"Your Project is Our Priority"

Hydrology and Hydraulic Study

For

Mitsubishi Building Addition

1200 North Mitsubishi Parkway
Franklin, Indiana
Johnson County

Prepared for:

Runnebohm Construction
144 East Rampart Street
Shelbyville, IN 46176
Phone: (317) 398-4722
Fax: (317) 536-0015
Contact: James Marshall

March 2014

Banning Engineering, P.C. • 698 Tower Road, Suite 100 • Plainfield, IN 46168
Phone: (317) 839-2581 • Fax: (317) 838-9171 • E-mail: banning@BanningEngineering.com

Drainage Narrative for:

Mitsubishi Building Addition

1200 North Mitsubishi Parkway
Franklin, Indiana

Existing Characteristics:

The purpose of the project is to construct a new 30,400 S.F. building addition on the north side of the Mitsubishi manufacturing facility. The project is located at the northeast corner of McClain Drive and Mitsubishi Parkway, in Johnson County, Franklin, IN; Section 18; Township 12 North; Range 5 East.

Design Criteria:

Adjoining land conditions: North: Residential & Agricultural
South: Industrial (McClain Dr.)
East: Agricultural
West: Residential (Interstate 65)

Existing Conditions Analysis:

Using construction plans from 1996, and a current topographic survey, it was determined that the existing project site lies within an 11+/- acre drainage area. The area drains to a dry bottom detention basin located north of the existing Mitsubishi building, and discharges to the east through a 21 inch concrete pipe. Approximately 53% of the 11± acre drainage area consists of impervious area, including the existing building and some parking and drive areas west and north of the existing building. The remaining 47% is generally grass. The existing project site is a flat, grassy area, and is shown on the 1996 plans as "Possible Future Addition".

Proposed Conditions Analysis:

Stormwater runoff from the proposed building addition will be collected in roof downspouts and routed to the ground surface, and ultimately to the detention basin. A paved loading area will also be constructed on the east side of the new building addition. A trench drain will collect stormwater runoff from the loading area and drain to the detention basin through a 12 inch pipe.

As a result of the new building addition and loading area, the impervious surfaces that drain to the detention pond are increased by 0.80 acres, generating a slightly higher runoff volume. The proposed building addition was shown as future on the 1996 plans, so it was likely included in the original detention calculations. However, records verifying this were unable to be obtained. Therefore, the existing detention basin will be expanded to provide additional storage for the increased runoff volume. The expansion in the detention basin is designed so that stormwater runoff from the new building addition will not increase the discharge rate during a 100-year storm event. See the following table for a summary of the results.

DETENTION BASIN EXPANSION SUMMARY AT PEAK 100-YEAR STORM			
Condition	**Detention Volume (CF)**	**Stage Elevation**	**Discharge (CFS)**
Existing	23,308	735.89	13.8
Proposed	32,525	735.86	13.7

Methodology

Interconnected Channel and Pond Routing Software (ICPR) was utilized to model the site. For the existing and proposed conditions, the 1, 2, 3, 6, 12, and 24 hour, 100-yr storm events were modeled using the Huff 50% probability rainfall distribution. Detailed input can be found in the attached appendices.

References

Design data and methods are based on the following reference materials:

1. Johnson County Soils Map (http://websoilsurvey.sc.egov.usda.gov/)
2. Technical Report 55, Small Watershed Hydrology, NRCS
3. Bulletin 71, Rainfall Frequency Atlas of the Midwest
4. USGS Mapping
5. ICPR v3.02, Streamline Technologies

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7. STORM SEWER CALCULATIONS
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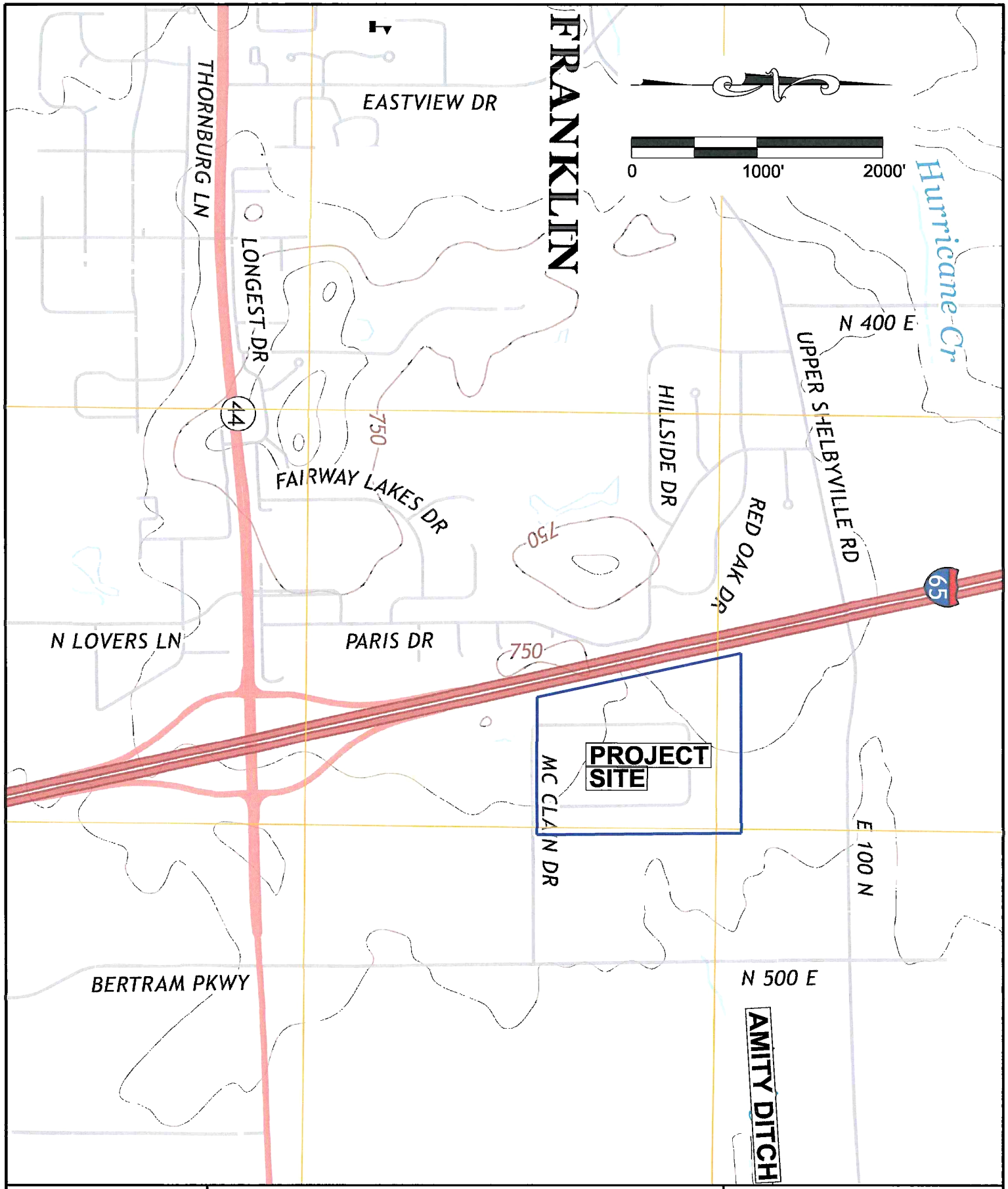
LOCATION MAPS



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DATE: 3/17/2014
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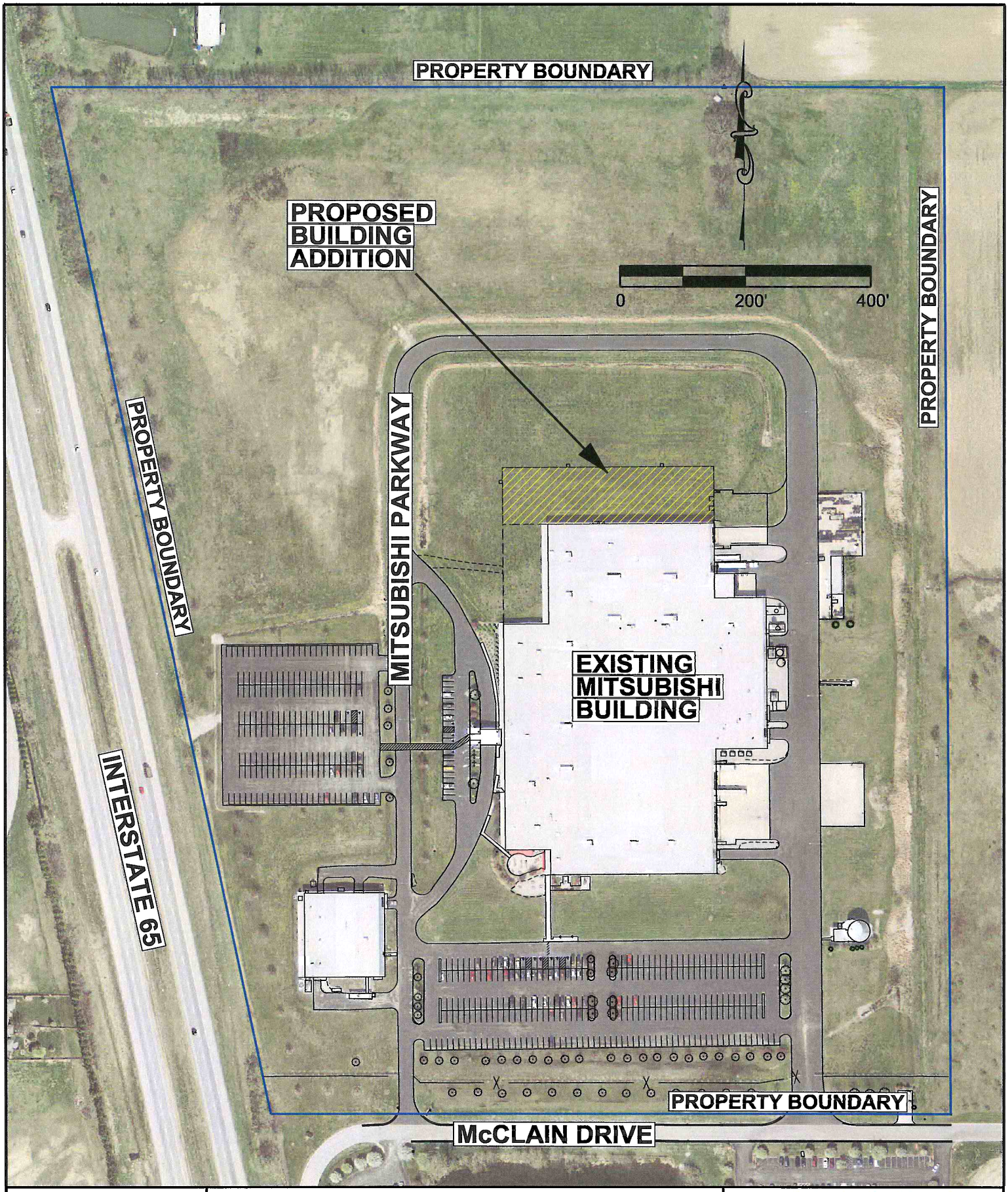
PAGE: 1 OF 1

USGS AREA MAP
MITSUBISHI BUILDING ADDITION

CITY OF FRANKLIN
JOHNSON COUNTY, INDIANA

BANNING ENGINEERING
853 COLUMBIA ROAD, SUITE #101
PLAINFIELD, IN 46168
BUS: (317) 707-3700, FAX: (317) 707-3800
E-MAIL Banning@BanningEngineering.com
WEB: www.BanningEngineering.com



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PAGE: 1 OF 1

SITE MAP

MITSUBISHI BUILDING ADDITION

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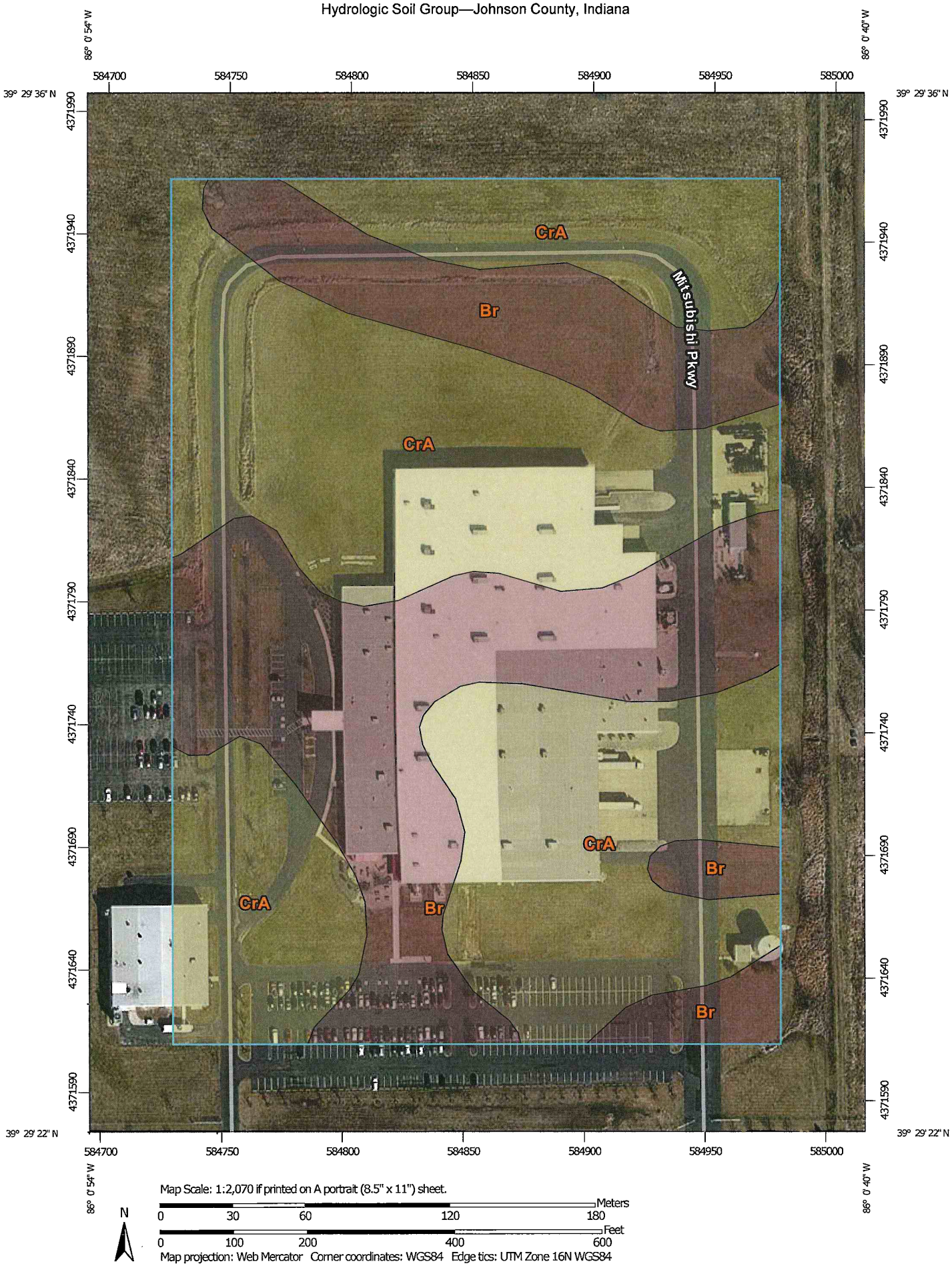
853 COLUMBIA ROAD, SUITE #101
PLAINFIELD, IN 46168
BUS: (317) 707-3700, FAX: (317) 707-3800
E-MAIL. Banning@BanningEngineering.com
WEB: www.BanningEngineering.com

SOILS MAP

Hydrologic Soil Group—Johnson County, Indiana



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1 15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http //websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below

Soil Survey Area: Johnson County, Indiana
Survey Area Data: Version 21 Dec 21, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger

Date(s) aerial images were photographed: Sep 17 2011—Apr 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Johnson County, Indiana (IN081)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Br	Brookston silty clay loam	B/D	8.4	38.1%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	C/D	13.6	61.9%
Totals for Area of Interest			**22.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

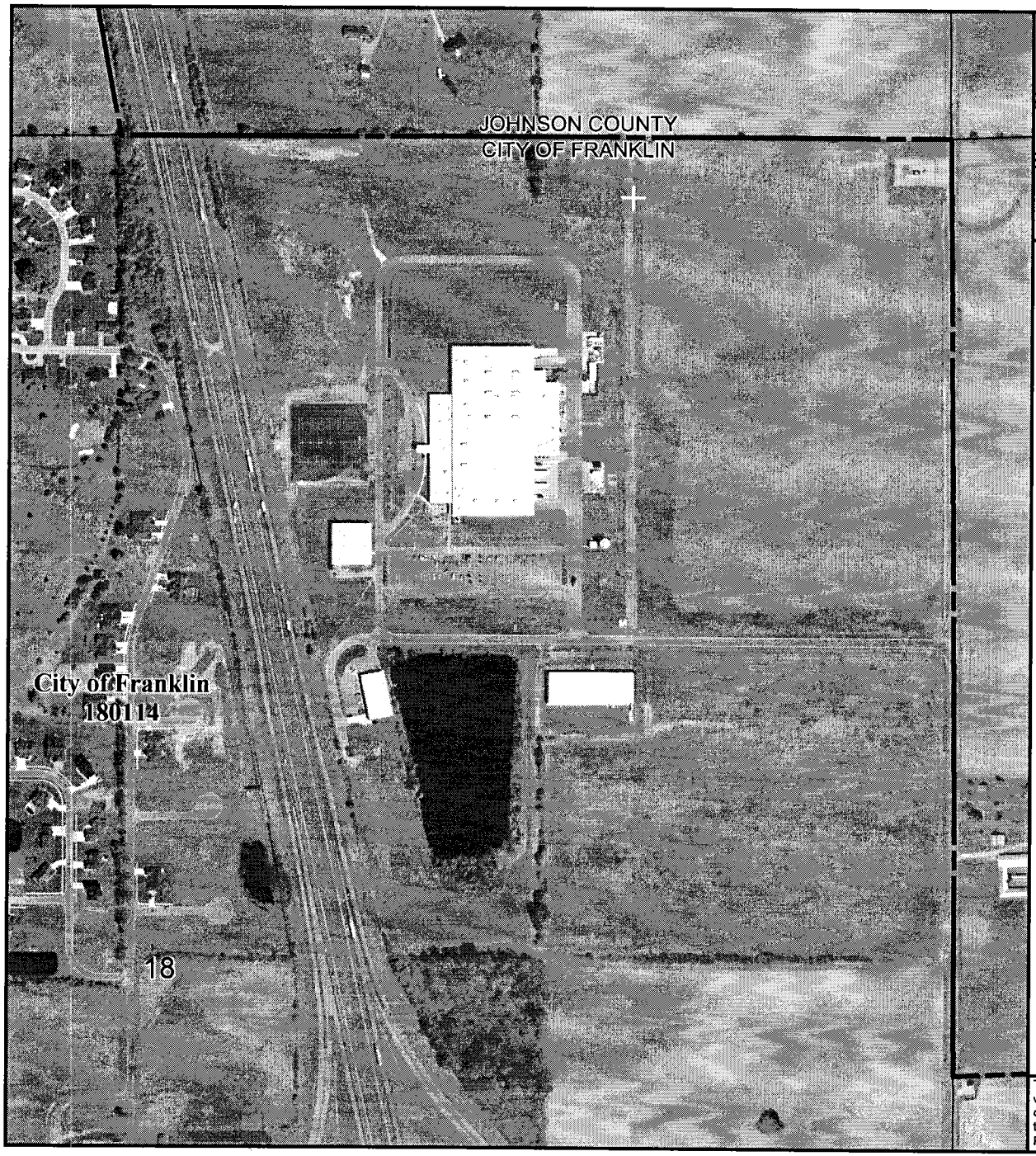
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

FLOOD MAP



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METER 0 150 300

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0232D

FIRM

FLOOD INSURANCE RATE MAP

JOHNSON COUNTY, INDIANA

AND INCORPORATED AREAS

PANEL 232 OF 352

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRANKLIN, CITY OF	180114	0232	D
JOHNSON COUNTY	180111	0232	D

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
18081C0232D

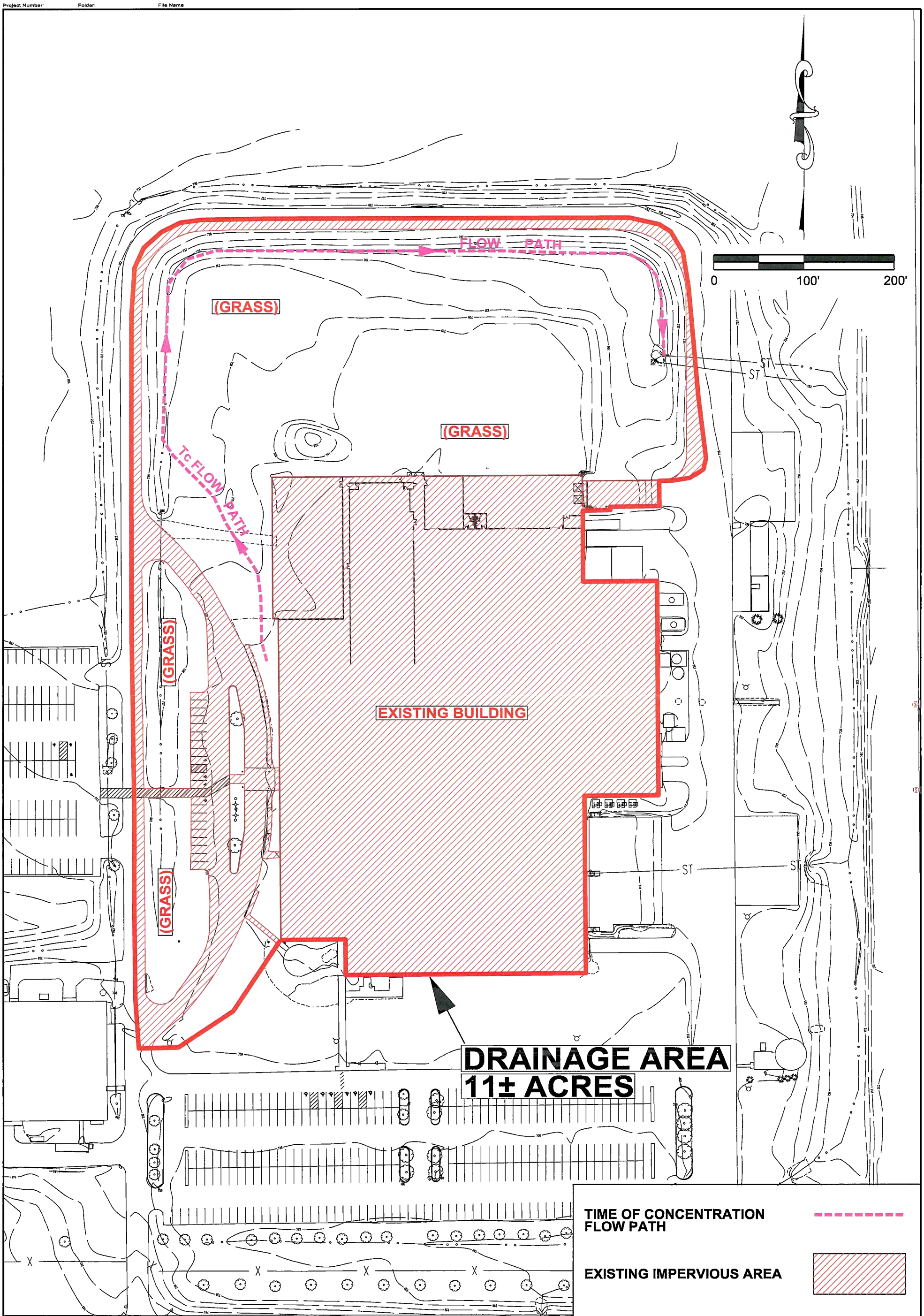
EFFECTIVE DATE
AUGUST 2, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

EXISTING CONDITIONS BASIN MAP

03\20\2014
SCALE 100.0000 ' / in.
Project Number: Folder: File Name



Sheet No: E1

Project No: 13294

BANNING ENGINEERING
853 COLUMBIA ROAD, SUITE #101
PLAINFIELD, IN 46168
BUS: (317) 707-3700, FAX: (317) 707-3800
E-MAIL: Banning@BanningEngineering.com
WEB: www.BanningEngineering.com

EXISTING BASIN MAP

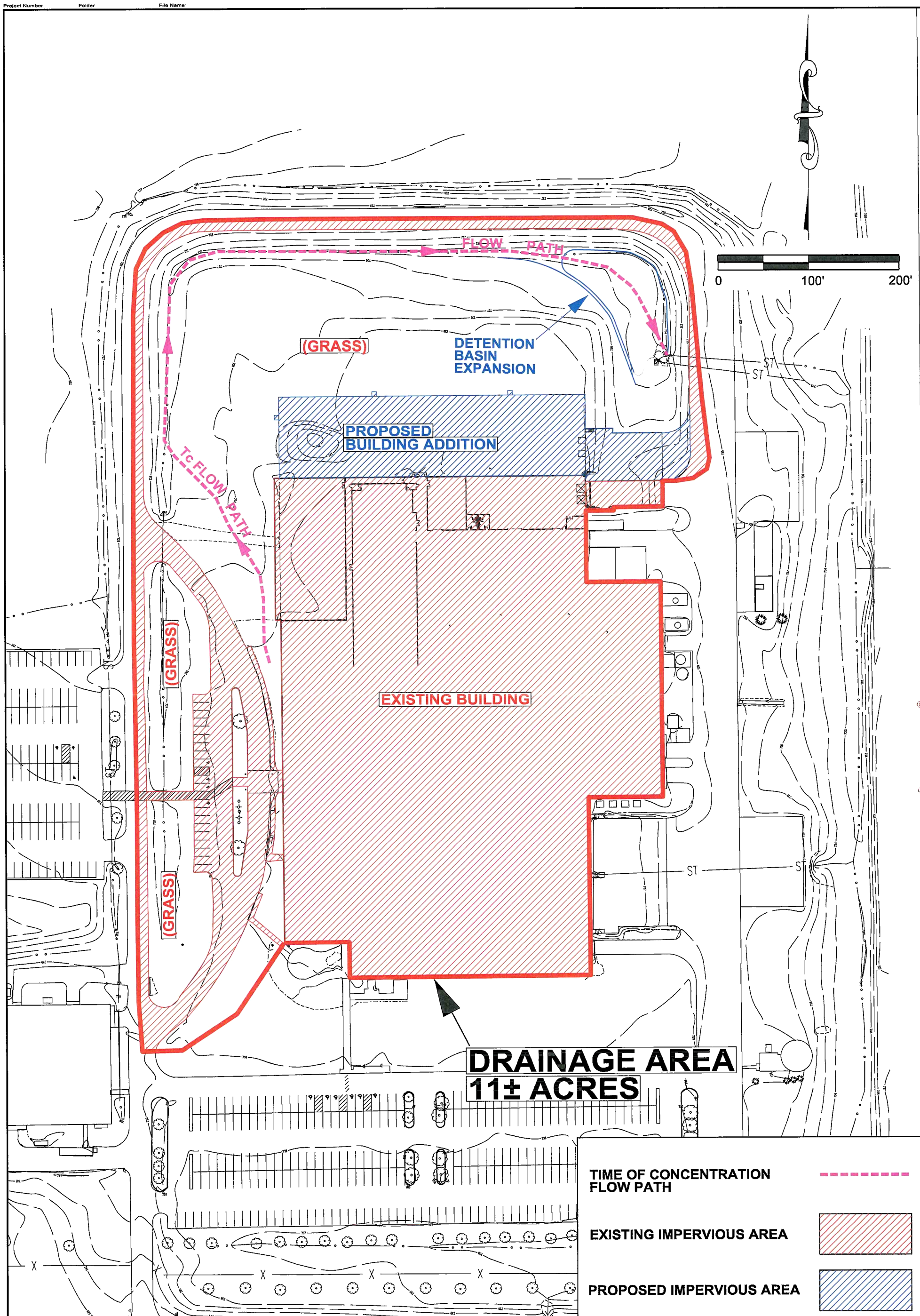
MITSUBISHI BUILDING ADDITION

CITY OF FRANKLIN
JOHNSON COUNTY, INDIANA

Designed:	Sym.	Revisions	Date
Drawn: WCZ			
Checked:			
Scale: AS SHOWN			
Date: 3/17/2014			

PROPOSED CONDITIONS BASIN MAP

03\20\2014
SCALE: 100.0000 ' / in.
Project Number Folder File Name:



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E-MAIL: Banning@BanningEngineering.com
WEB: www.BanningEngineering.com

PROPOSED BASIN MAP
MITSUBISHI BUILDING ADDITION
CITY OF FRANKLIN
JOHNSON COUNTY, INDIANA

Designed:	Sym.	Revisions	Date
Drawn: WCZ			
Checked:			
Scale: AS SHOWN			
Date: 3/17/2014			

EXISTING VS PROPOSED ICPR CALCULATIONS

DETENTION BASIN
(100-YEAR STORM)

Mitsubishi Building Addition
Detention Basin Calculations
100-Year Storm

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDY-Existing	BASEhuff_100yr_01hr		0.00	732.18	732.20	0.00	6	1.13	13.8	0.00	0.0
BNDY-Existing	BASEhuff_100yr_02hr		0.00	732.18	732.20	0.00	6	1.49	12.8	0.00	0.0
BNDY-Existing	BASEhuff_100yr_03hr		0.00	732.18	732.20	0.00	6	1.24	12.3	0.00	0.0
BNDY-Existing	BASEhuff_100yr_06hr		0.00	732.18	732.20	0.00	6	1.85	10.6	0.00	0.0
BNDY-Existing	BASEhuff_100yr_12hr		0.00	732.18	732.20	0.00	6	5.48	7.6	0.00	0.0
BNDY-Existing	BASEhuff_100yr_24hr		0.00	732.18	732.20	0.00	6	16.75	5.8	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_01hr		0.00	732.18	732.20	0.00	6	1.15	13.7	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_02hr		0.00	732.18	732.20	0.00	6	1.70	12.8	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_03hr		0.00	732.18	732.20	0.00	6	1.29	12.1	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_06hr		0.00	732.18	732.20	0.00	6	1.91	10.6	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_12hr		0.00	732.18	732.20	0.00	6	5.50	7.9	0.00	0.0
BNDY-Proposed	BASEhuff_100yr_24hr		0.00	732.18	732.20	0.00	6	14.55	5.9	0.00	0.0
Deten-Existing	BASEhuff_100yr_01hr		1.13	735.89	736.00	-0.00	27078	0.50	22.3	1.13	13.8
Deten-Existing	BASEhuff_100yr_02hr		1.49	735.63	736.00	0.00	22353	0.67	20.9	1.49	12.8
Deten-Existing	BASEhuff_100yr_03hr		1.24	735.51	736.00	-0.00	19992	0.83	17.8	1.24	12.3
Deten-Existing	BASEhuff_100yr_06hr		1.85	735.13	736.00	-0.00	12967	1.33	13.0	1.85	10.6
Deten-Existing	BASEhuff_100yr_12hr		5.50	734.46	736.00	0.00	5637	3.67	7.7	5.48	7.6
Deten-Existing	BASEhuff_100yr_24hr		16.75	734.20	736.00	-0.00	3281	16.73	5.8	16.75	5.8
Deten-Proposed	BASEhuff_100yr_01hr		1.15	735.86	736.00	0.00	26947	0.50	25.0	1.15	13.7
Deten-Proposed	BASEhuff_100yr_02hr		1.70	735.63	736.00	0.00	23302	0.67	23.0	1.70	12.8
Deten-Proposed	BASEhuff_100yr_03hr		1.29	735.46	736.00	0.00	20543	0.83	19.4	1.29	12.1
Deten-Proposed	BASEhuff_100yr_06hr		1.91	735.13	736.00	0.00	15236	1.33	14.0	1.91	10.6
Deten-Proposed	BASEhuff_100yr_12hr		5.50	734.50	736.00	0.00	10969	3.67	8.3	5.50	7.9
Deten-Proposed	BASEhuff_100yr_24hr		14.58	734.22	736.00	0.00	9776	14.50	5.9	14.55	5.9

EXISTING VS PROPOSED DISCHARGE RATE

EXISTING VS PROPOSED DETENTION BASIN STAGE ELEVATION

Mitsubishi Building Addition
Expanded Detention Basin Input

Name: Deten-Existing Base Flow(cfs): 0.000 Init Stage(ft): 732.920
Group: BASE Warn Stage(ft): 736.000
Type: Stage/Area

Stage(ft)	Area(ac)
732.920	0.0010
733.000	0.0030
734.000	0.0300
735.000	0.2400
736.000	0.6700

Name: Deten-Proposed Base Flow(cfs): 0.000 Init Stage(ft): 732.920
Group: BASE Warn Stage(ft): 736.000
Type: Stage/Area

Stage(ft)	Area(ac)
732.920	0.0010
733.000	0.0030
734.000	0.2000
735.000	0.3000
736.000	0.6700

DETENTION BASIN EXPANSION

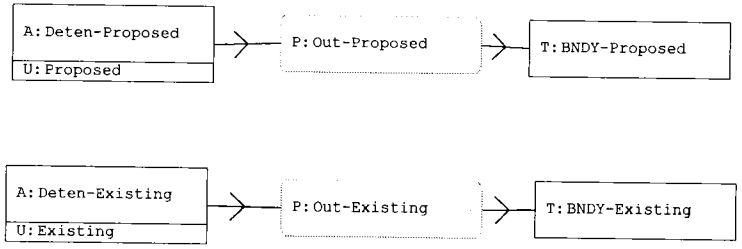
ICPR INPUT

Mitsubishi Building Addition
Node Diagram

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



==== Basins ====

Name: Existing
Group: BASE
Node: Deten-Existing
Status: Onsite
Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484
Rainfall File:
Rainfall Amount(in): 0.000
Area(ac): 11.000
Curve Number: 85.00
DCIA(%): 0.00

Peaking Factor: 484.0
Storm Duration(hrs): 0.00
Time of Conc(min): 22.00
Time Shift(hrs): 0.00
Max Allowable Q(cfs): 999999.000

Name: Proposed
Group: BASE
Node: Deten-Proposed
Status: Onsite
Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484
Rainfall File:
Rainfall Amount(in): 0.000
Area(ac): 11.000
Curve Number: 87.00
DCIA(%): 0.00

Peaking Factor: 484.0
Storm Duration(hrs): 0.00
Time of Conc(min): 22.00
Time Shift(hrs): 0.00
Max Allowable Q(cfs): 999999.000

==== Nodes ====

Name: BNDY-Existing
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 732.180
Warn Stage(ft): 732.200

Time(hrs)	Stage(ft)
0.00	732.180
60.00	732.180

Name: BNDY-Proposed
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 732.180
Warn Stage(ft): 732.200

Time(hrs)	Stage(ft)
0.00	732.180
60.00	732.180

Name: Deten-Existing
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 732.920
Warn Stage(ft): 736.000

Stage(ft)	Area(ac)
732.920	0.0010
733.000	0.0030
734.000	0.0300
735.000	0.2400
736.000	0.6700

Name: Deten-Proposed
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 732.920
Warn Stage(ft): 736.000

Stage(ft)	Area(ac)
732.920	0.0010
733.000	0.0030
734.000	0.2000
735.000	0.3000

736.000 0.6700

==== Pipes ====

```
        Name: Out-Existing        From Node: Deten-Existing     Length(ft): 146.00
       Group: BASE                  To Node: BNDY-Existing           Count: 1
                                                      Friction Equation: Average Conveyance
              UPSTREAM       DOWNSTREAM               Solution Algorithm: Most Restrictive
    Geometry: Circular       Circular                              Flow: Both
    Span(in): 21.00          21.00                    Entrance Loss Coef: 0.50
    Rise(in): 21.00          21.00                        Exit Loss Coef: 1.00
  Invert(ft): 732.920        732.180                      Bend Loss Coef: 0.00
 Manning's N: 0.013000       0.013000                   Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000          0.000                        Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000          0.000                     Stabilizer Option: None
```

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

```
        Name: Out-Proposed        From Node: Deten-Proposed     Length(ft): 146.00
       Group: BASE                  To Node: BNDY-Proposed           Count: 1
                                                      Friction Equation: Average Conveyance
              UPSTREAM       DOWNSTREAM               Solution Algorithm: Most Restrictive
    Geometry: Circular       Circular                              Flow: Both
    Span(in): 21.00          21.00                    Entrance Loss Coef: 0.50
    Rise(in): 21.00          21.00                        Exit Loss Coef: 1.00
  Invert(ft): 732.920        732.180                      Bend Loss Coef: 0.00
 Manning's N: 0.013000       0.013000                   Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000          0.000                        Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000          0.000                     Stabilizer Option: None
```

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

==== Hydrology Simulations ====

```
        Name: huff_010yr_01hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_01hr.R32

     Override Defaults: Yes
   Storm Duration(hrs): 1.00
         Rainfall File: Huff-indy1-50
   Rainfall Amount(in): 2.00
```

Time(hrs)	Print Inc(min)
2.000	5.00

```
        Name: huff_010yr_02hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_02hr.R32

     Override Defaults: Yes
   Storm Duration(hrs): 2.00
         Rainfall File: Huff-indy1-50
   Rainfall Amount(in): 2.46
```

Time(hrs)	Print Inc(min)
4.000	5.00

```
        Name: huff_010yr_03hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_03hr.R32

     Override Defaults: Yes
```

```
    Storm Duration(hrs): 3.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 2.72

Time(hrs)       Print Inc(min)
--------------- ---------------
6.000           5.00

-----------------------------------------------------------------------------------------------------
         Name: huff_010yr_06hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_06hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 6.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 3.19

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00

-----------------------------------------------------------------------------------------------------
         Name: huff_010yr_12hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_12hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 12.00
          Rainfall File: Huff-indy2-50
    Rainfall Amount(in): 3.70

Time(hrs)       Print Inc(min)
--------------- ---------------
20.000          10.00

-----------------------------------------------------------------------------------------------------
         Name: huff_010yr_24hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_24hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: huff_indy3-50
    Rainfall Amount(in): 4.25

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          15.00

-----------------------------------------------------------------------------------------------------
         Name: huff_100yr_01hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_01hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 1.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 3.21

Time(hrs)       Print Inc(min)
--------------- ---------------
2.000           5.00

-----------------------------------------------------------------------------------------------------
         Name: huff_100yr_02hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_02hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 2.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 3.97

Time(hrs)       Print Inc(min)
--------------- ---------------
4.000           5.00

-----------------------------------------------------------------------------------------------------
         Name: huff_100yr_03hr
     Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_03hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 3.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 4.38

Time(hrs)       Print Inc(min)
--------------- ---------------
6.000           5.00
```

```
--------------------------------------------------------------------------------------------------------------
          Name: huff_100yr_06hr
      Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_06hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 6.00
          Rainfall File: Huff-indy1-50
    Rainfall Amount(in): 5.13

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00

--------------------------------------------------------------------------------------------------------------
          Name: huff_100yr_12hr
      Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_12hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 12.00
          Rainfall File: Huff-indy2-50
    Rainfall Amount(in): 5.95

Time(hrs)       Print Inc(min)
--------------- ---------------
20.000          10.00

--------------------------------------------------------------------------------------------------------------
          Name: huff_100yr_24hr
      Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_24hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: huff_indy3-50
    Rainfall Amount(in): 6.84

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          15.00

==============================================================================================
==== Routing Simulations ======================================================================
==============================================================================================

          Name: huff_010yr_01hr     Hydrology Sim: huff_010yr_01hr
      Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_01hr.I32

       Execute: No          Restart: No            Patch: No
   Alternative: No

        Max Delta Z(ft): 1.00                      Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                       End Time(hrs): 5.00
     Min Calc Time(sec): 0.5000                 Max Calc Time(sec): 60.0000
       Boundary Stages:                             Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
1.000           5.000
5.000           10.000

Group           Run
--------------- -----
BASE            Yes


--------------------------------------------------------------------------------------------------------------
          Name: huff_010yr_02hr     Hydrology Sim: huff_010yr_02hr
      Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_02hr.I32

       Execute: No          Restart: No            Patch: No
   Alternative: No

        Max Delta Z(ft): 1.00                      Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                       End Time(hrs): 6.00
     Min Calc Time(sec): 0.5000                 Max Calc Time(sec): 60.0000
       Boundary Stages:                             Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
```

```
1.000           5.000
6.000           10.000

Group           Run
--------------- -----
BASE            Yes


-----------------------------------------------------------------------------------------------
        Name: huff_010yr_03hr     Hydrology Sim: huff_010yr_03hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_03hr.I32

     Execute: No          Restart: No            Patch: No
 Alternative: No

       Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
   Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                     End Time(hrs): 10.00
    Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.000

Group           Run
--------------- -----
BASE            Yes


-----------------------------------------------------------------------------------------------
        Name: huff_010yr_06hr     Hydrology Sim: huff_010yr_06hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_06hr.I32

     Execute: No          Restart: No            Patch: No
 Alternative: No

       Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
   Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                     End Time(hrs): 15.00
    Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
15.000          10.000

Group           Run
--------------- -----
BASE            Yes


-----------------------------------------------------------------------------------------------
        Name: huff_010yr_12hr     Hydrology Sim: huff_010yr_12hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_12hr.I32

     Execute: No          Restart: No            Patch: No
 Alternative: No

       Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
   Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                     End Time(hrs): 30.00
    Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          10.000

Group           Run
--------------- -----
BASE            Yes


-----------------------------------------------------------------------------------------------
        Name: huff_010yr_24hr     Hydrology Sim: huff_010yr_24hr
    Filename: S:\Projects\13294\ICPR\Developed\huff_010yr_24hr.I32

     Execute: No          Restart: No            Patch: No
```

Alternative: No

Max Delta Z(ft): 1.00
Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000
End Time(hrs): 60.00
Min Calc Time(sec): 0.5000
Max Calc Time(sec): 60.0000
Boundary Stages:
Boundary Flows:

Time(hrs)	Print Inc(min)
60.000	15.000

Group	Run
BASE	Yes

Name: huff_100yr_01hr Hydrology Sim: huff_100yr_01hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_01hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00
Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000
End Time(hrs): 5.00
Min Calc Time(sec): 0.5000
Max Calc Time(sec): 60.0000
Boundary Stages:
Boundary Flows:

Time(hrs)	Print Inc(min)
1.000	5.000
5.000	10.000

Group	Run
BASE	Yes

Name: huff_100yr_02hr Hydrology Sim: huff_100yr_02hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_02hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00
Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000
End Time(hrs): 6.00
Min Calc Time(sec): 0.5000
Max Calc Time(sec): 60.0000
Boundary Stages:
Boundary Flows:

Time(hrs)	Print Inc(min)
1.000	5.000
6.000	10.000

Group	Run
BASE	Yes

Name: huff_100yr_03hr Hydrology Sim: huff_100yr_03hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_03hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00
Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000
End Time(hrs): 10.00
Min Calc Time(sec): 0.5000
Max Calc Time(sec): 60.0000
Boundary Stages:
Boundary Flows:

Time(hrs)	Print Inc(min)

10.000	10.000

Group	Run
BASE	Yes

Name: huff_100yr_06hr Hydrology Sim: huff_100yr_06hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_06hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 15.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
15.000	10.000

Group	Run
BASE	Yes

Name: huff_100yr_12hr Hydrology Sim: huff_100yr_12hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_12hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
30.000	10.000

Group	Run
BASE	Yes

Name: huff_100yr_24hr Hydrology Sim: huff_100yr_24hr
Filename: S:\Projects\13294\ICPR\Developed\huff_100yr_24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 60.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
60.000	15.000

Group	Run
BASE	Yes

Tc and Cn CALCULATIONS

TR-55

-COMPOSITE CN-VALUES & TIME OF CONCENTRATION-

Existing vs Proposed

PROJECT: Mitsubishi Building Addition
JOB #: 13294
DATE: 3/14/14
COMPUTED BY: WCZ

BASINS					
BASIN	Composite CN	Area (ft^2)	Area (acres)	Area (miles)	Tc
Existing	85.00	481338	11	0.02	22.0
Proposed	87.00	481338	11	0.02	22.0

Basin	Cover Description	Soil Group	Area (Acres)	CN	CN * Acres	number
Existing	Good condition; grass cover > 75%	C	3.35	74	247.9	4
Existing	Good condition; grass cover > 75%	B	1.8	61	109.8	3
Existing	Paved parking lots, roofs, driveways	C	5.9	98	578.2	4
Proposed	Good condition; grass cover > 75%	C	2.83	74	209.42	4
Proposed	Good condition; grass cover > 75%	B	1.52	61	92.72	3
Proposed	Paved parking lots, roofs, driveways	C	6.7	98	656.6	4

Basin #	CN	Acres	CN * Acres
Existing	85	11	935.9
Proposed	87	11	958.74

Time of Concentration Worksheet
Based on TR-55

PROJECT: Mitsubishi Building Addition
JOB #: 13294

Typical values for Manning's n

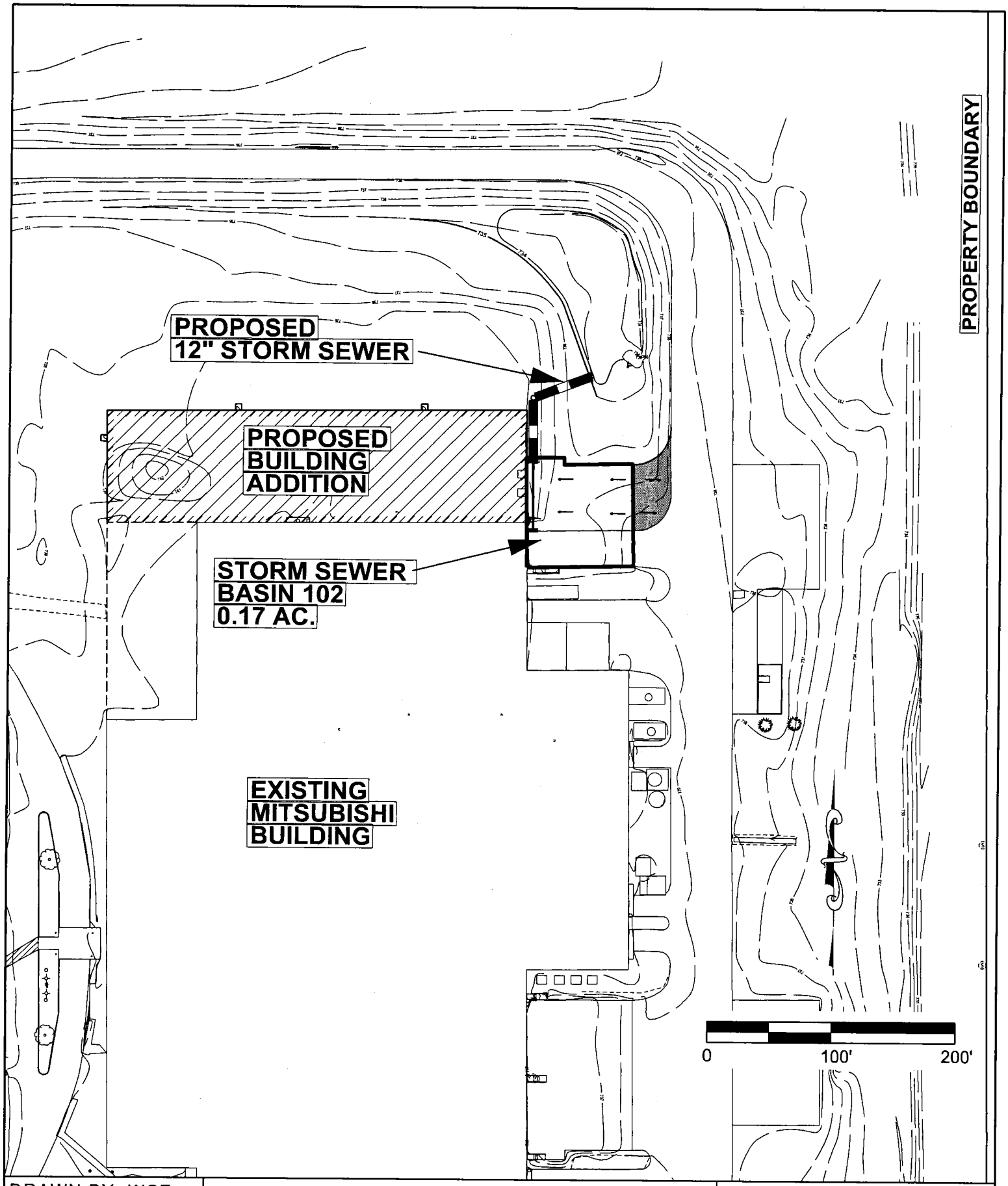
Overland Flow		Channel Flow	
short grass	0.15	grass	0.03
dense grass	0.24	concrete	0.02
pavement	0.011	rip-rap	0.04
woods light	0.4		
cultivated > 20%	0.17		

2 year, 24 hour rainfall = 2.94 inches
minimum T_c = 6 minutes

Basin name	Overland flow Length (ft)	S %	n	T_t (min)	Shallow Concentrated Flow (1) Length (ft)	S %	Paved/Un (P or U)	Vel. (ft/s)	T_t (min)	Shallow Concentrated Flow (2) Length (ft)	S %	Paved/Un (P or U)	Vel. (ft/s)	T_t (min)	Channel Flow Length (ft)	a (s.f.)	Pw (ft)	r (ft)	S %	n	Vel. (ft/s)	T_t (min)	T_c (min)
				0					0					0								0	
				0					0					0								0	
Existing	100	1.2	0.24	18	190	1.2	U	1.8	2					0	822	15	20	0.75	3	0.03	7.10	2	21.98
				0					0					0								0	
Proposed	100	1.2	0.24	18	190	1.2	U	1.8	2					0	822	15	20	0.75	3	0.03	7.10	2	21.98
				0					0					0								0	
				0					0					0								0	
				0					0					0								0	
				0					0					0								0	
				0					0					0								0	

STORM SEWER CALCULATIONS

STORM SEWER BASIN MAP



DRAWN BY: WCZ
DATE: 3/17/2014
JOB #:13294
SCALE: AS SHOWN
PAGE: 1 OF 1

STORM SEWER BASINS

MITSUBISHI BUILDING ADDITION

CITY OF FRANKLIN
JOHNSON COUNTY, INDIANA

BANNING ENGINEERING
853 COLUMBIA ROAD, SUITE #101
PLAINFIELD, IN 46168
BUS: (317) 707-3700, FAX: (317) 707-3800
E-MAIL: Banning@BanningEngineering.com
WEB: www.BanningEngineering.com

RATIONAL METHOD CALCULATIONS

STORM SEWER DESIGN CALCULATIONS
-PIPE DESIGN-

PROJECT:	Mitsubishi Building Addition	STORM:	10 Year
JOB #:	13294	COMPUTED BY:	WCZ
DATE:	3/20/14	SHEET NO.:	

STRUCTURE FROM	TO	DESIGN Q (cfs)	L (ft)	DIA. (in)	SLOPE %	CAP. Q (cfs)	VEL. (ft/s)	RIM ELEV. UP	DOWN	INVERT ELEV. UP	DOWN	COVER (ft)
102	101	0.95	53	12	0.30	1.96	2.50	736.20	738.70	734.31	734.15	0.72
101	100	0.95	51	12	0.30	1.96	2.50	738.70	E.S.	734.15	734.00	3.38

STORM SEWER DESIGN CALCULATIONS
-RATIONAL METHOD-

PROJECT:	Mitsubishi Building Addition	STORM:	10 Year
JOB #:	13294	COMPUTED BY:	WCZ
DATE:	3/20/14	SHEET NO.:	

STRUCTURE		BASINS							COMPOSITE BASINS				TRAVEL
FROM	TO	BASIN #	c	A (acres)	c*A	Tc (min)	I (in/hr)	Q (cfs)	SUM (c*A)	Tc (min)	I (in/hr)	Q (cfs)	TIME (min)
102	101	102	0.82	0.17	0.14	5.00	6.98	0.95	0.14	5.00	6.98	0.95	0.35
101	100	101	0.00	0.00	0.00	5.00	6.98	0.00	0.14	5.35	6.98	0.95	0.34

Time of Concentration Worksheet
Based on TR-55

PROJECT: Mitsubishi Building Addition
JOB #: 13294

Typical values for Manning's n			
Overland Flow		Channel Flow	
short grass	0.15	grass	0.03
dense grass	0.24	concrete	0.015
pavement	0.011	rip-rap	0.035

2 year, 24 hour rainfall = 2.94 inches
minimum T_c = 5 minutes

Basin name	Overland flow seg. 1				Overland flow seg. 2				Shallow Concentrated Flow seg.1					Shallow Concentrated Flow seg.2					Channel Flow								T_c
	Length (ft)	S %	n	T_t (min)	Length (ft)	S %	n	T_t (min)	Length (ft)	S %	Paved/Un (P or U)	Vel. (ft/s)	T_t (min)	Length (ft)	S %	Paved/Un (P or U)	Vel. (ft/s)	T_t (min)	Length (ft)	a (s.f.)	Pw (ft)	r (ft)	S %	n	Vel. (ft/s)	T_t (min)	(min)
102	75	5.00	0.01	0.70																							5.00
101																			52						3.00	0.29	5.00