December 6, 2024

Mr. Chad Anderson
Manager, Watershed Division
Minnesota Pollution Control Agency
Brainerd Regional Office
7678 College Rd, Ste 105
Baxter, MN 56425

Re: Straight River (Hubbard County) Nutrient Study, MPCA, July 2024

Dear Mr. Anderson,

As a follow up to the meeting last week, please find attached to this letter a response from Central Minnesota Irrigators (CMI) related to specific statements directed toward irrigated agriculture as presented in the above-referenced report. The CMI finds the report to contain peculiar content for a scientific-based study and misleading statements that implicate irrigated agriculture as the "problem causing" source of nitrate detected in the Straight River.

CMI is a farming-based organization with offices in Wadena and Staples that was established in 1969 to represent and advocate for irrigated agriculture in the counties of Becker, Otter Tail, **Hubbard**, Cass, Wadena, Crow Wing, Todd, Morrison and surrounding communities; CMI is also a local chapter of the state-wide Irrigators Association of Minnesota (IAM). Our members are passionate about agriculture. We are multi-generational farmers who work hard to protect the land, air and water by which we make our livelihoods.

Also, CMI and IAM members support science-based research on irrigation management. We actively engage with the University of Minnesota on best management practices and share results with our membership, fellow commodity groups, the Minnesota Department of Agriculture and other academic entities. Many of our members have enrolled in the Minnesota Agriculture Water Quality Program (MAWQCP) and are continually seeking ways to be more efficient in their farming operations.

We share a desire to protect natural resources and want to advance farming practices that safeguard the land, air and water that sustain us. However, when a report like the Straight River Nutrient Study is published without input or notice from agricultural communities that are implicated, our trust in public agencies erodes. We strive to work with the state agencies that regulate our members.

We appreciate the opportunity you provided us and several of the CMI and IAM board members to meet with you and your staff and discuss our concerns about the report. We are hopeful that MPCA will carefully consider our comments.

Following the agency's review of the attached information, CMI requests that a revision of the report be written and subsequently submitted to CMI/IAM for review and comment prior to republishing it. Please contact us at our email addresses below with any questions and related correspondence. We look forward to your response. Thank you.

Sincerely,

Ben Deuel
CMI President
Parkers Prairie, MN

Kristina Anderson, PG
CMI Vice President
Wadena, MN

Attachment: Central Minnesota Irrigators Response Comments

Central Minnesota Irrigators
c/o Tyler Grunewald
1850 Airport Road
Staples, MN 56479

Attachment

Straight River (Hubbard County) Nutrient Study, MPCA, July 2024

Central Minnesota Irrigators Response Comments
Letter Attachment

Statements of Concern:

The following are CMI's responses to statements that the organization finds not only misleading, but also that lack an unbiased assessment respective of other potential sources of nitrate in the respective watershed:

- In the Background section, the report cites several newspaper articles about the Straight River, some from more than 20 years ago, one that was published in sister-agency DNR's *Conservation Volunteer* magazine and others that implicate agriculture causing nitrate pollution in other areas of the state but are unrelated to the report's watershed. We find these references to newspaper articles and magazines to be highly unusual for a science-based report and provide zero value to the reader.

- Finding: *Nitrate concentrations in the river at US Highway 71…have statistically-significantly increased since the 2004 through 2010 period, leveling off recently as the pace of new row crop acre additions in the Straight River drainage have slowed. The timelines of cropping intensification and increasing levels of nitrate concentrations in the Straight River correlate.*

    1) When reviewing Figure 27, the "leveling off" appears to occur among the 2015-2016 and 2020-2022 data sets. Consequently, the nitrate concentrations detected in the river began to stabilize with the 2015-2016 sampling event, not "recently" as stated. Considering the time of travel for groundwater in the Straight River basin (150 ft/year based on hydraulic conductivity and potentiometric surface values presented in Stark et al. (1994)), a likely cause for this stabilization is the implementation of UMN developed nutrient and irrigation management practices (BMPs) by area farmers over the past couple decades. Consequently, the CMI believes the benefits (e.g., less leaching) of the BMPs have been realized since growing season 2015 with "less nitrate concentrated" groundwater reaching the river since then and should be recognized as such in the requested revision.

    2) Furthermore, even though the report presents the likelihood of a domestic septic system leaching nitrate (13 -16 mg/l) into a spring near the CR125 crossing, CMI finds that the MPCA did not consider the "leveling off" of new homes/structures construction near or along the Straight River. A review of aerial photos shows an 80% increase in housing-like structures within ½ mile distance of the river between 2004 and 2010, and only a 9% increase between 2010 and 2022 ***which also correlates nicely with the timelines of increasing nitrate concentrations***. Conversely, within a 2-mile distance from the river, Figure 6 of the report reveals only a 20% increase in irrigated row crop acreage between 2004 and 2010 and a 15% increase from 2010 to 2022. Also, Figure 6 and Table 1 reveal that the leveling off of irrigated acreage actually began in 2013, not "recently" as stated. CMI requests that the contribution of septic system leaching from the domestic structures along and near the banks of the river be considered, as well as quantified, as a significant contributor of nitrate to the Straight River in a future revision.

- Assumption: *Efforts to date in the Straight River Watershed to reduce nitrate loss from fertilized fields to the river via groundwater have not shown success yet (as of 2022) in the river, based on monitoring of nitrate in the Straight River.*

    1) The CMI finds the statement blatantly biased and derogatory toward irrigated agricultural as it misleads the public into believing that the UMN developed irrigation and nutrient management BMPs implemented by area farmers are not working with respect to reducing nitrate leaching beneath their irrigated fields. Recent studies by the UMN at Becker Farms and a privately funded study at Central Lakes College Staples campus reveal the effectiveness of these BMPs in reducing nitrate leaching. Furthermore, CMI is currently studying nutrient concentrations in the Straight River in which samples are collected monthly. Our monitoring shows concentrations that are equal to those detected during the 2015 – 2016 MPCA sampling period, and similar to July and August 2024 concentrations at the Hwy 71 crossing to those detected in the same two months at the same location during the 2004 - 2010 sampling events. Such findings (stabilization and reduction) translate into success; therefore, the CMI requests that the statement be removed as part of the requested revision of the report.

- Incomplete narrative: *The nearness of [irrigated] fields to the river mean that nitrate-containing groundwater has little distance to travel before it emerges in the river channel to become part of the Straight River's flow.*

    1) The above statement is made in reference to Figure 8 of the report. CMI recognizes that the MPCA fails to mention in the respective paragraph that a riparian forest exists between the referenced fields and the river as shown in Figure 8. GIS mapping reveals that there are approximately a combined 360 acres of riparian forest that traverses along both sides of the river between the CR123 and Hwy 71 road crossings. Approximately 40% of this acreage (150 acres) occurs between the CR125 and CR115 crossings. For each of the October through May sampling events (excluding April), the nitrate concentration increases, on average, approximately 2.5 mg/l between CR123 and Hwy 71; 80% of this increase (2.0 mg/l) occurs between CR125 and CR115 which is where 40% of the riparian forest acreage occurs.

        Nitrate leaching from forested watersheds is well documented. Williard et al. (1997) state that (and provide references to) "substantial exports of nitrogen from forested watersheds have been discovered over extended periods of time" and found that medium to high soil moisture contents enhanced soil microbial dynamics in forests soils resulting in increased mineralization, nitrification and nitrate leaching from forested ecosystems. Burns et al. (1998) have shown that nitrate concentrations in springs of forested watersheds within the Catskill Mountain region "remain relatively constant throughout the summer and fall at values just [greater than] 20 umol/L" which equates to 1.24 mg/l. Observed increases in nitrate concentrations in the streams fed by these springs are believed to be due to flushing of excess nitrate from the soils during spring runoff and storms. Aber et al. (1989) contribute excess nitrogen in forested soils of northern temperate regions to wet and dry atmospheric nitrogen deposition from fossil fuel combustion, and state that, "Nitrogen-saturated forests may become net sources of nitrogen, rather than sinks" which could lead to "considerable nitrate leaching to streams and groundwater".

        The MPCA report, "Nitrogen in Minnesota Surface Waters (June 2013)" also recognizes atmospheric deposition as a source of nitrogen to surface waters and the contribution of nitrate to surface waters via groundwater baseflow from forest leaching. Both sources are estimated to contribute approximately 17% of the statewide annual amounts of N reaching surface waters (when excluding municipal and industrial point sources) (see Table 2, page D1-5), yet there is no mention of either source as potentially contributing nitrate to the

Straight River in the Nutrient Study report. The CMI finds this exclusion perplexing being that one of the reviewers of the nutrient report was also one of the lead authors of the June 2013 report. Therefore, CMI recommends that this oversight be acknowledged by including this source in a subsequent revision.

- Finding: *The nitrate concentration in the Straight River, especially at the US Highway 71 site, is much higher than nitrate concentrations in most other streams of the Crow Wing River/Pine River/Leech Lake River/Mississippi River - Headwaters Watersheds during the growing season.*

  1) The CMI finds this statement misleading. Most of the data sets used for the comparison analysis to conclude this finding consists of only one sample result as stated in Table 2, whereas a hundred or more samples have been collected from the Straight River. Also, no distinction is provided to whether the streams/rivers of the above watersheds in which the Straight River is being compared to are mainly surface water fed, groundwater fed or a combination of both. The most recent Straight River Groundwater Management Area Monitoring and Analysis Report (April 2024) states that "Groundwater baseflow provides 93–97% of streamflow to the Straight River, its headwaters, and its tributaries. This baseflow is likely delivered continuously along the river and its tributary…" Such an impressive groundwater contribution to the total flow of a river is undoubtedly unique within the above-mentioned watersheds, yet the MPCA fails to mention such a distinction when comparing it to the other streams/rivers.

     Furthermore, the Straight River flows through approximately 600 acres of riparian wetlands between the CR 123 and Hwy 71 crossings. Approximately 60% of the wetlands occur between CR125 and CR115, the same stretch of river where 80% of the total increase in nitrate concentrations occurs (see above). Mitch and Gosselink (2000, pg. 198) state that "In the spring, excessive runoff coupled with still cooler temperatures lead to high throughflow and less nutrient retention [in wetlands]. This generally leads to a diminished or net export of nutrients in the fall through the early spring." From a study conducted in Ohio, wetland basins were found to "retain 50% to 60% of nitrate nitrogen…in the summer but were not nearly as effective in the winter and spring" as one of the wetlands "showed signs of nitrate-nitrogen export in the spring" (Mitch and Gosselink, 2000).

     With respect to the Straight River and the consistency of the fall through spring nitrate concentrations, nitrification of ammonium nitrogen to nitrate nitrogen may be occurring in the oxidized layer in which the plants are growing and diffusing into the river via groundwater upwelling (baseflow being 93% - 97% of the flow in the river); thereby naturally increasing the concentration of nitrate in the areas that are dense in wetlands. Although a novel idea, this nitrification process, coupled with nitrate leaching from the adjacent riparian forests, may be contributing to the sharp increase in the nitrate detected between CR125 and CR115.

     Additionally, the wetlands may be a source of the increase in nitrate that occurs in early to mid-spring. For example, the results of the sampling conducted by the CMI in April show a substantial increase in nitrate compared to the previous months. Then in May, the concentration falls back to the October thru March concentration values. The samples were collected on April 25th; the last precipitation event prior to sample collection was the 16th and the streamflow decreased slightly during that 9-day period. Therefore, nitrate contributions from agricultural runoff is unlikely. However, the average temperature of the stream almost doubled between the March and April sampling events (4^{o} C to 8^{o} C, respectively). A literature search conducted by CMI board members suggests that nitrosomonas and nitrobacter bacteria in the oxidized layer of wetlands move from a dormant to active stage at

these temperatures. Perhaps the cause of the spike in late April is the release of nitrate from the oxidized layer of the wetlands due to an increase of nitrification caused by rejuvenated bacterial activity.

From this, CMI contends that the MPCA was remiss in the nutrient assessment of the river by not considering the uniqueness of the groundwater baseflow contribution and extensive acreage of riparian wetlands present prior to comparing the water quality results to rivers with different hydrologic and riparian settings.

2) The MPCA also emphasizes in the report that "…the Shell River is the only location that has anywhere near the nitrate concentrations in the upper and lower parts of the Straight River. The Shell River's sample site is on a reach that has many irrigated row crop fields nearby that are in the site's drainage area." The CMI notes that the comparison is for only one sample site along the Shell versus several sample sites along the Straight, again, indicating the biased assessment of the data. Furthermore, the CMI recognizes that portions of the Shell River are also groundwater fed, and that the sole sampling location (lower Shell River) is within an area of row-crop irrigation. Yet the nitrate concentrations from samples collected at 3 locations (similar to the MPCA sample locations) along the lower section (downstream of Twin lakes outlet) of the river as part of the current CMI study range from approximately 1 mg/l in November to less than 0.3 mg/l in June, which are well within the range of background concentration values. CMI contends that a decrease in the number of domestic septic systems along and near the river may play a role in the nitrate concentrations being less than those of the Stright River and should have been evaluated by the MPCA as part of their assessment.

3) With respect to comparing the water quality of other streams and rivers of other watersheds to that of the Straight River, the CMI recommends that the MPCA considers a quote from the author of the Nutrient Study under the news and stories link of their own website which states, *"…we need to know information about a lot of fields: hydrology, hydrogeology, water chemistry, landscape ecology, aquatic biology, and stream ecology. At times, it can feel a bit daunting because so many individual fields of study are involved. And no two streams are alike!"* The last sentence puts into perspective the importance of identifying similarities (e.g. groundwater vs surface water components of flow) and differences of rivers within and adjacent to watersheds (and riparian forests) before blaming farmers or any other sector of our state's economy for adversely impacting the water quality of a river when such blame uses data from another for simple "one-point" comparison purposes.

- Finding: *The City of Park Rapids municipal wastewater treatment ponds are located near the Straight River (Figure 11). After treatment in the ponds, the water is irrigated onto several nearby fields. These fields are outside of the surficial subwatershed boundary contributing to the river where it is sampled at US Highway 71. …and so any nitrate in the treated wastewater that enters groundwater should be contributing either to a location on the Straight River downstream of Highway 71, or to the Fishhook River.*

  1) Such a combination of statements supports CMI's perception of the bias toward irrigated agriculture in the report, and questions, why the MPCA makes a point to exclude the City of Park Rapids wastewater treatment operations from potentially having an impact (although likely small) on the water quality of the Straight River? A review of the potentiometric surface contour maps presented as Figure 15 in Stark et al., 1994 (which is provided as a reference in the Nutrient report) and Figure 3 in Ruhl, 1995 along with an approximation of the groundwater flow field reveals that any nitrate impacted groundwater that occurs beneath

the three fields closest to the treatment ponds would eventually discharge to the Straight River, upstream of the Hwy 71 crossing.

To support the statement about the groundwater flow beneath the respective fields, the author uses a "subwatershed" map that falls within of which he refers to as the Full Straight River Subwatershed (see Figure 11 of the Nutrient Report). Such maps are used to depict the flow of surface water drainage to a particular surface water body. The author failed to consider the groundwater flow/potentiometric maps of the Straight River watershed referenced above when presenting "his defense" of the wastewater treatment ponds. In addition, the northwestern section of the "full Straight River Subwatershed" as drawn in the report differs from the watershed map provided as Figure 1 in Stark et al., 1994 which is based on USGS digital data.

As a point of interest, several irrigated fields that are shown within the "full watershed" are outside of the watershed boundary presented in the Stark report. A recent review by CMI board members of the topography and drainage patterns via topographic LiDar mapping reveals that the respective Stark map is a more accurate depiction of the boundaries of the Straight River watershed. CMI recommends that the MPCA conduct a similar assessment of the watershed boundaries in the northwestern portion of the map due to the number of agricultural fields that occur within that area and were used by the agency as a basis to support their contentions about irrigated agriculture.

The above information leads to questioning the degree of accuracy of the statements centered round the Park Rapids treatment plant, in particular, that the groundwater beneath them does not contribute nitrate to the Hwy 71 crossing sampling location. The CMI requests that the MPCA provide an explanation for the inconsistencies in their argument between the location of the wastewater treatment pond related fields and the above referenced groundwater potentiometric surface/flow maps.

- Finding: *Several findings lead to a plausible conclusion that irrigated row crop agriculture, and its local intensification, have and are contributing significant amounts of nitrate to the Straight River. Two factors related to the interplay of irrigated row crop agriculture with natural hydrological pathways may be contributing to [the] impairment, those being 1) the export of the agricultural fertilizer nitrate to the river via groundwater… and 2) possible reduction of groundwater input to the river....*

    1) Because 93% - 97% of the streamflow is derived from groundwater baseflow, it is very likely that a combination of sources is the cause of the "significant" concentrations of nitrate detected in the river. Some of the potential sources, both point and non-point, that the agency failed to recognize as contributors of nitrate include:
        a) nitrate leaching from adjacent riparian forests as a result of nitrogen saturation and enhanced soil microbial dynamics,
        b) nitrate leaching from septic systems (especially pre-1990 systems) along the riverbanks, near the riverbanks and from single homes and residential developments throughout the watershed (which also likely includes lawn fertilizer as a source)
        c) diffusion of nitrate from the oxidized layer of the extensive riparian wetland acreage throughout given sections of the river,
        d) nitrate leaching from the application of municipal biosolids and domestic (septic tank) wastewater on surrounding farm fields,
        e) nitrate leaching from animal waste below feedlots and manure applied fields, and associated runoff that occur during intense storm events,
        f) nitrate leaching from former/defunct fertilizer storage areas,

g) transport of "legacy" waste from unknown or "defunct" straight-pipe domestic sewage disposal connections to the river,
h) animal waste inputs from wildlife such as beavers, ducks, geese and deer,
i) nitrate leaching from soil organic matter.

Of particular interest to the latter, Ruhl (1995) found that nitrate from soil organic matter rather than from animal waste appeared to have been present in the groundwater beneath a feedlot and adjacent manured field within the Straight River watershed. Also, Ruhl (1996) references a study on the water quality of the Anoka sand plain aquifer by Anderson (1993) in which he states that "nitrate-nitrogen concentrations less than or equal to 3 mg/L are generally considered to be natural background levels attributable to soil organic nitrogen."

Of further note, the CMI recognizes that decades ago, nutrients were applied to row crop fields at much different rates and timing during the growing season than they are today; therefore, "legacy" nitrate impacted groundwater from past leaching is most likely still moving to the river due to the relatively low velocity of the groundwater (150 ft/year) and the distance from the river that most of the farm fields occur. Also, CMI recognizes that some nitrate from current nutrient applications may be leaching beyond the root zone, but to a much lesser degree, because of the widespread implementation of irrigation and nutrient management BMPs. However, as technology advances with respect to irrigation and nutrient application management, soil moisture sensors, in-field plant health and crop ET detectors, and real-time in-field weather monitoring of temperature, precipitation, wind, humidity, and solar radiation to "name a few", nitrate leaching below the crop root zone will continue to diminish. It is apparent that the MPCA failed to recognize the measures and technological advances that farmers have been implementing, and will continue to implement, to reduce nitrate leaching below their fields.

When considering the potential sources listed above, a question that stems from the accompanying information is, "How much and at what percentage is each of these sources contributing to the nitrate concentrations detected at each of the sampling locations in the river?" The CMI believes it is a question that the author and the MPCA should have asked themselves, followed by employing the science and in-field research necessary to answer the questions. Furthermore, CMI requests that the MPCA rewrite the Nutrient Study report to include these potential sources, as well as include a detailed discussion on the difficulty of defining and determining the magnitude of contribution from each of them.

2) With respect to the statement about the impairment of the river due partly to the *possible reduction of groundwater input to the river* from irrigated agriculture, the DNR concluded in the previously mentioned Straight River Groundwater Management Area report (April 2024) that, "The 5-year average summer streamflow shows that there does not appear to be a strong signal of decreased total summer streamflow in the Straight River GWMA despite large increases in annual water use in the area. This system is currently resilient enough to recover from these concentrated impacts. The summer streamflow measured at the outlet of the SRGWMA, where the accumulation of impacts should be most apparent, is not showing a decline in annual or summer seasonal discharge." The CMI recommends that the MPCA review this report and reconsider the respective reduction in groundwater input statement in a subsequent revision to the Nutrient Study.

References Cited

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Central Minnesota Irrigators