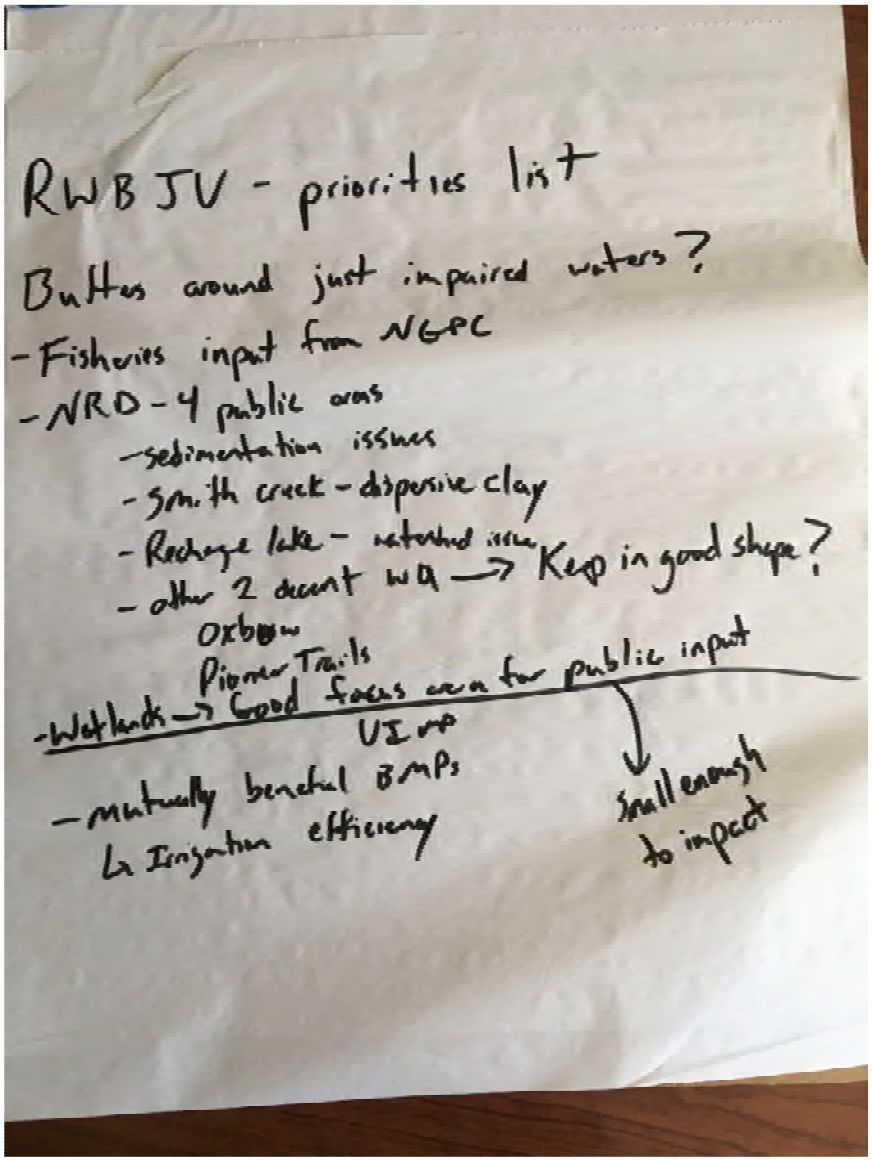
Wetlands

How to quantify benefits?
Priorities?

- LB NRD Plan includes these
- Hydrologically connected to impairment?
  - LEPA needs?
- Hydrogeorphic model developed


RWBJV - priorities list
Buffers around just impaired waters?
- Fisheries input from NGPC
- NRD - 4 public areas
- sedimentation issues
- Smith creek - dispersive clay
- Recharge lake - watershed area
- other 2 decent WQ → Keep in good shape?
Oxbow
Pioneer Trails
-Wetlands → Good focus area for public input
UI map
- mutually beneficial BMPs
i.e. Irrigation efficiency
Small enough to impact

Prioritization

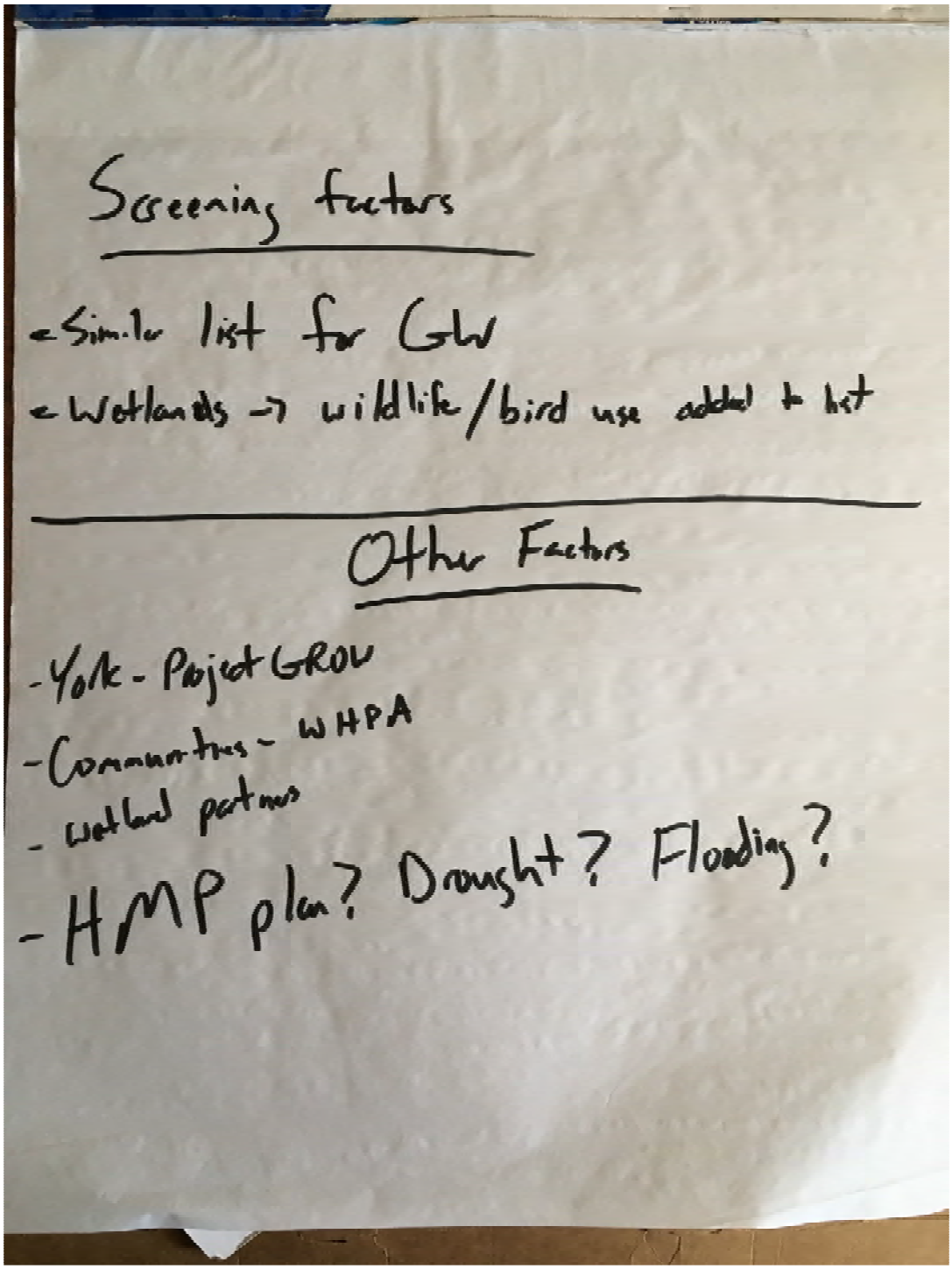
Analysis of WQ data
↳ Add in GW?

Fairness?

WHPA Plans → Initial list?

DWP/MP Plans
↳ Prioritize by concentration
↳ by Trend?

→ Phase Areas - too big?
→ No bad HPAs over 10 mg/L currently
→ Protective areas → focus here?
→ Focus on stream corridors?
↳ 20%?
→ Headwaters? . Modeling


Screening factors
- Similar list for GW
- Wetlands → wildlife/bird use added to list
Other Factors
- York - Project GROW
- Communities - WHPA
- wetland partners
- HMP plan? Drought? Flooding?

- Hastings NW lake – private
- Watershed size → move to 1st screening priority list?
- Rotational methodology for larger target areas
- Just focus on monitoring in large basins? - EPA focuses upon stand alone

Upper Big Blue NRD – Water Quality Management Plan
"Technical Advisory Committee (TAC) Meeting #3"
UBBNRD Office – Monday, October 1, 2018; 1:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

Present	NAME	TITLE	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
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Please Sign In!

ENGINEERING ■ ARCHITECTURE ■ SURVEYING ■ PLANNING

UBBNRD Water Quality Management Plan and Voluntary Integrated Management Plan Facilitation

Technical Advisory Committee (TAC) Meeting #3 Minutes

DATE AND TIME | October 1, 2018; 1:00 p.m.
JEO PROJECT NO. | 161356.00
LOCATION | York, NE - UBBNRD Office
ATTENDEES | Sign in Sheet Attached

1. Meeting Overview and Purpose

- This was the 3rd of 6 planned Technical Advisory Committee (TAC) Meetings
- Provide project updates
- Review NRD and NeDNR efforts related to VIMP
- Gather feedback on draft list of priorities for WQMP

2. Discussion Items

- Rick provided an update on project activities and reviewed comments that have been received at recent stakeholder meetings. Those can be found in the appropriate meeting minutes.
- Stakeholder comments are being taken into consideration for writing goals and identifying priorities
- The last two stakeholder meetings are scheduled for November 27, 2018 and January 14, 2019.
- Amy provided an overview of the presentation that NeDNR gave at the October 1st stakeholder meeting. This included presentations from Jeremy Gaily, Surface Water Administration Manager and Jennifer Shellpeper, Water Planning Supervisor.
- Marie provided an overview the presentation she provided at the October 1st stakeholder meeting. Her portion was focused on the existing NRD rules and regulations.
- Adam provided a presentation on the process being used to identify priority waterbodies.
    - The presentation discussed what a priority waterbody is and why the water quality management plan (WQMP) focusses on them.
    - May of the waterbodies (lakes and stream) are excluded from the initial list because there is no water quality data to support an assessment to identify if there are any water quality problems in those waterbodies
    - Setting these priorities early in the planning process is critical to completing the WQMP document on time
    - The WQMP also addresses special priority areas, which include groundwater (addressed through wellhead protection areas), wetlands, and nonpermitted animal feeding operations
    - A preliminary list of priorities was presented and discussed
    - A technical memorandum is being drafted by JEO to fully document the process and the priorities identified. It will be shared with the TAC once it is complete.

    - It was noted that the NRD does not have to identify a minimum of 20% of each HUC 8, but that was only a maximum
- Josh noted that the NRCS doesn't have any prioritized areas across the district to include
- Adam gave a brief overview of the status of the WQMP document. Draft versions of chapters 1 – 5 will submitted to the NRD soon. Following the NRD's reviews, the chapters will be updated and submitted to NDEQ for an initial review.
- The plan will need to be finalized and accepted by EPA by September 2019.
- Rick facilitated a roundtable discussion.
    - Keep in mind the goals of the VIMP when identifying BMPs and other priorities for the WQMP.
    - Stress that landowner and public input is important in picking priorities so there is realistic chance of project acceptance
    - Background information on priorities should be included so that Board of Directors sees the links in the plan. Adam will include notes on why each waterbody was or wasn't included on the draft prioritization list.
    - Discussion focused on just how many priorities the NRD should be identifying in the plan. It was clarified that only those with a realistic chance of being addressed in the next 5-10 years should be included.
        - Marie was very hesitant to lay out too many priorities for the NRD, as some of these projects could take up not just a lot of funding but staff time as well
        - While lake projects do not take a large geographical area, they can be very expensive if in-lake work is needed
    - Andy said that the Rainwater Basin Joint Venture (RWBJV) can help bring in many different partners and funding sources once priorities are identified
    - It is unlikely at this time that the NRD Board of Directors is not likely to support the idea of hiring additional staff
        - This means that the NRD will need to rely on strong partnerships. This may be a good role that the RWBJV may be able to fill.
    - A comment was made that the planning process shouldn't be limited to just working within the Section 319 (NDEQ) guidelines. Ideally it would be written to cover as many options as possible. Adam replied clarified that is the intent, but that 319 is paying for the plan so special attention is paid to their requirements
    - The plan should look at utilizing all potential funding and education opportunities from other partners. Additionally, the right "messenger" should be identified for the activities identified. Farmers and producers get more information and trust certain individuals more than others.

3. Meeting Adjourn

- Next TAC meeting December 3, 2018; 1:00 p.m. at UBBNRD office
    - Tentative Agenda includes: review water quality modeling, finalize priorities, discuss implementation. Rod will send out a Doodle poll to figure out next meeting dates.
- Next stakeholder meeting: November 27, 2018; 7:00 p.m. at UBBNRD office
    - Tentative agenda: finalize goals and objectives

4. Action Items

- JEO to finalize and send out draft prioritization memo
- Rod to send a Doodle poll about possibly rescheduling TAC meetings

Upper Big Blue NRD – Water Quality Management Plan
"Technical Advisory Committee (TAC) Meeting #3"
UBBNRD Office – Monday, October 1, 2018; 1:00 p.m.

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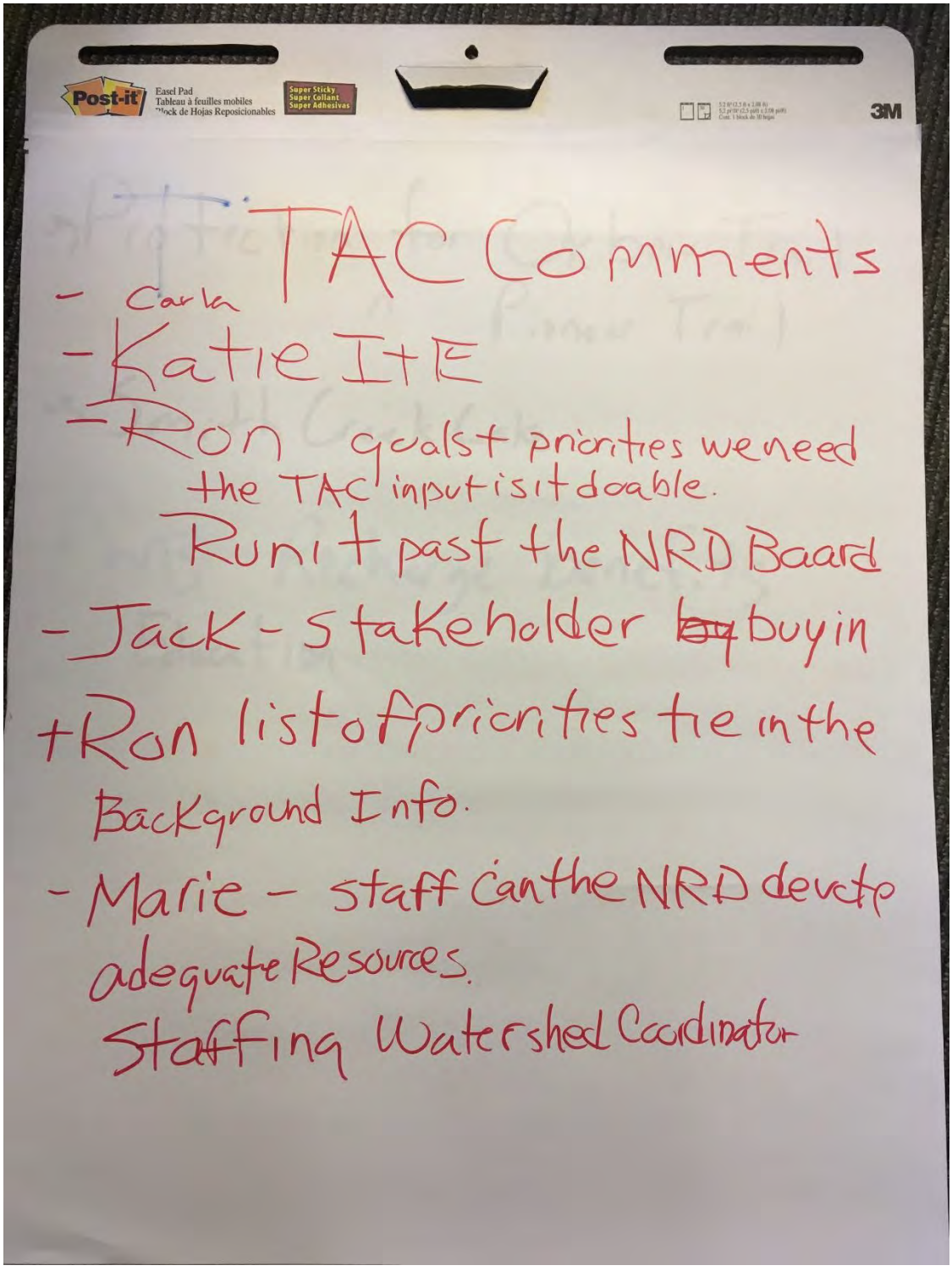
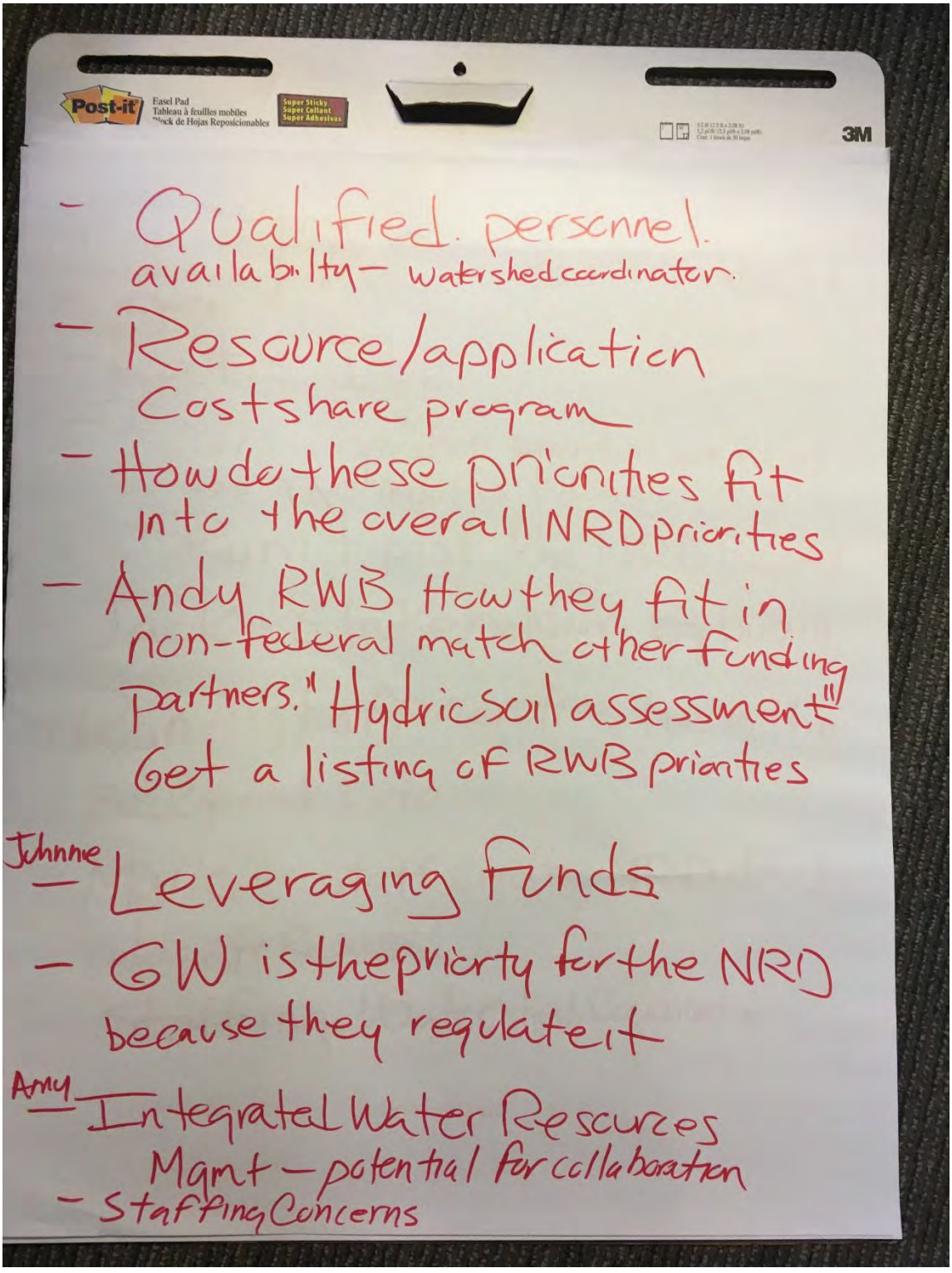
Additional meeting notes are attached, in the form of photographs of the flipchart notes (4)

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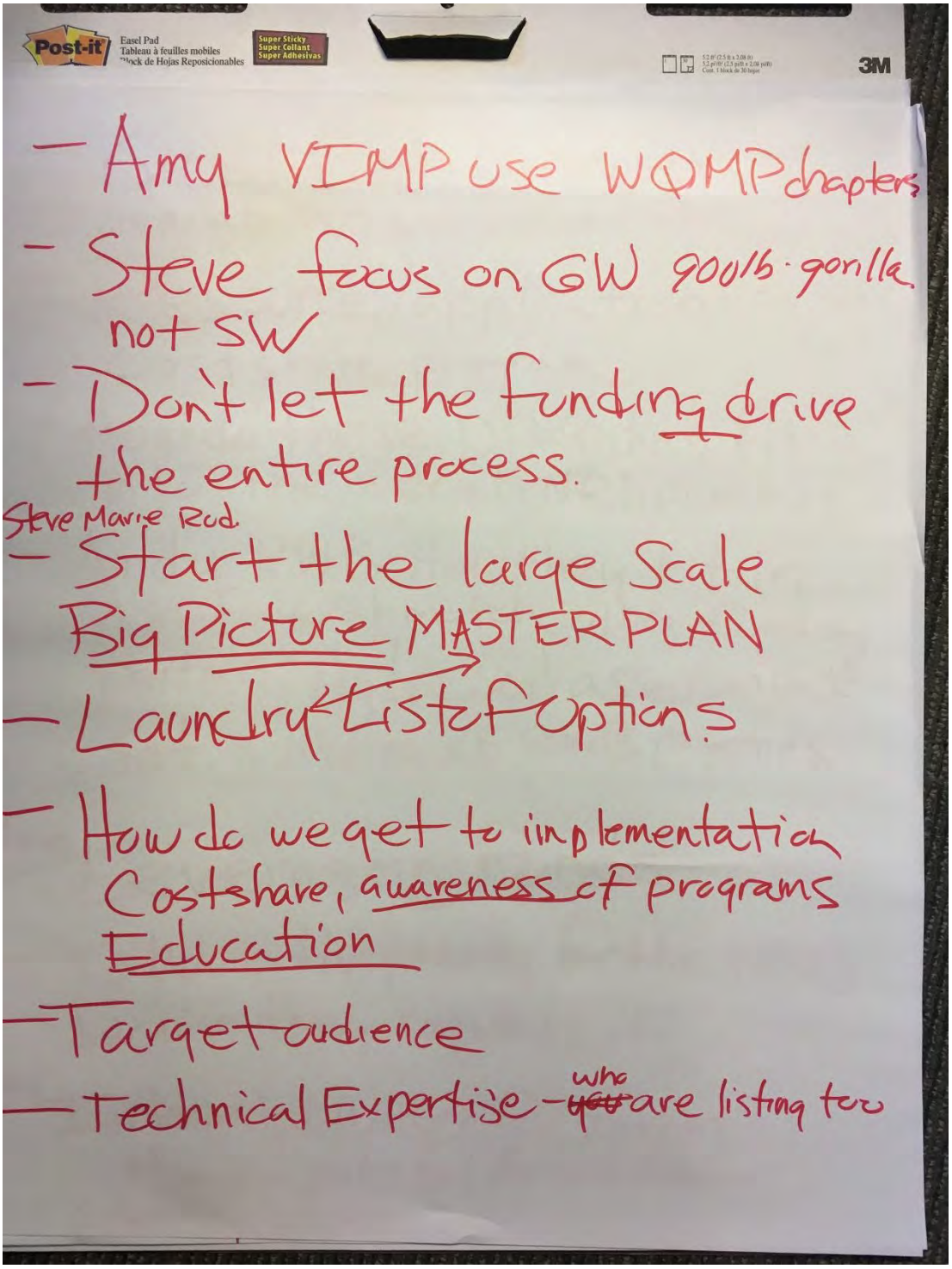
Super Adhesivas
3M
- Qualified personnel availability – watershed coordinator.
- Resource/application Costshare program
- How do these priorities fit into the overall NRD priorities
- Andy RWB How they fit in non-federal match other funding partners." Hydric soil assessment"
Get a listing of RWB priorities
Johnnie – Leveraging funds
- GW is the priorty for the NRD because they regulate it
Amy – Integrated Water Resources Mgmt – potential for collaboration
- Staffing Concerns


Post-it
Easel Pad
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Super Sticky
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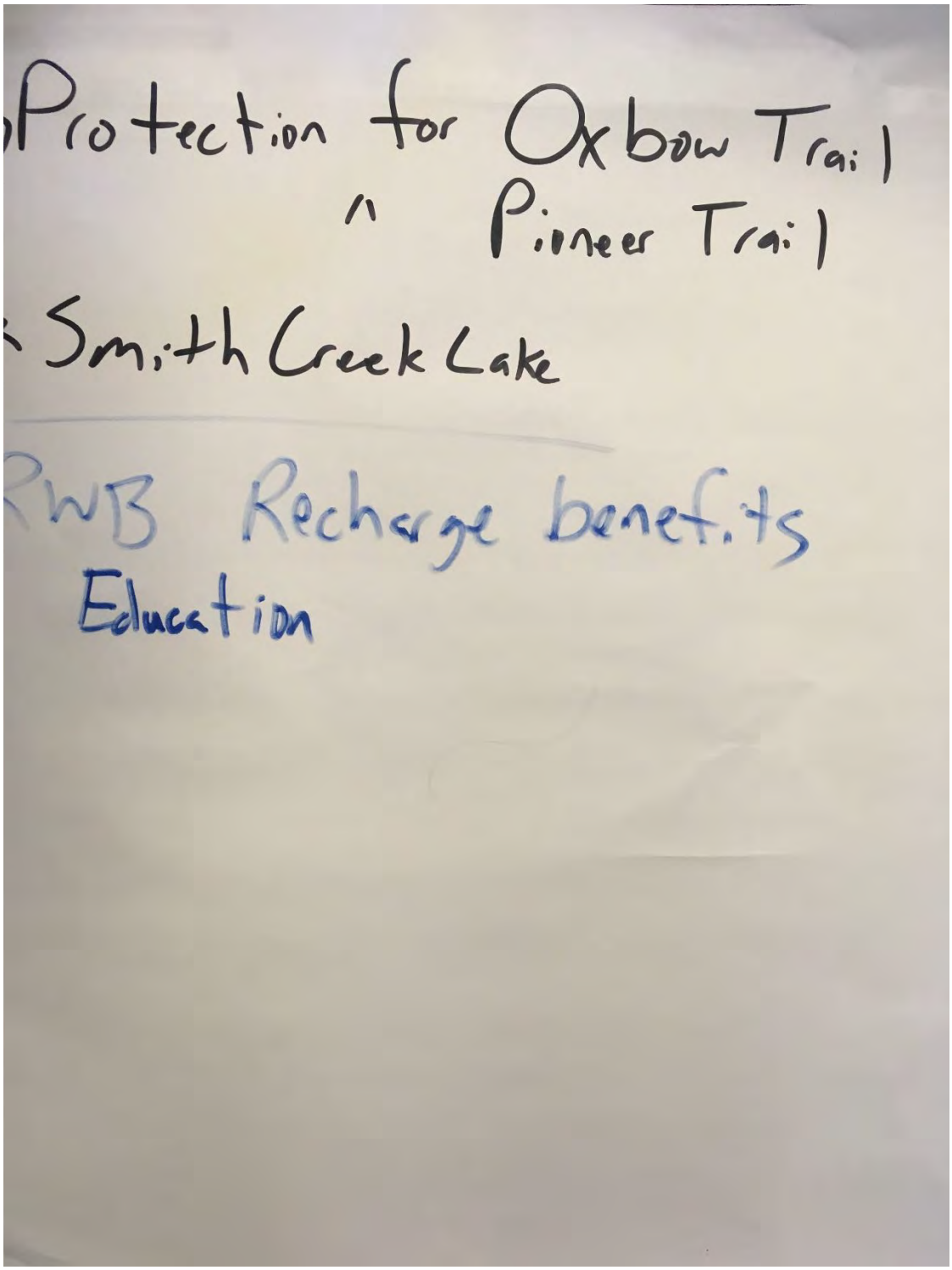
Super Adhesivas
3M
- Amy VIMP use WQMP chapters
- Steve focus on GW 90/6 · gorilla not SW
- Don't let the funding drive the entire process.
Steve Marie Rod
- Start the large Scale Big Picture MASTER PLAN
- Laundry List of options
- How do we get to implementation Costshare, awareness of programs Education
- Target audience
- Technical Expertise - who are listing too


Protection for Oxbow Trail
& Pioneer Trail
Smith Creek Lake
RWB Recharge benefits
Education

Upper Big Blue NRD – Water Quality Management Plan
"Technical Advisory Committee (TAC) Meeting #4"
UBBNRD Office – Monday, December 3, 2018; 1:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

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ENGINEERING ■ ARCHITECTURE ■ SURVEYING ■ PLANNING

UBBNRD Water Quality Management Plan and Voluntary Integrated Management Plan Facilitation

Technical Advisory Committee (TAC) Meeting #4 Minutes

DATE AND TIME | December 3, 2018; 1:00 p.m.
JEO PROJECT NO. | 161356.00
LOCATION | York, NE - UBBNRD Office
ATTENDEES | Sign in Sheet Attached

1. Meeting Overview and Purpose

- Talk about stakeholders' goals and objectives and related action items.
- Update on where the plan writing is. Several chapter almost out for editing.
- Rainwater basin joint venture
- Overview of Implementation strategy
- Reminder that there is one more stakeholder meeting, and two more TAC meeting to go.

2. Discussion Items

- Two sets of goals and objectives: one for Water Quality and one for the Voluntary integrated Management Plan.
    - Describe how the goals and objectives flow into the action items.
    - Still a working document, live edits last stakeholder meeting.
    - Comments on the goals and objectives: None
    - Send goals and objectives out to TAC members.
    - Rick asked for advice on education and outreach
        - Picture of stakeholder group in the newsletter. List their names in newsletter. Makes people more aware that things are happening.
        - Flyers at Co-ops (Used in Bazil plan)
        - Sign at end of drive way days leading up to meeting
        - Radio, spots by ag reports (effective if timed well)
        - Central and LPS run TV adds
        - FB/Twitter can work if you have good followers
        - Pandora or YouTube adds
- Rick poses the Fall Fertilization question:
    - Nothing good happens when you put your fertilizer on 6 months before the crops need it. Benefits- labor saver and cheaper in the fall. Negatives outweigh the benefits.
    - Education is the main struggle of this issue. People still disobey the Nov. 1 rule, some neighbors turn them in.
    - Logistic issue for Co-ops and farmers. Co-ops have said that they can make the spring work with enough lead time. Some said 3 years notice. CO-OPs need more storage for anhydrous.
    - Currently phase three areas require the use of an inhibitor. Inhibitor was somewhat meant as a deterrent for fall fertilizer. But no way to ensure that they are applying the inhibitor correctly.

  - Allowing only half needed was brought up in stakeholders discussion. Main issue is how to enforce this or any rule about amount of inhibitor use.
  - No fall fertilizer would be easier to enforce.
  - Perhaps only limit to phase 2 and 3 areas. The fairness of only certain areas having these regulations is constantly discussed. Whenever you draw a line, there will be a fairness issue.
- Andy - Rainwater Joint Basin Venture Presentation and Questions (starts at 41:45; ends 1:20:00ish)
  - Who the joint venture is. What they do. Where they are located.
    - Overseen by public/private partnership of Game and Parks, Fish and Wildlife, NRCS, Farm Service Agency, 3 NRDs and 6 Landowners.
    - Conservation delivery is core, but planning is used to make this work. And monitoring to see if plans/projects successful.
  - Projects
    - 8 separate geographies to plan for.
    - Beginning to investigate how they can make their projects good for birds and water resources issues.
    - Use conservation easements
    - Trying to strategically remove irrigation reuse pits to improve their wetland function.
    - Regional Conservation Partnership Program-Long term- restore wetlands and improve irrigation function.
    - See that the only way they will be able to achieve their goals is to partner with others to also help solve groundwater issues.
    - Don't want to see more regulation, but more cooperation
    - Questions include a discussion of 319 grant fund use and other funding options.
    - Discussion on how to get people interested in programs and help them select the right option for them.
- Adam discusses prioritization process and implementation strategy overview:
  - Process to identify priority water bodies, narrowing to find water bodies that can have something done with them in the next 5-10 years: Tier one waterbodies. Would be eligible for 319 funding.
  - All priority water bodies are in Beaver Creek Watershed.
  - Add wetlands to Beaver Creek Map.
  - Prioritize Wellhead Protection Areas.
  - Detailed prioritization process information is in the Memo.
  - Special Priority areas: Address specific local areas. Consist of wetlands, ground water (only when related to health), cattle (e.coli risk- small feed lots and pasture management), stream riparian areas.
  - Implementation strategy
    - Over all approach follows conservation pyramids. Soil health, then control pollutant entering, finally riparian management.
    - Next step is identifying priority BMPs. Discussed how these are selected and the current information on these.
    - Email TAC sources for load reduction estimates.
    - Suggested to include crop rotation in priority BMPs

        - How will BMPs be ranked? Rank by efficiency? Or efficiency per dollar spent?
    - Final Comments from TAC
        - If you could highlight the similarity/complement between plans. Symbol in plan or called out in some way.

3. Meeting Adjourn

- Next TAC meeting: February 4, 2019; 1:00 p.m. at UBBNRD office.
- Next stakeholder meeting: January 14, 2019; 7:00 p.m. at UBBNRD office.

4. Action Items

- Send Goals and objectives out to TAC members.
- Email TAC sources for load reduction estimates.

Upper Big Blue NRD – Water Quality Management Plan
"Technical Advisory Committee (TAC) Meeting #5"
UBBNRD Office – Monday, February 4, 2019; 1:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

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X	Steve Melvin	Extension Educator-Southeast Research and Extension Center	UNL Extension	1510 18th Street, PO Box 27, Central City, NE 68826-0027	308.946.3843	steve.melvin@unl.edu
	Jenny Rees	Extension Educator-Southeast Research and Extension Center	UNL Extension	2345 Nebraska Avenue, York, NE 68467-1104	402.363.5508	jrees2@unl.edu
	Mike Zwingman	Technical Development Manager	Verdesian Life Sciences		402.366.3442	mike.zwingman@vlsci.com
X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com
X	Adam Rupe	Natural Resources Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	arupe@jeo.com

Please Sign In!

Upper Big Blue NRD – Water Quality Management Plan
"Technical Advisory Committee (TAC) Meeting #6"
UBBNRD Office – Monday, April 1, 2019; 1:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

Present	NAME	TITLE	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
X	Carla McCullough	319 Nonpoint Source Coordinator	NDEQ	1200 N St., The Atrium, Suite 400, Lincoln, NE 68509	402.471.3382	Carla.mccullough@nebraska.gov
✓	Craig Romary	Environmental Programs Specialist	NE Dept. of Ag	PO Box 94947, Lincoln, NE	402.471.6883	Craig.romary@nebraska.gov
	Ted LaGrange	Wetland Program Manager	NGPC	2200 N. 33rd St., Lincoln, NE 68503	402.471.5436	Ted.lagrange@nebraska.gov
X	Amy Zoller	Integrated Water Management Coordinator	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	amy.zoller@nebraska.gov
X	Josh Bowers	District Conservationist	NRCS	419 W 6th St, #2, York, NE 68467	402.908.3157	joshua.bowers@ne.usda.gov
	Andy Bishop	Coordinator	Rainwater Basin Joint Venture	2550 N Diers Ave, Grand Island, NE 68803	308.382.8112	andy_bishop@fws.gov
	Matt Poesnecker	General Manager/Co-Owner	S & P Irrigation	110 S 16th St., Aurora, NE 68818	402.694.4011	matt@spirrigation.com
X	Lynn Yates	UBB Board Chairman	UBB NRD	915 Road 12, Geneva, NE 68361	402.759.4732	vyates53@gmail.com
	Doug Dickinson	UBB Board Projects Committee Chairman	UBB NRD	3354 McKelve Road, Seward NE 68434-7510	402.643.5456	farm_life@hotmail.com
X	John Miller	UBB Board Projects Committee Chairman	UBB NRD	165 Driftwood Drive, Aurora, NE 68818-1413	402.694.3570	pandj@hamilton.net
X	Rod DeBuhr	UBB Staff	UBB NRD	319 E 25th St, York, NE 68467	402.362.6601	rdebuhr@upperbigblue.org
X	Jack Wergin	UBB Staff	UBB NRD	319 E 25th St, York, NE 68467	402.362.6601	jwergin@upperbigblue.org
X	Marie Krausnick	UBB Staff	UBB NRD	319 E 25th St, York, NE 68467	402.362.6601	mebel@upperbigblue.org
X	Katie Pekarek	Associate Extension Educator- School of Natural Resources	UNL Extension	912 Hardin Hall, Lincoln, NE 68583-0989	402.817.5097	kpekarek2@unl.edu
X	Steve Melvin	Extension Educator-Southeast Research and Extension Center	UNL Extension	1510 18th Street, PO Box 27, Central City, NE 68826-0027	308.946.3843	steve.melvin@unl.edu
	Jenny Rees	Extension Educator-Southeast Research and Extension Center	UNL Extension	2345 Nebraska Avenue, York, NE 68467-1104	402.363.5508	jrees2@unl.edu
	Mike Zwingman	Technical Development Manager	Verdesian Life Sciences		402.366.3442	mike.zwingman@vlsci.com
X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com
X	Adam Rupe	Natural Resources Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	arupe@jeo.com

Please Sign In!

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #1"
UBBNRD Office – Monday, June 18, 2018; 7:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL	OK to share info with group?
✓	Dan Aspergren	Farmer	Farmer - Groundwater user	1060 North 1ST ST Geneva, NE68361	402.759.1420	aspegrend@Windstream.net	OK
	Mark Bailey	Farmer	Farmer- Past SPA Advisory Committee	42140 RD T Saronville, NE 68975	402.985.5106		
	John Denton	Ducks Unlimited	Wetlands/Wildlife	2121 N Webb RD STE 309 Grand Island, NE 68803	308.258.4682		
✓	Steve Driewer	GPM Enterprises Inc	Meter repair business	115 So. 16th St, Aurora NE 68818	210.862.9729	GPM@hamilton.net	yes
✓	~~Glen~~ Mick Franzluebbers Gwidukon	Central Valley Ag (COOP)	Agriculture / consulting	2803 N Nebraska Ave PO BOX 429 York, NE 68467	402.380.0521	michaelgoodukon@cvagcoop.com	yes
	Brandon Hegeholz	Farmer	Surface water/groundwater user	1177 North Columbia Ave Seward NE 68434	402.643.5662		
	Brandon Hunnicutt	Farmer	Farmer - Groundwater user	609 South G RD Giltner NE 68841			
X	Luke Jacobsen	Farmer	Farmer - Former NRD board Marginal groundwater area	2204 RD R Marquette NE 68854	402.694.9607	jacobsen14@yahoo.com	OK
	Steve Kier	Manager	Pioneer Seed York Plant	1410 Hwy 34, York NE 68467	402.362.3349		
X	Christine Lawrence	4 Corners Health Dept	Public Health	2101 North Lincoln Ave, York NE 68467	402.362.2621	clawrence@fourcornersne.org	yes
✓	Teresa Otte	Farmer	Woman farmer - Groundwater user	3471 H Rd David City, NE 68632	402.525.7900	gr82farm@gmail.com	yes
	Jason Perdue	Farmer	Young Farmer	1209 RD Q York NE 68467	402.366.2821		
	Tim Richtig	City of Seward	Municipal	City of Seward, Seward, NE 68434	402.643.3433		
✓	Marty Stange	Environmental Supervisor	Hastings Utilities	1228 North Denver Avenue	402.831.1399	mstange@hastingsutilities.com	yes
✓	Larry Tonniges	Farmer	Farmer - Soybean Growers Rep	4210 Branched Oak RD Utica NE68456	402.535.2331	Larry Tonniges	Prefers paper copy
✓	Tom Weber	Farmer/livestock	Farmer/livestock	~~1773 State HWY 33~~ 405 STATE Hwy 14 Dorchester NE 68343	402.432.4674	tweber68343@Hotmail.com	✓
✓	Greg Whitmore	Farmer	Farmer - Corn Growers Rep	12959 W RD Shelby NE 68662	402.362.8653	megafarmestew@inelsscom	✓
	Bill Whitney	Prairie Plains Institute	Environment	1307 L Street, Aurora, NE 68818	402.694.5535		
✓	Jim Green	Zoning Administrator	Village of McCool Junction	P.O. Box 145 McCool Jct., NE 68401	402 363 4081	mccooljunction@aol.com	yes

Please Sign In!

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #1"
UBBNRD Office – Monday, June 18, 2018; 7:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

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X	Steve Wolf	Community Engagement Director	JEO Consulting Group	111717 Burt Street, Suite 210, Omaha, NE 68154	402.392.9907	swolf@jeo.com	
X	Adam Rupe	Natural Resources Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	arupe@jeo.com	
X	Becky Appleford	Hazard Mitigation and Emergency Planning	JEO Consulting Group	111717 Burt Street, Suite 210, Omaha, NE 68154	402.934.3680	rappleford@jeo.com	
X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com	
X	Rod DeBuhr	UBB Staff	Upper Big Blue NRD	310 E 25th St, York, NE 68467	402.362.6601	rdebuhr@upperbigblue.org	
X	Jack Wergin	UBB Staff	Upper Big Blue NRD	310 E 25th St, York, NE 68467	402.362.6601	jwergin@upperbigblue.org	
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	Katie Pekarek	Associate Extension Educator-School of Natural Resources	UNL Extension	912 Hardin Hall, Lincoln, NE 68583-0989	402.817.5097	kpekarek2@unl.edu	
X	Amy Zoller	Integrated Water Management Coordinator	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	amy.zoller@nebraska.gov	
X	Elbert Traylor		NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.2585	elbert.traylor@nebraska.gov	
	Craig Romary		NDA				
	Ronda Rich		UBBNRD				
	Lyn Jobs		UBBNRD				
	Larry Jensen		UBBNRD				
	John Miller		UBBNRD				
1	Steve Melvin						
X	Grant Jackson		NRCS				
X	Jenny Rees		UNL				
X	Jon Schlapper		NeDNR				

Please Sign In!

UPPER BIG BLUE NRD

WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Minutes from Stakeholder Meeting 1

June 18, 2018
7:00 p.m. - 9:00 p.m.

Upper Big Blue NRD Office
319 E. 25th St.
York, NE 68467

Attendees

See attached attendance sheet

Agenda

1. Welcome

Rod DeBuhr, UBBNRD, provides welcome and discusses:

- District background – protects ground water quantity and quality through education, incentives, and regulations
- Project purpose/need – build relationships, identify and prioritize projects, identify future funding sources, etc.
- Project slogan: One District, Two Plans, One Water

2. Purpose of Stakeholder Committee

Steve Wolf, JEO facilitator, discusses:

Historic joint planning process - Collaborative planning process between NRD, NDEQ, and NeDNR
Goals – stakeholders to identify
Objectives – incremental steps to achieve goals
Ground rules, to respect people and meeting time were laid out:

- Discussions – one person talks at a time
- No side bars
- No personal attacks
- Parking lot – table issues if needed

3. Technical Presentation

Amy Zoller, NeDNR, and Elbert Traylor, NDEQ (see slides):
Voluntary Integrated Management Plans (VIMP) 101
Water Quality Management Plans 101

Discussion

Can we have a paper copy of the current plan and how this one is submitted and what progress has been made? Do we have a current plan?

- No current plan.

Are there examples of other plans for us to look at?

- Amy brought an example for LPNNRD Voluntary Integrated Management Plan
- Adam Rupe, JEO, brought a water quality plan from the South Loup River
- Additional plans available online at the NeDNR website (see binder for more information)

There are both required and voluntary management plans. Who imposes those standards?

- The NRDs in fully appropriated water basins (determined in 2004-05) had to develop an Integrated Management Plan (IMP). The State required so, implemented by the NeDNR and NRD. NRDs that are not Fully Appropriated may develop a VIMP.
- DEQ plans work with water quality and with non-point source pollution, which are voluntary. Non-point source is not currently required, strictly voluntary.
- The NRD does have regulatory authority over some things such as groundwater, but that is separate from this planning process. There can be some integration, but there are already regulations on reporting fertilizer use, water and soil samples.

Is there a point in terms of water quality that it can be bad enough where it would be imposed on the NRD by the NDEQ?

- NDEQ: No, they do not have any regulatory authority. NRD only have groundwater quality authority. Strictly a local authority.
- NDEQ does help NRDs delineate areas for sampling if requested.

Will annual reports be needed for each of the projects?

- They do semi-annual reports for NDEQ funded projects, but can be adjusted based on project needs
- NeDNR does annual reporting with the NRD
- It is recommended that both plans have an annual reporting process

4. Stakeholder Research

Binders were provided to each Stakeholder to save and review information handed out at each meeting

The Groundwater Atlas of Nebraska was also provided to each Stakeholder and should focus on the following sections: Introduction, Groundwater quantity, and Groundwater Quality

Discussion

The map shows pre-development, what data did they use to develop that?

- Data started in 1951. Original data in the map was with USGS and Nebraska Conservation and Survey Division. Then a few years later, the groundwater conservation boards in the area, which were districts preceding the NRD (mid to late 60s).
- USGS has data points back to 40s. However, there aren't enough data points to have a good confidence in it.
- Development here really started in the 50s. Pre-development means 1950 by USGS nomenclature

Is some of this data from well diggers?

- Could be but only if they had registered the wells and registration wasn't required until 1957.
- A lot of the early test wells were included in the mapping, however there's not very much data.

5. Stakeholder Roundtable

Digital records present at meetings to capture discussion and questions

Stakeholder map shows the diversity across the NRD

- Consent was asked to be given to share the map with the public
    - All present consented to allow the map to be shared with the public
- Speak with Rod or on the way out, place a checkmark on the sign-in sheet
    - This will allow the NRD to share the stakeholders contact information with each (not with the public). Only names will be provided to the public

Discussion

Are stakeholders working on consensus or veto power? (how to moderate power?)

- See if there's consensus. What has been set as goals and objections should be viewed as recommendations. Ultimately up to the NRD board to take what has been recommended to them and decide what ends up in the plan.
- Possible that not all recommendations will end up in the plan
- If we can't get to an overall agreement, offer up to do a vote or put things in the parking lot.

Each Stakeholder given chance to comment on expectations and why they are here:

- Ensure there's understanding between groundwater use and overirrigation, which can tie into nitrates. When talking about quality, consider water conservation as a potential avenue.
- Confused about implementation of the plan. That's strictly voluntary? (Yes.) "I have no problem doing it, if my neighbor's going to do it too." That's a question for another day.
    - Implementation will be discussed in further detail at later meetings.
- Goal setting = easier to see progress made. I like to set goals and I like to see the progress of where we are getting to them.
    - Stakeholders will get to directly see how their contributions are incorporated. A lot of transparency and accountability in this process.
- Nitrates are a big problem. Small communities spend a lot of money on new wells.
- Focused on ensuring access to water in future for irrigation or drinking
- Education is critical. Quality will enhance your quantity by using good conservation practices
- Historically, groundwater and surface water have been politically separated. But in practicality they're connected. Want to see all partners work together to find solutions.
    - Steve: This process has a great opportunity to make the needle move to bring things together. Getting to this point makes the NRD really hopeful.
- State of Nebraska's NRD system is way ahead of other states. Wants this to be a more collaborative rather than combative situation.

6. Public Comment

NRDs have come a long way since the 70s and folks are friendly. Good chance at being sustainable. Water quality harder piece to maintain. End goal is to ensure drinking water for the future.

Prefer doing voluntary plans rather than being forced as an NRD board to enforce rules.

Overall goal is to be proactive now with the help of this group.

Stakeholders – please be our ambassadors. Reach out to neighbors. Also, this is not about regulating and will not turn into regulation.

NRCS provides cost-share on nutrient management and irrigation water management.

Next Meeting Date: August 14, 2018 at 7 p.m.

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #1"
UBBNRD Office – Monday, June 18, 2018; 7:00 p.m.

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL	OK to share info with group?
X	Dan Aspergren	Farmer	Farmer - Groundwater user	1060 North 1st St, Geneva, NE68361	402.759.1420	aspergren@windstream.net	Yes
	Mark Bailey	Farmer	Farmer- Past SPA Advisory Committee	42140 RD T, Saronville, NE 68975	402.985.5106		
	John Denton	Ducks Unlimited	Wetlands/Wildlife	2121 N Webb Rd Ste 309, Grand Island, NE 68803	308.258.4682		
X	Steve Driewer	GPM Enterprises Inc	Meter repair business	115 So. 16th St, Aurora, NE 68818	210.862.9729	gpm@hamilton.net	Yes
X	Mick Goedeken	Central Valley Ag (COOP)	Agriculture / consulting	340 Oak St, Shelby, NE 68662	402.860.2489	michael.goedeken@cvacoop.com	Yes
	Brandon Hegeholz	Farmer	Surface water/groundwater user	1177 North Columbia Ave, Seward, NE 68434	402.643.5662		
	Brandon Hunnicutt	Farmer	Farmer - Groundwater user	609 South G Rd, Giltner, NE 68841			
X	Luke Jacobsen	Farmer	Farmer - Former NRD board Marginal groundwater area	2204 Rd R, Marquette, NE 68854	402.694.9607	jacobsenlu@yahoo.com	Yes
	Steve Kier	Manager	Pioneer Seed York Plant	1410 Hwy 34, York, NE 68467	402.362.3349		
X	Christine Lawrence	4 Corners Health Dept	Public Health	2101 North Lincoln Ave, York, NE 68467	402.362.2621	chrisl@fourcorners.ne.org	Yes
X	Teresa Otte	Farmer	Woman farmer - Groundwater user	3471 H Rd, David City, NE 68632	402.525.7900	gr82farm@gmail.com	Yes
	Jason Perdue	Farmer	Young Farmer	1209 RD Q, York, NE 68467	402.366.2821		
	Tim Richtig	Water/Wastewater Superintendent	Municipal	537 Main St, Seward, NE 68434	402.643.3433	Tim.Richtig@CityofSewardNE.gov	
X	Marty Stange	Environmental Supervisor	Hastings Utilities	1228 N Denver Ave, Hastings, NE 68901	402.831.1399	mstange@hastingsutilities.com	Yes
X	Larry Tonniges	Farmer	Farmer - Soybean Growers Rep	4210 Branched Oak Rd, Utica, NE68456	402.535.2331	(prefers paper copies)	Yes
X	Tom Weber	Farmer/livestock	Farmer/livestock	405 State HWY 15, Dorchester, NE 68343	402.432.4674	tweber68343@hotmail.com	Yes
X	Greg Whitmore	Farmer	Farmer - Corn Growers Rep	12959 W Rd, Shelby, NE 68662	402.362.8653	megafarm@stewireless.com	Yes
	Bill Whitney	Prairie Plains Institute	Environment	1307 L Street, Aurora, NE 68818	402.694.5535		
X	Jim Green	Zoning Administrator	Village of McCool Junction	PO Box 145, McCool Junction, NE 68401	402.363.4081	mccoolutilities@galaxycable.com	Yes
X	Steve Wolf	Community Engagement Director	JEO Consulting Group	111717 Burt Street Ste 210, Omaha, NE 68154	402.392.9907	swolf@jeo.com	

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #1"
UBBNRD Office – Monday, June 18, 2018; 7:00 p.m.

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X	Becky Appleford	Hazard Mitigation and Emergency Planning	JEO Consulting Group	111717 Burt Street Ste 210, Omaha, NE 68154	402.934.3680	rappleford@jeo.com	
X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com	
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X	Marie Krausnick	UBB Staff	Upper Big Blue NRD	310 E 25th St, York, NE 68467	402.362.6601	mebel@upperbigblue.org	
	Katie Pekarek	Associate Extension Educator- School of Natural Resources	UNL Extension	912 Hardin Hall, Lincoln, NE 68583-0989	402.817.5097	kpekarek2@unl.edu	
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X	Elbert Traylor		NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.2585	elbert.traylor@nebraska.gov	
X	Craig Romary		NDA				
X	Ronda Rich	Board Member	Upper Big Blue NRD	310 E 25th St, York, NE 68467			
X	Lynn Yates	Board Chairman	Upper Big Blue NRD	310 E 25th St, York, NE 68467			
X	Larry Moore	Board Member	Upper Big Blue NRD	310 E 25th St, York, NE 68467			
X	John Miller	Board Member	Upper Big Blue NRD	310 E 25th St, York, NE 68467			
X	Dave Eigenberg	General Manager	Upper Big Blue NRD	310 E 25th St, York, NE 68467			
X	Steve Melvin						
X	Grant Jackson	Resource Conservationist	NRCS				
X	Jenny Rees	Extension Educator	UNL				
X	Jen Schellpeper	Water Planning Division Head	NeDNR				

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #2"
UBBNRD Office – Tuesday, August 14, 2018; 7:00 p.m.

9

Please place a check next to your name, if present. | If any information is incorrect, or needs updated, please cross out and provide

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
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	Mark Bailey	Farmer	Farmer- Past SPA Advisory Committee	42140 RD T Saronville, NE 68975	402.985.5106	
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	Jason Perdue	Farmer	Young Farmer	1209 RD Q York NE 68467	402.366.2821	
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✓	Bill Whitney	Prairie Plains Institute	Environment	1307 L Street, Aurora, NE 68818	402.694.5535 631-7052	pprairieplains@hamiltontel.net
✓	Jim Green	Zoning Administrator	Village of McCool Junction	PO Box 145, McCool Junction, NE 68001	402.363.4081	mccoolutilities@galaxycable.net

Please Sign In!

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
"Stakeholder Meeting #2"
UBBNRD Office – Tuesday, August 14, 2018; 7:00 p.m.

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✓	Jack Wergin	UBB Staff	Upper Big Blue NRD	310 E 25th St, York, NE 68467	402.362.6601	jwergin@upperbigblue.org
✓	Marie Krausnick	UBB Staff	Upper Big Blue NRD	310 E 25th St, York, NE 68467	402.362.6601	mebel@upperbigblue.org
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	Scott Swee	P.R. MANAGER	UBBNRD			
	Larry K Owens	UBB BOARD				
	Kenda Buck	UBB Board of NRD Director				
	Eugene Ulmer	Former NRD Director				
	Jan Schyll	P. RLV				

Please Sign In!

UPPER BIG BLUE NRD

WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Minutes from Stakeholder Meeting 2

August 14, 2018
7:00 p.m. - 9:00 p.m.

Upper Big Blue NRD Office
319 E. 25th St.
York, NE 68467

Attendees

See attached attendance sheet

Agenda

1. **Welcome** provided by Steve Wolf, JEO Consulting Group
2. **Water Quality**

- Overview of Water Quality Management Plans – presentation by Adam Rupe, JEO
  - A WQMP is a voluntary approach to reducing pollution that is entering waterways. Nebraska Department of Environmental Quality (NDEQ) helps take a lead on it.
  - Developing a WQMP makes groups eligible for grant funding Section 319 grant funding, provided through U.S. Environmental Protection Agency (EPA). The plan needs to be approved by NDEQ and follow a set of requirements (i.e., "9 Elements"). Update cycle is every five years. Funding is also required to have match dollars from a local source.
  - Main purpose of the plan is to encourage landowners to voluntarily install BMPs. The plan will help prioritize actions based on the science and what the public is interested in. Without public interest and willingness, the plan will not be able to be implemented.
- Surface Water Quality – presentation by Adam Rupe, JEO
  - Data collected mainly by NDEQ for surface water quality. The NRD focuses on the groundwater side. NDEQ has two main programs: Ambient Sampling and the Basin Rotation Program.
    - Ambient Sampling - NDEQ samples at 101 sites across the state throughout the year. Sampling looks at Nitrogen, *E. coli* bacteria, phosphorus, pesticides (atrazine). This plan will also look at these. There are no ambient lake sites, though they do get sampled but not on a regular basis.

- There is another program based on rotational sampling that provides a deep dive into one of the basins in the state every six years. Right now, NDEQ is in the Big Blue basin doing samplings. The same parameters plus bacteria that gets sampled.

- Data is used to find the trends in the water; identify sources of pollution to make prioritization; and evaluate projects/alternatives/BMPs proposed.
- Key takeaways from technical presentation:
  - There are only four sites in the district that have continuous data (ambient). All the other water bodies only have one or two years of sampling data. Collectively, we have an overall picture, but the limited data makes it difficult to assess what is happening on a long-term or site specific basis.
  - Atrazine is a pollutant of concern. There are multiple streams that are impaired for high levels of atrazine. There are no natural sources of atrazine—it is typically applied to corn, sorghum, and pine tree farms. Highest runoff potential is June, when most of it is being applied and there are springtime rainfalls.
  - *E. coli* is another parameter of concern. Wildlife and cattle (that aren't in regulated facilities) are major sources.

Discussion

- Have there been any cases of human *E. coli* problems that can be traced back to water quality problems?
  - Not that anyone has heard, but not all cases are known.
- How do you test for the nutrients in the river?
  - Grab samples are sent to several different labs. If wanted, can give information on the labs.
- When doing nutrient testing, is there a way to tell where N/P came from?
  - It is difficult to determine source of pollutants. The numerical water quality models help predict some of that. We have a general idea of where the sources are at, which can then go into mapping analysis.
- When looking for *E. coli* do you look for a specific strand?
  - Testing is not species specific. *E. coli* is used to indicate a general presence of fecal contamination. No specific strain is identified currently, however methods are being developed to track source of contaminant.
- For pesticides, the only one we are looking at is Atrazine?
  - Correct. The sampling does include multiple types of pesticides but for the plan, only atrazine data is analyzed.
- Is there a correlation between stream buffers/drainage ditches and atrazine levels? We see more and more fields cleaning tilled, which means it's hard to stop or slow down sediment erosion.
  - No formal data available but it has been discussed to include a review of land use over time.

- Groundwater Quality – presentation provided Upper Big Blue NRD staff

Marie Krausnick, Water Department Manager, Upper Big Blue NRD

- Pollutants of concern are long term impacts: selenium, arsenic, and uranium.
- Nitrate is linked to health impacts and worse for young and elderly.
- Annually, the UBBNRD sample wells annually so have trends on all wells.
- Current research is still being done to determine all long-term impacts. Some preliminary data indicates that increases in nitrogen in the aquifer are triggering natural release of selenium, arsenic, and uranium from geologic material.
- Not every well is sampled every year. Based on criterion established by location, construction date, past data, etc. Single screen dedicated sampling lines. Today they sample about half of the district on an annual basis. Right now, sampling sectors 7 and 8.
- Maintain same standard operating procedures (SOPs) for taking samples to make data comparable year after year.
  - Purge wells for an hour or two before taking a sample.
  - Always check parameters.
  - Will take duplicates and blanks.
  - Current lab is Servitech in Hastings. Different lab from one had problems with a few years ago
  - Will always have at least 30 sites of data.

Discussion

- Say you miss one year of sampling at a site, will you take the average of the year prior and year after missing to fill that data point in?
  - That could be an option, yes. We are trying to get samples every year. It would be different if you need to go back a long period (10-year sample).
- On the walk-in testing, is that only for landowners?
  - No, we do irrigation wells as well (required every three years). Will test them for free, will even give farmers/landowners bottles to take samples in.

Rod DeBuhr, Assistant General Manager, Upper Big Blue NRD

- Provided an overview of existing NRD programs (i.e., buffer strips, filter strips, riparian strips) and funding information.
  - They will go out and inspect the buffer strips once have a contract. Have found errors where, rather than the farmer keeping strip between stream and crop ground, land can't go into CRP. Disqualifies them from the buffer strip cost reduction, so if they do want to put crop land into CRP they need to rollover that strip too. Otherwise will lose payment on the strip.
  - Have also seen some poorly grassed (lots of weeds) and such on strips so need to remind landowners that they need to maintain the buffer strips.

- The Upper Big Blue NRD started a variable rate irrigation pilot program that provides incentives to improve irrigation application efficiency. Not always a water savings, could be other methods. (zone patrol, speed controls, etc.). Currently limited to one line per one owner.
- Have talked to pivot producers and they said most equipment is set up for speed patrol, but most people aren't using them.
- In 2016, the Upper Big Blue started private dams program, providing financial incentives for property owners to rebuild dams that had been washed out or damaged. Also covers new dams. The NRD will fund 75% up to $50,000. 2017 had three dams, 2018 had seven dams. Average cost of Upper Big Blue cost share is $19,000.

Discussion

- A large amount of money was spent on terraces, was that due to the NRCS cracking down on?
  - It was mainly because it is one of our higher funded programs, especially in the affected counties. Have been consistent in the amount over the past few years. State funding has dropped however.

Scott Snell, Public Relations Manager, Upper Big Blue NRD

- All these plans will eventually culminate in policy. In the past NRDs have acted independently and made their own plans and policies based on annual rainfall and local geographic profiles. Because of that, everyone has different rules and regulations across the 23 NRDs. There is a traveling display with the rules from each NRD.
- Scholarships are in place. Help encourage the use and knowledge of policy in place. Fact sheets - they're not afraid to talk about themselves. This NRD also has a long and comprehensive annual report.
- Project Grow - an area where they bring components of policy to a more local level. Crop rotation, pollinators, community garden. The NRD is really trying to be open and transparent about projects and goals with the public and decisionmakers.
- Rules:
  - Can't evangelize if you antagonize. Don't want to alienate people.
  - Optimism achieves activism
  - Don't forget where you came from and why you came this way
- Involving shareholders is important with policy to get the lay of the land from people that are in the situation.
- Building bridges = engaging partnerships. You cannot build a bridge from one side to the other, instead you start from either side and move in the middle.

Discussion

- Do you take the river run (one of the public displays) to the state fair?
  - We used to. It's so large that it takes a whole room, so they have decided not to have us back due to space constraints.

3. Stakeholder Discussion facilitated by Steve Wolf, JEO Consulting Group

- What problems and problem areas do you see that you think should be addressed?
    - Seems like it boils down to point source pollution versus nonpoint source.
    - Making sure we're looking at the different sources of point-source and nonpoint-source pollution.
    - All wells may have different test results even within the same aquifer. Most of those are from nonpoint source pollution as its coming from upgrading. There are going to be variations across a same area as all nonpoint source is really an accumulation of point sources. The sample area is so large that there will be some that are high and others that are low.
    - surface water is part of the recharge for groundwater. Protecting surface water is protecting recharge.
        - For that recharge water, where do we need to protect it? Is it in certain areas?
            - Depends on where the waterbody of concern is and where it feeds into groundwater.
    - It's all one water.
    - Are we prioritizing anything – groundwater or source water or are they all the same priority in the process?
        - Project Team response: That's a good question without a right or wrong answer. It is up to the stakeholders to say what the priorities are, and we will use data to help inform prioritization decisions.
    - Depth of the well is very important to know. A deeper well will have lower nitrates than shallow wells. That could be a factor in this variability
    - Stream degradation: at what point is there regulatory oversite if there is stream degradation? Is it the point at which communities downstream have trouble with reservoir? (Tongue Creek used as an example.)
        - Project Team response: Kansas City area does divert water from Tongue Creek for drinking water, and they do test the water for contaminants as it enters the state. In Nebraska, no one uses surface water for drinking water.
    - How far upstream does stream degradation go and where do the regulatory teeth come out? If Kansas is testing and have high test results, can they say "Nebraska, you need to stop that"?
        - Project Team response: There have been friendly discussions with Kansas. The Kansas-Nebraska Big Blue Compact is the on compact Nebraska has that incorporates water quality to water quantity. Nebraska meet with them on an annual basis and we talk about things like that. Kansas is excited that Nebraska is completing water plans here that are addressing these issues. As far as regulatory concerns, I don't know if the teeth are through that compact. Stream degradation is an issue, but it is not a regulated issue
    - Stream degradation is a problem and even if there are no teeth to regulation for it, it deserves our attention.

- As far as your mind or that you hear around, are there any perceptions or talk going on right now about groundwater?
    - I have heard we will never run out, so it is not a big deal. And that was from some very well-educated people so I'm just like, "What?" It's exactly what Kansas did. So, part of it is education.
    - I think everyone tends to look at the boundaries of their own responsibilities. We lack perception of landscape scale in terms of stream degradation. Some of these issues won't be solved until we look at the whole watershed and change the way we interact with the natural processes for the streams. A lot like the spread of trees and shrubs across the grasslands. It has major degrading effects across the plains. If we had a bigger landscape view, I think it's something that leaders need to work to understand. There are no band-aids to fix it and it makes it really challenging.
    - What's the cost of treating water? As a rural state, we have a lot of smaller communities and a lot of these communities do not have tax base to afford to treat their water. They are going to be looking at alternative ways to get water. It can be millions of dollars to get clean safe treated water to a community of say 500. They cannot withstand that sort of cost.
- What do you feel is your role or your organizations role in helping to address these issues? Some of you are farmers, some of you are organizations–what is your perspective?
    - Share your knowledge. Do not hesitate to stand in front of someone and talk to them.
    - Research for more and for better data, particularly for soil health. This is not talked about much because we do not have very good testing metrics.
    - Better nutrient management for crops.
    - It seems like over recent years there has been an economic incentive for more corn and more irrigation, more fertility to produce more crops. I think one of the solutions is crop diversity. We are all incentivized by economics, but we should argue for diversity.
    - We need to work to develop a passion for where we live. We need to get people interested in something they will be active in helping to address. Goes along with educating people to do things.
    - If we look at economics, it is a huge economic problem for small towns—and it is a challenge to address nitrates, one of the biggest problems we face. I think small towns are afraid to get the test results back high and to be asked how they are going to address it.
    - Is uranium mobile?
        - Project Team response: With nitrogen, uranium becomes mobile and thus becomes the problem
    - Is there a way to mitigate uranium?
        - Project Team response: We do not know yet. What we are trying to do is reduce the food source, the nitrates, then that could slow up the biological growth and uranium leach. But I don't know how we can change that recharge. We know nitrates are coming down from the surface and unfortunately, there's already a 120-foot profile that has

nitrogen in it, and it will take years to go away. Will it mitigate if we just stop irrigating? We don't know.
        - If we mitigate it, we have to get rid of what we already have and that's very expensive. Right now, there's enough uranium in plants – PPD just shut down a plant and there's more and more plants going to be shut down. We're concerned we're not going to be able to get rid of the uranium. We put it in a mountain somewhere, we're responsible for it for forever. If it leaks in 100-200 years from now, our community is responsible for it. We don't need to take that responsibility on.
- What questions do you or your neighbors have about water quality best management practices?
    - People aren't ignorant, but the issues are scary. Adding up figures that are going to tax people to death. Something said in small communities and village water system – why deal with all this? We'll just drill a new well and add it to the system.
    - There is a landfill that takes low action radiation waste from out of state. This creates concern about it being managed properly and if it's leaching down into the groundwater system. It also prompts questions about why it is coming to our state—keep it where you made it.
    - Manure application, particularly with Costco chickens coming in. One of the silent questions is what other bacteria are we adding and spreading to the community? Are we causing antibiotic resistance?
        - People ask, "what aren't we testing for that?" The reason they do not test for things is that it is expensive.
    - Why don't we have grassed waterways? People plant every inch and then rain comes and washes out a wide path through the field. Why aren't we having those wash areas grassed? What will it take to fix that problem?
- Is there anything you feel the NRD should address? What's the best way to get that information out to the public?
    - I think the NRD does a good job. You are trying to talk to an audience who does not want to listen.
    - I think some of the education starts at the school level. create awareness of what they can do. Some of the pollution we have comes from the urban sector just as much as from the farm.
        - Expand that through 4H and FFA programs.
    - The NRD can be a very strong advocate for natural resource education. That is needed everywhere, more than what they already do. It needs to address both traditional and non-traditional school programs and methods. This is a team effort because the plate is so big. We all have something to contribute.
    - We take a lot of pride in the NRD system here in the state, but there's more that can be done.
        - Scott Snell, Upper Big Blue NRD: NRD Papio-Missouri NRD has four people on staff who do what I do. They have two people dedicated just to going to schools. I mean my kids at home had their first day of school and instead I'm here working rather than asking them how their day went. If we need to do more to engage, we need more people and budget.

        - The need is greater than our willingness to address it.
- What are the incentives to get you and your neighbors to contribute to these projects and address problems? What's the carrot and/or stick?
    - Money
        - Money for education.
        - Hastings has a rebate for soil testing, but very few farmers do come in for their rebate. They say, "it's just not worth my time."
    - Attitude differences in generations.
- Are there any other best ways to communicate and educate the public we don't have yet?
    - Upper Big Blue NRD's *Blueprint* newsletter and other publications

4. Stakeholder Research Assignment

- Hand out from Adam Rupe.

5. Stakeholder Roundtable

- Keep up with the discussion.
- We really hammered on that we need to educate. I've seen some great opportunities from NRDs north of here with two schools with science teachers have water quality programs over the summer. It's a great way to have schools help check water quality.
- Sharing knowledge is an integral part of this process
- Sometimes we get a little impatient, remember to be patient with education.
- Challenge will be how to get people interested. We can talk about education but is a high school senior interested in his groundwater or is it just if his shower tonight is going to be clean?
- Can we make it personal about concerns? Specific about e. coli or uranium.
- The NRDs (the Blues) have provided so much technical support and share knowledge. It's been a great resource. Thank you.
- Education would be great, but you can preach and preach yet it will not do anything. But start a sentence with a dollar sign, tell people that if we do not do this now, it will cost everyone one of you what it will cost to fix it. Maybe we should put these figures out here what it is costing per person in communities to get clean water. We can educate but that does not make people listen.
- Had a meeting in York about raising taxes and then everyone started coming to meetings.
- We went through questions at the end pretty fast - will there be a chance for stakeholders to add additional thoughts and comments if we didn't get to it tonight?
    - Project Team response: if you have comments please send them to us.

Next Meeting Dates

- September 10, 2018 at 7 p.m. – focus will be on water QUANTITY

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 3
UBBNRD Office – Monday, September 10, 2018; 7:00 p.m.

Please place a check next to your name, if present. If any information needs revised, please cross out and updated accordingly.

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	Brandon Hunnictt	Farmer	Farmer - Groundwater user	609 South G RD Giltner NE 68841		dirtpoorfarmer@gmail.com
	Christine Lawrence	4 Corners Health Dept	Public Health	2101 North Lincoln Ave, York NE 68467	402.362.2621	chris1@fourcorners.ne.org
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X	Greg Whitmore	Farmer	Farmer - Corn Growers Rep	12959 W RD Shelby NE 68662	402.362.8653	megafarm@stewireless.com
	Jason Perdue	Farmer	Young Farmer	1209 RD Q York NE 68467	402.366.2821	
	Jim Green	Zoning Administrator	Village of McCool Junction	PO Box 145, McCool Junction, NE 68001	402.363.4081	mccoolutilities@galaxycable.net
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	Larry Tonniges	Farmer	Farmer - Soybean Growers Rep	4210 Branched Oak RD Utica NE68456	402.535.2331	
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X	Tim Richtig	City of Seward	Municipal	City of Seward, Seward, NE 68434	402.643.3433	tim.richtig@cityofsewardne.com
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Please Sign In!

NEBRASKA DEPT. OF ENVIRONMENTAL QUALITY

NEBRASKA Good Life. Great Water. DEPT. OF NATURAL RESOURCES

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 3
UBBNRD Office – Monday, September 10, 2018; 7:00 p.m.

Please place a check next to your name, if present. If any information needs revised, please cross out and updated accordingly.

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
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✓	Steve Melvin					
✓	John Miller	UBB NRD				
C	Lynn Yates	UBB NRD				
	Josh Bowers	NRCS				
	Ronda Rich	UBB NRD				
	EUGENE ULMER	FORMER DIRECTOR UBBNRD				

Please Sign In!

UPPER BIG BLUE NRD

WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Minutes from Stakeholder Meeting 3

September 10, 2018
7:00 p.m. - 9:00 p.m.

Upper Big Blue NRD Office
319 E. 25th St.
York, NE 68467

Attendees

See attached attendance sheet

Agenda

1. **Welcome** provided by Steve Wolf, JEO Consulting Group
    - Introductions by Stakeholders
    - Other observers are in the room and we may provide them time to provide comments at the end. However, purpose of meeting is for the stakeholders.
    - Follow up Discussion: What kind of things did you observe in materials since our last meeting?
        - Marty – mentioned that really good information was shared at the last meeting. Modeling tools and concepts are really helpful.
        - Comment – when talking about monitoring wells it has to be there 90 days, it's a short period of time. But with municipal wells we'll put it in and it may take us nine months or so to get to that well. We like to keep it there to do the draw down tests. We can't meet the 90-day timelines. We abandon it at the end of the monitoring. But we need longer than the 90 days to meet regulations.
        - Rod – that 90-day rule is statute.

2. **Water Quantity**
    - NRD actions/efforts – presentation by Marie Upper Big Blue NRD
        - Groundwater works on the correlative rights system
        - Currently the district has a groundwater management plan.
            - This does not include any discussion of surface water.

        - Rule 5 – all water quantity hinges on GW quantity charts set in 1978. This chart provides benchmarks about where groundwater levels have to be.
        - The NRD takes new measurements each year, each well is done within a few days of each other.
        - Voluntary Water Quality Management Plan
            - Can build off existing rules but draws in hydrologically connected areas.
        - In 2005, they hit the allocation trigger from Rule 5.
            - Began putting in metering on all new or existing high capacity wells (pump over 50 gallons per minute)
    - Currently the board sets allocations
        - These were based on yearly metering data
        - First allocation is 30 inches over 3 years
        - Second allocation is 45 inches over 5 years
    - Additional programs set up to help farmers be efficient with their water
        - Water Quality Management Area came into Phase II
            - Water Mark Sensors helped lead to a Soil Moisture discount (available at a 50% discount)
        - Recently elected to pilot a Variable Rate Irrigation Program
            - May not be a water savings program, but is a water application efficiency program

- NeDNR actions/efforts – presentation by Jeremy Gehle, NeDNR
    - Surface Water
        - Comes from rivers, lakes, and streams. Supplied by precipitation.
        - Rather than correlative rights, surface water is regulated by prior appropriation doctrine (first in time, first in right)
        - Since we rely on precipitation, the supply of surface water is as reliable as the weather.
    - NeDNR has several offices to administer throughout the state of Nebraska
        - The Blue River Basin is covered out of the Lincoln office
        - Department is charged with administration and data collection for water based on:
            - Blue River Compact
            - Surface Water Rights
        - Data Collection
            - 250 stream gages across the state
        - Surface Water Permitting
            - Applications can be for any use or purpose (irrigation, storage, municipal, recreation, wetland enhancement, etc.)
            - Have to provide a map with the number of acres planning to apply water to. Appropriation is based on this.
        - Can also require annual reports from irrigators or water users
    - What happens when people run short of water?
        - Department gets a call for a request for water

        - Have to go through and verify the report
        - If verified, then will go through and shut down junior water users and ensure all senior appropriators are pumping what they're allocated
    - The Blue River Compact
        - Approved in 1972, Priority Date of Nov 1, 1968
        - First compact in the nation to include water quality between NE and KS
        - Unique aspect: There is a section of the river between KS and Beatrice where wells can be administrated as if they have surface water rights.
            - It's up to the Department to administrate wells in the same way as surface water in order to sustain flows for the compact.

- Joint NRD/NeDNR – presentation provided by Marie, Jeremy, Jennifer
    - How do we manage ground water quantity and surface water quantity as one in the hydrologically connected areas?
    - The idea of this plan is to be PROACTIVE. We want to be continually engaged between state, agencies, and local stakeholders
    - What is the data we have built so far?
        - INSIGHT is a website that provides a variety of data and information about the basin.
        - Includes Long Term Water Balance
    - Water Budgets
        - Water uses and supplies across the basin
    - Integrated management will look at all activities and help determine which activities are impacting the amount of water in the stream. What is depleting the flows to the stream?
        - A broad range of complicated components go into determining groundwater depletion.
    - A lot of data and information to capture, how do they collect that across the region? They look at groundwater models. There is a joint groundwater modeling effort going on between NRD and NeDNR. Does include Upper Big Blue, Little Blue, Lower Big Blue, and Tri-Basin NRDs.
        - Marie: We currently require that any water user that comes in and wants to pull more than 500 acre-feet annually needs to complete a hydrologic evaluation. This new model will help communities avoid going to engineering firms to do an evaluation, as those could be run for communities internally.
        - With this model, also looking to include contaminant transport and scenarios. Ergo, a multi-purpose model.

    Discussion
        - Tim Richtiq: what did you say was the water usage for those evaluations? Can you give me an idea of who that would include?
            - 500 acre-feet. Ethanol manufacturers, City of York, Nitrogen plant by Geneva, power plants

- Tim Richtiq: How much water do beef (meat or industrial) processing plants use?
    - The largest user that they have in the district is the ethanol plant. Seward could, but to increase by 200 acre-feet would take quite a bit of development.
- Teresa: Is farmland in Crete part of our district?
    - No, it is not. There might be a subdivision within the district, but not much. We come right up to the edge of the city.
    - So for our area the dairy would probably be our biggest user.
    - Maria: Even they don't use that much water (over 500 acre-feet)
    - Once they have used their water (first use) through their wastewater system, it doesn't count towards their allocation. So recycling water is basically free water.
- Other Nonstakeholder Comment: How much water fills Memorial Stadium? How does it relate to water usage by the farmers?
    - Roughly equivalent of 4 pivots
- Luke: Aurora and York have some ethanol plant so looks like there are increases there. Is there any thought about that could have an influence?
    - Have to keep in mind that these maps are for visual purposes and should not be used explicitly. Example: a group of wells was measured and four were down one foot, but one was down almost five feet. So that one well made the 'red blob' north of Seward.
- Mark: So of those five wells in your example, how do you weight those wells?
    - Marie: So when you have wells, they aren't on a perfect grid. For each well we use a "Thiessen Polygon Method of Weighting" within GIS. Now instead of by hand, GIS can help us calculate weights. We set the parameters and GIS gives us the polygon. Each polygon has a different area which is then weighted.
    - Each well represents a certain amount of area. They further apart wells are, the more they represent.
- Teresa: Do surface water users have to have flow meters? Do they use flowmeters? How do you measure the flow?
    - Jeremy: There's not a blanket coverage for surface water. However, the UBB is one of the few areas in the state that do require meters during times of shortage and the requirement for meters for SW is primarily for the need of water administration.
    - As soon as there's a closure on the river, basically everyone above that requires meters on the river. Different types of meters allow for faster recording.
- Tom: Is there a setback between streams and irrigation wells?

  - Jeremy: No. One of the requirements for the permit is to file your map. They can be side by side.
- Mark: About the modeling, according to the data only one-half of a percent of irrigated acres in UBB are fed by surface water. If you're tying stream depletion into it, how big of an area in the district is that? Does that affect 10% of our irrigators?
  - That's why we're doing a model. Answers depend on who you ask. In the preliminary work done, we're talking a few thousand acres.
  - We're working jointly to get a model that we both (both NRD and NDR) feel is correct. And we're in the early stages of that.
  - Hydrologically connected is a scientific idea. Management perspective doesn't think 1000 years ahead. There is a limitation to what we look at. For management we look at 10% over 50 years. Over 50 years, did pumping affect 10% of the system? That's how it works in the State of Nebraska.
- Greg: How sensitive is the model? How fine is the detail for it?
  - This model will be far more detailed (than the original models). It has a 160-acre grid (1/4 section), and will have a 5-layer model integrated into it. New modeling packages and algorithms will be used. Daily rainfall versus seasonal rainfall averages. All in all, far more detailed.
- Greg: So the assumption of conductivity through the aquifer will have an impact?
  - Maria: Yes, there is some stream bed conductivity data available that will be incorporated in.
  - Jennifer: Computing power has changed tremendously and allows us to calculate a much larger area. We can store, analyze, and keep it organized.
- Rod: Going back to what Mark said, this is a voluntary program and we're really looking for ways to avoid regulations that might affect integrated management. There are a lot of things we can do voluntarily to reduce water impacts before ever having to be regulated. That's what we want to pick your brain about.
- Other Stakeholder: What's the percentage of people who aren't using meters (either for wells or surface water) right now?
  - For SW, it's more the norm than not to use a meter. Probably 75% for SW in the UBB district. For wells everyone must have a meter.
- Marty: When talking about irrigators, some will do better than others. What's the percentage of people of who do good versus those who waste a lot of water?
  - Marie: Yes. Within the system, we do look at "pooling" – different landowners and wells based on operations pool water together then break it down into segments for efficiency. However, have to look at additional factors (i.e. rainfall).

- TAC member (Steve Melvin): This past year working with the NRD, I reviewed a bunch of charts for how wet the fields are kept and roughly 12% keep the fields really wet. About 80% use all the same model of equipment. Another 10-12% who are fairly wet. About 15-20% who are doing a really great job.
- Marty: working with the City of Hastings, we see it's really a social/economic relationship. People who can afford the water, will use more water.

3. **Stakeholder Discussion** facilitated by Steve Wolf, JEO Consulting Group

- What steps would you like the NRD and NeDNR to take together?
  - Tom Weber: We have two entities coming together. One is going to lead, and one is going to follow. And I would prefer that the NRD takes the lead over DNR simply because of public input and local control.
    - Steve: Clarifies that the state really does want the district to figure this out. The State will check things because they have certain things to look at, they're there to provide quality control but not to micromanage.
    - Jennifer: Our constraint is the state statute that we have to meet. However, within that there is a lot of wiggle room. And for voluntary plans there are very few hard requirements.
  - Mark: Surface water side is roughly 75% metered currently. We farmers use groundwater and have for years with wells that are metered. I would like to see a quantified amount that is being used from the surface water.
  - Greg: One step that you should continue doing is maintain the voluntary aspect. We don't want to get to the regulatory side.
  - Teresa: One of the things the NRD could do is help copay like the NRCS EQIP program, for water sensing probes.
    - Greg: it's a great product. It helps actually show if it rains 2", how much of that actually runs off?
    - Teresa: That might be something for those irrigators that leave their fields super wet. They probably are on an electric system and are afraid that if they get shut off they won't get enough water.
    - Greg: We rely somewhat on the forecast. Trusting the forecast is sometimes hit or miss.
  - Tim: The reuse of water. Look at what the city discharges into the stream instead of the land application of treated waste water. We should put it back to use instead of sending it down the stream. We should put it back to use, unless you have high sodium levels, which can affect crop yields.
  - Dan: We had cost share for watermark sensors for years. I like the idea of the electronic sensors. There isn't a cost share for that right now is there?
    - Rod: No there is not right now. There are some other NRDs who have – we could use those as an example.
    - Dan: Could experiment with one. Have people use one, get used to it, experiment. My neighbor was watering twice as much as me this summer, but he's a young guy who had an agronomist who said he

needed the water. He was way overwatering. But I was using the watermark sensors. If there was something electronic someone younger would be on it. Educating is a slow process.

- Luke: Proactive approach is important. Over the last few decades, our problems are from less diversification. Most producers are maximizing production. How do we change the market production value? We used to have more pasture and grasslands. How do we voluntarily increase crop diversification?
- Mick: Continued education – especially with the general public who may not have a great understanding of water use.
- Bill: It's remarkable how since the 60's, how effective Nebraska is about knowing where the water is and how it's used. I'm worried about the future and how these are things we have to do. We can improve modeling, but what assumptions are there, that we are not asking about are actually there?
    - What if the drought cycle of 2012 came back for 10 years? Is that an assumption as something to even think about?

- Ideas on Goals
    - Steve: Already touched on goal of diversifying crops and the value of education
    - Marty: I was glad to hear that modeling may include travel of contaminants within the aquifer. A joint modeling has a lot of data and a lot more complex, but whatever we can do to address both quantity and quality is great.
    - Tom: We need to make sure that our watersheds are fully developed. We put dams in (the Lower Big Blue) and really helped control our water and the flooding issues.
    - Greg: Agrees with Tom in regards to surface water, but in regards to groundwater concerns if we have limitations then we're diminishing the margin of leeway. If we have another 2012 situation, I would like to build in more reserve.
        - Suggesting a reservoir for surface water to capture rainfall, rather than allowing it to runoff.
        - Education side: is there a way we can reduce evaporation with what we have captured, can we keep it there? Lake Wanahoo has massive amounts of water go over the spillway.
        - We won't see another big lake, but we can put in small structures.
        - Couldn't the capture be at the top of the field instead of downstream?
            - Yes.
            - Then we have to intercept and hold the water closer to the field that has contaminants so then we need biological remediation. This takes a more integrated approach to looking at our watershed. This means looking at things at a smaller scale. If we're talking about ways to improve groundwater we have to have a modeling component of how that impacts surface water.
    - Brandon: Talking a lot about irrigation but consider the people further out (Utica and Timora) there's 7 or 8 miles of water that flows right into the creek. When you get out there isn't a lot of irrigation where there isn't groundwater.

Talk to them about where their water is going (Surface Water), there's a lot of water and nutrients coming from these sources. There's a lot of young people out there who would take these ideas on, but there are also a lot of people who won't change unless they're forced to.

- Are there any current water quantity areas of concern?
    - Brandon: For contamination in surface water in relation to groundwater, we see contamination of nitrates in groundwater, are we also seeing that in surface water? Is there any relative connection?
        - Carla: Not sure about surface water in particular. I know up by Bazile they're really connected but no answer as to this particular area.
        - Rod: The testing for surface water is fairly limited. Perhaps we should do more for that.
        - Adam: There is some stream sampling being done but is pretty limited. Generally, in surface water streams have typically lower rates of nitrates due to biological activity.
    - Greg: Is there any part of the district that is less responsive to recovery after having a drawdown?
        - Marie: There are areas that have a bigger influence (south of Sutton/Grafton). It's not uncommon to see 4 to 8 feet of change between years, where other parts of the district stay pretty even.
        - Data doesn't currently show any specific areas that have consistent problems. Changes are dependent on precipitation.
        - Rod: Southern parts of the district have declined more than the rest of the district. Since the 80s there have been recovering – which the entire district experienced.
    - Mark: When we go back to the 60s and 70s, how much data do we have to look at when discussing well monitoring?
        - Rod: We have quite a bit of data, although not as much as we have now, in the five groundwater districts (Fillmore, Clay, Seward, Hamilton, York)
        - Marie: USGS has historical data along with the old groundwater district data. That data goes into the model. Really good data starts in the 50s.
        - Luke: Did USGS data start in the 50s?
        - Marie: There is data from USGS all the way back to the 40s.
    - Mark: I don't have a lot of concerns. When we look at the UBB and the charts, it looks like people have done a really good job conserving water and taking into consideration the amount of land developed over the course of time. However, we can always be more efficient.
    - Teresa: Are there wells in the district that are going unused?
        - There are about 12,000 registered wells with about 11,000 of those active. The others are unused, but the farmers choose to not abandon them for various reasons.
    - Luke: CPNRD is fully appropriated and to my understanding, we are not. At what point do we decide we are fully appropriated?

        - Jennifer: There are rules based on how we designated fully appropriated areas following statute. There's the 65/85 % rule – how often the district meets it's designated beneficial uses.
        - Luke: are you talking about surface water?
        - Jennifer: It's the amount of water in streams and surface sources but we account for hydrologically connected groundwater and how its connected to the steam.
        - Luke: I'm thinking about groundwater specifically.
        - Jennifer: So there is no fully appropriated rule based on GW.
        - Rod: There is actually, but that's not what it's called. When groundwater levels drop below the red line [on chart provided] that's the trigger.
        - Luke: So that curtails new wells?
        - Rod: It's written in our rules that if we hit that point there is a moratorium on drilling.
    - Mark: Will that be part of the modeling? Do we know how close we are to being fully appropriated?
        - Those are different things. We wouldn't use this to determine fully appropriated as we're talking groundwater here.
        - Rod: Current reports say the basin will not be "fully appropriated in the foreseeable future" but what that means is up for discussion.
        - Jennifer: It takes more surface water administration to get to that designation.
        - Greg: Then maybe that should be added to the goals. To be responsive to a change of the cycle, early enough. Monitor weather and changes to climate to watch for impacts to fully appropriated status.
- Any perspectives on water quantity limitations in District?
    - No Comments.
- What are the perspectives from friends, neighbors, or others and their feedback?
    - Dan: I haven't heard anything. Even in a dry year we're still coming in way under our allocation. Economics really take care of that. At the end will there be a report for each well and how many inches can be put on from each well? Area wide average?
        - Rod: The area wide averages we have, we can publish those maps. Sending individual data back is a challenge. The board/NRD is looking into generating that sort of data, but with the plethora of wells, landowners, etc. it's a challenge that they haven't figured it out yet.
    - Marty: For moratorium of wells it really just matters how much water is being put on versus one well or five wells.
    - Brandon: How do you guys determine the City's water needs for the year?
        - Marty: For Hastings, we average about 7 inches per acre (of city area). However, that does not include power production as power production is not just for the City of Hastings but instead provides power for the entire Midwest. Power production is out of our control. For irrigation, when comparing summer to winter months, we do about 7 to 8 inches per green acre.

- Luke: In regard to water use, there is a perspective out there that the users in which the NRD are typically concerned about (via regulations), are the same people who are typically not big NRD supporters.

4. Stakeholder Research Assignment

- Hand out provided and explained by Adam Rupe, JEO Consulting Group.
- Each stakeholder was tasked with drafting one goal for water quality management, and one goal for water quantity management.

5. Stakeholder Roundtable

- Mark: When looking at the people at the table when discussing surface water, there are some of us who use surface water but a lot of us aren't. I'd like to see more people involved on that side of it.
- Nick: As I think of this model, I want to make sure we don't limit ourselves with this model. Be sure we have the ability to continue to build to it.
- Luke: Collaboration between NeDNR and the NRD is good, I appreciate that. Continuation of that is important.
- Dan: Quality issues – education over the past five/ten years. Regulation of nitrogen application will help improve quality.
- Teresa: When we talked about the city water use, it would be important to the people in town if we could recognize how they're putting as much water on their lawn as farmers put on their farms.
  - Once start talking about how much water they use then ease into water quality issue discussion.
- Tim: When in Kansas if you stayed under 700-acre feet you were fine, but if you went over you were penalized. That gave them incentive to start looking at what water was used for.
- Marty: I just appreciate everyone's comments. We think everyone deserves a certain amount of water to keep their lawns green, but we should be taxing people who go way over. Water Rate Structures.

Next Meeting Date

- November 27, 2018 at 7 p.m.

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 4
UBBNRD Office – Tuesday, November 27, 2018; 7:00 p.m.

Please place a checkmark next to your name, if present. If any information needs revised, please cross out and updated accordingly.

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
X	Bill Whitney	Prairie Plains Institute	Environment	1307 L Street, Aurora, NE 68818	402.631.7002	ppri@hamilton.net
	Brandon Hegeholz	Farmer	Surface water/groundwater user	1177 North Columbia Ave Seward NE 68434	402.643.5662	hartmanfarmsseed@gmail.com
	Brandon Hunnictt	Farmer	Farmer - Groundwater user	609 South G RD Giltner NE 68841		dirtpoorfarmer@gmail.com
X	Christine Lawrence	4 Corners Health Dept	Public Health	2101 North Lincoln Ave, York NE 68467	402.362.2621	chris1@fourcorners.ne.org
	Dan Aspergren	Farmer	Farmer - Groundwater user	1060 North 1st St Geneva, NE68361	402.759.1420	aspegrend@windstream.net
X	Greg Whitmore	Farmer	Farmer - Corn Growers Rep	12959 W RD Shelby NE 68662	402.362.8653	megafarm@stewireless.com
	Jason Perdue	Farmer	Young Farmer	1209 RD Q York NE 68467	402.366.2821	
X	Jim Green	Zoning Administrator	Village of McCool Junction	PO Box 145, McCool Junction, NE 68001	402.363.4081	mccoolutilities@galaxycable.net
X	John Denton	Ducks Unlimited	Wetlands/Wildlife	2121 N Webb RD STE 309 Grand Island, NE 68803	308.258.4682	jdenton@ducks.org
X	Larry Tonniges	Farmer	Farmer - Soybean Growers Rep	4210 Branched Oak RD Utica NE68456	402.535.2331	
X	Luke Jacobsen	Farmer	Farmer - Former NRD board Marginal groundwater area	2204 RD R Marquette NE 68854	402.694.9607	jacobsen14@yahoo.com
	Mark Bailey	Farmer	Farmer- Past SPA Advisory Committee	42140 RD T Saronville, NE 68975	402.985.5106	Mbailey@superiorinet.net
X	Marty Stange	Environmental Supervisor	Hastings Utilities	1228 North Denver Avenue	402.831.1399	mstange@hastingsutilities.com
	Mick Goudeken	Central Valley Ag (COOP)	Agriculture / consulting	2803 N Nebraska Ave PO BOX 429 York, NE 68467	402.380.0521	michael.goedeken@cvacoop.com
X	Steve Driewer	GPM Enterprises Inc	Meter repair business	115 So. 16th St, Aurora NE 68818	210.862.9729	GMP@hamilton.net
	Teresa Otte	Farmer	Woman farmer - Groundwater user	3471 H Rd David City, NE 68632	402.525.7900	gr82farm@gmail.com
	Tim Richtig	City of Seward	Municipal	City of Seward, Seward, NE 68434	402.643.3433	tim.richtig@cityofsewardne.com
X	Tom Weber	Farmer/livestock	Farmer/livestock	405 State HWY 15, Dorchester, NE 68343	402.432.4674	tweber68343@hotmail.com

Please Sign In!

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 4
UBBNRD Office – Tuesday, November 27, 2018; 7:00 p.m.

Please place a checkmark next to your name, if present. If any information needs revised, please cross out and updated accordingly.

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
X	Adam Rupe	Natural Resources Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	arupe@jeo.com
X	Amy Zoller	Integrated Water Management Coordinator	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	amy.zoller@nebraska.gov
X	Andrea Gebhart	Community Engagement Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402-435.3080	agebhart@jeo.com
X	Carla McCullough	319 Program Coordinator	NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.3382	carla.mccullough@nebraska.gov
	Elbert Traylor	NDEQ Staff	NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.2585	elbert.traylor@nebraska.gov
X	Jack Wergin	UBBNRD Staff	Upper Big Blue NRD	319 E 25th St, York, NE 68467	402.362.6601	jwergin@upperbigblue.org
X	Jennifer Schellpeper	Integrated Water Management Division Manager	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	jennifer.schellpeper@nebraska.gov
	Katie Pekarek	Associate Extension Educator- School of Natural Resources	UNL Extension	912 Hardin Hall, Lincoln, NE 68583-0989	402.817.5097	kpekarek2@unl.edu
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X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com
X	Rod DeBuhr	UBB Staff	Upper Big Blue NRD	319 E 25th St, York, NE 68467	402.362.6601	rdebuhr@upperbigblue.org
X	Steve Wolf	Community Engagement Director	JEO Consulting Group	111717 Burt Street, Suite 210, Omaha, NE 68154	402.392.9907	swolf@jeo.com
X	John Miller		UBB NRD			
X	Lynn Yates		UBBNRD			

Please Sign In!

UPPER BIG BLUE NRD

WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Minutes from Stakeholder Meeting 4

November 27, 2018
7:00 p.m. - 9:00 p.m.

Upper Big Blue NRD Office
319 E. 25th St.
York, NE 68467

Attendees

See attached attendance sheet

Agenda

1. **Welcome** provided by Steve Wolf, JEO Consulting Group

   - We are starting to see how your feedback is directly shaping the goals and objectives for each plan. Reminder that there will be two plans at the end of this planning process.
   - In review of past meeting minutes, several concepts emerged and serve as major themes of both plans:
     - Local management
     - Need for education
     - Ensuring future water supply

2. **Discuss/Review Draft Goals and Objectives** facilitated by Steve Wolf, JEO

   The stakeholders collectively reviewed, discussed, and modified the draft goals and objectives that, with permission from the group, were assembled by the project team based on stakeholder discussion, technical expertise, and review of other relevant plans and existing rules, regulations, and polices in the District. The stakeholder group's revised draft goals and objectives, including tracked changes, are provided in Attachment 2.

   Key points of discussion during review of VIMP draft goals and objectives
   - Quality is connected to these, but part of WQMP.
   - Need to enhance "land literacy" or focus on all types of natural resources, not just water.
   - We should focus on targeted public outreach.
   - We could do a better job of reaching technical advisors.

- Stakeholder group should also be invited to participated in NRD and NeDNR's joint annual activity.
- We should include action items related to forecasting.

Key points of discussion during review of WQMP draft goals and objectives

- "Partnerships and collaboration" seem to be a theme of both plans.
- Is industrial use considered domestic or should that be added to Goal 4?
- "Wellhead protection" would be better for action item rather than in objective.

3. Stakeholder Discussion

- How do you see your (the stakeholder) involvement? Do you see your efforts in the plan?
  - Impressed by the effort that has gone into the plan.
  - Happy about wetland incorporation.
- The nature of the NRD is more voluntary regulations and controls but they are trying to develop a relationship with regulators. It will be interesting to see how flexible NeDNR will need to be.
  - This process, and the involvement of state agencies, seems to have a different spirit, more cooperative, than that other agencies.

4. Stakeholder Research Assignment

- *Conservation Choices* brochure and VIMP Controls handout provided and explained by Adam Rupe, JEO.
- Stakeholders are to review brochure and handout, and bring to next meeting any ideas, thoughts, or questions about the materials.

5. Stakeholder Roundtable

- I see verification of things we are doing, almost like a "license to carry on" with the education, land restoration prototypes and other things we all are working on.
- This exercise has been worthwhile, but I wish I was more optimistic about its effectiveness, particularly with municipalities.
  - The voluntary approach is what will fly, and that has been front and center of our conversations so far.
- We've been making good progress. This is a good process. Reflecting back, NeDNR and NRD used to be at each other's throats for water management. We've come a long way, but we've still got a way to go.
- This is great progress. It's good we're talking about this. It's important that the NRD has expanded its reach and is about more than just groundwater. This is also a good revisit of the pressure of water.
  - It would be a good action item to revisit goals and objectives, and current policies, with stakeholders every five or so years.
- This is coming together nicely. These plans will be effective and useful to find and pursue funding.

- I like everything we're doing. I was very impressed with this.
    - Education has and will be important. I would love to see more availability and attendance of rainfall simulator. Motivate people to learn and be interested.
    - Water and soil conservation will take care of quality.
- It comes down to this: we're making progress working together. For a small community to address nitrates, an increase of $45 per month is a lot. It'd be great to work together to prevent and eliminate this.
    - What's the social equitability of water problem? We need to develop a culture that is literate of this.
- I'm impressed with all the work that been done. Aside from nitrates, the quality around here has really improved over the years, including in the creek near me.
- What you're/we're doing is great. This is ahead of the curve. Keep doing what you're/we're doing.
- It can be scary to wonder if this will make a difference, but it's like planting a seed. We just have to do it. The best time to plant a tree was twenty years ago. The next best time is now. If we continue communicating, we can do this.

6. Public Comments

- A question was posed to the stakeholder group: what do you think about banning fall fertilizer?
    - It is not a best management practice. I'm against fall application. Other methods, like fertigation, are more effective. There is likely a lot of need for education. Would like to see more research on how fall applications effect yield.
    - Is there data on how many acres are fall fertilized?
        - Answer: No specific fall data, Last year 70% of fertilizer is preplant. Currently looking into the economic benefits of post plant. Most people are over applying by 60 to 70 lbs.
    - Can never address N issues until all N is applied post plant.
    - Fertigation has its own risks that can be worse than fall application. Disease and directly injecting contaminates into groundwater.
    - Why are nitrates so high in this area?
        - Answer: Subsoil and leaching rate.
    - Very little fertilizer happened this fall, but not sure how all the fertilizer will get applied this coming spring unless the weather is perfect. The fertilizer needs are too great to only do it in the spring.
        - Education is huge. Educate don't regulate. Show farmers how they can raise more bushels by breaking up the applications.
    - We have to find a way to reduce N or be okay with dealing with the consequences.
    - Has to have economic push, in the present, or farmers won't change.
    - Fertigation is a logistic issue. Hard to apply enough N and get the timing right. Also difficult for people to get enough product from co-op.
    - How to get N fertilizer to non-irrigated acres? Maybe, reduce the amount that can be applied in the fall.
    - How to you enforce?

- N is no longer the limiting yield factor.
- Cropping mix is different, far more corn now. So it could be that the number of acres of corn is possibly the issue, not fall fertilizing.
- Part of the logistics is the need for innovation.
- We can't pass the buck any more. We have to make the change now.

Next Meeting Date

- January 14, 2019 at 7 p.m.

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 5
UBBNRD Office – Monday, January 14, 2019; 7:00 p.m.

Please place a checkmark next to your name, if present. If any information needs revised, please cross out and updated accordingly.

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
	Bill Whitney	Prairie Plains Institute	Environment	1307 L Street, Aurora, NE 68818	402.631.7002	ppri@hamilton.net
	Brandon Hegeholz	Farmer	Surface water/groundwater user	1177 North Columbia Ave Seward NE 68434	402.643.5662	hartmanfarmsseed@gmail.com
	Brandon Hunnictt	Farmer	Farmer - Groundwater user	609 South G RD Giltner NE 68841		dirtpoorfarmer@gmail.com
	Christine Lawrence	4 Corners Health Dept	Public Health	2101 North Lincoln Ave, York NE 68467	402.362.2621	chris1@fourcorners.ne.org
	Dan Aspergren	Farmer	Farmer - Groundwater user	1060 North 1st St Geneva, NE68361	402.759.1420	aspegrend@windstream.net
✓	Greg Whitmore	Farmer	Farmer - Corn Growers Rep	12959 W RD Shelby NE 68662	402.362.8653	megafarm@stewireless.com
	Jason Perdue	Farmer	Young Farmer	1209 RD Q York NE 68467	402.366.2821	
	Jim Green	Zoning Administrator	Village of McCool Junction	PO Box 145, McCool Junction, NE 68001	402.363.4081	mccoolutilities@galaxycable.net
	John Denton	Ducks Unlimited	Wetlands/Wildlife	2121 N Webb RD STE 309 Grand Island, NE 68803	308.258.4682	jdenton@ducks.org
	Larry Tonniges	Farmer	Farmer - Soybean Growers Rep	4210 Branched Oak RD Utica NE68456	402.535.2331	
✓	Luke Jacobsen	Farmer	Farmer - Former NRD board Marginal groundwater area	2204 RD R Marquette NE 68854	402.694.9607	jacobsen14@yahoo.com
	Mark Bailey	Farmer	Farmer- Past SPA Advisory Committee	42140 RD T Saronville, NE 68975	402.985.5106	Mbailey@superiorinet.net
✓	Marty Stange	Environmental Supervisor	Hastings Utilities	1228 North Denver Avenue	402.831.1399	mstange@hastingsutilities.com
✓	Mick Goudeken	Central Valley Ag (COOP)	Agriculture / consulting	2803 N Nebraska Ave PO BOX 429 York, NE 68467	402.380.0521	michael.goedeken@cvacoop.com
✓	Steve Driewer	GPM Enterprises Inc	Meter repair business	115 So. 16th St, Aurora NE 68818	210.862.9729	GMP@hamilton.net
	Teresa Otte	Farmer	Woman farmer - Groundwater user	3471 H Rd David City, NE 68632	402.525.7900	gr82farm@gmail.com
	Tim Richtig	City of Seward	Municipal	City of Seward, Seward, NE 68434	402.643.3433	tim.richtig@cityofsewardne.com
✓	Tom Weber	Farmer/livestock	Farmer/livestock	405 State HWY 15, Dorchester, NE 68343	402.432.4674	tweber68343@hotmail.com

Please Sign In!

Upper Big Blue NRD
Water Quality Management & Voluntary Integrated Management Plans
Stakeholder Meeting 5
UBBNRD Office – Monday, January 14, 2019; 7:00 p.m.

Please place a checkmark next to your name, if present. If any information needs revised, please cross out and updated accordingly.

Present	NAME	OCCUPATION	ORGANIZATION / INTEREST Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
X	Adam Rupe	Natural Resources Specialist	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	arupe@jeo.com
X	Amy Zoller	Integrated Water Management Coordinator	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	amy.zoller@nebraska.gov
✓	Katy Mattheis	Community Engagement Specialist	JEO Consulting Group	111717 Burt Street, Suite 210, Omaha, NE 68154	402.392.9907	agebhart@jeo.com
✓	Carla McCullough	319 Program Coordinator	NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.3382	carla.mccullough@nebraska.gov
	Elbert Traylor	NDEQ Staff	NDEQ	1200 N St, The Atrium, Suite 400, Lincoln, NE 68509	402.471.2585	elbert.traylor@nebraska.gov
✓	Jack Wergin	UBBNRD Staff	Upper Big Blue NRD	319 E 25th St, York, NE 68467	402.362.6601	jwergin@upperbigblue.org
	Jennifer Schellpeper	Integrated Water Management Division Manager	NeDNR	P.O. Box 94676, Lincoln, NE 68509-4676	402.471.0625	jennifer.schellpeper@nebraska.gov
X	Katie Pekarek	Associate Extension Educator- School of Natural Resources	UNL Extension	912 Hardin Hall, Lincoln, NE 68583-0989	402.817.5097	kpekarek2@unl.edu
✓	Marie Krausnick	UBBNRD Staff	Upper Big Blue NRD	319 E 25th St, York, NE 68467	402.362.6601	mebel@upperbigblue.org
X	Rick Wilson	Project Manager	JEO Consulting Group	2700 Fletcher Ave, Lincoln, NE 68504	402.435.3080	rwilson@jeo.com
X	Rod DeBuhr	UBB Staff	Upper Big Blue NRD	319 E 25th St, York, NE 68467	402.362.6601	rdebuhr@upperbigblue.org
✓	Steve Wolf	Community Engagement Director	JEO Consulting Group	111717 Burt Street, Suite 210, Omaha, NE 68154	402.392.9907	swolf@jeo.com
✓	John Miller	NRD Board Member	Upper Big Blue NRD	165 Driftwood Drive, Aurora, NE 68818	(402) 694-3570	
	Lynn Yates	NRD Board Member	Upper Big Blue NRD	915 Road 12, Geneva, NE 68361	(402) 759-4732	

Please Sign In!

UPPER BIG BLUE NRD

WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Minutes from Stakeholder Meeting 5

January 14, 2019
7:00 p.m. - 9:00 p.m.

Upper Big Blue NRD Office
319 E. 25th St.
York, NE 68467

Attendees

See attached attendance sheet

Agenda

1. **Welcome and Update** provided by Steve Wolf and Rick Wilson, JEO Consulting Group

   Welcome to our fifth stakeholder meeting. This is where we are going to be wrapping up this phase of our two plans. We hope you've had a chance to review the materials we provided in advance and were able to see how all your suggestions have been tracked. Your work is moving forward in the development of these goals and objectives. We can't thank you enough for how diligent and seriously involved you've been to put this together. In our team meetings, we review and look at the progress that's been made, and it's really because of the stakeholders. Things are going well. We're very busy and very involved in the writing process. There are multiple chapters in production. Along with that, there is water quality modeling that is coming along. As a project, we're happy; we know our end date is coming up in the end of April. We are on track, and that's because of the stakeholders.

2. **Discuss Stakeholder Research Assignment** facilitated by Adam Rupe, JEO

   Adam reminded the stakeholders of the handouts from the last meeting: a NRCS pamphlet that discusses main Best Management Practices (BMPs) utilized and a handout the project team put together to give background information on Voluntary Integrated Management Plans (VIMPs) and authorized groundwater/surface water controls (VIMP controls).
   - He directed the stakeholders' attention to the BMPs specifically and asked whether any stood out from the list provided.
     - I think, as far as water quality goes, there's two things to look at: grass filter strips and bank stabilization. Any time there's water moving, it seems like once you go through a grass filter strip, it really clears the water up before it moves into a stream.

    - There are quite a bit more cover crops taking off. There's more research going into it. People are starting to see benefits. Is it economical? Well, that's a tough one, but how much does that erosion cost you in productivity in the future? It's kind of hard to put a dollar figure on that. They can accomplish a lot of different things, and I won't dispute the claims on any of them. Some of them sound pretty outlandish, but I mean, apparently, they can do some of those things, like helping with nutrients and keeping the soil stabilized. Not blowing away, not washing away. Those are the key ones I see on it.
- For any of these BMPs, is it the cost-share that is the main incentive that gets people to install them or are there other motivators that could be helpful?
    - I would say cost-share. It's all about economics. If there's no economic benefit, then why do it?
    - When you talk about long-term benefits, we tend to be a bit shorter-sighted with the economics benefits right now. That's the stumbling block to some of these things. One of the benefits I see to cover crops is that, when you see dirt blowing, there's nothing more helpless. Those dirt clouds, that's a tough thing to see.
    - There's a certain amount of peer pressure. If somebody's field is blowing around, it doesn't reflect well on them.
    - Efforts of the City of Hastings are more towards providing cost-share for things like washer sensors for evapotranspiration (ET) gauges, soil sampling, those kinds of things. We haven't gone into things like cover crops or anything like that yet; we're more on the education side rather than the boots on the ground.
    - Are there any urban water quality management practices?
        - We offer soil sampling to the homeowners as well. We also do rain sensors; the idea is to shut their sprinklers off when there's been a certain amount of rain. We've also done discounts for mulching mowers and blades. We've done rain gardens, those kinds of thing. You can offer it, but most people just don't; they say it's not worth the paperwork.
- We're working on a list of priority BMPs to include in the Water Quality Management Plan. It's not to exclude any; it's more to narrow down for scenarios and cost-estimating. Is there anything on this list you haven't heard of?
    - If I may just say, we need to use the words soil conservation. When you look at cover crops or buffer strips or terraces or anything like that, we just generally need to get back to good soil conservation practices.
- Is there anything on here that you don't feel like your neighbors would be interested in, something that isn't appropriate for the landscape across the district?
    - Well closures.
        - Adam Rupe, JEO: That's a good one to put on there.
    - How about irrigated land retirement? Isn't that a program where someone can opt to take a payment to retire irrigated land?
        - Rod DeBuhr, UBBNRD: The NRCS has had—I don't know what the current program is—a program where you can get a three-

year payment for a 4-year retirement. They can farm it; they just can't irrigate.

- I'd like to make a comment about the well abandonment. In Hastings, we actually pay for some of well abandonment; it's basically 50% of what the NRDs don't pay. If the NRD doesn't pay for anything, we still pay 50%; though we like to see contributions from the NRDs on that. I think it's been a good program. You still have some people who won't abandon wells, but there are others who decide to do it and seem very appreciative of the help from the city and NRD.
  - One thing about well abandonment is that a licensed well driller has to do it, and it's really not their highest priority. If you could just sign off that you followed all the practices and you did it yourself, it would probably just happen. You could get it done, but well drillers usually wait until they have about four- or five-days' worth of work to do.
  - There was an interesting project, a source water protection grant, where they put together a list of 30 wells that needed to be closed. They decided to have a contract with one well driller to close all of them. They really focused in and got it done. That might be a strategy to think about.
  - We also do septic tanks besides that. The same thing applies to that as wells. What we find is contractors look at it and go, "Am I going to get paid for that by a private citizen?" If we could get the citizen to give us the $50, we could just pay the bill, and that way, the contractor will know that they will get paid.

Adam then referred the stakeholders to the other handout regarding authorized VIMP controls and unauthorized controls. He asked whether there were any the stakeholders were unsure about or if they had any general thoughts they'd like to share. Amy Zoller, NeDNR, provided handouts to the stakeholders and presented the following information:

- NeDNR has several VIMPs that are either adopted or close to being adopted.
- NeDNR has new measures in place, including requiring flowmeters on new surface water uses, tracking municipal uses, publishing notices of new surface water applications, and requiring education for new groundwater and surface water permits.
- The NRD and NeDNR are ultimately in charge of setting VIMP controls, but they are really interested in knowing what the stakeholders think.
  - Rod DeBuhr, UBBNRD: There are already groundwater controls in this area. We have triggers set for allocation, well spacing requirements, mandatory water use reporting, and rules for groundwater transfer. We already have those in place, but if you think of something else, please speak up.

3. **Review and Discuss Potential Action Items** facilitated by Adam Rupe, JEO

   Adam went through the handouts to explain that the action items listed for the WQMP and VIMP have been updated to reflect the stakeholder comments made in the prior meetings, as well as technical expertise and review of other relevant plans and existing rules, regulations, and polices in the district. He then asked the stakeholders to review and revise the potential action items listed. The stakeholder group's revised potential action items. The tracked changes of these revisions are provided in Attachment 2.

4. **Review Draft Goals and Objectives** facilitated by Steve Wolf, JEO

   Steve Wolf thanked the stakeholders again and asked them to take one last look through the goals and objectives for the WQMP and VIMP to ensure it reflect their hard work and research. No further changes were requested by the stakeholder group.

5. **Stakeholder Concurrence of the Draft Goals and Objectives**

   Stakeholders concurred with the final draft of their goals and objectives for the WQMP and the VIMP. Steve Wolf, JEO, explained that, going forward, this work will be turned over to the NRD board, and they will be encouraged to move forward to the maximum extent they can with the recommendations provided by the stakeholders. He emphasized that this is not the end of the stakeholders' ability to be involved, as they are welcome to attend NRD board meetings. There will also an open house meeting on April 2 to allow the public to weigh in before the WQMP is submitted to the State of Nebraska. Writing on the VIMP will begin in the summer of 2019. It was noted that these documents would be made available with the meeting minutes on the NRD website.

6. **Stakeholder Roundtable**

   - I think it's been pretty good, what's come out of this. It's incorporated a lot of things I'd like to see in there.
   - We talked a lot about water quality and quantity, and we've briefly touched on soil health. I think maybe we might be missing how vitally important soil health would help water quality and quantity, possibly. We're just getting into new ways to measure soil health. It will improve nutrient management. I think that may need to be stressed a little more.
   - We had a stakeholder research assignment and were supposed to write notes. There is so much data we're dealing with here, for example the data that's collected to make sure we are statistically correct. I was just wondering if there was a way to actually manage this data. Is there a statistician in-house? With all the data coming in, just managing it is a huge process. It takes more than one person to do that. That's my concern. I think we've got enough regulating entities out there already. If something new comes up, it should be able to be handled under one of them already without creating a new one. On BMPs, the big emphasis on that should be the marginal lands; that's really where the problem is centered.
   - I want to echo earlier comments on soil health. When I think of soil, I don't only think of it as a growth medium, it's also a filter for our water. If we have healthier soils, the quality and quantity of water certainly go hand-in-hand, because our water use

efficiency goes up. We have neglected soil health long enough. I think we'll learn a lot in the future.

- One of the things I really liked was the projects. Providing technical and financial assistance, emphasizing those things I think is great. Studying on-farm research and that stuff was great. My main thing that I would caution is anything that says mandatory or things like that.
- I like the idea that education is always kind of the forefront of what you're trying to do here. For me, I've learned a lot just going through this process. Even if this process doesn't go any further, I still take this knowledge back to the system, so you're already working on what the VIMP is trying to do. I think the idea of bringing stakeholders back and so forth is a good step to continue education for all of us. Even though we have a few years to go through it, there may be people who move on, but I would say go find someone to represent that person. I think there are a lot of people who could fill that role. Thank for allowing me to be a part of this process!
    - Steve Wolf, JEO: The NRD did an exceptional job finding someone from every part of this district that also represents every strata of a type of water user.

7. Public Comments

- One thing that I see is that we are getting a lot more cooperation from the co-ops on sharing data back and forth. We are getting more and more on the same page as far as things like fertilizer recommendations and soil health. The quantity thing, I feel that, as a district, we have a good handle on. The quality thing is hard to get a hold of. We know we need to do it. If we don't have quality, quantity doesn't mean a thing.
- Another instance of lack of coordination is the extra road ditch incident when the Corps of Engineers came out on a road ditch that held water. All it took was a backhoe and take five or six inches of dirt out of the bottom of the road ditch, but it didn't turn out that way. There were all kinds of problems. They thought maybe they should change the elevation of the road or maybe they should change the culverts, but nobody thought maybe they could just backhoe a little dirt out of the road ditch. I thought maybe that was an example of an out-of-control situation, but if it had been a farmer out there, it would have just been cleaned up. Since they were a government entity, they were following all the governmental rules. They could've just done it and not talked about it. There needs to be…we all need to get on the same page and have a little common sense.
- We are trying to get into online reporting. When you're online, it's so easy to go over there and see how I compare to somebody else if all that information is on there.
- I feel that we (NRD) have a real good relationship with the NRCS. If we need something, they'll help us out.
- Thank you for letting me hear your conversation. I've enjoyed it, and I think it worked out well, came up with some great ideas. I appreciate being able to listen in.
- On behalf of the NRD, I've known most of you guys for many years one way or another, and I really appreciate you taking the time to do this.

Prior to the meeting adjournment, Steve Wolf asked the stakeholders to take a moment to absorb what they've been doing through this process: helping to make state history in the first

joint planning process between water quality and water management between the NeDNR and NDEQ. Hopefully, this precedent may have helped to create an innovation that is used in other parts of the state. Amy Zoller thanked the stakeholders on behalf of the NeDNR, and the meeting was adjourned.

Next Meeting Date

- Open House Public Meeting on April 2, 2019 at 7 p.m.

UPPER BIG BLUE NRD
WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Water Quality Management Plan (WQMP) Draft Goals and Objectives

JOINT PLANNING VISION STATEMENT

The water resources of the Upper Big Blue Natural Resources District will be locally managed by the District, in cooperation with its partners and stakeholders, through conservation, protection, and responsible development for the health and welfare of the people of the District.

MAJOR THEMES FROM STAKEHOLDER CONVERSATIONS

- Need to look at both point-source and nonpoint-source pollution
- Protecting surface water also protects groundwater recharge
- Well depth is a factor in groundwater sampling
- Stream degradation (erosion) deserves attention
- Look at whole watershed to develop solutions
- More and better data
- Soil health
- Nutrient management
- Crop diversity
- Treatment is more expensive than prevention
- Educate in and with schools and existing programs
- Quality can enhance quantity
- Ensure drinking water for future

In Partnership With

NEBRASKA DEPT. OF ENVIRONMENTAL QUALITY

NEBRASKA DEPT. OF NATURAL RESOURCES

DRAFT GOALS AND OBJECTIVES FOR WQMP

as of January 14, 2019 Stakeholder Meeting

GOAL 1: The quality of surface water and groundwater resources in the basin will be enhanced through a comprehensive and collaborative program that efficiently and effectively implements actions to restore and protect natural resources from degradation and impairment.

- OBJECTIVE: Natural resources management actions will be based on sound data and effective directing of resources.
- OBJECTIVE: Enhance and continue water quality monitoring to develop a more comprehensive understanding of surface and groundwater conditions.
- OBJECTIVE: Strong working partnerships and collaboration among appropriate local, state, and federal agencies and organizations will be established and maintained regarding management of nonpoint source pollution.

GOAL 2: Resource managers, public officials, community leaders, and private citizens will understand the effects of human activities on water quality and support actions to restore and protect water resources from impairment by nonpoint source pollution.

- OBJECTIVE: Deficiencies in knowledge needed to improve natural resource management decisions will be identified and investigated.
- OBJECTIVE: Develop or identify educational products and opportunities that highlight the interrelated nature of water quality and quantity.
- OBJECTIVE: Tools to effectively transfer knowledge and facilitate actions regarding management of natural resources will be developed, improved, and maintained.

GOAL 3: Land and water resources will be stable and productive using community-supported best management practices.

- OBJECTIVE: Soil resources will be maintained or improved by keeping erosion rates below defined soil loss tolerance rates utilizing soil health practices.
- OBJECTIVE: Streams and riparian corridors will be managed to reduce or eliminate threats to property or infrastructure and improve aquatic and riparian habitats.
- OBJECTIVE: Reduce levels of atrazine runoff into wetlands, streams, and lakes.
- OBJECTIVE: Reduce levels of *E. coli* bacteria in runoff to streams.
- OBJECTIVE: Restore and protect historic wetland features to enhance watershed hydrology, naturally improve water quality, and increase groundwater recharge.

GOAL 4: The water quality of surface and groundwater resources will meet the conditions necessary to support domestic, industrial, agricultural, recreational, and ecological uses.

- OBJECTIVE: Ensure the safety and quality of drinking water supplies.
- OBJECTIVE: Track progress towards meeting water quality goals or standards (as appropriate) on an annual basis, including forecasting of trends.

POTENTIAL ACTION ITEMS

as of January 14, 2019 Stakeholder Meeting

The draft action items have been identified through a number of sources, including input from stakeholders and project partners. Final action items will need to be support the plan's goals and objectives. The draft action items have been provided to the stakeholders for the purposes of discussion, but the final decision on action items will be made by the UBBNRD.

The action items are organized based on four types of activity:

- **Monitoring**, which refers to consistently collecting and evaluating data over time to track progress. Baseline measures and goal benchmarks will help assess progress of activities of all types.
- **Education**, which refers to information and outreach efforts aimed at increasing awareness of and encouraging participation in water quantity improvement activities. Target audiences should be defined, with communication and informational materials crafted specifically for those audiences. This is measurable in terms of changes in knowledge, attitude, and behavior.
- **Policy**, which refers to guidelines or protocols set forth by a governing authority to achieve a specific outcome. Whenever possible, policy should promote incentives rather than be punitive. This is measured by tracking the development of formal policies adopted by governing entities. Compliance of polices may also be tracked.
- **Projects**, which refers to specific initiatives that seek to enhance or improve water quantity in the district. Projects may be time-bound or on-going, and they can range from preliminary research to physical "on the ground" efforts. Measuring or tracking projects is completed through compiling and summarizing the efforts of participants. Projects should be well defined to assist in measuring their completion or impact.

In the WQMP, the following information will be provided for each action item:

- Management Activity – a description of the activity or action to be taken.
- Goals Addressed – which goals of this plan the activity seeks to advance.
- Timeline/Milestones – an estimate of when, or at what interval, the activity should be completed.
- Activity Lead – who is responsible for leading or facilitating the activity.
- Potential Partners – a list of agencies or organizations that may directly partner with the activity lead to complete the action.
- Technical & Funding Resources – a list of the most likely resources that could aid in completion of the activity.

Monitoring

1. Review current water quality sampling and monitoring activities and make recommendations for improving the monitoring network.
2. Survey producers and water supplies on their needs and attitudes.
3. Add at least 3 continuous water quality monitoring stations in the NRD near or above US Hwy 81. Where possible, pair these with stream gages. Potential sites include Lincoln Creek, Beaver Creek, and West Fork Big Blue River.
4. Review and publish an annual review of water quality data and trends for both surface and groundwater resources.
5. Have communities report gallons/acre or gallons/person/day and share that with public to help continue education.
6. Establish a system of water quality milestones to incrementally track progress towards meeting water quality goals or standards.
7. Complete and monitor unsaturated, vadose, zone sampling

Education

1. Continue to identify new stakeholders.
2. Continue and expand education of stakeholders on the importance of environmental stewardship and safe water supply, with a focus on nitrate contamination in groundwater.
3. Contact, engage, solicit feedback, and educate crop consultants, agri-chemical dealers, organic producers, and other agricultural service providers about water quality issues and programs available to producers.
4. Continue and improve education requirements of producers within Phase II and Phase III groundwater management areas.
5. Develop and distribute educational materials regarding BMPs.
6. Pursue and provide opportunities for NRD citizens and organizations to attend a rainfall simulator demonstration that illustrates benefits of no-till, cover crops, and other in-field management decisions.
7. Provide education materials to farmers discussing the benefits of soil health and the practices they can take to enhance it.

Policy

1. Compare goals and objectives and applicable plan elements between the WQMP and VIMP to ensure consistency where appropriate.
2. Budget funding to support NRD-sponsored programs that support water quality improvement.
3. Continue to promote the collaboration between NeDNR, NDEQ, and UBBNRD on water quantity and quality issues.

Projects

1. Identify critical areas along streams where sediment losses have significant impact on surface water quality with a focus on the Nebraska-Kansas border.
2. Continue to utilize and seek outside funding sources (federal, state, local, and others) that can supplement NRD funds for water quality programs.
3. Identify potential partnerships where education, technical, and financial resources could be leveraged.
4. Provide technical assistance to participants in selecting, installing, and maintaining BMPs.
5. Continue to assist landowners with proper decommissioning of wells.
6. Implement BMPs that
    a. decrease erosion and improve soil health, such as no-till and cover crops.
    b. decrease runoff, such as buffer strips, farm ponds, and terraces.
    c. restore watershed hydrology, such as cover crops, terraces, and wetlands.
    d. control and trap atrazine-contaminated runoff before it enters a waterbody, such as grassed waterways, filter strips, and integrated pest management.
    e. Reduce E.coli contamination from livestock on stream corridors, such as fencing, alternative water sources, riparian buffers, and stream restoration.
    f. protect existing wetlands, such as buffers and irrigation management.
    g. restore wetland hydrology, such as filling of pits and ditches, irrigation conversions, and land use conversions.
    h. improve the quality of pastures and other grazing areas, such as management plans and stream crossings.
7. Implement BMPs and activities that
    a. repair and prevent streambank erosion with a focus on critical infrastructure and natural streambank stabilization.
    b. reduce the amount of fertilizer leaching from residential lawns and other urban areas.
8. Restore stream meanders through the establishment of riparian buffers, oxbow restorations, and other BMPs.
9. Develop programs to protect and stabilize stream channel beds from downcutting, such as grade control, weirs, and other BMPs.
10. Develop programs for source water protection, including Wellhead Protection Plans and/or Drinking Water Protection Management Plans and projects.
11. Promote pet waste clean-up activities in urban and residential areas.
12. Work with owners of non-permitted animal feeding operations to voluntarily install BMPs, such as manure management, water diversions, manure storage, and vegetated treatment systems.
13. Prioritize activities that eliminate or reduce leaching of nitrogen from agriculture fields, such as irrigation water management, crop rotations, and nitrogen inhibitors.

UPPER BIG BLUE NRD
WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

Voluntary Integrated Management Plan (VIMP) Draft Goals and Objectives

JOINT PLANNING VISION STATEMENT

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MAJOR THEMES FROM STAKEHOLDER CONVERSATIONS

- Ensure current and future access to water supplies
- Increase reserves
- Maintain local control
- Emphasize voluntary, and seek to minimize regulation
- Water use/conservation seems to be socio-economic issue
- More data on surface water usage needed
- Cost-sharing programs are helpful
- Encourage and/or require moisture sensor probes
- Reuse and conservation
- Crop diversification
- Be responsive to trends and be mindful of possibility of fully-appropriated status
- More education, both for general public and producers

In Partnership With

NEBRASKA DEPT. OF ENVIRONMENTAL QUALITY

NEBRASKA DEPT. OF NATURAL RESOURCES

DRAFT GOALS AND OBJECTIVES FOR VIMP

as of January 14, 2019 Stakeholder Meeting

GOAL 1: Integrated surface and groundwater resources will be proactively managed using the best available science and data.

- OBJECTIVE: Develop and maintain a comprehensive database of the sources and locations of the district's water supplies, uses, and outflows.
- OBJECTIVE: Enhance and continue water monitoring to develop a more comprehensive understanding of supplies and uses.
- OBJECTIVE: Review data on an annual basis to ensure accuracy and maintain a sustainable balance of supply and demand.
- OBJECTIVE: Perform studies and work to utilize data to refine delineations of hydrologically connected surface and groundwater.

GOAL 2: The public will better understand and more fully support actions to restore and protect water supplies while developing broader understanding of resource management.

- OBJECTIVE: Continue and expand, if possible, existing public outreach programs.
- OBJECTIVE: The NRD and NeDNR will partner together at least once a year for a joint educational activity or event.
- OBJECTIVE: Partner with other organizations to leverage educational and technical assistance resources.
- OBJECTIVE: Seek to develop a broader public understanding of how land management affects water management.

GOAL 3: Existing and future water uses and supplies will be protected through community-supported best management practices.

- OBJECTIVE: Seek to use voluntary water use management and conservation strategies before regulations.
- OBJECTIVE: Develop and implement programs and projects that conserve water within the district.

POTENTIAL ACTION ITEMS

as of January 14, 2019 Stakeholder Meeting

The draft action items have been identified through a number of sources, including input from stakeholders and project partners. Final action items will need to be support the plan's goals and objectives. The draft action items have been provided to the stakeholders for the purposes of discussion, but the final decision on action items will be made by the UBBNRD.

The action items are organized based on four types of activity:

- **Monitoring**, which refers to consistently collecting and evaluating data over time to track progress. Baseline measures and goal benchmarks will help assess progress of activities of all types.
- **Education**, which refers to information and outreach efforts aimed at increasing awareness of and encouraging participation in water quantity improvement activities. Target audiences should be defined, with communication and informational materials crafted specifically for those audiences. This is measurable in terms of changes in knowledge, attitude, and behavior.
- **Policy**, which refers to guidelines or protocols set forth by a governing authority to achieve a specific outcome. Whenever possible, policy should promote incentives rather than be punitive. This is measured by tracking the development of formal policies adopted by governing entities. Compliance of polices may also be tracked.
- **Projects**, which refers to specific initiatives that seek to enhance or improve water quantity in the district. Projects may be time-bound or on-going, and they can range from preliminary research to physical "on the ground" efforts. Measuring or tracking projects is completed through compiling and summarizing the efforts of participants. Projects should be well defined to assist in measuring their completion or impact.

In the VIMP, the following information will be provided for each action item:

- Management Activity – a description of the activity or action to be taken.
- Goals Addressed – which goals of this plan the activity seeks to advance.
- Timeline/Milestones – an estimate of when, or at what interval, the activity should be completed.
- Activity Lead – who is responsible for leading or facilitating the activity.
- Potential Partners – a list of agencies or organizations that may directly partner with the activity lead to complete the action.
- Technical & Funding Resources – a list of the most likely resources that could aid in completion of the activity.

Monitoring

1. Continue to map and track surface water and groundwater irrigation acres.
2. Continue surface water monitoring to identify non-use of surface water irrigation.
3. Implement and maintain voluntary water use reporting system for surface water users.
4. Develop a scalable database for surface water and groundwater irrigation use reporting.
5. Identify areas where irrigation is done efficiently and inefficiently.
6. Evaluate currently installed stream gages and the need for l additional stream gages to meet the goals and objectives of the water plans. Coordinate most cost-beneficial site selection with the NDEQ, NeDNR and the NRD.
7. Consider climate cycles/variations during review of long-term trends in data.
8. Investigate real-time groundwater monitoring.
9. Continue to analyze data trends and correlate to the NRD appropriation status.
10. Survey producers and water supplies on their needs and attitudes.

Education

1. Maintain public education programs including newsletters, newspaper articles, radio spots, public notices, fliers, social medial, and NRD and NeNDR websites.
2. Provide or develop education materials that
    a. focus on hydrologically connected groundwater and surface water.
    b. raise awareness of surface water and integrated water management laws, rules, and regulations
    c. raise awareness about benefits of crop diversification.
    d. increase understanding of the effects of groundwater irrigation runoff on surface water quality.
    e. inform producers on the economic benefits and costs of incorporating water quality and water conservation BMPs into their operations.
    f. promote the use of water saving devices and practices within an urban setting (lawns, homes, parks, etc.).
    g. educate producers on monetary savings for using water use efficiently
    h. Learning alternative methods from organic producers
3. Continue to develop a cooperative relationship with UNL Extension and private sector (e.g. co-ops, organic producers, and crop consultants) to assist in on-farm research and outreach and education activities.
4. Promote practices focused on reuse of excess water, such as excess flows (stormwater, flood water, etc.) and wastewater (industrial, irrigation, etc.).
5. Continue to identify new stakeholders and encourage their engagement in the implementation of the IMP.
6. Develop and distribute educational materials regarding BMPs.

Policy

1. Meet annually to discuss implementation of the VIMP. The meeting will include, but not be limited to, an annual report of IMP activities by each entity, the exchange of data being monitored, discussion of prioritizing IMP implementation actions for the upcoming year, and discussion of stakeholder engagement activities.
2. Consider updating the VIMP every 5 years following a stakeholder process similar to that used to develop this VIMP.

3. Compare the goals and objectives and applicable plan elements between the VIMP and WQMP to ensure consistency where appropriate.
4. When developing regulations and policies, prioritize water use first for human consumption, according to state law.
5. Continue voluntary water use management program.
6. Ensure that surface water rights are being utilized and are accounted for
7. Evaluate and encourage, if appropriate, municipal water rate structures that encourage conservation.
8. Management actions are sufficient to ensure that the State will remain in compliance with the Blue River Compact, and other applicable state and federal laws.
9. Continue to promote the collaboration between NeDNR, NDEQ, and UBBNRD on water quantity and quality issues.
10. Protect the groundwater users whose water wells are dependent on recharge from the river and the surface water users from streamflow depletion within state law

Projects

1. Develop, improve, and maintain groundwater models to aid in water resources management. Purposes of the model may include, but not be limited to, delineations of the hydrologically connected ground and surface waters.
2. Identify potential partnerships, including existing resources and grant programs, where technical and/or financial resources could be leveraged
3. Provide technical and financial assistance to participants in selecting, installing, and maintaining BMPs that lead to water use reductions or increases in efficiency. Examples include: forecasting tools, crop diversification, soil moisture sensors, irrigation scheduling, variable rate irrigation, etc.
4. Use existing and new research and analyses to assess and quantify farm-scale irrigation efficiency.
5. Study and implement, as needed, additional surface water storage and groundwater recharge projects.
6. Develop a drought mitigation plan for the NRD.
7. Evaluate and encourage use of new technologies that support water management goals.

UPPER BIG BLUE NRD
WATER QUALITY MANAGEMENT PLAN AND VOLUNTARY INTEGRATED MANAGEMENT PLAN

One District, Two Plans, One Water

STAKEHOLDER SUMMARY REPORT

As of April 2019

Project sponsors Upper Big Blue Natural Resources District (UBBNRD), Nebraska Department of Environmental Quality (NDEQ), and the Nebraska Department of Natural Resources (NeDNR) worked in collaboration to—for the first time in Nebraska history—use the same community-based planning process to support the development of a Water Quality Management Plan (WQMP) and Voluntary Integrated Management Plan (Voluntary IMP) for the district. Recognizing the immense value of involving community members affected most by these plans, the project sponsors contracted with JEO Consulting Group (JEO) to ensure the stakeholder process was community-based and met WQMP and Voluntary IMP statutory compliance. Working closely with project sponsors, JEO sought to empanel a diverse set of stakeholders who represent all aspects of water users dependent upon quality and quantity.

Facilitated by JEO, the public involvement process was guided by the collaboration principles of the International Association for Public Participation's spectrum of public participation. At this level, the project sponsors collect and incorporate, to the maximum extent possible, the input and recommendations provided by the Stakeholder Advisory Committee (SAC). The stakeholders provided recommendations related to the goals and objectives for incorporation into the WQMP and Voluntary IMP, but ultimately, the UBBNRD, NDEQ, and NeDNR will have the final say in the goals and objectives for each plan. This document summarizes public involvement efforts during the development of the UBBNRD's WQMP and Voluntary IMP.

STAKEHOLDER ADVISORY COMMITTEE

To aid in the development of goals and objectives for the WQMP and Voluntary IMP, as well as meet requirements set forth by NDEQ and NeDNR, the UBBNRD formed a Stakeholder Advisory Committee (SAC) through local solicitations and nominations. A total of eighteen stakeholders agreed to participate in this process, as shown listed below, representing a diverse cross-section of the community with a variety of interests in the water, including agricultural, environmental, municipal, and medical. Figure 1 illustrates the geographical dispersion of the stakeholders.

The SAC held a total of five meetings for this project. Of these meetings, one was dedicated exclusively to WQMP elements (water quality), another to Voluntary IMP elements (water quantity), and the other three were considered joint meetings, during which both water quality and quantity were discussed. The purpose of the meeting series was to provide stakeholders the opportunity to discuss and develop goals and objectives for each plan. The UBBNRD, NDEQ, NeDNR, and JEO played an active role in these meetings, primarily through sharing and presenting information to the stakeholders.

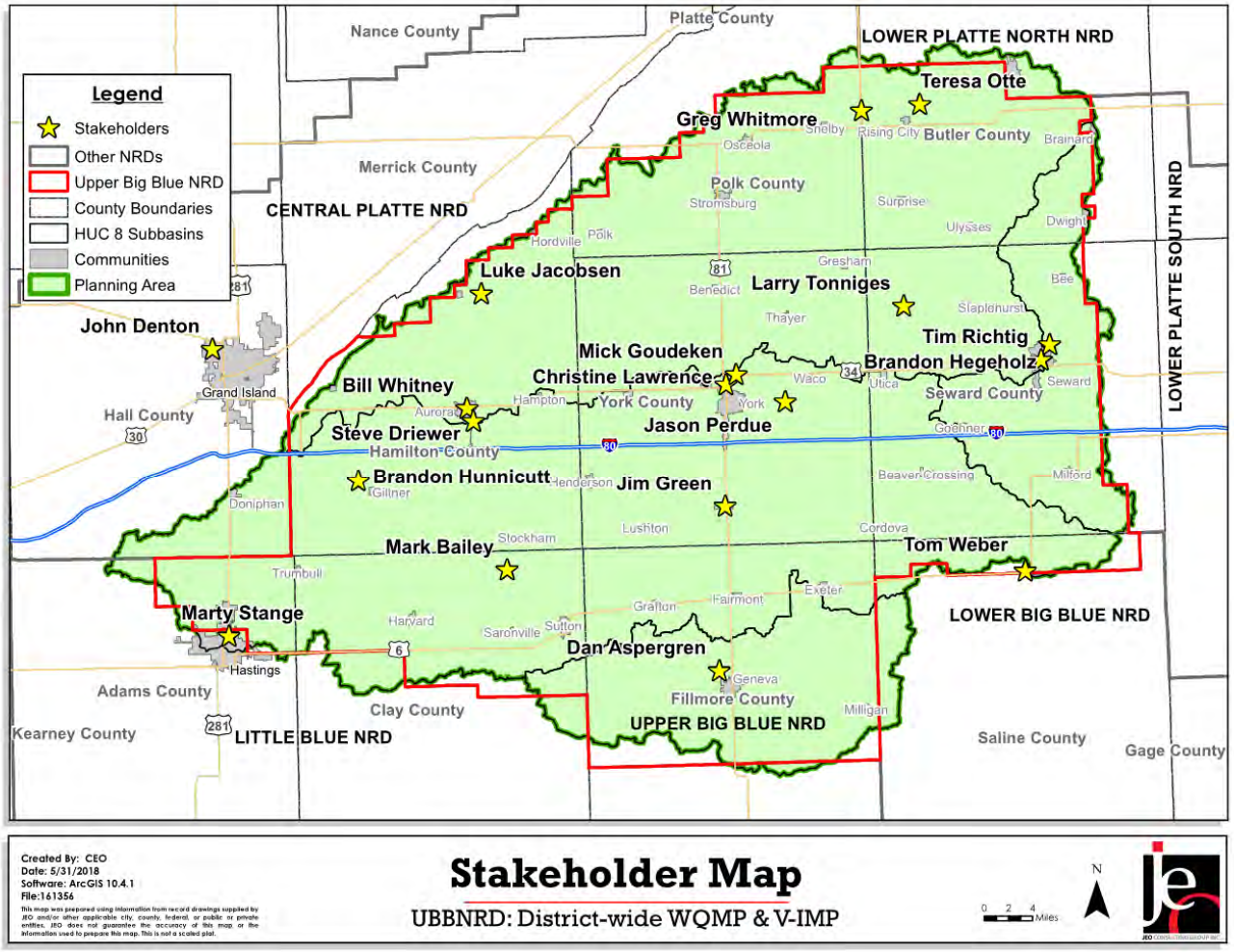


Figure 1: UBBNRD WQMP and VIMP stakeholder map

Stakeholder Advisory Committee

- Bill Whitney, Prairie Plains Institute
- Brandon Hegeholz, Farmer
- Brandon Hunnicutt, Farmer
- Christine Lawrence, 4 Corners Health Dept.
- Dan Aspergren, Farmer
- Greg Whitmore, Farmer
- Jason Perdue, Farmer
- Jim Green, Zoning Administrator
- John Denton, Ducks Unlimited
- Larry Tonniges, Farmer
- Luke Jacobsen, Farmer
- Mark Bailey, Farmer
- Marty Stange, Environmental Supervisor
- Mick Goudeken, Central Valley Ag
- Steve Driewer, GPM Enterprises Inc.
- Teresa Otte, Farmer
- Tim Richtig, City of Seward
- Tom Weber, Farmer

TECHNICAL ADVISORY COMMITTEE

Specific to the development of the WQMP, UBBNRD and NDEQ assembled a Technical Advisory Committee (TAC). The TAC included a total of seventeen representatives from NDEQ, Nebraska Department of Agriculture, Nebraska Game and Parks, NeDNR, Natural Resources Conservation Services, UBBNRD, University of Nebraska–Lincoln Extension, and other prominent organizations. Throughout six meetings, TAC members provided input into the development of technical components of the project, reviewed draft deliverables, provided data that is available from their organizations, and supported public meetings and other outreach activities. TAC members were also invited to attend SAC meetings to help share their expertise and information with the stakeholders.

STAKEHOLDER INVOLVEMENT

Stakeholder Meeting #1: Joint Water Quality and Water Quantity Focused (June 18, 2018)

The first SAC meeting was held at the UBBNRD office on June 18, 2018, from 7:00-9:00 p.m. Eleven of the eighteen stakeholders were present at this meeting. Also in attendance were representatives from JEO, UBBNRD NeDNR, NDEQ, and UNL. The purpose of this meeting was to provide stakeholders an overview of project and process and to begin to identify stakeholder priorities.

UBBNRD Assistant General Manager Rod DeBuhr opened the meeting by welcoming the stakeholders. He went on to discuss the district's background, explaining that the NRD protects groundwater quantity and quality through education first, incentives second, and regulations last. He also explained the purpose and needs of the project: to build relationships, identify and prioritize projects, and identify future funding sources.

JEO facilitator Steve Wolf stated that this joint planning effort between the NRD, NDEQ, and NeDNR is historic, as a WQMP and Voluntary IMP have never before been drafted concurrently. The facilitator informed stakeholders about their role to identify goals and objectives for each plan. He also laid out the ground rules for SAC meetings to ensure that the people involved and meeting times are respected.

A technical presentation was given by Amy Zoller, NeDNR, and Elbert Traylor, NDEQ, providing the stakeholders with a general overview of Voluntary IMP and WQMP. Discussion was held, and stakeholders were given the opportunity to ask questions regarding the presentation.

Binders were provided to each stakeholder to save and review information handed out at each meeting. The Groundwater Atlas of Nebraska was also provided to each stakeholder, and it was recommended they focus on the following sections: Introduction, Groundwater Quantity, and Groundwater Quality. A roundtable discussion was held, during which stakeholders were asked to comment on their expectations for this process. Stakeholders emphasized their priorities of collaboration and education. After a public comment period, the meeting adjourned.

Stakeholder Meeting #2: Water Quality Focused (August 14, 2018)

The second SAC meeting focused on WQMP elements (water quality) and was held at the UBBNRD office on August 14, 2018, from 7:00-9:00 p.m. Nine of the eighteen stakeholders attended this meeting. The objective of this meeting was to provide overview of existing water quality conditions and identify issues and solutions.

Adam Rupe, JEO planner, presented an overview of the WQMP, which is a voluntary approach to reducing pollution in watersheds and also makes groups eligible for Section 319 grant funding, provided through U.S. Environmental Protection Agency (EPA). The main purpose of a WQMP is to encourage landowners to voluntarily install best management practices (BMPs). Rupe also gave a presentation regarding surface water quality, explaining that the data collected by the NDEQ is used to find the trends

in the water, identify sources of pollution to make prioritization, and evaluate projects/alternatives/BMPs proposed. Discussion on the presentations was held between the stakeholders, and key topics of discussion included E.coli contaminations, nutrient testing, and pesticides.

Marie Krausnick, Water Department Manager for the UBBNRD, and Scott Snell, Public Relations Manager for the UBBNRD, then presented on a variety of topics, including pollutants with long-term impacts, existing NRD programs and funding, and the district's efforts involved its citizens in the projects that culminate in policy.

Following the technical and NRD presentation, the SAC meeting was opened to stakeholder discussion. Facilitator Steve Wolf asked the stakeholders to identify the problems and problem areas that should be addressed. Initially, different stakeholders discussed point-source and nonpoint-source pollution. One stakeholder questioned whether they are supposed to prioritize groundwater or surface water or if they are of equal importance in this process. To which, the project team replied that there is no right or wrong answer, as the stakeholders get to decide what topics are prioritized. The stakeholders also discussed stream degradation, well depths, and regulatory requirements of other jurisdictions.

The facilitator then asked stakeholders to describe their personal perceptions or the public perceptions they have heard regarding groundwater. One remarked that he has heard that the groundwater will never run out, so it isn't a big deal. Another stated that everyone tends to look at the boundaries of their own responsibilities and that some of these issues won't be solved until we look at the whole watershed and change the way we interact with the natural processes for the streams. A stakeholder also expressed concern over the cost of water treatment options, emphasizing that a lot of these communities do not have a sufficient tax base to afford to treat their groundwater.

The various stakeholders discussed and clarified what they feel their role is in this process, and the facilitator asked them if there is any additional information or issues they felt the NRD should address. The consensus was that NRD does an excellent job educating the population, however some may not necessarily want to listen. When asked what methods may be most successful to get information out to the public, many stakeholders remarked that education through programs like Future Farmers of America and 4-H could be expanded. The UBBNRD's *Blueprint* newsletter and other publications were suggested as possible methods of educating the public.

During the stakeholder roundtable, many stakeholders reiterated that education will be vital and also suggested that, in order for education to be truly engaging, it must be made personal.

Stakeholder Meeting #3: Water Quantity Focused (September 10, 2018)

The third SAC meeting focused on Voluntary IMP elements (water quantity) and was held in the UBBNRD office on September 10, 2018 from 7:00-9:00 p.m. Eleven of the eighteen stakeholders were present. The meeting began with stakeholders sharing what items of note they observed in materials provided during the previous meeting. One stakeholder mentioned that the modeling tools and concepts were really helpful. Another stated that the 90-day timeline for measuring/monitoring wells is too short to meet regulations. Rod DeBuhr informed the stakeholders that the 90-day rule is statute.

Marie Krausnick, UBBNRD, gave a presentation regarding the NRD actions and efforts. Currently, the district has a groundwater management plan that does not include any discussion of surface water. She explained that water quantity hinges on groundwater quantity charts set in 1978. This chart provides benchmarks for groundwater levels and management.

Jeremy Gehle, NeDNR, presented information regarding the NeDNR's role on this subject. The NeDNR's multiple offices throughout the state manage and collect water data for the Blue River Compact and administer surface water rights. He explained that surface water permitting applications can be used for multiple purposes, and that the applicants must provide a map with number of acres to which the water will be applied, as appropriation is based on this. The NeDNR can also require annual reports from irrigators or water users.

A presentation of joint efforts between the NRD and NeDNR was provided by Marie Krausnick, Jeremy Gehle, and Jennifer Schellpeper. They emphasized that the intent of the Voluntary IMP is to be proactive. They discussed water uses and supplies across the basin and explained that integrated management will look at all activities and help determine which activities are impacting the amount of water in the stream. There is a lot of data and information to capture, so the NRD and NeDNR have a joint groundwater modeling effort that includes Upper Big Blue, Little Blue, Lower Big Blue, and Tri-Basin NRDs. The UBBNRD currently requires any water user wanting to pump more than 500 acre-feet annually to complete a hydrologic evaluation. This new groundwater model will help communities avoid going to engineering firms to do an evaluation, as those could be run for communities internally.

A stakeholder questioned what the water usage requirement was for those evaluations and asked for an idea on who that would include; he was informed that it requires 500 acre-feet and that ethanol manufacturers, power plants, the nitrogen plant by Geneva, and the City of York meet this criterion. It was also explained that once an entity has used their water through their wastewater system, it no longer counts towards their allocation, so recycled water is basically free water. Gehle mentioned that the UBBNRD is one of the areas in Nebraska that does require flowmeters during times of shortage. The stakeholders continued to discuss their questions on the groundwater model.

During stakeholder discussion, stakeholders were first asked what steps they would like to see the NRD and NeDNR take together. Stakeholder responses to this primarily related to a desire for local control, maintaining the voluntary and non-regulatory nature of participation, and availability of cost-share programs.

The SAC was then asked to identify their goals. Stakeholder-identified goals included: joint hydrologic modeling to address both quantity and quality, making sure that the watersheds are fully developed, building in a reservoir to capture surface water rather than letting it run off, and reducing evaporation in what has been captured.

In discussing water quantity areas of concern, one stakeholder asked whether the area is seeing contamination of nitrates in surface water, and Rod DeBuhr stated that testing for surface water is fairly limited and should possibly be expanded. Another stakeholder said he didn't have a lot of concerns, as he believes people have done a really good job conserving water, but that there is always room for more efficiency. A stakeholder expressed concern regarding unused and abandoned wells. The group then discussed the rules that designate whether an area is designated as fully appropriated.

Following this discussion, stakeholders were tasked with drafting one goal for water quality management and one goal for water quantity management. Stakeholders were then given the opportunity to provide their final comments in a roundtable format before the meeting was adjourned.

Stakeholder Meeting #4: Joint Water Quality and Water Quantity Focused (November 27, 2018)

The fourth SAC meeting was held at the UBBNRD office on November 27, 2018 from 7:00-9:00 p.m. with ten of the eighteen stakeholders in attendance. The goal of the meeting was to work on the goals and objectives for the WQMP and Voluntary IMP. Facilitator Steve Wolf opened the meeting by telling the stakeholders how their feedback from the prior meetings has already began to shape the goals and objectives of the two plans with the emerging themes of local management, need for education, and ensuring future water supply.

The stakeholders then collectively reviewed, discussed, and modified the draft goals and objectives that, with permission from the group, were assembled by the project team based on stakeholder discussion, technical expertise, and review of other relevant plans and existing rules, regulations, and polices in the district. Key topics of discussion during the WQMP review included emphasizing a theme of partnership and collaboration, questioning whether industrial use is considered domestic, and moving wellhead protection items into the action items section rather than the objectives section. Key topics of discussion during the Voluntary IMP review included enhancing the focus on all types of natural resources rather than just water, implementing targeted public outreach, adding action items related to forecasting, and participating in NRD and NeDNR's joint annual activity.

When asked whether they could see their discussions reflected in the goals and objectives, multiple stakeholders indicated that they were impressed by the effort that has gone into this process. They also went on to say that this process, including the involvement of state agencies, seems to have a different spirit, more cooperative.

Stakeholders were provided the USDA Conservation Choices brochure and a project-team-developed Voluntary IMP Controls handout. They were asked to review the brochure and handout and bring to the next meeting any ideas, thoughts, or questions they have about the materials to aid in discussions regarding action items.

During the stakeholder roundtable, many of the stakeholders expressed their approval of the stakeholder process as well as their belief that great progress has been made on the goals and objectives. A question regarding the application of fall fertilizer was posed to the stakeholders during the public comments portion of the meeting, and robust discussion regarding this topic was held until the meeting adjourned.

Stakeholder Meeting #5: Joint Water Quality and Water Quantity Focused (January 14, 2019)

The fifth and final meeting of the SAC was held on January 14, 2019, from 7:00-9:00 p.m. in the UBBNRD office with six of the eighteen stakeholders in attendance. The purpose of this meeting was to continue discussion and make final revisions to goals and objectives for each plan.

Adam Rupe facilitated a brief stakeholder discussion about the BMPs outlined in the Conservation Choices brochure (provided during the previous meeting). Stakeholders emphasized that financial incentives, like cost-share opportunities, would likely be the most successful in motivating individuals to utilize the BMPs. However, it was also noted that people may not feel that the cost-share is worth the paperwork they would have to complete.

Amy Zoller provided a handout to the stakeholders regarding authorized and unauthorized Voluntary IMP groundwater/surface water controls. She stated that, while the UBBNRD and NeDNR are ultimately in charge of setting Voluntary IMP controls, they are interested in getting input from the SAC. Rod DeBuhr also mentioned that there are already controls in this area, including groundwater triggers set for allocation, well spacing requirements, mandatory water use reporting, and rules for groundwater transfer.

With this technical context, stakeholders were asked to review and revise the potential action items provided for each plan. Discussion and revisions mostly pertained to altering the wording of existing action items.

In a final review of the draft goals and objectives for the WQMP and Voluntary IMP, no further changes were requested by the stakeholder group. The SAC concurred with their revised version of the goals and objectives for each plan. Steve Wolf explained that, going forward, this work will be provided to the NRD board, and they will be encouraged to move forward to the maximum extent they can with the recommendations provided by the stakeholders. The WQMP is on track to be completed in April 2019, and the Voluntary IMP will be developed upon completion of the WQMP. It was noted that these documents would be made available with the meeting minutes on the NRD website.

Stakeholders were invited to share their final comments in a roundtable format. The need to address soil health and its benefits for water quality and quantity was discussed by several stakeholders. Data collection and management was also a prominent topic of conversation between the stakeholders and the project team. One stakeholder pointed out that education, which has been on the forefront of each conversation, is already occurring, as each stakeholder will take the knowledge gleaned from these meetings with them when they leave.

Prior to the meeting adjournment, Facilitator Steve Wolf asked the stakeholders to take a moment to absorb what they've been doing through this stakeholder process: the SAC helped make state history in the first joint planning process between water quality and water quantity between NDEQ and NeDNR. He expressed this hope that this precedent may help to create an innovation that is used in other parts of the state. Amy Zoller and Carla McCullough thanked the stakeholders on behalf of the NeDNR and NDEQ, respectively, and the meeting was adjourned.

PUBLIC INVOLVEMENT

WQMP OPEN HOUSE PUBLIC MEETING (April 2, 2019)

The WQMP open house public meeting was held on April 2, 2019, from 7:00-8:30 p.m. in the UBBNRD office with 30 members of the public signed in to the meeting and an additional 11 project team members and NRD board members who signed in on behalf of the project. Other project team members and NRD board members were in attendance to staff the meeting but did not sign in. The purpose of this meeting was to share information from the planning process and draft water quality management plan (WQMP), answer questions the public may have, and discuss what the public can do to help protect this shared resource.

The meeting was arranged in six stations for attendees to sequentially visit. The first station provided an overview of the project, including a description of water quality management plans and voluntary integrated management plans and their benefits. This station also included a board provided by the NeDNR giving more in-depth information on voluntary integrated management plans. The second station described the community-guided planning process that resulted in the two voluntary plans. The third station addressed existing conditions and concerns within the district. The fourth station focused on how the NRD is addressing these issues. The fifth station provided meeting attendees with information regarding how they can help protect and conserve the shared resource. The sixth station provided information about nitrate in groundwater and how that relates to fall fertilizer application.

Each station was staffed by project team members and included supplemental materials and handouts to better inform the public about these topics. After visiting each station, the public was encouraged to complete comment forms to share their thoughts regarding the meeting topics. All meeting attendees were encouraged to share ideas and concerns with the project team, as well as complete a comment form before the open house public meeting was adjourned. A total of 12 comment forms were collected during the meeting.

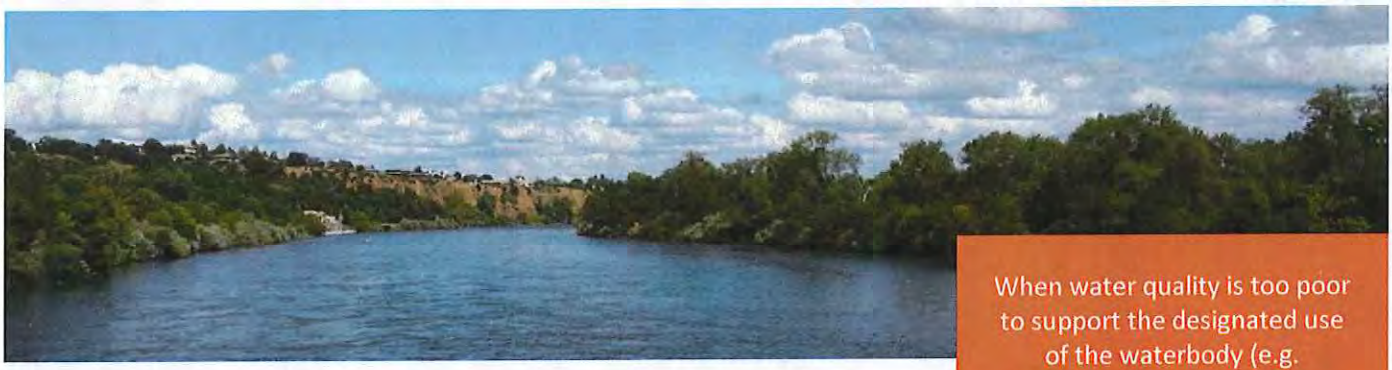
WATER QUALITY MANAGEMENT PLANS

NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

A Water Quality Management Plan (WQMP) identifies water quality problems in a watershed, proposes solutions, and creates a strategy for putting those solutions into action. Like a road map directing you from the start to finish, it helps to create a strategic, targeted plan for making changes in a watershed to achieve water quality goals.

A **WATERSHED** is the area of land that drains to a common point, such as a lake, river, stream, or wetland.

The primary purpose of a WQMP is to guide watershed coordinators, natural resource managers, policy makers and community organizations in voluntary efforts to improve water quality in a watershed and restore impaired water bodies. A WQMP is a living document, meaning that as conditions change in a watershed with time, the plan is re-examined and revised. Each WQMP uniquely reflects the environmental, cultural, and socio-economic needs of the watershed.



When water quality is too poor to support the designated use of the waterbody (e.g. recreation, drinking water supply, etc) the water body is deemed an **IMPAIRED WATERBODY.**

Addressing Pollution through a WQMP

A WQMP primarily addresses water quality problems resulting from nonpoint source pollution (NPS). NPS pollution occurs when rainfall or snowmelt runs off and moves over or through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants which end up in rivers, streams, lakes, and wetlands. This can result in an impaired waterbody. The development of this WQMP is a joint effort between the Upper Big Blue Natural Resources District (UBBNRD) and the Nebraska Department of Environmental Quality.

Stakeholder Involvement

How does it work?

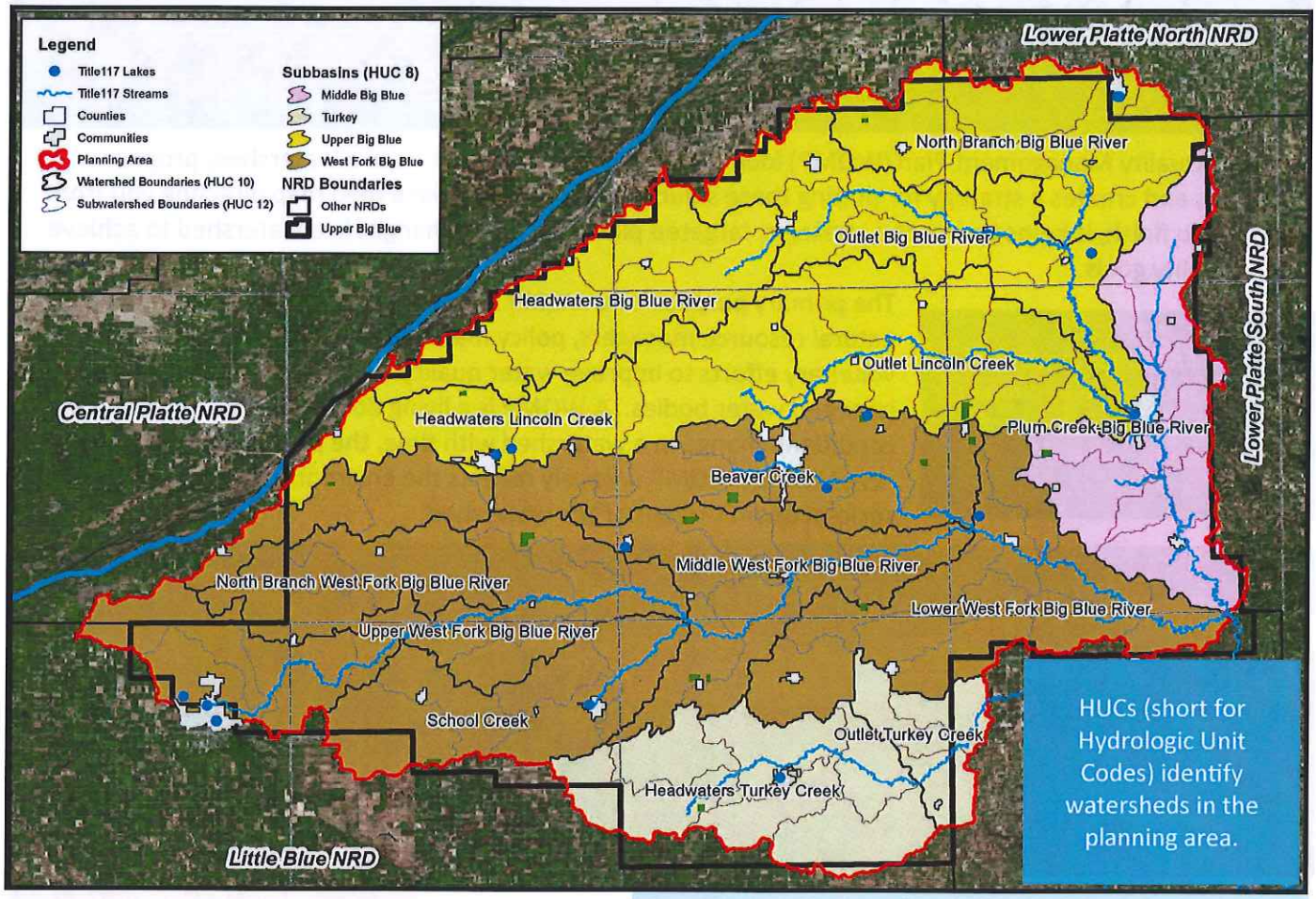
The development of a WQMP requires both technical expertise and participation of stakeholders with diverse skills and knowledge. Stakeholders provide input on the content and function of the WQMP.

How Can You Be Involved?

As a stakeholder, your participation is essential to guide decisions for the WQMP. Talk to others in your community to make them aware or get them involved with the WQMP!

Upper Big Blue NRD Water Quality Management Plan Area

The Upper Big Blue NRD WQMP Area is divided into smaller watersheds for the purpose of modeling watershed conditions, selecting priority areas, and monitoring water quality.



Waterbody Impairments in the Upper Big Blue NRD

Streams and lakes across Nebraska are evaluated for water quality by the state. When water quality is too poor to support the designated uses of the waterbody (e.g. recreation, drinking water supply, etc) the water body is deemed as impaired. E-coli, aquatic habitat and Atrazine are the primary causes of impairments in surface waters of the UBBNRD watershed. Nitrate is the primary contaminant of concern for groundwater.

PRIORITY AREAS are selected as part of the plan for project implementation based on the potential impact for improving water quality. Priority areas maybe selected based on land use, soils, proximity to streams or other factors.

What are the steps in developing a WQMP?

Although the steps may be different in developing each plan, they generally include:

1. Build partnerships
2. Characterize the watershed
3. Identify priority areas and priority management actions based on water quality issues (impairments)
4. Set goals and identify solutions
5. Design an implementation program
6. Development of an outreach strategy to educate and engage residents in protecting and conserving water resources
7. Implement the watershed plan
8. Measure progress and make adjustments

"1 District - 2 Plans - 1 Water"

WATER QUANTITY PLAN: Nebraska Department of Natural Resources

Sustainability in the Upper Big Blue NRD

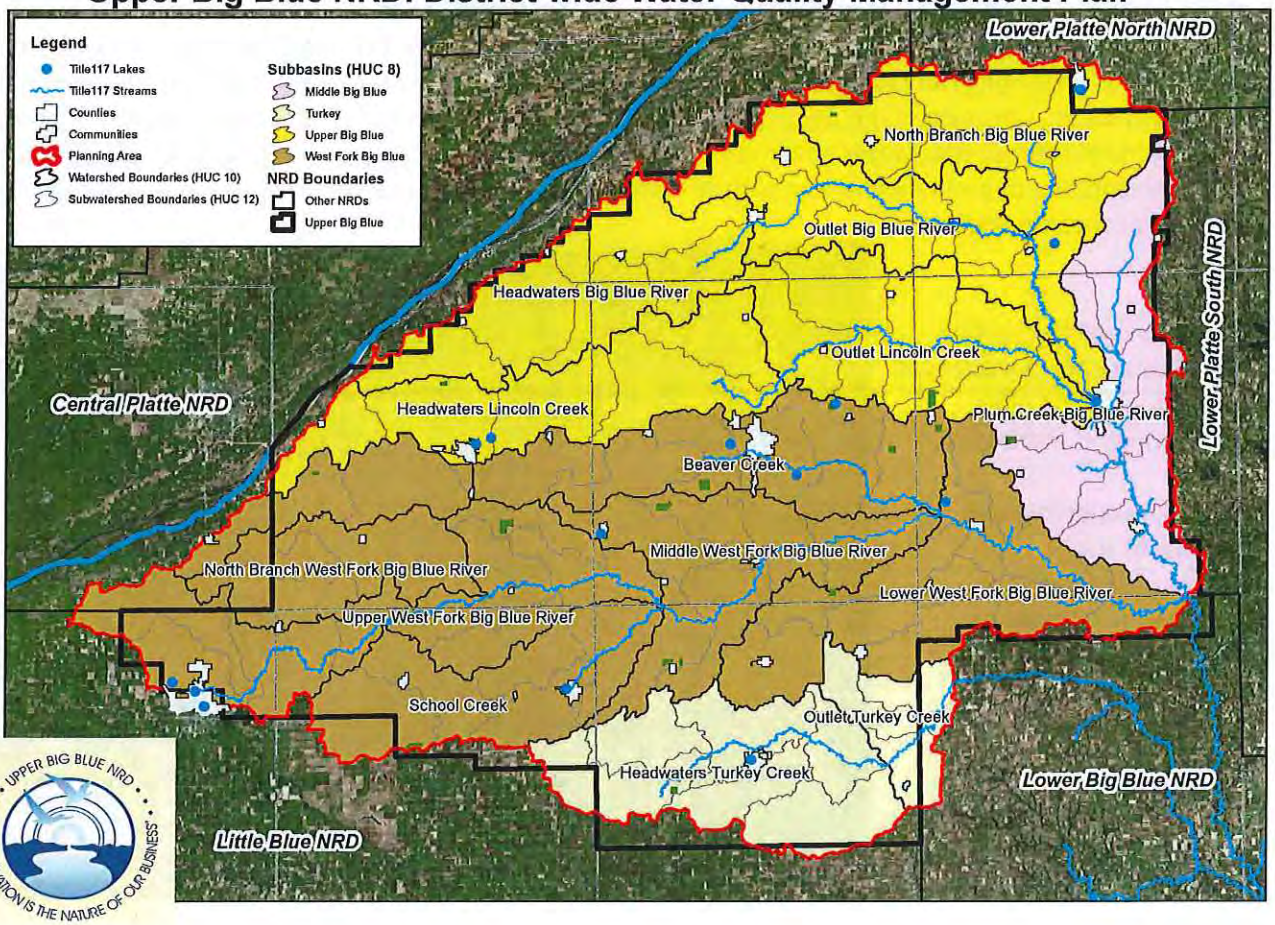
The Nebraska Department of Natural Resources (NeDNR) seeks to ensure a balance between water supplies and uses through our science-based technical expertise, planning, and coordination of efforts with NRDs and stakeholders (you). NeDNR's actions are focused on protecting and preserving the water rights of existing users of surface water and groundwater. Finding a balance between competing demands is a key to Nebraska's resource future. Assessing impacts of alternative soil and water management options requires an understanding of complex issues and substantial amounts of reliable data. NeDNR is committed to providing Nebraska's citizens and leaders with the data and analyses they need to make wise resource decisions for the benefit of all Nebraskans both now and in the future.

WATER QUALITY PLAN: Nebraska Department of Environmental Quality

Waterbody Impairments in the Upper Big Blue NRD

Streams and lakes across Nebraska are evaluated for water quality by the state. When water quality is too poor to support the designated uses of the waterbody (e.g. recreation, drinking water supply, etc.) the water body is deemed as impaired. E-coli, aquatic habitat and Atrazine are the primary causes of impairments in surface waters of the Upper Big Blue NRD watershed. Nitrate is the primary contaminant of concern for groundwater.

Planning Area
Upper Big Blue NRD: District-wide Water Quality Management Plan



"1 District - 2 Plans - 1 Water"

This project is unique for Nebraska when talking about water management plans.
For the first time, both a water **quantity** plan and a water **quality** plan will be written simultaneously and in partnership with the Nebraska Department of Natural Resources, the Nebraska Department of Environmental Quality and a NRD...the Upper Big Blue. The consulting and engineering firm of JEO will be steering the process. The idea of co-jointly planning water quantity & quality plans makes sense. As Nebraskans, we need an ample and sustainable amount of water for daily use, but we must also ensure that the water meets quality drinking standards. In other words, what's the use of having plenty of water on hand, but it is not potable? The following prescriptions provide an overview of the tandem plans:

Voluntary Integrated Management Planning (V-IMP)

The District has also entered into an agreement with the Nebraska Department of Water Resources to prepare a Voluntary Integrated Management Plan. This planning effort will look at the relationship between groundwater and surface water use in the District. The same stakeholder group from the WQMP will be tasked with making recommendation on the efforts need for the V-IMP. Both planning efforts will occur concurrently in an effort to promote efficiency and in recognition that solutions to these problems are often related.

Water Quality Management Planning (WQMP)

The District has entered into an agreement with the Nebraska Department of Environmental Quality (NDEQ) to prepare a Water Quality Management Plan for the Upper Big Blue River Basin. The planning effort will involve public stakeholders to identify surface water and groundwater quality issues and how to solve them. The plan will be completed by September of 2019.

"Voice of the People": Technical Advisory & Stakeholder Advisory Committees

This partnered approach between three governmental agencies will be closely and enthusiastically viewed as a modern and equitable way of managing Nebraska's most precious natural resource...water. Yet there is another integral piece to this planning process: the voice of the people. The Technical Advisory Committee (TAC) is composed of officials from various agencies representing water governance. The Stakeholders Advisory Committee (SAC) is a geographical & vocational representation of groundwater and surface water irrigators, municipalities , ag business, public health & safety, and other concerned citizens of the District.

These two groups will be meeting over the next two years to assist with the planning process and offer suggestions, opinions, and advice.

Please visit: *www.upperbigblue.org* for meeting dates and times of both committees. We invite public participation, so please feel free to join us at these meetings!

APPENDIX B: TECHNICAL MEMORANDUMS

PRIORITIES IDENTIFICATION

EXISTING BMP TREATMENT LEVELS

NON-PERMITTED AFO FACILITIES

SURFACE WATER QUALITY DATA REVIEW AND SUMMARY

RUNOFF YIELD ESTIMATION

2018 INTEGRATED REPORT SUMMARY TABLES

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Technical Memo – Priorities Identification

Prepared By: Adam Rupe
JEO Project # 161356.00

Purpose

Water quality management plans (WQMPs), which follow Nebraska Department of Environmental Quality (NDEQ) requirements are written to address specific causes of impairments of surface waterbodies (lakes and streams). Current guidelines require targeting implementation efforts [primarily best management practices (BMPs)] to a small area (known as a target area) within a watershed where measurable improvement of water quality within a waterbody is likely to be achieved in a relatively short time (feasible to address within the first 5-10 year increment of the WQMP). This memorandum has been developed to define and clarify the process used to identify priorities during the development of the Upper Big Blue Natural Resources District (UBBNRD) WQMP. This memo is not intended to be all encompassing, as it serves only to supplement the WQMP. Information within this memo will be incorporated into the WQMP. Priority implementation efforts may include:

- Installation of Best Management Practices (BMPs) within target areas and special priority areas
- Monitoring or data collection efforts
- Education and Information efforts

Terminology

The following terminology is provided to assist the reader throughout the rest of this document.

- Priority Waterbodies
    - The actual resource the UBBNRD intends to protect or restore through implementation of the WQMP
    - Selected from the specific lakes or streams that are listed in Title 117 (NDEQ, 2014)
    - Priority waterbodies are identified through a screening process, stakeholder input, and analysis of technical data as outlined in this memo
    - Priority waterbodies are divided into two tiers:
        - Tier 1 waterbodies will have a detailed implementation strategy developed for them within the WQMP and will be eligible for Section 319 project funding.
        - Tier 2 waterbodies do not have a detailed implementation strategy developed. Implementation work related to Tier 2 waterbodies will not

be eligible to receive Section 319 funding, however, nonfederal funds utilized for water quality protection/improvement on Tier 2 waterbodies may count towards matching dollars for Section 319 projects on Tier 1 waterbodies.

- Target Areas
  - The defined areas within a watershed where implementation of Best Management Practices (BMPs) will be focused to improve or protect the water quality of priority waterbodies
  - A target area is typically delineated using the HUC 12 watershed boundary dataset (WBD) from USGS, but the final delineation may be modified for various reasons
  - GIS analysis of land use, topography, soils, and other data sets; water quality modeling; or other tools are used to define target areas
  - Selection of these areas can be based on varying factors such as pollutant loads and, achievable results, landowner interest, etc.
  - The 2015 State Nonpoint Source Management Plan (NDEQ, 2015) specifies that target areas may only make up a maximum of 20% of a HUC 8 level watershed area, also known as the 20% Rule
- Special Priority Areas
  - Typically identified through stakeholder input and existing plans/documents such as: 303(d) list of impaired waters, State Nonpoint Source Management Plan, Wellhead Protection Areas, Nebraska Game and Park Commission's (NGPC's) Aquatic Habitat Plan, wetland complexes identified by NGPC, and others
  - Provide flexibility to address distinct areas with specific, limited, and timely needs that lie outside of the target areas, but within the watershed
  - These areas do not count towards the 20% Rule
  - SPAs are eligible for Section 319 funding outside of target areas, but BMPs are restricted to those necessary to address the specific needs of the SPA.
    - For the purposes of utilizing Section 319 funding, the implementation of BMPs within the SPA must be administratively tied to a Section 319 project (i.e. part of the same project) where the majority of BMPs are focused within a target area
  - SPAs may receive enhanced Section 319 funding when they lie within a target area of a tier 1 priority waterbody.
  - SPAs do not need a detailed implementation plan (containing BMP load reductions, schedule, costs, etc.) as a part of the WQMP
  - Common examples are onsite wastewater systems, wetlands, nonpermitted animal feeding operations, riparian zones, and wellhead protection areas

- Priority Practices
    - Best management practices (BMPs) identified for the purposes of water quality modeling
    - These are typically screened down from a large list of BMPs based on agency and public input. Special consideration is given for landowner or producer acceptability and new/innovative BMPs.
    - Additional detailed information is then identified for each priority BMP, such as treatment efficiency and landowner acceptance
- Critical Source Areas (CSA)
    - A relatively small fraction of a watershed that generates a disproportionate amount of pollutant load (Meals, 2012)
    - Identifying these areas allows BMPs to be better targeted to areas in order to use financial and technical resources effectively
        - These are the areas where Section 319 project funding will be encouraged the most
    - CSAs occur where a pollutant source in the landscape coincides with an active hydrologic transport mechanism; therefore, identifying the pollutant of concern, it's source, and understanding hydrology are first steps in CSA identification
    - These are identified within target areas, which often requires detailed assessments, modeling, GIS analysis, or in-field work to identify and define.
    - Availability of data will determine the extent of which these can be identified within the WQMP
- Monitoring Priorities
    - Monitoring is necessary for a variety of uses, including baseline data, filling in data gaps, water quality modeling, and evaluating plan progress.
    - Priorities may vary, but could include:
        - Water quality – certain sites, techniques, or pollutants
        - Streamflow – certain sites or monitoring regimes
        - Social indicators of change
        - BMP adoption levels and effectiveness
- Education & Information (I&E) Priorities
    - These are I&E priorities that are separate from I&E necessary as part of implementing BMPs within target areas. I&E priorities are typically related to specific issues identified by stakeholders, or large data gaps
        - For each priority, it will be important to identify target audiences, desired outcomes, specific strategies or techniques to use, and evaluation methods.

Identification of Priority Waterbodies - Methodology

Priority waterbodies are those whose protection or restoration will become the focus of the first five-years of the WQMP. The identification and selection of priority waterbodies followed a process that recognizes the inherent differences of each waterbody and the resources and effort required to protect or restore it. This process is discussed below and is illustrated in Figure 1.

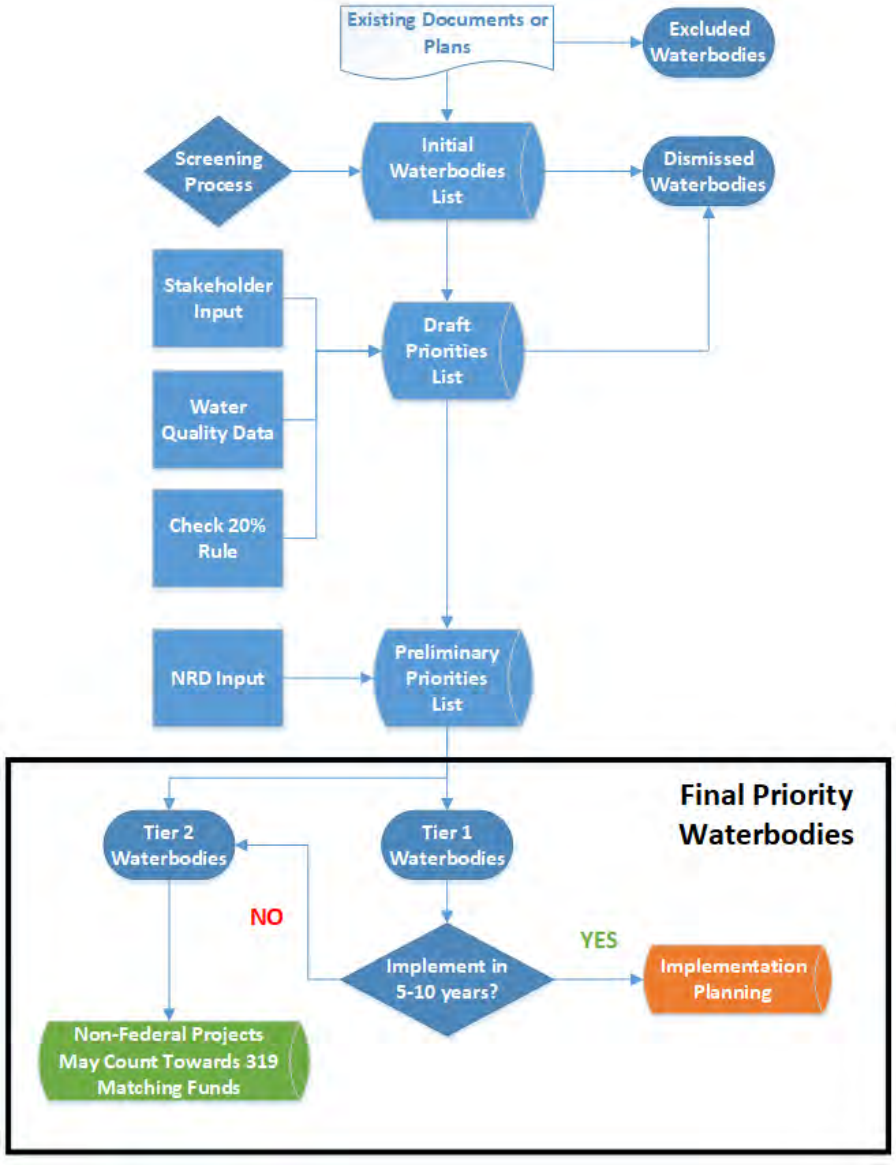


Figure 1: Overview of the Process for Selecting Priority Waterbodies for the UBBNRD WQMP

The initial list of waterbodies to be prioritized was identified from existing documents and was limited to those lakes or streams that have been identified as impaired (NDEQ, 2018) or are designated as a high quality or unique resource (NDEQ, 2015). Waterbodies lacking complete assessments (NDEQ categories 2 or 3) were excluded. Additionally, waterbodies whose only impairments are caused by natural background sources or are caused by pollution sources other than nonpoint source pollution (e.g. mercury) were excluded.

A screening process was then utilized to narrow down the options from the initial list of waterbodies to a draft list of priority waterbodies. This process has been used successfully on previous WQMPs. The screening process utilizes a point-based system representing various interests of resource management agencies and the public. Waterbodies that scored low were dismissed from further consideration as a priority. There is equal weighting for each screening factor to represent the inherent subjectivity of each category. The screening process was completed through an Excel document (results are attached to this memo). The list below identifies the factors used in the screening process:

- 1st Screen Criteria
  - More than one impaired beneficial use
  - Water quality trends indicate future impairment
  - Human health concern
  - Ongoing management efforts
  - Watershed conservation opportunity
  - Fisheries priority
  - High public use
- 2nd Screen Criteria
  - Lake renovation and/or watershed implementation completed in past 15 years
- 3rd Screen Criteria
  - Total Maximum Daily Load (TMDL) in Place
  - Active approved watershed management plan or aquatic habitat program project
  - High quality stream (NDEQ, 2015)

Once a draft list of priority waterbodies was assembled, a review of water quality data, identification of contributing drainage area for streams (20% rule check), and input from stakeholders was considered by UBBNRD. Waterbodies were either dismissed from further consideration or were added to a list of preliminary priorities. It should be noted that waterbodies which failed the 20% rule check could be included in future updates to the WQMP,

if water quality monitoring data was able to better delineate areas within those drainage areas that should be prioritized.

Preliminary List of Priority Waterbodies

From an initial list of 26 stream segments and 16 lakes, there were five streams and three lakes identified in the preliminary list of priority waterbodies. These are listed by HUC 8 subbasin below. To assist with final selection, each waterbody on the preliminary list was assigned either a draft Tier 1 or a Tier 2 status, as shown in Table 1. A map of the waterbodies and their contributing drainage areas is shown in Figure 2.

Middle Big Blue HUC 8 Subbasin

- None identified

Turkey HUC 8 Subbasin

- None identified

Upper Big Blue HUC 8 Subbasin

- Lincoln Creek (2 segments – BB4-2800, BB4-20900)
- Oxbow Trail Reservoir

West Fork Big Blue HUC 8 Subbasin

- Beaver Creek (2 segments – BB3-10300, BB310-400)
- School Creek (BB3-20100)
- Recharge Lake
- Lake Hastings

Table 1: Preliminary List of Priority Waterbodies

Waterbody ID	Name	Impairment Cause	Draft Status	20 % Check (with headwaters)	Reason / Discussion
West Fork HUC 8 Subbasin					
BB3-10300	Beaver Creek - Unnamed Creek to West Fork Big Blue River	Atrazine	Possible Tier 1	~2% (22.5%)	high scoring
BB3-10400	Beaver Creek - Headwaters to Unnamed Creek	Unknown (Aq. Community)	Possible Tier 2	~16.5%	Low scoring, but lower portion is possible Tier 1
BB3-20100	School Creek	Atrazine	Possible Tier 1	~13%	Low scoring, but manageable size
BB3-L0080	Recharge Lake	Nutrients	Possible Tier 1	n/a	high scoring, high visibility, UBBNRD - issues with sedimentation
BB3-L0050	Lake Hastings	Nutrients & Sediment	Possible Tier 2	n/a	high scoring, partially in LBNRD
Upper Big Blue HUC 8 Subbasin					
BB4-20800	Lincoln Creek - Unnamed Creek to Big Blue River	None	Possible Tier 1	~16% (~40%)	high scoring, opportunity for "protective actions", atrazine trends looks bad
BB4-20900	Lincoln Creek - Headwaters to Unnamed Creek	None (Aq. Community)	Possible Tier 2	~23.5%	Scored no points, but lower portion of creek is possible Tier 1
BB4-L0035	Oxbow Trail Reservoir	Nutrients	Possible Tier 1	n/a	high scoring, proximity to a community (Ulysses)

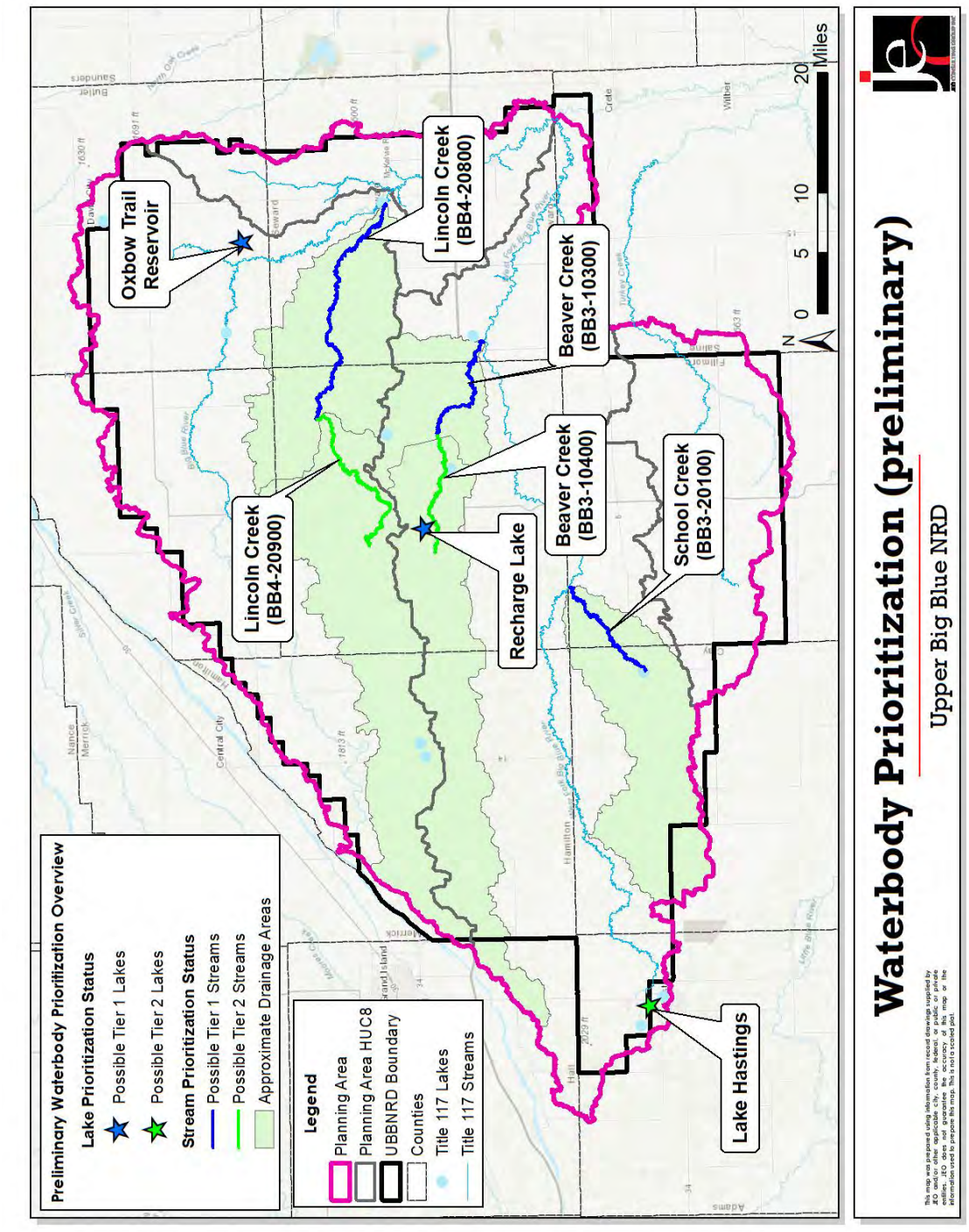


Figure 2: Preliminary Map of Priority Waterbodies

Priority Waterbodies - Final List

The UBBNRD made the final selection of priority waterbodies, and the final assignment as either tier 1 or tier 2. Figure 3 displays a map of the final tier 1 waterbodies. This important selection was made after consideration of the capacity of the UBBNRD to take on any future projects and an examination of what was considered feasible to accomplish. If it was felt that if it was not feasible for a waterbody to be addressed within the first 5-10-year increment of the WQMP, then the waterbody was assigned a tier 2 status. The following list identifies the final prioritization of waterbodies:

Tier 1

- Beaver Creek (2 segments)
  - Downstream segment (ID: BB3-10300) – Aquatic life use impaired due to Atrazine.
  - Headwaters segment (ID: BB3-10400) – Aquatic life use impaired due to unknown cause
- Recharge Lake
  - ID: BB3-L0080 – Aquatic life use impaired due to high nutrients

Tier 2

- School Creek (ID: BB3—L0080)
- Lake Hastings (BB3-L0050)
- Lincoln Creek (2 segments)
  - BB4-20800
  - BB4-20900
- Oxbow Trail Reservoir (ID: BB3-L0035)

Detailed implementation plans will be prepared to address the atrazine impairment on Beaver Creek, and the nutrient impairment on Recharge Lake. The aquatic life impairment on the headwaters of Beaver Creek will be addressed indirectly through recommendations of stream assessments and habitat restoration projects. These implementation plans will be included in the HUC 8 chapters of the WQMP and will include information necessary to meet EPA's Nine Elements.

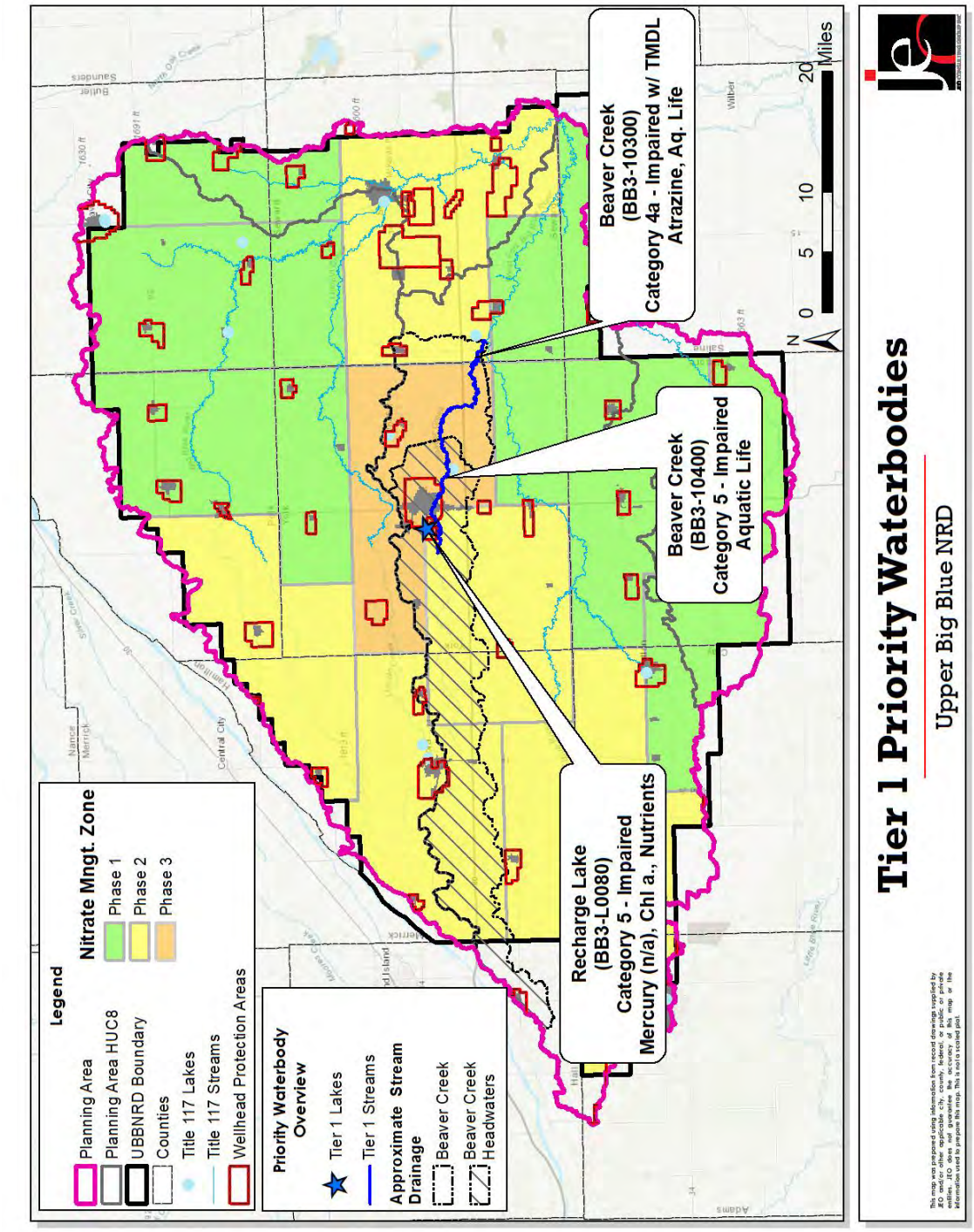


Figure 3: Map of Final Selection of Priority Waterbodies

Summary of Other Priorities Identified

The following are additional priorities that were identified through the stakeholder involvement and plan development process, as of the time of the preparation of this memo:

Special Priority Areas

- Wellhead Protection Areas (WHP areas), specifically York and Seward
- Non-permitted animal feeding operations (AFOs)
- Rainwater Basin wetlands
- Stream corridors and riparian areas

Monitoring Priorities

- Inventory of Existing BMPs
- Any waterbody that requires additional data before implementation can occur (pre-project monitoring)
- Reservoir bathymetric surveys – to estimate sedimentation rates
- At least one year or season of water quality data collection on waterbodies that don't have data
- Stream erosion

Education & Information Priorities

- Stream erosion
- Crop and land use diversity
- Overall water quality and supply status
- BMP demonstrations
- Costs verses benefits of conservation
- Target audiences
    - Generational change
    - 4H, FFA, and other youth
- Additional staff and budget

References

Meals, D. W., A. N. Sharpley, and D. L. Osmond, 2012, Lessons Learned from NIFA-CEAP: Identifying Critical Source Areas, NC State University, Raleigh, NC, 7 p.

NDEQ, 2015, Strategic Plan and Guidance for Implementing the Nebraska Nonpoint Source Management Program - 2015 through 2030: Nebraska Department of Environmental Quality, 98 p.

NDEQ, 2018, 2018 Surface Water Quality Integrated Report, Nebraska Department of Environmental Quality,

Nebraska Department of Environmental Quality, 2014, Title 117–Water quality standards for surface waters of the State, Lincoln, NE: Planning Unit, Water Quality Division. (retrieved from: https://deq.ne.gov/RuleAndR.nsf/Title_117.xsp).

Watershed	Waterbody		Pollutants	>1 Use Impaired(a)	Trends indicate future impairment	Human Health Concern(b)	Ongoing Management Efforts(c)	Watershed Conservation Opportunity(d)	Fisheries Priority(e)	High Public Use(f)	Sub-Total Points	Lake Renovated and/or Watershed Implementation Completed in Past 15 Years	Move Forward to 3rd Screen	TMDL in Place	Active Approved Watershed Management	High Quality Stream (2015 State Plan)	Sub-Total Points	Total Points
BB4-20800	Lincoln Creek		Atrazine		1	1		1			3	No		1			1	4
BB4-20900	Lincoln Creek		Aq. Comm								0	No					0	0
BB4-40000	Big Blue River		Atrazine					1	1	1	3	No		1			1	4
BB4-10000	Big Blue River		E.coli, Atrazine	1		1		1	1	1	5	No		1			1	6
BB4-20000	Big Blue River		E.coli			1		1	1	1	4	No		1			1	5
BB3-10000	West Fork Big Blue River		E.coli, Atrazine, Aq. Comm.	1		1		1	1	1	5	No		1			1	6
BB3-10200	Walnut Creek		Aq. Comm								0	No					0	0
BB3-10300	Beaver Creek		Atrazine			1		1			2	No		1			1	3
BB3-10400	Beaver Creek		Aq. Comm								0	No					0	0
BB3-20000	West Fork Big Blue River		E.coli, Atrazine, Aq. Comm.	1		1		1	1	1	5	No		1			1	6
BB3-20100	School Creek		Atrazine			1		1			2	No					0	2
BB4-L0010	David City Park Lake		Nutrients						1	1	2	Yes					0	
BB3-L0030	Waco Basin		E.coli, Nutrients	1		1					2	No	1				0	2
BB3-L0050	Lake Hastings		Nutrients, Sediment					1	1	1	3	No	1				0	3
BB3-L0060	Hastings Northwest Dam Lake		Nutrients, pH								0	No	1				0	0
BB3-L0070	Heartwell Lake		Nutrients						1	1	2	No	1				0	2
BB3-L0080	Recharge Lake		Nutrients						1	1	2	No	1				0	2
BB3-L0040	Henderson Pond		Nutrients						1	1	2	Yes					0	2
BB4-L0035	Oxbow Trail Reservoir		Nutrients, Chl. A	1					1	1	3	No	1				0	3

Streams		Final Rating	Manageable Size Watershed (< 250,000 acres?)	Top Priorities	
BB4-10000	Big Blue River	6	No		
BB3-10000	West Fork Big Blue River	6	No		
BB3-20000	West Fork Big Blue River	6	No		
BB4-20000	Big Blue River	5	No		
BB4-20800	Lincoln Creek	4	Yes	X	
BB4-40000	Big Blue River	4	No		
BB3-10300	Beaver Creek	3	Yes	X	
BB3-20100	School Creek	2	Yes		
BB4-20900	Lincoln Creek	0	Yes		Also addressed since other segment is a priority.
BB3-10200	Walnut Creek	0	Yes		
BB3-10400	Beaver Creek	0	Yes		Also addressed since other segment is a priority.

Lakes				
BB3-L0050	Lake Hastings	3	Yes	X
BB3-L0030	Waco Basin	2	No longer a lake?	
BB3-L0070	Heartwell Lake	2	No-too large.	
BB3-L0080	Recharge Lake	2	Yes	
BB3-L0060	Hastings Northwest Dam Lake	0	Not sure what watershed is?	
BB4-L0035	Oxbow Trail Reservoir	3	Yes	X

NOTES

(a) Addressing waterbodies that have more than one beneficial use impaired increases project benefits.

(b) Human health concerns are a high priority (bacteria, atrazine, algae toxins). Atrazine was added as human health concern.

(c) Historic and Ongoing Work: Waterbody or watershed is currently or has been the focus of targeted management actions.

(d) Aquatic Community Impairments are assumed to be driven by in- and near channel conditions. These impiarments are not considered to be opportunities for watershed conservation work.

(e) Fisheries priorities were given to all public lakes and larger streams (e.g., Blue River, Turkey Creek).

(f) Signifies areas with highest potential for an economic return from water quality improvement.

Technical Memo – Existing BMP Treatment Levels

Prepared By: Dillon Vogt
JEO Project # 161356.00

Purpose:

This memorandum has been developed to document sources of information which provide data on the existing levels of land treatment or Best Management Practices (BMPs), within the planning area for the Upper Big Blue NRD Watershed Management Plan. The results of this effort will be used for the following purposes:

- Assist in developing a water quality model
- Identifying if there are still opportunities for additional BMP implementation
- Accurately estimate pollutant load reductions as a result of recommended BMPs

Methods

For the current planning purposes, only existing data sources will be used. No on-the-ground or GIS-based field assessments will be conducted. There is no comprehensive database of existing BMPs in Nebraska. Existing data is primarily limited to what is reported through various government programs, such as EQIP, however many landowners utilize BMPs on their own and those are hard to identify without conducting additional studies. The following data source was used to compile this memo:

- **Natural Resources Conservation Service (NRCS) Conservation Agronomists** are individuals hired by the United States Department of Agriculture (USDA) to manage and administer farm programs to monitor and improve soil, water, and air quality. These programs can involve education, financial or technical assistance, and collaboration with various government entities and private individuals. One Agronomist centrally located in the UBBNRD was surveyed in July 2018 to quantify the management practices present in the region.

Results

A summary of the results of the survey are shown below in Table 1.

Table 1: Summary of NRCS Survey Results

Question	Response
What are typical crop rotations?	1 yr corn – 1 yr soybeans, or 2 yrs corn – 1 yr soybeans. For seed corn usually 1 yr seed corn – 1 yr commercial corn – 1 yr soybean (lots of seed corn in this region)
What are typical livestock stocking rates?	Recommended is 4-5 acres per cow calf pair. More realistically found is about 3 acres per cow calf pair.
What are typical manure application rates?	Swine deep pit barn – 2-3,000 gal/acre Beef cattle solids – 15-20 tons/acre Beef holding pond water – 4-7 ac-in/ac annually Dairy – no estimate
What percent of treatable land is treated by the following BMPs?	
Nonstructural and avoidance practices (nutrient/manure management, planning, etc.)	Most producers have crop consultants and use soil sampling/crop scouting. Most do not follow NRCS standards.
Grazing lands management (exclusionary fencing, alternate water supplies, etc.)	Most grazing land does not follow NRCS standards, but livestock wells and cross fencing can be common.
Cover crops	Majority of seed corn acres utilize cover crops, about 25% of conventional crops use cover crops.
Riparian buffers	Not common, very few meet NRCS standards
Reduced tillage (no-till, strip till, etc.)	No-till and strip till are common, probably 50-60% district wide. Convention till is 40-50%
Contour buffer strips/filter strips	Buffer strips are not common, the few that exist do not meet NRCS standards
Non-permitted animal feeding operation BMPs (animal waste systems, diversions, manure storage, etc.)	Do not have the information to answer this question.
Wetlands/farm ponds/sediment basins	Lots of wetlands. Many are farmed, many larger ones are used as pasture. Farm ponds – yes there are many in the district but NRCS does little work with them. Sediment basins have the same issues as terraces
Terraces	Not many in the district, too flat. Seward County has the most, however many terraces are being removed to accommodate larger machinery.
Grassed waterways	Same issues as terraces.

Discussion

Non-structural management practices of some sort may not be found in a majority of fields but are still common throughout the UBBNRD. Reduced tillage practices are the most popular, and many producers utilize crop rotations and cover crop plantings. Corn and soybeans are the most common crops in this region. Some grazing management practices are common, such as cross fencing, but most practices do not meet NRCS standards. Additionally, many pastures are overstocked. Practices designed to trap or treat runoff such as terraces, grassed waterways, and sediment basins are rarely found in this region due to the flat landscape.

It is recommended that additional studies or surveys should be conducted prior to future updates of the watershed management plan to provide a more accurate estimate of existing land treatment. This would also be an opportunity to gain insight into what barriers may exist which prevent or reduce BMP adoption by producers and landowners.

Technical Memo – Non-permitted AFO Facilities

Prepared By: Dillon Vogt
JEO Project # 161356.00

Purpose:

The purpose of this memo is to outline methods and procedures used to estimate the number and location of cattle and animal feeding operations (AFOs) within the study area. The study area includes 4 HUC 8s (West Fork Big Blue, Upper Big Blue, Middle Big Blue, and Turkey). These livestock estimates will be used to calculate approximate *E. coli* loadings within HUC 12s as a part of the Upper Big Blue Natural Resources District (UBBNRD) Water Quality Management Plan (WQMP). Livestock estimates were based on aerial analysis, information from the United States Department of Agriculture (USDA) census of agriculture, and permitted facility data from the Nebraska Department of Environmental Quality (NDEQ).

AFOs are facilities that confine livestock in a limited feeding space for an extended period of time. The Nebraska Livestock Waste Management Act authorizes the NDEQ to regulate discharge of livestock waste from these operations. Nebraska's Livestock Waste Control Regulations (Title 130) classifies AFOs as small, medium or large operations based on the number and type of livestock confined in the facility. Title 130 also requires inspection of medium and large operations to assess the potential for waste discharge. Depending on the size of the operation and potential to discharge pollutants, the operation may be required to obtain a construction and operating permit for a waste control facility from NDEQ. AFOs confining less than the equivalent of 300 beef cattle are considered administratively exempt from inspection and permitting unless they have a history or potential to discharge pollutants to Waters of the State.

For the purposes of the WQMP, permitted AFOs (typically medium and large operations) are not considered to be a pollutant source due to regulatory requirements. Non-permitted (typically small AFOs) do not have regulatory requirements imposed on them and are thus treated as potential nonpoint sources of pollution for management recommendation purposes.

Aerial Analysis:

The study area was visually surveyed using aerial imagery through a combination of ArcGIS and Google Earth. The public land survey system grid was layered over the base-map to break up the study area into manageable sections for the analysis. AFOs were initially identified in ArcGIS by looking for several key features in aerial photography, confirmed in Google Earth, and then checked to ensure they were not near a permitted AFO location (discussed below). A point for each non-permitted AFO was then created in ArcGIS. A total of 1,110 Non-permitted AFOs were identified in the study area. The following key features were used to identify them:

- clearly visible cattle trails between water sources
- stream crossings
- bare or disturbed ground around water tanks or feeding areas
- barns or sheds with bare earth corrals
- evidence of highly worn areas in pastures where cattle dig and roll
- individual cattle in feedlots or pastures
- lagoons for manure storage

Figure 1 below shows an example of a typical non-permitted AFO. There are barns with bare earth corrals present, as well as possible cow trails leading to the pond on the right side of the image. This image was taken from the base-map view in ArcGIS. Figure 2 shows a more in depth look at the same location in Google Earth. The Google Earth imagery was taken at a different time of year and date than the ArcGIS imagery, and clearly shows cow trails running to the pond as well as individual cattle in the pasture.

Figure 1 – Example Non-permitted AFO as seen in ArcGIS.

Figure 2 – A zoomed in view of the same operation as in Figure 1, taken at a different date (via Google Earth).

NDEQ Records:

NDEQ permitted facility records were utilized to identify permitted AFOs. Livestock waste control facility records were downloaded for the study area from the NDEQ website via the online Interactive Mapping utility. NDEQ records consist of only those AFO facilities which require a permit. There are three size-based classifications used by the NDEQ to classify cattle operations:

- Small
  - Contains less than 200 dairy cattle
  - Or contains less than 300 beef cattle
- Medium
  - Contains 200 – 699 dairy cattle
  - Or contains 300 – 999 beef cattle
- Large
  - Contains 700 or more dairy cattle
  - Or contains 1,000 or more beef cattle

Table 1 below shows an example of the NDEQ record formatting. The records include a facility ID, facility name, address, description, status, and latitude and longitude coordinates. Facilities described as active cattle feeding operations or dairies were pulled from the records and used for this study. A point was mapped in ArcGIS for each permitted facility based on their latitude

and longitude coordinates. Of the 1,016 permitted active cattle feeding operations identified, none were assigned size descriptions. Most small AFOs are not required to apply for a permit, therefore it was assumed that most permitted facilities are medium or large in size, despite the lack of description in NDEQ records.

Table 1 – Example of NDEQ registered facility records.

Facility_ID	Facility_Name	Street	City	County	Zip_Code	Status	Program	Program_ID	Program_Description	Program_Status	Latitude	Longitude
58076	UNL East Campus		Lincoln	Lancaster	68502	O	LWC	2-053	Cattle, sheep & horses	Active	40.83365	-96.66776
61618	Todd Farms	1618 Todd Dr	Union	Cass	68455	O	LWC	20-005	Feeder Cattle	Active	40.864444	-95.93611
49214	Mohrhauser Farms	11080 SW 119th St	Denton	Lancaster	68339	P	LWC	2-1084	Feeder Cattle	Active	40.70192	-96.88245
66671	Duane Hottovy Livestock	1675 23 Rd	Dwight	Butler	68635	O	LWC	25-1048	cattle	Active	41.07158	-96.95147
66693	John Kozisek Farm	2097 22 Rd	Dwight	Butler	68635	O	LWC	25-1011	Cattle	Active	41.06093	-96.989644
67193	Clarence Luebbe Livestock	1458 Fletcher Rd	Pleasant Dale	Seward	68423	O	LWC	16-178	Beef Cows	Active	40.87201	-96.91769
67199	Thomas Sieck Livestock	1856 Holdrege Rd	Pleasant Dale	Seward	68423	O	LWC	16-1058	beef cows	Active	40.82856	-96.9752

USDA Agriculture Census:

The USDA 2012 Agriculture Census (AgCensus) is the most recent freely available data source for Nebraska that provides a total count of cattle by county. It also provides counts by size of farm. Table 2 below shows an example of the AgCensus information. The census is broken up into categories of total cattle and calves by county, and total number of farms per county based on the size of their herds. The AgCensus counts all cattle in Nebraska, regardless of whether they are in permitted AFOs or non-permitted AFOs. The size categories available for farms are; 1 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 199, 200 to 499, and 500 or more. The AgCensus size classes were reclassified into 3 categories to more closely follow NDEQ size guidelines; 1 to 199 head as small, 200 to 499 as medium, and 500 or more as large.

Table 2 – Example of USDA Agriculture Census by county.

Item		Knox	Lancaster	Lincoln
INVENTORY				
Cattle and calves	farms, 2012	700	477	625
	2007	559	421	537
	number, 2012	123,103	21,732	267,865
	2007	115,709	23,323	248,876
Farms by inventory:				
1 to 9	farms, 2012	69	157	98
	2007	34	109	66
	number, 2012	355	671	475
	2007	207	542	297
10 to 19	farms, 2012	57	134	48
	2007	39	79	33
	number, 2012	777	1,765	663
	2007	525	1,106	480
20 to 49	farms, 2012	140	94	140
	2007	82	117	95
	number, 2012	4,199	2,657	4,599
	2007	2,771	3,849	2,984
50 to 99	farms, 2012	149	54	79
	2007	120	65	70
	number, 2012	10,118	4,007	5,240
	2007	8,123	4,369	4,644
100 to 199	farms, 2012	109	22	98
	2007	121	31	86
	number, 2012	15,096	3,038	14,061
	2007	17,101	4,249	12,073
200 to 499	farms, 2012	134	10	84
	2007	122	16	96
	number, 2012	41,572	2,840	27,121
	2007	38,238	5,200	31,618
500 or more	farms, 2012	42	6	78
	2007	41	4	91
	number, 2012	50,986	6,754	215,706
	2007	48,744	4,008	196,780

Analysis:

The study area contains parts of 10 counties. The percentage of each county's area included in the study area was calculated. To determine an approximate count of cattle within the study area, the total numbers of cattle per county from the AgCensus were multiplied by the percentage of county area included in the study. The summation of these approximations gives an estimate of the total number of cattle in the study area: 244,969.

The number of permitted cattle was found by comparing the percentage of each county included in the study area, the numbers of each size of permitted facility in each county, and the total number of cattle in each county. To estimate the size class of each permitted facility the number of operations of each size were determined from the reclassified USDA AgCensus counts and compared to the list of NDEQ permitted facilities within the study area. Each facility was assigned an assumed size class based on its location to match the estimated number of facilities of each size class per county. Once all medium and large facilities were accounted for,

the remaining facilities were assumed to be small. As seen in Table 3 below, large facilities were assumed to have 1,000 cattle each, medium 500, and small 100. The count of facilities in each size class were then multiplied by the estimated number of head in each facility class, then summed. This gave the total number of permitted cattle in the study area: 222,900.

The difference between permitted and total cattle yields 22,069 non-permitted cattle in the study area. Dividing this by the number of non-permitted facilities that were identified during aerial analysis, 1,110, yields an average of 20 cattle per non-permitted facility.

Table 3 – Calculations for cattle numbers.

Permitted Large facilities	Cattle (assume 1000)										
97	97000										
Permitted Medium facilitie	Cattle (assume 500)										
85	42500										
Permitted Small facilities	Cattle (assume 100)										
834	83400										
Total Active Permits		222900 Total Registered Cattle									
1016											
Unregistered facilities											
1110											
		Operations			Cattle						
County	Cattle in county (2012)	Small	Medium	Large	Small	Medium	Large	Area of County (acres)	Approx study area per county (acres)	% of County in Study	Approx cattle in study area by %
Adams	59282	157	14	5	1700	4377	Unreported	360924.5	52413.49	0.1452	8608.938
Butler	34030	292	28	8	11491	7378	15107	370360.87	181031.5	0.4820	16425.750
Clay	51336	132	22	9	4740	5659	40937	366912.51	165590.83	0.4513	23168.387
Fillmore	31023	145	8	13	6507	2358	22158	368890.41	262315.56	0.7111	22060.253
Hall	68546	205	24	27	9257	7210	52079	353223.78	40550.69	0.1148	7869.197
Hamilton	41093	160	14	19	6632	4108	30353	349715.15	317917.51	0.9091	37356.644
Polk	68799	126	22	33	5793	6057	56949	282128.42	172389	0.6110	42038.270
Saline	25879	332	16	4	13209	5477	7193	368534.16	50825.57	0.1379	3569.045
Seward	48059	322	21	13	11871	6379	29809	368258.05	296131.99	0.8041	38646.290
York	45226	123	6	28	3740	1783	39703	368441.54	368441.54	1.0000	45226.000
											244969 Total
[Ag census] - [Permitted cattle]											
	22069 Unregistered Cattle										
[Unregistered Cattle] / [Unregistered Facilities]											
	20 Unregistered Cattle per Facility										

To summarize:

1. Determine which counties the study area overlaps.
2. Determine the percentage of each county's area that is included in the study area.
3. Multiply total cattle per county from the AgCensus by the percentage from step 2, yielding cattle per county in the study area.
4. Sum the cattle per county by percentage, giving total number of cattle in the study area, both permitted and non-permitted.
5. Determine the size class of each permitted facility by county.
6. Multiply the count of each facility size by assumed cattle numbers to yield total permitted cattle in the study area.
7. Subtract permitted cattle from total cattle to yield total non-permitted cattle in the study area.
8. Divide non-permitted cattle by number of non-permitted facilities to find average cattle per non-permitted AFO.

Technical Memo – Surface Water Quality Data Review and Summary

Prepared By: Dillon Vogt
JEO Project # 161356.00

Purpose:

This memo will provide a brief overview of the surface water quality data available in the planning area for the Upper Big Blue NRD District-Wide Water Quality Management Plan (WQMP). Total Maximum Daily Load (TMDL) summaries and Integrated Report (IR) information were summarized from the 2018 Nebraska Department of Environmental Quality (NDEQ) Water Quality Integrated Report, and the available TMDLs for the planning area. Surface water quality data record requests were received by JEO from the NDEQ in early July 2018. Supplementary data was downloaded through the Water Quality Portal by JEO in May 2018. The Water Quality Portal data includes both NDEQ and Environmental Protection Agency (EPA) monitoring stations and data. The data was compiled from the various sources into Microsoft Excel worksheets, sorted by station, parameter, and date, then cleanup was performed by removing missing and overlapping measurements.

Parameters of Interest:

The primary contaminants of interest for the WQMP are *E. coli*, atrazine, total phosphorous, total nitrogen, and total suspended solids (TSS) (as a surrogate for sediment). Other contaminants were not included in this summary as they are not pollutants of concern.

Streamflow Data:

Table 1 below details the United States Geological Survey (USGS) stream gages relevant to the planning area. Figure 1 provides the locations of the streamflow gages. Note that there is only one gage inside the planning area, West Fork Big Blue near Dorchester. The Nebraska Department of Natural Resources (NDNR) maintains a separate system of stream gages across the state of Nebraska, three of which are located inside the planning area. The NDNR gages were not included in this data summary due to their limited period of record. Additional information on gages across Nebraska, can be found at the following website: https://nednr.nebraska.gov/RealTime/.

Table 1 – USGS Stream Gages In or Near the WQMP Planning Area

Gage ID	Gage Name	Data Type	Data Category	Period of Record
06880800	West Fork Big Blue near Dorchester	Instantaneous	Discharge	10/01/1990 – Present
		Instantaneous	Gage Height	10/01/2007 – Present
06881000	Big Blue River at Crete	Instantaneous	Discharge	2/12/1991 – Present
		Instantaneous	Gage Height	10/01/2007 – Present

Integrated Report Summary:

The 2018 Surface Water Quality Integrated Report (IR), which is published every two years by NDEQ, was reviewed to identify the current status of water quality conditions for each lake and stream segment within the study area. Tables 2 and 3 provide a summarization of the information included in the 2018 IR relevant to the planning area, broken down by HUC 8 subbasins. While there are multiple streams and lakes identified as impaired (indicating they are not meeting one or more water quality standards), there are many others that are not able to be assessed due to a lack of monitoring data. This further highlights the challenges of the limited data available in the planning area. A complete summary of the IR categorizations of streams and lakes in the planning area can be seen in Figures 2 and 3. The 2018 IR, as well as previous years, is available online at: http://deq.ne.gov/NDEQProg.nsf/OnWeb/TMDL.

Table 2 – Summary of Streams in the 2018 Integrated Report by HUC 8 Subbasin

	Upper Big Blue	Middle Big Blue	West Fork Big Blue	Turkey Creek
Total Stream Segments	6	10	8	2
Number Assessed	4	5	7	2
Number Impaired	2	2	6	0
% of Segments Impaired	33%	20%	75%	0%
Total Segment Miles	172 miles	80 miles	244 miles	80 miles
Miles Assessed	155 miles	60 miles	236 miles	80 miles
Miles Impaired	84 miles	33 miles	144 miles	0 miles
% of Miles Impaired	49%	41%	59%	0%

Table 3 – Summary of Lakes in the 2018 Integrated Report by HUC 8 Subbasin

	Upper Big Blue	Middle Big Blue	West Fork Big Blue	Turkey Creek
Total Lakes	7	0	9	1
Number Assessed	5	0	8	0
Number Impaired	3	0	6	0
% of Lakes Impaired	43%	0%	67%	0%
Total Acres	56 acres	0 acres	200 acres	1 acres
Acres Assessed	17 acres	0 acres	189 acres	0 acres
Acres Impaired	15 acres	0 acres	168 acres	0 acres
% of Acres Impaired	27%	0%	84%	0%

Total Maximum Daily Loads:

One Total Maximum Daily Load (TMDL) document is applicable to the planning area. The TMDL document was published in August 2013 by NDEQ for the Big Blue River and parameters of concern include atrazine and *E. coli.* The document is available online at: http://deq.ne.gov/NDEQProg.nsf/OnWeb/TMDLlist. Table 4 below shows an overview of the impaired streams in the planning area, along with the TMDLs that have been developed for them. Not all impaired streams have a TMDL developed for them at this time. No 5-alt data has been developed or is planned to be developed for this planning area (personal communication with NDEQ, March 29, 2018).

Table 4 – Streams with a TMDL and Impaired in the WQMP Planning Area

Stream Impairment & TMDL Summary					
Segment	Waterbody	Impairment cause		Aquatic Life Impaired	Listed in TMDL
		Atrazine	*E. coli*	Unknown Cause	
BB3-10000	West Fork Big Blue River, near Dorchester	X	X	X	X
BB3-10300	Beaver Creek - unnamed Creek to West Fork Big Blue River	X			X
BB3-20000	West Fork Big Blue River, near Cordova	X	X	X	X
BB4-20100	School Creek	X			
BB4-10000	Big Blue River at Milford	X	X		X
BB4-40000	Big Blue River - Headwaters to North Fork Big Blue River	X			X
BB4-20800	Lincoln Creek - Unnamed Creek to Big Blue River*	X*			X*
BB4-30000	Big Blue River - North Fork BBR to Lincoln Creek	X			
BB3-10200	Walnut Creek			X	
BB3-10400	Beaver Creek			X	
BB4-20900	Lincoln Creek			X	

**In the 2018 IR Lincoln Creek has been delisted for atrazine, but it is listed in the 2013 TMDL document*

Surface Water Quality Data:

Water quality data has been compiled for 36 monitoring locations from the NDEQ and EPA. These locations include 12 lake sites and 24 stream sites. Note that a single lake can contain multiple monitoring locations. The 12 lake monitoring sites are located in 8 separate lakes across the planning area. Figures 4 and 5 show a summary of the available water quality data for streams and lakes from all agencies for the parameters of interest. Figure 6 shows the locations of water quality monitoring stations relevant to the planning area. Figure 7 categorizes the water quality monitoring stations based on their period of record. JEO requested records from 1999-2018 in an effort to capture the most relevant and recent monitoring data. Surface water quality records are available for a longer period of record; however, historical water quality data is likely not relevant to current conditions. The longest period of record for water quality data that JEO compiled is 19 years, which was assumed to be sufficient to accurately portray existing conditions for the purposes of this project.

The NDEQ maintains a system of 97 ambient stream monitoring sites across the state. These sites are monitored monthly for common pollutants, with additional sampling for herbicides throughout the spring and summer. The WQMP planning area contains three ambient stream monitoring sites, shown below in Table 5. A fourth ambient site is located outside the planning area but is relevant due to its downstream position and proximity to the planning area.

Table 5 – NDEQ Ambient Stations In or Near the WQMP Planning Area

WBID	Monitoring Station ID	Name	Location
BB1-20000	SBB1BBLUE275	Big Blue River South of Crete, NE	Outside of Planning Area but still relevant
BB3-10000	SBB3WFBBR160	West Fork Big Blue River Northwest of Dorchester, NE	Inside Planning Area
BB4-40000	SBB4BBLUE411	Big Blue River at Surprise, NE	Inside Planning Area
BB4-20800	SBB4LNCLN107	Lincoln Creek West of Seward, NE	Inside Planning Area

It must also be noted that the NDEQ samples water quality parameters based on a periodic basin rotation, as shown in Figure 8. Basin rotations occur on a six-year schedule. The last basin rotation for the Big Blue watershed was in 2012. Due to the 2012 basin rotation, it can be seen in Figure 4 that there is data available for more stations in 2012 than other, non-basin rotation years. The same is true of 2006. 2018 is an active basin rotation year, but the data is currently incomplete. A representation of which monitoring locations are NDEQ ambient sites, NDEQ basin rotation sites, or EPA sites can be seen in Figure 9.

Stream samples are taken for *E. coli* only during the summer months of a basin rotation year. The NDEQ's basin rotation cycle was started on a five-year rotation in the early 2000s, then changed to a six-year rotation before a full sampling cycle could be completed. This created a gap in data specifically for stream *E. coli*, while other contaminants were sampled more regularly.

Figure 1 – USGS Stream Gage Locations In or Near the WQMP Planning Area

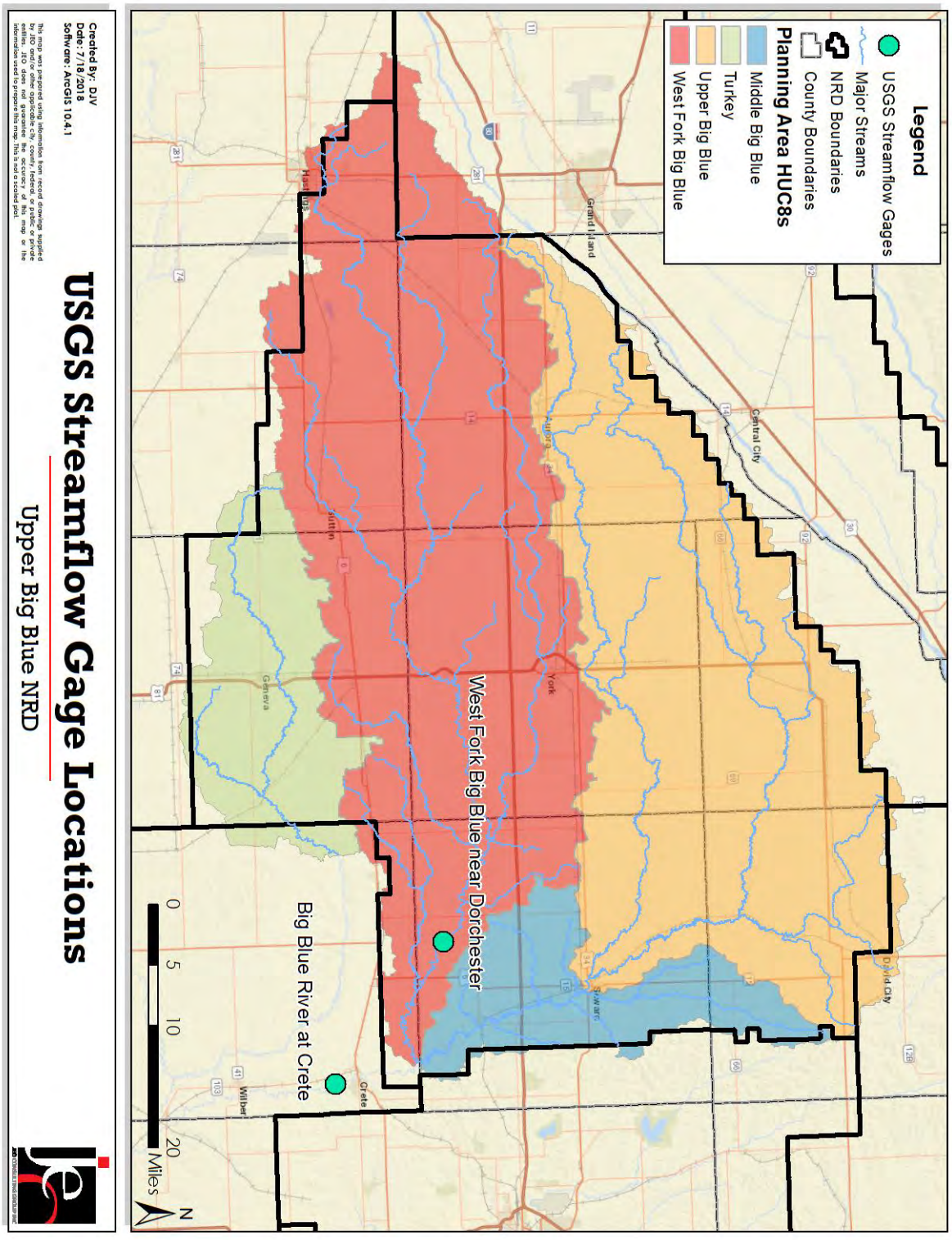


Figure 2 – 2018 IR Summarization of all Planning Area Streams

WBID	Name	Recreation	Aquatic Life	Agriculture	Aesthetic	Overall	IR Category	Impairment
BB4-20800	Lincoln Creek - Unnamed Creek (Sec 20-12N-1W) to Big Blue River		S	S	S	S	1	
BB4-30000	Big Blue River - North Fork Big Blue River to Lincoln Creek		S	S	S	S	1	
BB2-30000	Turkey Creek - Unnamed Creek (Sec 27-7N-2W) to Spring Creek		S	NA	S	S	2	
BB2-40000	Turkey Creek - Headwaters to Unnamed Creek (Sec 27-7N-2W)		S	NA	S	S	2	
BB3-30000	West Fork Big Blue River - Headwaters to School Creek		S	NA	S	S	2	
BB4-20500	Unnamed Creek (Sec 28-11N-3E)		S	NA	S	S	2	
BB4-20600	Plum Creek - Big Weedy Creek to Big Blue River		S	NA	S	S	2	
BB4-20700	Plum Creek - Headwaters to Big Weedy Creek		S	NA	S	S	2	
BB3-10100	Johnson Creek		NA	NA	NA	NA	3	
BB4-20100	Coon Creek		NA	NA	NA	NA	3	
BB4-20200	Wolf Creek		NA	NA	NA	NA	3	
BB4-20300	Crooked Creek		NA	NA	NA	NA	3	
BB4-20400	Clark Creek		NA	NA	NA	NA	3	
BB4-20610	Big Weedy Creek		NA	NA	NA	NA	3	
BB4-30100	North Fork Big Blue River - Sec 27-14N-2E to Big Blue River		NA	NA	NA	NA	3	
BB4-30200	North Fork Big Blue River - Headwaters to Sec 27-14N-2E		NA	NA	NA	NA	3	
BB3-10000	West Fork Big Blue River - Beaver Creek to Big Blue River	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life - Impaired Aquatic Community_Unknown, May-June Atrazine
BB3-10200	Walnut Creek		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB3-10400	Beaver Creek - Headwaters to Unnamed Creek (Sec. 12-10N-2W)		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB3-20000	West Fork Big Blue River - School Creek to Beaver Creek	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life - Impaired Aquatic Community_Unknown, May-June Atrazine
BB3-20100	School Creek		I	S	S	I	5	Aquatic Life_May-June Atrazine
BB4-20900	Lincoln Creek - Headwaters to Unnamed Creek (Sec 20-12N-1W)		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB4-40000	Big Blue River - Headwaters to North Fork Big Blue River		I	S	S	I	5	Aquatic Life_May-June Atrazine
BB3-10300	Beaver Creek - Unnamed Creek (Sec 12-10N-2W) to West Fork Big Blue River		I	NA	S	I	4a	Aquatic Life_May-June Atrazine
BB4-10000	Big Blue River - Blue Bluff Dam (Sec 19-9N-4E) to West Fork Big Blue River	I	I	S	S	I	4a	Recreation_E. coli, Aquatic Life_May-June Atrazine
BB4-20000	Big Blue River - Lincoln Creek to Blue Bluff Dam (Sec 19-9N-4E)	I	S	S	S	I	4a	Recreation_E. coli

Figure 3 – 2018 IR Summarization of all Planning Area Lakes

WBID	Area_acres	Waterbody_	Recreati_1	Aquatic__1	Agricult_1	Aestheti_1	Overall_As	Overall_IR	Impairment
BB4-L0020	1.97055	Seward City Park Pond_Independence Landing Pond	S	S	S	S	S	1	
BB4-L0045	2.99239	Aurora Leadership Center Lake	S	S	S	S	S	1	
BB3-L0010	19.8062	Smith Creek Lake	NA	S	S	S	S	2	
BB3-L0045	0.728648	Clarks Pond_Sutton	NA	NA	NA	S	S	2	
BB2-L0040	1.04966	Geneva City Lake	NA	NA	NA	NA	NA	3	
BB3-L0035	11.8421	Overland Trail Reservoir	NA	NA	NA	NA	NA	3	
BB4-L0030	5.01072	Surprise City Lake	NA	NA	NA	NA	NA	3	
BB4-L0040	6.17804	Pioneer Trails Lake	NA	NA	NA	NA	NA	3	
BB3-L0030	2.56728	Waco Basin	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life_Total Nitrogen, Total Phosphorus
BB3-L0050	75.7018	Lake Hastings	NA	I	S	I	I	5	Aquatic Life - Fish Consumption Advisory_Hazard Index Compounds*, Cancer Risk Compounds*, Chlorophyll a_Total Nitrogen, Total Phosphorus, Aesthetics_Sediment
BB3-L0060	45.6072	Hastings Northwest Dam Lake	S	I	S	S	I	5	Aquatic Life - Chlorophyll a, pH_Total Nitrogen, Total Phosphorus
BB3-L0070	2.85728	Heartwell Lake	NA	NA	NA	I	I	5	Aesthetics-Algae Blooms_Unknown
BB3-L0080	36.3032	Recharge Lake	NA	I	S	S	I	5	Aquatic Life - Fish Consumption Advisory_Mercury, Chlorophyll a_Total Nitrogen, Total Phosphorus
BB4-L0010	1.87503	David City Park Lake	S	I	S	S	I	5	Aquatic Life - Chlorophyll a_Total Nitrogen, Total Phosphorus
BB4-L0035	34.5042	Oxbow Trail Reservoir	S	I	S	S	I	5	Aquatic Life - Chlorophyll a, pH_Total Nitrogen, Total Phosphorus
BB3-L0040	4.95032	Henderson Pond	S	I	S	S	I	5	Aquatic Life - Chlorophyll a_Total Nitrogen, Total Phosphorus

Figure 4 – Water Quality Data period of Record for Streams.

**Basin rotation years outlined in red.*

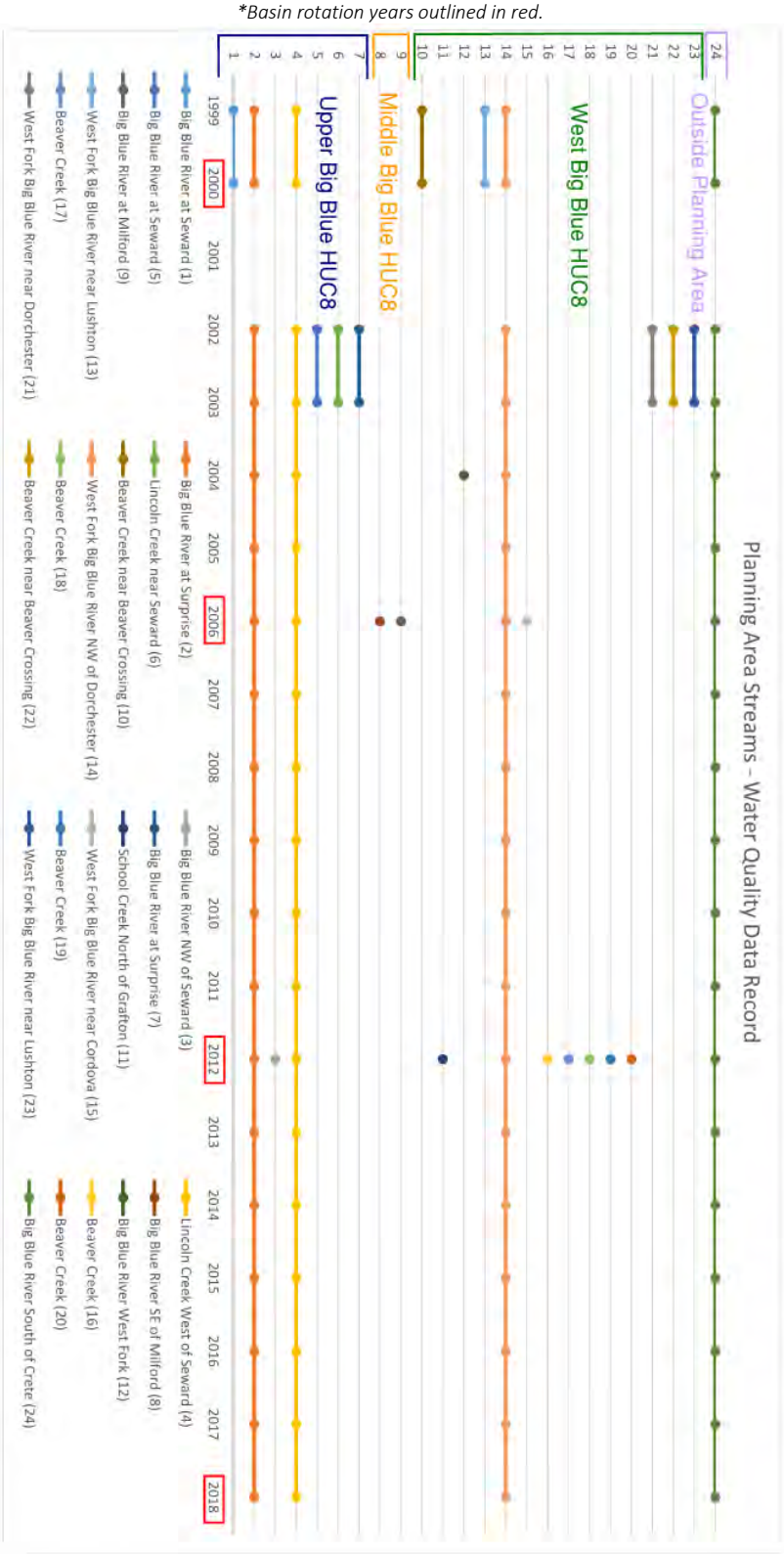


Figure 5 – Water Quality Data period of Record for Lakes.

**Basin rotation years outlined in red.*

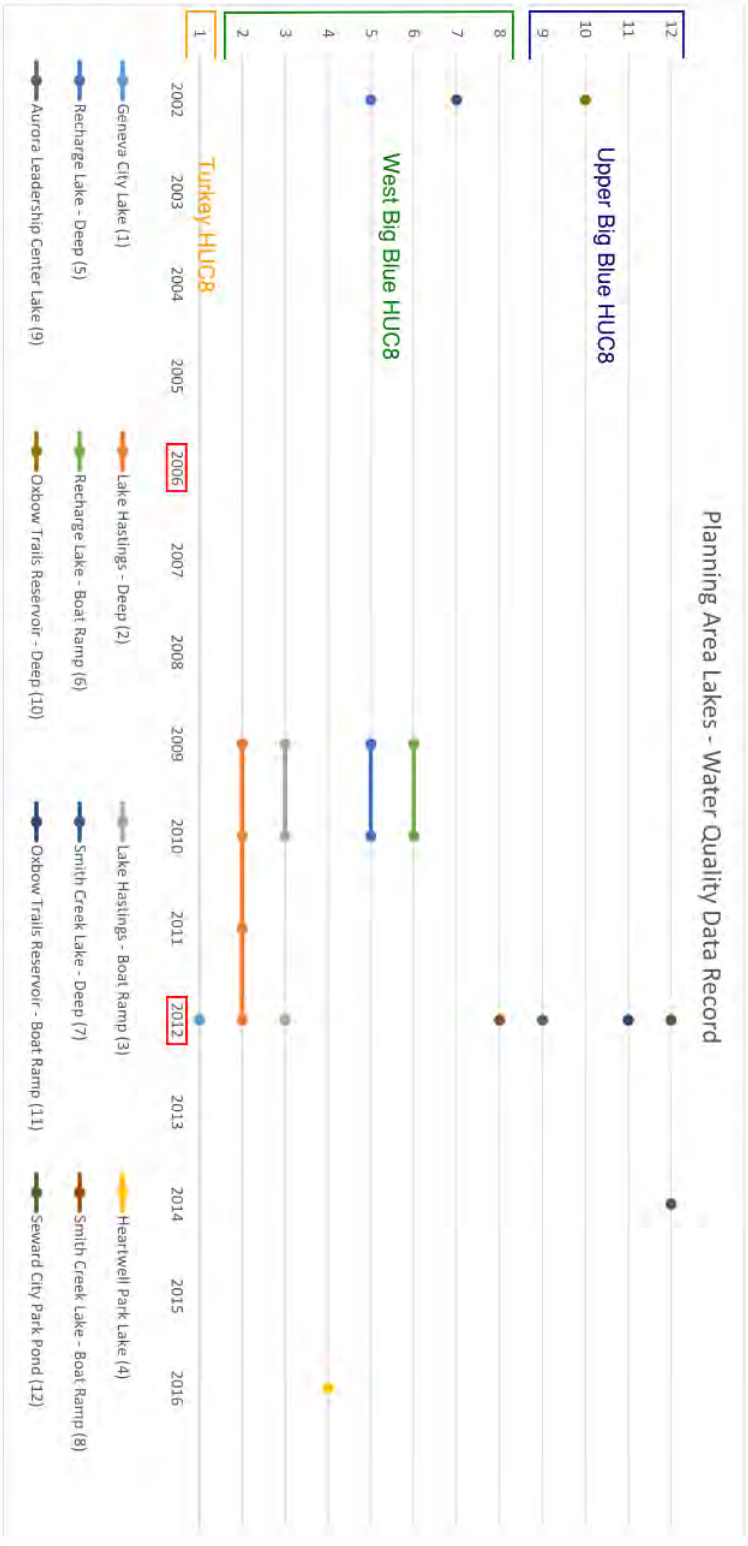


Figure 6 – Water Quality Monitoring Station Locations In or Near the WQMP Planning Area.
**Points may overlap due to proximity of stations.*

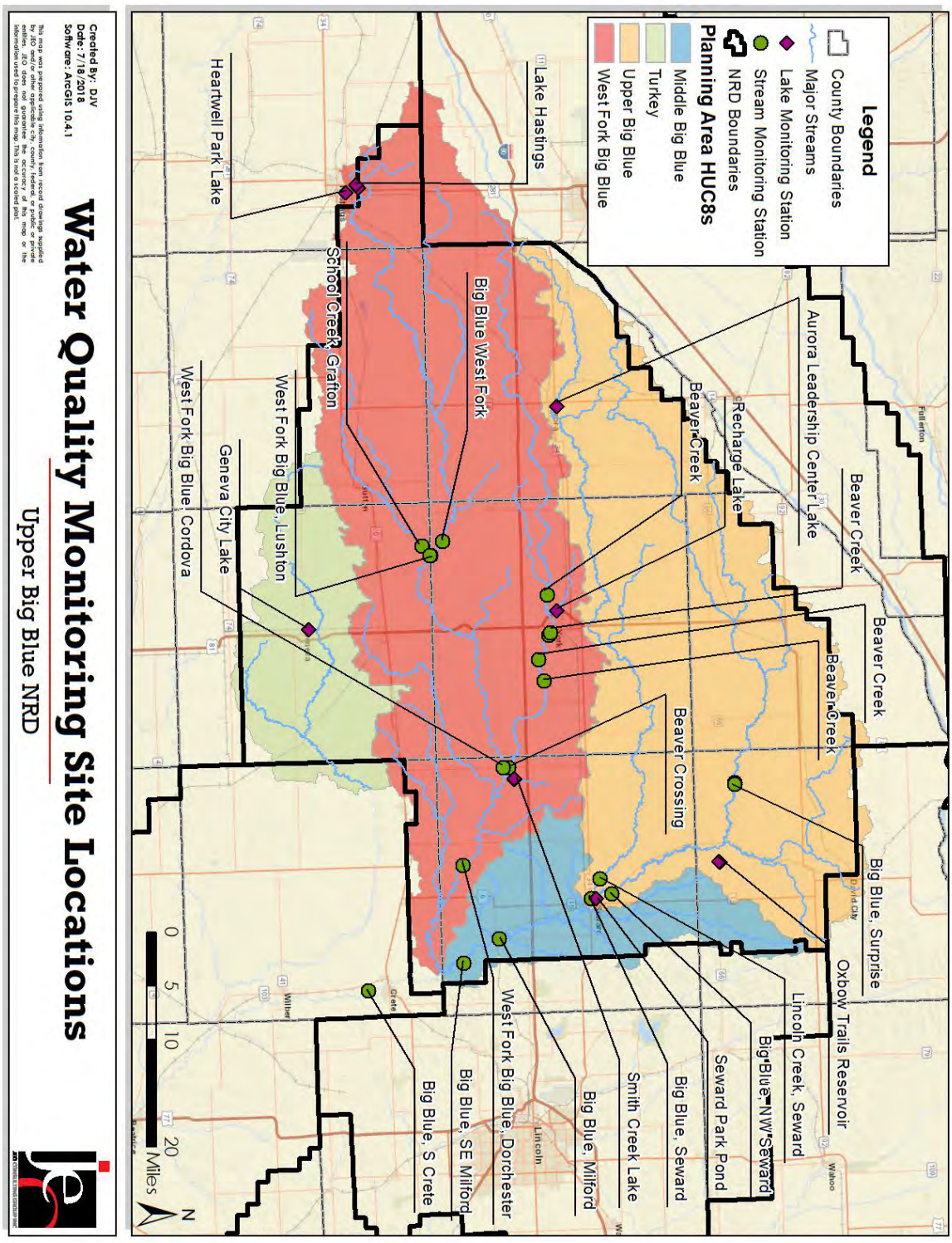


Figure 7 – Water Quality Monitoring Stations Categorized by Data Availability.
**Points may overlap due to proximity of stations.*

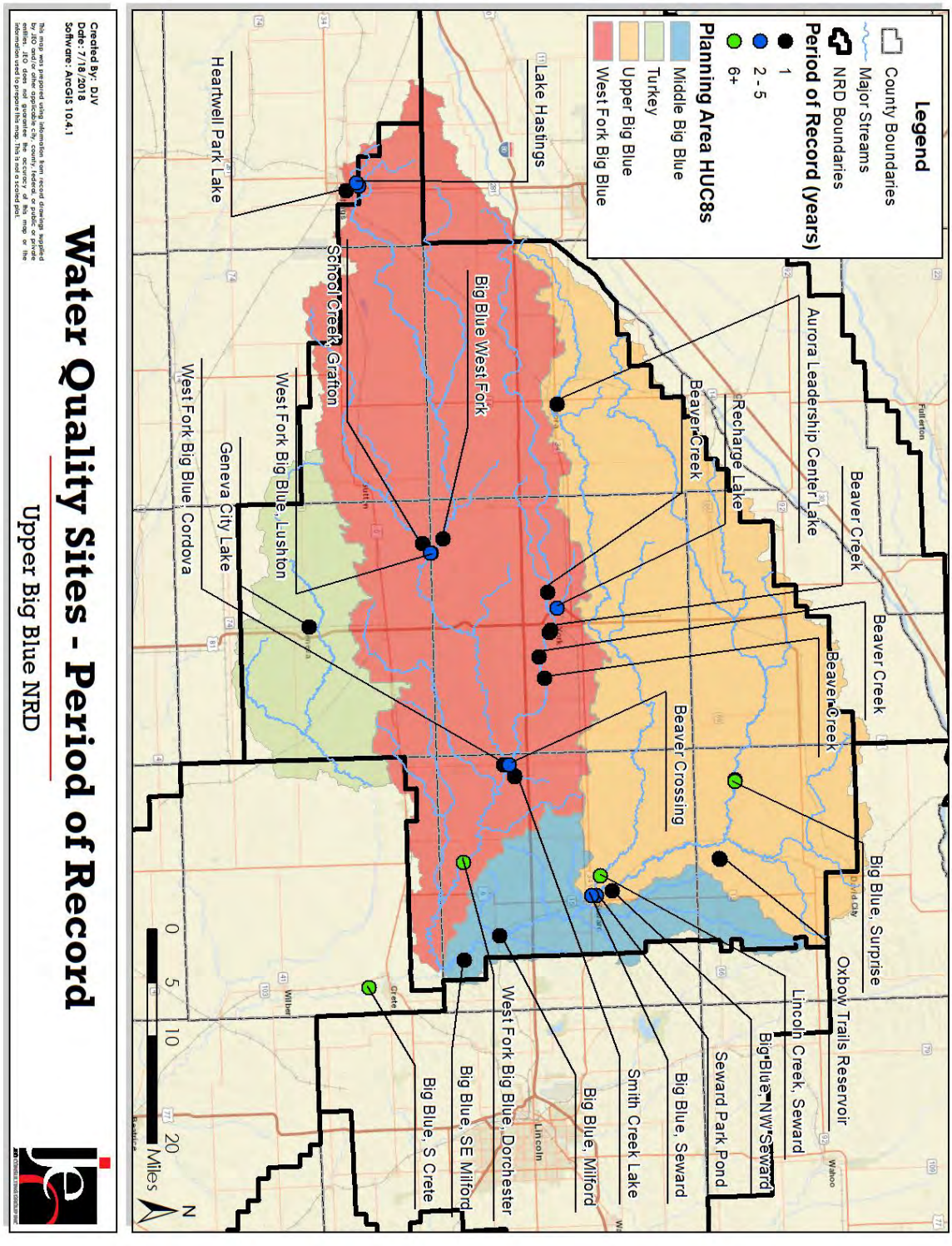


Figure 8 – NDEQ Six-year Basin Rotation Monitoring Schedule.

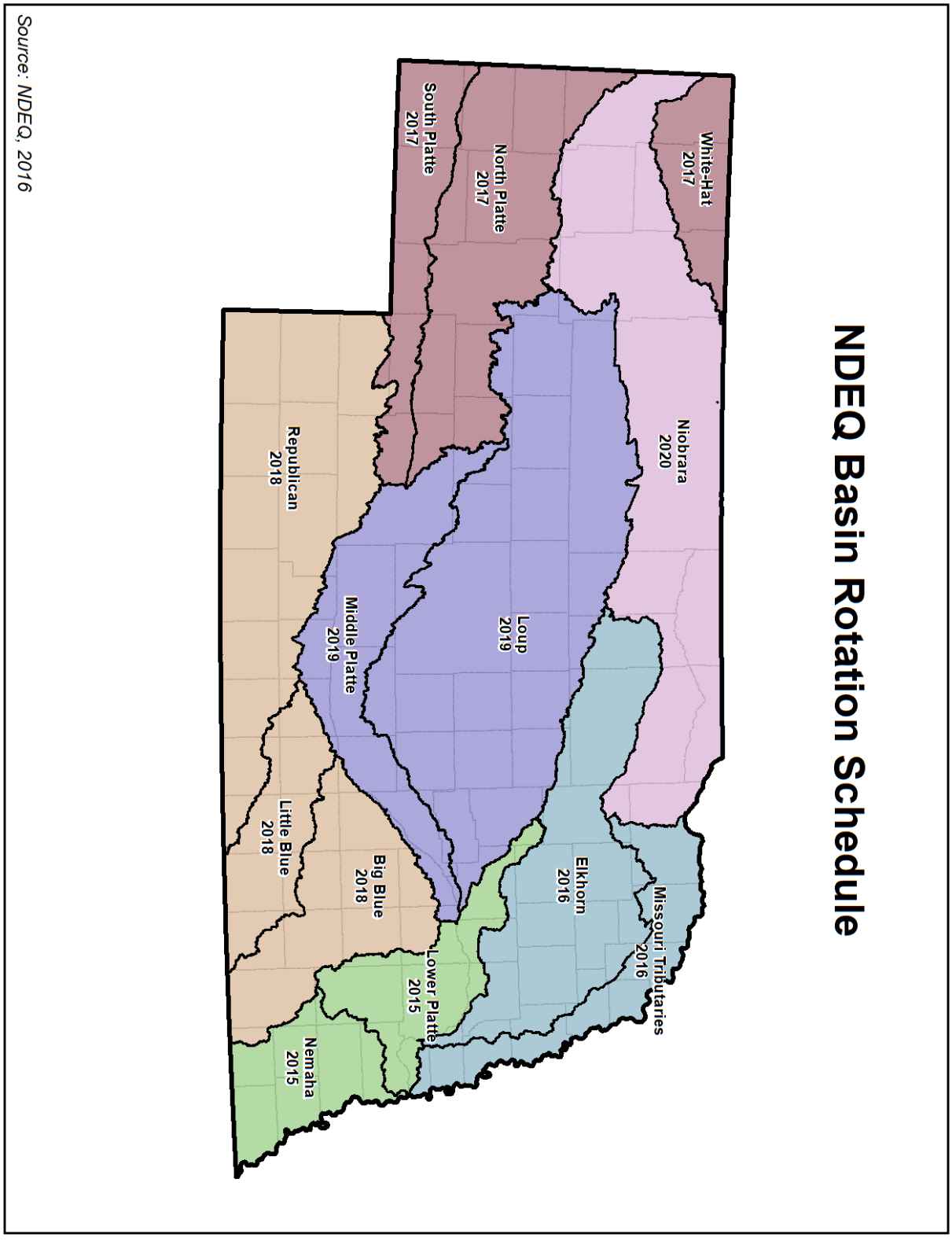
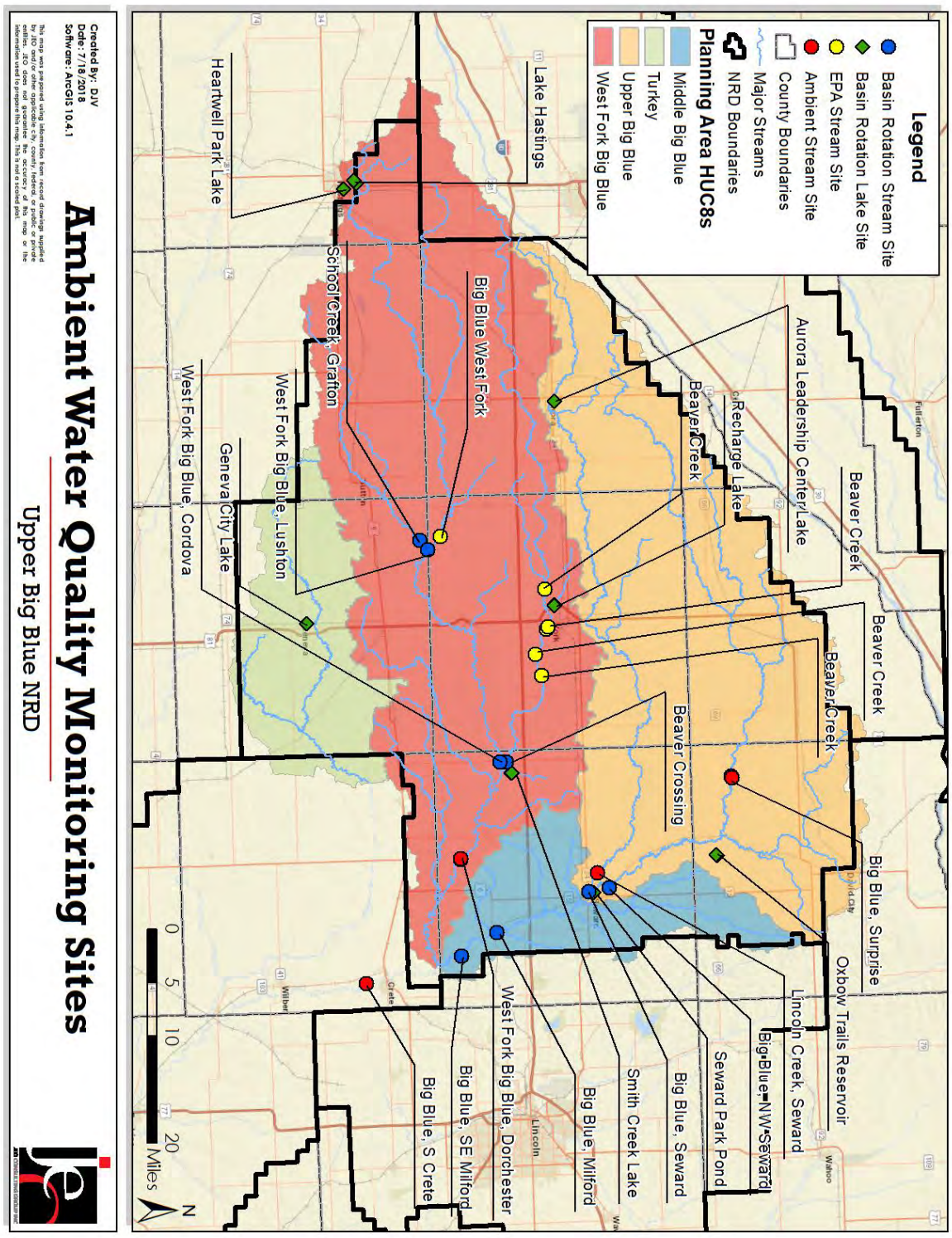


Figure 9 – Water Quality Monitoring Stations Categorized by Sampling Type and Organization.
**Points may overlap due to proximity of stations.*



Technical Memo - Runoff Yield Estimation

Prepared By: Dillon Vogt
JEO Project # 161356.00

Purpose:

The purpose of this memo is to outline methods and procedures used to estimate runoff yield from the Upper Big Blue NRD. These runoff yield estimates will be used by Wright Water Engineers to estimate pollutant loadings for individual HUC 12s as part of both the Upper Big Blue NRD Water Quality Management Plan (WQMP) and Voluntary Integrated Management Plan. Runoff yield estimations were largely based on the interaction of runoff coefficients determined from soil type, land use, and slope of the contributing watershed with estimated annual runoff values provided by United States Geological Survey (USGS) gaging stations with annual water summaries.

Gaging Stations:

Due to a lack of available stations within the Upper Big Blue NRD, a runoff yield model initially developed for the Lower Platte South NRD WQMP was modified and updated with new gage information to better portray the conditions of the Upper Big Blue NRD. Stations used as part of this analysis were limited to stream flow gages with five or more years of record whose long-term trends (specifically annual runoff depths) have been provided in annual water summaries published by the USGS. In total, 13 gages within the Lower Platte South NRD were used, along with two supplementary gages located in or near the Upper Big Blue NRD.

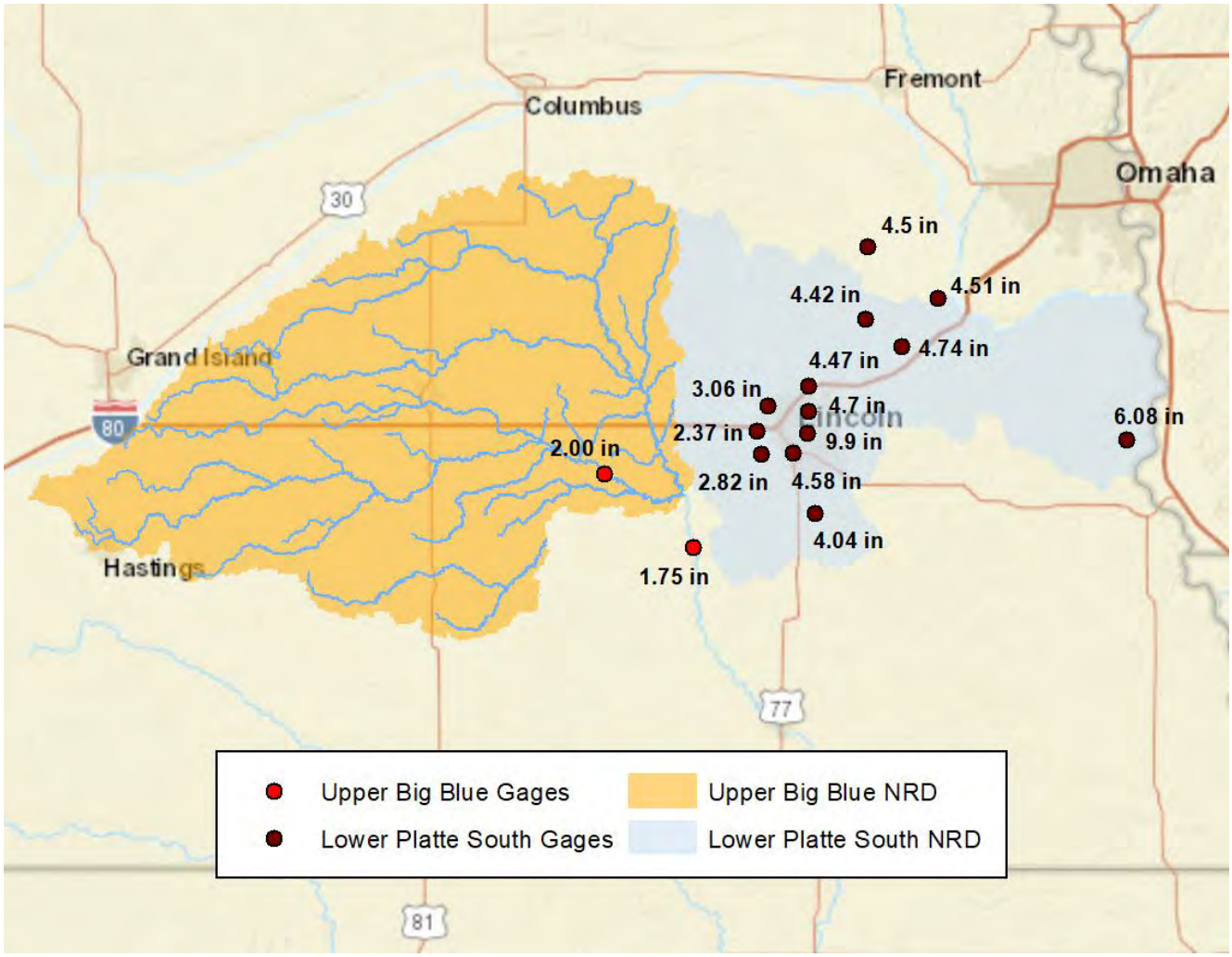
A list of gaging stations used as part of this analysis, as well as their annual estimated runoff depth are provided in Table 1.

Table 1: USGS Gages used for Analysis (Gages in study area denoted with an asterisk)

Gage ID	Gage Name	Drainage Area (Square Miles)	Period of Record[1]	Annual Runoff (Watershed Inches)
06803000	Salt Creek at Roca, NE	167.4	1952-2016	4.04
06803080	Salt Creek at Pioneers Blvd	220.6	2005-2016	4.58
06803300	Antelope Creek at 27th Street	11.0	2012-2016	9.90
06803510	Little Salt Creek Near Lincoln, NE	43.6	1969-2016	4.47
06803530	Rock Creek Near Ceresco	119.6	1971-2016	4.42
06803555	Salt Creek at Greenwood	1051.5	1952-2016	4.74
06804700	Wahoo Creek at Ashland, NE	417.3	1990-2016	4.51
06804000	Wahoo Creek at Ithaca, NE	240.7	1950-2016	4.50
06806500	Weeping Water Creek at Union, NE	271.4	1951-2016	6.08
06803093	Haines Branch at SW 56th Street	57.1	1995-2016	2.82
06803170	Middle Creek at SW 63rd	90.1	1995-2016	2.37
06803486	Oak Creek at Air Park Road	241.4	2005-2016	3.06
06803500	Salt Creek at Lincoln NE	683.8	2005-2016	4.70
06880800	West Fork Big Blue at Dorchester*	1192.0	2005-2017	2.00
06881000	Big Blue River at Crete*	2710.0	2005-2017	1.96

1 – Period of Record refers to the years analyzed as part of the average annual runoff estimation by USGS.

Figure 1 – USGS gaging location within study area. (Labeled with average annual runoff depth)



Runoff Coefficient Estimation:

Runoff coefficients used as part of this analysis were determined as outlined in the WetSpa User Manual, and were based on surface soil texture, land use, and land slope. A summary of these runoff coefficients is provided in Table 2.

Table 2 – Runoff Coefficients for different land use, soil type, and slopes.

Land use	Slope (%)	Sand	Loamy sand	Sandy loam	Loam	Silt loam	Silt	Sandy clay loam	Clay loam	Silty clay loam	Sandy clay	Silty clay	Clay
Forest	<0,5	0.03	0.07	0.10	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40
	0,5-5	0.07	0.11	0.14	0.17	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44
	5-10	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50
	>10	0.25	0.29	0.32	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.59	0.62
Grass	<0,5	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50
	0,5-5	0.17	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44	0.47	0.51	0.54
	5-10	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60
	>10	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.59	0.62	0.65	0.69	0.72
Crop	<0,5	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60
	0,5-5	0.27	0.31	0.34	0.37	0.41	0.44	0.47	0.51	0.54	0.57	0.61	0.64
	5-10	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70
	>10	0.45	0.49	0.52	0.55	0.59	0.62	0.65	0.69	0.72	0.75	0.79	0.82
Bare soil	<0,5	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70
	0,5-5	0.37	0.41	0.44	0.47	0.51	0.54	0.57	0.61	0.64	0.67	0.71	0.74
	5-10	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80
	>10	0.55	0.59	0.62	0.65	0.69	0.72	0.75	0.79	0.82	0.85	0.89	0.92
IMP		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The 2017 Cropland Data Layer (CDL) was used to define land use as part of this analysis due to relatively good spatial resolution and detailed land use categories that can easily be reclassified to fit the four types of land use considered under this methodology. It was assumed that all crop types have similar runoff coefficients. Grass was assumed to include pasture and alfalfa type land uses, and runoff coefficients for urban areas were assumed to be a mixture of grass and the average imperviousness listed in the CDL legend. Because open water areas do not have any water-soil interaction and therefore do not allow infiltration, these areas were assumed to have a runoff coefficient of 1.0. Soil texture was obtained through the USDA Web Soil Survey, and slope was calculated directly through the use of 30-meter digital elevation models (DEMs).

These data coverages were combined using the Union tool in ArcGIS resulting individual polygon elements that had exactly one soil texture, land use, and slope class. Individual elements were then assigned a runoff coefficient based on the above table and a runoff coefficient raster was created. Land Use, Soil Texture, and Slope Class and the resulting runoff coefficient estimates can be seen in Figures 2 through 4 below. The resulting raster coverage across the planning are can be seen in Figures 2 through 5 on the following pages.

Figure 2 – Land Use in the Study Area (Source: CDL 2017)

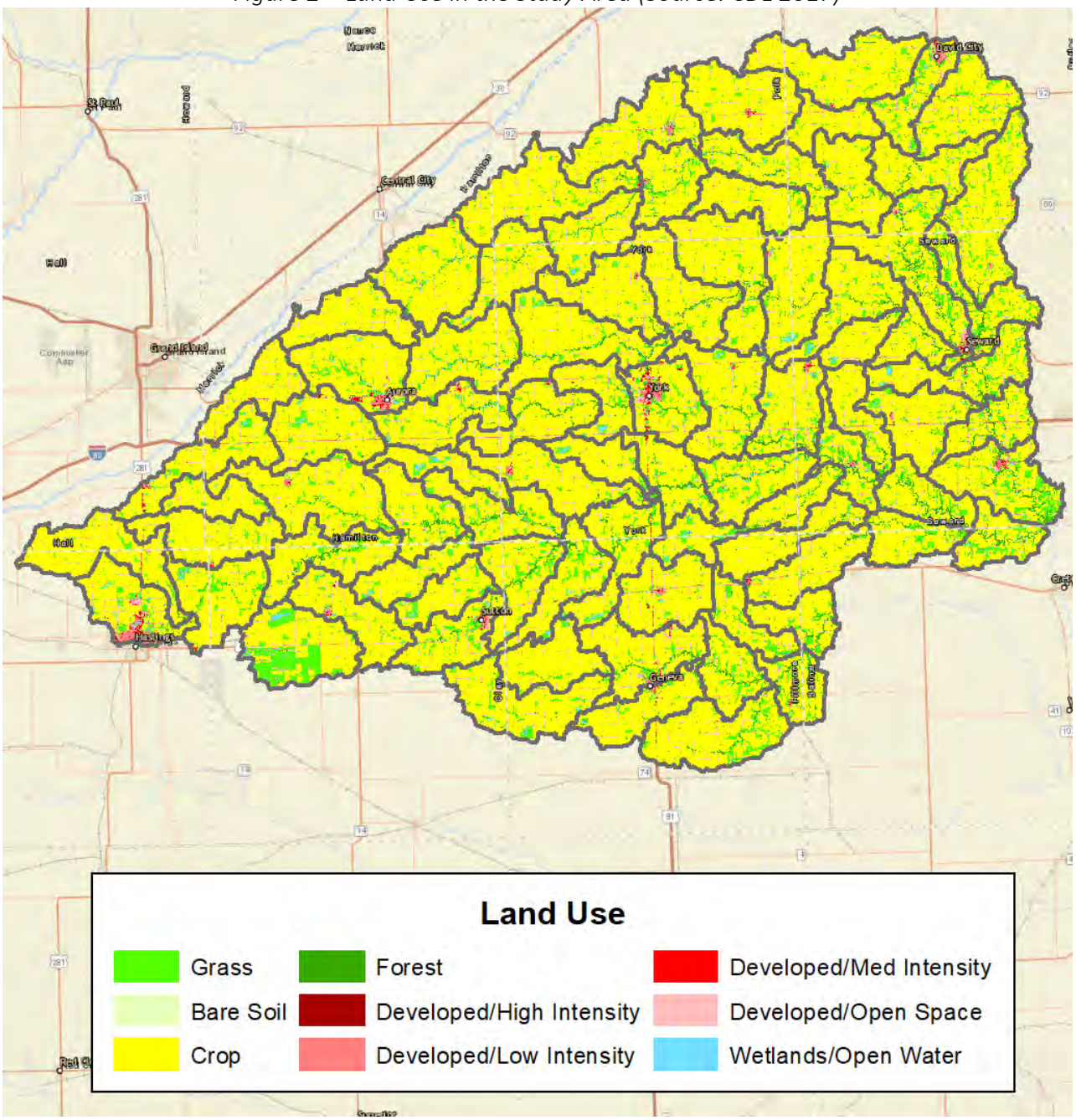


Figure 3 – Slope Classes in the Study Area (Source: Derived from 30m Digital Elevation Model)

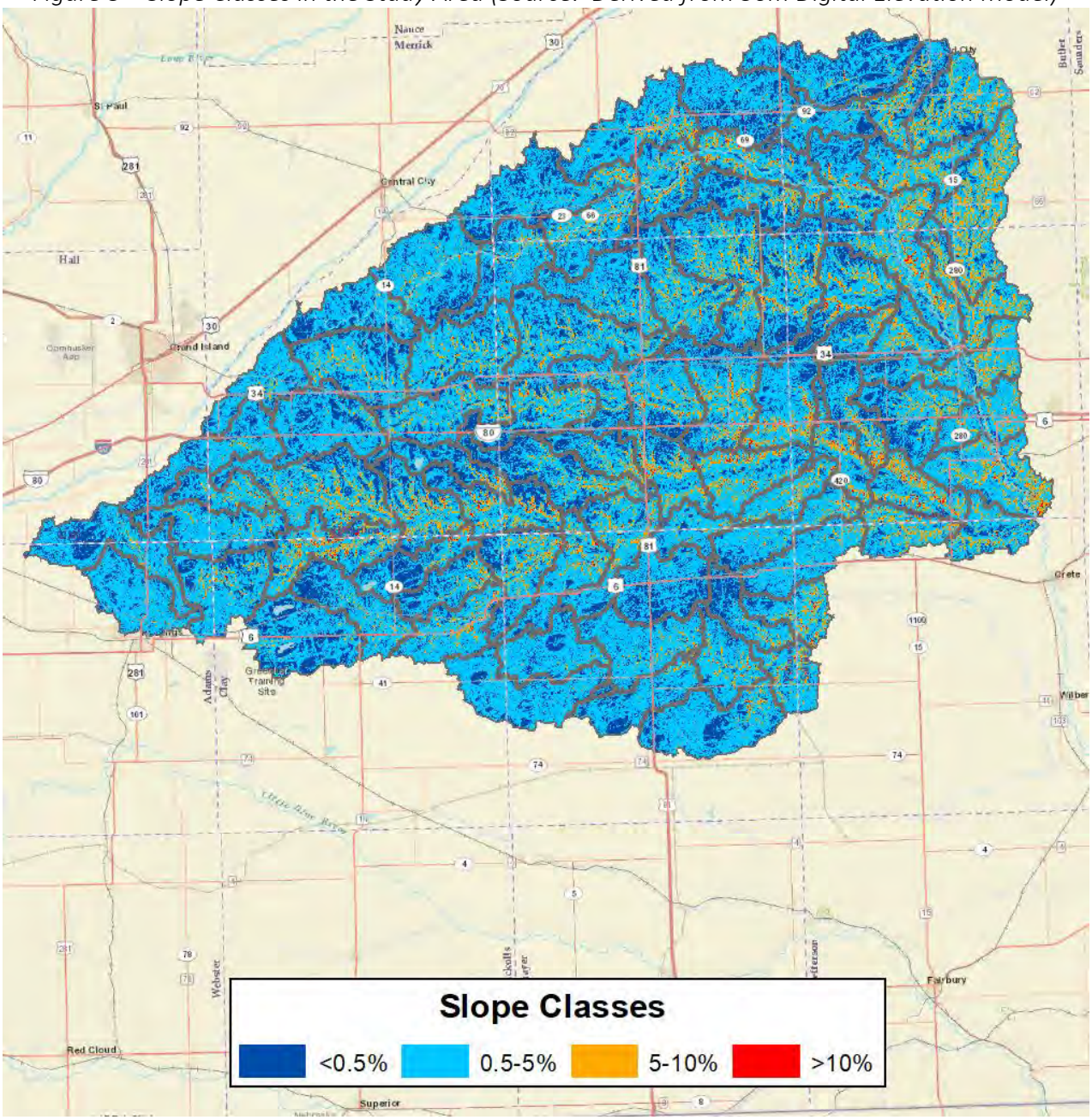


Figure 4 – Soil Surface Texture in the Study Area (Source: Web Soil Survey)

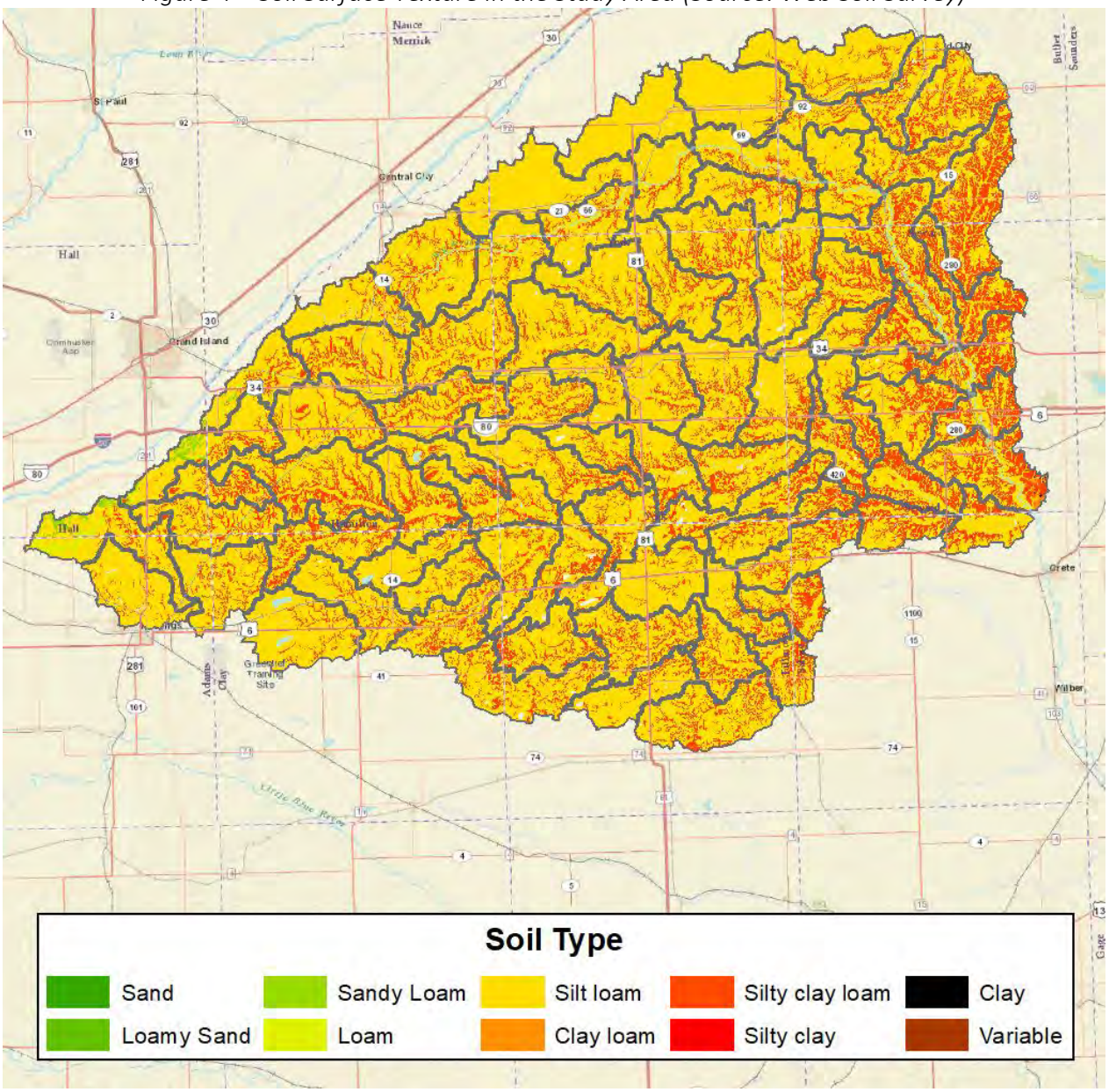
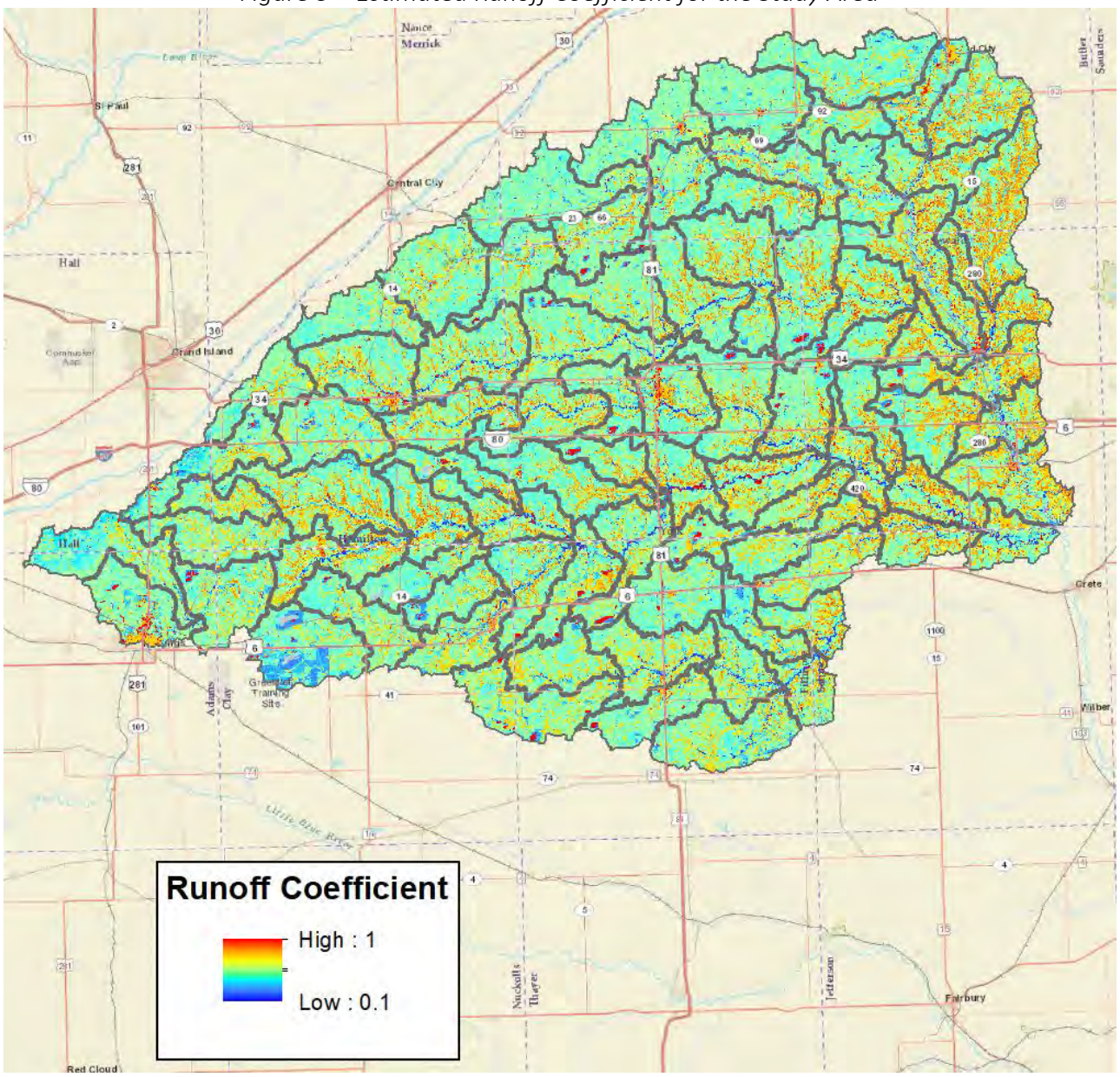


Figure 5 – Estimated Runoff Coefficient for the Study Area



Regression Analysis:

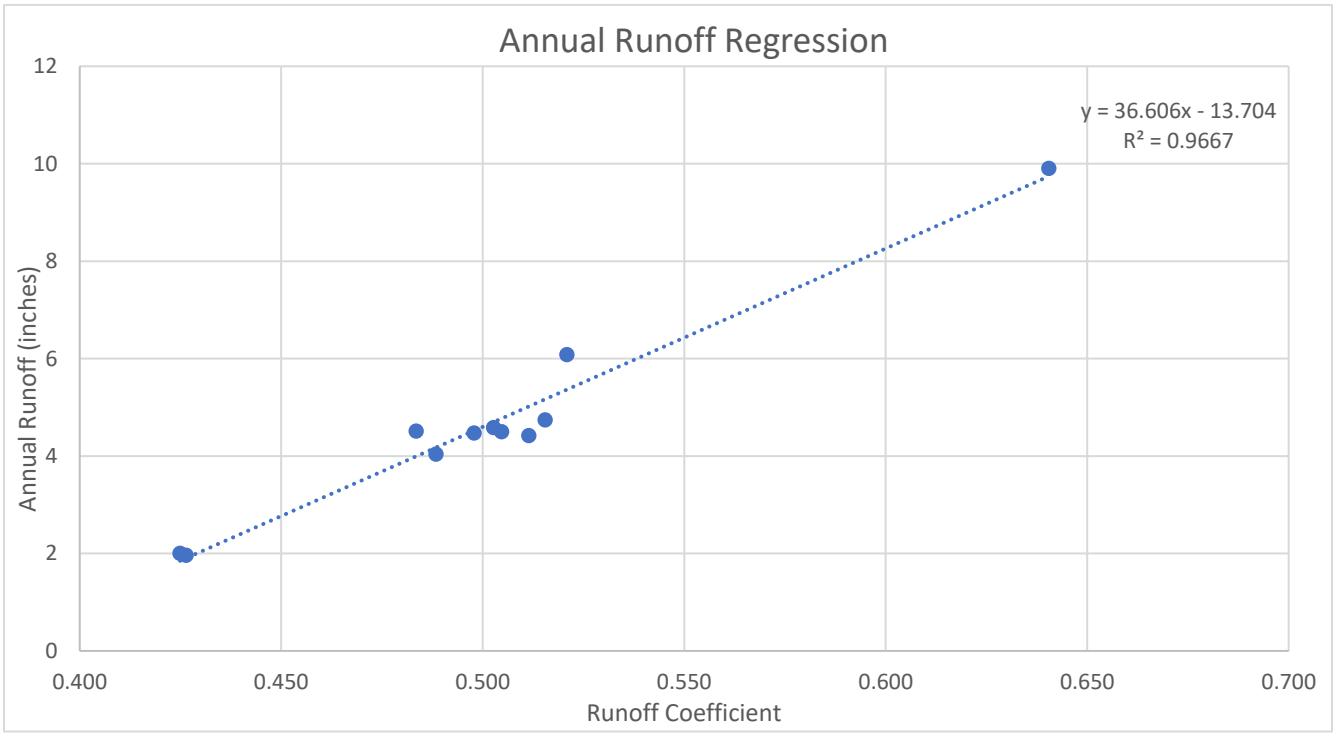
Watersheds contributing to the USGS gaging stations were delineated using ArcHydro tools, and average runoff coefficients were determined for these watersheds through GIS based analysis. These runoff coefficients were then plotted against annual average runoff estimates (from USGS) to determine if these runoff coefficients could be used as a predictor of annual runoff. Any USGS gages influenced by larg dams were omitted from this analysis as it was anticipated that significant amounts of runoff would be attenuated by these structures and therefore appear as downstream baseflow. Since the USGS removes baseflow when estimating runoff these attenuated flows would not be reflected in the average annual rainfall depth. These sites that were removed are :

- 06803093 - Haines Branch at SW56th Street (Influenced by Conestoga)
- 06803170 - Middle Creek at SW 63rd (Influenced by Pawnee)
- 06803486 - Oak Creek at Air Park Road (Influenced by Branched Oak)
- 06803500 - Salt Creek at Lincoln Nebraska (Influenced by all Three)

Note that all these gage sites were in the original Lower Platte South NRD model.

A plot of annual runoff depth and runoff coefficient from the remaining stations is provided in Figure 6 below:

Figure 6 - Runoff Regression Results



A linear regression was fit to the data and based on an R-squared value of 0.9667 it was determined that the runoff coefficient was a reasonably accurate predictor of annual runoff depth. Thus, annual runoff depths for individual HUC 12s were initially estimated based on the following equation:

$$\text{Annual Runoff} = 36.606 \times (\text{Runoff Coefficient}) - 13.704$$

Comparison of Estimates to Gage Data:

Average runoff coefficients for each HUC 12 within Upper Big Blue NRD were determined using the created runoff coefficient raster and GIS based analysis. Runoff depths for individual HUC12s were then calculated based on the regression equation presented in the previous section. To check for accuracy the predicted runoff for individual HUC12's contributing to the same gage were added together and then checked against the USGS prediction.

$$\text{Estimation at Gage} = \frac{\sum(Area)*(Runoff\ Depth)}{Total\ Contributing\ Area}$$

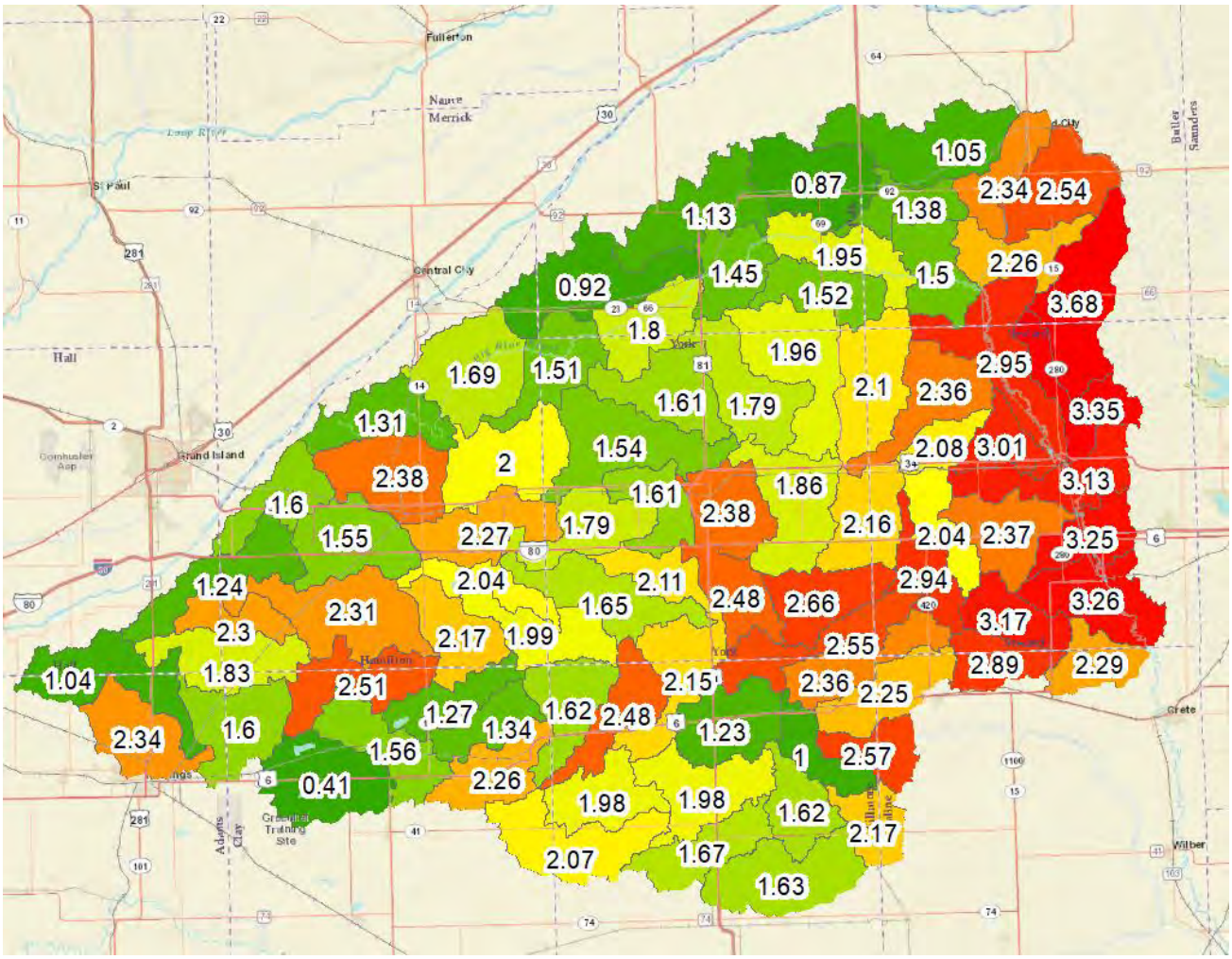
This analysis was done at every gage within the study area. Note that for the initial Lower Platte South NRD model, runoff from the area of upstream significant dams (Branched Oak, Pawnee, and Conestoga) was assumed to largely be trapped in the lake so was omitted in the analysis, however the drainage area was considered when calculating runoff depth to be consistent with USGS methodology. The table below outlines this comparison. In general, predictions for individual gages had errors ranging from approximately 2 to 12%. In areas where the estimated runoff depth differed from the USGS gage depth by more than 10%, a correction factor was applied to the contributing HUC 12s to better match the USGS gage results. A comparison of estimated runoff with USGS gage runoff is provided in Table 3, applicable correction factors are listed in the explanation of results column if applied.

Table 3 - Estimated Runoff Comparisons with Gage Data

Gage Name	Sum of Contributing Runoff Depth x Area (Sq. Mi – Inches)	Contributing Drainage Area (Sq. Mi)	Estimated Runoff Depth (in)	USGS Runoff Depth (in)	Percent Error (%)	Explanation of Results
Salt Creek @ Roca	688.0	166.8	4.12	4.04	2.08	
Salt Creek @ Pioneers	1166.5	242.7	4.81	4.58	4.95	
Salt Creek @ Lincoln	3299.2	683.4	4.83	4.70	2.71	
Little Salt Creek Near Lincoln	208.5	45.8	4.55	4.47	1.79	
Rock Creek Near Ceresco	677.2	137.2	4.93	4.42	11.64	No Dam Influence. Based on Results contributing area runoff altered by a factor of 0.90
Salt Creek at Greenwood	5079.3	1034.7	4.91	4.74	3.57	
Weeping Water Creek at Union	1329.9	250.7	5.30	6.08	12.76	No Dam Influence. Based on Results contributing area runoff altered by a factor of 1.15
Oak Creek at Air Park Road	830.6	257.9	3.22	3.06	5.23	Runoff From Areas upstream of Branched Oak Ignored
Middle Creek at SW 63rd	192.6	79.8	2.41	2.37	1.90	Runoff From Areas upstream of Pawnee Ignored when estimating Runoff Volume.
Antelope Creek at 27th	154.8	14.6	10.63	9.9	7.42	Heavily Urbanized (Downtown areas) not included at the gage. Overprediction expected
Haines Branch at SW 56th	203.0	68.0	2.98	2.82	5.84	Runoff from Areas Upstream of Conestoga not included in runoff.
West Fork Big Blue at Dorchester	2507.8	1289.7	1.94	2.00	2.8	No Dam Influence. Based on Results contributing area runoff altered by a factor of 1.08
Big Blue River at Crete	5364.5	2682.4	2.00	1.96	2.0	No Dam Influence. Based on Results contributing area runoff altered by a factor of 1.03

Based on these results, and the acceptable error of the predictions this regression method was determined to be accurate enough for planning purposes. Note that the prediction error for the two stream gages in the Upper Big Blue NRD study area is less than three percent. Initial predictions gave a percent error of 7.4% for West Fork Big Blue at Dorchester, and 2.8% for Big Blue River at Crete before the correction factors were applied. Figure 7 depicts the final estimated runoff depths (in watershed inches) for the study area. These estimates include any correction factors applied as part of this analysis.

Figure 7 – Estimated Annual Runoff Depths for Individual HUC 12s in Watershed Inches



Overview of Results

Watershed runoff varies across the watershed. Most of the lowest runoff estimates were noted along the northern edge of the study area nearest to the Platte River. Land use in this area consists mostly of row crops, primarily corn and soybeans, with soils in the loam to clay loam range. Moving southeast across the study area, land use includes more grass/pasture, slopes become steeper, and the soil type ranges from silt loam to silty clay. These combined factors increase the runoff coefficient and thus result in higher predicted runoff values. Displaying runoff units in terms of watershed inches allows for a better comparison of relative contributions from specific HUC12s throughout the watershed. Table 4 outlines some summary statistics for the study area.

Table 4 - HUC 12 Runoff Estimation Summary

Average Runoff (in):	2.01
Max Runoff (in):	3.68
Min Runoff (in):	0.41
Highest Contributors:	Headwaters Plum Creek
	Outlet Plum Creek
	Coon Creek-Big Blue River
Lowest Contributors:	Headwater School Creek
	City of Shelby
	Prairie Creek

Individual HUC 12 Breakdowns by Land Use

For pollutant modeling purposes the total runoff for individual HUC12s were partitioned into runoff volumes from specific land uses. This was done through a weighted average approach using both the total area of a specific land use multiplied by its associated runoff coefficient.

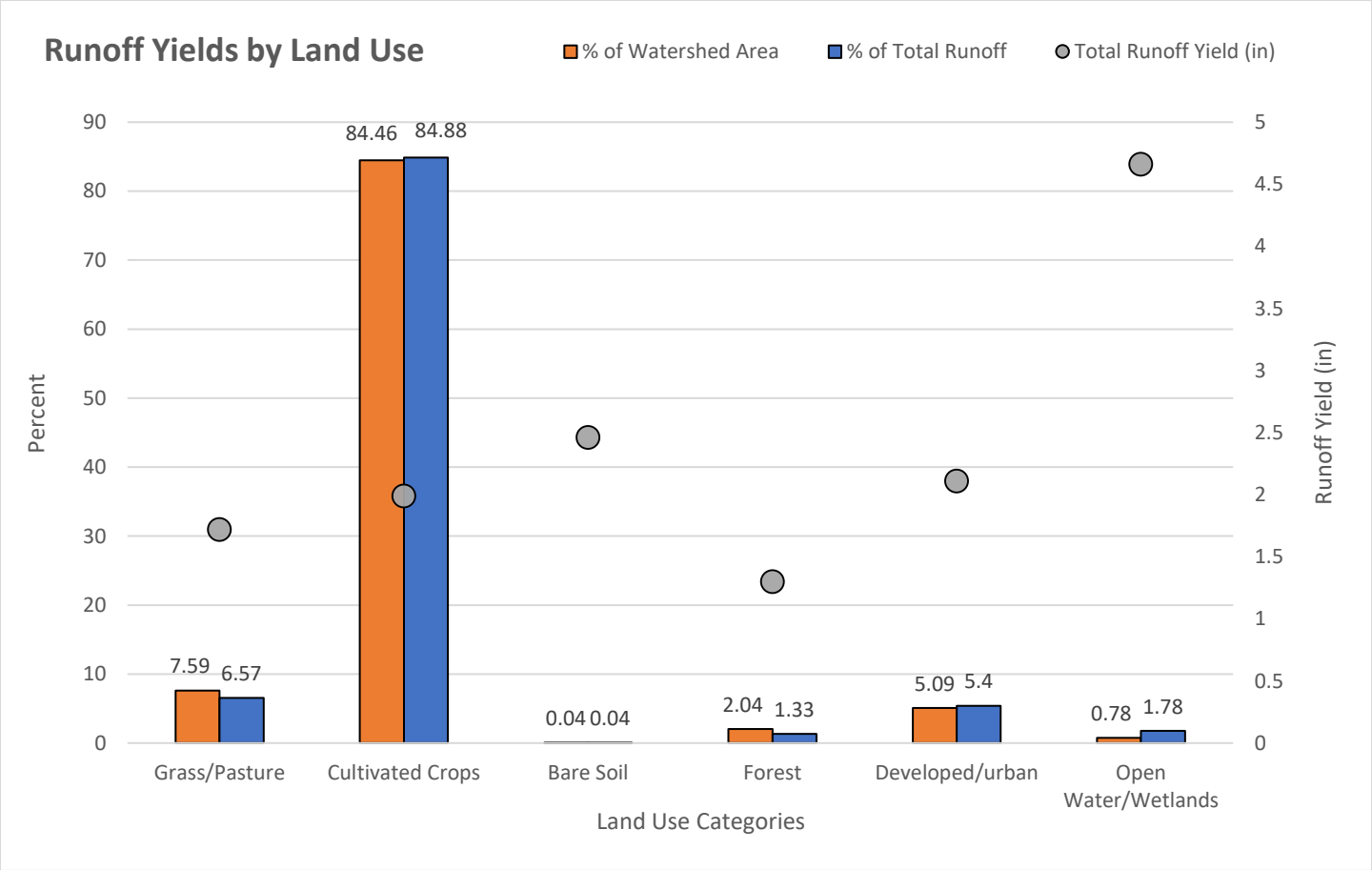
$$\%\ Runoff = \frac{Individual\ Land\ Use\ Area \times Runoff\ Coefficent}{\sum(Land\ Use\ x\ Runoff)} \times 100$$

A summary of individual land use contributions for each HUC 12 are available in the Yield Analysis spreadsheet developed from Excel. An overall breakdown for the entire study area is provided in Table 5. A graphical representation of these values is presented in Figure 8. It is shown that certain types of land use have a disproportionately high runoff yield despite their relatively small overall areas and runoff percentages.

Table 5- Breakdown of Runoff by Land Use for the Entire Study Area

Land Use	Percent of Area	Percent of Runoff	Total Runoff (Acre-ft)	Total Runoff Yield (in)
Grass/Pasture	7.59	6.57	20747	1.72
Cultivated Crops	84.46	84.88	268028	1.99
Bare Soil	0.04	0.04	129	2.46
Forest	2.04	1.33	4207	1.30
Developed/Urban	5.09	5.40	17034	2.11
Open Water/Wetlands	0.78	1.78	5618	4.66
Total	100%	100%	315763	n/a

Figure 8 – Land Use and Runoff Contribution Percentages



Stream Summary

WBID	Name	Recreation	Aquatic Life	Agriculture	Aesthetic	Overall	IR Category	Impairment
BB4-20800	Lincoln Creek - Unnamed Creek (Sec 20-12N-1W) to Big Blue River		S	S	S	S	1	
BB4-30000	Big Blue River - North Fork Big Blue River to Lincoln Creek		S	S	S	S	1	
BB2-30000	Turkey Creek - Unnamed Creek (Sec 27-7N-2W) to Spring Creek		S	NA	S	S	2	
BB2-40000	Turkey Creek - Headwaters to Unnamed Creek (Sec 27-7N-2W)		S	NA	S	S	2	
BB3-30000	West Fork Big Blue River - Headwaters to School Creek		S	NA	S	S	2	
BB4-20500	Unnamed Creek (Sec 28-11N-3E)		S	NA	S	S	2	
BB4-20600	Plum Creek - Big Weedy Creek to Big Blue River		S	NA	S	S	2	
BB4-20700	Plum Creek - Headwaters to Big Weedy Creek		S	NA	S	S	2	
BB3-10100	Johnson Creek		NA	NA	NA	NA	3	
BB4-20100	Coon Creek		NA	NA	NA	NA	3	
BB4-20200	Wolf Creek		NA	NA	NA	NA	3	
BB4-20300	Crooked Creek		NA	NA	NA	NA	3	
BB4-20400	Clark Creek		NA	NA	NA	NA	3	

BB4-20610	Big Weedy Creek		NA	NA	NA	NA	3	
BB4-30100	North Fork Big Blue River - Sec 27-14N-2E to Big Blue River		NA	NA	NA	NA	3	
BB4-30200	North Fork Big Blue River - Headwaters to Sec 27-14N-2E		NA	NA	NA	NA	3	
BB3-10000	West Fork Big Blue River - Beaver Creek to Big Blue River	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life - Impaired Aquatic Community_Unknown, May-June Atrazine
BB3-10200	Walnut Creek		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB3-10400	Beaver Creek - Headwaters to Unnamed Creek (Sec. 12-10N-2W)		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB3-20000	West Fork Big Blue River - School Creek to Beaver Creek	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life - Impaired Aquatic Community_Unknown, May-June Atrazine
BB3-20100	School Creek		I	S	S	I	5	Aquatic Life_May-June Atrazine
BB4-20900	Lincoln Creek - Headwaters to Unnamed Creek (Sec 20-12N-1W)		I	NA	NA	I	5	Aquatic Life - Impaired Aquatic Community_Unknown
BB4-40000	Big Blue River - Headwaters to North Fork Big Blue River		I	S	S	I	5	Aquatic Life_May-June Atrazine
BB3-10300	Beaver Creek - Unnamed Creek (Sec 12-10N-2W) to West Fork Big Blue River		I	NA	S	I	4a	Aquatic Life_May-June Atrazine
BB4-10000	Big Blue River - Blue Bluff Dam (Sec 19-9N-4E) to West Fork Big Blue River	I	I	S	S	I	4a	Recreation_E. coli, Aquatic Life_May-June Atrazine
BB4-20000	Big Blue River - Lincoln Creek to Blue Bluff Dam (Sec 19-9N-4E)	I	S	S	S	I	4a	Recreation_E. coli

Stream Summary w/ TMDL Info

Stream Impairment & TMDL Summary						
		Impairment cause				
Segment	**Waterbody**	**Atrazine**	**E. coli**	**Aquatic Life (Unknown)**	**Listed in TMDL**	**Notes**
BB3-10000	West Fork Big Blue River, near Dorchester	X	X	X	X	
BB3-10300	Beaver Creek - unnamed Creek to West Fork Big Blue River	X			X	
BB3-20000	West Fork Big Blue River, near Cordova	X	X	X	X	
BB4-20100	School Creek	X				
BB4-10000	Big Blue River at Milford	X	X		X	
BB4-40000	Big Blue River - Headwaters to North Fork Big Blue River	X			X	
BB4-20800	Lincoln Creek - Unnamed Creek to Big Blue River	X			X	2018 IR delisted for atrazine, but is listed in TMDL
BB4-30000	Big Blue River - North Fork BBR to Lincoln Creek	X				
BB3-10200	Walnut Creek			X		
BB3-10400	Beaver Creek			X		
BB4-20900	Lincoln Creek			X		

Lake Summary

WBID	Area_acres	Waterbody_	Recreati_1	Aquatic__1	Agricult_1	Aestheti_1	Overall_As	Overall_IR	Impairment
BB4-L0020	1.97055	Seward City Park Pond_Independence Landing Pond	S	S	S	S	S	1	
BB4-L0045	2.99239	Aurora Leadership Center Lake	S	S	S	S	S	1	
BB3-L0010	19.8062	Smith Creek Lake	NA	S	S	S	S	2	
BB3-L0045	0.728648	Clarks Pond_Sutton	NA	NA	NA	S	S	2	
BB2-L0040	1.04966	Geneva City Lake	NA	NA	NA	NA	NA	3	
BB3-L0035	11.8421	Overland Trail Reservoir	NA	NA	NA	NA	NA	3	
BB4-L0030	5.01072	Surprise City Lake	NA	NA	NA	NA	NA	3	
BB4-L0040	6.17804	Pioneer Trails Lake	NA	NA	NA	NA	NA	3	
BB3-L0030	2.56728	Waco Basin	I	I	S	S	I	5	Recreation_E. coli, Aquatic Life_Total Nitrogen, Total Phosphorus
BB3-L0050	75.7018	Lake Hastings	NA	I	S	I	I	5	Aquatic Life - Fish Consumption Advisory_Hazard Index Compounds*, Cancer Risk Compounds*, Chlorophyll a_Total Nitrogen, Total Phosphorus, Aesthetics_Sediment

BB3-L0060	45.6072	Hastings Northwest Dam Lake	S	I	S	S	I	5	Aquatic Life - Chlorophyll a, pH_Total Nitrogen, Total Phosphorus
BB3-L0070	2.85728	Heartwell Lake	NA	NA	NA	I	I	5	Aesthetics-Algae Blooms_Unknown
BB3-L0080	36.3032	Recharge Lake	NA	I	S	S	I	5	Aquatic Life - Fish Consumption Advisory_Mercury, Chlorophyll a_Total Nitrogen, Total Phosphorus
BB4-L0010	1.87503	David City Park Lake	S	I	S	S	I	5	Aquatic Life - Chlorophyll a_Total Nitrogen, Total Phosphorus
BB4-L0035	34.5042	Oxbow Trail Reservoir	S	I	S	S	I	5	Aquatic Life - Chlorophyll a, pH_Total Nitrogen, Total Phosphorus
BB3-L0040	4.95032	Henderson Pond	S	I	S	S	I	5	Aquatic Life - Chlorophyll a_Total Nitrogen, Total Phosphorus

2.0 Surface Water Waterbody Categories

Similar to the previous Integrated Reports (IR), the 2018 IR includes multiple categories of waterbodies to present information in a descriptive and comprehensive manner. The designated uses of waterbodies are explained in Section 5. The five waterbody categories are as follows with the possibility of multiple sub-category 4 combinations and one sub-category within category 5:

Category 1 – Waterbodies where all designated uses are met.

Category 2 – Waterbodies where some of the designated uses are met but there is insufficient information to determine if all uses are being met.

Category 3 – Waterbody where there is insufficient data to determine if any beneficial uses are being met.

Category 4 – Waterbody is impaired, but a TMDL is not needed. Sub-categories 4A, 4B, 4C and 4R outline the rationale for the waters not needing a TMDL:

> ***Category 4A*** – Waterbody assessment indicates the waterbody is impaired, but all of the required TMDLs have been completed.
>
> ***Category 4B*** – Waterbody is impaired, but "other pollution control requirements" are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control requirements include but are not limited to, National Pollutant Discharge Elimination System (NPDES) permits and best management practices.
>
> ***Category 4C*** – Waterbody is impaired but the impairment is not caused by a pollutant. This category also includes waters where natural causes/sources have been determined to be the cause of the impairment. In general, natural causes/sources shall refer to those pollutants that originate from landscape geology and climactic conditions. It should be noted; this general description can only be utilized when appropriate justification is provided.
>
> ***Category 4R*** – Waterbody data exceeds the impairment threshold, however a TMDL is not appropriate at this time. The category will only be used for nutrient assessments in new or renovated lakes and reservoirs. Newly filled reservoirs usually go through a period of trophic instability – a trophic upsurge followed by the trophic decline (Holdren, et. al. 2001). Erroneous or non-representative water quality assessments are likely to occur during this period. To account for this, all new or renovated reservoirs will be placed in this category for a period not to exceed eight years following the fill or re-fill process. After the eighth year monitoring data will be assessed and the waterbody will be appropriately placed into category 1, 2, or 5.

Category 5 – Waterbody where one or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. ***Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval***.

> ***Category 5-Alt*** – Waterbody is impaired, but "other pollution control alternatives besides a TMDL" are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control alternatives include, but are not limited to, watershed management plan development, best management practice implementation and adaptive management strategies ***Category 5-Alt waters are not approved or disapproved by EPA; however, EPA agrees to accept the alternative.***

APPENDIX C: WATER QUALITY MODELING RESULTS & REPORTS

BACTERIA LOAD ESTIMATE REPORT

- Prepared by Wright Water Engineers (WWE), July 2019

RECHARGE LAKE AND BEAVER CREEK REPORT

- Prepared by LakeTech, April 2019

TECHNICAL MEMO – STEPL MODEL GUIDANCE

- Prepared by JEO, June 2019

RECHARGE LAKE AND BEAVER CREEK STEPL MODELING RESULTS

- Existing Loads
- Load Reductions

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Bacteria Load Estimation Report for the Upper Big Blue Natural Resources District

District-Wide Water Quality Management Plan, Nebraska

Prepared for:

JEO Consulting Group, Lincoln NE

Wright Water Engineers, Inc.

JULY 2019

031-139. 070

Bacteria Load Estimation Report for the Upper Big Blue Natural Resources District

District-Wide Water Quality Management Plan, Nebraska

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ATTACHMENTS

Attachment 1 – JEO (2018) – Technical Memo – Runoff Yield Estimation for the Upper Big Blue NRD Watershed Management Plan and Integrated Management Plan
Attachment 2 – JEO (2018a) – Technical Memo – Non-permitted AFO Facilities for the Upper Big Blue NRD Watershed Management Plan and Integrated Management Plan
Attachment 3 – JEO (2019) – Existing Best Management Practice Treatment Levels for the Upper Big Blue NRD Watershed Management Plan and Integrated Management Plan

EXECUTIVE SUMMARY

A subwatershed scale bacteria load estimation tool for the Upper Big Blue Natural Resources District (UBBNRD) in Nebraska was developed in support of a nonpoint source district-wide plan to help better understand and quantify existing sources of *E. coli* loads to the Upper Big Blue River and its tributaries. The primary goal of the tool was to reasonably quantify existing bacteria loads in the watershed, and potential load reductions as a result of implementing various Best Management Practices (BMPs) within targeted HUC12 subwatersheds in the UBBNRD. The existing seasonal geometric mean bacteria concentration was estimated at specific points in the watershed from NDEQ (2013).

Based on the results, bacteria loads within the UBBNRD can be reduced through the use of a variety of properly designed, constructed, and maintained BMPs. This improved water quality is expected to enable more frequent achievement of NDEQ's designated beneficial uses and accompanying numeric standards for stream segments in the UBBNRD. Eight targeted subwatersheds, Bear Creek-Beaver Creek, Bethesda Cemetery, City of Doniphan, City of Hampton, City of York, Dry Run-Beaver Creek, Prairie Gem Cemetery, and Sleepy Hollow Creek-Beaver Creek, were identified within the UBBNRD to receive BMPs as part of this initial phase of the district-wide plan. The tool estimates that by using a variety of non-structural and structural BMPs at targeted locations in these subwatersheds, more frequent achievement of NDEQ's state water quality standards may be achievable. The estimated load and concentration reductions by different BMPs presented herein are based on readily available literature, and water quality improvements will vary based on the location and unique characteristics of the subwatersheds in which they are implemented.

Numerous conservatively designed and well maintained structural BMPs, paired with successful non-structural management practices will be needed in order to help achieve the estimated reductions. Bacteria concentrations are especially difficult to manage, because even if the seasonal geometric mean goal is achieved, there will likely continue to be recreational contact standard exceedances at various times through the year as natural sources of bacteria fluctuate. For example, one USGS study recorded increases in bacteria concentration after installing similar types of BMPs in an agricultural watershed in Wisconsin (Corsi et al, 2005) (please see additional discussion of the difficulties encountered when attempting to meet instream bacteria limits in this report and in UWRRC (2014)).

It is recommended that implementation of BMPs and land management practices be performed using an adaptive management approach. The assumptions used as a basis to develop the tool should be updated as more water quality data in the district become available and the results of the tool reassessed.

Bacteria Load Estimation Report for the Upper Big Blue Natural Resources District
District-Wide Water Quality Management Plan, Nebraska

1.0 INTRODUCTION

The Upper Big Blue Natural Resources District (UBBNRD) bacteria load estimation tool presented herein was developed as part of a district-wide Water Quality Management Plan (WQMP) located in Nebraska. The plan area is approximately 2,980 square miles, and encompasses all or portions Adams, Clay, Hamilton, Fillmore, York, Polk, Saline, Seward, and Butler Counties. Land use within the planning area consists of agricultural land uses, including permitted livestock facilities, exempt/grazing livestock, irrigated farmland, and municipal communities.

There are four stream segments in the UBBNRD which are listed as impaired for *E. coli* in the Nebraska Department of Environmental Quality (NDEQ) 2013 Total Maximum Daily Loads for Big Blue River Parameter of Concern: Atrazine & *E. coli* (NDEQ, 2013). The NDEQ 2018 Nebraska Water Quality Integrated Report (NDEQ, 2018) also provides summary of impaired waters in the UBBNRD. Table 1 provides a summary of the streams within the UBBNRD listed with impairments.

During development of the WQMP, one stream segment, BB3-10300 Beaver Creek and its associated tributary subwatersheds were identified by the UBBNRD as target areas, including Bear Creek-Beaver Creek, Bethesda Cemetery, City of Doniphan, City of Hampton, City of York, Dry Run-Beaver Creek, Prairie Gem Cemetery, and Sleepy Hollow Creek-Beaver Creek. The remainder of this report is dedicated to documenting target water quality criteria, existing water quality data, and parameter assumptions used to develop existing *E. coli* load estimates for the planning area, and associated load reductions as a result of implementing stormwater Best Management Practices (BMP's) in the target subwatersheds.

Table 1. Listed Streams in the UBBNRD with *E. coli* Impairments in NDEQ (2018)

Water Body Name	Waterbody ID	2018 NDEQ IR Category	Beneficial Use Impairment	Approved TMDL
West Fork Big Blue				
Beaver Creek: Headwaters to Unnamed Creek	BB3-10400	5	Aquatic Life - Impaired Aquatic Community (Unknown)	No
Beaver Creek: Unnamed Creek to West Fork Big Blue River	BB3-10300	4a	Aquatic Life (Atrazine)	Yes
School Creek	BB3-20100	5	Aquatic Life (Atrazine)	No
West Fork Big Blue River: School Creek to Beaver Creek	BB3-20000	5	**Recreation (*E. coli*)**	Yes
			Aquatic Life - Impaired Aquatic Community (Unknown)	No
			Aquatic Life (Atrazine)	Yes
Walnut Creek	BB3-10200	5	Aquatic Life - Impaired Aquatic Community (Unknown)	No
West Fork Big Blue River: Beaver Creek to Big Blue River	BB3-10000	5	**Recreation (*E. coli*)**	Yes
			Aquatic Life - Impaired Aquatic Community (Unknown)	No
			Aquatic Life (Atrazine)	Yes
Upper Big Blue				
Lincoln Creek: Headwaters to Unnamed Creek	BB4-20900	5	Aquatic Life - Impaired Aquatic Community (Unknown)	No
Big Blue River: Headwaters to North Fork Big Blue River	BB4-40000	5	Aquatic Life (Atrazine)	Yes
Middle Big Blue				
Big Blue River - Lincoln Creek to Blue Bluff Dam	BB4-20000	4a	**Recreation (*E. coli*)**	Yes
Big Blue River - Blue Bluff Dam to West Fork Big Blue River	BB4-10000	4a	**Recreation (*E. coli*)**	Yes
			Aquatic Life (Atrazine)	Yes

1.1 Water Quality Data and Impairments Related to *E. coli*

A primary parameter of concern for waterbodies in the planning area is *E. coli*. Based on NDEQ (2018) the existing seasonal geometric mean for *E. coli* exceeds the target recreational standard of 126 CFU/100 mL for four stream segments in the UBBNRD. Water quality data collected to make this assessment were based upon data collected by the NDEQ, and stream flow data collected by the United States Geological Survey (USGS) and Nebraska Department of Natural Resources (NDNR).

NDEQ (2013) identifies potential point and nonpoint sources of *E. coli* in the UBBNRD. Potential Point sources identified include municipal wastewater treatment facilities and industrial facilities, nonpermitted animal feeding operations (AFO's), illicit connections and discharges, combined sewer overflows; sanitary sewer overflows, direct connections from septic tanks or other on-site wastewater systems.

Nonpoint sources identified in NDEQ (2013) include failing septic tanks or other on-site wastewater systems, run-off from livestock pastures, improper or over-application of biosolids and urban stormwater runoff.

Natural sources of *E. coli* include wildlife such as waterfowl and game and non-game species which inhabit the plan area.

1.2 Existing *E. coli* Seasonal Geometric Mean

Table 2 provides a summary of the calculated *E. coli* seasonal geometric mean performed by NDEQ (2013). Figure 1 shows the spatial location of the impaired stream segments in the UBBNRD.

Table 2. NDEQ (2013) Calculated *E. coli* Seasonal Geometric Mean Summary

Water Body Name	Waterbody ID	Seasonal Geometric Mean (#/100ml)
West Fork Big Blue		
West Fork Big Blue River: School Creek to Beaver Creek	BB3-20000	2019
West Fork Big Blue River: Beaver Creek to Big Blue River	BB3-10000	1699
Middle Big Blue		
Big Blue River - Lincoln Creek to Blue Bluff Dam	BB4-20000	782
Big Blue River - Blue Bluff Dam to West Fork Big Blue River	BB4-10000	776

2.0 EXISTING LOAD ESTIMATE APPROACH

Annual existing *E. coli* load contributions from both nonpoint and point sources were estimated for the study area on a Hydrologic Unit Code (HUC) 12 basis. For simplicity, the load estimates calculated for both nonpoint and point sources contributing to each of the segments listed in Table 2 were assumed to generate the existing seasonal geometric mean concentration for each stream segment. Existing land treatment levels (area already treated by BMPs) were identified and considered in this existing load analysis using results from stakeholder input, existing plans and studies, and NRCS data. Existing land treatment areas were considered by utilizing the approaches outlined in the BMP implementation phase discussed in Section 3.0 of this report.

Please note that no calibration or *E. coli* fate and transport modeling was performed due to the size of the study area and the complexity associated with bacteria fate and transport processes. The

results of this analysis are intended to provide the UBBNRD with a better understanding of the relative magnitude of bacteria sources and their location in the study area which is consistent with the goals of the WQMP.

2.1 Existing Nonpoint Source Load Estimate

2.1.1 Annual Loadings from Land Use Areas (Background Loadings)

The overall approach used to estimate annual *E. coli* loadings from various land uses in the plan area is summarized as follows:

1) A watershed yield analysis, developed by JEO (2018), was utilized as the hydrologic basis for quantifying existing *E. coli* loads. This yield analysis provides an estimate of annual surface runoff volumes for each HUC 12 by land use. Table 3 provides an example of the output generated by the yield analysis for the City of York HUC 12 basin. JEO (2018) is provided as Attachment 1 to this report.

Table 3. Example Watershed Yield Analysis Output from JEO (2018)

HUC	Land Use	Annual Surface Runoff (ac-ft)
10270203040 6 City of York	Barren Land	13
	Cultivated Crops	6410
	Developed	2146
	Forested Land	117
	Grass and Pastureland	834
	Open Water	204
	Total	**9724**

2) Next, *E. coli* loadings from various land use areas were calculated using the Simple Method (Schueler, 1987), which estimates the annual load as a product of the annual runoff volume and associated concentration of *E. coli* in the runoff:

$$L_{E.coli} = 1.03 \times 10^{-3} \times R \times C_{E.coli} \times A$$

where $L_{E.coli}$ = Annual Load (billions of CFU), R = annual runoff (inches), $C_{E.coli}$ = Bacteria Concentration in runoff (MPN/l00mL), A = land area (acres), and $1.03x10^{-3}$= conversion factor. Initial concentrations for *E. coli* in runoff from the land uses within the planning area were estimated from values published in peer reviewed literature. Once initial loads based on this peer reviewed literature were estimated, the results of a microbial source tracking analysis for the Plum Creek Watershed in Nebraska presented in Vogel et al. (2007) were used to adjust the estimated *E. coli* concentration in runoff from each land use in order to reasonably match the relative load contribution percentages reported by Vogel et al. (2007). Table 4 provides a summary of the relative *E. coli* load contributions by land use within the Plum Creek watershed reported by Vogel et al. (2007). Table 4 also

provides the results of the microbial source tracking study which estimated how much of the load from each land use was attributable to cattle, horse, human or wildlife sources.

E. coli concentrations for each land use in the UBBNRD were estimated (within typical ranges reported by peer reviewed literature) to develop similar relative *E. coli* load contributions by land use on a watershed scale when compared with the results of Vogel et al. (2007). Table 5 presents the estimated *E. coli* concentrations utilized to estimate annual loads in stormwater runoff from land uses in the UBBNRD watershed.

Table 4. Watershed *E. coli* Load Contributions by Land Use and Source (Vogel et al., 2007) for the Plum Creek Watershed in Nebraska

Land Use	*E. coli* load contribution	Percent of Total Load by Source			
		Cattle	Horse	Human	Wildlife
Barren Land	<1%	0%	0%	0%	<1%
Cultivated Crops	26%	17%	0%	0%	8%
Developed	7%	0%	0%	7%	<1%
Grass and Pastureland	67%	40%	7%	0%	20%
Open Water	<1%	0%	0%	0%	<1%
Total	100%				

Table 5. Estimated *E. coli* Concentrations in Stormwater Runoff from Land Uses in the UBBNRD Watershed Adjusted to Approximately Match Values Reported by Vogel et al. (2007)

Land Use	*E. coli* (CFU/100 mL)	*E. coli* load contribution	Reported Ranges from Literature[1]
Barren Land	300	<1%	270 to > 400,000
Cultivated Crops	560	25%	10 to 8,300
Developed	460	<1%	100 to 100,000
Grass and Pastureland	350	75%	270 to >400,000
Open Water	11	<1%	1 to 600
Total		100%	
Land Use Not Included in Vogel et al. (2007)			
Forested Land	300	N/A	50 to 21,000

[1]UWRRC (2014), NSQD (2015), Caraco (2013), Harmel et. al (2013), and Barl et. al (2016).

As more water quality data is collected in the planning area, it is recommended that the assumed *E. coli* concentrations for each land use be updated, and the results of this tool revaluated to further asses the feasibility of achieving required load reductions.

2.1.2 Annual Loadings from Non-Permitted Livestock Facilities / Livestock Grazing Operations

Animal feeding operations (AFO) are facilities that confine livestock in a limited feeding space for an extended period of time. The Nebraska Livestock Waste Management Act authorizes the Nebraska Department of Environmental Quality to regulate discharge of livestock waste from these operations. Nebraska's Livestock Waste Control Regulations (Title 130) classifies AFOs as

small, medium or large operations based on the number and type of livestock confined in the facility. Title 130 also requires inspection of medium and large operations to assess the potential for waste discharge. Depending on the size of the operation and potential to discharge pollutants, the operation may be required to obtain a construction and operating permit for a waste control facility from NDEQ. AFOs confining less than the equivalent of 300 beef cattle are considered administratively exempt from inspection and permitting unless they have a history or potential to discharge pollutants to Waters of the State.

Permitted facilities must be designed to contain any runoff generated by storm events that are less in intensity than the 25-year, 24-hour rainfall. Based on the TMDL load allocation for *E. coli* developed by the NDEQ for segments in the UBBNRD, all permitted facilities are considered to be "zero" discharging, and their specified waste load allocation is zero (0). For this reason, potential discharges from permitted livestock facilities were not included in the load estimate analysis.

The number of cattle associated with non-permitted livestock operations (meaning those cattle operations that are not required to have a permit from the State of NE) have been estimated using the procedure outlined in JEO (2018a) which is Attachment 2 to this report.

The annual *E. coli* load from non-permitted livestock in each HUC12 is based on the methodology described in Caraco (2013). The total load from each animal unit (AU) was calculated by multiplying the loading rate, delivery ratio, and fraction exposed to runoff parameters, as shown in Table 6.

Table 6. Loading Rates from Cattle – Adapted from Caraco (2013)

Animal	Fraction Exposed to Runoff[1,2]	Parameter	Loading Rate	Delivery Ratio[3]
Cattle	100%	Bacteria	2,000 (billions of CFU/year)[2]	10%

[1]Reflects fraction of animal waste exposed to runoff.
[2]Metcalf and Eddy (1991)
[3]Palace et al. (1998) – The delivery ratio is the % of the load that actually reaches the receiving water

2.1.3 Annual Loadings from Onsite Wastewater Treatment Systems (OWTS)

Surface discharges from OWTS typically result from septic system failure, and the average failure rate for OWTS in Nebraska is estimated at 40% (Mohamed R., 2009). Historically, OWTS for residential homes were not required to be registered. New systems installed after January 1, 2004 must be registered with the NDEQ; however, systems installed prior to that date do not require registration with the State unless major repair or replacement is needed.

The number of unregistered OWTS was estimated using the Spreadsheet Tool for Estimating Pollutant Loads (STEP-L) data server (Tetra Tech, 2017). According to Tetra Tech (2018) septic system data for each HUC12 subwatershed are based on septic system surveys performed by the EPA National Small Flow Clearing House (1992 and 1998). Registered OWTS were downloaded and mapped into their respective HUC12 subwatershed based on information available from NDEQ (2019).

Estimated annual *E. coli* loadings from septic systems were based on the methodology described in Caraco (2013). Annual surface loads are calculated using the following:

$$L_{surfaceOSWT} = (L_{OSWTdelivery}) \times SF \times D \times f$$

where $L_{surfaceOSWT}$ = Load to surface waters from OWTS's, SF = OWTS failure rate (%), D = delivery ratio (i.e. fraction of effluent reaching surface waters) and f = decay factor (i.e. fraction of *E. coli* that remains within the effluent after decay), and ($L_{OSWTdelivery}$) = load delivered to the OWTS (billions of bacteria/year), calculated using the following:

$$L_{OSWTdelivery} = H \times IH \times C \times Q \times f$$

where H = number of systems, IH =Individuals per household, C = pollutant concentration (MPN/100mL), Q = average wastewater use per capita (gallons/capita/day), and f = conversion factor (1.38×10^{-5} for bacteria). Table 7 summarizes the values that were used to calculate loads for the study area.

Table 7. Parameters for OWTS Wastewater Loading and Surface Loading – Adapted from Caraco (2013)

Input Parameter	Value	Reference
Individuals per Household	2.7	Reese (2000)
Sewer Use	70 (gal per capita per day)	Metcalf and Eddy (1991)
Bacteria Concentration	1×10^6 (MPN/100mL)	Based on Range of 10^6 to 10^{10} per Metcalf and Eddy (1991)
Unregistered System Base Failure Rate (SF)[1]	40%	(Mohamed R., 2009)
Registered System Base Failure Rate (SF)	5%	Based on a range of 3% to 10% per EPA (2002)
Delivery Ratio (D)[2]	0.5	Caraco (2013)
Bacteria Decay Factor (f)[2]	0.08 (average)	Caraco (2013)
Bacteria Conversion Factor (f)	1.38×10^{-5}	Caraco (2013)

[1]The total failure rate is calculated by adding the base failure rate, a maintenance factor (-5 High maintenance, 0 average maintenance, 5 poor maintenance), separation distance from groundwater factor (5 if depth <3 feet, otherwise 0), and a density factor (5 if Density >2 systems/acre, otherwise 0).
[2]Assumes majority of OWTS are not located within 100 feet of the receiving waterbody.

2.2 Annual Point Source Load Estimates

According to NDEQ (2013) potential *E. coli* point sources include stormwater outfalls from municipalities, municipal wastewater treatment effluent, and animal feeding operations. Annual point source loadings were based on the NDEQ (2013), which provides Waste Load Allocation (WLA) for each permitted discharge in the UBBNRD.

2.3 Existing Treatment Level Estimate

Attachment 3 (JEO, 2019) provides a summary of how existing treatment levels for various BMPs were estimated in the plan area. Table 8 below provides a summary of the existing treatment levels estimated for each BMP.

Table 8. Estimated Existing BMP Treatment Levels in the LPS Watershed

Best Management Practice	Land Use / Source Targeted	Estimated % of Land Use Already Treated
Pet Waste Pick-Up	Developed Areas	8%
Practice Suite Non-structural & avoidance BMPs (i.e. Working Lands Management)	Cropland / Manure Application Sites	50%
Practice Suite Irrigation Water Management	Irrigated Cropland	35%
Practice Suite Grazing Lands Management BMPs	Pastureland	25%
Cover Crops	Cropland	25%
Riparian Buffers	Cropland	5%
No-Till	Cropland	25%
Reduced-Till	Cropland	30%
Contour Buffer Strips (Filter Strips)	Cropland	5%
Practice Suite Non-Permitted AFO Facility BMPs	Non-Permitted AFOs	5%
Constructed Wetlands / Farm Ponds / Sedimentation Basins	Cropland / Pastureland	40%
Stream Restoration / Stabilization	Watershed	75%
Terraces	Farmland	10%
Water and Sediment Control Basins (WASCOBS)	Cropland / Pastureland	5%
Grassed Waterways	Cropland	10%
Practice Suite Urban Stormwater BMPs	Developed Areas	5%

2.4 Existing Sources and Loads Summary

Figure 2 presented at the end of this report provides a summary of estimated annual bacteria load contributions from various land uses and point sources in the UBBNRD. Figure 3 and Figure 4 present a more detailed bacteria load summary for the target stream reach, BB3-10300 Beaver Creek, and its associated tributary subwatersheds including Bear Creek-Beaver Creek, Bethesda Cemetery, City of Doniphan, City of Hampton, City of York, Dry Run-Beaver Creek, Prairie Gem Cemetery, and Sleepy Hollow Creek-Beaver Creek.

3.0 LOAD REDUCTIONS

NDEQ (2015) requirements stipulate that Best Management Practice (BMP) implementation associated with a basin-wide water quality management plan target a maximum of 20% of a HUC 8 level subbasin area in order to meet water quality objectives. To meet this criterion, BMP implementation within the planning area was only performed within eight targeted HUC 12's identified by the UBBNRD; Bear Creek-Beaver Creek, Bethesda Cemetery, City of Doniphan, City of Hampton, City of York, Dry Run-Beaver Creek, Prairie Gem Cemetery, and Sleepy Hollow Creek-Beaver Creek.

The total target area of the eight targeted HUC 12 subbasins is approximately 300 square miles or approximately 10% of the total area in the UBBNRD (approximately 2,980 square miles).

E. coli load reductions as a result of implementing various BMPs were estimated using one or a combination of the following methods: (1) changing input parameters to reflect the implementation of BMPs, or (2) by reducing the annual pollutant loadings by a single or combined (if more than one BMP was implemented) BMP efficiency factor. Combined BMP efficiencies for parallel and in-series configurations were calculated using the following (adapted from Tetra Tech, 2018):

$$E_{eff-Parallel} = 1 - \frac{\sum L_n \times (1 - E_n)}{\sum L_n}$$

$$E_{eff-series} = 1 - \frac{\sum L_n \times (1 - E_n) \times (1 - E_{n+1})}{\sum L_n}$$

where $E_{eff-Parallel}$ = overall efficiency of BMPs in parallel, $E_{eff-series}$ = overall efficiency of BMPs in-series, L = equal to total load from land use area, and E = efficiency of the BMP. As more BMP's are implemented the overall calculated efficiency of the BMP "treatment train" system becomes more efficient, providing an estimated cumulative load reduction after each BMP is implemented.

As stated previously, no bacteria fate or transport modeling was performed. Therefore, for the purposes of this plan, the estimated reduction in bacteria load resulting from implementing one or more BMPs is assumed to reduce the instream seasonal geometric mean by the same relative reduction.

4.0 BMP IMPLEMENTATION STRATEGY

BMPs and land management practices were conceptually located in the target subwatersheds of Bear Creek-Beaver Creek, Bethesda Cemetery, City of Doniphan, City of Hampton, City of York, Dry Run-Beaver Creek, Prairie Gem Cemetery, and Sleepy Hollow Creek-Beaver Creek using a "treatment train" approach. A BMP treatment train is a term commonly used to describe a multi-BMP approach to the management and treatment of stormwater quantity and quality within a watershed. For urban areas, the treatment train generally starts at the watershed scale with **Pollution Prevention** a management practice which utilizes non-structural BMPs such as education and public outreach. The following management practices are implemented after

pollution prevention, typically in the following order: 1) S**ource Control,** which utilizes management practices such as street sweeping and detection and elimination of illicit discharges, 2) **Onsite Best Management Practices** such as bioretention systems, permeable pavements, and disconnecting impervious area, 3) **Regional Best Management Practices** such as regional detention ponds, wetlands, or underground detention facilities.

For more agricultural areas, such as the target subwatersheds, a similar treatment train approach was used. NDEQ (2015) states, "an effective systems approach must be based on a hierarchy of managing pollutants first at the source and last at the point of delivery." The three steps of this "ACT" system generally described by NDEQ (2015) are as follows:

> **Avoid** – This first step focuses on avoidance based BMPs which help to eliminate pollutant contamination at the source. Avoidance practices could include but not be limited to retiming of fertilizer (manure) application to agronomic rates, timing manure application to maximize the amount of time before being exposed to runoff, and limiting livestock direct access to a stream.
>
> **Control** – This second step focuses on land management activities which help control the direction and rate of runoff from a land area to a receiving water. These practices promote infiltration and reduce or eliminate direct surface water runoff connections between the land area and the receiving water. Control practices could include but not be limited to filter strips, terraces, and stream buffers.
>
> **Trap** – This third and final step focuses on structural practices which physically trap and store pollutants before they can enter the receiving water. Surface water is directed to these structural practices where treatment processes such as sedimentation and infiltration can take place prior to the runoff being discharged to a receiving water. Trapping practices could include but not be limited to sedimentation ponds, and constructed wetlands.

Table 9 provides a BMP implementation summary for the target subwatersheds. Report section 4.0 provides a summary of the BMP implementation strategy utilized for each target area.

Table 9. BMP Implementation Summary

Order	Land Use / Source Targeted	Priority BMP	*E. coli* Treatment Efficiency
1	All	General Watershed I&E	10%
2	Unregistered OSWT	Onsite Wastewater Treatment System (OWTS) Upgrade	Change OWTS Failure Rate from 40% to 5% for unregistered systems
3	Urban	Pet Waste Pick-up	20%
4	Cropland Manure application sites	Practice Suite: Non-structural & avoidance BMPs (i.e. Working Lands Management)	10%
5	Irrigated Cropland	Practice Suite: Irrigation Water Management	10%
6	Pastureland	Practice Suite: Grazing Lands Management BMPs	40%
7	Cropland	Cover Crops	40%
8	Cropland	Riparian Buffers	70%
9	Cropland	No-Till	0%
10	Cropland	Reduced-Till	0%
11	Cropland	Contour Buffer Strips (Filter Strips)	70%
12	Non-permitted AFOs	Practice Suite: Non-Permitted AFO Facility BMPs	75%
13	Cropland / Pastureland	Constructed Wetlands/Farm Ponds/Sed. Basins	78%
14	Cropland	Wetland Restoration	Change in land use type
15	In-Stream load from watershed	Stream Restoration / Stabilization	35%
16	Cropland	Terraces	70%
17	Cropland / Pastureland	Water & Sediment Control Basins (WASCOBS)	70%
18	Cropland	Grassed Waterways	70%
19	Cropland	Land Use Change: Perennial vegetation (CRP, pasture, etc.) Diversified crop production	Change in land use type
20	Urban	Practice Suite: Urban Stormwater BMPs	37%

4.1 General Watershed I&E (Watershed Education and Outreach)

The effectiveness of watershed education and outreach depends heavily on the level of public participation and awareness. The effectiveness of in-stream responses to watershed education and outreach is not well documented. Caraco (2013) suggests an overall reduction of 20% as a result of pet waste ordinances and education programs in urban or developed areas. An assumed treatment efficiency of 10% was used for the target subwatershed areas.

The watershed education and outreach BMP was implemented and applied to all land uses within the target subwatersheds. The effect of this BMP on water quality within the target subwatersheds was estimated by reducing the associated *E. coli* loadings from all land uses by this BMPs respective efficiency value shown in Table 9.

4.2 Onsite Wastewater Treatment System (OWTS) Education and Outreach

Many of the OWTS within the UBBNRD are unregistered. A homeowner education and outreach program to educate homeowners about OWTS maintenance requirements and signs of failure will help to reduce bacteria and other pollutant loads discharged by failing systems. The initial target areas for this outreach program should be in locations where homes with an OWTS have been built immediately adjacent to receiving streams or drainageways. The program should then be expanded outward, to the remainder of the target area.

The OWTS education and outreach BMP was implemented for all unregistered OWTS systems in the target subwatersheds. The effect of this BMP on water quality was estimated by reducing the failure rate of unregistered systems from 40% to 5%. Approximately 1,600 unregistered systems in the target subwatersheds were assumed to be treated based on implementation of this BMP.

4.3 Pet Waste Pick-Up

The effectiveness of pet waste pick-up programs and ordinances depends heavily on the level of enforcement from the local municipality and public participation and awareness. The effectiveness of in-stream responses to pet waste ordinances is not well documented; however, some studies have reported a 37% reduction in pet waste in city parks as a result of an ordinance (UWRRC, 2014). Caraco (2013) suggests an overall reduction of 20% as a result of pet waste ordinances and education programs. A survey of local municipalities indicated approximately 5 of the 49 municipal communities in the UBBNRD have existing pet waste ordinances. These 5 communities represent approximately 8% of the total urban land use in the UBBNRD. As a result, the existing treatment level estimated for this BMP was 8%.

The pet waste ordinance BMP was implemented on 42% of the developed land within the target subwatersehds, for a total treatment area goal of 50%. The effect of this BMP on water quality in the Beaver Creek target reach was estimated by reducing the associated *E. coli* loadings from developed land uses by the efficiency value shown for this BMP in Table 9.

4.4 Practice Suite: Non-Structural & Avoidance BMPs (Working Lands Management)

Non-structural and avoidance BMPs generally consist of a site-specific suite of nonstructural / management based BMPs targeted at nutrient, manure, and pesticide management. They include planning, modified application timing, rates, placement, inhibitors, changing sources, and sampling. This management practice includes utilizing the 4Rs of nutrient management and integrated pest management practices (**Right fertilizer source** at the **Right rate**, at the **Right time**, and in the **Right Place**).

The primary benefit of this practice which can reduce *E. coli* loads to receiving waters is fertilizer (manure) management at agronomic rates. Literature suggests the effectiveness of lowering manure application rates as a management practice for reducing concentrations of bacteria in runoff is highly variable. While some evidence suggests reductions in manure application rates can help reduce bacteria counts in runoff, there does not appear to be a definitive trend (Cook et al., 1997 and Jamieson et al., 2002). An assumed treatment efficiently of 10% was used to estimate load reductions within the target subwatersheds.

Based on a survey of local NRCS offices, approximately 50% of agricultural operations in UBBNRD already use non-structural and avoidance BMPs. The working lands management BMP was implemented and applied to 25% of the cropland and manure application lands within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from each land use by the efficiency value shown for this BMP in Table 9.

4.5 Practice Suite: Irrigation Water Management

Irrigation water management can help reduce the movement of pollutants from cropland into both groundwater and surface water by making irrigation systems more efficient. Some of these practices include irrigation scheduling, variable rate irrigation, flowmeters, using more efficient application practices, tailwater recovery, and soil moisture probes. Education outreach and cost-share programs will be the most effective means to get agricultural users to use these types of practices. EPA (2003) suggests effective irrigation water management strategies can reduce the amount of irrigation water applied by approximately 30%.

The UBBNRD estimates that approximately 35% of existing irrigators in the UBBNRD utilize irrigation water management techniques. The irrigation water management BMP was implemented and applied to 40% of cropland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland by the efficiency value shown for this BMP in Table 9.

4.6 Practice Suite: Grazing Lands Management

EPA (2003) suggests grazing management practices provide an *E. coli* treatment efficiency of approximately 40% based upon a comparison of geometric mean fecal coliform count concentrations in runoff from an unmanaged grazing location and a managed grazing location under similar stocking rates. Meals (2001) reported indicator bacteria counts were reduced by a

range of 29 to 46% following the implementation of various grazing management practices. Grazing lands management practices could include, but not be limited to the following:

Alternative livestock water sources – installation of watering sources which divert off of a receiving water limit can reduce or eliminate the need for livestock to enter the stream.

Grazing Management – this practice limits the amount of time livestock are allowed to graze in a specific area. This minimizes impacts to the native vegetation and helps to ensure adequate residual vegetative cover after grazing has occurred. This practice also should provide adequate regrowth and rest time for vegetation before the area is grazed again.

Exclusionary Practices – exclusionary practices generally consist of livestock fencing to protect critical habitat areas such as riparian corridors and wetlands areas. A healthy riparian corridor provides a buffer between the area being grazed and the receiving water which can help to filter out and reduce pollutant loading to the stream. Wetland areas provide valuable biological treatment processes which trap and remove pollutants before discharge to receiving waters.

An assumed treatment efficiently of 40% was used to estimate load reductions within the target subwatersheds.

Based on a survey of local NRCS offices, approximately 25% of animal grazing operations in UBBNRD already use grazing lands management BMPs. The grazing lands management BMP was implemented and applied to 50% of pastureland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from pastureland by the efficiency value shown for this BMP in Table 9.

4.7 Cover Crops

Cover crops help to reduce wind and water erosion by stabilizing soil surfaces, thereby reducing the potential for detachment and transport of nutrient rich soil particles into nearby surface waters. They also help to enhance nutrient adsorption into the soil matrix, and trap and retain nutrients that would otherwise leech into the shallow groundwater. Depending on the cover crop type and density, surface runoff from farmland can be reduced by 42 to 82% (Gilley et al., 2002). An assumed *E. coli* treatment efficiency of 40% was used to estimate load reductions within target subwatersheds.

Based on a survey of local NRCS offices, approximately 25% of agricultural operations in UBBNRD already use cover crops as a BMP. The cover crop BMP was implemented and applied to 50% of cropland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland by the efficiency value shown for this BMP in Table 9.

4.8 Riparian Buffers

Riparian buffers installed adjacent to (along the perimeter) or within areas receiving manure fertilizer application have been shown to be effective management practices for reducing *E. coli* concentrations in surface runoff. Reductions ranging from 16% to 99% have been shown in various studies (Wagner, 2010). A literature review by Koelsch et al. (2010) suggests the average reduction as a result of vegetative buffer treatment at 76%. An assumed treatment efficiency of 70% was used to estimate load reductions within the target subwatershed areas.

The Agricultural Conservation Planning Framework (ACPF) watershed planning tool was used to locate riparian buffers within each target subwatershed. The results of this tool provided recommended locations for riparian buffers to treat runoff from cropland uses within each target subwatershed.

Based on a survey of local NRCS offices, approximately 5% of agricultural operations in UBBNRD already use riparian buffers as a BMP. The riparian buffer BMP was implemented and applied to 45% of cropland within the target subwatersehds, for a total treatment area goal of 50%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland by the efficiency value shown for this BMP in Table 9.

4.9 No-till and Reduced-Till

No-till farming has been shown to have little to no effect on transport of bacteria from agricultural land uses (Jamieson et al., 2002). Therefore, no reductions in bacteria loads were estimated as a result of implementing these BMPs.

4.10 Contour Buffer (Filter) Strips

Contour buffer strips (also commonly referred to as filter strips), are strips of perennial vegetation alternated across slopes in cropland. Contour buffer strips are most appropriate for fields with a milder slope as opposed to a steeper slope where terracing would be more appropriate. Due to the functional similarity of stream buffers and filter strips, filter strips installed immediately adjacent to agricultural land uses were assumed to have the same *E. coli* treatment efficiency as riparian buffers (see section 4.8 for discussion).

The ACPF watershed planning tool was used to locate contour buffers within the target subwatersheds for farmland with slopes of less than 10%. The results of this tool provided recommended locations for contour buffers to treat runoff from farmland uses within each target area.

Based on a survey of local NRCS offices, approximately 5% of agricultural operations in UBBNRD already use contour buffer strips as a BMP. This BMP was implemented and applied to 70% of cropland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland by the efficiency value shown for this BMP in Table 9.

4.11 Practice Suite: Non-Permitted AFO Facility BMPs

AFO facility management practices for non-permitted livestock facilities will vary depending on site specific site conditions. Practices could include but are not limited to the following: 1) animal waste systems, 2) clean water diversion systems, 3) vegetative treatment systems (VTS), 4) terraces, 4) containment structures, 5) evaporation ponds, 6) open lot runoff management, 7) heavy use area protection, and 8) Feed management practices. Identifying specific management practices for individual non-permitted livestock facilities was outside the scope of this planning effort, however the relative gross effectiveness of these practices provided in EPA (2003) suggests these management practices provide *E. coli* treatment efficiencies ranging from 55 to 90%. An assumed treatment efficiently of 75% was used to estimate load reductions within the target subwatersheds.

It was estimated that approximately 5% of non-permitted AFO operations in UBBNRD utilize one or more of these types of BMPs. The non-permitted AFO facility BMP practice suite was implemented and applied to 70% of non-permitted livestock AU's within the target subwatersheds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from exempt livestock AU's by the efficiency value shown for this BMP in Table 9.

4.12 Treatment Wetlands, Farm Ponds and Sedimentation Basins

Based on an analysis of *E. coli* water quality data in the International Stormwater BMP Database (Wright Water Engineers and Geosyntec, 2016), constructed wetlands and wet retention ponds were conservatively assumed to have a 70% efficiency for reducing *E. coli* loads from contributing areas within the target subwatersheds.

The ACPF watershed planning tool was used to locate constructed wetlands and wet retention ponds within the target subwatersheds.

Based on a survey of local NRCS offices, approximately 40% of the agricultural land area in the UBBNRD already use wetlands, farm pond or sedimentation basins as a BMP. This BMP was implemented and applied to 35% of cropland and pastureland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from all land uses upstream of the BMP by the efficiency value shown for this BMP in Table 9.

4.13 Wetland Restoration

The restoration of existing and or historical wetland areas can provide water quality benefits to a watershed. Recommended BMPs for restoration of existing or historical wetland areas includes: rest, prescribed grazing, prescribed burning, herbicide, haying/shredding, disking, water level manipulation, sediment removal, hydrologic restoration, and upland buffers.

This BMP was implemented and applied to 15% of cropland within the target subwatersehds, for a total treatment area goal of 15%. The effect of this BMP on water quality was estimated by converting 15% of cropland area in each target subwatershed to a forested land use type. A forested land use was selected since there was no specific wetland land use type identified in the

yield analysis (JEO, 2018). A forested land use was selected since its runoff characteristics are most similar to a wetland when compared with other available land uses (barren land, cultivated crops, developed, grass and pastureland, and open water) summarized in JEO (2018).

4.14 Stream Restoration / Stabilization

Stream restoration projects can help to restore or encourage a more balanced ecosystem within the stream system. These practices include stream bank stabilization, instream stabilization, riparian corridor restoration, riparian habitat enhancement, and instream habitat enhancement. Wagner et al. (2008) states:

> Once microbes enter streams, their interaction with sediments and the availability of nutrients and organic matter greatly influences their survivability. External sources of nitrogen increase the survival rates of *E. coli* in aquatic environments (Lim et al., 1998). Adsorption to sediments/solids increased survivability by providing protection from inactivation by toxins, UV, and microbial antagonism (Ferguson et al. 2003).

Brenner (1996) found that stream fecal coliform levels were reduced 41% after flowing through a 4-mile forested riparian buffer zone (Wagner et al., 2008). Stream restoration projects were assumed to have 35% efficiency for reducing *E. coli* loads from contributing land source areas after implementing stream restoration downstream of the contributing area. Additional benefits of using stream restoration as a BMP can also be found at the International Stormwater BMP Database (http://www.bmpdatabase.org/stream.html) (Clary et al., 2017).

Based on USGS (2003), it was assumed that approximately 75% of the stream network associated with the target subwatersheds are in a state of dynamic equilibrium. This BMP was implemented and applied to 15% of all the land areas within the target subwatersehds, for a total treatment area goal of 90%. The effect of this BMP on water quality was estimated by reducing *E. coli* loadings from land areas upstream of the restored stream segment by the associated *E. coli* efficiency value shown for this BMP in Table 9.

4.15 Terraces

Due to the functional similarity of terraces and filter strips, both of which serve to promote infiltration and reduce erosion, terraces installed immediately adjacent to agricultural land uses were assumed to have the same *E. coli* treatment efficiency as filter strips (see report section 4.9 for additional discussion).

The ACPF watershed planning tool was used to locate terraces within the target subwatersheds for cropland with slopes of greater than 10%. The results of this tool provided recommended locations for contour buffers to treat runoff from cropland uses within the target subwatersheds.

Based on a survey of local NRCS offices, approximately 10% of the agricultural land area in the UBBNRD already use terraces as a BMP. This BMP was implemented and applied to 65% of cropland within the target subwatersehds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland upstream of the BMP by the efficiency value shown for this BMP in Table 9.

4.16 Water and Sediment Control Basin (WASCOB)

USDA (2017) defines a water and sediment control basin (WASCOB) as an "earth embankment or a combination ridge and channel constructed across the slope of a minor drainageway." Due to the functional similarity of retention ponds and WASCOBs, both of which serve to promote sedimentation, WASCOBs installed in minor drainage ways within the target subwatersheds were assumed to have the same *E. coli* treatment efficiency as a retention pond (see report section 4.12 for additional discussion).

The ACPF watershed planning tool was used to locate WASCOBs within the target subwatersheds. The results of this tool provided recommended locations for WASCOBs to treat runoff from cropland and pastureland within each target subwatershed.

It was estimated that approximately 5% of the agricultural land area in the UBBNRD already use WASCOBs as a BMP. This BMP was implemented and applied to 70% of cropland and pastureland area within the target subwatersheds, for a total treatment area goal of 75%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from cropland and pastureland upstream of the BMP by the efficiency value shown for this BMP in Table 9.

4.17 Grassed Waterways

Grassed waterways have been shown to have little to no treatment benefits for bacteria (Wright Water Engineers and Geosyntec, 2016). Therefore, no reductions in bacteria loads were estimated as a result of implementing these BMPs.

4.18 Perennial Vegetation and Diversified Crop Production

The conversion of existing cropland to perennial vegetation can provide water quality benefits including reduced erosion, and restoration of more natural hydrologic functions. Support for this practice has been historically funded via the USDA Conservation Reserve Program (CRP).

Spatial cropland data from USDA (2017) estimates approximately 8% of cropland in the UBBNRD is currently enrolled in the USDA CRP. This BMP was implemented and applied to 12% of cropland within the target subwatersehds, for a total treatment area goal of 20%. The effect of this BMP on water quality was estimated by converting 12% of cropland area in each target subwatershed to a grass land use type.

4.19 Practice Suite: Urban Stormwater BMPs

Based on a recent review of data from the International Stormwater BMP database (Wright Water Engineers and Geosyntec, 2016), median treatment efficiencies for *E. coli* can range between 64% and 96% for commonly constructed urban BMPs including bioretention systems, retention ponds, wetland basins, and wetland basins / retention ponds. Urban stowmater BMPs were conservatively assumed to have a 70% efficiency for reducing *E. coli* loads from contributing areas within the target subwatersheds.

It was estimated that approximately 5% of the urban land area in the UBBNRD already use stormwater BMPs since approximately 5% of the urban lands are regulated as a Phase 1 Municipal Separate Storm Sewer System (MS4). This BMP was implemented and applied to 45% of urban land area within the target subwatersheds, for a total treatment area goal of 50%. The effect of this BMP on water quality was estimated by reducing the associated *E. coli* loadings from urban land area upstream of the BMP by the efficiency value shown for this BMP in Table 9.

5.0 SUMMARY OF ESTIMATED LOAD REDUCTIONS AFTER BMP IMPLEMENTAITON

Please note that the quantity, size, and treatment area associated with many of the implemented BMPs are highly ambitious, and will take many years and extensive funding to implement. Additionally, facilities such as unregistered onsite wastewater treatment systems and non-permitted livestock facilities will need to be targeted in order to help reduce bacteria loading within each target area. Table 10 provides a summary of the estimated bacteria reduction for Beaver Creek and the West Fork Big Blue River. Table 11 provides a summary of the estimated cumulative load reductions as a result of BMP implementation and the estimated physical area or number of structures associated with each BMP as applicable. Figure 5 provides a summary of the estimated reduced *E. coli* loadings by land use / source for the target area contributing to Beaver Creek.

As shown in Figure 1, Beaver Creek is tributary to the West Fork Big Blue River (Segment ID: BB3-10000). While Beaver Creek is not currently listed by NDEQ (2018) as impaired for *E. coli*, the West Fork Big Blue River is listed as impaired for *E. coli* and has an associated TMDL. By reducing *E. coli* loads to Beaver Creek, it is estimated that loads in the West Fork Big Blue River could be reduced by 15%. Table 10 provides a summary of the estimated *E. coli* seasonal geometric mean in the West Fork of the Big Blue River post-BMP implementation.

Table 10. Estimated *E. coli* Load Reductions Within the Targeted Title 117 Segments after BMP Implementation

Segment ID	Waterbody Name	Pre-BMP Implementation		Post-BMP Implementation		
		Existing Annual Load (billion CFU)	Existing Seasonal Geometric Mean (CFU/100 ml)	Estimated Load (billion CFU)	Estimated Percent Reduction	Estimated Seasonal Geometric Mean (CFU/100 ml)
BB3-10300	Beaver Creek	650800	N/A	259400	60%	N/A
BB3-10000	West Fork Big Blue River	2841900	1699	2407800	15%	1444

Table 11. Cumulative Estimated Bacteria Load Reductions as a Result of BMP Implementation

BB3-10300 - Beaver Creek - Unnamed Creek to West Fork Big Blue River						
Practice Type	**Land Use / Source Targeted**	**Best Management Practice**	**Treatment Efficiency**	**Area of BMP or Number of Structures**	**Cumulative Estimated Load Reduction after BMP Implementation**	
			Surface Runoff		***E. coli* (Billion CFU)**	
			E. coli		**Surface Runoff**	**Cumulative % Reduction**
				Existing Load / Concentration	650800	0%
Non-Structural	All	General Watershed I&E	10%	NA	560900	14%
	Unregistered OSWT	Onsite Wastewater Treatment System (OWTS) Upgrade	Changes to failure rate	1,600 systems	535100	18%
	Urban	Pet Waste Pick-up	20%	NA	532300	18%
	Cropland Manure application sites	**Practice Suite** Non-structural & avoidance BMPs (i.e. Working Lands Management)	10%	NA	523400	20%
	Irrigated Cropland	**Practice Suite** Irrigation Water Management	10%	NA	509100	22%
	Pastureland	**Practice Suite** Grazing Lands Management BMPs	40%	1,500 acres[1]	507100	22%
Structural	Cropland	Cover Crops	40%	120,600 acres	489200	25%
	Cropland	Riparian Buffers	70%	7,000 acres	473100	27%
	Cropland	No-Till	0%	80,400 acres	473100	27%
	Cropland	Reduced-Till	0%	80,400 acres	473100	27%
	Cropland	Contour Buffer Strips (Filter Strips)	70%	700 acres	448100	31%
	Non-permitted AFOs	**Practice Suite** Non-Permitted AFO Facility BMPs	75%	70 facilities	387500	40%
	Cropland Pastureland	Constructed Wetlands/Farm Ponds/Sed. Basins	78%	61 acres	373600	43%
	Cropland	Wetland Restoration	Changes to land use area	24,100 acres	368200	43%
	In-Stream load from watershed	Stream Restoration / Stabilization	35%	11 miles	348200	46%
	Cropland	Terraces	70%	300 acres	324900	50%
	Cropland Pastureland	Water & Sediment Control Basins (WASCOBS)	70%	500 acres	297200	54%
	Cropland	Grassed Waterways	0%	1,500 acres	297200	54%
	Cropland	**Land Use Change** Perennial veg (CRP, pasture, etc.) Diversified crop production	Changes to land use area	32,200 acres	278400	57%
	Urban	**Practice Suite** Urban Stormwater BMPs	70%	4 municipalities	259400	60%

[1]**Assuming a animal stock rate of approximatley 1 AU / acre per Johnson (2006)**

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Figures