# Goals

1. Create flow to area curves and EAH for Baseline and State Recommended Option

# Files and Directories of Interest

1. Yolo Bypass Flows of interest for model input: [file:\\U:\Active Projects\CVFPP Phase 2\Analysis\Yolo Bypass Analysis\YoloBypass\_Options1\_2\_3\_4\_5\_Yolo\_Flow\_Inundation\_Graph\_031816.xlsx](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Yolo%20Bypass%20Analysis\YoloBypass_Options1_2_3_4_5_Yolo_Flow_Inundation_Graph_031816.xlsx)
2. EAH Script Documentation: [file:\\U:\Scripts\EAH\20160614 EAH Script Documentation.docx](file:\\U:\Scripts\EAH\20160614%20EAH%20Script%20Documentation.docx)
3. Daily Flows: [file:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\Hydrology)
4. Hydraulic Flow to Area for input to Script: [File:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA](File:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\FTA)
5. Compiled Results from Multiple Runs of Script: [file:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\Results)

# The Hydraulic Model

## Input Flows

* Need to model inundated areas at particular flows for input to the script
* Flows of interest from 1D model output at Woodland node
* 1D model here: [file:\\U:\Active Projects\CVFPP Phase 2\Modeling\EAH\_Models](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Modeling\EAH_Models)
* Flows for all options here: [file:\\U:\Active Projects\CVFPP Phase 2\Modeling\YoloBypass\_Options1\_2\_3\_4\_5\_StatePref\_Yolo\_Flow\_Inundation.xlsx](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Modeling\YoloBypass_Options1_2_3_4_5_StatePref_Yolo_Flow_Inundation.xlsx)

## Output Inundated Areas

* Generate “flow to area” (FTA) curves based on input flows and the resulting inundated area from model runs (SEE Flow to Area section)

# The Script

* Located here: <file://U:\Scripts\EAH>

## Opening and Running Python Script:

* On Willow, use command prompt
* Go to path U:\Scripts\EAH
  + Type “U:”, ENTER
  + “cd Scripts”, ENTER
  + “cd EAH”, ENTER
* Type “python eah.py –h”
  + Calls script
  + Prints out help menu = list of arguments and descriptions

### Arguments

* Syntax: Argument “U:\Path” or Argument option

#### Hydrology File

* Argument is “-hfile”
* Mean daily flow
* Location: [file:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\Hydrology\)
* 4 hydrology files in the folder. Assuming match the hydrology with the option (no notch, small notch, large notch). Not sure if using the combined file yet
* Currently using USGS “Yolo at Woodland” that starts in 1984 and ends 2013
* Might want to talk to Mark about changing to a longer record?
* USGS site (<http://waterdata.usgs.gov/nwis/inventory/?site_no=11453000&agency_cd=USGS>)

#### Flow to Area

* Argument is “-afile”
* Location: [File:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA](File:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\FTA)
* Flow to area CSV:
  + Column A
    - Column heading = “Flow”
    - Rows filled with modeled flows
  + Column B
    - Column heading = desired name for output (no spaces)
    - Rows filled with inundated areas

#### Output Directory

* Argument is “-odir”
* Location: [file:\\U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results](file:\\U:\Active%20Projects\CVFPP%20Phase%202\Analysis\Sac%20Analysis\Yolo%20Options\Results)\yyyymmdd\_OptionName
* Summary of all results, here: U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20150731\_YoloOptions\_EAH\_Summary.xlsx

#### Timing

* Start Month is “-smo”
* Start Day is “-sday”
* End Month is “-emo”
* End Day is “-eda”

#### Durations

* Can specify list of durations as “–durations 7 10 30” days
* Number of consecutive days a certain flow must be met or exceeded

#### Verbose

* Type “-verbose” in command line with other argument definitions
* Boolean
* Will create 4 output files:
  + “lp”
    - Log-Pearson calculation of flow at frequencies (year)
  + “peaks”
    - Peak mean daily flow within consecutive flows that meet criteria (duration and range) for each year and date
  + “rank”
    - Ranks the peak results
  + “ifta”
    - Interpolating flow to area in increments of 1 cfs

#### Probability

* Switches from Log-Pearson to regular probability calculation
* Boolean

### Output

#### Script Messages

* “YEARS WITH INCOMPLETE RECORD [XXXX, XXXX]” are years with less than 365 days of record (e.g., blank or missing days). These are thrown out by the model prior to looking at criteria specified.
* “NUMBER OF YEARS WITH ZERO FLOW (cfs)”
  + Used as an indicator on whether to use log pearson or probability method
  + Should have at least 10 years of data to use log pearson
  + Based on the duration specified. The number of years that had no days meeting the criteria specified. (i.e. consecutive days of flow in months specified, etc.)

#### Output directory

* Specified as an argument
* 3 types of output produced
  + Excel Summary “…blp”
    - Column A is frequency (years)
  + Interpolated Results “…ilp”
    - Column A is frequency (years)
  + Graph
    - Area v. Probability

#### Summary Tables

* Column A:
  + Frequency (years) based on the peak mean daily flow for each year selected from the set of all mean daily flows that meet the duration criteria during the months specified
* Column B, “Q”:
  + Flow (cfs) for the given frequency
* Column C:
  + Interpolated inundated area based on the corresponding flow
* Column D:
  + Probability (1/frequency)
* Column E:
  + EAH as the area under the Flow-Area curve
* Column F:
  + Species as specified as Argument

### Causes of script errors:

* Comma in thousands place
* Have output file open when it is trying to re-write

Sample command lines:

SRO with Notch

Spring-Run Juvenile Chinook:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname SRJC -smo 10 -sda 1 -emo 4 -eda 21 -durations 7 10 -probability

Winter-Run Juvenile Chinook:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname WRJC -smo 8 -sda 1 -emo 4 -eda 21 -durations 7 10 -probability

Steelhead Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname SJR -smo 2 -sda 1 -emo 3 -eda 31 -durations 7 10 -probability

Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname FRJR -smo 11 -sda 21 -emo 4 -eda 21 -durations 7 10 -probability

Late Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname LFRJR -smo 10 -sda 21 -emo 4 -eda 21 -durations 7 10 -probability

Late Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyBIOPSWithLargeNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloWithNotchSRO.csv " -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SROWithLargeNotch" -sname SSJR -smo 1 -sda 21 -emo 7 -eda 7 -durations 30 -probability

SRO No Notch

Spring-Run Juvenile Chinook:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname SRJC -smo 10 -sda 1 -emo 4 -eda 21 -durations 7 10 -probability

Winter-Run Juvenile Chinook:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname WRJC -smo 8 -sda 1 -emo 4 -eda 21 -durations 7 10 -probability

Steelhead Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname SJR -smo 2 -sda 1 -emo 3 -eda 31 -durations 7 10 -probability

Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname FRJR -smo 11 -sda 21 -emo 4 -eda 21 -durations 7 10 -probability

Late Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname LFRJR -smo 10 -sda 21 -emo 4 -eda 21 -durations 7 10 -probability

Late Fall-Run Juvenile Rearing:

U:\Scripts\EAH>python eah.py -hfile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Hydrology\HydrologyWithoutNotch1984.csv" -afile "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\FTA\YoloNoNotchSRO.csv" -odir "U:\Active Projects\CVFPP Phase 2\Analysis\Sac Analysis\Yolo Options\Results\20160623\_SRO\SRONoNotch" -sname SSJR -smo 1 -sda 21 -emo 7 -eda 7 -durations 30 -probability