

Hydrology Homework

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The following data was used to calculate flow at the three cross sections:

Site	Position	Distance (m)	Depth (ft)	Revolutions	Time (s)
Deer Creek Left	1	0.3	0.20	52	40
Deer Creek Left	2	0.6	0.15	27	40
Deer Creek Left	3	1.4	0.15	13	40
Deer Creek Right	1	0.2	0.70	31	40
Deer Creek Right	2	0.6	0.40	27	40
Deer Creek Right	3	0.8	0.50	36	40
Deer Creek Right	4	1.2	0.40	29	40
Deer Creek Right	5	1.5	0.30	16	40
Snake River	1	0.6	0.60	23	40
Snake River	2	1.1	0.30	106	55
Snake River	3	2.0	0.20	42	40
Snake River	4	2.6	0.15	18	40
Confluence	1	0.6	0.15	44	40
Confluence	2	1.0	0.35	35	40
Confluence	3	1.3	0.40	47	40
Confluence	4	1.9	0.50	75	40
Confluence	5	2.8	0.60	25	40
Confluence	6	5.1	0.50	17	40
Confluence	7	6.0	0.60	50	40

Calculating discharge:

$$Q_n = V_n * w_n * d_n$$

where

$$w_n = \frac{l_n - l_{n-1}}{2} + \frac{l_{n+1} - l_n}{2}$$

and

$$V_n = 0.9604 * \frac{rev}{sec} + 0.0312$$

```
flow_data <- flow_data %>%
  group_by(Site) %>%
  mutate(Position = as.integer(Position)) %>%
  mutate(final_position = max(Position)) %>%
  mutate(`width (m)` = case_when(`Position` == final_position ~
    (`Distance (m)` - lag(`Distance (m)`))/2,
    `Position` == 1 ~
    (lead(`Distance (m)` ) - `Distance (m)`)/2,
    TRUE ~
```

```

      (`Distance (m)` - lag(`Distance (m)`))/2 +
      (lead(`Distance (m)` ) - `Distance (m)`)/2)) %>%
mutate(`Velocity (ft/s)` = 0.9604*(Revolutions / `Time (s)`) + 0.0312) %>%
mutate(`width (ft)` = `width (m)` * 3.281) %>%
mutate(`discharge (ft^3/s)` = `Velocity (ft/s)`*`width (ft)`*`Depth (ft)`) %>%
summarise(`discharge (ft^3/s)` = sum(`discharge (ft^3/s)`) %>%
mutate(`discharge (ft^3/s)` = round(`discharge (ft^3/s)`, 2))

```

Site	discharge (ft ³ /s)
Confluence	7.63
Deer Creek Left	0.38
Deer Creek Right	1.46
Snake River	2.16

1. According to these calculations, total discharge above the confluence was $4.00 \text{ ft}^3/\text{s}$, a full $3.63 \text{ ft}^3/\text{s}$ lower than the value measured downstream of the confluence. One reason for this discrepancy could be inaccuracies in measurement—the USGS recommends 25-30 measurements while 3-7 were used here. Snake River may also be a gaining stream, although the contribution from groundwater would likely be minimal over the distances between the sampling sites.

