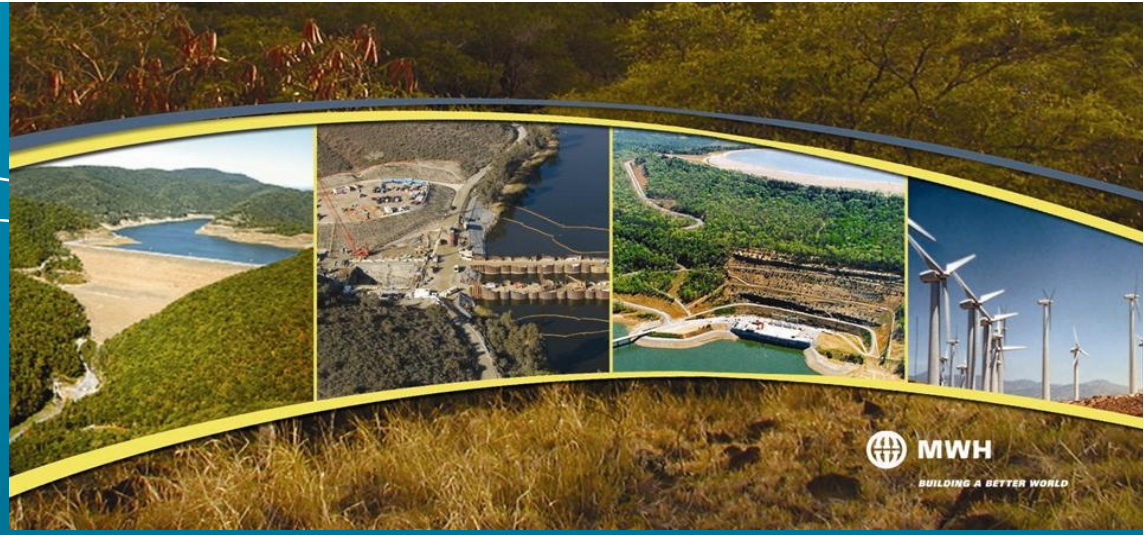


Kirby Gilbert  
MWH Americas, Inc.



# PUMPED HYDRO PROJECT DEVELOPMENT

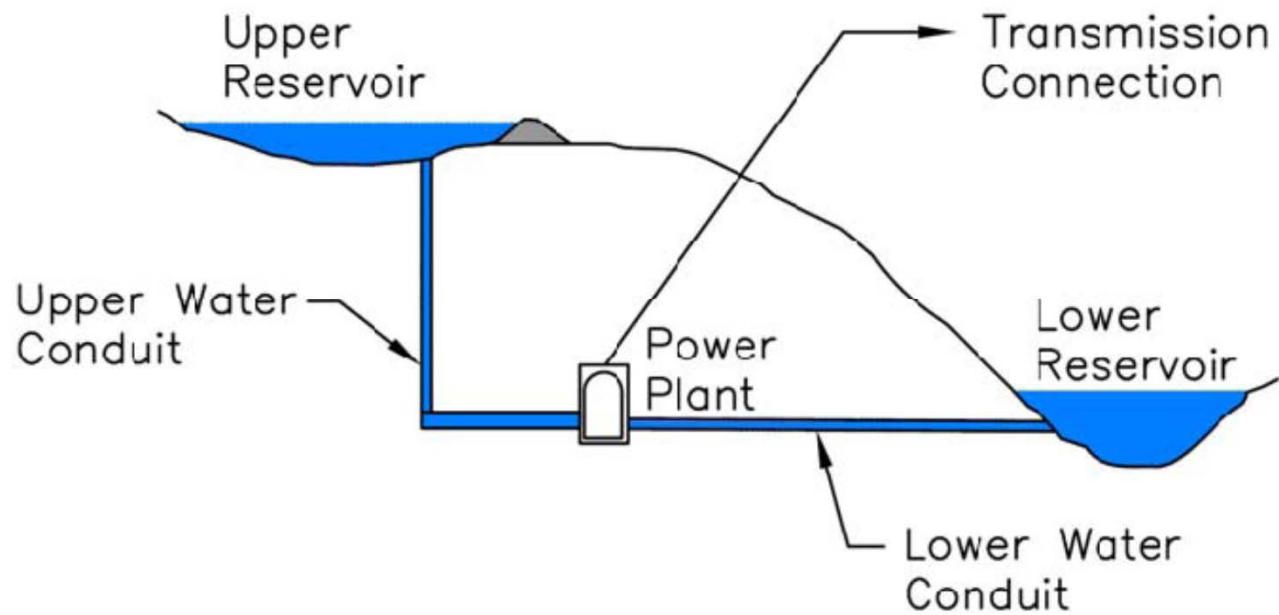
*BLM PUMPED HYDRO WORKSHOP*

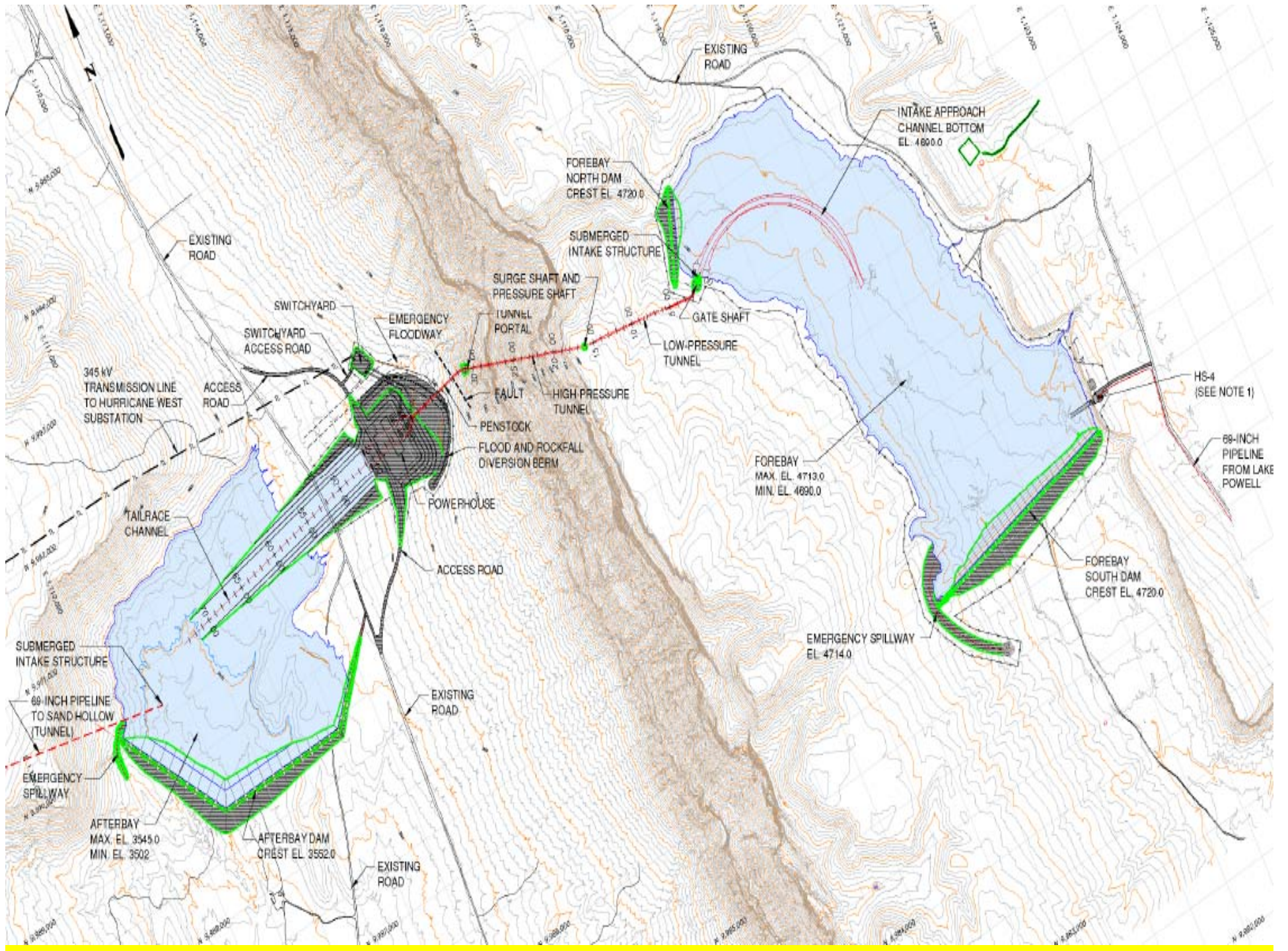
November 7, 2012



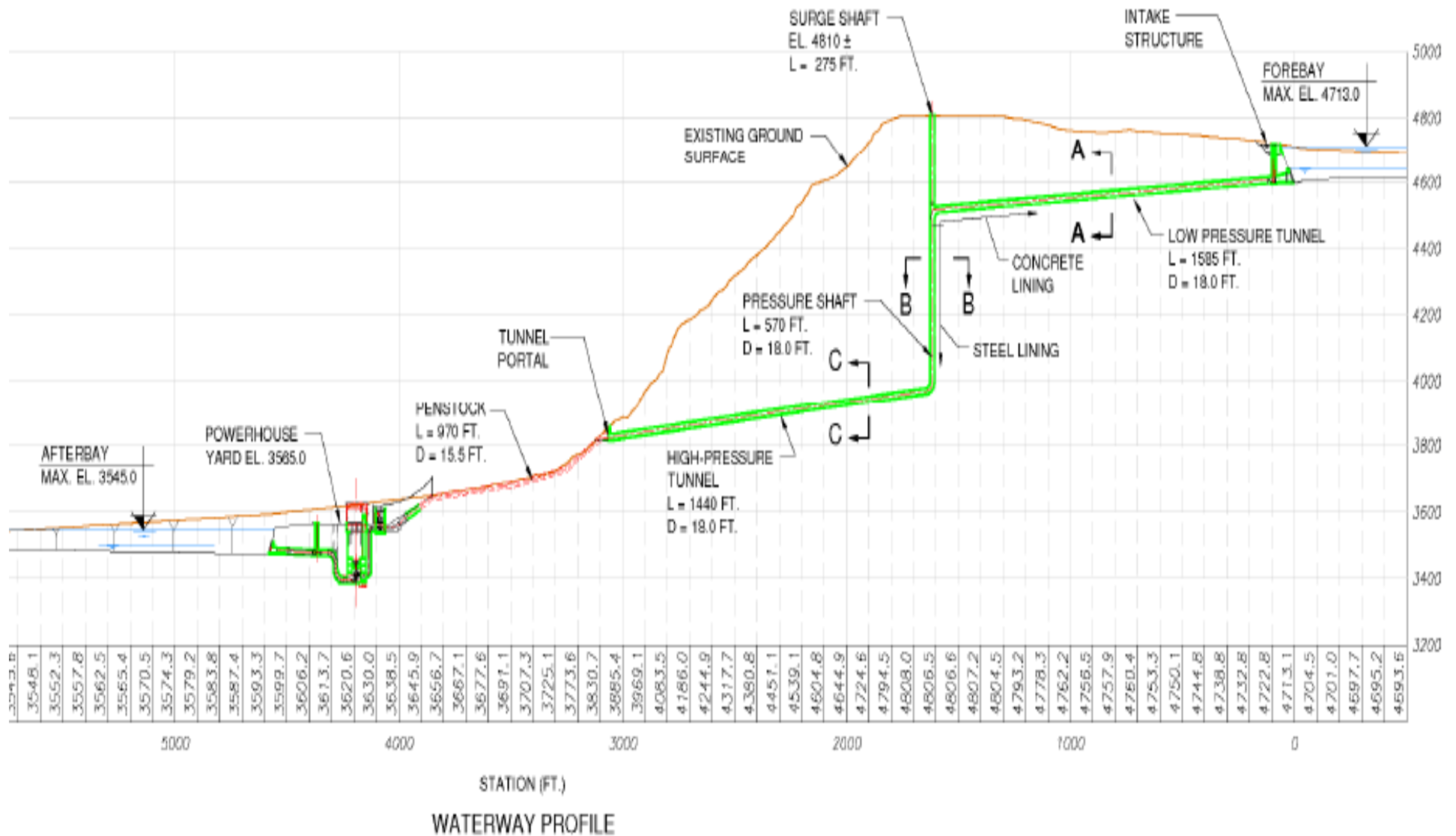
**BUILDING A BETTER WORLD**

# Typical Pumped Storage Project Components





# Profile of a Pumped Storage Project



# Siting Factors

- Physical Evaluation
  - Elevation (head)
  - Availability to water (surface, ground or treated)
  - Geology (seismic and underground conditions)
  - Access to roads, transmission, etc.
- Environmental Resources
- Regulatory
  - FERC Preliminary Permit
  - FERC Licensing
  - NEPA, CWA, ESA, NHPA, etc.
- Operational Factors
  - Closely linked to wind generation facilities
  - Ancillary Service Capabilities

# Pumped Storage Hydro Feasibility Study

## Relevant Planning Criteria

- Performance and Operational Objectives
  - Generating capacity
  - Energy storage
  - Equipment type and sizing criteria
  - Transmission interconnection opportunities
- Safety
  - Structural performance criteria
  - Dewatering practice and criteria
  - Floods
  - Controls
  - Emergency features and processes

# CA ISO Identified Wind Resource Areas



Eagle Mountain P-S Project

# HYDROELECTRIC PROJECT LIFECYCLE

Pre- Feasibility Study – Energy Potential/Relative costs/ Initial Siting of Major Components/Fatal Flaw Analysis – 6 months to 1 year

FERC Preliminary Permit – 3 years

Resource and environmental studies – same 3 years

- Reconnaissance surveys/hydraulic studies

- Feasibility study to Define Project for License Application

- License Application Preparation

- Permit Applications (404/401)

FERC NEPA and License Order – 2 years

License Implementation - 2 years

Design and Engineering (Geotech/surveys/modeling, etc) – same 2 years

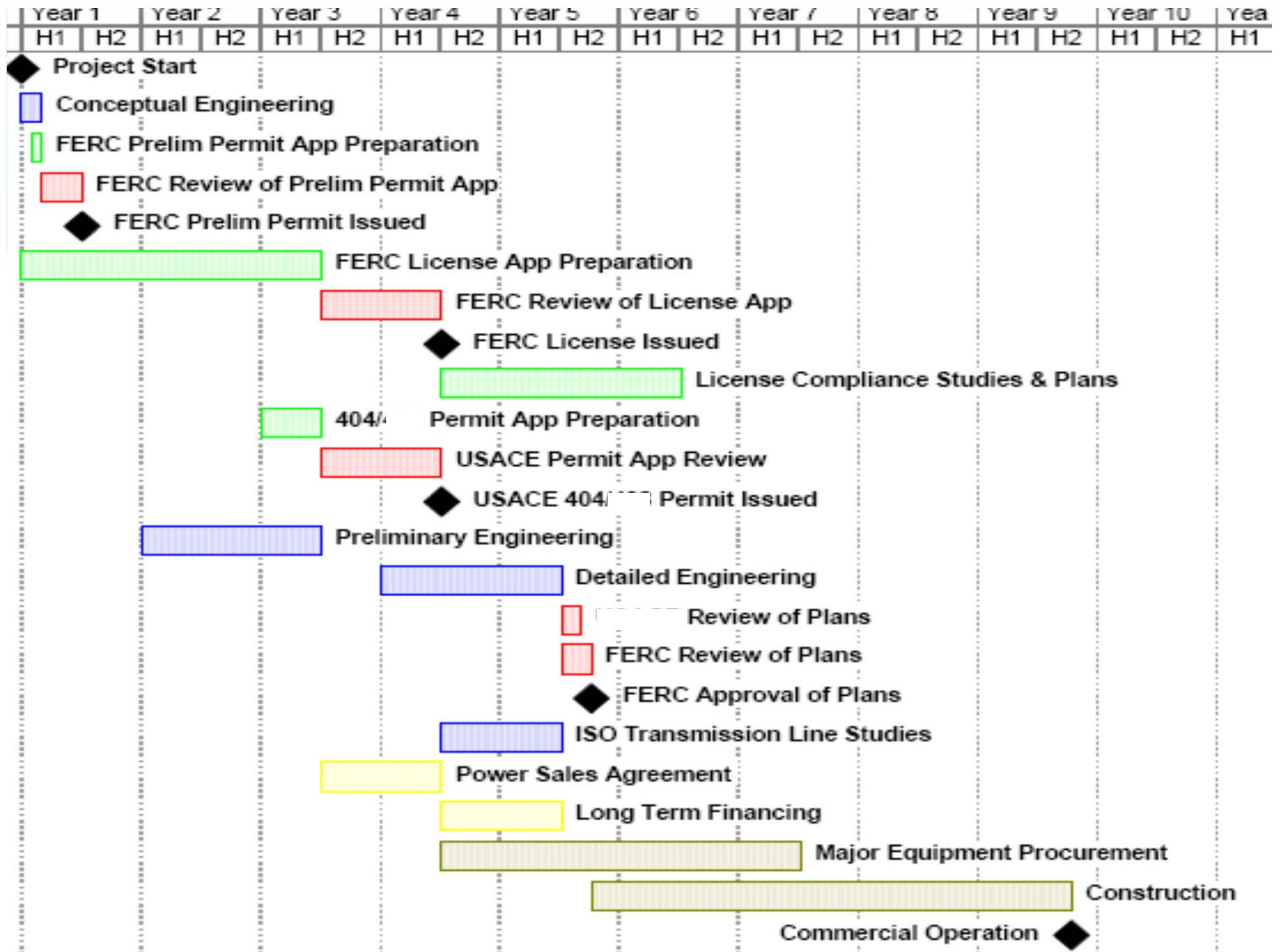
ISO Transmission Studies – 1 year

Plans and Specs /bid packages - 2 years

Major Equipment Procurement – 6 months

Construction – 2 to 4 years





# Siting a Pumped Storage Project



# Pumped Storage Hydro Feasibility Study

## Major Steps or Phases

- Background Review and Performance Criteria
- Alternative Concept Development and Evaluation
- Field Investigations
- Technical Studies to Define Concept
  - Optimization, Arrangements, Equipment Selection, Preliminary Design, Constructability Review
- Feasibility Level Concept Definition
- Implementation Planning and Opinion of Cost

# Typical Pumped Storage Environmental Studies

Terrestrial Resources Studies

Aquatic Resources Studies

ESA Species (BA)

Cultural Resources Study (SHPO)

Land Use or Special Interest Lands Consideration

Aesthetic Resources & Recreation Study

NEPA (Prepare Exhibit E like APEA)

Floodplain Analysis

Wetland Delineations

Water Use & Reuse Study

Socioeconomic Affects Study

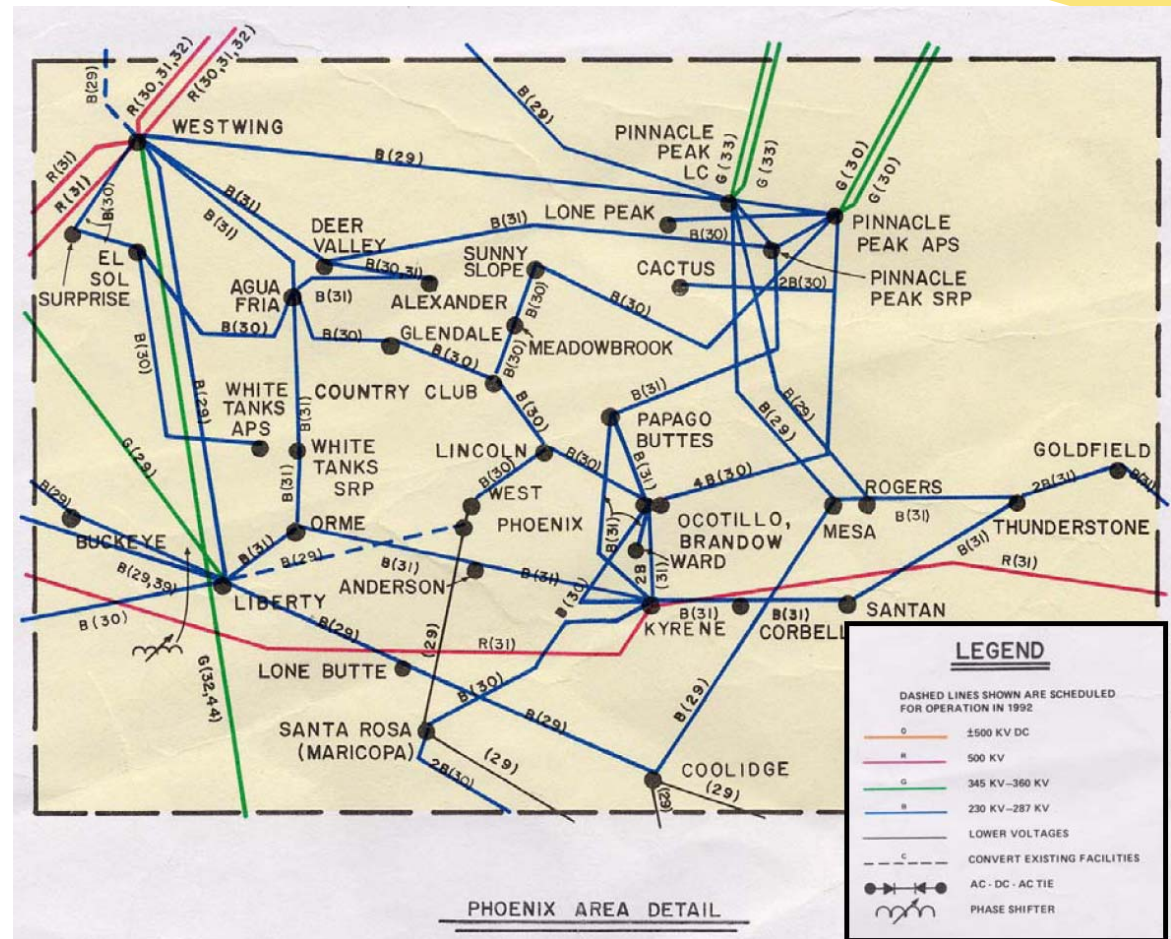
(agriculture/jobs/firming up renewables)

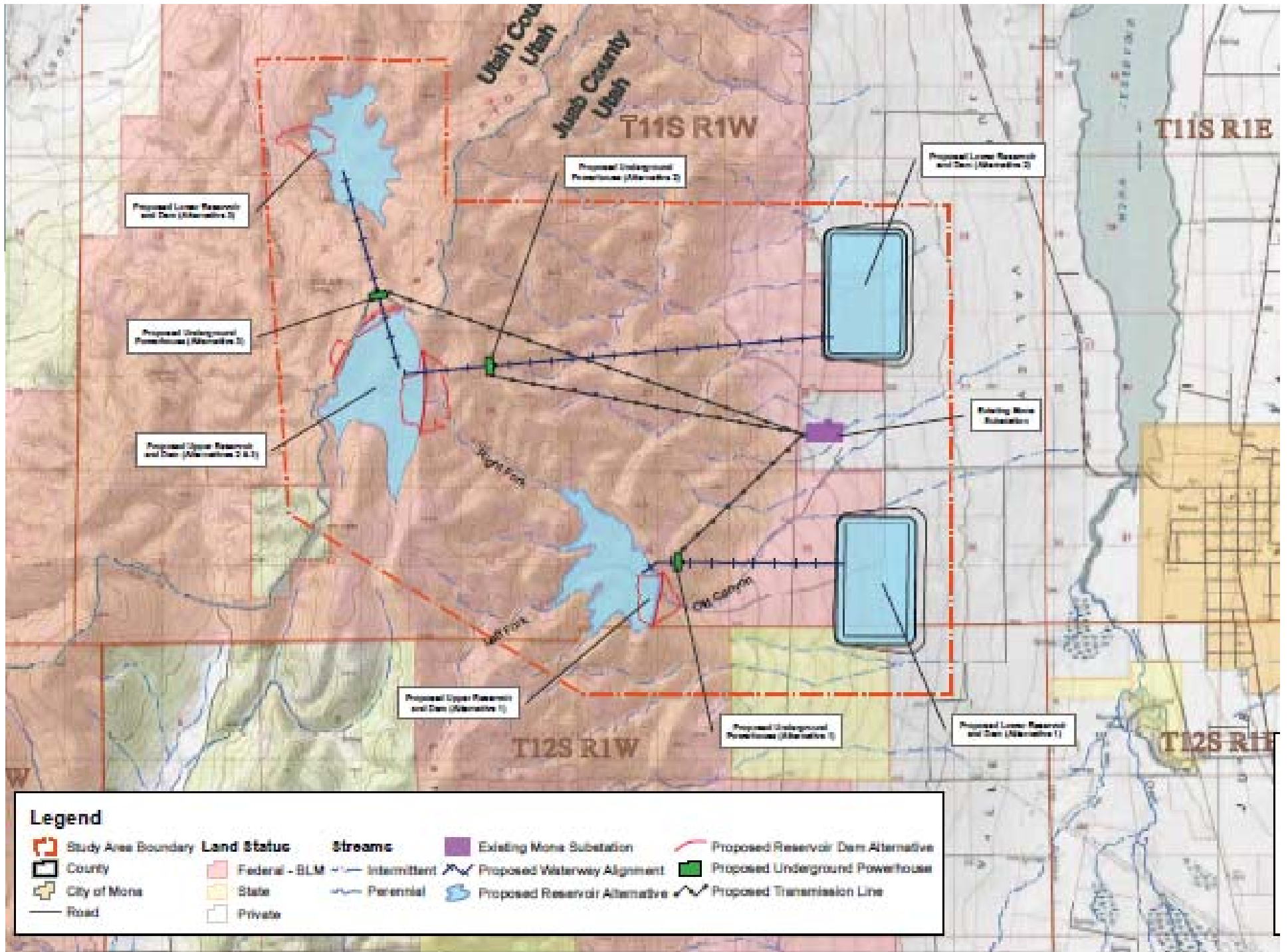
# Geologic/Geotechnical Needs

- Geological mapping
- Drilling data, core logs, core photos, availability of original core
- In situ test results (WPTs)
- Auger (soils) holes, test pits/trenches
- Laboratory test results

# Transmission Interconnection Process

- Identify point of interconnection
- Submit application – assign queue position
- Feasibility Study
- System Impact Study
- Facility Interconnection Study
- Large Generator Interconnection Agreement





# Pumped Storage Reservoir Recreation Opportunities





# Licensing & Approvals for Pumped Storage

- FERC License for Major Unconstructed Project (4.41)
- Three Stage Consultation, Pre and Post Filing
- Water Quality Certification, possibly 404 permit
- 5 Year + FERC process, then other permits

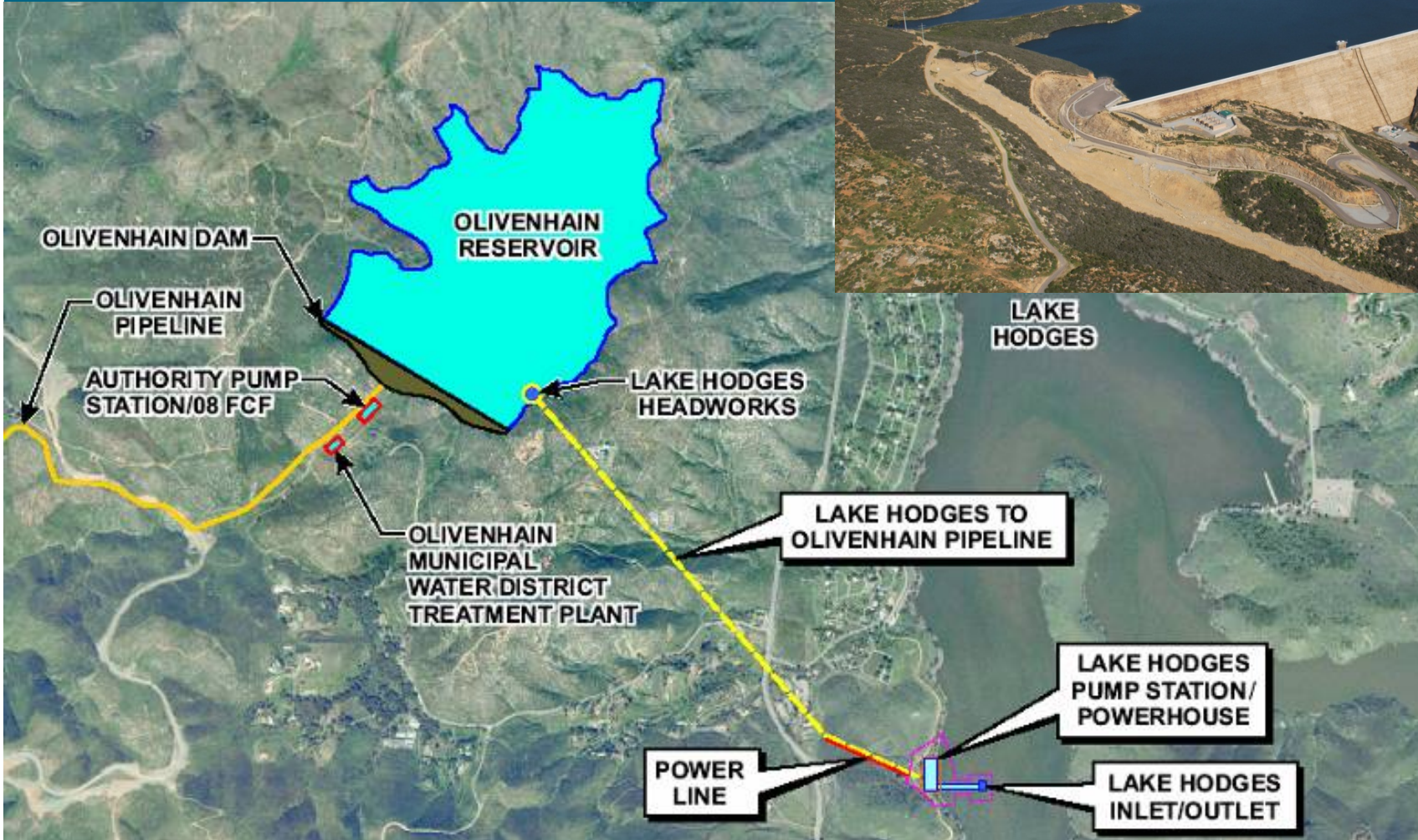
## PRELIMINARY PERMIT

- ☑ Does not authorize construction or any land-disturbing activities
- ☑ Issued for a term up to 3 years
- ☑ Reserves site for permit holder; includes progress reports
- ☑ No dam or land ownership required

## LICENSE

- ☑ Authorizes construction and operation of a hydropower project
- ☑ Issued for a term up to 50 years
- ☑ Includes measures to protect the environment
- ☑ Requires that licensee has or obtains ownership or easement on project lands and waters

# Olivenhain-Hodges Pumped Storage Project



# Olivenhain Hodges Pumped Storage

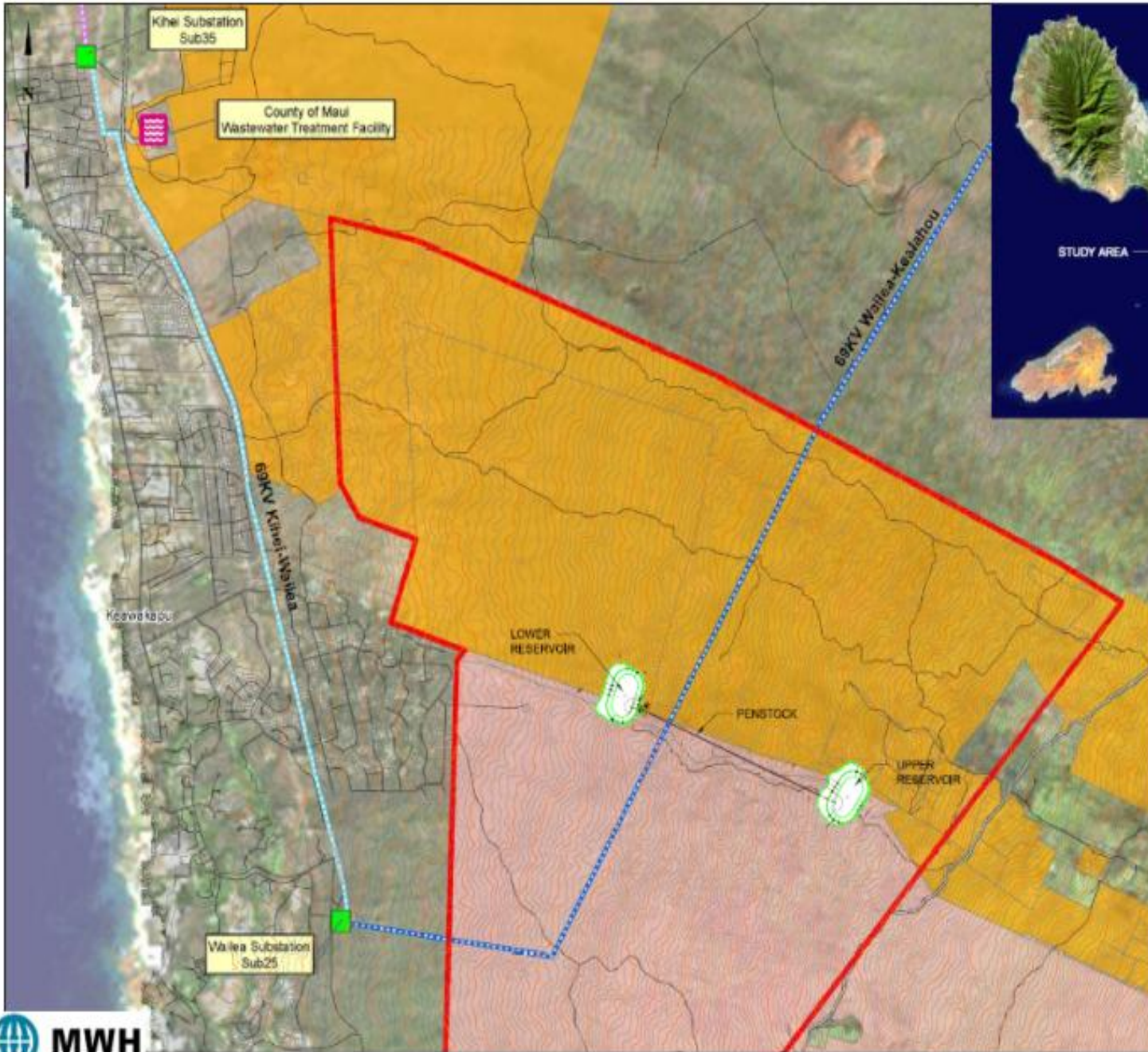


# Active Project Example (Just finishing Construction) Olivenhain-Hodges (CA) – San Diego Co Water Authority

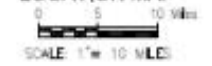


# Olivenhain-Hodges Underground Powerhouse





LOCATION MAP



NOTES:

1. EXHIBITS ARE INTENDED TO SHOW A 50MW PROJECT WITH 825 ac-ft ACTIVE STORAGE (3.6 HOURS OF OPERATION).
2. DRAWINGS ARE INTENDED TO SHOW PRELIMINARY PROJECT CONCEPTS, AND ARE INTENDED FOR PRELIMINARY STUDY PROPOSALS ONLY.



HECO PSH STUDY  
 HALEAKALA RANCH AND  
 ULUPALAKUA RANCH SITE  
**PROJECT LOCATION**



# Rocky Mountain PS Auxiliary Pools



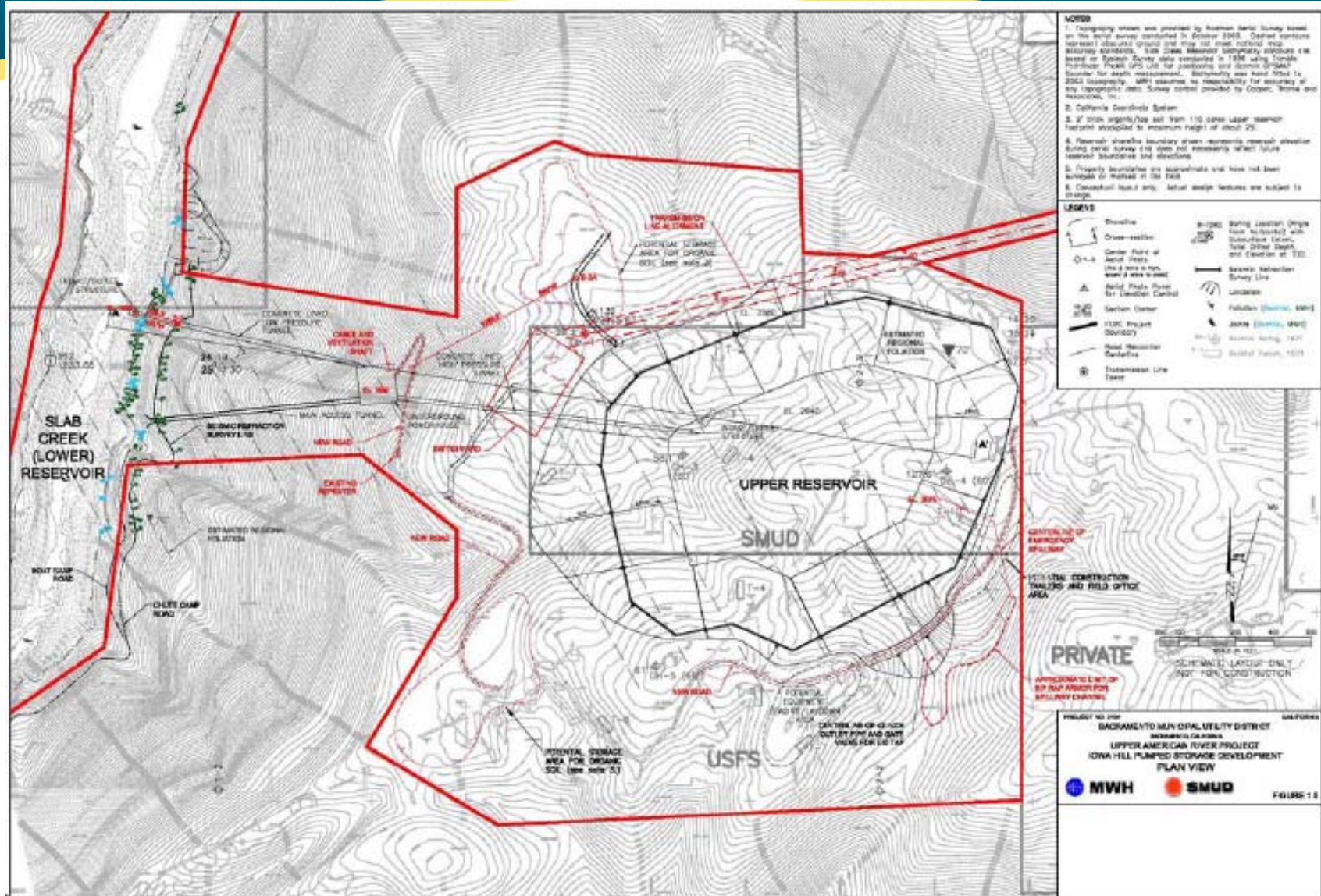
# Rocky Mountain Pumped Storage Project

Oglethorpe Power/Georgia Power





# Iowa Hill (CA) Pumped-Storage Project



**Thank You**

**Kirby Gilbert**

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