EXHIBIT H: PRELIMINARY DRAINAGE REPORT

PRELIMINARY STORMWATER REPORT

Carina Solar Project

South of E 100 S, North of E 400 S, West of S 525 E, East of S Gladstone Ave

Columbus Township, Sand Creek Township, Rock Creek Township, Bartholomew County, IN

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Prepared on: November 22nd, 2023
Revised on: January 8th, 2024

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EXHIBITS

1. PROJECT DESCRIPTION

The development is a proposed 100-MW Commercial Solar Energy System/Power Generation Facility located in Bartholomew County, IN. The proposed development will include solar panels, gravel access drives, associated electrical equipment, and a substation. The project will be surrounded by a perimeter fence.

This report evaluates the Pre and Post Development runoff characteristics of the development and addresses the stormwater requirements of Bartholomew County. The analysis compares peak runoff rates in Pre and Post Development conditions during large storm events. The analysis was completed with the assistance of HydroCAD Version 10.20.3c.

1.1. Pre-Development Conditions

The existing site is approximately 1,945 acres of agricultural land. The project is located in Bartholomew County, within Columbus Township, Sand Creek Township, and Rock Creek Township. In the existing condition, the site is split into four drainage areas with eventual discharges to Clifty Creek and Little Sand Creek - East Fork White River. The drainage areas can be broken down as follows:

- Drainage Area 1 flows to Clifty Creek – Columbus which flows west to Clifty Creek
- Drainage Area 2 flows to Brush Creek – Fishers Fork which flows south to Little Sand Creek – East Fork River
- Drainage Area 3 flows to East Fork White R – Armuth Ditch which flows west to Little Sand Creek – East Fork River
- Drainage Area 4 flows to Little Sand Creek - Headwaters which flows west to Little Sand Creek – East Fork River

Refer to **Exhibit 4** for the Drainage Areas Map.

Final engineering will obtain a Wetland and Waterbody Delineation Report to get a total of wetlands and waterbodies within the project area.

Per FEMA FIRM Map Panel 18005C0165E effective December 9th, 2014, flood plains are present within the project area. The area is designated as Zone "A", an area of special flood hazard. Flood plain shown on plans is from the Indiana flood plain information portal as shown on survey provided by Encompass dated April 18th, 2023. Development area is within Zone A and these areas will not be impacted by the proposed project (Refer to **Exhibit 2** for FEMA Map panel).

During final engineering a Geotechnical Engineer will be engaged to create a subterrain report. The USDA Web Soils Survey Map dated September 2nd, 2022, concludes that onsite soils consist mostly of silty loamy of hydraulic group A, A/D, B/D, C/D. Due to the existing agricultural use the site was considered to have Type D soils in the predevelopment condition. (Refer to **Exhibit 3** for the USDA Soils Map).

1.2. Post-Development Conditions

The proposed project is a Commercial Solar Energy System/Power Generation Facility. The project will consist of rows of Photovoltaic Solar Modules, gravel access driveways, associated electrical equipment, underground utilities, and a substation. Solar modules will be mounted on piles and elevated above the ground as to preserve the existing underlying soil and allow for revegetation and infiltration. The project will be surrounded by a perimeter fence. Ground area within the fence perimeter that is not occupied by gravel roads or foundations will be seeded. To conform with a study published in the Journal of Hydrologic Engineering, the proposed Commercial Solar Energy System/Power Generation Facility grass mix will be adequately established and well maintained to ensure the proposed Commercial Solar Energy System/Power Generation Facility does not have an adverse hydrologic impact from excess runoff or contribute eroded soil particles to receiving streams and waterways. Refer to **Exhibit 1** for the study published in the Journal of Hydrologic Engineering and the Carina Solar Landscape Plans for the proposed Commercial Solar Energy System/Power Generation Facility seed mix. The existing drainage patterns will be maintained in the proposed condition. Refer to **Exhibit 4** for the Drainage Areas Map and Section 2 – Stormwater Summary of this report for additional information on the storm water management design.

2. STORMWATER SUMMARY

2.1. Stormwater Management

A study published in the Journal of Hydrologic Engineering researched the hydrologic impacts of utility scale solar generating facilities. The study utilized a model to simulate runoff from Pre-and Post-solar panel conditions. The study concluded that the solar panels themselves have little to no impact on runoff volumes or rates. Rainfall losses, most notably infiltration, are not impacted by the solar panels. Rainfall that falls directly on a solar panel runs to the pervious areas around and under the surrounding panels.

2.2. Peak Flow Calculation Summary

The site peak discharges were estimated using methods outlined in the NRCS TR-20 and the following parameters: subbasin area (acres), flowlines (ft.), time of concentrations (Tc, hours), slope (ft./ft.), and Curve Number. Curve Numbers were determined based upon soil classification and land use for each subbasin. The 1-foot contour interval topographic survey was examined to identify points where onsite flow discharges from the development area. The release rates for the 10-year and 100-year storm were calculated using HydroCAD Version 10.20-3c. Per the Bartholomew County requirements the Post-Development 10–YR runoff rates were compared and limited to the Pre-Development 10–YR runoff rates and Post-Development 100–YR runoff rates were compared and limited to the Pre-Development 100–YR runoff rates. Detailed calculations have been provided in **Exhibits 5** and **Exhibit 6** and a summary of the Pre vs. Post Development runoff rates are provided below.

Table 1: Summary Pre-Development 10-Year vs. Post-Development 10-Year Storm Runoff Rates without Off Site Flow		
Drainage Area	*Pre 10-YR (cfs)*	*Post 10-YR (cfs)*
1	456.39	334.83
2	1,362.87	1,009.60
3	552.25	379.55
4	361.52	259.35

Table 2: Summary Pre-Development 100-Year vs. Post-Development 100-Year Storm Runoff Rates without Off Site Flow		
Drainage Area	*Pre 100-YR (cfs)*	*Post 100-YR (cfs)*
1	859.75	718.26
2	2,530.51	2,128.06
3	1,010.98	814.18
4	661.81	546.66

3. CONCLUSION

A study published in the Journal of Hydrologic Engineering researched the hydrologic impacts of utility scale solar generating facilities. The study utilized a model to simulate runoff from Pre and Post solar panel conditions. The study concluded that the solar panels themselves have little to no impact on runoff volumes or rates. Rainfall losses, most notably infiltration, are not impacted by the solar panels. Rainfall that falls directly on a solar panel runs to the pervious areas around and under the surrounding panels. Only minor grading is proposed with no changes to the existing site drainage patterns, and onsite access roads will be made of gravel. Based on the proposed improvements on the project site, the findings of the above referenced study, and the calculations included within this report, the proposed design meets the requirements of the Bartholomew County Drainage Ordinance to reduce the on-site runoff for Post-Development 10–YR Storm to the Pre-development 10–YR Storm and Post-Development 100–YR Storm to the Pre-development 100–YR Storm.

Exhibit 1 – Hydrologic Response of Solar Farms (By Others)

Hydrologic Response of Solar Farms

Lauren M. Cook, S.M.ASCE[1]; and Richard H. McCuen, M.ASCE[2]

Abstract: Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and postpaneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels. This study, along with design recommendations, can be used as a guide for the future design of solar farms. **DOI:** 10.1061/(ASCE)HE.1943-5584.0000530. © *2013 American Society of Civil Engineers.*

CE Database subject headings: Hydrology; Land use; Solar power; Floods; Surface water; Runoff; Stormwater management.

Author keywords: Hydrology; Land use change; Solar energy; Flooding; Surface water runoff; Storm-water management.

Introduction

Storm-water management practices are generally implemented to reverse the effects of land-cover changes that cause increases in volumes and rates of runoff. This is a concern posed for new types of land-cover change such as the solar farm. Solar energy is a renewable energy source that is expected to increase in importance in the near future. Because solar farms require considerable land, it is necessary to understand the design of solar farms and their potential effect on erosion rates and storm runoff, especially the impact on offsite properties and receiving streams. These farms can vary in size from 8 ha (20 acres) in residential areas to 250 ha (600 acres) in areas where land is abundant.

The solar panels are impervious to rain water; however, they are mounted on metal rods and placed over pervious land. In some cases, the area below the panel is paved or covered with gravel. Service roads are generally located between rows of panels. Although some panels are stationary, others are designed to move so that the angle of the panel varies with the angle of the sun. The angle can range, depending on the latitude, from 22° during the summer months to 74° during the winter months. In addition, the angle and direction can also change throughout the day. The issue posed is whether or not these rows of impervious panels will change the runoff characteristics of the site, specifically increase runoff volumes or peak discharge rates. If the increases are hydrologically significant, storm-water management facilities may be needed. Additionally, it is possible that the velocity of water draining from the edge of the panels is sufficient to cause erosion of the soil below the panels, especially where the maintenance roadways are bare ground.

The outcome of this study provides guidance for assessing the hydrologic effects of solar farms, which is important to those who plan, design, and install arrays of solar panels. Those who design solar farms may need to provide for storm-water management. This study investigated the hydrologic effects of solar farms, assessed whether or not storm-water management might be needed, and if the velocity of the runoff from the panels could be sufficient to cause erosion of the soil below the panels.

Model Development

Solar farms are generally designed to maximize the amount of energy produced per unit of land area, while still allowing space for maintenance. The hydrologic response of solar farms is not usually considered in design. Typically, the panels will be arrayed in long rows with separations between the rows to allow for maintenance vehicles. To model a typical layout, a unit width of one panel was assumed, with the length of the downgradient strip depending on the size of the farm. For example, a solar farm with 30 rows of 200 panels each could be modeled as a strip of 30 panels with space between the panels for maintenance vehicles. Rainwater that drains from the upper panel onto the ground will flow over the land under the 29 panels on the downgradient strip. Depending on the land cover, infiltration losses would be expected as the runoff flows to the bottom of the slope.

To determine the effects that the solar panels have on runoff characteristics, a model of a solar farm was developed. Runoff in the form of sheet flow without the addition of the solar panels served as the prepaneled condition. The paneled condition assumed a downgradient series of cells with one solar panel per ground cell. Each cell was separated into three sections: wet, dry, and spacer.

The dry section is that portion directly underneath the solar panel, unexposed directly to the rainfall. As the angle of the panel from the horizontal increases, more of the rain will fall directly onto

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Note. This manuscript was submitted on August 12, 2010; approved on October 20, 2011; published online on October 24, 2011. Discussion period open until October 1, 2013; separate discussions must be submitted for individual papers. This paper is part of the ***Journal of Hydrologic Engineering***, Vol. 18, No. 5, May 1, 2013. © ASCE, ISSN 1084-0699/2013/5-536-541/$25.00.

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the ground; this section of the cell is referred to as the wet section. The spacer section is the area between the rows of panels used by maintenance vehicles. Fig. 1 is an image of two solar panels and the spacer section allotted for maintenance vehicles. Fig. 2 is a schematic of the wet, dry, and spacer sections with their respective dimensions. In Fig. 1, tracks from the vehicles are visible on what is modeled within as the spacer section. When the solar panel is horizontal, then the length longitudinal to the direction that runoff will occur is the length of the dry and wet sections combined. Runoff from a dry section drains onto the downgradient spacer section. Runoff from the spacer section flows to the wet section of the next downgradient cell. Water that drains from a solar panel falls directly onto the spacer section of that cell.

The length of the spacer section is constant. During a storm event, the loss rate was assumed constant for the 24-h storm because a wet antecedent condition was assumed. The lengths of the wet and dry sections changed depending on the angle of the solar panel. The total length of the wet and dry sections was set equal to the length of one horizontal solar panel, which was assumed to be 3.5 m. When a solar panel is horizontal, the dry section length would equal 3.5 m and the wet section length would be zero. In the paneled condition, the dry section does not receive direct rainfall because the rain first falls onto the solar panel then drains onto the spacer section. However, the dry section does infiltrate some of the runoff that comes from the upgradient wet section. The wet section was modeled similar to the spacer section with rain falling directly onto the section and assuming a constant loss rate.

For the presolar panel condition, the spacer and wet sections are modeled the same as in the paneled condition; however, the cell does not include a dry section. In the prepaneled condition, rain falls directly onto the entire cell. When modeling the prepaneled condition, all cells receive rainfall at the same rate and are subject to losses. All other conditions were assumed to remain the same such that the prepaneled and paneled conditions can be compared.

Rainfall was modeled after an natural resources conservation service (NRCS) Type II Storm (McCuen 2005) because it is an accurate representation of actual storms of varying characteristics that are imbedded in intensity-duration-frequency (IDF) curves. For each duration of interest, a dimensionless hyetograph was developed using a time increment of 12 s over the duration of the storm (see Fig. 3). The depth of rainfall that corresponds to each storm magnitude was then multiplied by the dimensionless hyetograph. For a 2-h storm duration, depths of 40.6, 76.2, and 101.6 mm were used for the 2-, 25-, and 100-year events. The 2- and 6-h duration hyetographs were developed using the center portion of the 24-h storm, with the rainfall depths established with the Baltimore IDF curve. The corresponding depths for a 6-h duration were 53.3, 106.7, and 132.1 mm, respectively. These magnitudes were chosen to give a range of storm conditions.

During each time increment, the depth of rain is multiplied by the cell area to determine the volume of rain added to each section of each cell. This volume becomes the storage in each cell. Depending on the soil group, a constant volume of losses was subtracted from the storage. The runoff velocity from a solar panel was calculated using Manning's equation, with the hydraulic radius for sheet flow assumed to equal the depth of the storage on the panel (Bedient and Huber 2002). Similar assumptions were made to compute the velocities in each section of the surface sections.

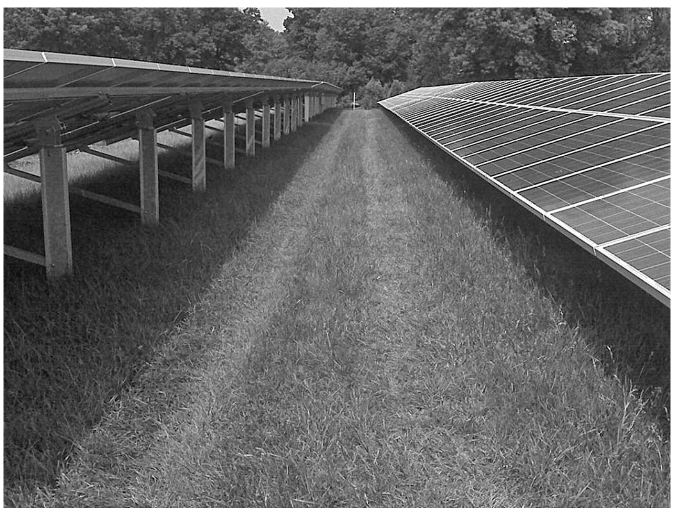

Fig. 1. Maintenance or "spacer" section between two rows of solar panels (photo by John E. Showler, reprinted with permission)

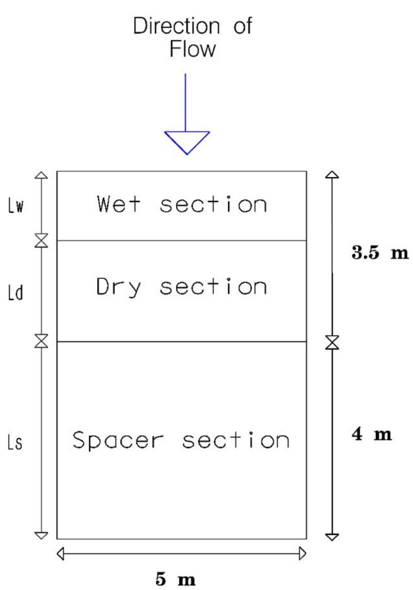

Fig. 2. Wet, dry, and spacer sections of a single cell with lengths *Lw*, *Ls*, and *Ld* with the solar panel covering the dry section

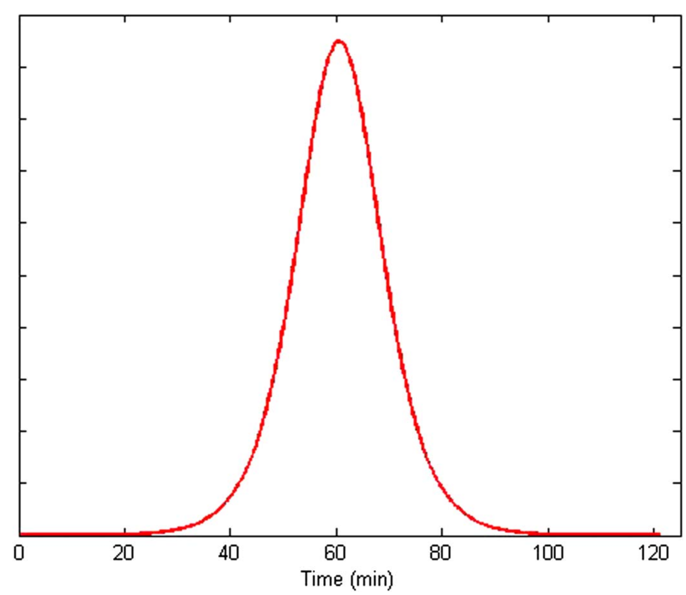

Fig. 3. Dimensionless hyetograph of 2-h Type II storm

Runoff from one section to the next and then to the next downgradient cell was routed using the continuity of mass. The routing coefficient depended on the depth of flow in storage and the velocity of runoff. Flow was routed from the wet section to the dry section to the spacer section, with flow from the spacer section draining to the wet section of the next cell. Flow from the most downgradient cell was assumed to be the outflow. Discharge rates and volumes from the most downgradient cell were used for comparisons between the prepaneled and paneled conditions.

Alternative Model Scenarios

To assess the effects of the different variables, a section of 30 cells, each with a solar panel, was assumed for the base model. Each cell was separated individually into wet, dry, and spacer sections. The area had a total ground length of 225 m with a ground slope of 1% and width of 5 m, which was the width of an average solar panel. The roughness coefficient (Engman 1986) for the silicon solar panel was assumed to be that of glass, 0.01. Roughness coefficients of 0.15 for grass and 0.02 for bare ground were also assumed. Loss rates of 0.5715 cm/h (0.225 in./h) and 0.254 cm/h (0.1 in./h) for B and C soils, respectively, were assumed.

The prepaneled condition using the 2-h, 25-year rainfall was assumed for the base condition, with each cell assumed to have a good grass cover condition. All other analyses were made assuming a paneled condition. For most scenarios, the runoff volumes and peak discharge rates from the paneled model were not significantly greater than those for the prepaneled condition. Over a total length of 225 m with 30 solar panels, the runoff increased by 0.26 m^3, which was a difference of only 0.35%. The slight increase in runoff volume reflects the slightly higher velocities for the paneled condition. The peak discharge increased by 0.0013 m^3, a change of only 0.31%. The time to peak was delayed by one time increment, i.e., 12 s. Inclusion of the panels did not have a significant hydrologic impact.

Storm Magnitude

The effect of storm magnitude was investigated by changing the magnitude from a 25-year storm to a 2-year storm. For the 2-year storm, the rainfall and runoff volumes decreased by approximately 50%. However, the runoff from the paneled watershed condition increased compared to the prepaneled condition by approximately the same volume as for the 25-year analysis, 0.26 m^3. This increase represents only a 0.78% increase in volume. The peak discharge and the time to peak did not change significantly. These results reflect runoff from a good grass cover condition and indicated that the general conclusion of very minimal impacts was the same for different storm magnitudes.

Ground Slope

The effect of the downgradient ground slope of the solar farm was also examined. The angle of the solar panels would influence the velocity of flows from the panels. As the ground slope was increased, the velocity of flow over the ground surface would be closer to that on the panels. This could cause an overall increase in discharge rates. The ground slope was changed from 1 to 5%, with all other conditions remaining the same as the base conditions.

With the steeper incline, the volume of losses decreased from that for the 1% slope, which is to be expected because the faster velocity of the runoff would provide less opportunity for infiltration. However, between the prepaneled and paneled conditions, the increase in runoff volume was less than 1%. The peak discharge and the time to peak did not change. Therefore, the greater ground slope did not significantly influence the response of the solar farm.

Soil Type

The effect of soil type on the runoff was also examined. The soil group was changed from B soil to C soil by varying the loss rate. As expected, owing to the higher loss rate for the C soil, the depths of runoff increased by approximately 7.5% with the C soil when compared with the volume for B soils. However, the runoff volume for the C soil condition only increased by 0.17% from the prepaneled condition to the paneled condition. In comparison with the B soil, a difference of 0.35% in volume resulted between the two conditions. Therefore, the soil group influenced the actual volumes and rates, but not the relative effect of the paneled condition when compared to the prepaneled condition.

Panel Angle

Because runoff velocities increase with slope, the effect of the angle of the solar panel on the hydrologic response was examined. Analyses were made for angles of 30° and 70° to test an average range from winter to summer. The hydrologic response for these angles was compared to that of the base condition angle of 45°. The other site conditions remained the same. The analyses showed that the angle of the panel had only a slight effect on runoff volumes and discharge rates. The lower angle of 30° was associated with an increased runoff volume, whereas the runoff volume decreased for the steeper angle of 70° when compared with the base condition of 45°. However, the differences (~0.5%) were very slight. Nevertheless, these results indicate that, when the solar panel was closer to horizontal, i.e., at a lower angle, a larger difference in runoff volume occurred between the prepaneled and paneled conditions. These differences in the response result are from differences in loss rates.

The peak discharge was also lower at the lower angle. At an angle of 30°, the peak discharge was slightly lower than at the higher angle of 70°. For the 2-h storm duration, the time to peak of the 30° angle was 2 min delayed from the time to peak of when the panel was positioned at a 70° angle, which reflects the longer travel times across the solar panels.

Storm Duration

To assess the effect of storm duration, analyses were made for 6-h storms, testing magnitudes for 2-, 25-, and 100-year return periods, with the results compared with those for the 2-h rainfall events. The longer storm duration was tested to determine whether a longer duration storm would produce a different ratio of increase in runoff between the prepaneled and paneled conditions. When compared to runoff volumes from the 2-h storm, those for the 6-h storm were 34% greater in both the paneled and prepaneled cases. However, when comparing the prepaneled to the paneled condition, the increase in the runoff volume with the 6-h storm was less than 1% regardless of the return period. The peak discharge and the time-to-peak did not differ significantly between the two conditions. The trends in the hydrologic response of the solar farm did not vary with storm duration.

Ground Cover

The ground cover under the panels was assumed to be a native grass that received little maintenance. For some solar farms, the area beneath the panel is covered in gravel or partially paved because the panels prevent the grass from receiving sunlight. Depending on the

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volume of traffic, the spacer cell could be grass, patches of grass, or bare ground. Thus, it was necessary to determine whether or not these alternative ground-cover conditions would affect the runoff characteristics. This was accomplished by changing the Manning's n for the ground beneath the panels. The value of n under the panels, i.e., the dry section, was set to 0.015 for gravel, with the value for the spacer or maintenance section set to 0.02, i.e., bare ground. These can be compared to the base condition of a native grass ($n = 0.15$). A good cover should promote losses and delay the runoff.

For the smoother surfaces, the velocity of the runoff increased and the losses decreased, which resulted in increasing runoff volumes. This occurred both when the ground cover under the panels was changed to gravel and when the cover in the spacer section was changed to bare ground. Owing to the higher velocities of the flow, runoff rates from the cells increased significantly such that it was necessary to reduce the computational time increment. Fig. 4(a) shows the hydrograph from a 30-panel area with a time increment of 12 s. With a time increment of 12 s, the water in each cell is discharged at the end of every time increment, which results in no attenuation of the flow; thus, the undulations shown in Fig. 4(a) result. The time increment was reduced to 3 s for the 2-h storm, which resulted in watershed smoothing and a rational hydrograph shape [Fig. 4(b)]. The results showed that the storm runoff increased by 7% from the grass-covered scenario to the scenario with gravel under the panel. The peak discharge increased by 73% for the gravel ground cover when compared with the grass cover without the panels. The time to peak was 10 min less with the gravel than with the grass, which reflects the effect of differences in surface roughness and the resulting velocities.

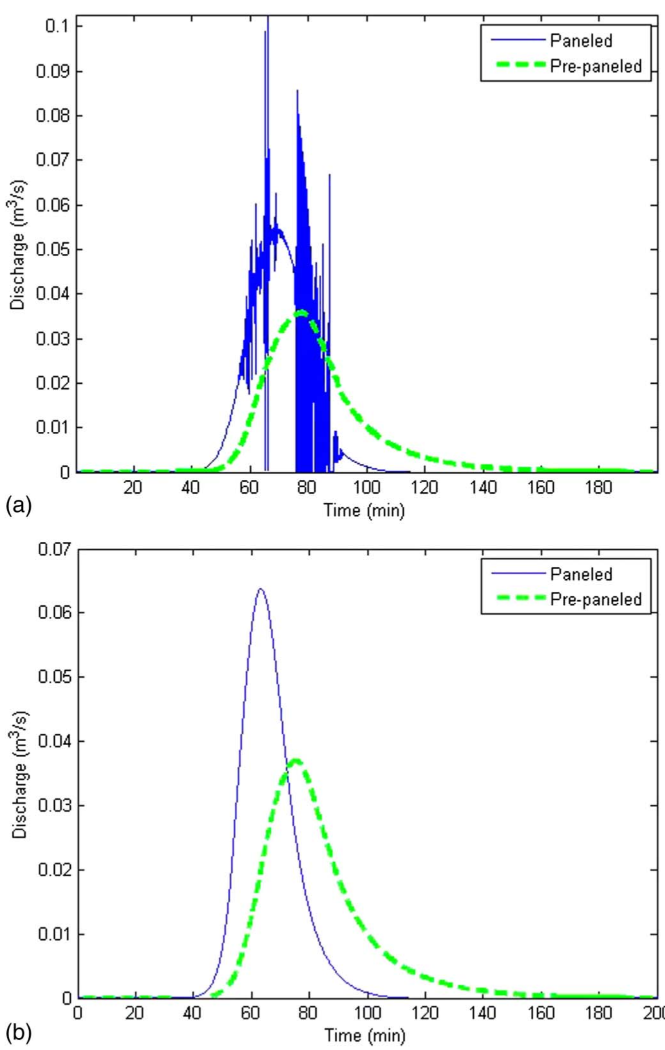

Fig. 4. Hydrograph with time increment of (a) 12 s; (b) 3 s with Manning's n for bare ground

If maintenance vehicles used the spacer section regularly and the grass cover was not adequately maintained, the soil in the spacer section would be compacted and potentially the runoff volumes and rates would increase. Grass that is not maintained has the potential to become patchy and turn to bare ground. The grass under the panel may not get enough sunlight and die. Fig. 1 shows the result of the maintenance trucks frequently driving in the spacer section, which diminished the grass cover.

The effect of the lack of solar farm maintenance on runoff characteristics was modeled by changing the Manning's n to a value of 0.02 for bare ground. In this scenario, the roughness coefficient for the ground under the panels, i.e., the dry section, as well as in the spacer cell was changed from grass covered to bare ground ($n = 0.02$).The effects were nearly identical to that of the gravel. The runoff volume increased by 7% from the grass-covered to the bare-ground condition. The peak discharge increased by 72% when compared with the grass-covered condition. The runoff for the bare-ground condition also resulted in an earlier time to peak by approximately 10 min. Two other conditions were also modeled, showing similar results. In the first scenario, gravel was placed directly under the panel, and healthy grass was placed in the spacer section, which mimics a possible design decision. Under these conditions, the peak discharge increased by 42%, and the volume of runoff increased by 4%, which suggests that storm-water management would be necessary if gravel is placed anywhere.

Fig. 5 shows two solar panels from a solar farm in New Jersey. The bare ground between the panels can cause increased runoff rates and reductions in time of concentration, both of which could necessitate storm-water management. The final condition modeled involved the assumption of healthy grass beneath the panels and bare ground in the spacer section, which would simulate the condition of unmaintained grass resulting from vehicles that drive over the spacer section. Because the spacer section is 53% of the cell, the change in land cover to bare ground would reduce losses and decrease runoff travel times, which would cause runoff to amass as it

Fig. 5. Site showing the initiation of bare ground below the panels, which increases the potential for erosion (photo by John Showler, reprinted with permission)

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moves downgradient. With the spacer section as bare ground, the peak discharge increased by 100%, which reflected the increases in volume and decrease in timing. These results illustrate the need for maintenance of the grass below and between the panels.

Design Suggestions

With well-maintained grass underneath the panels, the solar panels themselves do not have much effect on total volumes of the runoff or peak discharge rates. Although the panels are impervious, the rainwater that drains from the panels appears as runoff over the downgradient cells. Some of the runoff infiltrates. If the grass cover of a solar farm is not maintained, it can deteriorate either because of a lack of sunlight or maintenance vehicle traffic. In this case, the runoff characteristics can change significantly with both runoff rates and volumes increasing by significant amounts. In addition, if gravel or pavement is placed underneath the panels, this can also contribute to a significant increase in the hydrologic response.

If bare ground is foreseen to be a problem or gravel is to be placed under the panels to prevent erosion, it is necessary to counteract the excess runoff using some form of storm-water management. A simple practice that can be implemented is a buffer strip (Dabney et al. 2006) at the downgradient end of the solar farm. The buffer strip length must be sufficient to return the runoff characteristics with the panels to those of runoff experienced before the gravel and panels were installed. Alternatively, a detention basin can be installed.

A buffer strip was modeled along with the panels. For approximately every 200 m of panels, or 29 cells, the buffer must be 5 cells long (or 35 m) to reduce the runoff volume to that which occurred before the panels were added. Even if a gravel base is not placed under the panels, the inclusion of a buffer strip may be a good practice when grass maintenance is not a top funding priority. Fig. 6 shows the peak discharge from the graveled surface versus the length of the buffer needed to keep the discharge to prepaneled peak rate.

Water draining from a solar panel can increase the potential for erosion of the spacer section. If the spacer section is bare ground, the high kinetic energy of water draining from the panel can cause soil detachment and transport (Garde and Raju 1977; Beuselinck et al. 2002). The amount and risk of erosion was modeled using the velocity of water coming off a solar panel compared with the velocity and intensity of the rainwater. The velocity of panel

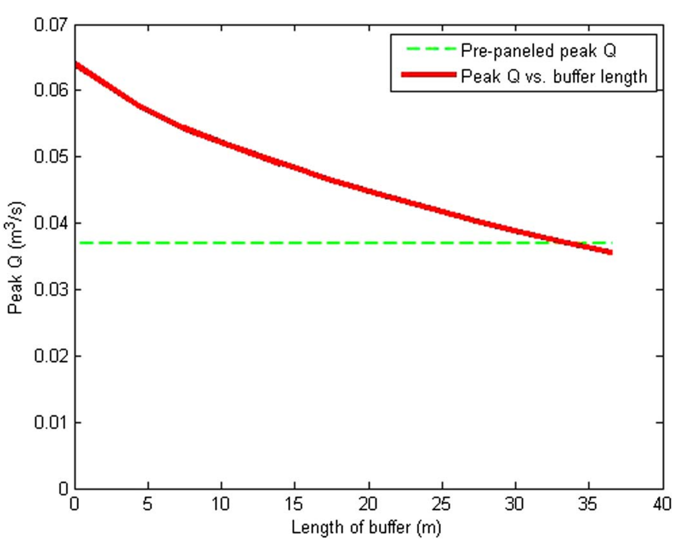

Fig. 6. Peak discharge over gravel compared with buffer length

runoff was calculated using Manning's equation, and the velocity of falling rainwater was calculated using the following:

$$V_t = 120\, d_r^{0.35} \tag{1}$$

where d_r = diameter of a raindrop, assumed to be 1 mm. The relationship between kinetic energy and rainfall intensity is

$$K_e = 916 + 330 \log_{10} i \tag{2}$$

where i = rainfall intensity (in./h) and K_e = kinetic energy (ft-tons per ac-in. of rain) of rain falling onto the wet section and the panel, as well as the water flowing off of the end of the panel (Wischmeier and Smith 1978). The kinetic energy (Salles et al. 2002) of the rainfall was greater than that coming off the panel, but the area under the panel (i.e., the product of the length, width, and cosine of the panel angle) is greater than the area under the edge of the panel where the water drains from the panel onto the ground. Thus, dividing the kinetic energy by the respective areas gives a more accurate representation of the kinetic energy experienced by the soil. The energy of the water draining from the panel onto the ground can be nearly 10 times greater than the rain itself falling onto the ground area. If the solar panel runoff falls onto an unsealed soil, considerable detachment can result (Motha et al. 2004). Thus, because of the increased kinetic energy, it is possible that the soil is much more prone to erosion with the panels than without. Where panels are installed, methods of erosion control should be included in the design.

Conclusions

Solar farms are the energy generators of the future; thus, it is important to determine the environmental and hydrologic effects of these farms, both existing and proposed. A model was created to simulate storm-water runoff over a land surface without panels and then with solar panels added. Various sensitivity analyses were conducted including changing the storm duration and volume, soil type, ground slope, panel angle, and ground cover to determine the effect that each of these factors would have on the volumes and peak discharge rates of the runoff.

The addition of solar panels over a grassy field does not have much of an effect on the volume of runoff, the peak discharge, nor the time to peak. With each analysis, the runoff volume increased slightly but not enough to require storm-water management facilities. However, when the land-cover type was changed under the panels, the hydrologic response changed significantly. When gravel or pavement was placed under the panels, with the spacer section left as patchy grass or bare ground, the volume of the runoff increased significantly and the peak discharge increased by approximately 100%. This was also the result when the entire cell was assumed to be bare ground.

The potential for erosion of the soil at the base of the solar panels was also studied. It was determined that the kinetic energy of the water draining from the solar panel could be as much as 10 times greater than that of rainfall. Thus, because the energy of the water draining from the panels is much higher, it is very possible that soil below the base of the solar panel could erode owing to the concentrated flow of water off the panel, especially if there is bare ground in the spacer section of the cell. If necessary, erosion control methods should be used.

Bare ground beneath the panels and in the spacer section is a realistic possibility (see Figs. 1 and 5). Thus, a good, well-maintained grass cover beneath the panels and in the spacer section is highly recommended. If gravel, pavement, or bare ground is

J. Hydrol. Eng. 2013.18:536-541.

deemed unavoidable below the panels or in the spacer section, it may necessary to add a buffer section to control the excess runoff volume and ensure adequate losses. If these simple measures are taken, solar farms will not have an adverse hydrologic impact from excess runoff or contribute eroded soil particles to receiving streams and waterways.

Acknowledgments

The authors appreciate the photographs (Figs. 1 and 5) of Ortho Clinical Diagnostics, 1001 Route 202, North Raritan, New Jersey, 08869, provided by John E. Showler, Environmental Scientist, New Jersey Department of Agriculture. The extensive comments of reviewers resulted in an improved paper.

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Exhibit 2 – FEMA Firm Map

85°52'30.87"W 39°11'28.21"N

USGS, USDA

85°48'44.16"W 39°7'16.85"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/3/2023 4:08 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

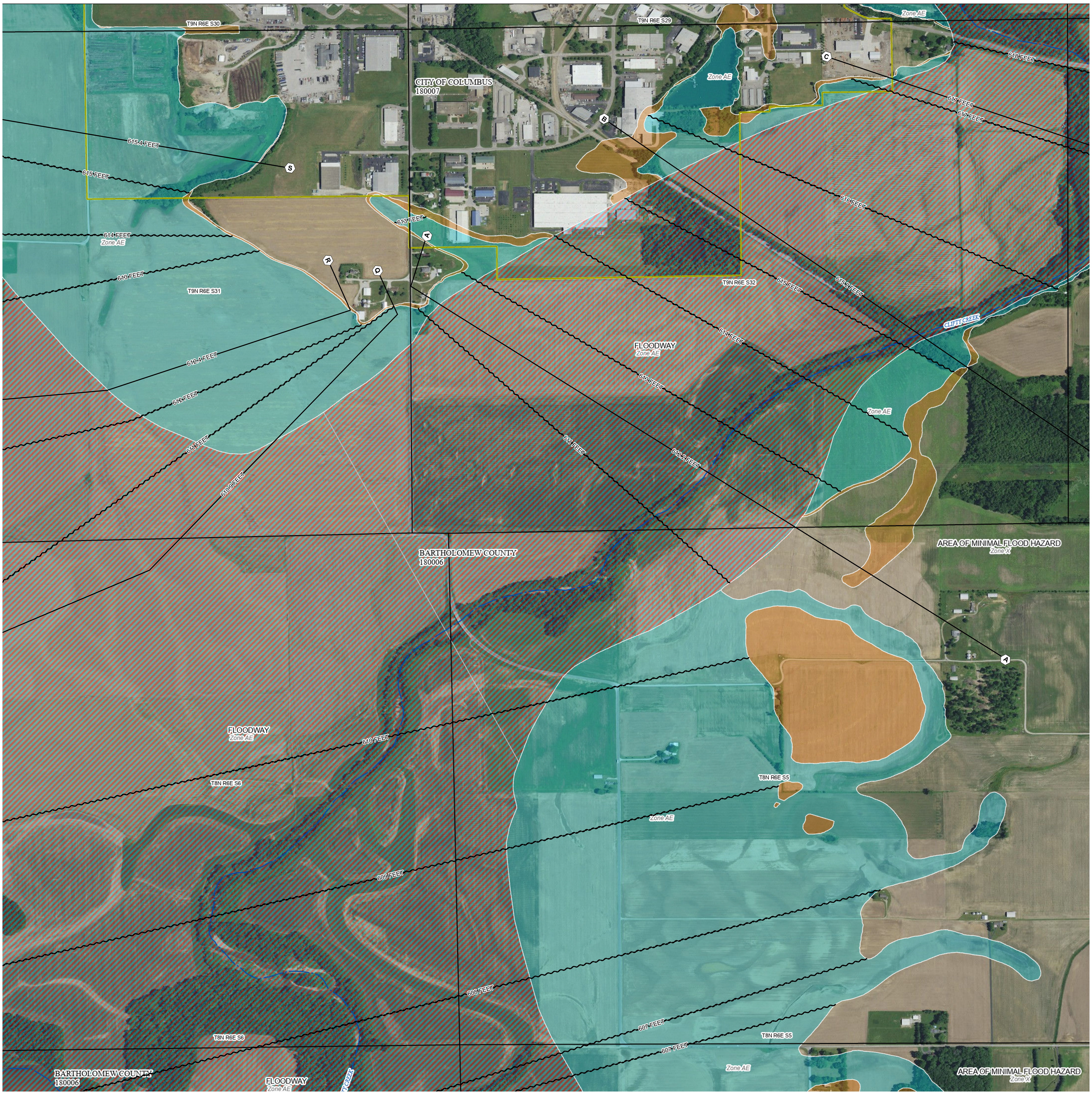
PANEL **165** OF **275**

Panel Contains:

COMMUNITY	NUMBER	PANEL
TOWN OF ELIZABETHTOWN	180605	0165
BARTHOLOMEW COUNTY	180006	0165

MAP NUMBER
18005C0165E
EFFECTIVE DATE
December 09, 2014

85°54'22.95"W 39°11'21.62"N



85°52'29.59"W 39°9'15.94"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	[light blue]	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR*
	[hatched]	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	[orange]	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee See Notes *Zone X*
		Area with Flood Risk due to Levee *Zone D*
	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
		Effective LOMRs
OTHER AREAS		Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2	Cross Sections with 1% Annual Chance
	17.5	Water Surface Elevation
	8	Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
	513	Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

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To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

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This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/3/2023 4:09 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

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SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 500 feet   1:6,000

0 250 500 1,000 1,500 2,000 Feet

0 50 100 200 300 400 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

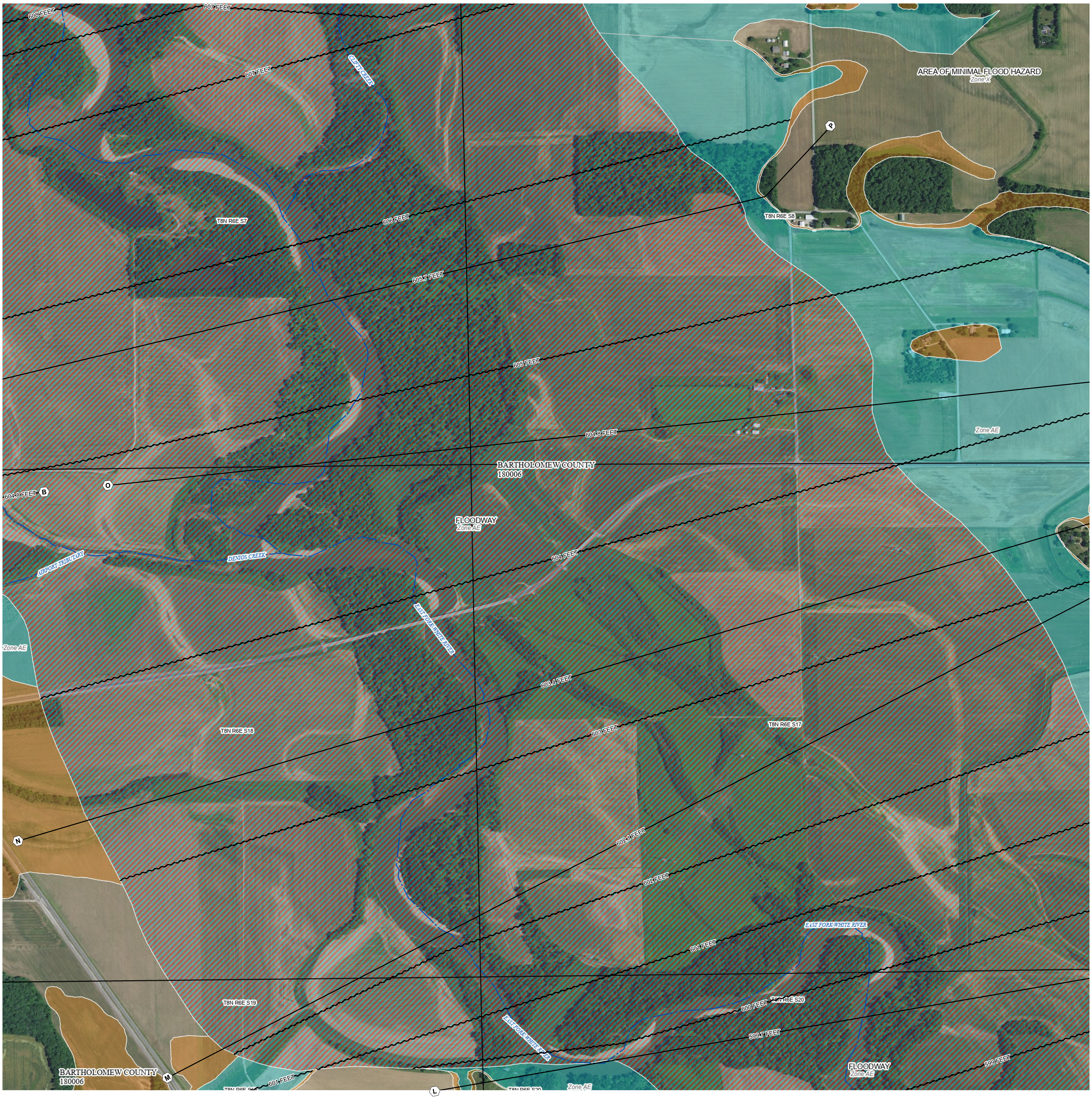
PANEL 142 OF 275

Panel Contains:

COMMUNITY	NUMBER	PANEL
CITY OF COLUMBUS	180007	0142
BARTHOLOMEW COUNTY	180006	0142

MAP NUMBER
18005C0142E
EFFECTIVE DATE
December 09, 2014

85°54'22.95"W 39°9'29.12"N



85°52'29.59"W 39°7'23.44"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	(B) 20.2 Cross Sections with 1% Annual Chance
	17.5 Water Surface Elevation
	(8) Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

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Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

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This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 500 feet 1:6,000

0 250 500 1,000 1,500 2,000 Feet

Meters
0 50 100 200 300 400

FEMA
National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **144** OF **275**

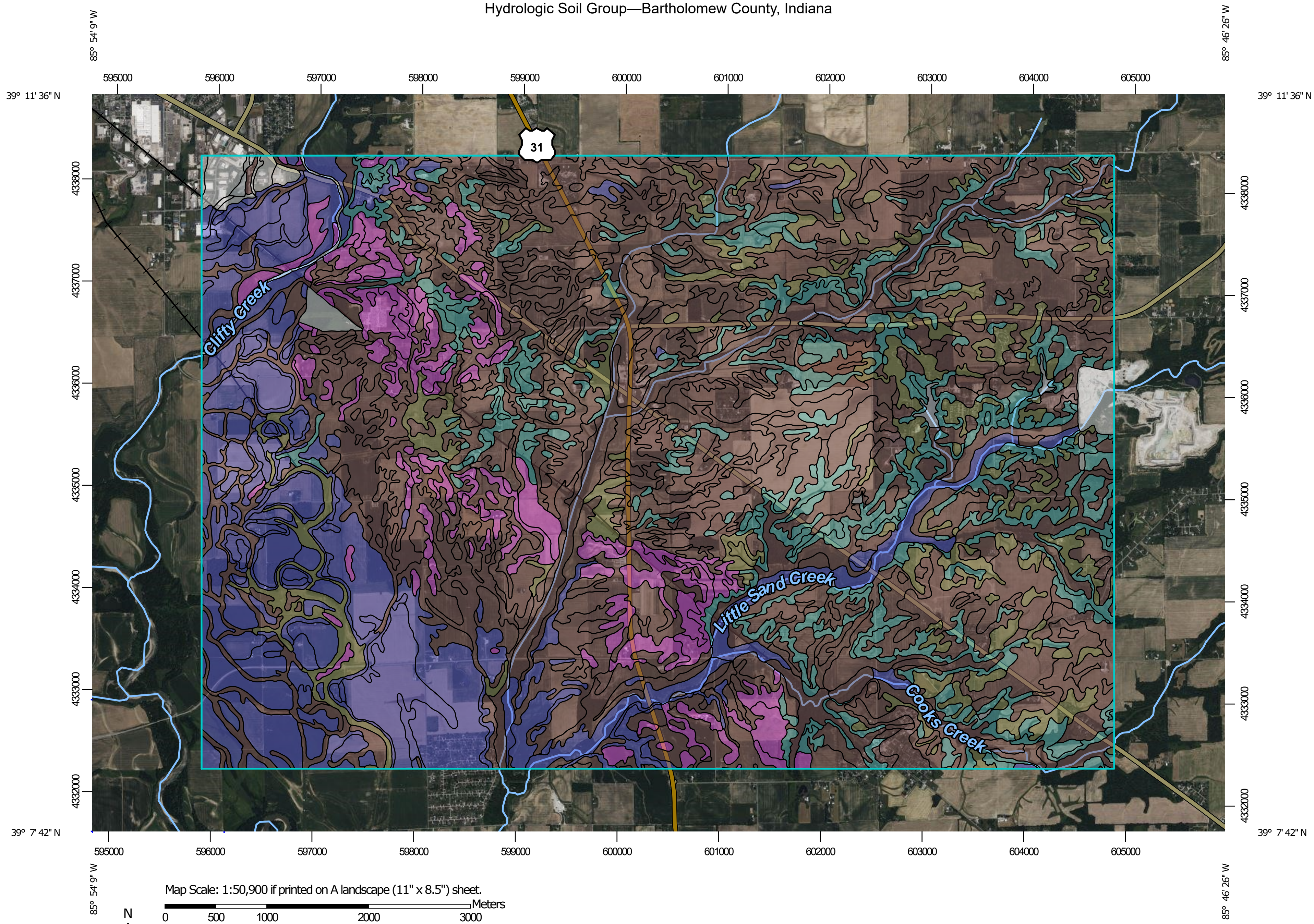
Panel Contains:

COMMUNITY	NUMBER	PANEL
BARTHOLOMEW COUNTY	180006	0144

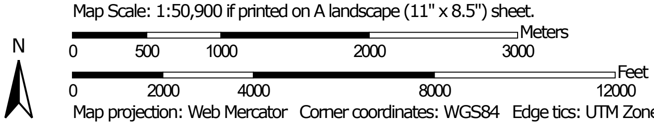
MAP NUMBER
18005C0144E
EFFECTIVE DATE
December 09, 2014

Exhibit 3 – USDA Web Soils Survey Map

Hydrologic Soil Group—Bartholomew County, Indiana



Map Scale: 1:50,900 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

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 1:12,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Bartholomew County, Indiana
Survey Area Data: Version 25, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 15, 2022—Jun 21, 2022

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AfsB	Alvin-Princeton fine sandy loams, 2 to 6 percent slopes	A	491.1	3.7%
AfsC2	Alvin-Princeton fine sandy loams, 6 to 12 percent slopes, eroded	A	277.1	2.1%
AmkA	Ayrshire fine sandy loam, 0 to 2 percent slopes	B/D	630.0	4.7%
BdhAH	Bellcreek silty clay loam, 0 to 1 percent slopes, frequently flooded, brief duration	C/D	141.6	1.1%
BluC	Bloomfield-Alvin loamy sands, 6 to 12 percent slopes	A	70.6	0.5%
CulB	Crosby-Williamstown silt loams, 2 to 4 percent slopes	C/D	17.3	0.1%
CxdA	Cyclone silty clay loam, 0 to 2 percent slopes	B/D	698.8	5.2%
EcyAH	Eel loam, 0 to 2 percent slopes, frequently flooded, brief duration	B/D	188.3	1.4%
EcyAW	Eel loam, 0 to 2 percent slopes, occasionally flooded, very brief duration	B/D	178.5	1.3%
FdbA	Fincastle silt loam, New Castle Till Plain, 0 to 2 percent slopes	B/D	2,358.6	17.6%
FdqB	Fincastle-Xenia silt loams, 2 to 4 percent slopes	B/D	970.6	7.3%
FexA	Fox loam, 0 to 2 percent slopes	B	51.6	0.4%
FexB2	Fox loam, 2 to 6 percent slopes, eroded	B	45.8	0.3%
FgqC3	Fox-Casco sandy loams, 6 to 12 percent slopes, severely eroded	B	61.5	0.5%
GccAH	Genesee loam, 0 to 2 percent slopes, frequently flooded, brief duration	B	353.4	2.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GccAW	Genesee loam, 0 to 2 percent slopes, occasionally flooded, very brief duration	B	168.7	1.3%
LeaA	Lauer silt loam, 0 to 2 percent slopes	B/D	173.7	1.3%
MfwA	Martinsville loam, sandy substratum, 0 to 2 percent slopes	B	426.9	3.2%
MfwAQ	Martinsville loam, sandy substratum, 0 to 2 percent slopes, rarely flooded	B	66.8	0.5%
MfwB2	Martinsville loam, sandy substratum, 2 to 6 percent slopes, eroded	B	134.3	1.0%
MfxA	Martinsville sandy loam, sandy substratum, 0 to 2 percent slopes	B	344.5	2.6%
MjjAH	Medway silty clay loam, 0 to 2 percent slopes, frequently flooded, brief duration	B/D	140.6	1.1%
MmoC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	C	731.0	5.5%
MmoD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	C	196.5	1.5%
MnpB2	Miami silt loam, 2 to 6 percent slopes, eroded	C	396.6	3.0%
MnpC2	Miami silt loam, 6 to 12 percent slopes, eroded	C	180.9	1.4%
MnpD2	Miami silt loam, 12 to 18 percent slopes, eroded	C	16.4	0.1%
MqbA	Milton silt loam, 0 to 2 percent slopes	C	6.2	0.0%
NpcAQ	Nineveh gravelly sandy loam, 0 to 2 percent slopes, rarely flooded	B	36.6	0.3%
NpeA	Nineveh sandy loam, 0 to 2 percent slopes	B	130.8	1.0%
NpeAQ	Nineveh sandy loam, 0 to 2 percent slopes, rarely flooded	B	19.1	0.1%
NpeB2	Nineveh sandy loam, 2 to 6 percent slopes, eroded	B	54.1	0.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Pml	Pits, quarry		55.3	0.4%
ReyA	Rensselaer loam, 0 to 1 percent slopes	B/D	533.8	4.0%
RtxAH	Rossburg silt loam, 0 to 2 percent slopes, frequently flooded, brief duration	B	370.5	2.8%
RywB2	Russell silt loam, 2 to 6 percent slopes, eroded	B	43.9	0.3%
SifE	Senachwine loam, 18 to 25 percent slopes	C	28.3	0.2%
SifG	Senachwine loam, 25 to 70 percent slopes	C	44.2	0.3%
SldAH	Shoals silt loam, 0 to 2 percent slopes, frequently flooded, brief duration	B/D	432.9	3.2%
SldAW	Shoals silt loam, 0 to 2 percent slopes, occasionally flooded, very brief duration	B/D	362.4	2.7%
SuoAH	Stonelick fine sandy loam, 0 to 2 percent slopes, frequently flooded	A	50.0	0.4%
Uby	Udorthents, loamy		4.3	0.0%
UenA	Urban land-Fox complex, 0 to 2 percent slopes		48.7	0.4%
UenB	Urban land-Fox complex, 2 to 6 percent slopes		6.7	0.0%
UhyA	Urban land-Martinsville, sandy substratum, complex, 0 to 2 percent slopes		22.6	0.2%
UmqA	Urban land-Sleeth complex, 0 to 2 percent slopes	B/D	5.1	0.0%
Usl	Udorthents, rubbish		31.9	0.2%
W	Water		41.3	0.3%
WsuA	Whitaker loam, 0 to 2 percent slopes	B/D	451.7	3.4%
WsyAQ	Whitaker sandy loam, 0 to 2 percent slopes, rarely flooded	B/D	10.5	0.1%
WufB2	Williamstown silt loam, 2 to 6 percent slopes, eroded	C/D	673.3	5.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
XabB2	Xenia silt loam, 2 to 6 percent slopes, eroded	B/D	254.3	1.9%
ZboA	Zipp silty clay loam, 0 to 1 percent slopes	C/D	133.5	1.0%
Totals for Area of Interest			**13,365.3**	**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

Exhibit 4 – Drainage Areas Map

LEGEND

- DRAINAGE AREA 1 TO CLIFTY CREEK - COLUMBUS
  PARCEL AREA : ±318 ACRES
- DRAINAGE AREA 2 TO BRUSH CREEK - FISHERS FORK
  PARCEL AREA : ±917 ACRES
- DRAINAGE AREA 3 TO EAST FORK WHITE R - ARMUTH DITCH
  PARCEL AREA : ±360 ACRES
- DRAINAGE AREA 4 TO LITTLE SAND CREEK - HEADWATERS
  PARCEL AREA : ±236 ACRES
- PROPERTY LINE

PRE CONSTRUCTION

DRAINAGE AREA:	CN:	RUNOFF (INCH):	RUNOFF (CFS):
1	85	5.10	859.75
2	86	5.21	2530.51
3	87	5.32	1010.98
4	87	5.32	661.81

POST CONSTRUCTION

DRAINAGE AREA:	CN:	RUNOFF (INCH):	RUNOFF (CFS):
1	77	4.22	718.26
2	78	4.33	2128.06
3	77	4.22	814.18
4	78	4.33	546.66

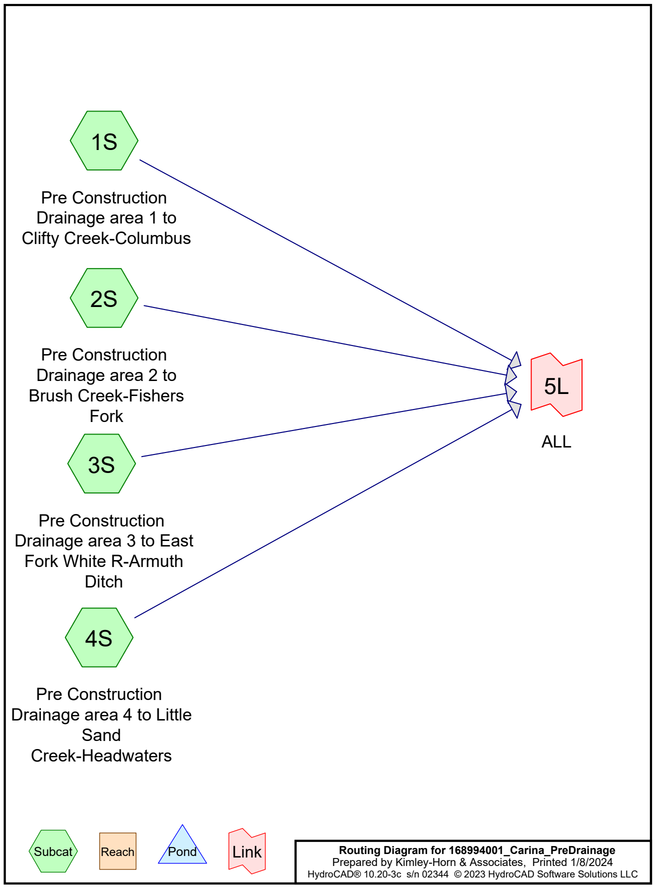
Kimley»Horn

CARINA SOLAR

DRAINAGE AREA MAP
BARTHOLOMEW COUNTY, IN
JANUARY 8, 2024

0' 2000 4000 NORTH

Exhibit 5 – Pre-Development HydroCAD Model



Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10YR 24HR	Type II 24-hr		Default	24.00	1	4.25	2
2	100YR 24HR	Type II 24-hr		Default	24.00	1	6.84	2

Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre Construction Runoff Area=317.573 ac 2.21% Impervious Runoff Depth=2.68"
Tc=60.0 min CN=85 Runoff=456.39 cfs 70.988 af

Subcatchment 2S: Pre Construction Runoff Area=917.330 ac 0.55% Impervious Runoff Depth=2.77"
Tc=60.0 min CN=86 Runoff=1,362.87 cfs 212.041 af

Subcatchment 3S: Pre Construction Runoff Area=359.980 ac 0.89% Impervious Runoff Depth=2.87"
Tc=60.0 min CN=87 Runoff=552.25 cfs 86.003 af

Subcatchment 4S: Pre Construction Runoff Area=235.650 ac 0.07% Impervious Runoff Depth=2.87"
Tc=60.0 min CN=87 Runoff=361.52 cfs 56.299 af

Link 5L: ALL Inflow=2,733.02 cfs 425.331 af
Primary=2,733.02 cfs 425.331 af

Total Runoff Area = 1,830.533 ac Runoff Volume = 425.331 af Average Runoff Depth = 2.79"
99.16% Pervious = 1,815.093 ac 0.84% Impervious = 15.440 ac

Summary for Subcatchment 1S: Pre Construction Drainage area 1 to Clifty Creek-Columbus

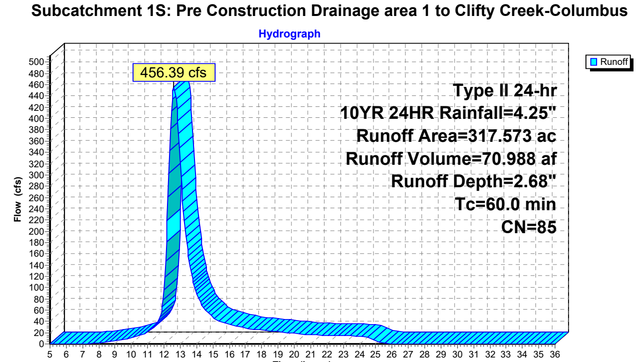
Runoff = 456.39 cfs @ 12.61 hrs, Volume= 70.988 af, Depth= 2.68"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	31.080	77	Pasture, HSG D
*	7.030	98	Impervious, HSG D
*	27.521	71	Wooded, HSG D
*	251.942	87	Farmsteads, HSG D
	317.573	85	Weighted Average
	310.543		97.79% Pervious Area
	7.030		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 1S: Pre Construction Drainage area 1 to Clifty Creek-Columbus



Summary for Subcatchment 2S: Pre Construction Drainage area 2 to Brush Creek-Fishers Fork

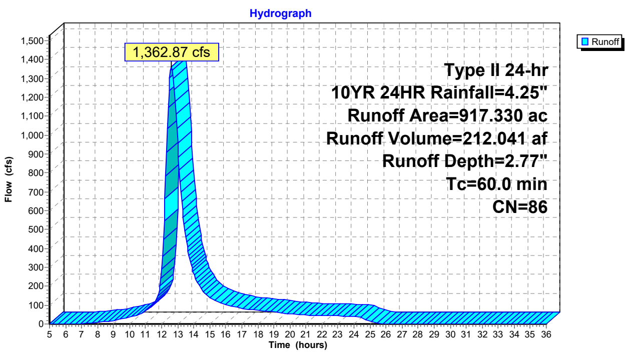
Runoff = 1,362.87 cfs @ 12.61 hrs, Volume= 212.041 af, Depth= 2.77"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	28.330	77	Pasture, HSG D
*	5.050	98	Impervious, HSG D
*	46.210	71	Wooded, HSG D
*	837.740	87	Farmsteads, HSG D
	917.330	86	Weighted Average
	912.280		99.45% Pervious Area
	5.050		0.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 2S: Pre Construction Drainage area 2 to Brush Creek-Fishers Fork



Summary for Subcatchment 3S: Pre Construction Drainage area 3 to East Fork White R-Armuth Ditch

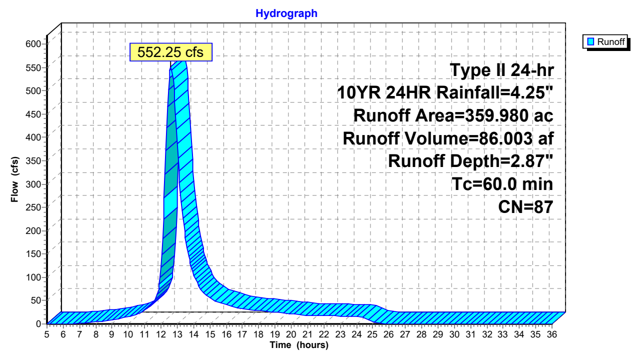
Runoff = 552.25 cfs @ 12.61 hrs, Volume= 86.003 af, Depth= 2.87"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	1.760	77	Pasture, HSG D
*	3.190	98	Impervious, HSG D
*	4.150	71	Wooded, HSG D
*	350.880	87	Farmsteads, HSG D
	359.980	87	Weighted Average
	356.790		99.11% Pervious Area
	3.190		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 3S: Pre Construction Drainage area 3 to East Fork White R-Armuth Ditch



Summary for Subcatchment 4S: Pre Construction Drainage area 4 to Little Sand Creek-Headwaters

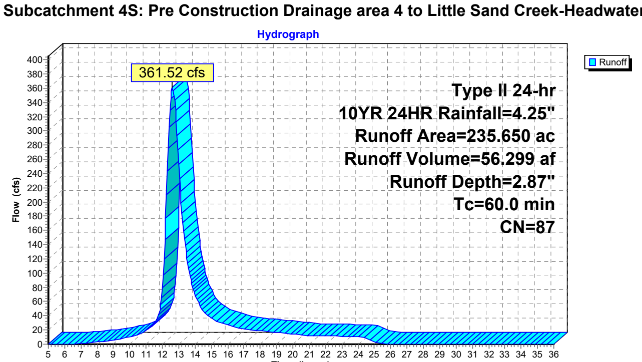
Runoff = 361.52 cfs @ 12.61 hrs, Volume= 56.299 af, Depth= 2.87"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	1.890	77	Pasture, HSG D
*	0.170	98	Impervious, HSG D
*	233.590	87	Farmsteads, HSG D
	235.650	87	Weighted Average
	235.480		99.93% Pervious Area
	0.170		0.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 4S: Pre Construction Drainage area 4 to Little Sand Creek-Headwaters

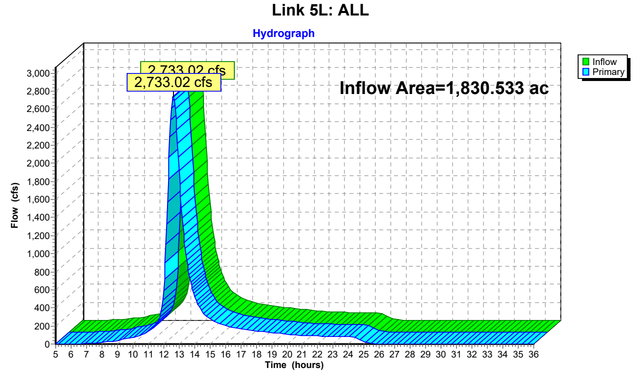


Summary for Link 5L: ALL

Inflow Area = 1,830.533 ac, 0.84% Impervious, Inflow Depth = 2.79" for 10YR 24HR event
Inflow = 2,733.02 cfs @ 12.61 hrs, Volume= 425.331 af
Primary = 2,733.02 cfs @ 12.61 hrs, Volume= 425.331 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Link 5L: ALL



Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre Construction	Runoff Area=317.573 ac 2.21% Impervious Runoff Depth>5.10" Tc=60.0 min CN=85 Runoff=859.75 cfs 134.959 af
Subcatchment 2S: Pre Construction	Runoff Area=917.330 ac 0.55% Impervious Runoff Depth>5.21" Tc=60.0 min CN=86 Runoff=2,530.51 cfs 398.382 af
Subcatchment 3S: Pre Construction	Runoff Area=359.980 ac 0.89% Impervious Runoff Depth>5.32" Tc=60.0 min CN=87 Runoff=1,010.98 cfs 159.684 af
Subcatchment 4S: Pre Construction	Runoff Area=235.650 ac 0.07% Impervious Runoff Depth>5.32" Tc=60.0 min CN=87 Runoff=661.81 cfs 104.533 af
Link 5L: ALL	Inflow=5,063.05 cfs 797.558 af Primary=5,063.05 cfs 797.558 af

Total Runoff Area = 1,830.533 ac Runoff Volume = 797.558 af Average Runoff Depth = 5.23"
99.16% Pervious = 1,815.093 ac 0.84% Impervious = 15.440 ac

Summary for Subcatchment 1S: Pre Construction Drainage area 1 to Clifty Creek-Columbus

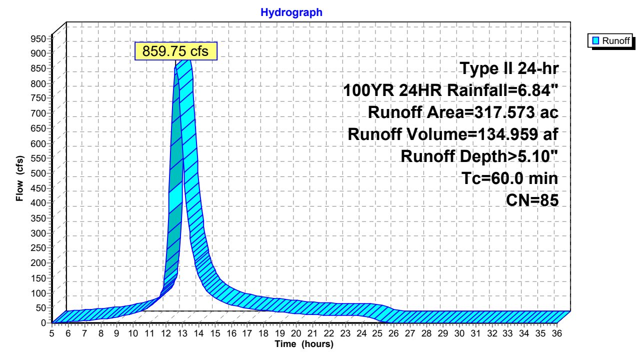
Runoff = 859.75 cfs @ 12.60 hrs, Volume= 134.959 af, Depth> 5.10"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	31.080	77	Pasture, HSG D
*	7.030	98	Impervious, HSG D
*	27.521	71	Wooded, HSG D
*	251.942	87	Farmsteads, HSG D
	317.573	85	Weighted Average
	310.543		97.79% Pervious Area
	7.030		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 1S: Pre Construction Drainage area 1 to Clifty Creek-Columbus



Summary for Subcatchment 2S: Pre Construction Drainage area 2 to Brush Creek-Fishers Fork

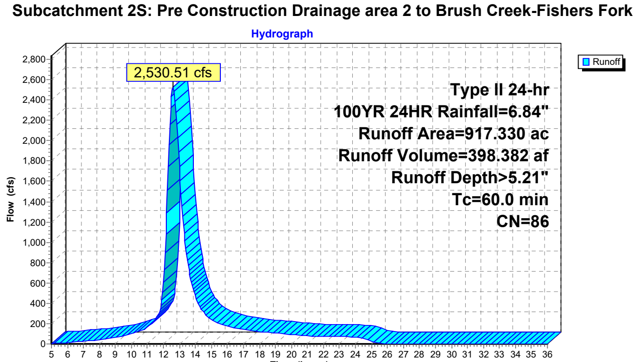
Runoff = 2,530.51 cfs @ 12.60 hrs, Volume= 398.382 af, Depth> 5.21"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	28.330	77	Pasture, HSG D
*	5.050	98	Impervious, HSG D
*	46.210	71	Wooded, HSG D
*	837.740	87	Farmsteads, HSG D
	917.330	86	Weighted Average
	912.280		99.45% Pervious Area
	5.050		0.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 2S: Pre Construction Drainage area 2 to Brush Creek-Fishers Fork



Summary for Subcatchment 3S: Pre Construction Drainage area 3 to East Fork White R-Armuth Ditch

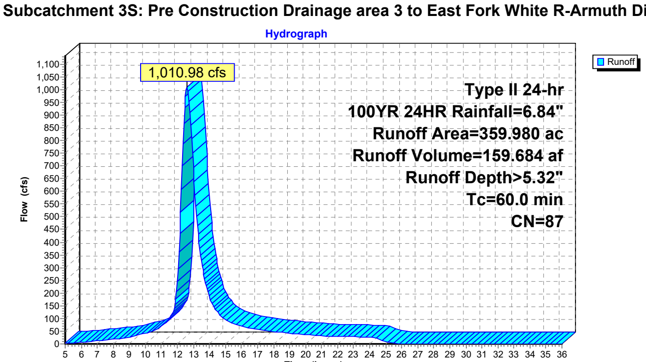
Runoff = 1,010.98 cfs @ 12.60 hrs, Volume= 159.684 af, Depth> 5.32"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	1.760	77	Pasture, HSG D
*	3.190	98	Impervious, HSG D
*	4.150	71	Wooded, HSG D
*	350.880	87	Farmsteads, HSG D
	359.980	87	Weighted Average
	356.790		99.11% Pervious Area
	3.190		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 3S: Pre Construction Drainage area 3 to East Fork White R-Armuth Ditch



Summary for Subcatchment 4S: Pre Construction Drainage area 4 to Little Sand Creek-Headwaters

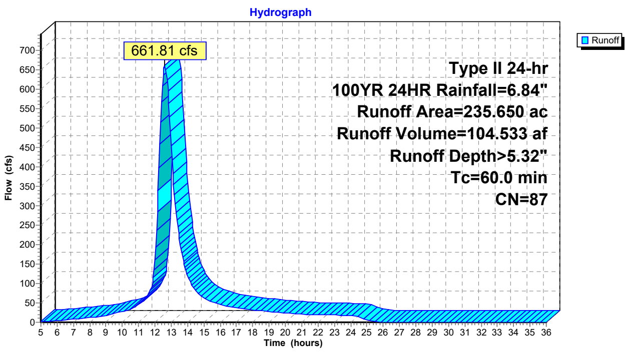
Runoff = 661.81 cfs @ 12.60 hrs, Volume= 104.533 af, Depth> 5.32"
Routed to Link 5L : ALL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	1.890	77	Pasture, HSG D
*	0.170	98	Impervious, HSG D
*	233.590	87	Farmsteads, HSG D
	235.650	87	Weighted Average
	235.480		99.93% Pervious Area
	0.170		0.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 4S: Pre Construction Drainage area 4 to Little Sand Creek-Headwaters



Summary for Link 5L: ALL

Inflow Area = 1,830.533 ac, 0.84% Impervious, Inflow Depth > 5.23" for 100YR 24HR event
Inflow = 5,063.05 cfs @ 12.60 hrs, Volume= 797.558 af
Primary = 5,063.05 cfs @ 12.60 hrs, Volume= 797.558 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Link 5L: ALL

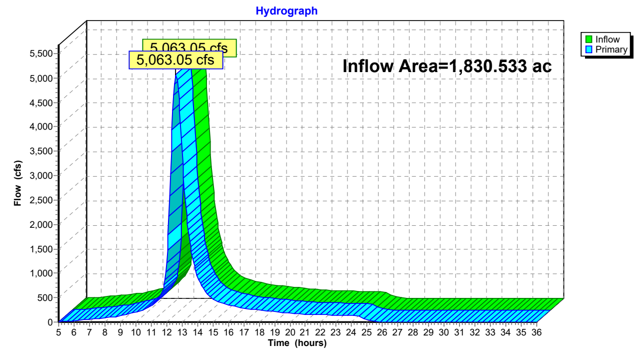
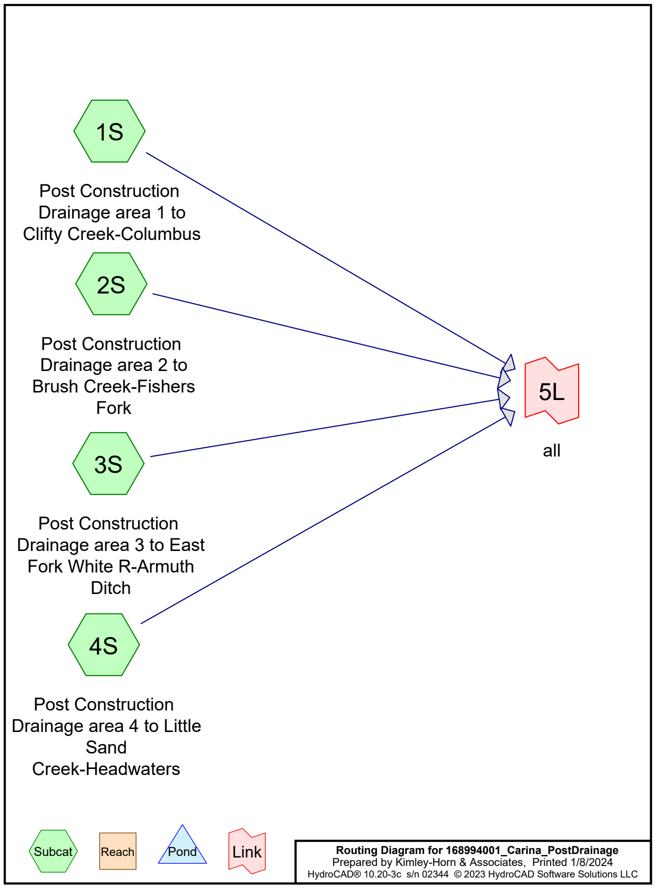


Exhibit 6 – Post-Development HydroCAD Model



Project Notes

Rainfall events imported from "168994001_S_PreliminaryDrainage_2023-08-01.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10YR 24HR	Type II 24-hr		Default	24.00	1	4.25	2
2	100YR 24HR	Type II 24-hr		Default	24.00	1	6.84	2

Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=317.570 ac 1.41% Impervious Runoff Depth=2.01"
Tc=60.0 min CN=77 Runoff=334.83 cfs 53.176 af

Subcatchment 2S: Post Construction Runoff Area=917.340 ac 1.30% Impervious Runoff Depth=2.09"
Tc=60.0 min CN=78 Runoff=1,009.60 cfs 159.623 af

Subcatchment 3S: Post Construction Runoff Area=359.980 ac 1.65% Impervious Runoff Depth=2.01"
Tc=60.0 min CN=77 Runoff=379.55 cfs 60.278 af

Subcatchment 4S: Post Construction Runoff Area=235.650 ac 2.03% Impervious Runoff Depth=2.09"
Tc=60.0 min CN=78 Runoff=259.35 cfs 41.004 af

Link 5L: all Inflow=1,983.31 cfs 314.081 af
Primary=1,983.31 cfs 314.081 af

Total Runoff Area = 1,830.540 ac Runoff Volume = 314.081 af Average Runoff Depth = 2.06"
98.52% Pervious = 1,803.450 ac 1.48% Impervious = 27.090 ac

Summary for Subcatchment 1S: Post Construction Drainage area 1 to Clifty Creek-Columbus

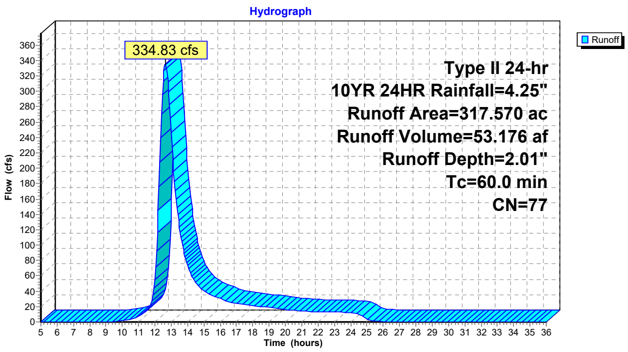
Runoff = 334.83 cfs @ 12.63 hrs, Volume= 53.176 af, Depth= 2.01"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	269.640	77	Pasture, HSG D
*	4.470	98	Impervious, HSG D
*	27.520	71	Wooded, HSG D
*	15.940	87	Farmsteads, HSG D
	317.570	77	Weighted Average
	313.100		98.59% Pervious Area
	4.470		1.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 1S: Post Construction Drainage area 1 to Clifty Creek-Columbus



Summary for Subcatchment 2S: Post Construction Drainage area 2 to Brush Creek-Fishers Fork

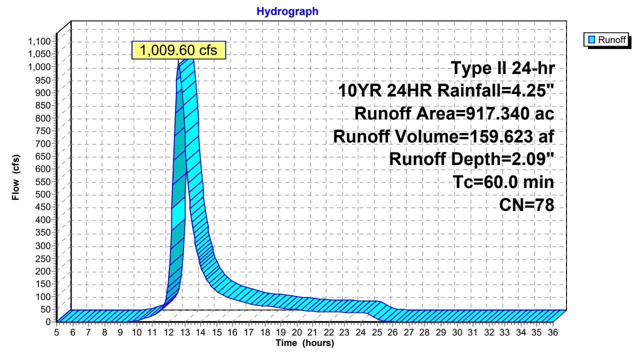
Runoff = 1,009.60 cfs @ 12.63 hrs, Volume= 159.623 af, Depth= 2.09"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	781.240	77	Pasture, HSG D
*	11.890	98	Impervious, HSG D
*	46.210	71	Wooded, HSG D
*	78.000	87	Farmsteads, HSG D
	917.340	78	Weighted Average
	905.450		98.70% Pervious Area
	11.890		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 2S: Post Construction Drainage area 2 to Brush Creek-Fishers Fork



Summary for Subcatchment 3S: Post Construction Drainage area 3 to East Fork White R-Armuth Ditcl

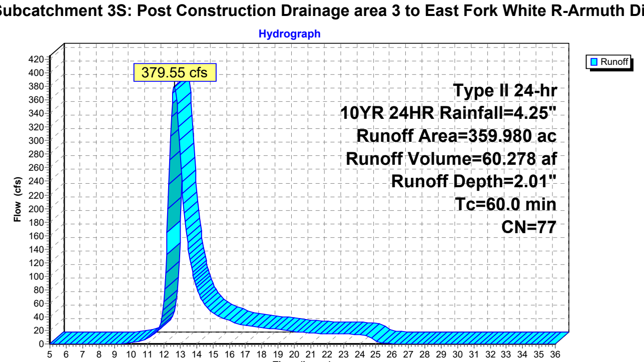
Runoff = 379.55 cfs @ 12.63 hrs, Volume= 60.278 af, Depth= 2.01"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	347.640	77	Pasture, HSG D
*	5.950	98	Impervious, HSG D
*	4.150	71	Wooded, HSG D
*	2.240	87	Farmsteads, HSG D
	359.980	77	Weighted Average
	354.030		98.35% Pervious Area
	5.950		1.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 3S: Post Construction Drainage area 3 to East Fork White R-Armuth Ditch



Summary for Subcatchment 4S: Post Construction Drainage area 4 to Little Sand Creek-Headwaters

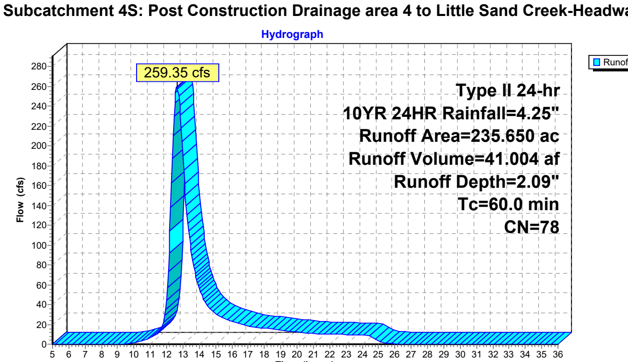
Runoff = 259.35 cfs @ 12.63 hrs, Volume= 41.004 af, Depth= 2.09"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10YR 24HR Rainfall=4.25"

	Area (ac)	CN	Description
*	210.760	77	Pasture, HSG D
*	4.780	98	Impervious, HSG D
*	20.110	87	Farmsteads, HSG D
	235.650	78	Weighted Average
	230.870		97.97% Pervious Area
	4.780		2.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 4S: Post Construction Drainage area 4 to Little Sand Creek-Headwaters

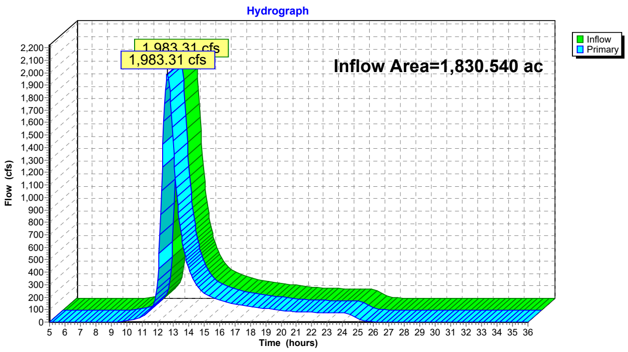


Summary for Link 5L: all

Inflow Area = 1,830.540 ac, 1.48% Impervious, Inflow Depth = 2.06" for 10YR 24HR event
Inflow = 1,983.31 cfs @ 12.63 hrs, Volume= 314.081 af
Primary = 1,983.31 cfs @ 12.63 hrs, Volume= 314.081 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Link 5L: all



Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=317.570 ac 1.41% Impervious Runoff Depth=4.22"
Tc=60.0 min CN=77 Runoff=718.26 cfs 111.739 af

Subcatchment 2S: Post Construction Runoff Area=917.340 ac 1.30% Impervious Runoff Depth=4.33"
Tc=60.0 min CN=78 Runoff=2,128.06 cfs 331.002 af

Subcatchment 3S: Post Construction Runoff Area=359.980 ac 1.65% Impervious Runoff Depth=4.22"
Tc=60.0 min CN=77 Runoff=814.18 cfs 126.661 af

Subcatchment 4S: Post Construction Runoff Area=235.650 ac 2.03% Impervious Runoff Depth=4.33"
Tc=60.0 min CN=78 Runoff=546.66 cfs 85.029 af

Link 5L: all Inflow=4,207.16 cfs 654.432 af
Primary=4,207.16 cfs 654.432 af

Total Runoff Area = 1,830.540 ac Runoff Volume = 654.432 af Average Runoff Depth = 4.29"
98.52% Pervious = 1,803.450 ac 1.48% Impervious = 27.090 ac

Summary for Subcatchment 1S: Post Construction Drainage area 1 to Clifty Creek-Columbus

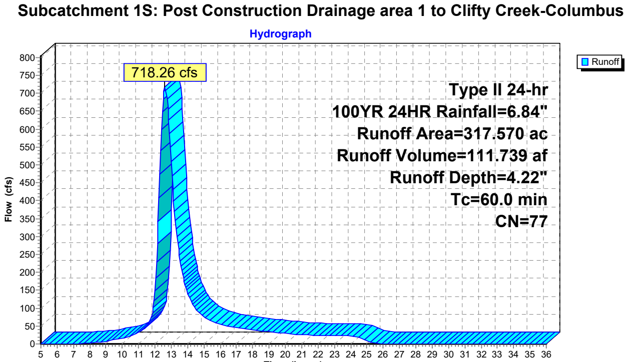
Runoff = 718.26 cfs @ 12.61 hrs, Volume= 111.739 af, Depth= 4.22"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	269.640	77	Pasture, HSG D
*	4.470	98	Impervious, HSG D
*	27.520	71	Wooded, HSG D
*	15.940	87	Farmsteads, HSG D
	317.570	77	Weighted Average
	313.100		98.59% Pervious Area
	4.470		1.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 1S: Post Construction Drainage area 1 to Clifty Creek-Columbus



Summary for Subcatchment 2S: Post Construction Drainage area 2 to Brush Creek-Fishers Fork

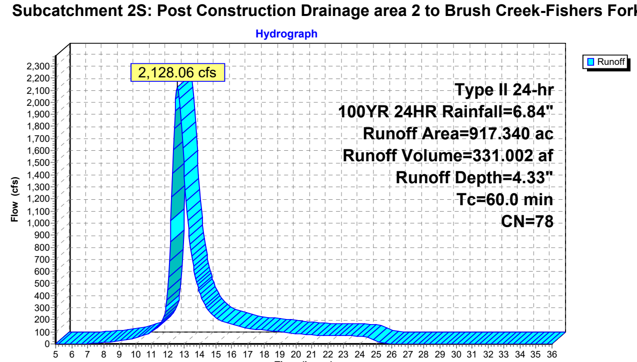
Runoff = 2,128.06 cfs @ 12.61 hrs, Volume= 331.002 af, Depth= 4.33"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	781.240	77	Pasture, HSG D
*	11.890	98	Impervious, HSG D
*	46.210	71	Wooded, HSG D
*	78.000	87	Farmsteads, HSG D
	917.340	78	Weighted Average
	905.450		98.70% Pervious Area
	11.890		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, 60**

Subcatchment 2S: Post Construction Drainage area 2 to Brush Creek-Fishers Fork



Summary for Subcatchment 3S: Post Construction Drainage area 3 to East Fork White R-Armuth Ditch

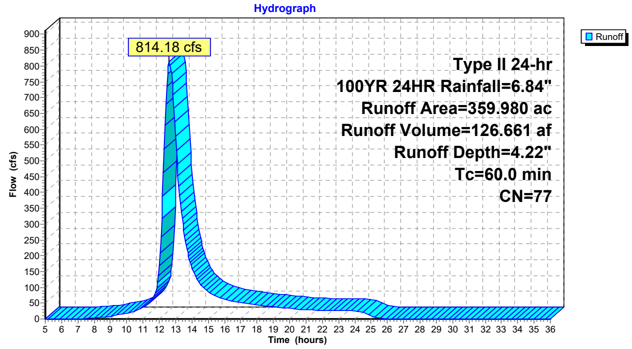
Runoff = 814.18 cfs @ 12.61 hrs, Volume= 126.661 af, Depth= 4.22"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	347.640	77	Pasture, HSG D
*	5.950	98	Impervious, HSG D
*	4.150	71	Wooded, HSG D
*	2.240	87	Farmsteads, HSG D
	359.980	77	Weighted Average
	354.030		98.35% Pervious Area
	5.950		1.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					Direct Entry, 60

Subcatchment 3S: Post Construction Drainage area 3 to East Fork White R-Armuth Ditch



Summary for Subcatchment 4S: Post Construction Drainage area 4 to Little Sand Creek-Headwaters

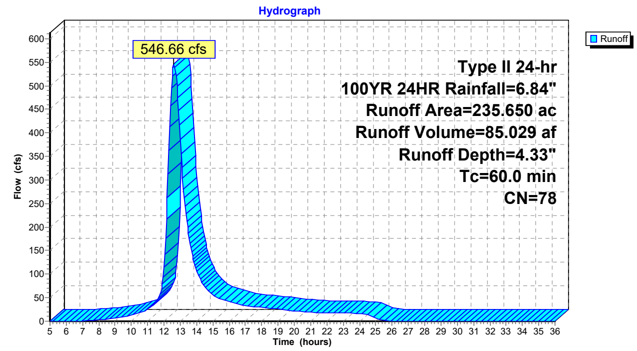
Runoff = 546.66 cfs @ 12.61 hrs, Volume= 85.029 af, Depth= 4.33"
Routed to Link 5L : all

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100YR 24HR Rainfall=6.84"

	Area (ac)	CN	Description
*	210.760	77	Pasture, HSG D
*	4.780	98	Impervious, HSG D
*	20.110	87	Farmsteads, HSG D
	235.650	78	Weighted Average
	230.870		97.97% Pervious Area
	4.780		2.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					Direct Entry, 60

Subcatchment 4S: Post Construction Drainage area 4 to Little Sand Creek-Headwaters



Summary for Link 5L: all

Inflow Area = 1,830.540 ac, 1.48% Impervious, Inflow Depth = 4.29" for 100YR 24HR event
Inflow = 4,207.16 cfs @ 12.61 hrs, Volume= 654.432 af
Primary = 4,207.16 cfs @ 12.61 hrs, Volume= 654.432 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Link 5L: all