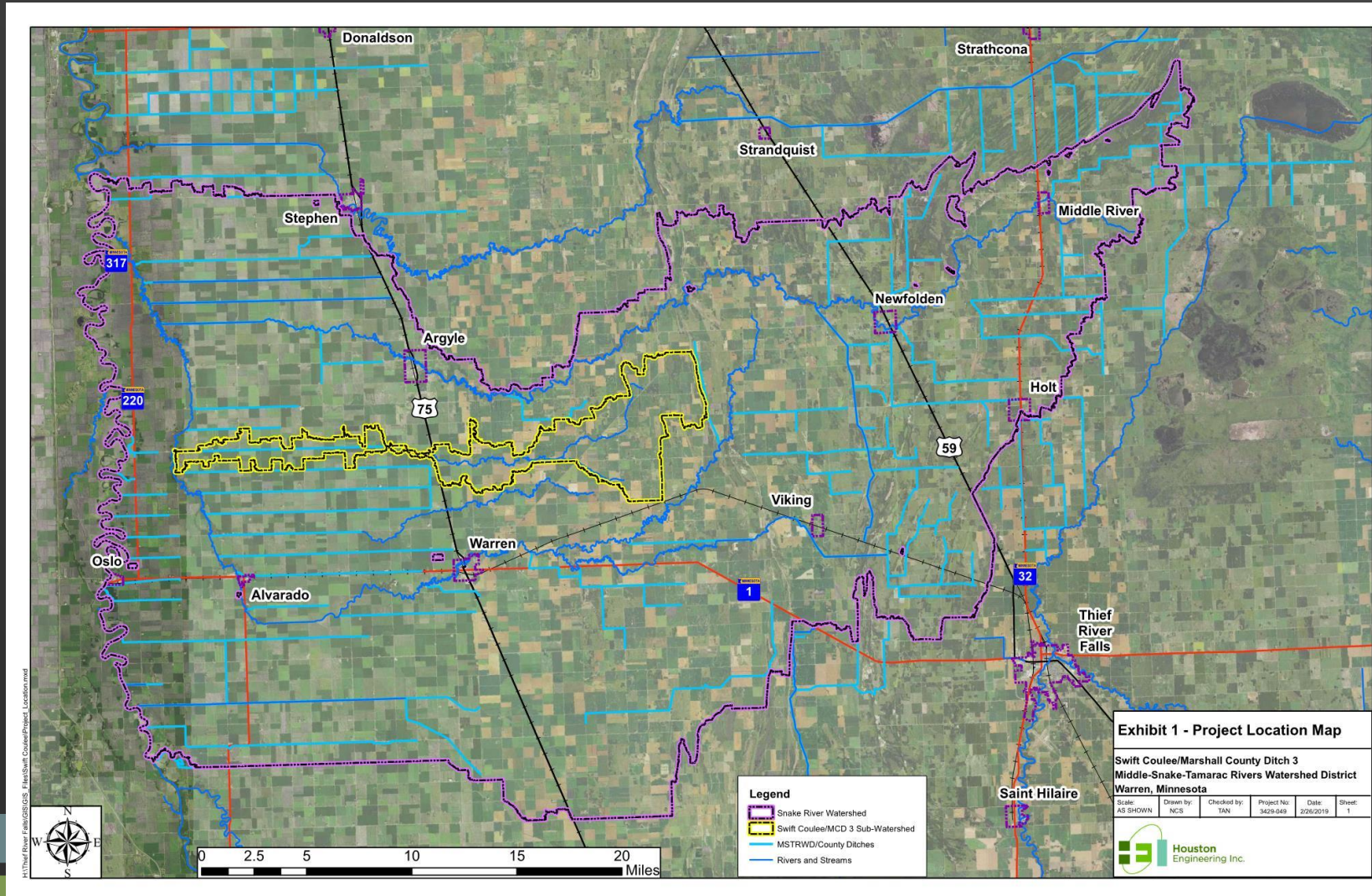


SWIFT COULEE / MARSHALL COUNTY DITCH #3 PROJECT TEAM MEETING

MIDDLE-SNAKE-TAMARAC RIVERS WATERSHED DISTRICT
DECEMBER 10, 2019





■ Tasks Completed

- Purpose and Need of Project – Concurrence Point #1 Army Corps of Engineers Permit Process
 - Provide flood damage reduction to agricultural lands due to a 10-year 24-hour rainfall event and to reduce flood damage to public transportation infrastructure in the Swift Coulee / MCD #3 sub-watershed.
- Survey
- Existing Conditions Hydraulic and Hydrologic (H&H) Modeling
- H&H Modeling of Conceptual Alternatives
- Potential Alternatives and Alternatives to Carry Forward – Concurrence Point #2
 - Reduce Flood Volume, Increase Conveyance Capacity, Increase Temp. Flood Storage, Protection/Avoidance
- Individual Meetings with Majority Landowners where Alternatives were Identified
- Identification of the Selected Alternative – Concurrence Point #3
 - Today's Meeting Topic

SWIFT COULEE / MARSHALL COUNTY DITCH #3 WATERSHED PLANNING



Swift Coulee Sub-Watershed Middle-Snake-Tamarac Rivers Watershed District

Concurrence Point #3: Identification of the Selected Alternative

September 11, 2019



M^W
S^R
T^D

Prepared by:
Houston Engineering, Inc.
208 4th Street East
Thief River Falls, MN 56701
Phone # 218.681.2951

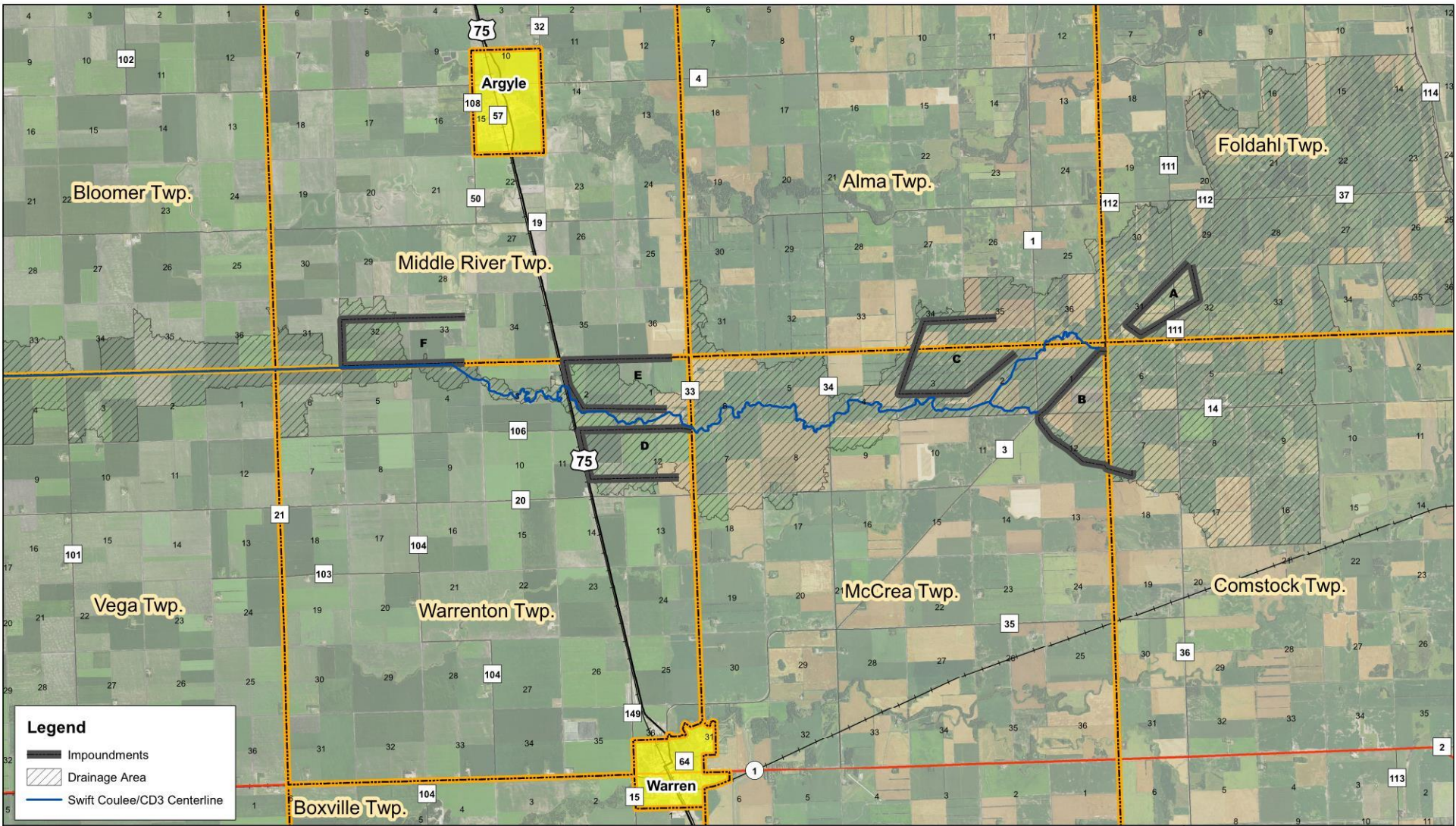


1. Restore or create wetlands
2. Agricultural drainage and side inlet pipe installations
3. Diversion
4. Off-channel impoundment site
5. Channel restoration, set back levees, and side inlet pipe installations
6. Combination of alternative 1, 2, and 3
7. Combination of alternative 1, 2, and 4
8. Combination of alternative 1, 3, and 4
9. Combination of alternative 1, 2, 3, and 4
10. Combination of alternative 1, 2, and 5
11. Combination of alternative 1, 4, and 5
12. Combination of alternative 1, 2, 4, and 5

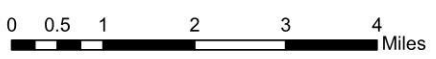


- ~~1. Restore or create wetlands~~
- ~~2. Agricultural drainage and side inlet pipe installations~~
- ~~3. Diversion~~
- ~~4. Off-channel impoundment site~~
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- ~~7. Combination of alternative 1, 2, and 4~~
8. Combination of alternative 1, 3, and 4
9. Combination of alternative 1, 2, 3, and 4
- ~~10. Combination of alternative 1, 2, and 5~~
11. Combination of alternative 1, 4, and 5
12. Combination of alternative 1, 2, 4, and 5

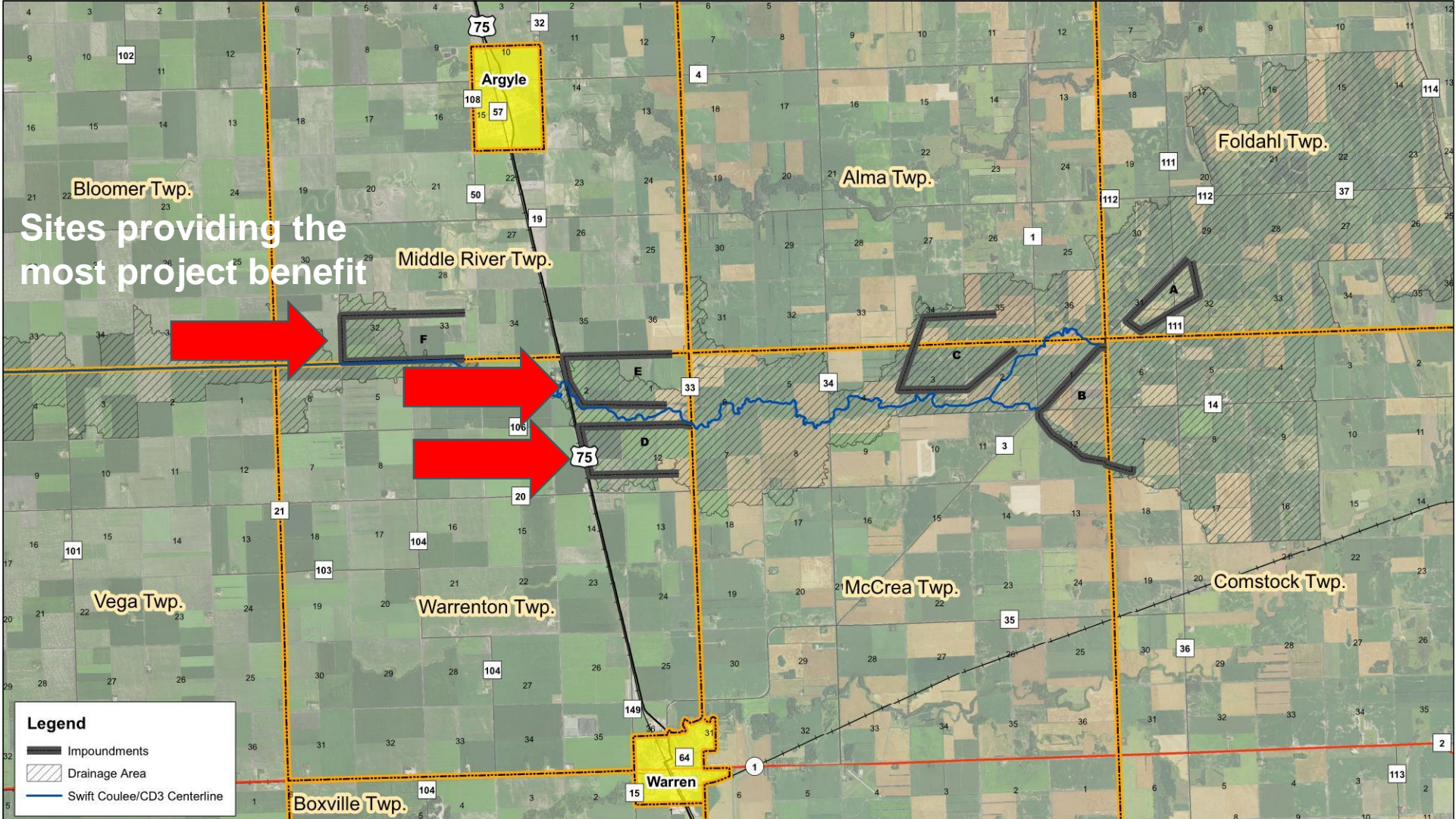
POTENTIAL IMPOUNDMENT INVESTIGATION



Potential Impoundment Alternatives
 Swift Coulee/Marshall County Ditch 3
 Middle-Snake-Tamarac Rivers Watershed District



POTENTIAL IMPOUNDMENT INVESTIGATION

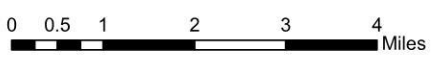


Sites providing the most project benefit

Legend

- Impoundments
- Drainage Area
- Swift Coulee/CD3 Centerline

Potential Impoundment Alternatives
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District



SITE D



Option A	
Drainage Area	37 (Mi ²)
Gated Elevation	863.4 (Ft.)
Gated Storage	3,965 (Ac.-Ft.)
Max Gated Pool Depth	13 (Ft.)
Average Gated Pool Depth	9 (Ft.)
Emergency Spillway Elevation	864.3 (Ft.)
Ungated Storage	500 (Ac.-Ft.)
Ungated Pool Footprint	637 (Ac.)
Embankment Length	20,485 (Ft.)
Wetland Impact (NWI) fill	0 (Ac.)
Wetland Impact (NWI) excavation	.10 (Ac.)
Wetland Impact (NWI) inundate	0 (Ac.)

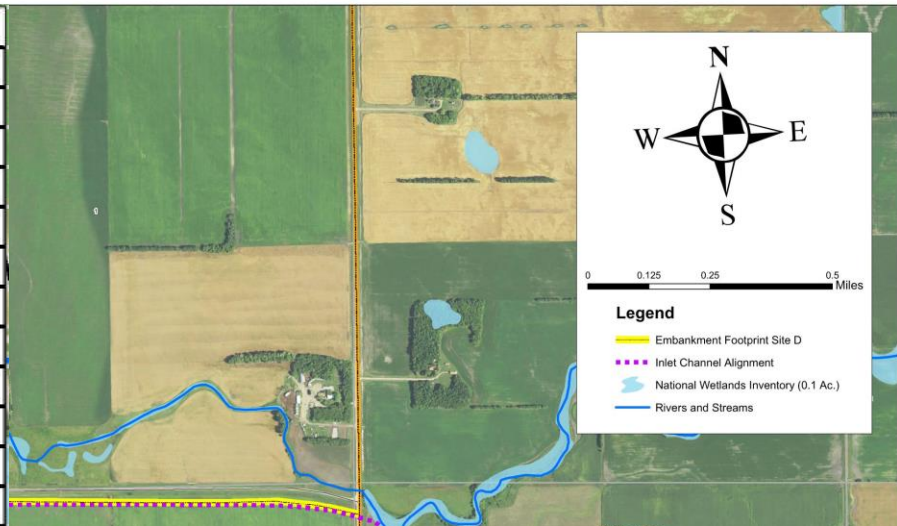
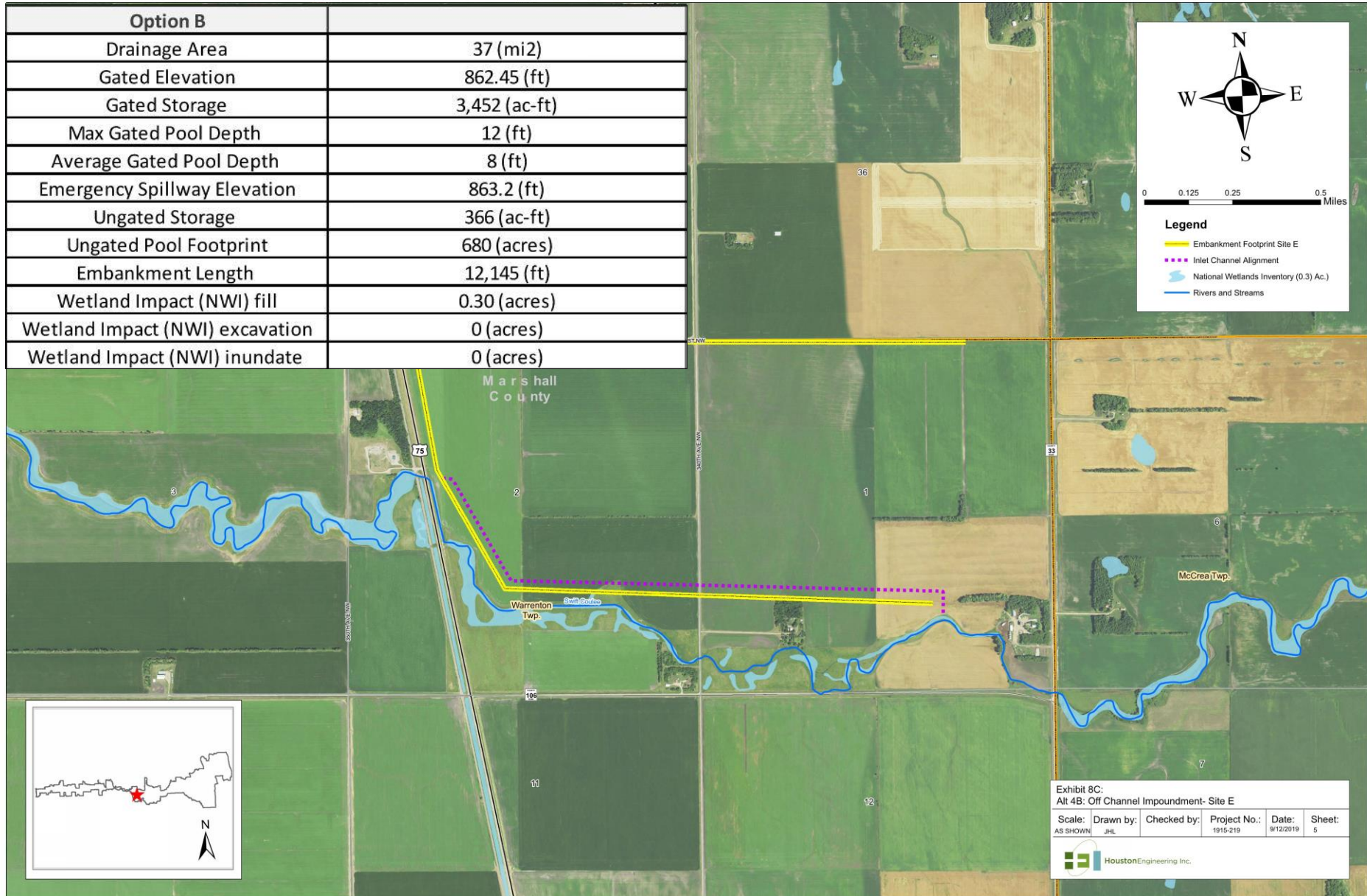


Exhibit 8B:
Alt 4A: Off Channel Impoundment-Site D

Scale: AS SHOWN	Drawn by: JHL	Checked by:	Project No.: 1915-219	Date: 9/12/2019	Sheet: 4
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HoustonEngineering Inc.

SITE E



SITE F



Option C	
Drainage Area	39 (mi ²)
Gated Elevation	839.42(ft)
Gated Storage	3512 (ac-ft)
Max Gated Pool Depth	12 (ft)
Average Gated Pool Depth	10 (ft)
Emergency Spillway Elevation	840.3 (ft)
Ungated Storage	672 (ac-ft)
Ungated Pool Footprint	782 (acres)
Embankment Length	24735 (ft)
Wetland Impact (NWI) fill	0 (acres)
Wetland Impact (NWI) excavation	0 (acres)
Wetland Impact (NWI) inundate	1.00 (acres)



Legend

- Embankment Footprint Site F
- - - Inlet Channel Alignment
- National Wetlands Inventory (1.0 Ac.)
- Rivers and Streams

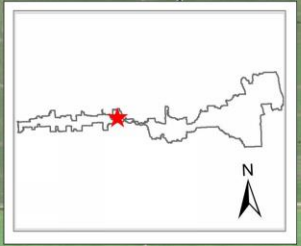


Exhibit 8D:
Alt 4C: Off Channel Impoundment-Site F

Scale: AS SHOWN	Drawn by: JHL	Checked by:	Project No.: 1915-219	Date: 9/12/2019	Sheet: 6
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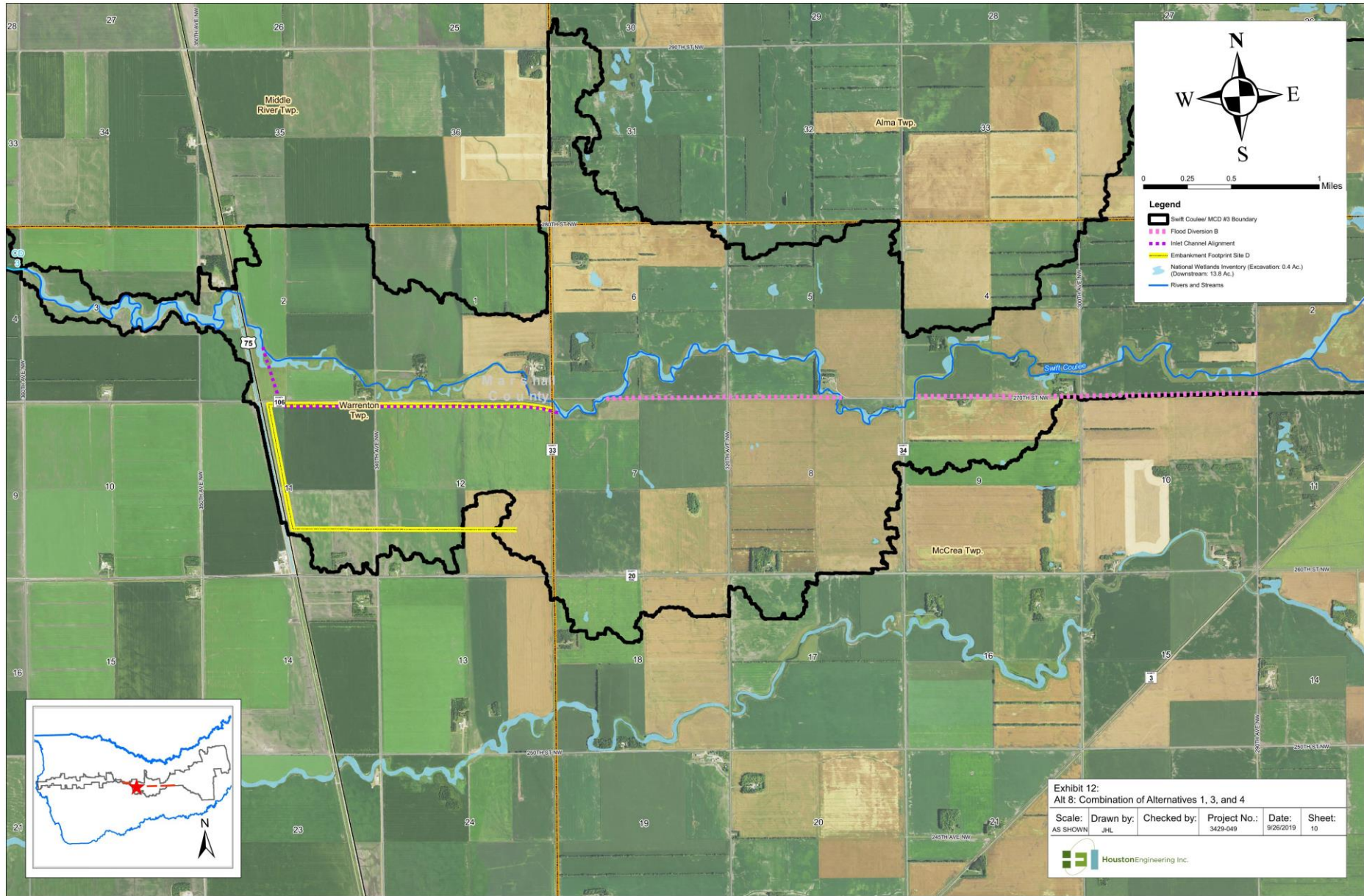
HoustonEngineering Inc.

ALTERNATIVES IDENTIFIED, ANALYZED, AND SCREENED



- ~~1. Restore or create wetlands~~
- ~~2. Agricultural drainage and side inlet pipe installations~~
- ~~3. Diversion~~
- ~~4. Off-channel impoundment site~~
- ~~5. Channel restoration, set back levees, and side inlet pipe installations~~
- ~~6. Combination of alternative 1, 2, and 3~~
- ~~7. Combination of alternative 1, 2, and 4~~
8. **Combination of alternative 1, 3, and 4**
9. Combination of alternative 1, 2, 3, and 4
- ~~10. Combination of alternative 1, 2, and 5~~
11. Combination of alternative 1, 4, and 5
12. Combination of alternative 1, 2, 4, and 5

ALTERNATIVE 8

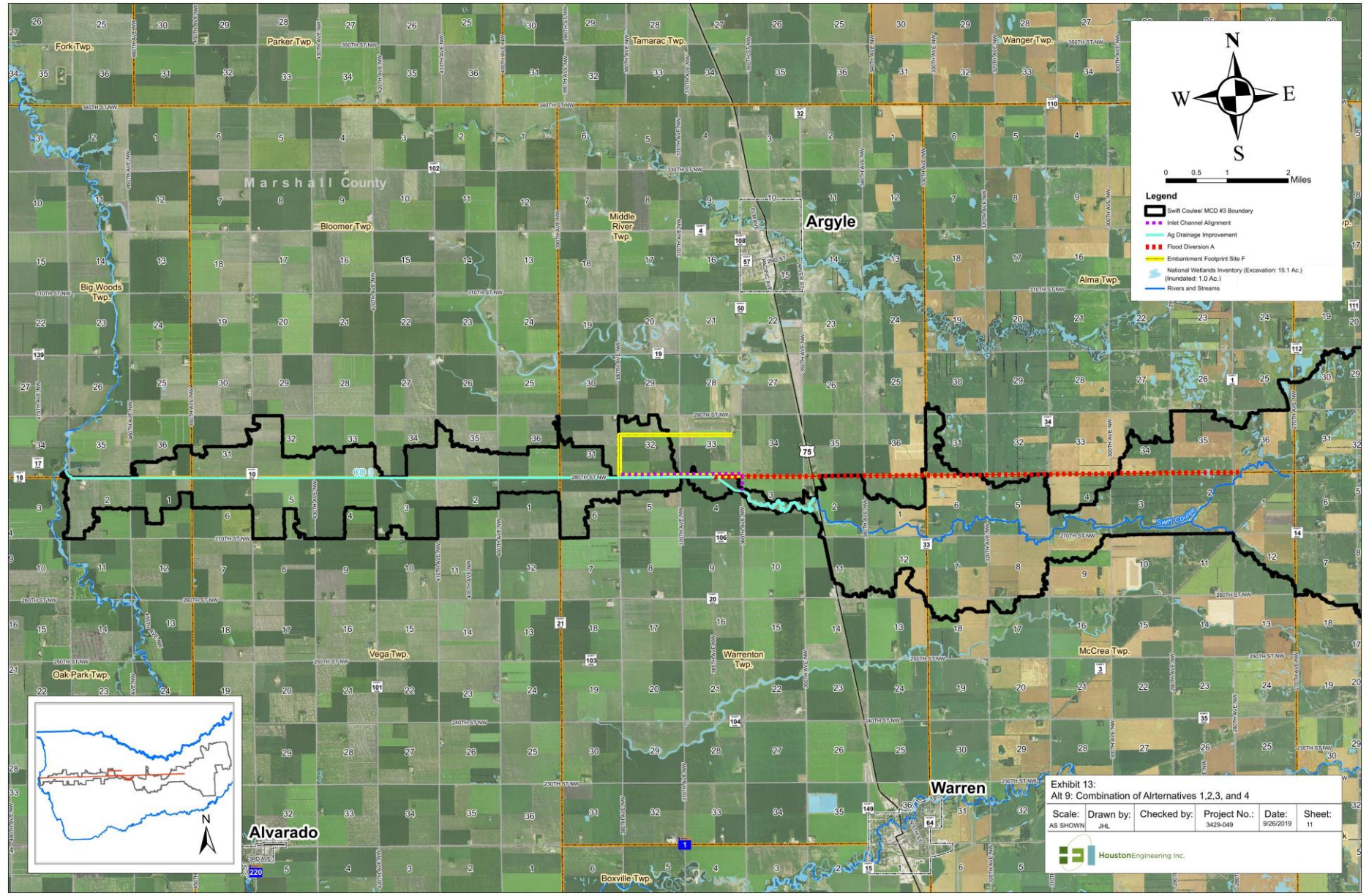


ALTERNATIVES IDENTIFIED, ANALYZED, AND SCREENED



- ~~1. Restore or create wetlands~~
- ~~2. Agricultural drainage and side inlet pipe installations~~
- ~~3. Diversion~~
- ~~4. Off-channel impoundment site~~
- ~~5. Channel restoration, set back levees, and side inlet pipe installations~~
- ~~6. Combination of alternative 1, 2, and 3~~
- ~~7. Combination of alternative 1, 2, and 4~~
8. Combination of alternative 1, 3, and 4
9. **Combination of alternative 1, 2, 3, and 4**
- ~~10. Combination of alternative 1, 2, and 5~~
11. Combination of alternative 1, 4, and 5
12. Combination of alternative 1, 2, 4, and 5

ALTERNATIVE 9

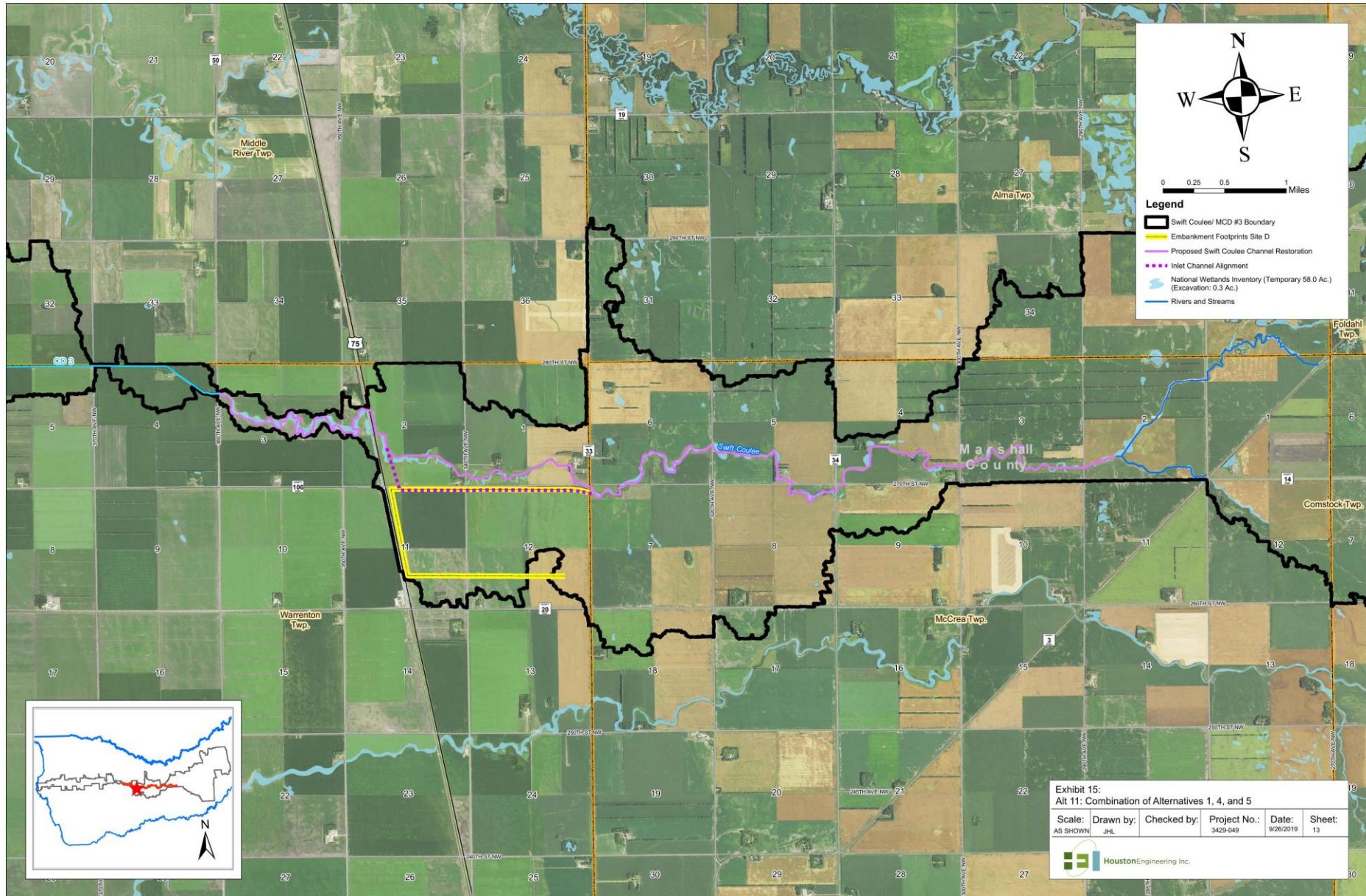


ALTERNATIVES IDENTIFIED, ANALYZED, AND SCREENED



- ~~1. Restore or create wetlands~~
- ~~2. Agricultural drainage and side inlet pipe installations~~
- ~~3. Diversion~~
- ~~4. Off-channel impoundment site~~
- ~~5. Channel restoration, set back levees, and side inlet pipe installations~~
- ~~6. Combination of alternative 1, 2, and 3~~
- ~~7. Combination of alternative 1, 2, and 4~~
8. Combination of alternative 1, 3, and 4
9. Combination of alternative 1, 2, 3, and 4
- ~~10. Combination of alternative 1, 2, and 5~~
11. **Combination of alternative 1, 4, and 5**
12. Combination of alternative 1, 2, 4, and 5

ALTERNATIVE 11



N
W —+— E
S

0 0.25 0.5 1 Miles

Legend

- Swift Coulee MCD #3 Boundary
- Embankment Footprints Site D
- Proposed Swift Coulee Channel Restoration
- Inlet Channel Alignment
- National Wetlands Inventory (Temporary 58.0 Ac.) (Excavation: 0.3 Ac.)
- Rivers and Streams

Exhibit 15:
 Alt 11: Combination of Alternatives 1, 4, and 5

Scale: AS SHOWN	Drawn by: JHL	Checked by:	Project No.: 3429-049	Date: 9/26/2019	Sheet: 13
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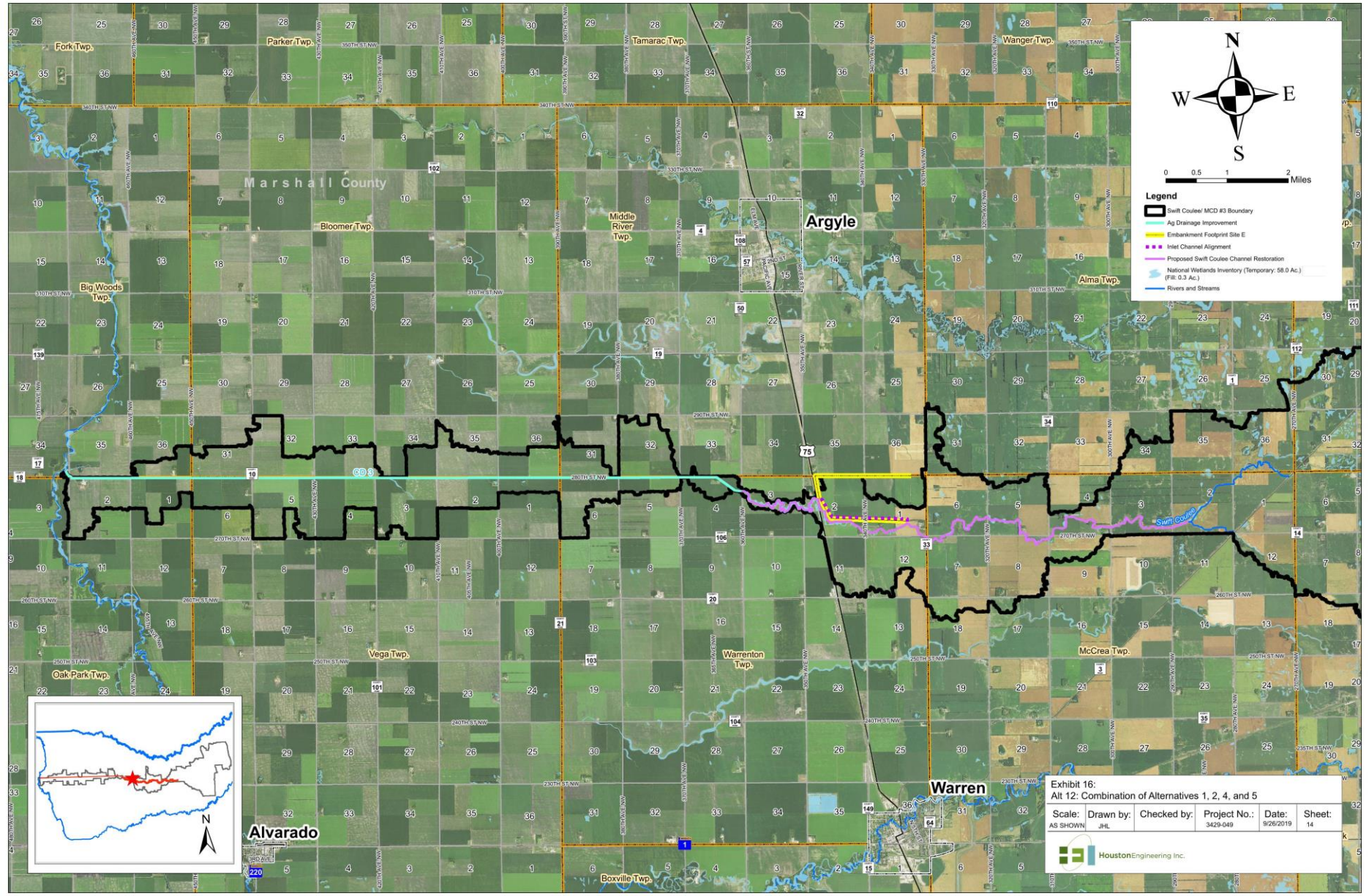
Houston Engineering Inc.

ALTERNATIVES IDENTIFIED, ANALYZED, AND SCREENED



- ~~1. Restore or create wetlands~~
- ~~2. Agricultural drainage and side inlet pipe installations~~
- ~~3. Diversion~~
- ~~4. Off-channel impoundment site~~
- ~~5. Channel restoration, set back levees, and side inlet pipe installations~~
- ~~6. Combination of alternative 1, 2, and 3~~
- ~~7. Combination of alternative 1, 2, and 4~~
8. Combination of alternative 1, 3, and 4
9. Combination of alternative 1, 2, 3, and 4
- ~~10. Combination of alternative 1, 2, and 5~~
11. Combination of alternative 1, 4, and 5
12. **Combination of alternative 1, 2, 4, and 5**

ALTERNATIVE 12



SELECTING ALTERNATIVE



Alternative	Resource Type	Impact Type	Impact Amount	Meets the Purpose and Need		
1 Restore or Create Wetlands	• Wetlands	• Temporary excavation / fill to create wetland embankment and outlet	• Varies by wetland but generally small.	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No
2 Agriculture Drainage and Side Inlet Pipe Installations	• MCD #3 • Snake River	• Permanent excavation to ditch • Increased peak flows and potentially higher flood damages	• 13.5 channel miles within MCD #3 and the Swift Coulee • 14.5 acres of potential temporary wetland impact	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input type="checkbox"/> Partially <input checked="" type="checkbox"/> No	NRE Benefits <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No
3 Flood Diversion A	• MCD #3	• Wetlands adjacent to MCD #3 will be impacted, increased flow and potentially higher flood damages	• Downstream wetland impact of 5.6 acres • Excavation wetland impact of 0.6 acres • Estimated impact of 10.6 miles of MCD #3	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No
3 Flood Diversion B	• Swift Coulee • MCD #3	• Wetlands adjacent Swift Coulee will be impacted • Wetlands adjacent to MCD #3 will be impacted, increased flow and potentially higher flood damages	• Downstream wetland impact of 101.3 acres • Excavation wetland impact of 0.1 acres • Estimated impact of 5.3 miles of Swift Coulee • Estimated impact of 11.1 miles of MCD #3	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No
4 Off Channel Impoundment Site D	• Swift Coulee • Wetlands	• Temporary excavation / fill to create coulee diversion inlet • Excavation under ditch footprint, fill under embankment footprint, inundation (during high runoff event only)	• Estimated 125 feet of chanel levee would be removed and replaced with a weir that would direct flows about bankfull elevation into a channel leading to the impoundment • Excavation: 0.3 Ac. • Fill: 0 Ac. • Inundation: 0 Ac.	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	100-YR Protection of Farmsteads <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
4 Off Channel Impoundment Site E	• Swift Coulee • Wetlands	• Temporary excavation / fill to create coulee diversion inlet • Excavation under ditch footprint, fill under embankment footprint, inundation (during high runoff event only)	• Estimated 125 feet of chanel levee would be removed and replaced with a weir that would direct flows about bankfull elevation into a channel leading to the impoundment • Excavation: 0 Ac. • Fill: 0.3 Ac. • Inundation: 0 Ac.	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	100-YR Protection of Farmsteads <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
4 Off Channel Impoundment Site F	• Swift Coulee • Wetlands	• Temporary excavation / fill to create coulee diversion inlet • Excavation under ditch footprint, fill under embankment footprint, inundation (during high runoff event only)	• Estimated 125 feet of chanel levee would be removed and replaced with a weir that would direct flows about bankfull elevation into a channel leading to the impoundment • Excavation: 0 Ac. • Fill: 0 Ac. • Inundation: 1.0 Ac.	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	100-YR Protection of Farmsteads <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
5 Channel Restoration, Setting Back Existing Levees and Side Inlet Pipe Installations	• Swift Coulee	• Excavation of the channel to natural design	• 11.3 channel miles along Swift Coulee • Wetland impacted adjacent to the Swift Coulee would be 58.0 Ac.	10-YR Protection of Ag Land <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No	NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No

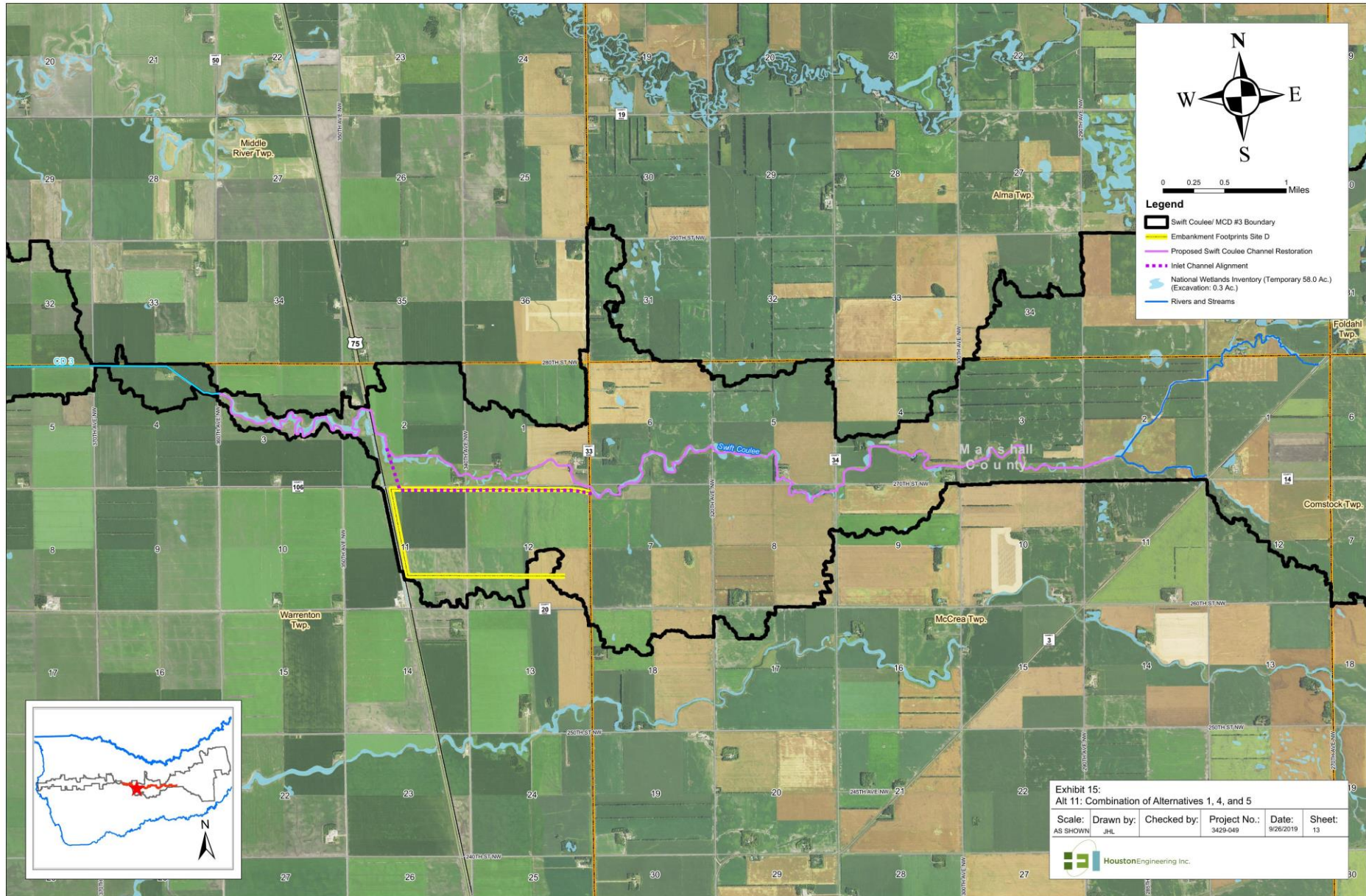
SELECTING ALTERNATIVE



<p>6 Combination of Alternatives 1, 2, and 3 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 • Snake River 	See 1, 2, and 3 Impact Types Above	See 1, 2, and 3 Impact Amounts Above	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
<p>7 Combination of Alternatives 1, 2, and 4 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 	See 1, 2, and 4 Impact Types Above	See 1, 2, and 4 Impact Amounts Above	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
<p>8 Combination of Alternatives 1, 3, and 4 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 	See 1, 3, and 4 Impact Types Above	See 1, 3, and 4 Impact Amounts Above • The downstream wetland impacts from the Flood Diversion would be reduced.	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No
<p>9 Combination of Alternatives 1, 2, 3, and 4 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 	See 1, 2, 3, and 4 Impact Types Above	See 1, 2, 3, and 4 Impact Amounts Above	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
<p>10 Combination of Alternatives 1, 2, and 5 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 • Snake River 	See 1, 2, and 5 Impact Types Above	See 1, 2, and 5 Impact Amounts Above • The wetland impacts from 2 and 4 would be 58.0 Ac. combined	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input type="checkbox"/> Partially <input checked="" type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
<p>11 Combination of Alternatives 1, 4, and 5 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee 	See 1, 4, and 5 Impact Types Above	See 1, 4, and 5 Impact Amounts Above	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No
<p>12 Combination of Alternatives 1, 2, 4, and 5 above</p>	<ul style="list-style-type: none"> • Wetlands • Swift Coulee • MCD #3 	See 1, 2, 4, and 5 Impact Types Above	See 1, 2, 4, and 5 Impact Amounts Above • The wetland impacts from 2 and 4 would be 58.3 Ac. combined	10-YR Protection of Ag Land <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No Flood Reduction to Infrastructure <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Partially <input type="checkbox"/> No NRE Benefits <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No



SELECTED ALTERNATIVE



N
W —+— E
S

0 0.25 0.5 1 Miles

Legend

- Swift Coulee MCD #3 Boundary
- Embankment Footprints Site D
- Proposed Swift Coulee Channel Restoration
- Inlet Channel Alignment
- National Wetlands Inventory (Temporary 58.0 Ac.) (Excavation: 0.3 Ac.)
- Rivers and Streams

Exhibit 15:
Alt 11: Combination of Alternatives 1, 4, and 5

Scale: AS SHOWN	Drawn by: JHL	Checked by:	Project No.: 3429-049	Date: 9/26/2019	Sheet: 13
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- Alternative 11
 - Meets the Purpose and Need throughout Sub-Watershed
 - Low Potential Impacts to Aquatic Ecosystem
 - Preferred off-channel impoundment site (Site D)
 - Largest Gated Storage Capacity
 - Minimal Environmental Impact
 - No Drain Tile, Least Amount of Landowners
 - Channel Restoration – Environmental Enhancement (Outside Funding)



Questions/Discussion

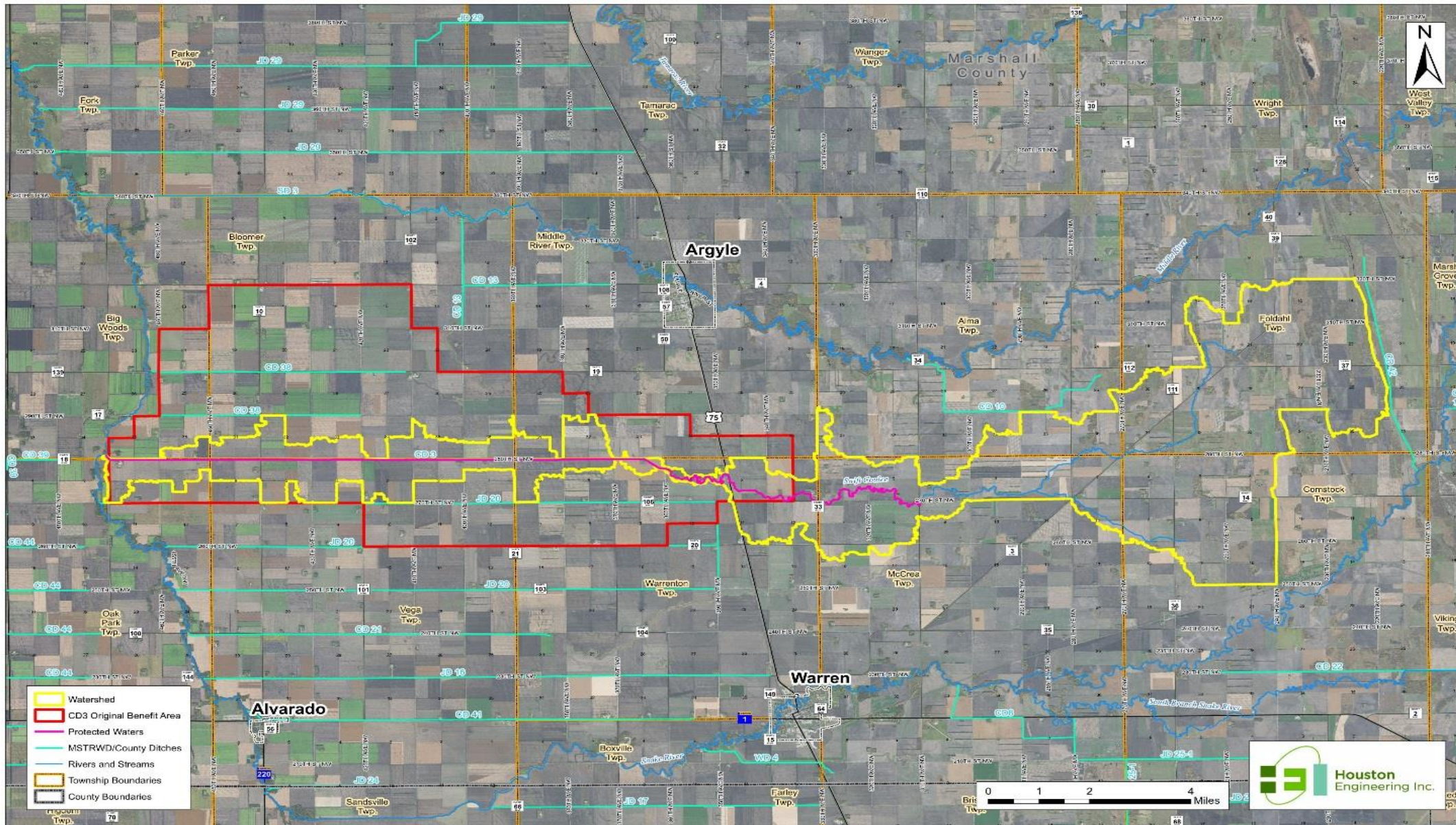


- Comment Period on Concurrence Point #3 (Identification of Selected Alternative)
 - Posted on the Middle-Snake-Tamarac Rivers Watershed District Website
 - <https://mstrwd.org/>
 - Comment Period Ends December 31, 2019



- Review and address comments on CP #3
- Submit CP #3 to USACE for approval
- Begin Preliminary Design of Selected Alternative
- Draft Preliminary Engineer's Report
- Continue project discussion/communication with landowners

SITE MAP



PHASE 1 – H & H REPORT NOAA ATLAS 14



Return Period	24-Hour Rainfall (in.)	4-Day Rainfall (in.)
2 – year	2.3	3.0
5 – year	2.9	3.7
10 – year	3.5	4.3
25 – year	4.4	5.3
50 – year	5.1	6.1
100 – year	5.9	7.0