



Iowa Saturated Buffers

(IA-HAMILTON1, IA-HAMILTON3, IA-TAMA)

Saturated Buffer

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SITE SUMMARY

The research was conducted in Hamilton and Tama counties in Iowa on private farms. All buffers were installed next to fields under a corn-soybean rotation.

IA-HAMILTON1 was installed in fall of 2010. The estimated initial tile drainage area was approximately 25 acres, but this was reduced to approximately 14.5 acres in fall 2013. The tile outlet size is a 6-inch drain tile and the total distribution pipe length is approximately 1,100 feet. The buffer width is 70 feet with a predominant soil type of Coland clay loam.

IA-HAMILTON3 was installed in spring of 2013. The estimated tile drainage area is approximately 11.5 acres. The tile outlet size is an 8-inch drain tile and the total distribution pipe length is approximately 1,010 feet. The buffer width is 80 feet with a predominant soil type of Coland-Terril complex.

IA-TAMA was installed in fall of 2014. The estimated tile drainage area is approximately 17.5 acres. The tile outlet size is a 6-inch drain tile and the total distribution pipe length is approximately 377 feet. The buffer width is 13 feet with a predominant soil type of Colo silty clay loam.

For each site, 4-inch perforated drain tile was used as the distribution pipe, installed at a target depth of 2.5 feet at 0% grade. Due to topography upstream and downstream of the buffer control structure, actual distribution pipe depths varied between 1.6 to 4.0 feet.

Buffer control structures consisted of a 3-chamber AgriDrain structure, with stoplogs separating each chamber. The first (upstream) set of stoplogs were set to be 7 inches higher than the second (downstream) set of stoplogs. Drained water from the field would overtop the first set of stoplogs, flowing into the second chamber where it would then be diverted along the distribution pipe. Drained water exceeding the capacity of the second chamber would overtop the second stoplogs and be discharged to the adjacent stream. Water level within the two most upstream chambers was measured using pressure transducers and the topmost stoplog for each chamber had a 45-degree v-notch to allow for flow measurements.

Box 1. SITE INFO

WATER MANAGEMENT PRACTICES

- Saturated Buffer (distribution tile: depth 30 inches, length 377 to 1,100 feet)

SITE CHARACTERISTICS

IA-HAMILTON1

- Saturated buffer installed in 2010
- Soil: Coland clay loam

IA-HAMILTON3

- Saturated buffer installed in 2013
- Soil: Coland-Terril complex

IA-TAMA

- Saturated buffer installed in 2014
- Soil: Colo silty clay loam

MEASUREMENTS IN DATABASE

IA-HAMILTON1

- Soil moisture and temperature (2015-2018)
- Tile flow, water table depth, nitrate-N concentration, nitrate-N load (2011-2018)
- Ortho-P concentration (2012-2013)
- Soil texture (2010, 2013, 2015), sand-silt-clay percentage (2010), bulk density (2015), hydraulic conductivity (2013), SOC (2010), total nitrogen (2010)

IA-HAMILTON3

- Soil moisture and temperature (2015-2018)
- Tile flow, water table depth, nitrate-N concentration, nitrate-N load (2013-2018)
- Ortho-P concentration (2013)
- Soil texture (2011, 2013, 2015), sand-silt-clay percentage (2010), bulk density (2013, 2015), SOC (2011), total nitrogen (2011)

IA-TAMA

- Soil moisture and temperature (2016-2018)
- Tile flow, nitrate-N concentration, nitrate-N load (2016-2018)
- Soil texture, sand-silt-clay percentage, SOC, total nitrogen (2014)

SUMMARY OF RESULTS

FLOW

Flow from the field tile and any flow exiting the control box directly to the stream was measured continuously. The difference between these measured flows represent the water entering the saturated buffer. Annual tile flow averaged 11.4, 7.5, and 2.0 inches for sites IA-Hamilton1, IA-Hamilton3, and IA-Tama, respectively. The percentage of this flow diverted to the buffer averaged 42%, 94%, and 51% for sites IA-Hamilton1, IA-Hamilton3, and IA-Tama, respectively.

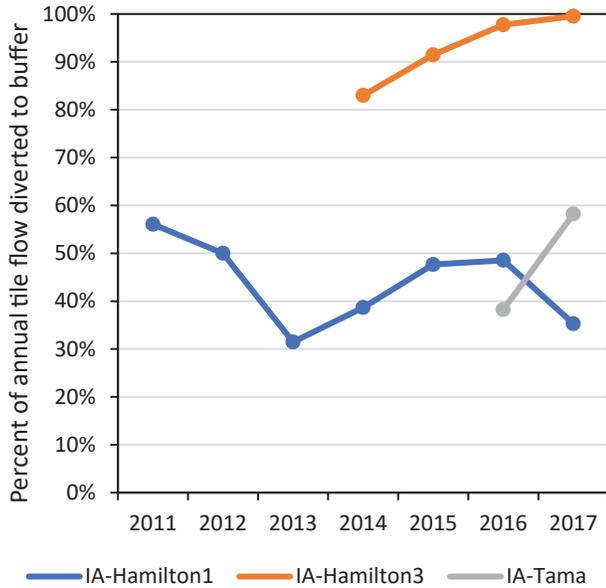


Figure 1. Percent of annual tile flow diverted to saturated buffer

WATER QUALITY

Nitrate-nitrogen (NO_3) concentration was measured at observation well transects extending from the distribution pipe and extending towards the adjacent stream. Average annual flow-weighted NO_3 was 11.6, 9.5, and 16.3 mg L^{-1} for sites IA-Hamilton1, IA-Hamilton3, and IA-Tama, respectively. NO_3 in the wells decreased, due to denitrification and potentially plant uptake, as water from the distribution pipe flowed through the shallow buffer soil to the stream. The total amount of NO_3 removed in the buffer on average was 214 (39% of total NO_3 load), 115 (84% of total NO_3 load), and 53 lb N (48% of total NO_3 load) for sites IA-Hamilton1, IA-Hamilton3, and IA-Tama, respectively.

PUBLISHED WORKS FROM THE SITE

Jaynes, D.B., and T.M. Isenhardt. 2014. Reconnecting tile drainage to riparian buffer hydrology for enhanced nitrate removal. *Journal of Environmental Quality*, 43(2): 631-638.

Jaynes, D.B., and T.M. Isenhardt. 2019. Performance of saturated riparian buffers in Iowa, USA. *Journal of Environmental Quality* 48:289-296.

Data Access

Data from this site are available through the USDA National Ag Library Ag Data Commons repository (<https://doi.org/10.15482/USDA.ADC/1521092>) or the interactive website at Iowa State University with visualization and querying capabilities (<https://drainagedata.org>).

ACKNOWLEDGEMENTS

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● Observation Well ■ Control Structure — Drain Tile

Figure 1. Map of Iowa saturated buffers.