

Development of a Cyberinfrastructure for Assessment of the Lower Rio Grande Valley North and Central Watersheds Characteristics

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Background

Cyberinfrastructure

- A study observed that not only did the use of technical infrastructure increase the widespread access to data; the available computing power also made it possible for the researchers to analyze large amounts of data, over longer time spans and a greater range of locations (Yu et al., 2021)
- An author stated that the cyberinfrastructure secures data and delivers interpreted information via a sequence of web services distinct stakeholders (Gutenson et al.,2020).
 - REON.cc now serves as a cyber-collaboratory platform for engaging stakeholders with an interest in data and information for a certain location

Watershed Delineation

- A study conducted a hydrological analysis with watershed GIS-based applications to assist both technical and non-technical users for decision-making (Gutenson et al., 2020).
- A study highlighted the importance of high resolution in data resources to obtained accurate results in watershed drainage areas (Amatya et al., 2013).



Background

Sources of Pollution

- A report indicated that more than 40 percent of all impaired waters were affected solely by nonpoint sources, while only 10 percent of impairments were caused by point source discharges(EPA, n.d.-b).
- Urbanization has led to increased water transfers from agriculture to urban uses(Hernandez & Uddameri, 2013;Black&Veatch,2016)

Water Quality

- In the US, 70% of rivers and streams are not assessed (EPA 2017). 53% that are assessed are considered impaired.
- A study stated that fecal bacteria usually comes from stormwater discharges (Abrams 2012).
- Improper wastewater management practices have caused severe water quality problems regarding dissolved oxygen, bacteria, and algae (TCEQ, 2006a).



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Figure 1: Location of the North and Central Watersheds

Study Area





Watershed Delineation



Figure 4: LIDAR elevation data



Figure 5: LIDAR elevation data recondition



Cyberinfrastructure

REON Website

Welcome

REON

The River and Estuary Observation Network (REON) is a community network of real-time data providers and users committed to the philosophy of enabling local and regional water resource management through sharing of water data and open exchange of water information.

Get Started »

Search for Data.

Q Search



Figure 6: Cyberinfrastructure site













Table 2: Point Sources of pollution

	HWMD	RVD	IBWCNF	Total
TLAP	0.006	0.004	0.004	0.014
wwo	0.008	0.005	0.012	0.025
MSW	0.013	0.004	0.004	0.021
MS4s	3.383	0.055	6.133	9.571
DP	0.006	0.001	0.016	0.023







Figure 13: North and Central Watersheds Point Sources



Water Quality Samples

Hidalgo Willacy Main Drain

- Clean Rivers Program
- 8 Samples
- 2017-2019

Raymondville Drain

- Clean Rivers Program
- 8 Samples
- 2017-2019

IBWC North Floodway

- SWQMs
- 29 Samples
- 2011-2019







Figure 16: Predominant Levels for Total Nitrogen



Figure 17: Predominant Levels for Total Phosphorus



Figure 18: Predominant Levels for Nitrate and Nitrite



Figure 19: Predominant Levels for Chlorophyll-a



Figure 20: Predominant Levels for Organic Nitrogen

Loading Concentrations

Water Quality + Flow Data



Hidalgo Willacy Main Drain

- Clean Rivers Program
- 8 Samples
- 2017-2019

Raymondville Drain

- Clean Rivers Program
- 8 Samples
- 2017-2019

IBWC North Floodway

- SWQMs
- 29 Samples
- 2011-2019

Flow Data

Table 5. North and Central Watersheus Flow Data						
	HWMD	RVD	IBWCNF			
Median	7.1	1.2	1.8			
Mean	8.8	2.7	6.3			
Min	2.9	0.9	0			
Max	21.4	8.6	8,412.6			

Table 3: North and Central Watersheds Flow Data

HWMD



IBWCNF Near Sebastian



Figure 21: North and Central Watershed Boxplots for Flow Data

Flow Data + Water Quality + Watershed Area

Unit Area Loading Rates

Table 4: North and Central Watersheds Loading Rates

Water Quality Parameters		HWMD	RVD	IBWCNF
Bacteria (E.Coli)	MPN/km²/year	17.24*	1.86*	6.91*
Ammonia	kg/km²/year	120.68	30.77	47.72
TKN		1,586.32	669.73	477.14
TKN-Ammonia		1,465.64	638.96	429.42
ТР		518.85	63.29	122.67
Nitrite +Nitrate		2,950.04	581.46	1,512.10
Chlorophyll-a		31,593.23	9,870.43	13.24
* <i>E. Coli</i> In trillions		Higher Loadings	}	28



Bacteria

Total Nitrogen

Figure 22: Concentration vs. Loadings



Figure 23: Concentration vs. Loadings





Figure 25: Concentration vs. Loadings

Subwatershed Loadings



Subwatershed Loadings





Cyberinfrastructure

- The site satisfies EPA guidelines manual for watershed characterization.
- Facilitated an effective data collection to extract distinct information into one single source.
- Enables Stakeholder's input to have a better overview of the watershed characteristics.

Watershed Delineation

- •Elevation reconditioning showed satisfactory results for unique features for flat topography and man-made waterways.
- Areas contribution for HWMD watershed was 1,357 Km2.
 Covers 68 % of its area in Hidalgo County, 13 % in Willacy County, and a small portion of 1 % in Cameron County

Get Started »

Search for Data.







Sources of Pollution

 Point Sources seem to have more impact on the watershed

Water Quality

•Several water quality parameters were identified.

•Surpasses screening levels



Sources of Pollution

 Non-point sources seem to have more impact on the watershed

Water Quality

•Only one water quality parameter seem to impact the most.



Sources of Pollution

 Point Sources seem to have more impact on the watershed

Water Quality

•Several water quality parameters were identified



Loading Concentrations

- HWMD watershed was the watershed to contribute the most to loadings.
- High presence of NPS and PS as well as high flow records contributes to this loads
- Relation between water quality concentrations, NPS and PS



Figure 32: High Loadings

Acknowledgements

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Thank You