District 88

Willowbrook High School

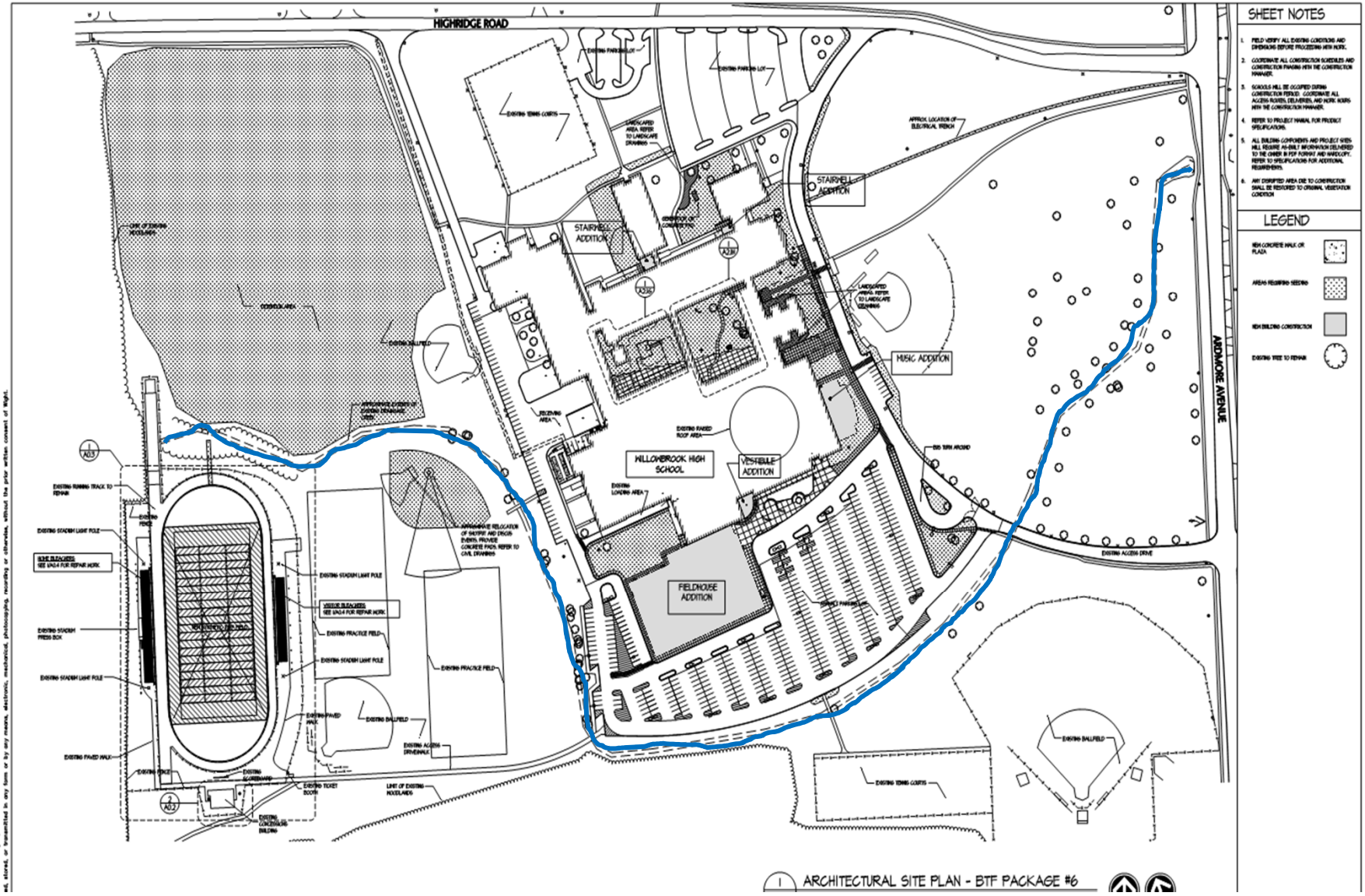
Presented by: Tom Powers *P.E.,*
CFM, LEED AP, CPESC

Wight
wightco.com

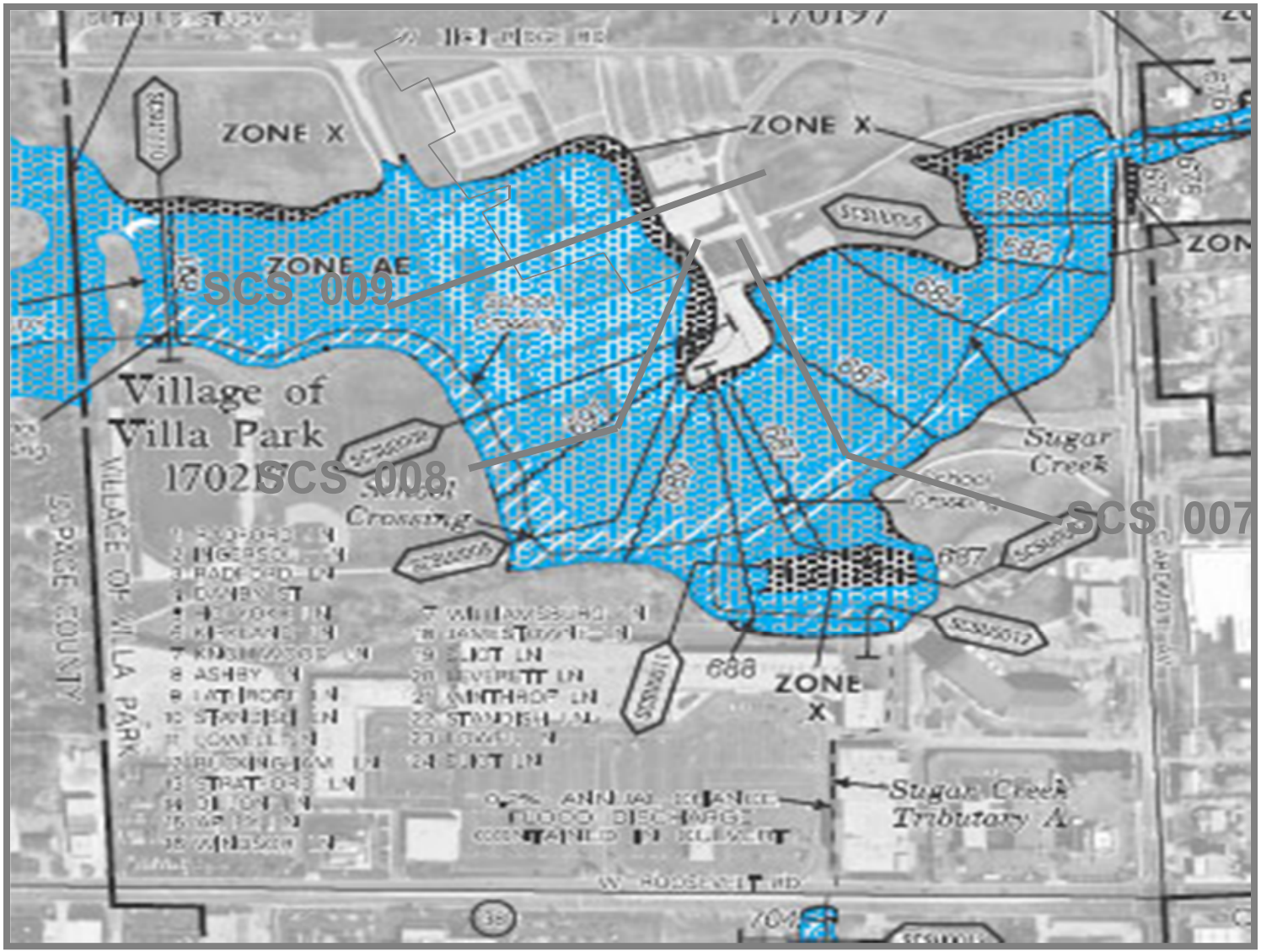
Floodplain Players and Bio's

- DuPage County – Local Floodway and Wetland Authority
- Villa Park – Local Floodplain Authority
- IDNR – State Floodway Authority
- FEMA – Federal Administrator of Nation Flood Insurance Program
- Christopher Burke (CBBEL) – FEQ Specialist
- Wight & Company – Project Manager & HEC Consultant
- Owner/Client, Build Partner, Design Disciplines

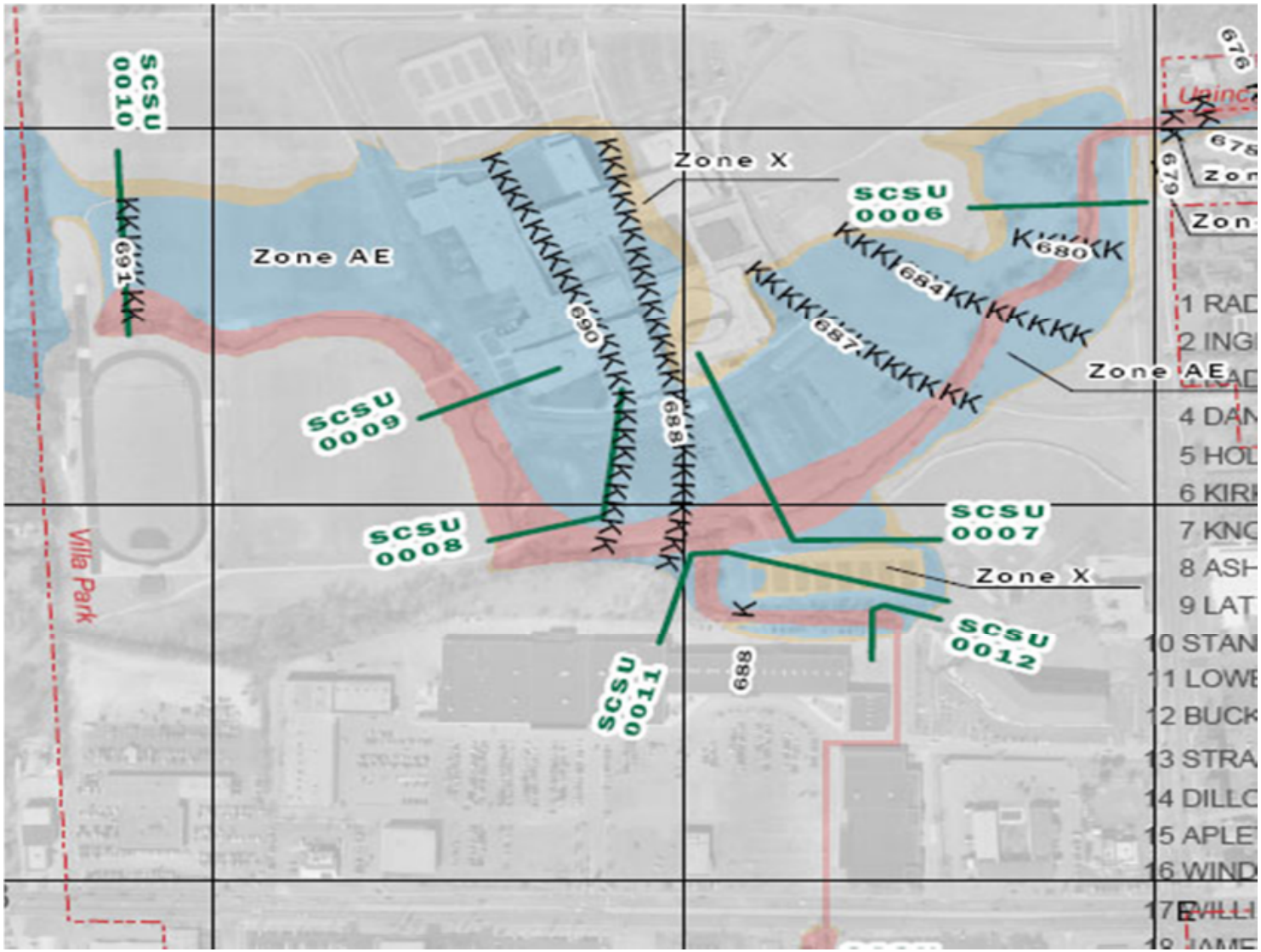
Site Orientation



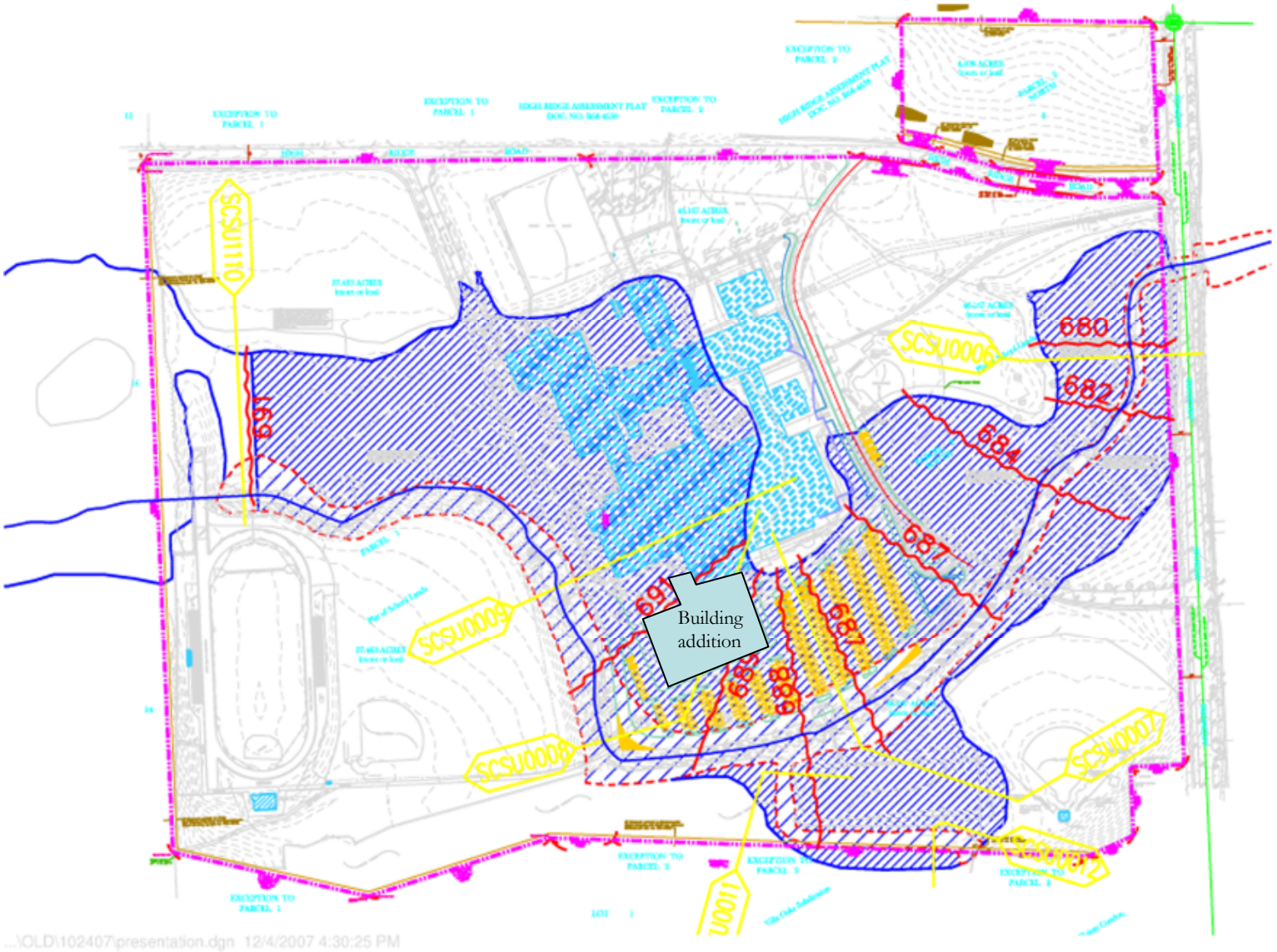
HEC 2 BASED


ZONE X
ZONE X
ZONE AE
SCS 009
SCS 008
SCS 007
Village of
Villa Park
Sugar
Creek
688
ZONE
X
Sugar Creek
Tributary A
VILLAGE OF VILLA PARK
DUPAGE COUNTY

FEQ BASED


SCSU 0010
Zone AE
Zone X
SCSU 0006
Zone AE
SCSU 0009
SCSU 0008
SCSU 0007
Zone X
SCSU 0012
SCSU 0011
Villa Park

Building Addition in Floodplain



Who makes which rules?

- DuPage County – Local stormwater ordinance.
- IDNR – Floodway rules.
- FEMA – Minimum ordinance requirements and ordinance administration rules for certified communities.

Why can’t we bend the rules for schools?

- To remain certified, a community must meet the minimum NFIP requirements for floodplain development regulation.
- If a community (DuPage or Villa Park) loses certification, then it loses flood insurance benefits for its residents.
- FEMA audits floodplain permit records to verify rules are followed.

What are some of the rules?

- DuPage County – Flood protection elevation (FPE) = Base flood elevation (BFE) + 1’.
- DuPage County – No adverse impacts downstream or upstream demonstrated by FEQ computer model.
- DuPage County – Compensatory storage.
- DuPage County and IDNR – Appropriate uses in floodway.
- FEMA/DuPage/Village – Substantial improvement limitations.

Existing Preconditions

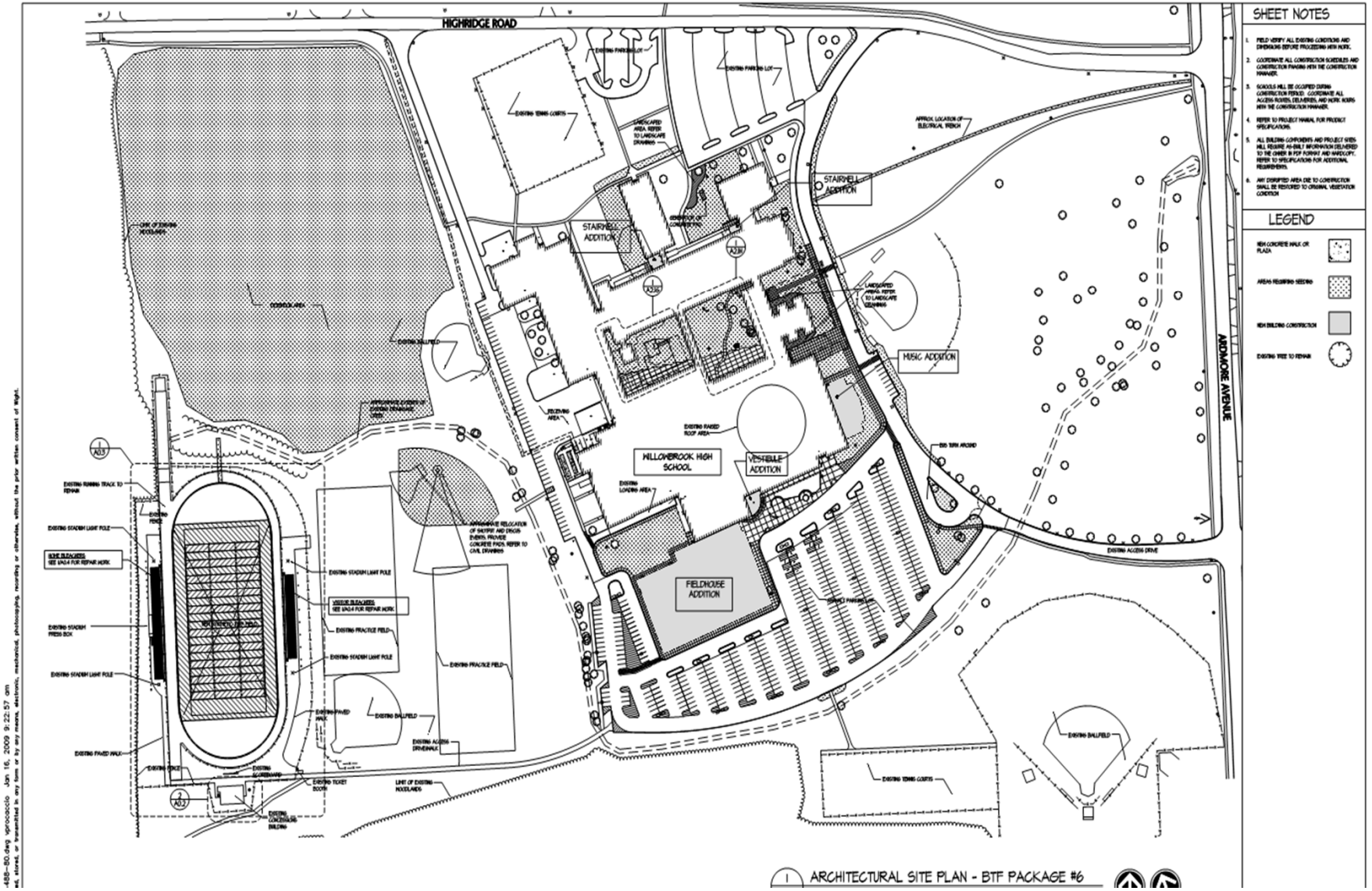
- Finished Floor Elevation = 688.69
- FEMA Flood Insurance Study (FIS)
  100-Year base flood elevation = 690.80

- 690.8 >688.69 = Floodplain Problems

Why is this a problem?

- Flood Risk has been identified (SFHA)
- Additions must be built to the FPE, where FPE = 691.8, existing finished floor = 688.7
- Compensatory Storage is calculated based on the FIS BFE
- Substantial improvements require that the existing building is brought into flood protection compliance.

Elevate this? 450,000 SF?

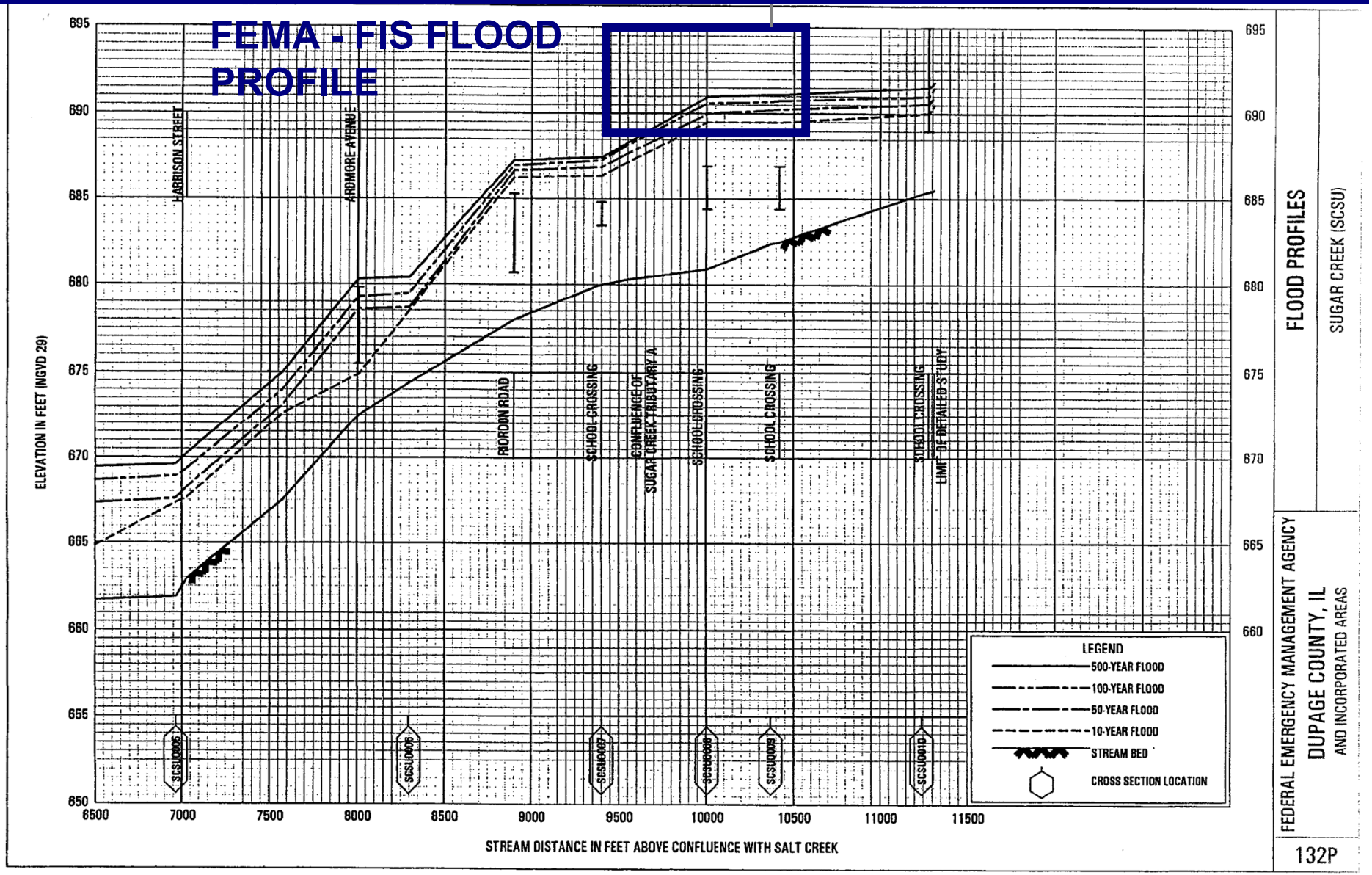


What the HEC? And who gives a FEQ?

The tale of two models:

- FEMA prepared FIS study with HEC-2 computer program (determines BFE and FIS profile)
- DuPage requires FEQ model for any floodway improvements (determine feasibility of improvement)
- FEMA accepts HEC results but not FEQ for Sugar Creek (or didn't)
- DuPage will require HEC and FEQ for our improvement, both must demonstrate compliance with rules

FEMA - FIS FLOOD PROFILE



Original Plan

- Verify Base Flood Elevations (BFE's), revise as necessary
- Determine if there are feasible drainage improvements available to improve BFE (alternative analysis) .
- Determine scope of flood protection required.
- Obtain a CLOMR* and/or LOMR* for revised BFE's –
- Obtain a permit based on CLOMR and /or LOMR BFE and FEQ results
- Obtain a Letter of Map Revision (LOMR) after construction .
- While easy to spell, the CLOMR/LOMR process can be difficult and arduous. Success isn't guaranteed.

Initial Process

- Researched original HEC model development.
- Revised HEC model based on current survey
- Prepared FEQ analysis for various "Improvement Scenario's"
- Developed feasible drainage improvement plan which results in lower BFE's and is DuPage ordinance compliant
- Continuous communications with regulatory agencies

Scenario Considerations

- Remove channel restrictions
- Flood proofing – Structural
- Flood proofing – Non-structural (if feasible)
- Reservoir routing AKA combined detention and compensatory storage

Substantial Improvement

- How to estimate replacement cost of a large public building?

  Keep it simple -

  Rough cost would be $230/SF*

455,475 SF x $230 /SF= $104,759,250

* Based on historic data for similar structures WCS

Substantial Improvement

- Construction Hard Cost – Life Safety Items + Improvements since 1992 = Cost of Improvement

$38,477,132.00[1] - $646,219.20[2] + 1,834,205.00[3] + $3,670,000.00 [4]/$104,759,250

= 41%.....phew

1 Based on Bid Results

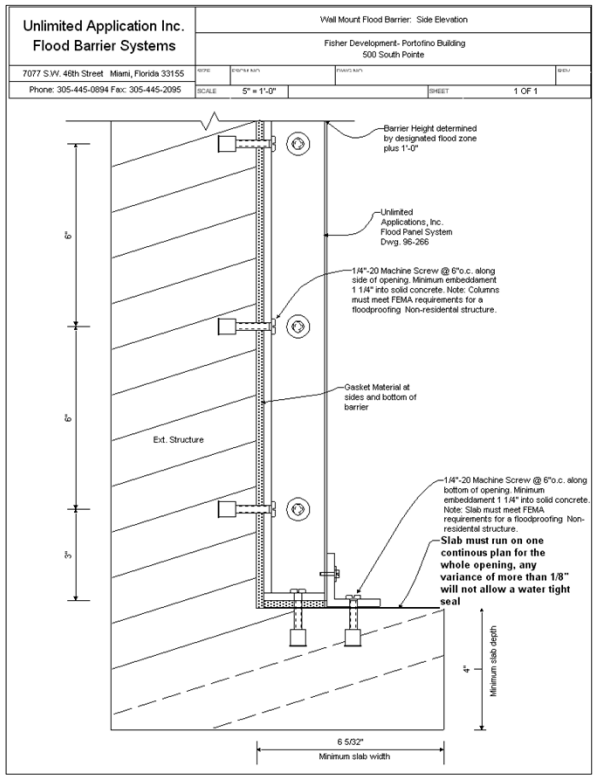
2 Based on Bid Results

3 Historic Budget Records

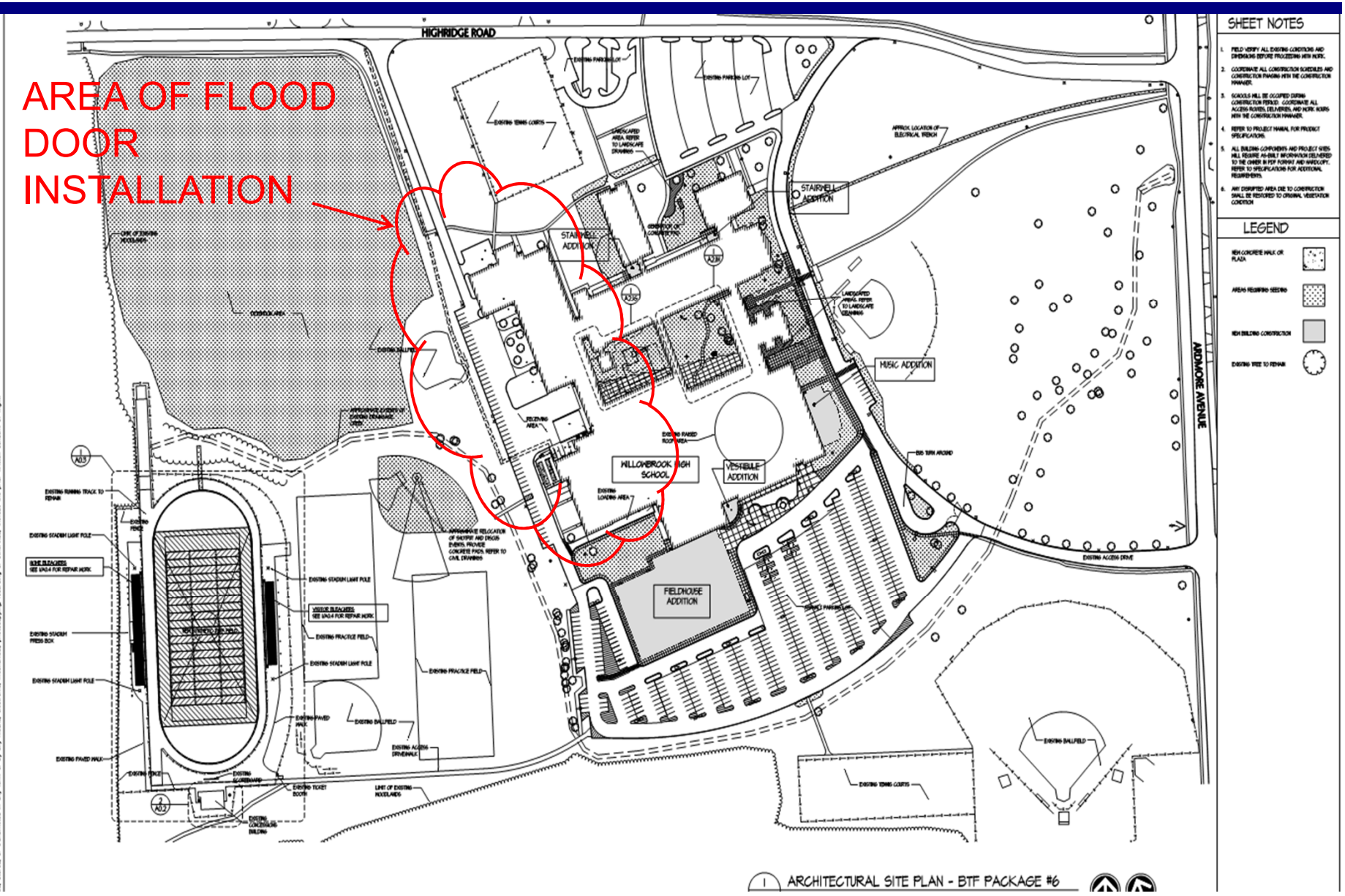
4 Typical Annual Budget Special Projects

Flood Doors – Design Build

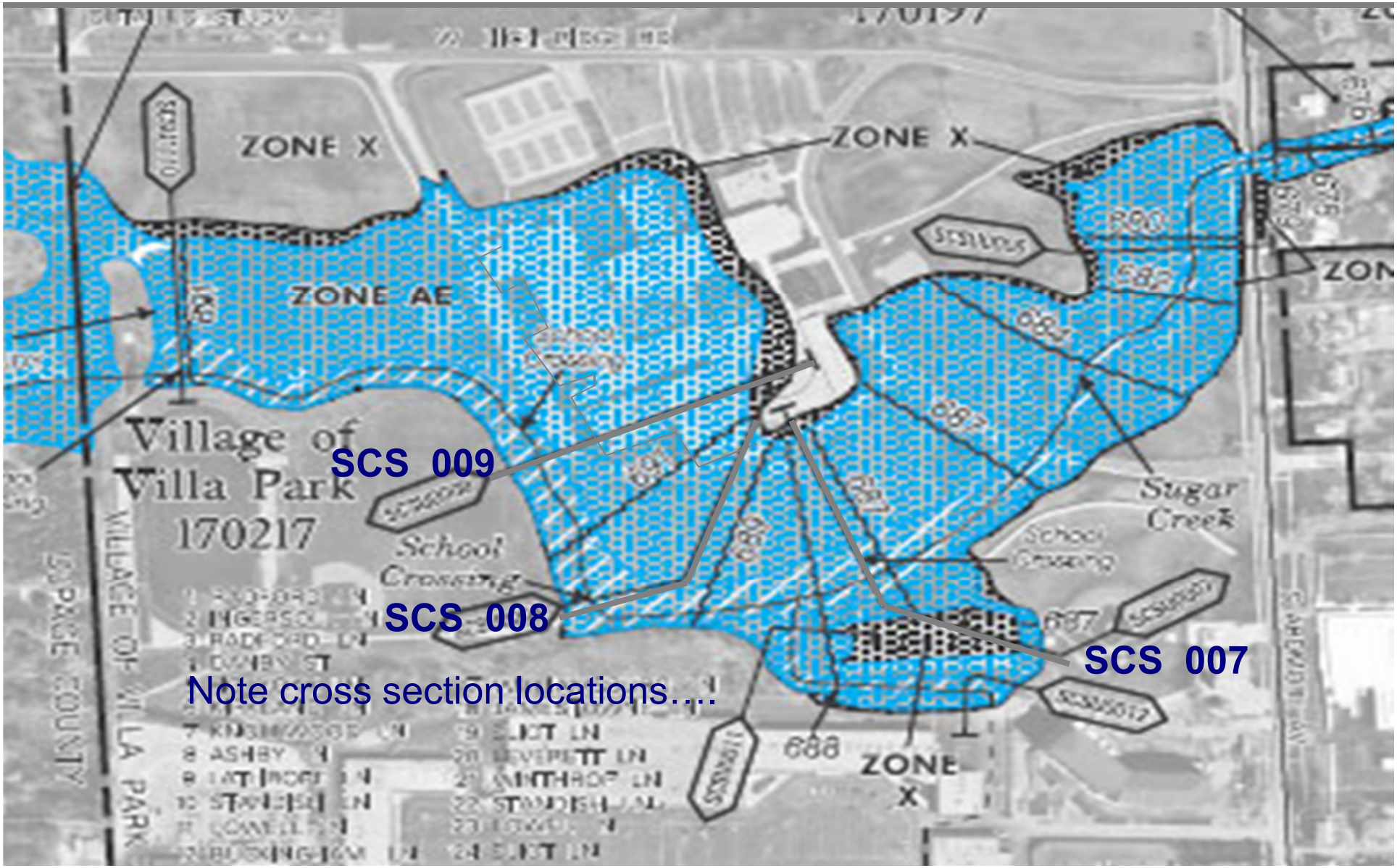
Performance Specification: Comply with requirements indicated in FEMA Bulletin 3-93 "Non-Residential Floodproofing," and FEMA Bulletin 102 "Flood Proofing Non-Residential Structures" for hydrostatic pressure from freestanding water, buoyancy resistance, hydrodynamic force resistance, and debris impact force resistance.



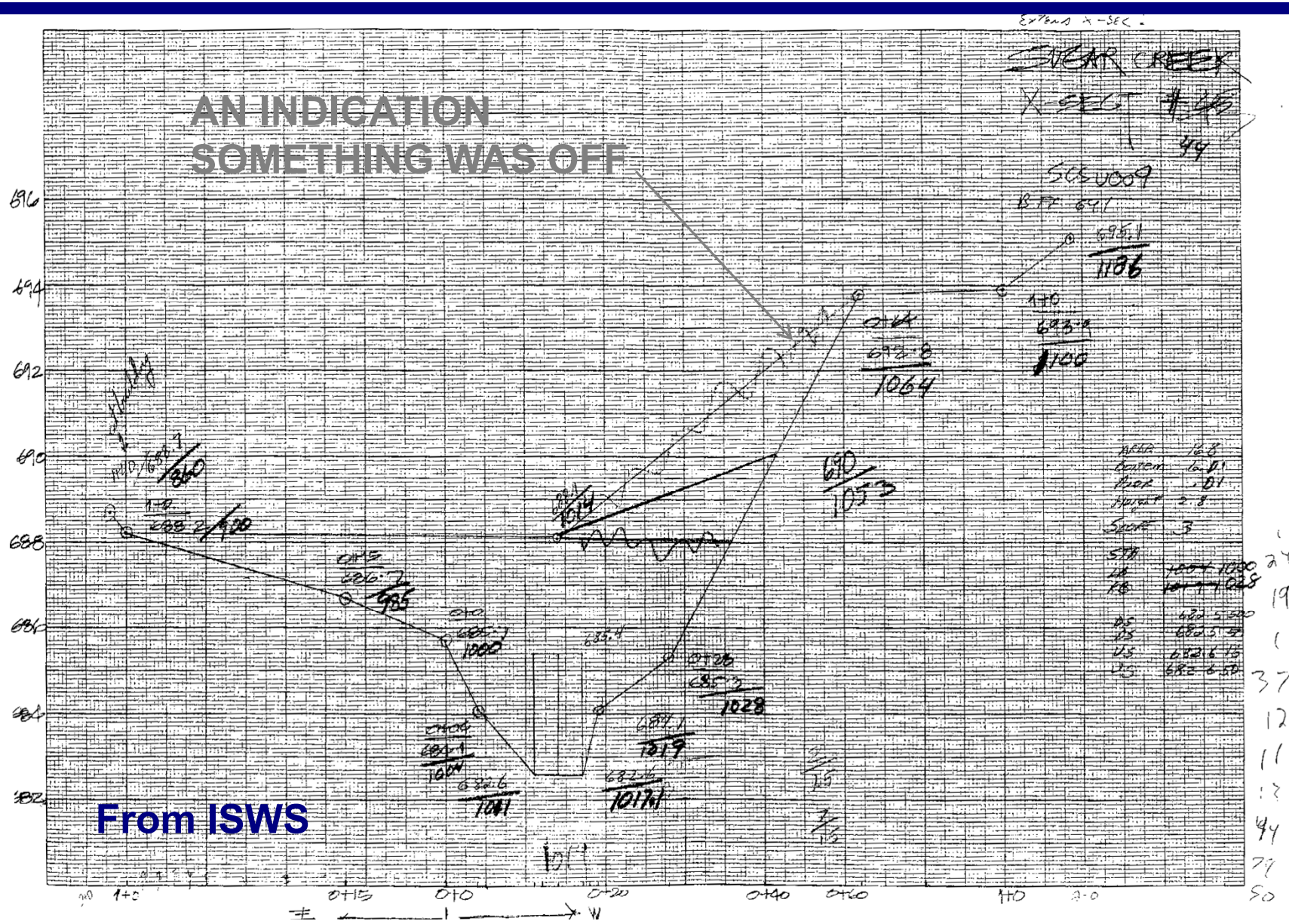
Flood Doors – Design Build



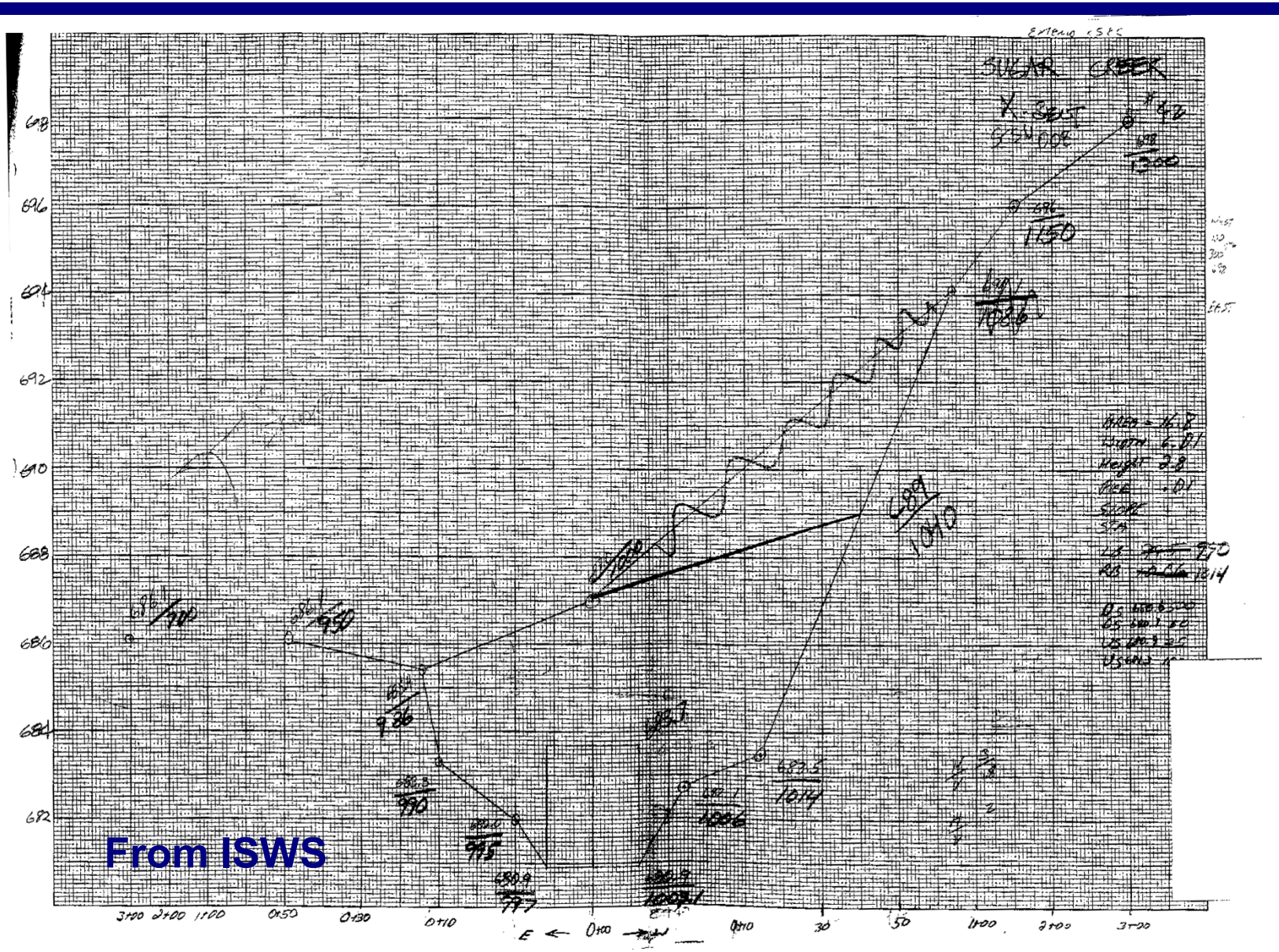
Engineering Analysis



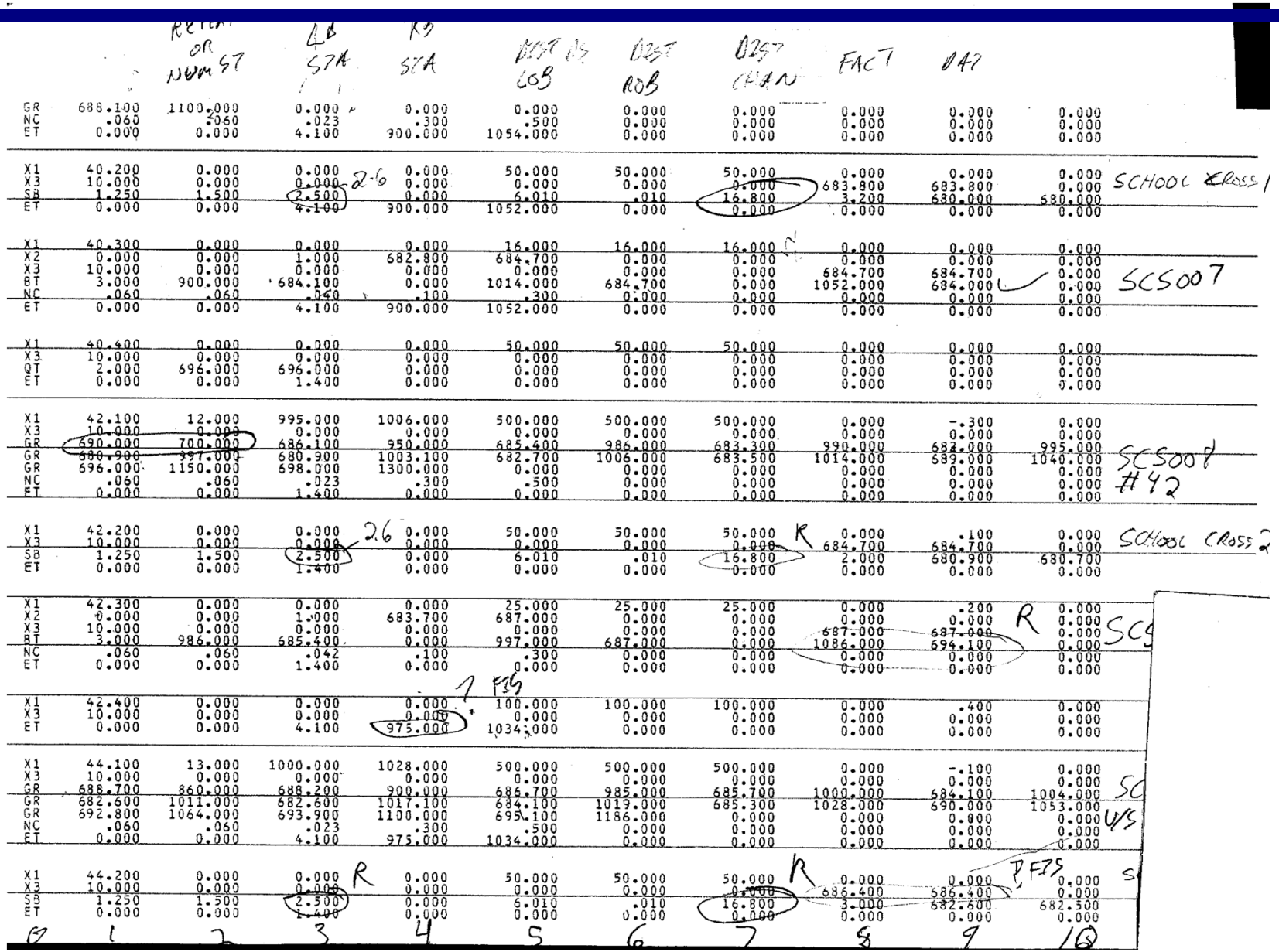
ORIGINAL MODEL CROSS-SECTION SCS 009



ORIGINAL MODEL CROSS-SECTION – SCS 008

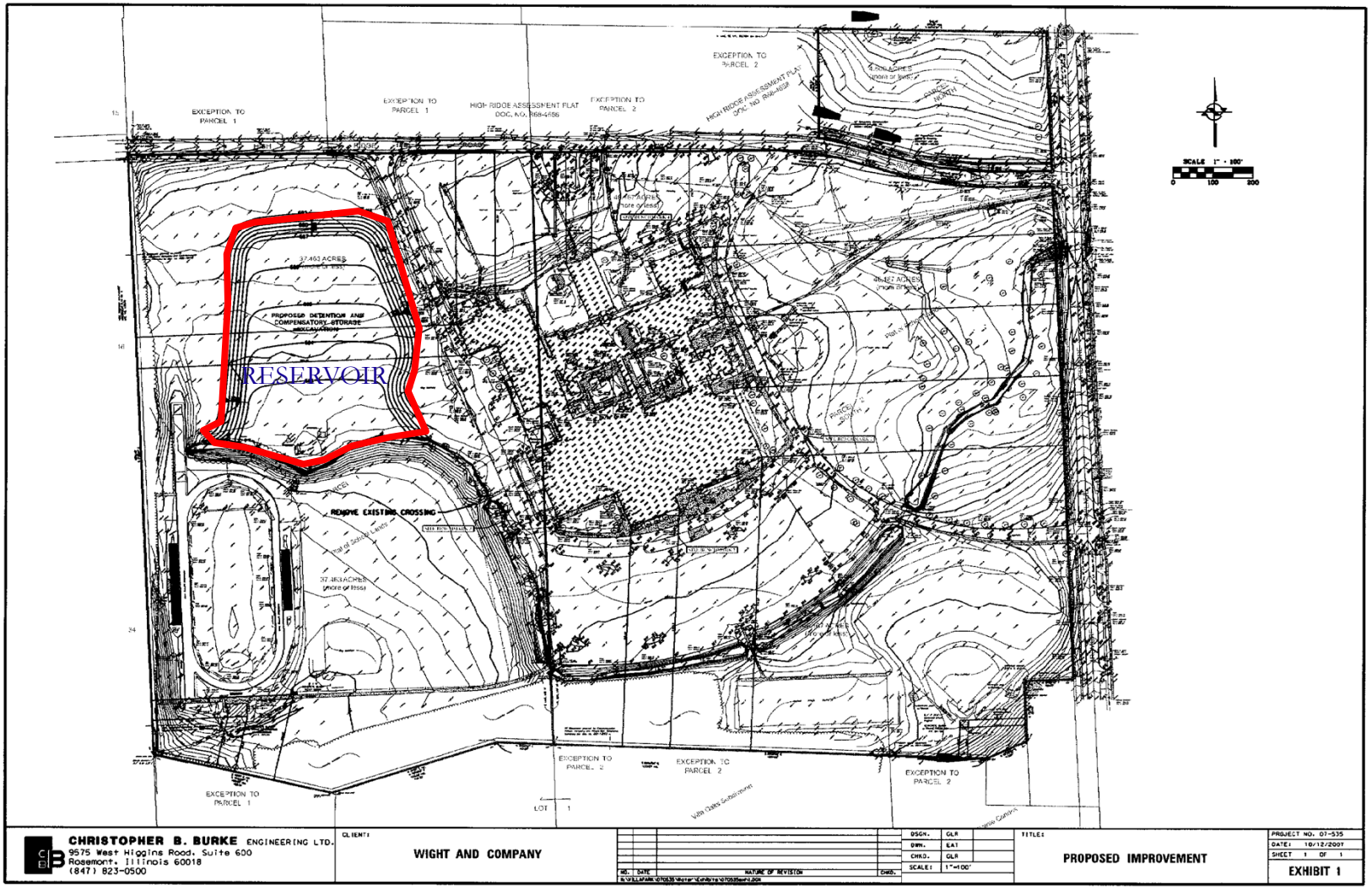


MAYBE ENGINEERS DO SPEAK A DIFFERENT LANGUAGE?



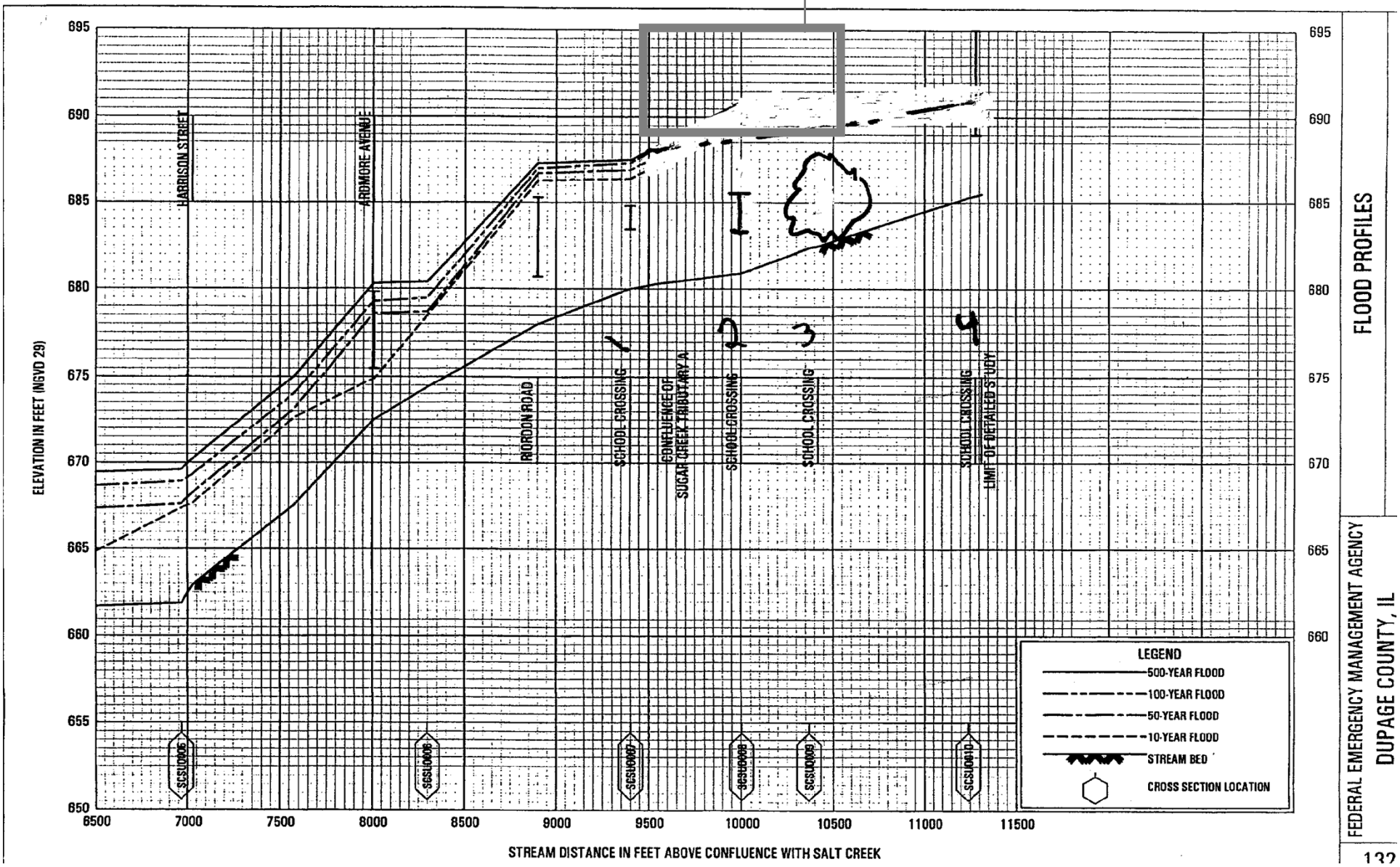
		RETAIN OR NOW ST	LB STA	RT STA	DIST RT LOB	DIST ROB	DIST CHAN	FACT	DAT		
GR	688.100	1100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
NC	.060	.060	.023	.300	.500	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	4.100	900.000	1054.000	0.000	0.000	0.000	0.000	0.000	
X1	40.200	0.000	0.000	0.000	50.000	50.000	50.000	0.000	0.000	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	683.800	683.800	0.000	SCHOOL CROSS 1
SB	1.250	1.500	2.500	0.000	6.010	.010	16.800	3.200	680.000	680.000	
ET	0.000	0.000	4.100	900.000	1052.000	0.000	0.000	0.000	0.000	0.000	
X1	40.300	0.000	0.000	0.000	16.000	16.000	16.000	0.000	0.000	0.000	
X2	0.000	0.000	1.000	682.800	684.700	0.000	0.000	0.000	0.000	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	684.700	684.700	0.000	SCS007
BT	3.000	900.000	684.100	0.000	1014.000	684.700	0.000	1052.000	684.000	0.000	
NC	.060	.060	.040	.100	.300	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	4.100	900.000	1052.000	0.000	0.000	0.000	0.000	0.000	
X1	40.400	0.000	0.000	0.000	50.000	50.000	50.000	0.000	0.000	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
QT	2.000	696.000	696.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
X1	42.100	12.000	995.000	1006.000	500.000	500.000	500.000	0.000	-.300	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
GR	690.000	700.000	686.100	950.000	685.400	986.000	683.300	990.000	684.000	995.000	SCS008
GR	680.900	997.000	680.900	1003.100	682.700	1006.000	683.500	1014.000	689.000	1040.000	#42
GR	696.000	1150.000	698.000	1300.000	0.000	0.000	0.000	0.000	0.000	0.000	
NC	.060	.060	.023	.300	.500	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
X1	42.200	0.000	0.000	0.000	50.000	50.000	50.000	0.000	.100	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	684.700	684.700	0.000	SCHOOL CROSS 2
SB	1.250	1.500	2.500	0.000	6.010	.010	16.800	2.000	680.900	680.700	
ET	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
X1	42.300	0.000	0.000	0.000	25.000	25.000	25.000	0.000	.200	0.000	
X2	0.000	0.000	1.000	683.700	687.000	0.000	0.000	0.000	0.000	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	687.000	687.000	0.000	SCS
BT	3.000	986.000	685.400	0.000	997.000	687.000	0.000	1086.000	694.100	0.000	
NC	.060	.060	.042	.100	.300	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
X1	42.400	0.000	0.000	0.000	100.000	100.000	100.000	0.000	.400	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	4.100	975.000	1034.000	0.000	0.000	0.000	0.000	0.000	
X1	44.100	13.000	1000.000	1028.000	500.000	500.000	500.000	0.000	-.100	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
GR	688.700	860.000	688.200	900.000	686.700	985.000	685.700	1000.000	684.100	1004.000	SC
GR	682.600	1011.000	682.600	1017.100	684.100	1019.000	685.300	1028.000	690.000	1053.000	
GR	692.800	1064.000	693.900	1100.000	695.100	1186.000	0.000	0.000	0.000	0.000	
NC	.060	.060	.023	.300	.500	0.000	0.000	0.000	0.000	0.000	
ET	0.000	0.000	4.100	975.000	1034.000	0.000	0.000	0.000	0.000	0.000	
X1	44.200	0.000	0.000	0.000	50.000	50.000	50.000	0.000	0.000	0.000	
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	686.400	686.400	0.000	
SB	1.250	1.500	2.500	0.000	6.010	.010	16.800	3.000	682.600	682.500	
ET	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
0	1	2	3	4	5	6	7	8	9	10	

ORIGINAL RECOMMENDED ALTERNATIVE

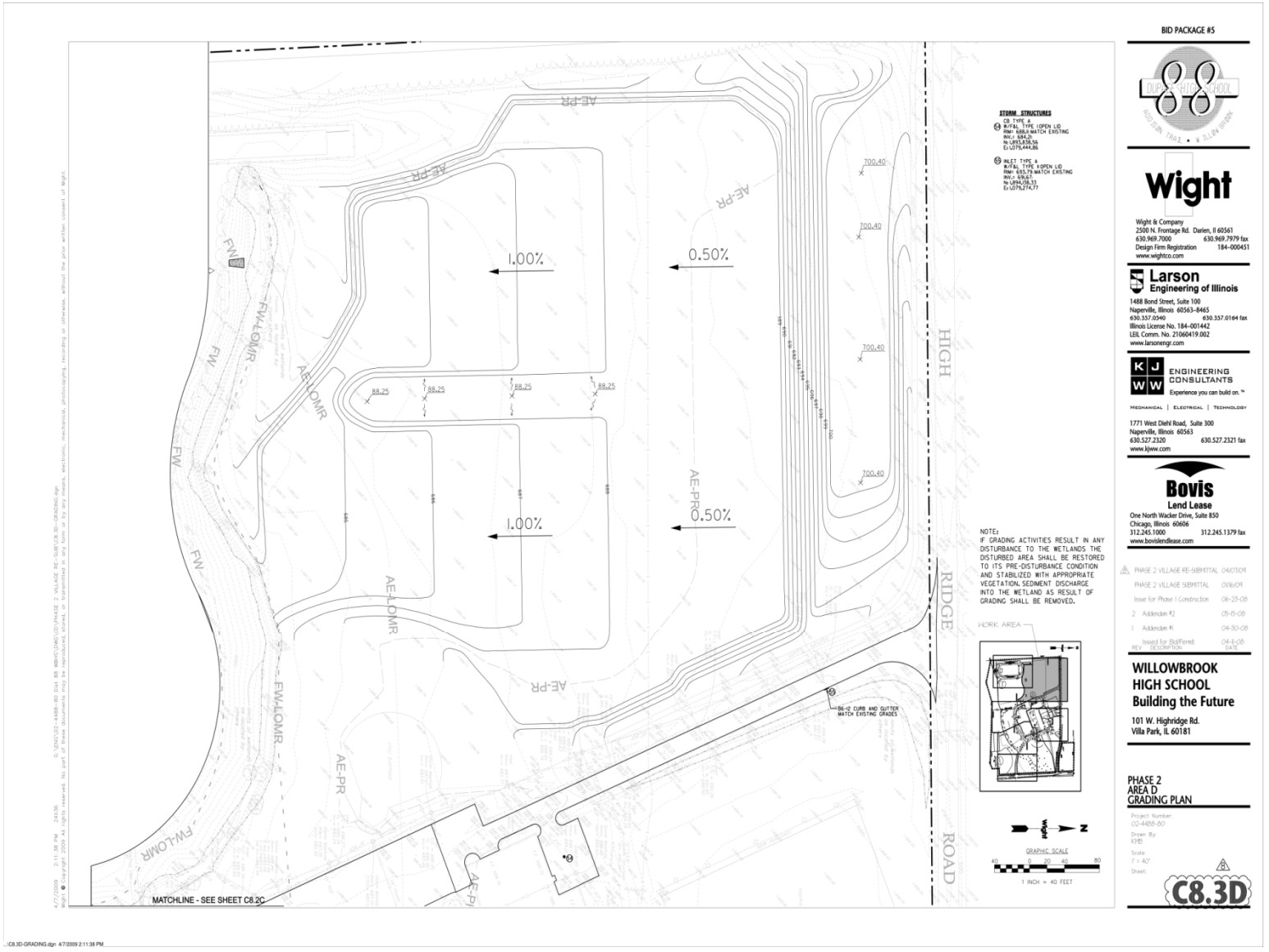


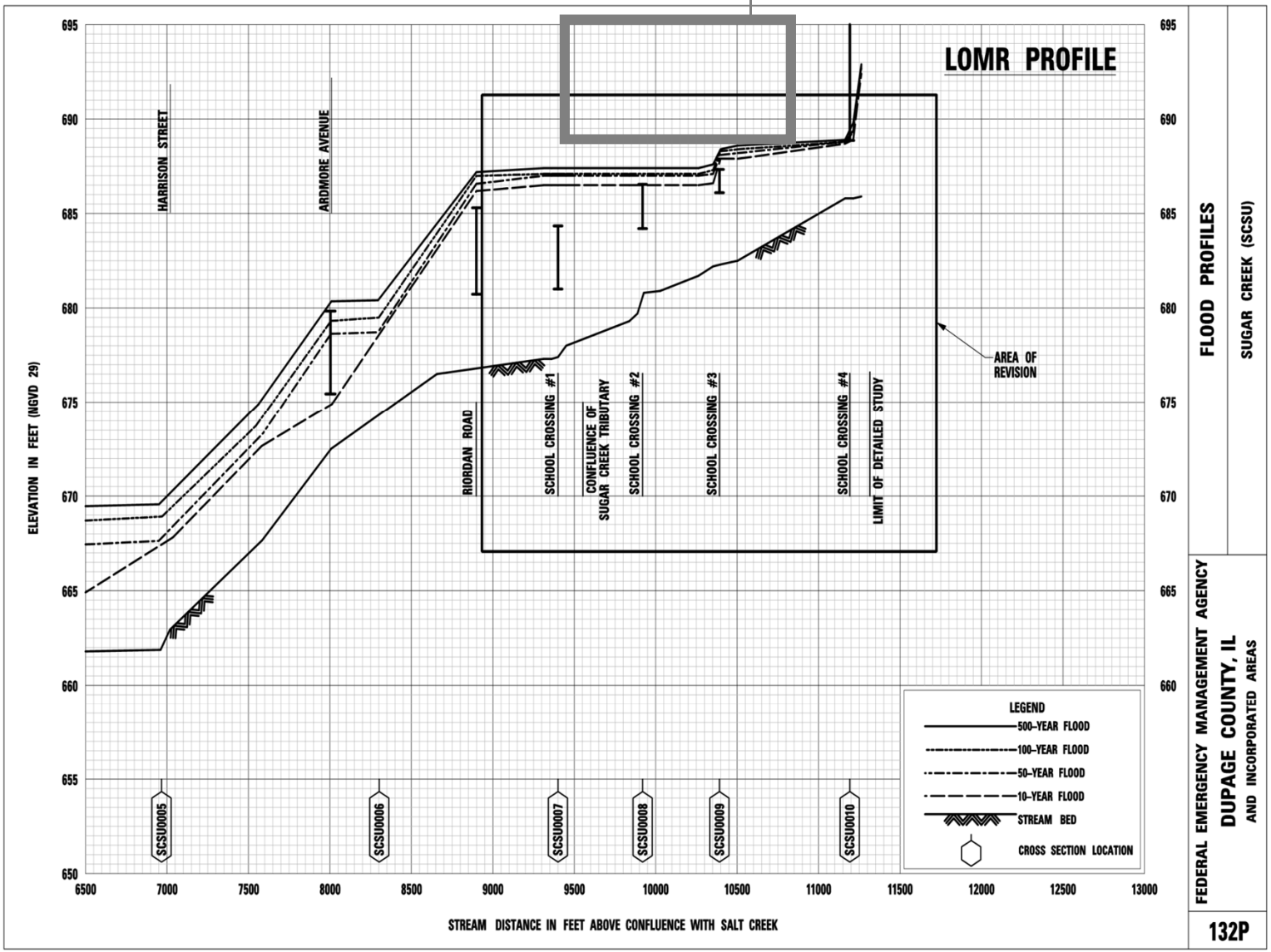
BASIS FOR GMAX

ORIGINAL CONCEPT REVISION (CLOMR)



FINAL DESIGN





FLOOD PROFILES

SUGAR CREEK (SCSU)

FEDERAL EMERGENCY MANAGEMENT AGENCY

DUPAGE COUNTY, IL

AND INCORPORATED AREAS

132P

Proposed Conditions Including Revision

- Existing Finished Floor Elevation = 688.69
- LOMR Proposed 100-Year Base Flood Elevation = 687.10

- 687.10 <688.69 = Problems Minimized

Extended Analysis

1. FEMA Pre-LOMR Regulatory model HEC 2 - 690.6 - BFE
2. FEMA LOMR Regulatory Model HEC 2 687.1 BFE
3. Wight Modified Existing Conditions HEC 2 687.1 BFE
4. Wight Proposed Conditions HEC 2 687.1 BFE
5. Provisional PVSTATs 688.17 BFE
6. DuPage FEQ Model August 1972 event - 688.66 Flood of Record
7. DuPage FEQ Enhanced - 688.79 Flood of Record
8. DuPage FEQ Proposed- 688.78 Flood of Record

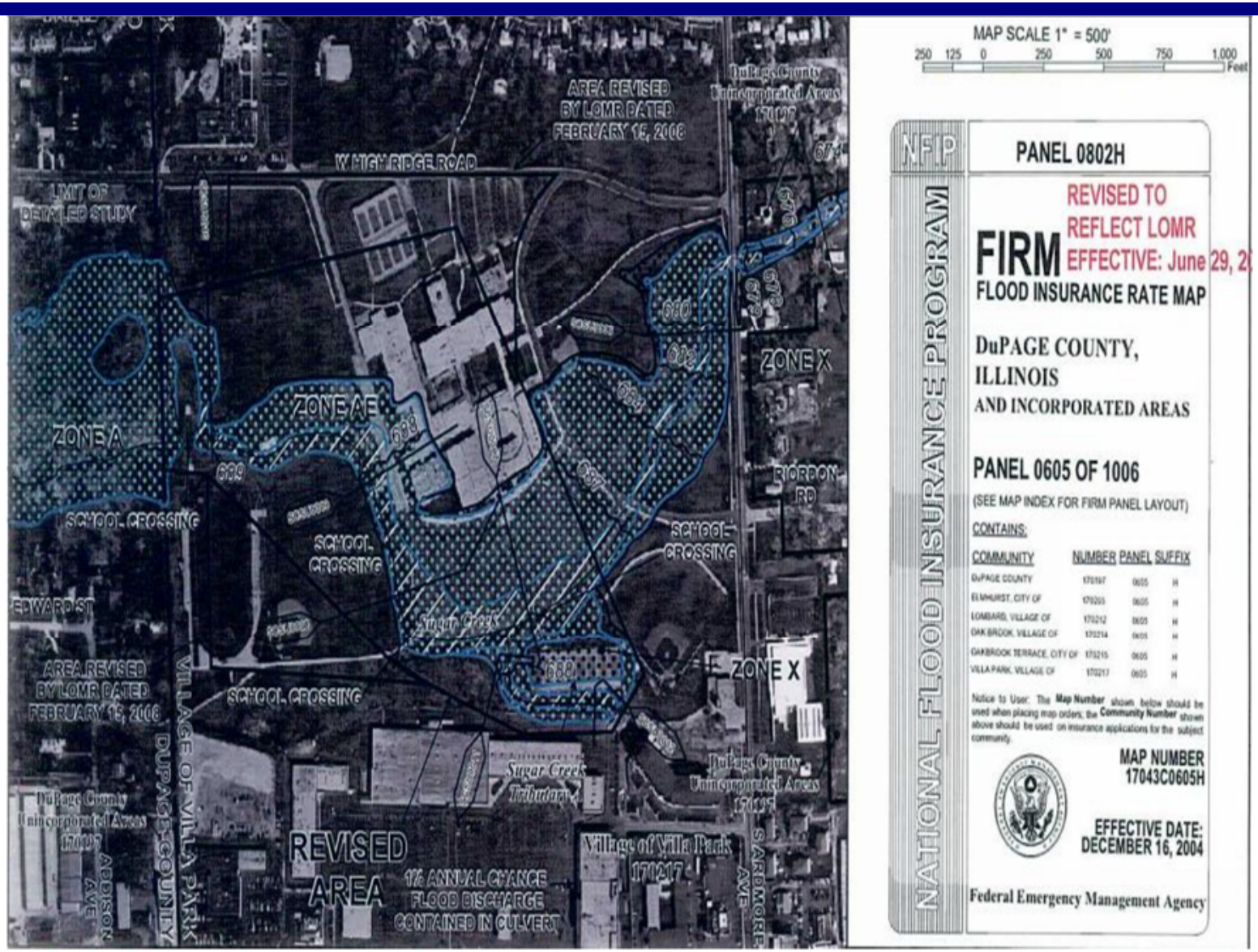
The finished floor/Flood Protection Elevation of the building addition was determined by selecting the best available information between: 1) BFE +1 or 2) flood of record elevation.

Therefore the most conservative flood protection elevation at the field house addition was determined to be 688.17 + 1 = 689.17 The design finished floor is at elevation 689.30

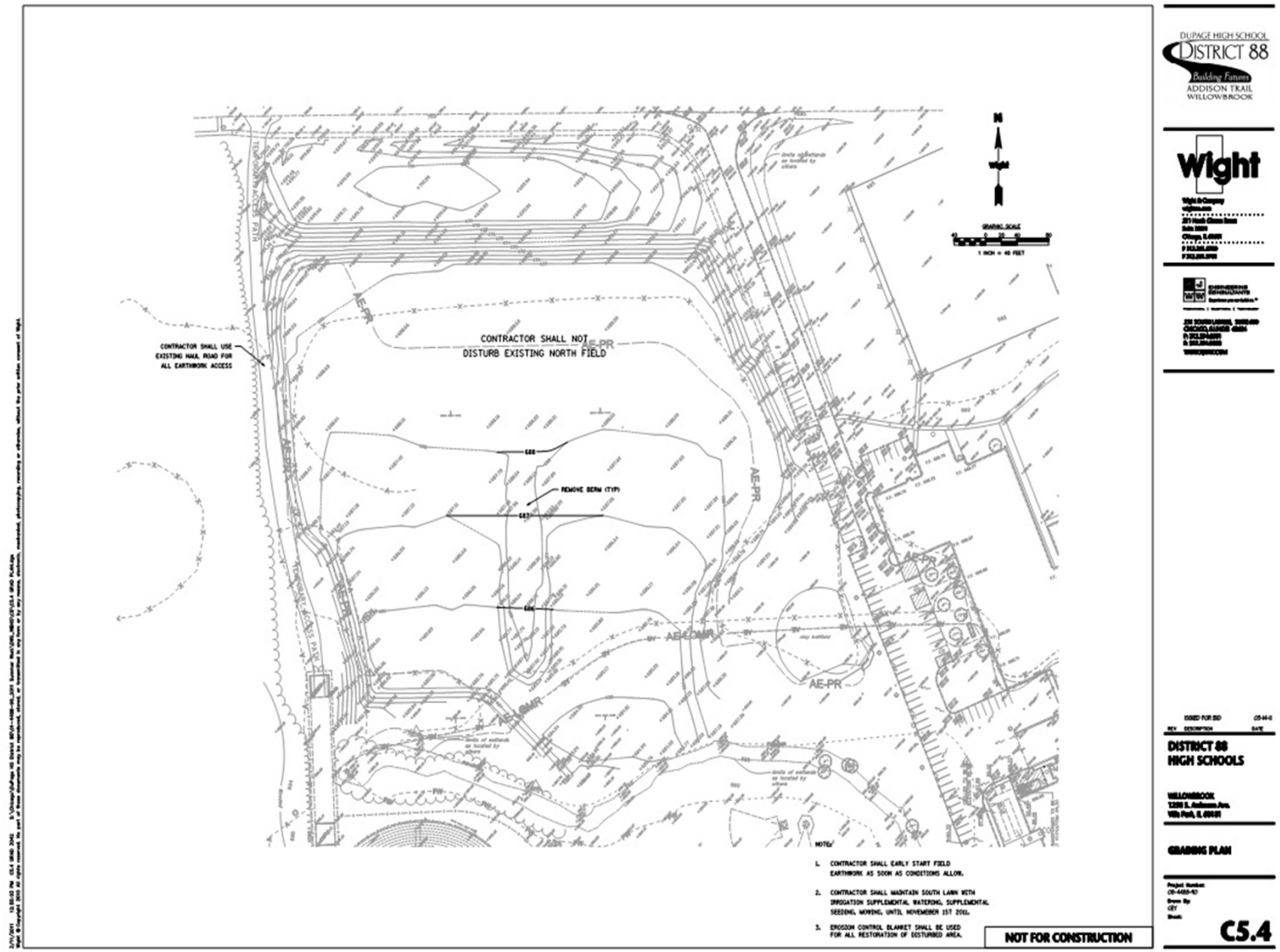
End Result

- Errors in the existing condition model were discovered
- School decided that they would prefer to maintain multiple stream crossings if possible
- Profile improvements caused by culvert removal did not offset loss of access
- Final solution - Provide online detention and compensatory storage, raise new building addition to higher Flood Protection Elevation.
- Documented Project would not qualify as substantial improvement.
- Provide Flood Doors for Existing School
- Model Revisions incorporated into County Study

1.5 Years later….
Building remains in floodplain



Lesson learned – Setting expectations and the value of value engineering



Lessons Learned

- Set the Owner and Team expectation
- Not Design-Build friendly project – be aware of pricing based on over simplification.
- If you draw it they will price it……
- Be careful of tight flood intervals NWL-10, 10-100
- Make the conversion to HEC- RAS
- CLOMR require Hydraulics & Hydrology

Thank you!

Wight & Company | Wightco.com

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