Assignment 1: Aidan Power, Fiona Price, and Emily Burghart

2024-09-18

Setting up the packages and data

Loading in the packages:

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(ggplot2)
library(here)
```

```
## here() starts at /home/guest/Hydrology/Assignment 1
```

```
library(dplyr)
```

Now, we will load in the Eno data and make separate dataframes for the median outflow, mean outflow, and volume.

```
#Eno data:
eno_outflows <- read.csv(
  file = here("./Data Raw/Eno_River_monthly_flow_data_through-2022.csv"),
  stringsAsFactors = TRUE)
#Average of median outflow:
eno_average_median <- eno_outflows %>%
  group_by(year) %>%
  summarise(avg_median_flow = mean(median_flow, na.rm = TRUE))
#Average of mean outflow:
eno_average_mean <- eno_outflows %>%
  group_by(year) %>%
  summarise(avg_mean_flow = mean(mean_flow, na.rm = TRUE))
#Average of volume:
eno_volume_mean <- eno_outflows %>%
  group_by(year) %>%
  summarise(avg_vol = mean(total_volume, na.rm = TRUE))
```

Now, we will load in the Flat data and make separate dataframes for the median outflow, mean outflow, and volume.

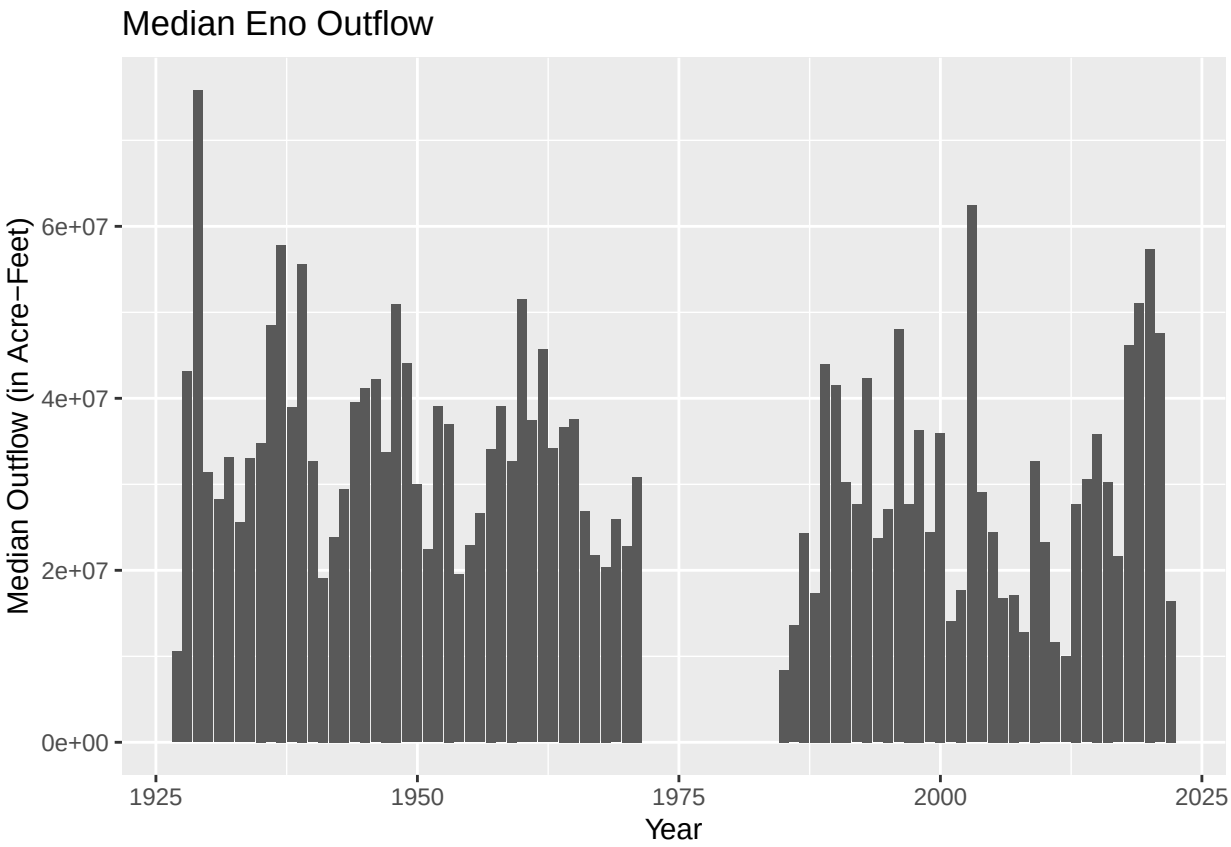
```
#Flats data:
flat_outflows <- read.csv(
  file = here("./Data Raw/Flat_River_monthly_flow_data_through-2022.csv"),
  stringsAsFactors = TRUE)
#Average of median outflow:
flat_average_median <- flat_outflows %>%
  group_by(year) %>%
  summarise(avg_median_flow = mean(median_flow, na.rm = TRUE))
#Average of mean outflow:
flat_average_mean <- flat_outflows %>%
  group_by(year) %>%
  summarise(avg_mean_flow = mean(mean_flow, na.rm = TRUE))
#Average of volume:
flat_volume_mean <- flat_outflows %>%
  group_by(year) %>%
  summarise(avg_vol = mean(total_volume, na.rm = TRUE))
```

Now, we will load in the Neuse data and make separate dataframes for the median inflow, mean inflow, and volume.

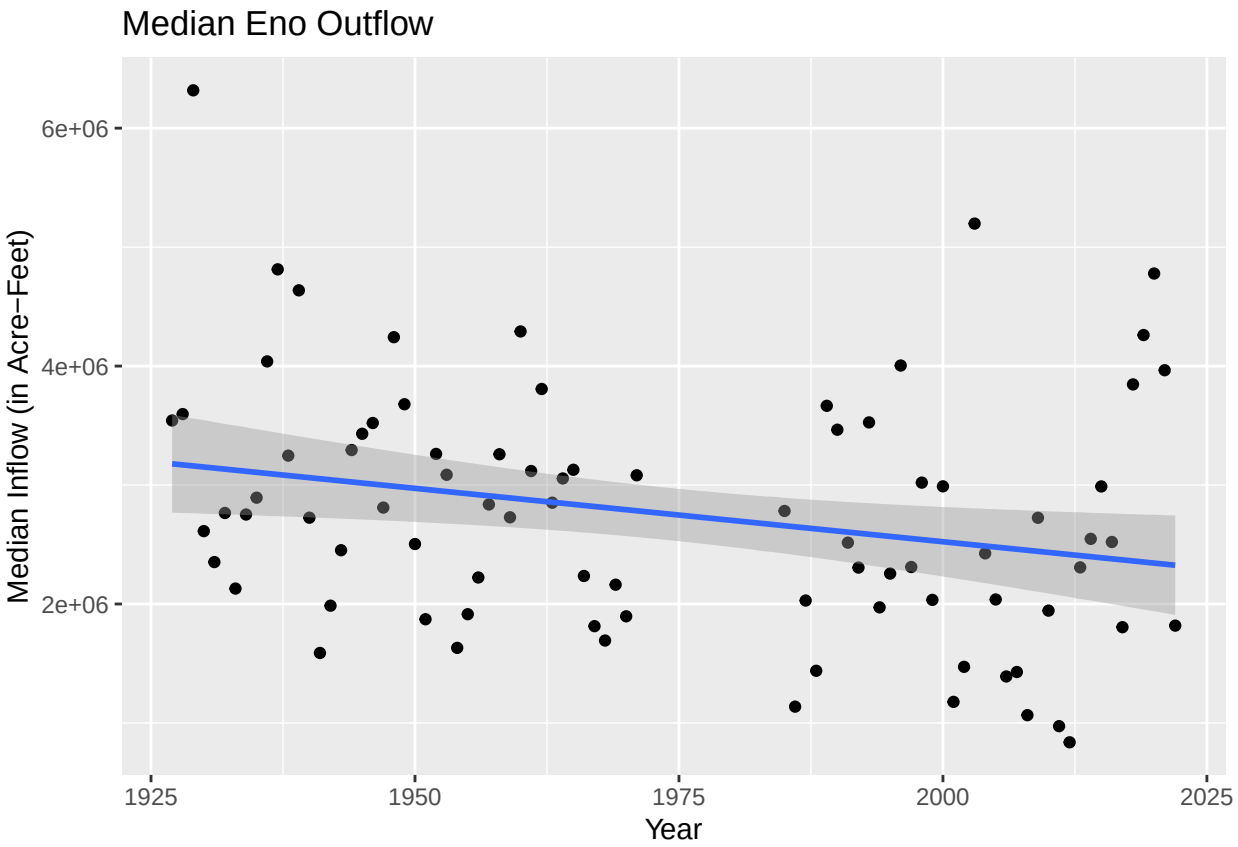
```
#Neuse data:
neuse_inflows <- read.csv(
  file = here("./Data Raw/Falls_Lake_outlet_Neuse_River_monthly_flow_data_through-2022.csv"),
  stringsAsFactors = TRUE)
#Average of median inflow:
neuse_average_median <- neuse_inflows %>%
  group_by(year) %>%
  summarise(avg_median_flow = mean(median_flow, na.rm = TRUE))
#Average of mean inflow:
neuse_average_mean <- neuse_inflows %>%
  group_by(year) %>%
  summarise(avg_mean_flow = mean(mean_flow, na.rm = TRUE))
#Average of volume:
neuse_volume_mean <- neuse_inflows %>%
  group_by(year) %>%
  summarise(avg_vol = mean(total_volume, na.rm = TRUE))
```

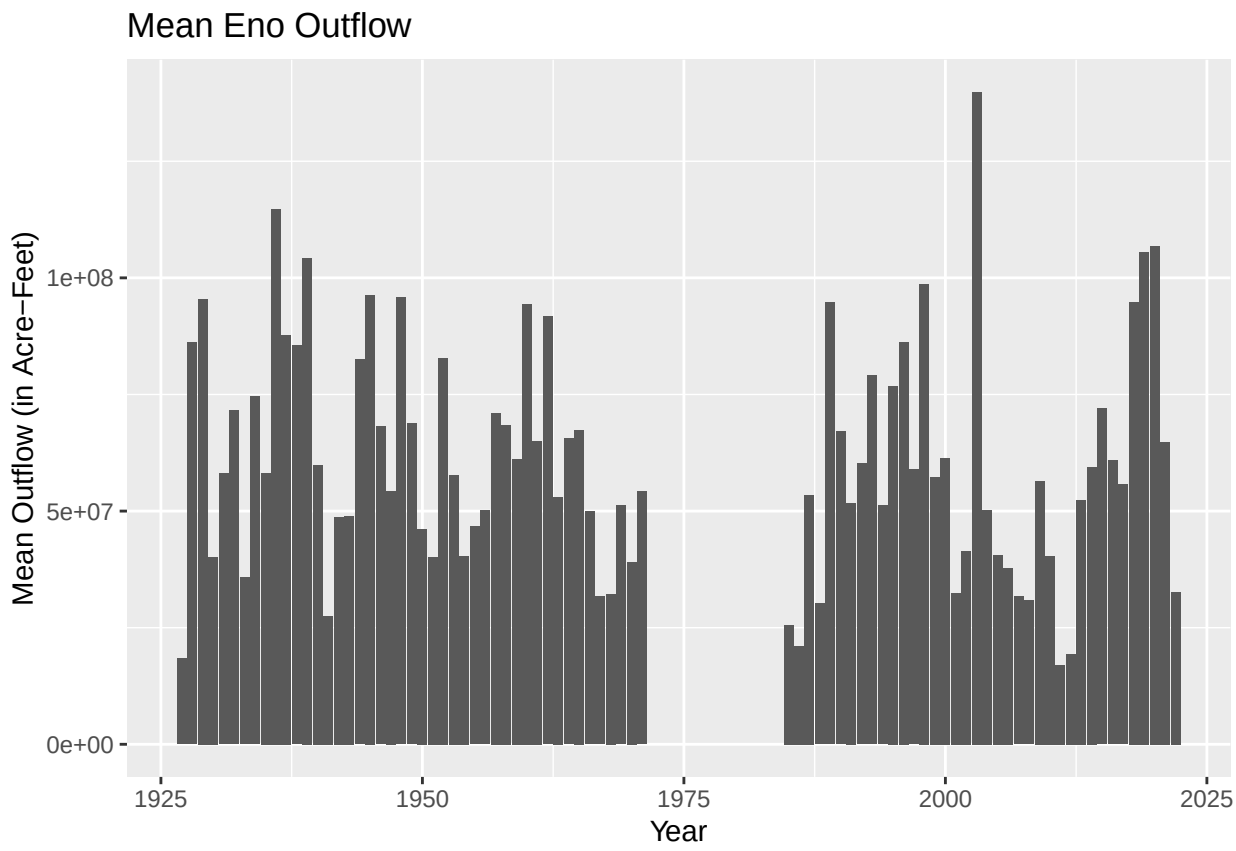
Plots

Now, we will start making graphs. First, we will look at Eno. We will start with all years.

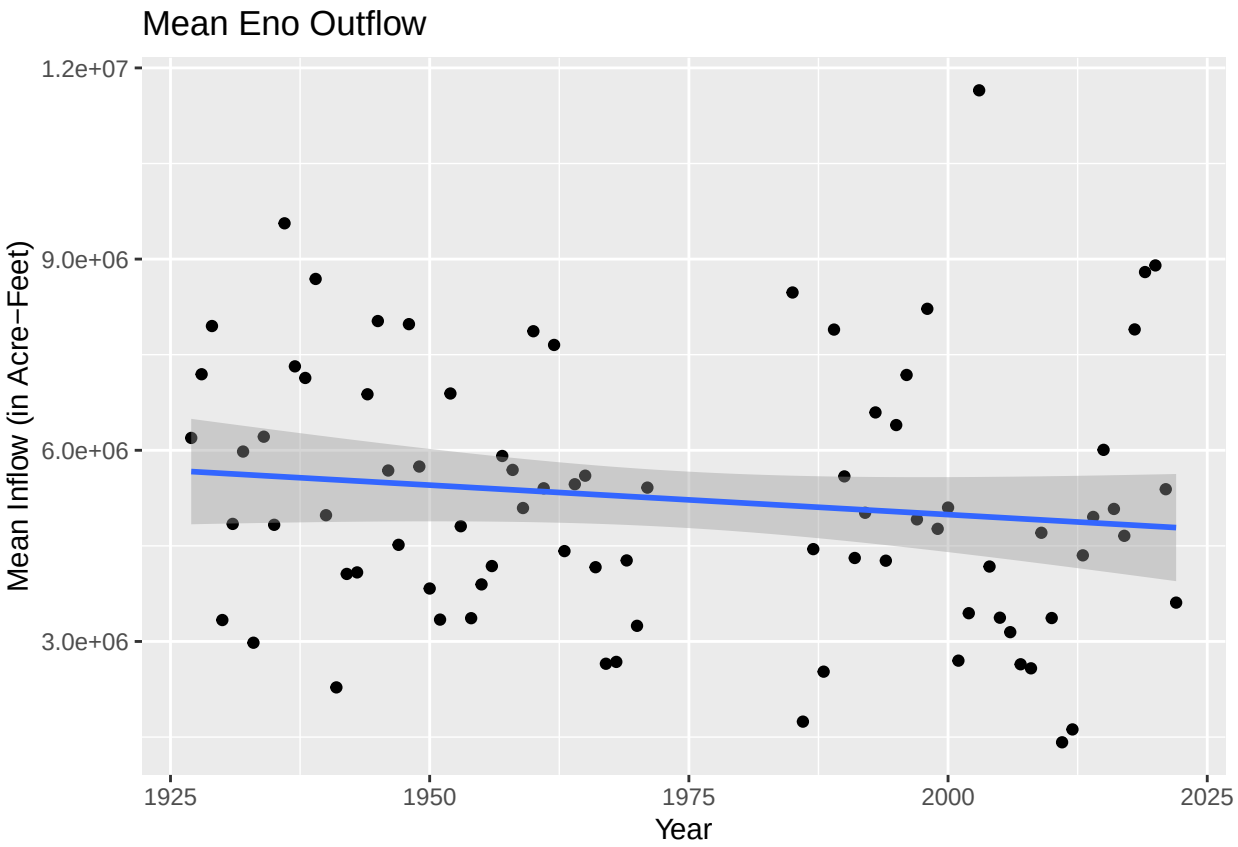


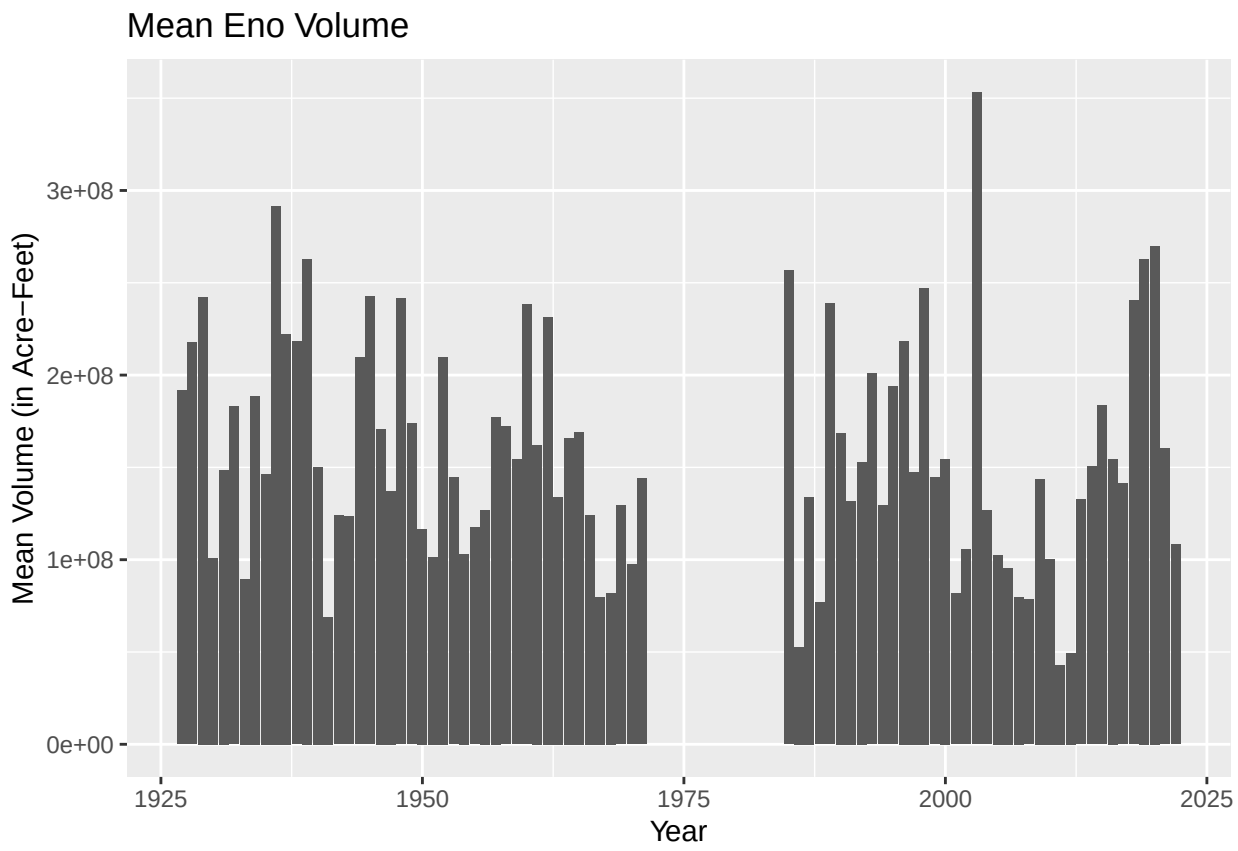

```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Eno Outflow
Median Inflow (in Acre−Feet)
6e+06
4e+06
2e+06
1925
1950
1975
2000
2025
Year

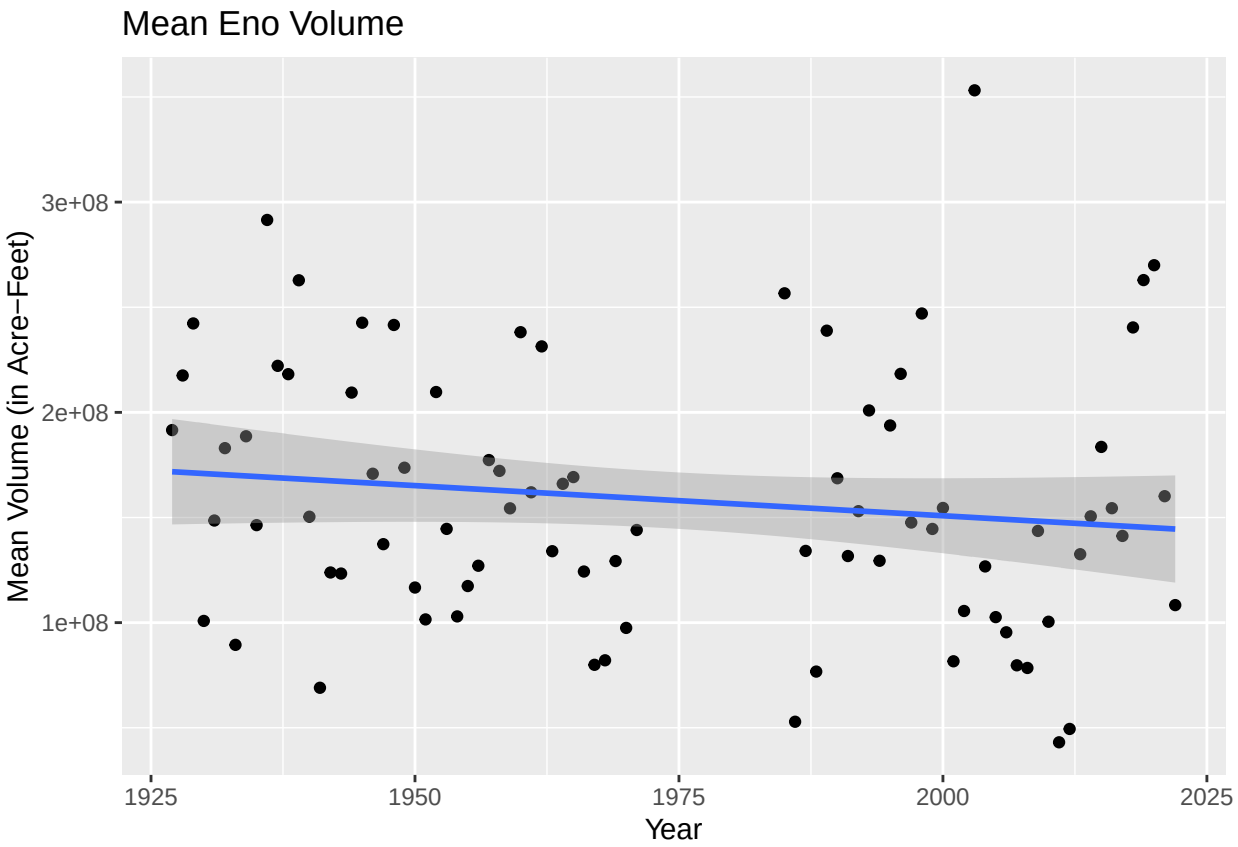



```
## `geom_smooth()` using formula = 'y ~ x'
```

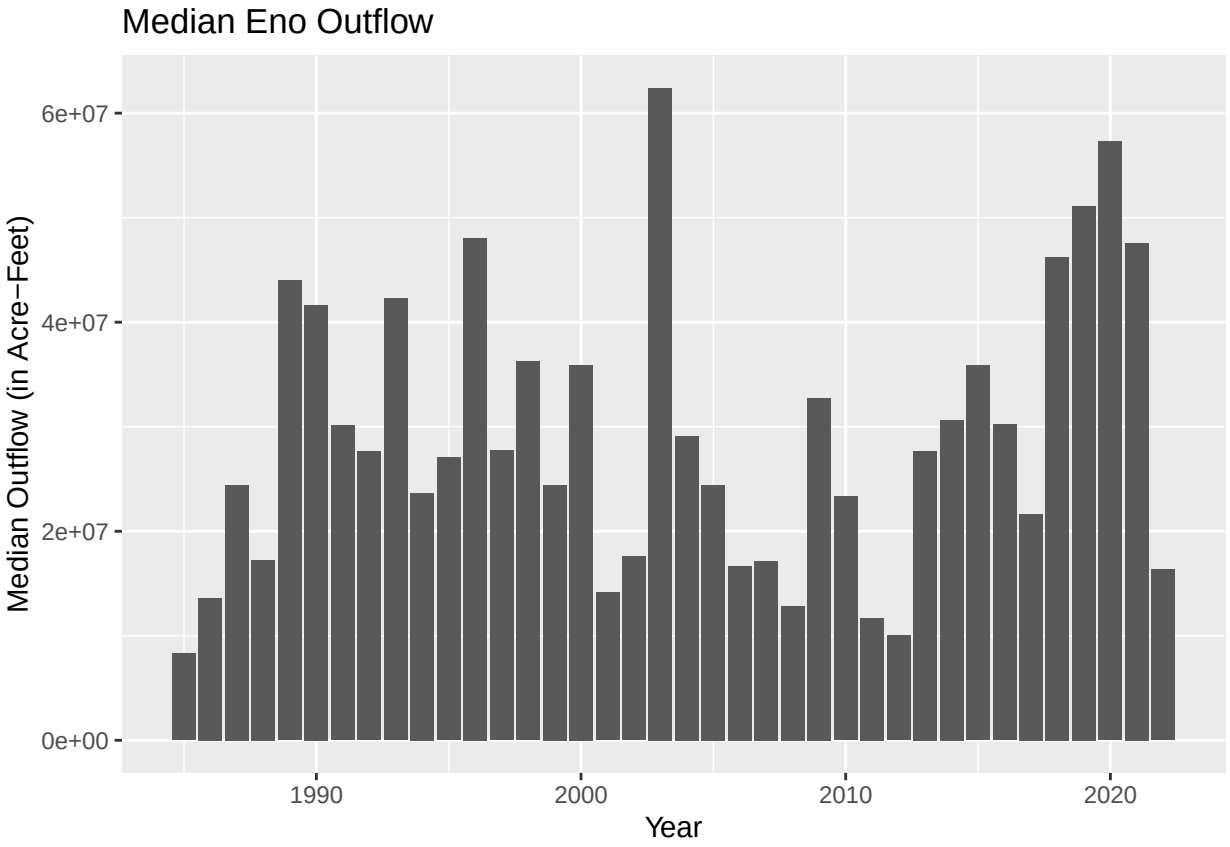

Mean Eno Outflow
1.2e+07
9.0e+06
6.0e+06
3.0e+06
Mean Inflow (in Acre−Feet)
1925
1950
1975
2000
2025
Year



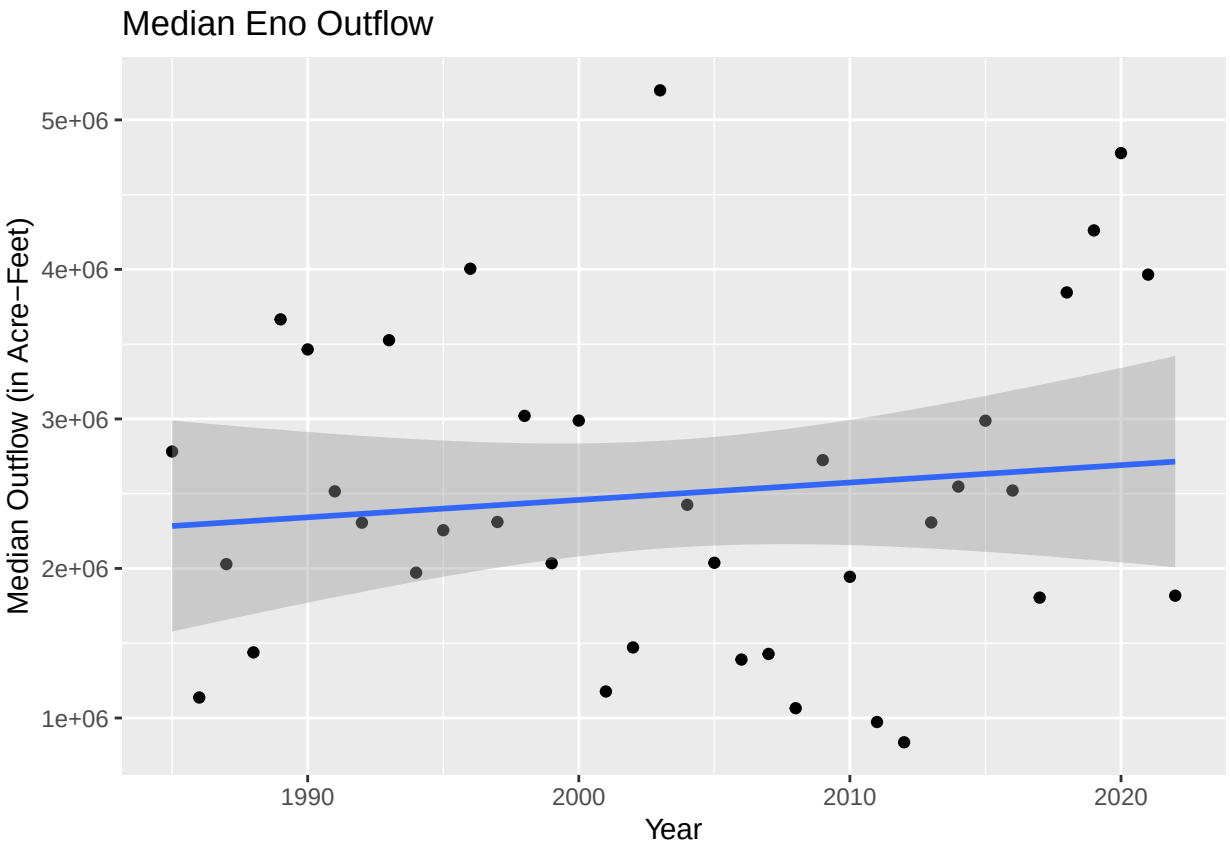

```
## `geom_smooth()` using formula = 'y ~ x'
```

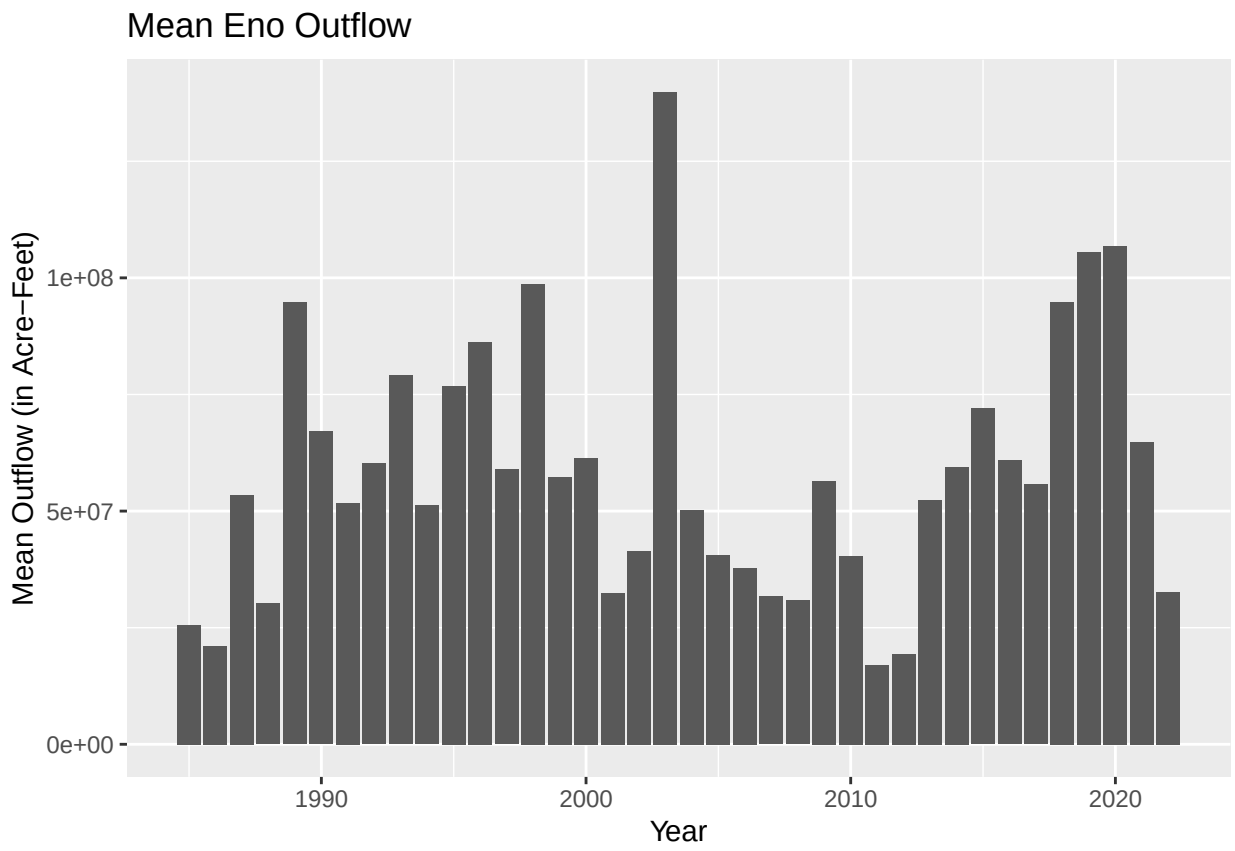


There is a gap in Eno data from 1971-1985. Now, we will look only at the post-1985 data.

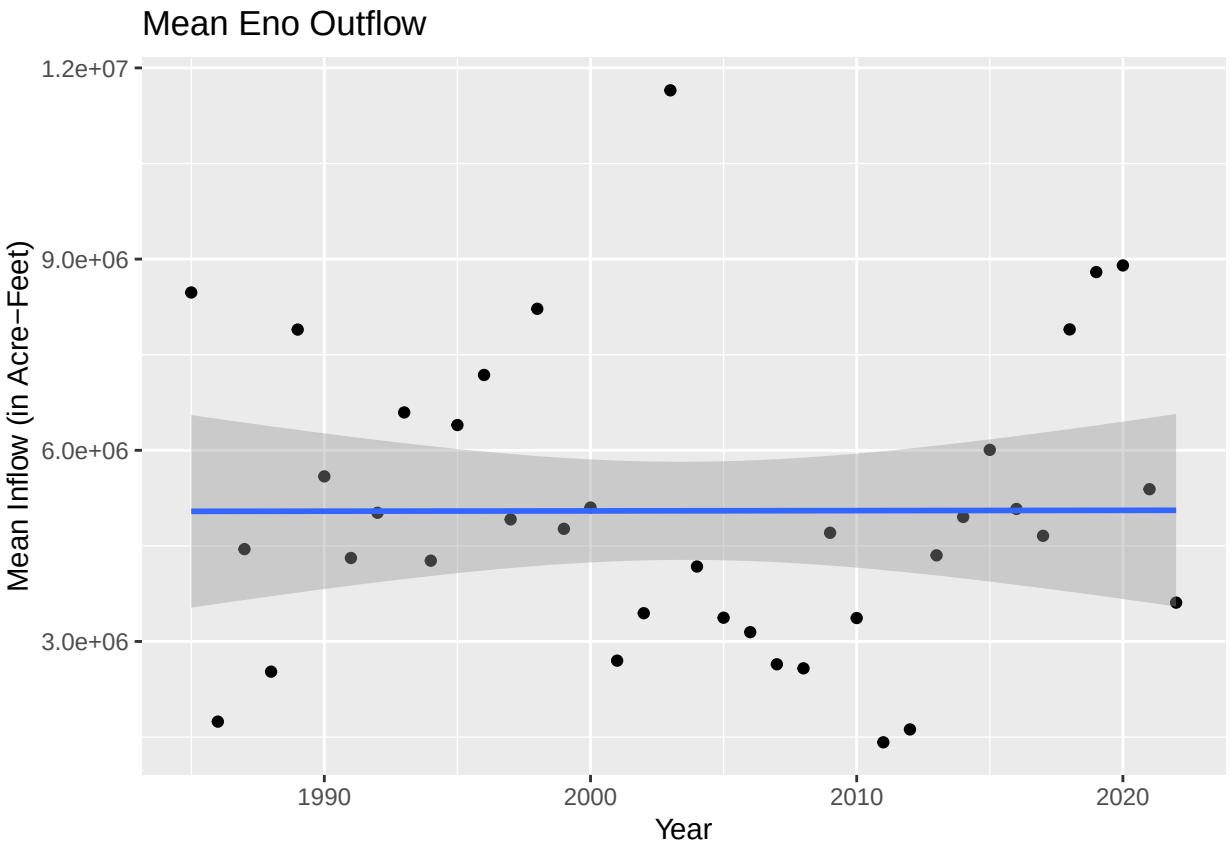


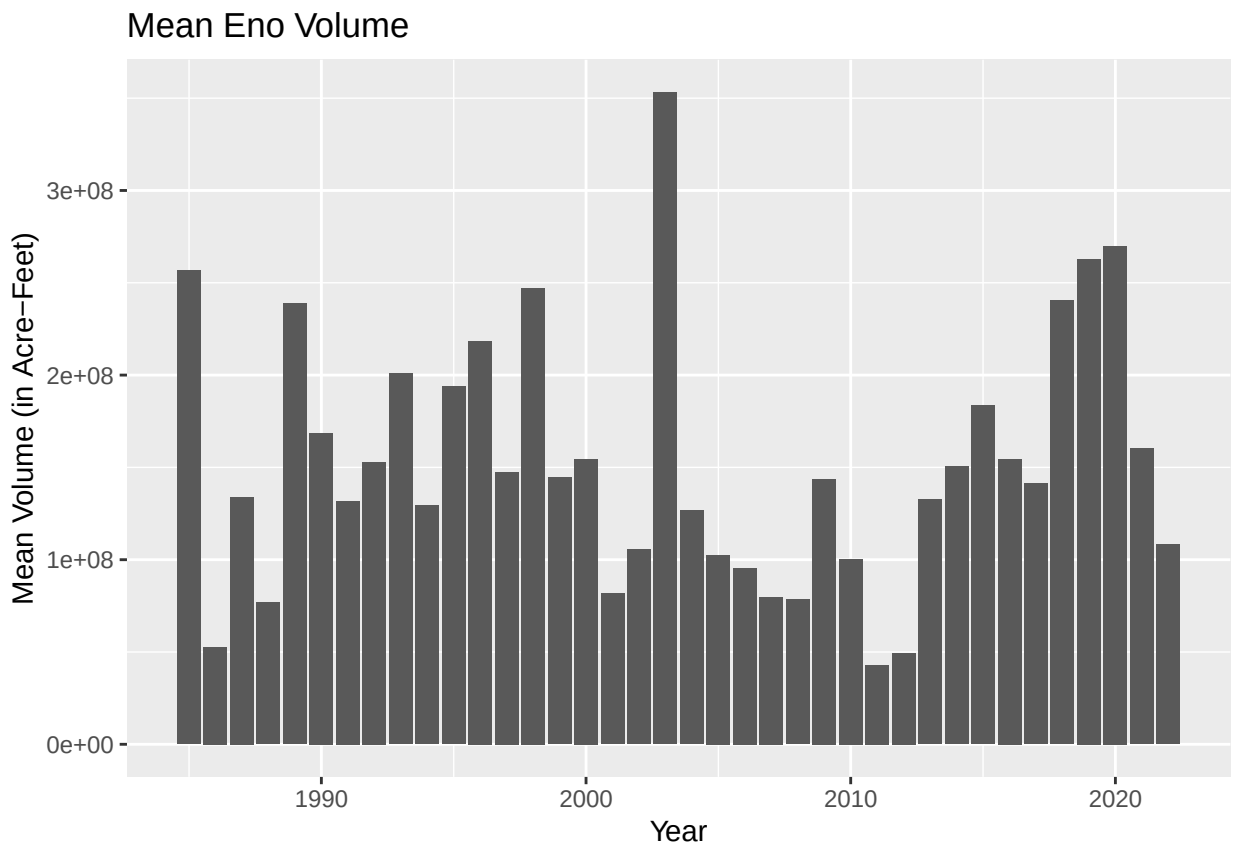

```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Eno Outflow
Median Outflow (in Acre−Feet)
5e+06
4e+06
3e+06
2e+06
1e+06
1990
2000
2010
2020
Year

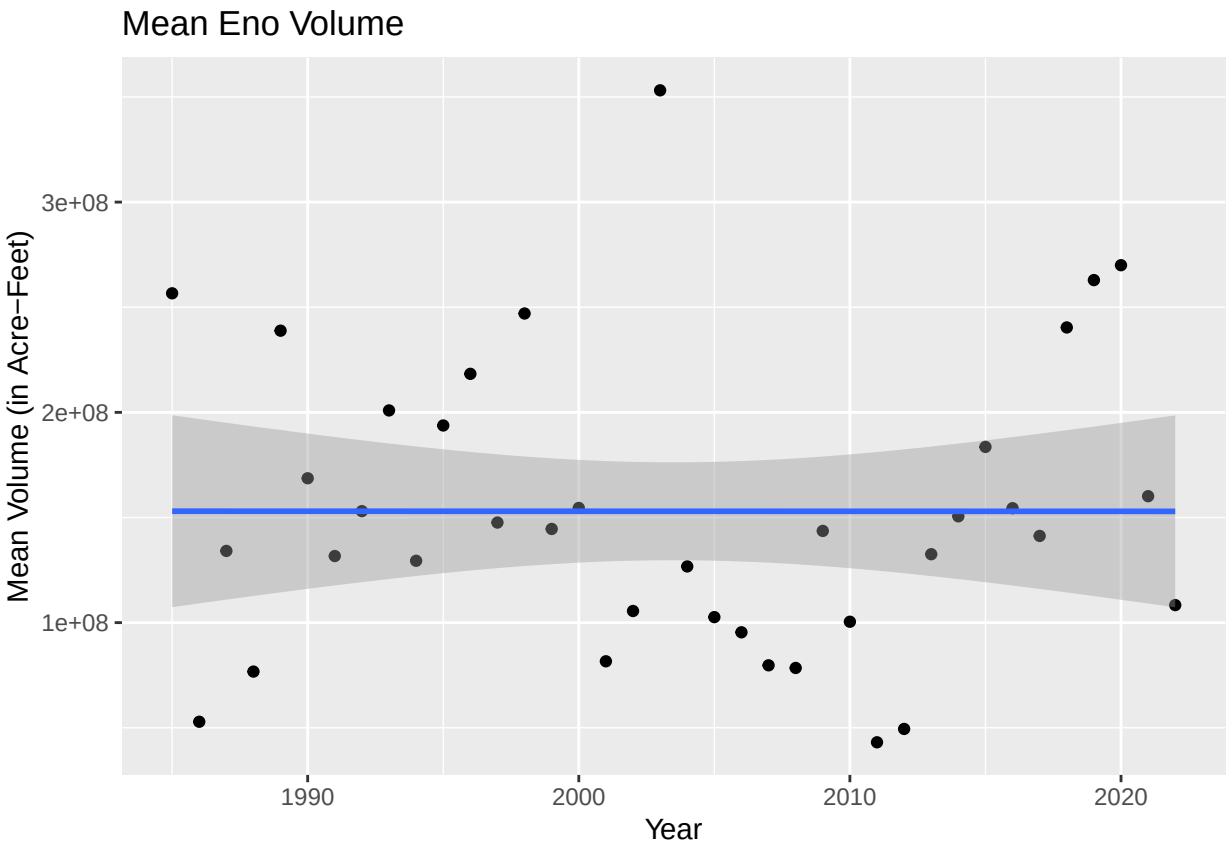


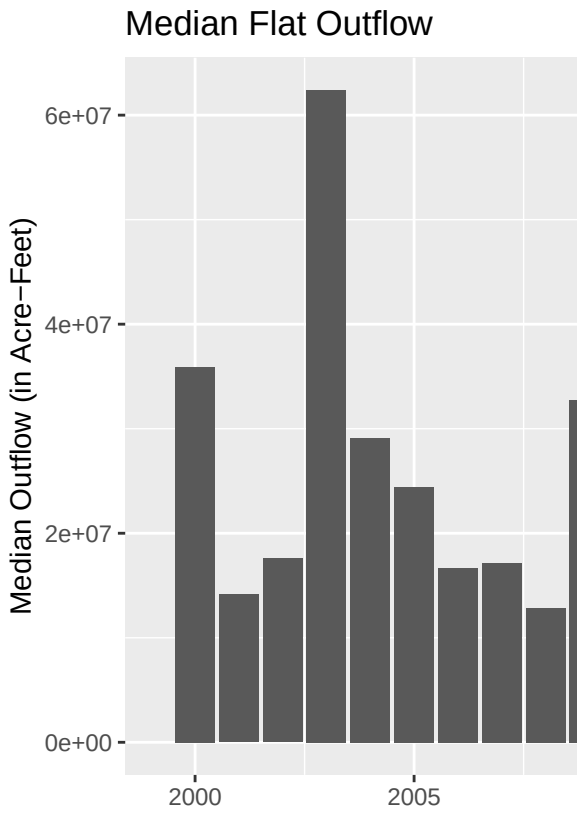

```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Eno Outflow
1.2e+07
9.0e+06
6.0e+06
3.0e+06
Mean Inflow (in Acre−Feet)
1990
2000
2010
2020
Year



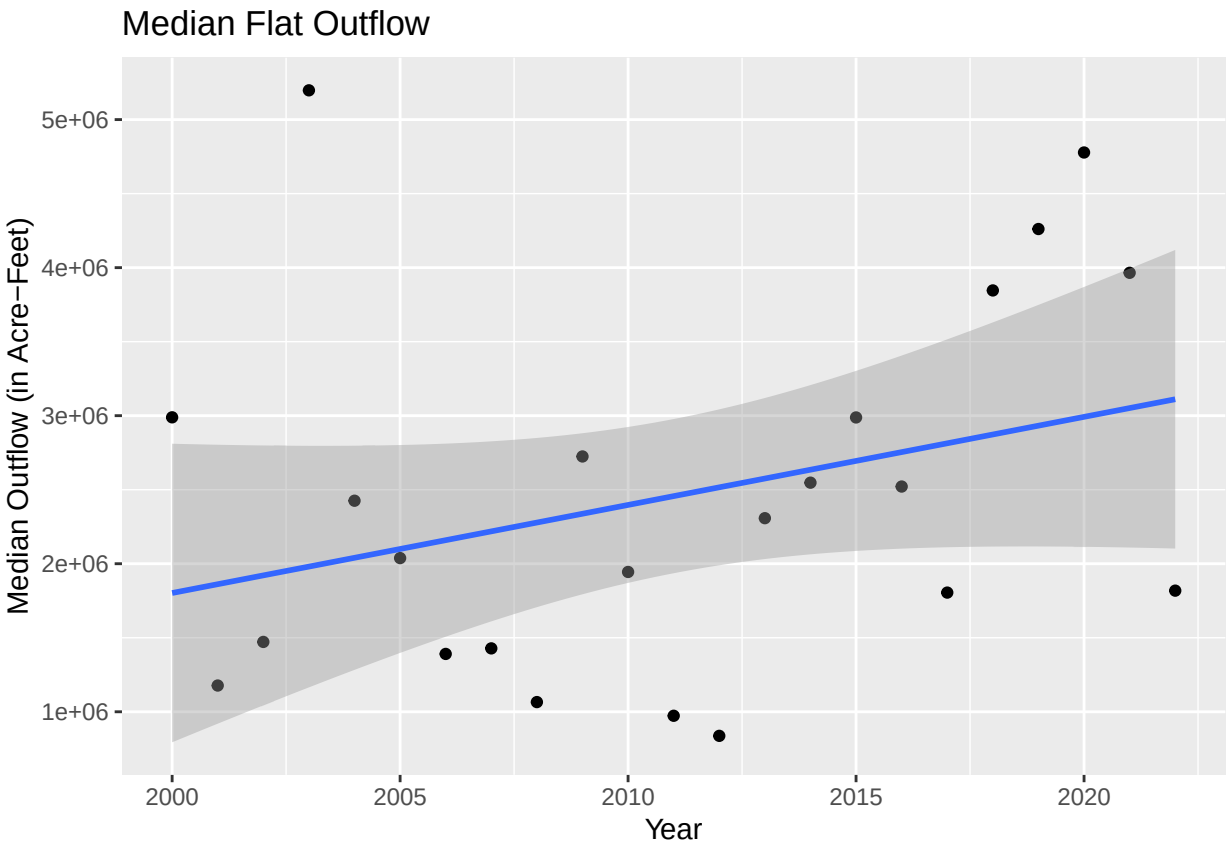

```
## `geom_smooth()` using formula = 'y ~ x'
```

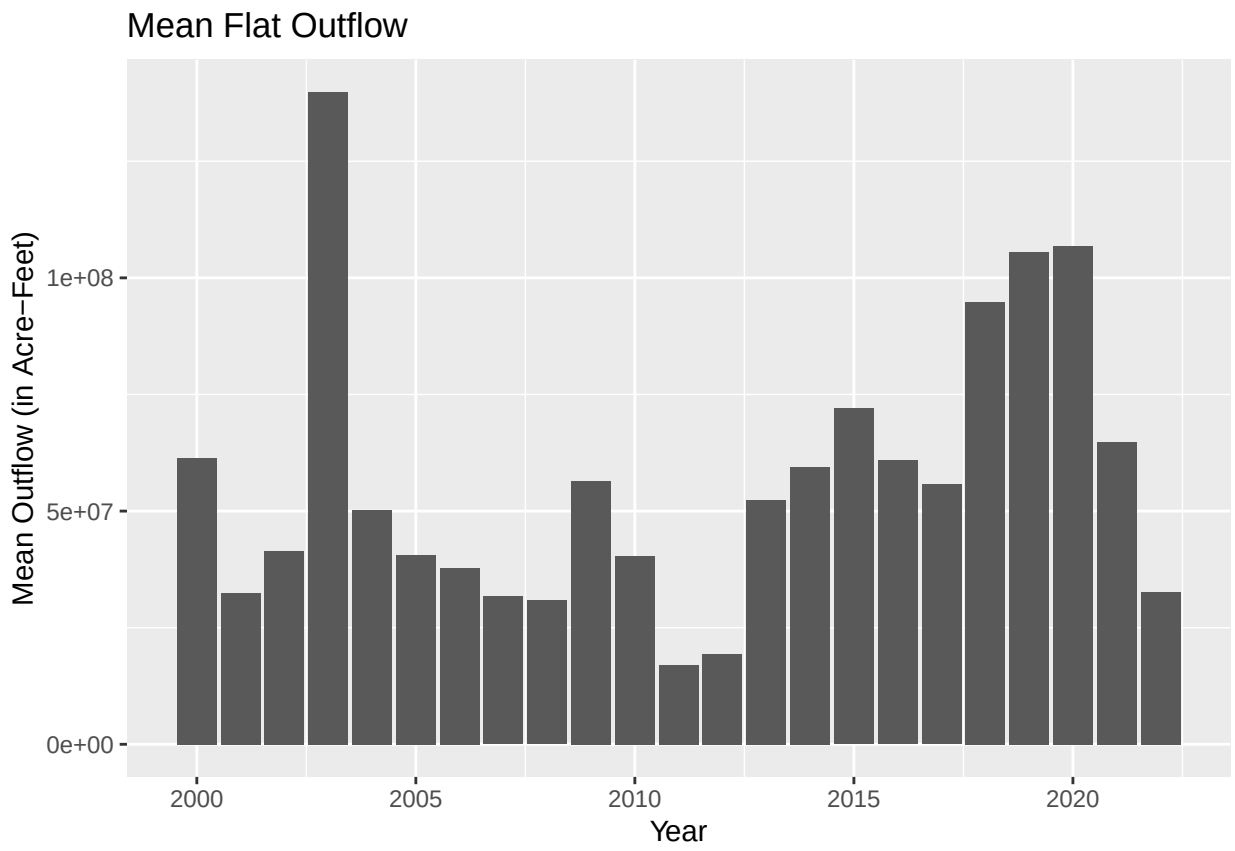

Mean Eno Volume
Mean Volume (in Acre−Feet)
3e+08
2e+08
1e+08
1990
2000
2010
2020
Year



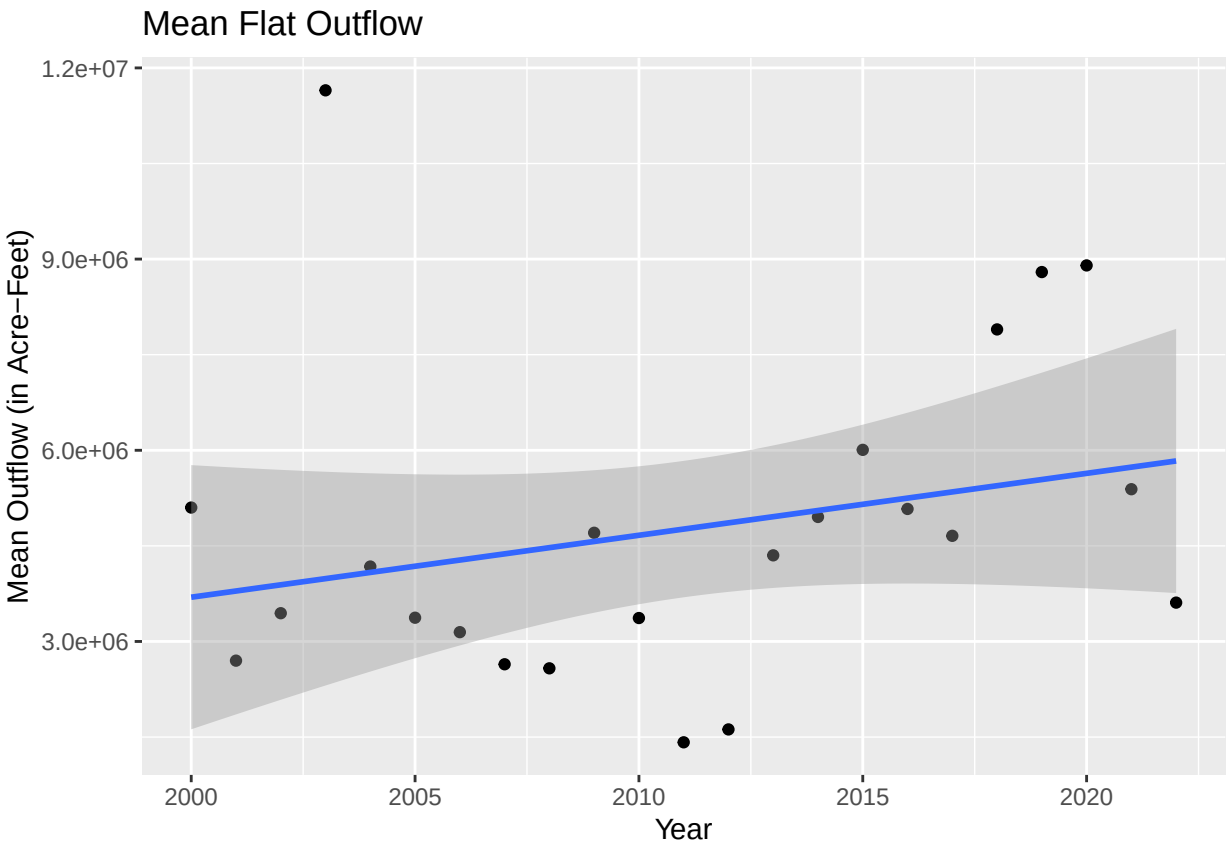
Lastly, we will look at only years 2000 and beyond to capture recent trends.

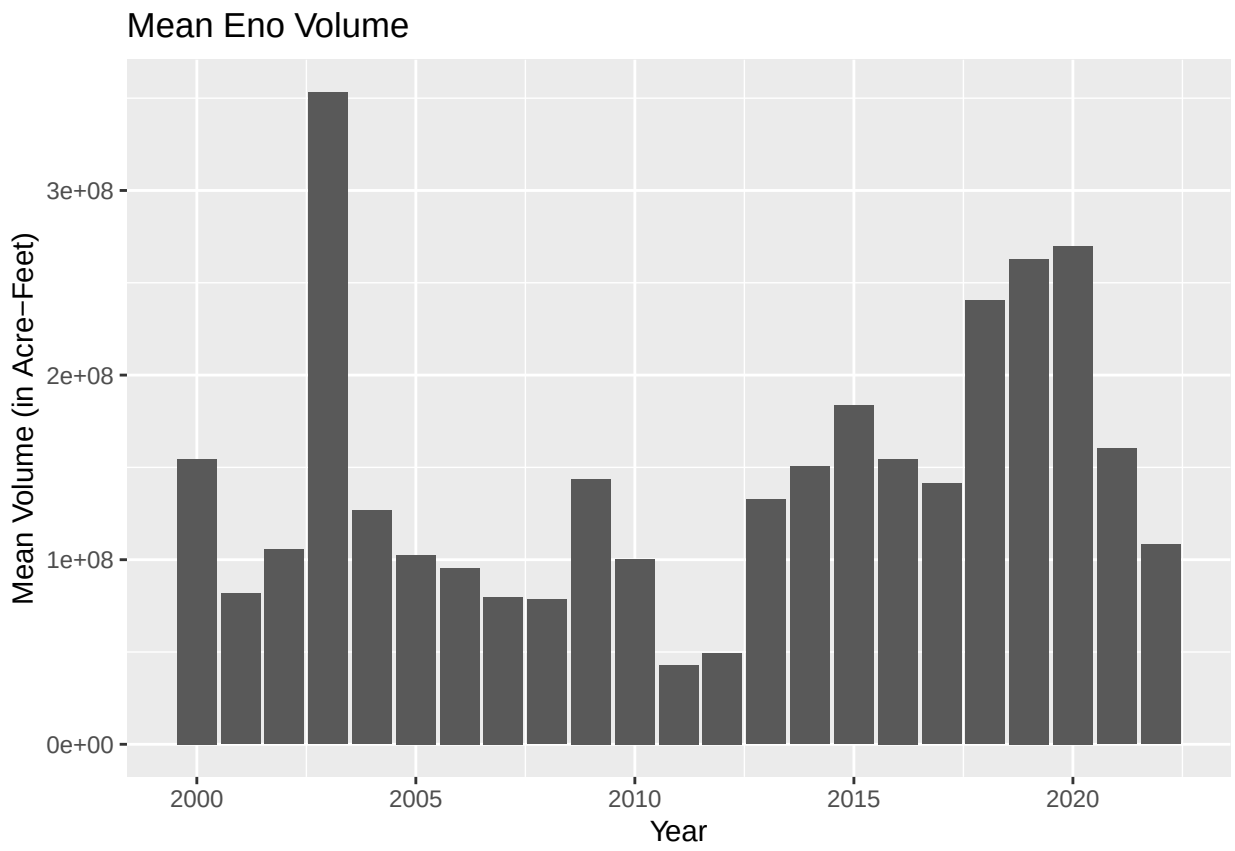
```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Flat Outflow
Median Outflow (in Acre−Feet)
5e+06
4e+06
3e+06
2e+06
1e+06
2000
2005
2010
2015
2020
Year

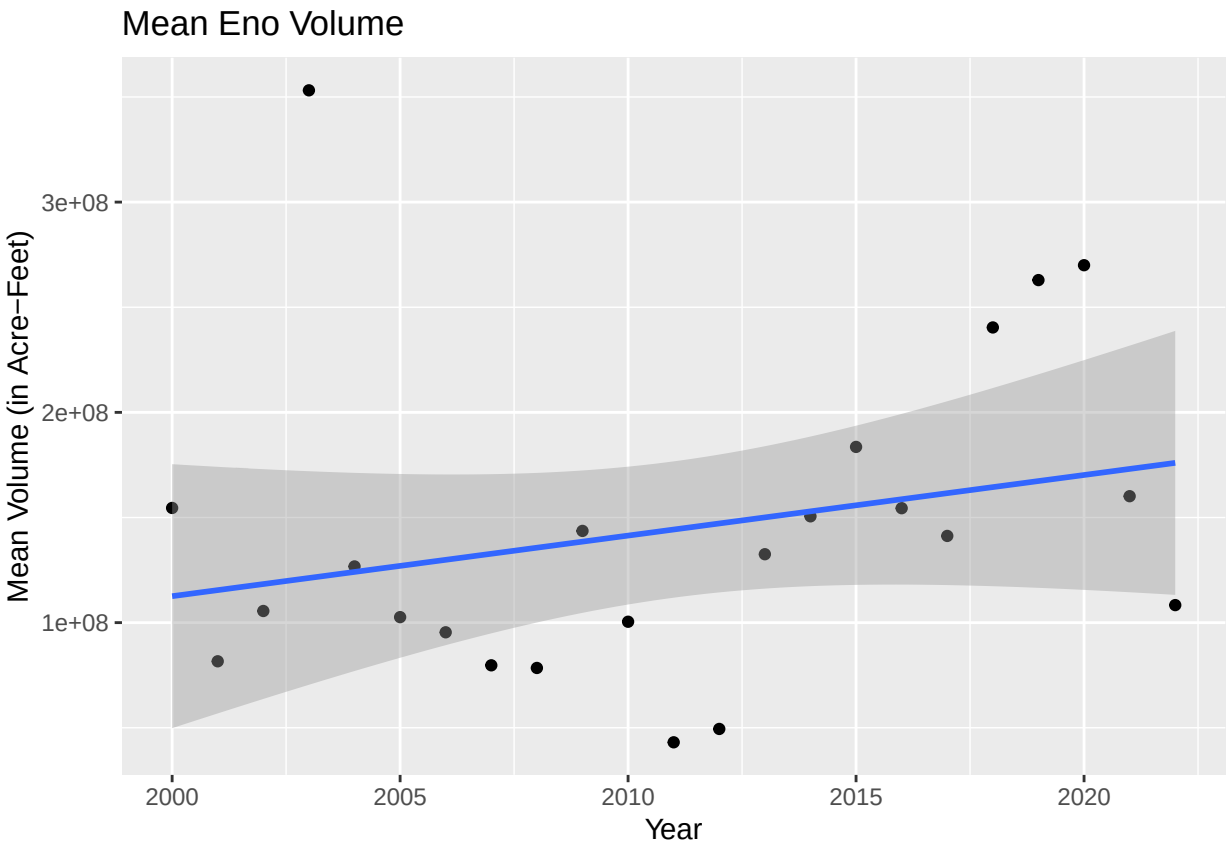


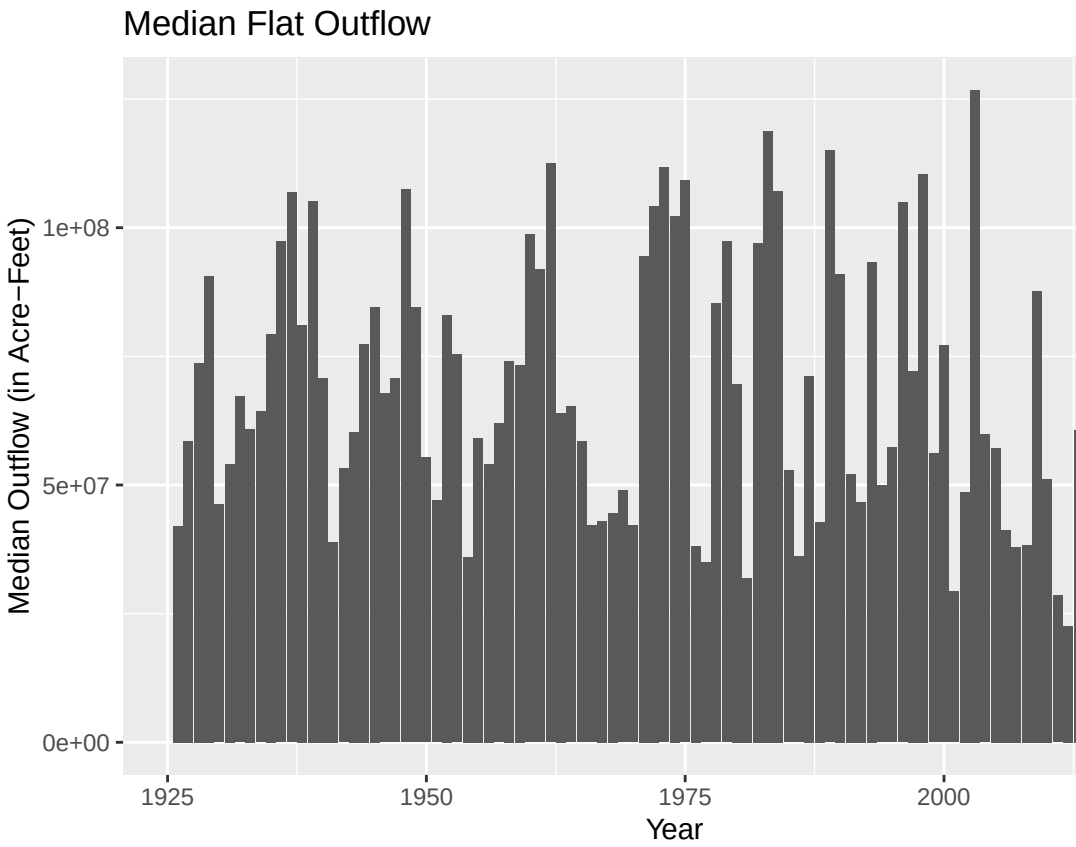

```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Flat Outflow
1.2e+07
9.0e+06
6.0e+06
3.0e+06
Mean Outflow (in Acre−Feet)
2000
2005
2010
2015
2020
Year



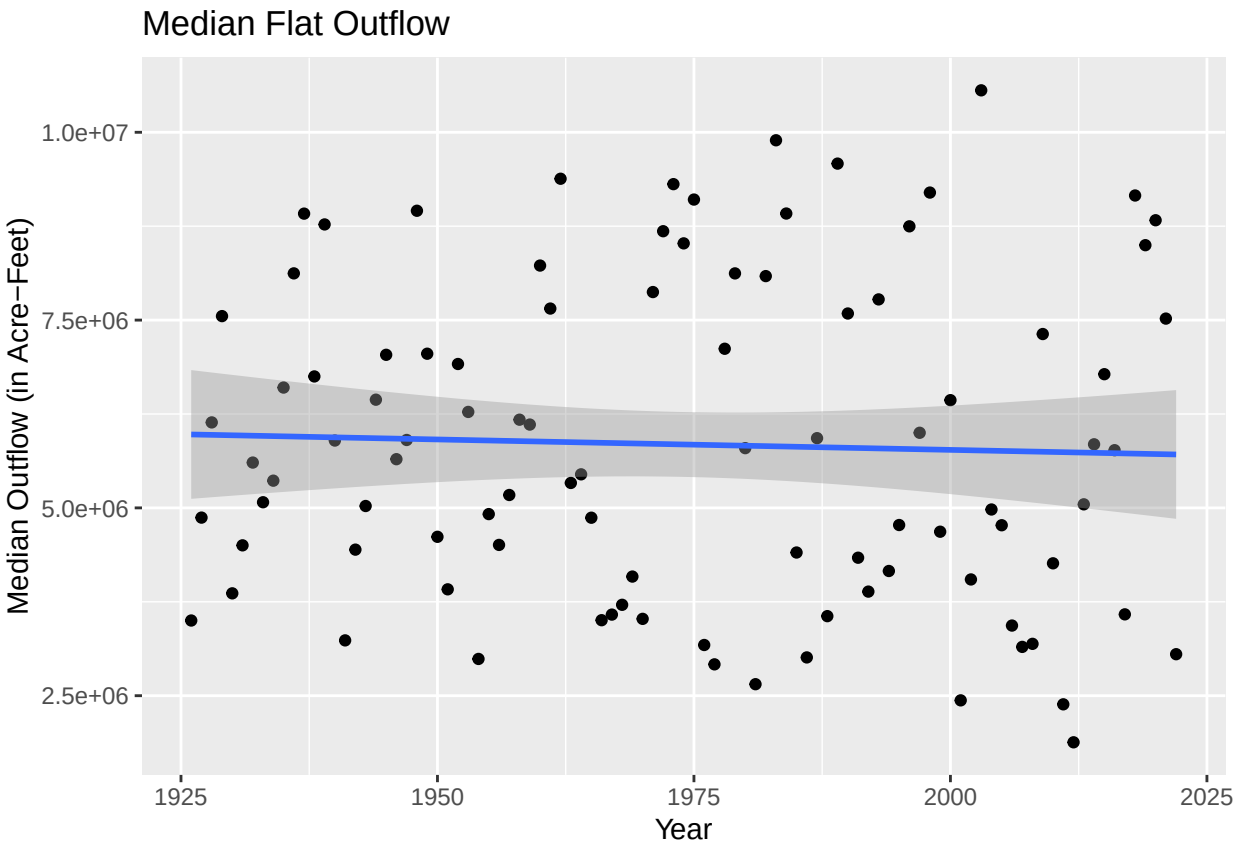

```
## `geom_smooth()` using formula = 'y ~ x'
```

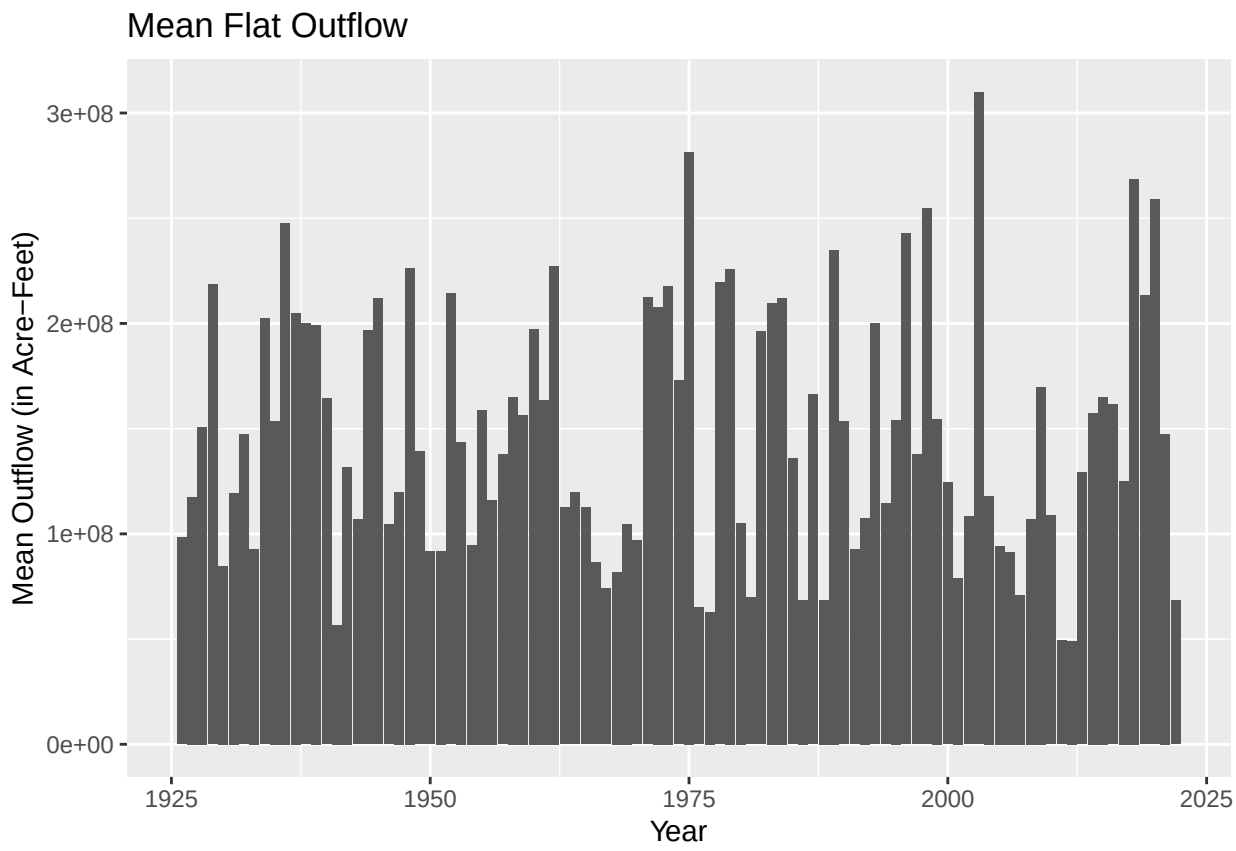

Mean Eno Volume
Mean Volume (in Acre−Feet)
3e+08
2e+08
1e+08
2000
2005
2010
2015
2020
Year



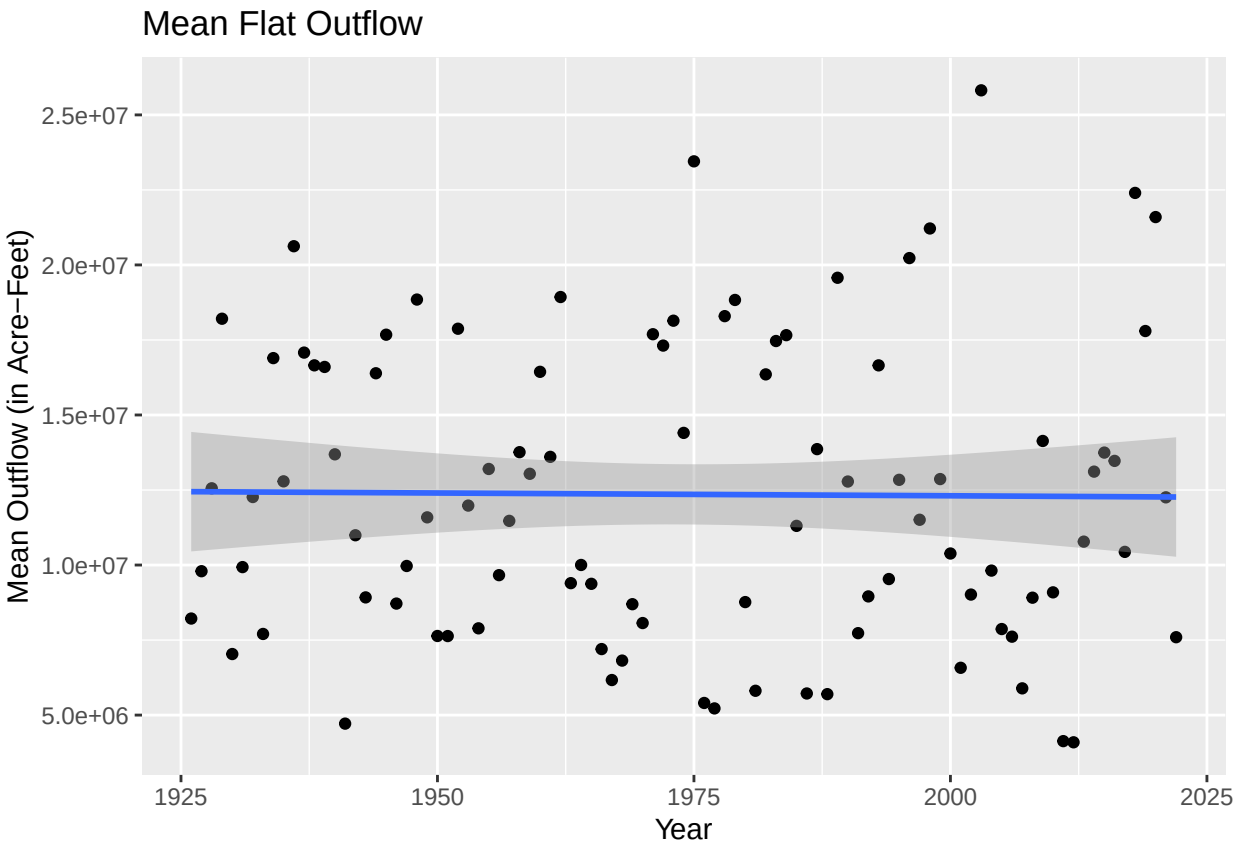
Now, we will look at Flat data.

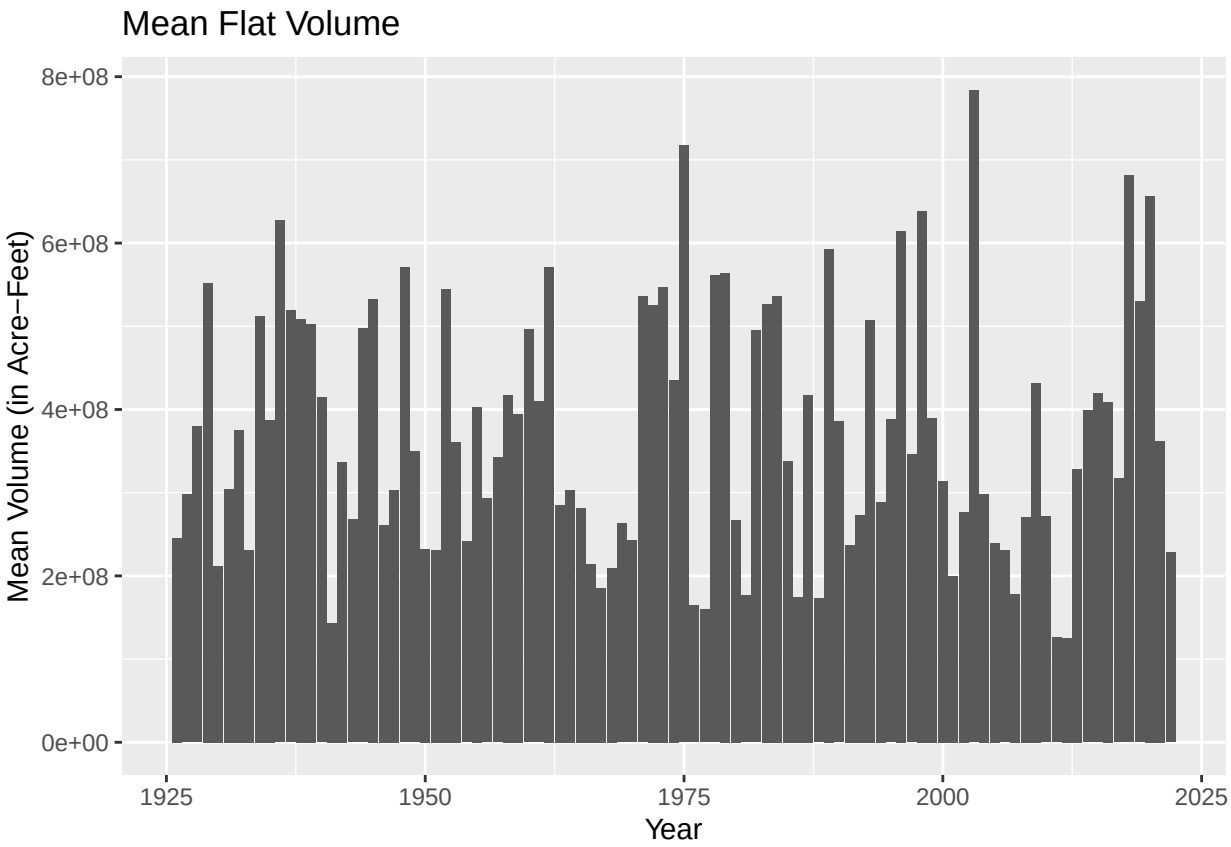
```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Flat Outflow
Median Outflow (in Acre−Feet)
1.0e+07
7.5e+06
5.0e+06
2.5e+06
1925
1950
1975
2000
2025
Year

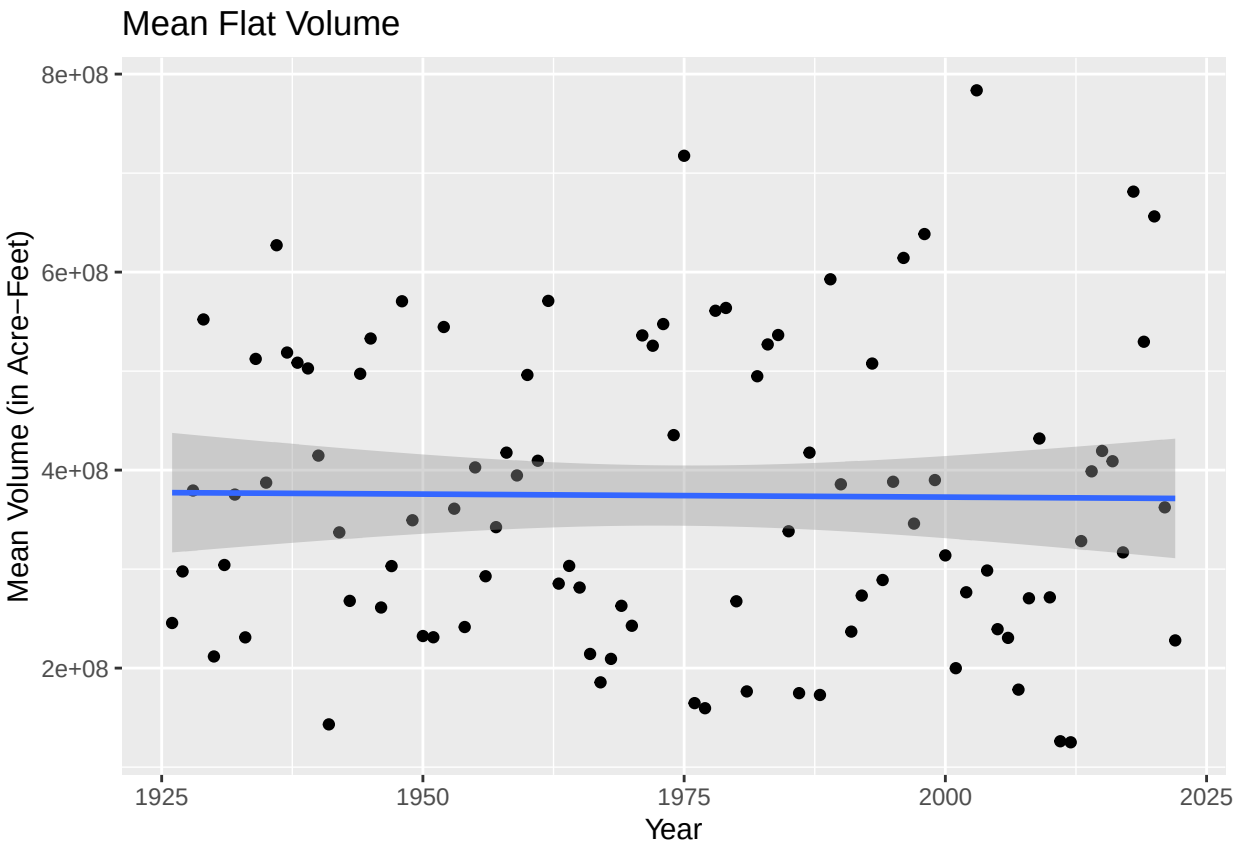


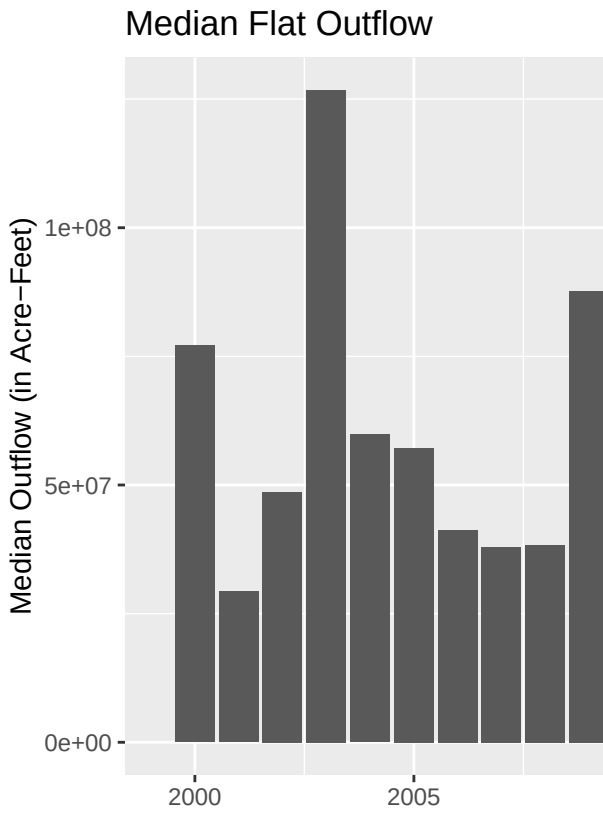

```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Flat Outflow
Mean Outflow (in Acre−Feet)
2.5e+07
2.0e+07
1.5e+07
1.0e+07
5.0e+06
1925
1950
1975
2000
2025
Year



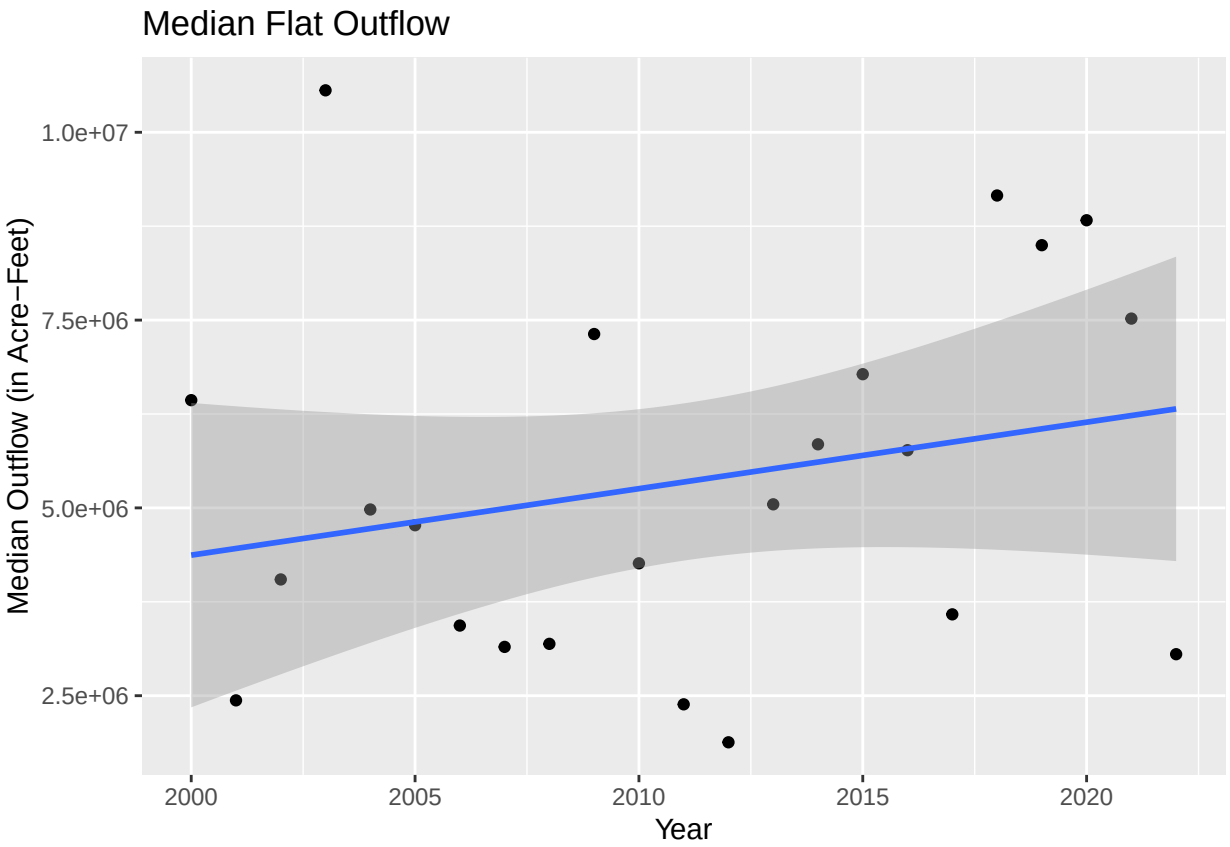

```
## `geom_smooth()` using formula = 'y ~ x'
```

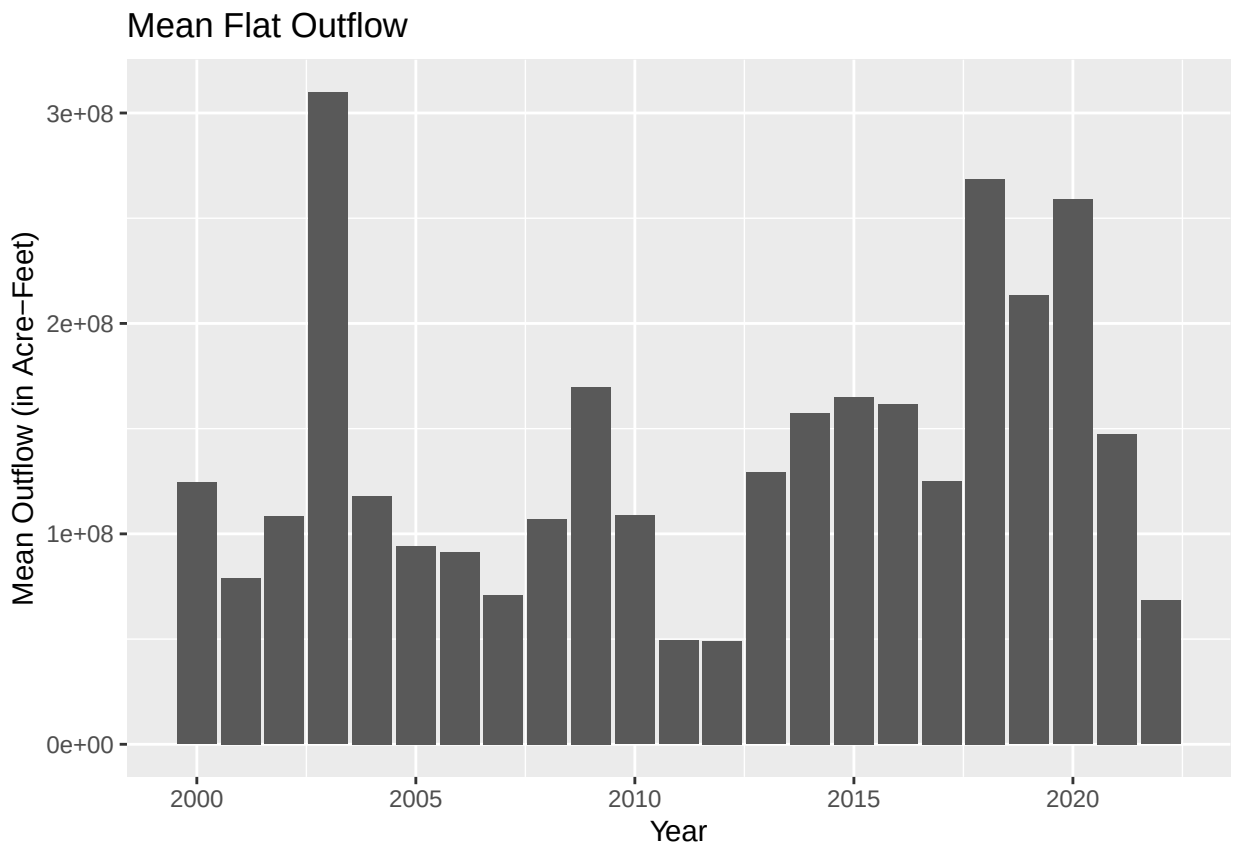

Mean Flat Volume
8e+08
6e+08
4e+08
2e+08
Mean Volume (in Acre−Feet)
1925
1950
1975
2000
2025
Year



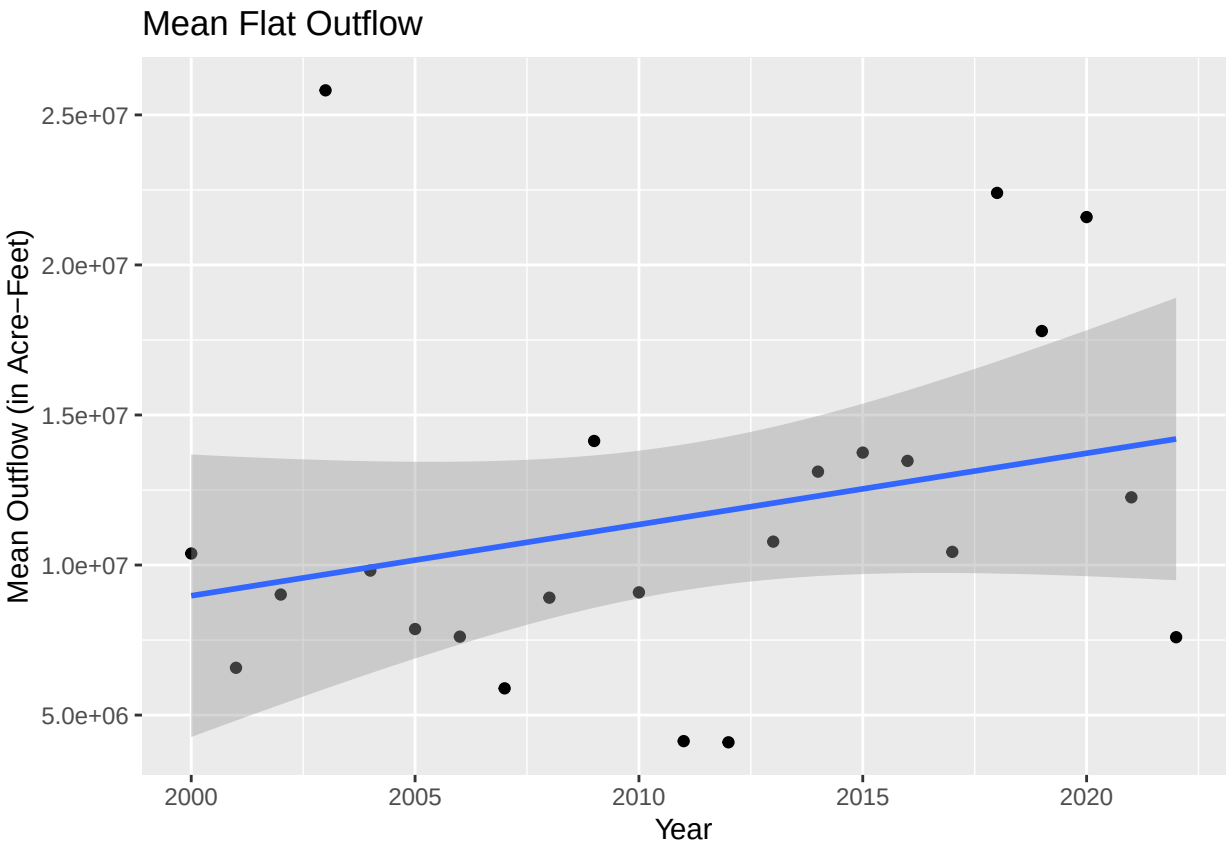
Now we will look at only years 2000 and beyond to capture recent trends.

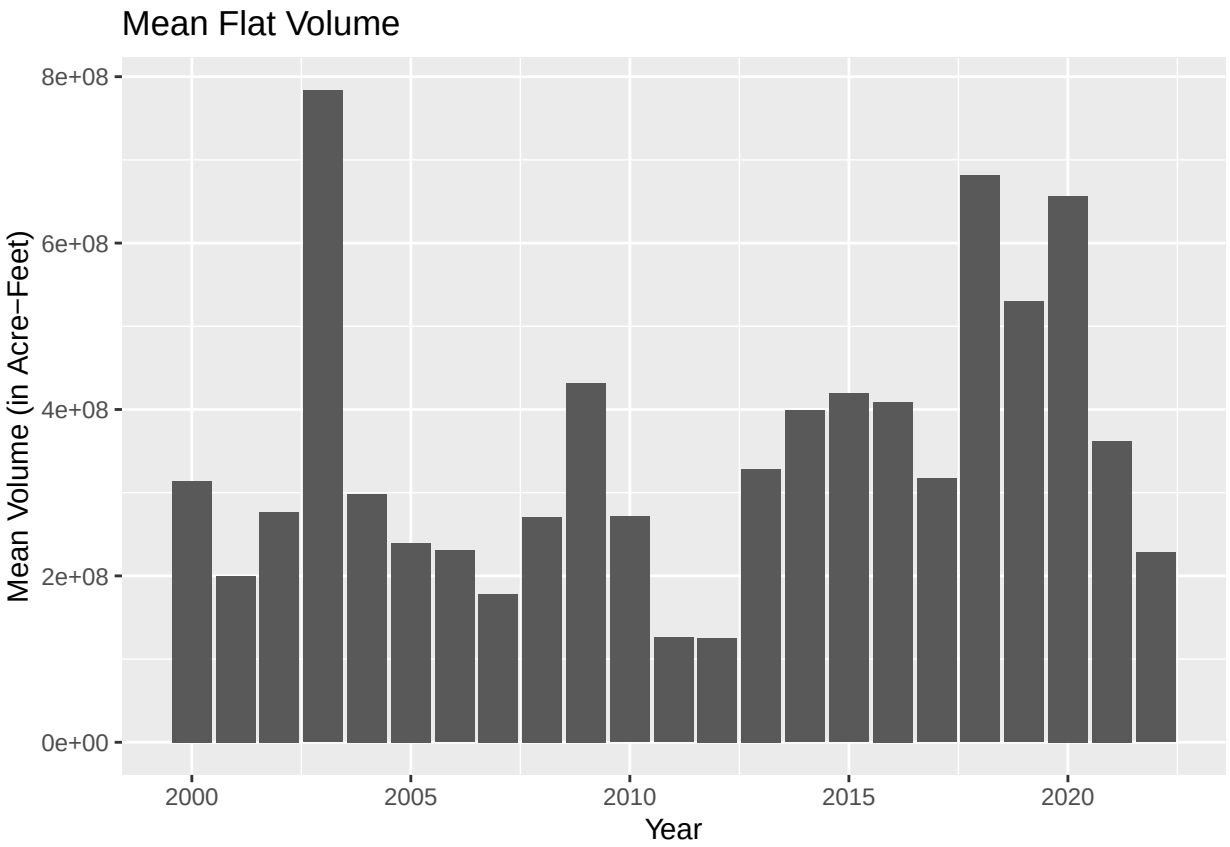
```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Flat Outflow
Median Outflow (in Acre−Feet)
1.0e+07
7.5e+06
5.0e+06
2.5e+06
2000
2005
2010
2015
2020
Year

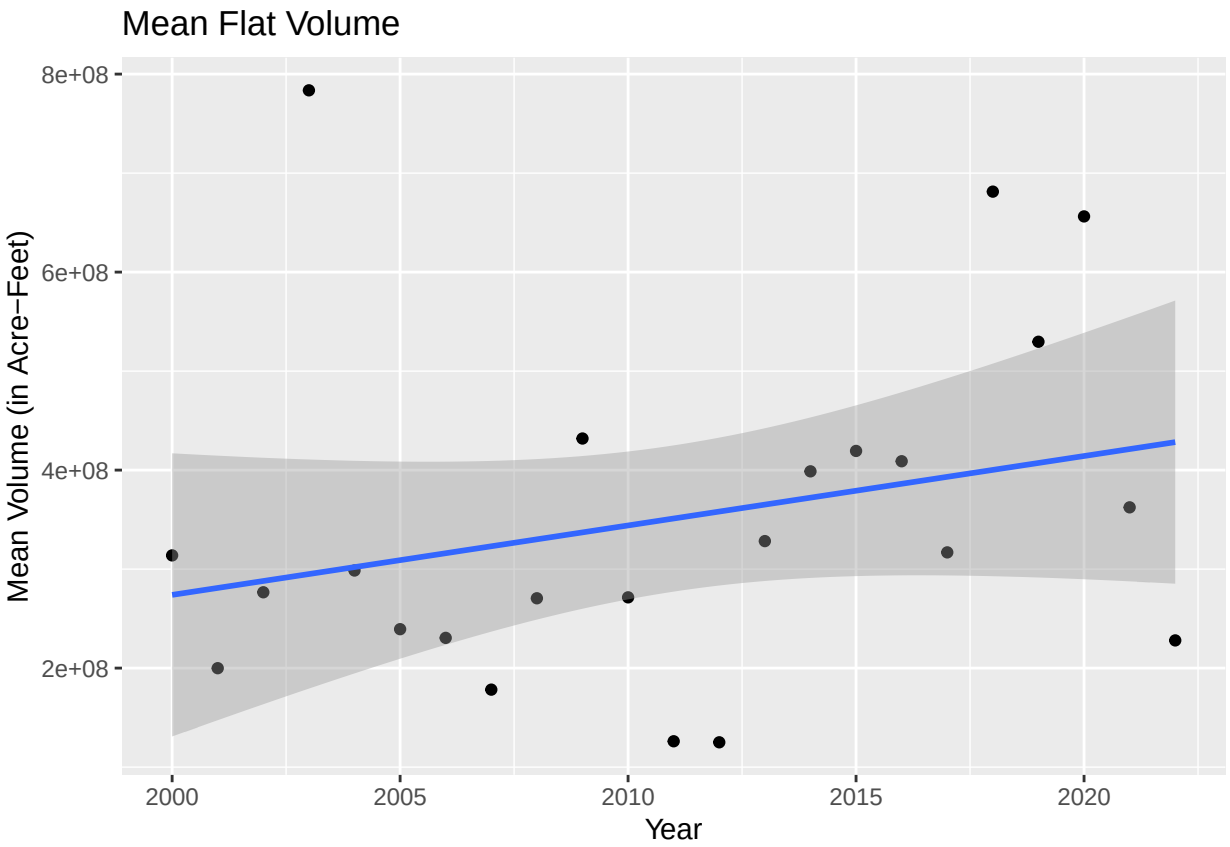


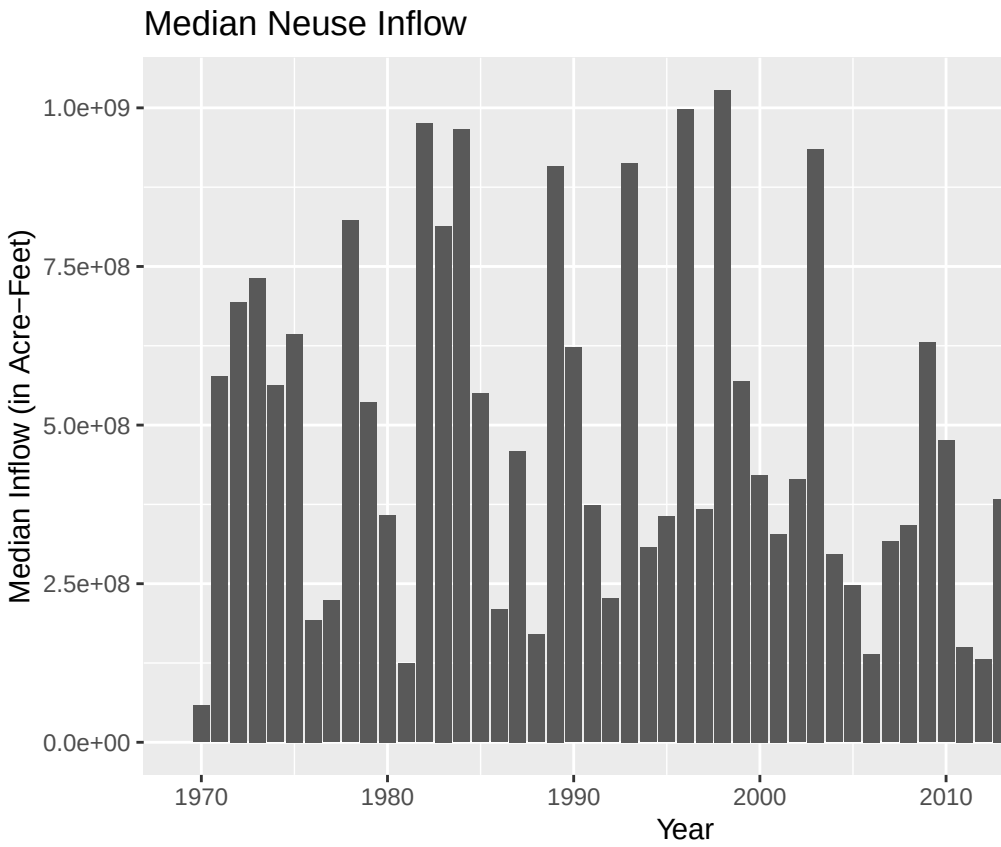

```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Flat Outflow
Mean Outflow (in Acre−Feet)
2.5e+07
2.0e+07
1.5e+07
1.0e+07
5.0e+06
2000
2005
2010
2015
2020
Year



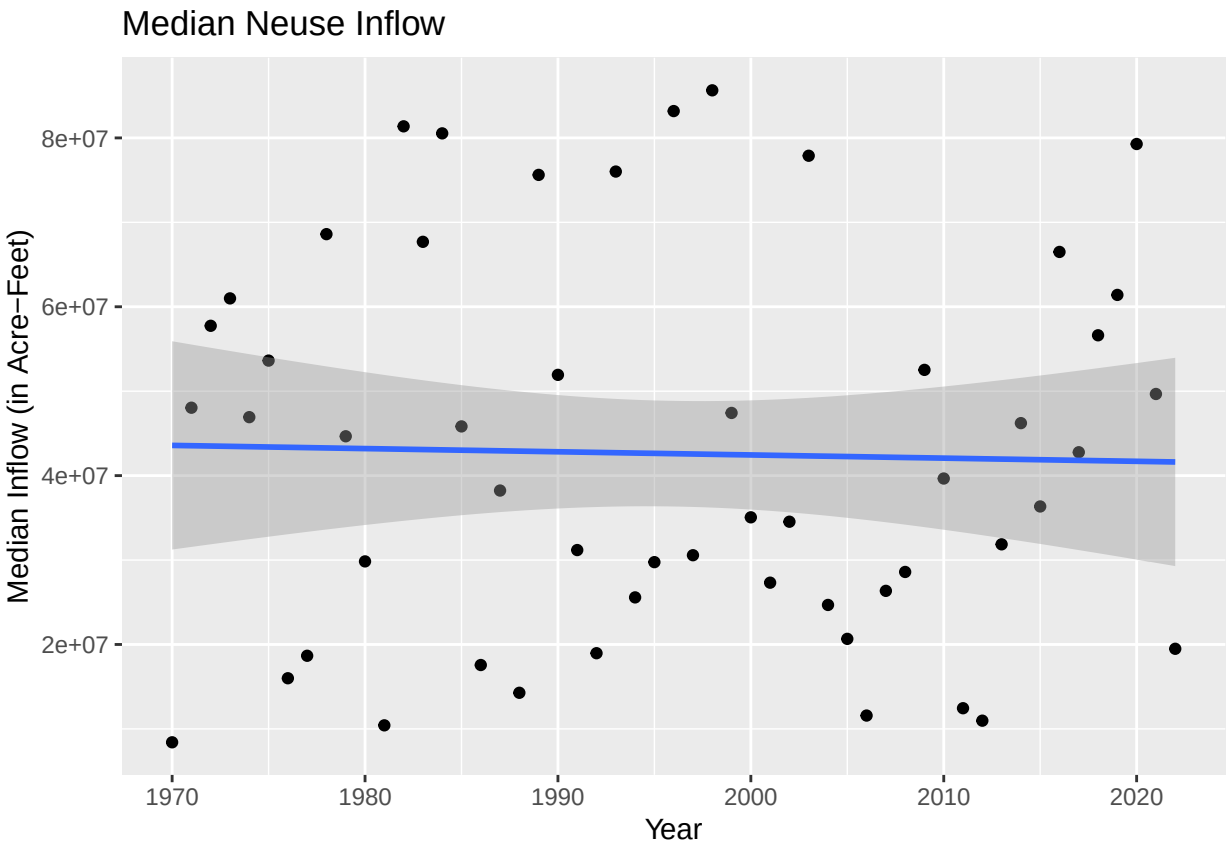

```
## `geom_smooth()` using formula = 'y ~ x'
```

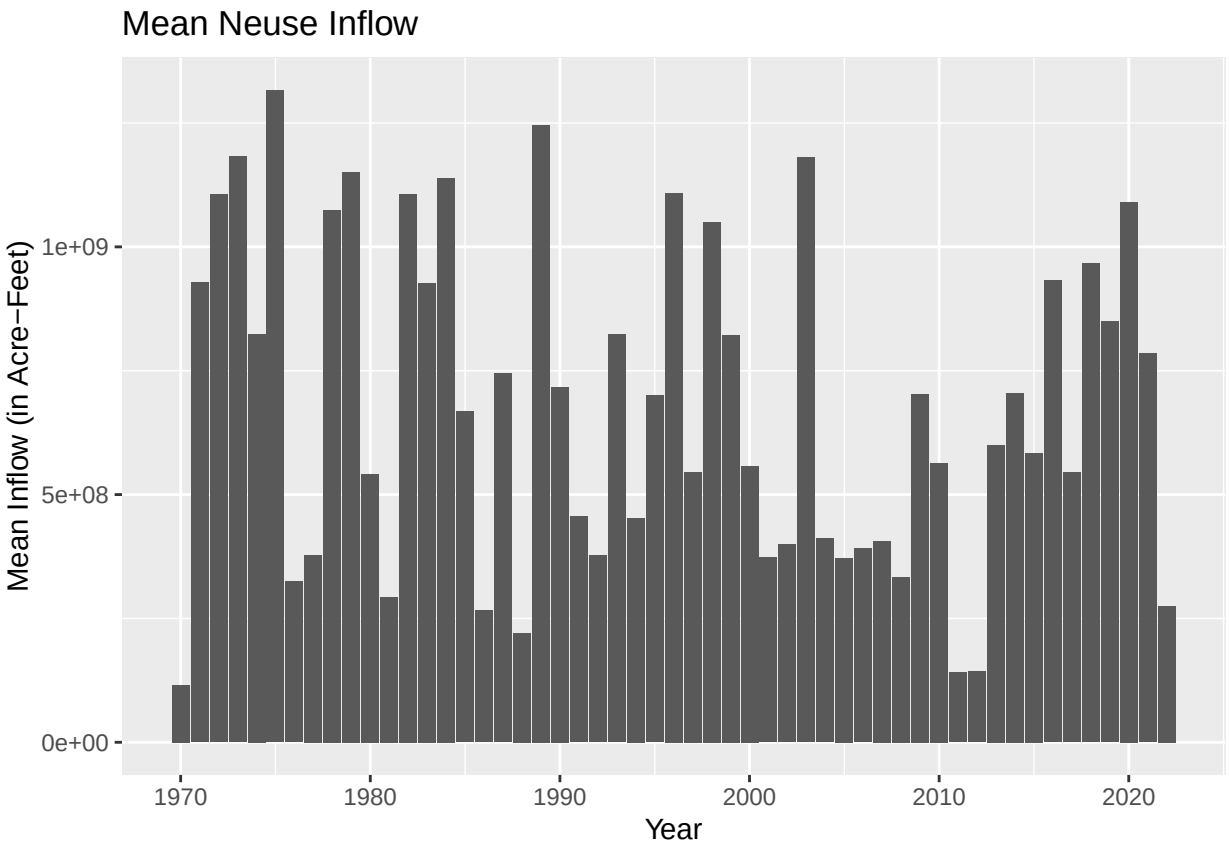

Mean Flat Volume
Mean Volume (in Acre−Feet)
8e+08
6e+08
4e+08
2e+08
2000
2005
2010
2015
2020
Year



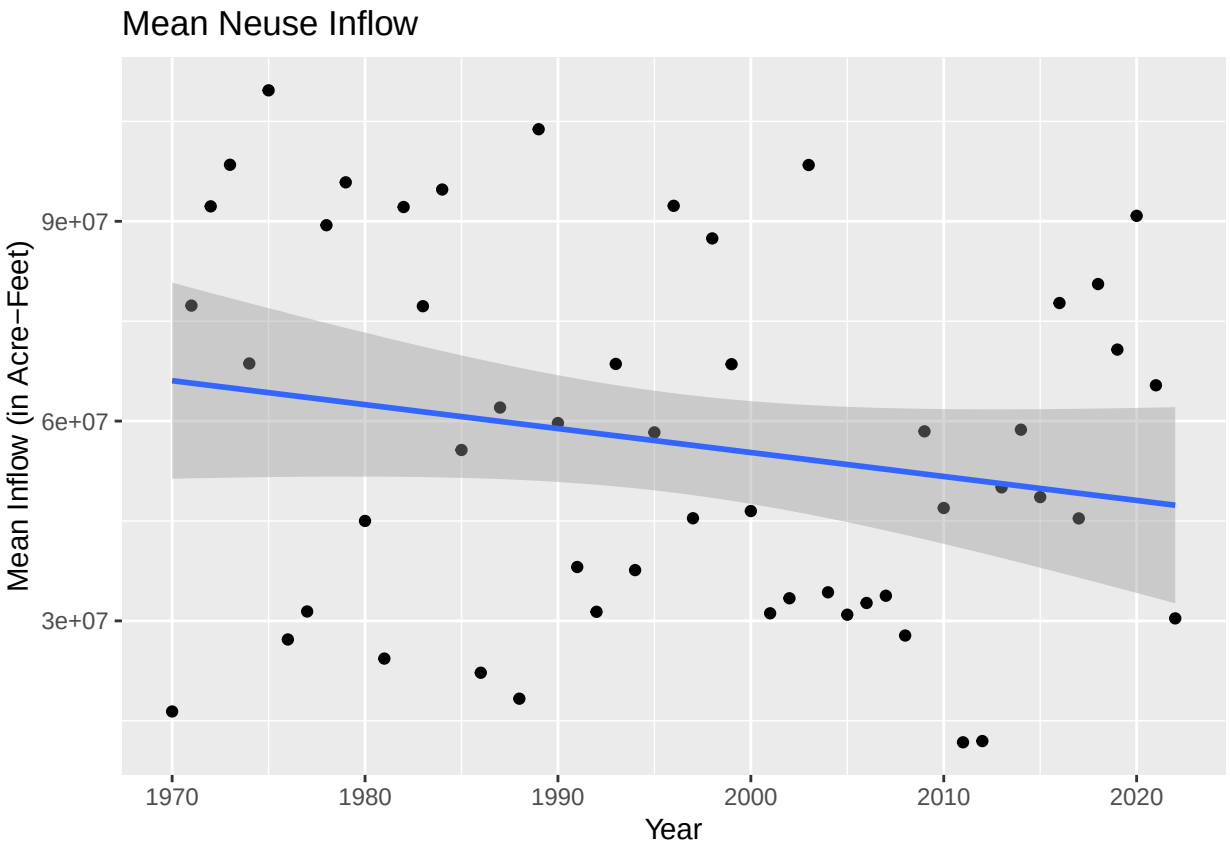
Finally, we will look at Neuse inflows.

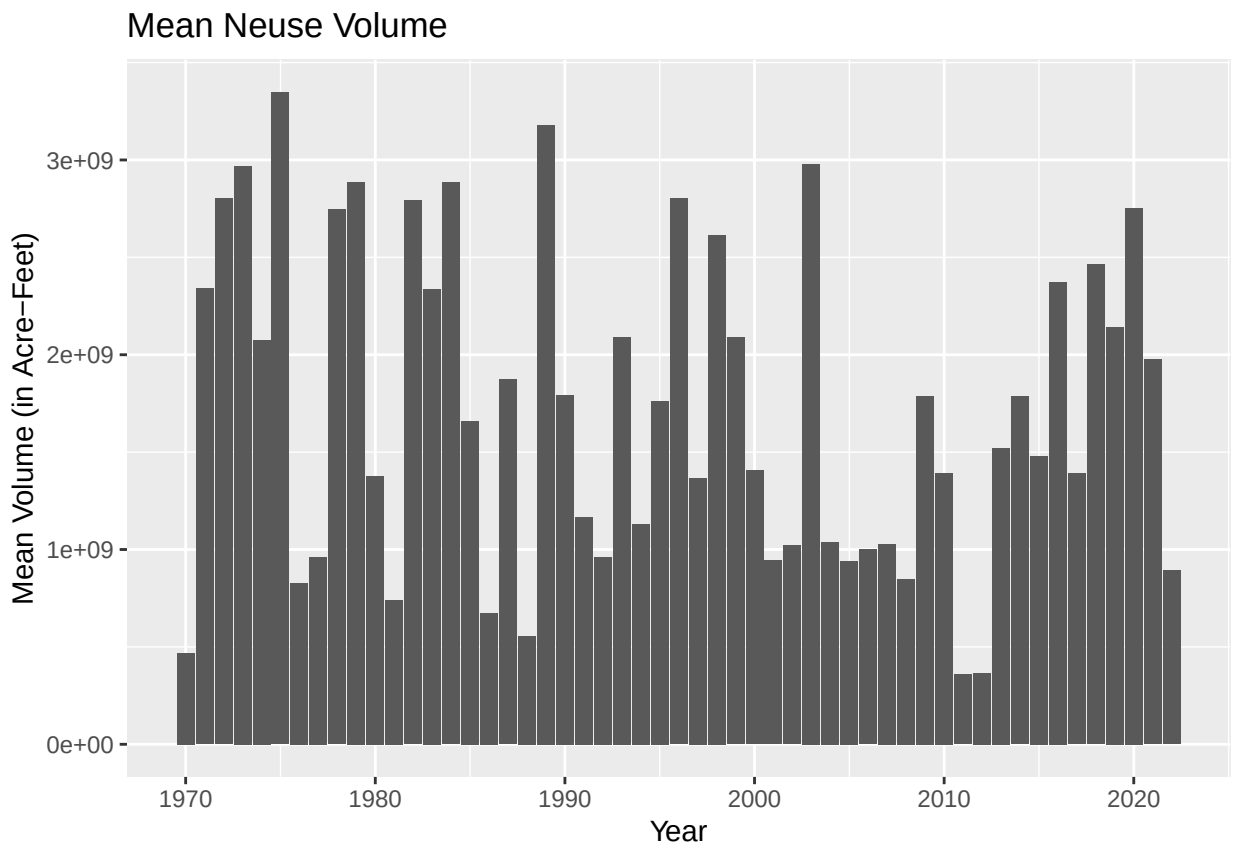
```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Neuse Inflow
Median Inflow (in Acre−Feet)
8e+07
6e+07
4e+07
2e+07
1970
1980
1990
2000
2010
2020
Year

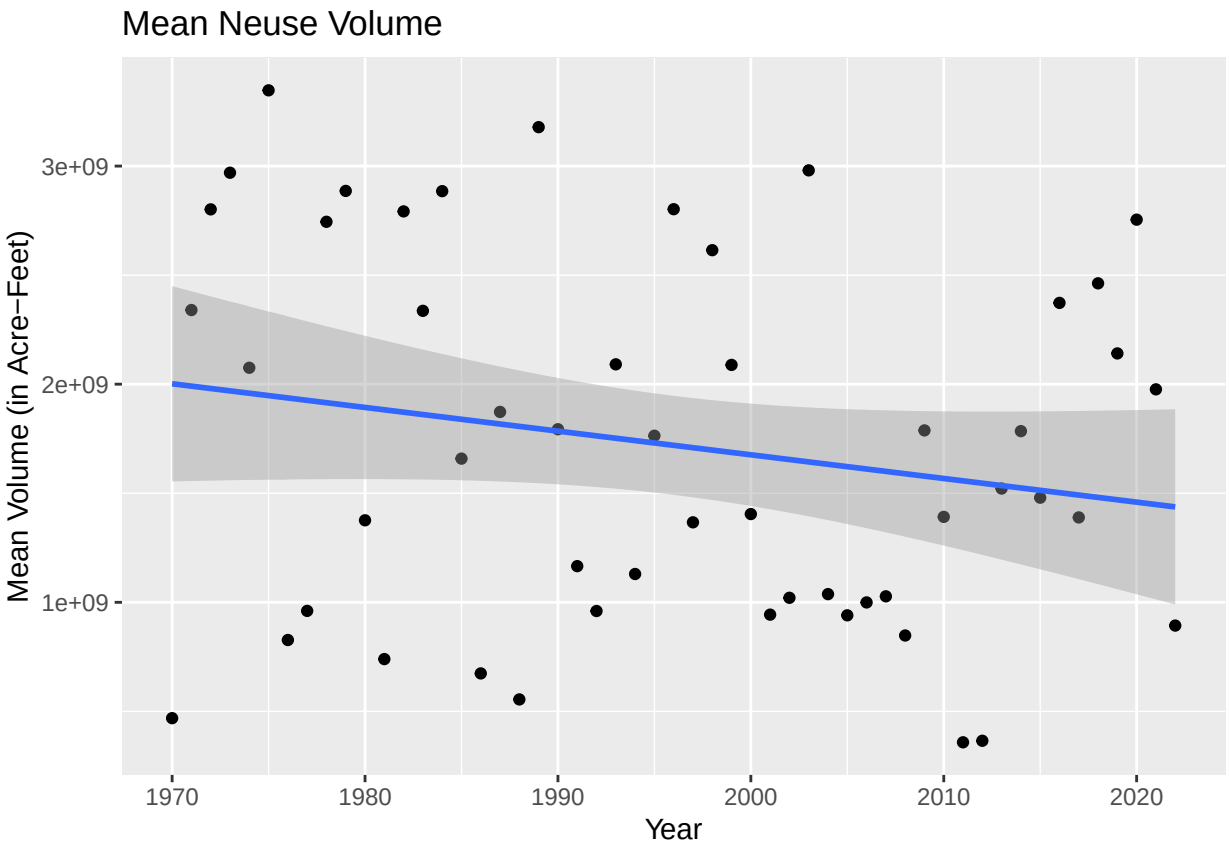


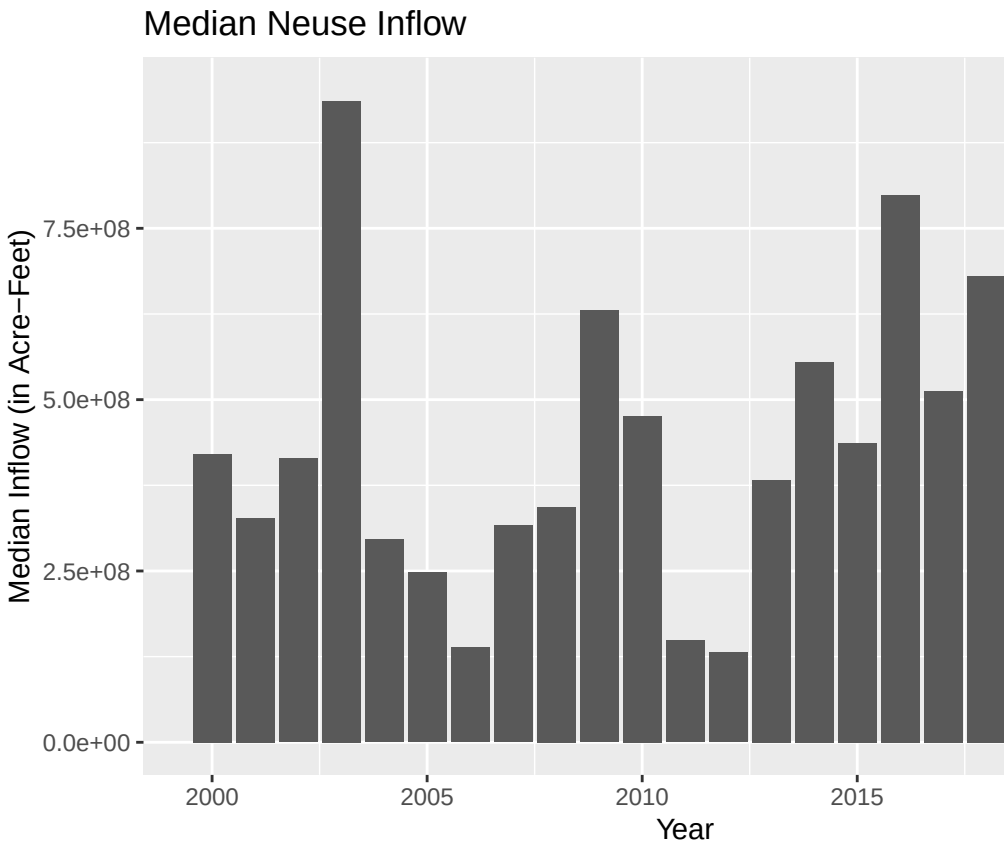

```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Neuse Inflow
Mean Inflow (in Acre−Feet)
9e+07
6e+07
3e+07
1970
1980
1990
2000
2010
2020
Year



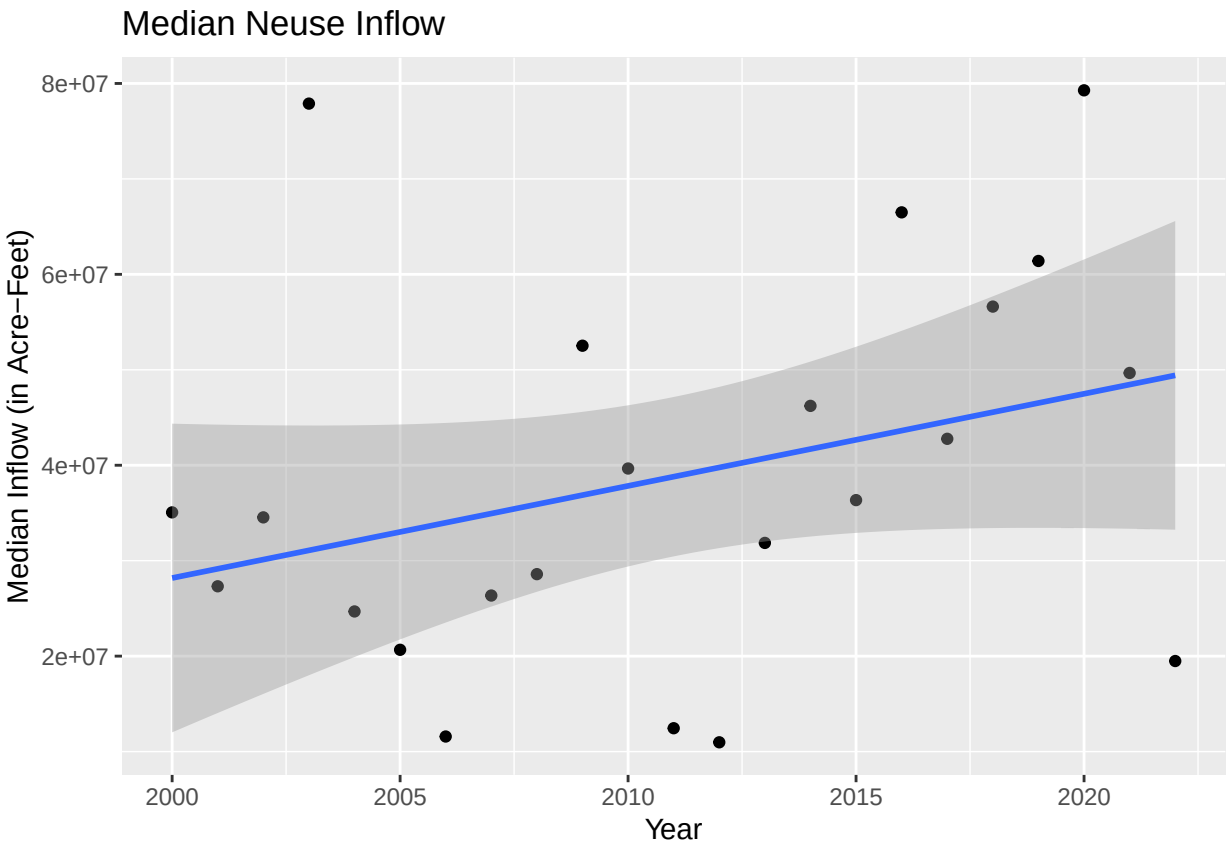

```
## `geom_smooth()` using formula = 'y ~ x'
```

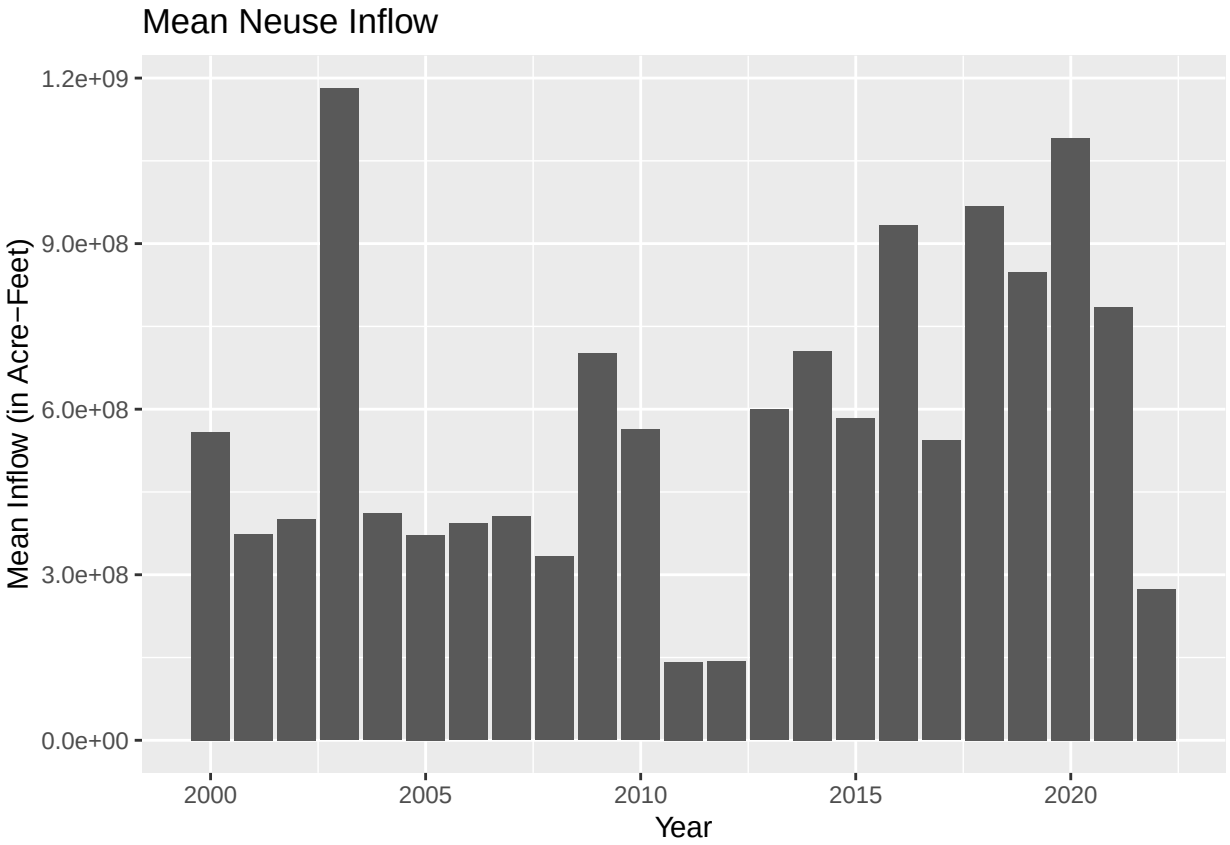

Mean Neuse Volume
Mean Volume (in Acre−Feet)
3e+09
2e+09
1e+09
1970
1980
1990
2000
2010
2020
Year



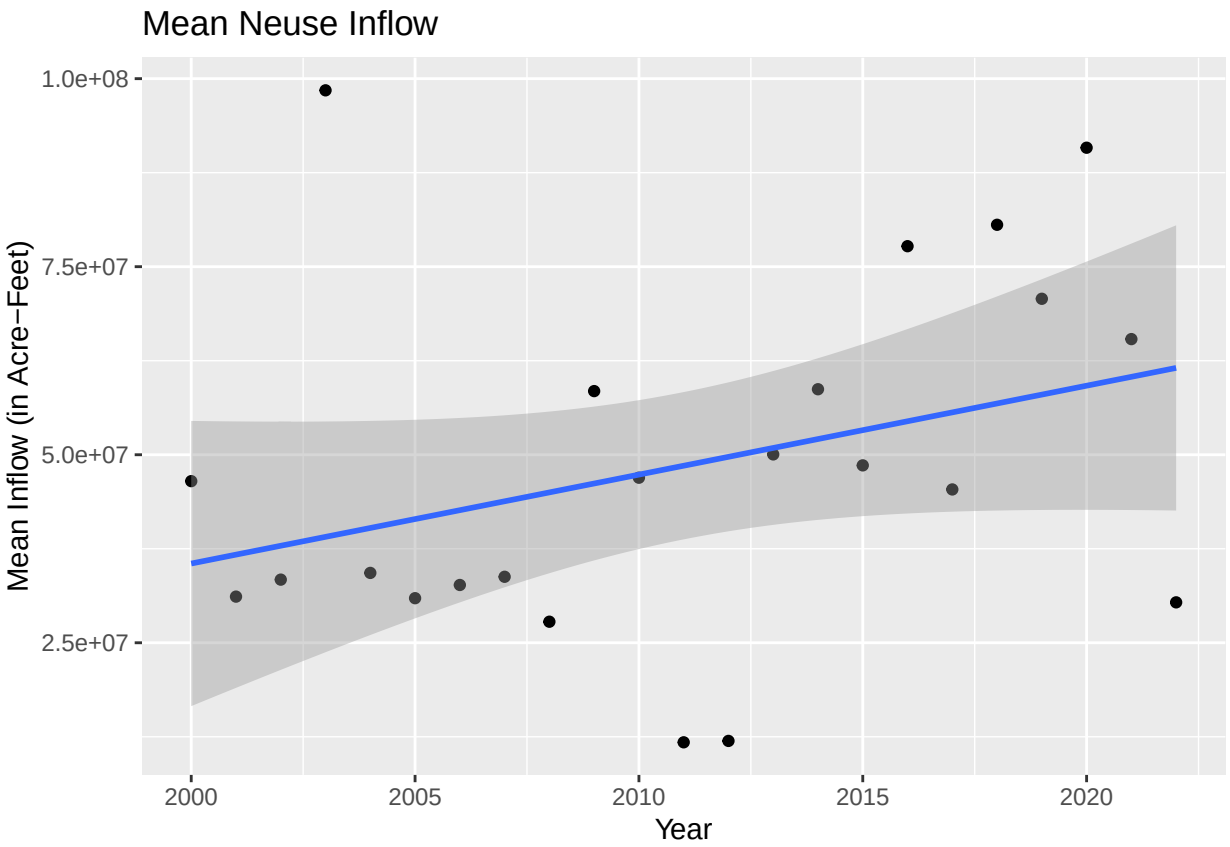
And now with only 2000 and beyond:

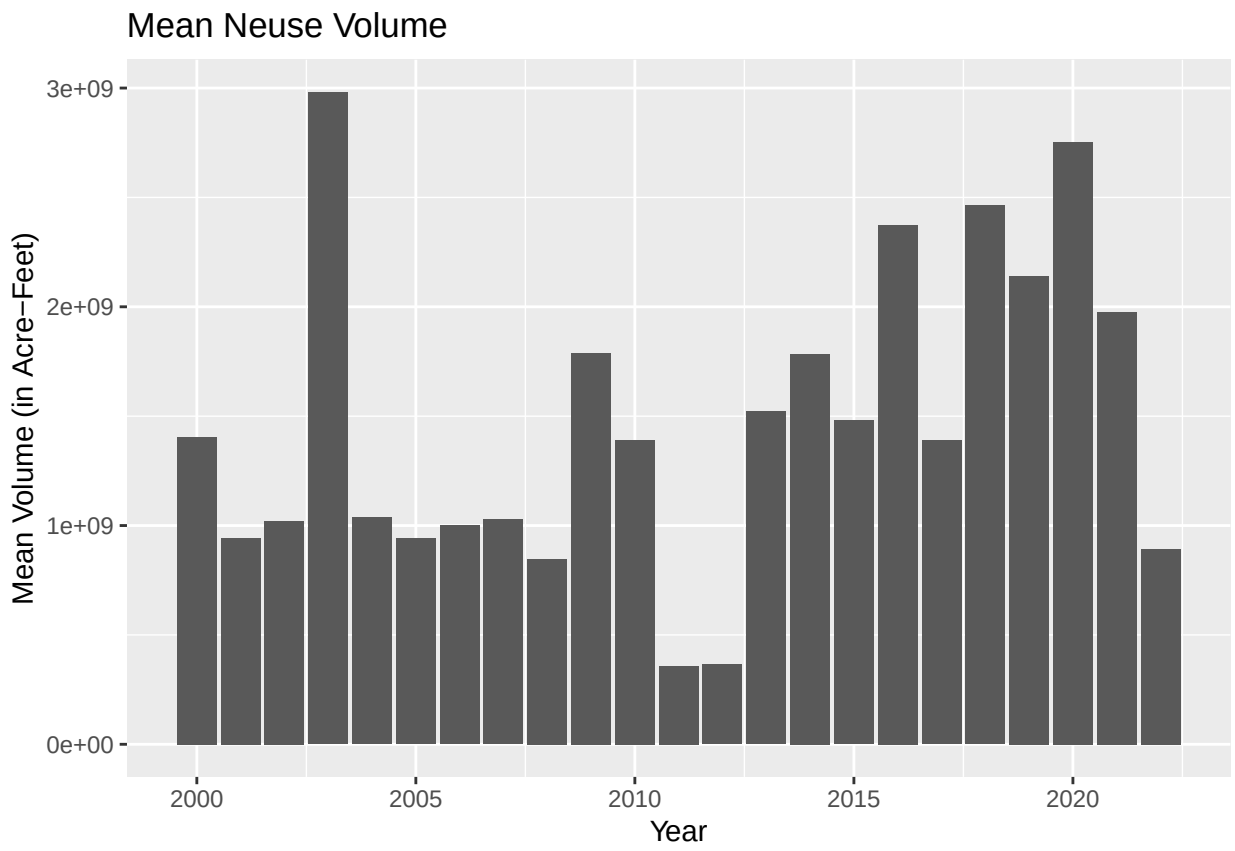
```
## `geom_smooth()` using formula = 'y ~ x'
```


Median Neuse Inflow
Median Inflow (in Acre−Feet)
8e+07
6e+07
4e+07
2e+07
2000
2005
2010
2015
2020
Year

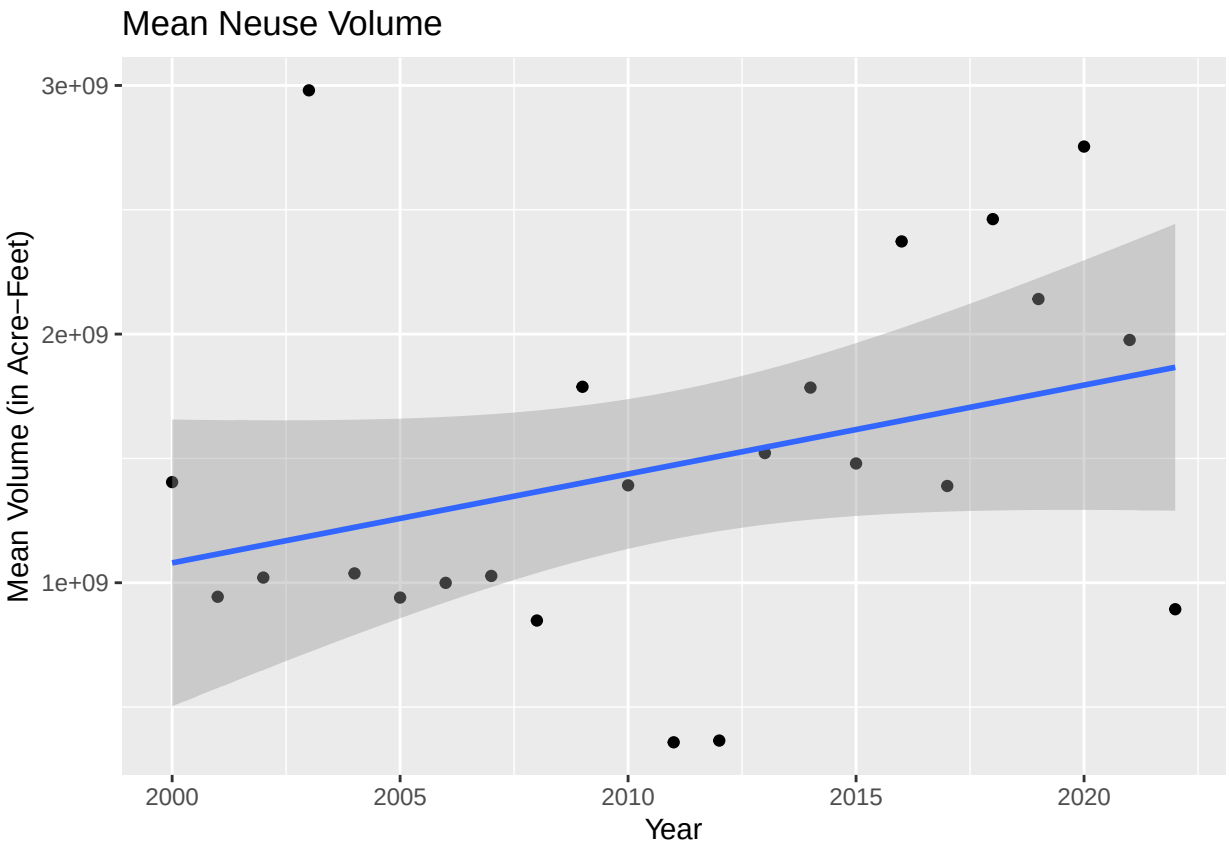



```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Neuse Inflow
1.0e+08
7.5e+07
5.0e+07
2.5e+07
Mean Inflow (in Acre−Feet)
2000
2005
2010
2015
2020
Year




```
## `geom_smooth()` using formula = 'y ~ x'
```


Mean Neuse Volume
Mean Volume (in Acre−Feet)
3e+09
2e+09
1e+09
2000
2005
2010
2015
2020
Year