# PERMITTING DISCHARGES TO LEWISVILLE LAKE

**Brian Kelm,** *Technical Services*

**Chris Pasch**, *Senior Consultant*

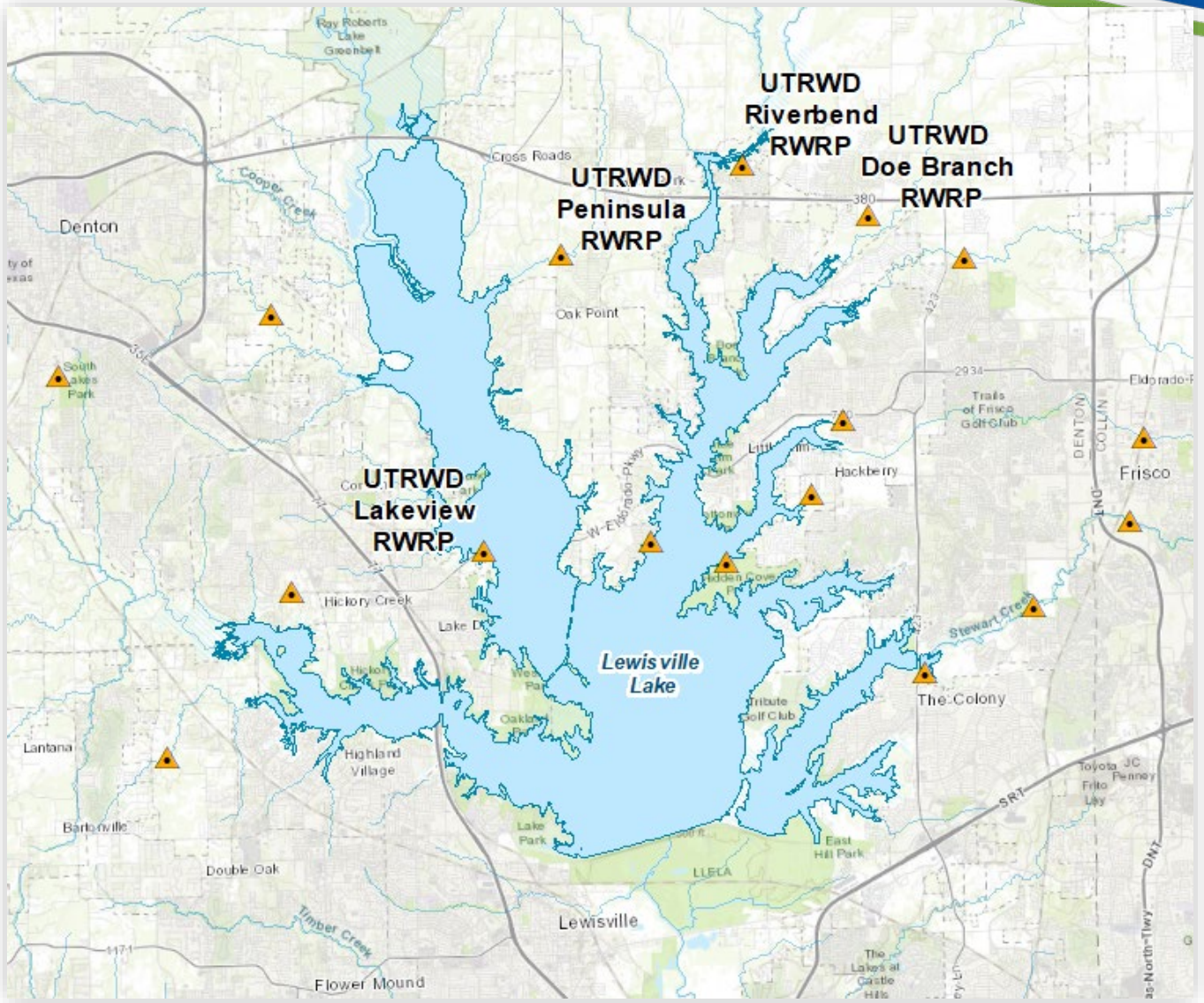
**Ashley Lewis**, *Project Manager*

**Kristin Arnold**, *Project Scientist*

PLUMMER

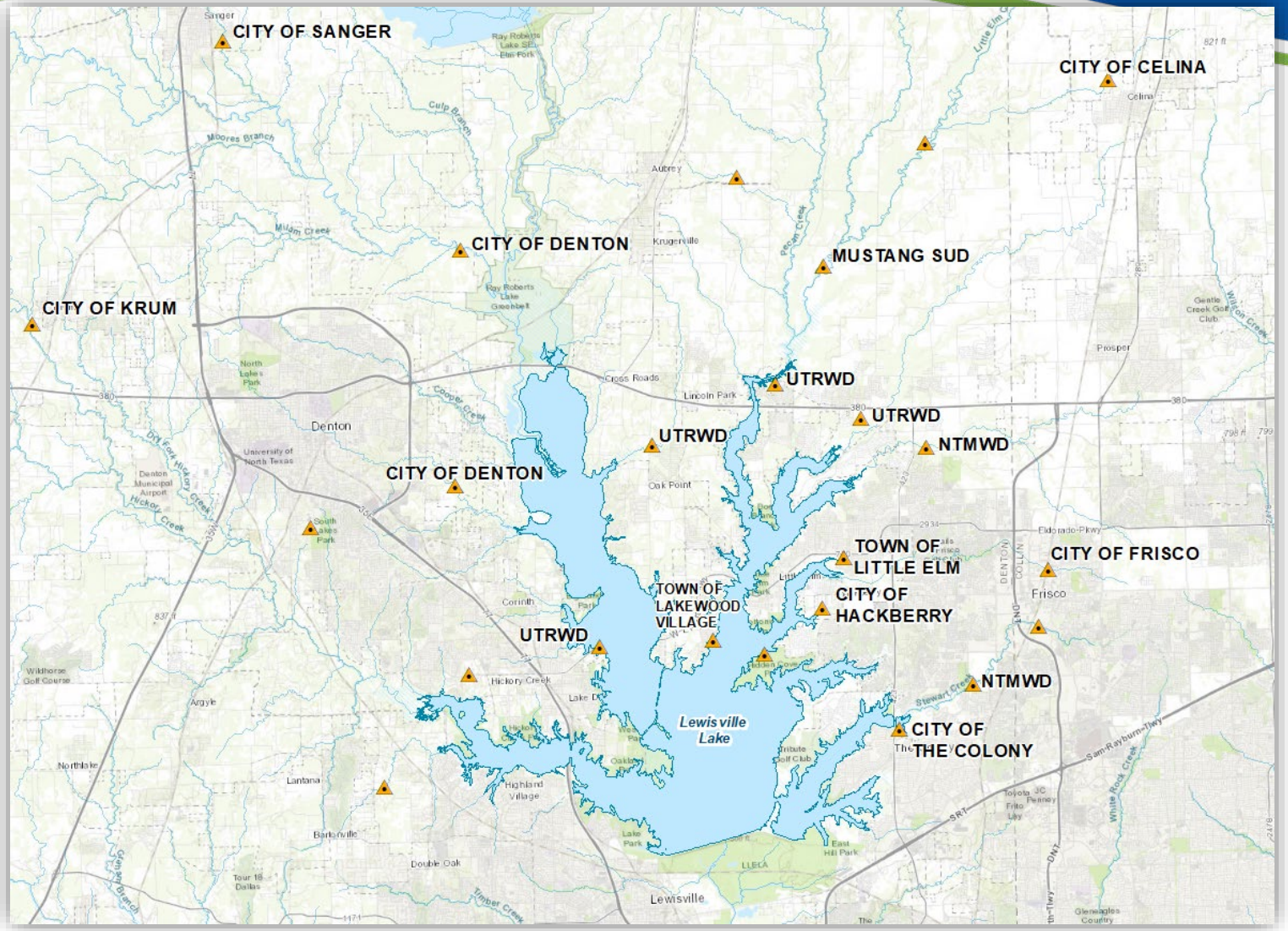
UPPER TRINITY REGIONAL WATER DISTRICT

# UTRWD RWRPs




UPPER TRINITY
REGIONAL WATER DISTRICT

# DEVELOPMENT IN LEWISVILLE LAKE WATERSHED



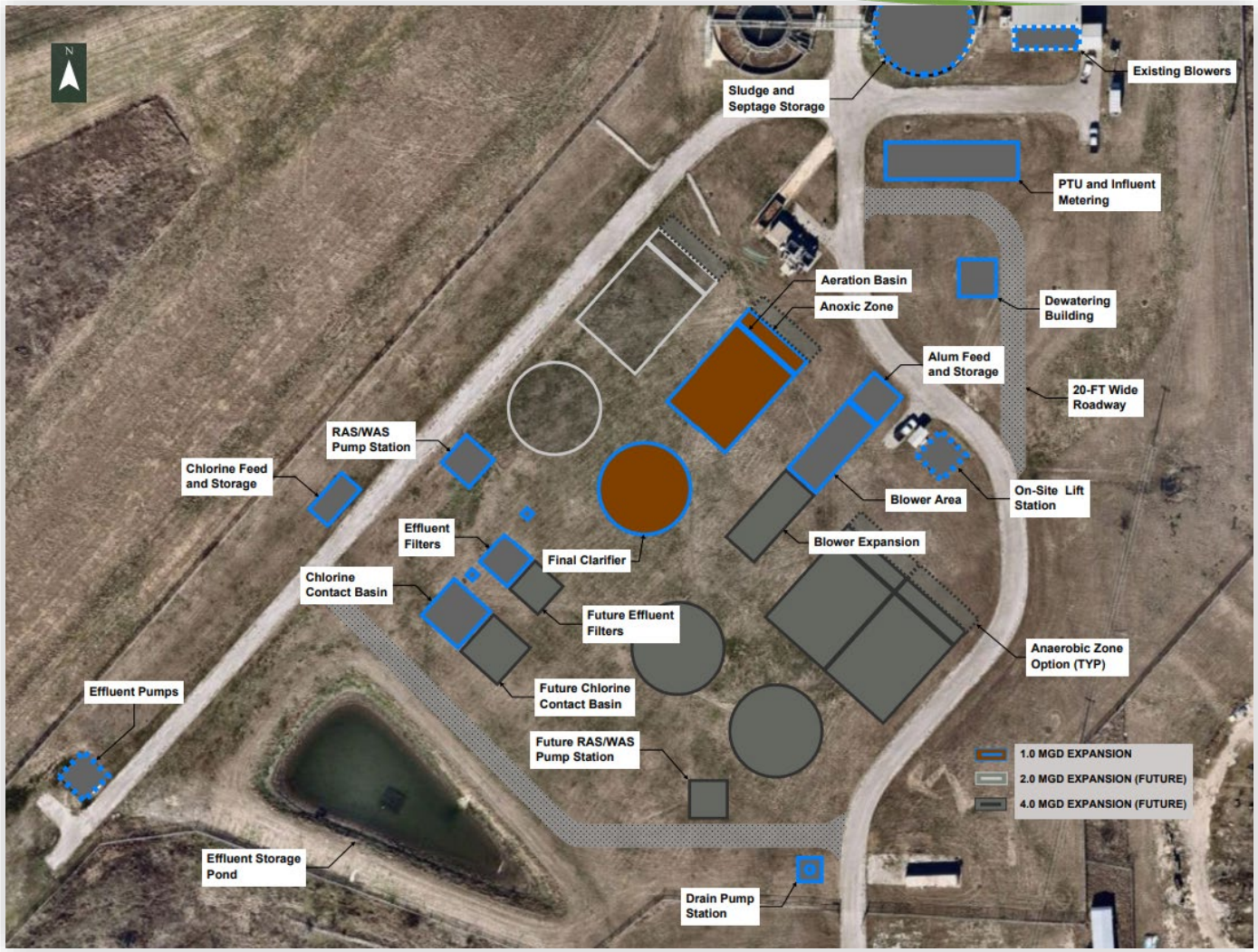
# PLANNING FOR GROWTH

## Engineer's Phasing Plan

- Existing 1 MGD
- Second 2 MGD
- Third 4 MGD
- Fourth 8 MGD
- Final 12 MGD

## Permit Phases

- Existing 1 MGD
- Second 2 MGD
- Final 12 MGD



# PLANNING FOR GROWTH

Engineer's Phasing Plan

- Existing 1 MGD
- *2 MGD – under construction*
- 4 MGD
- 8 MGD
- 12 MGD

Permit Phases

- Existing 1 MGD
- *2 MGD – under construction*
- 4 MGD
- 12 MGD

# PLANNING FOR GROWTH

## Engineer's Phasing Plan

- Existing 1 MGD
- *2 MGD – under construction*
- 4 MGD
- 8 MGD
- 12 MGD

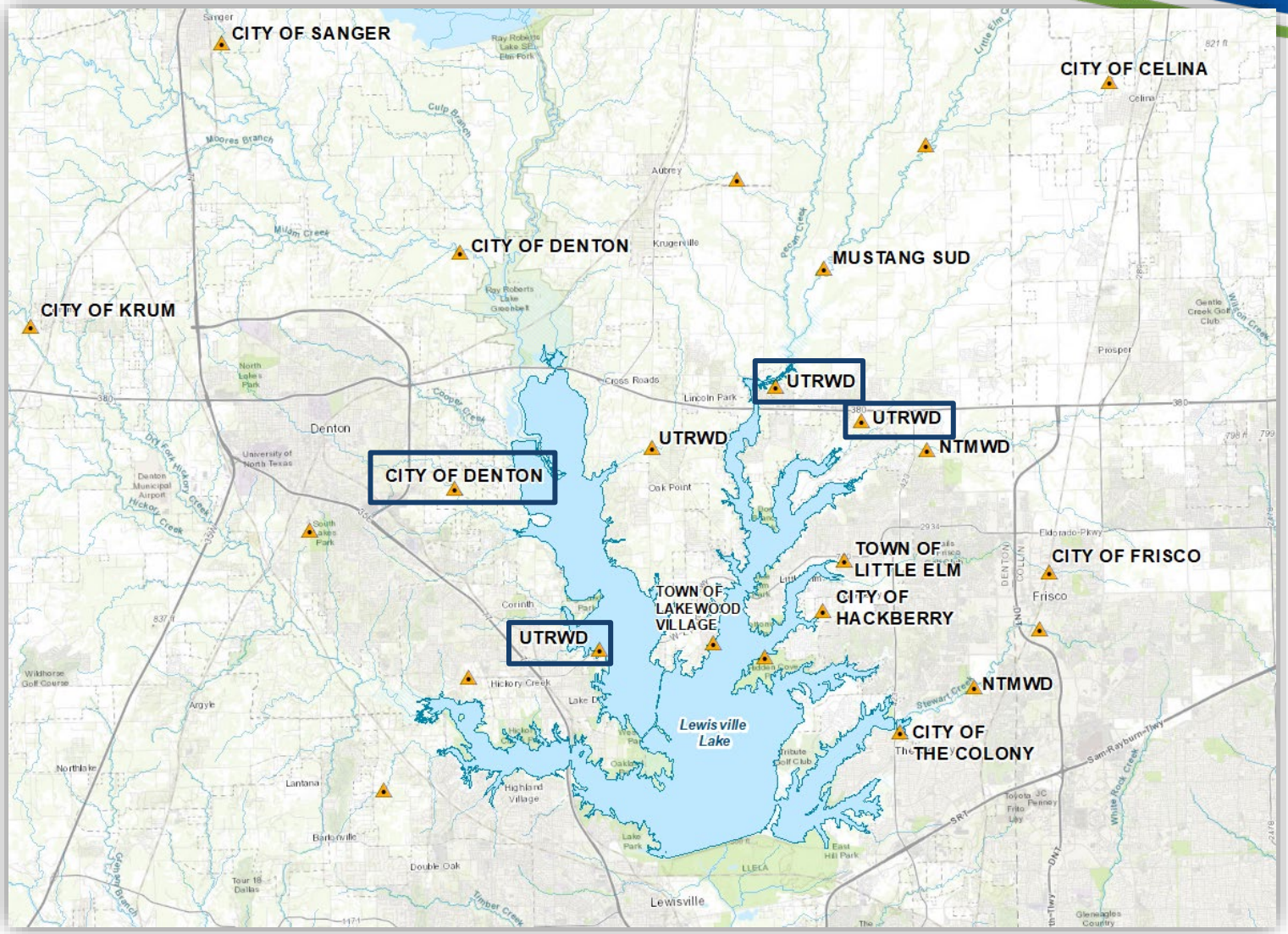
## Permit Phases

- *1 MGD - Existing*
- 2 MGD – under construction
- 4 MGD
- 12 MGD

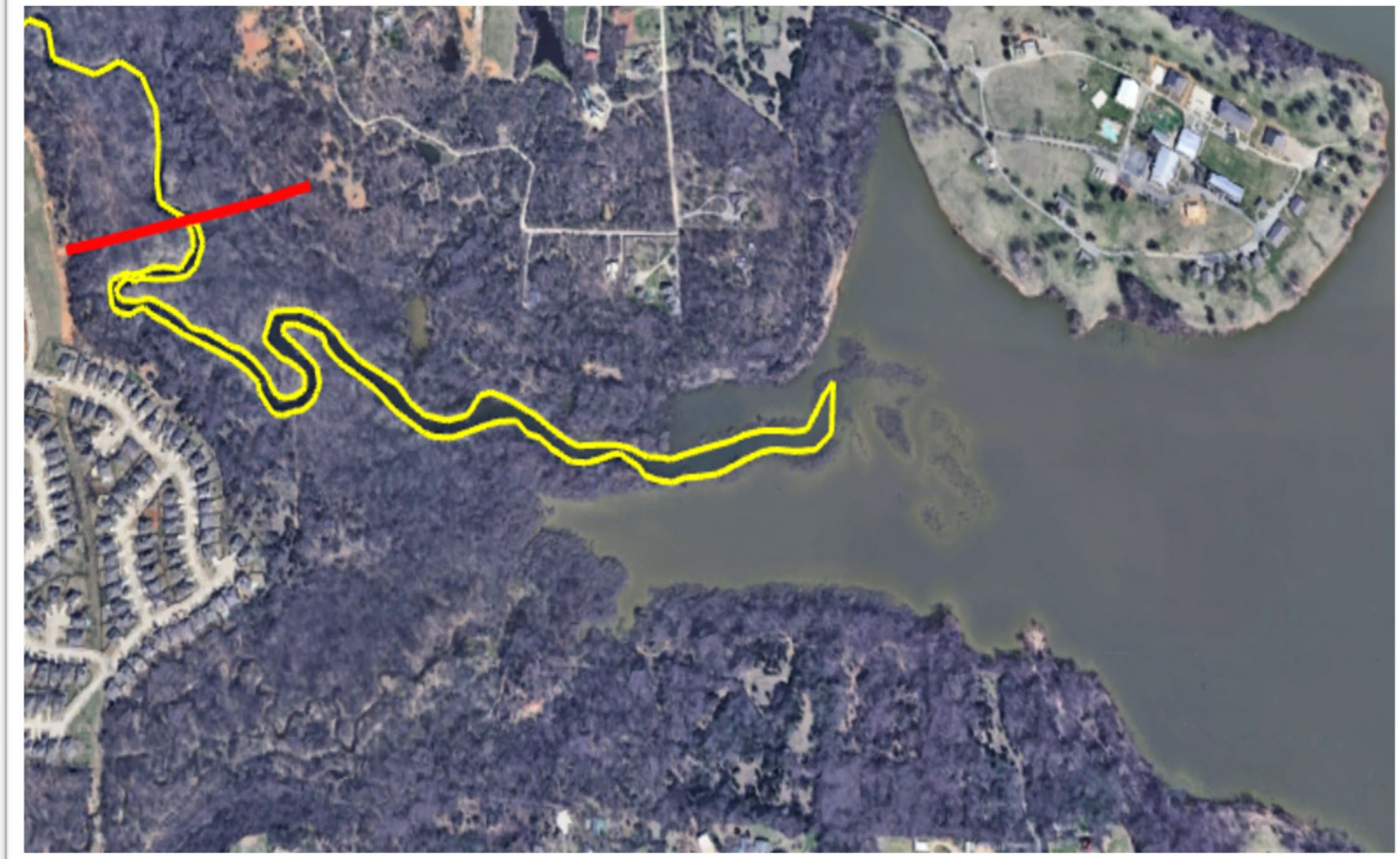
## Future Permit Phases

- *2 MGD – New Existing*
- 4 MGD *under construction*
- 8 MGD – new phase
- 12 MGD

# MODELING


CITY OF SANGER
CITY OF CELINA
CITY OF DENTON
MUSTANG SUD
CITY OF KRUM
UTRWD
UTRWD
UTRWD
NTMWD
CITY OF DENTON
TOWN OF LITTLE ELM
CITY OF FRISCO
TOWN OF LAKEWOOD VILLAGE
CITY OF HACKBERRY
UTRWD
NTMWD
CITY OF THE COLONY
Lewisville Lake
Denton
Lewisville
Frisco
Prosper
Celina
Aubrey
Krugerville
Oak Point
Corinth
Lantana
Highland Village
Double Oak
Argyle
Northlake
Bartonville
Hickory Creek

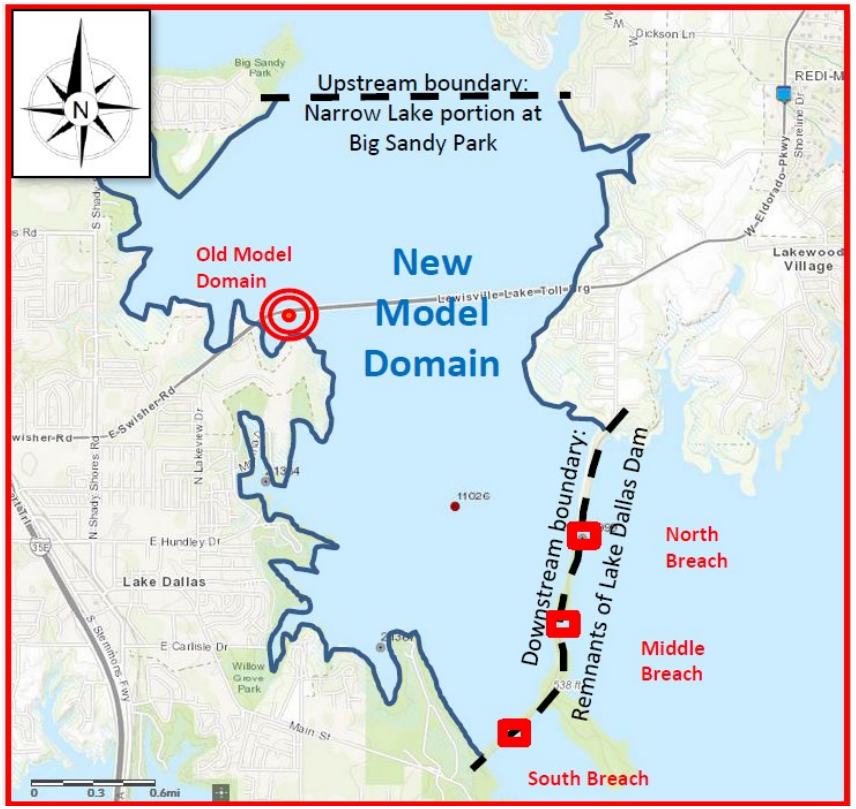
# MODELING – CITY OF DENTON

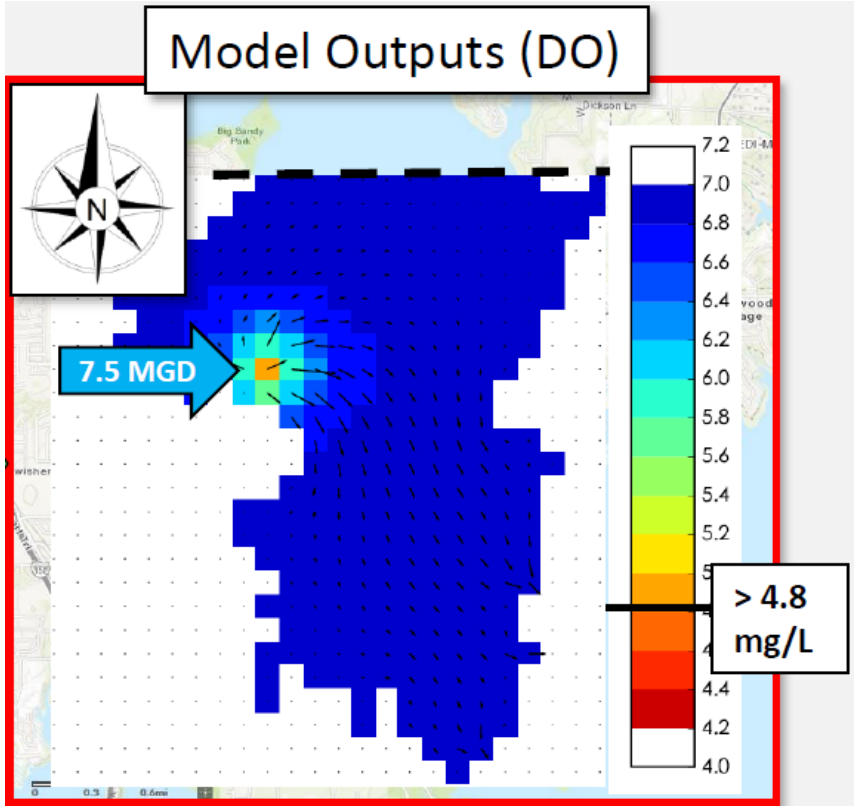


# MODELING EXAMPLE – UTRWD LAKEVIEW

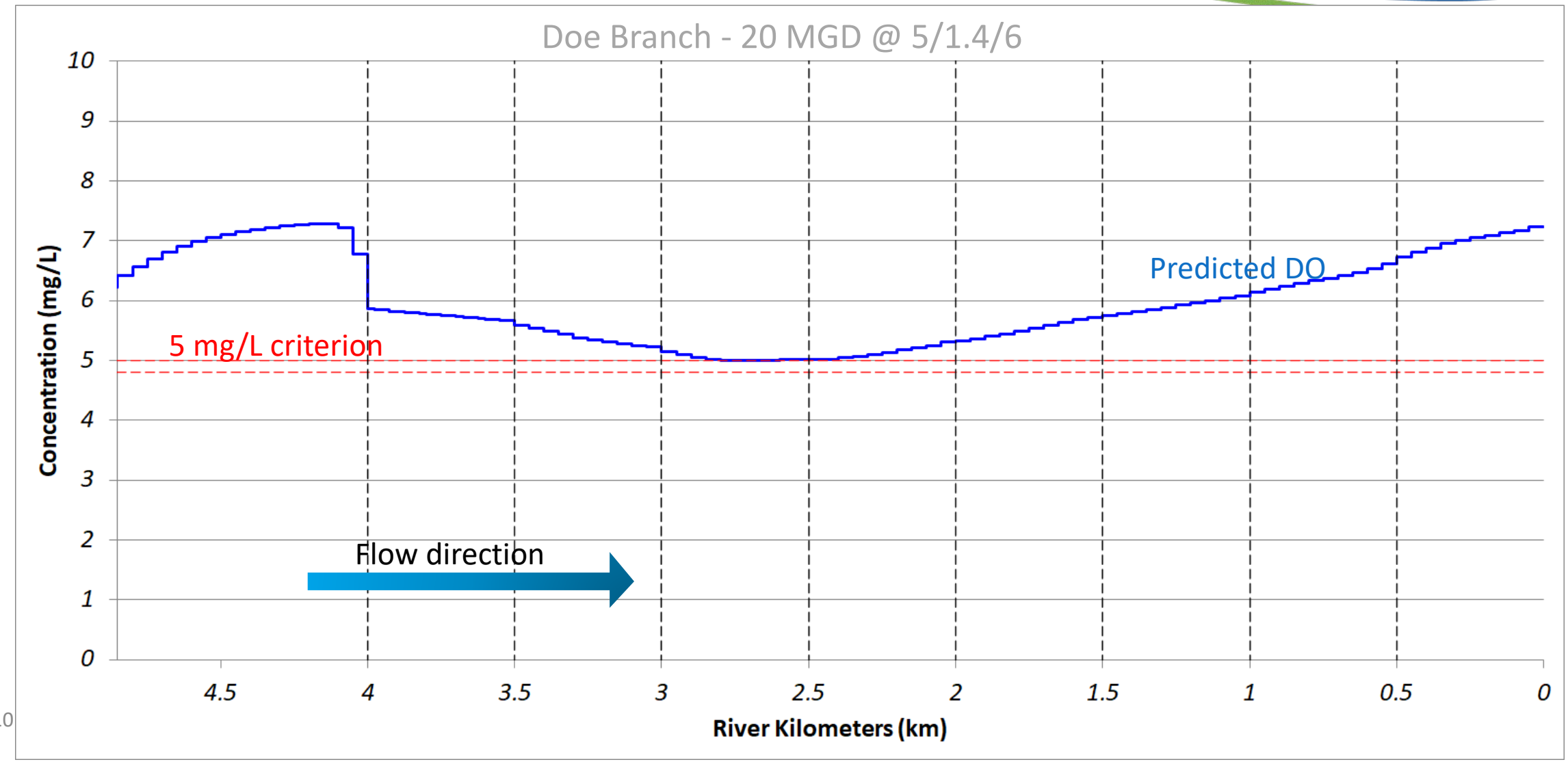
## Change of modeling platform

CORMIX → CSTR → WASP



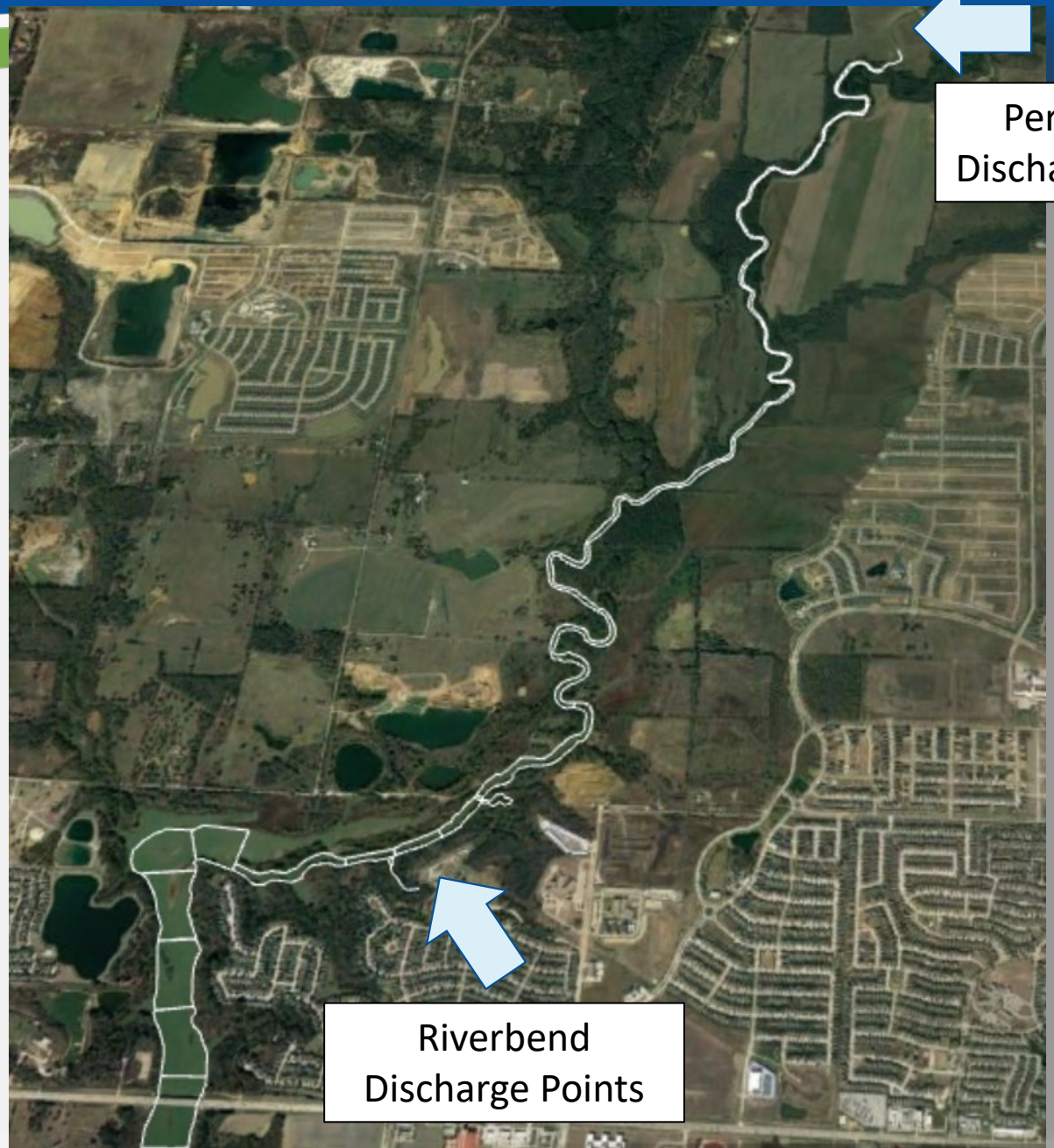



# MODELING – UTRWD'S DOE BRANCH

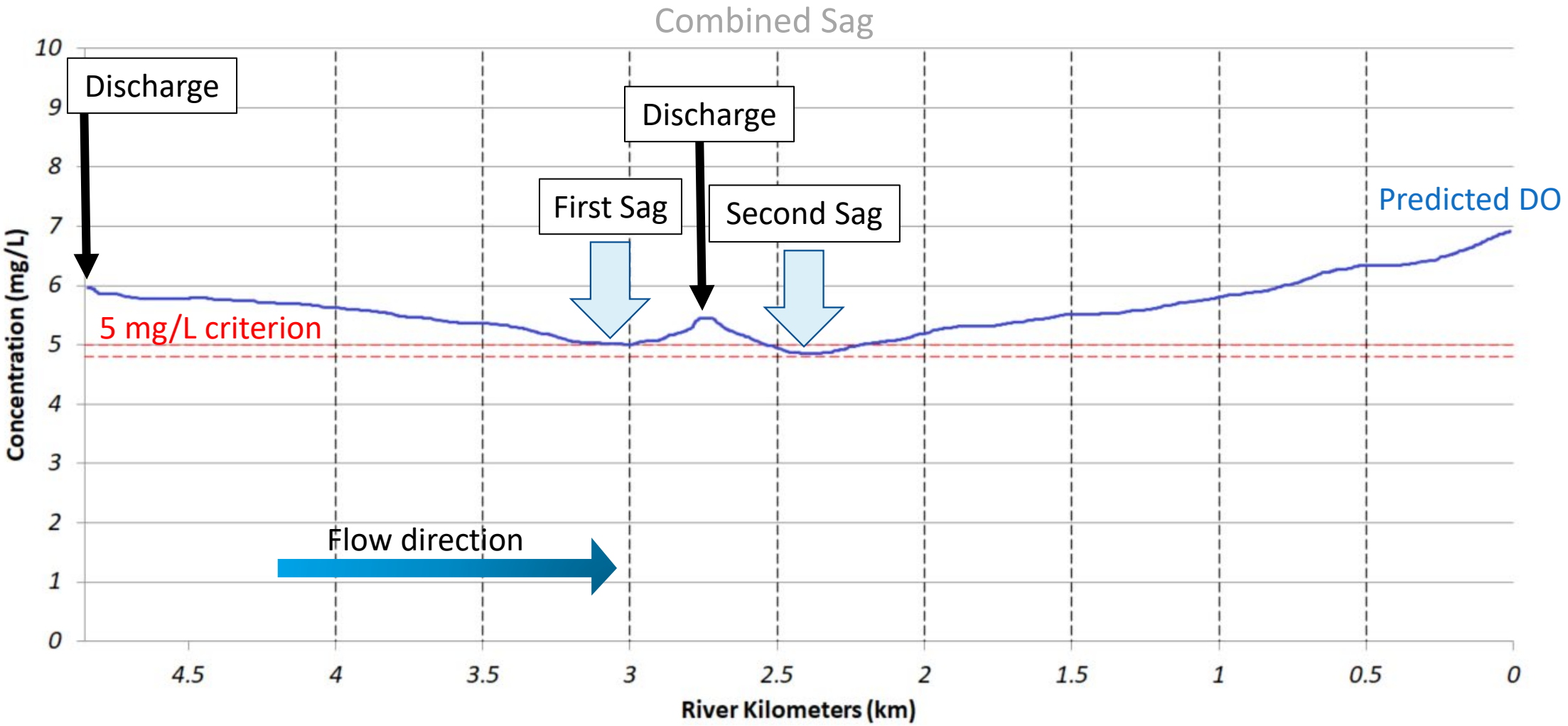


# MODELING – UTRWD'S DOE BRANCH

# MODELING – UTRWD'S RIVERBEND



# MODELING – UTRWD'S RIVERBEND



# NUTRIENTS

## 2010 TSWQS

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| (0100)[2] | Palo Duro Reservoir | 10005 | 21.73 |
| 0208 | Lake Crook | 10137 | 7.38 |
| 0209 | Pat Mayse Lake | 10138 | 12.40 |
| 0212 | Lake Arrowhead | 10142 | 11.21 |
| 0213 | Lake Kickapoo | 10143 | 6.13 |
| 0217 | Lake Kemp | 10159 | 8.83 |
| 0223 | Greenbelt Lake | 10173 | 5.00 (4.59) |
| (0229) | Lake Tanglewood | 10192 | 43.71 |
| 0302 | Wright Patman Lake | 10213 | 21.49 |
| 0405 | Lake Cypress Springs | 10312 | 17.54 |
| 0507 | Lake Tawakoni | 10434 | 37.18 |
| 0509 | Murvaul Lake | 10444 | 55.80 |
| 0510 | Lake Cherokee | 10445 | 8.25 |
| 0512 | Lake Fork Reservoir | 10458 | 14.50 |
| 0603 | B. A. Steinhagen Lake | 10582 | 11.67 |
| 0605 | Lake Palestine | 16159 | 27.34 |
| 0610 | Sam Rayburn Reservoir | 14906 | 6.22 |
| 0613 | Lake Tyler | 10637 | 13.38 |
| 0613 | Lake Tyler East | 10638 | 10.88 |
| 0614 | Lake Jacksonville | 10639 | 5.60 |
| 0803 | Lake Livingston | 10899 | 22.96 |
| 0807 | Lake Worth | 10942 | 34.18 |
| 0809 | Eagle Mountain Reservoir | 10944<br>10945 | 25.37 |
| 0811 | Bridgeport Reservoir | 10970 | 5.32 |
| 0813 | Houston County Lake | 10973 | 11.10 |
| 0815 | Bardwell Reservoir | 10979 | 22.84 |
| 0816 | Lake Waxahachie | 10980 | 19.77 |
| 0817 | Navarro Mills Lake | 10981 | 15.07 |
| 0818 | Cedar Creek Reservoir | 10982<br>16749 | 30.40 |
| 0823 | Lewisville Lake | 11027 | 18.45 |
| 0826 | Grapevine Lake | 11035<br>16113<br>17827 | 11.90 |

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| 0827 | White Rock Lake | 11038 | 33.65 |
| 0830 | Benbrook Lake | 15151<br>11046 | 27.15 |
| 0836 | Richland-Chambers Reservoir | 15168 | 15.29 |
| 1012 | Lake Conroe | 11342 | 24.27 |
| 1203 | Whitney Lake | 11851 | 18.34 |
| 1205 | Lake Granbury | 11860 | 22.16 |
| 1207 | Possum Kingdom Lake | 11865 | 10.74 |
| (1208) | Millers Creek Reservoir | 11679 | 15.65 |
| 1212 | Somerville Lake | 11881 | 53.05 |
| 1216 | Stillhouse Hollow Lake | 11894 | 5.00 (2.07) |
| 1220 | Belton Lake | 11921 | 6.38 |
| 1222 | Proctor Lake | 11935 | 28.15 |
| 1225 | Waco Lake | 11942 | 23.16 |
| 1228 | Lake Pat Cleburne | 11974 | 19.04 |
| 1231 | Lake Graham | 11979 | 6.07 |
| 1233 | Hubbard Creek Reservoir | 12002 | 5.61 |
| 1234 | Lake Cisco | 12005 | 5.00 (4.64) |
| 1235 | Lake Stamford | 12006 | 16.85 |
| 1237 | Lake Sweetwater | 12021 | 13.28 |
| 1240 | White River Lake | 12027 | 13.85 |
| 1247 | Granger Lake | 12095 | 11.72 |
| 1249 | Lake Georgetown | 12111 | 5.00 (3.87) |
| 1252 | Lake Limestone | 12123 | 19.26 |
| 1254 | Aquilla Reservoir | 12127 | 14.10 |
| 1403 | Lake Austin | 12294 | 5.00 (3.58) |
| 1404 | Lake Travis | 12302 | 5.00 (3.66) |
| 1405 | Marble Falls Lake | 12319 | 10.48 |
| 1406 | Lake Lyndon B. Johnson | 12324 | 10.29 |
| 1408 | Lake Buchanan | 12344 | 9.82 |
| (1412) | Lake Colorado City | 12167 | 15.60 |
| (1416) | Brady Creek Reservoir | 12179 | 24.15 |
| 1419 | Lake Coleman | 12398 | 6.07 |
| 1422 | Lake Nasworthy | 12418 | 16.91 |
| 1423 | Twin Buttes Reservoir | 12422 | 14.44 |
| 1425 | O.C. Fisher Lake | 12429 | 39.13 |
| (1426) | Oak Creek Reservoir | 12180 | 6.93 |
| 1429 | Lady Bird Lake (Town Lake) | 12476 | 7.56 |
| 1433 | O.H. Ivie Reservoir | 12511 | 5.77 |
| 1805 | Canyon Lake | 12597 | 5.00 (4.11) |
| 1904 | Medina Lake | 12826 | 5.00 (2.15) |

# NUTRIENTS

## 2010 TSWQS

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| (0100)[2] | Palo Duro Reservoir | 10005 | 21.73 |
| 0208 | Lake Crook | 10137 | 7.38 |
| 0209 | Pat Mayse Lake | 10138 | 12.40 |
| 0212 | Lake Arrowhead | 10142 | 11.21 |
| 0213 | Lake Kickapoo | 10143 | 6.13 |
| 0217 | Lake Kemp | 10159 | 8.83 |
| 0223 | Greenbelt Lake | 10173 | 5.00 (4.59) |
| (0229) | Lake Tanglewood | 10192 | 43.71 |
| 0302 | Wright Patman Lake | 10213 | 21.49 |
| 0405 | Lake Cypress Springs | 10312 | 17.54 |
| 0507 | Lake Tawakoni | 10434 | 37.18 |
| 0509 | Murvaul Lake | 10444 | 55.80 |
| 0510 | Lake Cherokee | 10445 | 8.25 |
| 0512 | Lake Fork Reservoir | 10458 | 14.50 |
| 0603 | B. A. Steinhagen Lake | 10582 | 11.67 |
| 0605 | Lake Palestine | 16159 | 27.34 |
| 0610 | Sam Rayburn Reservoir | 14906 | 6.22 |
| 0803 | Lake Livingston | 10899 | 22.96 |
| 0807 | Lake Worth | 10942 | 34.18 |
| 0809 | Eagle Mountain Reservoir | 10944<br>10945 | 25.37 |
| 0811 | Bridgeport Reservoir | 10970 | 5.32 |
| 0813 | Houston County Lake | 10973 | 11.10 |
| 0815 | Bardwell Reservoir | 10979 | 22.84 |
| 0816 | Lake Waxahachie | 10980 | 19.77 |
| 0817 | Navarro Mills Lake | 10981 | 15.07 |
| 0818 | Cedar Creek Reservoir | 10982<br>16749 | 30.40 |
| 0823 | Lewisville Lake | 11027 | 18.45 |
| 0826 | Grapevine Lake | 11035<br>16113<br>17827 | 11.90 |

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| 0827 | White Rock Lake | 11038 | 33.65 |
| 0830 | Benbrook Lake | 15151<br>11046 | 27.15 |
| 0836 | Richland-Chambers Reservoir | 15168 | 15.29 |
| 1012 | Lake Conroe | 11342 | 24.27 |
| 1203 | Whitney Lake | 11851 | 18.34 |
| 1205 | Lake Granbury | 11860 | 22.16 |
| 1207 | Possum Kingdom Lake | 11865 | 10.74 |
| (1208) | Millers Creek Reservoir | 11679 | 15.65 |
| 1212 | Somerville Lake | 11881 | 53.05 |
| 1216 | Stillhouse Hollow Lake | 11894 | 5.00 (2.07) |
| 1220 | Belton Lake | 11921 | 6.38 |
| 1222 | Proctor Lake | 11935 | 28.15 |
| 1225 | Waco Lake | 11942 | 23.16 |
| 1228 | Lake Pat Cleburne | 11974 | 19.04 |
| 1231 | Lake Graham | 11979 | 6.07 |
| 1233 | Hubbard Creek Reservoir | 12002 | 5.61 |
| 1234 | Lake Cisco | 12005 | 5.00 (4.64) |
| 1235 | Lake Stamford | 12006 | 16.85 |
| 1249 | Lake Georgetown | 12111 | 5.00 (3.87) |
| 1252 | Lake Limestone | 12123 | 19.26 |
| 1254 | Aquilla Reservoir | 12127 | 14.10 |
| 1403 | Lake Austin | 12294 | 5.00 (3.58) |
| 1404 | Lake Travis | 12302 | 5.00 (3.66) |
| 1405 | Marble Falls Lake | 12319 | 10.48 |
| 1406 | Lake Lyndon B. Johnson | 12324 | 10.29 |
| 1408 | Lake Buchanan | 12344 | 9.82 |
| (1412) | Lake Colorado City | 12167 | 15.60 |
| (1416) | Brady Creek Reservoir | 12179 | 24.15 |
| 1419 | Lake Coleman | 12398 | 6.07 |
| 1422 | Lake Nasworthy | 12418 | 16.91 |
| 1423 | Twin Buttes Reservoir | 12422 | 14.44 |
| 1425 | O.C. Fisher Lake | 12429 | 39.13 |
| (1426) | Oak Creek Reservoir | 12180 | 6.93 |
| 1429 | Lady Bird Lake (Town Lake) | 12476 | 7.56 |
| 1433 | O.H. Ivie Reservoir | 12511 | 5.77 |
| 1805 | Canyon Lake | 12597 | 5.00 (4.11) |
| 1904 | Medina Lake | 12826 | 5.00 (2.15) |

| 0823 | Lewisville Lake | 11027 | 18.45 |

# NUTRIENTS

## 2010 TSWQS

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| (0100)[2] | Palo Duro Reservoir | 10005 | 21.73 |
| 0208 | Lake Crook | 10137 | 7.38 |
| 0209 | Pat Mayse Lake | 10138 | 12.40 |
| 0212 | Lake Arrowhead | 10142 | 11.21 |
| 0213 | Lake Kickapoo | 10143 | 6.13 |
| 0217 | Lake Kemp | 10159 | 8.83 |
| 0223 | Greenbelt Lake | 10173 | 5.00 (4.59) |
| (0229) | Lake Tanglewood | 10192 | 43.71 |
| 0302 | Wright Patman Lake | 10213 | 21.49 |
| 0405 | Lake Cypress Springs | 10312 | 17.54 |
| 0507 | Lake Tawakoni | 10434 | 37.18 |
| 0509 | Murvaul Lake | 10444 | 55.80 |
| 0510 | Lake Cherokee | 10445 | 8.25 |
| 0512 | Lake Fork Reservoir | 10458 | 14.50 |
| 0603 | B. A. Steinhagen Lake | 10582 | 11.67 |
| 0605 | Lake Palestine | 16159 | 27.34 |
| 0610 | Sam Rayburn Reservoir | 14906 | 6.22 |
| 0803 | Lake Livingston | 10899 | 22.96 |
| 0807 | Lake Worth | 10942 | 34.18 |
| 0809 | Eagle Mountain Reservoir | 10944<br>10945 | 25.37 |
| 0811 | Bridgeport Reservoir | 10970 | 5.32 |
| 0813 | Houston County Lake | 10973 | 11.10 |
| 0815 | Bardwell Reservoir | 10979 | 22.84 |
| 0816 | Lake Waxahachie | 10980 | 19.77 |
| 0817 | Navarro Mills Lake | 10981 | 15.07 |
| 0818 | Cedar Creek Reservoir | 10982<br>16749 | 30.40 |
| 0823 | Lewisville Lake | 11027 | 18.45 |
| 0826 | Grapevine Lake | 11035<br>16113<br>17827 | 11.90 |

| Segment No. | Reservoir Name | Site ID | Chlorophyll a Criteria (µg/L) |
|---|---|---|---|
| 0827 | White Rock Lake | 11038 | 33.65 |
| 0830 | Benbrook Lake | 15151<br>11046 | 27.15 |
| 0836 | Richland-Chambers Reservoir | 15168 | 15.29 |
| 1012 | Lake Conroe | 11342 | 24.27 |
| 1203 | Whitney Lake | 11851 | 18.34 |
| 1205 | Lake Granbury | 11860 | 22.16 |
| 1207 | Possum Kingdom Lake | 11865 | 10.74 |
| (1208) | Millers Creek Reservoir | 11679 | 15.65 |
| 1212 | Somerville Lake | 11881 | 53.05 |
| 1216 | Stillhouse Hollow Lake | 11894 | 5.00 (2.07) |
| 1220 | Belton Lake | 11921 | 6.38 |
| 1222 | Proctor Lake | 11935 | 28.15 |
| 1225 | Waco Lake | 11942 | 23.16 |
| 1228 | Lake Pat Cleburne | 11974 | 19.04 |
| 1231 | Lake Graham | 11979 | 6.07 |
| 1233 | Hubbard Creek Reservoir | 12002 | 5.61 |
| 1234 | Lake Cisco | 12005 | 5.00 (4.64) |
| 1235 | Lake Stamford | 12006 | 16.85 |
| 1249 | Lake Georgetown | 12111 | 5.00 (3.87) |
| 1252 | Lake Limestone | 12123 | 19.26 |
| 1254 | Aquilla Reservoir | 12127 | 14.10 |
| 1403 | Lake Austin | 12294 | 5.00 (3.58) |
| 1404 | Lake Travis | 12302 | 5.00 (3.66) |
| 1405 | Marble Falls Lake | 12319 | 10.48 |
| 1406 | Lake Lyndon B. Johnson | 12324 | 10.29 |
| 1408 | Lake Buchanan | 12344 | 9.82 |
| (1412) | Lake Colorado City | 12167 | 15.60 |
| (1416) | Brady Creek Reservoir | 12179 | 24.15 |
| 1419 | Lake Coleman | 12398 | 6.07 |
| 1422 | Lake Nasworthy | 12418 | 16.91 |
| 1423 | Twin Buttes Reservoir | 12422 | 14.44 |
| 1425 | O.C. Fisher Lake | 12429 | 39.13 |
| (1426) | Oak Creek Reservoir | 12180 | 6.93 |
| 1429 | Lady Bird Lake (Town Lake) | 12476 | 7.56 |
| 1433 | O.H. Ivie Reservoir | 12511 | 5.77 |
| 1805 | Canyon Lake | 12597 | 5.00 (4.11) |
| 1904 | Medina Lake | 12826 | 5.00 (2.15) |


| 0823 | Lewisville Lake | 11027 | 18.45 |
|---|---|---|---|


## 2018 TSWQS

| Segment No. | Reservoir Name | Site ID | Chlorophyll *a* Criteria (µg/L) |
|---|---|---|---|
| 0208 | Lake Crook | 10137 | 7.38 |
| 0209 | Pat Mayse Lake | 10138 | 12.40 |
| 0213 | Lake Kickapoo | 10143 | 6.13 |
| 0217 | Lake Kemp | 10159 | 8.83 |
| 0223 | Greenbelt Lake | 10173 | 5.00 (4.59) |
| 0405 | Lake Cypress Springs | 10312 | 17.54 |
| 0510 | Lake Cherokee | 10445 | 8.25 |
| 0603 | B. A. Steinhagen Lake | 10582 | 11.67 |
| 0610 | Sam Rayburn Reservoir | 14906 | 6.22 |
| 0613 | Lake Tyler | 10637 | 13.38 |
| 0613 | Lake Tyler East | 10638 | 10.88 |
| 0614 | Lake Jacksonville | 10639 | 5.60 |
| 0811 | Bridgeport Reservoir | 10970 | 5.32 |
| 0813 | Houston County Lake | 10973 | 11.10 |
| 0816 | Lake Waxahachie | 10980 | 19.77 |
| 0817 | Navarro Mills Lake | 10981 | 15.07 |
| 1207 | Possum Kingdom Lake | 11865 | 10.74 |
| 1216 | Stillhouse Hollow Lake | 11894 | 5.00 (2.07) |
| 1220 | Belton Lake | 11921 | 6.38 |
| 1228 | Lake Pat Cleburne | 11974 | 19.04 |
| 1231 | Lake Graham | 11979 | 6.07 |
| 1233 | Hubbard Creek Reservoir | 12002 | 5.61 |
| 1234 | Lake Cisco | 12005 | 5.00 (4.64) |
| 1235 | Lake Stamford | 12006 | 16.85 |
| 1240 | White River Lake | 12027 | 13.85 |
| 1249 | Lake Georgetown | 12111 | 5.00 (3.87) |
| 1403 | Lake Austin | 12294 | 5.00 (3.58) |
| 1404 | Lake Travis | 12302 | 5.00 (3.66) |
| 1405 | Marble Falls Lake | 12319 | 10.48 |
| 1406 | Lake Lyndon B. Johnson | 12324 | 10.29 |
| 1408 | Lake Buchanan | 12344 | 9.82 |
| 1419 | Lake Coleman | 12398 | 6.07 |
| 1422 | Lake Nasworthy | 12418 | 16.91 |
| (1426) | Oak Creek Reservoir | 12180 | 6.93 |
| 1429 | Lady Bird Lake (Town Lake) | 12476 | 7.56 |
| 1433 | O.H. Ivie Reservoir | 12511 | 5.77 |
| 1805 | Canyon Lake | 12597 | 5.00 (4.11) |
| 1904 | Medina Lake | 12826 | 5.00 (2.15) |
| 2116 | Choke Canyon Reservoir | 13019 | 12.05 |

# STEP 1 – EFFECTS ON MAIN POOL TP CONCENTRATION

Harmonic mean flow

Volume of the reservoir

Size of the reservoir

Reservoir retention time

Total phosphorus

Distance

Final permitted flow

Total phosphorus

Total phosphorus percent change

# STEP 1 – EFFECTS ON MAIN POOL TP CONCENTRATION

**STEP 1 - Effects on main pool TP concentration (See pages 21 - 25 of the draft IPs for more details)**

*Enter data into the black font columns. Blue font indicates formulas. Green font indicates constants.*

| Permit #, Permittee, Outfall, Segment | Distance (m, 1609.344 m = 1 mile) | Permitted flow (mgd) | Harmonic mean flow (cfs) | Permitted flow (m3/s) | Harmonic mean flow (m3/s) | Fraction of TP remaining | TP of effluent (mg/L) |
|---|---|---|---|---|---|---|---|
| **WQ0010698003; UTRWD; Seg 0823** | 1862 | 20 | 0.1 | 0.8764 | 0.002832 | 0.975736 | 0.5 |
| Predicted change in % TP due to discharge = | 13.04 | | | | | | |

*If predicted change in % TP is greater than 10%, then proceed to Step 2 below*

| Daily Avg Load (lbs/day) | Annual Avg Load (lbs/year) | **TP concentration delivered (mg/L)** | **TP loading (g/yr)** | Reservoir surface area (acres), Table F-2 in IPs | Reservoir volume (ac-ft), Table F-2 in IPs | Reservoir ambient TP (mg/L), Table F-1 in IPs | Mean depth | TP areal loading (g/m2xyr) | Settling velocity (m/yr) - assumed to be 13 for TP | Retention time (yrs), Table F-2 in IPs | TP increase due to discharge (mg/L) | TP % change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83.4 | 30441 | 0.488 | 13,480,036 | 29,170 | 571,926 | 0.046 | 20 | 0.1142 | 13 | 0.99 | 0.0059984 | 13.04 |

# STEP 1 – EFFECTS ON MAIN POOL TP CONCENTRATION

**STEP 1 - Effects on main pool TP concentration (See pages 21 - 25 of the draft IPs for more details)**

*Enter data into the black font columns. Blue font indicates formulas. Green font indicates constants.*

| Permit #, Permittee, Outfall, Segment | Distance (m, 1609.344 m = 1 mile) | Permitted flow (mgd) | Harmonic mean flow (cfs) | Permitted flow (m3/s) | Harmonic mean flow (m3/s) | Fraction of TP remaining | TP of effluent (mg/L) |
|---|---|---|---|---|---|---|---|
| **WQ0010698003; UTRWD; Seg 0823** | 1862 | 20 | 0.1 | 0.8764 | 0.002832 | 0.975736 | 0.5 |
| Predicted change in % TP due to discharge = | 13.04 | | | | | | |

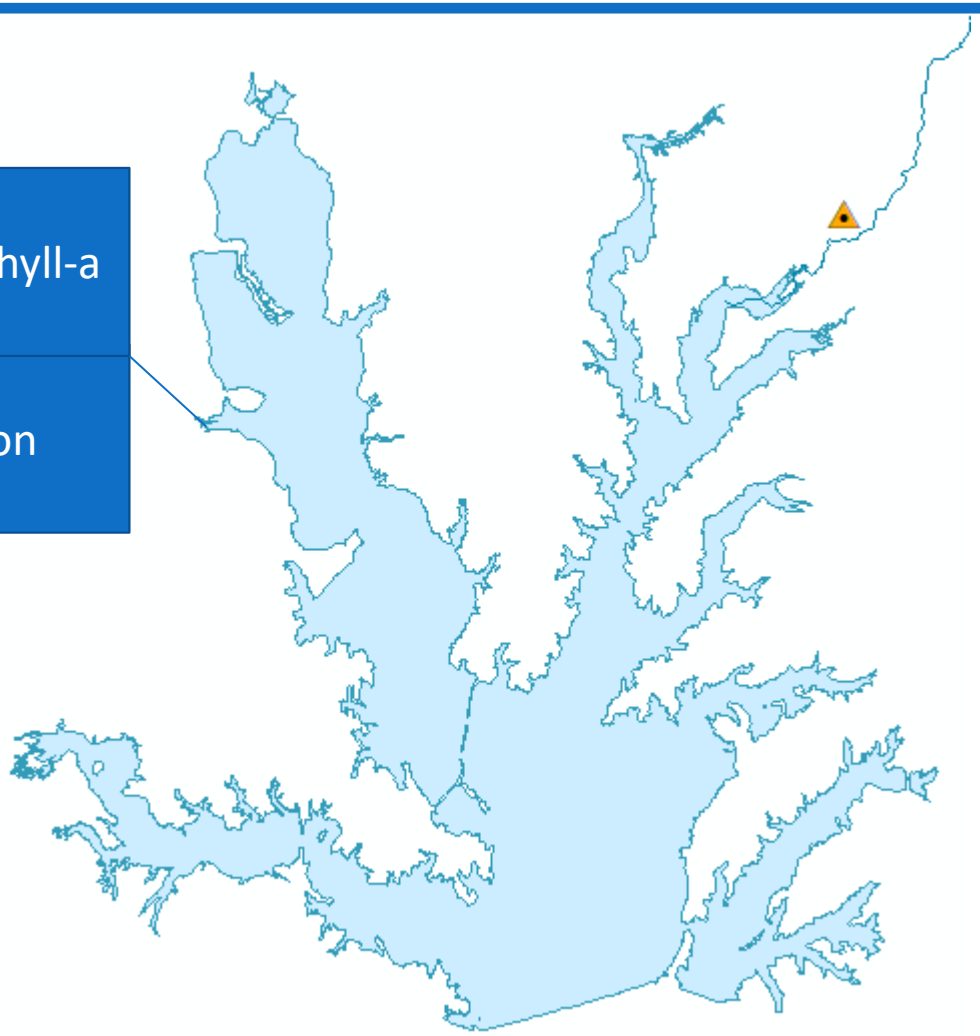
*If predicted change in % TP is greater than 10%, then proceed to Step 2 below*

| Daily Avg Load (lbs/day) | Annual Avg Load (lbs/year) | **TP concentration delivered (mg/L)** | **TP loading (g/yr)** | Reservoir surface area (acres), Table F-2 in IPs | Reservoir volume (ac-ft), Table F-2 in IPs | Reservoir ambient TP (mg/L), Table F-1 in IPs | Mean depth | TP areal loading (g/m2xyr) | Settling velocity (m/yr) - assumed to be 13 for TP | Retention time (yrs), Table F-2 in IPs | TP increase due to discharge (mg/L) | TP % change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83.4 | 30441 | 0.488 | 13,480,036 | 29,170 | 571,926 | 0.046 | 20 | 0.1142 | 13 | 0.99 | 0.0059984 | 13.04 |

# STEP 2 – ESTIMATE CHANGE IN CHLOROPHYLL-A

Mean reservoir chlorophyll-a

Chlorophyll-a criterion



Chlorophyll-a without discharge

Chlorophyll-a with discharge

Change in chlorophyll due to discharge

Percent change in assimilative capacity

# STEP 2 – ESTIMATE CHANGE IN CHLOROPHYLL-A

| | |
|---|---|
| Chlorophyll criterion from Appendix F, Standards (ug/L) | 16.39 |
| Mean reservoir chlorophyll from Table F-1,IPs (ug/L) | 11.67 |
| Chlorophyll without discharge | 9.67 |
| Chlorophyll with discharge | 10.94 |
| Change in chlorophyll due to discharge | 1.27 |
| % change in assimilative capacity | 27.00 |

# NUTRIENTS

| Permitted Flow (MGD) | Typical TP Limit (mg/L) |
|---|---|
| < 0.5 | 1.0 |
| 0.5 – 3.0 | 1.0 to 0.5 |
| > 3.0 | 0.5 |

Procedures to Implement the Texas Surface Water Quality Standards, June 2010

# NUTRIENTS

North Texas Municipal Water District — TPDES Permit No. WQ0014245001

INTERIM I EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 001

1. During the period beginning upon the date of issuance and lasting through the completion of expansion to the 15.0 million gallons per day (MGD) facility, the permittee is authorized to discharge subject to the following effluent limitations:

   The annual average flow of effluent shall not exceed 10.0 MGD, nor shall the average discharge during any two-hour period (2-hour peak) exceed 20,833 gallons per minute.

| Effluent Characteristic | Discharge Limitations | | | | Min. Self-Monitoring Requirements | |
|---|---|---|---|---|---|---|
| | Daily Avg | 7-day Avg | Daily Max | Single Grab | Report Daily Avg. & Daily Max. | |
| | mg/l (lbs/day) | mg/l | mg/l | mg/l | Measurement Frequency | Sample Type |
| Flow, MGD | Report | N/A | Report | N/A | Continuous | Totalizing Meter |
| Carbonaceous Biochemical Oxygen Demand (5-day) | | | | | | |
| April-October | 5 (417) | 10 | 20 | 30 | One/day | Composite |
| November-March | 7 (584) | 12 | 22 | 32 | One/day | Composite |
| Total Suspended Solids | 12 (1001) | 20 | 40 | 60 | One/day | Composite |
| Ammonia Nitrogen | | | | | | |
| April - October | 2 (167) | 5 | 10 | 15 | One/day | Composite |
| November - March | 4 (334) | 6 | 10 | 15 | One/day | Composite |
| Total Phosphorus | 1 (83) | 2 | 4 | 6 | One/day | Composite |
| *E. coli*, CFU or MPN* per 100 ml | 126 | N/A | 399 | N/A | Daily | Grab |

*CFU or MPN - colony-forming units or most probable n

2. The permittee shall utilize an Ultraviolet Light (UV) sys substituted only with prior approval of the Executive Dire
3. The pH shall not be less than 6.0 standard units nor great
4. There shall be no discharge of floating solids or visible foa
5. Effluent monitoring samples shall be taken at the followin
6. The effluent shall contain a minimum dissolved oxygen of
7. The annual average flow and maximum 2-hour peak flow

Page 2


| | | | | |
|---|---|---|---|---|
| Carbonaceous Biochemical Oxygen Demand (5-day) | | | | |
| April-October | 5 (417) | 10 | 20 | 30 |
| November-March | 7 (584) | 12 | 22 | 32 |
| Total Suspended Solids | 12 (1001) | 20 | 40 | 60 |
| Ammonia Nitrogen | | | | |
| April - October | 2 (167) | 5 | 10 | 15 |
| November - March | 4 (334) | 6 | 10 | 15 |
| Total Phosphorus | 1 (83) | 2 | 4 | 6 |
| *E. coli*, CFU or MPN* per 100 ml | 126 | N/A | 399 | N/A |

# NUTRIENTS

North Texas Municipal Water District — TPDES Permit No. WQ0014245001

INTERIM II EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 001

1. During the period beginning upon the date of completion of expansion to the 15.0 million gallons per day (MGD) facility and lasting through the date of completion of expansion to the 20.0 MGD facility, the permittee is authorized to discharge subject to the following effluent limitations:

   The annual average flow of effluent shall not exceed 15.0 MGD, nor shall the average discharge during any two-hour period (2-hour peak) exceed 31,250 gallons per minute.

| Effluent Characteristic | Discharge Limitations | | | | Min. Self-Monitoring Requirements | |
|---|---|---|---|---|---|---|
| | Daily Avg | 7-day Avg | Daily Max | Single Grab | Report Daily Avg. & Daily Max. | |
| | mg/l (lbs/day) | mg/l | mg/l | mg/l | Measurement Frequency | Sample Type |
| Flow, MGD | Report | N/A | Report | N/A | Continuous | Totalizing Meter |
| Carbonaceous Biochemical Oxygen Demand (5-day) | | | | | | |
| April-October | 5 (626) | 10 | 20 | 30 | One/day | Composite |
| November-March | 7 (876) | 12 | 22 | 32 | One/day | Composite |
| Total Suspended Solids | 12 (1,502) | 20 | 40 | 60 | One/day | Composite |
| Ammonia Nitrogen | | | | | | |
| April - October | 2 (250) | 5 | 10 | 15 | One/day | Composite |
| November - March | 4 (501) | 6 | 10 | 15 | One/day | Composite |
| **Total Phosphorus | Report (Report) | N/A | N/A | N/A | One/day | Composite |
| *E. coli*, CFU or MPN* per 100 ml | 126 | N/A | 399 | N/A | Daily | Grab |

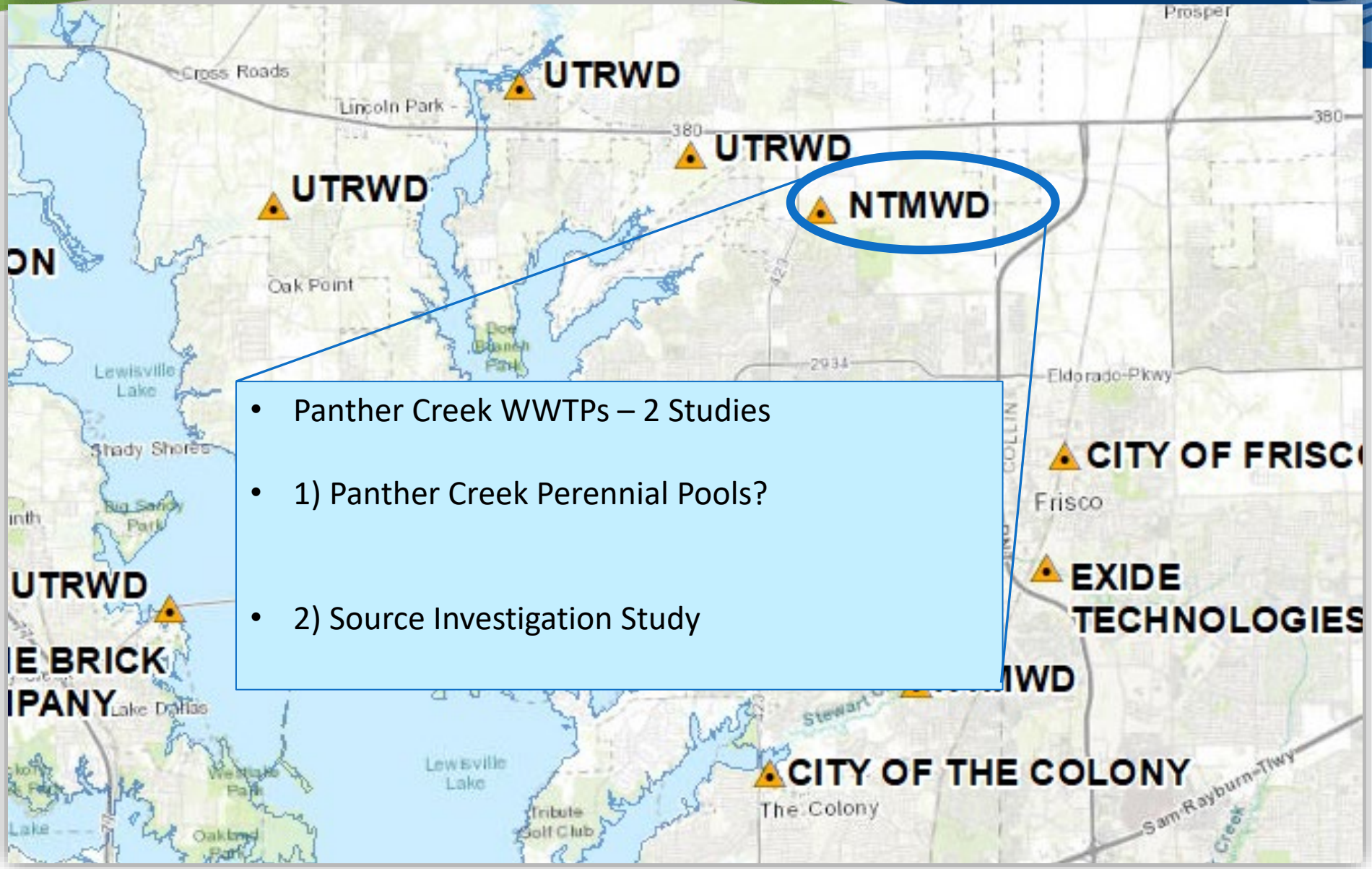
2. The permittee shall utilize an Ultraviolet Light (UV) system for
   with prior approval of the Executive Director.
3. The pH shall not be less than 6.0 standard units nor greater than
4. There shall be no discharge of floating solids or visible foam in ot
5. Effluent monitoring samples shall be taken at the following locat
6. The effluent shall contain a minimum dissolved oxygen of 6.0 mg
7. The annual average flow and maximum 2-hour peak flow shall be

*CFU or MPN - colony-forming units or most probable number
**The daily mass loading calculated for each day of the month sh
the calendar month. The annual mass loading for the discharge sh
shall be calculated each month by dropping the older month's ma
loading data. The total monthly and rolling annual mass loadings

Page 2a

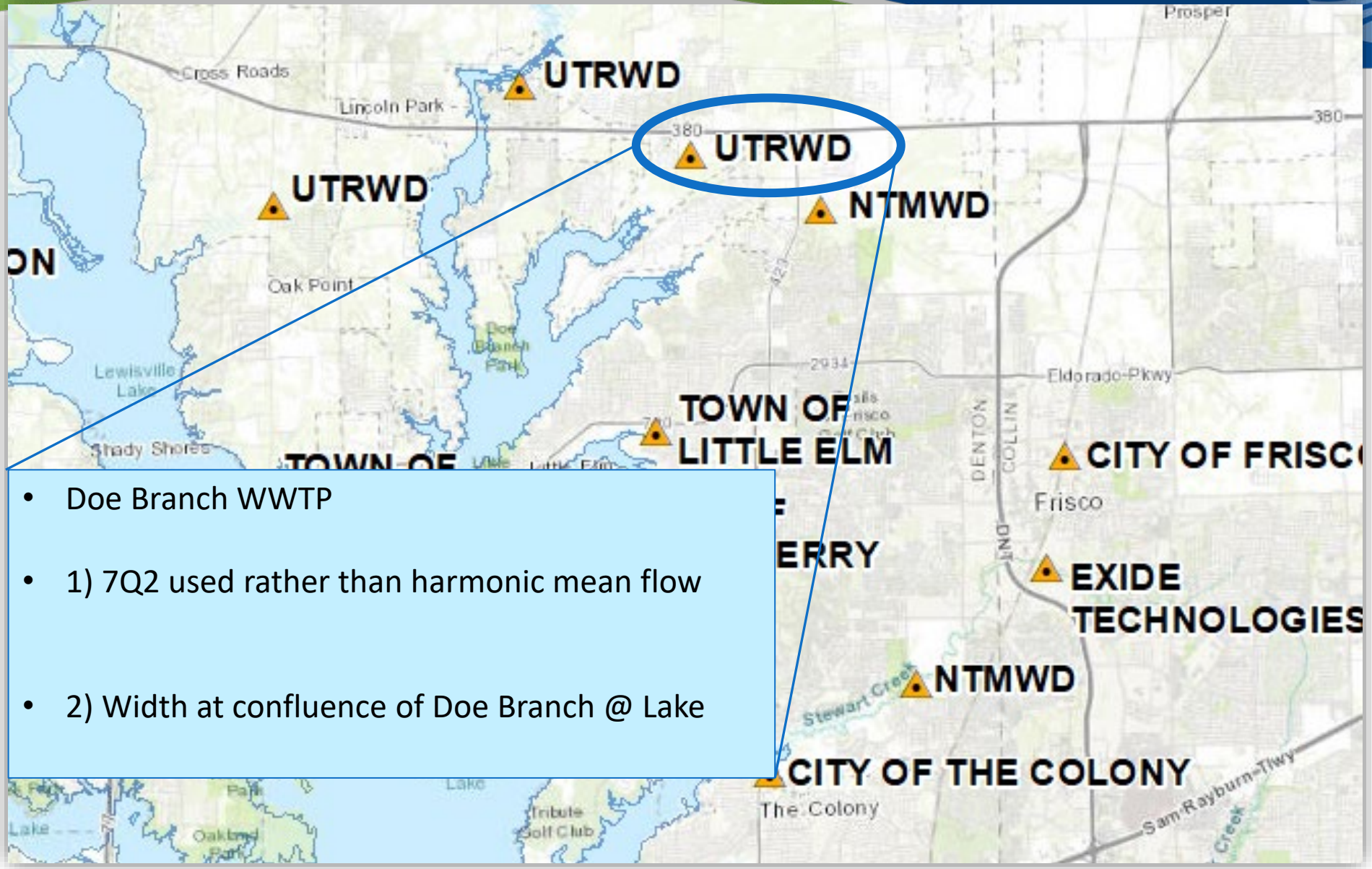

| | | | | |
|---|---|---|---|---|
| Carbonaceous Biochemical Oxygen Demand (5-day) | | | | |
| April-October | 5 (626) | 10 | 20 | 30 |
| November-March | 7 (876) | 12 | 22 | 32 |
| Total Suspended Solids | 12 (1,502) | 20 | 40 | 60 |
| Ammonia Nitrogen | | | | |
| April - October | 2 (250) | 5 | 10 | 15 |
| November - March | 4 (501) | 6 | 10 | 15 |
| **Total Phosphorus | Report (Report) | N/A | N/A | N/A |
| *E. coli*, CFU or MPN* per 100 ml | 126 | N/A | 399 | N/A |

# TDS, CHLORIDE, AND SULFATE



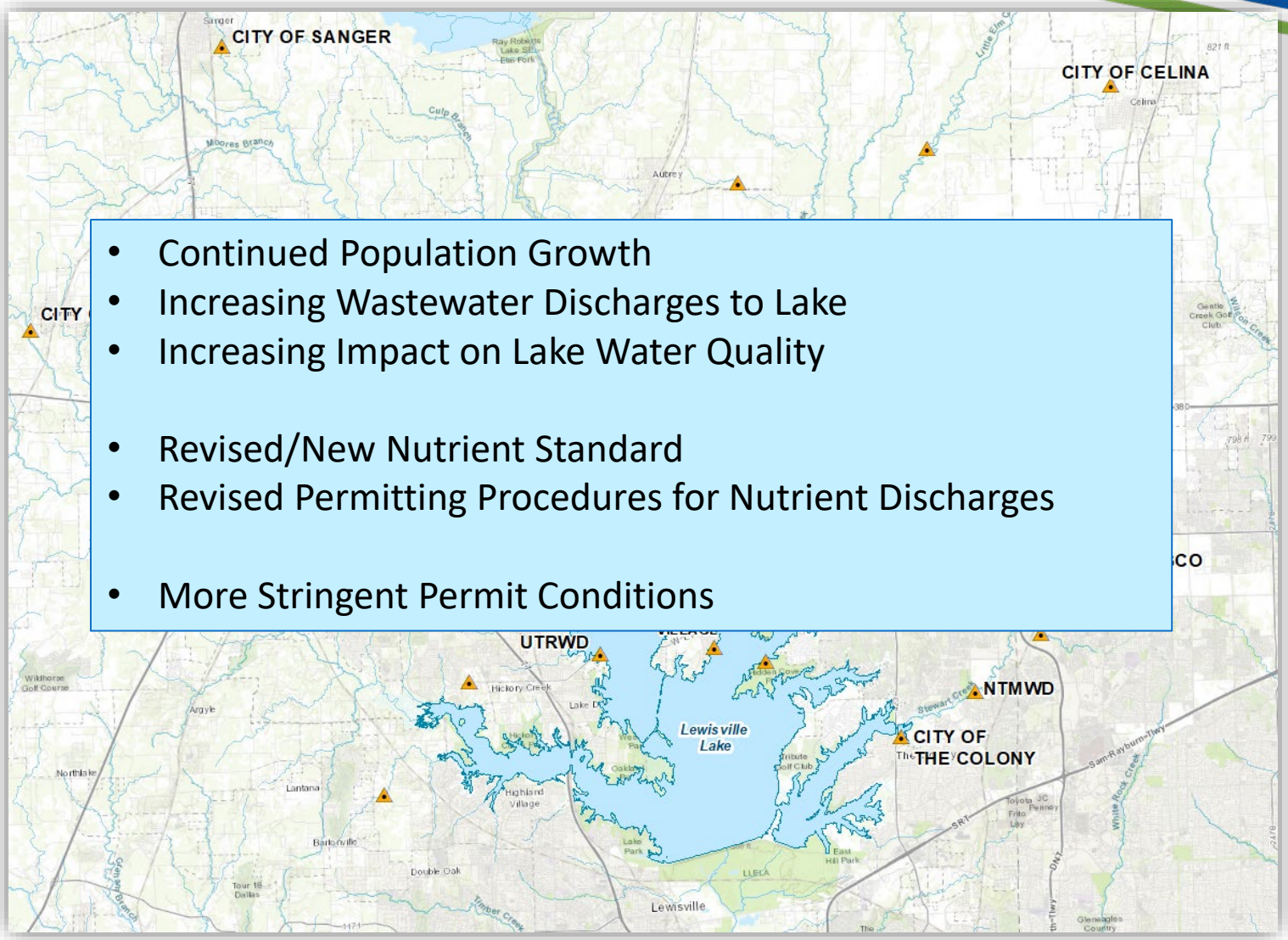

- Panther Creek WWTPs – 2 Studies
- 1) Panther Creek Perennial Pools?
- 2) Source Investigation Study

# TDS, CHLORIDE, AND SULFATE




- Doe Branch WWTP
- 1) 7Q2 used rather than harmonic mean flow
- 2) Width at confluence of Doe Branch @ Lake

# FUTURE FOR LEWISVILLE LAKE WATERSHED

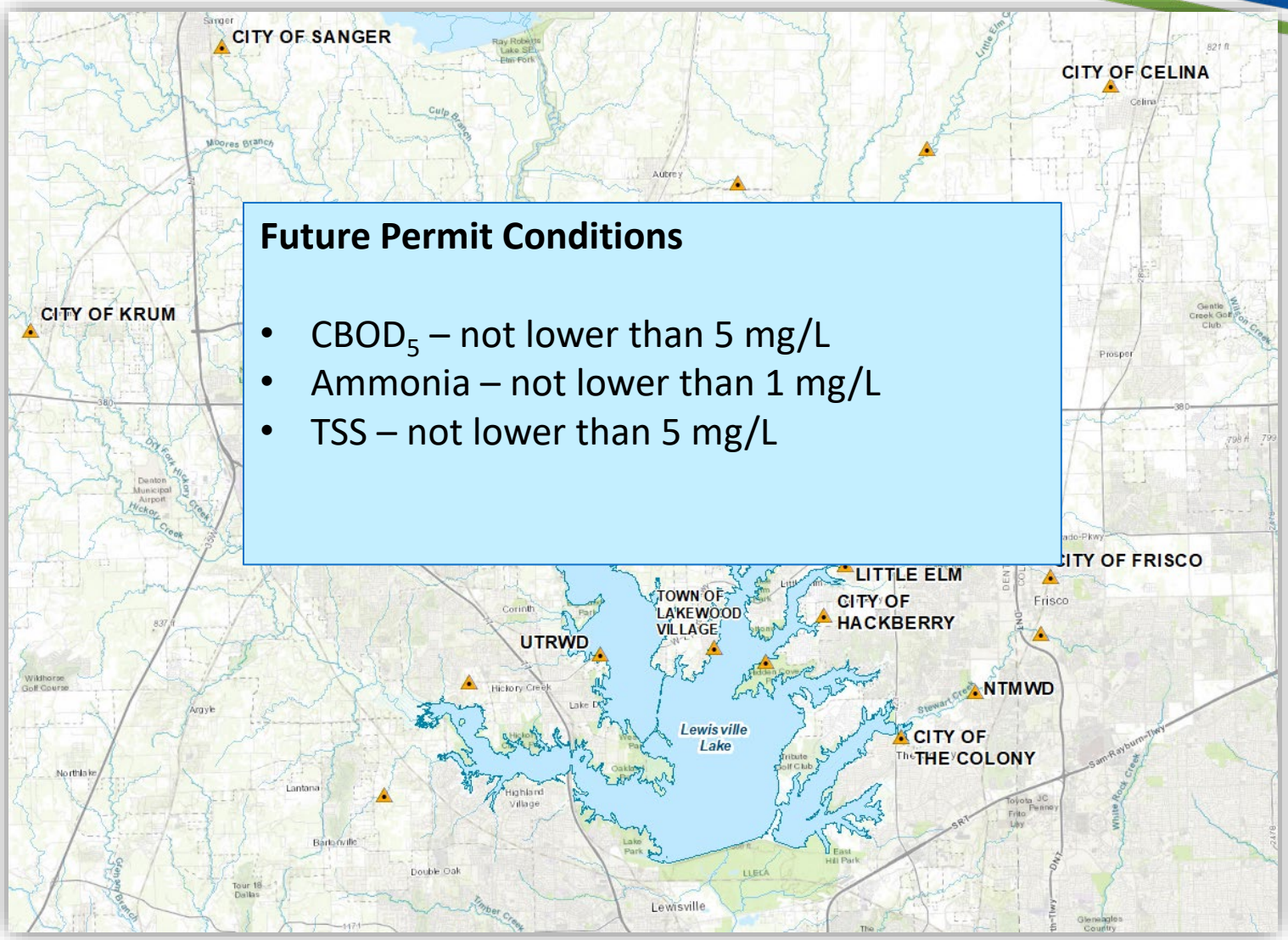



- Continued Population Growth
- Increasing Wastewater Discharges to Lake
- Increasing Impact on Lake Water Quality

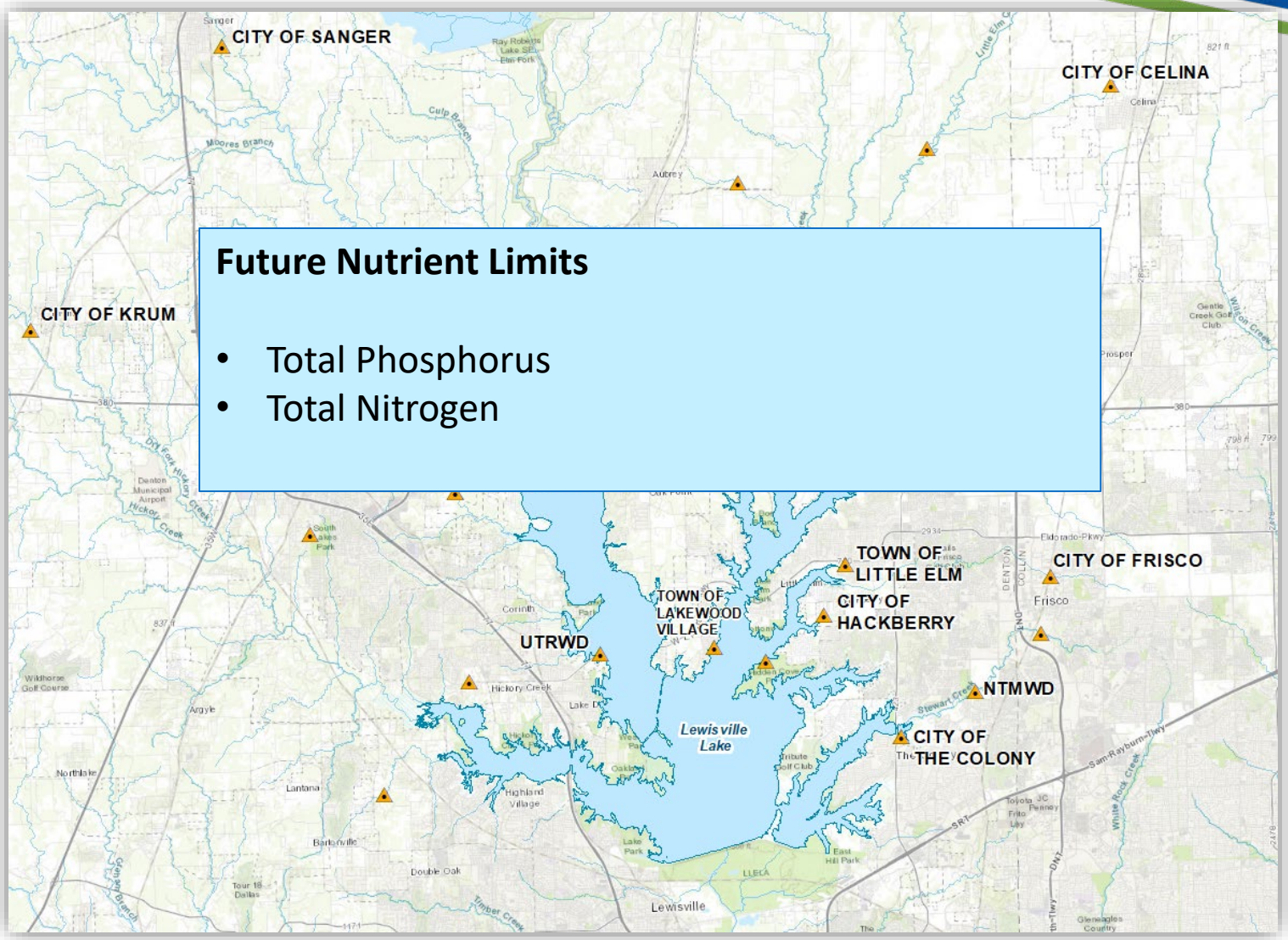
- Revised/New Nutrient Standard
- Revised Permitting Procedures for Nutrient Discharges

- More Stringent Permit Conditions

# FUTURE FOR LEWISVILLE LAKE WATERSHED



# FUTURE FOR LEWISVILLE LAKE WATERSHED



***Brian Kelm,*** *bkelm@utrwd.com*
***Chris Pasch****, cpasch@plummer.com*
***Ashley Lewis****, alewis@plummer.com*
***Kristin Arnold****, karnold@plummer.com*

PLUMMER