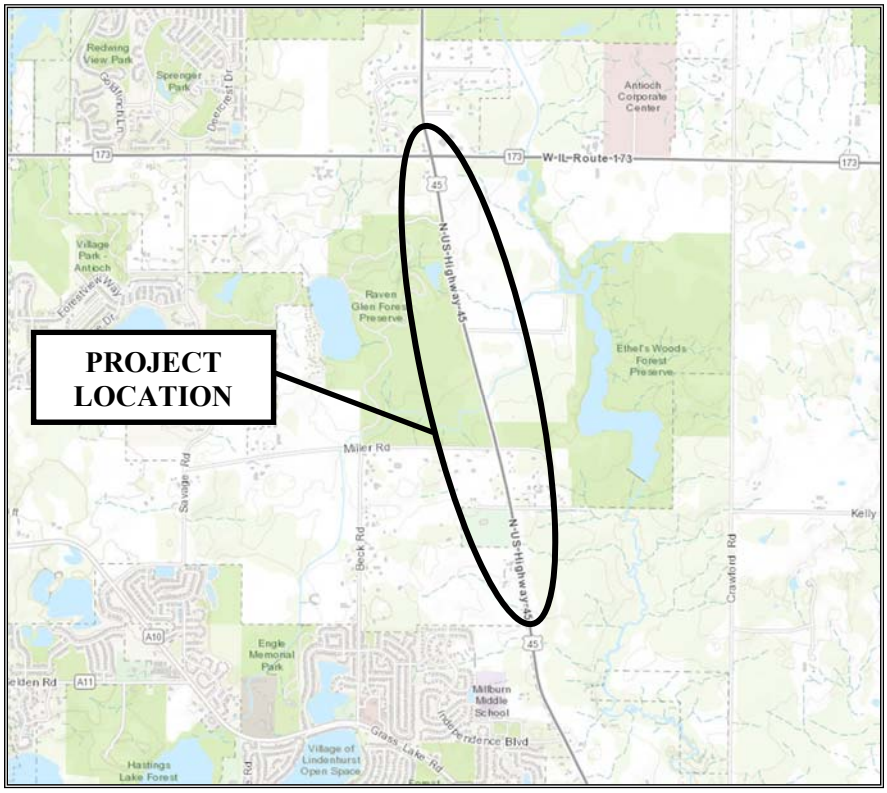
Illinois Department of Transportation

DESIGN REPORT

U.S. Route 45
Millburn Bypass to Illinois Route 173



P-91-388-10

Lake County, Illinois

IDOT – Division of Highways – District One

July 2019

Volume IV
Location Drainage Study

Contact Information

Job Number: P-91-388-10

Project: U.S. Route 45

Location: Millburn Bypass to Illinois Route 173

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Table of Contents (Volume IV)

LOCATION DRAINAGE STUDY

Illinois Department of Transportation

Location Drainage Study

PROJECT ROUTE: U.S. Route 45 – (Millburn Bypass to IL Route 173)
LIMITS: Station 165+98 (North of Independence Blvd) to Station 312+93.7(IL RT 173)

MUNICIPALITY/COUNTY: Village of Lindenhurst, Village of Old Mill Creek, Village of Antioch, and Unincorporated Lake County

JOB NUMBER: P-91-388-10

Volume 1

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TABLE OF CONTENTS

VOLUME 1

1-00 EXISTING DRAINAGE SYSTEM

1-01 IDENTIFIED DRAINAGE PROBLEMS

1-02 IDENTIFIED BASE FLOODPLAINS

1-03 MAJOR DRAINAGE FEATURES

2-00 PROPOSED DRAINAGE SYSTEM

2-01 DESIGN CRITERIA

2-02 OUTLET EVALUATION

2-03 STORM WATER DETENTION ANALYSIS

2-04 RIGHT OF WAY ANALYSIS

2-05 DRAINAGE ALTERNATIVES

2-06 LOCAL AND OTHER AGENCY COORDINATION

2-07 PROPOSED DRAINAGE PLAN

3-00 FLOODPLAIN ENCROACHMENT EVALUATION

4-00 ILLINOIS DEPARTMENT OF NATURAL RESOURCES OFFICE OF WATER RESOURCES (IDNR-OWR) PERMIT

5-00 Appendix A: Source Data Reviewed

Appendix B: Exhibits

Appendix C: Correspondence

Appendix D: Supporting Documents

VOLUME 2

Appendix D: Supporting Documents (Continued)

Appendix E: Erosion and Sediment Control

Appendix F: Water Quality/BMP White Paper

LOCATION DRAINAGE STUDY CHECKLIST

Project Route: U.S. Route 45 – (Millburn Bypass to IL Route 173)

Limits: Station 165+98 (North of Independence Blvd) to Station 312+93.7(IL RT 173)

Municipality/County: Village of Lindenhurst, Village of Old Mill Creek, Village of Antioch, and Unincorporated Lake County

Job Number: P-91-388-10

1-00 **EXISTING DRAINAGE SYSTEM** (see Exhibit 1-00a, General Location Drainage Map;
☒ Exhibit 1-00b, Existing Drainage Plan)
(If Exhibit 1-00b is not available, provide a brief description)

1-01 IDENTIFIED DRAINAGE PROBLEMS (see Appendix C)

☒ Yes (continue below) ☐ No (delete below)

1-01.1 Description: Pavement Flooding south of U.S. Route 45 and IL Route 173 on July 18, 1996; June 16, 1997; April 23, 1999; May 22, 2004; June 9, 2008; and December 27, 2008.

Responsibility ☒ IDOT ☐ Others

Action:
The existing cross culvert will be upsized to provide required freeboard and eliminate roadway overtopping. The proposed roadway will be properly drained via curb and gutter.

☒ Incorporate into the Study
(See Section 2-05 and/or Section 2-07)

1-01.2 Description: Pavement Flooding at the northeast corner of the intersection of U.S. Route 45 and IL Route 173 on February 5, 2005 and June 19, 2009.

Responsibility ☒ IDOT ☐ Others

Action:
This issue was incorporated into a Drainage Technical Memo (DTM) as part of P-91-692-09 US Route 45 at IL Route 173. It was solved by extending the curb and gutter to prevent water ponding at the roadside edge. As part of this project curb and gutter will still drain the road and proper ditch grading will be provided to properly drain the offsite area.

☒ Incorporate into the Study as data base
(See Section 2-05 and/or Section 2-07)

1-02 IDENTIFIED BASE FLOODPLAINS (see Exhibit 1-02a Flood Insurance Rate Map and Section 3-00)

The Flood Insurance Rate Maps for the Village of Lindenhurst and the County of Lake were examined for identified base floodplains which were either traversed by or adjacent to (U.S. Route 45).

Floodplains ☒ Yes ☐ No

Floodways ☒ Yes ☐ No

1-03 MAJOR DRAINAGE FEATURES (see Exhibit 1-00a)

1-03.1 Bridges

N/A

1-03.2 Major Culvert Crossings

Location: Crossing No. 11 Existing U.S. Route 45 at Station 170+65 (Drains to Existing Outlet No. 11)

Structure No: N/A

Hydraulic Report Prepared by: N/A

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 2- 4' (wide) by 2' (height) box culvert is approximately 100 feet in length with a tributary area of 34 acres and has been constructed as a part of the Millburn Bypass Project. As the culvert was modeled as part of the Millburn Bypass project the structure will provide adequate freeboard and will not overtop.

Location: Crossing No. 12 Existing U.S. Route 45 at Station 176+20 (Existing Outlet No. 12)

Structure No: N/A

Hydraulic Report Prepared by: N/A

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 2- 4' (wide) by 2' (height) box culvert box culvert is approximately 93 feet in length with a tributary area of 54 acres and has been constructed as a part of the Millburn Bypass Project. As the modeled as part of the Millburn Bypass project the structure will provide adequate freeboard and will not overtop.

Location: Crossing No. 13 Existing U.S. Route 45 at Station 185+75 (Existing Outlet No. 13 – Unnamed Tributary to North Mill Creek)

Structure No: 049-0578

Hydraulic Report Prepared by: N/A

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 6' (wide) by 4' (height) box culvert is approximately 49 feet in length with a tributary area of 261 acres. Under existing conditions, the roadway will overtop the 100-year event and provides 0.36' of freeboard for the 50-year event.

Location: Crossing No. 16 Existing U.S. Route 45 at Station 240+10 (Existing Outlet No. 16 – Hastings Creek)

Structure No: 049-0577

Hydraulic Report Prepared by: CBBEL/RWA

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 9' (wide) by 5' (height) box culvert is approximately 68 feet in length with a tributary area of 6.1 square miles. The existing culvert overtops for events less than the 500-year event and provides -0.43' of freeboard for the 50-year event. This crossing is located within regulatory floodplain.

Location: Crossing No. 18 Existing U.S. Route 45 at Station 266+39 (Existing Outlet No. 18 – Unnamed Tributary to Hastings Creek)

Structure No: 049-0547

Hydraulic Report Prepared by: CBBEL/RWA

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 36" CMP culvert is approximately 77 feet in length with a tributary area of 1.0 square miles. The existing culvert overtops for events less than the 10-year event and provides -0.73' for the 50-year event. This crossing is located within regulatory floodplain.

Location: Crossing No. 19 Existing U.S. Route 45 at Station 310+38 (Existing Outlet No. 19)

Structure No: N/A

Hydraulic Report Prepared by: N/A

Waterway Information Table Available:
☒ Yes (Exhibit 1-03.1a)
☐ No

Narrative Summary: The existing 4' (wide) by 2' (height) RCBC is approximately 64 feet in length with a tributary area of 133 acres. The existing culvert overtops for events less than the 10-year even and provides -0.38' freeboard for the 50-year event.

1-03.3 Pump Stations
N/A

1-03.4 Reservoirs/Detention Facilities
N/A

1-03.5 Subways
N/A

1-03.6 Channels
N/A

2-00 PROPOSED DRAINAGE SYSTEM (☒ Exhibit 2-00a, Proposed Drainage Plan)

2-01 DESIGN CRITERIA (☒ Exhibit 2-01a - Typical Existing Cross Section.
☒ Exhibit 2-01b - Typical Proposed Cross Sections)

Check all that apply:

☐ New Construction ☒ Reconstruction ☐ 3R Projects (Non-Freeways)
☐ 3R Projects (Freeways)

Reconstruction and widening on existing alignment will begin at Station 165+98 (North of Independence Blvd) to Station 315+93.7 (IL Route 173)

1. Proposed storm sewer conveyance systems will be designed for a (10) year storm frequency with a velocity between 900 mm/sec (3 ft./sec) and 3000 mm/sec (10 ft./sec).

   ☒ Yes ☐ No ☐ N/A

2. Proposed ditches will be designed for a 50 year storm frequency and desirable ditch grades will be no less than 0.5%.

   ☐ Yes ☒ No ☐ N/A
   Majority of ditches designed for 0.5%, minimum ditch slope used is 0.3%. All ditches designed for 50 year storm frequency.

3. The roadway edge of pavement at the low grade point in a floodplain area for highways with a Design Hourly Volume (DHV) of 100 or more shall be a minimum of three feet above design headwater elevation.

   ☒ Yes ☐ No ☐ N/A

4. It is required that a minimum clearance of two (2) feet be established between the design high water and the low beam elevation of bridge structures. The bottom of the bridge super structure shall not be below the all-time high water elevation for the new freeway and expressway construction.

   ☐ Yes ☐ No ☒ N/A

5. The waterway openings of bridges and culverts will be designed for a 50 year storm frequency.

   ☒ Yes ☐ No ☐ N/A

6. The vertical alignment for curbed pavements will have a minimum grade of 0.3% and a drainage maximum “K” value of 51 (167 English Unit).

   ☒ Yes ☐ No ☐ N/A

A drainage design exception is not required at this stage based on the proposed scope of work. If the scope of work is changed during the P.S. & E. stage, the appropriate drainage design exemption approval, if any, will be processed through the Hydraulics Section by the District’s Bureau of Design.

2-02 OUTLET EVALUATION

Unless otherwise noted below, the various outlets within the limits of the subject improvement were determined to be suitable for continued use under proposed conditions without modifications or the provision of storm water detention.

Unsuitable outlets: ☐ Yes ☒ No

Sensitive (receptor to rate, volume, and/or water quality) outlets:
☒ Yes ☐ No

All outlets along the US Route 45 corridor north of the proposed Millburn Bypass drain to Hastings Creek, Tributary to Hastings Creek, or unnamed ditches that all drain to the ultimate outfall, North Mill Creek. The Creeks include Lake County mapped ADID wetland areas and Hastings Creek and North Mill Creek are listed as impaired waters in IEPA 303(d). Based on the receiving waters' impaired status all outlets are considered sensitive to water quality. This portion of the US Route 45 corridor improvement is over 3.3 miles long, and all added impervious area drains to the same ultimate outfall. Detention was provided where feasible to minimize total negative impacts to North Mill Creek.

Location: Crossing No. 11 Station 169+26 (Drains to Existing Outlet No. 11)

Source: Project survey notes, contour maps, Millburn Bypass Location Drainage Plans, and IDOT as-built plans.

Evaluation: Existing offsite tributary area, existing roadside ditches on the west side of U.S. Route 45 and existing roadside ditches on the north side of Independence Boulevard drain to existing 2 – 4' (wide) by 2' (high) RCBC to Existing Outlet No. 11. (RCBC constructed as a part of the Millburn Bypass Project.)

Existing roadside ditches along the east side of U.S. Route 45 drain to existing Stormwater Detention Basin No. 11 that discharges to Existing Outlet No. 11 through an outlet control structure. (Basin constructed as a part of the Millburn Bypass Project.) The existing storm sewers in the Millburn Bypass convey the roadway runoff to the existing Stormwater Detention Basin No. 11 that discharges through an outlet control structure to Existing Outlet No. 11 to Unnamed Tributary No. 1 to Millburn Creek.

Existing Outlet No. 11 is considered sensitive to both volume and flow rate since it discharges into a basin constructed as part of the Millburn Bypass, which discharges into a delineated wetland depression. It is sensitive to water quality as the it discharges to a delineated wetland and the ultimate outfall of North Mill Creek.

Recommendation: Existing Outlet No. 11 will be maintained and the existing 2 - 4'(wide) by 2' (high) RCBC will be extended to accommodate the roadway widening of U.S. Route 45. Detention is provided due to the added pavement.

- Existing offsite tributary area, existing roadside ditches on the west side of U.S. Route 45 and existing roadside ditches on the north side of Independence Boulevard will be maintained to drain to the extended existing 2 – 4' (wide) by 2' (height) RCBC to Existing Outlet No. 11.
- Existing roadside ditches along the east side of U.S. Route 45 will be maintained and continue to drain to the existing Stormwater Detention Basin No. 11 that discharges to Existing Outlet No. 11 through an outlet control structure.
- The existing storm sewers constructed in the Millburn Bypass will be maintained and continue to convey the roadway runoff to the existing Stormwater Detention Basin No. 11 that discharges to Existing Outlet No. 11 through an existing outlet control structure. Where the existing Millburn Bypass transitions to the south project limits, the storm sewer will be relocated to accommodate the widening of U.S. Route 45.
- The proposed storm sewer from Station 168+50 to Station 170+25 will convey roadway runoff to Existing Stormwater Detention Basin No. 11.
- Stormwater detention storage volume will be for the 100-year critical storm. The 100-year volume will be provided at the 10-year existing release rate.

Location: Crossing No. 12 Station 176+20 (Existing Outlet No. 12)

Source: Project survey notes, contour maps, Millburn Bypass Location Drainage Plans, and IDOT as-built plans.

Evaluation: The existing roadside ditches and offsite tributary area drain to Existing 2-4' (wide) by 2' (high) RCBC to Existing Outlet No. 12. (RCBC constructed as a part of the Millburn Bypass Project.)

Existing Outlet No. 12 is not considered sensitive to volume or flow rate since there are no sensitive receptors downstream. It is sensitive to water quality as it discharges to a delineated wetland and the ultimate outfall of North Mill Creek.

Recommendation: Existing Outlet No. 12 will be maintained and the existing 2 - 4' (wide) by 2' (high) RCBC will be extended to accommodate the roadway widening of U.S. Route 45. Detention will be provided in Basin No. 11 to accommodate the widening of US Route 45 in the spirit of local ordinances.

- The proposed roadside ditch on the west side of U.S. Route 45 from Station 173+40 to Station 178+82 drains to Existing Outlet No. 12 through the to the extended Existing 2 – 4' (wide) by 2' (high) RCBC.
- The proposed roadside ditch on the east side of U.S. Route 45 from Station 170+93 to Station 175+87 drains to Existing Outlet No. 12.
- The proposed storm sewer from LT Station 170+95 to 173+30 conveys roadway drainage directly to Outlet No, 12.

Location: Crossing No. 13 Station 185+75 (Existing Outlet No. 13)

Source: Project survey notes, contour maps and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and Heritage Trails Subdivision offsite tributary area drain to 6' (wide) by 4' (high) box culvert to Existing Outlet No.13 to Unnamed Tributary No. 3 to North Mill Creek.

Existing Outlet No. 13 is not considered sensitive to volume or flow rate since there are no sensitive receptors downstream. It is sensitive to water quality as it discharges to a delineated wetland and the ultimate outfall of North Mill Creek.

Recommendation: This outlet will be maintained and the 6' (wide) by 4' (height) box culvert will be replaced with 2-9' (wide) by 4' (height) reinforced concrete box culverts (RCBC). 0.01 Acres will be redirected from Outlet No.14 to Outlet No. 13, due to geometrics changes. Detention is provided in Detention Site 13, due to the additional pavement, to help mitigate negative impacts to the downstream wetland and to the ultimate outfall, North Mill Creek.

- Proposed roadside ditches on the west side of U.S. Route 45 from Station 179+00 to 185+00 will discharge directly to Existing Outlet No. 13.
- Proposed roadside ditches on the west side of U.S. Route 45 from Station 185+92 to 202+50 will drain to Existing Outlet No. 13 through a proposed 2-9' (wide) by 4' (high) RCBC.
- The proposed storm sewers from Station 178+00 to 185+60 will convey the roadway runoff to the roadside BMP ditch which then discharges to Existing Outlet No. 13 downstream to Unnamed Tributary No. 3 to North Mill Creek.
- The proposed storm sewer from Station 186+75 to 200+00 will convey the roadway runoff to Detention Site No. 13 which then discharges to Outlet No. 13.
- Stormwater detention storage volume will be for the 100-year critical storm. The 100-year volume will be provided at the 10-year existing release rate. A BMP volume 0.5' below the normal water level is proposed.

Location: Crossing 14 at Station 207+26 (Existing Outlet No. 14)

Source: Project survey notes, contour maps, Church as-built plans, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 24" CMP culvert and to Existing Outlet No. 14 which drains offsite out of the right-of-way. An existing outlet for the Church that drains into the ROW approximately at Outlet No. 14 will need to be maintained.

Existing Outlet No. 14 is not considered sensitive to volume or flow rate since there are no sensitive receptors downstream. It is not sensitive to water quality as it discharges to a grassed waterway through a farm field.

Recommendation: This outlet will be maintained and the existing 24" CMP culvert will be replaced with a 24" RCP culvert. Due to geometric constraints 0.06 Acres of pavement will be redirected from Outlet No. 15 to Outlet No. 14 and 0.01 acres will be redirected from Outlet No. 14 to Outlet No 13. The existing Church outlet will be modified to drain into the IDOT ditch, to convey offsite.

Detention is provided in Detention Site 14 to accommodate the additional pavement to help mitigate negative impacts to the ultimate outfall, North Mill Creek, in the spirit of local ordinances.

- Proposed roadside swales and ditches and on the west side of U.S. Route 45 from Station 202+50 to 215+63 will drain to Existing Outlet No. 14 through a proposed 24" RCP culvert.
- Proposed roadside ditches on east side of U.S. Route 45 from Station 209+20 to 215+00 will drain to proposed Stormwater Detention Basin No. 14 that discharges to Existing Outlet No. 14 through an outlet control structure.
- Stormwater detention storage volume will be provided for the 100-year critical storm. The 100-year volume will be provided to meet the 10-year existing release rate. A BMP water quality volume 0.5' below the normal water level is proposed.
- The proposed storm sewers from Station 205+00 to 212+50 will convey the roadway runoff to proposed Stormwater Detention Basin No. 14 that discharges to Existing Outlet No. 14 through an outlet control structure

Location: Crossing 15 at Station 221+18 (Existing Outlet No. 15)

Source: Project survey notes, contour map, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 15" CMP culvert Existing Outlet No. 15 which drains out of the right-of-way. This outlet is tributary to Hastings Creek (Existing Outlet No. 16.)

Existing Outlet No. 15 is considered sensitive to both volume and release rate since it discharges into a closed depressional area adjacent to residential area.

Recommendation: This outlet will be maintained and the existing 15" CMP culvert will be replaced with a 24" RCP culvert. Roadway drainage will be rerouted to discharge directly to Hastings Creek Outlet No. 16. Storage for this rerouting will be provided within Detention Basin No. 15. This rerouting is not considered a diversion since Outlet No. 15 is naturally tributary to Outlet No. 16,

- Proposed roadside swales and ditches on west side of U.S. Route 45 from Station 215+61 to 223+60 drain to Existing Outlet No. 15
- Proposed roadside swales and ditches on east side of U.S. Route 45 from Station 219+50 to 225+00 drain to Existing Outlet No. 15 through a proposed a 24" RCP culvert.
- The proposed storm sewers from Station 218+00 to 228+00 will convey the roadway runoff to Stormwater Detention Basin No. 15. Detention Basin No. 15 will outlet directly to Hastings Creek via outlet control structure to storm sewer.
- Stormwater detention storage volume will be for the 100-year critical storm. The 100-year volume will be provided at the 10-year existing release rate. A BMP volume 0.5' below the normal water level is proposed.

Location: Crossing No. 16 Station 240+10 (Existing Outlet No. 16 – Hastings Creek)

Source: Project survey notes, contour map, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 9' (wide) by 5' (high) box culvert to Hastings Creek.

Existing Outlet No. 16 is not considered sensitive to volume or flow rate since it does not outlet into a sensitive receptor. It is sensitive to water quality since Hastings Creek is an impaired water with associated wetlands.

Recommendation: The existing outlet will be maintained and the existing 9' (wide) by 5' (high) RCBC will be replaced with 1-low flow 8'x7' and 2- high flow 8'x7' RCBCs. Stormwater detention storage will be provided upstream in proposed Stormwater Detention Basin No. 16. Outlet No. 15 is rerouted to outlet directly into Outlet No. 16 and is not considered a diversion since it is naturally tributary to Outlet No. 16. Outlet No. 17 and Outlet No. 21 roadway drainage is proposed to be rerouted to Outlet No. 16. Detention volume for the rerouted flow and added pavement will be provided in Detention Basins No. 15 and No. 16.

- Proposed roadside swales and ditches on west side of U.S. Route 45 from Station 233+00 to 235+42 will drain to Existing Outlet No. 16 through via storm sewer.
- Proposed roadside ditches on the east side of U.S. Route 45 from Station 233+00 to 237+00 drain to proposed compensatory storage site that discharges directly to Existing Outlet No. 16.
- The proposed storm sewer from Station 241+50 to Station 258+50 will convey water to Detention Basin No. 16, which will outlet directly to Hastings Creek after passing through an outlet control structure. This storm sewer will convey water from Outlet No. 17.
- Proposed storm sewer from Station 228+50 to Station 238+00 will serve as the Outlet for Detention Basin No.15, provide drainage for the east ditch conveying offsite area from Station 225+00 to Station 230+15, drain the roadway. This storm sewer will be shallow as it passes over the bike path.
- Stormwater detention storage volume will be provided detention to meet the 10-year existing release rate for the 100-year volume any diversion. A BMP volume 0.5' below the normal water level is proposed.
- Compensatory storage has been provided for fill within the floodplain at a ratio of 1.2:1.

Location: Crossing 17 at Station 255+04 (Existing Outlet No. 17)

Source: Project survey notes, contour map, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 12" CPP/PVC culvert Existing Outlet No. 17 which drains out of the right-of-way.

Existing Outlet No. 17 is considered sensitive to volume and flow rate since it outlets directly into a closed depressional area.

Recommendation: This outlet will be maintained and the existing 12" CPP/PVC culvert will be replaced with a 24" RCP culvert. Roadway drainage will be redirected to Outlet No.16, in order to drain through a detention facility discharging to Hastings Creek.

- Proposed ditches on the west side of U.S. Route 45 from Station 247+83 to 261+00 drain to Existing Outlet No. 17 through proposed 24" RCP culvert.
- Under proposed conditions tributary area to Outlet No. 21 will be redirected past Outlet No. 17 to Outlet No. 16.

Location: Crossing 21 at Station 256+85 (Existing Outlet No. 21)

Source: Project survey notes, contour map, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside drainage leaves the right-of-way via sheet flow from the roadside ditch.

Existing Outlet No. 21 is considered sensitive to volume and flow rate since it outlets directly into a closed depressional area.

Recommendation: This outlet only had roadway drainage tributary to it. Under proposed conditions the roadway drainage has been redirected to Outlet No.16, to drain through a detention facility discharging to Hastings Creek.

Location: Crossing No. 18 Station 266+39 (Existing Outlet No. 18 – Tributary to Hastings Creek)

Source: Project survey notes, contour map, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 36" CMP culvert to Tributary to Hastings Creek.

Existing Outlet No. 18 is not considered sensitive to volume or flow rate since it does not outlet into a sensitive receptor. It is sensitive to water quality since Hastings Creek, including this tributary, is an impaired water with associated wetlands.

Recommendation: The existing outlet will be maintained and the existing 36" CMP will be replaced with an 8' (wide) by 7' (high) RCBC. Stormwater detention storage will be provided in proposed Stormwater Detention Basin No. 18B. Detention is being provided in Detention Basin 18B to accommodate the proposed increase in pavement area. 0.15 Acres of pavement is diverted from Outlet No.18 to Outlet No. 24 due to geometric changes.

- Proposed roadside ditches on west side of U.S. Route 45 from Station 261+00 to 272+00 will outlet to Existing Outlet No. 18.
- Proposed roadside ditches on the west side of U.S. Route 45 from Station 272+00 to 285+89 drain offsite to an existing depressional area.
- Proposed roadside ditches on the east side of U.S. Route 45 from Station 270+00 to 272+50 drains to proposed Stormwater Detention Basin No. 18B that discharges to Existing Outlet No. 18 through an outlet control structure downstream to Tributary to Hastings Creek.
- Proposed roadside swales and ditches on the east side of U.S. Route 45 from Station 282+00 to 293+28 drain offsite out of the right-of-way.
- The proposed storm sewers from Station 263+75 to 266+00 will convey the roadway runoff to the compensatory storage site before discharging to Tributary to Hastings Creek.
- The proposed storm sewer from Station 268+50 to Station 290+50 will convey water to Detention Basin No. 18, which will outlet directly to Tributary to Hastings Creek.
- Stormwater detention storage volume will be for the 100-year critical storm. The 100-year volume will be provided at the 10-year existing release rate. A BMP volume 0.5' below the normal water level is proposed.
- Compensatory storage has been provided for fill within the floodplain at a ratio of 1.2:1.

Location: Existing Outlet No. 27 – IL Route 173 Station 1212+24 RT
Existing Outlet No. 24 – IL Route 173 Station 1212+24 LT

Source: Project survey notes, contour maps, IDOT as-built plans, and IL Route 173 Drainage Technical Memo.

Evaluation: Existing roadside ditches leave project limits. Existing Outlets No. 24 and No. 27 are considered sensitive to flow rate since both outlets are existing roadside ditches. The ditches are considered sensitive receptors since they are closed channels adjacent to the road.

Recommendation: The existing outlets will be maintained and the existing 24" - 30" storm sewer will be removed and replaced with a proposed storm sewer that drains to Proposed Stormwater Detention Basin No. 24 that discharges to Existing Outlet No. 24 to North Mill Creek. There is a 0.11 acre of pavement rerouted from Outlet No. 19 to Outlet No. 24 due to changes in geometrics. An additional 0.15 Acres of pavement is diverted from Outlet No.18 to Outlet No. 24 due to geometric changes. Outlet No. 27 will be rerouted to Outlet No. 24 to provide detention.

Detention volume will be provided in Basin No. 24 to accommodate the additional proposed pavement.

- Existing offsite roadside ditches (approximately 1200' west of project limits), proposed roadside swales and ditches from Station 1184+75 to Station 1195+00 (West of U.S. Route 45), and offsite tributary area along the north side of IL Route 173 drains to proposed storm sewer that drains to Proposed Stormwater Detention Basin No. 24 that discharges to Existing Outlet No. 24 to North Mill Creek.
- Proposed roadside swales along the east side of U.S. Route 45 from Station 300+87 to Station 297+91 and offsite tributary area drains to proposed Stormwater Detention Basin No. 24 that discharges to Existing Outlet No. 24 to North Mill Creek.
- The proposed storm sewers from Station 1186+38 to Station 1209+54 will convey the roadway runoff to Stormwater Detention Basin No. 24 that discharges to Existing Outlet No. 24 through an outlet control structure to North Mill Creek.
- The existing storm sewer from 1194+00 LT to 1205+50 LT will be adjusted to accommodate the proposed changes.
- The roadside ditch from 1205+00 to 1210+00 will be conveyed under IL 173 to Basin No. 24 to provide detention.

Location: Crossing 19 at Station 310+38 (Existing Outlet No. 19)

Source: Project survey notes, contour maps, and IDOT as-built plans.

Evaluation: Existing U.S. Route 45 roadside ditches and offsite tributary area drain to existing 42” x 30” CMP culvert.

Existing Outlet No. 19 is considered sensitive to volume and flow rate since it is located directly upstream of a private pond.

Recommendation: The existing outlet will be maintained and the existing 42” x 30” CMP culvert will be replaced with a 7’ x 4’ RCBC. Stormwater detention storage will be provided upstream in proposed Stormwater Detention Basin No. 19 to accommodate the additional pavement. 0.11 acres of pavement are rerouted from Outlet No. 19 to Outlet No. 24 due to changes in geometrics.

- Proposed roadside swales and ditches on the west side of U.S. Route 45 from Station 301+00 to 308+00 drain to proposed Stormwater Detention Basin No. 19A that discharges to Existing Outlet No. 19 through an outlet control structure.
- Proposed and existing roadside swales and ditches on the west side of U.S. Route 45 from Station 312+00 to 315+00 drains directly to Existing Outlet No. 19.
- Proposed roadside swales and ditches on the east side of U.S. Route 45 from Station 304+00 to Station 307 drain to a storm sewer which drains the shoulder of the road. This storm sewer drains into Detention basin 19 before outletting to Existing Outlet No. 19.
- Proposed and existing roadside ditches on the east side of U.S. Route 45 from Station 311+50 to 315+00 drain to Existing Outlet No. 19.
- Proposed roadway runoff drains to proposed roadside swales and ditches from Station 302+20 to Station 312+67 (North Project Limits).
- Stormwater detention storage volume will be provided for the 100-year critical storm. The 100-year volume will be provided at the 10-year existing release rate. A BMP volume 0.5’ below the normal water level is proposed.

Location: Crossing 26 at Miller Road Station 1995+00 (Proposed Outlet No. 26)

Source: Project survey notes, contour maps, and IDOT as-built plans.

Evaluation: Existing Miller Road drains via roadside ditches and swales. Offsite tributary area west of existing U.S. Route 45 and south of Miller Road drains via a field tile system that drains directly to Hastings Creek. The roadside ditches on the north side of Miller Road drain via overland flow to Hastings Creek.

Existing Outlet No. 26 is sensitive to flow rate since it outlets into an existing underdrain system.

Recommendation: The existing ditches will be regraded to provide adequate drainage to the existing outlet.

- Roadside ditches on both sides of the road from Station 1991+00 to Station 1998+00 will be regraded to maintain the existing drainage pattern.
- The field tile within IDOT ROW will be replaced with RCP and have catch basins/observation structures are proposed on both sides of the road to maintain existing drainage patterns. Field tile location to be field verified.

2-03 STORM WATER DETENTION ANALYSIS

This project has been reviewed in accordance with the Drainage Manual, Section 1-304.03 “Storm Water Storage”. Stormwater detention is designed in accordance with Drainage Manual, Chapter 12 – Detention Storage.

2-03.1 Evaluation

☐ No storm water detention required

☒ Storm water detention required

2-.03.2 Recommendation

Detention Ponds ☒ Yes (continue below) ☐ No (delete below)

For Existing Outlet No. 11 (Station 169+26) and Outlet No.12 (Station 176+20) 307 Cu. Yds. 100-year storm frequency

Pond location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.25 AC-FT (403 Cu. Yds.) for both Outlets No. 11 and No. 12.

Detention Basin No.11 is located on the east side of U.S. Route 45 approximately between Station 167+00 and Station 169+50. The basin is proposed as part of the Millburn Bypass. Basin No. 11 discharges to Existing Outlet No. 11. Basin No.11 has 0.53 AC-FT (855 Cu. Yds.) excess storage volume beyond what was required for the Millburn Bypass, that will be available to use as part of this subject project.

For Existing Outlet No. 13 (Station 185+75)
1,307 Cu. Yds. 100-year storm frequency

Basin location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.81 AC-FT (1,307 Cu. Yds.).

Basin No. 13 will be located on the west side of U.S. Route 45 approximately between Station 187+50 and Station 189+00. Basin No. 13 will discharge to Existing Outlet No. 13 through a proposed 2 – 9’x 4’ RCBC which outlets outside the ROW. Provided volume at this location is 0.88 AC-FT (1,420 Cu. Yds.)

For Existing Outlet No. 14 (Station 207+26)
629 Cu. Yds. 100-year storm frequency

Basin location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.39 AC-FT (629 Cu. Yds.). 0.06 acres of pavement will be diverted to Outlet No.14 from Outlet No. 15.

Basin No. 14 will be located on the east side of U.S. Route 45 approximately between Station 207+52 and Station 209+30. Basin No. 14 will discharge to Existing Outlet No. 14. Provided volume at this location is 0.52 AC-FT (839 Cu. Yds.)

For Existing Outlet No. 15 and Outlet No. 26
646 Cu. Yds. 100-year storm frequency

Pond location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.33 AC-FT (533 Cu. Yds.). The detention being provided at Outlet No.15 accounts for the increase in impervious for the tributary area associated with Outlet No.15.

An additional 0.07 AC-FT (113 cubic yards) is provided for the added impervious associated with Outlet No. 26. Outlet No. 15 is naturally tributary to Outlet No. 26.

Basin No. 15 will be located on the west side of U.S. Route 45 approximately between Station 224+00 and Station 228+00. Basin No. 15 will discharge to Hastings Creek via storm sewer system. Provided volume at this location is 0.52 AC-FT (839 Cu. Yds.)

For Existing Outlet No. 16, No. 17, and No. 21
1,952. Yds. 100-year storm frequency

Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. The required detention volume is 1.21 AC-FT (1,952 Cu. Yds.). The detention being provided at Outlet No.16 accounts for the increased pavement area for Outlets No. 16, and from Outlets No. 17 and 21 which are redirected to Outlet 16.

Basin No. 16 will be located on the east side of U.S. Route 45 approximately between Station 244+20 and Station 247+47. Basin No. 16 will discharge to Existing Outlet No. 16 to Hastings Creek. Provided volume at this location is 1.36 AC-FT (2,194 Cu. Yds.)

For Existing Outlet No. 18 (Station 266+39)
1,516 Cu. Yds. 100-year storm frequency

Basin location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.94 AC-FT (1,532 Cu. Yds.). 0.15 Acres of pavement is diverted from Outlet No. 18 to Outlet No. 24.

Basin No. 18 will be located on the east side of existing U.S. Route 45 approximately between Station 268+50 and Station 270+18. It will discharge into existing Outlet No. 18 to Tributary to Hastings Creek. Provided volume at this location is 1.12 AC-FT (1,807 Cu. Yds.)

For Existing Outlet No. 19 (Station 310+38)
451 Cu. Yds. 100-year storm frequency

Basin location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.28 AC-FT (451 Cu. Yds.).

Basin No. 19 will be located on the east side of existing U.S. Route 45 approximately between Station 308+00 and Station 309+00. It will discharge into existing Outlet No. 19. Provided volume at this location is 0.31 AC-FT (500 Cu. Yds.)

For Existing Outlet No. 24 – IL Route 173 (Station 1212+24)
1371 Cu. Yds. 100-year storm frequency for Outlet No.24
532 Cu. Yds. 100-year storm frequency for Outlet No.27

Basin location: Required detention volume has been determined per the IDOT detention spreadsheet based on the 10-year release rate using the 100-year proposed volume. This required detention volume is 0.81 AC-FT (1371 Cu. Yds.). 0.15 Acres of pavement is diverted from Outlet No. 18 to Outlet No. 24.

An additional 0.33 AC-FT (532 cubic yards) is provided for the added impervious associated with Outlet No. 27.

Basin No. 24 will be located on the north side of existing IL route 173 approximately between Station 308+00 and Station 309+00. It will discharge into existing Outlet No. 24. Provided volume at this location is 1.19 AC-FT (1210 Cu. Yds.) Runoff from offsite area located northwest of Basin No. 24 will be routed around the north side of the basin in a new ditch to its existing discharge point to the east, maintaining existing drainage patterns.

Storage Pipes ☐ Yes ☒ No

Ditch Storage ☐ Yes
☒ No

Control structure schematics (see Exhibit 2-03.2a)

☒ Yes ☐ No

Detailed evaluation and supporting calculations are included in Appendix D.

☒ Yes ☐ No

2-04 RIGHT OF WAY ANALYSIS

☒ Yes ☐ No

Additional right of way is required to accommodate the proposed drainage system. ROW for detention basins, swales, ditches, etc.

US ROUTE 45

Location: Station 185+00 to Station 186+50, 110' Left

Description: Additional right of way is required at this location to construct the headwall of the culvert. See Proposed Drainage Plan (PDP) sheet 2 of 18 for proposed right of way layout.

Location: Station 186+50 to Station 188+65, 240' Right

Description: Additional right of way is required at this location to construct a detention facility. See Proposed Drainage Plan (PDP) sheet 2 of 18 for proposed right of way layout.

Location: Station 185+25 to Station 186+75, 90' Right

Description: Additional right of way is required at this location to construct a culvert and headwall. See Proposed Drainage Plan (PDP) sheet 2 of 18 for proposed right of way layout.

Location: Station 204+50 to Station 208+50, 149' Right

Description: Additional right of way is required at this location to construct a culvert with headwall and detention basin. See Proposed Drainage Plan (PDP) sheet 4 of 18 for proposed right of way layout.

Location: Station 205+50 to Station 208+00, 85' Left

Description: Additional right of way is required at this location to construct a culvert and headwall. See Proposed Drainage Plan (PDP) sheet 4 of 18 for proposed right of way layout.

Location: Station 220+25 to Station 221+50, 85' Left

Description: Additional right of way is required at this location to construct a culvert and headwall. See Proposed Drainage Plan (PDP) sheet 5 of 18 for proposed right of way layout.

Location: Station 225+75 to Station 228+00, 150' Left

Description: Additional right of way is required at this location to construct a detention facility. See Proposed Drainage Plan (PDP) sheets 6 of 18 for proposed right of way layout.

Location: Station 237+00 to Station 247+88, 142' Right

Description: Additional right of way is required at this location to construct a detention facility, compensatory storage and culvert and headwall. See Proposed Drainage Plan (PDP) sheets 6/7 of 18 for proposed right of way layout.

Location: Station 254+75 to Station 255+73, 96' Right

Description: Additional right of way is required at this location to construct culvert and headwall. See Proposed Drainage Plan (PDP) sheet 8 of 18 for proposed right of way layout.

Location: Station 261+50 to Station 271+56, 136' Right

Description: Additional right of way is required at this location to construct a detention facility, compensatory storage and culvert and headwall. See Proposed Drainage Plan (PDP) sheets 8/9 of 18 for proposed right of way layout.

Location: Station 307+74 to Station 312+94, 144' Left

Description: Additional right of way is required at this location to construct a detention facility, and culvert and headwall. See Proposed Drainage Plan (PDP) sheet 13 of 18 for proposed right of way layout.

<u>IL Route 173</u>

Location: Station 1209+17 to Station 1212+26, 145' Left

Description: Additional right of way is required at this location to construct a detention facility. See Proposed Drainage Plan (PDP) sheet 18 of 18 for proposed right of way layout.

<u>Miller Road</u>

Location: Station 1994+49 to Station 1995+49, 45' Left
Station 1994+46 to Station 1996+46, 50' Right

Description: Additional right of way is required at this location to construct a drainage swale and outlet system. See Proposed Drainage Plan (PDP) sheet 14 of 18 for proposed right of way layout.

☐ Yes ☒ No

A drainage easement(s) is required to accommodate the proposed drainage system.

2-05 DRAINAGE ALTERNATIVES (Briefly describe each alternative and justify the selection)

Multiple design alternatives were considered for the concept for U.S. Route 45 North, the first being adapting the Lake County Watershed development ordinance for the project. This alternative was not considered feasible since there is limited ROW available for this project corridor. It was also considered to provide detention solely in storm sewers, this is considered ineffective storage, and would not provide the water quality benefit that detention basins provide.

Multiple alternatives were considered to drain the Bike path north of Miller. Each of these bike path alternatives would require additional ROW and Temporary Easements that would involve the taking of land from the Lake County Forest Preserve.

Under proposed conditions roadway drainage for Outlet No. 15, Outlet No. 17 and Outlet No. 21 has been redirected to Outlet 16. It was considered leaving each outlet as is, but both Outlet No. 17 and Outlet No. 21 discharge into a closed depression on private property before overflowing toward Hastings Creek. It was decided to redirect roadway runoff from these outlets to their ultimate outfall at Hastings Creek, in order

consolidate storage, which requires less ROW, and have one outlet location, which provides a more effective outlet.

2-06 LOCAL AND OTHER AGENCY COORDINATION (see Appendix C)

☒ Yes	☐ No	Local ordinances considered
☐ Yes	☒ No	Joint participation
☐ Yes	☒ No	Sewer separation
☐ Yes	☒ No	Jurisdictional transfer
☐ Yes	☒ No	Letter of intent required/processed/approved
☒ Yes	☐ No	Coordination completed and comments provided.

2-07 PROPOSED DRAINAGE PLAN

2-07.1 Roadway Drainage

☒ Yes	☐ No	Utilize Existing Drainage System
☒ Yes	☐ No	Utilize existing storm sewers with minor extensions and/or adjustment of existing drainage structures • Station 166+00 to Station 167+00 (US Route 45 Milburn Bypass Sewer) • Station 1194+60 RT to Station 1207+00RT (IL Route 173 • Station 1194+60 LT to Station 1206+00 LT (Illinois Route 173)
☐ Yes	☒ No	Utilize existing combined sewers with minor extensions and/or adjustment of existing drainage structures
☒ Yes	☐ No	Regrade/reestablish existing ditches • Station 1212+00 to Station 1212+25 (IL Route 173) • Station 166+00 to Station 177+98 (U.S. Route 45)
☐ Yes	☒ No	Regrade/reestablish existing swales
☒ Yes	☐ No	Replace/relocate existing storm sewers
☐ Yes	☒ No	Replace/relocate existing combined sewers
☒ Yes	☐ No	Abandon existing storm sewers • Existing Outlet No. 21 (Station 256+00)
☐ Yes	☒ No	Abandon existing combined sewers

☒ Yes ☐ No Regrade/reestablish/maintain existing outlets

- Existing Outlet No. 11 (Station 169+26)
- Existing Outlet No. 12 (Station 176+20)
- Existing Outlet No. 13 (Station 185+75)
- Existing Outlet No. 14 (Station 207+26)
- Existing Outlet No. 15 (Station 221+18)
- Existing Outlet No. 16 (Station 240+10)
- Existing Outlet No. 17 (Station 255+04)
- Existing Outlet No. 18 (Station 266+39)
- Existing Outlet No. 19 (Station 310+38)
- Existing Outlet No. 24 (Station 1212+24) – IL Route 173
- Existing Outlet No. 26 (Station 1995+00) – Miller Road
- Existing Outlet No. 27 (Station 1212+24) – IL Route 173

☒ Yes ☐ No Maintain/replace/extend existing cross road culverts

- Crossing 11 Station 170+65 – The 2 - 4' (wide) by 2' (height) box culvert will be extended (Drains to Existing Outlet No. 11)
- Crossing 12 Station 176+20– The 2 - 4' (wide) by 2' (height) box culvert will be extended (Existing Outlet No. 12)
- Crossing 13 Station 185+75– The 6' (wide) by 4' (height) box culvert will be replaced with an 8' (wide) by 5' (height) RCBC (Existing Outlet No. 13)
- Crossing 14 Station 207+26 - The existing 24" culvert will be replaced with 24" RCP culvert. (Existing Outlet No. 14)
- Crossing 15 Station 221+18 - The existing 15" CMP culvert will be replaced with a 24" RCP culvert. (Existing Outlet No. 15)
- Crossing 16 Station 240+10- The existing 9' (wide) by 5' (height) RCBC will be replaced with 12' (wide) by 7' (height) low flow RCBC and 2-7' (wide) by 7' (height) high flow RCBCs. (Existing Outlet No. 16)
- Crossing 17 Station 255+04 - The existing 12" CPP/PVC culvert will be replaced with a 24" RCP culvert. (Existing Outlet No. 17)
- Crossing 18 Station 266+39 - The existing 36" CMP will be replaced with a 7' (wide) by 7' (height) RCBC. (Existing Outlet No. 18)
- Crossing 19 Station 310+38- The existing 42" by 30" CMP culvert will be replaced with a 7' (wide) by 4' (height) RCBC. (Existing Outlet No. 22)

☒ Yes ☐ No

Construct new storm sewers

- U.S. Route 45 (Station 168+50 to Station 170+25)
  Station 170+25RT to Station 168+50RT (12” Dia.)
  Station 168+50RT to Exiting Basin No. 11 (15” Dia.)
- U.S. Route 45 (Station 170+90 to Station 172+30)
  Station 172+30LT to Station 170+90LT (12” Dia.)
  Station 170+90LT to Station 170+90RT (12” Dia.)
- U.S. Route 45 (Station 172+50 to Station 175+00)
  Station 172+50RT to Station 175+00RT (12” Dia.)
  Station 175+00RT to Station 175+00LT (18” Dia.)
- U.S. Route 45 (Station 177+00 to Station 178+80)
  Station 177+LT to Station 178+80LT (12” Dia.)
- U.S. Route 45 (Station 178+00 to Station 185+65)
  Station 178+00RT to Station 180+50RT (15” Dia.)
  Station 180+50RT to Station 183+00RT (18” Dia.)
  Station 183+00RT to Station 183+00LT (30” Dia.)
  Station 185+65RT to Station 183+00 LT (24” Dia.)
- U.S. Route 45 (Station 186+00 to Station 200+00)
  Station 200+00LT to Station 195+50LT (12” Dia.)
  Station 195+50LT to Station 193+00LT (15” Dia.)
  Station 193+00LT to Station 190+50LT (18” Dia.)
  Station 190+50LT to Station 188+00LT (18” Dia.)
  Station 188+00LT to Basin No. 13 (24” Dia.)
- U.S. Route 45 (Station 205+00 to Station 212+50)
  Station 205+00RT to Station 207+50RT (12” Dia.)
  Station 212+50RT to Station 210+50RT (12” Dia.)
  Station 210+00RT to Station 207+50RT (15” Dia.) to Basin No. 14 (15” Dia.)
  Station 207+50RT to Basin No. 14 (24” Dia.)
- U.S. Route 45 (Station 218+00 to Station 228+00)
  Station 218+00LT to Station 220+50LT (15” Dia.)
  Station 220+50LT to Station 225+50LT (18” Dia.)
  Station 225+00LT to Basin No. 15 (24” Dia.)
  Station 228+00LT to 225+50 LT (18” Dia.)
- U.S. Route 45 (Station 233+00 to Station 246+50)
  Basin No. 15 Control Structure to Station 230+50LT (24” Dia.)
  Station 230+50LT to Station 230+50 RT (24” Dia.)
  Station 230+50LT to Station 230+50TT (30” Dia.)
  Station 230+50RT to 232+20RT (24”x38” Dia.)
  Station 232+20RT to Station 233+20RT (30” Dia.)
  Station 233+20RT to Station 235+50RT (30” Dia.)
  Station 235+50RT (30” RCP) to Station 238+00RT (30” Dia.) to Comp Storage Site No. 16

- U.S. Route 45 (Station 241+50 to Station 258+50)
  Station 241+50RT to Station 244+00RT (18" Dia.)
  Station 244+00RT to Station 246+50RT (24" Dia.)
  Station 258+50RT to Station 256+00 RT (15" Dia.)
  Station 256+00RT to Station 253+50RT (18" Dia.)
  Station 253+50RT to Station256+50RT (24" Dia.)
  Station 246+50 5RT to Basin No. 16 (24" Dia.)
- U.S. Route 45 (Station 263+50 to Station 266+00)
  Station 263+50RT to Station 265+00RT (12" Dia.)
  Station 266+00RT to Station 265+00RT (15" Dia.)
  Station 265+00RT to Comp. Storage Site No. 18A (18" Dia.)
- U.S. Route 45 (Station 268+50 to Station 291+00)
  Station 291+00RT to Station 288+50RT (15" Dia.)
  Station 288+50RT to Station 283+50RT (18" Dia.)
  Station 283+50RT to Station 271+00RT (24" Dia.)
  Station 269+50RT to Station 271+00RT (15" Dia.)
  Station 271+004RT to Station 271+00RT to Basin No. 18B (30" Dia.)
- U.S. Route 45 (Station 295+00 to Station 300+35) and IL Route 173 (Station 1186+38 to Station 1209+54)
  Station 300+35RT to Station 299+00RT (18" Dia.)
  Station 299+00RT to Station 298+80RT (24" Dia.)
  Station 295+00RT to Station 298+00RT (24" Dia.)
  Station 1186+38LT to Station 1190+15LT (24" Dia.)
  Station 1190+15LT to Station 1195+00LT (30" Dia.)
  Station 1195+00LT to Station 1209+54LT (42" Dia.)
  Station 1199+23LT to Station 1209+54LT (42" Dia.)
- U.S. Route 45 (Station 303+80 to Station 310+00)
  Station 306+80 RT to Station 308+60RT (15" Dia.)
  Station 308+60 RT to Basin No. 19 (18" Dia.)

☐ Yes ☒ No Construct new combined sewers

☐ Yes ☒ No Construct special drainage structures

☒ Yes ☐ No Construct new ditches (standard ditches desired)
Limits: U.S. Route 45

- Station 185+50RT to Station 194+00RT
- Station 209+27RT to Station 215+00RT
- Station 220+75RT to Station 225+00RT
- Station 227+00RT to Station 231+50RT
- Station 234+00RT to Station 237+00RT
- Station 271+150T to Station 273+00RT
- Station 283+00RT to Station 293+00RT
- Station 308+00RT to Station 309+00 RT
- Station 174+82LT to Station 179+00LT
- Station 179+00LT to Station 202+00LT

- Station 203+0LT to Station 209+00LT
- Station 219+00LT to Station 221+00LT
- Station 240+00LT to Station 246+00LT
- Station 248+00LT to Station 267+00LT
- Station 275+00LT to Station 283+00LT
- Station 303+00LT to Station 307+00LT

- Station 311+00LT to Station 312+00LT
  Limits: Miller Road
  - Station 1997+00LT to Station 1998+00LT

  Limits: IL Route 173
  - Station 1185+0RT to Station 1194+70RT
  - Station 1205+00RT to Station 1213+00RT

Comments: The proposed ditches will have 2' bottoms based on roadway design and right of way constraints. Driveway culverts will be sized in Phase II.

☒ Yes ☐ No Construct new swales
Limits: U.S. Route 45
- Station 212+40LT to Station 215+69LT
- Station 216+00LT to Station 219+00LT
- Station 234+70LT to Station 235+55T
- Station 232+98LT to Station 234+44LT
- Station 266+00LT to Station 272+00LT
- Station 283+000LT to Station 286+00LT
- Station 292+70LT to Station 296+00LT
- Station 301+00LT to Station 302+00LT
- Station 305+53LT to Station 309+00LT

- Station 191+48RT to Station 194+50RT
- Station 218+60RT to Station 220+00RT
- Station 225+00RT to Station 225+90RT
- Station 292+58RT to Station 296+03RT
- Station 297+80RT to Station 301+32RT
- Station 301+5RT to Station 303+00RT

Limits: IL Route 173
- Station 1187+44LT to Station 1190+00LT
- Station 1209+16LT to Station 1212+15LT
- Station 1192+00LT to Station 1195+00LT
- Station 1205+00RT to Station 1212+15RT

Comments: The swales are necessary due to right of way constraints and for draining to the proposed Stormwater Detention Basin.

☐ Yes ☒ No Construct new outlets

☐ Yes ☒ No Construct new cross road culverts

☒ Yes ☐ No Stormwater detention to be provided (see Section 2-03)

☒ Yes ☐ No Compensatory storage for floodway to be provided (See Section 3-00)

2-07.2 Proposed Action for all Major Drainage Features

- At crossing No. 13 Station 185+75, there is an existing 6' (wide) by 4' (high) box culvert approximately 49 feet in length with a tributary area of 261 acres. Under existing conditions, the roadway will overtop the 100-year event. The culvert will be upsized to 2 – 9' (wide) x 4' (high) RCBC with one foot of embedment. The proposed culverts will provide 1.19' freeboard for the 50-year event (due to tailwater conditions) and 100-year edge of pavement protection. The roadway will not overtop for any event up to and including the 500-year event. This culvert is not located within floodplain.

- At crossing No. 16, Hastings Creek, at Station 240+10, the existing 9' (wide) by 5' (high) box culvert is approximately 68 feet in length with a tributary area of 6.1 square miles. The existing culvert overtops for events less than the 500-year event, but greater than the 100-year and provides less than three feet of freeboard for the 50-year event. Under proposed conditions the existing culvert will be replaced by 1-low flow 8'x7' RCBC and 2- high flow 8'x7' RCBCs. All culverts will be embedded. The proposed culvert will provide 3.14' freeboard for the 50-year event and the roadway will not overtop any event up to the 500-year event. This culvert is located within regulatory floodplain and floodway.

- At crossing No. 18, Tributary to Hastings Creek, at Station 266+39, the existing 36" CMP will be replaced with an 8' (wide) by 7' (high) RCBC approximately 118 feet long proposed to convey an area of 1.0 square miles to existing Outlet No. 18. The existing culvert overtops for events less than the 10-year event. Under proposed conditions the existing culvert will be replaced with an 8'x7' RCBC with one foot of embedment. The proposed culvert will provide 3.53' freeboard for the 50-year event and the roadway will not overtop any event up to the 500-year event. This culvert is located within regulatory floodplain.

- At crossing No. 19 Station 310+38 the 3' (wide) by 2' (high) box culvert with a length of approximately 74 feet. The culvert is proposed to convey the offsite tributary area to Existing Outlet No. 19. The existing culvert overtops for events less than the 10-year event. Under proposed conditions the existing culvert will be replaced with a 7'x4' RCBC with one foot of embedment. The proposed culvert will provide 3.03' freeboard for the 50-year event and the roadway will not overtop for events up to the 500-year event. This culvert is not located within floodplain.

3-00 FLOODPLAIN ENCROACHMENT EVALUATION

The proposed project has been reviewed in accordance with Executive Order 11988 "Floodplain Management"; Section 26-7.05(d) "Assessment and Documentation of Floodplain Encroachments" as contained in the Illinois Department of Transportation, Bureau of Design and Environment Manual; Drainage Manual; and 17 Illinois Administration Code 3708 "Floodway Construction in Northeastern Illinois."

☐ No Potential Floodplain Encroachment

☒ Potential Floodplain Encroachment

3-00.1 Location of base floodplain: Station: 185+75 Stream: Unnamed Tributary No. 3 to North Mill Creek

(see Exhibit 1-02a, Flood Boundary and Floodway Map or Flood Insurance Rate Map)

Type of potential encroachment

☒ Transverse ☐ Longitudinal

Overtopping elevation

☒ greater than 100 year frequency flood elevation

☐ less than 100 year frequency flood elevation

Fill in the floodplain, fringe, or floodplain if no floodway:

☐ Yes ☒ No

Excavation in the Floodplain fringe, or floodplain if no floodway:

☐ Yes (continue below) ☒ No (delete below)

Evaluation: The existing 6' (wide) x 4' (high) box culvert at Station 185+75 is located approximately 2400' north of Independence Boulevard. The existing box culvert will be replaced with 2 – 9' (wide) by 4' (high) box culverts. There is an unstudied Zone A floodplain associated with the Unnamed Tributary No. 3 to North Mill Creek located just east of the US Route 45 alignment. Based on the FIRM, the floodplain limit is outside of the proposed ROW and no encroachment will occur.

The project will not result in any significant adverse impacts on the natural and beneficial floodplain values; will not result in any significant change in flood risks or damage; and they do not have significant potential for interruption or termination of emergency service or emergency evacuation routes.

3-00.2 Location of base floodplain: Station: 240+10 Stream: Hastings Creek

(see Exhibit 1-02a, Flood Boundary and Floodway Map or Flood Insurance Rate Map)

Type of potential encroachment

☒ Transverse ☐ Longitudinal

Overtopping elevation

☒ greater than 100 year frequency flood elevation

☐ less than 100 year frequency flood elevation

Fill in the floodway:

☒ Yes (continue below) ☐ No (delete below)

254.0 Cubic yards at normal-10 year storm frequency elevation

164.50 Cubic yards at 10-100 year storm frequency elevation

Compensatory storage for fill in the floodway
☒ Yes (continue below) ☐ No (delete below)

922.53 Cubic yards at normal 10 year storm frequency elevation

345.30 Cubic yards at 10-100 year storm frequency elevation

Fill in the Floodplain, fringe or floodplain
668.7 Cubic yards at normal -10 year storm frequency elevation
641.2 Cubic yards at 10 -100 year storm frequency elevation

Excavation in the floodplain fringe, or floodplain if no floodway:

☒ Yes (continue below) ☐ No (delete below)

922.53 Cubic yards at normal-10 year storm frequency elevation

345.30 Cubic yards at 10-100 year storm frequency elevation

Evaluation: The existing 9' (wide) by 5' (high) box culvert at Station 240+10 (Crossing No. 16) is located approximately 1100' north of Miller Road. The existing culvert will be will be replaced with low flow 8'x7' and 2- high flow 8 'x7' box culverts. The Zone AE floodplain associated with Hastings Creek coincides with the regulatory floodway. Based on the modeled floodplain limit from the Hydraulic Report, the floodplain at the proposed crossing is approximately 80' wide downstream of US Route 45 and 100' wide upstream. The mapping shows the floodplain over the road; however, based on the 1' topographic mapping and published base flood elevations, the 100-year flood is contained within the existing culvert. Requests for the regulatory hydraulic model were made to FEMA, IDOT, and the Illinois State Water Survey. The model was not available from any source. Therefore, a new hydraulic model was created from surveyed cross sections, and ran using the published FEMA flood flows. Using accepted modeling techniques, the model was adjusted to match the published FEMA flood elevations as closely as possible.

The proposed US Route 45 improvements at Hastings Creek are designed not to cause adverse impacts to base flood conveyance. A hydraulic analysis has been completed, and an increase in flood heights and flood limits is not anticipated. Floodway encroachment associated with this project will not result in a significant change in flood risks or damage, and does not have significant potential for interruption or termination of emergency service or emergency evacuation routes; therefore, it has been determined that this encroachment is not significant. Since the work associated with the proposed US Route 45 improvements will occur in the floodplain with a regulatory floodway, an IDNR-OWR Floodway permit under the Part 3708 Rules is required.

Location of base floodplain: Station: 266+39 Stream: Tributary to Hastings Creek

(see Exhibit 1-02a, Flood Boundary and Floodway Map or Flood Insurance Rate Map)

Type of potential encroachment

☒ Transverse ☐ Longitudinal

Overtopping elevation

☒ greater than 100 year frequency flood elevation

Fill in the floodplain:

☒ Yes ☐ No

328.0 cubic yards at normal - 10 year storm frequency elevation
79.1 cubic yards at 10-100 year storm frequency elevation

Excavation in the Floodplain:

☒ Yes ☐ No

518.52 cubic yards at normal - 10 year storm frequency elevation
100.97 cubic yards at 10 - 100 year storm frequency elevation

Evaluation:

The existing 36" CMP culvert at Station 266+35 is located approximately 3900' south of IL Route 73. The existing culvert will be will be replaced with a 8' (wide) by 7' (high) RCBC. The floodplain associated with the unnamed tributary to Hastings Creek is unstudied Zone A, meaning no base flood elevation has been determined. Based on the modeled floodplain limit from the Hydraulic Report, the floodplain at the proposed crossing is approximately 135' wide upstream of US Route 45. However, based on the 1' topographic mapping, this floodplain is shown to vary at the site from elevation 755 to elevation 760.

The proposed structure carrying US Route 45 over the unnamed tributary to Hastings Creek has been designed not to cause adverse impacts to base flood conveyance. Hydrologic and hydraulic analyses have been completed, and an increase in flood heights and flood limits is not anticipated. Since the work associated with the proposed US Route 45 structure will occur in the floodplain with a drainage area greater than 1 square mile that does not have a regulatory floodway, an IDNR-OWR "Individual Floodway" permit under the Part 3700 Rules is required.

The project will not result in any significant adverse impacts on the natural and beneficial floodplain values; will not result in any significant change in flood risks or damage; and does not have significant potential for interruption or termination of emergency service or emergency evacuation routes.

4-00 ILLINOIS DEPARTMENT OF NATURAL RESOURCES

OFFICE OF WATER RESOURCES (IDNR-OWR) PERMIT

☒ Required (continue below) ☐ Not Required (delete below)

- ☒ Individual Permit

  Location: Crossing No. 18 Station 266+39 Tributary to Hastings Creek

- ☐ Statewide Permit #

  Location:

- ☒ Floodway Permit

  - ☒ Regulated Floodway Construction Permit

    Location: Crossing No. 16 Station 240+10 Hastings Creek

  - ☐ Regional Permit #1

    Location:

  - ☐ Regional Permit #2

    Location:

  - ☐ Regional Permit #3

    Location:

  - ☒ Permit Summary forms completed and included in Section 4

- ☐ IDNR-OWR coordination documented and included in Appendix C

Illinois Department of Transportation

Permit Summary for Floodway Construction in Northeast Illinois

Applicant Agency:	IDOT	County:	Lake
Route:	US Route 45	Stream:	Hastings Creek
Section:	05-00262-02-RP	SN:	n/a

General Description The roadway, which is located within the floodway and floodplain of Hastings Creek, will be resurfaced, widened, and profile raised with the existing structure being replacing with a larger structure
Existing Facility: 9' x 5' Proposed Facility: 1 Low Flow-8'x7' and 2-8'x7'
Proposed Improvement: The existing roadway is proposed to be widened and raised, with the existing culvert replaced.

1. Is the proposed work classified as repairs such as deck replacement, pavement resurfacing, or the armoring or filling of a scour hole? ☐ Yes ☒ No

2. Does the proposed work only consist of modifications to the existing structure which will occur above the regulatory 100-year flood profile? ☐ Yes ☒ No

Note: If the answer to question 1 or 2 is yes, no permit is required and questions 3 through 12 may be omitted.

3. Does the proposed work below the regulatory 100-year flood profile consist of widening of the existing structure by 12 feet or less? ☐ Yes ☒ No

Note: If yes, Regional Permit No. 2 applies and questions 4 through 9 may be omitted.

4. Is the proposed improvement, including the approach roadway, more restrictive to normal and flood flows than the existing structure? ☐ Yes ☒ No

5. Is a Channel Modification proposed? ☐ Yes ☒ No

6. Are there any buildings or structures located upstream in the 100-year floodplain within the influence of the structure backwater? ☐ Yes ☒ No

   6a. If no, does the backwater of the proposed improvement exceed the backwater of the existing structure by more than 0.1 foot? ☐ Yes ☒ No

   6b. If yes, does the proposed backwater exceed the natural high water elevation by more than 0.1 foot? ☐ Yes ☒ No

7. Are transitions required for this project? ☐ Yes ☒ No

8. Is the flood profile at the project site impacted by backwater from a downstream receiving stream? ☐ Yes ☒ No

   If yes, list frequency of starting elevation for analysis:

9. Is backwater from a downstream structure affecting the flood profile at the project site? ☐ Yes ☒ No

   9a. Was the existing downstream structure used in the analysis for determining flood profile at the project site? years? (Attach documentation) ☐ Yes ☒ No

   9b. Is the downstream structure scheduled for improvement in the next 5 ☐ Yes ☒ No

   9c. Was the proposed downstream improvement used in the analysis? ☐ Yes ☒ No

10. Is a floodway map change required due to the proposed project? ☐ Yes ☒ No

11. Will fill or material be placed in the floodway due to the proposed work? ☒ Yes ☐ No

   11a. If yes, is compensatory storage provided at the project location? (Attach a copy of completed Attachment A) ☒ Yes ☐ No

   11b. If the answer to 11a is no, is compensatory storage provided at another location? If yes, give location and attach a copy of completed Attachment A. ☐ Yes ☒ No

   11c. Has compensatory storage relief been granted? (Attach Documentation) ☐ Yes ☒ No

12. Coordination based on Memorandum of Agreement has occurred with Agency(ies) (Attach documentation):. ☐ Yes ☒ No

All engineering analysis has been performed by me or under my direct supervision.

Signature: Alene A Dailey IL/P.E. #: 062-47420

Date: 01/18/2018 P.E. Expiration Date: 11/30/2019

FOR DEPARTMENTAL USE ONLY

Is a permit required for this project? ☐ Yes ☐ No

If yes, specify type of permit: ☐ Floodway, ☐ Regional 1, ☐ Regional 2

Permit Summary
(Attachment A - Compensatory Storage)

Part of Permit Summary for Floodway Construction in Northeast Illinois:

☒ Phase I (Preliminary) ☐ Phase II (Final)

Applicant Agency:	IDOT	County:	Lake
Route:	US Route 45	Stream:	Hastings Creek
Section:	05-00262-02-RP	SN:	n/a

Provide the following information for Item 11:

a. Flood Water Elevations (Natural): 100-year 749.44 ft. 10-year 748.68 ft.
Normal 744.98 ft.

b. Determine the amount of fill or material being placed in the floodway:

1. Between the 100-year and 10-year flood elevation 164.5 cu. yds.
2. Between the 10-year and normal water elevation 254.0 cu. yds.

c. Determine the volume being provided to compensate for above item b:
(i.e. from structures removal, excavation, etc.)

1. Between the 100-year and 10-year flood elevation 345.30 cu. yds.
2. Between the 10-year and normal water elevation 922.53 cu. yds.

d. Mark on the exhibits the location and amount of compensatory storage to be excavated. Also show the location of floodway and floodplain boundaries. (Include a set of plans and cross sections)

Attach copy of calculations and Exhibit(s) reflecting the above finding.

All engineering analysis has been performed by me or under my direct supervision.

Signature:	Steve A Daily	IL/P.E. #:	062-47420
Date:	01/10/2018	P.E. Expiration Date:	11/30/2019

TAB A

5-00 Appendix A: Source Data Reviewed

USGS Maps

Antioch, ILL.-WIS. Quadrangle, U.S.GS, 1993
Floods in Antioch Quadrangle, Hydrologic Investigations Atlas HA-226, U.S.GS, 1966

Survey Notes

Christopher B. Burke Engineering, Ltd. May 2011 to October 2011.

Local Drainage Plans

Millburn Bypass Location Drainage Study, Approved August 2013.
Stormwater Management Report Children of America, by Spaceco Inc., August 2013

U.S. Route 45 at IL Route 173 Location Drainage Study Technical Memorandum, Approved August 2013

Lindenhurst Plaza (Walgreens) Site Development Report, by IG Consulting, Inc., June 2006

Stormwater Management Report Heritage Park, by Spaceco Inc., May 2006

Lake County Forest Preserve District, Raven Glen South Trail, by RHMG, February 2006.

Engineering Improvement Plans for Raven Glen Forest Preserve, Trail and Parking Lot Improvements, by V3 Companies, August 2005

Hydrologic and Hydraulic Analysis of Unnamed Tributary to Mill Creek, Prepared for AETNA Development Corporation, by Christopher B. Burke Engineering, Ltd, October 2003

Cross Creek Subdivision Drainage Plan, by Henderson and Bodwell, LLP, October 1998

Falling Waters Subdivision Improvement Plans, by Henderson and Bodwell, LLP, March 1998

Harvest Hill Subdivision Public Improvement Plans, by Spies & Associates, Inc., September 1998

Farmington Green Estates Subdivision Public Improvement Plans, by Spies & Associates, Inc., January 1998

Lake County Forest Preserve Subsurface Drainage Inventory, by Hey and Associates, November 2014

As Built and/or Microfilm Highway Plans

F.A. Route 177 (U.S. 45), Sec. (39 & 41) W & RS, Lake County, IL 132 to IL 173, 1957.

F.A. Route 872 (U.S. 45), Sec. 1977-025-N, Lake County, US 45 at IL 132, IDOT, 1977

F.A. Route 872 (U.S. 45), Sec. (39 & 41) RS-1, Lake County, IL 132 to WI State Line, IDOT, 1979.

F.A.P. Route 344 (U.S. Route 45), Sec. (39 &41) N-1, Lake County, US 45 at Sandlake Road, 1994

Proposed Plans

Millennium Trail – U.S. Route 45 Underpass Received 12-05-2018

FEMA Flood Insurance Rate Map (FIRM)

Lake County, Illinois and Incorporated Areas, Panels 32, 34 and 42 of 295,
Map Number 17097C0032K, 17097C0034K, 17097C0042K, Effective Date: September 18, 2013

TAB B

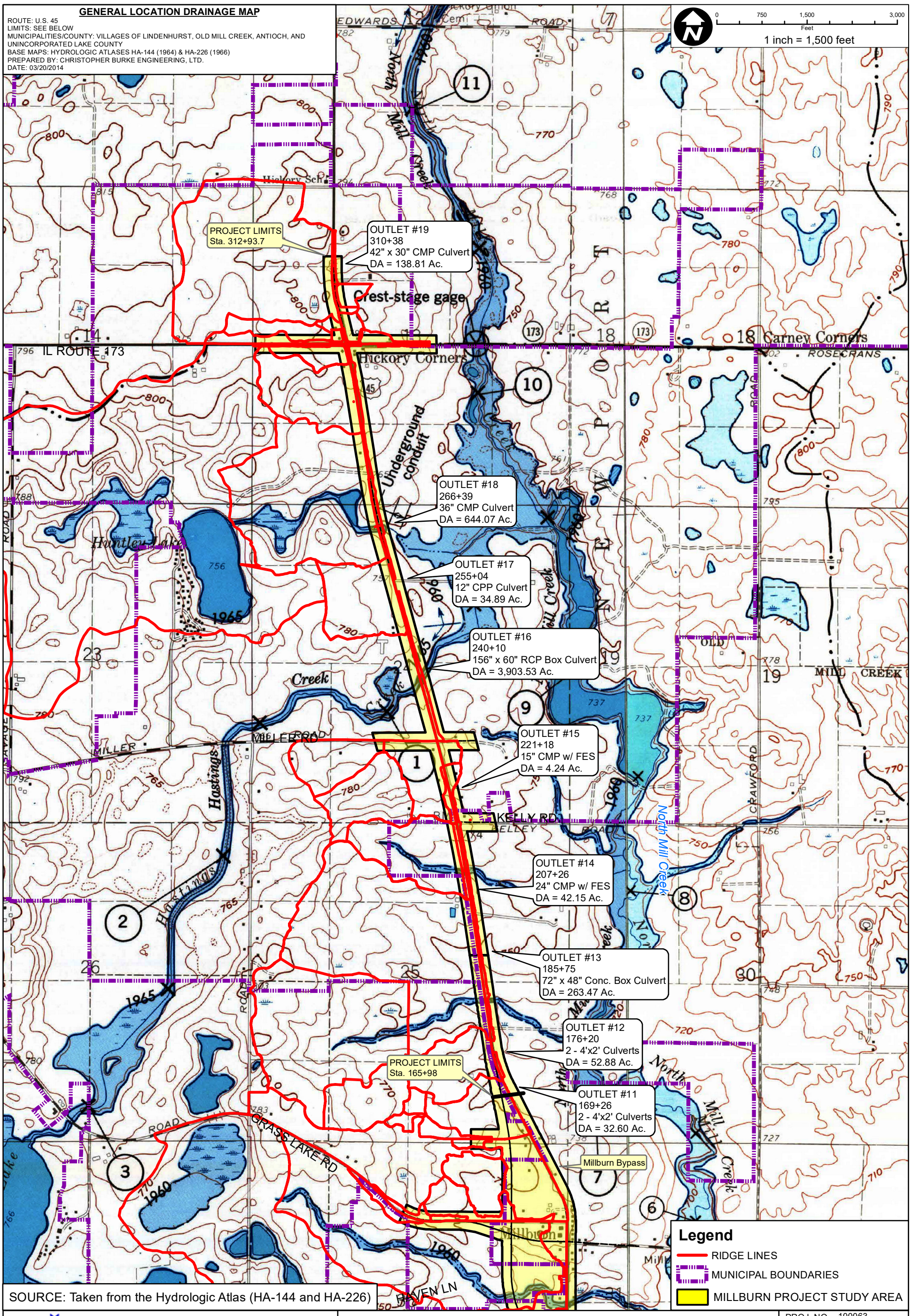
5-00 Appendix B: Exhibits

1. General Location Drainage Map, Exhibit 1-00a
2. Existing Drainage Plan, Exhibit 1-00b
3. Flood Insurance Rate Map, Exhibit 1-02a
4. Waterway Information Tables, Exhibit 1-03.1a
5. Proposed Drainage Plan, Exhibit 2-00a
6. Typical Cross Sections, Exhibit 2-01
7. Drainage Crossing Locations, Exhibit 2-02a
8. Control Structure Schematic, Exhibit 2-03a

GENERAL LOCATION DRAINAGE MAP
EXHIBIT 1-00a

GENERAL LOCATION DRAINAGE MAP

ROUTE: U.S. 45
LIMITS: SEE BELOW
MUNICIPALITIES/COUNTY: VILLAGES OF LINDENHURST, OLD MILL CREEK, ANTIOCH, AND UNINCORPORATED LAKE COUNTY
BASE MAPS: HYDROLOGIC ATLASES HA-144 (1964) & HA-226 (1966)
PREPARED BY: CHRISTOPHER BURKE ENGINEERING, LTD.
DATE: 03/20/2014



SOURCE: Taken from the Hydrologic Atlas (HA-144 and HA-226)

LakeCounty Division of Transportation
600 W Winchester Rd Libertyville, Illinois 60048

Illinois Departmant of Transportation
201 West Center Court
Schaumburg, IL 60196

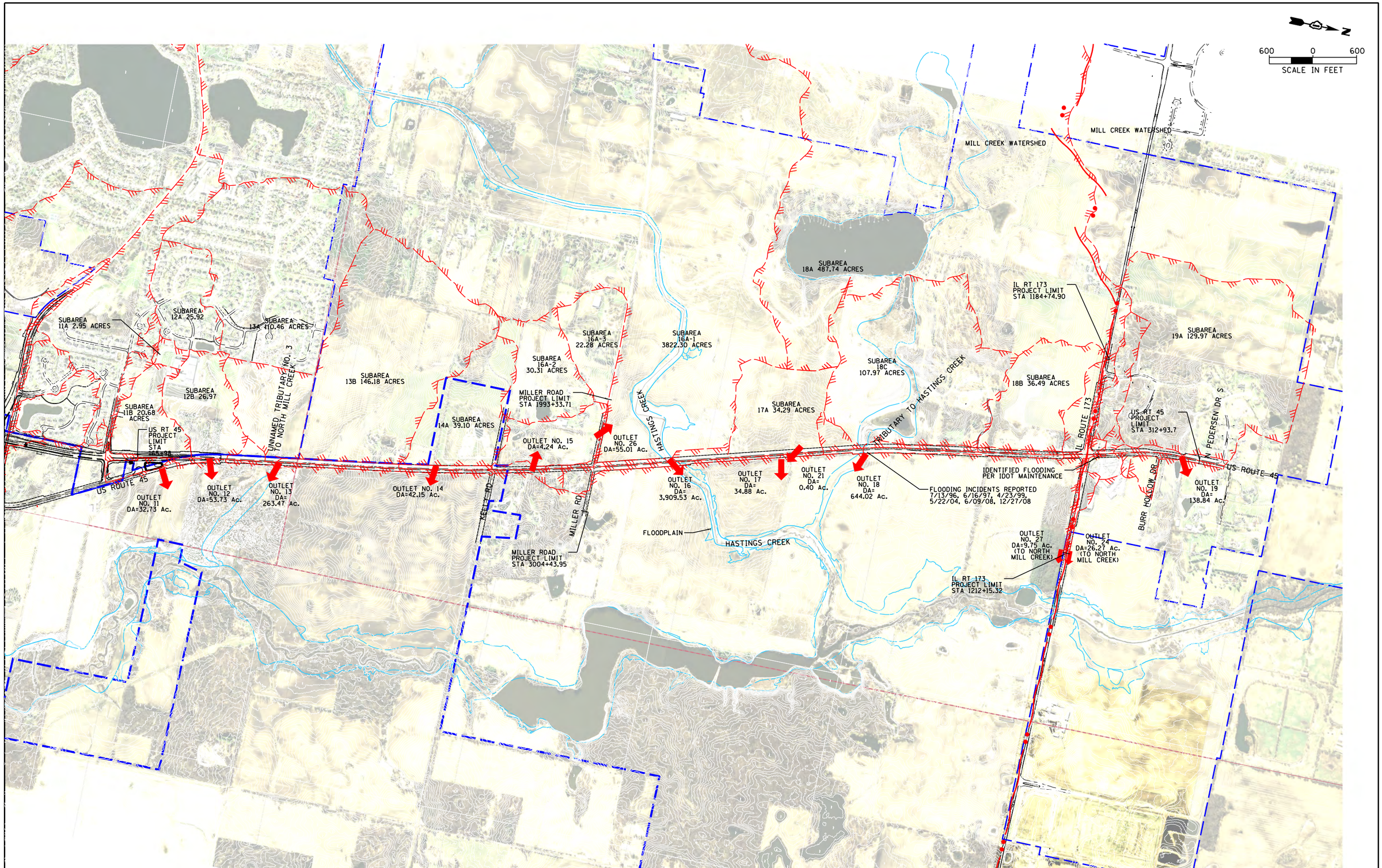
PROJ. NO.	100063
DATE:	04-04-2011
SHEET	1 OF 1
DRAWING NO.	EXH 1-00a

TITLE:
GENERAL LOCATION DRAINAGE MAP

DSGN.			SCALE:	1"= 1,500'
DWN.			GIS USER	MHAYES
CHKD.			PLOT DATE	
FILE:				

Path: N:\dot\100063\GIS\Exhibits\Study Limits HA Map NORTH.mxd
Date: 3/2/2018 Time: 11:41:17 AM

EXISTING DRAINAGE PLAN
EXHIBIT 1-00b



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		DRAWN -	REVISED -			344	05-00262-06-RO		18 / 1
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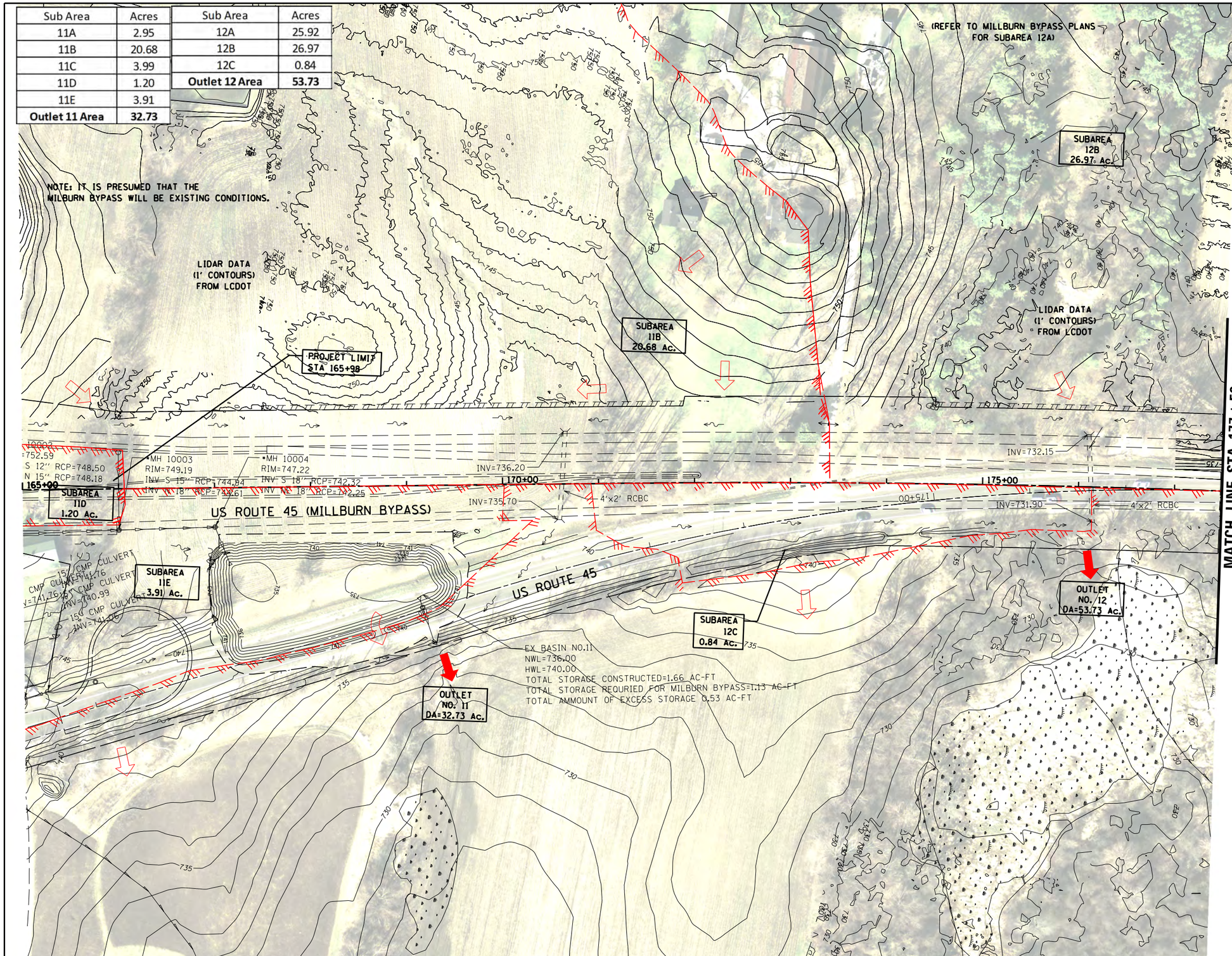
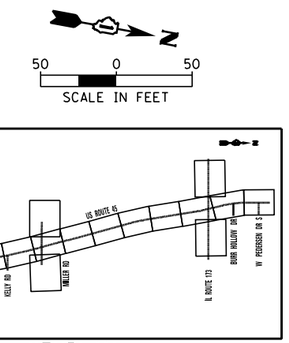
Default	PLOT DATE = 8/24/2018	DATE -	REVISED -		SCALE: 1"=600' SHEET 1 OF 18 SHEETS STA. TO STA.		ILLINOIS FED. AID PROJECT		

Sub Area	Acres
11A	2.95
11B	20.68
11C	3.99
11D	1.20
11E	3.91
Outlet 11 Area	**32.73**

Sub Area	Acres
12A	25.92
12B	26.97
12C	0.84
Outlet 12 Area	**53.73**





KEYPLAN

N

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SCALE IN FEET

LEGEND

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DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 165+00 TO STA. 177+50

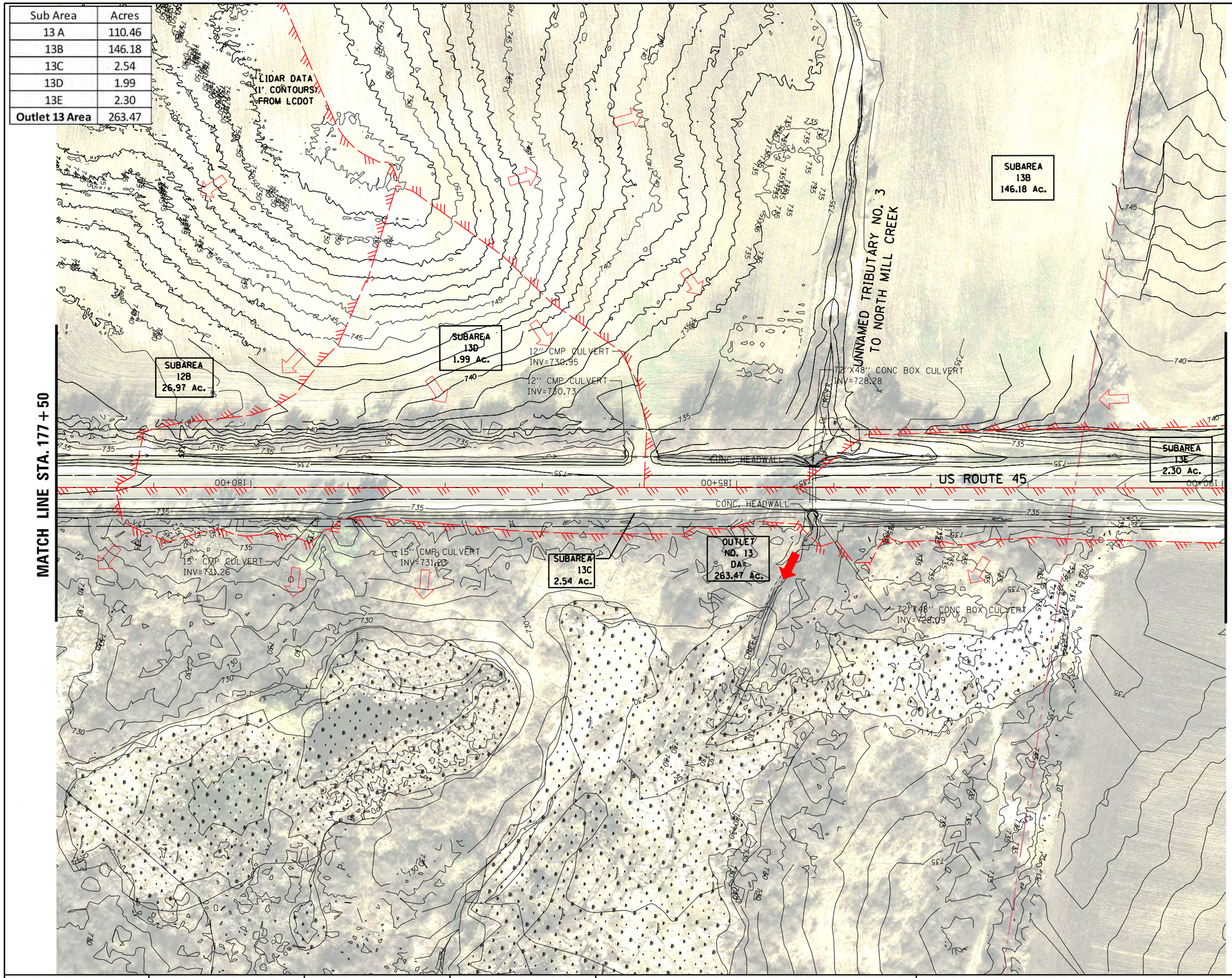
SCALE: 1"=50' | SHEET NO. 2 OF 18 SHEETS | STA. 165+00 TO STA. 177+50

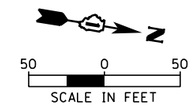
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-R0	LAKE	18	2

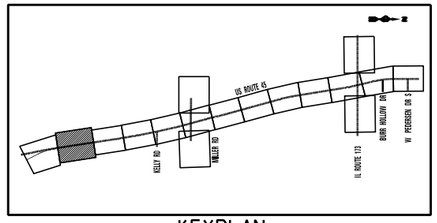
CONTRACT NO.

ILLINOIS FED. AID PROJECT

Sub Area	Acres
13 A	110.46
13B	146.18
13C	2.54
13D	1.99
13E	2.30
Outlet 13 Area	263.47







KEYPLAN

LEGEND

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INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

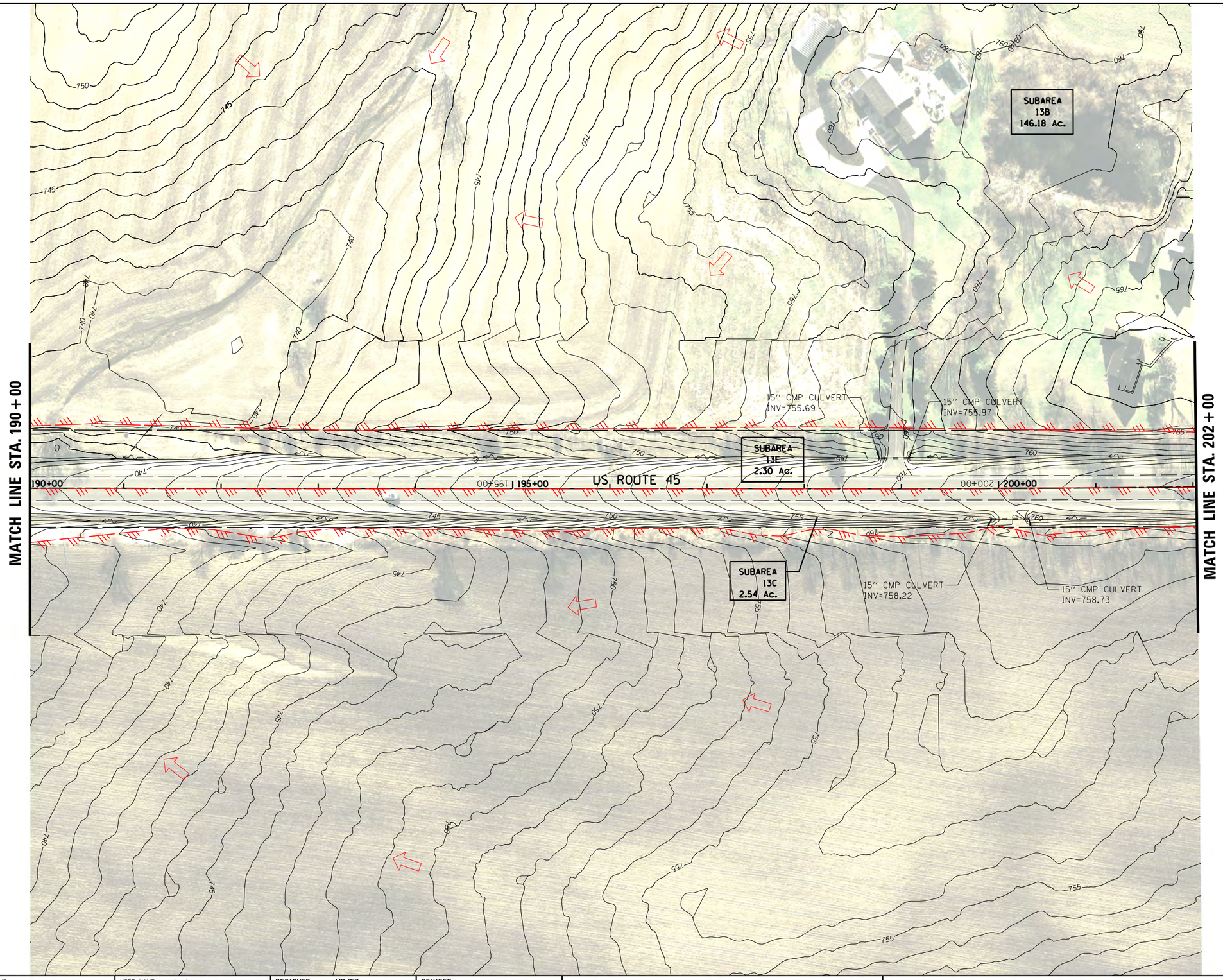
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 177+50 TO STA. 190+00

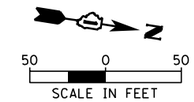
SCALE: 1"=50' | SHEET NO. 3 OF 18 SHEETS | STA. 177+50 TO STA. 190+00

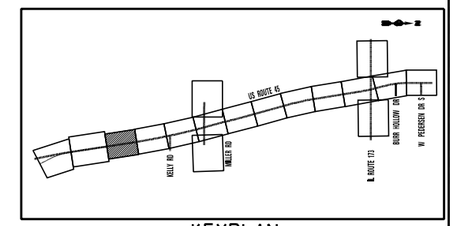
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	3

CONTRACT NO.

ILLINOIS FED. AID PROJECT







KEYPLAN

LEGEND

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INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
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SANITARY SEWER	
COMBINED SEWER	
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CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 190+00 TO STA. 202+00

SCALE: 1"=50' | SHEET NO. 4 OF 18 SHEETS | STA. 190+00 TO STA. 202+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	4

CONTRACT NO.

ILLINOIS FED. AID PROJECT

Sub Area	Acres
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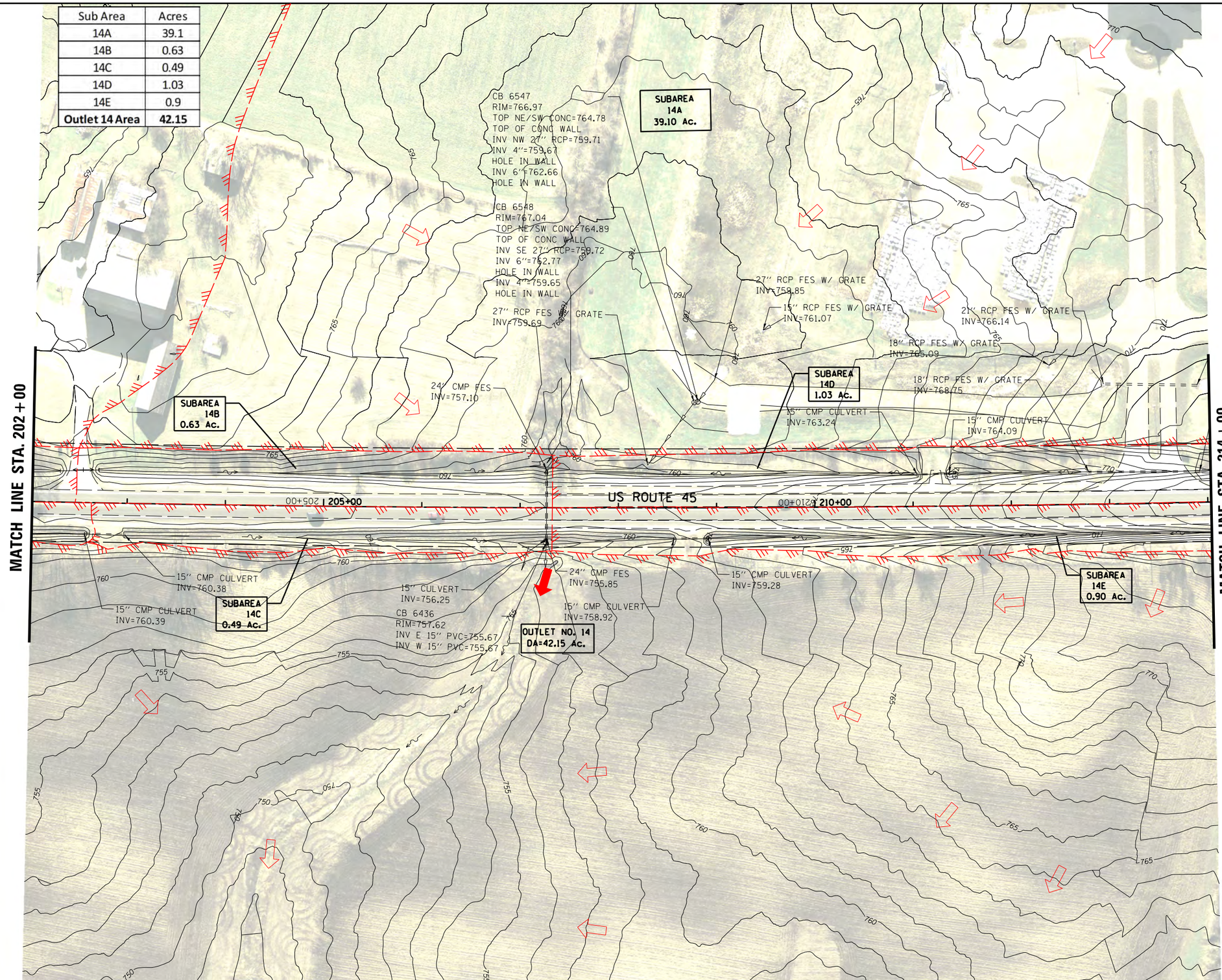
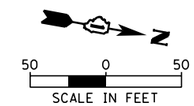
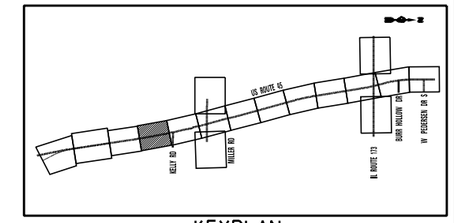
14B	0.63
14C	0.49
14D	1.03
14E	0.9
Outlet 14 Area	**42.15**







KEYPLAN

LEGEND

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INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 202+00 TO STA. 214+00

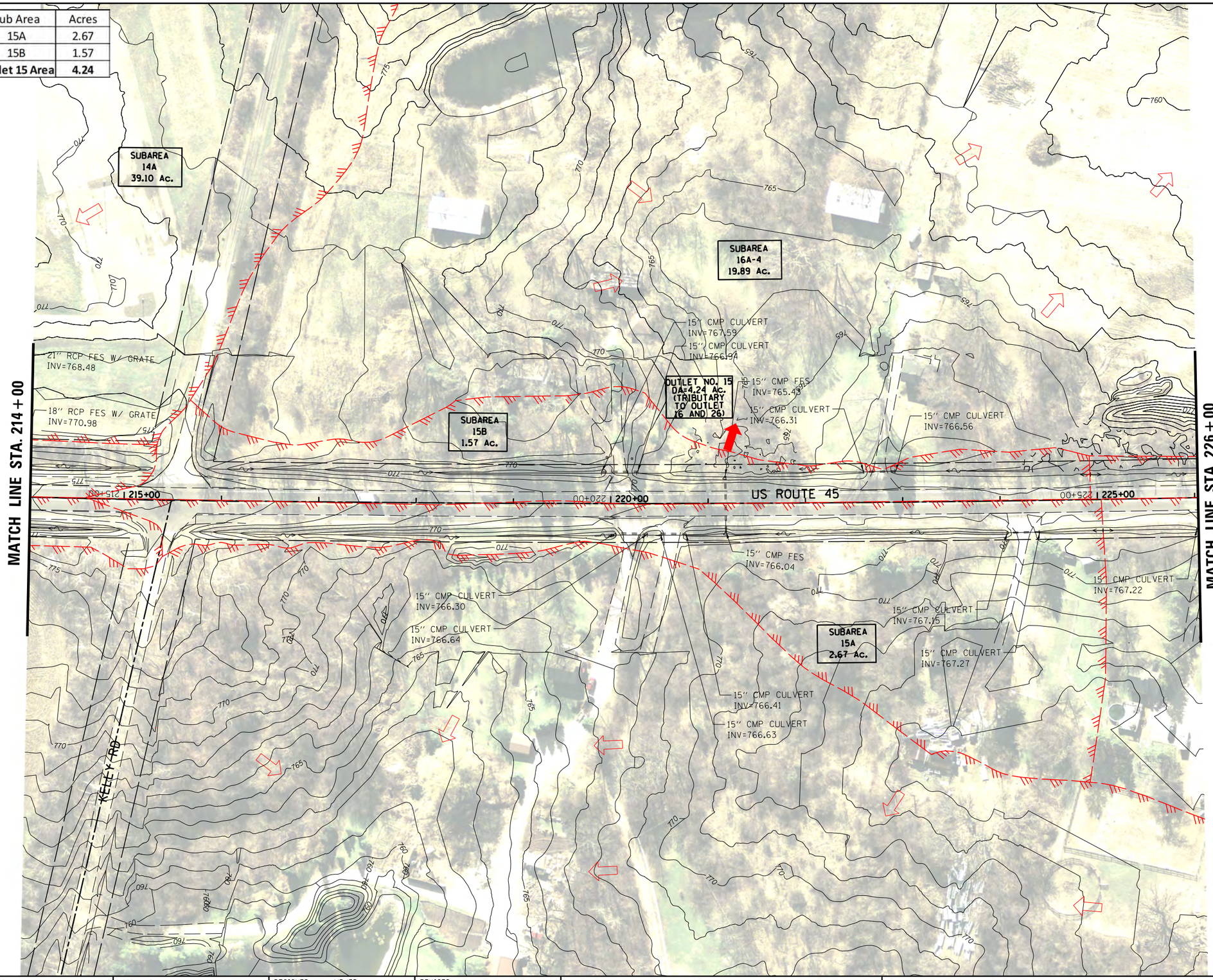
SCALE: 1"=50' | SHEET NO. 5 OF 18 SHEETS | STA. 202+00 TO STA. 214+00

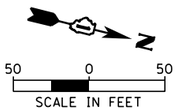
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	5

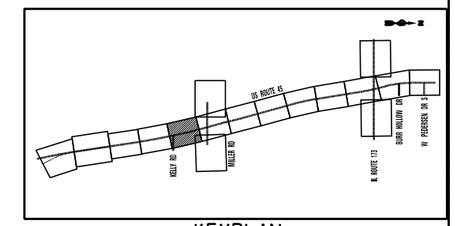
CONTRACT NO.

ILLINOIS FED. AID PROJECT

Sub Area	Acres
15A	2.67
15B	1.57
Outlet 15 Area	**4.24**







KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT SCALE = 100'	CHECKED - IAD/JOC	REVISED -
	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

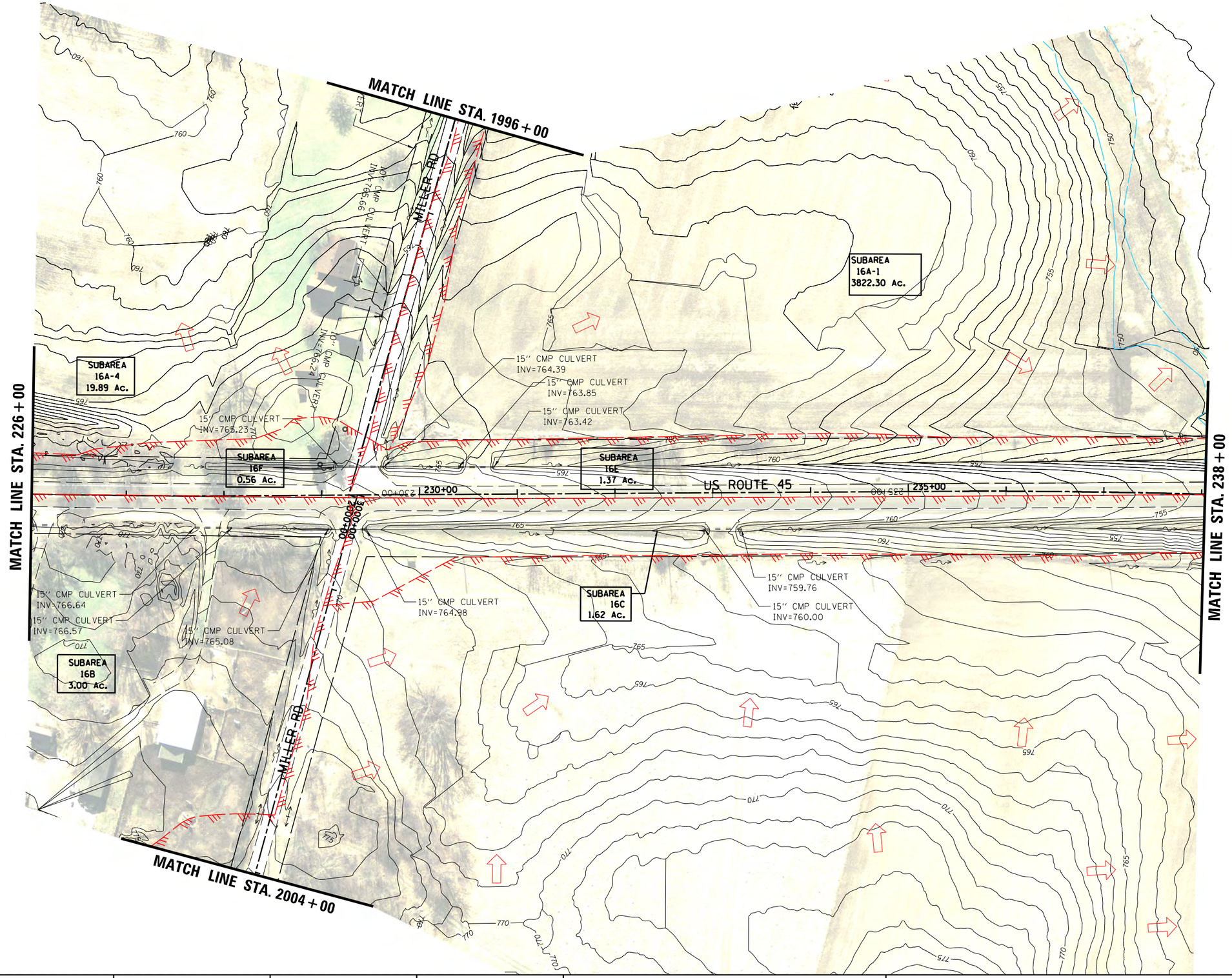
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 214+00 TO STA. 226+00

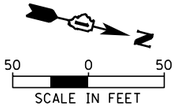
SCALE: 1"=50' | SHEET NO. 6 OF 18 SHEETS | STA. 214+00 TO STA. 226+00

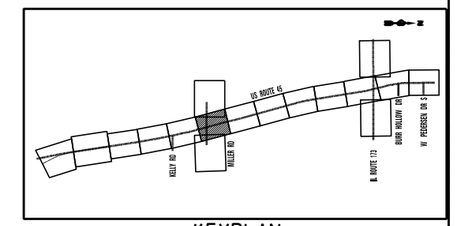
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	6

CONTRACT NO.

ILLINOIS FED. AID PROJECT







KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

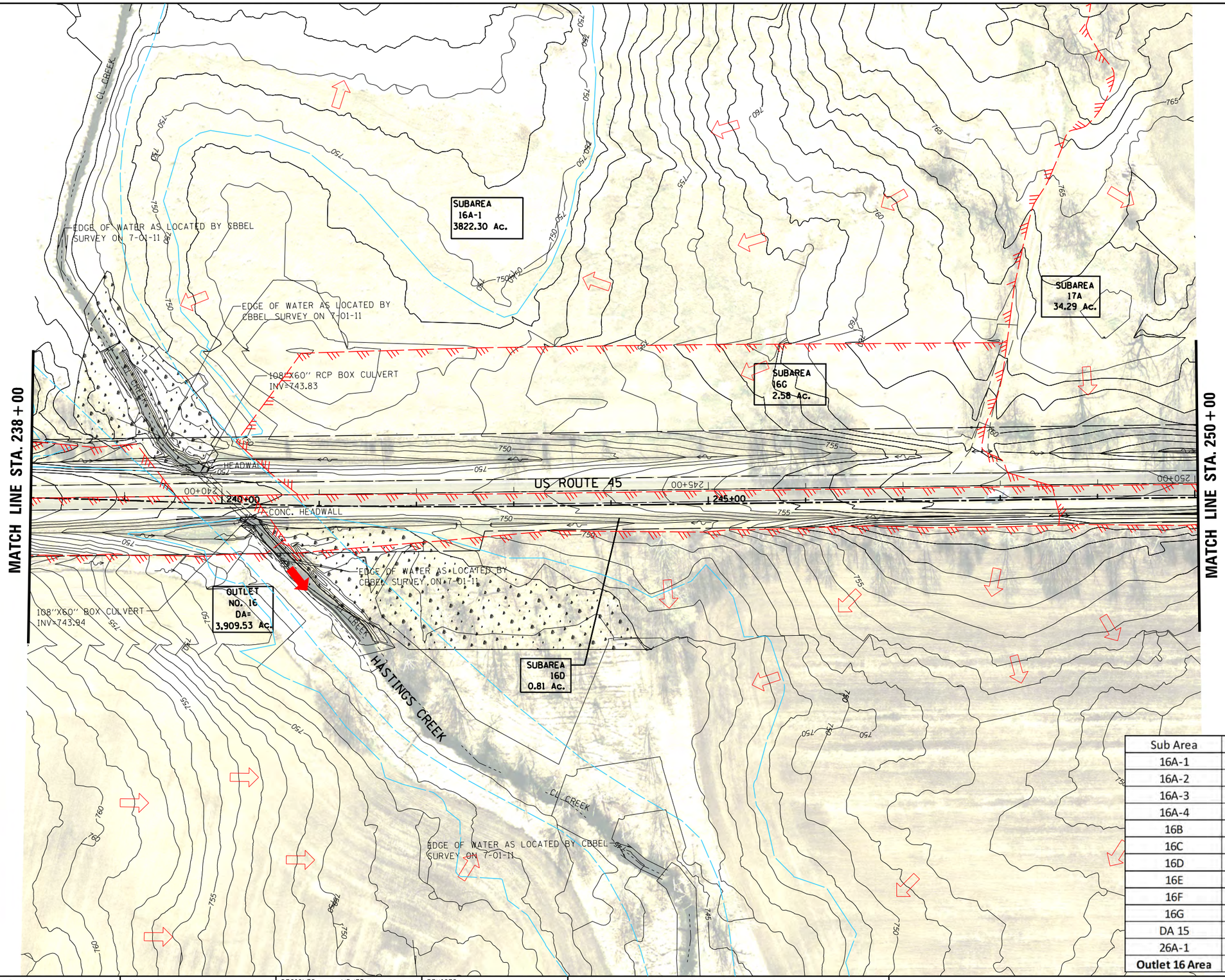
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 226+00 TO STA. 238+00

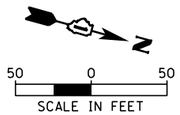
SCALE: 1"=50' | SHEET NO. 7 OF 18 SHEETS | STA. 226+00 TO STA. 238+00

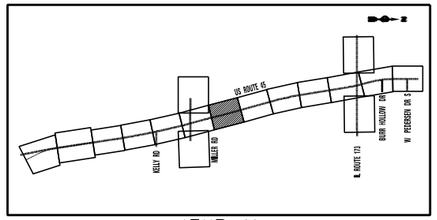
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	7

CONTRACT NO.

ILLINOIS FED. AID PROJECT







KEYPLAN

Sub Area	Acres
16A-1	3822.3
16A-2	30.31
16A-3	22.28
16A-4	19.89
16B	3
16C	1.62
16D	0.81
16E	1.37
16F	0.56
16G	2.58
DA 15	4.24
26A-1	0.57
Outlet 16 Area	3909.53

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 238+00 TO STA. 250+00

SCALE: 1"=50' | SHEET NO. 8 OF 18 SHEETS | STA. 238+00 TO STA. 250+00

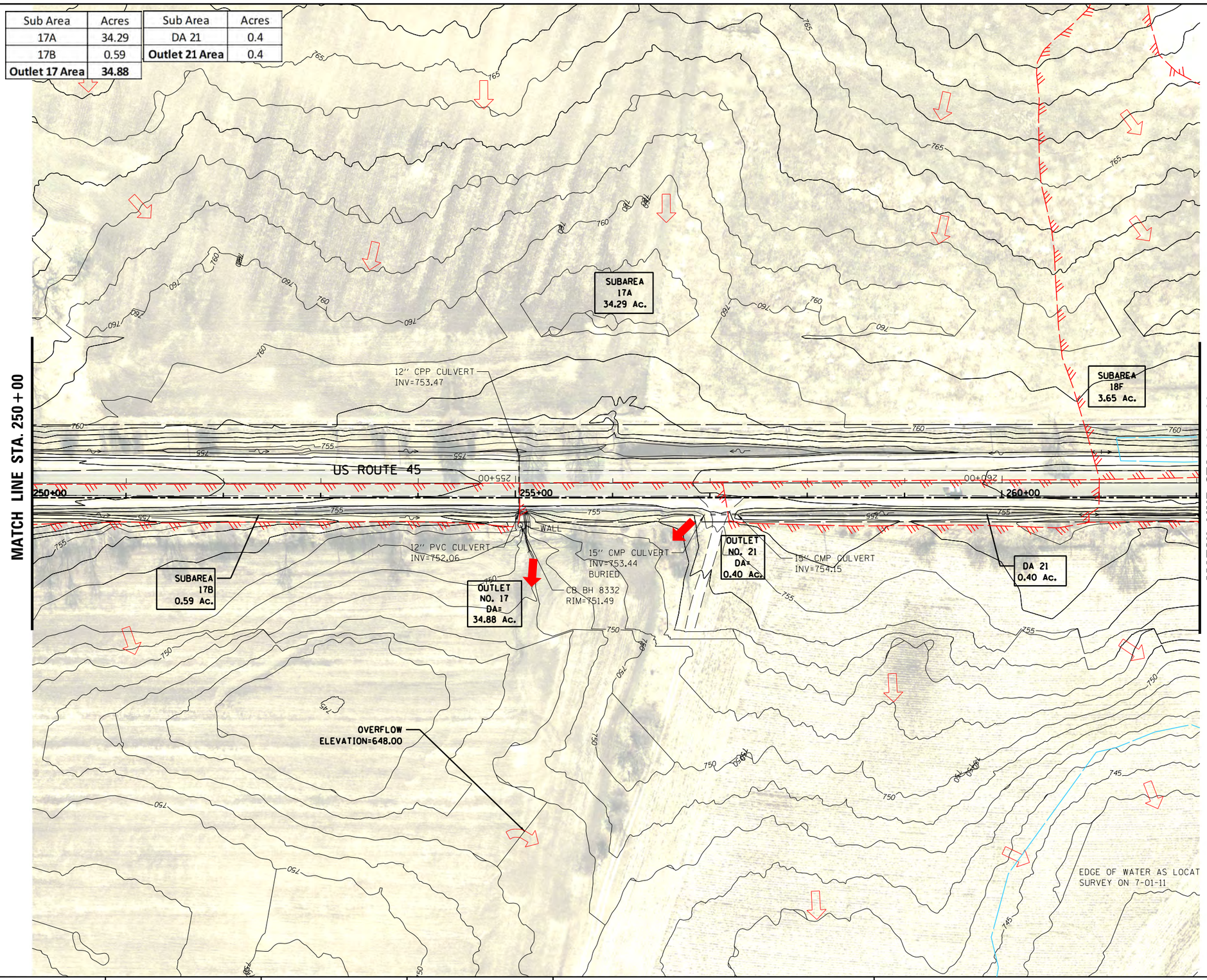
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	8

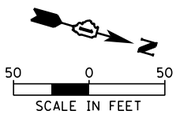
CONTRACT NO.

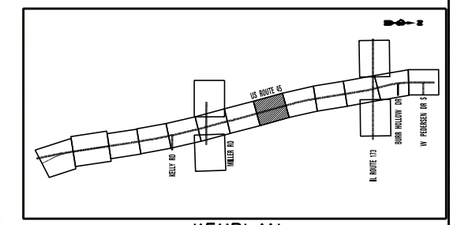
ILLINOIS FED. AID PROJECT

Sub Area	Acres
17A	34.29
17B	0.59
Outlet 17 Area	**34.88**

Sub Area	Acres
DA 21	0.4
Outlet 21 Area	0.4







KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

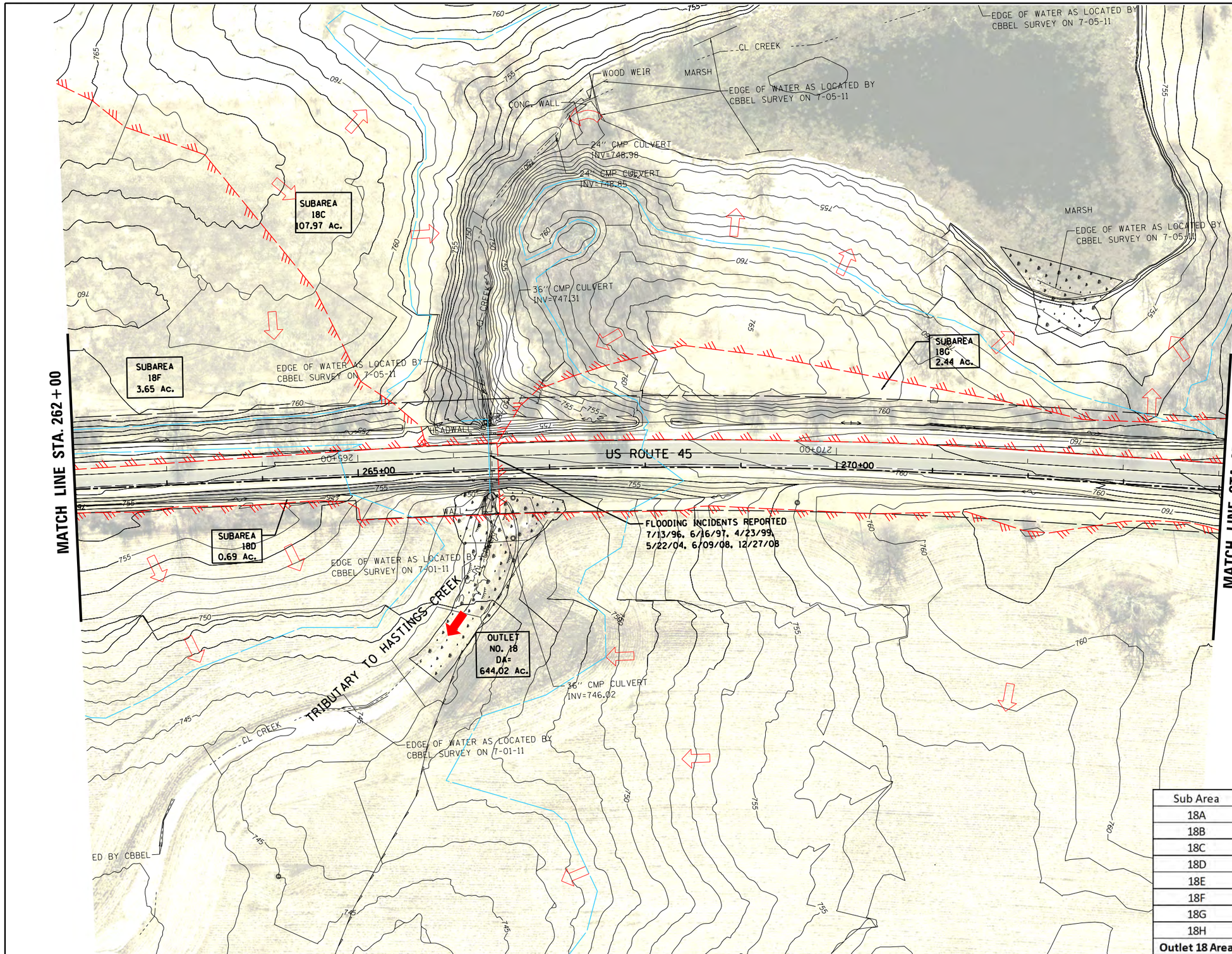
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 250 + 00 TO STA. 262 + 00

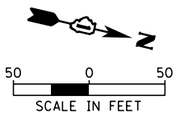
SCALE: 1"=50' | SHEET NO. 9 OF 18 SHEETS | STA. 250+00 TO STA. 262+00

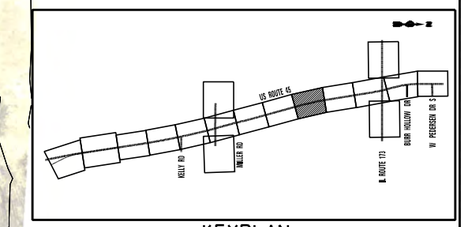
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	9

CONTRACT NO.

ILLINOIS FED. AID PROJECT







KEYPLAN

Sub Area	Acres
18A	487.74
18B	36.49
18C	107.97
18D	0.69
18E	3.48
18F	3.65
18G	2.44
18H	1.56
Outlet 18 Area	**644.02**

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

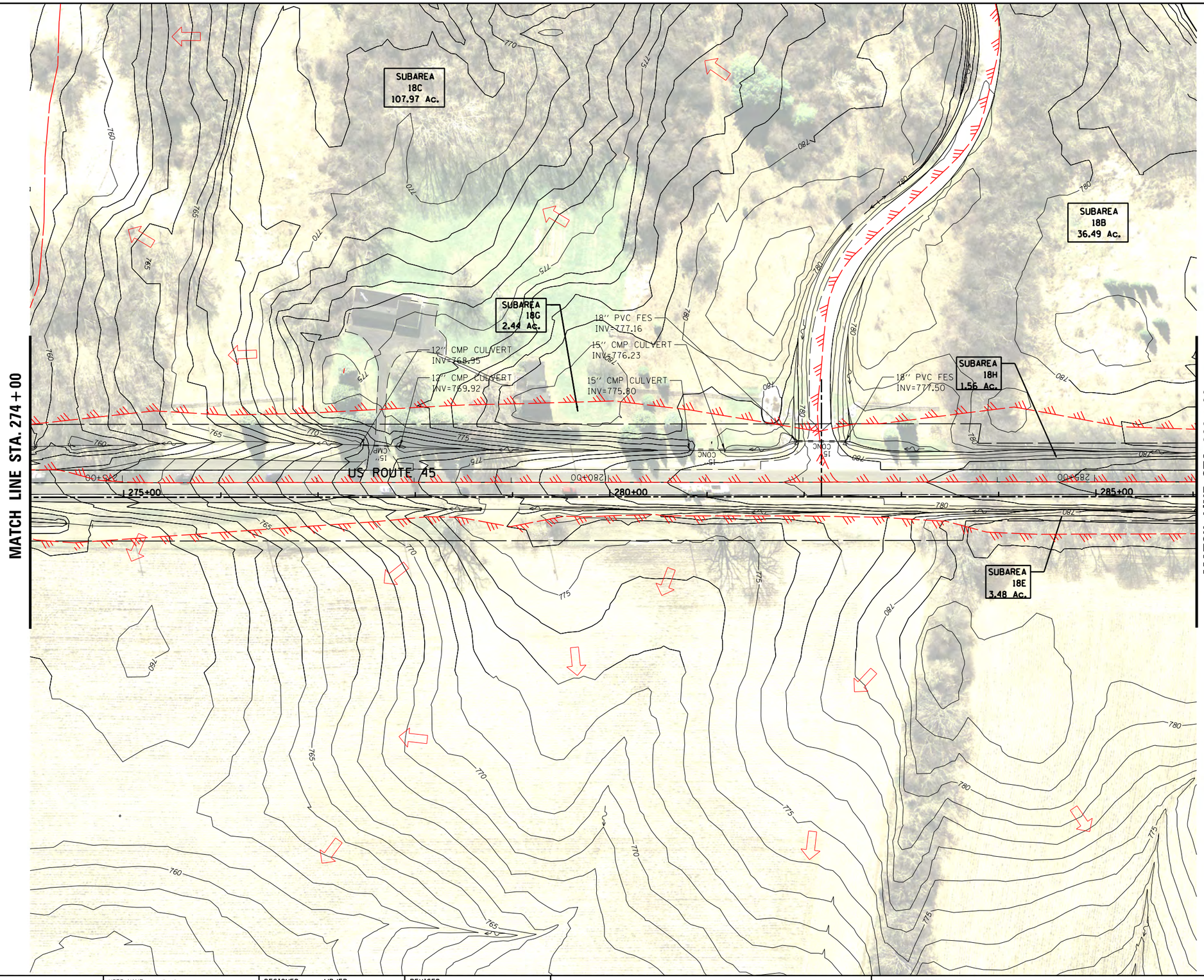
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 262+00 TO STA. 274+00

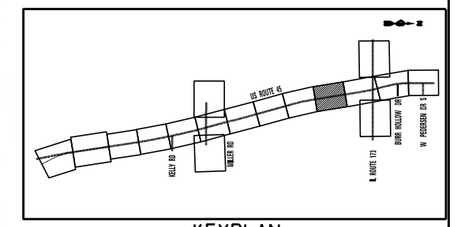
SCALE: 1"=50' | SHEET NO. 10 OF 18 SHEETS | STA. 262+00 TO STA. 274+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	10

CONTRACT NO.

ILLINOIS FED. AID PROJECT





KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

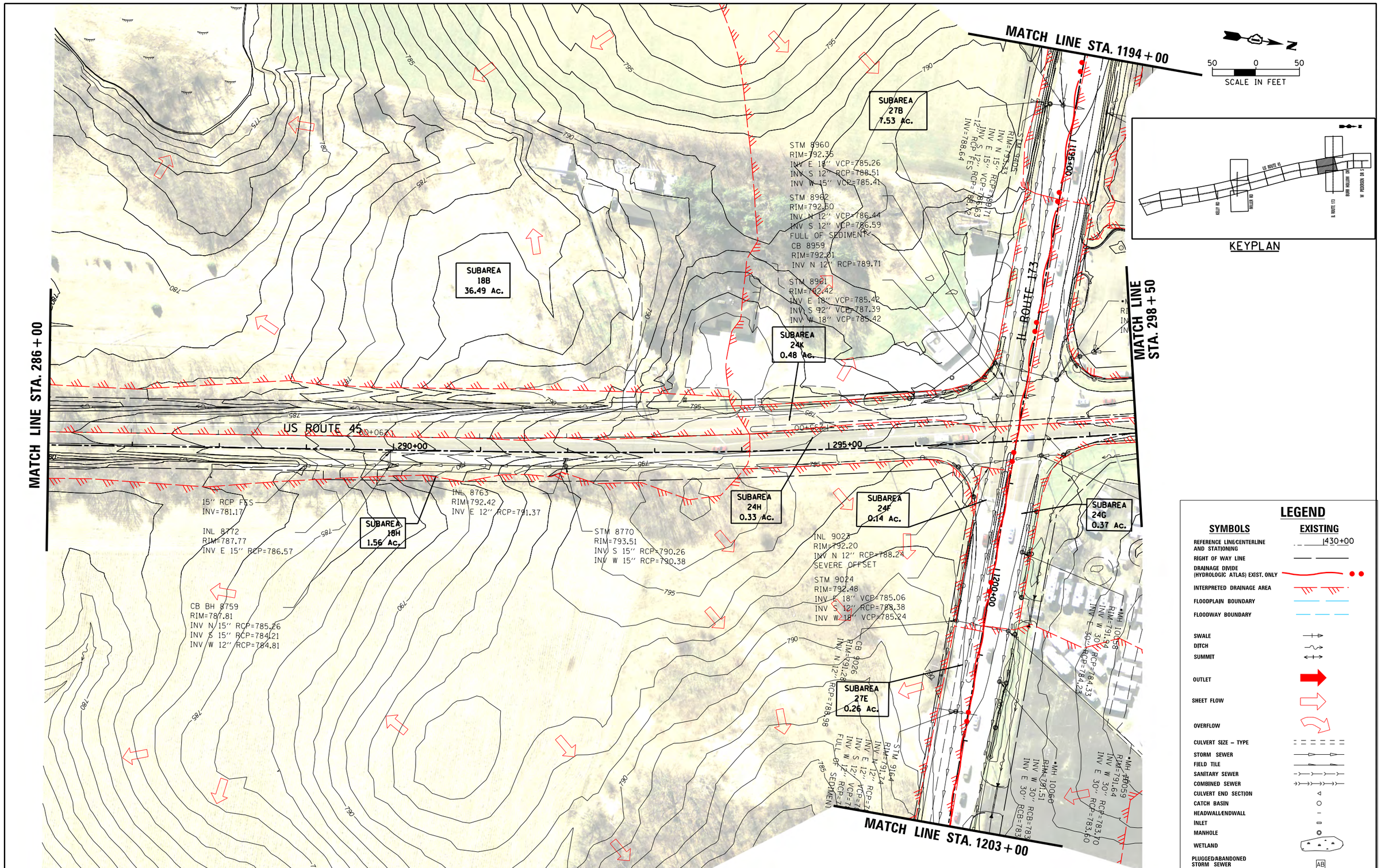
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 274+00 TO STA. 286+00

SCALE: 1"=50' | SHEET NO. 11 OF 18 SHEETS | STA. 274+00 TO STA. 286+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	11

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 286+00 TO STA. 298+50

SCALE: 1"=50' | SHEET NO. 12 OF 18 SHEETS | STA. 286+00 TO STA. 298+50

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	12

CONTRACT NO.

ILLINOIS FED. AID PROJECT

SUBAREA 24A 10.28 Ac.

MH 10054
RIM=795.00
INV S 8" RCP=788.41

MH 10055
RIM=790.43
INV N 8" RCP=788.40
INV E 24" RCP=786.95

CB 8970
RIM=791.85
INV N 12" RCP=788.99
INV SE 12" RCP=788.97
INV W 12" RCP=789.04

SUBAREA 24C 0.71 Ac.

STM 8965
RIM=792.37
INV E 24" RCP=785.72
INV W 24" RCP=785.74
INV NW 12" RCP=788.35

MH 10056
RIM=792.65
INV W 24" RCP=785.74
INV E 30" RCP=785.74

15" RCP CULVERT
INV=793.05

SUBAREA 24D 1.96 Ac.

15" RCP CULVERT
INV=793.01

SUBAREA 19A 129.97 Ac.

SUBAREA 19E 1.72 Ac.

EDGE OF WATER AS LOCATED BY CBBEL SURVEY ON 7-07-11

24" CMP FES
INV=779.90

MATCH LINE STA. 298+50

MATCH LINE STA. 310+00

US ROUTE 45

300+00

305+00

IDENTIFIED FLOODING PER IDOT MAINTENANCE

15" CMP FES
INV=787.31

SUBAREA 19C 3.68 Ac.

POND

MH 10057
RIM=792.42
INV W 30" RCP=785.16
INV E 30" RCP=785.00

SUBAREA 24E 3.14 Ac.

SUBAREA 19B 1.84 Ac.

15" CMP CULVERT
INV=783.46

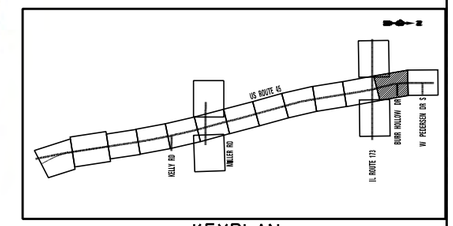
15" CMP CULVERT
INV=783.62

15" CMP FES
INV=785.98

BURR HOLLOW DR

N

50 0 50
SCALE IN FEET



KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

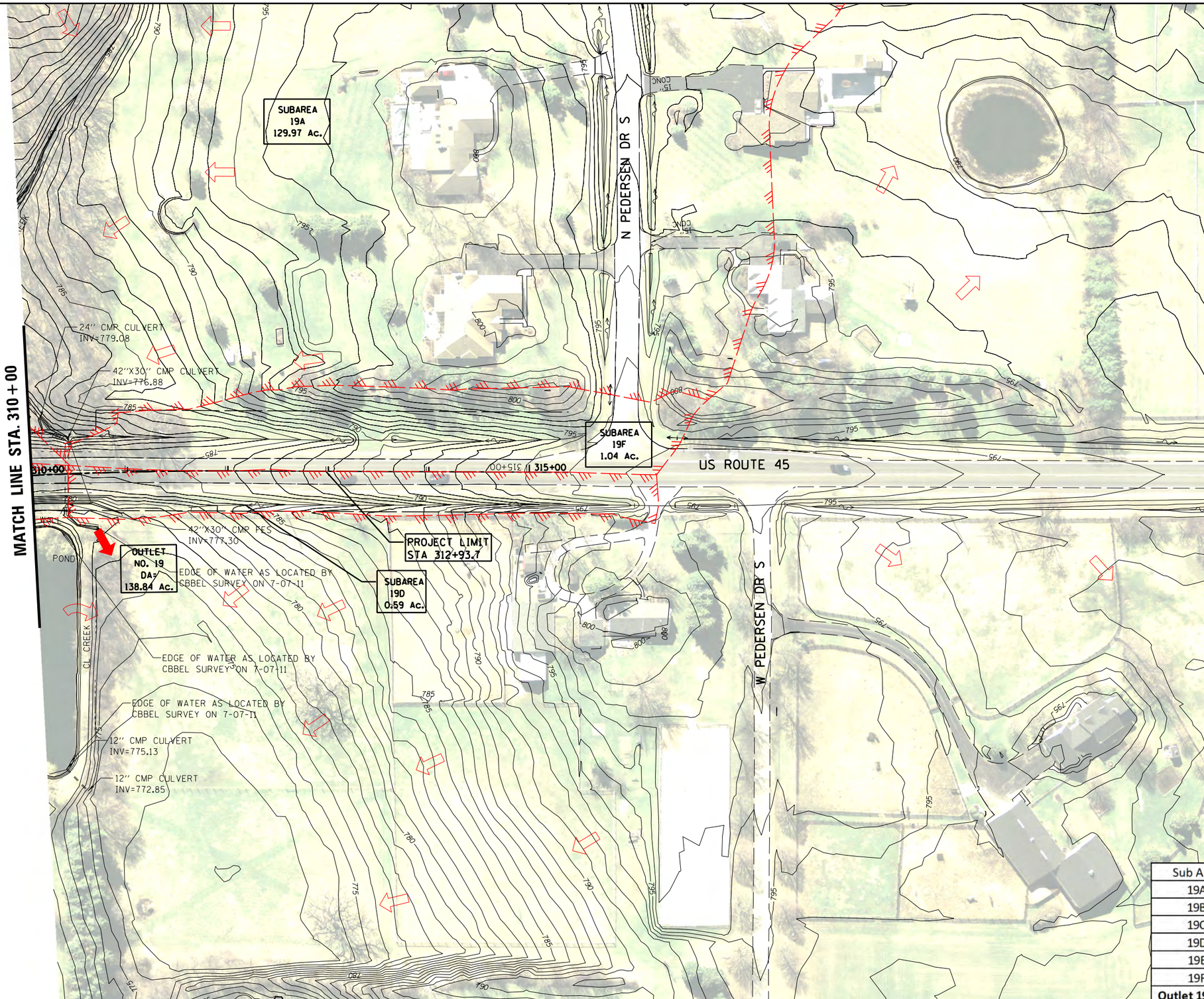
US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 298+50 TO STA. 310+00

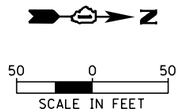
SCALE: 1"=50' | SHEET NO. 13 OF 18 SHEETS | STA. 298+50 TO STA. 310+00

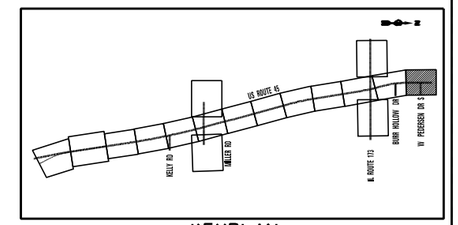
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	13

CONTRACT NO.

ILLINOIS FED. AID PROJECT







KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

Sub Area	Acres
19A	129.97
19B	1.84
19C	3.68
19D	0.59
19E	1.72
19F	1.04
Outlet 19 Area	138.84

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US ROUTE 45 – EXISTING DRAINAGE PLAN
STA. 310+00 TO STA. 315+00

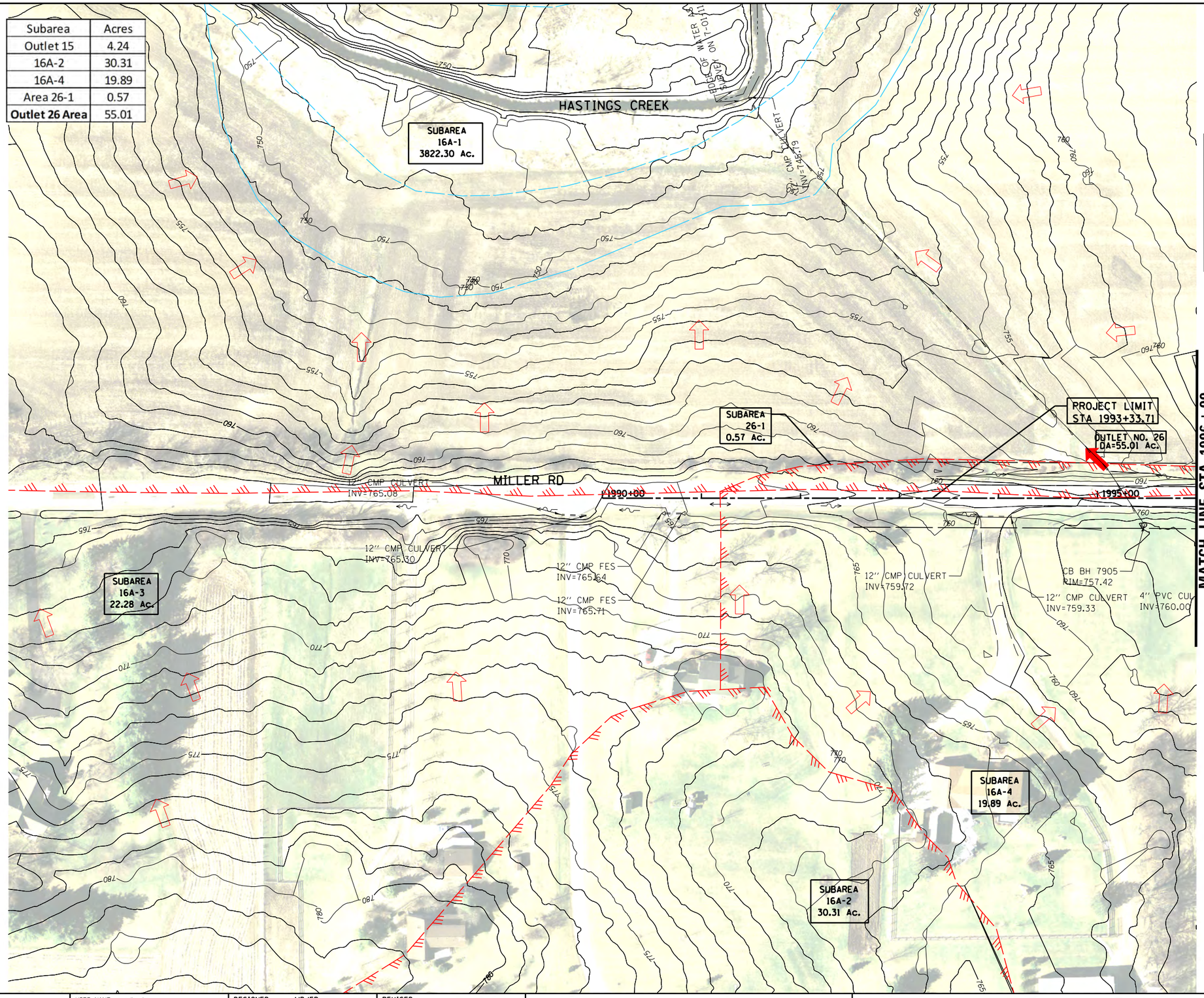
SCALE: 1"=50' | SHEET NO. 14 OF 18 SHEETS | STA. 310+00 TO STA. 315+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	14

CONTRACT NO.

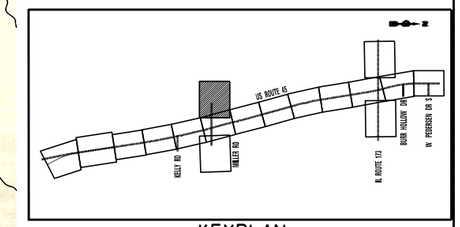
ILLINOIS FED. AID PROJECT

Subarea	Acres
Outlet 15	4.24
16A-2	30.31
16A-4	19.89
Area 26-1	0.57
Outlet 26 Area	55.01



N

50 0 50
SCALE IN FEET



KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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		DRAWN - MB/EB	REVISED -
	PLOT SCALE = 100'	CHECKED - IAD/JOC	REVISED -
	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

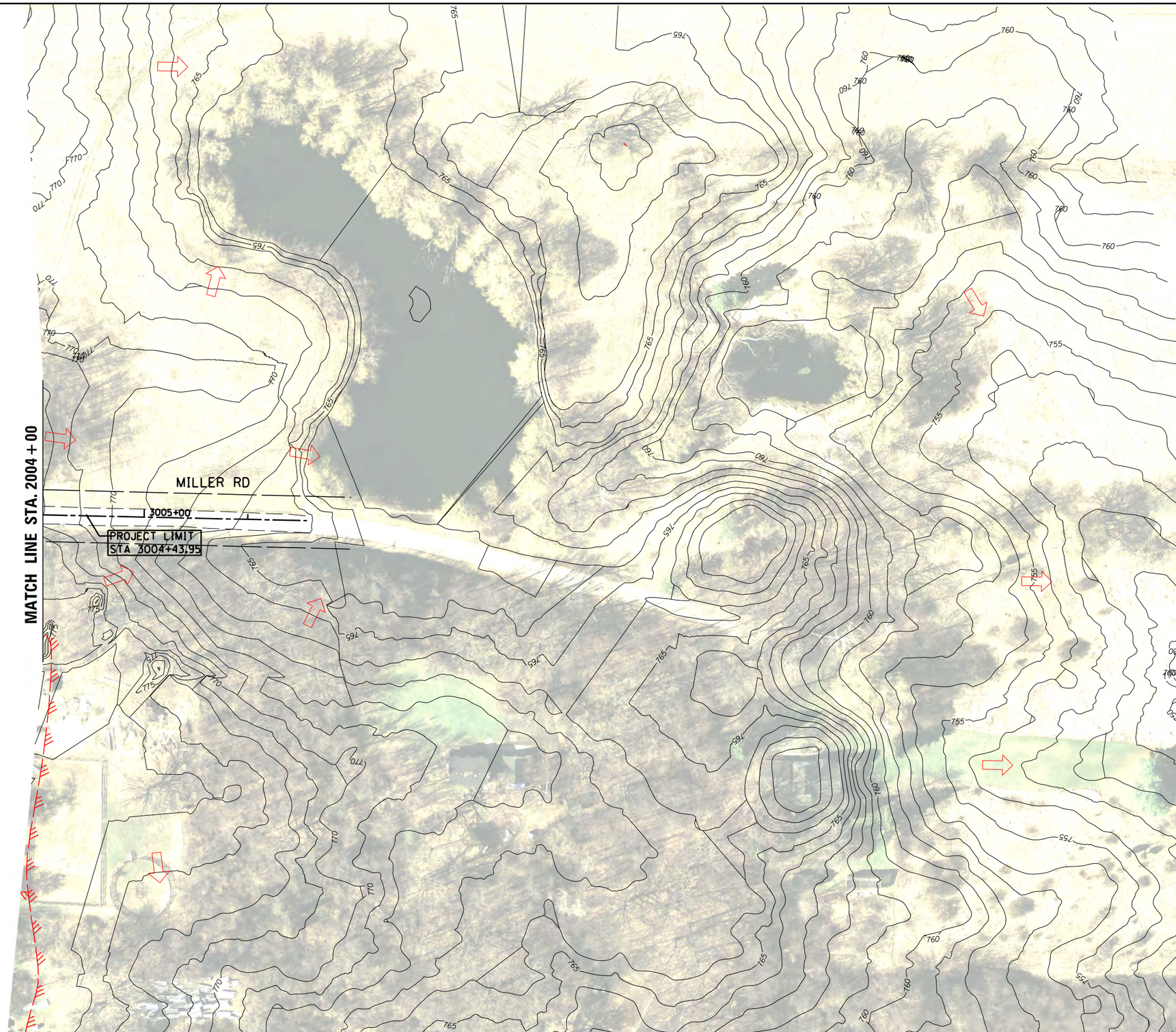
MILLER ROAD – EXISTING DRAINAGE PLAN
STA. 1990+00 TO STA. 1996+00

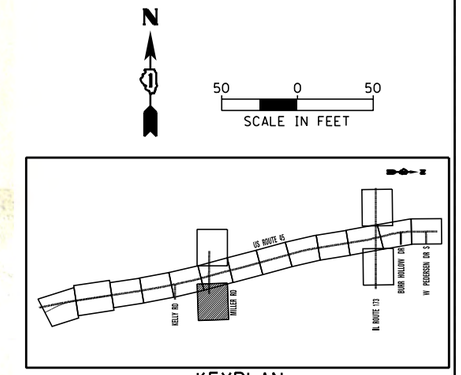
SCALE: 1"=50' | SHEET NO. 15 OF 18 SHEETS | STA. 1990+00 TO STA. 1996+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	15

CONTRACT NO.

ILLINOIS FED. AID PROJECT





KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

MILLER ROAD – EXISTING DRAINAGE PLAN
STA. 2004+00 TO STA. 2006+55

SCALE: 1"=50' | SHEET NO. 16 OF 18 SHEETS | STA. 2004+00 TO STA. 2006+55

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	16

CONTRACT NO.

ILLINOIS FED. AID PROJECT

SUBAREA 19A 129.97 Ac.

SUBAREA 24A 10.28 Ac.

SUBAREA 24B 6.00 Ac.

SUBAREA 27A 1.22 Ac.

SUBAREA 27B 7.53 Ac.

SUBAREA 18B 36.49 Ac.

PEDERSEN DRIVE

IL ROUTE 173

15" CMP FES INV=802.23

15" CMP FES INV=800.85

15" CMP

1185+00

1190+00

PROJECT LIMIT STA 1184+74.90

15" CMP CULVERT INV=793.53

15" CMP CULVERT INV=792.72

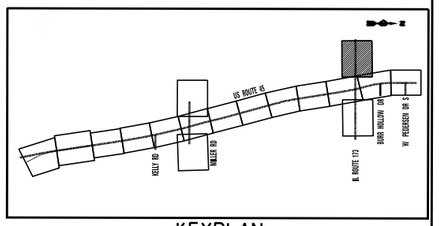
STM 9406 RIM=793.82 INV N 15" VCP=786.85 INV S 15" VCP=786.77 INV W 10" VCP=787.25

MATCH LINE STA. 1194+00

N

50 0 50

SCALE IN FEET



KEYPLAN

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
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FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

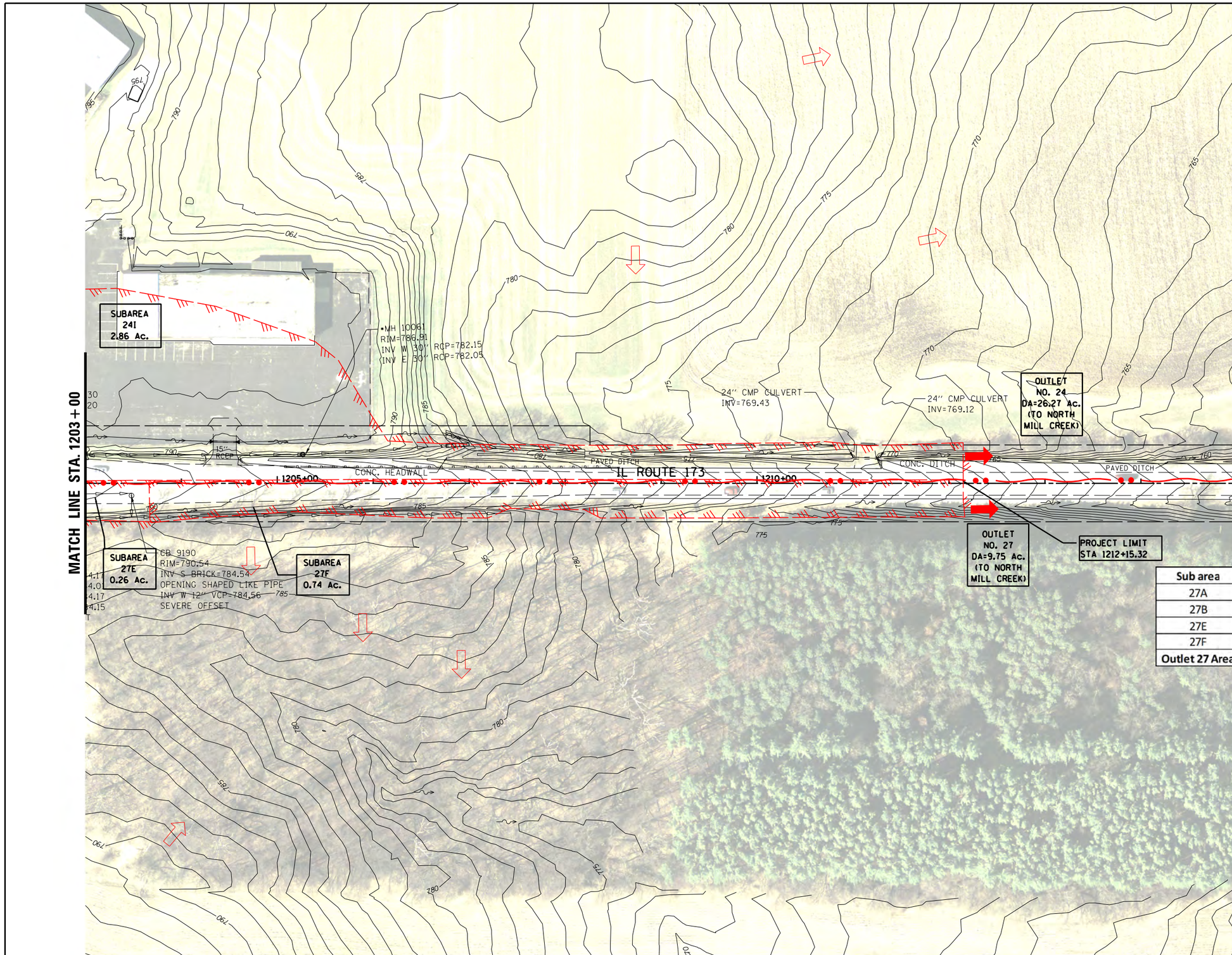
IL ROUTE 173 – EXISTING DRAINAGE PLAN
STA. 1182+00 TO STA. 1194+00

SCALE: 1"=50' | SHEET NO. 17 OF 18 SHEETS | STA. 1182+00 TO STA. 1194+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	17

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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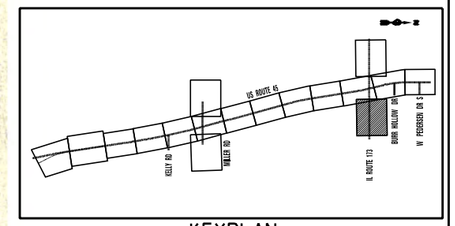
SCALE IN FEET: 50 0 50



KEYPLAN

Subarea	Acres
24A	10.28
24B	6.00
24C	0.71
24D	1.96
24E	3.14
24F	0.14
24G	0.37
24H	0.33
24I	2.86
24K	0.48
Outlet 24 Area	**26.27**

Sub area	Acres
27A	1.22
27B	7.53
27E	0.26
27F	0.74
Outlet 27 Area	**9.75**

LEGEND

SYMBOLS	EXISTING
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00
RIGHT OF WAY LINE	
DRAINAGE DIVIDE (HYDROLOGIC ATLAS) EXIST. ONLY	
INTERPRETED DRAINAGE AREA	
FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
SWALE	
DITCH	
SUMMIT	
OUTLET	
SHEET FLOW	
OVERFLOW	
CULVERT SIZE – TYPE	
STORM SEWER	
FIELD TILE	
SANITARY SEWER	
COMBINED SEWER	
CULVERT END SECTION	
CATCH BASIN	
HEADWALL/ENDWALL	
INLET	
MANHOLE	
WETLAND	
PLUGGED/ABANDONED STORM SEWER	AB

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	PLOT SCALE = 100'	CHECKED - IAD/JOC	REVISED -
	PLOT DATE = 8/24/2018	DATE - -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

IL ROUTE 173 – EXISTING DRAINAGE PLAN
STA. 1203+00 TO STA. 1215+00

SCALE: 1"=50' | SHEET NO. 18 OF 18 SHEETS | STA. 1203+00 TO STA. 1215+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	18	18

CONTRACT NO.

ILLINOIS FED. AID PROJECT

FLOOD INSURANCE RATE MAP
EXHIBIT 1-02a

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0032K

FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 32 OF 295
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANTIOCH, VILLAGE OF	170368	0032	K
LAKE COUNTY	170357	0032	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17097C0032K
MAP REVISED
SEPTEMBER 18, 2013

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0034K

FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 34 OF 295
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANTIOCH, VILLAGE OF	170368	0034	K
LAKE COUNTY	170357	0034	K
OLD MILL CREEK, VILLAGE OF	170368	0034	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17097C0034K
MAP REVISED
SEPTEMBER 18, 2013

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0044K

FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 44 OF 295
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GRAYSLAKE, VILLAGE OF	170383	0044	K
GURNEE, VILLAGE OF	170365	0044	K
LAKE COUNTY	170357	0044	K
LINDENHURST, VILLAGE OF	170379	0044	K
OLD MILL CREEK, VILLAGE OF	170385	0044	K
THIRD LAKE, VILLAGE OF	170392	0044	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17097C0044K
MAP REVISED
SEPTEMBER 18, 2013

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0055K

FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 55 OF 295
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANTIOCH, VILLAGE OF	170368	0055	K
LAKE COUNTY	170357	0055	K
OLD MILL CREEK, VILLAGE OF	170385	0055	K
WAUCONDA, VILLAGE OF	170395	0055	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17097C0055K
MAP REVISED
SEPTEMBER 18, 2013

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from the annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A — Cross section line
23 — 23 — Transect line
45° 02' 08", 93° 07' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4000000 FT — 1000-meter Universal Transverse Mercator grid values, zone 16
3000000 FT — 5000-foot grid ticks: Illinois State Plane East Coordinate System, 3776 zone (FIPSZONE 1201), Transverse Mercator
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.2 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

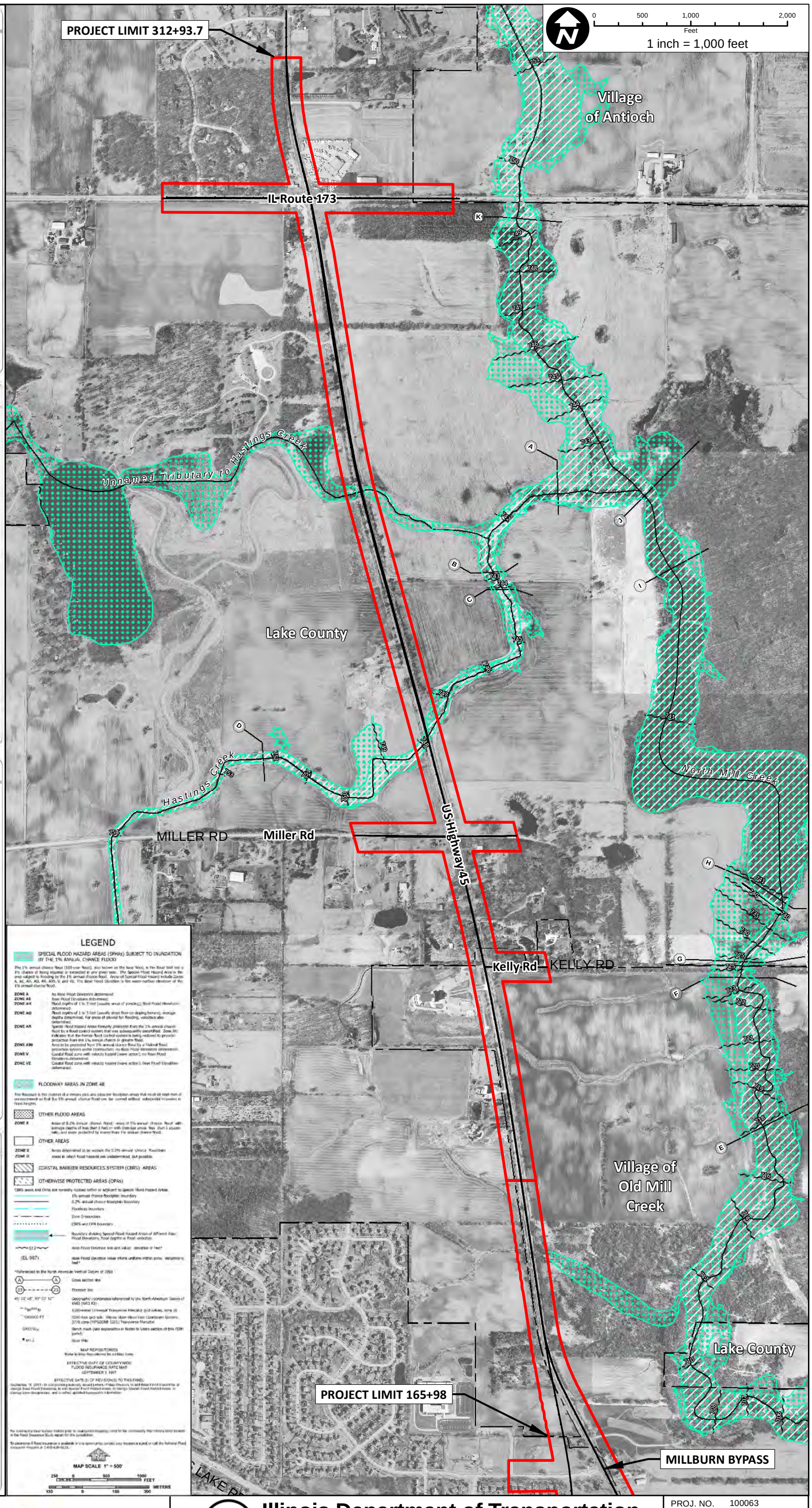
EFFECTIVE DATE(S) OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 1, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 18, 2013 - to incorporate previously issued Letters of Map Revision, to add Base Flood Elevations, or change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, and to reflect updated topographic information.

For community map revision history prior to countywide mapping, refer to the community map history table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS



LakeCounty
Division of Transportation
600 W Winchester Rd Libertyville, Illinois 60048

Illinois Departmant of Transportation
201 West Center Court
Schaumburg, IL 60196

PROJ. NO.	100063
DATE:	06-06-16
SHEET	1 OF 1
DRAWING NO.	EXH 1-02a

TITLE: FLOOD INSURANCE RATE MAP

DSGN.			SCALE:	1:12,000
DWN.			GIS USER	MHAYES
CHKD.			PLOT DATE	
FILE:				

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Date: 8/24/2018 Time: 11:25:02 AM

WATERWAY INFORMATION TABLES
EXHIBIT 1-03.1a

Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	n/a		
Waterway:	Unnamed Ditch (Crossing G/11)	Proposed SN:	n/a		
Section:	05-00262-02-RP	Prepared by:	EMB	Date:	2/28/2018
County:	Lake	Checked by:	IAD	Date:	2/28/2018

Drainage Area = .05 square miles

Existing Overtopping Elev. = 740.50 at Sta. 170+65
Proposed Overtopping Elev. =741.77 at Sta. 171+00

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	2	9.6	9.2	737.4	0.0	0.0	736.8	736.9
Design	50	45	16	16	738.2	0.0	0.0	737.9	738.0
Base	100	61	16	16	738.4	0.0	0.0	738.3	738.4
Scour Design Check	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overtop Existing	> 500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overtop Proposed	> 500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Max. Calc.	500	87	16	16	738.8	0.4	0.5	739.2	739.3

Datum: NAVD 88

All-Time H.W.E. & Date: n/a

Surveyed Normal Water Level: n/a

10-Year Velocity through Existing Structure = 4.8 ft/s

10-Year Velocity through Proposed Structure = 4.6 ft/s

2-Yr. Flow Rate = ~1 ft^3/s

EXISTING STRUCTURE

Type:	Reinforced Concrete Box Culvert
Length/Width:	L=100', 4'(W) x 2' (H)
# Cells:	2
Top Of Crown Elev.:	738.20
Skew:	0° (relative to road)
Clearance:	n/a
Culvert Inverts:	736.20 (u/s) 735.70 (d/s)
Low E.O.P:	740.50
Freeboard:	2.89'

PROPOSED STRUCTURE

Culvert Type:	Reinforced Concrete Box Culvert
Length/Width:	L= 128', 4'(W) x 2'(H)
# Cells:	2
Top Of Crown Elev.:	738.25
Skew:	0° (relative to road)
Culvert Invert Elev.:	736.25 (u/s) 735.57 (d/s)
Low E.O.P:	741.05
Freeboard:	3.1'

EXISTING EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

PROPOSED EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage. Outlet 11 –Flows from Milburn Bypass.

Route: FAP 344 (US Route 45) | Computed By: IAD | Date: 2/28/2018
Waterway: DA11 (Unnamed Ditch) | Checked By: EMB | Date: 2/28/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1)		Existing Headwater Elev. (ft)		Prop. Headwater Elev. (ft)		Created Head (ft.) (2) @ Approach Section If Applicable	
	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	Existing	Proposed
10-YEAR	737.4	NA	736.8	NA	736.9	NA	0.0	0.0
50-YEAR	738.21	NA	737.9	NA	738.0	NA	0.0	0.0
100-YEAR	738.48	NA	738.3	NA	738.4	NA	0.0	0.0
500-YEAR	738.84	NA	739.2	NA	739.3	NA	0.4	0.5

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	**Station**	**Proposed**	**Station**
740.5	170+65	741.05	171+00
Low Beam Elevation (Ft)			
Existing	**Station**	**Proposed**	**Station**
N/A	N/A	N/A	N/A
Existing Freeboard (ft)			
10-Year	**50-Year (4)**	**100-Year**	**500-Year**
3.7	2.6	2.2	1.3
Proposed Freeboard (ft)			
10-Year	**50-Year (4)**	**100-Year**	**500-Year**
4.15	3.05	2.65	1.75

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

CALCULATED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

U/S Flowline Elevation (ft)	
Existing	**Proposed**
736.2	736.25

Waterway Opening Area (ft^2) (6)		
Frequency	**Existing**	**Proposed**
10-Year	9.6	9.2
50-Year	16	16
100-Year	16	16
500-Year	16	16

(6) The waterway opening area is calculated based on the Natural Highwater Elevation and channel flowline elevation

Route: FAP 344 (US Route 45) Computed By: EMB Date: 2/28/2013
Waterway: DA11 (Unnamed Ditch) Checked By: IAD Date: 2/28/2013

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

Interpolator for 10-year WSE from HY-8

NWL DA 11

	Q	WSE
Known pair	45.00	738.16
Known pair	61.00	738.43
Interpolated pair	*2.00*	*737.43*

PRO DA 11

Known pair	45.00	738.00
Known pair	61.00	738.40
Interpolated pair	*2.00*	*736.93*

Proposed DA 13

	Q	WSE	
Known pair	45.00	737.90	
Known pair	61.00	738.30	
Interpolated pair	*2.00*	*736.83*	*10-Year*

U/S invert 736.25

Frequency	Tailwater Depth	N.W.E.
10 yr	-	
50 yr	1.96	738.21
100 yr	2.23	738.48
500 yr	2.59	738.84

Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	n/a		
Waterway:	Unnamed Ditch (Crossing 12)	Proposed SN:	n/a		
Section:	05-00262-02-RP	Prepared by:	EMB	Date:	2/28/2018
County:	Lake	Checked by:	IAD	Date:	2/28/2018

*No Well-Defined Channel Exists — Existing Overtopping Elev. = 737.30 at Sta. 176+20

Drainage Area = .08 square miles — Proposed Overtopping Elev. =738.46 at Sta. 177+00

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	17	n/a	n/a	n/a	n/a	n/a	733.1	733.1
Design	50	39	n/a	n/a	n/a	n/a	n/a	733.7	733.7
Base	100	56	n/a	n/a	n/a	n/a	n/a	734.1	734.2
Scour Design Check	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overtop Existing	> 500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overtop Proposed	> 500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Max. Calc.	500	80	n/a	n/a	n/a	n/a	n/a	734.7	734.7

Datum: NAVD 88

All-Time H.W.E. & Date: n/a

Surveyed Normal Water Level: n/a

10-Year Velocity through Existing Structure = n/a ft/s

10-Year Velocity through Proposed Structure = n/a ft/s

2-Yr. Flow Rate = 8 ft^3/s

EXISTING STRUCTURE

Type:	Reinforced Concrete Box Culvert
Length/Width:	L=93', 4'(W) x 2' (H)
# Cells:	2
Top Of Crown Elev.:	734.15
Skew:	0° (relative to road)
Clearance:	n/a
Culvert Inverts:	732.15 (u/s) 731.90 (d/s)
Low E.O.P:	737.30
Freeboard:	3.6'

PROPOSED STRUCTURE

Culvert Type:	Reinforced Concrete Box Culvert
Length/Width:	L= 111', 4'(W) x 2'(H)
# Cells:	2
Top Of Crown Elev.:	734.18
Skew:	0° (relative to road)
Culvert Invert Elev.:	732.18 (u/s) 731.85 (d/s)
Low E.O.P:	737.98
Freeboard:	4.3'

EXISTING EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

PROPOSED EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage. Outlet 12 –Flows from Milburn Bypass.

Route: FAP 344 (US Route 45) | Computed By: IAD | Date: 2/28/2018
Waterway: DA12 (Unnamed Ditch) | Checked By: EMB | Date: 2/28/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1)		Existing Headwater Elev. (ft)		Prop. Headwater Elev. (ft)		Created Head (ft.) (2) @ Approach Section If Applicable	
	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	Existing	Proposed
10-YEAR	NA	NA	733.1	NA	733.1	NA	NA	NA
50-YEAR	NA	NA	733.7	NA	733.7	NA	NA	NA
100-YEAR	NA	NA	734.1	NA	734.2	NA	NA	NA
500-YEAR	NA	NA	734.7	NA	734.7	NA	NA	NA

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	Station	Proposed	Station
737.3	726+20	737.98	177+00
Low Beam Elevation (Ft)			
Existing	Station	Proposed	Station
N/A	N/A	N/A	N/A
Existing Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
4.2	3.6	3.2	2.6
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
4.88	4.28	3.78	3.28

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

CALCULATED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

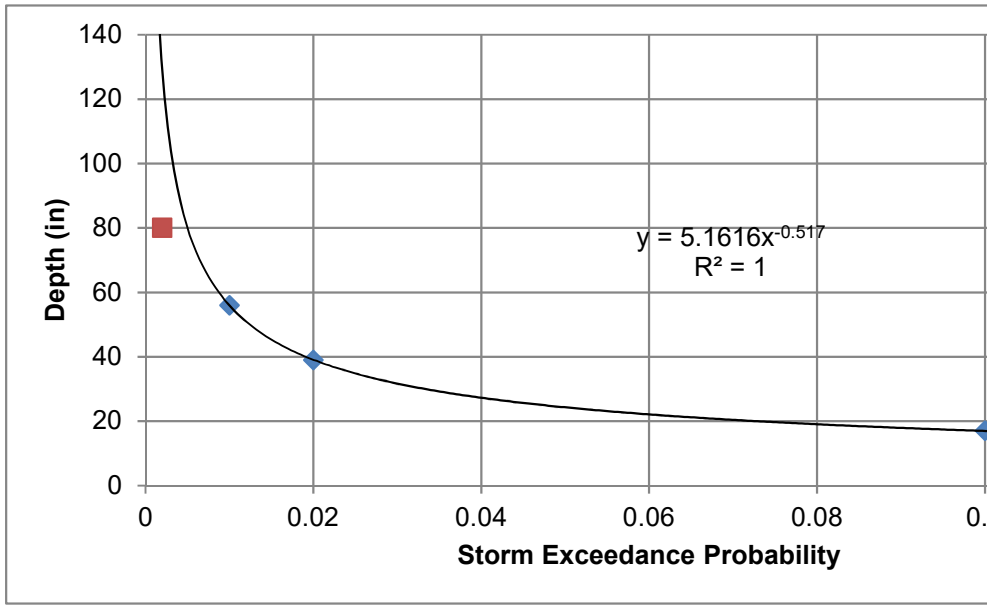
U/S Flowline Elevation (ft)	
Existing	Proposed
732.15	732.18

Waterway Opening Area (ft^2) (6)		
Frequency	Existing	Proposed
10-Year	na	na
50-Year	na	na
100-Year	na	na
500-Year	na	na

(6) The waterway opening area is calculated based on the Natural Highwater Elevation and channel flowline elevation

N:\Idot\100063\Drain\Docs\LDS North\Outlet 12 Updated\[DA12 WIT BackUp Calc's.xls]Sheet1

Flow Rates			
Event	**Storm Exceedance Probability**	**FIS Flow (cfs)**	***Calculated Flow (cfs)***
2-yr	0.5		*8*
10-year	0.1	**17**	*18*
30-yr	0.03		*32*
50-year	0.02	**39**	*42*
100-year	0.01	**56**	*60*
200-yr	0.005		
500-year	0.002	**80**	*137*
Note: 2-, 30-, and 200-year rainfall depths interpolated/extrapolated using a power regression trendline.			



UNT to Mill Creek flow rates from RWA TR-20 analysis.

Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	049-0578		
Waterway:	Unnamed Trib. to North Mill Creek	Proposed SN:	049-0626		
Section:	05-00262-02-RP	Prepared by:	IAD	Date:	01/23/2018
County:	Lake	Checked by:	EMB	Date:	01/23/2018

Drainage Area = 0.41 square miles

Existing Overtopping Elev. = 734.76 at Sta. 185+00
Proposed Overtopping Elev. = 735.20 at Sta. 185+68.15

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	71	23	54	732.06	0.28	0.08	732.34	732.14
Design	50	175	24	54	732.41	1.73	0.49	734.14	732.90
Base	100	244	24	54	732.57	2.45	0.95	735.02	733.52
Scour Design Check	n/a	n/a							
Overtop Existing	70	202	24	54	732.49	2.27	n/a	734.76	n/a
Overtop Proposed	> 500	386							
Max. Calc.	500	355	24	54	732.77	2.47	2.01	735.24	734.78

Datum: NAVD 88

All-Time H.W.E. & Date: 732 ft March-April 1960

Surveyed Normal Water Level: 730.93 ft

10-Year Velocity through Existing Structure = 3.1 ft/s

10-Year Velocity through Proposed Structure = 1.3 ft/s

2-Yr. Flow Rate = 30 ft^3/s

EXISTING STRUCTURE

Type:	Reinforced Concrete Box Culvert
Length/Width:	L=49’, 6’(W) x 4’ (H)
# Cells:	1
Top Of Crown Elev.:	732.28
Skew:	0° (relative to road)
Clearance:	n/a
Culvert Inverts:	728.28 (u/s) 728.09 (d/s)
Low E.O.P:	734.50
Freeboard:	0.36’

PROPOSED STRUCTURE

Culvert Type:	Reinforced Concrete Box Culvert
Length/Width:	L= 130’, 9’(W) x 4’(H)
# Cells:	2
Top Of Crown Elev.:	731.80
Skew:	10° (relative to road)
Culvert Invert Elev.:	727.80 (u/s) 727.50 (d/s)
Low E.O.P:	734.09
Freeboard:	1.19’

EXISTING EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

PROPOSED EMBEDMENT

Depth:	1’
U/S Streambed Elev.:	728.80
D/S Streambed Elev.:	728.50

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage. Outlet 13 – RWA TR-20 Flows.

Route: FAP 344 (US Route 45) Computed By: IAD Date: 1/23/2018

Waterway: DA13 (Unnamed Trib. To North Mill Creek) Checked By: EMB Date: 1/23/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1)		Existing Headwater Elev. (ft)		Prop. Headwater Elev. (ft)		Created Head (ft.) (2) @ Approach Section If Applicable	
	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	Existing	Proposed
10-YEAR	732.06	NA	732.34	NA	732.14	NA	0.28	0.08
50-YEAR	732.41	NA	734.14	NA	732.90	NA	1.73	0.49
OVT (E) 70-YEAR	732.49	NA	734.76	NA	NA	NA	2.27	NA
100-YEAR	732.57	NA	735.02	NA	733.52	NA	2.45	0.95
500-YEAR	732.77	NA	735.24	NA	734.78	NA	2.47	2.01

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure. Use TW elevation, as downstream restrictive XS has higher thalweg (730.01) than U/S face XS (

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	Station	Proposed	Station
734.5	184+70	734.09	185+68
Low Beam Elevation (Ft)			
Existing	Station	Proposed	Station
N/A	N/A	N/A	N/A
Existing Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
2.16	0.36	-0.52	-0.74
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
1.95	1.19	0.57	-0.69

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

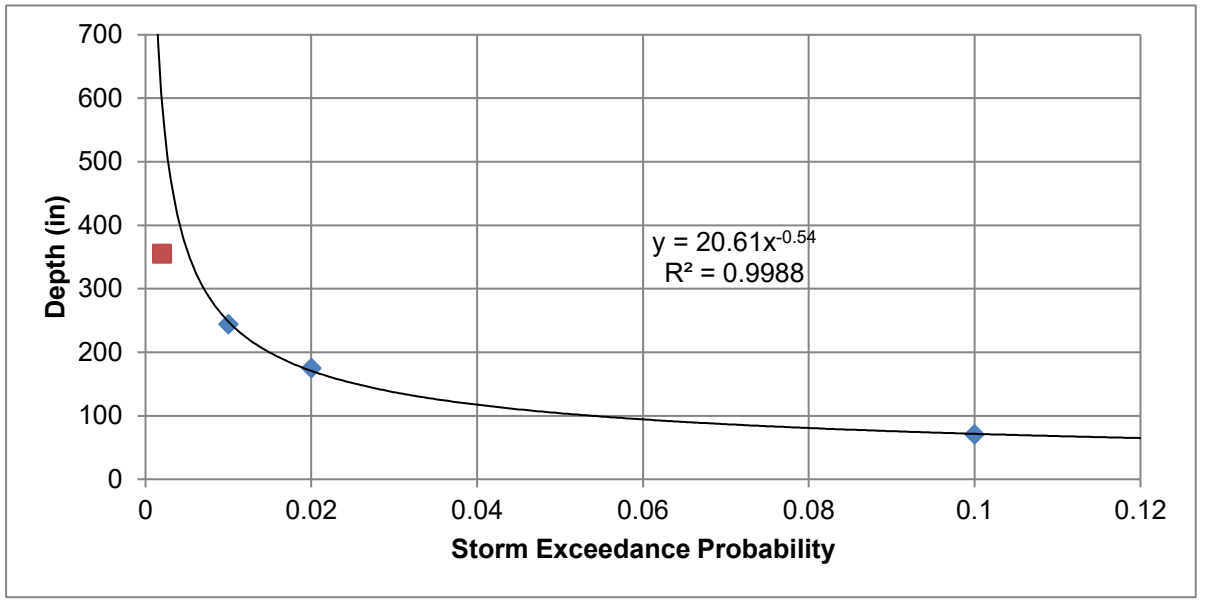
CALCULATED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

U/S Flowline Elevation (ft)	
Existing	Proposed
728.28	728.8

Waterway Opening Area (ft^2) (6)		
Frequency	Existing	Proposed
10-Year	22.68	54
50-Year	24	54
OVT	24	54
100-Year	24	54
500-Year	24	54

(6) The waterway opening area is calculated based on the Natural Highwater Elevation and channel flowline elevation

Flow Rates			
Event	**Storm Exceedance Probability**	**FIS Flow (cfs)**	***Calculated Flow (cfs)***
2-yr	0.5		*30*
10-year	0.1	**71**	*71*
30-yr	0.03		*129*
50-year	0.02	**175**	*170*
100-year	0.01	**244**	*248*
200-yr	0.005		
500-year	0.002	**355**	
Note: 2-, 30-, and 200-year rainfall depths interpolated/extrapolated using a power regression trendline.			



UNT to Mill Creek flow rates from RWA TR-20 analysis.

Route: FAP 344 (US Route 45) Computed By: IAD Date: 1/23/2018
Waterway: DA13 (Unnamed Trib. To North Mill Creek) Checked By: EMB Date: 1/23/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

Interpolator for 100-year WSE from HY-8

Existing DA 13

	Q	WSE
Known pair	241.40	735.01
Known pair	269.80	735.09
Interpolated pair	*244.00*	*735.02*

Proposed DA 13

	Q	WSE	
Known pair	241.40	733.49	
Known pair	269.80	733.78	
Interpolated pair	*244.00*	*733.52*	*100-Year*

Interpolator for OT Q Return Period

Existing DA 13

	Q		
Known pair	175	50	
Known pair	244	100	
Interpolated pair	*202*	*70*	*OT Return Period*

Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	049-0577		
Waterway:	Hastings Creek	Proposed SN:	049-1000		
Section:	05-00262-02-RP	Prepared by:	FDM	Date:	01/15/2018
County:	Lake	Checked by:	IAD	Date:	01/15/2018

Drainage Area = 6.1 square miles

Existing Overtopping Elev. = 750.28 at Sta. 241+50
Proposed Overtopping Elev. = 753.54 at Sta. 241+50.68

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	238	43.6	103.5	748.7	0.5	0.1	749.2	748.8
Design	50	380	45.0	116.7	749.2	1.5	0.2	750.7	749.4
Base	100	438	45.0	121.9	749.4	1.6	0.3	751.0	749.7
Scour Design Check	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overtop Existing	45	370	45.0	N/A	749.2	1.4	N/A	750.6	N/A
Overtop Proposed	>500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Calc.	500	580	45.0	128.0	749.8	1.7	0.5	751.5	750.3

Datum: NAVD 88

All-Time H.W.E. & Date: 748 ft April 1965

Surveyed Normal Water Level: 744.98 ft June 2011

10-Year Velocity through Existing Structure = 4 ft/s

10-Year Velocity through Proposed Structure = 2 ft/s

2-Yr. Flow Rate = 98 ft^3/s

EXISTING STRUCTURE

Type:	Rectangular Concrete Box Culvert
Length/Width:	68'
# Spans/Cells:	1 @ 9' (W) x 5' (H)
Top of Crown:	748.83'
Skew:	42° (relative to road)
Clearance:	n/a
Bridge Flow Line:	n/a (u/s) n/a (d/s)
Low E.O.P:	750.28
Freeboard:	-0.43'
Culvert Inverts:	743.83 (u/s) 743.94 (d/s)

PROPOSED STRUCTURE

Culvert Type:	Multi-cell Rectangular Concrete Box Culvert
Length Of Span:	159'
# Cells:	1 Low Flow @ 8' (W) x 7' (H) 2 High Flow @ 8' (W) x 7' (H)
Top Of Crown Elev.: Beam:	749.7 (u/s)
Skew:	41° (relative to road)
Culvert Invert Elev.:	742.7'(u/s)742.6'(d/s)
Low E.O.P:	752.56'
Freeboard:	3.14'

EXISTING EMBEDMENT

Depth:	N/A
U/S Streambed Elev.:	N/A
D/S Streambed Elev.:	N/A

PROPOSED EMBEDMENT

Depth:	1' Low Flow 2' High Flow
U/S Streambed Elev.:	Low Flow - 743.7' High Flow – 744.7'
D/S Streambed Elev.:	Low Flow - 743.6' High Flow – 744.6'

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.

Route: FAP 344 (US Route 45) | Computed By: FDM | Date: 1/15/2018

Waterway: DA16 (Hastings Creek) | Checked By: IAD | Date: 1/15/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1)		Created Head (ft.) (2) @ Approach Section If Applicable		Headwater Elev. (ft.)	
	Approach Section (XS 4520)	U/S Face of Structure				
			Existing	Proposed	Existing	Proposed
10-YEAR	748.8	748.7	0.5	0.1	749.2	748.8
OVT (E) 45-YEAR	749.3	749.2	1.4	N/A	750.6	N/A
50-YEAR	749.3	749.2	1.5	0.2	750.7	749.4
100-YEAR	749.5	749.4	1.6	0.3	751.0	749.7
500-YEAR	749.9	749.8	1.7	0.5	751.5	750.3

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	Station	Proposed	Station
750.28	241+50	752.56	241+50.68
Low Beam Elevation (Ft)			
Existing	Station	Proposed	Station
N/A	N/A	N/A	N/A
Existing Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
1.05	-0.43	-0.72	-1.26
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
3.80	3.14	2.87	2.26
Proposed Clearance (ft)			
10-Year	50-Year (5)	100-Year	500-Year
N/A	N/A	N/A	N/A

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

(5) Vertical clearance is calculated from the 50-year natural highwater elevation to the proposed low chord (beam) bridge elevation (2 ft min requirement

CALCULATE EXISITING EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

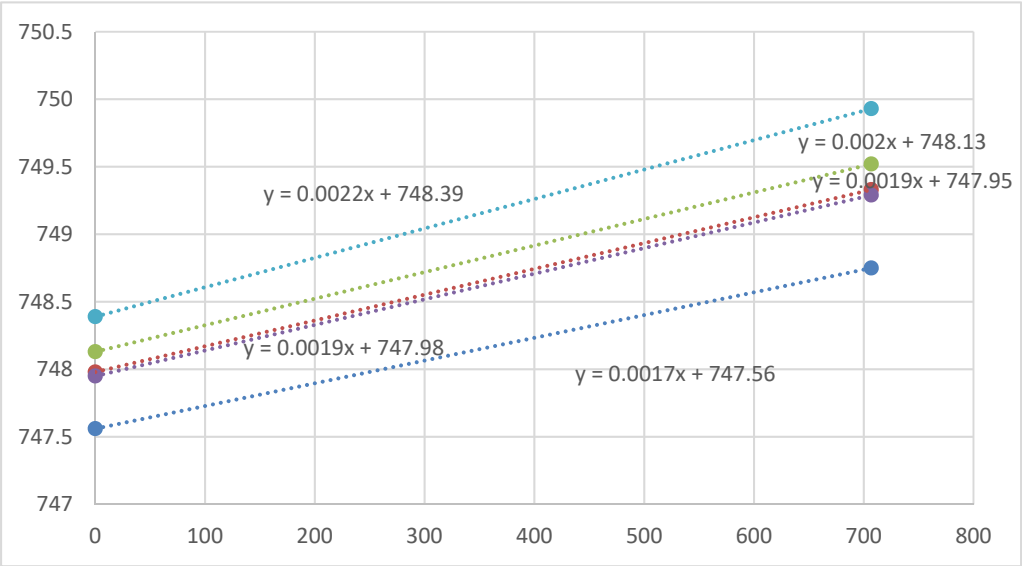
Frequency	Natural WSEL at Upstream Face[1]	Flowline of Upstream Face of Structure	Water Depth at Upstream Face (feet)	Culvert Width	Waterway Opening
	WSEL	Feet	Feet	Feet	Square Feet
10-year	748.7	743.83	4.85	9	43.6
OVT (E) 45-YEAR	749.2	743.83	5.00	9	45.0
50-year	749.2	743.83	5.00	9	45.0
100-year	749.4	743.83	5.00	9	45.0
500-year	749.8	743.83	5.00	9	45.0

CALCULATE PROPOSED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

Frequency	Natural WSEL at Upstream Face[1]	Flowline of Upstream Face of Structure of Low Flow Culvert	Water Depth at Upstream Face of Low Flow Culvert (feet)	Low Flow Culvert Width	Water Depth at Upstream Face of High Flow Culvert (feet)	Water Depth at Upstream Face of High Flow Culvert (feet)	High Flow Culverts Width	Waterway Opening
	WSEL	Feet	Feet	Feet		Feet		Square Feet
10-year	748.7	743.70	4.98	8	744.7	3.98	8	103.5
OVT (E) 45-YEAR	N/A							
50-year	749.2	743.70	5.53	8	744.7	4.53	8	116.7
100-year	749.4	743.70	5.74	8	744.7	4.74	8	121.9
500-year	749.8	743.70	6.00	8	744.7	5.00	8	128.0

Interpolate NHWE US Face of Proposed Structure

Cross Section	4520	3813	Interpolated U/S Face
River Station	707	0	657.25
10 Year	748.75	747.56	748.68
EX OT	749.29	747.95	749.23
50 Year	749.33	747.98	749.23
100 Year	749.52	748.13	749.44
500 Year	749.93	748.39	749.84



Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	049-1001		
Waterway:	Unnamed Tributary to Hastings Creek	Proposed SN:	049-0547		
Section:	05-00262-02-RP	Prepared by:	EMB	Date:	2/24/16
County:	Lake	Checked by:	IAD	Date:	2/24/16

Existing Overtopping Elev. = 757.87 at Sta. 266+39

Drainage Area = 1.0 square miles

Proposed Overtopping Elev. = 757.40 at Sta. 266+29.59

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	198	7.07	40.7	751.4	7.0	0.3	758.4	751.7
Design	50	277	7.07	42.9	751.7	6.9	1.2	758.6	752.9
Base	100	305	7.07	43.6	751.8	6.8	1.5	758.6	753.3
Scour Design Check	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overtop Existing	+1	92	7.07	N/A	750.7	7.2	N/A	757.9	N/A
Overtop Proposed	>500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Calc.	500	385	7.07	45.8	752.0	6.7	2.3	758.7	754.3

Datum:

All-Time H.W.E. & Date: 748 ft 1965 HA-226

Surveyed Normal Water Level: 747.76 ft @7-05-11

10-Year Velocity through Existing Structure = 13 ft/s

10-Year Velocity through Proposed Structure = 9 ft/s

2-Yr. Flow Rate = 117 ft^3/s

EXISTING STRUCTURE

Type:	Circular Corrugated Metal Pipe
Length/Width:	77'
# Spans/Cells:	1 @ 3' Diameter
Low Chord:	n/a
Skew:	n/a (relative to road)
Clearance:	n/a
Bridge Flow Line:	n/a (u/s) n/a (d/s)
Low E.O.P:	757.87'
Freeboard:	-0.73'
Culvert Inverts:	747.31 (u/s) 746.02 (d/s)

PROPOSED STRUCTURE

Culvert Type:	Rectangular Concrete Box Culvert
Length Of Span:	118.1'
# Cells:	1 @ 8' (W) x 7' (H)
Top Of Crown Elev.: Beam:	753.3'
Skew:	n/a (relative to road)
Culvert Invert Elev.:	746.30'(u/s)745.20'(d/s)
Low E.O.P:	756.42
Freeboard:	3.53'

EXISTING EMBEDMENT

Depth:	N/A
U/S Streambed Elev.:	N/A
D/S Streambed Elev.:	N/A

PROPOSED EMBEDMENT

Depth:	1'
U/S Streambed Elev.:	747.30'
D/S Streambed Elev.:	746.20'

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.

Route: FAP 344 (US Route 45) | Computed By: EMB | Date: 2/24/2016

Waterway: DA18 (UNT Trib to Hastings Creek) | Checked By: IAD | Date: 2/24/2016

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1) U/S Face of Structure/Approach Section	Created Head (ft.) (2) @ Approach Section If Applicable		Headwater Elev. (ft.)	
		Existing	Proposed	Existing	Proposed
10-YEAR	751.4	7.0	0.3	758.4	751.7
50-YEAR	751.7	6.9	1.2	758.6	752.9
100-YEAR	751.8	6.8	1.5	758.6	753.3
OVT (E)1+-YEAR	750.7	7.2	n/a	757.9	n/a
500-YEAR	752.0	6.7	2.3	758.7	754.3

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	Station	Proposed	Station
757.19	266+50	756.42	266+29.59
Low Beam Elevation (Ft)			
Existing	Station	Proposed	Station
N/A	N/A	N/A	N/A
Existing Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
-1.20	-1.41	-1.39	-1.50
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
4.72	3.53	3.14	2.11
Proposed Clearance (ft)			
10-Year	50-Year (5)	100-Year	500-Year
N/A	N/A	N/A	N/A

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

(5) Vertical clearance is calculated from the 50-year natural highwater elevation to the proposed low chord (beam) bridge elevation (2 ft min requirement

CALCULATE EXISITING EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

For all Storms the existing 36" RCP is flowing full. 36" Pipe flowing full=7.07 ft ^{2}

CALCULATE PROPOSED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

Frequency	Natural WSEL at Upstream Face[1]	Flowline of Upstream Face of Structure of Low Flow Culvert	Water Depth at Upstream Face of Low Flow Culvert (feet)	Culvert Width	Waterway Opening[2]
	WSEL	Feet	Feet	Feet	Square Feet
10-year	751.4	746.30	5.09	8	40.7
50-year	751.7	746.30	5.36	8	42.9
100-year	751.8	746.30	5.45	8	43.6
500-year	752.0	746.30	5.72	8	45.8

Illinois Department of Transportation

Culvert Waterway Information Table

Route:	FAP 344 US 45	Existing SN:	N/A		
Waterway:	Unnamed Trib. to North Mill Creek	Proposed SN:	N/A		
Section:	05-00262-02-RP	Prepared by:	IAD	Date:	01/26/2018
County:	Lake	Checked by:	EMB	Date:	01/26/2018

Drainage Area = 0.21 square miles

Existing Overtopping Elev. = 784.19 at Sta. 310+55
Proposed Overtopping Elev. = 784.42 at Sta. 310+25

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	54	6	13	780.4	3.92	0.0	784.32	780.38
Design	50	100	6	15	780.7	3.87	0.69	784.57	781.39
Base	100	131	6	17	780.9	3.76	1.33	784.66	782.23
Scour Design Check	n/a	n/a							
Overtop Existing	9	50	6	12	780.3	3.89	n/a	784.19	n/a
Overtop Proposed	> 500	190							
Max. Calc.	500	180	6	18	781.1	3.76	2.80	784.77	783.90

Datum: NAVD 88

All-Time H.W.E. & Date: N/A ft

Surveyed Normal Water Level: 778.24 ft

10-Year Velocity through Existing Structure = 9.0 ft/s

10-Year Velocity through Proposed Structure = 4.2 ft/s

2-Yr. Flow Rate = 29 ft^3/s

EXISTING STRUCTURE

Type:	Reinforced Concrete Box Culvert
Length/Width:	L=64', 3'(W) x 2' (H)
# Cells:	1
Top Of Crown Elev.:	779.68
Skew:	0° (relative to road)
Clearance:	n/a
Culvert Inverts:	776.68 (u/s) 777.30 (d/s)
Low E.O.P:	784.19
Freeboard:	-0.38'

PROPOSED STRUCTURE

Culvert Type:	Reinforced Concrete Box Culvert
Length/Width:	L= 79', 7'(W) x 4'(H)
# Cells:	1
Top Of Crown Elev.:	781.50
Skew:	19° (relative to road)
Culvert Invert Elev.:	777.50 (u/s) 776.70 (d/s)
Low E.O.P:	784.42
Freeboard:	3.03'

EXISTING EMBEDMENT

Depth:	none
U/S Streambed Elev.:	
D/S Streambed Elev.:	

PROPOSED EMBEDMENT

Depth:	1'
U/S Streambed Elev.:	778.50
D/S Streambed Elev.:	727.70

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage. Crossing DA 19, TR-20 Flows. Road is superelevated. Structure surveyed as 42"x30" CMP, structure was extended as the CMP size, but most of structure is 3'x2' RCBC. Smaller size was used for modeling purposes.

Route: FAP 344 (US Route 45) Computed By: IAD Date: 1/23/2018

Waterway: DA19 (Unnamed) Checked By: EMB Date: 1/24/2018

WATERWAY INFORMATION TABLE BACK-UP CALCULATIONS
BRIDGE OR CULVERT

CALCULATED CREATED HEAD

Frequency	Natural H.W.E. (ft) (1)		Existing Headwater Elev. (ft)		Prop. Headwater Elev. (ft)		Created Head (ft.) (2) @ Approach Section If Applicable	
	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	U/S Face of Structure	Approach Sect. (40' US)	Existing	Proposed
10-YEAR	780.4	NA	784.32	NA	780.38	NA	3.92	-0.02
50-YEAR	780.7	NA	784.57	NA	781.39	NA	3.87	0.69
100-YEAR	780.9	NA	784.66	NA	782.23	NA	3.76	1.33
OVT (E) 9-YEAR	780.3	NA	784.19	NA	NA	NA	3.89	NA
500-YEAR	781.1	NA	784.77	NA	783.9	NA	3.67	2.80

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the approach cross section, and not at the upstream face of the bridge/culvert. This difference in elevation is then added to the Natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. Headwater elevation = The natural highwater elevation + the created head.

CALCULATED FREEBOARD AND CLEARANCE

Low Road Elevation (Ft) (3)			
Existing	Station	Proposed	Station
784.19	310+55	784.42	310+25
Low Beam Elevation (Ft)			
Existing	Station	Proposed	Station
N/A	N/A	N/A	N/A
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
-0.13	-0.38	-0.47	-0.58
Proposed Freeboard (ft)			
10-Year	50-Year (4)	100-Year	500-Year
4.04	3.03	2.19	0.52

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation of the floodplain

(5) Vertical clearance is calculated from the 50-year natural highwater elevation to the proposed low chord (beam) bridge elevation (N/A for culvert)

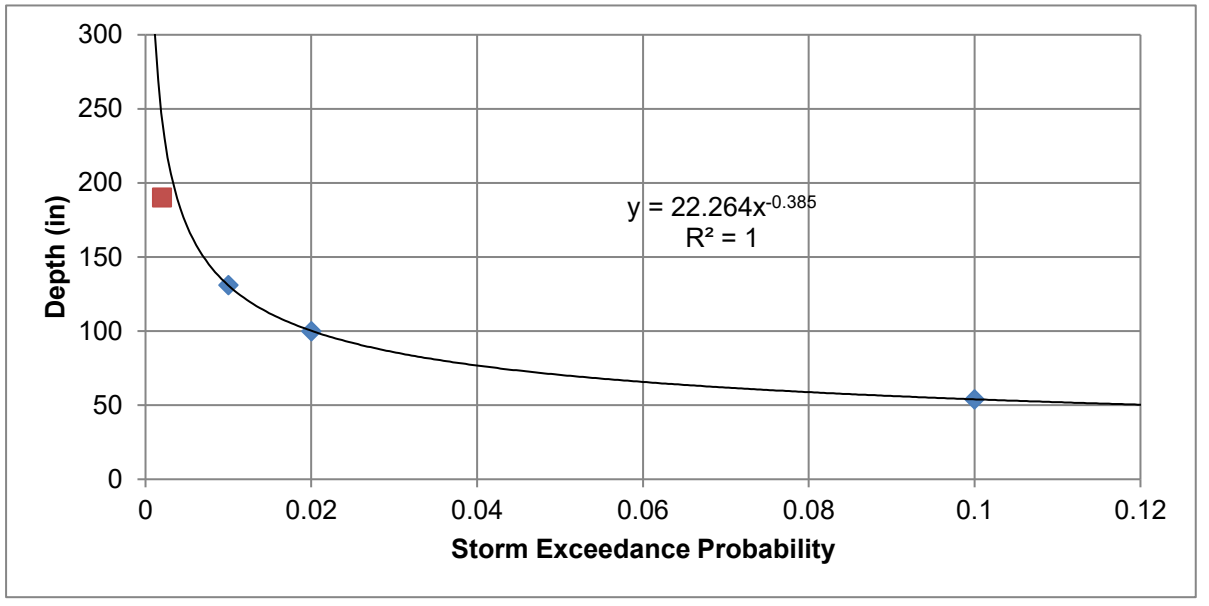
CALCULATED EFFECTIVE WATERWAY OPENING AREA FOR CULVERT

Structure Length (ft)		U/S Invert Elevation (ft)	
Existing	Proposed	Existing	Proposed Flowline
64	79	776.88	778.50

Waterway Opening Area (ft^2) (6)		
Frequency	Existing	Proposed
10-Year	6	13.3
50-Year	6	15.4
100-Year	6	16.8
OVT	6	12.6
500-Year	6	18.2

(6) The waterway opening area is calculated based on the Natural Highwater Elevation

Flow Rates			
Event	**Storm Exceedance Probability**	**FIS Flow (cfs)**	***Calculated Flow (cfs)***
2-yr	0.5		*29*
10-year	0.1	**54**	*54*
30-yr	0.03		*82*
50-year	0.02	**100**	*100*
100-year	0.01	**131**	*131*
200-yr	0.005		
500-year	0.002	**190**	
Note: 2-, 30-, and 200-year rainfall depths interpolated/extrapolated using a power regression trendline.			

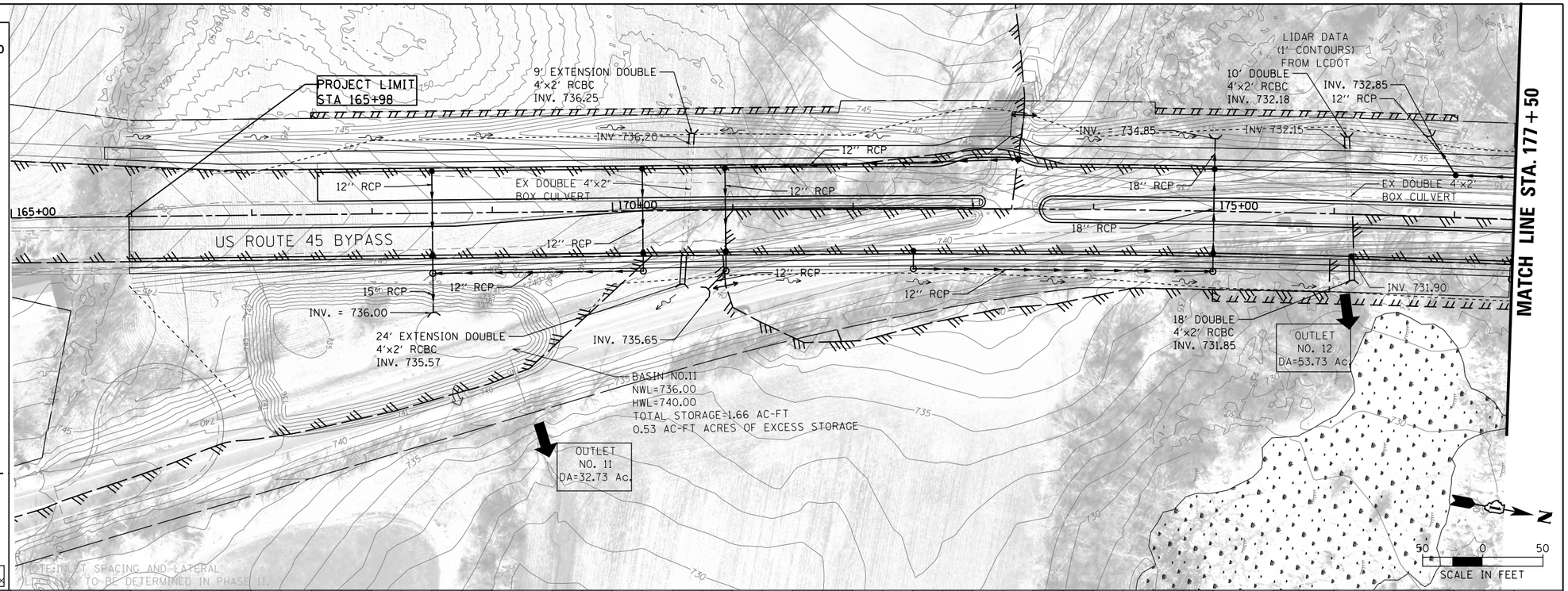


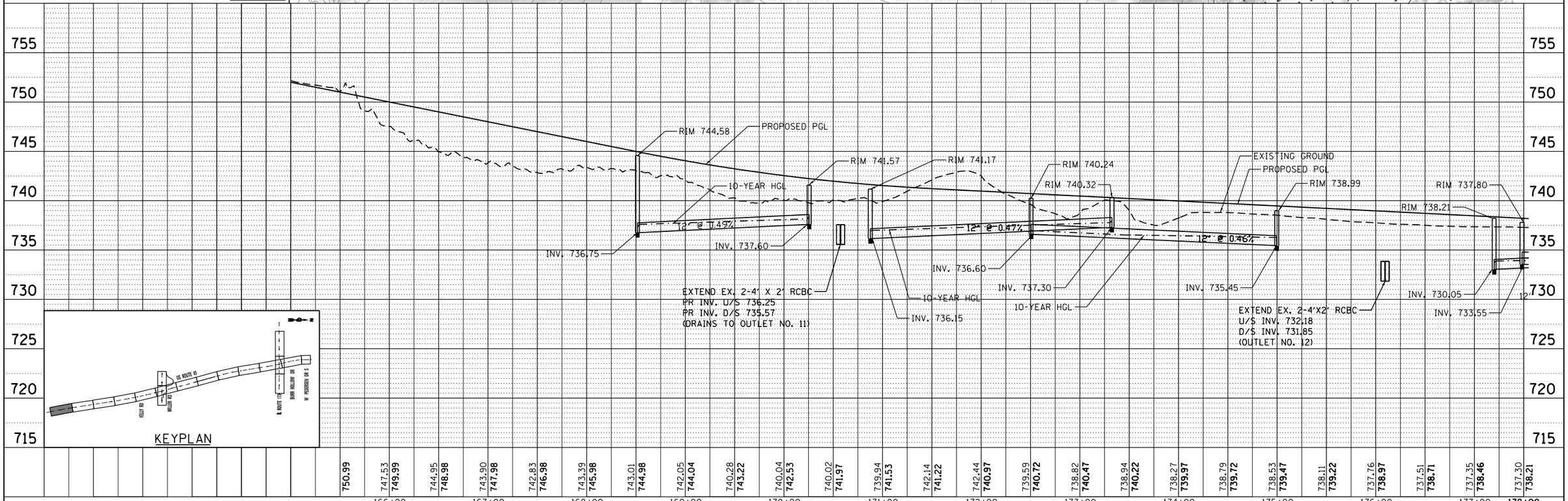
Outlet 19 flow rates from RWA TR-20 analysis.

PROPOSED DRAINAGE PLAN
EXHIBIT 2-00a

LEGEND

BOUNDARY LINES/SYMBOLS	EXISTING	PROPOSED
REFERENCE LINE/CENTERLINE AND STATIONING	1430+00	1430+00
SWALE		
DITCH		
CHANNEL		
DRAINAGE SUMMIT		
CULVERT SIZE - TYPE	2 X 2 BOX	2 X 2 BOX
BRIDGE LOCATION - BRIDGE NO.		
FLOODWAY		
STORM SEWER		
LOCAL STORM SEWER	L	
SANITARY SEWER		
FLARED END SECTION		
CATCH BASIN		
HEADWALL		
INLET		
MANHOLE		
100 YEAR FLOODPLAIN BOUNDARY		
RIGHT OF WAY LINE		
OUTLET		
SHEET FLOW		
OVERFLOW		
WATERS OF THE US		
FIELD TILE		
INTERPRETED DRAINAGE AREA TO OUTLET/SUB-DIVIDE		
INVERT	(XXX.XX)	XXX.XX
LINEAR ITEMS TO BE REMOVED		
FLOODPLAIN BY ELEVATION		
WETLANDS		
DIVERTED AREA		





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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

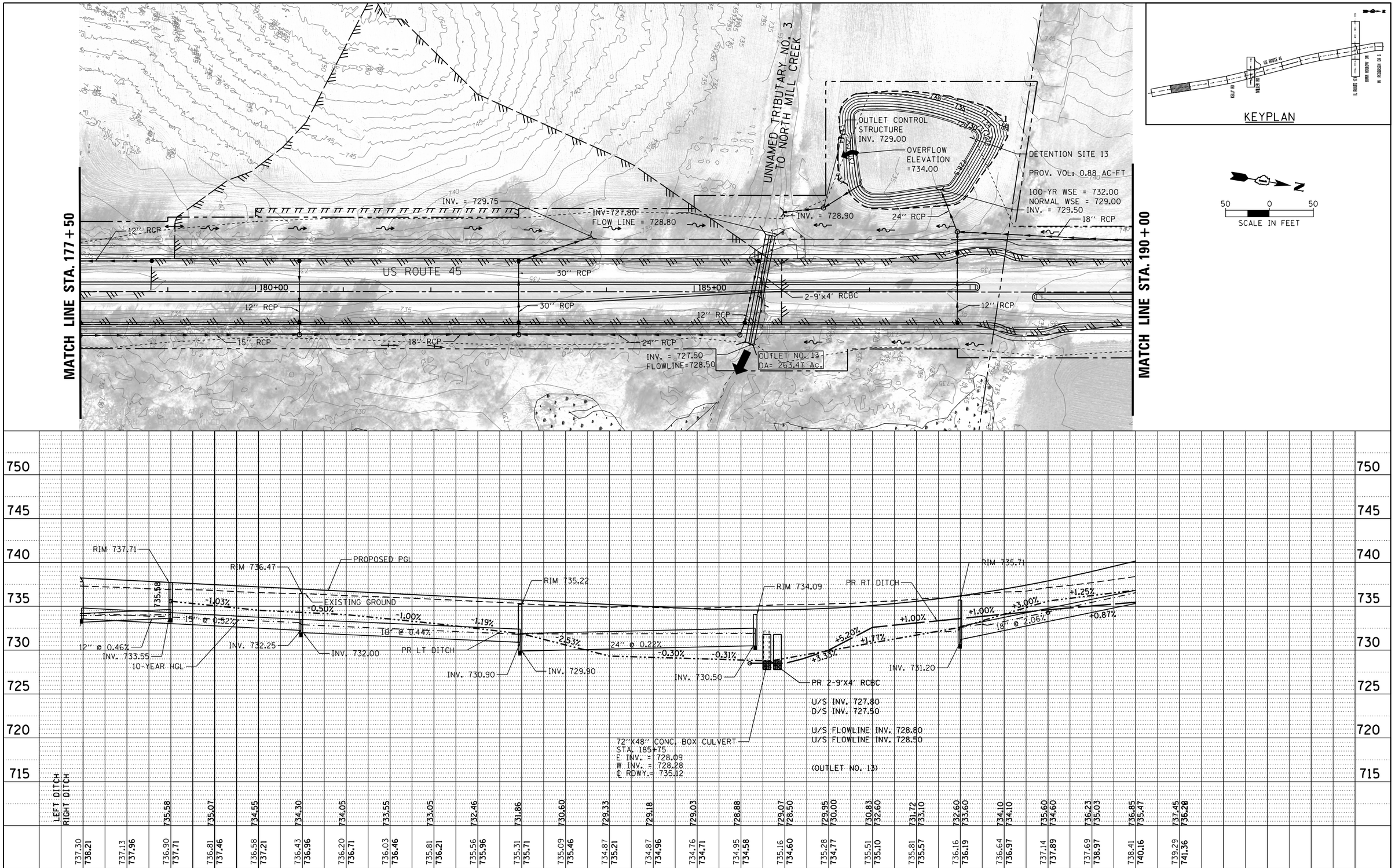
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 1 OF 18 SHEETS | STA. 165+00 TO STA. 177+50

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-R0	LAKE	18	1

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

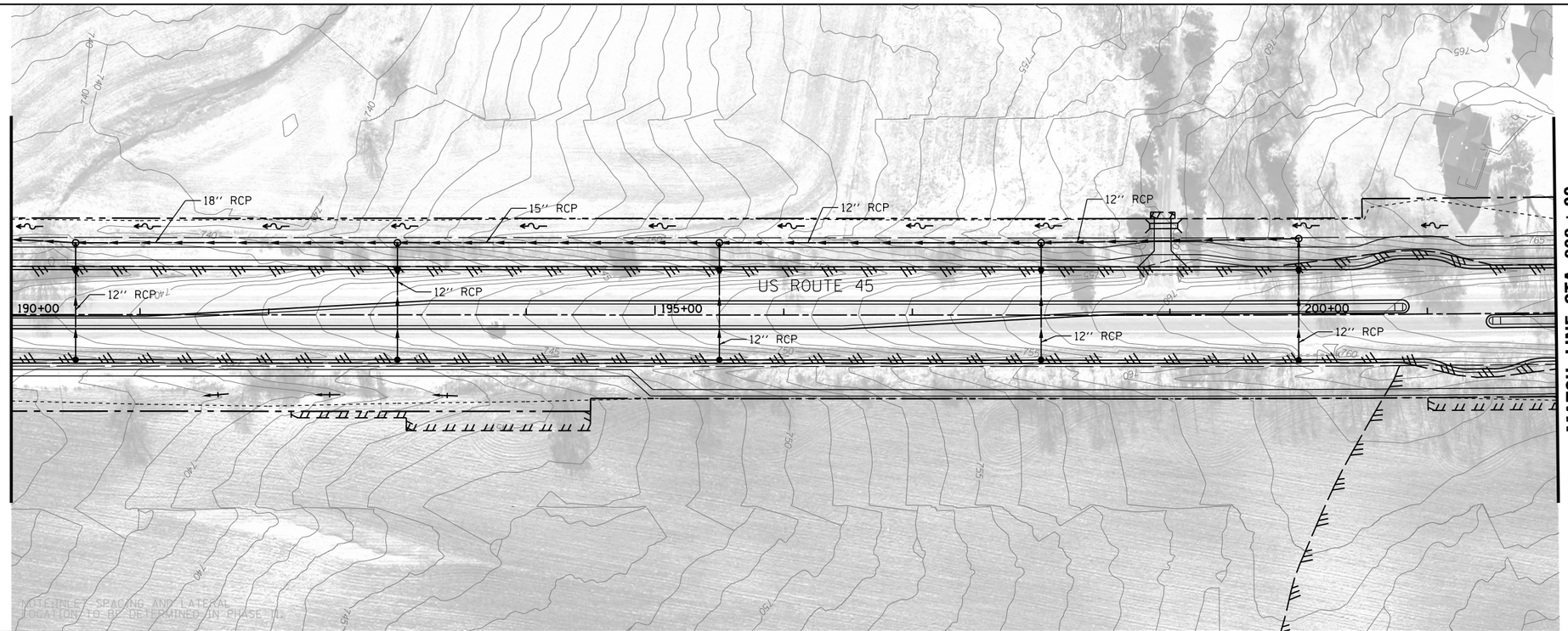
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

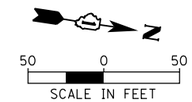
SCALE: 1" =100' | SHEET 2 OF 18 SHEETS | STA.178+06.47 TO STA190+00

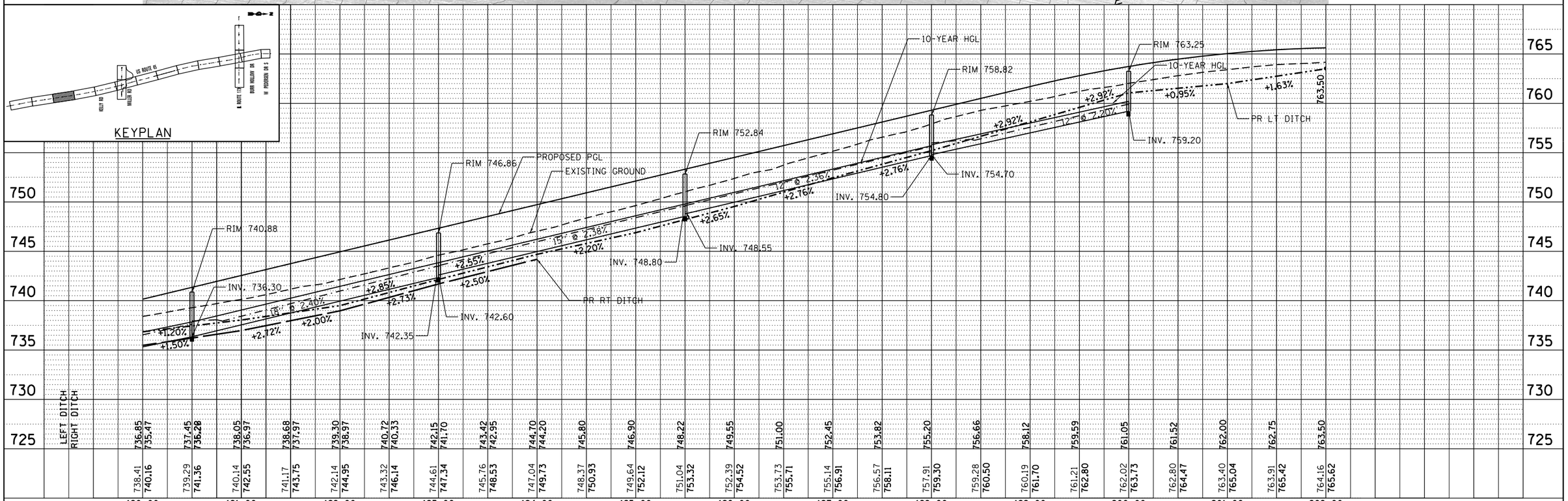
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	2

CONTRACT NO.

ILLINOIS FED. AID PROJECT







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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

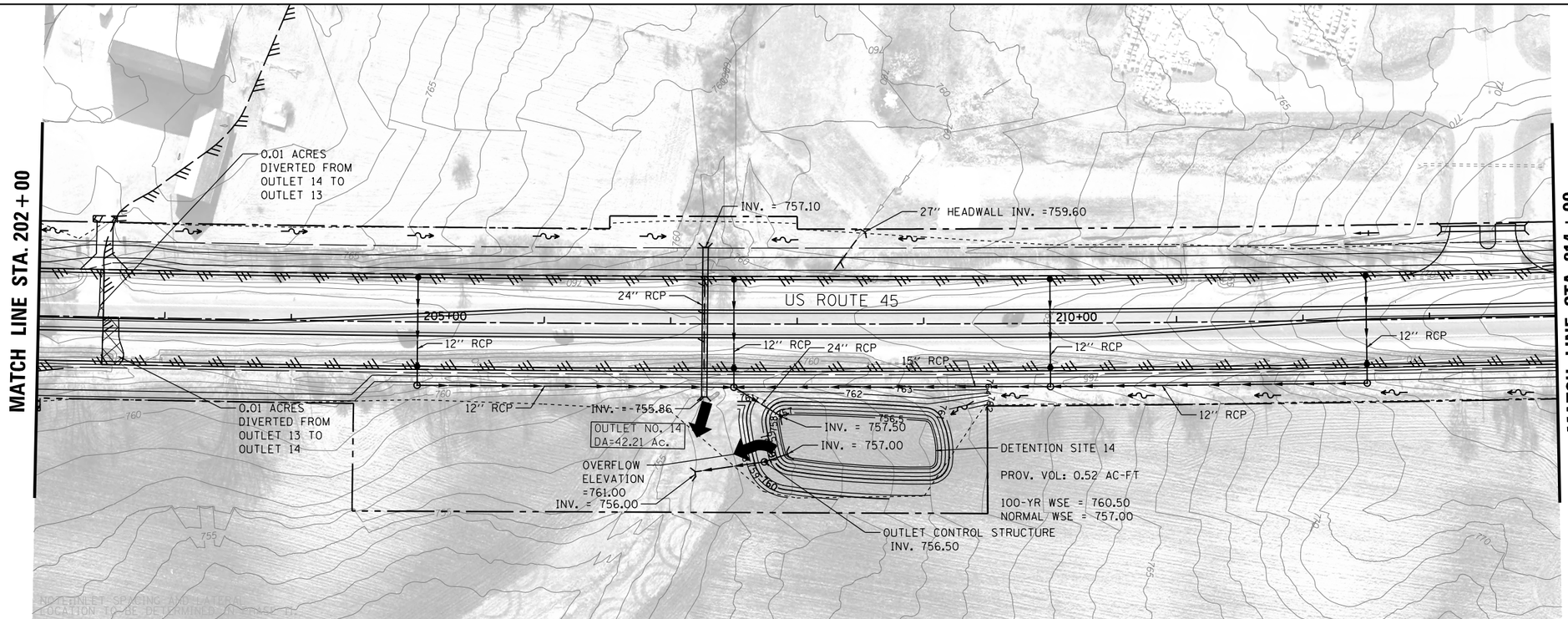
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 3 OF 18 SHEETS | STA. 190+00 TO STA. 202+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	3

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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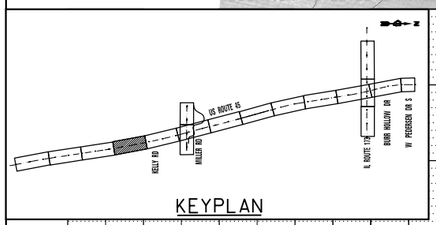

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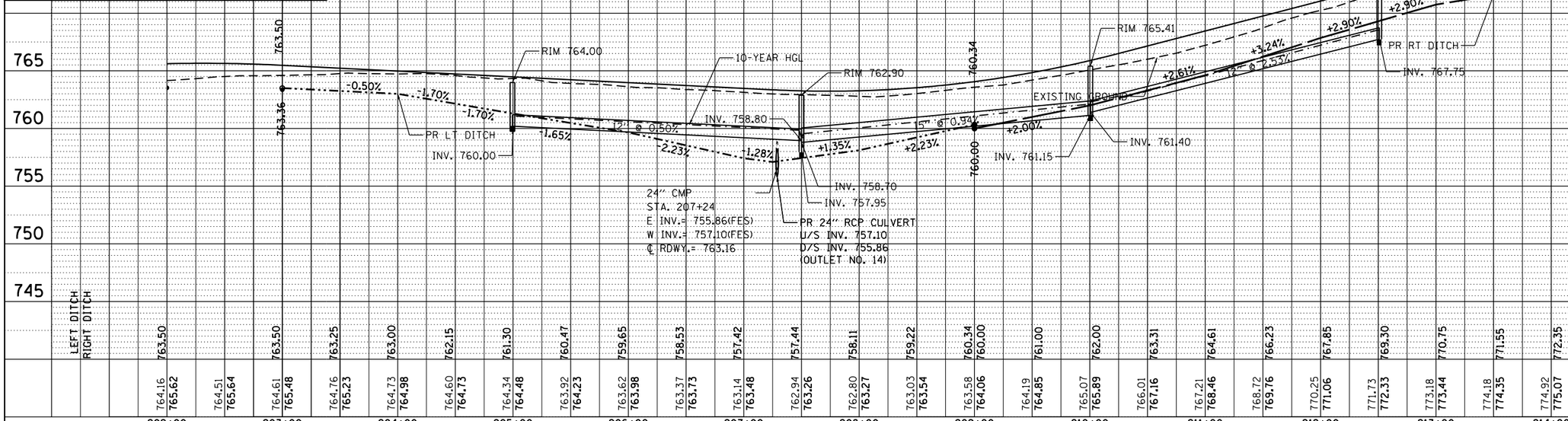

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

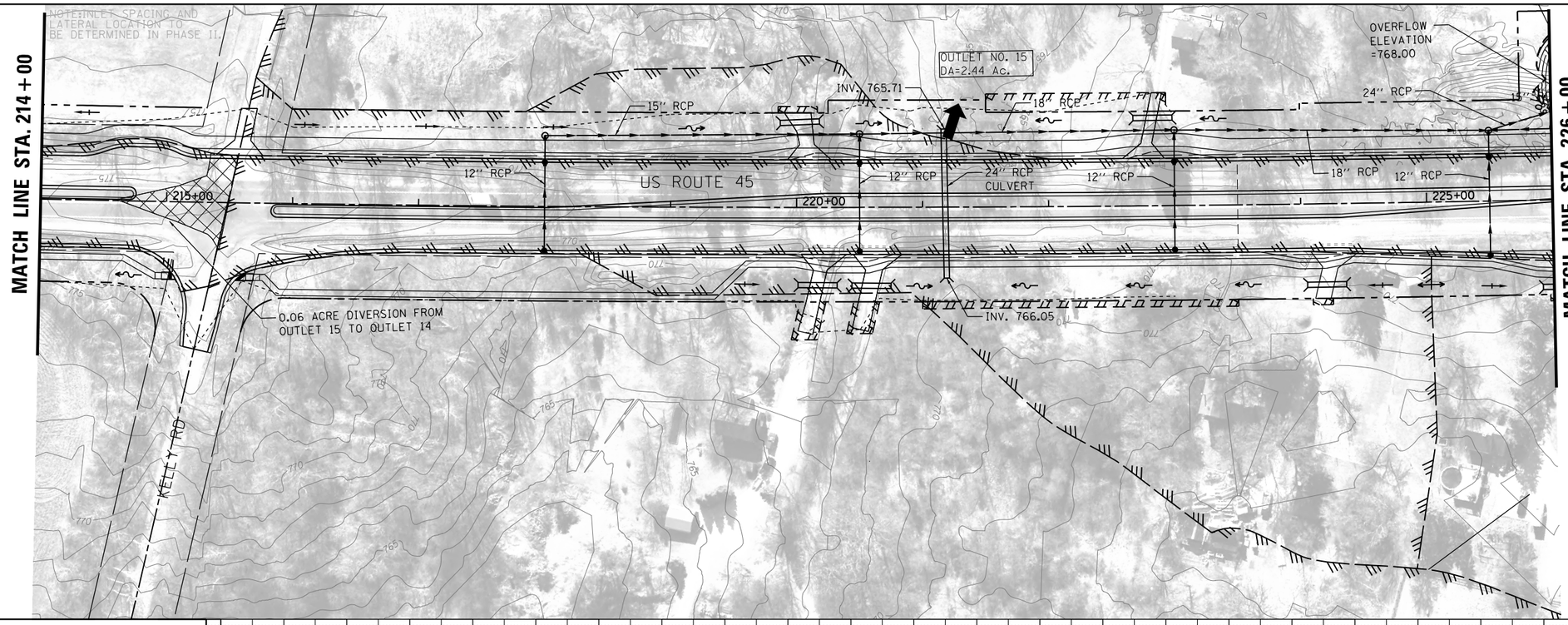
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

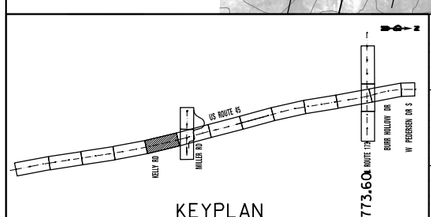
SCALE: 1" =100' | SHEET 4 OF 18 SHEETS | STA. 202+00 TO STA. 214+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	4

CONTRACT NO.

ILLINOIS FED. AID PROJECT





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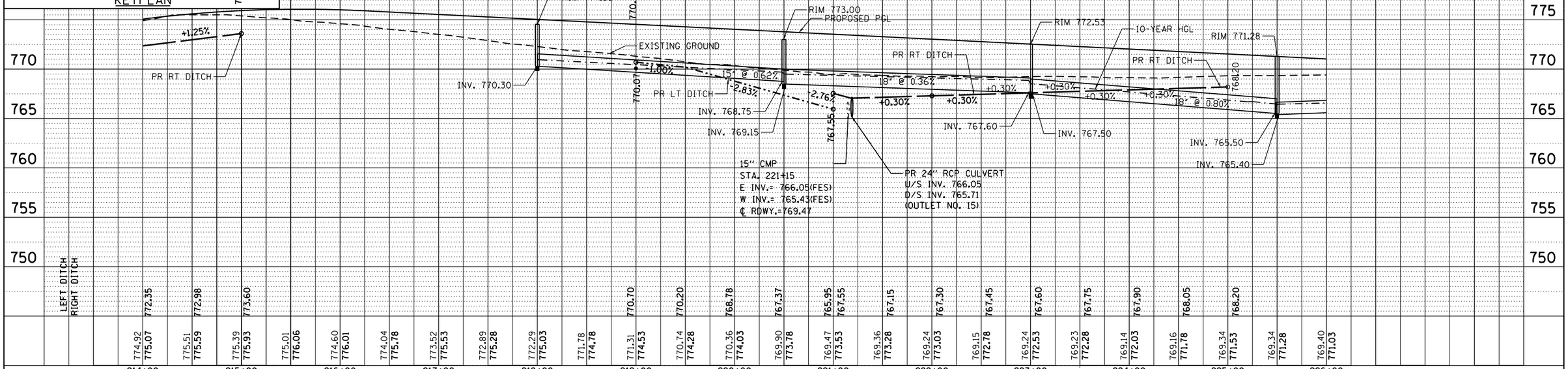

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

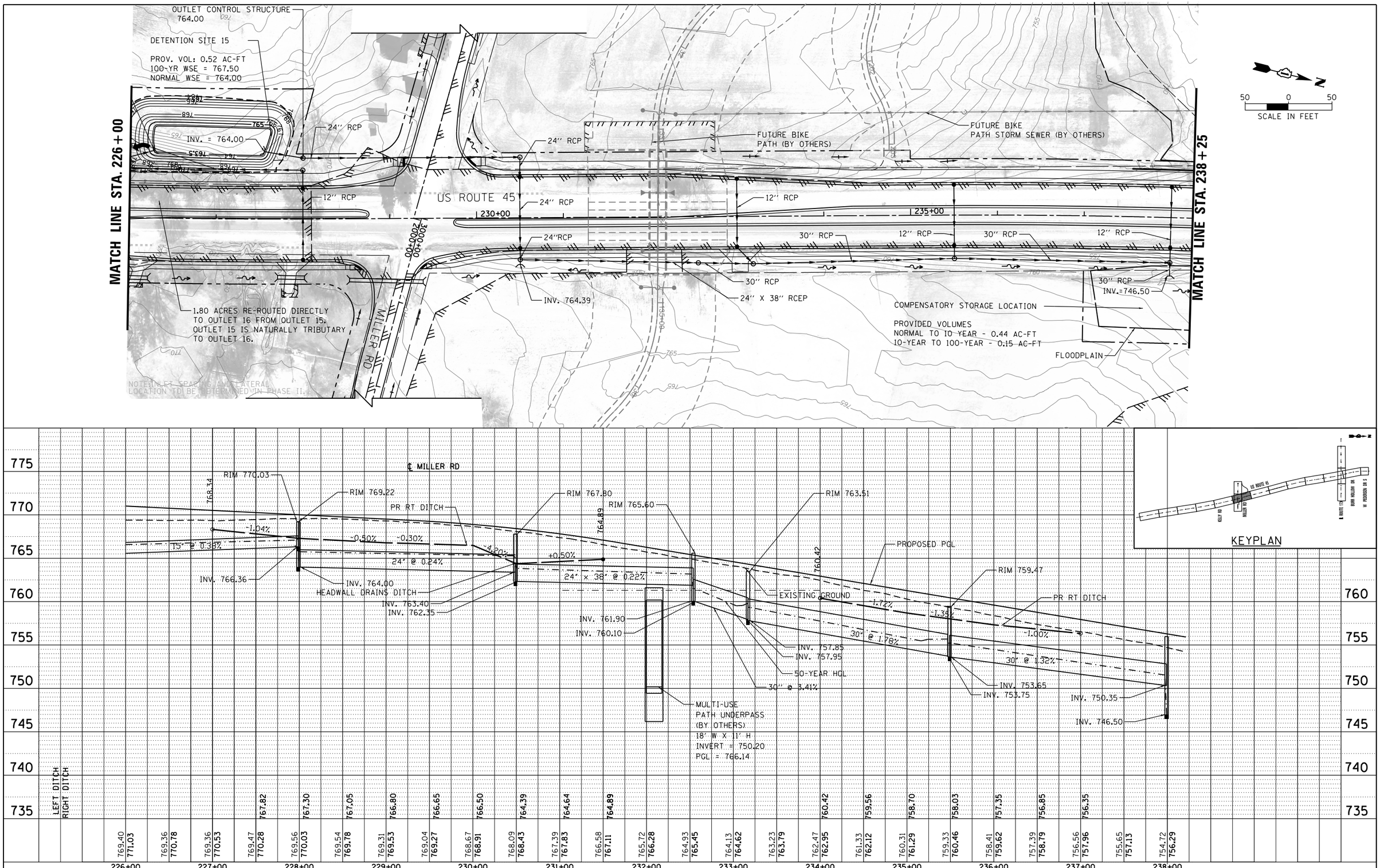
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 5 OF 18 SHEETS | STA. 214+00 TO STA. 226+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	5

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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NOTE BOOK NO.		

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

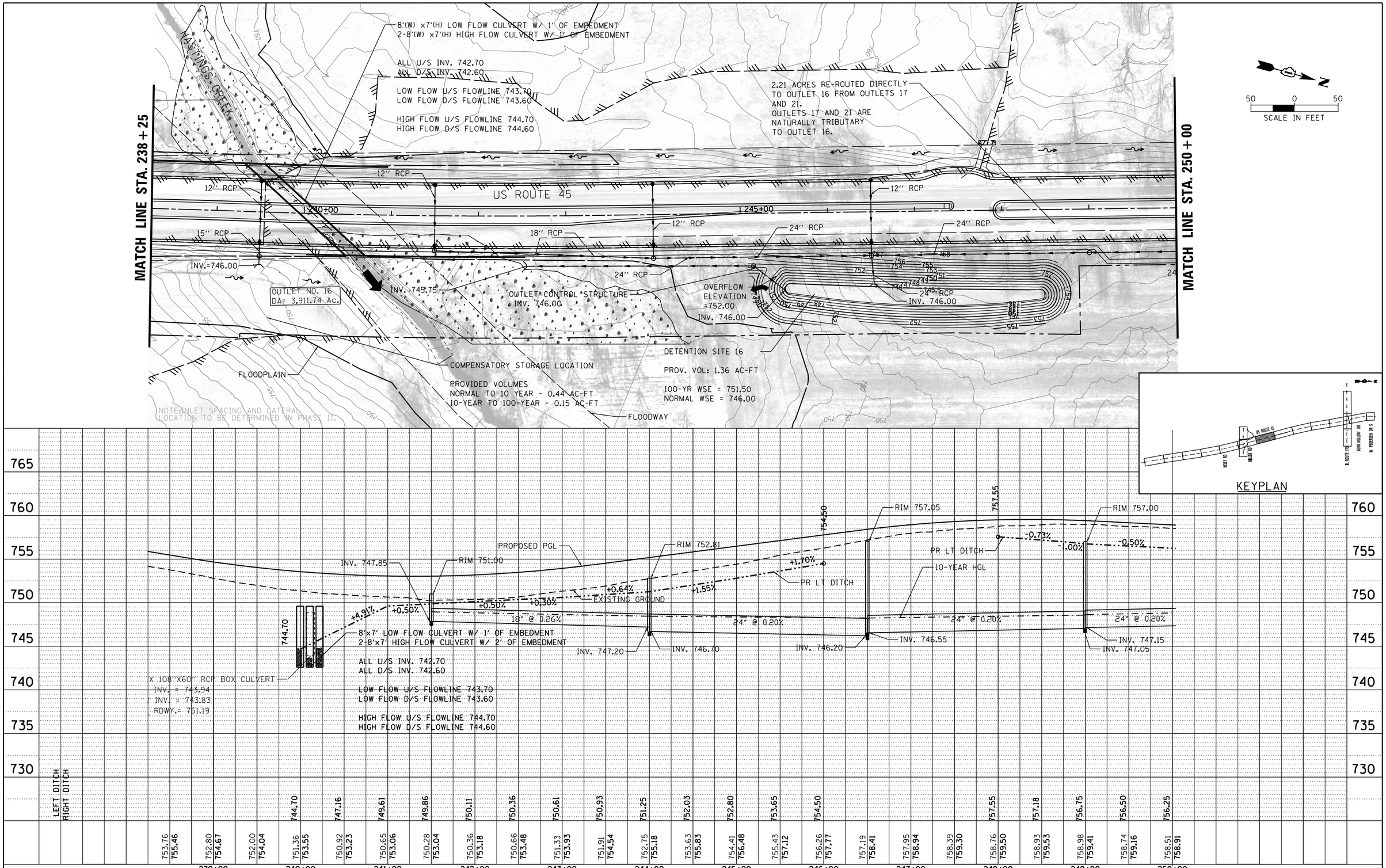
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" =100' | SHEET 6 OF 18 SHEETS | STA. 226+00 TO STA. 238+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-R0	LAKE	18	6

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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CADD FILE NAME		
NOTE BOOK NO.		

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NOTE BOOK NO.		

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

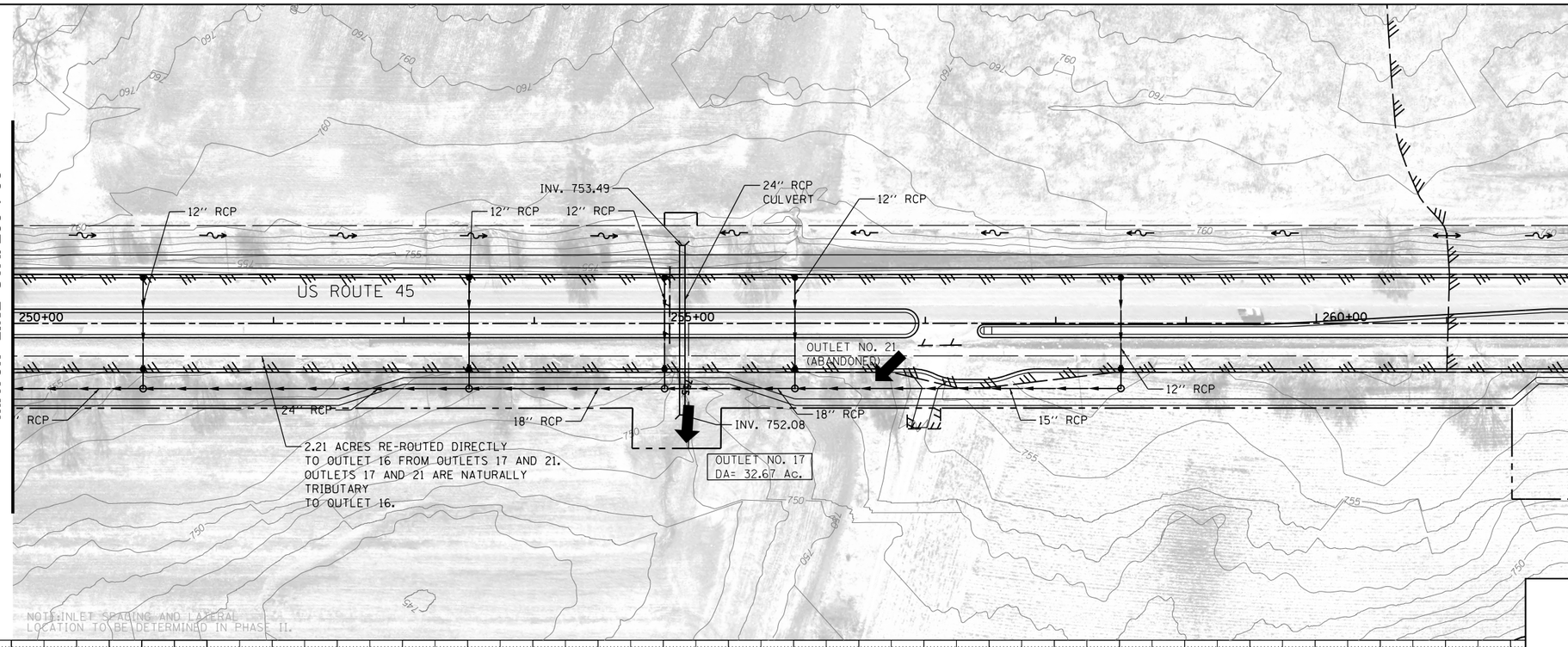
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

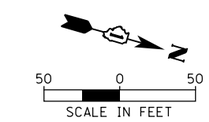
SCALE: 1" =100' | SHEET 7 OF 18 SHEETS | STA. 238+00 TO STA. 250+00

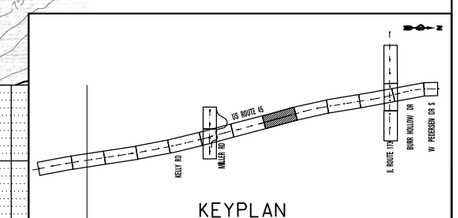
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	7

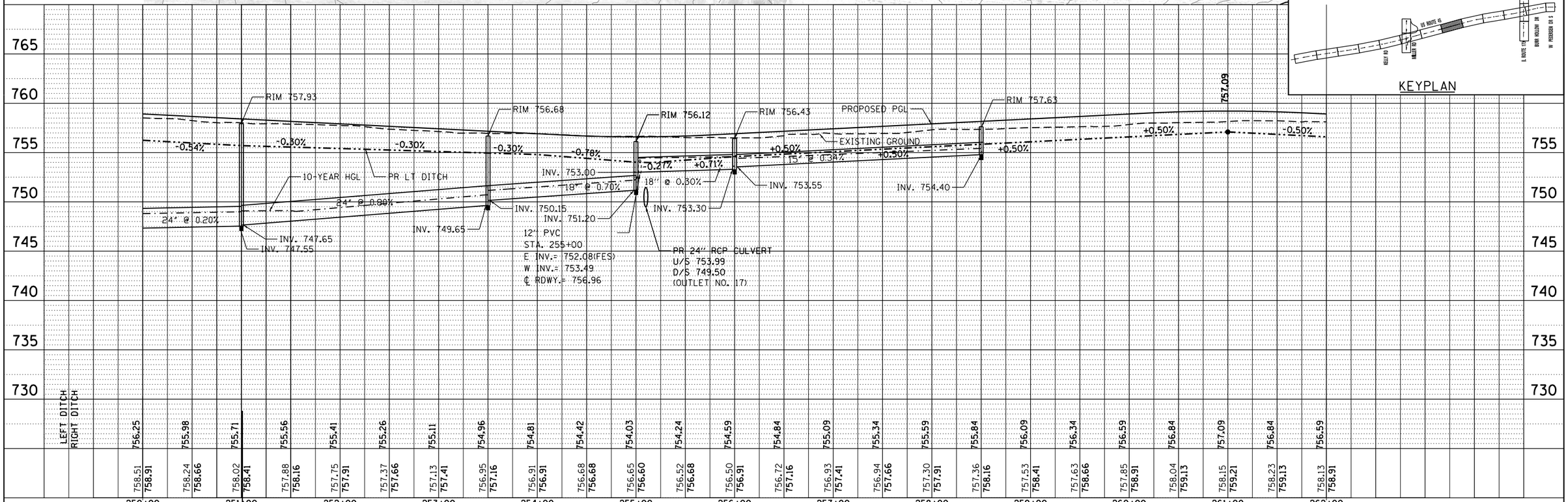
CONTRACT NO.

ILLINOIS FED. AID PROJECT









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CADD FILE NAME		
NOTE BOOK NO.		

PROFILE	BY	DATE
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BKM. NOTED		
STRUCTURE NOTATIONS CHKD		
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FILE NAME = N:\Idot\100063\CADD_Sheets\P138810-sht-drain-plnprf217.dgn	USER NAME = edburke	DESIGNED - EMB	REVISED -
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	PLOT SCALE = 100'	CHECKED - IAD	REVISED -
Default	PLOT DATE = 1/8/2019	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" =100' | SHEET 8 OF 18 SHEETS | STA. 250+00 TO STA. 262+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	8

CONTRACT NO.

ILLINOIS FED. AID PROJECT

NOTE: INLET SPACING AND LATERAL LOCATION TO BE DETERMINED IN PHASE II.

MATCH LINE STA. 262+00

MATCH LINE STA. 274+00

TRIBUTARY TO HASTINGS CREEK

8'(W) x7'(H) RCBC W/ 1' EMBEDMENT

U/S INV. 746.30
D/S INV. 745.20

U/S FLOWLINE 747.30
D/S FLOWLINE 746.20

US ROUTE 45

265+00

270+00

12" RCP

18" RCP

15" RCP

24" RCP

30" RCP

INV. 751.60

INV. 747.75

INV. 748.00

INV. 748.50

COMPENSATORY STORAGE LOCATION

PROVIDED VOLUMES
NORMAL TO 10 YEAR - 0.28 AC-FT
10-YEAR TO 100-YEAR -0.06 AC-FT

OUTLET
NO. 18
DA=
643.87 Ac.

OVERFLOW
ELEVATION
=755.00

DETENTION SITE 18B

PROV. VOL: 1.12 AC-FT

100-YR WSE = 754.00
NORMAL WSE = 748.00

N

50 0 50
SCALE IN FEET

KEYPLAN

US ROUTE 45
KELLY RD
MILBURN RD
E ROUTE 173
BOOR HOLLOW DR
NW PEDERSEN RD S

PROFILE

RIM 757.56

RIM 756.91

RIM 756.51

RIM 757.00

RIM 751.95

RIM 762.31

10-YEAR HGL

PROPOSED PGL

EXISTING GROUND

PR LT DITCH

PR RT DITCH

-0.50%

-0.50%

+0.30%

15" @ 0.47%

15" @ 0.34%

15" @ 0.36%

24" @ 2.15%

-2.89%

-14.89%

+12.42%

INV. 753.15

INV. 752.45

INV. 753.05

INV. 752.71

INV. 753.70

INV. 752.95

INV. 751.95

INV. 757.30

753.51

760.00

760.49

36" CMP(W/HDWL)
STA. 266+35
E INV.= 746.02
W INV.= 747.31
℄ RDWY.=757.95

8'(W) x7'(H) RCBC W/ 1' EMBEDMENT

U/S INV. 746.30
D/S INV. 745.20

U/S FLOWLINE 747.30
D/S FLOWLINE 746.20

770 765 760 755 750 745 740 735

LEFT DITCH: 756.59, 756.34, 756.09, 755.84, 755.59, 755.34, 755.09, 753.64, 752.20, 747.30, 753.51, 760.00, 760.49

RIGHT DITCH: 758.13/758.91, 758.11/758.66, 757.99/758.41, 757.87/758.16, 757.70/757.91, 757.64/757.66, 757.61/757.41, 757.32/757.16, 757.31/756.94, 757.19/756.92, 757.54/757.13, 757.77/757.54, 757.97/757.97, 758.10/758.41, 758.61/758.85, 759.14/759.28, 759.53/759.72, 760.01/760.16, 760.24/760.59, 760.41/761.03, 760.48/761.47, 760.76/761.91, 761.33/762.34, 761.53/762.78, 762.21/763.24

262+00 263+00 264+00 265+00 266+00 267+00 268+00 269+00 270+00 271+00 272+00 273+00 274+00

PLAN		BY	DATE
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CADD FILE NAME			
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PROFILE		BY	DATE
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Default	PLOT DATE = 1/8/2019	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

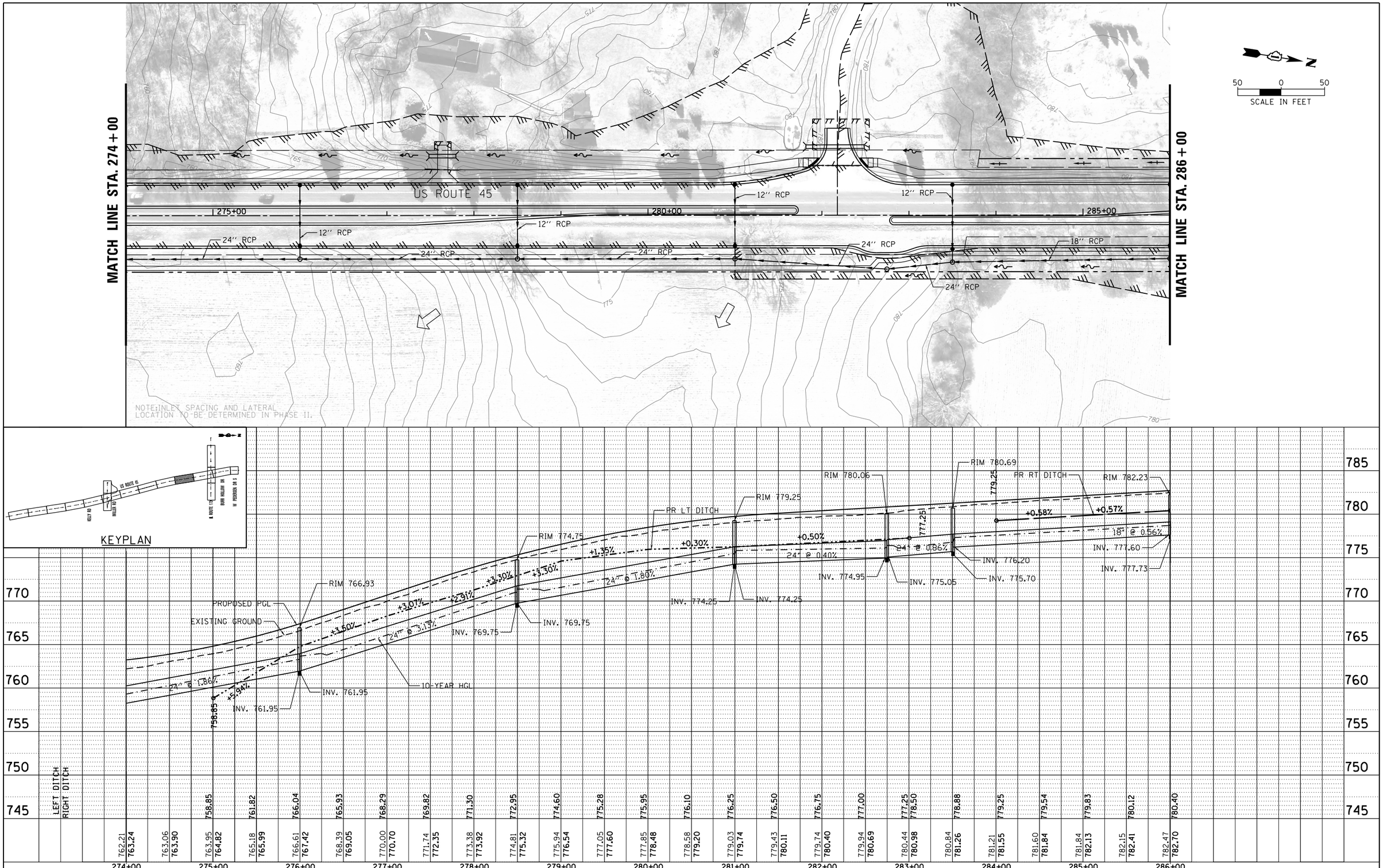
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" =100' | SHEET 9 OF 18 SHEETS | STA. 262+00 TO STA. 274+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	9

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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PROFILE	BY	DATE
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

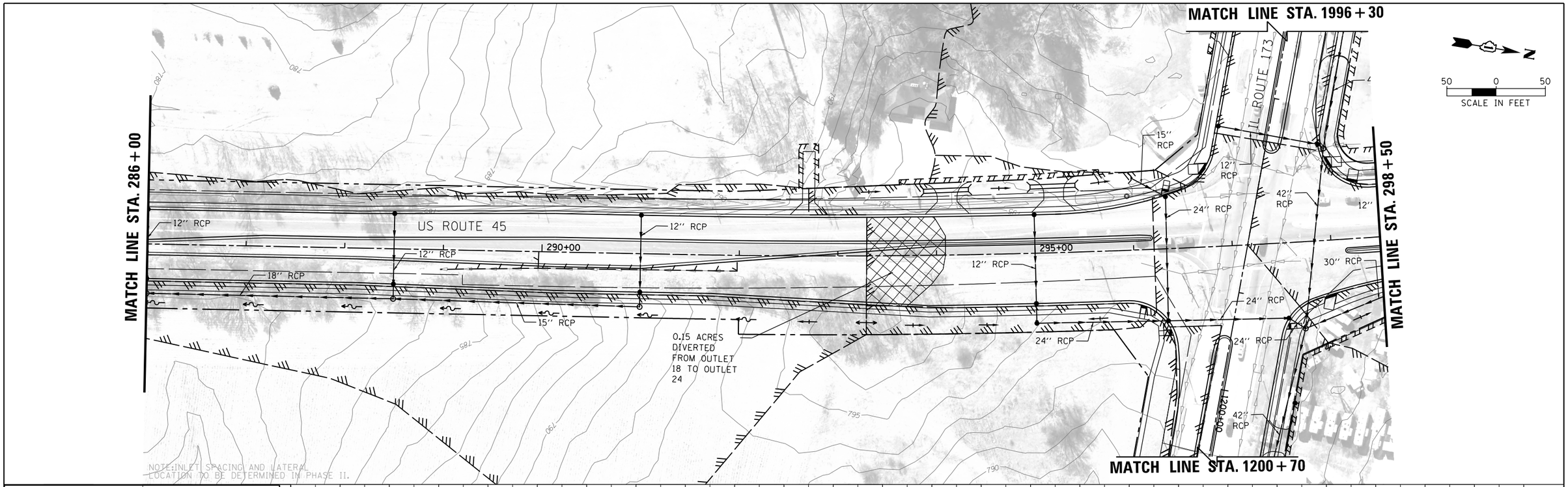
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

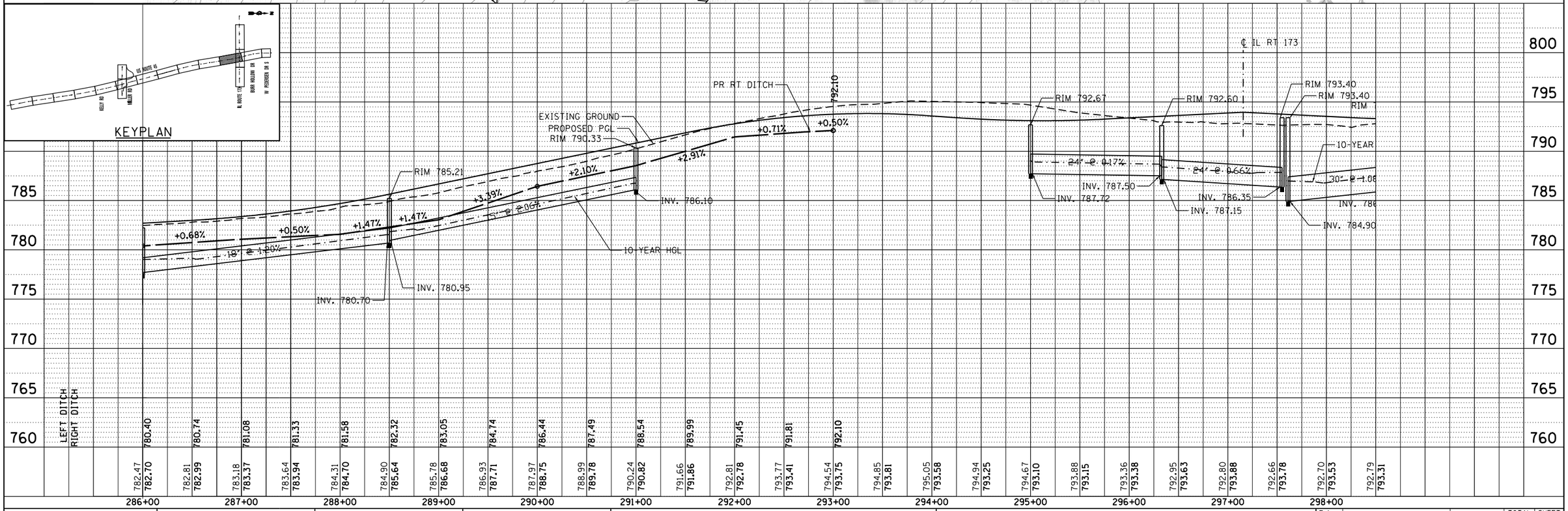
SCALE: 1" = 100' | SHEET 10 OF 18 SHEETS | STA. 274+00 TO STA. 286+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	10

CONTRACT NO.

ILLINOIS FED. AID PROJECT





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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

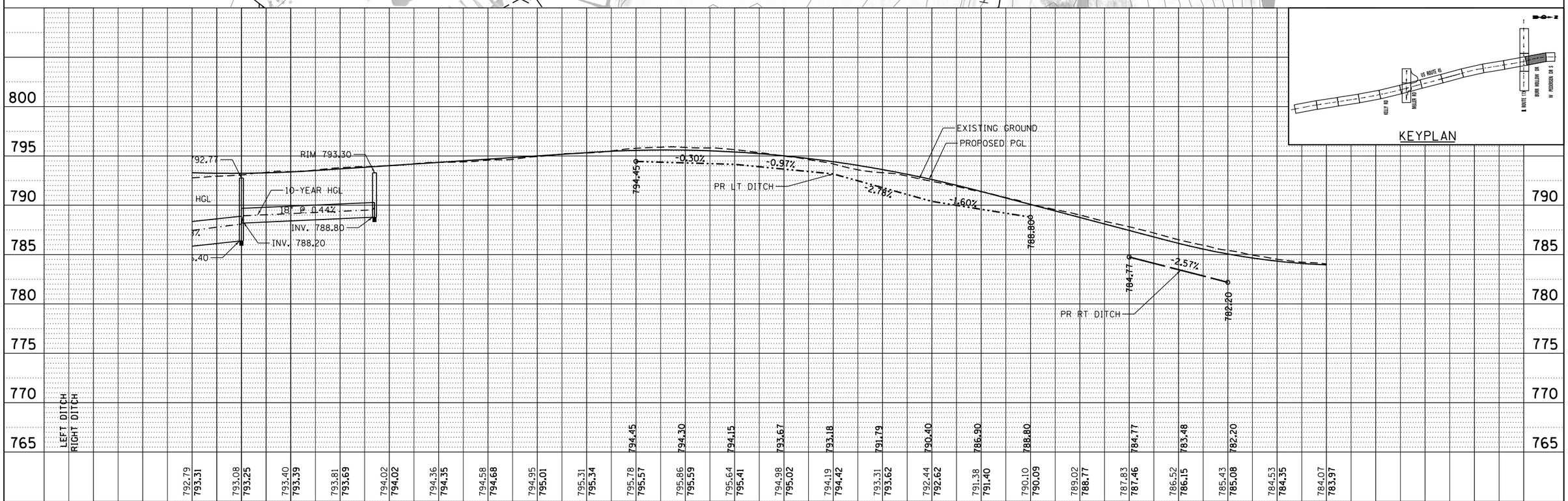
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 11 OF 18 SHEETS | STA. 286+00 TO STA. 298+50

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	11

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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BM. NOTED		
STRUCTURE NOTATNS CHKD		
NOTE BOOK NO.		

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Default	PLOT DATE = 1/8/2019	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

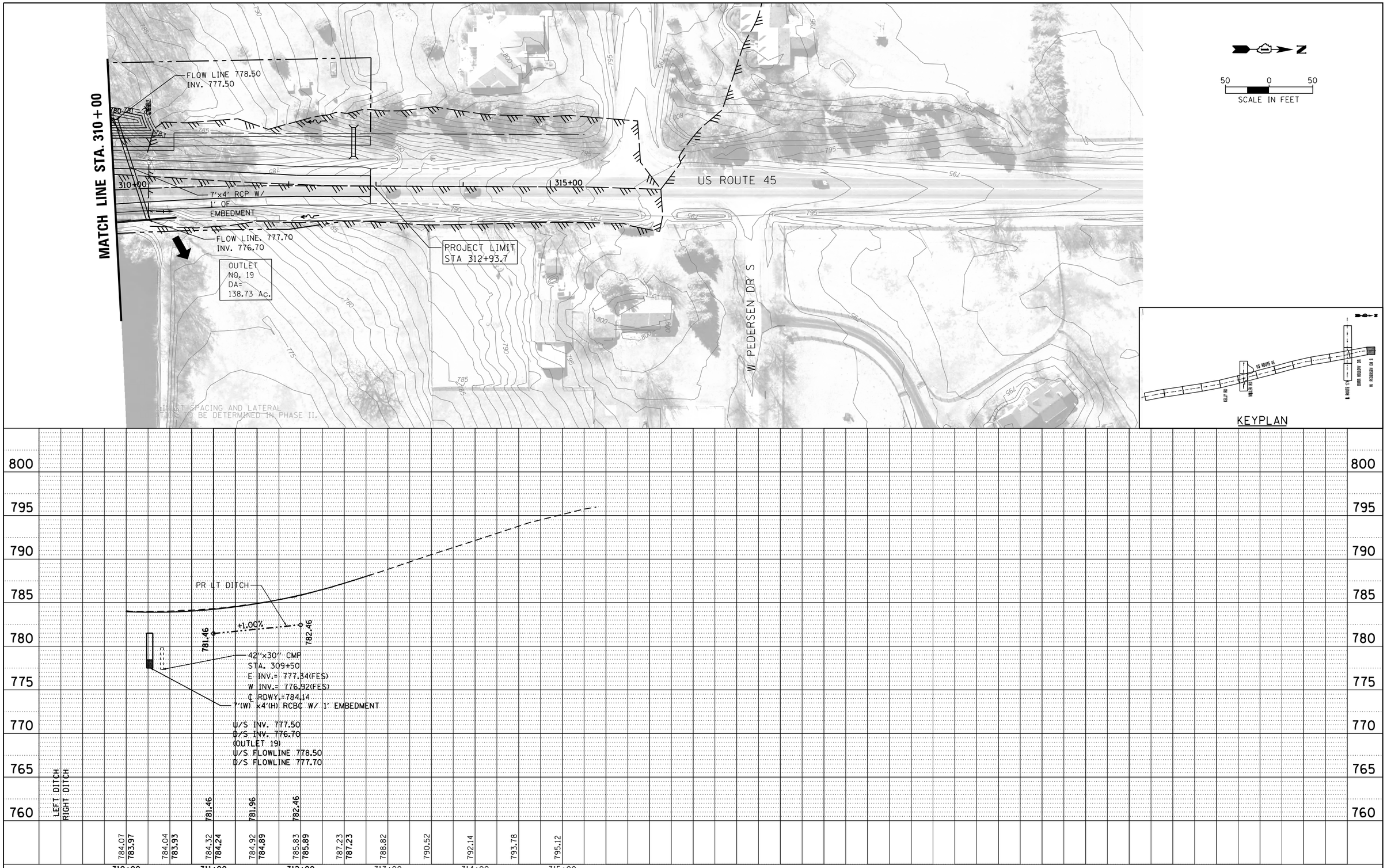
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 12 OF 18 SHEETS | STA. 298+50 TO STA. 310+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	12

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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B.M. NOTED		
STRUCTURE NOTATIONS CHKD		
NOTE BOOK NO.		

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

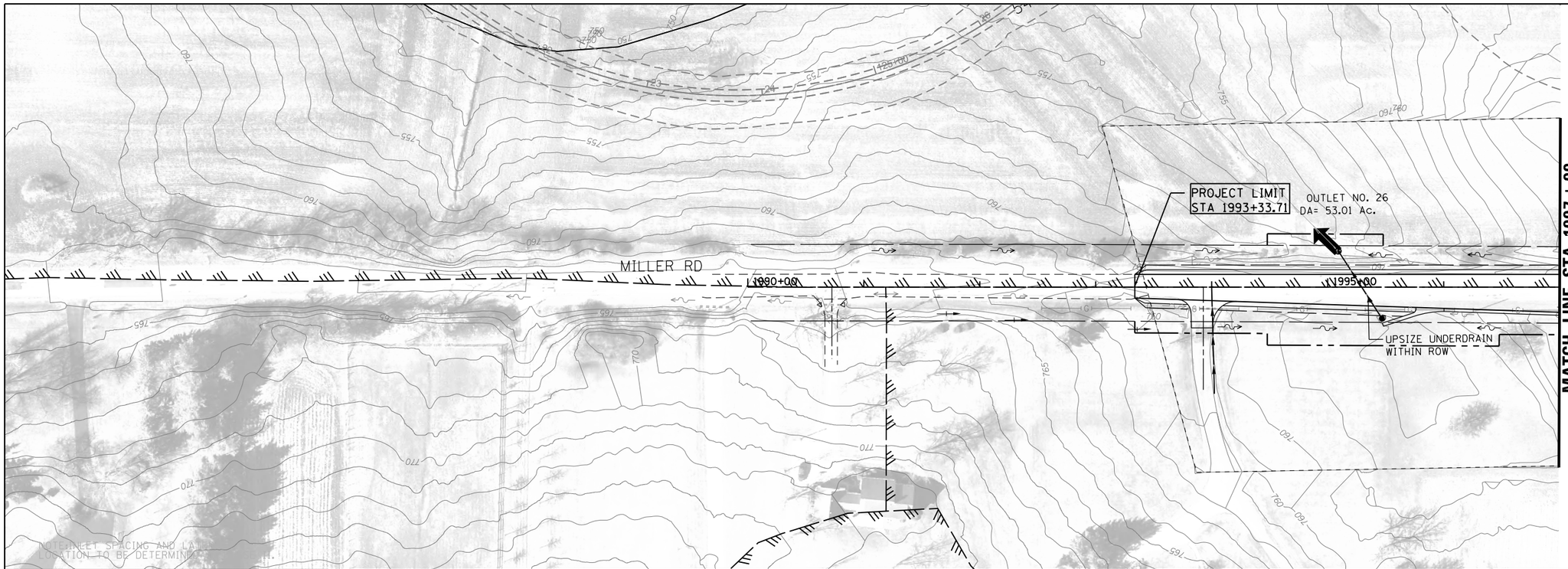
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 13 OF 18 SHEETS | STA. 310+00 TO STA. 315+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	13

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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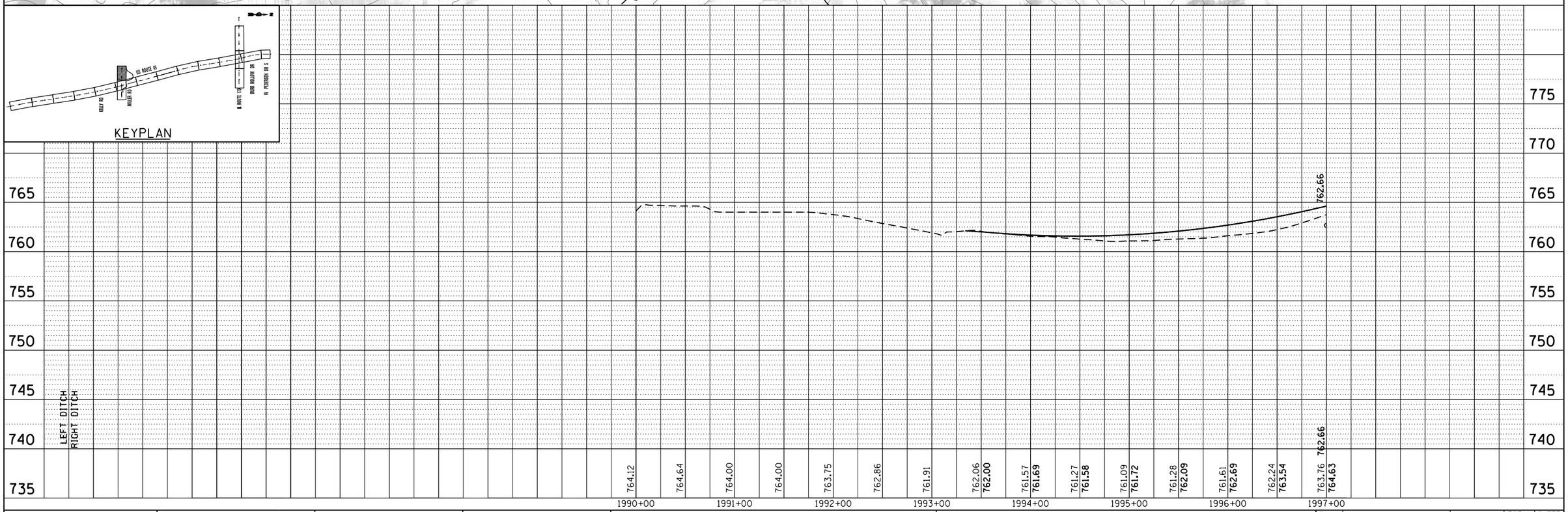
NOTE BOOK NO.		



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

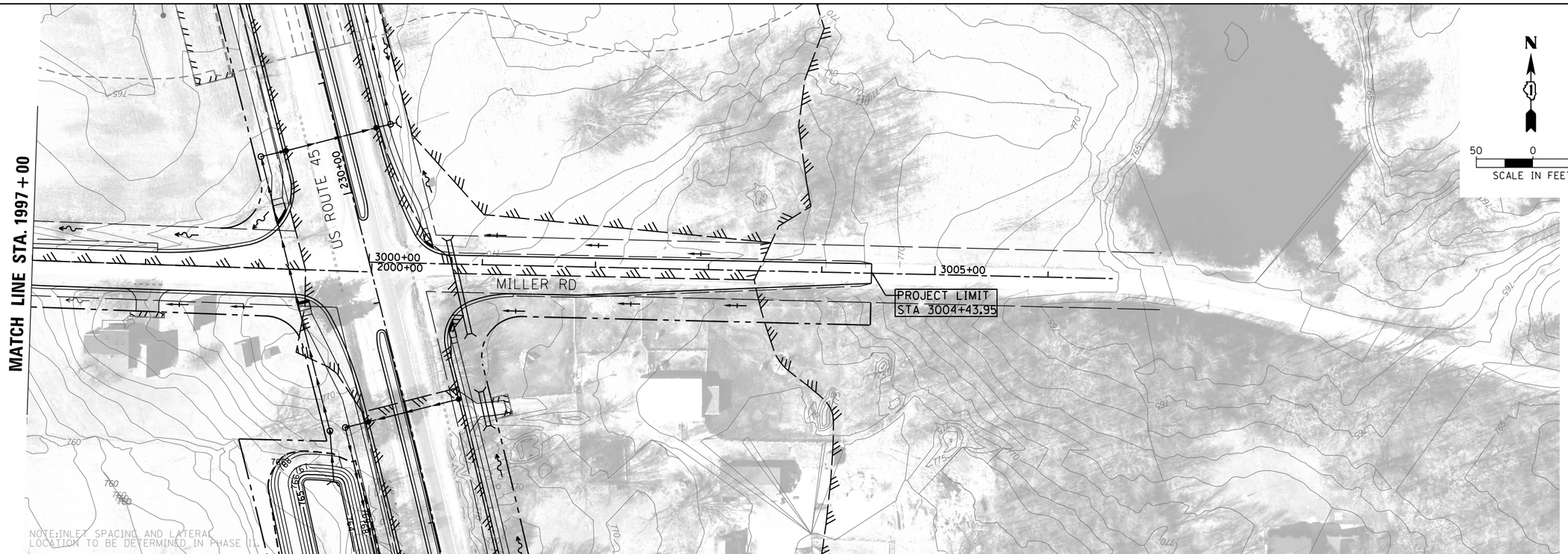
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" =100' | SHEET 14 OF 18 SHEETS | STA. 1990+00 TO STA. 1997+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-R0	LAKE	18	14

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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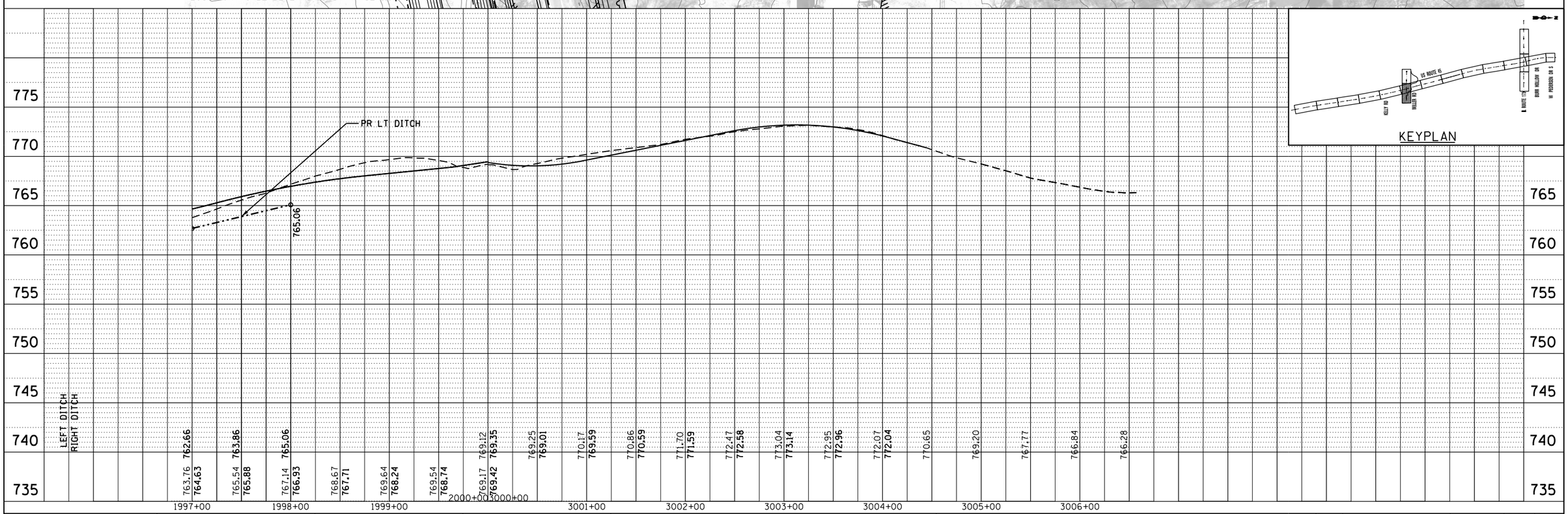

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

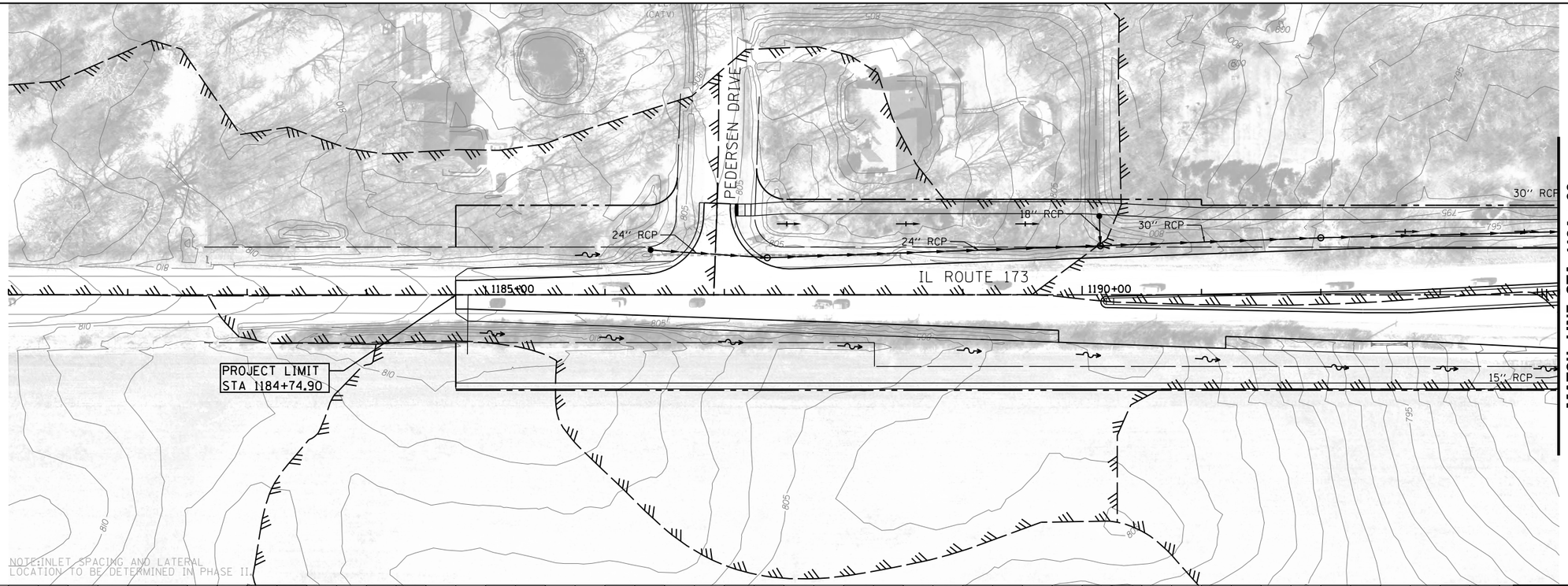
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

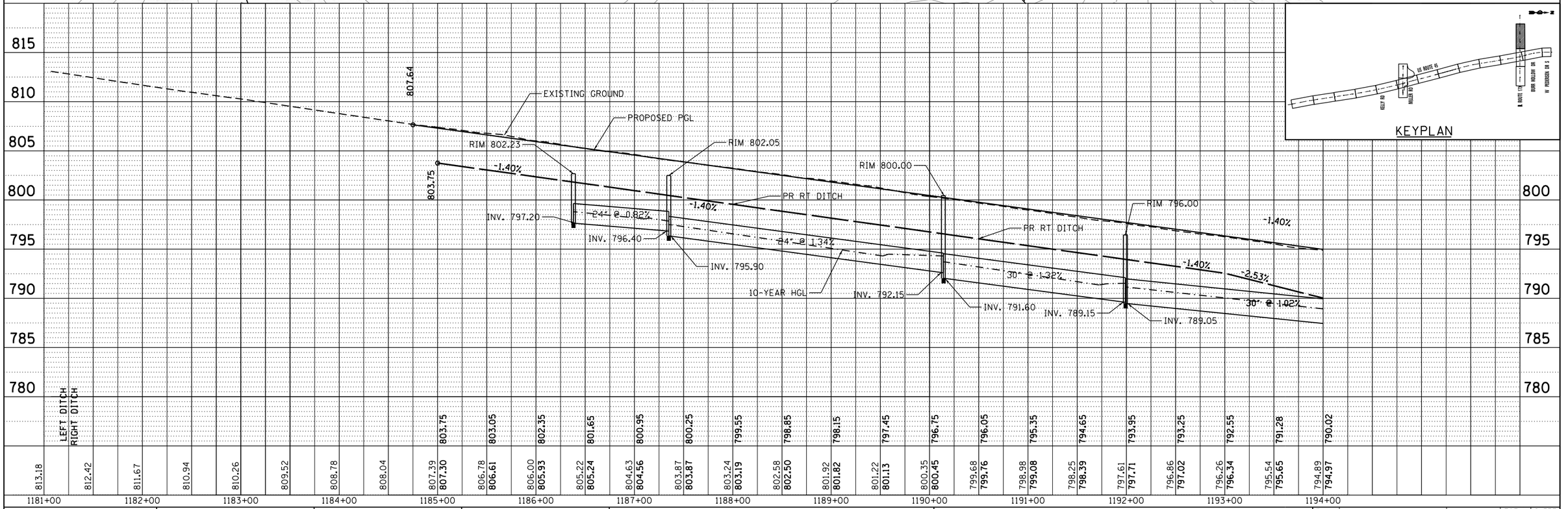
SCALE: 1" = 100' | SHEET 15 OF 18 SHEETS | STA. 1997+00 TO STA. 2006+55

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	15

CONTRACT NO.

ILLINOIS FED. AID PROJECT





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NOTE BOOK
NO.
BY
DATE

PROFILE
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PLOTTED
GRADES CHECKED
BM. NOTED
STRUCTURE NOTATNS CHKD
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BY
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

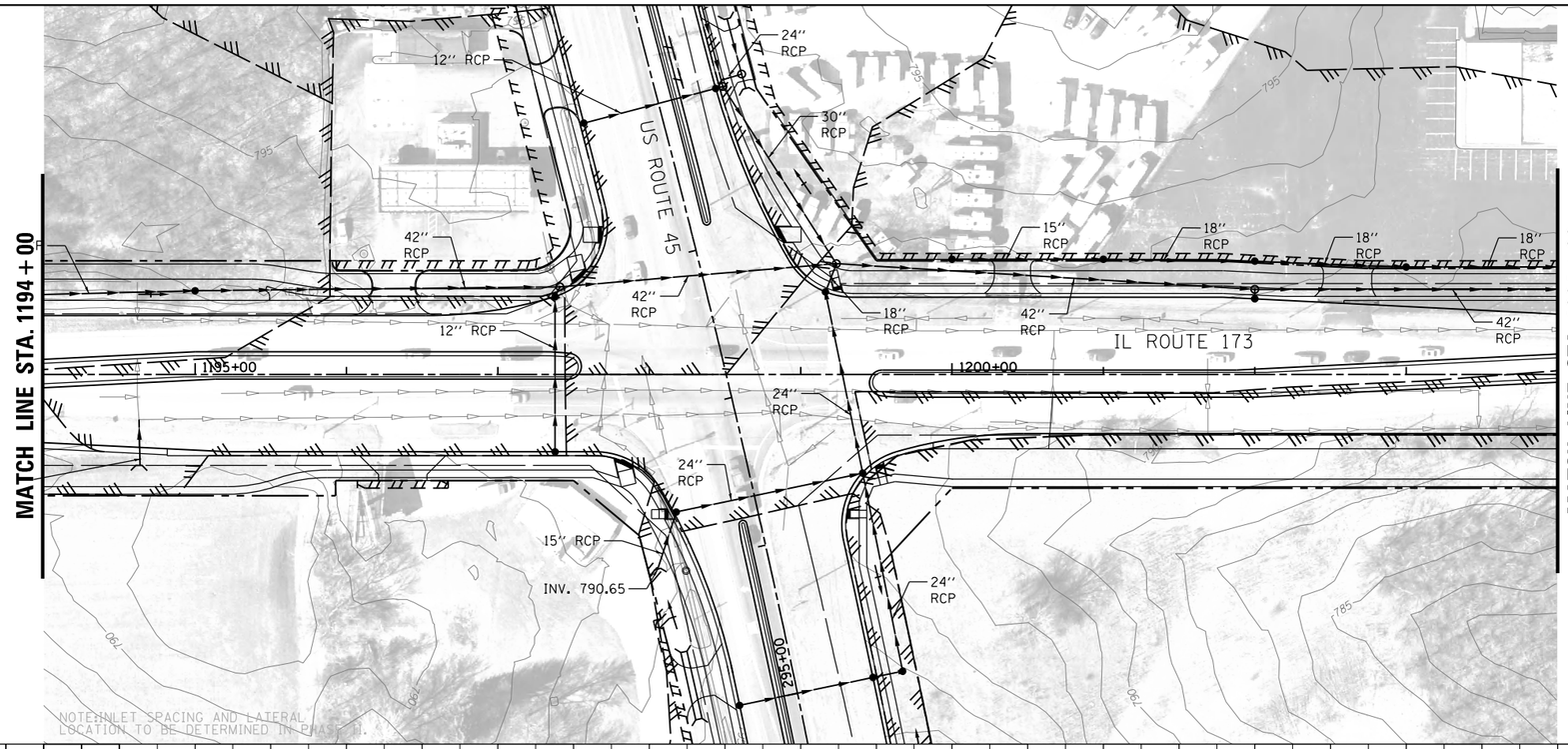
U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

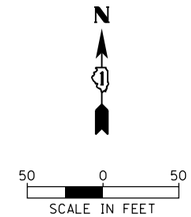
SCALE: 1" = 100' | SHEET 16 OF 18 SHEETS | STA. 1182+00 TO STA. 1194+00

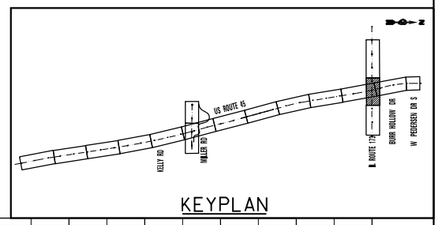
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	16

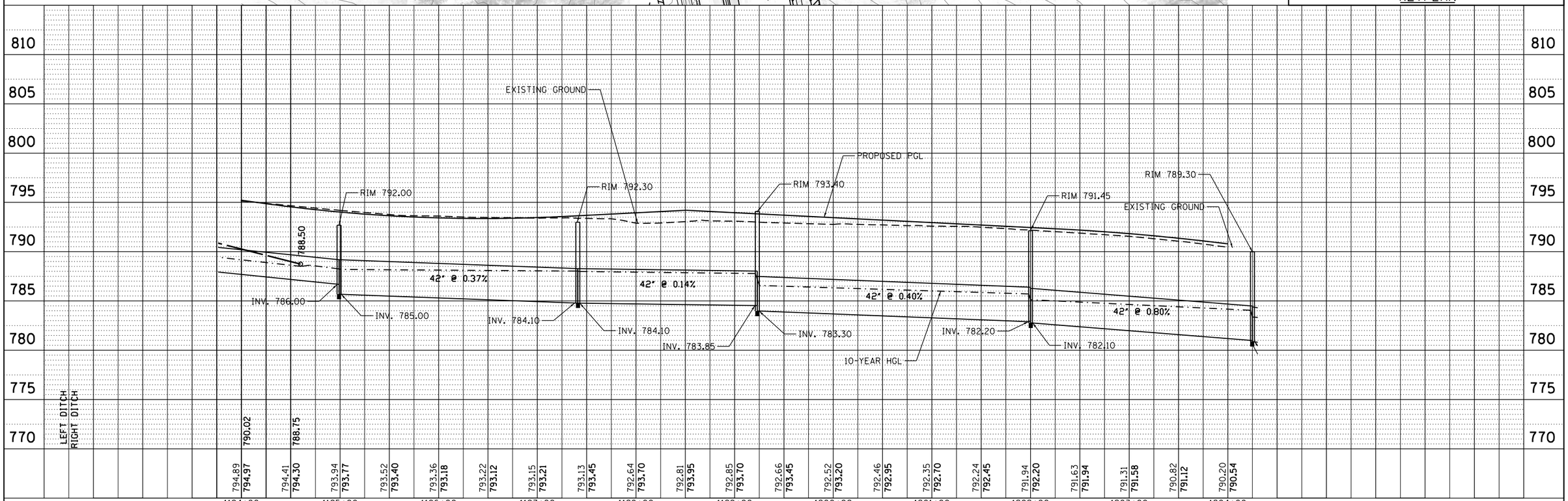
CONTRACT NO.

ILLINOIS FED. AID PROJECT









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PROFILE		BY	DATE
NOTE BOOK NO. ____	SURVEYED		
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

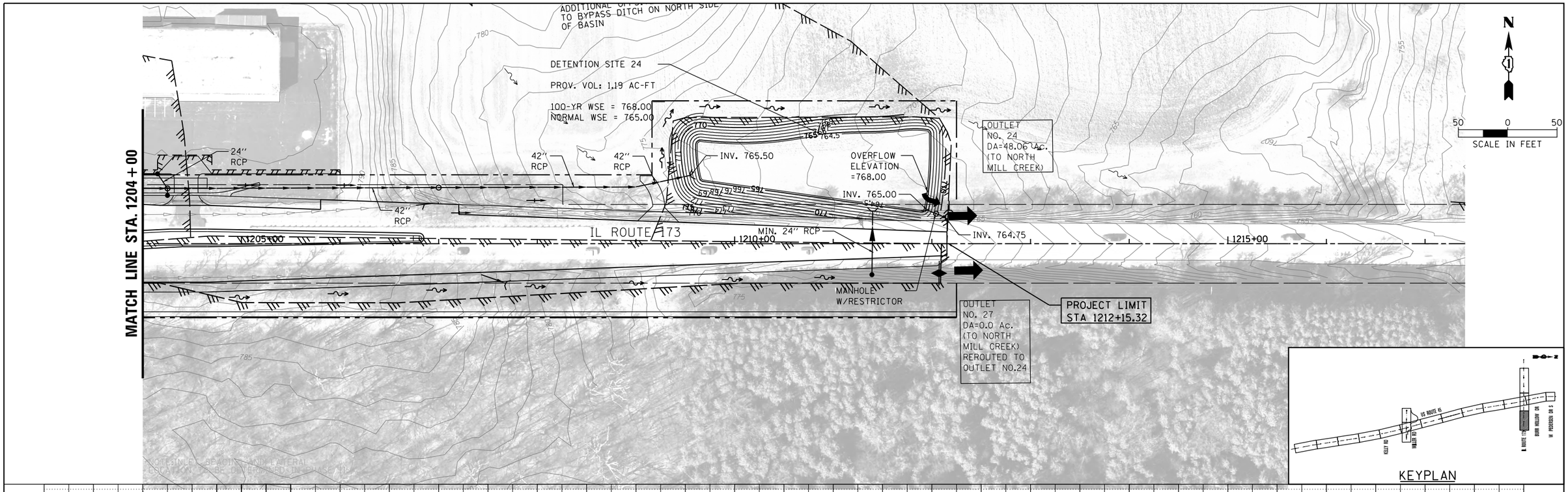
U.S. ROUTE 45 - DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

SCALE: 1" = 100' | SHEET 17 OF 18 SHEETS | STA. 1182+00 TO STA. 1194+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	17

CONTRACT NO.

ILLINOIS FED. AID PROJECT



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

U.S. ROUTE 45 – DRAINAGE PLAN AND PROFILE
MILBURN BYPASS TO IL ROUTE 173

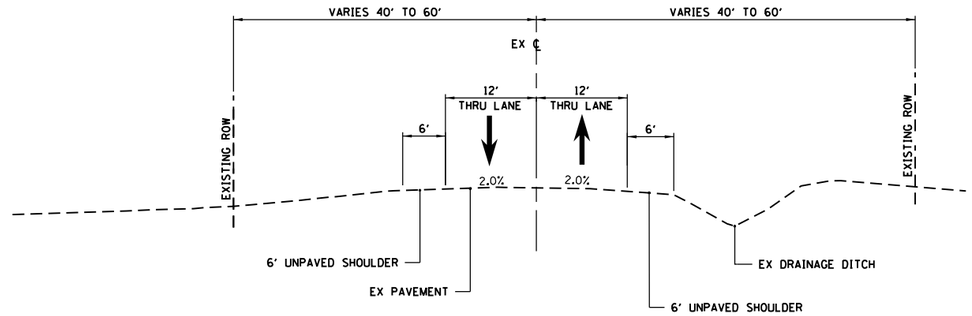
SCALE: 1" =100' | SHEET 18 OF 18 SHEETS | STA. 1203+00 TO STA. 1215+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0344	05-00262-06-RO	LAKE	18	18

CONTRACT NO.

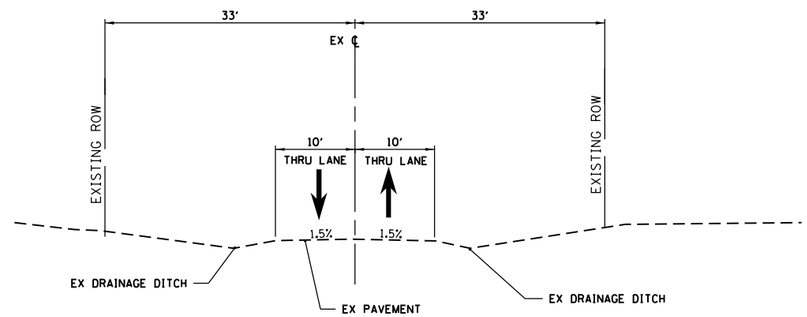
ILLINOIS FED. AID PROJECT

TYPICAL CROSS SECTIONS
EXHIBIT 2-01



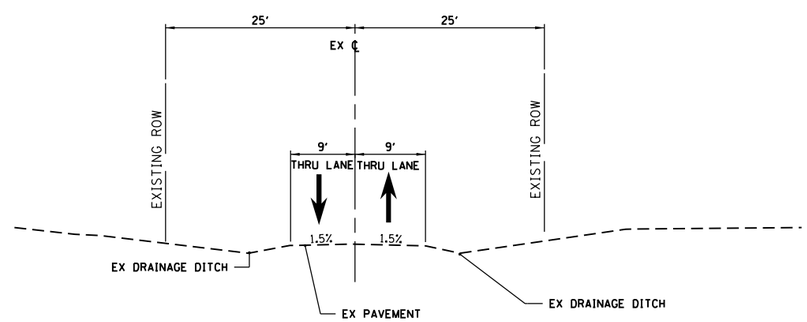
U.S. ROUTE 45

STA. 223+50 TO STA. 312+82



MILLER ROAD

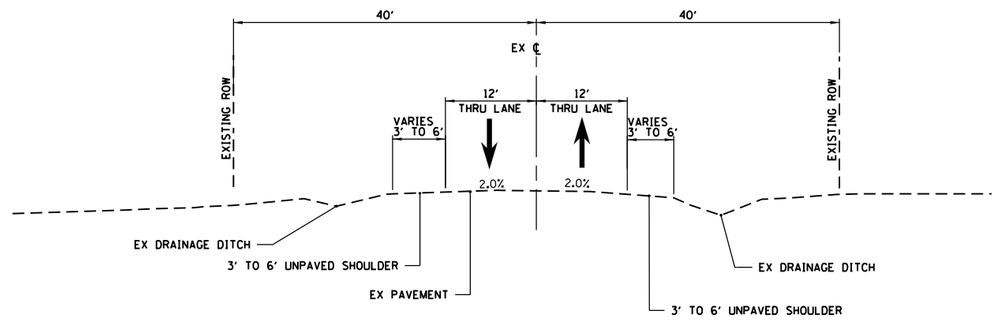
STA. 1990+48 TO STA. 1999+00



MILLER ROAD

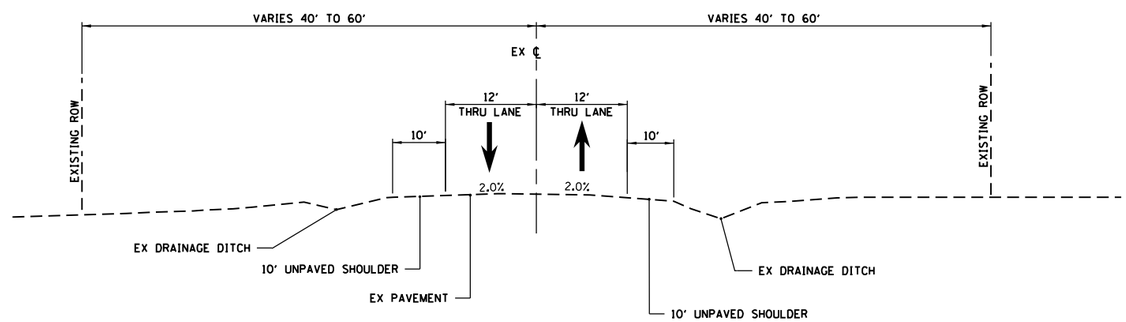
STA. 2100+00 TO STA. 2006+25

FILE NAME = N:\Idot\100063\CADD_Sheets\P138810_N-sht	USER NAME = psantos	DESIGNED - JA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	EXISTING TYPICAL SECTIONS U.S. ROUTE 45 /MILLER ROAD			F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	typical-003.dgn	DRAWN - TOM	REVISED -					0344	05-00262-06-R0	LAKE	24	3
	PLOT SCALE = 20'	CHECKED - MJH	REVISED -							CONTRACT NO.		
	PLOT DATE = 12/5/2017	DATE - 05/20/2016	REVISED -		SCALE: N.T.S.	SHEET NO. 3 OF 24 SHEETS	STA. TO STA.		ILLINOIS FED. AID PROJECT			



IL ROUTE 173

STA. 1184 + 85 TO STA. 1188 + 25
STA. 1208 + 25 TO STA. 1212 + 15



IL ROUTE 173

STA. 1188 + 25 TO STA. 1208 + 25

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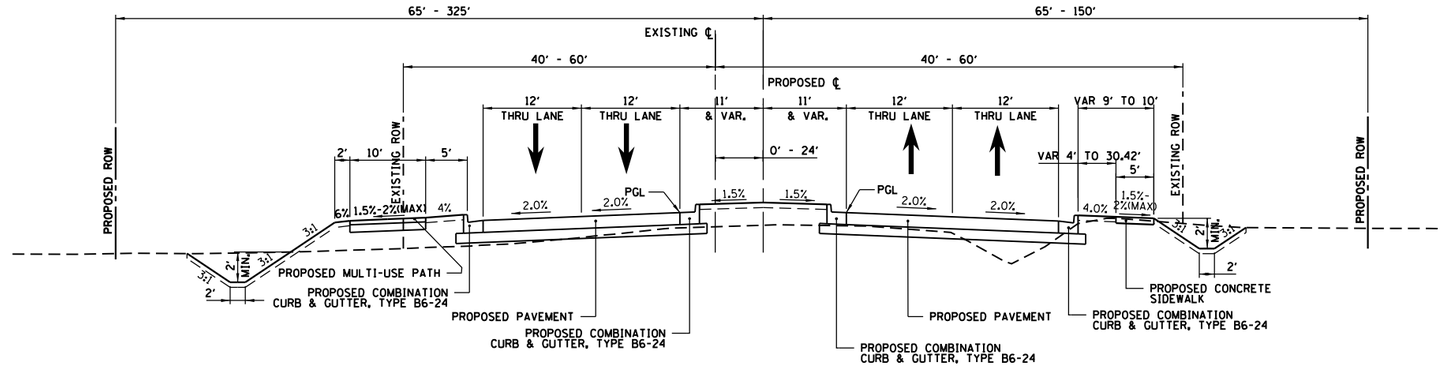
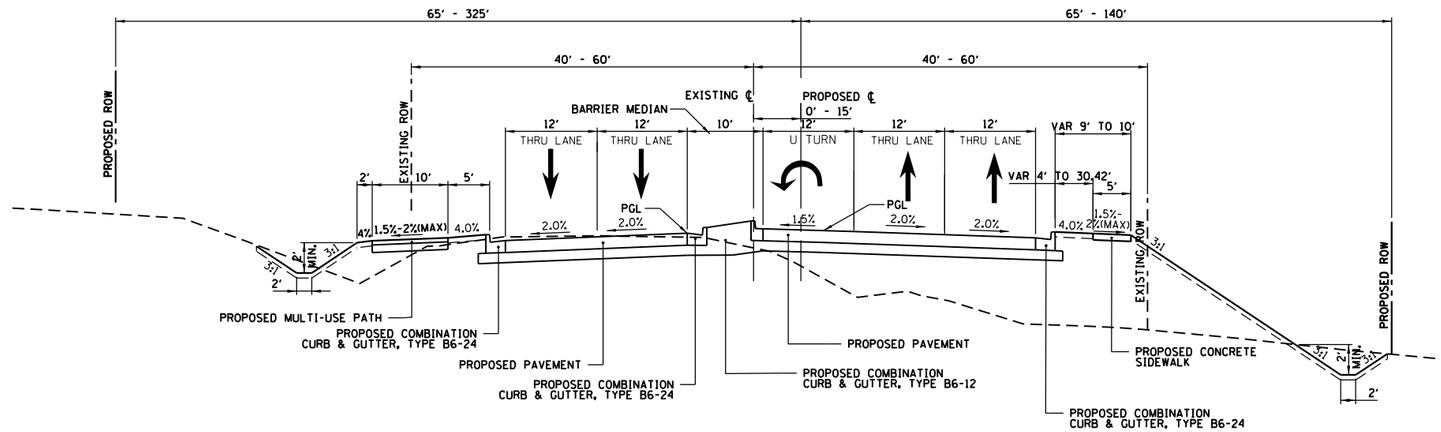
	PLOT DATE = 12/5/2017	DATE - 05/20/2016	REVISED -		SCALE: N.T.S. / SHEET NO. 4 OF 24 SHEETS / STA. / TO STA.		ILLINOIS	FED. AID PROJECT		



U.S ROUTE 45

STA. 175 + 00 TO STA. 183 + 85
STA. 193 + 25 TO STA. 196 + 45
STA. 205 + 85 TO STA. 210 + 35
STA. 220 + 76 TO STA. 222 + 58
STA. 234 + 54 TO STA. 243 + 05
STA. 248 + 10 TO STA. 256 + 75
STA. 261 + 80 TO STA. 277 + 32
STA. 287 + 17 TO STA. 296 + 15



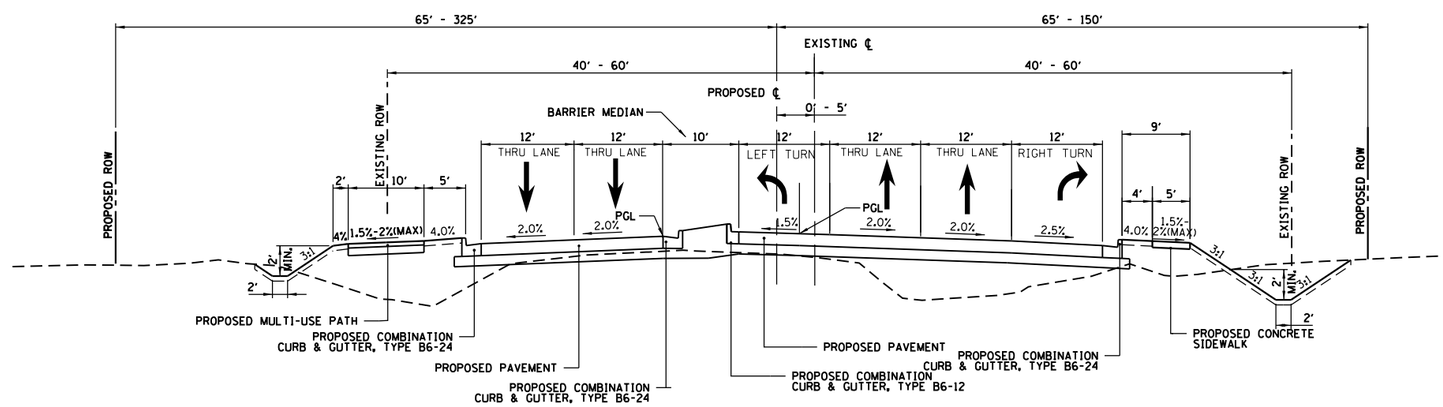
U.S. ROUTE 45 (U TURN)

NB

STA. 185 + 05 TO STA. 187 + 20
STA. 198 + 65 TO STA. 199 + 80
STA. 245 + 25 TO STA. 247 + 40
STA. 279 + 52 TO STA. 281 + 68

SB

STA. 189 + 90 TO STA. 191 + 05
STA. 202 + 50 TO STA. 203 + 65
STA. 257 + 45 TO STA. 259 + 60
STA. 282 + 82 TO STA. 284 + 97



U.S. ROUTE 45 AT MILLER ROAD INTERSECTION (LEFT TURN)

NB

STA. 212 + 56 TO STA. 214 + 71
STA. 226 + 38 TO STA. 228 + 53

SB

STA. 215 + 88 TO STA. 218 + 03
STA. 229 + 90 TO STA. 232 + 06

FILE NAME = N:\Idot\100063\CADD_Sheets\P138810_N-sht typical-005.dgn	USER NAME = psantos	DESIGNED - JA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS U.S. ROUTE 45			F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		DRAWN - TOM	REVISED -					344	05-00262-06-R0	LAKE	24	5
	PLOT SCALE = 20'	CHECKED - MJH	REVISED -							CONTRACT NO.		
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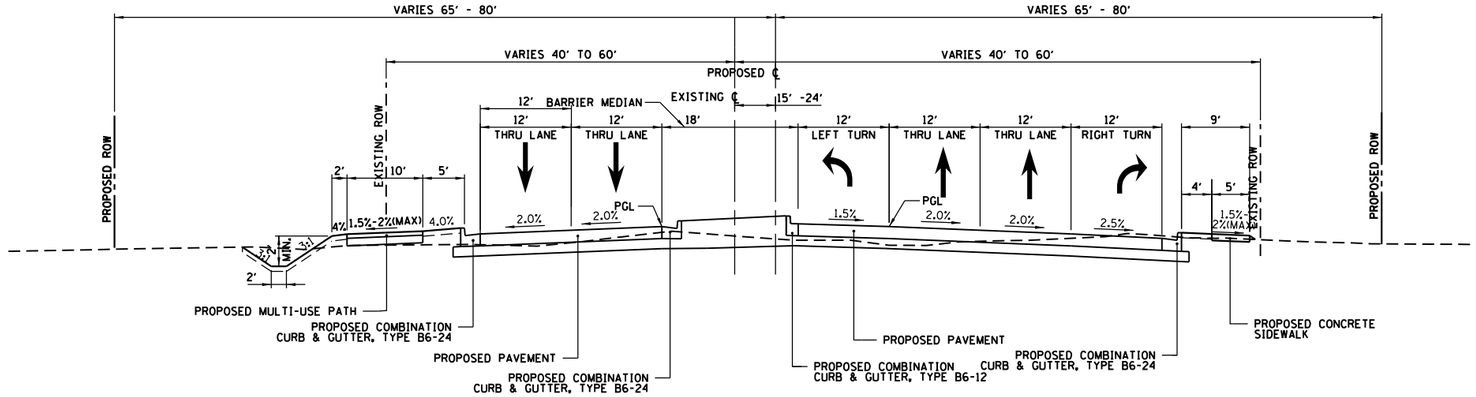
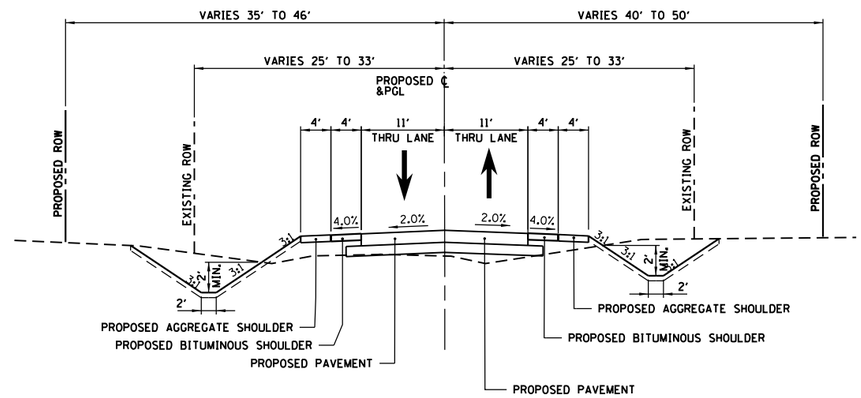


U.S. ROUTE 45 AT IL 173 INTERSECTION (LEFT TURN)

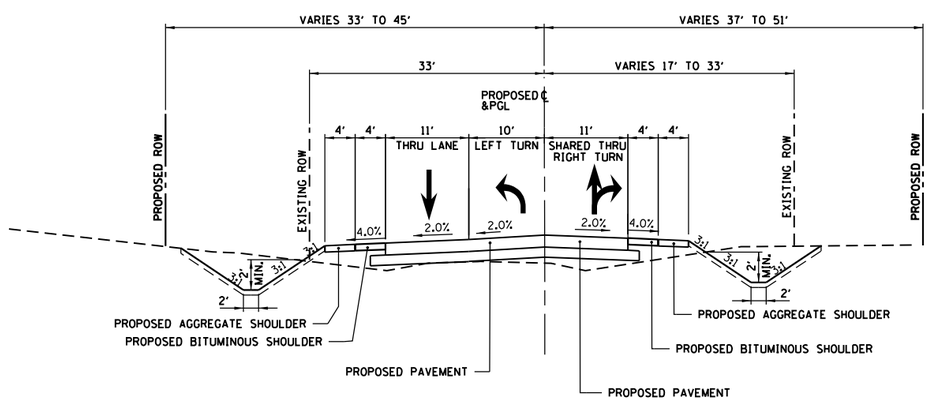
NB
STA. 293 + 13 TO STA. 296 + 16

SB
STA. 298 + 18 TO STA. 301 + 20



MILLER ROAD

STA. 1990 + 48 TO STA. 1994 + 85
STA. 2003 + 40 TO STA. 2006 + 25



MILLER ROAD AT US 45 INTERSECTION (LEFT TURN)

STA. 1994 + 85 TO STA. 1999 + 25
STA. 2000 + 65 TO STA. 2003 + 40

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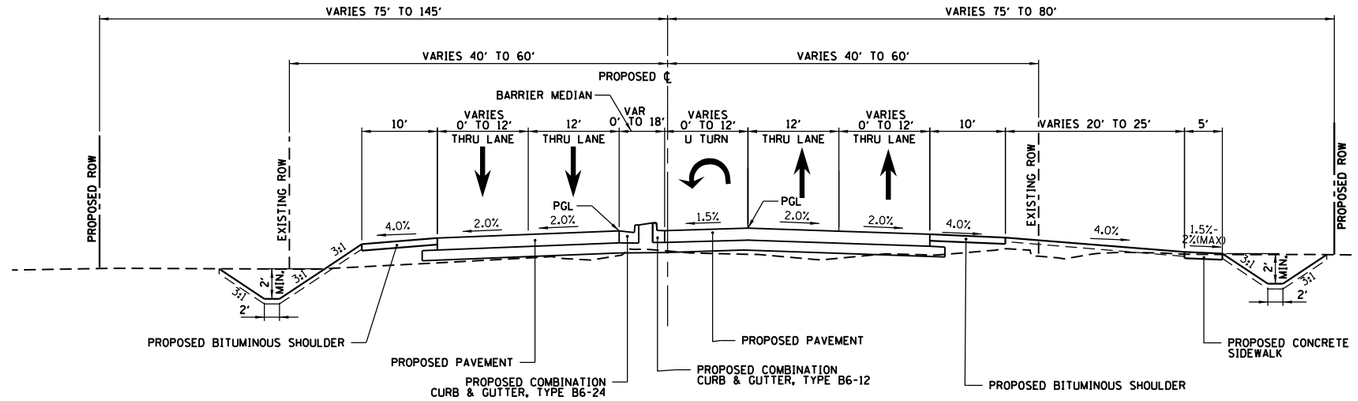
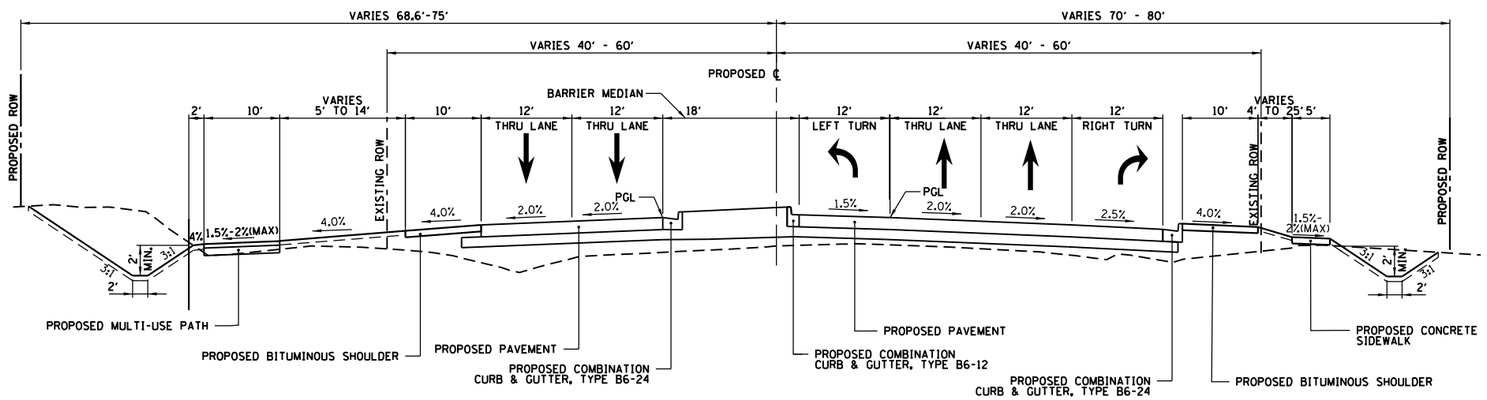
		DRAWN - TOM	REVISED -					344	05-00262-06-R0	LAKE	24	6
	PLOT SCALE = 20'	CHECKED - MJH	REVISED -							CONTRACT NO.		
	PLOT DATE = 12/5/2017	DATE - 05/20/2016	REVISED -		SCALE: N.T.S.	SHEET NO. 6 OF 24 SHEETS	STA. TO STA.		ILLINOIS	FED. AID PROJECT		



STA. 1184 + 85 TO STA. 1195 + 22
STA. 1201 + 79 TO STA. 1212 + 15

IL ROUTE 173 AT INTERSECTION (U TURN)



STA. 1195 + 22 TO STA. 1197 + 65
STA. 1199 + 36 TO STA. 1201 + 79

IL ROUTE 173 AT INTERSECTION (LEFT TURN)

FILE NAME =	USER NAME = psantos	DESIGNED - JA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS IL ROUTE 173			F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
N:\Idot\100063\CADD_Sheets\P138810_N-sht typical-007.dgn		DRAWN - TOM	REVISED -					344	05-00262-06-R0	LAKE	24 / 7
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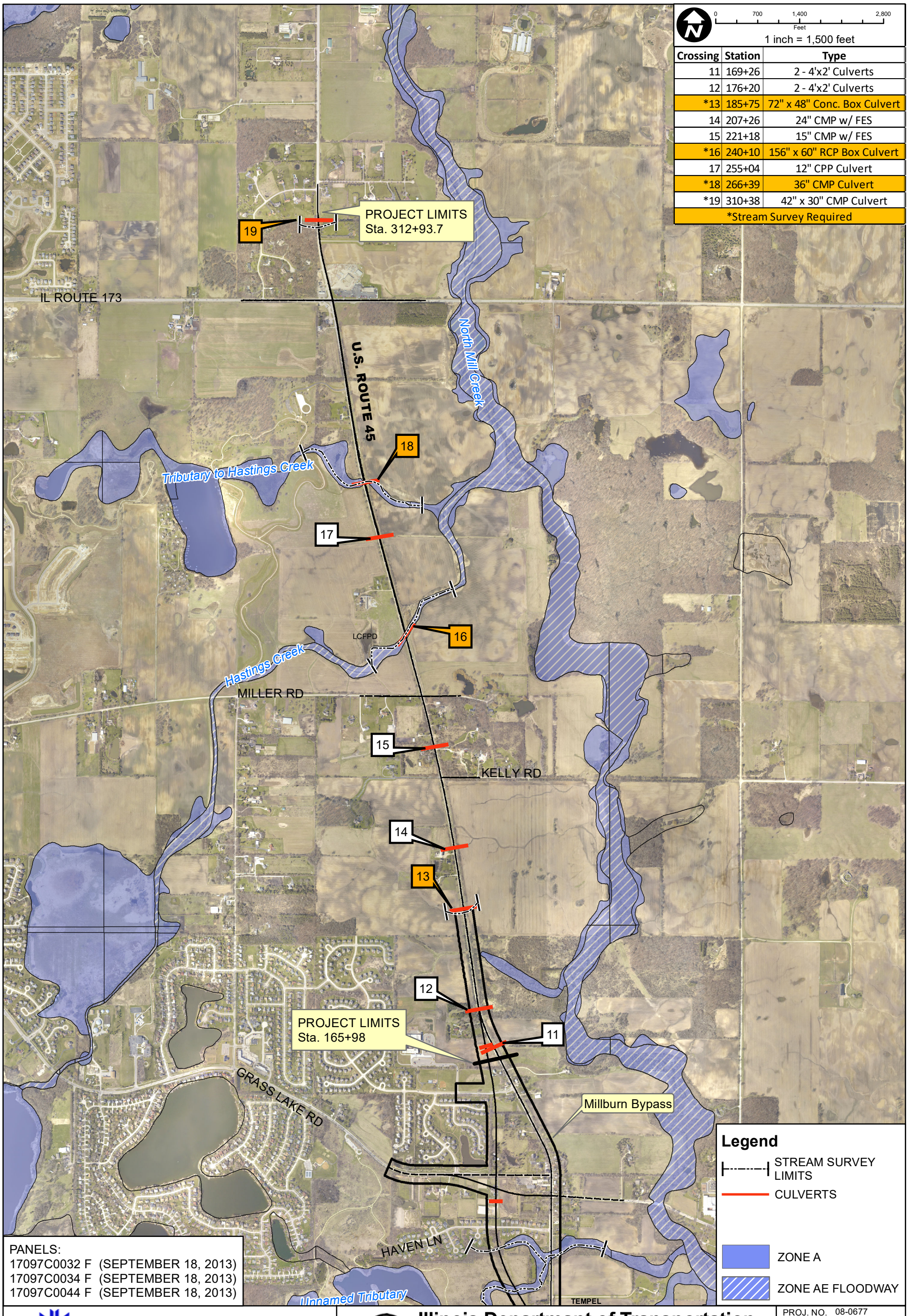
	PLOT DATE = 12/5/2017	DATE - 05/20/2016	REVISED -		SCALE: N.T.S.	SHEET NO. 7 OF 24 SHEETS	STA. TO STA.		ILLINOIS FED. AID PROJECT		

DRAINAGE CROSSING LOCATIONS
EXHIBIT 2-02a



Crossing	Station	Type
11	169+26	2 - 4'x2' Culverts
12	176+20	2 - 4'x2' Culverts
*13	185+75	72" x 48" Conc. Box Culvert
14	207+26	24" CMP w/ FES
15	221+18	15" CMP w/ FES
*16	240+10	156" x 60" RCP Box Culvert
17	255+04	12" CPP Culvert
*18	266+39	36" CMP Culvert
*19	310+38	42" x 30" CMP Culvert
*Stream Survey Required		

PANELS:
17097C0032 F (SEPTEMBER 18, 2013)
17097C0034 F (SEPTEMBER 18, 2013)
17097C0044 F (SEPTEMBER 18, 2013)

LakeCounty
Division of Transportation
600 W Winchester Rd Libertyville, Illinois 60048

Illinois Departmant of Transportation
201 West Center Court
Schaumburg, IL 60196

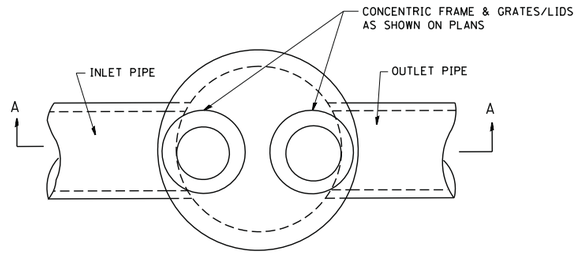
TITLE:
DRAINAGE CROSSING LOCATIONS

DSGN.			SCALE:	1"= 2,500'
DWN.			GIS USER	MHAYES
CHKD.			PLOT DATE	
FILE:				

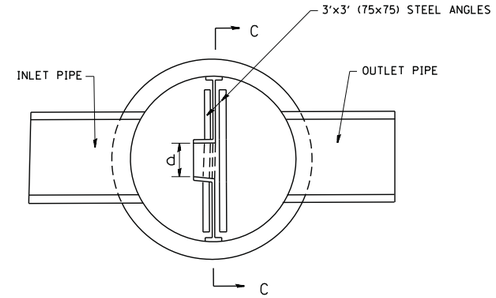
PROJ. NO. 08-0677
DATE: 04-04-2011
SHEET 1 OF 1
DRAWING NO.
EXH 2-02a

Path: N:\dot\100063\GIS\Exhibits\Study Limits FIRM and Culvert Map NORTH.mxd
Date: 3/2/2018 Time: 11:46:18 AM

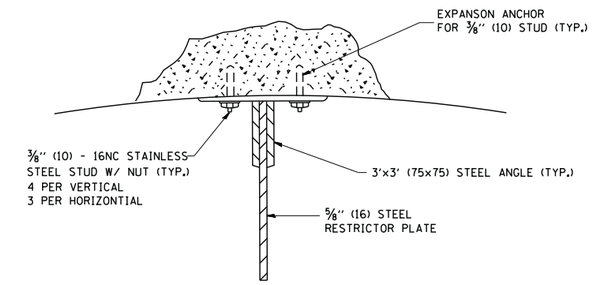
CONTROL STRUCTURE SCHEMATIC
EXHIBIT 2-03a



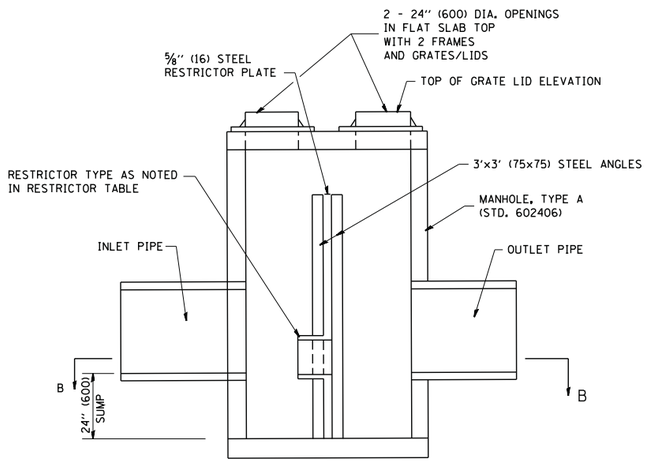
PLAN



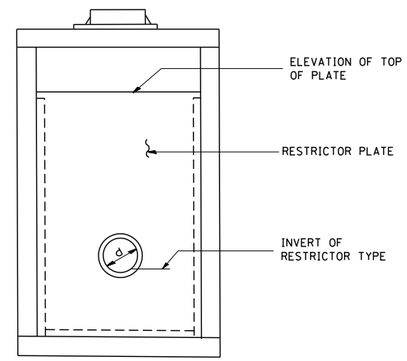
SECTION B-B



ANGLE FASTENER DETAIL



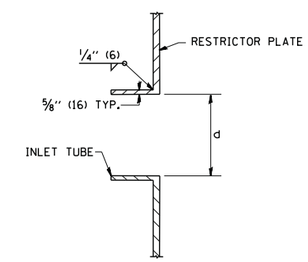
SECTION A-A



SECTION C-C

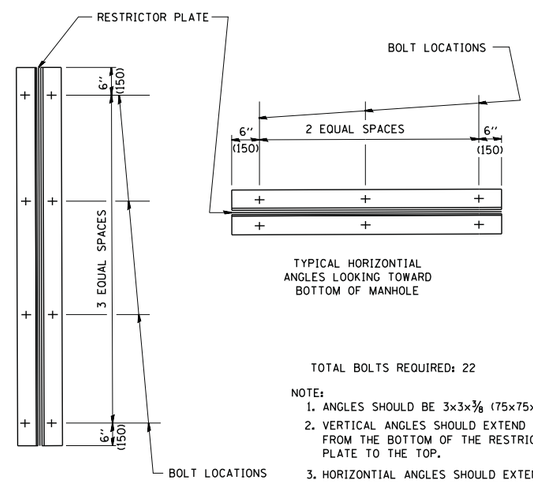
NOTES:

1. ALL STEEL ANGLES AND PLATES TO BE GALVANIZED AFTER FABRICATION.
2. ALL RESTRICTOR PLATES, ANGLES AND HARDWARE TO BE INCLUDED IN THE COST OF THE MANHOLE.
3. BASIS OF PAYMENT: "MANHOLES ,TYPE A, 6 FT. (1.8 m)-DIAMETER, TYPE 1 FRAME, CLOSED LID, RESTRICTOR PLATE" EACH



INLET TUBE DETAIL

STATION	MANHOLE DIAMETER	FRAME AND GRATE	RESTRICTOR TYPE	INSIDE RESTRICTOR TYPE DIAMETER in. (mm) (d)	INVERT OF RESTRICTOR TYPE	ELEVATION OF TOP OF PLATE OVERFLOW
186+54 Basin 13	6'	Type 1 Frame,CL	Type 2 or 3	12.6" (320.04)	729.00	732.00
207+50 Basin 14	6'	Type 1 Frame,CL	Type 2 or 3	11.0" (279.40)	757.00	760.50
228+00 Basin 15	6'	Type 1 Frame,CL	Type 2 or 3	11.6" (294.64)	764.00	767.50
245+15 Basin 16	6'	Type 1 Frame,CL	Type 2 or 3	7.0" (177.80)	746.00	751.50
268+15 Basin 18	6'	Type 1 Frame,CL	Type 2 or 3	15.4"(391.16)	748.00	754.00
309+00 Basin 19	6'	Type 1 Frame,CL	Type 2 or 3	9.6" (243.84)	780.00	783.00
1211+00 Basin 24	6'	Type 1 Frame,CL	Type 2 or 3	16.8" (476.72)	765.00	768.00



TYPICAL VERTICAL ANGLES
LOOKING TOWARD MANHOLE WALL

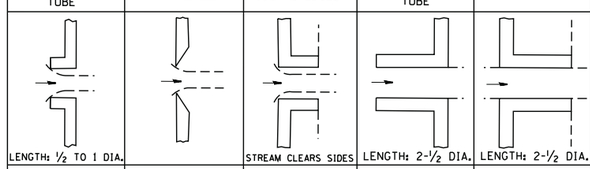
TYPICAL HORIZONTIAL
ANGLES LOOKING TOWARD
BOTTOM OF MANHOLE

TOTAL BOLTS REQUIRED: 22

NOTE:

1. ANGLES SHOULD BE 3x3x3/8 (75x75x75)
2. VERTICAL ANGLES SHOULD EXTEND FROM THE BOTTOM OF THE RESTRICTOR PLATE TO THE TOP.
3. HORIZONTIAL ANGLES SHOULD EXTEND FROM VERTICAL ANGLE TO VERTICAL ANGLE.

STEEL ANGLE BOLTING DETAILS

RESTRICTOR TYPE					
1	2	3	4	5	6
RE-ENTRANT TUBE	SHARP EDGED	SQUARE EDGED	RE-ENTRANT TUBE	SQUARE EDGED	ROUNDED
					
LENGTH: 1/2 TO 1 DIA.		STREAM CLEARS SIDES	LENGTH: 2-1/2 DIA.	LENGTH: 2-1/2 DIA.	
C=.52	C=.61	C=.61	C=.73	C=.82	C=.98

VALUES OF "C" FOR CIRCULAR
AND SQUARE ORIFICES

ALL DIMENSIONS ARE IN INCHES (MILLIMETERS) UNLESS OTHERWISE SHOWN.

FILE NAME = Wi\diststd\22x34\bd12.dgn	USER NAME = gaglianobt	DESIGNED - R. SHAH	REVISED - R. SHAH 10-25-94	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	MANHOLE WITH RESTRICTOR PLATE	F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
		DRAWN -	REVISED - E. GOMEZ 08-28-00						
	PLOT SCALE = 50.000 ' / IN.	CHECKED -	REVISED - M. GOMEZ 01-08-01			BD600-04	(BD-12)	CONTRACT NO.	
	PLOT DATE = 1/4/2008	DATE - 09-09-94	REVISED -		SCALE: NONE / SHEET NO. 1 OF 1 SHEETS / STA. / TO STA.	FED. ROAD DIST. NO. .	ILLINOIS	FED. AID PROJECT	

TAB C

5-00 Appendix C: Correspondence

1. Meeting Minutes, CBBEL meeting with IDOT, July 5, 2011.
2. Flooding records, Various Date
3. Agenda Item # 20, October 24, 2012.
4. Agenda Item # 2, December 5, 2012.
5. Meeting Minutes, CBBEL meeting with IDOT, April 30, 2013.

MINUTES OF MEETING

DATE:	July 5, 2011
MEETING DATE/TIME:	June 30, 2011; 2:00 p.m.
LOCATION:	Illinois Department of Transportation
SUBJECT:	US Route 45; IL Route 132 to IL Route 173 Lake County PTB 155-011 / P-91-388-10 Phase I Study-Kickoff Meeting
ATTENDEES:	See attached sign-in sheet

The purpose of this meeting was to initiate the Preliminary Engineering and Environmental Study (i.e.; Phase I Study) for US Route 45 from IL Route 132 to IL Route 173 in Lake County. A handout was provided to all meeting attendees which included the following information:

- Meeting Agenda
- Project Organization Chart
- Negotiated Scope of Work
- Bar Chart Project Schedule

Full authorization to proceed was received on May 11, 2011 subsequent to a previous Start-Up authorization for survey work. The proposed scope of work for the proposed improvement includes reconstruction of US Route 45 within the project limits to add one through lane in each direction (from one to two through lanes in each direction) as stipulated in the project Purpose and Need statement developed as part of the Environmental Assessment (EA) being prepared as part of the Lake County Division of Transportation (LCDOT) Millburn Bypass project. This Phase I Study will complete the Combined Design Report and Location Drainage Study for the sections of US Route 45 outside of the Millburn Bypass study area. As/if required, this Phase I Study will also include an addendum to the EA prepared as part of the LCDOT study which is anticipated to be concluded in advance.

The meeting began with introductions of IDOT personnel and CBBEL's project team. Marie Glynn is the IDOT Project Manager. Karla Mykytiuk is the IDOT Project Engineer and will be the lead contact for IDOT. Mike Matkovic, PE is the CBBEL Project Manager and Marty Worman, PE is the CBBEL Asst Project Manager and will be assisted by Matt Huffman, PE as the Project Engineer. Marty Worman will serve as the primary day-to-day CBBEL contact for this project, with Mike Matkovic and Matt Huffman being available in Marty's absense. Pete Knysz of CBBEL will prepare the environmental documentation and Chin Wang will be the lead in drainage coordination.

As regards subconsultants, _____

AES/MPDP
- Signed copy of MPDP due

Subconsultant Agreements
- Copies to Marie due

Scope Highlights

Schedule

Near Term Work

Counts and O/D
- Meetng with McAvoy

Data Collection
- HSIP Hot Spots
- Crash Data
- Permits/Lindenhurst Development

Admin/Record
- List of deliverables already completed with LCDOT study to IDOT
- Send everything as PDF for Admin Record

Meeting concluded at approximately 3:30 p.m.

Minutes Submitted by: Mike Matkovic, PE – CBBEL

cc: File; All Meeting Attendees

N:\Idot\100063\Admin\Kickoff Meeting Minutes_063011.doc

US Route 45; IL Route 132 to IL Route 173
Lake County – P-91-388-10

SIGN-IN SHEET

MEETING PURPOSE: Kick-Off Meeting
MEETING DATE: June 30, 2011
MEETING TIME: 2:00 p.m.
MEETING LOCATION: IDOT Executive Conference Room

ATTENDEES:

Signature	Representing	Email
1. Mike Matko	CBBEL	MMATKOVIC@CBBEL.COM
2. C. Mykytiuk	IDOT	carla.mykytiuk@illinois.gov
3. J Gnotenco	RWA	jgnatenco@rwaeng.news.com
4. MOHAMMED SALEEM	AES SERVICES	msaleem@aesser.com
5. STEVE PASNSKI	Thomas Eng. Group	steve.p@thomas-engineering.com
6. JASON SALLEY	IDOT / GEO UNIT	JASON.SALLEY @ILLINOIS.GOV
7. MARIE GLYNN	IDOT Extension Staff/Progr.	marie.glynn@illinois.gov
8. MARTIN WORMAN	CBBEL	MWORMAN@CBBEL
9. mehdi geramirezad	IDOT	mehdi.geramirezad@illinois.gov
10. Chinliang Wang	CBBEL	cwang@cbbel.com
11. JOHN BACZEK	IDOT	john.baczek@illinois.gov
12.		
13.		
14.		
15.		

2006 District One Pavement Flooding Prioritization

Arterial Routes

2005 RANK	2004 RANK	MARKED ROUTE	NAMED ROUTE	LOCATION	MUNICIPALITY	COUNTY	PUMP STA NO	1987 thru 1989	1990 thru 1994	1995 thru 1999	1985 thru 2001	2002	2003	2004	2005	2006	TOTAL	CURRENT AVERAGE DAILY TRAFFIC	TRAFFIC COUNT DATE	INITIAL RANKING (ADT x OCC) / 1000	LAST DATE FLOODED	COMMENTS	1	2	3	4+5
WL	WL	U.S. ROUTE 45	MUNDELIEN ROAD	AT ILLINOIS ROUTE 173 (S/O)	ANTIOCH TWSP	LAKE								1			1	8800	2003	8.80	05/22/04		05/22/04			
57	76	U.S. ROUTE 45		AT ILLINOIS ROUTE 137 (roadway viaduct)	LIBERTYVILLE	LAKE			1	2	4			1			5	28400	2003	142.00	05/18/04		09/02/92	05/20/96	02/19/95	6/9/2008
125	136	U.S. ROUTE 45		AT 195TH STREET TO 198TH STREET	FRANKFORT	WILL					1			1			2	26100	2003	52.20	05/30/04		02/08/01	05/30/04		12/27/20
173	190	U.S. ROUTE 45		AT MANHATTAN-MONEE ROAD TO 1 MI SOUTH	GREEN GARDEN TWSP	WILL			1		1		1	1			3	4750	2003	14.25	06/12/04		11/28/90	11/18/03	06/12/04	
WL	WL	U.S. ROUTE 45		AT PETERSON ROAD TO WINCHESTER ROAD	LIBERTYVILLE	LAKE				3	5						5	23900	2003	119.50	10/13/01		06/06/96	05/17/96	04/16/98	
WL	WL	U.S. ROUTE 45		AT LYNDALE STREET (N/O Illinois Route 176)	MUNDELIEN	LAKE			1	1	4						4	21900	2005	87.60	10/13/01		01/27/94	07/23/99	05/11/01	
WL	WL	U.S. ROUTE 45		AT DIVISION STREET (N/O)	MUNDELEIN	LAKE			3		3						3	27500	2008	82.50	06/19/93		03/27/91	09/14/91	06/19/93	
WL	WL	U.S. ROUTE 45		AT RAINEY (METRA STATION s/o EVERGREEN DRIVE)	VERNON HILLS	LAKE				3	4						4	17600	2005	70.40	10/23/01		01/22/99	10/23/01	05/20/96	
WL	WL	U.S. ROUTE 45		ILLINOIS ROUTE 21 TO BUTTERFIELD	VERNON HILLS	LAKE				1	1						1	33900	2005	33.90	02/21/97		02/21/97			
WL	WL	U.S. ROUTE 45		AT PRAIRIE (TO DEERPATH)	VERNON HILLS	LAKE				2	2						2	15800	2005	31.60	06/18/96		06/18/96	05/20/96		
WL	WL	U.S. ROUTE 45		AT ILLINOIS ROUTE 173 (3/10 MILE SOUTH)	ANTIOCH TWSP	LAKE				3	3						3	8500	2005	25.50	04/23/99		07/18/96	06/16/97	04/23/99	
WL	WL	U.S. ROUTE 45		AT CORPORATE WOODS PARKWAY	VERNON HILLS	LAKE					1						1	19000	2004	19.00	10/23/01		10/23/01			
WL	WL	U.S. ROUTE 45		AT E/O ILLINOIS ROUTE 83	LONG GROVE	LAKE					1						1	14800	2003	14.80	10/13/01		10/13/01			
WL	WL	U.S. ROUTE 45		AT SAND LAKE ROAD	LAKE VILLA TWP	LAKE					1						1	13200	2003	13.20	05/18/00		05/18/00			

ILLINOIS DEPARTMENT OF TRANSPORTATION
DISTRICT ONE
OPERATIONS AND COMMUNICATIONS CENTER
INCIDENT REPORT

DATE:	DAY:	TIME: am/pm	INFORMANT:
16 June 1997	Monday	0135	Lake County Sheriff / Leo

SUBJECT: Standing water/Requesting Sign

CONGESTION LIMITS DUE TO INCIDENT:

LOCATION: US 45 3/10 s/o Ill 173

COUNTY: LAKE

LOAD AND WEIGHT (Metal Coils) COMMERCIAL MCS #:

public + media check row	HAR on off	CRT on off	DOT-INFO on off	CMS on off	time on	time off

DETAILS IN CHRONOLOGICAL ORDER

TIME (am/pm)

0135/Received the above call from the above
0136/Called Mr. Hart at his residence, he advised me that he was off call at midnight, said that I would go to next man on list, Mr.McDonald. Mr. Hart advised me that he was off today.
0141/Received a call from Antioch P.D requesting signs also at Grand Ave e/o Sand Lake Rd. Received additional calls from Lake County with more locations.
0143/Callrf Mr. Rekar at his residence and advised him that I had atleast 5 calls for signs.

Additional locations are:
Grand Ave. at Deep Lake Rd
Ill 59 n/o Grand Ave
Ill 83 by Beach Grove Rd.

0340/RC244 advises that that lane 2 in both directions is closed because of high water. Barridades are in place.
0345/RC244 advises that the water has gone down at Grand e/o Sand Lake/no signs needed.
0356/RC244 advises water is down at Ill 59 n/o Ill 132, no signs needed.
0:54 AM - Control was advised by RC244 that Grand Ave. east of Deep Lake - Lane 2 in both directions was open. Also, Rte. 83 near Beach Grove the southbound lane has water on the pavement for 150' and has been signed.

NOTIFICATION CHECK LIST (print below in black or dark blue ink only)

NOTIFICATION - 1(who) _____ TIME: _____ am/pm

	N - notified, P - page AP - alpha-page	Time of First call	Time of Update	Time Cleared
Lafeta				
Fonda				
McDermott				
LA/MJ/JT				

FAX TO SPFLD. (TIME)

	N - notified, P - page AP - alpha-page	Time of First call	Time of Update	Time Cleared
Jonak				
Smith				
Schmidt				

DNA

VEHICLE INFO:
PLATE # STATE:
DRIVER/OWNER NAME:
ADDRESS: STATE:

DNA

ID/ACCIDENT REPORT or BADGE # | E.M.C. NAME and # | DATE + TIME

CLEARED DATE: 6/17/97 NAME: Tony Rekar FROM: Lake County TIME: 9:30 am INITIALS: LEL

COPIES SENT TO:
Fitzgerald, Fonda, McDERMOTT, SABOURIN, WANH

ComSpecialist(s) jd

INCIDENT REPORT
97 - 2637

ILLINOIS DEPARTMENT OF TRANSPORTATION
DISTRICT ONE
OPERATIONS AND COMMUNICATIONS CENTER

*** FLOODING ***

DATE: 5/22 DAY: SAT PAGE: 1 OF:

DISP INIT	INFORMANT TIME REC'D	LOCATION OF FLOODING CONDITION	LANE #'S	EST. DEPTH	PASSABLE (YES/NO)	PUMP STATION? NOTIFY ELEC. CONT.- NAME,COMPANY,TIME	MAINT. NOTIFIED YARD,PERSON,TIME	VERIFIED (NAME)	TIME/DATE & DISP.
JMB	#206 Gurnee PD 12:37A	US41/IL132	all	?	Yes		Frank Torrez Gurnee Yd 2:47A	No work	3:30A 5/22
JMB		Belle Plaine/IL132	all		~~No~~				
	1:08A	IL132/1st St NCIN = "0"	all	?	No	EB open 6:06A	Rdd Lay PD IDOT 3:20AM RC214 1:08A	WBlane RC214	open 5:57A 5/22 JMB
JAB	#1764 LK Co PD 1:31A	US45 S of IL173 CIO = 277	all	?	yes		Greg Barham Gurnee 2:01A	No work Greg G	3:17A 5/22 JMB
	#1697 McHenry Co 1:34A	EB IL120 E of KENT Kent Rd	all EB	?	yes		Mr Barch Wdst Yd 2:03A	WOP sign up Richard Barch	3:03A 5/22 JMB
JMB	#1357 McHenry Co 2:18A	EB IL176 @ Buehl Rd Buhl Rd, Cry Lk	all	?	yes		2:19A	WOP sign up RC274	3:22A 5/22 JMB
JMB	RC274	EB IL120 @ Hill Rd	all	?	yes				
JMB	RC216	NB US41 N of IL176 (JET+E rad)	12 NB		yes			WOP sign up RC216	3:18A 5/22 JMB
JMB	Gurnee PD 3:17A	IL137 1mi S of IL83	all		yes		RC244 3:12A (already out)	WOP sign up RC244	3:38A 5/22 JMB
JMB	RC216 3:38A	SB Old Skokie Rd @ Edwards Rd	L1-2 SB		yes			WOP sign up RC216	3:38A 5/22 JMB
JMB	RC216 3:58A	IL173/Delany Rd	all		yes			WOP sign up RC216	3:58A 5/22 JMB

COPIES TO: FITZGERALD, TYSZKIEWICZ, STUMPNER, VAITLA, WOJCIK.

2004

BLT 03/21/02

ILLINOIS DEPARTMENT OF TRANSPORTATION
DISTRICT ONE
OPERATIONS AND COMMUNICATIONS CENTER

5
BLT

*** FLOODING ***

DATE: 6/09 DAY: MONDAY PAGE: OF:

DISP.INIT. / TIME	INFORMANT / NAME OR #	LOCATION OF FLOODING CONDITION	LANE #'S	EST. DEPTH	PASSABLE (YES / NO)	PUMP STATION / YES CONT.NAME / TIME	MAINT. NOTIFIED NAME / TIME	VERIFICATIONS NAME / TIME	VERIFICATIONS INIT / DATE
BLT 1200m	Lake County Sheriff #9720	SB RTE 41 @ 1mi N/O Beach (Beach Park)	standing water		YES		Jeff B GURNEE	RC 273 6:36A	8/9
BLT 1200m		SB RTE 41 @ S/O Wadsworth (Beach Park)	standing water		YES		Jeff B GURNEE	RC 273 6:38A	
BLT 1200m		RTE 41 @ S/O RTE 173 Both Dir	standing water		YES		@ GURNEE	#9720 LT 3:40A	6/9
BLT 1200m		RTE 45 @ 1/2 mi S/O RTE 173 Both Dir	standing water		YES		Rich B GRAYSLAKE	RC 242 4:28AM	BLT 6/09
BLT 1200m	#9720	RTE 132 @ btwn RTE 59 + Fairfield (Lake Villa, Caboose Park)	standing water		YES		Rich B GRAYSLAKE	RC 242 4:28 AM	BLT 6/09
CDF 12:25A	Dep. Chgo	EB Des Plaines	E-W All lns standing water		yes		12:33A Eisenhower MRI Deering	RC 455 SIGNS UP 4:42 AM	BLT 6/09
12:23A	#27 Kane Co	E/W IL 64 E of IL 47	all	?	1-1 RA RB		R. Sidwell St Charles	R. Sidwell 2:00A	6/9
2:44A	#1697 McHenry Co	IL 23 (N/S) btwn Collins Rd - River Rd	all	?	yes		J. Terrebrini Wood St	J. Terrebrini 2:44A	6/9
1:17A	#130 Rd Lk Bch	NB IL 53 btwn Monaville Rd - Hook Rd	all	?	NB YES SB No		Rich B GRAYSLAKE	RC 242 SIGNS UP 4:39 AM	BLT 6/09
2:17A	Dennis Lindenhurst	WB IL 132 @ Victory Dr (E/O DEEP LAKE RD)	L4	8-10"	NO		Rich B GRAYSLAKE	RC 242 SIGNS UP 4:28 AM	BLT 6/09

COPIES TO: FITZGERALD, IACULLO, STUMPNER, VAITLA, WOJCIK.

2008

S/FORMS/DAILY/TREFIC

BLT 03/21/02

ILLINOIS DEPARTMENT OF TRANSPORTATION
DISTRICT ONE
OPERATIONS AND COMMUNICATIONS CENTER

WR

*** FLOODING ***

DATE: 12/27 DAY: SAT PAGE: 1 OF:

DISP.INIT. / TIME	INFORMANT / NAME OR #	LOCATION OF FLOODING CONDITION	LANE #'S	EST. DEPTH	PASSABLE (YES / NO)	PUMP STATION / YES CONT.NAME / TIME	MAINT. NOTIFIED NAME / TIME	VERIFICATIONS NAME / TIME	VERIFICATIONS INIT / DATE
DWL	PALOS	RT 83, E. OF SW HWY					RC 713	RC 716	GWO
11:05	HTS	UNDER RR VIADUCT			Y		ALSIP	11S	12/29
DWL	MUNDELEIN	3100 W. RT 60 (TARGET)					RC 242	Rich	J. Nob
11:07	PD	by IL 83 @ IL 60			Y		GRAYSLK	7:34A	12-30-08
DWL	KANE	IL 25 @ GILBERTS &					RC 539	RC 532	JB
11:37	CO.	IL 72/47/20			Y		ST. CHAR.	4:55	12/27
DWL	OAKLAND	143RD WB @					RC 713	Robert	J. Nob
11:46	PK.	VOLKS. RD.			Y		ALSIP	7:40A	12-30-08
DWL	LOCKPORT	RT 171 / STATE ~~@ between~~					RC 833	Calvin	J. Nob
11:56	PD	PARKVIEW & DAGGETT ~~BAGGETT~~.			Y		JOLIET	6:59A	12-30-08
DWL	LIBERTYVILLE	IL 173 @					RC 214	214	2:03
12:03	PD	DELANEY.			Y		GURNEE.	SIGNS OUT	DWL / closed.
DWL	LAKE CO.	RT 45 3/4 MI S.					RC 242	RC 244	HG
12:50	SHER.	RT. 173.			Y		GRAYLK.	1:02A	12-28-08
DWL	LILY	IL 64 W. RT. 47					RC 532	Ray	J. Nob
1:35	LK	IL 47 N. OF IL 64			Y		ST. CHARLES.	6:12AS	12-30-08
DWL	GRAYSLAKE	IL 137 between					RC 550	RC 244	HG
2:16	PD	CASEY & HARRIS.			Y		GRAYSLAKE	1:02A	12-28-08
DWL	NORTH CO.	IL 137 @ AMSTUTZ.					RC 214	Carabello	J. Nob
3:15	#3				Y		GURNEE.	6:37A	12-30-08

OPIES TO: FITZGERALD, IACULLO, STUMPNER, VAITLA, WOJCIK.

2008

3/FORMS/DAILY/TREFIC

BLT 03/21/02

AGENDA ITEM #20

US Route 45
IL Route 132 to IL Route 173
and Millburn Bypass
P-91-666-09
Lake County

October 24, 2012

This was the 13th presentation of this project. The previous presentation was on May 9, 2012. The purpose of this presentation was to discuss modifications to the previously submitted Environmental Assessment (EA) of U.S. Route 45 from IL Route 132 to IL Route 173 pertaining to the design and impacts associated with crossing of Millburn Creek and a Tributary to Millburn Creek and Back Channel. These design modifications occur within the Millburn Bypass (i.e.; the central section of the overall project). The EA describes that both of these creeks are delineated waters of the U.S. (WOUS) and mapped ADID. Based on this ADID designation, the EA further describes an objective to span both creeks to avoid placement of fill within the jurisdictional WOUS. However, based on further analysis and considering constructability, the required single span bridges would be longer and more expensive than desirable to avoid relatively minimal WOUS impacts. A memorandum was distributed to all attendees which summarized the proposed modifications to the EA and discussed in detail the design changes.

The design modifications to Millburn Creek include modifying the 60 feet long bridge to a three sided structure (open bottom) with a 42-ft span. The structure opening height will be eight feet from the stream bed. At the time of the wetland/waters delineations in August 2010, the creek depth was less than a foot and was approximately four feet wide. During the field surveys this year during drought condition, the crossing was dry as shown in the distributed memorandum.

As a result of this design modification, approximately 210 feet of Millburn Creek will need to be re-aligned or re-channelized within the proposed right-of-way to construct the three sided structure. This results in 0.02 additional acres of WOUS impacts. Due to the conversion from a bridge to a three sided culvert design at Millburn Creek, the roadway drainage from the south can be conveyed over the top of Millburn Creek via storm sewer and released at the main detention basin to the north within property already being acquired from the LCFPD. This eliminates the need for the previously proposed detention basin south of Millburn Creek, which eliminates the need for 0.67 acres of private property acquisition. The open bottom three sided culvert also allows for reinstating a meandering stream alignment as conceptually shown in the distributed memorandum.

The design modifications to the Tributary to Millburn Creek and Back Channel include modifying the 80 feet long bridge to two separate crossings. The main conveyance for the Tributary to Millburn Creek will be through two adjacent closed box culverts (a 10-ft x 6-ft cell for low flows, 4-ft x 6-ft cell for high/flood flows). The box culverts will be embedded a

depth of two feet, so the culverts will have approximately four feet from the stream bed elevation to the top of the culvert. At the time of the wetland/waters delineations in August 2010, the depth of the tributary and back channel was approximately one foot deep and ranged in width from 2 to 3 feet. A separate 4-ft x 6-ft closed box culvert is proposed 35-ft to the north for conveyance of the back channel. During the field surveys this year during drought condition, the crossing was dry as shown in the distributed memorandum.

Approximately 360 feet of the Tributary to Millburn Creek and the Back Channel will have to be re-aligned within the proposed right-of-way to construct the culverts. This results in 0.015 additional acres of WOUS impacts at each location (total 0.03 acres).

The modified crossings meet the hydraulic requirements at both locations and provide buffer areas for terrestrial wildlife passage for small to mid-size animals along the stream corridors. In addition, the modified crossings reduce private property impacts by eliminating the need for a separate detention basin south of Millburn Creek. The overall drainage plan for the Millburn Bypass meets IDOT and Lake County drainage requirements and maximizes the use of property already being acquired for the Millburn Bypass from the LCFPD for detention and water quality BMPs.

With the proposed design modifications, the following revisions to the EA will be required.

- Reduce right-of-way requirements by 0.67 acres resulting from elimination of detention pond south of Millburn Creek crossing
- Update EA text and tables to include the increase in WOUS impacts by 0.05 acres. The WOUS impacts (streams and wetlands) for the entire project from IL132 to IL173 would be increased from 0.61 acres to 0.66 acres.
- Updated EA text in multiple locations to reflect the modified proposed crossing type at both locations.

The IDOT District 1 Environmental Unit indicated that a regional permit will be sought based on these minor impacts. This project will be discussed at the upcoming Quarterly Resources Agency coordination meeting to seek their concurrence with the proposed stream crossings and that this qualifies for a regional permit. IDOT and FHWA concurred with this approach contingent upon the results of the resource agency meeting

Matt Huffman - CBBEL
Marie Glynn – IDOT/CH2M Hill

AGENDA ITEM #2

US Route 45
IL Route 132 to IL Route 173
and Millburn Bypass
P-91-666-09
Lake County

December 5, 2012

This was the 14th presentation of this project. The previous presentation was on October 24, 2012. The purpose of this presentation was to discuss the results from the presentation of the project at the IDOT Quarterly Resource Agency Meeting held on November 13, 2012. A project status update and next steps were also provided.

The meeting summary from the IDOT Quarterly Meeting held on November 13, 2012 was distributed to all attendees. The purpose of the Quarterly Meeting was to share with the U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service (USFWS) representatives, the proposed designs for the waterway crossings of the Waters of the United States (WOUS) located in the Central Section of the project, commonly referred to as the Millburn Bypass. The two crossings are the Millburn Creek (south location) and the Tributary to Millburn Creek and Back Channel (north location). Previously the proposed structures over these meandering creeks and backchannel were designed to avoid all WOUS impacts. However they would have been very long span bridges, been challenging to construct, and resulted in additional right-of-way for drainage detention.

The revised proposed crossing design Millburn Creek is a three sided 42-foot span structure (open bottom) over the 4-ft creek, permitting passage of small to medium sized animals on both sides of the creek. Approximately 201-feet of Millburn Creek would be re-aligned or re-channelized resulting in 0.02 additional acres of WOUS impacts. Roadway drainage from the south will be conveyed over the top of Millburn Creek via a storm sewer and released at the main detention basin within the property already being acquired from the LCFPD. This eliminates a previously proposed detention basin requiring 0.67 acres private property impact.

The revised proposed crossing design at the Tributary to Millburn Creek and Back Channel is a series of three closed box culverts. The main conveyance of the Tributary to Millburn Creek is carried through two adjacent closed box culverts with another closed box culvert 35-feet to the north for the conveyance of the Back Channel. Approximately 360-feet of the Tributary to Millburn Creek and Back Channel would be realigned resulting in 0.015 additional acres of WOUS impacts at each crossing (total 0.03 acres).

The creek crossings will have a total of 0.05 acres of WOUS impact. This increases the total WOUS/wetland impact for the entire project from IL Route 132 to IL Route 173 from 0.61 acres to 0.66 acres. It reduces the total right-of-way impact by 0.67 acres.

USFWS and USACE were comfortable with the proposed designs for the crossing and felt agreed that impacts would be necessary regardless of whether the west or east bypass was selected. A USACE Regional Permit will be required for the associated impacts of both crossings. Based on the above, neither IDOT nor FHWA had any objections to the creek crossings as proposed.

The Environmental Assessment is being revised to address the change in impacts. The project team is aiming for a February 2013 Public Hearing. In advance of the Public Hearing, IDOT and Lake County will coordinate with community groups and local agencies. All were in agreement with the proposed schedule of activities.

Matt Huffman – CBBEL
Marie Glynn – IDOT Extension Staff

US45_MillburnBypass_FHS:\WP\p&es\CONSULT\Projects - Active\US 45 Millburn Bypass\5.0_Correspondence&Meetings\5.4_MeetingSummaries\US45_MillburnBypass_FHWA14_Dec05_2012.doc14_Dec05_2012.doc

US Route 45
IL Route 132 to IL Route 173
Section No. 05-00262-02-RP
Illinois Department of Transportation

04/30/2013 IDOT- Drainage Meeting Minutes

DATE:	June 11, 2013
TO:	Attendees CBBEL Project File (10-0063)
FROM:	Martin Bojovic, P.E., CFM – CBBEL
MEETING DATE: TIME:	April 30, 2013 1:30 P.M.
SUBJECT:	U.S. 45 from IL 132 to IL 173/Millburn Bypass Proposed Drainage Plan
LOCATION:	Illinois Department of Transportation District One 201 West Center Court Schaumburg, IL 60196

ATTENDEES:	Rick Wojcik	- IDOT Hydraulics Section
	Lynn Hobbs	- IDOT Hydraulics Section
	Mehdi Gerami	- IDOT Hydraulics Section
	Perry Masoundis	- IDOT Hydraulics Section
	Ilene Dailey	- CBBEL
	Martin Bojovic	- CBBEL
	Matt Huffman	- CBBEL

On April 30, 2013, representatives from the Illinois Department of Transportation (IDOT) and Christopher B. Burke Engineering, Ltd. (CBBEL) met to discuss the concept Proposed Drainage Plan, permitting concerns, and project schedule for the proposed improvements along US Route 45 from IL Route 132 to IL Route 173, excluding the proposed Millburn Bypass. The project is located within in Lake County, including the Villages of Lindenhurst, Old Mill Creek, and Unincorporated Lake County. Roll plots of the proposed conceptual drainage plan were displayed. At the time of the meeting, the current roadway footprint is based off the plans developed for the Environmental Assessment from IL Route 132 to IL Route 173, including the Millburn Bypass. Detailed engineering is ongoing for the sections south and north of the Millburn Bypass, with the Millburn Bypass anticipating design approval sometime in July 2013.

Below is record of the discussion that occurred:

- Provide detention and water quality volumes per LCSMC standards if there is room.

- Drainage Alternatives – In the LDS discuss the need for two (2) detention Basins vs. one (1) Basin at each outlet.

- LCSMC wants "treatment train"; Lindenhurst and Old Mill Creek requested wet and vegetated ponds. Meander the channel through the bottom of proposed basin 9.

- IDOT requested a single 6" restrictor minimum size to minimize clogging.

- Have RWA provide the information on proposed culvert sizes, considering upstream detention. Obtain Old Mill Creek and Lindenhurst detention/subdivision plans if possible.

- Consider relocating or removing detention basins if local communities object.

- At Outlet No. 2, maintain the existing cross culvert size, due to the size limitation of the existing downstream (D/S) 36" storm sewer through the subdivision. Add Note to PDP. Verify D/S system.

- At Outlet No. 3, consider not using in order to keep salt/dirty runoff out of private ponds. Make sure the proposed storm sewer crosses over the existing culvert.

- Remove Basins 6A and 6B and provide water quality BMPs to Outlet No. 6; A Floodway Construction Permit may be needed.

- At Outlet No. 7, bring additional runoff from the intersection radius from Stearns School Road to Basin No. 7, and focus on water quality along Stearns School Road. Look into stream bank stabilization for Dodge Creek; guardrail, etc. Is a CLOMR needed? No, per Perry; only a Floodway Construction Permit is required under the Part 3700 Rules.

- At Outlet No. 13, eliminate Basin 13B. Provide oversize storm sewer with restrictor and outlet earlier and/or provide water quality in oversized ditches.

- At Outlet No. 14, eliminate Basin 14A.

- Check outlet of Basin 15. Can we outlet to the north side of Miller Road to a culvert?

- At the proposed pedestrian underpass keep the storm sewer pipe separate from the IDOT system, and drain straight to creek; Possibly provide oversize ditch storage in lieu of Basin 16A.

- At Outlet No. 17 eliminate Basin 17B.
- At Outlet No. 18 increase the size of the culvert.
- Can we over detain on north side at Pond 18B? If so, then only provide ditch water quality BMPs on south side of US Route 45.
- Basins 19 and 20 are subject to coordination with the IL Route 173 project. Add note on plans.
- Remove Basin 22, as it is detention "overkill". Instead provide ditch detention/water quality BMPs.
- Invite "Mill Creek Watershed" representatives of LCSMC to the next coordination meeting.
- Look at additional right of way at northeast corner IL Route 173 for a ditch.
- Compensatory Floodplain Storage per LCSMC required? Do floodplain encroachment calculation either way.
- Try to make Pond/Storage ditches with some meander.
- IDOT prefers oversized ditches for detention along the north part of US Route 45.

The meeting concluded at 3:40 P.M.

These notes represent the preparer's understanding of the items discussed and are not a verbatim account of the discussion. They are intended to generally document the discussions held; if any portion of these Minutes is found incomplete or inaccurate, please notify the preparer in writing within five business days from the receipt of the Minutes.

N:\Idot\100063\Admin\MM_US 45_IDOT_2013_0430.doc

TAB D

5-00 Appendix D: <u>Supporting Documents</u>

Volume 1

- Detention Analysis Calculations
- Restrictor Sizing Calculations

Volume 2

- For the major drainage crossings of the proposed U.S. Route 45, the following backup calculations are included:
- Crossing DA11 Calculations
- Crossing DA12 Calculations
- RWA Culvert Design Summary Memorandum: Hydrology for Major Drainage Features – US Route 45 North Segment

Crossing DA13 Station 185+75 (Existing Outlet No. 13)

- Drainage Area Location Exhibit
- Time of Concentration (Tc)
- Runoff Curve Number (CN)
- Existing Detention Calculations
- Existing Orifice Calculations
- Soils Map
- 500 – Year Storm Event Flow Calculation
- TR-20 Schematic
- TR-20 Model
- HY-8 Output

- Crossing DA19 at Station 310+38 (Existing Outlet No. 19)
  - Drainage Area Location Exhibit
  - Time of Concentration (Tc)
  - Runoff Curve Number (CN)
  - TR-20 Model
  - Soils Map
  - 500 – Year Storm Event Flow Calculation
  - TR-20 Schematic
  - HY-8 Output

- Storm Sewer Sizing Calculations.
- Floodplain Fill and Compensatory Storage Calculations

DETENTION VOLUME CALCULATIONS

Detention Summary
U.S. Route 45 (Milburn Bypass To IL Route 173)
CBBEL Project 10-0063
Date: 8/23/2018

Outlet	Required Detention (AC-FT)	Provided Detention (AC-FT)
11[C]	0.15	0.53[F]
12[C]	0.10	
13	0.81	0.88
14	0.38	0.52
15[B]	0.33	0.52
16[A]	0.86	1.36
17[A]	0.31	
21[A]	0.04	
18	0.94	1.12
19	0.28	0.31
24[D]	0.85	1.19
27[D]	0.33	
26[B]	0.07	-

Notes:
A.Outlet No. 17 and No. 21 roadway drainage rerouted to avoid draining to a local depression. Outlet No. 17 and Outlet No. 21 are naturally tributary to Outlet No. 16.

B. Detention volume for Outlet No. 26 is provided in Detention Basin No. 15.

C. Detention for Outlet Nos. 11 and 12 is provided in Existing Basin No. 11.

D. Detention to be provided in basin 24.

F. Value represents excess detention volume available in Millburn Bypass Detention Basin 11.

Existing C-coefficient Calculations U.S. Route 45 North Section				
Outlet No.	Pavement Area (Acres) C-0.9	Grass Area (Acres) C-0.3	Total Area (Acres)	Weighted-C
11	1.20	1.97	3.17	0.53
12	0.68	1.16	1.84	0.52
13	1.4	9.48	10.88	0.38
14	0.83	4.44	5.27	0.39
15	1.02	3.68	4.70	0.43
16	1.51	7.85	9.36	0.40
18	2.61	8.63	11.24	0.44
19	1.17	2.92	4.09	0.47
21	0.13	0.51	0.64	0.42
24	3.62	4.22	7.84	0.58
26	0.32	0.83	1.15	0.47
27	1.00	2.68	3.68	0.46

STORMWATER DETENTION CALCULATIONS

OUTLET 11 **US 45 Sta. 169+00 Basin No. 11**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	3.17	acres	Area =		acres
c =	0.53		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.34	in/hr			Q10 =	7.3	cfs
i(50) =	6.36	in/hr			Q50 =	10.6	cfs
i(100)=	7.32	in/hr	19.20	minutes	Q100=	12.2	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
1812	cubic ft	4584	cubic ft	6372	cubic ft
0.04	acre ft	0.11	acre ft	0.15	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.55	5	6.48	3.17	11.33	7.26	4.07	1221
0.55	10	5.88	3.17	10.28	7.26	3.02	1812
0.55	15	4.84	3.17	8.47	7.26	1.21	1089
0.55	20	4.22	3.17	7.38	7.26	0.12	144
0.55	25	3.75	3.17	6.56	7.26		
0.55	30	3.30	3.17	5.77	7.26		
0.55	40	2.75	3.17	4.81	7.26		
0.55	50	2.40	3.17	4.20	7.26		
0.55	60	2.10	3.17	3.67	7.26		
0.55	120	1.32	3.17	2.31	7.26		
0.55	180	0.94	3.17	1.64	7.26		
0.55	360	0.57	3.17	1.00	7.26		
		50 YEAR FREQUENCY					
0.55	5	9.36	3.17	16.37	7.26	9.11	2733
0.55	10	8.52	3.17	14.90	7.26	7.64	4584
0.55	15	7.00	3.17	12.24	7.26	4.98	4482
0.55	20	6.20	3.17	10.84	7.26	3.58	4296
0.55	25	5.40	3.17	9.44	7.26	2.18	3270
0.55	30	4.78	3.17	8.36	7.26	1.10	1980
0.55	40	3.80	3.17	6.65	7.26		
0.55	50	3.40	3.17	5.95	7.26		
0.55	60	3.04	3.17	5.32	7.26		
0.55	120	1.91	3.17	3.34	7.26		
0.55	180	1.37	3.17	2.40	7.26		
0.55	360	0.82	3.17	1.43	7.26		
		100 YEAR FREQUENCY					
0.55	5	10.92	3.17	19.10	7.26	11.84	3552
0.55	10	10.02	3.17	17.52	7.26	10.26	6156
0.55	15	8.20	3.17	14.34	7.26	7.08	6372
0.55	20	7.10	3.17	12.42	7.26	5.16	6192
0.55	25	6.30	3.17	11.02	7.26	3.76	5640
0.55	30	5.60	3.17	9.79	7.26	2.53	4554
0.55	40	4.60	3.17	8.05	7.26	0.79	1896
0.55	50	4.00	3.17	7.00	7.26		
0.55	60	3.56	3.17	6.23	7.26		
0.55	120	2.24	3.17	3.92	7.26		
0.55	180	1.60	3.17	2.80	7.26		
0.55	360	0.97	3.17	1.70	7.26		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 11 Station 169+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.03				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.22	+		=	0.22 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II		IIV						
Surface Description (paved or unpaved)		unp.		unp.						
Flow Length, L	(ft)	375		115						
Watercourse slope, s	(ft/ft)	0.0187		0.003						
Average velocity, V	(ft/s)	2.20		0.88						
Tt = L / 3600 V	(hr)	0.05	+	0.04	+		+		=	0.09 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	91				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.32 hr

= 19.20 min

STORMWATER DETENTION CALCULATIONS

OUTLET 12 US 45 Sta. 176+00 East Culvert

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	1.84	acres	Area =		acres
c =	0.52		c =		

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.84	in/hr			Q10 =	4.7	cfs
i(50) =	7.00	in/hr			Q50 =	6.7	cfs
i(100)=	8.20	in/hr	15.00	minutes	Q100=	7.9	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
1368	cubic ft	3240	cubic ft	4509	cubic ft
0.03	acre ft	0.07	acre ft	0.1	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.64	5	6.48	1.84	7.64	4.65	2.99	897
0.64	10	5.88	1.84	6.93	4.65	2.28	1368
0.64	15	4.84	1.84	5.70	4.65	1.05	945
0.64	20	4.22	1.84	4.97	4.65	0.32	384
0.64	25	3.75	1.84	4.42	4.65		
0.64	30	3.30	1.84	3.89	4.65		
0.64	40	2.75	1.84	3.24	4.65		
0.64	50	2.40	1.84	2.83	4.65		
0.64	60	2.10	1.84	2.48	4.65		
0.64	120	1.32	1.84	1.56	4.65		
0.64	180	0.94	1.84	1.11	4.65		
0.64	360	0.57	1.84	0.67	4.65		
		50 YEAR FREQUENCY					
0.64	5	9.36	1.84	11.03	4.65	6.38	1914
0.64	10	8.52	1.84	10.04	4.65	5.39	3234
0.64	15	7.00	1.84	8.25	4.65	3.60	3240
0.64	20	6.20	1.84	7.31	4.65	2.66	3192
0.64	25	5.40	1.84	6.36	4.65	1.71	2565
0.64	30	4.78	1.84	5.63	4.65	0.98	1764
0.64	40	3.80	1.84	4.48	4.65		
0.64	50	3.40	1.84	4.01	4.65		
0.64	60	3.04	1.84	3.58	4.65		
0.64	120	1.91	1.84	2.25	4.65		
0.64	180	1.37	1.84	1.61	4.65		
0.64	360	0.82	1.84	0.97	4.65		
		100 YEAR FREQUENCY					
0.64	5	10.92	1.84	12.87	4.65	8.22	2466
0.64	10	10.02	1.84	11.81	4.65	7.16	4296
0.64	15	8.20	1.84	9.66	4.65	5.01	4509
0.64	20	7.10	1.84	8.37	4.65	3.72	4464
0.64	25	6.30	1.84	7.43	4.65	2.78	4170
0.64	30	5.60	1.84	6.60	4.65	1.95	3510
0.64	40	4.60	1.84	5.42	4.65	0.77	1848
0.64	50	4.00	1.84	4.71	4.65	0.06	180
0.64	60	3.56	1.84	4.20	4.65		
0.64	120	2.24	1.84	2.64	4.65		
0.64	180	1.60	1.84	1.89	4.65		
0.64	360	0.97	1.84	1.14	4.65		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 12 176+00	Checked	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.03				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.22	+		=	0.22 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	178								
Watercourse slope, s	(ft/ft)	0.0225								
Average velocity, V	(ft/s)	2.42								
Tt = L / 3600 V	(hr)	0.02	+		+		+		=	0.02 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	94				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.25 hr

= 15.00 min

STORMWATER DETENTION CALCULATIONS

OUTLET 13 **US 45 Sta. 186+00 Culvert**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	10.88	acres	Area =		acres
c =	0.38		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	3.84	in/hr			Q10 =	15.8	cfs
i(50) =	5.56	in/hr			Q50 =	22.8	cfs
i(100)=	6.46	in/hr	24.60	minutes	Q100=	26.5	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
13032	cubic ft	27576	cubic ft	35415	cubic ft
0.3	acre ft	0.63	acre ft	0.81	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.57	5	6.48	10.88	40.51	15.78	24.73	7419
0.57	10	5.88	10.88	36.76	15.78	20.98	12588
0.57	15	4.84	10.88	30.26	15.78	14.48	13032
0.57	20	4.22	10.88	26.38	15.78	10.60	12720
0.57	25	3.75	10.88	23.45	15.78	7.67	11505
0.57	30	3.30	10.88	20.63	15.78	4.85	8730
0.57	40	2.75	10.88	17.19	15.78	1.41	3384
0.57	50	2.40	10.88	15.00	15.78		
0.57	60	2.10	10.88	13.13	15.78		
0.57	120	1.32	10.88	8.25	15.78		
0.57	180	0.94	10.88	5.88	15.78		
0.57	360	0.57	10.88	3.56	15.78		
		50 YEAR FREQUENCY					
0.57	5	9.36	10.88	58.52	15.78	42.74	12822
0.57	10	8.52	10.88	53.27	15.78	37.49	22494
0.57	15	7.00	10.88	43.76	15.78	27.98	25182
0.57	20	6.20	10.88	38.76	15.78	22.98	27576
0.57	25	5.40	10.88	33.76	15.78	17.98	26970
0.57	30	4.78	10.88	29.88	15.78	14.10	25380
0.57	40	3.80	10.88	23.76	15.78	7.98	19152
0.57	50	3.40	10.88	21.26	15.78	5.48	16440
0.57	60	3.04	10.88	19.01	15.78	3.23	11628
0.57	120	1.91	10.88	11.94	15.78		
0.57	180	1.37	10.88	8.57	15.78		
0.57	360	0.82	10.88	5.13	15.78		
		100 YEAR FREQUENCY					
0.57	5	10.92	10.88	68.27	15.78	52.49	15747
0.57	10	10.02	10.88	62.65	15.78	46.87	28122
0.57	15	8.20	10.88	51.27	15.78	35.49	31941
0.57	20	7.10	10.88	44.39	15.78	28.61	34332
0.57	25	6.30	10.88	39.39	15.78	23.61	35415
0.57	30	5.60	10.88	35.01	15.78	19.23	34614
0.57	40	4.60	10.88	28.76	15.78	12.98	31152
0.57	50	4.00	10.88	25.01	15.78	9.23	27690
0.57	60	3.56	10.88	22.26	15.78	6.48	23328
0.57	120	2.24	10.88	14.00	15.78		
0.57	180	1.60	10.88	10.00	15.78		
0.57	360	0.97	10.88	6.06	15.78		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 13 Sta. 186+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.03				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.22	+		=	0.22 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	1540								
Watercourse slope, s	(ft/ft)	0.0214								
Average velocity, V	(ft/s)	2.36								
Tt = L / 3600 V	(hr)	0.18	+		+		+		=	0.18 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	68				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.41 hr

= 24.60 min

STORMWATER DETENTION CALCULATIONS

OUTLET 14 **US 45 Sta. 207+00 Culvert**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	5.27	acres	Area =		acres
c =	0.39		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.47	in/hr			Q10 =	9.3	cfs
i(50) =	6.52	in/hr			Q50 =	13.6	cfs
i(100)=	7.54	in/hr	18.60	minutes	Q100=	15.7	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
5760	cubic ft	12756	cubic ft	16425	cubic ft
0.13	acre ft	0.29	acre ft	0.38	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.61	5	6.48	5.27	20.82	9.29	11.53	3459
0.61	10	5.88	5.27	18.89	9.29	9.60	5760
0.61	15	4.84	5.27	15.55	9.29	6.26	5634
0.61	20	4.22	5.27	13.56	9.29	4.27	5124
0.61	25	3.75	5.27	12.05	9.29	2.76	4140
0.61	30	3.30	5.27	10.60	9.29	1.31	2358
0.61	40	2.75	5.27	8.84	9.29		
0.61	50	2.40	5.27	7.71	9.29		
0.61	60	2.10	5.27	6.75	9.29		
0.61	120	1.32	5.27	4.24	9.29		
0.61	180	0.94	5.27	3.02	9.29		
0.61	360	0.57	5.27	1.83	9.29		
		50 YEAR FREQUENCY					
0.61	5	9.36	5.27	30.07	9.29	20.78	6234
0.61	10	8.52	5.27	27.37	9.29	18.08	10848
0.61	15	7.00	5.27	22.49	9.29	13.20	11880
0.61	20	6.20	5.27	19.92	9.29	10.63	12756
0.61	25	5.40	5.27	17.35	9.29	8.06	12090
0.61	30	4.78	5.27	15.36	9.29	6.07	10926
0.61	40	3.80	5.27	12.21	9.29	2.92	7008
0.61	50	3.40	5.27	10.92	9.29	1.63	4890
0.61	60	3.04	5.27	9.77	9.29	0.48	1728
0.61	120	1.91	5.27	6.14	9.29		
0.61	180	1.37	5.27	4.40	9.29		
0.61	360	0.82	5.27	2.63	9.29		
		100 YEAR FREQUENCY					
0.61	5	10.92	5.27	35.09	9.29	25.80	7740
0.61	10	10.02	5.27	32.19	9.29	22.90	13740
0.61	15	8.20	5.27	26.35	9.29	17.06	15354
0.61	20	7.10	5.27	22.81	9.29	13.52	16224
0.61	25	6.30	5.27	20.24	9.29	10.95	16425
0.61	30	5.60	5.27	17.99	9.29	8.70	15660
0.61	40	4.60	5.27	14.78	9.29	5.49	13176
0.61	50	4.00	5.27	12.85	9.29	3.56	10680
0.61	60	3.56	5.27	11.44	9.29	2.15	7740
0.61	120	2.24	5.27	7.20	9.29		
0.61	180	1.60	5.27	5.14	9.29		
0.61	360	0.97	5.27	3.12	9.29		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 14 Station 207+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.03				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.22	+		=	0.22 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	688								
Watercourse slope, s	(ft/ft)	0.0247								
Average velocity, V	(ft/s)	2.54								
Tt = L / 3600 V	(hr)	0.08	+		+		+		=	0.08 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	71				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.31 hr

= 18.60 min

STORMWATER DETENTION CALCULATIONS

OUTLET 15 **US 45 Sta. 221+00 west ditch**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	4.7	acres	Area =	-0.06	acres
c =	0.43		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.72	in/hr			Q10 =	9.5	cfs
i(50) =	6.84	in/hr			Q50 =	13.8	cfs
i(100)=	7.98	in/hr	16.80	minutes	Q100=	16.1	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
4968	cubic ft	11100	cubic ft	14364	cubic ft
0.11	acre ft	0.25	acre ft	0.33	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.66	5	6.48	4.70	19.63	9.54	10.09	3027
0.66	10	5.88	4.70	17.82	9.54	8.28	4968
0.66	15	4.84	4.70	14.67	9.54	5.13	4617
0.66	20	4.22	4.70	12.79	9.54	3.25	3900
0.66	25	3.75	4.70	11.36	9.54	1.82	2730
0.66	30	3.30	4.70	10.00	9.54	0.46	828
0.66	40	2.75	4.70	8.33	9.54		
0.66	50	2.40	4.70	7.27	9.54		
0.66	60	2.10	4.70	6.36	9.54		
0.66	120	1.32	4.70	4.00	9.54		
0.66	180	0.94	4.70	2.85	9.54		
0.66	360	0.57	4.70	1.73	9.54		
		50 YEAR FREQUENCY					
0.66	5	9.36	4.70	28.36	9.54	18.82	5646
0.66	10	8.52	4.70	25.82	9.54	16.28	9768
0.66	15	7.00	4.70	21.21	9.54	11.67	10503
0.66	20	6.20	4.70	18.79	9.54	9.25	11100
0.66	25	5.40	4.70	16.36	9.54	6.82	10230
0.66	30	4.78	4.70	14.48	9.54	4.94	8892
0.66	40	3.80	4.70	11.51	9.54	1.97	4728
0.66	50	3.40	4.70	10.30	9.54	0.76	2280
0.66	60	3.04	4.70	9.21	9.54		
0.66	120	1.91	4.70	5.79	9.54		
0.66	180	1.37	4.70	4.15	9.54		
0.66	360	0.82	4.70	2.48	9.54		
		100 YEAR FREQUENCY					
0.66	5	10.92	4.70	33.09	9.54	23.55	7065
0.66	10	10.02	4.70	30.36	9.54	20.82	12492
0.66	15	8.20	4.70	24.85	9.54	15.31	13779
0.66	20	7.10	4.70	21.51	9.54	11.97	14364
0.66	25	6.30	4.70	19.09	9.54	9.55	14325
0.66	30	5.60	4.70	16.97	9.54	7.43	13374
0.66	40	4.60	4.70	13.94	9.54	4.40	10560
0.66	50	4.00	4.70	12.12	9.54	2.58	7740
0.66	60	3.56	4.70	10.79	9.54	1.25	4500
0.66	120	2.24	4.70	6.79	9.54		
0.66	180	1.60	4.70	4.85	9.54		
0.66	360	0.97	4.70	2.94	9.54		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 15 Station 221+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.04				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.19	+		=	0.19 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	449								
Watercourse slope, s	(ft/ft)	0.0089								
Average velocity, V	(ft/s)	1.52								
Tt = L / 3600 V	(hr)	0.08	+		+		+		=	0.08 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	61				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.28 hr

= 16.80 min

STORMWATER DETENTION CALCULATIONS

OUTLET 16 **US 45 Sta. 240+00 Hastings Creek**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	9.36	acres	Area =		acres
c =	0.40		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	3.19	in/hr			Q10 =	11.9	cfs
i(50) =	4.58	in/hr			Q50 =	17.0	cfs
i(100)=	5.40	in/hr	32.40	minutes	Q100=	20.1	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
15252	cubic ft	29370	cubic ft	37332	cubic ft
0.35	acre ft	0.67	acre ft	0.86	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.62	5	6.48	9.36	37.71	11.85	25.86	7758
0.62	10	5.88	9.36	34.22	11.85	22.37	13422
0.62	15	4.84	9.36	28.17	11.85	16.32	14688
0.62	20	4.22	9.36	24.56	11.85	12.71	15252
0.62	25	3.75	9.36	21.83	11.85	9.98	14970
0.62	30	3.30	9.36	19.21	11.85	7.36	13248
0.62	40	2.75	9.36	16.01	11.85	4.16	9984
0.62	50	2.40	9.36	13.97	11.85	2.12	6360
0.62	60	2.10	9.36	12.22	11.85	0.37	1332
0.62	120	1.32	9.36	7.68	11.85		
0.62	180	0.94	9.36	5.47	11.85		
0.62	360	0.57	9.36	3.32	11.85		
		50 YEAR FREQUENCY					
0.62	5	9.36	9.36	54.48	11.85	42.63	12789
0.62	10	8.52	9.36	49.59	11.85	37.74	22644
0.62	15	7.00	9.36	40.74	11.85	28.89	26001
0.62	20	6.20	9.36	36.08	11.85	24.23	29076
0.62	25	5.40	9.36	31.43	11.85	19.58	29370
0.62	30	4.78	9.36	27.82	11.85	15.97	28746
0.62	40	3.80	9.36	22.12	11.85	10.27	24648
0.62	50	3.40	9.36	19.79	11.85	7.94	23820
0.62	60	3.04	9.36	17.69	11.85	5.84	21024
0.62	120	1.91	9.36	11.12	11.85		
0.62	180	1.37	9.36	7.97	11.85		
0.62	360	0.82	9.36	4.77	11.85		
		100 YEAR FREQUENCY					
0.62	5	10.92	9.36	63.55	11.85	51.70	15510
0.62	10	10.02	9.36	58.32	11.85	46.47	27882
0.62	15	8.20	9.36	47.72	11.85	35.87	32283
0.62	20	7.10	9.36	41.32	11.85	29.47	35364
0.62	25	6.30	9.36	36.67	11.85	24.82	37230
0.62	30	5.60	9.36	32.59	11.85	20.74	37332
0.62	40	4.60	9.36	26.77	11.85	14.92	35808
0.62	50	4.00	9.36	23.28	11.85	11.43	34290
0.62	60	3.56	9.36	20.72	11.85	8.87	31932
0.62	120	2.24	9.36	13.04	11.85	1.19	8568
0.62	180	1.60	9.36	9.31	11.85		
0.62	360	0.97	9.36	5.65	11.85		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 16 Station 240+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.01				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.34	+		=	0.34 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	1400								
Watercourse slope, s	(ft/ft)	0.0166								
Average velocity, V	(ft/s)	2.08								
Tt = L / 3600 V	(hr)	0.19	+		+		+		=	0.19 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	61				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.54 hr

= 32.40 min

STORMWATER DETENTION CALCULATIONS

OUTLET 17 **US 45 Sta. 255+00 east ditch**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	3.45	acres	Area =		acres
c =	0.41		c =		

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.13	in/hr			Q10 =	5.8	cfs
i(50) =	6.04	in/hr			Q50 =	8.5	cfs
i(100)=	6.94	in/hr	21.60	minutes	Q100=	9.8	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
5004	cubic ft	10500	cubic ft	13485	cubic ft
0.11	acre ft	0.24	acre ft	0.31	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.68	5	6.48	3.45	15.22	5.81	9.41	2823
0.68	10	5.88	3.45	13.81	5.81	8.00	4800
0.68	15	4.84	3.45	11.37	5.81	5.56	5004
0.68	20	4.22	3.45	9.91	5.81	4.10	4920
0.68	25	3.75	3.45	8.81	5.81	3.00	4500
0.68	30	3.30	3.45	7.75	5.81	1.94	3492
0.68	40	2.75	3.45	6.46	5.81	0.65	1560
0.68	50	2.40	3.45	5.64	5.81		
0.68	60	2.10	3.45	4.93	5.81		
0.68	120	1.32	3.45	3.10	5.81		
0.68	180	0.94	3.45	2.21	5.81		
0.68	360	0.57	3.45	1.34	5.81		
		50 YEAR FREQUENCY					
0.68	5	9.36	3.45	21.99	5.81	16.18	4854
0.68	10	8.52	3.45	20.01	5.81	14.20	8520
0.68	15	7.00	3.45	16.44	5.81	10.63	9567
0.68	20	6.20	3.45	14.56	5.81	8.75	10500
0.68	25	5.40	3.45	12.68	5.81	6.87	10305
0.68	30	4.78	3.45	11.23	5.81	5.42	9756
0.68	40	3.80	3.45	8.93	5.81	3.12	7488
0.68	50	3.40	3.45	7.99	5.81	2.18	6540
0.68	60	3.04	3.45	7.14	5.81	1.33	4788
0.68	120	1.91	3.45	4.49	5.81		
0.68	180	1.37	3.45	3.22	5.81		
0.68	360	0.82	3.45	1.93	8.50		
		100 YEAR FREQUENCY					
0.68	5	10.92	3.45	25.65	5.81	19.84	5952
0.68	10	10.02	3.45	23.54	5.81	17.73	10638
0.68	15	8.20	3.45	19.26	5.81	13.45	12105
0.68	20	7.10	3.45	16.68	5.81	10.87	13044
0.68	25	6.30	3.45	14.80	5.81	8.99	13485
0.68	30	5.60	3.45	13.15	5.81	7.34	13212
0.68	40	4.60	3.45	10.81	5.81	5.00	12000
0.68	50	4.00	3.45	9.40	5.81	3.59	10770
0.68	60	3.56	3.45	8.36	5.81	2.55	9180
0.68	120	2.24	3.45	5.26	5.81		
0.68	180	1.60	3.45	3.76	5.81		
0.68	360	0.97	3.45	2.28	9.76		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 17 Station 255+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.02				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.25	+		=	0.25 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	516								
Watercourse slope, s	(ft/ft)	0.0078								
Average velocity, V	(ft/s)	1.42								
Tt = L / 3600 V	(hr)	0.10	+		+		+		=	0.10 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	60				
Tt = L / 3600 V	(hr)	0.01	+		=	0.01 hr

Watershed or subarea Tc or Tt = 0.36 hr

= 21.60 min

STORMWATER DETENTION CALCULATIONS

OUTLET 21 **US 45 Sta. 257+00 east ditch**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	0.64	acres	Area =		acres
c =	0.42		c =		

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	6.48	in/hr			Q10 =	1.8	cfs
i(50) =	9.36	in/hr			Q50 =	2.5	cfs
i(100)=	10.92	in/hr	5.00	minutes	Q100=	3.0	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
588	cubic ft	1356	cubic ft	1860	cubic ft
0.01	acre ft	0.03	acre ft	0.04	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.73	5	6.48	0.62	3.01	1.75	1.26	378
0.73	10	5.88	0.62	2.73	1.75	0.98	588
0.73	15	4.84	0.62	2.25	1.75	0.50	450
0.73	20	4.22	0.62	1.96	1.75	0.21	252
0.73	25	3.75	0.62	1.74	1.75		
0.73	30	3.30	0.62	1.53	1.75		
0.73	40	2.75	0.62	1.28	1.75		
0.73	50	2.40	0.62	1.11	1.75		
0.73	60	2.10	0.62	0.98	1.75		
0.73	120	1.32	0.62	0.61	1.75		
0.73	180	0.94	0.62	0.44	1.75		
0.73	360	0.57	0.62	0.26	1.75		
		50 YEAR FREQUENCY					
0.73	5	9.36	0.62	4.35	1.75	2.60	780
0.73	10	8.52	0.62	3.96	1.75	2.21	1326
0.73	15	7.00	0.62	3.25	1.75	1.50	1350
0.73	20	6.20	0.62	2.88	1.75	1.13	1356
0.73	25	5.40	0.62	2.51	1.75	0.76	1140
0.73	30	4.78	0.62	2.22	1.75	0.47	846
0.73	40	3.80	0.62	1.77	1.75	0.02	48
0.73	50	3.40	0.62	1.58	1.75		
0.73	60	3.04	0.62	1.41	1.75		
0.73	120	1.91	0.62	0.89	1.75		
0.73	180	1.37	0.62	0.64	1.75		
0.73	360	0.82	0.62	0.38	2.53		
		100 YEAR FREQUENCY					
0.73	5	10.92	0.62	5.07	1.75	3.32	996
0.73	10	10.02	0.62	4.65	1.75	2.90	1740
0.73	15	8.20	0.62	3.81	1.75	2.06	1854
0.73	20	7.10	0.62	3.30	1.75	1.55	1860
0.73	25	6.30	0.62	2.93	1.75	1.18	1770
0.73	30	5.60	0.62	2.60	1.75	0.85	1530
0.73	40	4.60	0.62	2.14	1.75	0.39	936
0.73	50	4.00	0.62	1.86	1.75	0.11	330
0.73	60	3.56	0.62	1.65	1.75		
0.73	120	2.24	0.62	1.04	1.75		
0.73	180	1.60	0.62	0.74	1.75		
0.73	360	0.97	0.62	0.45	2.95		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

STORMWATER DETENTION CALCULATIONS

OUTLET 18 **US 45 Sta. 265+50 Trib to Hastings Creek**

STORMWATER DETENTION CALCULATIONS

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	11.24	acres	Area =	-0.15	acres
c =	0.44		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	3.48	in/hr			Q10 =	17.2	cfs
i(50) =	5.03	in/hr			Q50 =	24.8	cfs
i(100)=	5.88	in/hr	28.20	minutes	Q100=	29.0	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
15291	cubic ft	31908	cubic ft	40935	cubic ft
0.35	acre ft	0.73	acre ft	0.94	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.64	5	6.48	11.24	45.74	17.18	28.56	8568
0.64	10	5.88	11.24	41.51	17.18	24.33	14598
0.64	15	4.84	11.24	34.17	17.18	16.99	15291
0.64	20	4.22	11.24	29.79	17.18	12.61	15132
0.64	25	3.75	11.24	26.47	17.18	9.29	13935
0.64	30	3.30	11.24	23.29	17.18	6.11	10998
0.64	40	2.75	11.24	19.41	17.18	2.23	5352
0.64	50	2.40	11.24	16.94	17.18		
0.64	60	2.10	11.24	14.82	17.18		
0.64	120	1.32	11.24	9.32	17.18		
0.64	180	0.94	11.24	6.64	17.18		
0.64	360	0.57	11.24	4.02	17.18		
		50 YEAR FREQUENCY					
0.64	5	9.36	11.24	66.07	17.18	48.89	14667
0.64	10	8.52	11.24	60.14	17.18	42.96	25776
0.64	15	7.00	11.24	49.41	17.18	32.23	29007
0.64	20	6.20	11.24	43.77	17.18	26.59	31908
0.64	25	5.40	11.24	38.12	17.18	20.94	31410
0.64	30	4.78	11.24	33.74	17.18	16.56	29808
0.64	40	3.80	11.24	26.82	17.18	9.64	23136
0.64	50	3.40	11.24	24.00	17.18	6.82	20460
0.64	60	3.04	11.24	21.46	17.18	4.28	15408
0.64	120	1.91	11.24	13.48	17.18		
0.64	180	1.37	11.24	9.67	17.18		
0.64	360	0.82	11.24	5.79	17.18		
		100 YEAR FREQUENCY					
0.64	5	10.92	11.24	77.08	17.18	59.90	17970
0.64	10	10.02	11.24	70.73	17.18	53.55	32130
0.64	15	8.20	11.24	57.88	17.18	40.70	36630
0.64	20	7.10	11.24	50.12	17.18	32.94	39528
0.64	25	6.30	11.24	44.47	17.18	27.29	40935
0.64	30	5.60	11.24	39.53	17.18	22.35	40230
0.64	40	4.60	11.24	32.47	17.18	15.29	36696
0.64	50	4.00	11.24	28.24	17.18	11.06	33180
0.64	60	3.56	11.24	25.13	17.18	7.95	28620
0.64	120	2.24	11.24	15.81	17.18		
0.64	180	1.60	11.24	11.29	17.18		
0.64	360	0.97	11.24	6.85	17.18		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	5/29/2014
Location:	Outlet 18 Station 265+50	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.03				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.22	+		=	0.22 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	1842								
Watercourse slope, s	(ft/ft)	0.0157								
Average velocity, V	(ft/s)	2.02								
Tt = L / 3600 V	(hr)	0.25	+		+		+		=	0.25 hr

CHANNEL FLOW

Segment ID						
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)					
Flow length, L	(ft)					
Tt = L / 3600 V	(hr)		+		=	hr

Watershed or subarea Tc or Tt = 0.47 hr

= 28.20 min

STORMWATER DETENTION CALCULATIONS

OUTLET 19 **US 45 Sta. 310+50 east ditch**

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	4.09	acres	Area =		acres
c =	0.47		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.03	in/hr			Q10 =	7.8	cfs
i(50) =	5.88	in/hr			Q50 =	11.3	cfs
i(100)=	6.78	in/hr	22.20	minutes	Q100=	13.1	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
4236	cubic ft	9432	cubic ft	12165	cubic ft
0.1	acre ft	0.22	acre ft	0.28	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.62	5	6.48	4.09	16.35	7.78	8.57	2571
0.62	10	5.88	4.09	14.84	7.78	7.06	4236
0.62	15	4.84	4.09	12.21	7.78	4.43	3987
0.62	20	4.22	4.09	10.65	7.78	2.87	3444
0.62	25	3.75	4.09	9.46	7.78	1.68	2520
0.62	30	3.30	4.09	8.33	7.78	0.55	990
0.62	40	2.75	4.09	6.94	7.78		
0.62	50	2.40	4.09	6.06	7.78		
0.62	60	2.10	4.09	5.30	7.78		
0.62	120	1.32	4.09	3.33	7.78		
0.62	180	0.94	4.09	2.37	7.78		
0.62	360	0.57	4.09	1.44	7.78		
		50 YEAR FREQUENCY					
0.62	5	9.36	4.09	23.62	7.78	15.84	4752
0.62	10	8.52	4.09	21.50	7.78	13.72	8232
0.62	15	7.00	4.09	17.66	7.78	9.88	8892
0.62	20	6.20	4.09	15.64	7.78	7.86	9432
0.62	25	5.40	4.09	13.62	7.78	5.84	8760
0.62	30	4.78	4.09	12.06	7.78	4.28	7704
0.62	40	3.80	4.09	9.59	7.78	1.81	4344
0.62	50	3.40	4.09	8.58	7.78	0.80	2400
0.62	60	3.04	4.09	7.67	7.78		
0.62	120	1.91	4.09	4.82	7.78		
0.62	180	1.37	4.09	3.46	7.78		
0.62	360	0.82	4.09	2.07	7.78		
		100 YEAR FREQUENCY					
0.62	5	10.92	4.09	27.55	7.78	19.77	5931
0.62	10	10.02	4.09	25.28	7.78	17.50	10500
0.62	15	8.20	4.09	20.69	7.78	12.91	11619
0.62	20	7.10	4.09	17.91	7.78	10.13	12156
0.62	25	6.30	4.09	15.89	7.78	8.11	12165
0.62	30	5.60	4.09	14.13	7.78	6.35	11430
0.62	40	4.60	4.09	11.61	7.78	3.83	9192
0.62	50	4.00	4.09	10.09	7.78	2.31	6930
0.62	60	3.56	4.09	8.98	7.78	1.20	4320
0.62	120	2.24	4.09	5.65	7.78		
0.62	180	1.60	4.09	4.04	7.78		
0.62	360	0.97	4.09	2.45	7.78		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 19 Station 310+50	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.02				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.25	+		=	0.25 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	850								
Watercourse slope, s	(ft/ft)	0.0165								
Average velocity, V	(ft/s)	2.07								
Tt = L / 3600 V	(hr)	0.11	+		+		+		=	0.11 hr

CHANNEL FLOW

Segment ID		III						
Cross-sectional flow area, a	(ft^2)							
Wetted perimeter, Pw	(ft)							
Hydraulic radius, r = a/Pw	(ft)							
Channel slope, s	(ft/ft)							
Manning's roughness coeff., n								
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00						
Flow length, L	(ft)	65						
Tt = L / 3600 V	(hr)	0.01	+				=	0.01 hr

Watershed or subarea Tc or Tt = 0.37 hr

= 22.20 min

STORMWATER DETENTION CALCULATIONS

OUTLET 24 IL Route 173 North Ditch 1212+00

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	7.84	acres	Area =	0.15	acres
c =	0.58		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	2.54	in/hr			Q10 =	11.5	cfs
i(50) =	3.56	in/hr			Q50 =	16.1	cfs
i(100)=	4.24	in/hr	46.80	minutes	Q100=	19.2	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
15156	cubic ft	29055	cubic ft	36918	cubic ft
0.35	acre ft	0.67	acre ft	0.85	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.71	5	6.48	7.84	37.03	11.49	25.54	7662
0.71	10	5.88	7.84	33.60	11.49	22.11	13266
0.71	15	4.84	7.84	27.66	11.49	16.17	14553
0.71	20	4.22	7.84	24.12	11.49	12.63	15156
0.71	25	3.75	7.84	21.43	11.49	9.94	14910
0.71	30	3.30	7.84	18.86	11.49	7.37	13266
0.71	40	2.75	7.84	15.72	11.49	4.23	10152
0.71	50	2.40	7.84	13.72	11.49	2.23	6690
0.71	60	2.10	7.84	12.00	11.49	0.51	1836
0.71	120	1.32	7.84	7.54	11.49		
0.71	180	0.94	7.84	5.37	11.49		
0.71	360	0.57	7.84	3.26	11.49		
		50 YEAR FREQUENCY					
0.71	5	9.36	7.84	53.49	11.49	42.00	12600
0.71	10	8.52	7.84	48.69	11.49	37.20	22320
0.71	15	7.00	7.84	40.01	11.49	28.52	25668
0.71	20	6.20	7.84	35.43	11.49	23.94	28728
0.71	25	5.40	7.84	30.86	11.49	19.37	29055
0.71	30	4.78	7.84	27.32	11.49	15.83	28494
0.71	40	3.80	7.84	21.72	11.49	10.23	24552
0.71	50	3.40	7.84	19.43	11.49	7.94	23820
0.71	60	3.04	7.84	17.37	11.49	5.88	21168
0.71	120	1.91	7.84	10.92	11.49		
0.71	180	1.37	7.84	7.83	11.49		
0.71	360	0.82	7.84	4.69	11.49		
		100 YEAR FREQUENCY					
0.71	5	10.92	7.84	62.41	11.49	50.92	15276
0.71	10	10.02	7.84	57.26	11.49	45.77	27462
0.71	15	8.20	7.84	46.86	11.49	35.37	31833
0.71	20	7.10	7.84	40.58	11.49	29.09	34908
0.71	25	6.30	7.84	36.00	11.49	24.51	36765
0.71	30	5.60	7.84	32.00	11.49	20.51	36918
0.71	40	4.60	7.84	26.29	11.49	14.80	35520
0.71	50	4.00	7.84	22.86	11.49	11.37	34110
0.71	60	3.56	7.84	20.35	11.49	8.86	31896
0.71	120	2.24	7.84	12.80	11.49	1.31	9432
0.71	180	1.60	7.84	9.14	11.49		
0.71	360	0.97	7.84	5.54	11.49		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 24 Station 1212+00 Route 173	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.01				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.34	+		=	0.34 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	1800								
Watercourse slope, s	(ft/ft)	0.0136								
Average velocity, V	(ft/s)	1.88								
Tt = L / 3600 V	(hr)	0.27	+		+		+		=	0.27 hr

CHANNEL FLOW

Segment ID		III						
Cross-sectional flow area, a	(ft^2)							
Wetted perimeter, Pw	(ft)							
Hydraulic radius, r = a/Pw	(ft)							
Channel slope, s	(ft/ft)							
Manning's roughness coeff., n								
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00						
Flow length, L	(ft)	1250						
Tt = L / 3600 V	(hr)	0.17	+				=	0.17 hr

Watershed or subarea Tc or Tt = 0.78 hr

= 46.80 min

STORMWATER DETENTION CALCULATIONS

OUTLET 26 Miller Road Sta. 1995+00 North Ditch

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	1.15	acres	Area =		acres
c =	0.47		c =		

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	4.72	in/hr			Q10 =	2.5	cfs
i(50) =	6.84	in/hr			Q50 =	3.7	cfs
i(100)=	7.98	in/hr	16.80	minutes	Q100=	4.3	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
1074	cubic ft	2436	cubic ft	3228	cubic ft
0.02	acre ft	0.06	acre ft	0.07	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.64	5	6.48	1.15	4.76	2.53	2.23	669
0.64	10	5.88	1.15	4.32	2.53	1.79	1074
0.64	15	4.84	1.15	3.56	2.53	1.03	927
0.64	20	4.22	1.15	3.10	2.53	0.57	684
0.64	25	3.75	1.15	2.76	2.53	0.23	345
0.64	30	3.30	1.15	2.43	2.53		
0.64	40	2.75	1.15	2.02	2.53		
0.64	50	2.40	1.15	1.76	2.53		
0.64	60	2.10	1.15	1.54	2.53		
0.64	120	1.32	1.15	0.97	2.53		
0.64	180	0.94	1.15	0.69	2.53		
0.64	360	0.57	1.15	0.42	2.53		
		50 YEAR FREQUENCY					
0.64	5	9.36	1.15	6.88	2.53	4.35	1305
0.64	10	8.52	1.15	6.26	2.53	3.73	2238
0.64	15	7.00	1.15	5.15	2.53	2.62	2358
0.64	20	6.20	1.15	4.56	2.53	2.03	2436
0.64	25	5.40	1.15	3.97	2.53	1.44	2160
0.64	30	4.78	1.15	3.51	2.53	0.98	1764
0.64	40	3.80	1.15	2.79	2.53	0.26	624
0.64	50	3.40	1.15	2.50	2.53		
0.64	60	3.04	1.15	2.23	2.53		
0.64	120	1.91	1.15	1.40	2.53		
0.64	180	1.37	1.15	1.01	2.53		
0.64	360	0.82	1.15	0.60	2.53		
		100 YEAR FREQUENCY					
0.64	5	10.92	1.15	8.03	2.53	5.50	1650
0.64	10	10.02	1.15	7.36	2.53	4.83	2898
0.64	15	8.20	1.15	6.03	2.53	3.50	3150
0.64	20	7.10	1.15	5.22	2.53	2.69	3228
0.64	25	6.30	1.15	4.63	2.53	2.10	3150
0.64	30	5.60	1.15	4.12	2.53	1.59	2862
0.64	40	4.60	1.15	3.38	2.53	0.85	2040
0.64	50	4.00	1.15	2.94	2.53	0.41	1230
0.64	60	3.56	1.15	2.62	2.53	0.09	324
0.64	120	2.24	1.15	1.65	2.53		
0.64	180	1.60	1.15	1.18	2.53		
0.64	360	0.97	1.15	0.71	2.53		

* Qi = i(CA + CdAd) when diversions are involved / if diversion is away from outlet, then + becomes -

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 26 Miller Road Station 1995+00	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.02				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.25	+		=	0.25 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	288								
Watercourse slope, s	(ft/ft)	0.0382								
Average velocity, V	(ft/s)	3.15								
Tt = L / 3600 V	(hr)	0.03	+		+		+		=	0.03 hr

CHANNEL FLOW

Segment ID								
Cross-sectional flow area, a	(ft^2)							
Wetted perimeter, Pw	(ft)							
Hydraulic radius, r = a/Pw	(ft)							
Channel slope, s	(ft/ft)							
Manning's roughness coeff., n								
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)							
Flow length, L	(ft)							
Tt = L / 3600 V	(hr)		+				=	hr

Watershed or subarea Tc or Tt = 0.28 hr

= 16.80 min

STORMWATER DETENTION CALCULATIONS

OUTLET 27 IL Route 173 South Ditch 1212+00

(Illinois State Water Survey Bulletin #70 Rainfall Data)

Outflow Rate (Based on existing conditions)

Tributary Drainage Area			**Diverted Drainage Area**		
Area =	3.68	acres	Area =		acres
c =	0.46		c =	0.9	

RAINFALL INTENSITY (i)			**TIME OF CONCENTRATION (Tc)**		**EXISTING DISCHARGE (Qo)**		
i(10) =	3.03	in/hr			Q10 =	5.2	cfs
i(50) =	4.29	in/hr			Q50 =	7.3	cfs
i(100)=	5.10	in/hr	35.40	minutes	Q100=	8.7	cfs

DETENTION VOLUME REQUIRED

10 YEAR		**50 YEAR**		**100 YEAR**	
5736	cubic ft	11325	cubic ft	14505	cubic ft
0.13	acre ft	0.26	acre ft	0.33	acre ft

Proposed Runoff Factor c	Storm Duration t (min)	Rainfall Intensity i (in/hr)	Drainage Area a (acres)	*Inflow Rate Qi = cia (cfs)	Outflow Rate Qo (cfs)	Storage Rate Qi - Qo (cfs)	Stormwater Detention Volume Required 60(Qi-Qo)(t) (cu. ft.)
		10 YEAR FREQUENCY					
0.64	5	6.48	3.68	15.24	5.15	10.09	3027
0.64	10	5.88	3.68	13.83	5.15	8.68	5208
0.64	15	4.84	3.68	11.38	5.15	6.23	5607
0.64	20	4.22	3.68	9.93	5.15	4.78	5736
0.64	25	3.75	3.68	8.82	5.15	3.67	5505
0.64	30	3.30	3.68	7.76	5.15	2.61	4698
0.64	40	2.75	3.68	6.47	5.15	1.32	3168
0.64	50	2.40	3.68	5.64	5.15	0.49	1470
0.64	60	2.10	3.68	4.94	5.15		
0.64	120	1.32	3.68	3.10	5.15		
0.64	180	0.94	3.68	2.21	5.15		
0.64	360	0.57	3.68	1.34	5.15		
		50 YEAR FREQUENCY					
0.64	5	9.36	3.68	22.01	5.15	16.86	5058
0.64	10	8.52	3.68	20.04	5.15	14.89	8934
0.64	15	7.00	3.68	16.46	5.15	11.31	10179
0.64	20	6.20	3.68	14.58	5.15	9.43	11316
0.64	25	5.40	3.68	12.70	5.15	7.55	11325
0.64	30	4.78	3.68	11.24	5.15	6.09	10962
0.64	40	3.80	3.68	8.94	5.15	3.79	9096
0.64	50	3.40	3.68	8.00	5.15	2.85	8550
0.64	60	3.04	3.68	7.15	5.15	2.00	7200
0.64	120	1.91	3.68	4.49	5.15		
0.64	180	1.37	3.68	3.22	5.15		
0.64	360	0.82	3.68	1.93	5.15		
		100 YEAR FREQUENCY					
0.64	5	10.92	3.68	25.68	5.15	20.53	6159
0.64	10	10.02	3.68	23.57	5.15	18.42	11052
0.64	15	8.20	3.68	19.29	5.15	14.14	12726
0.64	20	7.10	3.68	16.70	5.15	11.55	13860
0.64	25	6.30	3.68	14.82	5.15	9.67	14505
0.64	30	5.60	3.68	13.17	5.15	8.02	14436
0.64	40	4.60	3.68	10.82	5.15	5.67	13608
0.64	50	4.00	3.68	9.41	5.15	4.26	12780
0.64	60	3.56	3.68	8.37	5.15	3.22	11592
0.64	120	2.24	3.68	5.27	5.15	0.12	864
0.64	180	1.60	3.68	3.76	5.15		
0.64	360	0.97	3.68	2.28	5.15		

CdAd) when diversions are involved / if diversion is away from outlet, the

Time of Concentration (Tc) or Travel Time (Tt)

Project:	10-63	By:	EMB	Date:	7/22/2014
Location:	Outlet 27 Station 1212+00 Route 173	Checked:	MA	Date:	10/20/2014
File:					

Present / Developed _____

Tc through subarea _____

SHEET FLOW

Segment ID		I				
Surface Description (table 3-1)		grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L =< 100')	(ft)	100				
Two-yr 24-hr rainfall, P2	(in)	2.8				
Land slope, s	(ft/ft)	0.015				
Tc = (0.007(nL)^0.8)/(P2^0.5 x s^0.4)	(hr)	0.29	+		=	0.29 hr

SHALLOW CONCENTRATED FLOW

Segment ID		II								
Surface Description (paved or unpaved)		unp.								
Flow Length, L	(ft)	1000								
Watercourse slope, s	(ft/ft)	0.019								
Average velocity, V	(ft/s)	2.22								
Tt = L / 3600 V	(hr)	0.12	+		+		+		=	0.12 hr

CHANNEL FLOW

Segment ID		III				
Cross-sectional flow area, a	(ft^2)					
Wetted perimeter, Pw	(ft)					
Hydraulic radius, r = a/Pw	(ft)					
Channel slope, s	(ft/ft)					
Manning's roughness coeff., n						
V = (1.49 * r^0.667 * s^0.5) / n	(ft/s)	2.00				
Flow length, L	(ft)	1300				
Tt = L / 3600 V	(hr)	0.18	+		=	0.18 hr

Watershed or subarea Tc or Tt = 0.59 hr

= 35.40 min

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Mon Aug 20 11:20:27 2018
**                                                             **
** From Elevation <732.000> to Object <OUTLET13>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         1596.511 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              1506.837 Sq Yards
**  Balance =           1596.511 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Mon Aug 20 11:17:01 2018
**                                                             **
** From Elevation <729.000> to Object <OUTLET13>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         183.873 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              1109.597 Sq Yards
**  Balance =           183.873 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

Total HW-OUTLET14.vol

```
*****************************************************************
**                                                             **
** Plane To TIN Volume Report -- Tue Sep 09 10:11:45 2014
**                                                             **
** From Elevation <760.500> to TIN <N:\Idot\100063\Civil\Geopak\OUTLET14.tin>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =          926.365 Cubic Yards
**  Total Fill =         0.000 Cubic Yards
**  Area =               850.542 Sq Yards
**  Balance =            926.365 Cubic Yards
**                                                             **
** Boundary Polygon Used
*****************************************************************
```

BMP NW-OUTLET14.vol

```
*****************************************************************
**                                                             **
** Plane To TIN Volume Report -- Tue Sep 09 10:11:13 2014
**                                                             **
** From Elevation <757.000> to TIN <N:\Idot\100063\Civil\Geopak\OUTLET14.tin>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =          79.869 Cubic Yards
**  Total Fill =         0.000 Cubic Yards
**  Area =               487.368 Sq Yards
**  Balance =            79.869 Cubic Yards
**                                                             **
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Thu Aug 16 14:08:40 2018
**                                                             **
** From Elevation <767.500> to Object <OUTLET 15>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         904.540 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              856.898 Sq Yards
**  Balance =           904.540 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Mon Aug 20 11:29:28 2018
**                                                             **
** From Elevation <764.000> to Object <OUTLET 15>
**                                                             **
** Gridded Volume Number of Grid Points = 50
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         71.350 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              435.565 Sq Yards
**  Balance =           71.350 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Mon Jan 08 15:50:21 2018
**                                                             **
** From Elevation <751.500> to Object <OUTLET 16B>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         2364.538 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              1867.087 Sq Yards
**  Balance =           2364.538 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Mon Jan 08 15:49:52 2018
**                                                             **
** From Elevation <746.000> to Object <OUTLET 16B>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         97.752 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              637.762 Sq Yards
**  Balance =           97.752 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane To TIN Volume Report -- Tue Jan 09 09:32:51 2018
**                                                             **
** From Elevation <754.000> to TIN <N:\Idot\100063\Civil\Geopak\OUTLET18D.tin>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         1846.878 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              1611.827 Sq Yards
**  Balance =           1846.878 Cubic Yards
**                                                             **
** Boundary Polygon Used
*****************************************************************
```

```
*****************************************************************
**                                                             **
** Plane To TIN Volume Report -- Tue Jan 09 09:33:44 2018
**                                                             **
** From Elevation <748.000> to TIN <N:\Idot\100063\Civil\Geopak\OUTLET18D.tin>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         31.876 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              242.817 Sq Yards
**  Balance =           31.876 Cubic Yards
**                                                             **
** Boundary Polygon Used
*****************************************************************
```

19

HW-OUTLET22_1.vol

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Thu Sep 25 10:36:06 2014
**                                                             **
** From Elevation <783.000> to Object <OUTLET 22>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =          549.000 Cubic Yards
**  Total Fill =         0.000 Cubic Yards
**  Area =               629.072 Sq Yards
**  Balance =            549.000 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

NW-OUTLET22_1.vol

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Thu Sep 25 10:14:19 2014
**                                                             **
** From Elevation <780.000> to Object <OUTLET 22>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =          57.355 Cubic Yards
**  Total Fill =         0.000 Cubic Yards
**  Area =               363.634 Sq Yards
**  Balance =            57.355 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

```
                    TOTAL-HW-OUTLET24B.VOL
Plane to Object Volume Report -- Fri Jan 12 08:49:18 2018
**                                                              **
** From Elevation <768.000> to Object <OUTLET 20>
**                                                              **
** Prismoidal Volume
**                                                              **
**                                                              **
****************************************************************
**                                                              **
**  Total Cut =   2184.703 Cubic Yards
**  Total Fill =    0.000 Cubic Yards
**  Area =                            2232.770 Sq Yards
**  Balance =                       2184.703 Cubic Yards
**                                                              **
** No Quantity Depth Used
** Boundary Polygon Used
```

```
*****************************************************************
**                                                             **
** Plane to Object Volume Report -- Tue Jan 09 11:53:23 2018
**                                                             **
** From Elevation <765.000> to Object <OUTLET 20>
**                                                             **
** Prismoidal Volume
**                                                             **
**                                                             **
*****************************************************************
**                                                             **
**  Total Cut =         261.801 Cubic Yards
**  Total Fill =        0.000 Cubic Yards
**  Area =              1619.576 Sq Yards
**  Balance =           261.801 Cubic Yards
**                                                             **
** No Quantity Depth Used
** Boundary Polygon Used
*****************************************************************
```

RESTRICTOR CALCULATIONS

Existing 10-year flow rate calculations

Rational Method, ISWS Bulletin 70 NE rainfall intensities.

Project: **IDOT US 45 North (10-0063)**

Date: 1/31/2018

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	Restrictor Size (in)
EX	13	0.94	3	3.94	0.44	24.6	3.84	6.71	6.46	11.28	12.60

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	14	0.81	1.89	2.70	0.48	18.6	4.47	5.79	7.54	9.77	11.00

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	15	0.84	1.95	2.79	0.48	16.8	4.72	6.32	7.98	10.70	11.60

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	16	0.84	0.63	1.47	0.64	32.4	3.19	3.01	5.40	5.10	7.00

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	18	3.95	2.2	6.15	0.69	28.2	3.48	14.67	5.88	-	15.40

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	19	0.65	1.36	2.01	0.49	22.2	4.03	4.00	6.78	6.73	9.60

	Basin	Pavement Area (Acres)	Grass Area (Acres)	Total Area (Acres)	Runoff Coefficient	Tc (mins)	I (in/hr)-10	Q(CFS) -10 Year	I (in/hr)-100	Q(CFS) -100 Year	
EX	24	3.62	4.21	7.83	0.58	46.8	2.54	11.48	6.78	30.65	16.80

Note: See following pages for orifice restrictor sizing calculations.

Subbasin Name: **Basin "13" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 10/13/2014

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 729.0
HWL = 732.5
Allow. Q10(cfs) = 6.71

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	729.00	**0.00**	12.6	729.0	-0.53
	730.00	**2.92**	12.6	729.0	0.48
	731.50	**5.96**	12.6	729.0	1.98
HWL	**732.00**	**6.67**	12.6	729.0	2.48
	732.50	**7.31**	12.6	729.0	2.98
	733.00	**7.90**	12.6	729.0	3.48

	Diameter	Invert
Input >>>	12.6	729.0

Subbasin Name: **Basin "14" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 10/13/2014

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 757.0
HWL = 760.5
Allow. Q10(cfs) = 5.79

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	757.00	0.00	11	757.0	-0.46
	758.00	2.38	11	757.0	0.54
	759.00	4.01	11	757.0	1.54
	760.00	5.15	11	757.0	2.54
HWL	760.50	5.63	11	757.0	3.04
	761.00	6.08	11	757.0	3.54
	761.50	6.49	11	757.0	4.04

	Diameter	Invert
Input >>>	11	757.0

Subbasin Name: **Basin "15" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 1/11/2018

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 764.0
HWL = 767.5
Allow. Q10(cfs) = 6.32

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	764.00	**0.00**	11.6	764.0	-0.48
	765.00	**2.58**	11.6	764.0	0.52
	766.00	**4.42**	11.6	764.0	1.52
	767.00	**5.70**	11.6	764.0	2.52
HWL	**767.50**	**6.24**	11.6	764.0	3.02
	768.00	**6.74**	11.6	764.0	3.52
	769.00	**7.64**	11.6	764.0	4.52

	Diameter	Invert
Input >>>	11.6	764.0

Subbasin Name: **Basin "16" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 1/11/2018

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 746.0
HWL = 750.0
Allow. Q10(cfs) = 3.01

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	746.00	0.00	7	746.0	-0.29
	747.00	1.10	7	746.0	0.71
	748.00	1.71	7	746.0	1.71
	749.00	2.15	7	746.0	2.71
	750.00	2.52	7	746.0	3.71
HWL	751.50	2.99	7	746.0	5.21
	752.50	3.26	7	746.0	6.21
	753.50	3.51	7	746.0	7.21
	752.50	3.26	7	746.0	6.21

	Diameter	Invert
Input >>>	7	746.0

Subbasin Name: **Basin "18" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 10/13/2014

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 748.0
HWL = 754.0
Allow. Q10(cfs) = 14.67

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	748.00	0.00	15.4	748.0	-0.64
	749.00	3.79	15.4	748.0	0.36
	750.00	7.38	15.4	748.0	1.36
	751.00	9.72	15.4	748.0	2.36
	752.00	11.60	15.4	748.0	3.36
	753.00	13.22	15.4	748.0	4.36
HWL	754.00	14.66	15.4	748.0	5.36
	755.00	15.97	15.4	748.0	6.36
	754.00	14.66	15.4	748.0	5.36

	Diameter	Invert
Input >>>	15.4	748.0

Subbasin Name: **Basin "19" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 10/13/2014

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 780.0
HWL = 783.0
Allow. Q10(cfs) = 4.00

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	780.00	**0.00**	9.6	780.0	-0.40
	781.00	**1.91**	9.6	780.0	0.60
	782.00	**3.11**	9.6	780.0	1.60
HWL	**783.00**	**3.97**	9.6	780.0	2.60
	783.50	**4.33**	9.6	780.0	3.10

	Diameter	Invert
Input >>>	9.6	780.0

Subbasin Name: **Basin "24" OCS**

Project: **IDOT US 45 North MAINLINE**
Calc. By: EMB
Date: 1/11/2018

Free Flow Orifice Calculations

Coeff. G = 32.2 ft./sec.^2
Coeff. C = 0.61

NWL = 765.0
HWL = 768.0
Allow. Q10(cfs) = 11.48

Q = C *A *sqrt(2 * g * h)

	WSEL (ft.)	Discharge (cfs)	Diameter (in.)	Invert (ft.)	Head (ft.)
	765.00	**0.00**	16.8	765.0	-0.70
	766.00	**4.13**	16.8	765.0	0.30
	767.00	**8.59**	16.8	765.0	1.30
HWL	**768.00**	**11.43**	16.8	765.0	2.30
	768.25	**12.03**	16.8	765.0	2.55

	Diameter	Invert
Input >>>	16.8	765.0