NUTRIENT ASSESSMENT REDUCTION PLAN

November 2024

COPPER SLOUGH

URBANA AND CHAMPAIGN SANITARY DISTRICT

SOUTHWEST WASTEWATER TREATMENT PLANT

NPDES Permit No. IL0031526

PREPARED BY: NORTHWATER CONSULTING AND DONOHUE & ASSOCIATES

PREPARED FOR: URBANA AND CHAMPAIGN SANITARY DISTRICT

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Cover page: Copper Slough looking upstream at site SWP-U

LIST OF ACROYNMS

CFS	Cubic Feet Per Second
CWA	Clean Water Act
DAF	Design Average Flow
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
ECHO	Enforcement and Compliance History Online
FOIA	Freedom of Information Act
HUC	Hydrologic Unit Code
INLRS	Illinois Nutrient Loss Reduction Strategy
KWA	Kaskaskia Watershed Association
MGD	Million Gallons per Day
NARP	Nutrient Assessment Reduction Plan
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NPS	Nonpoint Source
NWS	National Weather Service
NH_3	Ammonia
NO_3^-	Nitrate
NPDES	National Pollution Discharge Elimination System
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWCD	Soil and Water Conservation District
SWP	UCSD Southwest Plant
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
UCSD	Urbana and Champaign Sanitary District
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Urbana and Champaign Sanitary District (UCSD) Southwest Wastewater Treatment Plant (SWP) has a design average flow of 7.98 million gallons per day (MGD) and discharges treated effluent to Copper Slough, part of the Kaskaskia River watershed. The plant is subject to a Nutrient Assessment and Reduction Plan (NARP) Special Condition in its National Pollutant Discharge Elimination System (NPDES) permit. The NARP was triggered by historical Illinois EPA data indicating a risk of eutrophication downstream on Copper Slough and on the Kaskaskia River. The UCSD undertook a water quality monitoring program on Copper Slough with continuous sensors and grab samples for six months during 2023 to better understand risk of eutrophication conditions relevant to NARP requirements.

Stream Impairment and Risk of Eutrophication Status:

- Copper Slough (IL_OZYA) and the Kaskaskia River upstream of Copper Slough (IL_O-70) have supported all designated uses for which they were assessed since at least 2012, the oldest 303(d) list examined.
- The next downstream Kaskaskia River segment (IL_O-35) has been on each 303(d) list as impaired for aquatic life with causes of DO and pH since 2016; however, the 2018 Upper Kaskaskia and Lake Fork watershed Total Maximum Daily Load (TMDL) recommended delisting of the upper Kaskaskia based on additional data showing there is no DO or pH impairment.
- Illinois EPA data indicates risk of eutrophication on Copper Slough, the Kaskaskia River upstream of Copper Slough and the Kaskaskia River downstream of Copper Slough.

The addition of treated effluent reduces the occurrence of low DO conditions downstream on Copper Slough. Based on the monitoring data and the frequency of elevated pH and DO in waters upstream from the outfall that do not contain effluent, the risk of eutrophication would be present on Copper Slough and the Kaskaskia River even without the plant discharge.

Monitoring results exceed risk of eutrophication thresholds 57% of days upstream and 23% of days downstream. The wastewater treatment plant (WWTP) does contribute a minor phosphorus load to the stream; however, data shows that risk of eutrophication and low dissolved oxygen (DO) conditions are worse and more frequent upstream of the WWTP than downstream. Nutrient loading from nonpoint sources (NPS) and stream habitat conditions are the dominant contributors to water quality for these segments.

The WWTP currently outperforms a 0.5 mg/L total phosphorus (TP) effluent limit, with typical concentrations well below that level, averaging 0.32 mg/L during the monitoring period. The plant is currently being upgraded at a cost of over $32,000,000 which will result in improved reliability and operational efficiency. The capital improvements project will also increase the average day design flow from 7.98 to 9.2 MGD. The UCSD also supports NPS nutrient reductions through participation in a local watershed group.

Summary of Monitoring Program Results:

- Continuous monitoring and grab sampling occurred from May - October 2023.
- Monitoring took place at one site upstream of the WWTP outfall (SWP-U), and one site downstream (SWP-D).

- Continuous monitoring identified DO below the instantaneous water quality standard 41% of monitored days upstream and 21% downstream of the plant.
- Continuous monitoring identified significant risk of eutrophication upstream of the plant (57% of monitored days), and to a lesser extent downstream (23% of days).
- The addition of treated effluent improves DO conditions downstream.

Watershed Conditions and Phosphorus Loads:

- The watershed consists primarily of agricultural and urban land uses and is comprised of three twelve-digit Hydrologic Unit Code (HUC-12) subwatersheds.
- Plant effluent monitoring and NPS modeling indicates the current annual loading of phosphorus to the watershed is approximately 40,008 lbs/yr.
    - The WWTP contributes 5,632 lbs/yr (14% of Total).
    - Nonpoint sources contribute 34,376 lbs/yr (86% of Total).
- Copper Slough and the Kaskaskia River are highly channelized throughout their length with poor riparian buffer and canopy cover, exacerbating the effects of phosphorus loads.

NARP Actions:

- Upgrades currently in progress will increase operational efficiency and allow the plant to continue to outperform the TP effluent limit of 0.5 mg/L, with typical concentrations substantially below that level.
- The UCSD will continue to actively participate in local stakeholder groups, including the neighboring Salt Fork Watershed Group, which has been engaged for this NARP. The UCSD will also continue to participate with the Kaskaskia Watershed Association (KWA).
- The UCSD will continue to participate in stream restoration and stabilization efforts as part of its capital improvements program and will support and advocate for restoration in partnership with local and regional agencies and organizations.
- UCSD will continue to periodically monitor Copper Slough to observe impacts of management activities and plant upgrades.

Stakeholder Engagement:

- The Salt Fork Watershed Group, which includes entities from across Champaign County, is the primary stakeholder participation group for the SWP NARP. The UCSD staff and consultants presented and requested feedback and discussion at multiple meetings. Below are highlights, with a full list of meetings in Appendix D.
    - 2020 September 03 - Discussed NARP elements and its potential implementation. Formally requested the Salt Fork watershed group to be partners/stakeholders in NARP development.
    - 06 June 2022 – Presented general background on NARP requirements, the proposed SWP monitoring plan and requested feedback and discussion.
    - 07 March 2024 – Presented monitoring results. Shared preliminary conclusions, NARP strategy and actions. Requested feedback and discussion on results and activities toward NARP compliance.
    - 05 December 2024 – Present final NARP report to Salt Fork Watershed Group at quarterly meeting.

- The UCSD presented the NARP and requested feedback at a meeting of the KWA. This group is typically more active in the downstream reaches of the watershed, but it does cover Kaskaskia headwaters including Copper Slough.
    - 04 September 2024 - Draft NARP was presented at the regular meeting of the KWA. Feedback was solicited and discussion took place.
    - December 2024 – Final NARP report will be shared with KWA members for their comment.
- Staff and consultants of the UCSD have presented at the monthly UCSD Board of Trustees public meetings on numerous occasions. Highlights include:
    - 03 January 2023 – Presented monitoring plan for the SWP.
    - 05 March 2024 – Presented results of 2023 monitoring program. Discussed implications of results and presented preliminary strategy toward NARP compliance activities.
    - 07 November 2024 – Present final NARP report to Board of Trustees at public meeting.
- The UCSD regularly updates a NARP section on its public website, www.u-csd.com/207/UCSD-Projects

Site SWP-D looking downstream. 1 May 2023.

1. INTRODUCTION & BACKGROUND

In 2018, the Illinois EPA instituted nutrient reduction permit requirements applicable to WWTPs with effluent discharges greater than 1-million gallons per day (MGD). The nutrient reduction approach for WWTPs supports a pathway to establish site-specific permit limits for phosphorus at each facility that requires them, in lieu of instituting a statewide limit. The NARP requirement resulted from negotiations with environmental organizations, Illinois EPA, and the Illinois Association of Wastewater Agencies. A copy of the current NPDES Permit for the SWP is included in Appendix C.

A NARP Special Permit Condition is now included in a NPDES permit if a receiving stream segment or downstream segment is on the Illinois Clean Water Act (CWA) 303(d) list as impaired with phosphorus-related causes or if there is a "risk of eutrophication" as defined by meeting any of the three conditions outlined in Table 1. The NARP requirement is in the SWP NPDES Permit due to the risk of eutrophication criterion.

Table 1 - Illinois EPA Risk of Eutrophication Criteria

Risk of Eutrophication if any of these Conditions Met:		
pH	**Median Sestonic Chlorophyll α**	**On any Two Days During Illinois EPA Monitoring Week, Daily Max**
> 9	> 26 µg/L	pH > 8.35 and DO saturation > 110%

Whether the NARP special permit condition is triggered by a CWA 303(d) impairment listing, or eutrophication risk criteria, the designation is based on limited data. For example, the risk of eutrophication justification for sites is based on only two non-consecutive weeks of continuous DO and pH data collection performed by the Illinois EPA. In some cases, the data is over 10 years old.

For sites where actual impairment has not been found, the NPDES permittee should undertake additional data collection and assessment, which can confirm or refute the NARP triggering conditions, or determine if the watershed does have a phosphorus-related impairment. If sufficient evidence indicates no impairment or risk of eutrophication, it is possible that phosphorus regulation and mitigation measures may not be necessary. The following actions have been proposed to comply with the NARP permit condition:

- Examine if sufficient data exists to fully characterize a phosphorus-related impairment or assess risk of a future impairment in the receiving watershed.
    - If data is insufficient, create a water quality monitoring plan and collect data.
- If existing or new data indicates phosphorous-related impairment is present, potential steps include:
    - Undertake watershed characterization.
    - Model watershed and instream processes.
    - Establish defensible site-specific water quality criteria.
    - Define scenarios and strategies to achieve water quality targets.
    - Implement NARP recommended actions and engage stakeholders.

This report constitutes the NARP for the UCSD SWP and provides details of the monitoring program implemented to support it. Section 2 provides an overview of the NARP's water quality triggers. Section 3 describes the monitoring program, methods, and results with interpretation. Section 4 presents the NARP and Work Plan following a watershed characterization.

1.1 TREATMENT PLANT BACKGROUND

The UCSD owns and operates the SWP with a design average flow (DAF) of 7.98 MGD located in the City of Champaign, in Champaign County (NPDES Permit No. IL0031526). The WWTP was constructed in 1968 with expansions in the early 1980s and again in 2005. It serves a population equivalent to approximately 58,000. Treatment consists of screening, grit removal, excess flow treatment, activated sludge including enhanced biological phosphorous removal using the anaerobic/oxic process, secondary clarifiers, cloth disk filtration, gravity belt thickening, sludge storage tank and sludge hauling for final treatment and disposal. The plant discharges to Copper Slough, a tributary of the upper Kaskaskia River, and is characterized as a small urban creek upstream of SWP or an agricultural drainage ditch downstream. Streamflow is characterized by seven-day once in ten-year low flow (7Q10) of 0 cubic feet per second (CFS). The plant is subject to a NARP special permit condition with a revised deadline of December 31, 2024.

2. NARP TRIGGERS & ACTIONS

According to the 2020 NPDES permit renewal and amended in 2023, the NARP special condition was triggered by historical data indicating a risk of eutrophication. An Illinois Freedom of Information Act (FOIA) request revealed the triggers to be one site on Copper Slough and four sites on the Kaskaskia River (Figure 1) that exhibited DO and pH above the risk of eutrophication threshold. One of the Kaskaskia sites is upstream from the confluence with Copper Slough and not influenced by WWTP effluent. The other three are more than 15 miles downstream and capture a much larger watershed and associated agricultural and urban NPS pollution. Data supporting the risk of eutrophication designation that triggered the NARP was limited and considered inadequate to fully understand the extent and magnitude of the risk, as there was no monitoring upstream of the WWTP outfall on Copper Slough (Table 2, Figure 2). The NARP-triggering data, primarily from 2012 which experienced the most severe drought in recent history, is not conclusive in showing that the plant is the primary contributor to the threshold exceedances

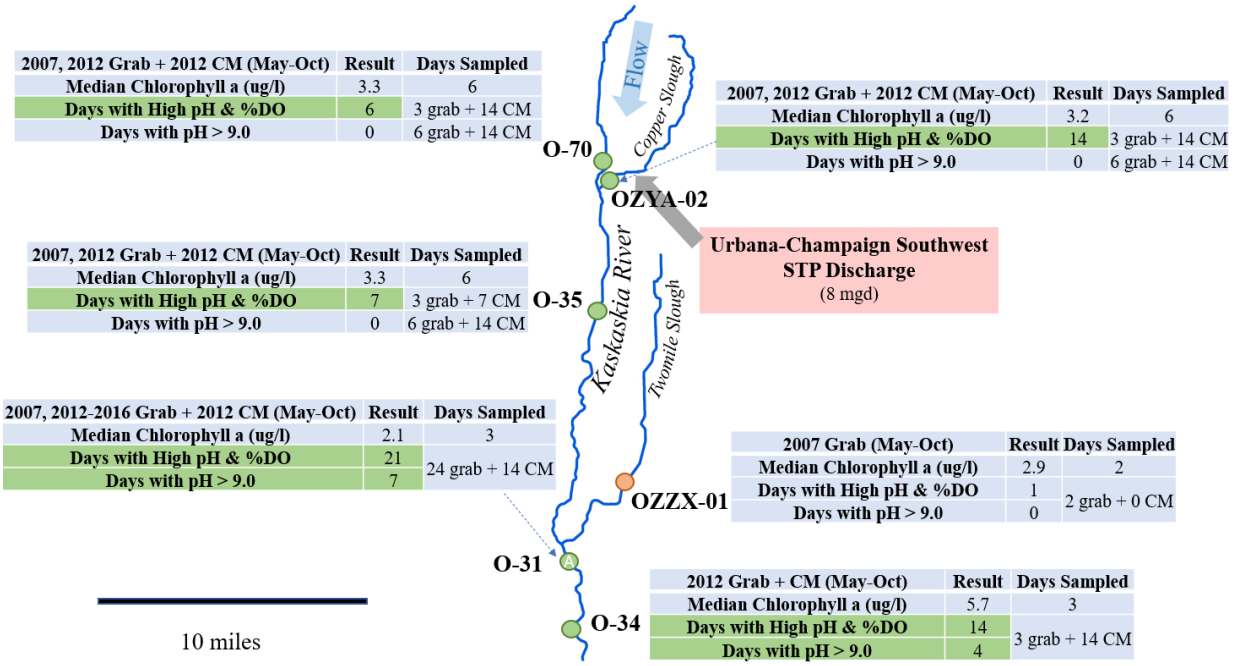

Figure 1 - Map Produced by Illinois EPA Illustrating NARP-triggering Risk of Eutrophication Data

Table 2 – Illinois EPA Risk of Eutrophication Trigger Data

Site	Description	Continuous Monitoring Duration	Continuous Monitoring Days Exceeding DO & pH Threshold	Continuous Monitoring Days Exceeding 9.0 pH Standard	Sestonic Chlorophyll α Samples	Sestonic Chlorophyll α Median
O-70	Kaskaskia River above Copper Slough	2 weeks in 2012	6 days in 2012	0	3 in 2007 3 in 2012	3.32
OZYA-02	Copper Slough Downstream from WWTP	2 weeks in 2012	13 days in 2012	0	3 in 2007 3 in 2012	3.25
O-35	Kaskaskia River Downstream from Copper Slough	1 week in 2012	7 days in 2012	0	3 in 2007 3 in 2012	3.32
O-31	Kaskaskia River Downstream of Twomile Slough	2 weeks in 2012	14 days in 2012	6	3 in 2007	2.1
O-34	Kaskaskia River at Champaign County Line	2 weeks in 2012	13 days in 2012	4	3 in 2007	5.66

Data mining was undertaken to compile any other informative and relevant nutrient, DO, pH or chlorophyll data beyond that in the Illinois EPA FOIA response. Nothing additional of relevance was found. With only limited data available, a water quality monitoring plan was created (Appendix A) and executed to further evaluate the risk of eutrophication and guide the NARP process.

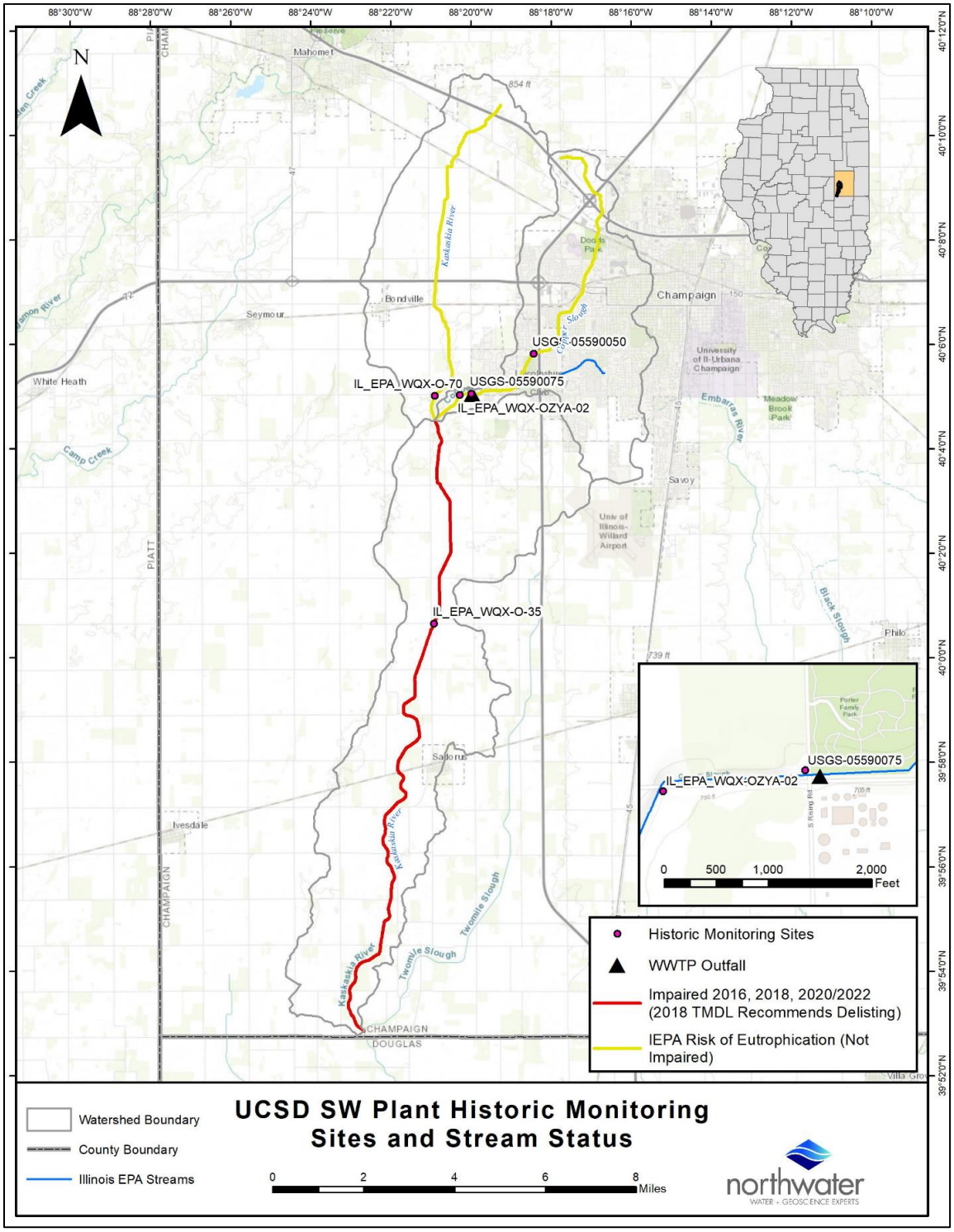

Figure 2 - Historic Monitoring Site Locations, Stream Segments with Nutrient-Related Impairments and Risk of Eutrophication Segments

3. WATER QUALITY MONITORING PROGRAM & RESULTS

Based on the monitoring plan, the program was carried out with three main objectives:

1. Confirm or contest if there is significant ongoing risk of eutrophication that could lead to Illinois EPA determining there is a phosphorus-related impairment on Copper Slough associated with the WWTP's discharge.
2. Improve understanding of nutrient dynamics and water quality to inform next steps of the NARP including potential for establishment of site-specific phosphorus limits and/or phosphorus input reductions.
3. Provide data to guide equitable implementation of nutrient reduction measures among contributors if the NARP determines such reductions are necessary to protect water quality and eliminate the risk of eutrophication conditions that could lead to Illinois EPA determining there was a phosphorus-related impairment.

The UCSD retained Donohue and Associates and Northwater Consulting to develop the monitoring plan and support implementation of the monitoring program. The NARP and Work Plan presented in Sections 4.2 and 4.3 are guided by the monitoring results and are the foundation of next steps in the NARP process.

3.1 NARP MONITORING STATIONS & INFRASTRUCTURE

Upstream of the outfall, Copper Slough is a small stream with a watershed that is predominantly medium-density urban. Throughout its length, it is a highly channelized open drainageway with minimal riparian buffers and very little canopy cover and littoral vegetation. The upper Kaskaskia River is similarly channelized and lacking littoral vegetation and canopy cover.

The monitoring program was designed in an upstream/downstream configuration. The upstream site was established close to the outfall to capture the influence of as much of the watershed as possible before the addition of treated effluent. The downstream site was located far enough downstream to ensure that the immediate impacts to Copper Slough from treated effluent were captured in the monitoring, while minimizing the amount of additional downstream watershed influence (Figure 3).

Data collection began May 2023 and continued through the end of October 2023. (Table 3).

Table 3 – NARP Monitoring Stations

Station ID	Name	Lat, Long (decimal degrees)	Approximate Distance from Outfall (mi)	Watershed area (mi^2)	Type of Sampling	Monitoring Periods
SWP-U	Copper Slough Upstream	40.085482, -88.332208	0.5 (upstream)	15.1	Continuous, Biweekly Grab	May - October 2023
SWP-D	Copper Slough Downstream	40.084077, -88.33800	0.4 (downstream)	15.3	Continuous, Biweekly Grab	May - October 2023

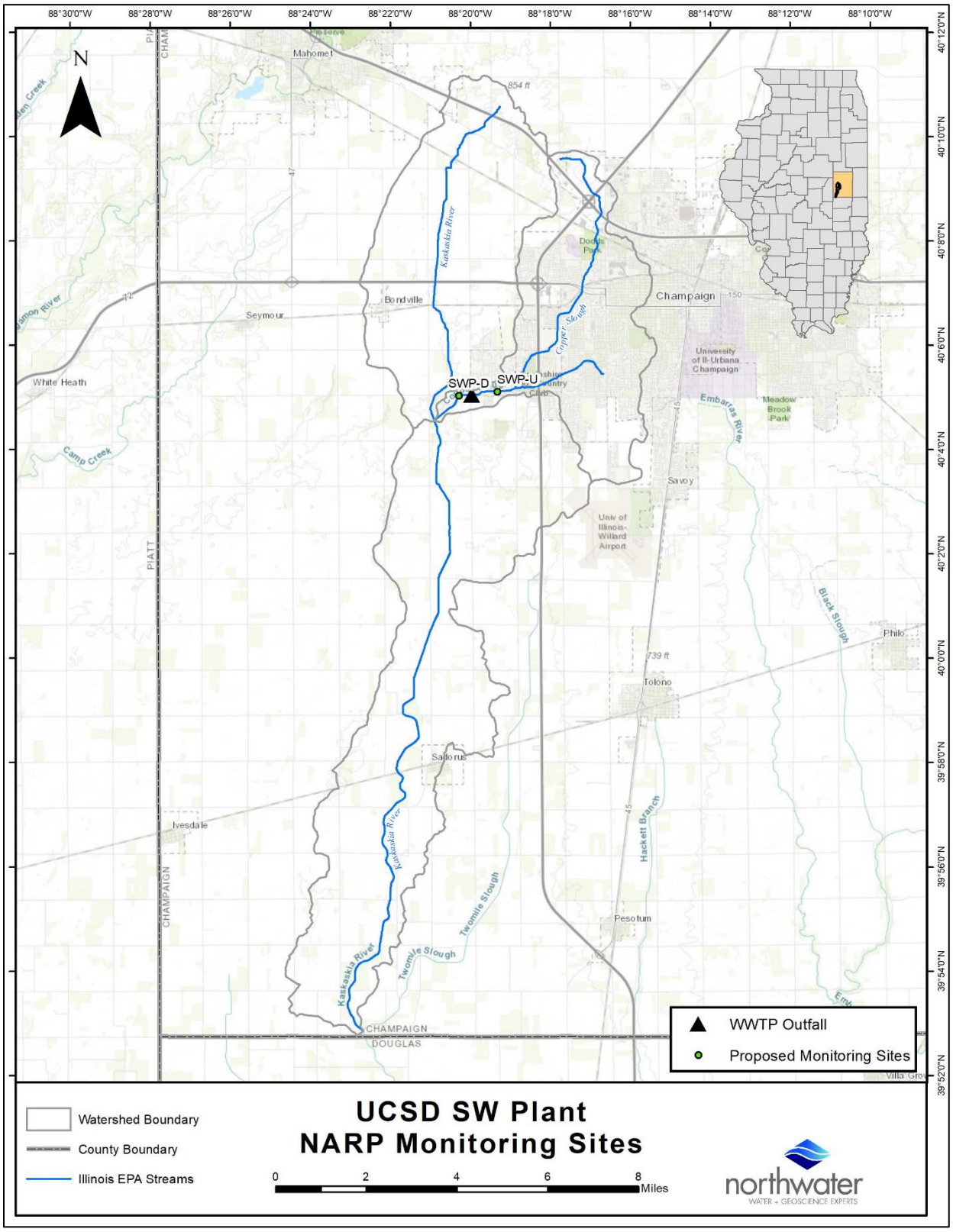

Figure 3 - NARP Monitoring Locations

3.2 MONITORING PERIOD & METHODS

Sampling parameters were selected to be directly responsive to the NARP triggering criteria, with a combination of continuous monitoring, spot checks with handheld meters, and grab samples submitted for lab analysis. Table 4 summarizes all parameters and other details including methods and sampling frequency. Continuous data collection stations utilized previously established permanent infrastructure to facilitate use of water quality sondes. Sondes were placed in 4" perforated PVC pipes that extended from the bank as close as practical to the channel thalweg. The sondes were positioned so that they were in flowing water and not influenced by stagnant or non-flowing backwater conditions.

Continuous Monitoring

- YSI EXO2 multiparameter continuous monitoring sondes with anti-fouling wiper, internal logging, and battery deployed at both stations.
    - Bi-weekly site visits to download data, calibrate and maintain the sensors and infrastructure. All instrument calibrations and maintenance followed manufacturer's recommended practices and calibration logs were saved.
- The sondes were equipped with pH, DO, temperature, conductivity, and chlorophyll α optical fluorescence sensors.
- A vented level logging pressure transducer (In-Situ LevelTroll) was used to record water height/stage.
- Data collection frequency was 15-minutes to enable the capture of daily maxima and minima of parameters such as pH and DO saturation and concentration, which is relevant to Illinois EPA eutrophication risk criteria.
- Chlorophyll α optical fluorescence data was collected to better understand its occurrence and variability through the monitoring period as it is a eutrophication risk criterion (a median of 26 µg/L is the NARP threshold). The sensor data is considered a qualitative measurement and not reliable to make conclusive determinations of NARP triggers.

Spot Checks and Field Water Quality Data

- Water quality spot checks were performed bi-weekly for DO, pH, temperature, conductivity, and turbidity using calibrated handheld water meters (YSI ProQuatro and YSI ProDSS).
- Flow was measured bi-weekly at all sites using a measuring tape, top set wading rod and electromagnetic flowmeter. The United States Geological Survey (USGS) midsection method was applied to measure flows using a Hach FH-950 electromagnetic velocity meter.
- The USGS also operates a stream gage that measures discharge on Copper Slough upstream from the outfall.
- Spot checks, flow measurement, and instrument calibration were performed by Northwater Consulting.

Laboratory Analysis

- Nutrient grab samples were collected by WWTP staff on a bi-weekly schedule at all stations.
- Parameters included TP, orthophosphate, chlorophyll α, total nitrogen (TN), ammonia (NH_3) and nitrate (NO_3^-) (Table 4).

  - Nitrogen analysis supports an improved understanding of in-steam chemistry processes and may be used for future analysis.
- Laboratory analysis for nutrients was performed by WWTP staff in-house. Chlorophyll α was sent to an accredited contract laboratory (Pace Analytics, Peoria, IL) for analysis.

WWTP Effluent

Effluent data is collected as part of the Illinois EPA-required Discharge Monitoring Report (DMR). Parameters relevant to the NARP study include daily discharge and TP which is monitored twice weekly.

- The average effluent flow during the May-October 2023 monitoring period was 4.76 MGD.
- The average TP concentration in twice-weekly effluent samples during the monitoring period was 0.32 mg/L.

Table 4 - Water Quality Monitoring Parameters and Methods

Parameter	Collection Type	Frequency	Method	Method Identifier	Sonde Calibration Method
Dissolved Oxygen (saturation and concentration)	Continuous Probe	Continuous	Optical	YSI: ASTM D888-09	100% Air Saturation
	Handheld Meter	Weekly	Membrane Electrode	SM 4500-O G	-
pH	Continuous Probe	Continuous	Potentiometric	EPA 150.2	2 Point 7 & 10 pH
	Handheld Meter	Weekly	Potentiometric	SM 4500 H^+ B	-
Water Temperature	Continuous Probe	Continuous	Thermistor	EPA 170.1	Factory Calibration
	Handheld Meter	Weekly	Thermistor	SM 2550	-
Chlorophyll-α	Grab	Weekly	Lab Spectrophotometric	SM 10200H	-
Total Phosphorus	Grab	Weekly	Colorimetry	SM 4500 P E	-
Orthophosphate	Grab	Weekly	Colorimetry	SM 4500 P E	-
Ammonia	Grab	Weekly	Ion Selective Electrode	SM 4500 NH_3 D	-
Nitrate	Grab	Weekly	Colorimetry	HACH 10206	-
Total Nitrogen	Calculated	-	-	-	-
Conductivity	Continuous Probe	Continuous	Resistor Network	EPA 120.1	1 Point 1,413 µS/cm
	Handheld Probe	Weekly	Resistor Network	SM 2510	-

3.3 MONITORING RESULTS

This section presents results of the monitoring program and is organized based on site and relevant parameters. The observations of flow/precipitation and chlorophyll apply to both sites. Next, data and observations specific to the upstream sampling location are presented, followed by data and observations specific to the downstream sampling location.

STREAMFLOW & PRECIPITATION

Figure 4 presents a summary of the flow data at the USGS station on Copper Slough during the monitoring period compared to the 2005-2023 monthly average. Nearly every month was below the long-term average, with May, June and July being particularly dry at 63%, 89% and 57% less than normal, respectively. Across the entire study, the hydrology and river flow were more significantly driven by WWTP effluent than is typical. These conditions likely had an impact on water quality, though flow was observed during every site visit and on the USGS discharge gauge.

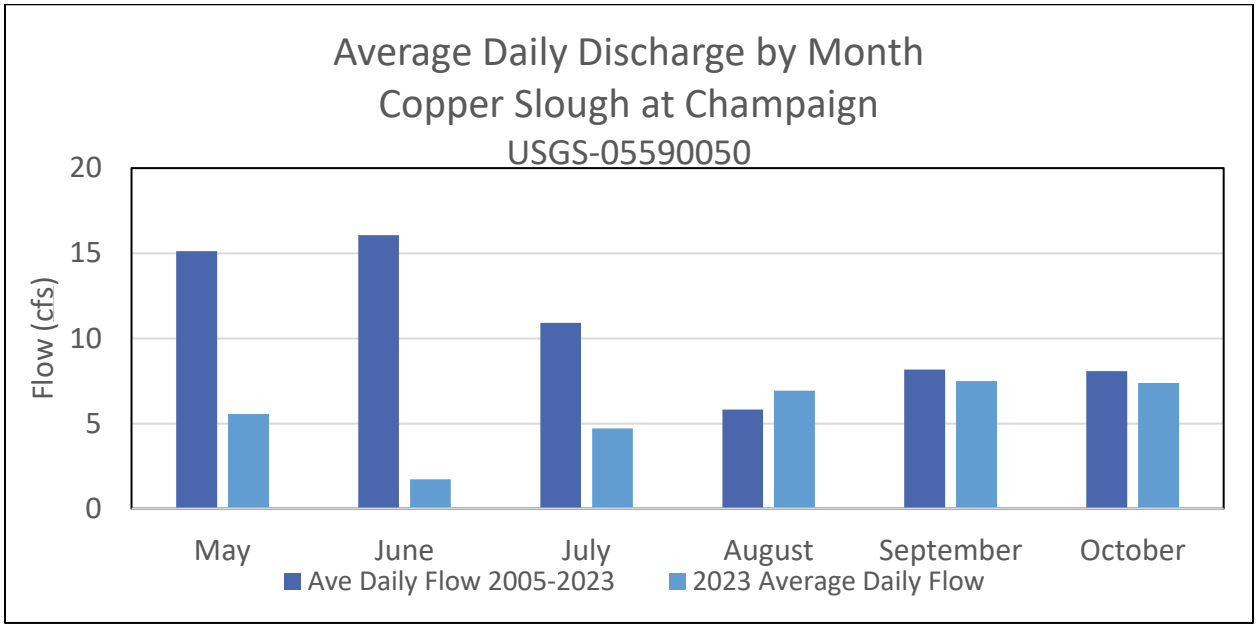

Figure 4 - Monthly Average Discharge at USGS-05590050, Copper Slough at Champaign

SESTONIC CHLOROPHYLL A

Boxplots of chlorophyll α results are shown in Figure 5 and were typically low throughout the monitoring period at all sites (n=14). They are typically far below the median 26 µg/L risk of eutrophication threshold.

- Results are similar at both the upstream and downstream sites.
- Laboratory results are low with medians well below risk of eutrophication thresholds. This is expected in small to mid-size streams with perennial baseflow conditions and indicates that sestonic algae concentrations are not symptomatic of a phosphorus impairment or risk of eutrophication in Copper Slough.
- Despite low sestonic chlorophyll concentrations, benthic algae, or periphyton was observed at both sites, but plentiful upstream.

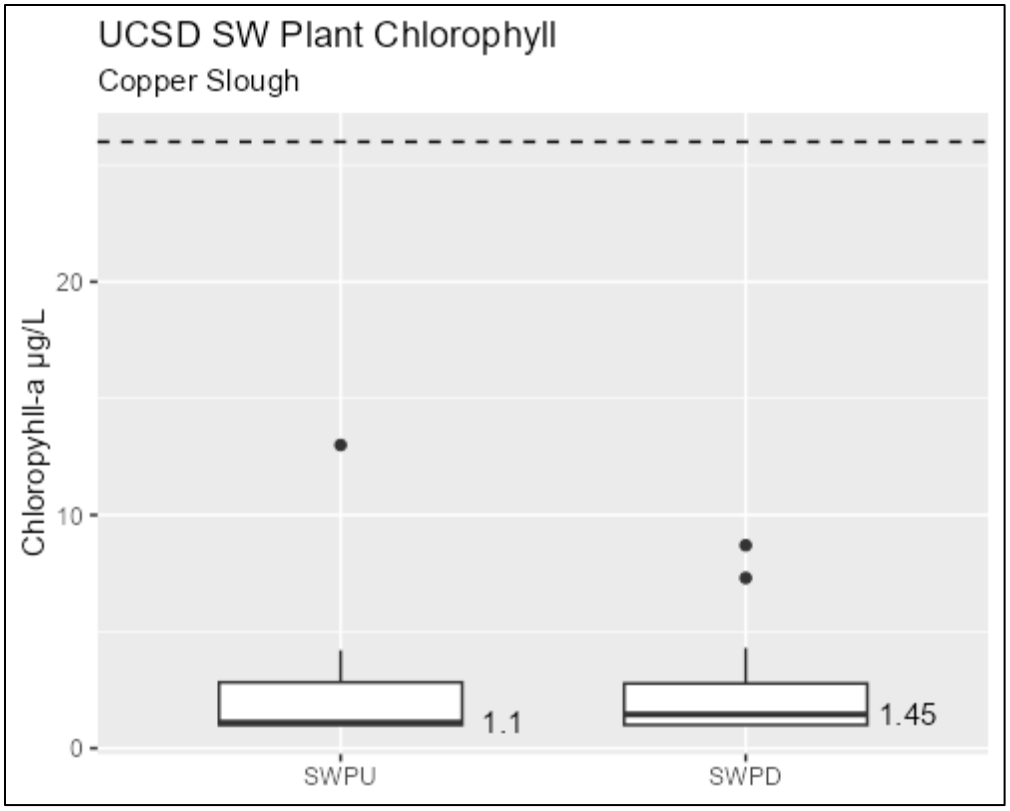

Figure 5 - Chlorophyll α Results (presented as box plots with sample medians annotated)

Abundant periphyton observed at Copper Slough Upstream (SWP-U). 31 May 2023

COPPER SLOUGH UPSTREAM (SWP-U) – DO, pH, PHOSPHORUS

SWP-U Key Takeaways:

- This station is upstream and outside of influence from WWTP effluent.
- There were 121 days with DO + pH continuous monitoring in 2023.
- Eutrophication risk conditions were observed based on the DO + pH criteria.
    - 69 of 121 days, or 57%
- Eutrophication risk conditions were not observed based on the pH > 9 criteria, nor the sestonic chlorophyll α criteria of median >26 µg/L.
- Dissolved oxygen concentration was recorded below the March - July 5.0 mg/L instantaneous water quality standard on 56 of 77 days monitored. It was below the August - February 3.5 mg/L standard on 9 of 82 days monitored, for a combined 41% below the standard.
- Total phosphorus concentrations increased in samples collected during high flow events.
- The risk of eutrophication data and DO concentration indicates there are nutrient issues in Copper Slough upstream of the outfall, and that NPS are a contributor of nutrient loads.

Copper Slough upstream of the plant was monitored with in-situ sensors from May-October 2023. There were 159 days with continuous DO data, and 122 days with continuous pH due to a sensor malfunction. Grab samples for TP (n=14), chlorophyll α (n=14) and other laboratory parameters were collected approximately every two weeks. Phosphorus grab sample results and continuous monitoring of DO saturation, DO concentration, pH and flow are illustrated in Figure 6. In 122 days monitored in 2023, the stream exceeded the DO >110% + pH >8.35 risk of eutrophication criteria on 72 days or 59% (Table 5). During the equipment outage, four pH grab samples were collected, with one exceeding the DO + pH risk of eutrophication threshold.

In addition to the risk of eutrophication exceedances, there is evidence of nutrient enrichment prior to the discharge of treated effluent. Continuous monitoring showed that the DO frequently fell below the instantaneous water quality standard. Dissolved oxygen fell below the standard of 5.0 mg/L from March through July on 56 of 77 days monitored, and below the standard of 3.0 mg/L from August through February on 9 of 82 days. The lowest concentration measured was 0.62 mg/L on 2 June 2023, during a small precipitation runoff event.

Table 5 - Copper Slough Upstream Risk of Eutrophication Summary

Days with Continuous Monitoring	Median Daily Maximum	# of Days (%) Exceeding the Risk of Eutrophication Criteria (8.35 pH + 110% DO)	# Days (%) Exceeding the Minimum DO Water Quality Standard (5.0 Mar-July; 3.5 Aug-Feb)
159 (DO) 121 (pH)	174% (DO Saturation) 8.4 (pH)	69 (57%)	65 (41%)

As expected in a small stream with consistent baseflow, sestonic chlorophyll α levels are low relative to the median 26 µg/L threshold (Figure 5), with a median concentration (n=14) of 1.1 µg/L and a maximum of 13 µg/L. However, abundant periphyton was observed at the site throughout the monitoring period, which is a more reliable indicator of nutrient enrichment in a stream of this size.

There is phosphorus available in the stream (Figure 6) from NPS, with a maximum concentration of 0.22 mg/L (n=14) and median of 0.06 mg/L. Phosphorus in samples collected during high discharge events is elevated, indicating that most the load is delivered during runoff events. During high flow, the diel DO and pH ranges are immediately reduced, then gradually return to a higher amplitude over a series of days. This is an indication that NPS nutrient loads are occurring during storms, and algal biomass and respiration is increasing with time due to additional nutrients.

Nitrogen data (n=14) was collected for future use and to better understand stream water quality dynamics. Median ammonia-nitrogen was 0.08 mg/L, median nitrate-nitrogen was 0.5 mg/L, and median total Kjeldahl nitrogen (TKN) was 1.0 mg/L.

Site SWP-U during normal flow conditions

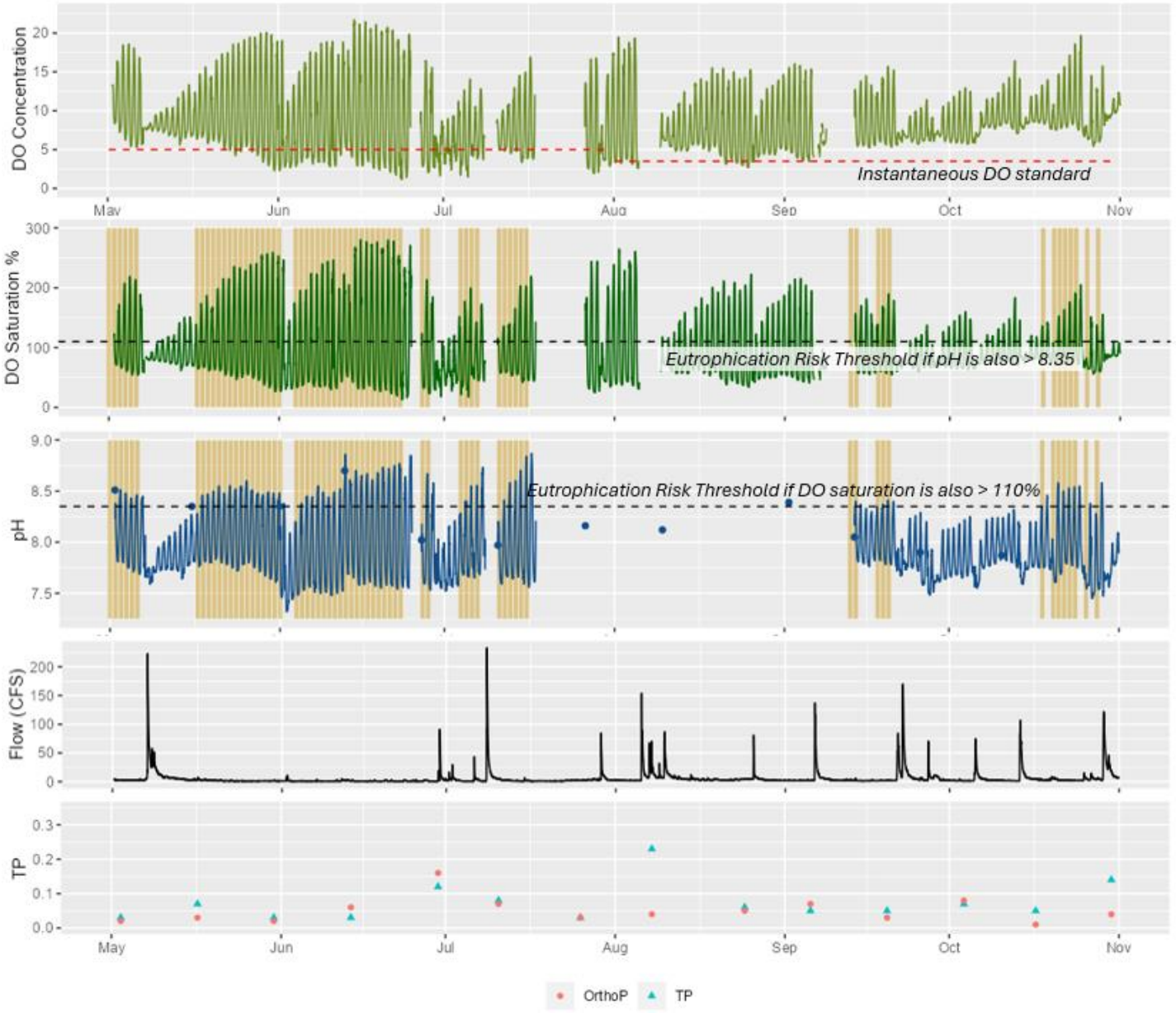

Figure 6 - SWP-U Grab Samples and Continuous Monitoring Results - gold bars indicate days that exceed risk of eutrophication threshold

COPPER SLOUGH DOWNSTREAM (SWP-D) – DO, pH, PHOSPHORUS

SWP-D Key Takeaways:

- This station is 0.4 miles downstream of the outfall.
- There were 163 days of continuous DO + pH monitoring in 2023.
- Eutrophication risk conditions were observed based on the, DO + pH criteria.
    - 38 of 163 days (23%).
- Eutrophication risk conditions were not observed based on the pH > 9 criteria, nor the sestonic chlorophyll α criteria of median >26 µg/L.
- Dissolved oxygen concentration was recorded below the March - July 5.0 mg/L instantaneous standard on 33 of 83 days monitored and below the August - February 3.5 mg/L standard on 1 of 80 days monitored (combined 21% of days).
- Data indicates that the addition of treated effluent to the stream improves DO.
    - Frequency of low DO conditions is reduced at this site.
    - Risk of eutrophication DO + pH threshold exceedances are reduced compared to upstream.

Copper Slough 0.4 miles downstream of the outfall was monitored with in-situ sensors from May - October 2023. There were 163 days with continuous DO and pH data. Grab samples for TP (n=14) and chlorophyll α (n=14) were collected approximately every two weeks. Phosphorus grab sample results and continuous monitoring of DO saturation, pH and flow are illustrated in Figure 7. In 163 days of monitoring in 2023, the stream experienced 38 days (23%) where the maximum DO and pH exceeded the DO >110% + pH >8.35 risk of eutrophication criteria. The instantaneous low DO standard was violated at this site on 33 of 163 days of monitoring, or 21% (Table 6).

Table 6 - Copper Slough Downstream Risk of Eutrophication Summary

Days with Continuous Monitoring	Median Daily Maximum	# of Days (%) Exceeding the Risk of Eutrophication Criteria (8.35 pH + 110% DO)	# Days (%) Exceeding the Minimum DO Water Quality Standard (5.0 Mar-July; 3.5 Aug-Feb)
163	141% (DO Saturation) 8.2 (pH)	38 (23%)	34 (21%)

As expected in a small stream with consistent baseflow, sestonic chlorophyll α levels are low relative to the median 26 µg/L threshold (Figure 5), with a median concentration (n=14) of 1.5 µg/L and a maximum of 8.7 µg/L. Periphyton was observed to be much less abundant at this site as compared to upstream.

There is phosphorus available in the stream (Figure 7) from NPS and WWTP effluent, with a maximum concentration of 0.32 mg/L (n=14), and a median of 0.19 mg/L. Based on the small number of storm events captured by grab samples, a systematic relationship between TP concentrations and flow conditions is not discernable at this site, with some high flow events showing elevated TP and some showing depressed concentrations.

Nitrogen data was collected (n=14) to aid in understanding water quality dynamics and for future use. Median ammonia-nitrogen was 0.07 mg/L, median nitrate was 4.8 mg/L, and median TKN was 1.2 mg/L.

Monitoring data showed less eutrophication risk at the downstream site based on the DO + pH criteria. Most of the low DO conditions occurred during the driest part of the monitoring period, with the exception of brief occurrences during runoff events.

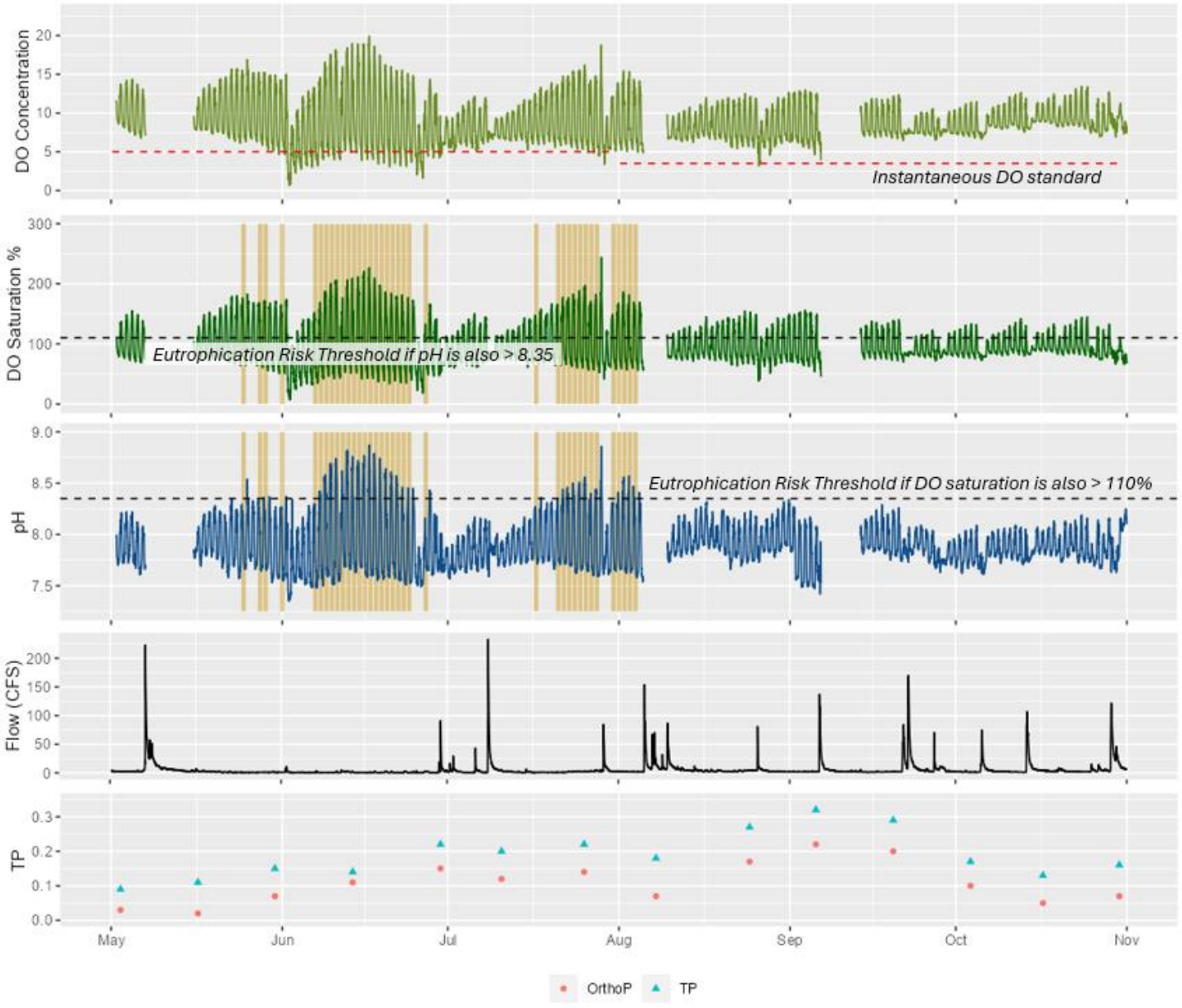

Figure 7 – SWP-D Grab Samples and Continuous Monitoring Results - gold bars indicate days that exceed risk of eutrophication threshold

3.4 INTREPRETATION & ANALYSIS

The monitoring results identify frequent exceedances of the risk of eutrophication criteria above the outfall (57% of days), and to a lesser extent below the outfall (23% of days). Similarly, above the outfall, DO is frequently below the instantaneous DO water quality standard (41% of days). This occurs less frequently downstream from the outfall (21% of days). With no upstream point source, NPS nutrients are the predominant contributor to the water quality issues in Copper Slough. The addition of treated effluent is improving stream DO conditions. There are fewer days when the DO water quality standard is not met and there are fewer days when the risk of eutrophication conditions are exceeded compared to upstream (Table 7).

As described in Section 3.3, a sensor malfunction resulted in a period of pH data being removed from the SWP-U dataset. To ensure that the missing data was not creating artificial inflation or deflation of the proportion of days with eutrophication risk, data was re-analyzed with the corresponding period removed from the SWP-D dataset as well. The risk of eutrophication proportion remains similar at 20% of the time versus 23% if the period is left in the dataset.

Table 7 - Risk of Eutrophication and DO Summary

Site	Days with Continuous Monitoring	Median Daily Maximum	# of Days (%) Exceeding the Risk of Eutrophication Criteria (8.35 pH + 110% DO)	# Days (%) Exceeding the Minimum DO Water Quality Standard (5.0 Mar-July; 3.5 Aug-Feb)
SWP-U	159 (DO) 121 (pH)	174% (DO Saturation) 8.4 (pH)	69 (57%)	65 (41%)
SWP-D	163 (DO) 163 (pH)	141% (DO Saturation) 8.2 (pH)	38 (23%)	34 (21%)

The upstream and downstream sites show generally similar patterns in DO and pH, although downstream the amplitude of the daily range of each parameter is typically smaller, resulting in fewer lows below the DO water quality standard, and fewer highs above the pH + DO risk of eutrophication criteria.

Total phosphorus concentrations increase substantially during high flow events at the upstream site, indicating NPS are important contributors in Copper Slough, with most of the load occurring during runoff events. Abundant periphyton observed at the upstream site throughout the monitoring period provides additional evidence. The SWP contributes a phosphorus load which is evident from the monitoring results, as downstream concentration during normal flow conditions is typically somewhat higher. The upstream median TP was 0.06 mg/L, and the downstream median was 0.18 mg/L. Despite the point source phosphorus and lower than average stream flow, the risk of eutrophication exceedances downstream were substantially less frequent than upstream.

Dissolved oxygen and pH data follow a distinct pattern at both sites. With each runoff event, the diel range of each attenuated to a very small range, then over a period of days steadily increasing until the next storm. An exception to this pattern is when the time between runoff events is unusually long. In this case, the DO and pH range steadily increase, then begin to decrease over a period of days. This is indicative of

NPS nutrients and oxygen demanding materials being delivered during storm events then being consumed over time by the stream biotic community. Algal growth is stimulated and over time runoff-related nutrients are consumed and diminished, leading to diminished photosynthesis. As this phenomenon occurs even when there is effluent phosphorus in the stream, it suggests that point source phosphorus is not present in high enough concentrations to sustain the high algal biomass that is produced after a runoff event delivers nutrients.

The physical condition of the stream is that of a highly channelized drainage ditch with minimal littoral vegetation, and almost devoid of canopy cover and riparian buffer. These stream conditions exacerbate the impacts of both NPS and point source nutrients and enable algal and macrophyte growth. Even though phosphorus concentrations are low, risk of eutrophication and low DO conditions persist. Based on the monitoring data, field observations and satellite image review, the physical condition of the stream and NPS nutrients appear to be the most significant driver of eutrophication risk.

Considering these observations and datasets, it is clear that treated effluent is not the primary driver of eutrophication risks and DO issues on Copper Slough, nor downstream on the Kaskaskia River. It is evident that the risk of eutrophication and low DO would be present even without the point source contribution. Without this effluent flow, poor water quality conditions observed upstream would persist the length of Copper Slough and on the Kaskaskia.

Nonpoint source load reductions and stream habitat restoration such as restoring channel sinuosity, planting overhanging vegetation and improving channel roughness with structures such as rock riffles will likely have more of a positive impact on water quality than extremely costly point source reductions.

Note: UCSD has an agreement to sell up to 6.3 MGD of treated effluent to a proposed fertilizer plant in Tuscola, IL. Excess effluent flow, greater than the volume purchased by the fertilizer plant, will be discharged to the creek. If the plant is built and the parties move forward with the agreement, the amount of effluent discharged to Copper Slough from the WWTP will decrease; however, there is a provision that the WWTP will discharge no less than 1.5 MGD to support stream biota. The decrease in effluent flow will result in a lower TP load. In addition, if the sale occurs, UCSD has committed to spending $50,000 per year to fund projects to improve the water environment.

4. NARP & WORK PLAN

Based on an understanding of the SWP NARP trigger, watershed dynamics and the results of the monitoring program, the NARP and Work Plan focuses on reducing phosphorus inputs to Copper Slough and the associated 44,909-acre watershed. The focus area is comprised of three HUC-12 subwatersheds that are within the Dry Fork - Kaskaskia HUC-10 watershed (Figure 8 references the focus area). The Copper Slough HUC-12 watershed area is dominated by urban land, while the remainder of the area is dominated by agriculture.

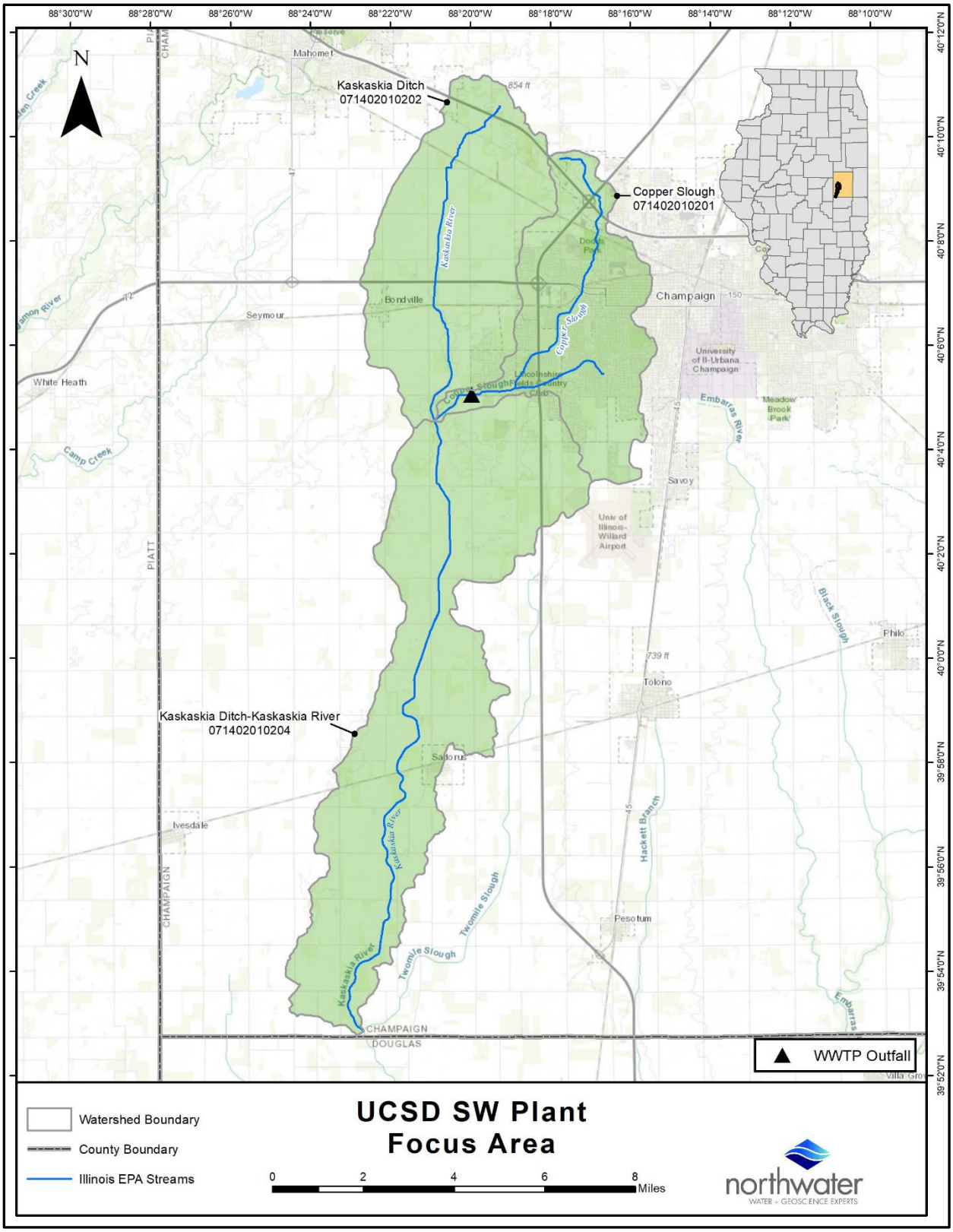

Figure 8 - NARP Focus Area

4.1 WATERSHED CHARACTERIZATION

A concise watershed characterization is presented and includes relevant information related to hydrology, landcover, climate, and demographics. Current and historical water quality impairments are summarized and estimates of phosphorus loading from NPS are presented from a map-based, planning-scale pollutant load model created for this NARP, using formulas and methods derived from the United States EPA Spreadsheet Tool for Estimating Pollutant Loads (STEPL). This section also details historic watershed preservation and restoration activities undertaken by UCSD, and links to relevant plans, efforts, and initiatives led by other groups.

HYDROLOGIC UNITS

The NARP focus area of the Dry Fork – Kaskaskia River HUC-10 consists of three HUC-12 subwatersheds (Table 8) totaling 44,909 acres. This watershed area lies in the east-central part of Illinois entirely in Champaign County. It is within the Kaskaskia River Basin, which drains to the Mississippi River.

Table 8 – UCSD Southwest WWTP NARP HUC 12 Subwatersheds

HUC Name	HUC12 ID	Area (acres)
Copper Slough	071402010201	10,126
Kaskaskia Ditch	071402010202	12,249
Kaskaskia Ditch – Kaskaskia River	071402010204	22,534
Total:		**44,909**

STREAMS & LAKES

According to the National Hydrography Dataset (NHD) there are 67 miles of streams and rivers in the planning area, including artificial drainageways (Table 9). The Kaskaskia River/ Kaskaskia Ditch is the longest named stream at 11.6 miles followed by Copper Slough (11.6 miles). The NHD also identifies 221 acres of lakes, ponds and reservoirs. The largest lake is Maynard Lake at 14 acres.

Table 9 – Relevant Stream Segments and Illinois EPA Assessment ID

Stream Name	Illinois EPA Assessment IDs	Length (Miles)
Unnamed Tributary/Drainage Way	N/A	45
Kaskaskia River/ Kaskaskia Ditch	IL_O-35, IL_O-37	11.6
Copper Slough	IL_OZYA	8.7
Phinney Branch	IL_OZYB	2.3
Total:	**-**	**67**

CLIMATE NORMALS

Based on climate normals published by the National Oceanic and Atmospheric Administration for a weather station in Urbana, for the period of 1991 – 2020 (NOAA NCEI, 2024), the area experiences an average of 40.9 inches of precipitation per year (3.4 inches/month). June is typically the wettest month, with an average of 4.8 inches of rain.

The region experienced approximately 24% less precipitation than average during the monitoring period. Data supporting this NARP is from a climatic and hydrological period that is drier than average conditions.

LANDCOVER

Table 10 presents watershed landcover. The two predominant categories are (i) 73% agriculture comprising 33,271 acres of cultivated crops, and (ii) 25% developed/urban areas or 11,366 acres according to the National Land Cover Database (NLCD) (Dewitz, J., 2021). The Copper Slough, Kaskaskia Ditch, and Kaskaskia Ditch-Kaskaskia River HUC basins have 22%, 85%, and 90% agriculture/cultivated crops respectively.

Table 10 – Copper Slough NARP Watershed Landcover

Landcover	Area (acres)	% of Watershed Area
Cultivated Crops	33,721	73%
Developed	11,366	25%
Grasslands/Hay/Pasture	527	1.1%
Forest	149	0.3%
Open Water	81	0.2%
Wetlands	42	0.1%
Barren Land	21	0.05%
Total:	**45,907**	**100%**

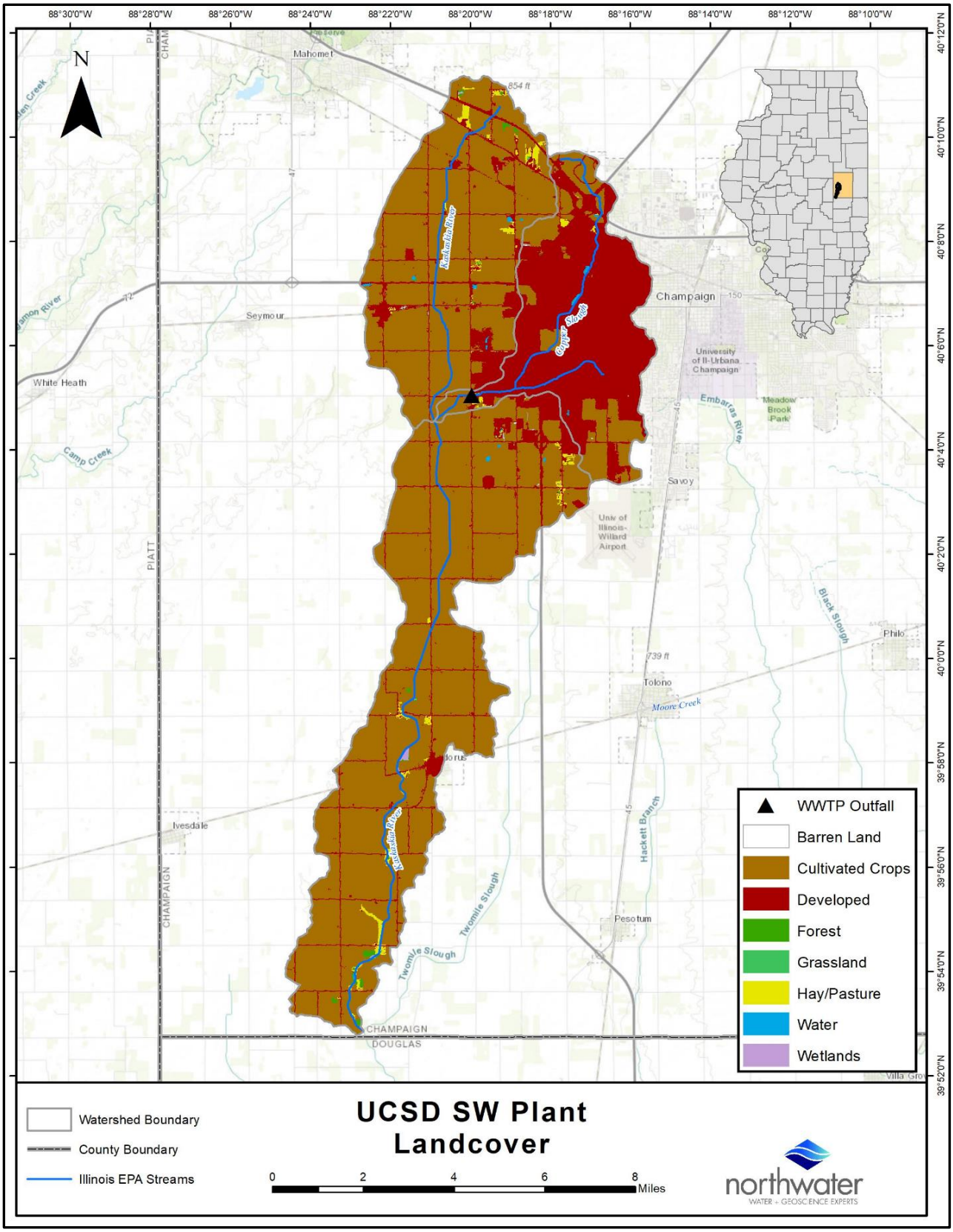

Figure 9 – NARP Landcover

DEMOGRAPHICS & ECONOMY

Approximately one third of the City of Champaign is located within the watershed. Champaign has a population of 89,189, an increase of ~10% since 2010 according to the US Census Bureau. Median household income (2018 – 2022) is $58,273 in Champaign, compared to $78,433 for Illinois and the national average of $75,149.

WATER QUALITY IMPAIRMENTS

Copper Slough segment IL_OZYA, which receives the treated effluent from the WWTP, has supported all its designated uses since at least 2012, the oldest 303(d) list examined. On the Kaskaskia River upstream from its confluence with Copper Slough, segment IL_O-37 has not been on the 303(d) list with nutrient-related impairments (Figure 2). Downstream from the confluence, the Kaskaskia River segment IL_O-35 has been on each 303(d) list since 2016 with an aquatic life impairment caused by DO and pH; however, the 2018 Upper Kaskaskia and Lake Fork watershed TMDL recommended delisting of the segment due to data indicating that there is not an impairment.

RELATIONSHIP TO OTHER PLANS & WATERSHED EFFORTS

A formal watershed plan has not been developed for the Upper Kaskaskia River, including Copper Slough. However, in 2018 due to the impairment listing on Kaskaskia River segment O-35 downstream of the confluence with Copper Slough for aquatic life with causes of pH, DO and chloride, Illinois EPA initiated the TMDL process. The Stage III TMDL report reviewed historic data and new continuous monitoring data collected in 2019, which indicated no strong link between DO and pH and a pollutant source. The report recommended that DO and pH impairments be removed, and based on this recommendation, the TMDL was completed for chloride only. Nutrient management practices are recommended to reduce chloride on at least 50% of the agricultural lands in the watershed, which will reduce NPS nutrients as well.

The Illinois Nutrient Loss Reduction Strategy (INLRS) is a state-wide strategy for nutrient reduction, with an interim goal of a 25% reduction in phosphorus loads and 15% reduction in nitrogen loads to Illinois waters by 2025 and a long-term goal of 45% reduction in both nutrients from the 2011 baseline. The WWTP has been subject to a 0.5 mg/L TP limit since 2019, and the reduced effluent concentrations have led to substantial progress toward INLRS goals. Nonpoint source reductions will provide further progress.

While there are several watershed groups that focus on the Kaskaskia Basin, none have been consistently active in the headwater reaches. However, in response to IDNR's interest in reviewing how to spend spill remediation funding and the NARP requirement being imposed on 3 area POTWs, the local Salt Fork Watershed Group, in which UCSD is a participating member, has expanded its reach to cover Copper Slough. The group has recently been exploring an Illinois EPA 604(b) watershed planning grant with an emphasis on NPS pollution. This planning effort will be directly relevant to advancing the goals of the NARP. The UCSD has also been engaged in the KWA, an active stakeholder group that covers Copper Slough, though the group is more active in the lower Kaskaskia basin.

UCSD WATERSHED RESTORATION AND PROTECTION EFFORTS

The community is committed to active watershed protection and restoration. Currently, the Salt Fork Watershed Group is in the early stages of working with the Illinois Department of Natural Resources to commit $100,000 to $150,000 toward stream restoration on Copper Slough. Potential projects include installation of riffles to support reaeration and re-vegetation of stream banks with native plants and overhanging canopy to provide shade and habitat. Larger projects could include restoring a naturalized channel geometry and sinuosity, as well as streambank stabilization. Several other examples of stream restoration that the City of Champaign has participated in include:

Copper Slough

- Dodds Park (Parkland Way to Bradley Avenue) – re-graded sometime in the past, mostly turf grass banks with tree vegetation on the east side of the channel.
- Heritage Park (Bradley to I72) - channel re-graded more than 15 years ago. The city stabilized about 200 feet of channel near 432 Clearwater Drive with rip-rap toes, floodplain shelf, two “J” hooks and native vegetation planting.
- West side of Duncan Road – City project reconstructed about 165 feet of channel, with rip-rap toes, permanent turf reinforcement matt, floodplain shelf, one “J” hook, and native vegetation planting.
- South of William Road to Rising Road - most of this channel section has been reconstructed over the years. Much of it has a rip-rap toe and turf vegetated banks with some hard armored areas consisting of gabion baskets, shotcrete etc.

Phinney Branch (Upstream of Copper Slough)

- Mattis Ave bridge to northwest – City project re-graded channel “S” curve for about 170 feet including rip-rap toe and bridge embankment armoring, floodplain shelf, permanent turf reinforcement mat on outer curves. Channel weir. Vegetation clearing and replanting with turf grasses and some native plant material was completed in 2022.
- 2001 Barberry - channel grading, bank stabilization and 85 feet of permanent turf reinforcement mat and rip-rap toe on the west bank, native vegetation, and turf grasses completed in 2019.
- 2005 S Mattis – removed channel oxbow, re-graded 80 feet of channel, permanent turf reinforcement mat on banks, rip-rap toe, floodplain shelf, native vegetation, and turf grasses completed in 2011.
- 1910 and 1912 Barberry – gabion baskets to stabilize south channel bank completed in 2008.
- 9 & 11 Alder Court – gabion baskets to stabilize east channel bank completed in 2011.
- 2304 & 2306 Broadmoor Drive – City project to reconstruct a stabilized channel for about 150 feet. Some tree clearing, regrading, rip-rap toe, floodplain shelf, permanent turf reinforcement matt, two J hooks, and one stone weir completed in 2019.

POINT & NONPOINT SOURCE LOADING

Point source pollution is defined by the United States EPA as “any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack” (Hill, 1997). The NPDES, a provision of the Clean Water Act, prohibits point source discharge of pollutants into waters of the United States unless a permit is issued by the USEPA or a state or tribal government. Individual permits are specific to individual facilities (e.g., water or wastewater treatment facilities), and general permits are for a group of facilities in a geographical area. Permits describe the allowed discharge of pollutant concentrations (mg/L) and loads (lbs/day). The SWP has an effluent phosphorus limit of 0.5 mg/L annual geometric mean in its current permit. This limit was instituted in the NPDES permit renewal in 2019 and is decreased from the 1.0 mg/L that was in place since the 1980s (Figure 10).

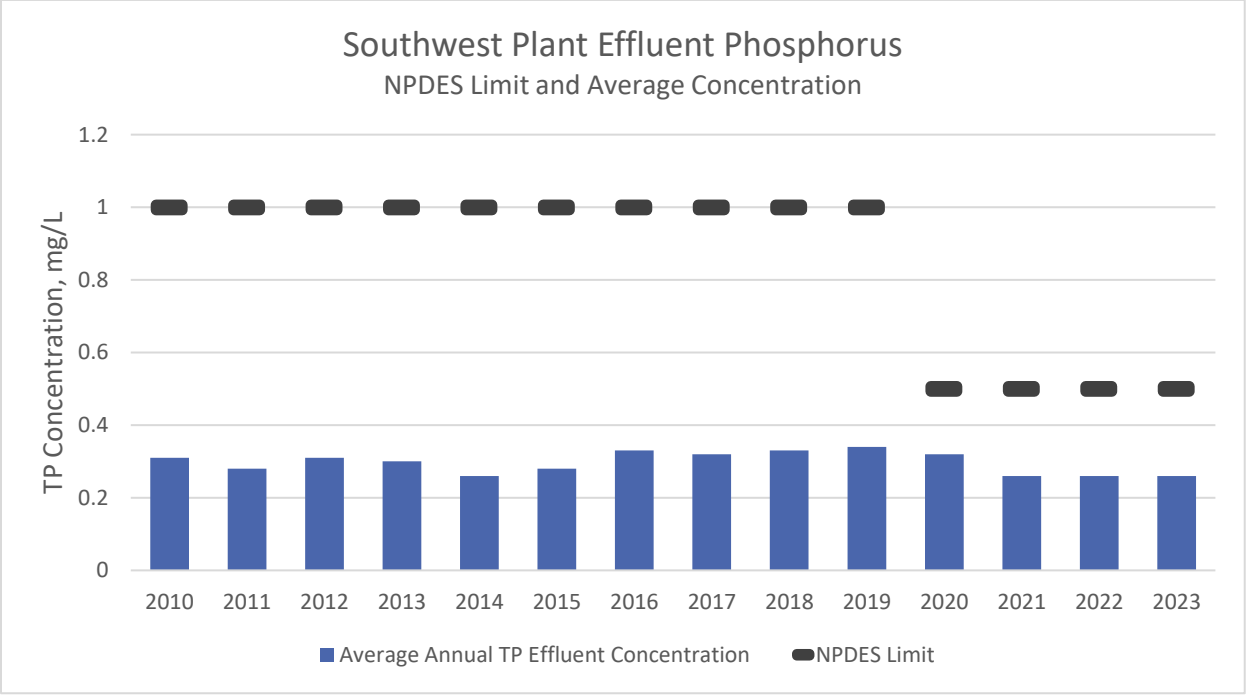

Figure 10 - Annual Average Effluent TP Concentration and NPDES Permitted Effluent Limit

Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source." Unlike pollution from point sources like industrial and sewage treatment plants, NPS pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. The runoff picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters (USEPA, 2018).

Annual point source loading of phosphorus from the WWTP is provided in Table 11. Based on USEPA-required DMR data retrieved from USEPA ECHO (Enforcement and Compliance History Online), and from UCSD data, average annual loading from 2020 through 2023 is 5,632 lbs with an average discharge of 6.68 MGD. Average effluent TP concentration during the same period was 0.28 mg/L.

Table 11 - Annual Phosphorus Load – UCSD Southwest WWTP (Data Source: UCSD and USEPA ECHO)

WWTP	2020	2021	2022	2023	Annual Average
UCSD Southwest	7,596	5,535	4,899	4,453	**5,632 lbs**

Nonpoint source loading was estimated using a customized planning scale map-based STEPL model. Outputs were adjusted to ensure results were in the correct range by using another calibrated model created by Northwater Consulting for the nearby Wildcat Creek watershed, with similar landcover, soils and precipitation characteristics. Results indicate an average annual phosphorus load of 34,376 lbs/yr for the 44,909-acre watershed. Total average annual phosphorus loading from all sources is estimated at 40,008 lbs/yr with the WWTP accounting for only 14% and NPS 86% (Figure 11).

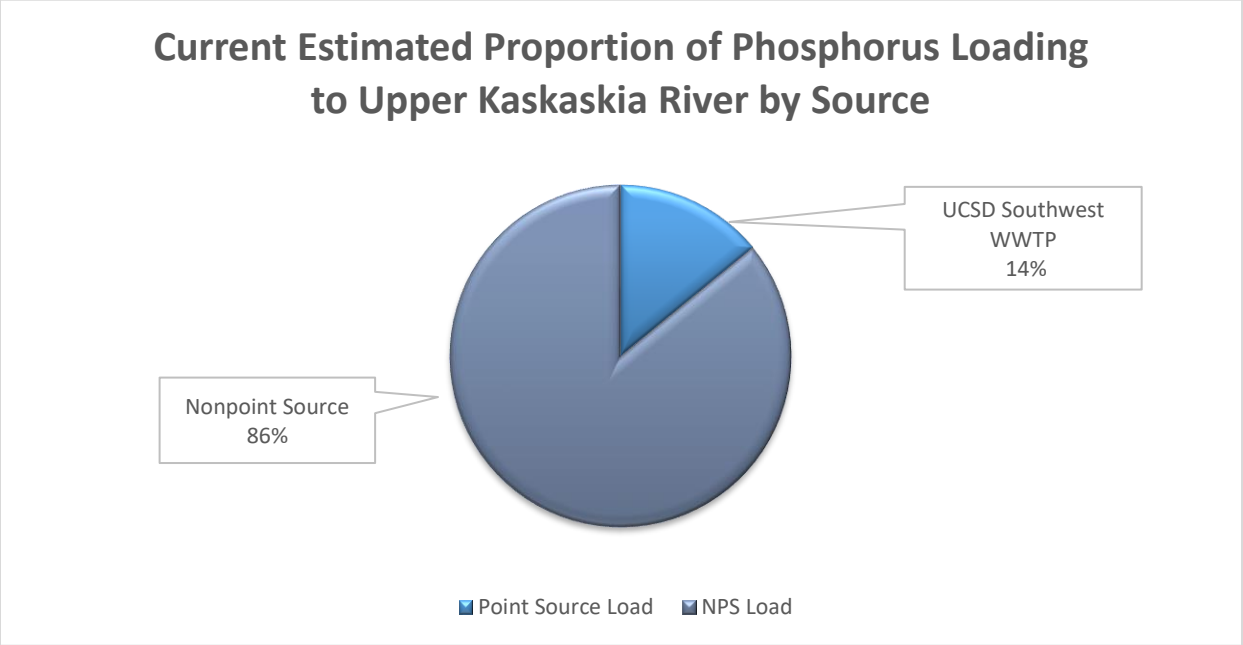

Figure 11 - Proportion of Annual Phosphorus Load to Upper Kaskaskia Watershed by Source

4.2 NARP

The NARP focuses on 44,909-acre Upper Kaskaskia / Copper Slough watershed. Based on an analysis of landcover, watershed nutrient load estimates and monitoring data, NPS pollution and altered stream habitat are major contributors to water quality issues. Currently, the WWTP contributes approximately 14% of the average annual phosphorus loading to the receiving watershed, with NPS the remaining 86% (Figure 11). The availability of phosphorus in the stream systems is systemic due to the agricultural and urban land that dominate the watershed. In addition, the stream is highly channelized throughout its length, with highly modified riparian conditions and near-complete lack of canopy cover, allowing algae to flourish.

The UCSD recognizes the plant as a contributor of phosphorus to Copper Slough and the upper Kaskaskia, and this input is part of complex and dynamic processes that affect the conditions in the stream and watershed. However, after examining both historical data and that collected for this NARP, it is clear that

eutrophic conditions would exist even without the relatively low point source contribution. Treated effluent appears to positively impact the stream by decreasing the frequency of low DO conditions and decreasing the frequency of risk of eutrophication exceedances compared to those observed upstream. Except in limited instances, UCSD does not have relevant jurisdiction over land management practices in the watershed, nor jurisdiction over the physical condition of the streams, which are likely the most significant factor contributing to the eutrophication risk occurrences.

The UCSD has a long history of working proactively to optimize effluent chemistry, such as modifying the treatment process to improve the historic average effluent pH of over 8 to the current average of 7.4, which has direct benefits to stream biota. As previously noted, the plant has been subject to a 1.0 mg/L TP effluent limit since the 1980s with a lower limit of 0.5 mg/L beginning in the 2019 NPDES permit renewal. The average TP concentration since 2020 has been 0.28 mg/L, significantly better than the permitted limit. If further effluent phosphorus reductions were to be mandated, it is unlikely that stream conditions would improve downstream, as significant water quality issues occur above the outfall on Copper Slough. Continued optimization may be able to continue incrementally improving effluent chemistry, however UCSD has been proactive in its work improving effluent quality, and further improvements are likely to be extremely costly and of little benefit.

In this context, the NARP is focused on improving water quality in the watershed in four ways:

1. **WWTP Plant Upgrades and Optimization** – UCSD is in the process of treatment system and common upgrades. This will allow for continued optimization of operations and the plant will continue to meet the effluent phosphorus concentration limit of 0.5 mg/L annual geometric mean in accordance with the NPDES permit. Upgrades will allow treatment to continue without the nitrifying towers that elevated effluent pH during their final years of operation. The improvements will also expand the average day design flow from 7.98 to 9.2 MGD.
2. **Collaborate on NPS Reduction** – UCSD will continue to collaborate with stakeholders and support future watershed planning efforts that address NPS loading. For instance, UCSD has been an active participant in the local watershed group for more than 25 years. Though primarily focused on the Salt Fork watershed, they agreed to be the stakeholder group for the Copper Slough NARP as many of the issues and stakeholders' interests span watersheds. The UCSD has presented NARP data and drafts of this plan on multiple occasions in 2022, 2023 and 2024. In addition, UCSD has presented information on the NARP to the KWA, and will continue to collaborate with this group, though it is typically much more active in the Lower Kaskaskia Basin than in the headwaters. The UCSD will encourage, and support watershed planning led by stakeholders that will lead to NPS reductions.
3. **Continue to Emphasize Ecosystem Restoration** – UCSD and its associated contributing communities emphasize ecosystem restoration in its capital improvements. When feasible and reasonable, these governmental bodies will continue to prioritize restoration and enhancement of the streams in the watershed. In addition, UCSD will support and advocate for ecosystem restoration activities on Copper Slough with its partners such as the City of Champaign, the Champaign Parks District, State of Illinois and others. These habitat improvements are likely to have a significantly bigger impact per dollar spent in reducing risk of eutrophication and potential for future impairment than further effluent phosphorus reductions. For example, one such collaborative project in early planning is an ecosystem restoration project with the Illinois Department of Natural Resources on Copper Slough.

4. **Continue Periodic Monitoring of Copper Slough –** UCSD proposes to periodically monitor upstream and downstream of the outfall using continuous monitoring equipment and discrete sampling to track water quality indicators such as DO, pH and TP, similar to the program completed for this NARP assessment. Monitoring will coincide with plant operational changes and management and restoration activities. Data will assess whether these changes are having the desired impact on stream water quality of reducing the chances for phosphorus impairment on Copper Slough and the upper Kaskaskia.

4.3 NARP WORK PLAN

The Work Plan includes a schedule and cost estimate for NARP activities moving forward. The UCSD is committed to a series of key activities that will allow for continued phosphorus discharge optimization, as well as contributing to source reductions needed to meet targets in the Illinois NLRS. Furthermore, UCSD will continue to work with area stakeholders to further limit NPS loading through collaborative efforts outside of its jurisdiction. Actions include plant upgrades, watershed group involvement, and an emphasis on stream restoration.

ACTIONS & SCHEDULE

An estimated schedule of activities is presented in Table 12. Plant upgrades are currently in progress and scheduled to be complete in 2027. These upgrades will allow for significant operational and reliability improvements. The UCSD will support and participate in the watershed groups and will support funding requests for watershed planning, will contribute meaningfully to plan development and continue its commitment to restoring and enhancing Copper Slough when opportunities arise.

Table 12 - NARP Actions and Estimated Schedule

NARP Action	Anticipated Start Date	Estimated End Date	Notes
Plant upgrades for operational efficiency	In Progress	2027	Plant upgrades will allow the SWP to improve reliability and operational efficiency. The upgrades will also allow for significant sustainability improvements with reduced energy needs and production of biogas to be used for power generation. This extensive capital project, estimated to cost over $30,000,000 is detailed in the Facility Plan Update that was submitted to Illinois EPA in March 2022. Upgrades will allow for UCSD to continue with the high efficacy of the treatment process and continue to exceed nutrient removal requirements.
Watershed Group / Watershed Planning	In Progress	Ongoing	UCSD will continue to actively participate in and support the local watershed group's activities, specifically supporting watershed planning to reduce NPS phosphorus on Copper Slough and/or the upper Kaskaskia.

NARP Action	Anticipated Start Date	Estimated End Date	Notes
Stream Restoration and Stabilization	In Progress	Ongoing	UCSD will continue to emphasize stream restoration and protection as part of its capital improvements project activities. In addition, will support stream restoration and NPS reduction efforts of local and regional partners.
Ongoing Monitoring	2026	Ongoing	UCSD will periodically monitor the Copper Slough upstream and downstream of the outfall using continuous monitoring equipment, similar to the program completed for the NARP assessment. Monitoring will coincide with plant upgrades or significant stream restoration or watershed management activities. Monitoring will provide before and after data to confirm that management activities are having the desired impact on stream water quality and reducing the chances for phosphorus impairment.

BUDGET & COST ESTIMATES

The WWTP capital improvements and plant upgrades are estimated at over $30,000,000. Participation in the watershed group is estimated at $1,500 per year, with additional support likely for a proposed watershed plan under consideration. One stream restoration project that is in the initial planning phase is estimated at roughly $100,000 - $150,000. The cost of further NPS reduction and restoration measures is unknown at this time. Continuous monitoring is estimated at approximately $40,000 per season.

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APPENDIX A: DATA MINING AND MONITORING PLAN

Village of Rantoul & Urbana-Champaign Sanitary District

Nutrient Assessment Reduction Plan Data Mining and Proposed Monitoring Plan

April 2022

Prepared for: Urbana-Champaign Sanitary District
Village of Rantoul
Prepared by: Northwater Consulting & Donohue and Associates

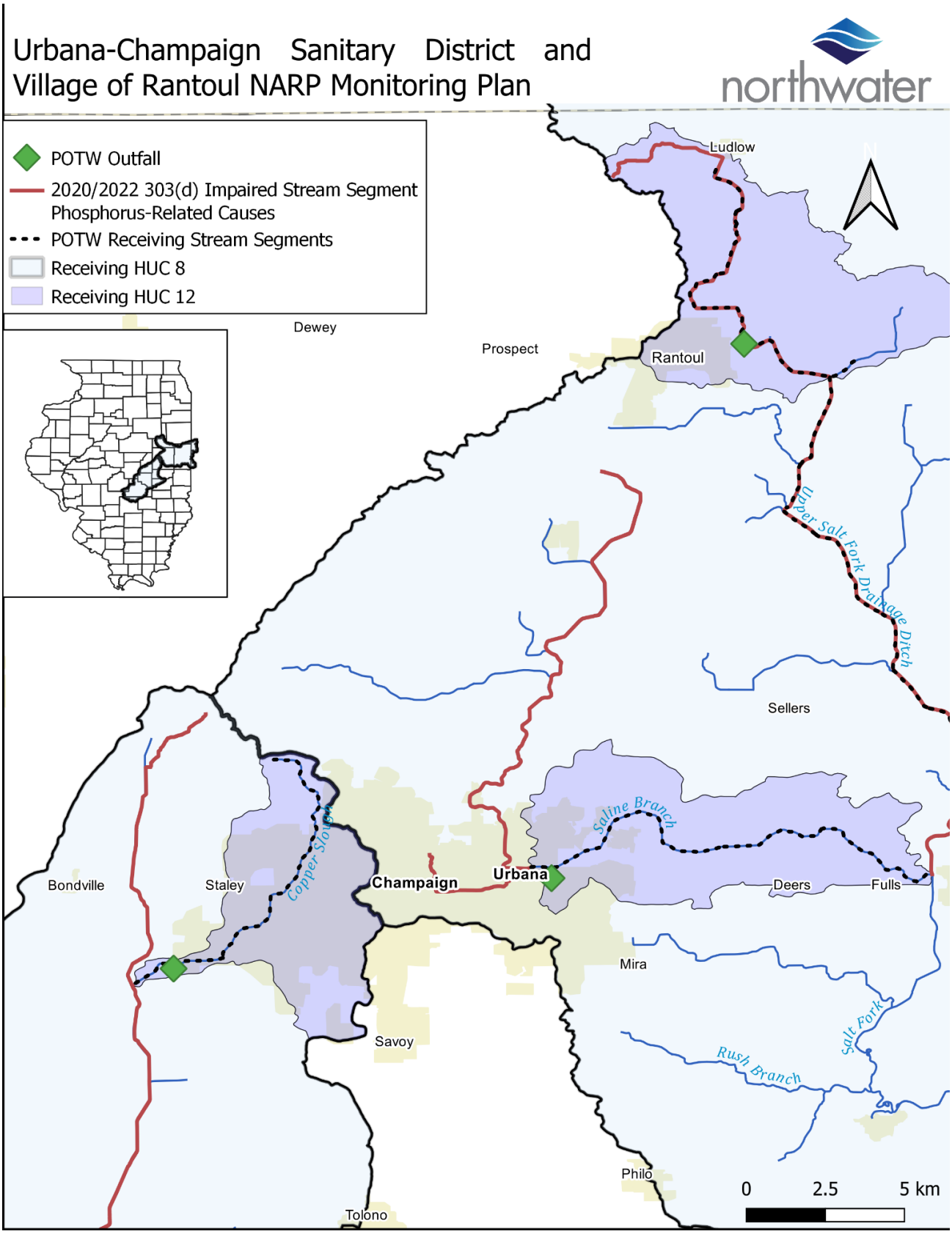

Figure 1. Project Area

DONOHUE

northwater
WATER + GEOSCIENCE EXPERTS

Contents

1 Introduction

1.1 NARP Process & Requirements

In 2018, the Illinois EPA (IEPA) instituted a new process for NPDES permitting of POTW discharges that would allow for consideration of site-specific conditions for phosphorus limits. The Nutrient Assessment Reduction Plan (NARP) process resulted from negotiations with environmental organizations, IEPA, and the Illinois Association of Wastewater Agencies. A NARP is required if a receiving stream segment or downstream segment is on the Illinois Clean Water Act 303(d) list as impaired with phosphorus-related causes. A NARP is also required if there is a "risk of eutrophication" as defined by meeting any of the conditions outlined in Table 1.

Table 1. IEPA Risk of Eutrophication Criteria

Risk of eutrophication if any of these conditions met		
pH	Median sestonic chlorophyll *a*	On any two days during IEPA monitoring week, daily max
>9	>26 u/l	pH>8.35 and DO sat >110%

The Village of Rantoul operates one treatment plant and the Urbana-Champaign Sanitary District (UCSD) operates two that are required to undertake the NARP process as part of their National Pollution Discharge Elimination System (NPDES) permits. However, in this process, it may be determined through assessment of relevant data that the watershed does not have a phosphorus-related impairment. In this case, phosphorus input reductions and other measures may not be necessary. Donohue & Associates and Northwater Consulting were retained by the Village of Rantoul and UCSD to assess if a NARP is required for these facilities, and if so, develop a strategy for development of a full NARP. This process has several components which include:

- Examining if there is sufficient water quality data to determine if NARP requirements apply.
    - If data insufficient, a create a water quality monitoring plan and collect data.
- Undertake watershed characterization and determine if a full NARP is required.
- If a NARP is required:
    - Engage stakeholders throughout the process.
    - Model watershed and instream processes.
    - Establish defensible site-specific water quality criteria.
    - Define scenarios and strategies to achieve water quality targets.
    - Implement the recommendations of the NARP.

1.2 Data for NARP Determination

To make a NARP determination, sufficient dissolved oxygen (DO), pH and sestonic chlorophyll *a* data must be available between May 1 and October 31 to assess if any of the eutrophication risk criteria are met. Based on mining and analysis of existing datasets for the three outfalls and associated stream

segments, it was determined that additional water quality data collection is necessary to evaluate impairments and eutrophication risks according to NARP criteria.

This plan outlines the recommended monitoring and data collection actions necessary to assess NARP requirements for each treatment plant. The data will also support focused recommendations and a strategy to develop additional NARP components for each, if required. The plan is intended to guide the Urbana-Champaign Sanitary District (UCSD) and Village of Rantoul through the data collection and assessment phase. More detailed results of the process and plan are presented herein.

2 Data Mining Results

The three receiving streams were cross referenced with the 2020/2022 Illinois EPA (IEPA) Clean Water Act Section 303(d) list[1] of impaired waters. Details of phosphorus-related impairments are summarized for each treatment plant. The only stream segment currently impaired for phosphorus is associated with the Village of Rantoul, which has been on the 303(d) list since 2010. The two UCSD treatment plants receiving stream segments have not been listed as impaired with P-related causes since 2010.

A search was completed for existing water quality data over the past 10 years from the USEPA Water Quality Portal.[2] Each facility also provided data available from effluent and receiving stream water quality monitoring. Existing datasets were examined to determine if eutrophication risk determinations could be made using DO, pH, chlorophyll-*a* and water temperature data. Data collected during the last 5 years was prioritized over older data. A summary of the data mining and analysis results for each treatment plant is presented below.

2.1 Village of Rantoul Wastewater Treatment Plant

The effluent-receiving stream Upper Salt Fork Drainage Ditch (IL_BPJG-01) is impaired with P-related causes (Table 2). The next downstream segment (IL_BPJG-07) is also impaired for DO.

Table 2. Village of Rantoul Wastewater Plant

Village of Rantoul Receiving Stream Segment				
Receiving Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes Related to P & Years on List
Upper Salt Fork Drainage Ditch	051201090301	IL_BPJG-01	Aesthetic Value; Aquatic Life	DO: '20/22, '18, '16, '14 pH: '20/22, '18, '16, '14 TP: '20/22, '18, '16, '14, '12

Receiving Major Watershed	POTW Design Average Flow	POTW Design Maximum Flow
Vermilion River-Wabash River	4.33 MGD	8.65 MGD

[1] https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Pages/303d-list.aspx
[2] www.waterqualitydata.us

Few usable monitoring sites sourced from publicly available data were found for the Upper Salt Fork Drainage Ditch. Of the three potential sites identified, one is upstream, and two downstream of the outfall. At all three, data was only available for a single collection event in 2016. There are additional IEPA monitoring stations with 2016 data much further downstream in the assessment unit, with pH increasing with distance from the outfall. However, these sites are significantly influenced by tributaries and their associated point and nonpoint sources and thus are less appropriate for determining if NARP thresholds are met. Additional data was provided by the Village and included upstream and downstream sampling approximately two days per month during portions of 2020 and 2021. Parameters include temperature, DO and pH. Chlorophyll *a* data was not collected during this monitoring period.

From this limited data set it appears that pH and DO do not meet the threshold criteria that trigger a NARP (8.35 with 110% saturation). However, because the facility discharges into a stream that is impaired with likely causes related to phosphorus, the facility would be required to complete a full NARP. Additional data collection and analysis will help to better assess the contributions of the treatment plant to the receiving stream water quality and allow for an informed decision on the necessity of undertaking a full NARP that includes watershed characterization, development of site-specific water quality targets, and implementing management actions.

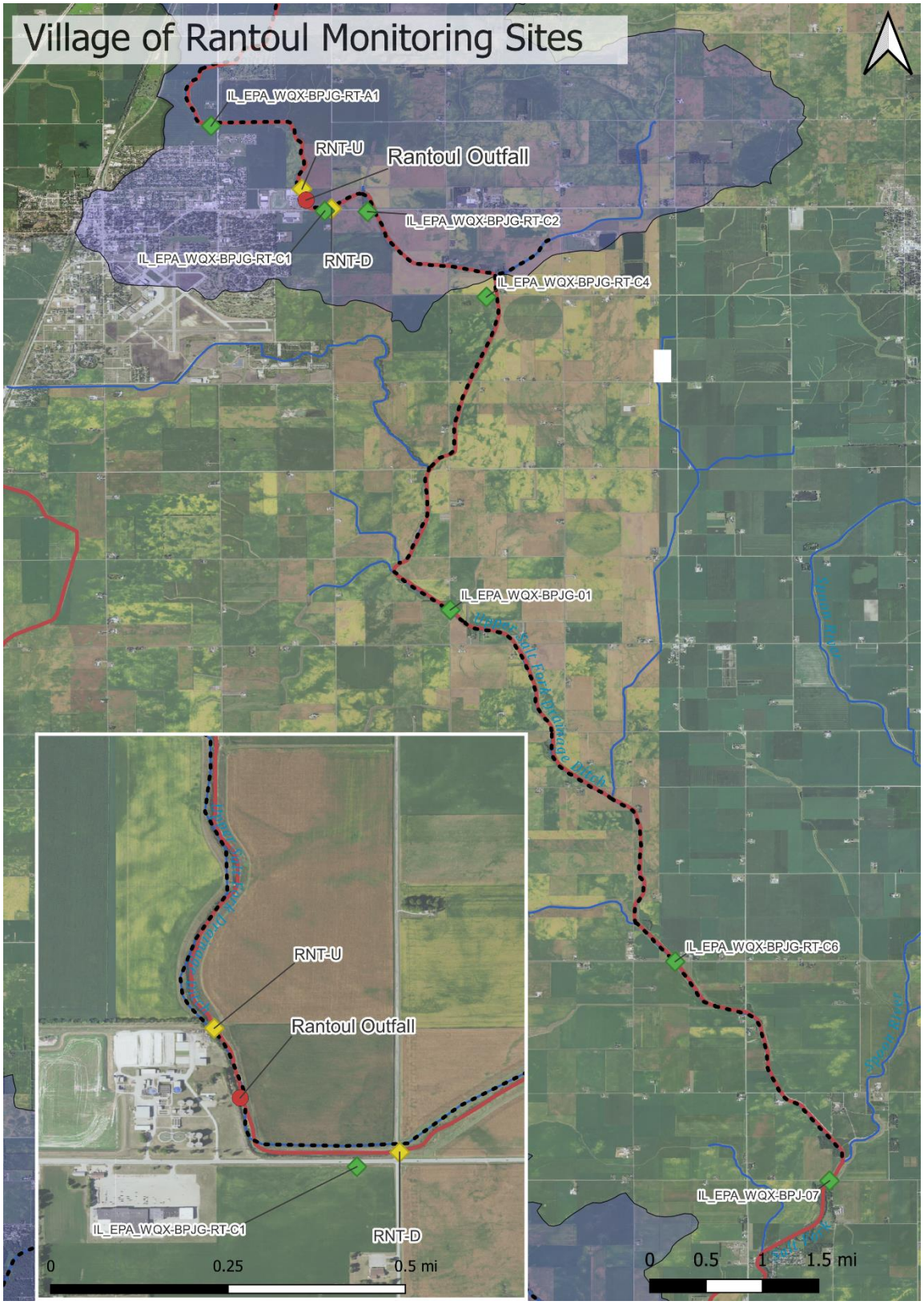

Figure 2. Village of Rantoul Detail

2.2 UCSD Northeast Wastewater Treatment Plant

The effluent-receiving stream segment, Saline Branch (IL_BPJC-06), fully supports its designated uses. Two stream segments above the receiving segment are impaired with P-related causes. Boneyard Creek (IL_BPJA) for DO and total phosphorus (TP), and Saline Branch Drainage Ditch (IL_BPJC-08) for pH and DO. The next several segments downstream have no P-related impairments. Upstream of the confluence, the Upper Salt Fork Drainage Ditch is impaired for DO.

Table 3. UCSD Northeast Wastewater Treatment Plant Receiving Stream Information

UCSD Northeast Plant Receiving Stream Segment				
Receiving Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes Related to P & Years on List
Saline Branch	051201090203	IL_BPJC-06	None – Fully Supports Designated Uses	N/A

Receiving Major Watershed	POTW Design Average Flow	POTW Design Maximum Flow
Vermilion River - Wabash River	17.3 MGD	34.6 MGD

There are three monitoring sites with publicly available data in the receiving watershed, all of which are downstream of the outfall. The IEPA Ambient Network monitoring site (IL_BPJC-06) includes approximately 8 samples per year in years data was collected for relevant parameters. USGS monitoring station 03337700 is co-located here and has data collected during 2019 and 2020. These sampling locations, though in the same assessment unit, are greater than 5 miles downstream of the plant outfall, which allows instream processes to alter the effects of the effluent on stream water quality and introduces potential for pollutant additions from nonpoint sources and tributaries. The IEPA ambient site has one sample out of 25 in the last 5 years with values for pH and DO saturation meeting the upper threshold of NARP criteria of 8.35 pH with 110% DO saturation. (02/20/2017 sample was 8.54 pH and 153.5% DO). Five samples of 53 older than five years meet the threshold, however emphasis is placed on the most recent sampling efforts. Chlorophyll *a* data is not available. The USGS site has 15 pH and DO samples, none of which meet the NARP threshold.

The UCSD provided additional data from the receiving stream above and below the plant outfall, though the majority of that data is greater than 5 years old and is not current enough to determine if the NARP thresholds are being met. Because of limited current water quality monitoring data and past indicators of eutrophication risk, additional monitoring is recommended up and downstream of the treatment plant.

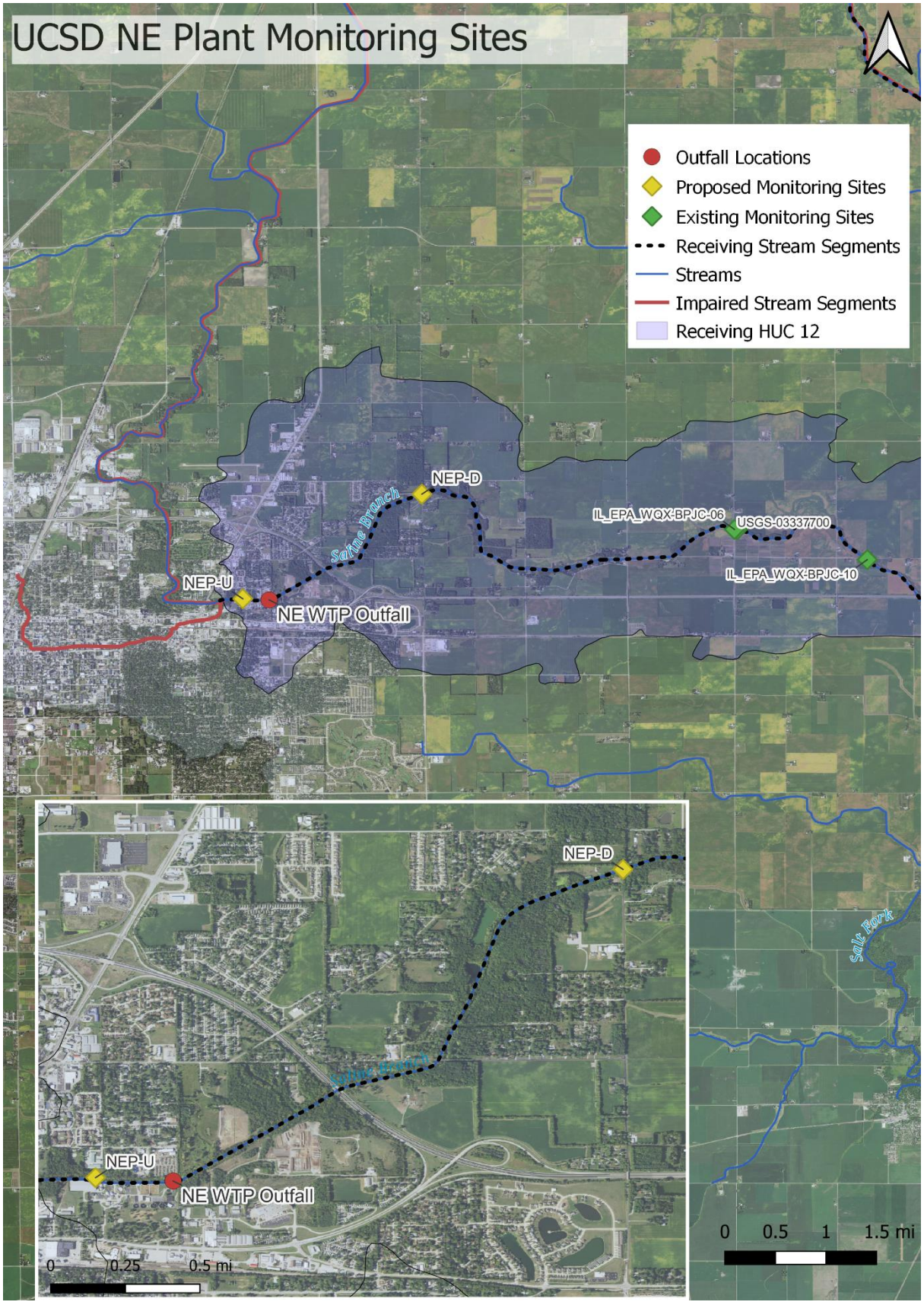
UCSD NE Plant Monitoring Sites
Outfall Locations
Proposed Monitoring Sites
Existing Monitoring Sites
Receiving Stream Segments
Streams
Impaired Stream Segments
Receiving HUC 12
NEP-D
NEP-U
NE WTP Outfall
Saline Branch
IL_EPA_WQX-BPJC-06
USGS-03337700
IL_EPA_WQX-BPJC-10
Salt Fork
0 0.5 1 1.5 mi
0 0.25 0.5 mi

Figure 3. UCSD Northeast Plant Detail

2.3 UCSD Southwest Wastewater Treatment Plant

The effluent-receiving stream, Copper Slough, fully supports its designated uses. However, it empties into the Kaskaskia River (segment IL_O-35) which is impaired for DO and pH, and the segment upstream from the confluence (IL_O-37) is impaired for DO.

Table 4. UCSD Southwest Wastewater Treatment Plant Receiving Stream Information

UCSD Southwest Plant Design Flow & Receiving Stream				
Receiving Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes Related to P & Years on List
Copper Slough	071402010201	IL_OZYA	None – Fully Supports Designated Uses	N/A
Receiving Major Watershed		POTW Design Average Flow		POTW Design Maximum Flow
Kaskaskia River		7.98		17.25

Based on data mining, IEPA data was only available at one location in the assessment unit, approximately 0.25 miles downstream of the Southwest Wastewater Treatment Plant outfall. The data included three measurements of DO, pH and chlorophyll *a* from 2017, thus these data are of limited utility.

UCSD performed a study in the summer and early fall of 2020 at locations above and below the outfall on Copper Slough. Continuous monitoring equipment was used to measure DO and pH, as well as other ancillary parameters. Chlorophyll *a* was not monitored. However, issues with sensors and data quality were reported by staff. As a result of inconclusive water quality data results, additional monitoring is recommended.

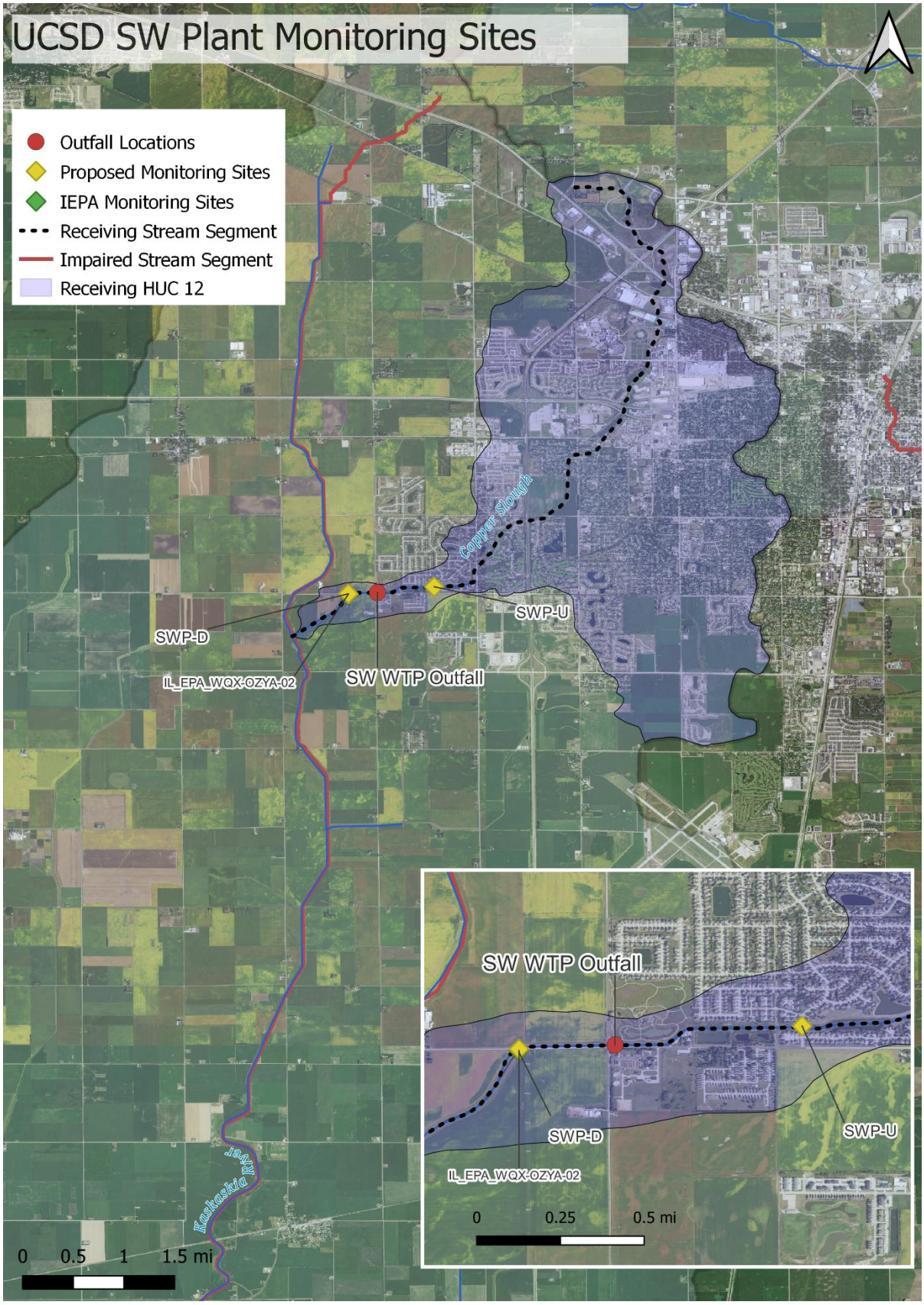

Figure 4. UCSD Southwest Plant Detail

3 Monitoring Plan Overview

Considering the effort and investment necessary for NARP development, and the lack of data available to make "at risk" determinations, stream monitoring is recommended at all three treatment plants. The water quality data will facilitate the assessment of the risk of eutrophication and guide further NARP development if required.

The proposed in-stream water quality monitoring expands upon past data collection efforts at each treatment plant. The monitoring program will be organized by Northwater Consulting and Donohue & Associates, in partnership with UCSD and the Village of Rantoul. To augment existing records, data collection is prioritized to locations with previous monitoring. The goal of this plan is to collect adequate data during the critical period between May and October when NARP triggering conditions are most likely to occur. Monitoring will determine if each receiving stream is at risk of eutrophication and will guide future stages of the NARP such as watershed characterization, assessing impairment causes/sources, and water quality model development. Further, the contribution of each treatment plant to the stream impairment or risk of eutrophication can be evaluated.

Recommended monitoring elements include:

1. Retrofit existing stations to monitor upstream and downstream of each outfall (6 total stations)
2. Installation of water quality sonde and sensors from Mid-May through October
    a. Hydrological Parameters: Stream stage
    b. Water Quality Parameters: pH, sestonic chlorophyll *a*, water temp, DO, conductivity
3. Bi-weekly storm monitoring
    a. Stream discharge/flow
    b. In-situ analysis of pH, conductivity, oxidation reduction potential, temperature, dissolved oxygen and turbidity
    c. Grab samples for laboratory analysis of orthophosphate, total phosphorus, chlorophyll *a*

These recommended parameters capture data critical for making the NARP determination. While there are myriad sampling methods that could be employed and characteristics available to measure, such as periphyton (attached algae chlorophyll) and nitrogen, this limited sampling scheme is designed to adhere closely to Illinois EPA NARP guidance.

4 Stream Monitoring

4.1 General Schedule

Data collection will commence for the UCSD Northeast Plant and Village of Rantoul Plant as soon as possible, on or around May 1, 2022 and will continue through October 31. This period captures the time of year when water quality issues are most likely to occur in these streams. The UCSD Southwest Plant is scheduled to have upgrades and operating changes designed to improve its effluent pH throughout 2022. Additionally, a stream restoration project in its receiving stream, Copper Slough, is scheduled to be installed. To capture the impacts of these changes relevant to NARP determination, data collection for the Southwest Plant will take place in summer 2023.

4.2 Stations

Three pairs of stations are recommended to be monitored one in each receiving stream. Stations will be located up and downstream of each outfall (Figures 5-7 and Table 5). This approach will characterize conditions and the effluent's effect on water quality. The additional water quality monitoring will provide sufficient data for NARP determination and next stages of NARP development, if necessary. The six stations are located at bridge crossings or preestablished access points. All have been monitored to some degree. Upstream sites are close enough to the outfall to capture as much upstream watershed as possible without the influence of effluent. Downstream sites are located at an ideal distance to allow for sufficient mixing of effluent and streamflow and to determine the immediate impacts of nutrients from the treatment plant. Station selections also eliminate the influence of other point and nonpoint sources that contribute to algal growth and are technically infeasible to isolate from plant effluent. Data collected using this approach can then be used to develop a predictive model estimating the potential impacts to downstream water quality.

Table 5 – Proposed Water Quality Monitoring Stations

Station ID	Name	Lat/Long	Station ID and organization which previously collected data at this site	Approximate distance from outfall	Year Monitoring Begins
SWP-U*	Copper Slough Southwest Plant Upstream – Mullikin Dr	40.085482, -88.332208	UCSD SW Upstream	0.5 mi	2023
SWP-D*	Copper Slough Southwest Plant Downstream – Windsor Road	40.084077, -88.33800	UCSD SW Downstream	0.4 mi	2023
NEP-U	Saline Branch Northeast Plant Upstream Plant Grounds	40.139727, -88.162975	UCSD NE Stream Point 1	0.25 mi	2022
NEP-D	Saline Branch Northeast Plant Downstream High Cross Road	40.139694, -88.162941	UCSD NE Stream Point 2	2.2 mi	2022
RNT-U	Salt Creek Ditch Rantoul Upstream Plant Grounds	40.31571, -88.12234	Rantoul WWTP Upstream	0.15 mi	2022
RNT-D	Salt Creek Ditch Rantoul Downstream Township 178E	40.31240, -88.11739	Rantoul WWTP Downstream	0.30 mi	2022
*Proposed Copper Slough monitoring site locations may change after stream restoration project completed.					

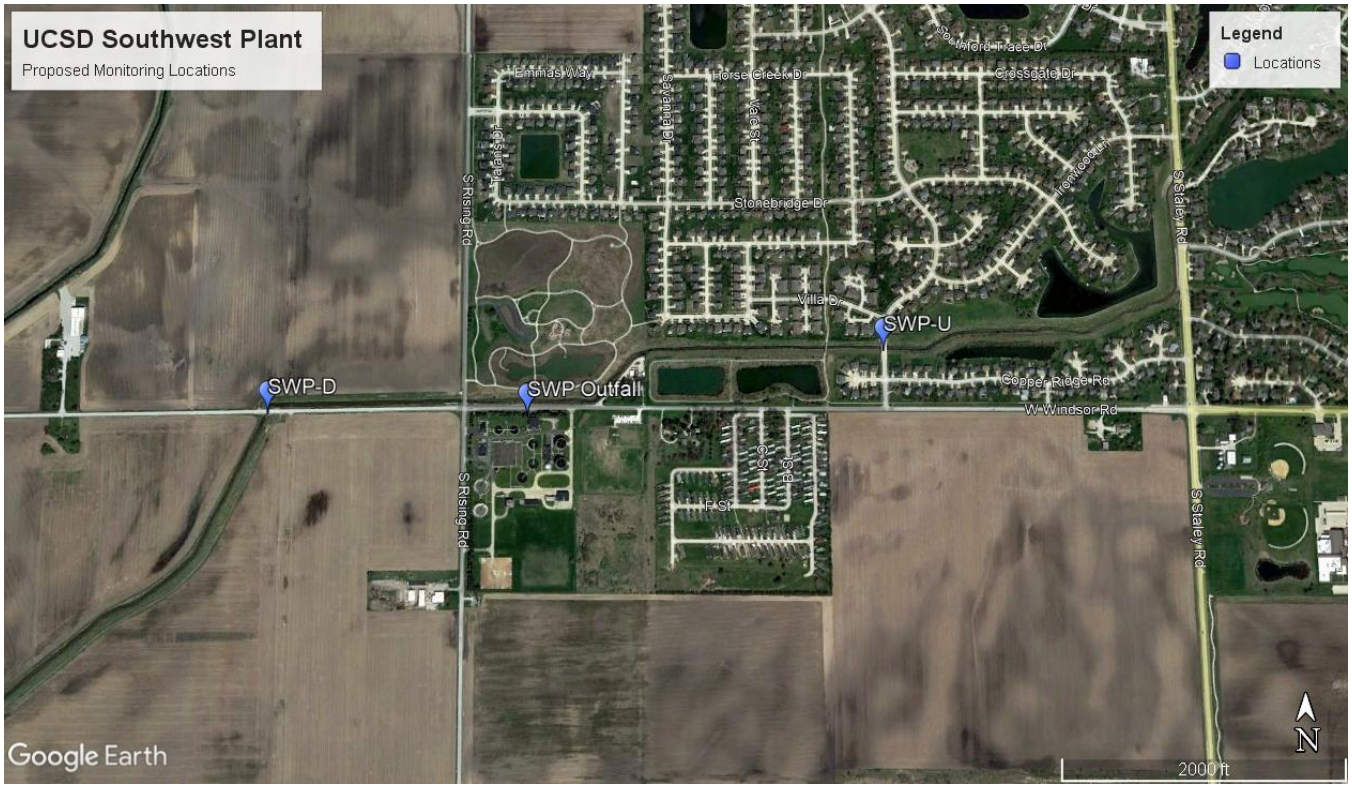

Figure 5. UCSD Southwest Plant Monitoring Locations

4.2.1 UCSD Southwest Plant Monitoring Location Information

Monitoring will begin in summer 2023 after changes in plant operations and a stream restoration project are in place. The proposed sites may be modified based on outcomes of construction. The upstream site is about 0.5 miles from the outfall with no significant point or nonpoint sources between. The downstream monitoring site on Copper Slough is approximately 0.4 miles from the outfall, which enters the stream from the bank and travels over a series of rocks to agitate the water to increase mixing. There is a bend in the river that also enhances mixing. Between the proposed site and where Copper Slough joins the Kaskaskia River stream access is not possible. This site represents the best chance of capturing the initial impact of the effluent on Copper Slough, as water quality at potential sites further downstream will have significant influence from another watershed and its point and nonpoint sources, therefore it will not be feasible to determine where the population of algae got its nutrients. However, the data collected at this site can be used in a predictive model to estimate the potential impact to downstream water quality.

Figure 6. UCSD Northeast Plant Monitoring Locations

4.2.2 UCSD Northeast Plant Monitoring Location Information

Monitoring in the Saline Branch will begin in May 2022. The upstream site is located on plant property, approximately 0.25 miles from the outfall, which enters the stream from the side and passes over rocks and concrete to agitate the water and enhance mixing. The stream channel has some sinuosity and traverses multiple bends before reaching the downstream sample site approximately 2.2 miles downstream. UCSD has historically monitored at this site. The proposed site represents an ideal location for capturing the impact of the effluent on water quality in the Saline Branch. Data from this site can be used in a predictive model to estimate the impact on downstream water quality.

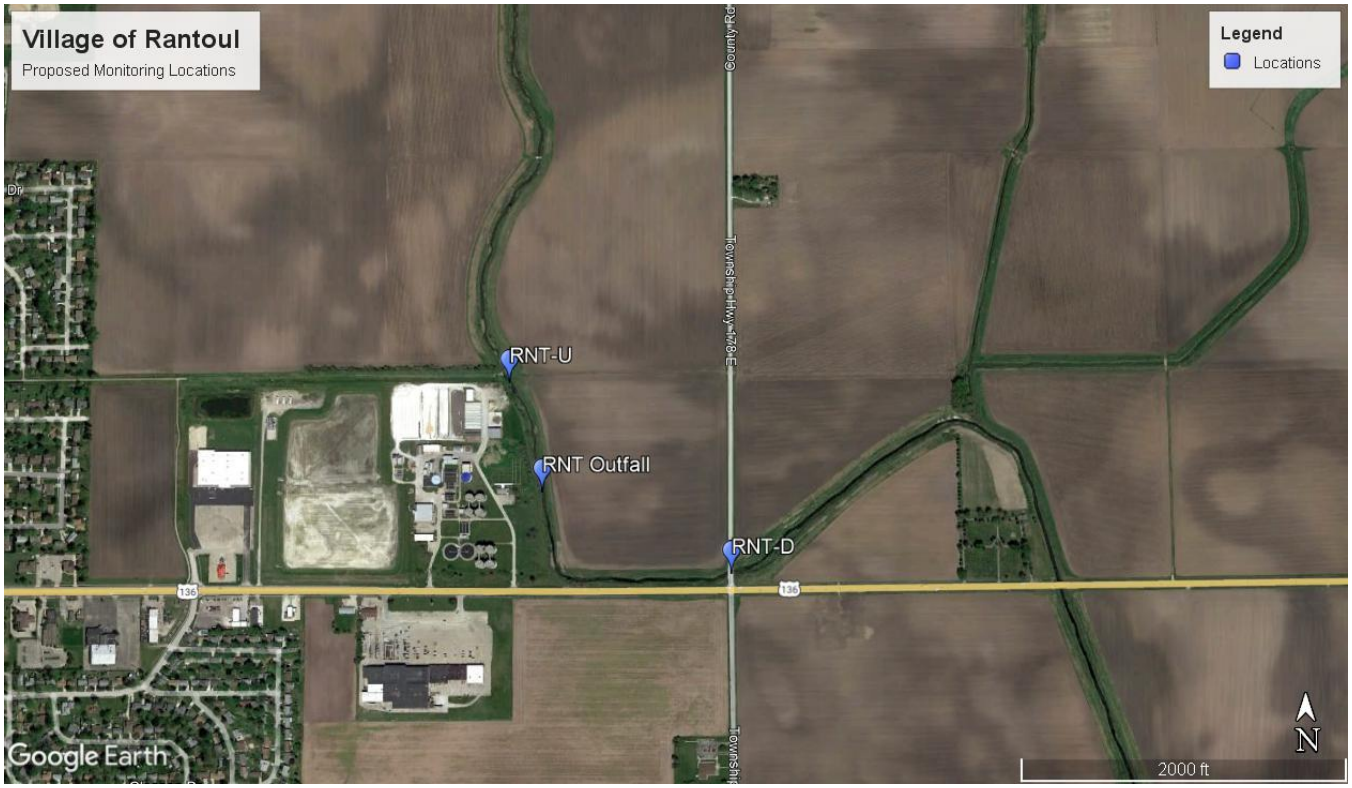

Figure 7. Village of Rantoul Monitoring Locations

4.2.3 Village of Rantoul Plant Monitoring Location Information

Monitoring on the Salt Fork Drainage Ditch will begin in May 2022 and continue through October. The upstream site is located approximately 0.15 miles from the outfall, which enters the stream from the side and is agitated by passing over rock. The downstream site is approximately 0.3 miles away from the outfall and traverses a significant bend in the stream and follows a somewhat sinuous channel. Streamflow and effluent at the sampling location will be fairly well mixed. This location represents the best chance of capturing the initial impact on water quality, as it avoids impacts from downstream tributaries and point and nonpoint sources, yet it is far enough away from the outfall to observe impacts on the aquatic community in the stream. Because there is no technically feasible method of determining from what source a far downstream algal population's nutrients came, a predictive model incorporating data from this site can be developed to estimate impacts on the aquatic community.

4.3 Sampling and Analyses

Sampling will be identical at each site unless circumstances arise that require a modification in protocol. Industry standard and manufacturer protocols for calibration, maintenance, data collection, and analysis will be followed and documented.

4.3.1 Hydrology Data

Stream stage and discharge data will be collected at each site (Table 6). If a sufficient range of flows is captured with monitoring, a rating curve can support estimates of watershed loading which could support watershed characterization and NARP development.

Table 6. Hydrology Parameters

Parameter	Collection Type	Frequency	Instrument/Method
Stream Stage	Continuous Probe	Continuous	Vented Pressure Transducer
Discharge	Manual	Bi-weekly, with additional storm samples	Digital Electromagnetic Flow Meter + wading staff or ADCP

4.3.2 Water Quality Data

Multiparameter sondes with integrated sensor wipers to reduce biofouling will be installed at each site and will collect data (Table 7) at a continuous 15-minute interval. Sondes will be left in place for multi-week deployments and will be serviced and/or calibrated no less frequently than every 30 days using manufacturer protocols. Multiparameter sondes manufactured by In-Situ instruments and YSI will be deployed for the water quality sampling. Grab samples and in-situ water quality measurements will be collected to augment the sonde monitoring data and will support quality assurance of sensor data and provide additional parameters useful for the NARP assessment. Grab samples will be collected on a bi-weekly frequency (Table 7) and 40 CFR Part 136 procedures will be followed and will include using laboratory-provided bottles with appropriate preservative, adherence to recommended holding times and conditions for samples, and daily duplicates for quality control. Where appropriate, a depth integrated, isokinetic sampler will be used for collection. Grab samples will be analyzed in-house at USCD and Rantoul laboratories, with chlorophyll *a* samples being sent to an accredited environmental laboratory.

Table 7. Water Quality Parameters

Parameter	Collection Type	Frequency	Method	Method Identifier
Dissolved Oxygen	Continuous Probe	Continuous	Optical	InSitu: EPA approved method YSI: ASTM D888-09
	Handheld Meter	Bi-weekly, Storm	Optical	ASTM D888-09
pH	Continuous Probe	Continuous	Potentiometric	EPA 150.2
	Handheld Meter	Bi-weekly, Storm	Potentiometric	EPA 150.2
Water Temperature	Continuous Probe	Continuous	Thermistor	EPA 170.1
	Handheld Meter	Bi-weekly, Storm	Thermistor	EPA 170.1
Chlorophyll-a	Continuous Probe	Continuous	In-situ Optical Fluorescence	Instrument Manufacturer Optical Method
	Grab	Bi-weekly, Storm	Lab Spectrophotometric	EPA 445.0
Total Phosphorus	Grab	Bi-weekly, Storm	Colorimetry	EPA 365.1 / EPA 365.3
Orthophosphate	Grab	Bi-weekly, Storm	Colorimetry	EPA 365.1 / EPA 365.3
Conductivity	Continuous Probe	Continuous	Resistor Network	EPA 120.1
	Handheld Probe	Bi-weekly, Storm	Resistor Network	EPA 120.1

5 Data Management & Quality Control

Data will be downloaded from each logger at each site visit and will be maintained in a relational Microsoft Access database or Microsoft Excel spreadsheet. Continuous data will be corrected for drift using the statistical software R, package driftR[3] using a standard procedure based on instrument calibration.

[3] https://rdocumentation.org/packages/driftR/versions/1.1.0

APPENDIX B: WATER QUALITY DATA

UCSD 2023

SWP NARP DATA

Upstream **Mulikin Dr.**

Sample Date	5/2/23	5/16/23	5/30/23	6/13/23	6/29/23	7/10/23	7/25/23	8/7/23	8/24/23	9/5/23	9/19/23	10/3/23	10/16/23	10/30/23
Sample Time	12:13 PM	12:30 PM	10:50 AM	12:52 PM	10:50 AM	12:00 PM	10:50 AM	11:45 AM	10:50 AM	10:55 AM	10:40 AM	11:00 AM	1:55 PM	9:30 AM
Dissolved Oxygen, mg/L	13.7	9.2	13.4	14.7	5.5	8.6	11.7	7.4	10.7	9.8	11.2	9.7	11.4	10.1
pH	8.22	7.28	8.13	8.35	7.53	7.72	8.05	7.80	7.88	7.82	7.65	7.78	8.01	7.70
Temperature ^{o}C	14.5	18.5	26.9	22.6	23.2	26.3	28.8	22.5	28.0	24.9	20.1	22.8	15.0	10.5
Chlorophyll-a, mg/m3	4.2	3.7	< 1.0	< 1.0	1.2	< 1.0	< 1.0	3	< 1.0	1.2	< 1.0	< 1.0	2.3	13
T-PO4-P, mg/L	0.03	0.07	0.03	0.03	0.12/0.10	0.08	0.03	0.23	0.06	0.05	0.05	0.07	0.05	0.14
o-PO4-P, mg/L	< 0.02	0.03	< 0.02	0.06	0.16	0.07	0.03	0.04	0.05	0.07	0.03	0.08	0.01	0.04
Ammonia, mg/L	0.05	0.07	0.08	0.04	0.09	0.14	0.08	0.07	0.11	0.08	0.06	0.09	0.06	0.07
TKN, mg/L	0.8	1.2	0.8	1.0	1.3	1.1	0.7	1.0	1.0	1.0	0.1	1.1	0.9	1.3
Nitrate, mg/L	1.1	1.6	0.6	1.1	0.8	0.3	0.0	0.5	0.2	0.1	0.3	0.4	0.3	1.0
Conductivity, µS/cm	780	660	800	670	480	550	720	280	760	780	750	670	580	530

Downstream **West Road Bridge**

Sample Date	5/2/23	5/16/23	5/30/23	6/13/23	6/29/23	7/10/23	7/25/23	8/7/23	8/24/23	9/5/23	9/19/23	10/3/23	10/16/23	10/30/23
Sample Time	12:02 PM	12:40 PM	11:10 AM	1:10 PM	11:03 AM	12:20 PM	11:20 AM	12:00 AM	11:03 AM	11:10 AM	11:12 AM	11:20 AM	2:23 PM	10:15 AM
Dissolved Oxygen, mg/L	11.9	9.0	11.6	12.4	6.7	8.7	13.5	8.0	10.8	9.7	11.2	9.7	10.6	10.6
pH	7.98	7.64	8.09	8.30	7.68	7.77	8.36	7.81	7.72	7.98	8.10	7.76	8.05	7.89
Temperature ^{o}C	14.7	19.2	23.2	20.0	23.5	24.5	26.7	22.2	26.6	23.6	22.4	24.6	17.0	11.2
Chlorophyll-a, mg/m3	4.3	2.0	2.7	< 1.0	7.3	< 1.0	1.4	2.8	1.2	< 1.0	< 1.0	< 1.0	1.5	8.7
T-PO4-P, mg/L	0.09	0.11	0.15	0.14	0.22	0.20	0.22	0.18	0.27	0.32	0.29	0.17	0.13	0.16
o-PO4-P, mg/L	0.03	0.02	0.07	0.11	0.15	0.12	0.14	0.07	0.17	0.22	0.20	0.10	0.05	0.07
Ammonia, mg/L	0.06	0.09	0.08	0.04	0.07	0.13	0.06	0.06	0.11	0.10	0.07	0.08	0.06	0.07
TKN, mg/L	1.2	1.3	1.1	1.3	1.2	1.2	1.2	1.0	1.3	1.0	1.5	1.4	1.0	1.0
Nitrate, mg/L	4.5	3.7	5.1	5.5	2.8	3.1	5.7	1.8	6.5	5.3	7.1	6.0	4.2	2.5
Conductivity, µS/cm	810	720	740	730	590	640	700	350	730	700	730	710	700	580

APPENDIX C: NARP SPECIAL PERMIT CONDITION

Special Conditions

A waterbody or segment is at risk of eutrophication if there is available information that plant, algal or cyanobacterial growth is causing or will cause violation of a water quality standard.

The Permittee shall develop, or be a part of a watershed group that develops, a Nutrient Assessment Reduction Plan (NARP) that will meet the following requirements:

A. The NARP shall be developed and submitted to the Agency by December 31, 2024. This requirement can be accomplished by the Permittee, by participation in an existing watershed group or by creating a new group. The NARP shall be supported by data and sound scientific rationale.

B. The Permittee shall cooperate with and work with other stakeholders in the watershed to determine the most cost-effective means to address the risk of eutrophication. If other stakeholders in the watershed will not cooperate in developing the NARP, the Permittee shall develop its own NARP for submittal to the Agency to comply with this condition.

C. In determining the target levels of various parameters necessary to address the risk of eutrophication, the NARP shall either utilize the recommendations by the Nutrient Science Advisory Committee or develop its own watershed-specific target levels.

D. The NARP shall identify phosphorus input reductions from point sources and non-point sources in addition to other measures necessary to remove the risk of eutrophication characteristics that will cause or may cause violation of a water quality standard. The NARP may determine, based on an assessment of relevant data, that the watershed does not have a risk of eutrophication related to phosphorus, in which case phosphorus input reductions or other measures would not be necessary. Alternatively, the NARP could determine that phosphorus input reductions from point sources are not necessary, or that phosphorus input reductions from both point and nonpoint sources are necessary, or that phosphorus input reductions are not necessary and that other measures, besides phosphorus input reductions, are necessary.

E. The NARP shall include a schedule for the implementation of the phosphorus input reductions and other measures. The NARP schedule shall be implemented as soon as possible and shall identify specific timelines applicable to the permittee.

F. The NARP can include provisions for water quality trading to address the phosphorus related risk of eutrophication characteristics in the watershed. Phosphorus/Nutrient trading cannot result in violations of water quality standards or applicable antidegradation requirements.

G. If the NARP determines that a limit lower than the 0.5 mg/L Phosphorus limit is necessary and attainable, the lower limit and timeline identified in the NARP shall apply to the Permittee.

H. The Permittee shall request modification of the permit within 90 days after the NARP has been completed to include necessary phosphorus input reductions identified within the NARP. The Agency will modify the permit if necessary

I. If the Permittee does not develop or assist in developing the NARP and such a NARP is developed for the watershed, the Permittee will become subject to effluent limitations necessary to address the risk of eutrophication. The Agency shall calculate these effluent limits by using the NARP and any applicable data. If no NARP has been developed, the effluent limits shall be determined for the Permittee on a case-by-case basis, so as to ensure that the Permittee's discharge will not cause or contribute to violations of the dissolved oxygen or narrative offensive condition water quality standards.

SPECIAL CONDITION 21 – DETAILS OF COMPLIANCE WITH PERMIT REQUIREMENTS

Below is a summary of responsiveness to each subpart of NARP special condition.

A. Progress reports have been submitted semi-annually to date. The UCSD participates in the existing Salt Fork Watershed Group and KWA. Progress reports will continue to be submitted annually as required. Extensive monitoring, watershed modeling and scientific analysis performed to support NARP activities as detailed in this report.
B. UCSD has worked with the Salt Fork Watershed Group throughout NARP development, and with the KWA.
C. Nonpoint source input reductions and stream restoration will provide impactful results, reducing risk of eutrophication. Monitoring shows the most severe risk of eutrophication is upstream, and not related to the low WWTP phosphorus contribution.
D. UCSD has pledged to actively support NPS phosphorus reductions and stream restoration in the watershed which will reduce the risk of eutrophication.
E. A timeline is provided in Section 4.3 of this report.
F. Trading is not proposed.
G. A limit lower than 0.5 mg/L is not necessary to reduce the risk of eutrophication.
H. Permit modification is not necessary, as the 0.5 mg/L TP effluent limit is already in place.
I. Submitted NARP satisfies this condition.

APPENDIX D: STAKEHOLDER ENGAGEMENT

WATERSHED GROUP MEETINGS – SALT FORK WATERSHED GROUP

Meeting minutes are available upon request.

- 2019 December 12:
  - Discussed NARP requirements and that the UCSD SWP will likely be subject to Special Condition.
- 2020 March 05:
  - Discussed NARP triggers and the reasons for NARP parameters of interest. Reminded group that UCSD will likely be required to complete a NARP for Copper Slough and that public participation is a key element of the process.
- 2020 June 06:
  - Confirmed NARP was in UCSD SW Plant NPDES permit and discussed public participation and the watershed group's involvement.
- 2020 September 03:
  - Discussed NARP elements and its potential implementation.
  - **Formally requested the Salt Fork Watershed Group to be partners/stakeholders in NARP development.**
- 2020 December 12:
  - Discussed plans for the NARP study. Again, reminded the group that stakeholder involvement is important and that UCSD has requested involvement and input.
- 2021 June 03:
  - UCSD Gave update and overview of NARP requirements.
- 2021 September 02:
  - UCSD on agenda to discuss NARP – meeting cancelled.
- 2021 December 02:
  - Discussion of NARP requirements, request to watershed group with regards to being involved.
  - Discussed UCSD's proactive approach of improving effluent chemistry to help stream ecosystems.
- 2022 March 03:
  - UCSD gave a detailed overview of NARP requirements for new group members.
  - Discussed first steps toward NARP compliance.
  - Committee members agreed that the watershed group will engage and provide input.
- 2022 June 02:
  - **Provided overview of the NARP process and the NARP monitoring plan to determine the extent of risk of eutrophication or impairment in the Copper Slough and how to proceed with TP reductions if necessary.**
  - **UCSD asked for feedback and input on the goals of the monitoring plan and the proposed steps toward compliance with the NARP special condition.**
- 2022 September 01:
  - Gave update on NARP study progress.

  - Discussed data collection and QA/QC measures in place for the study.
- 2022 December 01:
  - Gave brief update on NARP study.
- 2023 March 13:
  - **Discussed plans for Copper Slough monitoring in 2023.**
  - **Gave comprehensive update and results of the 2022 program for UCSD Northeast Plant (Saline Branch) and Village of Rantoul (Salt Fork Drainage Ditch), indicating SWP data collection would follow similar protocol and similar methods.**
  - **Requested feedback and discussion occurred with participants.**
  - **Slide presentation including data was distributed to participants.**
- 2023 June 01:
  - Provided update that Copper Slough monitoring is in progress and results should be expected near year end.
  - Discussed 1 year extension of NARP due date to align with Northeast Plant.
- 2023 September 07:
  - Provided general NARP update for UCSD SW Plant data collection.
- 2023 December 07:
  - Provided general NARP update for data collection.
- 2024 March 07:
  - **Gave a detailed presentation on monitoring results.**
  - **Requested feedback.**
  - **Provided preliminary NARP conclusions including proposed actions such as stream restoration projects and encouraging additional watershed planning.**
- 2024 June 06
  - Provided update on NARP report progress.
- 05 December 2024
  - Present final NARP report to Salt Fork Watershed Group at quarterly meeting.

SALT FORK WATERSHED GROUP PARTICIPANT LIST AS OF MARCH 2023

Names have been redacted for privacy. The individuals on this list receive quarterly meeting announcements and other correspondence. Other individuals not on this list frequently participate in meetings.

1. City of Champaign
2. Illinois DNR
3. UCSD
4. City of Urbana
5. Illinois DNR
6. Prairie Rivers Network
7. Danville Sanitary District
8. Resident
9. Urbana Park District
10. Village of Rantoul
11. Prairie Rivers Network
12. Farnsworth Group
13. University of Illinois
14. Resident
15. NRCS
16. Village of Rantoul
17. Illinois EPA
18. Krukewitt Farms
19. Resident, Farmer
20. Vermilion County SWCD
21. Resident, Farmer
22. University of Illinois
23. Champaign County Forest Preserve District
24. Sierra Club
25. Vermilion County SWCD
26. Danville Sanitary District
27. City of Champaign
28. USGS
29. UCSD
30. Resident
31. Audubon Society
32. Illinois DNR
33. Illinois EPA
34. UCSD
35. Champaign County SWCD

WATERSHED GROUP MEETINGS – KASKASKIA WATERSHED ASSOCIATION

- 04 September 2024 – Agenda available upon request.
    - **Provided comprehensive presentation on monitoring results.**
    - **Requested feedback on NARP monitoring results.**
    - **Provided preliminary NARP conclusions including proposed actions such as stream restoration and encouraging additional watershed planning.**
- December 2024
    - Will present final NARP to group members for their comment.

UCSD BOARD OF TRUSTEES PUBLIC MEETINGS

- Staff and consultants of the UCSD have presented at the monthly Board of Trustees public meetings on numerous occasions. Highlights include:
    - 03 January 2023 – Presented an overview of next steps toward NARP compliance and a plan for monitoring.
    - 05 March 2024 – Presented results of monitoring. Discussed key takeaways and presented a preliminary strategy toward NARP compliance activities.
    - 07 November 2024 – Presented a final draft of the NARP to Board of Trustees at public meeting.
- The UCSD regularly updates a NARP section on its public website, www.u-csd.com/207/UCSD-Projects.