HANSON

Engineering | Planning | Allied Services

Aspirin for Floodplain Managers

Hydrologic and Hydraulic Modeling of Alternatives

Scott M. Arends, P.E., CFM

IAFSM 2017 Annual Conference

Acknowledgements


JACK NICKLAUS DR
ARNOLD PALMER DR
TIGERS WAY
Farm Rd
SLAMMER DR
ZONE X
LIMIT OF DETAILED STUDY
ZONE AE
FOURLAKES DR
SEVENTH FAIRWAY CT
PRO TOUR DR
FAIRWAY DR
TENTH FAIRWAY DR
31
455
458
458
459
460
461
466
469
468
467
466
462
459
BOBBY
BEN HO
Unnamed Tr
to Loop C
PROFILE BASE
MOO
PLUM HILL SC

General Approach

- Known Areas of Concern Identified by City
  - Water entering walkout basements (at least 15 known)
  - Water ponding in yards
  - Water ponding in streets
  - Erosion issues
- Resident input (30+ submittals received)
- Surveyed existing conditions & drainage patterns
- Develop conceptual recommendations to address each area of concern (23 improvements)

Key Observations

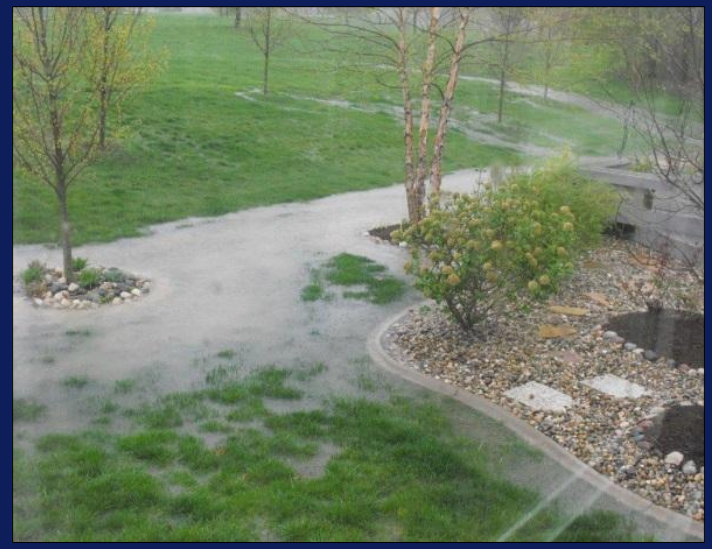
- Outfall Structure
  - Overflow elevation is 1.5’ higher than design
  - Decreases storage capacity
  - Increases risk of overtopping roadway

Key Observations – Maintenance Concerns

- Debris and Sedimentation in/near Culverts

Key Observations – Maintenance Concerns

- Swale obstructions
  - Landscaping
  - Basketball hoops
  - Swing sets
  - Putting greens
- Typically in drainage easements
- Reduces effectiveness



Key Observations– Permitted Detention

- Off-line detention
  - Does not appear to have been maintained
  - Breach reduces storage functionality

Key Observations– Permitted Detention

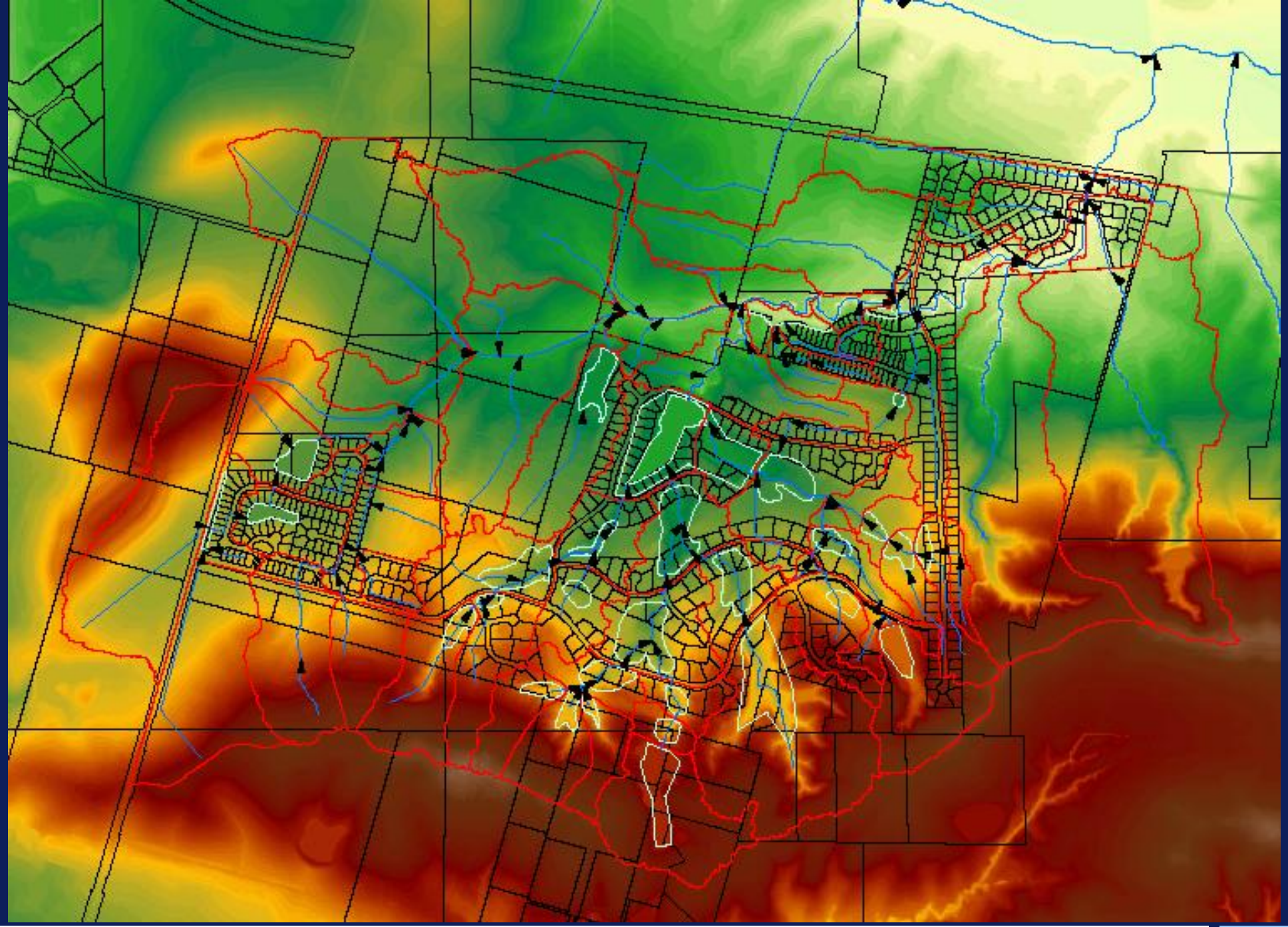
- Inline detention
  - Excavation of detention area required by IDNR permit
  - Never constructed

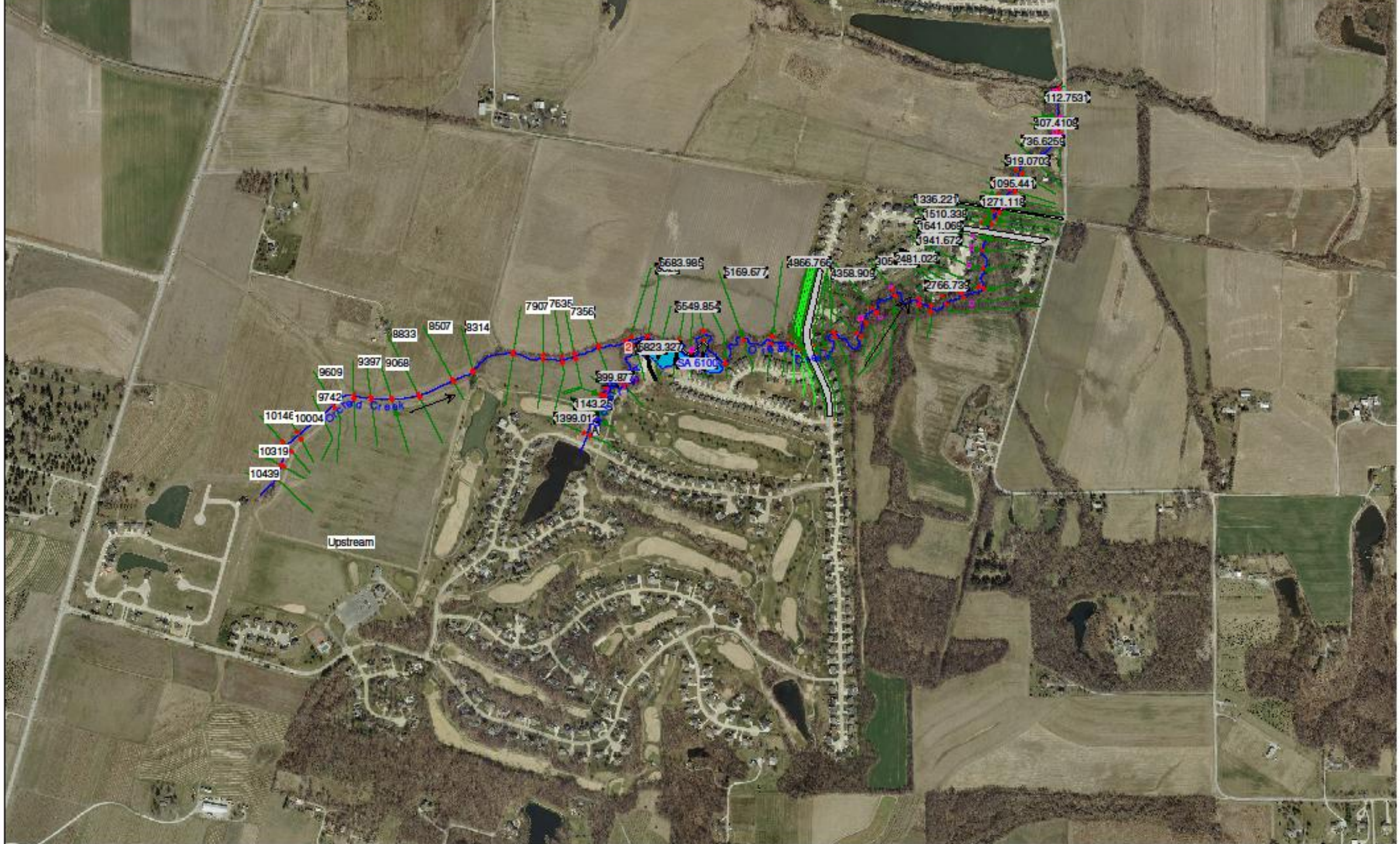
Key Observations– Walkout Basements

- Issues with basements near creek
- Development plans
  - Stated requirement for separate drainage study if exposed basement desired
  - Unknown if any were ever performed
- Many residents have constructed flood protection improvements such as retaining walls and berms

Great for keeping water out…

and for keeping water in.




112.7531
907.4109
736.6255
919.0703
1095.441
1336.221
1271.118
1510.339
1641.069
941.672
2481.023
2766.739
4866.766
4358.909
5169.677
5683.985
5549.854
7907
7635
7356
9833
8507
9314
9397
9068
9609
9742
10146
10004
10319
10439
5823.327
399.87
143.25
1399.01
SA 6100
Upstream

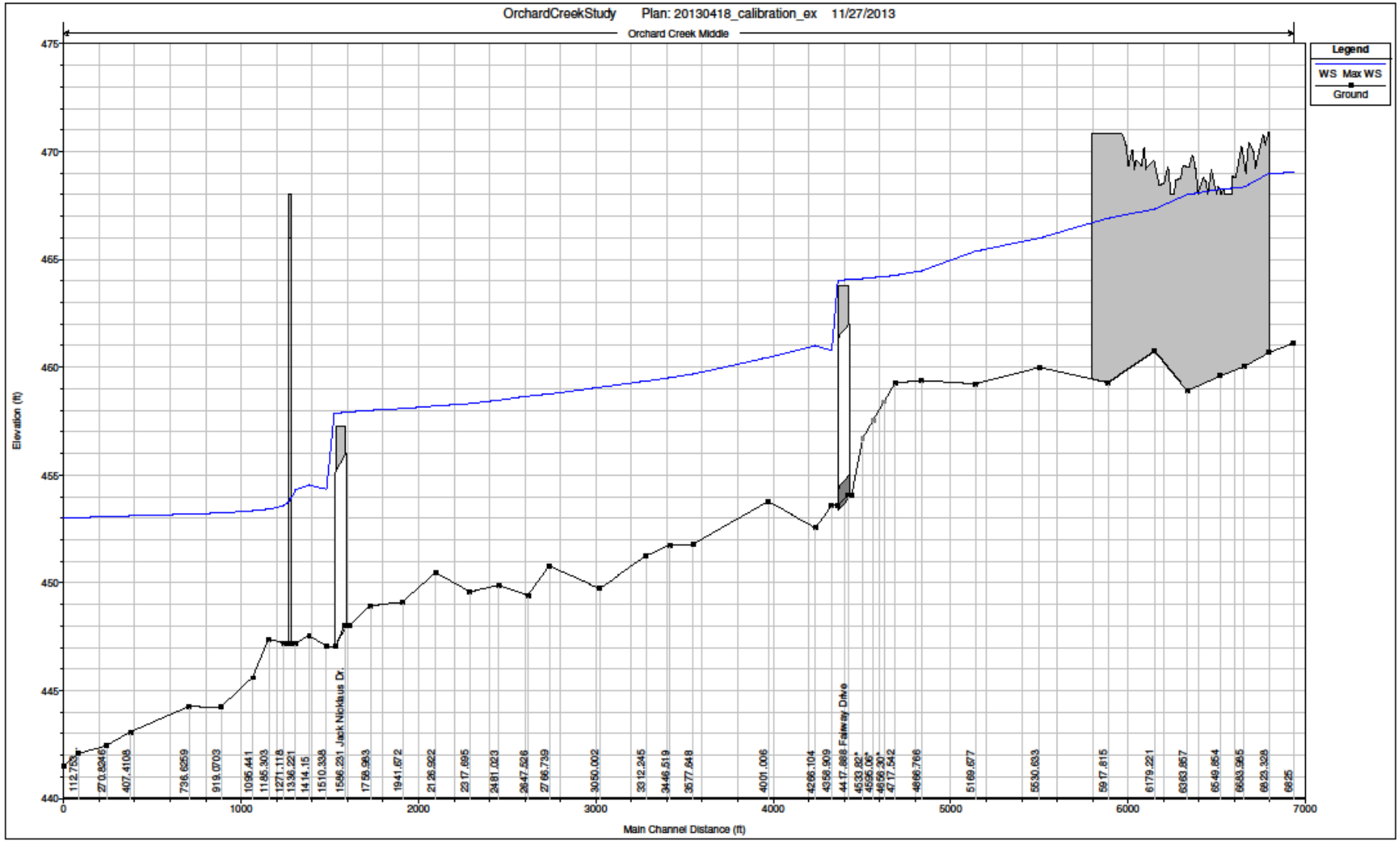


Figure 6-2: HEC-RAS Calibration Model Profile

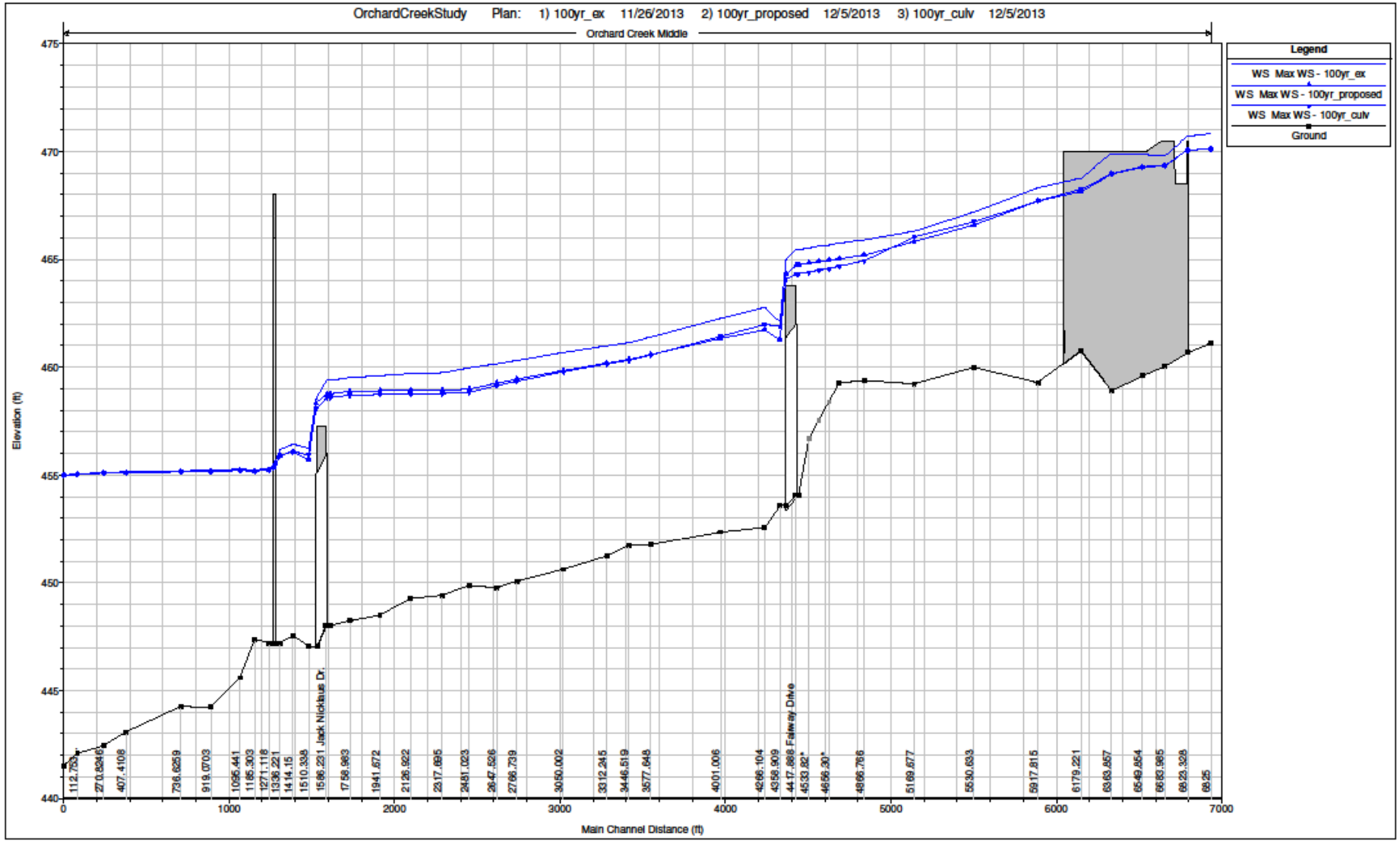
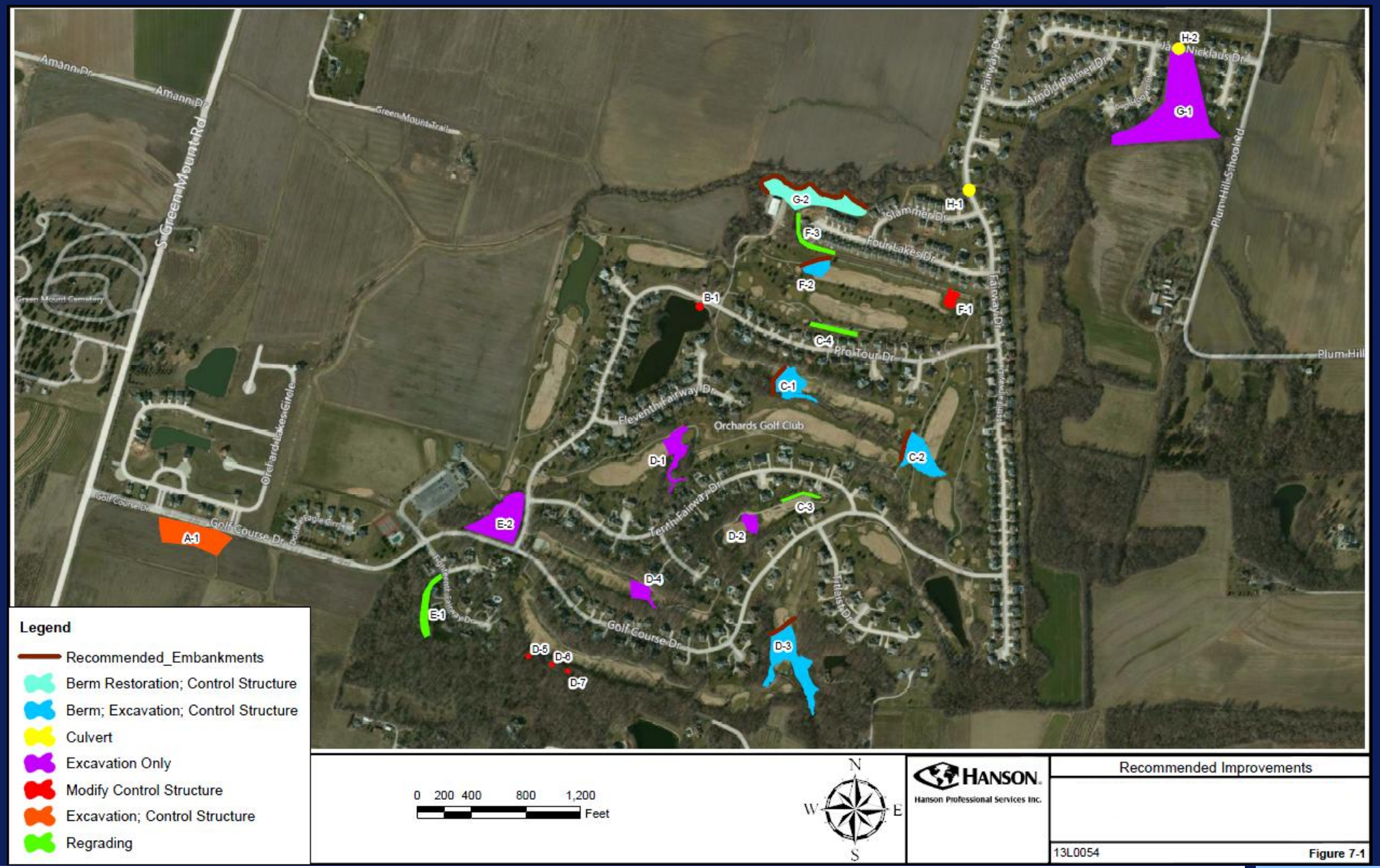


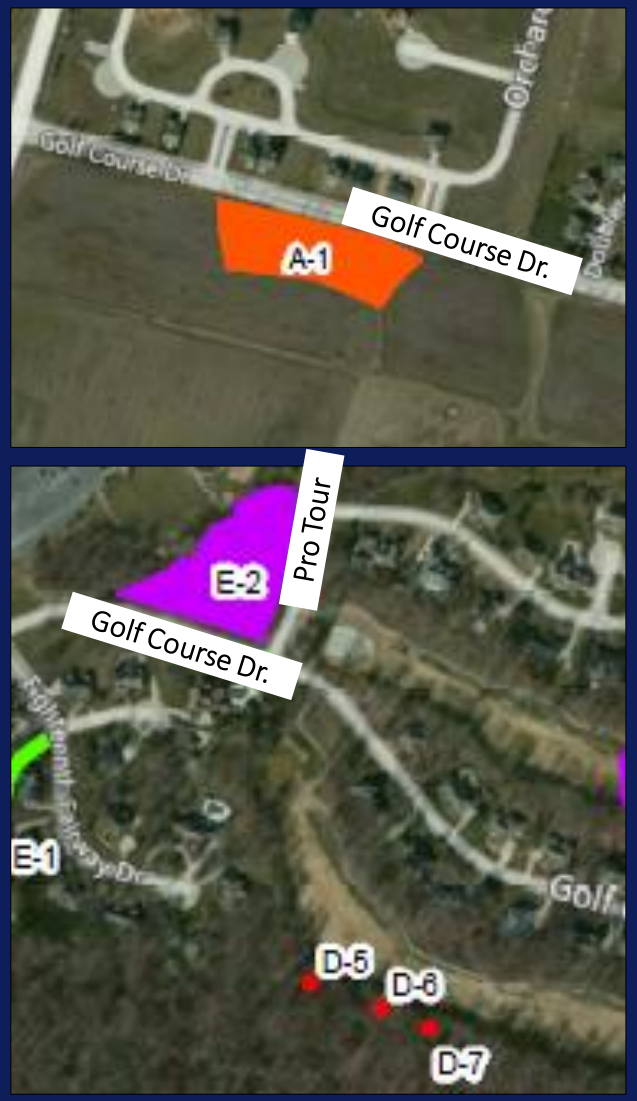
Figure 6-4: HEC-RAS 100-year Model Profile

Conceptual Improvements



Conceptual Improvements – Storage

- Dry Detention
  - Reduces peak flows through development
  - Drains down after peak of the storm passes
  - Proposed away from homes
  - Provides benefit to all areas located downstream



Conceptual Improvements – Storage

Conceptual Improvements – Storage

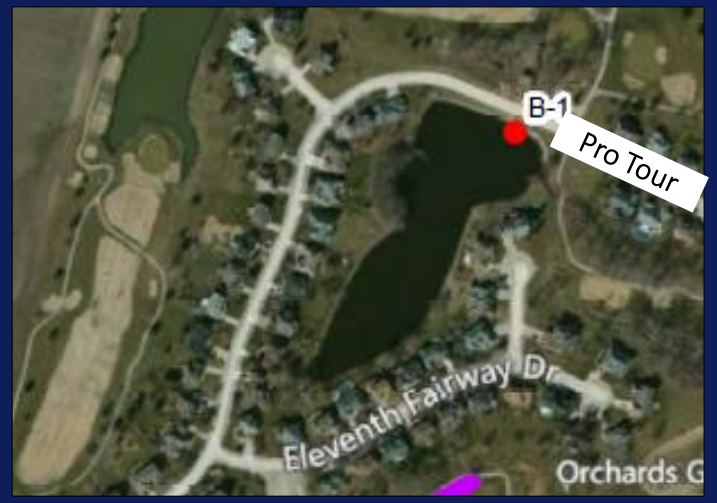
Location	10-year Flow Reduction (%)	100-year Flow Reduction (%)
1. Lakes Estates	76%	62%
2. Lake Inflow (west)	46%	49%
3. Lake Inflow (central)	36%	28%
4. Lake Inflow (east)	77%	77%
5. Lake Outflow	38%	40%
6. Fairway Drive	20%	32%
7. Jack Nicklaus Drive	20%	16%

After

Before

Conceptual Improvements – Structures

- Pro Tour Drive Lake (B-1)
  - Restore spillway design configuration
  - Added storage and reduces risk of overtopping
  - Benefits residents directly upstream and those downstream of the lake
- Four Lakes Drive (F-1)
  - Convert lake to dry detention
  - Size structure to reduce risk of overtopping cart path
  - Benefits properties on Four Lakes Drive



Conceptual Improvements – Culverts

- Add a 6-ft diameter culvert at each location to increase flow capacity at each crossing

Benefits

- Reduce flood stage in area
- Reduce frequency of overtopping of roadways

Conceptual Improvements – 100yr

Conceptual Improvements – 10yr

Conceptual Improvements – Grading

- Recommend grading improvements to minimize nuisance drainage issues
  - Remove obstructions from existing swales
  - Construct berms / swales at rear or side of yards to direct flow away from homes
  - Ensure yards are sloped away from homes

Suggested Priority Ranking

- Priority was placed on:
  - Reducing risk of stormwater entering homes
  - Maximizing the amount of residents benefitting from the recommendation
    - Hazard Factor – a catastrophic failure would put downstream homes at risk
- Cost was not considered in the ranking

Future Maintenance Recommendations

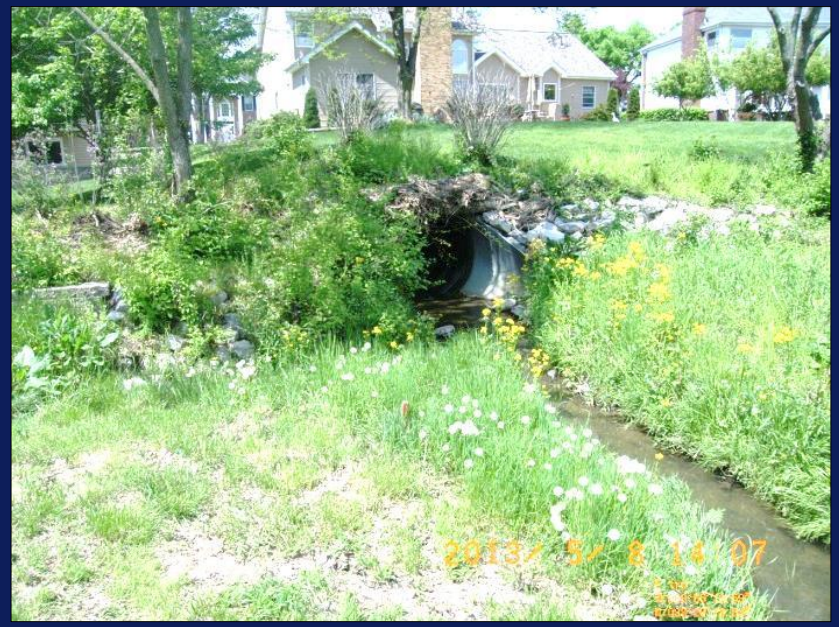
- Remove obstructions from swales and drainage easements
- Perform regular maintenance / cleaning of culverts in development
- Construct berms for protection of homes in areas prone to flooding, especially walk-outs and exposed basements
- Ensure future development does not increase potential for increased flows through subdivision

Options not Recommended

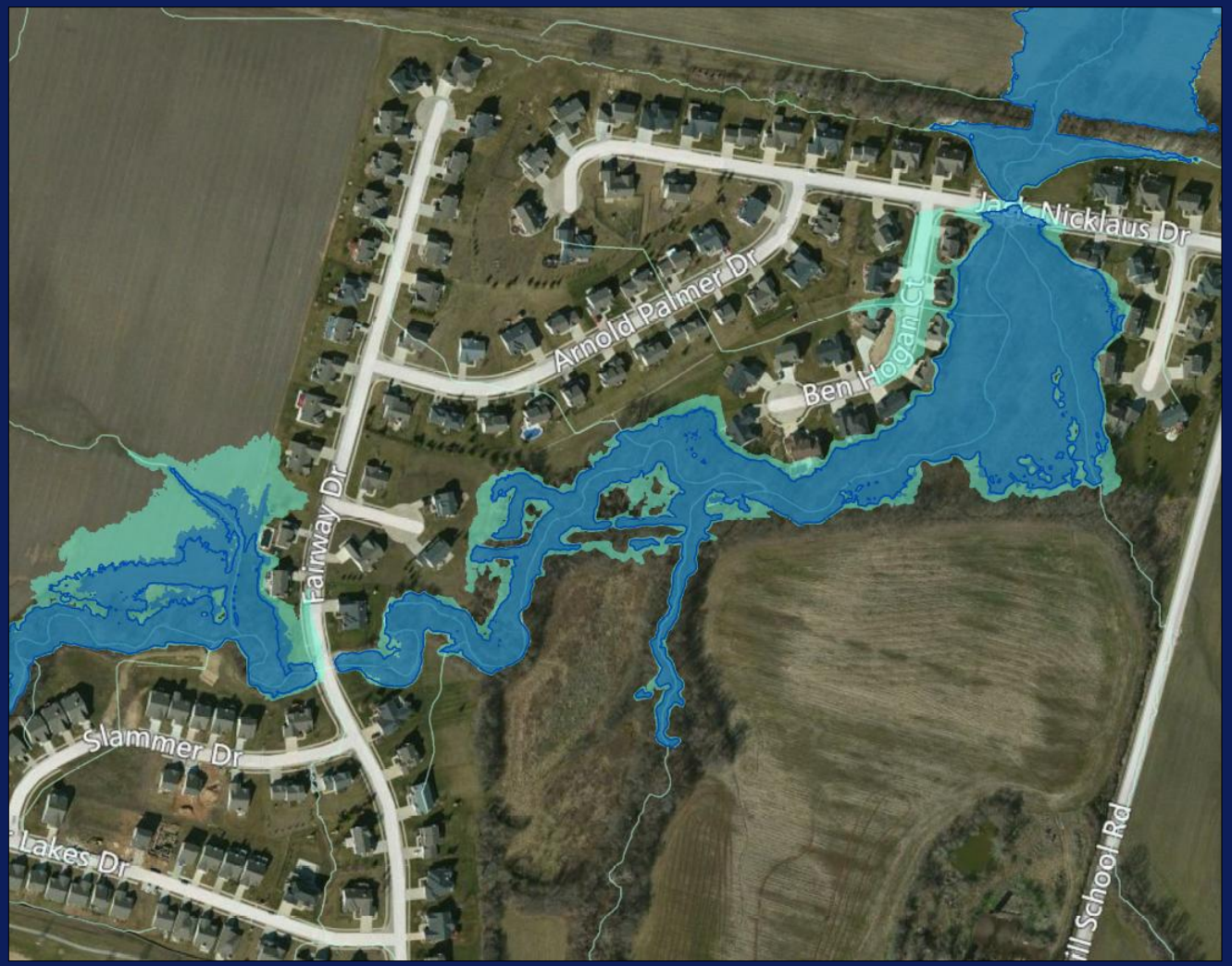
- Remove railroad trestle downstream of subdivision
  - Removal would have little to no impact to upstream properties
  - Water surface along creek is controlled by existing culvert capacity

Options not Recommended

- Increase culvert sizes upstream of Pro Tour Drive Lake
  - Existing pipes are 36” to 66” diameter
  - Transfers problems with flow rates downstream
  - Still prone to debris and clogging



Questions?


Arnold Palmer Dr
Ben Hogan Ct
Nicklaus Dr
Fairway Dr
Slammer Dr
Lakes Dr