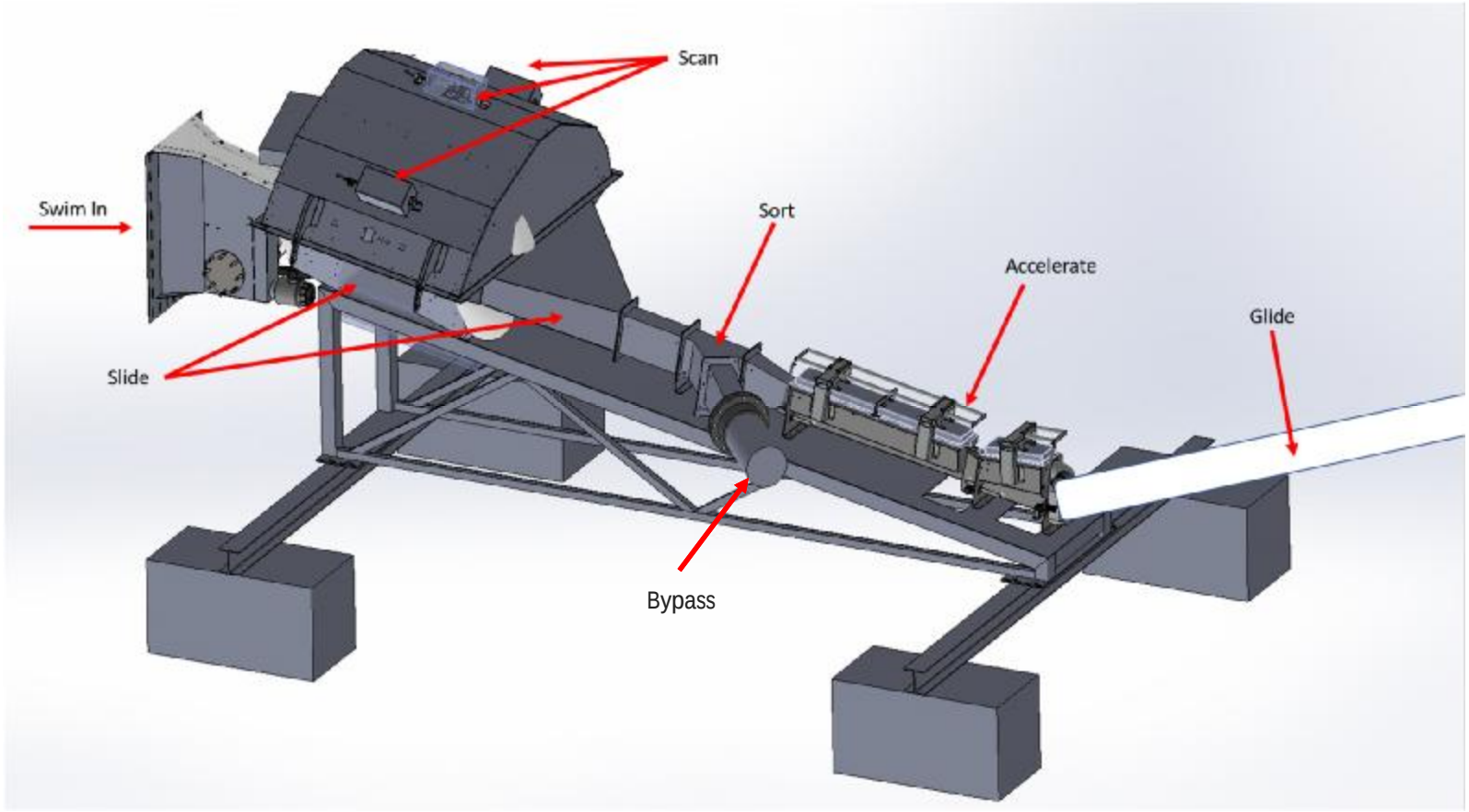

2017 Study Plans – Field Evaluation

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- Evaluation of the entrance and sorting system
  - Three treatments
    - Controls
    - Bypassed – Fish climb Alaska Steeppass, are bypassed
    - Whoosh – Fish climb Alaska Steeppass, are sorted based on size
      - Pass through Whooshh tube
      - Bypassed
  - Metrics
    - Immediate survival
    - Gross macroscopic injury rates
    - Sorting efficiency
    - Quantification of unexpected events

Lessons Learned

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- Meet with regulator(s) as early as possible
  - Identify the concerns and desired information
- Appreciate the limited time of regulators and that they're under scrutiny
  - Provide adequate time for review
  - Succinct communications
  - Defensible data
- Third-party evaluators may reduce bias and avoid delay in acceptance

Acknowledgements

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