Engineers, Surveyors, Planners, Scientists

May 24, 2022

City of Columbus, Department of Public Utilities
Attn: Greg Fedner, P.E.
Section manager, Private Development
910 Dublin Road
Columbus, Ohio 43215

Subject: Type II Variance for Bachman Site (Winchester Pike)

Dear Mr. Fedner,

We are requesting a Type II variance to the Stormwater Drainage Manual, Section 3.1.7 General Criteria. The project is known as the Bachman Site and is located on the north and south side of Winchester Pike currently within the Franklin County but will be annexed into the City of Columbus. The project is adjacent to the Coble Bowman Ditch which has a FEMA studied flood plain. The site will be developing an existing agricultural field into a residential subdivision. There are three wet basins (01-03) being proposed with the development, two on the south side and one on the north side of Winchester Pike. All basins will provide water quality and detention for each respective area of the development. The basins will outlet to the Coble Bowman Ditch. The full build layout of the site can be seen in Exhibit 1.

The relative elevation of the south side of the site ranges between 750 and 753 and the north side falls generally from south to north with the majority of the site being between 753 and 755. The FEMA flood plain along the Coble Bowman ditch varies from approximately 747.5 to 749.5 from south to north along the western portions of the site. The wet basins will be located adjacent to the flood plain of the ditch and outside the City of Columbus defined stream corridor protection zone. The proposed basin outlets are located along the ditch at locations that would equate to FEMA base flood elevations of 747.5 for the south outlet and 749.5 for the north outlet. These elevations are very close to the elevations of the actual site elevations, thus, limiting the available storage space between the base flood elevation and the proposed site grading.

As the site was being evaluated for storm water control, the understanding that having storm water control practices below the floodplain elevation requires specific design elements to prevent floodwaters from compromising the performance of the storm water control practice (SCP). Specifically, the following are the minimum requirements:

1. The top of embankment of the basin, including any primary or emergency spillways must have an elevation higher than the 100-year base flood elevation.
2. All outlets from the basin to the stream must have a backflow preventer to prevent flood water from flowing into the basin.

These requirements preserve the volume of the SCP to be used for water quality and peak flow rate control. However, the elevation of the stream during a flood event may prevent the SCP from draining properly and could cause the basin to overtop releasing flow to the stream at a rate that may exceed allowable peak flow rates. Overtopping of the basin may also weaken the embankment increasing risk of an embankment breach and failure.
To size the basin properly, a joint probability analysis is required to understand an appropriate flood elevation to use during a local 100-year rainfall event. The analysis will evaluate the correlation between the timing of a local 100-year rainfall event with the timing of the receiving stream. For example, a large

watershed such as the Scioto River peaks well after the peak of the rainfall event, whereas a much smaller stream will peak shortly after the rainfall event. The Federal Highway Administration (FHWA) has a chart, shown on the following flow chart that estimates the stream flood elevation based on the ratio of the local watershed area to a stream vs. the tributary of the stream. So to estimate the river flood elevation for a 10-year local event with a watershed ratio of 100:1, a stream elevation equal to the 5-year flood event should be used.

A practical application of the joint probability analysis is to perform a two-step design of the outlet structure of the SCP to meet water quality and peak flow requirements for all storms up to the 100-year event. The first step is to design the outlet to meet water quality and peak flow rate requirements for all storms up to the 100-year event with a free outfall. This ensures that no matter what the tailwater elevation is, the SCP is not going to release flow at a rate higher than the allowable peak flow rate.

The second step is the model the same SCP outlet device but with a constant tailwater elevation obtained from the FHWA joint probability chart for the 100-year event. So for a stream with a watershed area 100 times larger than the local watershed area tributary to the SCP, the tailwater elevation is the 25-year flood level. A 100-year storm is then routed through the SCP with no changes to the outlet structure or basin volume. If the SCP is still able to hold the 100-year event with the restrictive tailwater elevation limiting the ability for the SCP to drain to the stream, one can conclude that the SCP has sufficient volume.

If the SCP overtops during the 100-year, it has insufficient volume and must be redesigned so that it does not overtop. The SCP is then redesigned with a new outlet structure, larger volume, and/or higher normal pool elevation. The new design for this example is then again tested to meet water quality and peak flow rate criteria with a free outfall then during a 100-year event with a 25-year constant tailwater elevation. If the SCP does not overtop, the design is complete. The lower the SCP is in relation to the required tailwater elevation for the 100-year event, the larger the basin volume needs to become. This policy essentially discourages SCPs from being significantly below the required 100-year tailwater elevation. As the invert or normal pool elevation of the basin rises in relation to the required tailwater elevation, the smaller the increase in basin volume from the free outfall condition. In many cases, a slightly larger SCP volume is not nearly as detriment to the cost of a project when compared to having to raise the elevation of the entire site.

For reference, the attached flowchart takes the designer of a SCP through the step by step process described herein. This process was applied to the proposed site in the design of the basins.

The tributary area of the site in relation to the stream resulted in a 1:1 ratio per the chart below, which, requires the storm water control practice to be designed to the 100yr event of the stream. As a result the basin requirements for sizing are as follows:

Table 1 - Estimated Required Storage Volume

Basin Name	Estimate Storage Volume at the 100-Year Elevation (ac-ft) without tailwater	Estimated Storage Volume at the 100-Year Elevation (ac-ft) with tailwater
Basin 01	25.677	28.886
Basin 02	7.530	10.507
Basin 03	1.134	1.797

Based on the above volumes, the basin sizing, placement and volume were then evaluated in two scenarios:

1. Meeting the Storm Water Manual – normal pools and storage volume utilized above the base flood elevation (Exhibit 3)
2. Preferred Option – normal pools and storage volume utilized below the base flood elevation (Exhibit 4)

In Scenario 1 (above base flood elevation) the normal pools were 747.5 (south) and 749.5 (north). The storage volume required for the basins resulted in top of banks being 753.0 (south) and 754.0 (north). The site was then roughly graded to accommodate drainage to the basins and proposed storm sewer pipe. As a result the site was raised approximately 3-6 feet moving from west to east on the south side and 2-4 feet moving west to east. This resulted in approximately 221,100 cubic yards of clay import required for the site development. Not only is this a very large quantity that would be difficult for the Developer to locate, but the cost to truck that amount of clay would be roughly $4,422,000, not including the additional time/cost to structurally fill the sites. This amount of earthwork is not economically feasible or affordable as it would be a pass through cost to the development of the lots and home buyers.

In Scenario 2 (below base flood elevation) the normal pools were dropped to 745.0 (south) and 747.0 (north). The storage volume required for the basins resulted in top of banks being 750.5 (south) and 751.0 (north). With this normal pool lowering and utilization of storage below the base flood elevation the site is much closer to a balanced site that could be finalized during the time of final engineering. The basin outlet as mentioned above would be required to have a back flow preventer to separate the stream and basin in this scenario. The allowance of the variance provides a much more feasible and economical site for the development and ultimately the home buyer.

If you have any questions or need more clarity on any of the issues described please do not hesitate to give me a call at 614-775-4443.

Thank you for your consideration on this matter.

Sincerely,

Kyle J. Shreves, PE

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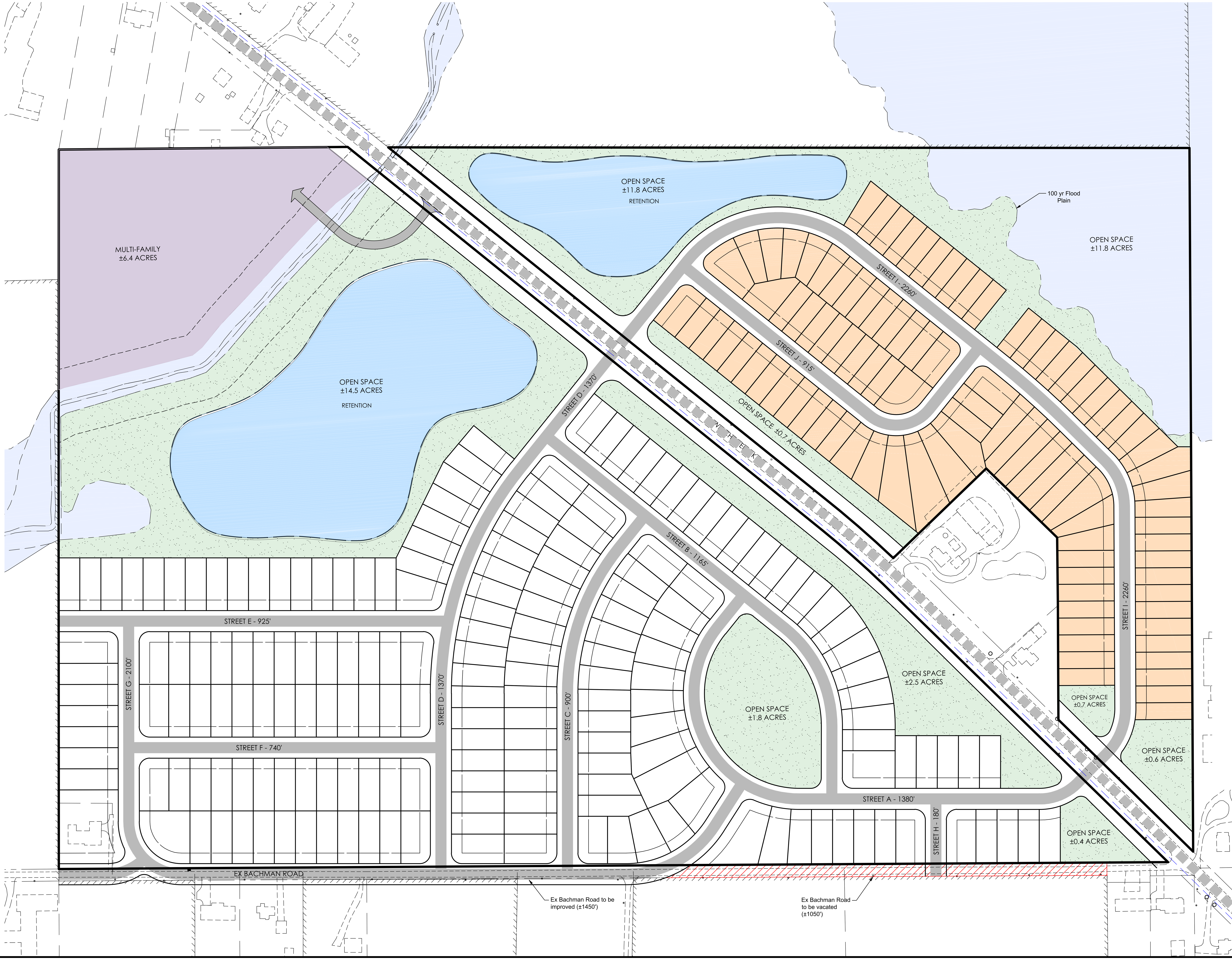


BACHMAN ROAD TRACT

CONCEPT PLAN

EXHIBIT 1

Date: April 27, 2022

Client: Tamarack Land Development

Job Number: 20211307

DETENTION BELOW THE BASE FLOOD ELEVATION
DESIGN FLOWCHART

Note 1: A joint probability analysis or JPA is a statistical analysis of the correlation between intense rainfall and high streamflow. Recorded gage data and rainfall data are required. The common calculations used to do this are as follows:

1. Correlation coefficient and coeffcient of determination per USACE EM 1110-2-1415 and EM 1110- 2-1413.
2. Kendall's Tau
3. Spearman's Rho

Note 2: The backflow preventer will allow the basin volume to be available for the various storm events, but may not allow outflow. The lower the normal pool is relative to the base flood elevation the more volume that may be needed.

Table 1

Use the following tailwater elevation controls for the Stormwater Control Practice (SCP) when directly Tributary to Scioto or Olentangy rivers.

WQ Event = Free Tailwater
1-year Local Event = 1-year River Elevation
2-year Local Event = 1-year River Elevation
5-year Local Event = 1-year River Elevation
10-year Local Event = 1-year River Elevation
25-year Local Event = 1-year River Elevation
50-year Local Event = 1-year River Elevation
100-year Local Event = 1-year River Elevation

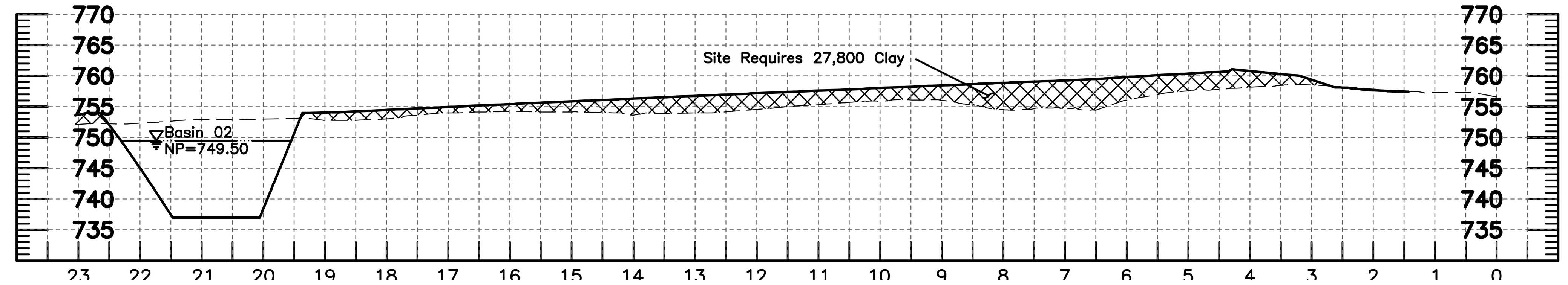
Table 2: Stream Flood Elevation Year

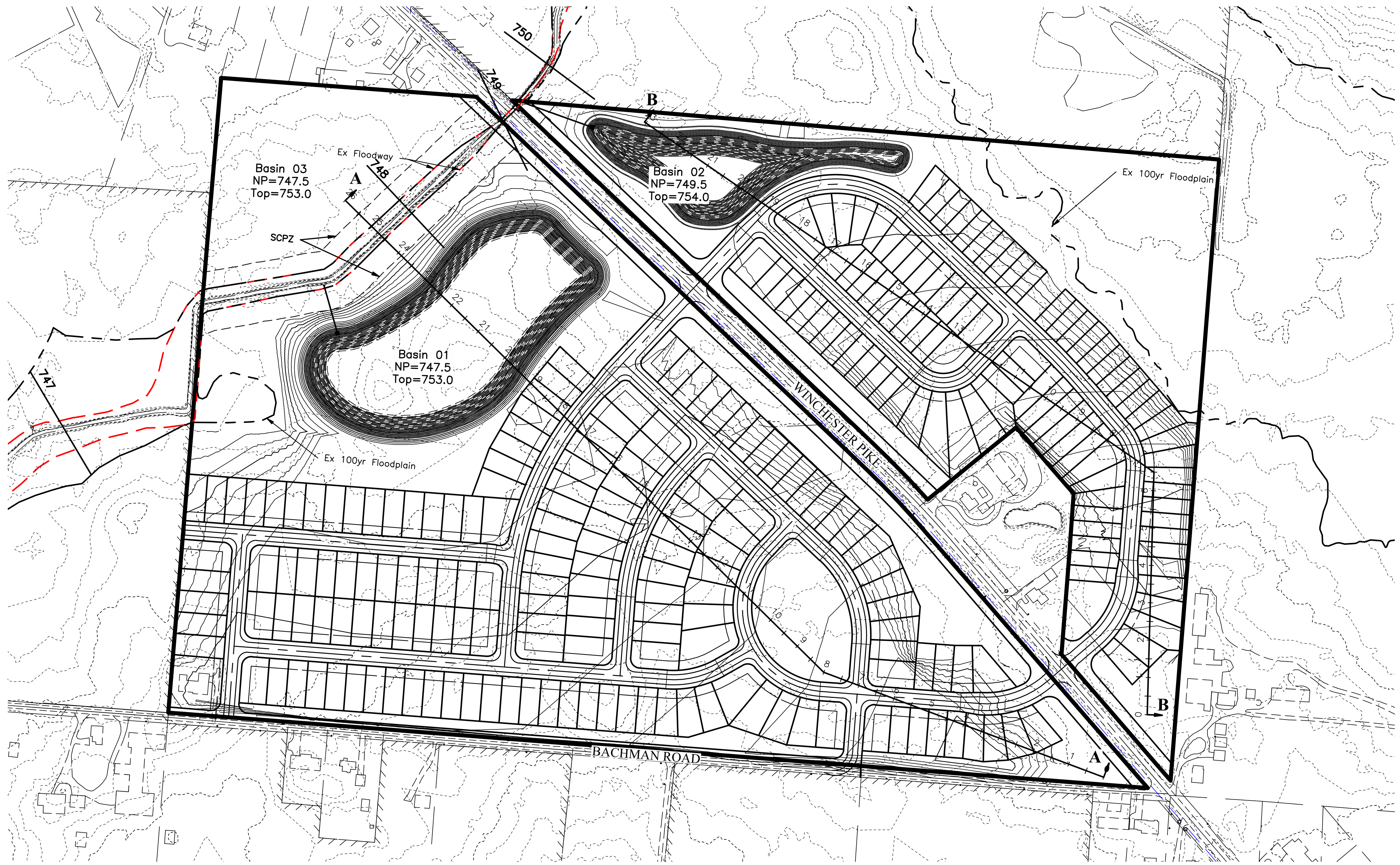
SCP Design Event	Area Ratio	1 to 1	10 to 1	100 to 1	1,000 to 1	10,000 to 1
1-year		1	1	1	1	1
2-year		2	2	2	1	1
5-year		5	5	5	2	1
10-year		10	10	5	2	1
25-year		25	25	10	5	1
50-year		50	25	10	5	2
100-year		100	50	25	10	2

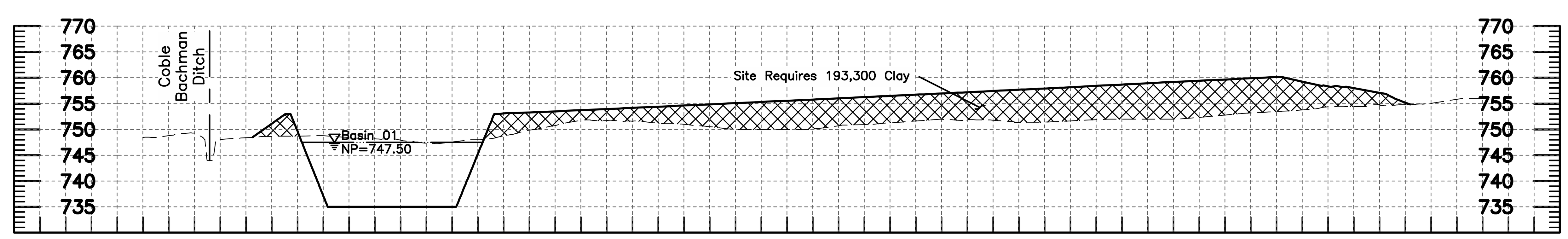
Area Ratio is the Stream Tributary Area Divided by SCP Tributary Area

(green) From Federal Highway Administration Urban Drainage Design Manual, HEC-22, Table 7-3

EMH&T April 2021







Storage Volume Utilized Above Base Flood Elevation Only

- Requires 221,100 cy of imported clay (accounts for clay generated by basins)
- Approximately $4,422,000 cost to truck clay to site

GRAPHIC SCALE

0 100 200 400

1 inch = 200 feet

PRELIMINARY

NOT TO BE USED FOR CONSTRUCTION

PLAN SET DATE
May 23, 2022

MARK	DATE	DESCRIPTION

REVISIONS

D.R. Horton

CITY OF COLUMBUS OHIO, FRANKLIN COUNTY, OHIO
EXHIBIT
FOR
BACHMAN ROAD
EXHIBIT 3

EMHT
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Toll Free: 888.775.3648
emht.com

DATE: May 23, 2022

SCALE: 1" = 200'

JOB NO.: 2021-1307

SHEET: 1/1

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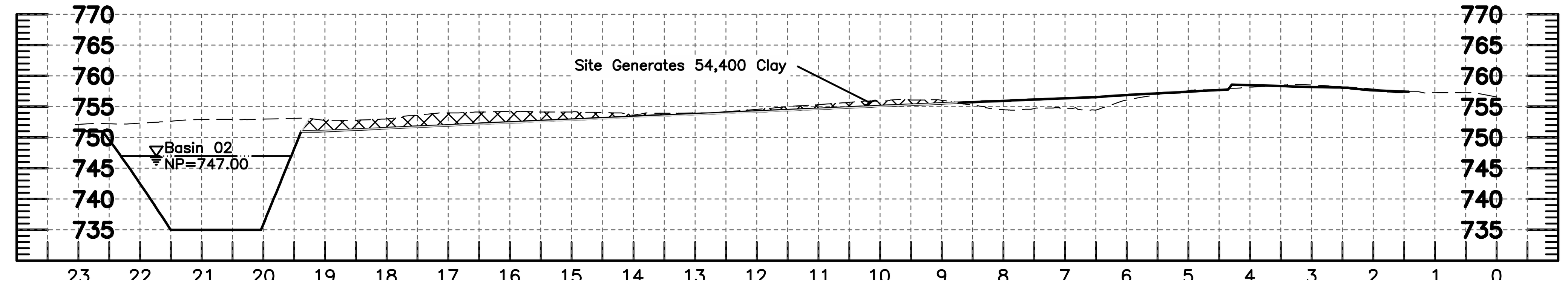

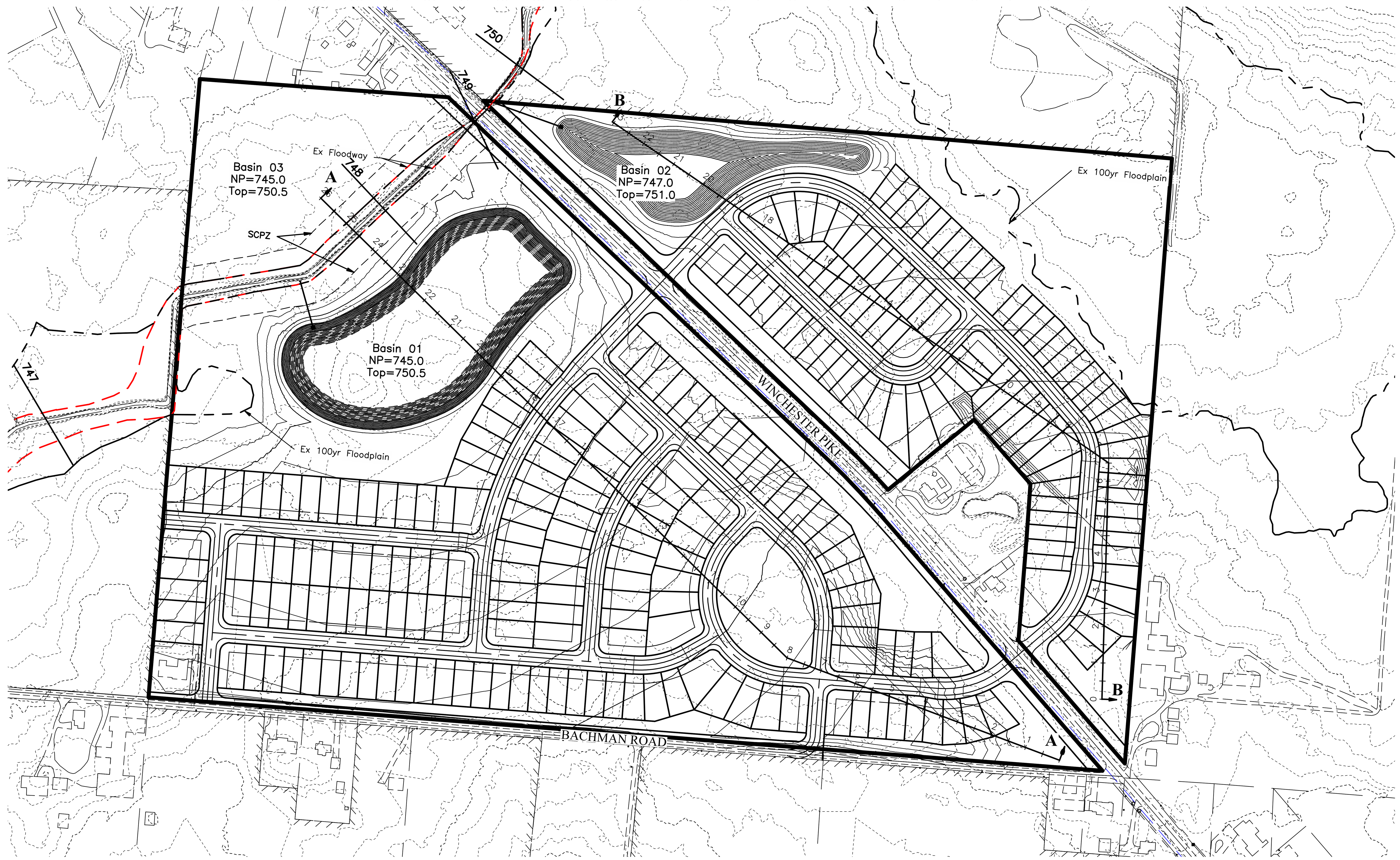

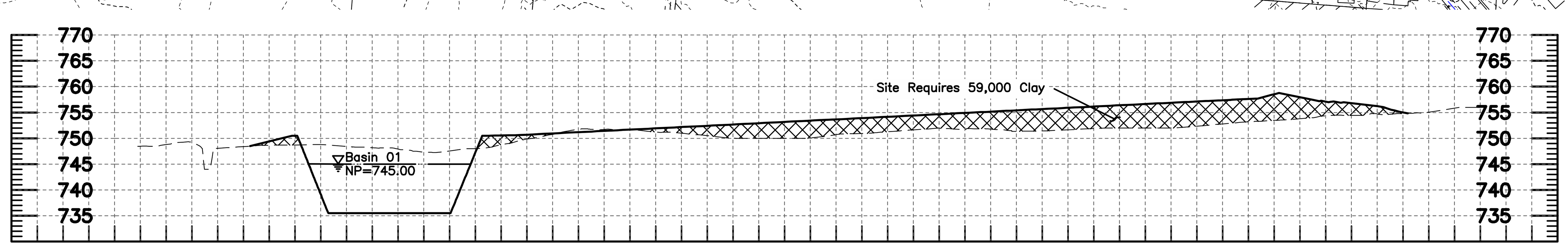

Storage Volume Utilized Below Base Flood Elevation

- Overall Site within 5,000 cy of site balance
- Utilize backflow preventer on outlet
- Provides Site 100 yr storage during flood conditions

GRAPHIC SCALE

0 100 200 400

1 inch = 200 feet

PRELIMINARY

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REVISIONS

CITY OF COLUMBUS OHIO, FRANKLIN COUNTY, OHIO

EXHIBIT
FOR

BACHMAN ROAD

EXHIBIT 4

EMH&T
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Toll Free: 888.775.3648
emht.com

DATE
May 23, 2022

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1" = 200'

JOB NO.
2021-1307

SHEET
1/1