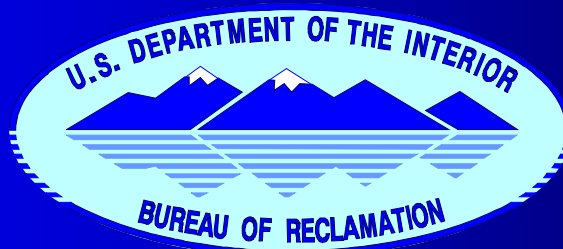


# *An Analysis of Phosphorus Perchlorate Inputs to Lake Mead*

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# Introduction

- Considered phosphorus and perchlorate loadings from the four major inlets to Lake Mead
- Based on data collected by USBR and other available data
- Significant data gaps exist

# Sources of Colorado River Data

- Phosphorus Inputs
  - USBR at CR413.0 and CRLM\_B
  - USGS at Station 09404200 (Colorado River above Diamond Creek near Peach Springs, AZ)
- Flow
  - USGS Station 09404200
- Comments
  - USGS Station is 130 miles upstream of Hoover Dam (approx 60 miles upstream of Lake Mead)

# Sources of Las Vegas Wash Data

- Phosphorus Inputs
  - USBR at LVB0.8 and LWLVB
  - Clean Water Coalition
  - USGS at Station 09419800 (Las Vegas Wash near Boulder City, NV – upstream of North Shore Road)
- Flow
  - USGS Station 09419790 (Las Vegas Wash below Lake Las Vegas)
- Comments
  - Need more information to account for NPS inputs

# Sources of Virgin River Data

- Phosphorus Inputs
  - USBR at VR32.9 and VRLM\_B
- Flow
  - USGS Station 09415000 (Virgin River at Littlefield, AZ)
- Comments
  - Station is located 38 miles upstream of Lake Mead
  - Seriously over-estimates flow, especially during summer, when the entire flow of the Virgin River is diverted through the Riverside and Bunkerville diversion dams

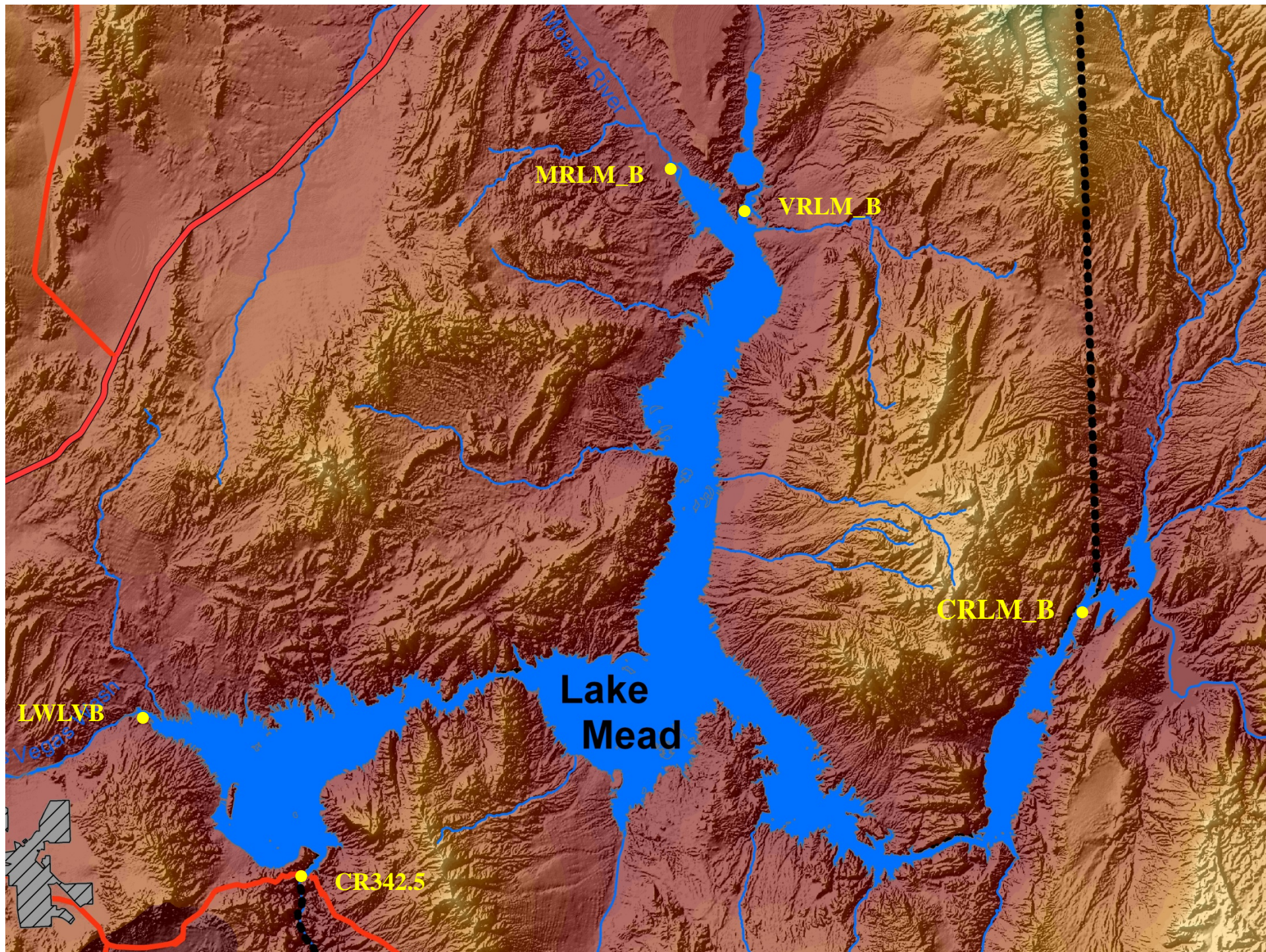
# Sources of Muddy River Data

- Phosphorus Inputs
  - USBR at MR6.2 and MRLM\_B
- Flow
  - USGS Station 09419507 (Muddy River at Lewis Avenue at Overton, NV)
- Comments
  - Station located 1.5 miles upstream of Lake Mead
  - Discharge is predominately irrigation return flow – an irrigation diversion 7 miles upstream of the gage diverts the entire base flow of the Muddy River

# Sources of Perchlorate Data

- Collected from all lake stations, from 2001 through Spring 2005
- Except for Station CR360.7, all values were below detection limits except for one suspect occurrence (8/22/01) at the Virgin River inflow (Station VLRM\_B)
- Acoustic Doppler studies conducted by Reclamation show that water at Station CR360.7, located at the Narrows, can flow upstream from Boulder Basin
- Perchlorate was detected 9 times at Station CR360.7



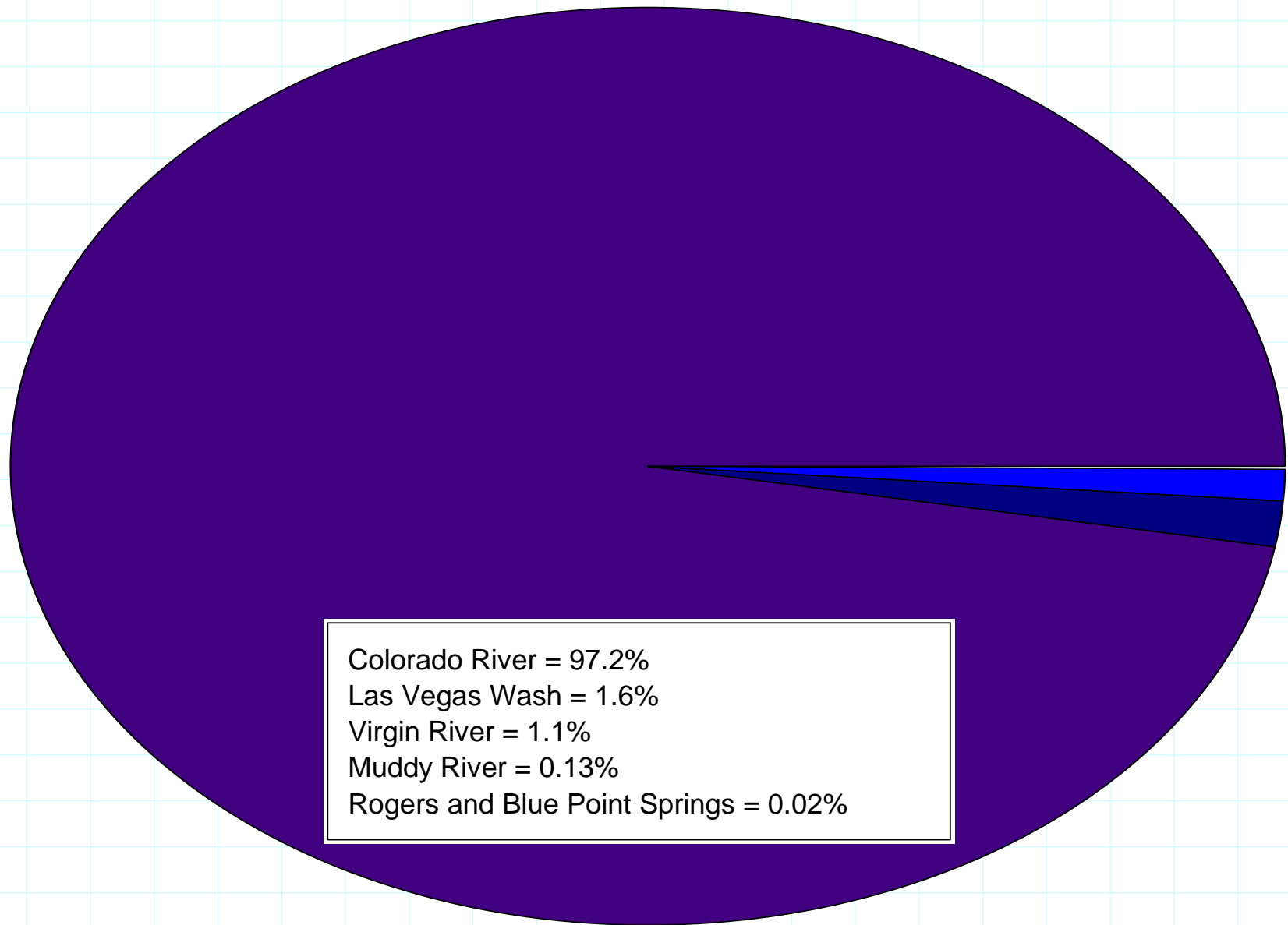




# Inflows

- Colorado River – average of 10,470,800 ac-ft/yr for water years 1999-2001
- Las Vegas Wash – average of 167,980 ac-ft/yr for water years 1999-2001
- Virgin River – average of 118,000 ac-ft/yr for water years 1999-2001
- Muddy River – average of 14,491 ac-ft/yr for water years 1999-2001
- Rogers and Blue Point Springs – 1,670 ac-ft/yr for water years 1999-2001

# Inflows to Lake Mead



## Dissolved Ortho P

- Colorado River average concentration = 3.0  $\mu\text{g/L}$ ,  $n = 29$
- Las Vegas Wash average concentration = 98  $\mu\text{g/L}$ ,  $n = 27$
- Virgin River average concentration = 3.6  $\mu\text{g/L}$ ,  $n = 24$
- Muddy River average concentration = 2.3  $\mu\text{g/L}$ ,  $n = 20$
- Rogers Spring concentration = 4  $\mu\text{g/L}$ ,  $n = 1$

# Total Phosphorus

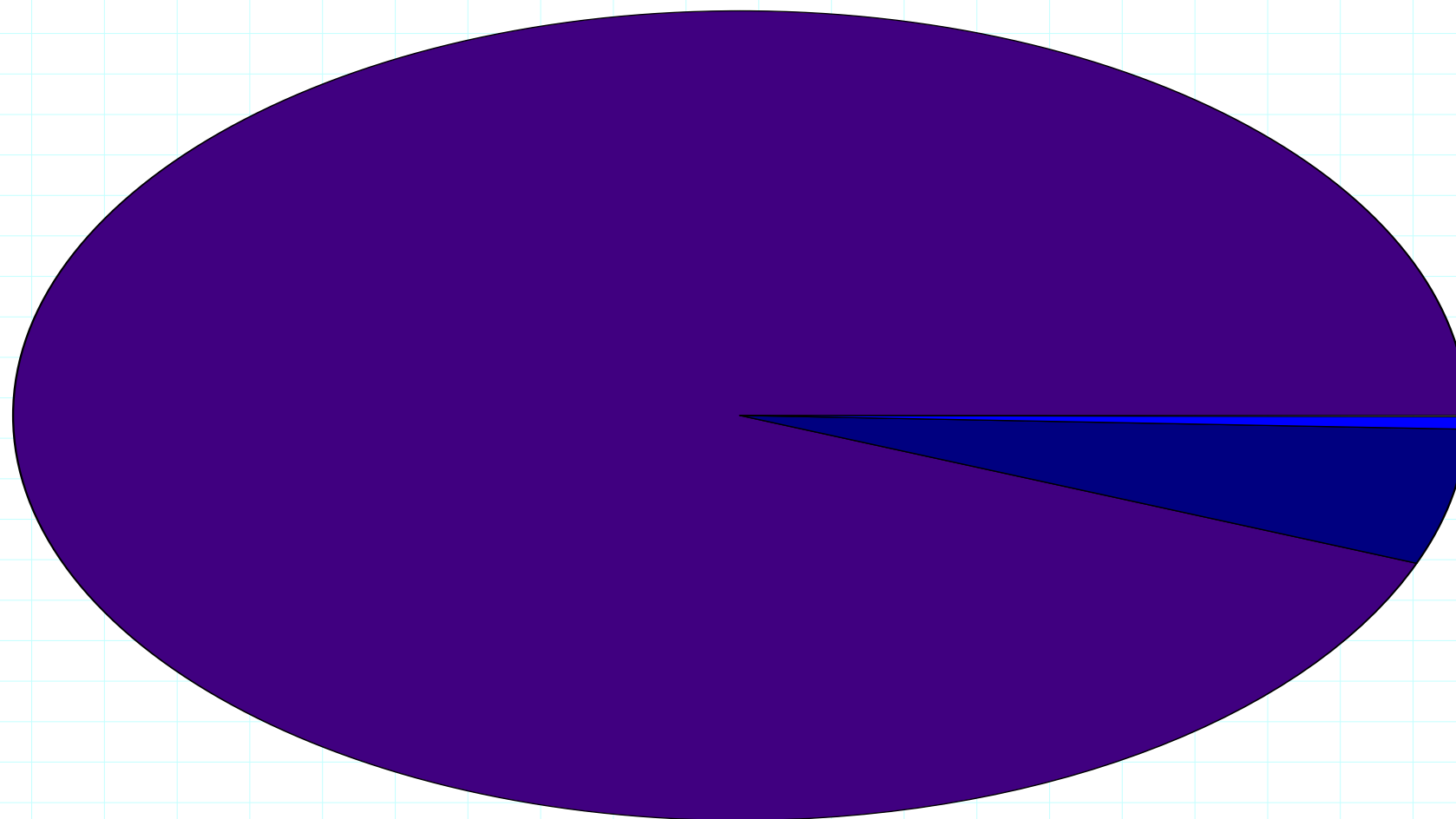
- Colorado River average concentration = 224  $\mu\text{g/L}$ ,  $n = 34$
- Las Vegas Wash average concentration = 788  $\mu\text{g/L}$ ,  $n = 26$
- Virgin River average concentration = 98  $\mu\text{g/L}$ ,  $n = 23$
- Muddy River average concentration = 78  $\mu\text{g/L}$ ,  $n = 19$
- Rogers Spring concentration = 9  $\mu\text{g/L}$ ,  $n = 1$



# Total Phosphorus Loads

- Colorado River =  $2.9 \times 10^6$  kg/yr
- Las Vegas Wash =  $1.67 \times 10^5$  kg/yr
- Virgin River average =  $1.43 \times 10^4$  kg/yr
- Muddy River =  $1.39 \times 10^3$  kg/yr

# T o t a l P h o s p h o r u s I n p u t s t o L a k e M e a d

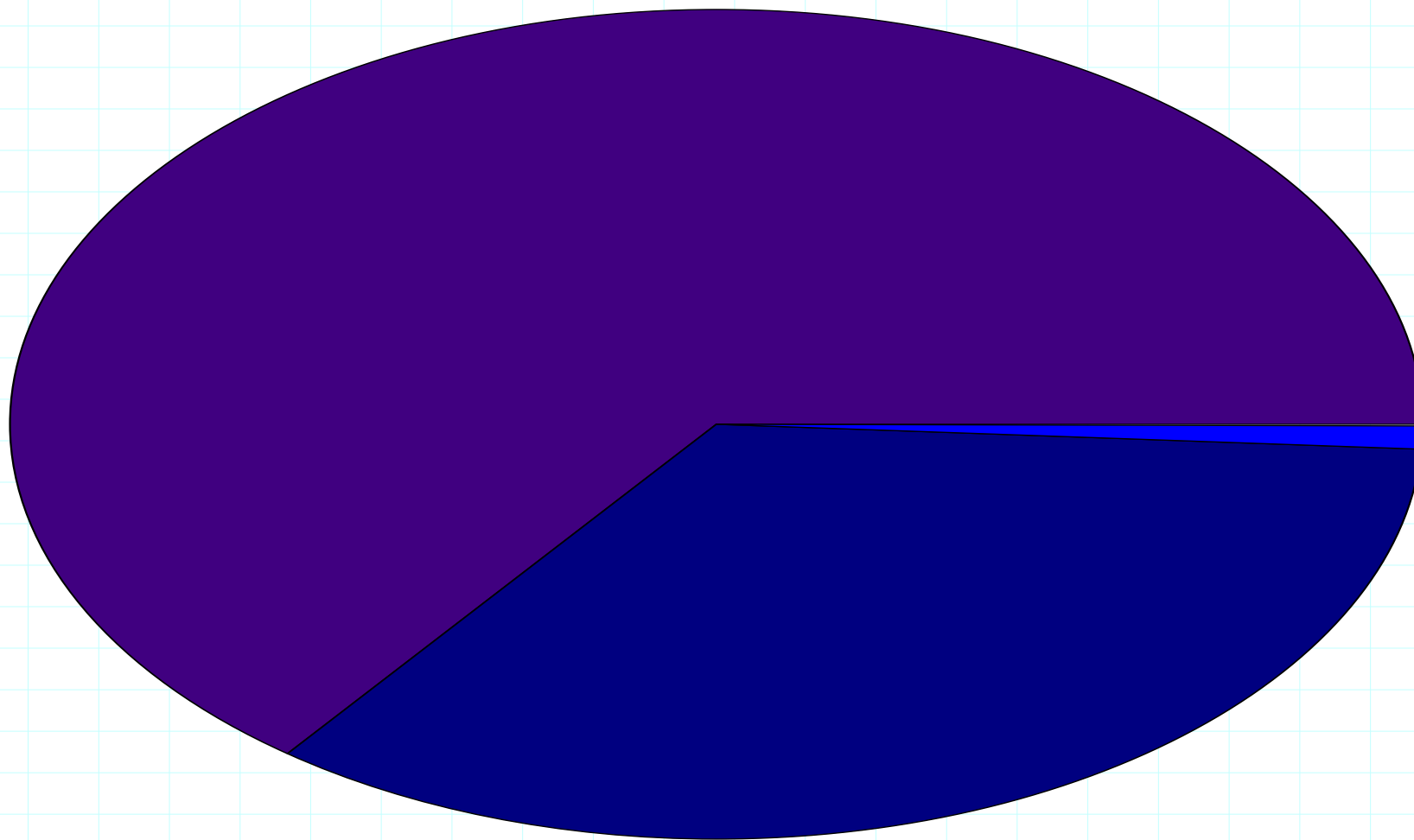


■	C o l o r a d o R i v e r =	9 4 . 1 %
■	L a s V e g a s W a s h =	5 . 4 %
■	V i r g i n R i v e r =	0 . 5 0 %
■	M u d d y R i v e r =	0 . 0 5 %

## Dissolved Ortho P Loads

- Colorado River =  $3.90 \times 10^4$  kg/yr
- Las Vegas Wash =  $2.80 \times 10^4$  kg/yr
- Virgin River average = 523 kg/yr
- Muddy River = 49 kg/yr

# S o l u b l e   O r t h o   P   I n p u t s   t o   L a k e   M e a d



C o l o r a d o   R i v e r   =   6 4 . 6 %  
L a s   V e g a s   W a s h   =   3 4 . 4 %  
V i r g i n   R i v e r   =   0 . 9 0 %  
M u d d y   R i v e r   =   0 . 0 7 %



# Perchlorate Budget

- Perchlorate was detected at all Las Vegas Bay and most Boulder Basin stations on every sampling date
- Perchlorate was detected 9 times at Station CR360.7 but only one time at all other upstream stations
- Acoustic Doppler studies conducted by Reclamation show that water at Station CR360.7, located at the Narrows, can flow upstream from Boulder Basin
- All perchlorate in Lake Mead appears to originate in Las Vegas Wash

## Next Steps

- Look for correlations between flow and concentrations to improve loading calculations
- Use data from Interagency Database and CWC to evaluate nonpoint source loadings from Las Vegas Wash
- Provide a better accounting of flows from treatment plants
- Evaluate phosphorus losses from the system

