Submitted to
Northwest Power &
Conservation Council

JD Pool Pumped Storage Project

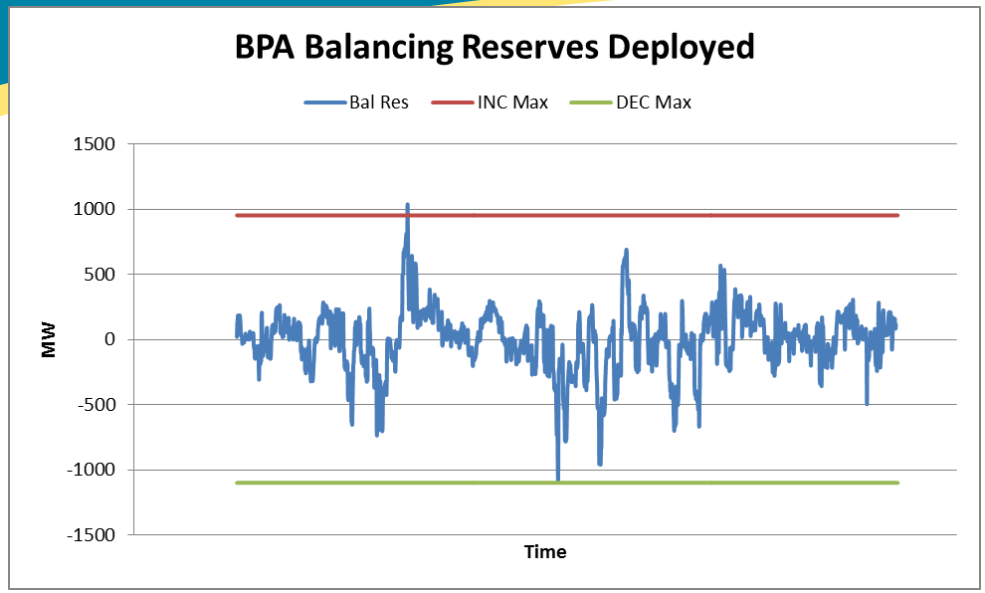
FERC No. 13333

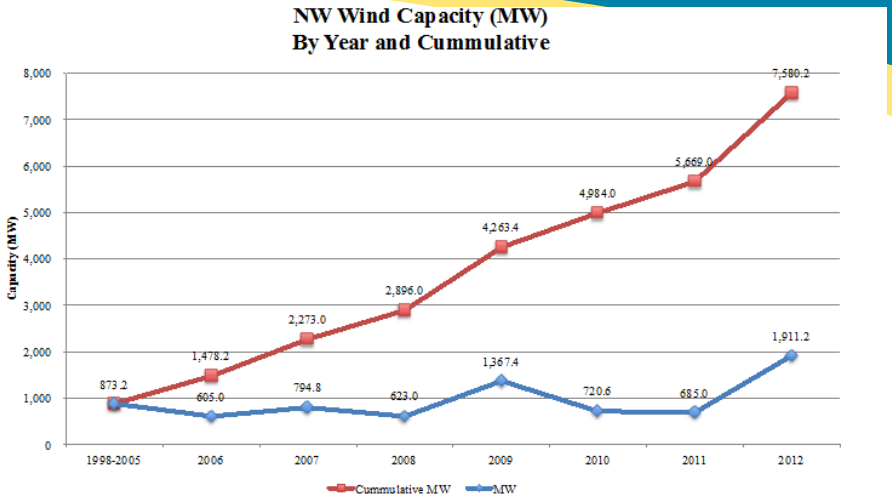
January 27, 2015

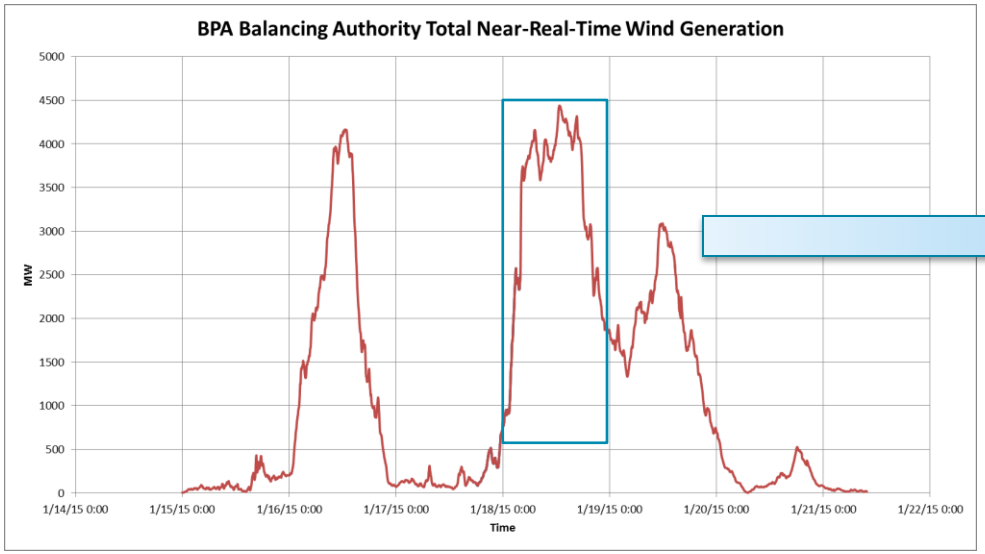
Klickitat PUD
Owned By Those It Serves

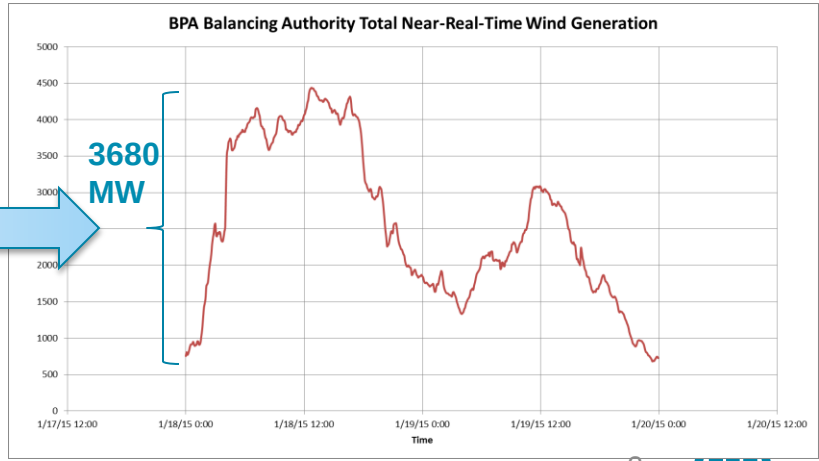
MWH®
BUILDING A BETTER WORLD

Project purpose & need – flexible capacity/energy





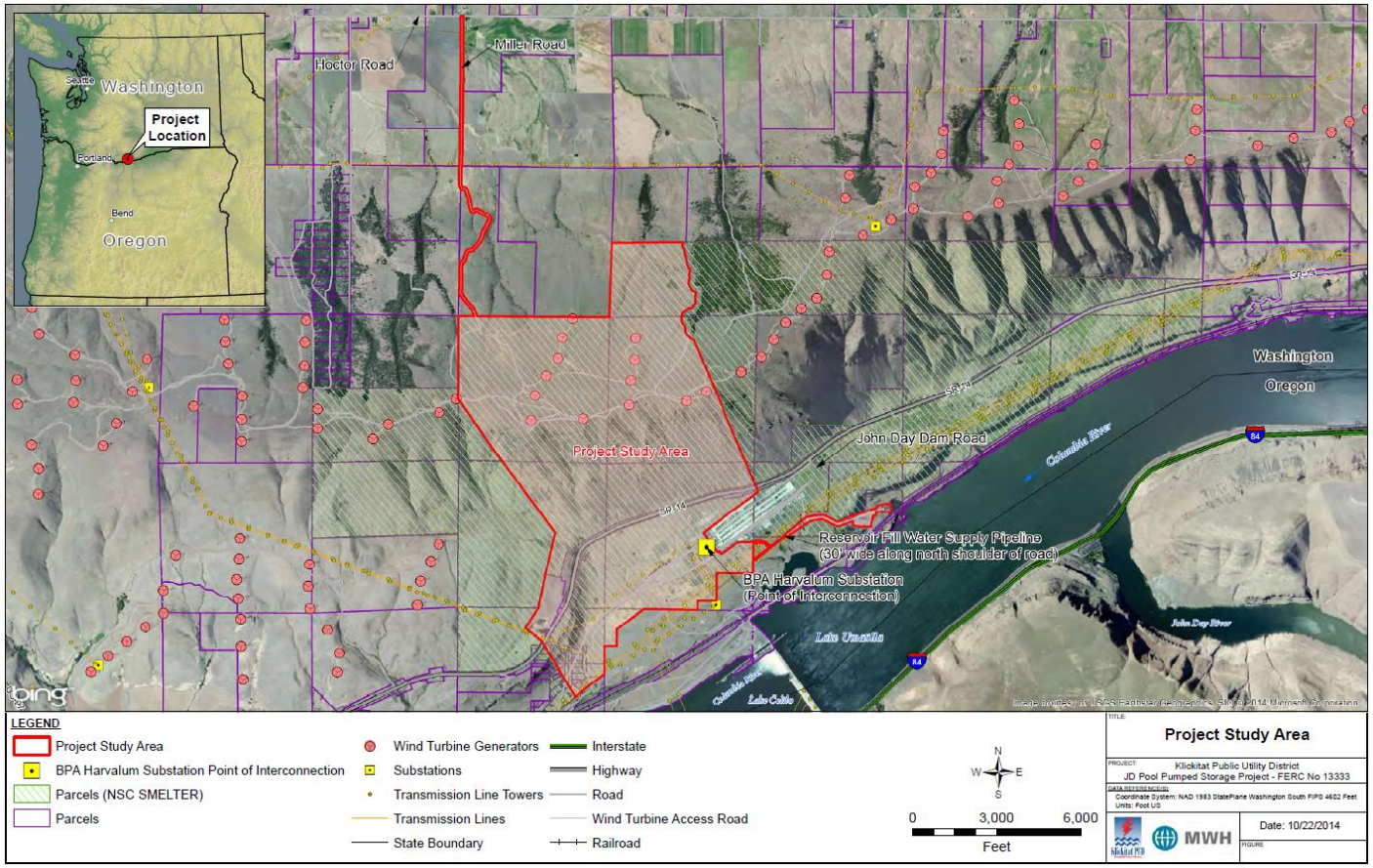




Future Market and Regulatory Drivers

- Energy Imbalance Market
- Optimization of FCRPS/Columbia River Treaty (i.e. flood, power, irrigation, ecosystem function, etc.)
- EPA Section 111(d)
- Washington State 2015 Climate Legislation
- California 50% RPS

Regional Project Location and Study Area



- Near significant high-voltage transmission (i.e. 500kV, DC Intertie)
- Close to 1000's of MWs of Gorge wind
- Brownfield re-development (i.e. former aluminum smelter)
- Technically attractive site (over 2000' net head, < 5 for L:H ratio)

Preliminary Design Concept Project Features

- **Reservoirs** – formed with cut/fill embankment dams, fully lined with concrete
  - 2 × Upper Reservoirs (UR):
    - UR1: 5,000 AF active + dead volume (**4,700 AF active**)
    - UR2: 7,700 AF active + dead volume (**7,100 AF active**)
  - Lower Reservoirs (LR): 12,100 AF active + dead volume (**11,800 AF active**)
  - 2 × waterways/conveyances between URs and LR (each 21' diameter, 9,500' length)

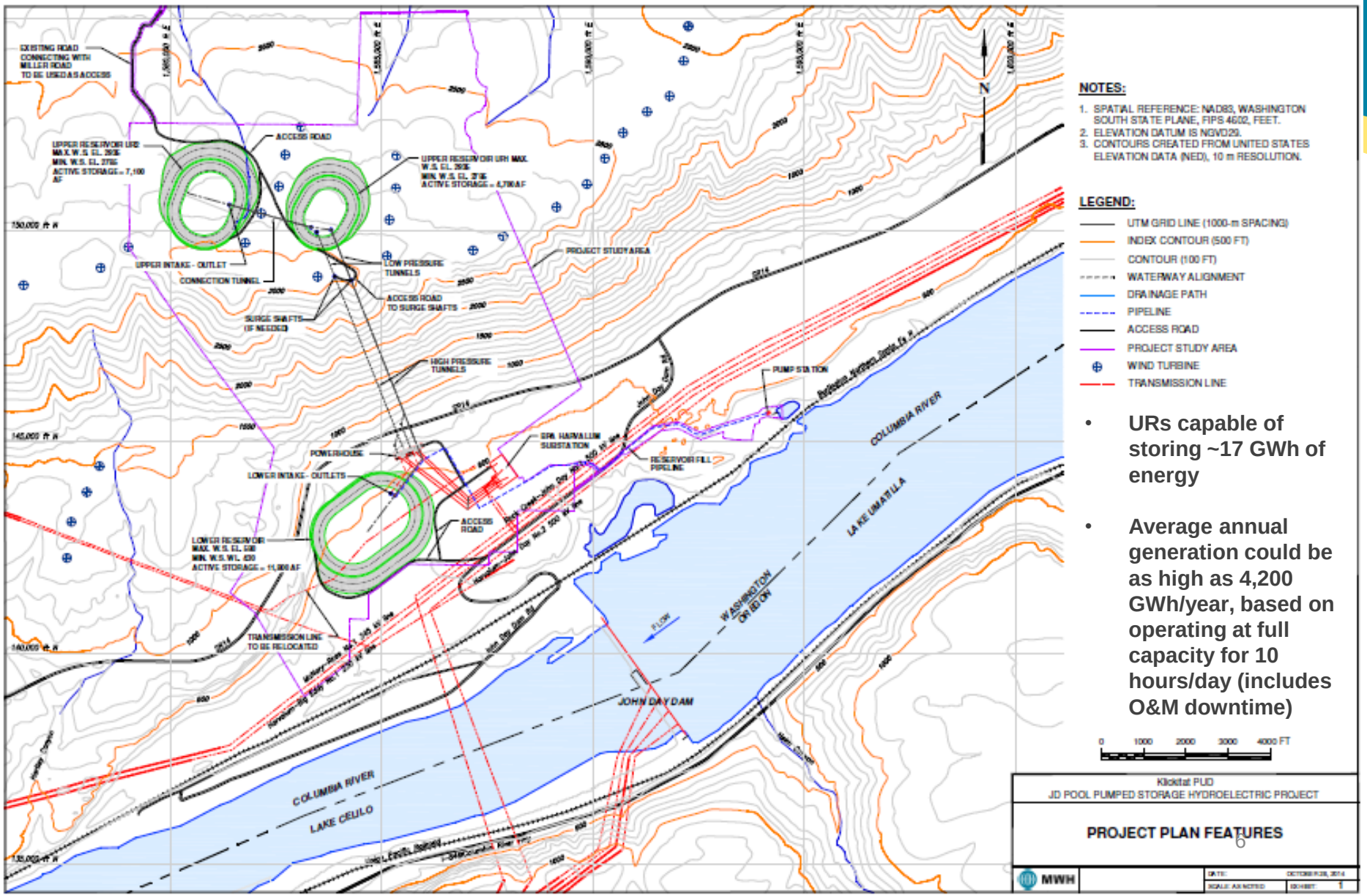
- **"Pit-style" powerhouse** (PH) – **1,200 MW** nameplate capacity (4 × 300-MW reversible pump/turbine motor/generator units

- **Interconnection** – 3,000' new 230-kV from PH to BPA's **existing Harvalum Substation** within project area

- **Upgraded river intake** and 11,000' water supply pipeline for initial fill and periodic make-up water

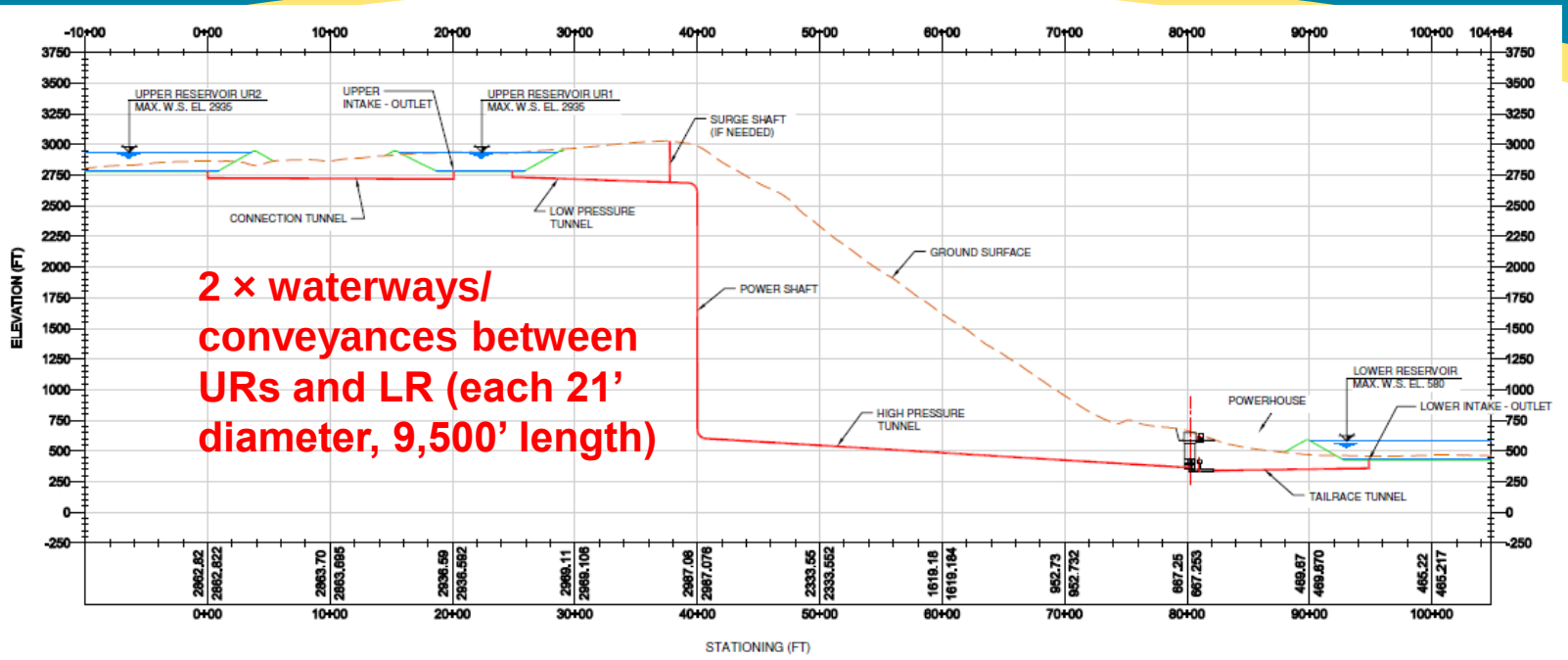
The Pre-Application Document (PAD) can be found at:
http://www.klickitatpud.com/yourPUD/projects/PumpedStorage.aspx

Project Preliminary Concept Design



- URs capable of storing ~17 GWh of energy
- Average annual generation could be as high as 4,200 GWh/year, based on operating at full capacity for 10 hours/day (includes O&M downtime)

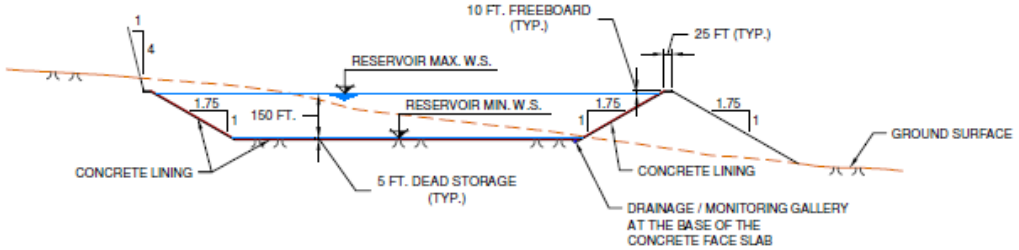
Project Profile



2 × waterways/ conveyances between URs and LR (each 21' diameter, 9,500' length)

WATERWAY PROFILE

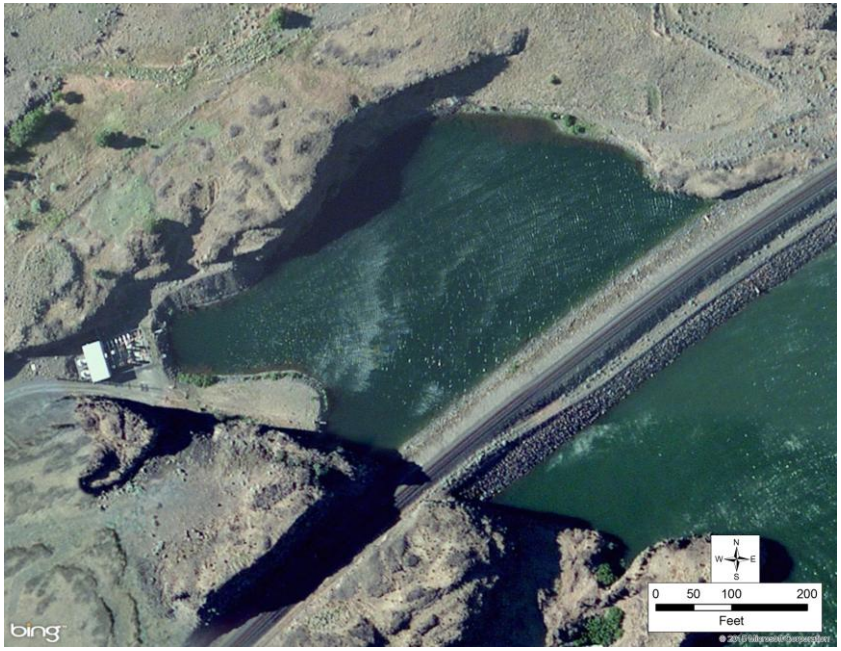
150' water level fluctuation



TYPICAL SECTION
RESERVOIR

0 250 500 750 1000 FT

Existing water right and intake ("closed-loop")



	KPUD Water Right	As Percent of Min River Flow	As Percent of Max River Flow	As Percent of Avg. River Flow
Max Instantaneous Flow (cfs)	34.63	0.05%	0.02%	0.03%
Max Cumulative Annual Volume (AFY)	15,479			

	UR1	UR2	Lower Reservoir
Volume at Mean Sea Level	5,000 AF	7,700 AF	12,100 AF
Surface Area at Mean Sea Level	46 acres	67 acres	100 acres
Estimated Net Loss / Estimated Refill	161 AFY	235 AFY	350 AFY
Initial Fill Volume, total project	13,000 AF		

Time required for initial fill and make-up water:

- Initial fill: ~ 6 months
- Annual make-up: ~ 10 days (timing flexible)

Viable, constructable site with positive development characteristics

- Site has previously studied for energy projects
- **No desktop fatal flaws**, but significant geotechnical studies necessary
- **Water rights** secured by KPUD and for the specific purpose of pumped storage facility by Washington law
- **Site control** – land lease agreed upon by landowner and KPUD
- **Broad-based favorable support** from surrounding counties, stakeholders, etc. lending certainty that a license will be issued by FERC in a reasonable timeframe without controversy

Preliminary Overall Project Schedule

Project Development, Design and Construction

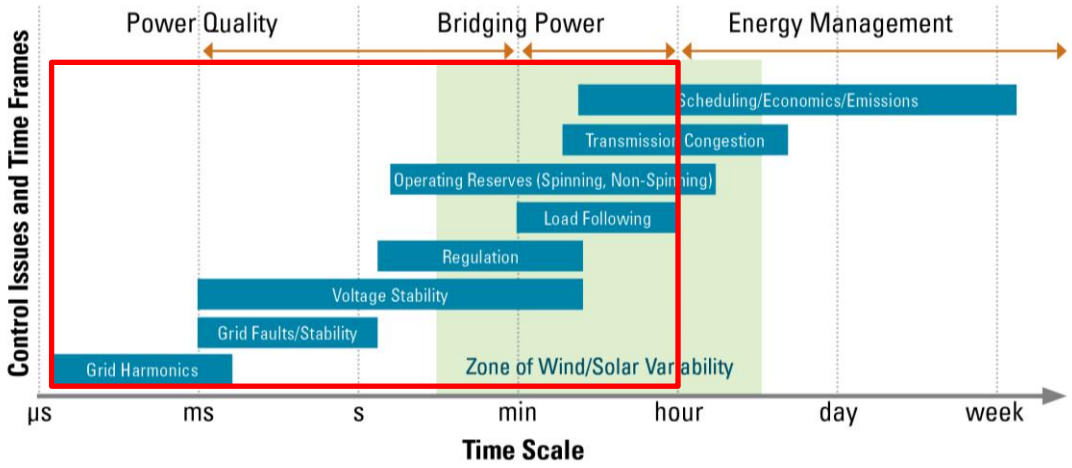
2024 Earliest COD

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Studies, DLA, FLA										
FERC NEPA										
FERC License Issued										
Geotechnical investigations										
Preliminary Design (30%)										
Procurement										
Detailed Design (100%)										
Equipment Fabrication										
Construction										
Commissioning										

Long lead-time project (i.e. 10+ years)

JD Pool barriers to development

1. Economic analysis and modelling for **sub-hourly energy grid services** and **environmental benefits** not traditionally valued both as generation and load



Environmental

- *GHG*
- *Renewable Integration*
- *Ecosystem Function*

2. Market/regulatory framework to support a pumped storage project

3. Sponsor to **fund** a **capital intensive**, **long lead-time** project with certainty of cost-recovery, rate of return, return on investment, etc.