



# **SR 15/SR 274 Traffic Analysis Watts Twp Access Road Evaluation**

September 28, 2023

BY: GANNETT FLEMING

FOR: TRI COUNTY PLANNING COMMISSION



## Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>2</b>
<b>INTRODUCTION .....</b>	<b>5</b>
Study Location and Background .....	5
Study Scope.....	6
<b>PART 1: DUNCANNON SR 15 AND SR 274 TRAFFIC ANALYSIS.....</b>	<b>7</b>
Environmental Evaluation.....	7
Data Collection.....	9
Traffic Safety Audit.....	15
Travel Projections .....	28
Operational Analysis .....	30
Park and Ride Evaluation .....	40
<b>PART 2: ACCESS ROAD EVALUATION IN WATTS TOWNSHIP .....</b>	<b>43</b>
Environmental Evaluation.....	43
Conceptual Roadway Design .....	46
Park and Ride Evaluation .....	57

## EXECUTIVE SUMMARY

This work was performed under Service Agreement (SA) #2 for the Tri-County Regional Planning Commission (TCRPC). It consists of two separate studies referenced in this report as Part 1 and Part 2:

- **Part 1: Duncannon SR 15 and SR 274 Traffic Analysis.** This is an engineering analysis to recommend offsite mitigation resulting from the installation of median barrier along SR 22/322 in the Clarks Ferry area. This will result in the closure of the left-turn from westbound SR 22/322 onto westbound SR 849. This is currently a major entrance to Duncannon. It is expected that a significant amount of traffic will utilize SR 11/15 and use the intersection of the SR 11/15 ramps and SR 274.
- **Part 2: Access Road Evaluation in Watts Township.** This will evaluate design concepts for access roads along SR 11/15 to the north in Watts Township to accommodate the potential for development just north of the Clarks Ferry median barrier project in the vicinity of the SR 22/322 interchange with SR 11/15.

**Part 1. Duncannon SR 15 and SR 274 Traffic Analysis.** The following tasks were completed for Part 1: an environmental analysis, a crash analysis, traffic data collection (traffic counts) at key intersections in the study area, and a summary of existing conditions and observations at the study locations. Traffic conditions were estimated for the design condition, considering the closure of the left-turn from westbound SR 22/322 onto westbound SR 849, known growth in the Duncannon area, and a background growth factor. An operational analysis was conducted to evaluate the proposed future conditions. The only study intersection requiring improvements is the intersection of SR 274 and the SR 11/15 ramps. Four alternatives were considered to mitigate operations at this intersection:

1. Eastbound approach widening and two-way STOP for northbound/southbound:  
Widen to provide a through and a through/right lane configuration for the eastbound approach. The leftmost lane would drop as a left only at the SR 11/15 NB on ramps, while the rightmost through lane would continue into Duncannon. The American Legion access at the southwest corner of the intersection would need closed and parking would be slightly impacted. The intersection would still operate at a LOS F but with significantly reduced PM delay compared to future no-build operations. The estimated cost of this option is \$95,000.
2. 2-Way Stop Control N/S with Existing Lane Configurations:  
Option 2 is similar to Option 1 in that the north/south approaches would operate under conventional 2-way stop control, except there is no widening. This option would also result in LOS F but as with Option 2 would provide significantly reduced PM delay compared to future no-build operations. The cost for this option is minimal since there is no physical construction.

3. EB/SB Channelized Rights with 2-Way Stop Control N/S:  
Option 3 includes two-way stop control while constructing channelized right turns for the eastbound and southbound directions. This will help improve LOS on the southbound approach, as well as overall LOS when compared to Options 1 and 2. The American Legion access at the southwest corner of the intersection would need closed for this option and parking would be impacted. Based on the analysis, the intersection would operate at a LOS E and F for the northbound left turn movement during both the AM and PM peak periods, respectively. As with Options 1 and 2, this option would result in LOS F, and would provide significantly reduced PM delay compared to future no-build operations. The estimated cost for this option is \$150,000.
4. Future Build SR 274/SR 15 SB Ramp (Roundabout). Option 4 involves constructing a one-lane roundabout at the intersection. This alternative would require a larger footprint and would be the costliest to build. The American Legion access at the southwest corner of the intersection would need closed like the other options but parking lot impacts would be more significant. Left turns out of the American Legion and onto New Bloomfield Road would be prohibited. It is the only option evaluated that provides acceptable LOS during all peak periods. The estimated cost for this option is \$910,000.

Two potential Park and Ride locations were identified in the vicinity of the study area.

1. Location 1 – Along SR 11/15 adjacent to the Sheetz in the closed car wash area in Perdix.
2. Location 2 – Along Business Campus Way just south of Penn Lane.

Further coordination with the property owners would be necessary.

**Part 2. Watts Township Access Road Evaluation.** The purpose of this study was to develop and evaluate alternative access road design concepts along SR 11/15 with the intent to minimize conflict points on SR 11/15 by providing controlled movements for potential future development. The alternatives were developed considering planned development, environmental resources, residential impact, traffic analysis, and overall improved roadway safety, and are designed to follow PennDOT design criteria.

Three alternatives were developed. The alternatives are located on the north side of SR 11/15 between Amity Hall and Old Trail Road and are designed to create connectivity between Old Trail Road and Amity Hall with controlled access points to SR 11/15 and SR 22/322.

Alternative 1 connects to Old Trail Road and is aligned to parallel SR 11/15. It is to the south of and at a lower elevation than potential warehouse development but higher than SR 11/15. This alternative utilizes Taylor Road as the primary access to SR 11/15. The

alignment continues west of Taylor Road, connecting to SR 11/15 and SR 22/322 at Amity Hall. The estimated cost of this option is \$9.2 M.

Alternative 2 connects to Old Trail Road and is aligned to parallel SR 11/15 at a higher elevation, north of potential warehouse development. The location was chosen to minimize impacts to residences along SR 11/15 as well as minimize excavation compared to Alternative 1. The alignment continues west and connects to SR 11/15 and SR 22/322 at Amity Hall. The estimated cost of this option is \$13.8 M.

Alternative 3 connects to SR 11/15 at Amity Hall with access to SR 22/322. It is aligned to the north to utilize the future access to the proposed distribution center and to avoid impact to Taylor and Old Trail Road. The estimated cost of this option is \$7.4 M.

Alternative 2 is the preferred alternative due to the maximized safety improvements along SR 11/15, minimized potential environmental impact, decreased impact on residential property, and minimum impact to Taylor Road.

Three potential Park and Ride locations were identified in the vicinity of the study area.

1. Location 1 and 2 – Just north of the SR 22/322 and SR 11/15 interchange. One park and ride would be provided on each side of SR 22/322.
2. Location 3 – Along SR 11/15 and adjacent to Island Road. This is located adjacent to the Ranch House.

## INTRODUCTION

### Study Location and Background

This work was performed under Service Agreement (SA) #2 for the Tri-County Regional Planning Commission (TCRPC). It consists of two separate studies referenced in this report as Part 1 and Part 2, as summarized below.

#### **Part 1: Duncannon SR 15 and SR 274 Traffic Analysis**

Tri-County Regional Planning Commission initiated a traffic engineering analysis to identify the impacts of median barrier along SR 22/322 at Clark's Ferry. The barrier is to be installed from the Clark's Ferry Bridge to just east of the interchange with SR 11/15, as part of the Route 22/322 Clark's Ferry Improvement Project, scheduled to take place between 2026 and 2031<sup>1</sup>. Under existing conditions, there is a heavy left-turn movement during the PM peak period from westbound SR 22/322 onto SR 849 to cross the Juniata River into Duncannon. While there are several access points along SR 22/322 with turning traffic, this is by far the highest volume movement affected by this project. This movement would be eliminated with installation of the median barrier causing a change in traffic patterns in Duncannon at the interchange of SR 11/15 and SR 274. A traffic analysis was necessary to evaluate the anticipated new traffic patterns in Duncannon and their potential impacts. A location map is shown in exhibit 1.

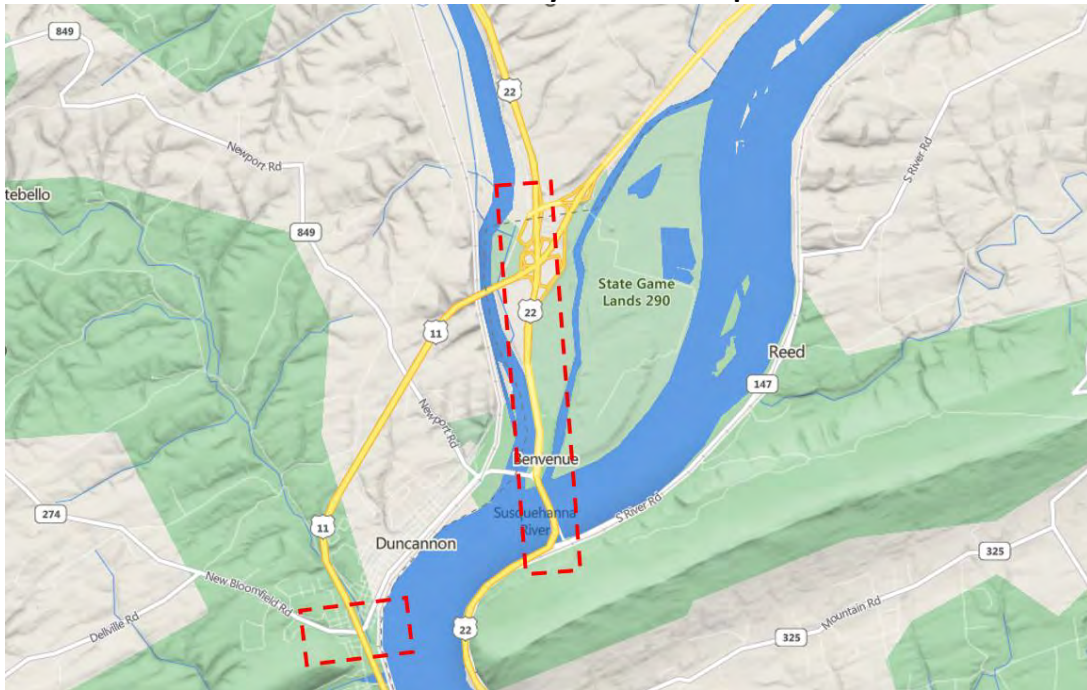
#### **Part 2: Access Road Evaluation in Watts Township**

The potential for development exists just north of the Clarks Ferry median barrier project in the vicinity of the SR 22/322 interchange with SR 11/15, and to the north along SR 11/15 where land is commercially zoned. Part 2 of this report will evaluate design concepts for access roads along SR 11/15 to the north in Watts Township. The intent is to minimize conflict points currently present in the Clark's Ferry portion of SR 22/322, by providing parallel service roads and controlled access roads along SR 11/15 which would support potential future development in this area, while minimizing access points on SR 11/15.

---

<sup>1</sup>[https://www.penndot.pa.gov/RegionalOffices/district-8/PublicMeetings/DauphinCounty/Route22\\_322ClarksFerryImprovementsProject/Pages/default.aspx](https://www.penndot.pa.gov/RegionalOffices/district-8/PublicMeetings/DauphinCounty/Route22_322ClarksFerryImprovementsProject/Pages/default.aspx)

### Exhibit 1: Study Location Map



### Study Scope

As discussed, this study consists of two parts. The purpose of part one is to evaluate the potential impacts in Duncannon caused by installation of median barrier in Clark's Ferry and to identify future improvements that can be made to mitigate any impacts. The following tasks were conducted for part one:

- Potential Environmental Resource Identification
- Traffic volume data collection
- Crash data analysis
- Roadside safety audits
- Traffic volume projections
- Intersection analyses
- Improvement concepts
- Park and ride site evaluation

The purpose of part two is to evaluate three (3) alternative access road design concepts along SR 11/15 northeast of its interchange with SR 22/322. The following tasks were conducted during the analysis:

- Potential Environmental Resource Identification
- Roadway improvement concepts
- Park and ride site evaluation

## PART 1: DUNCANNON SR 15 AND SR 274 TRAFFIC ANALYSIS

### Environmental Evaluation

The SR 11/15 and SR 274 Traffic Analysis report includes evaluation of environmental features at the SR 274 and SR 11/15 interchange in Duncannon, park and ride locations at the Sheetz car wash facility along SR 11/15, and the Business Campus Way south of Penn Lane. Within the vicinity of these sites, environmental features were limited due to surrounding development at each location.

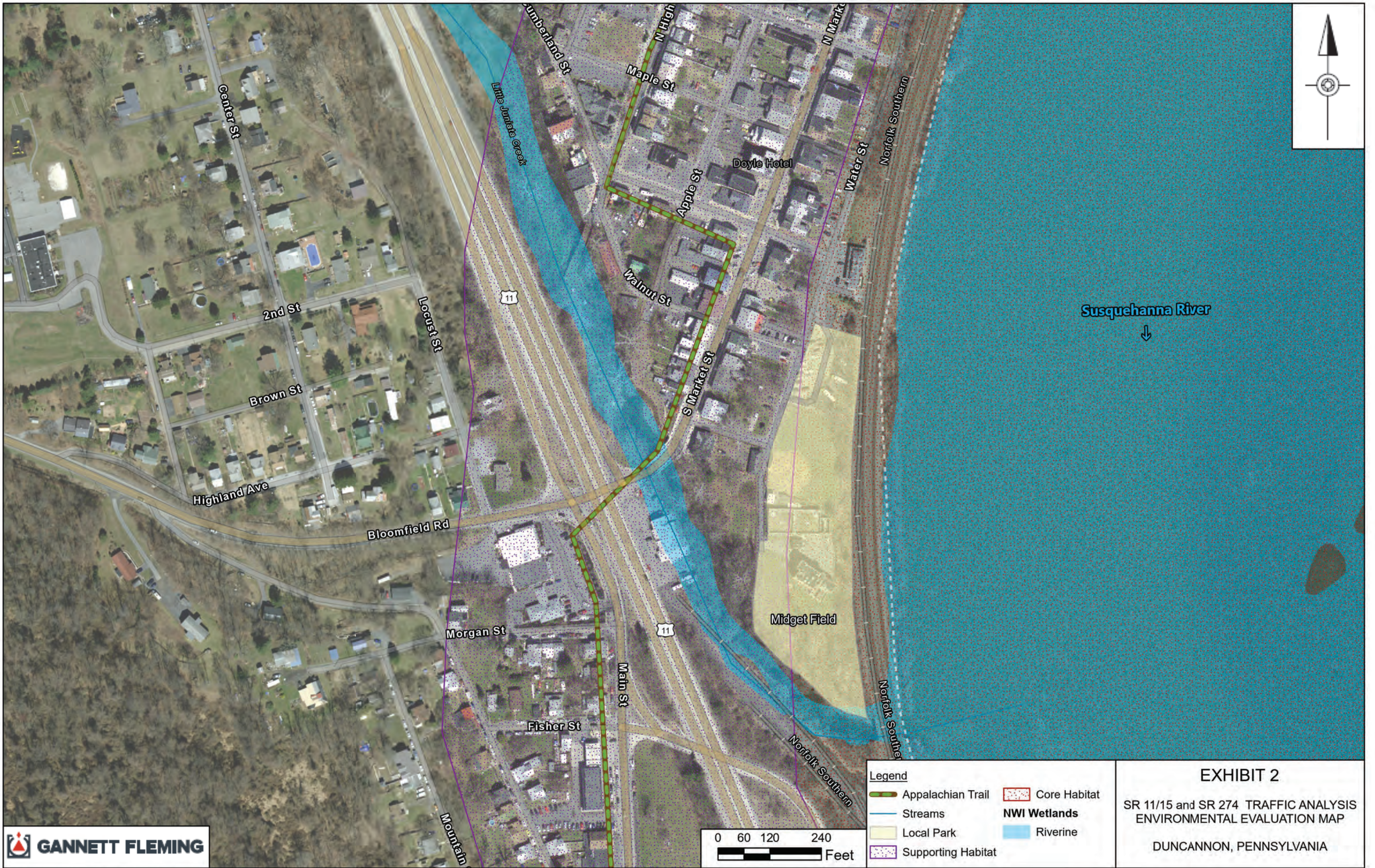
The Appalachian Trail crosses through the Borough of Duncannon, from Inn Road, west of SR 11/15, through the SR 274 and SR 11/15 interchange on SR 274, through the Borough and to the SR 849 bridge crossing. The Appalachian Trail is listed as eligible for the National Register of Historic Places at a national level for recreation and conservation and the exceptional significance within the past 50 years.

Little Juniata Creek is classified as a cold-water fishery (CWF) in Title 25, Chapter 93. Little Juniata Creek is stocked with trout a couple of miles upstream of the study area, but not within the vicinity of the study area. Little Juniata Creek is not listed as containing wild trout.

A review of the Pennsylvania Department of Conservation and Natural Resources (DCNR), Conservation Planning Report identified one Natural Heritage Area within the study limits. The core habitat for a DCNR species of concern encompasses the Susquehanna River and Little Juniata River, with the supporting habitat buffering the core. Habitat buffering the core habitat extends up into the proposed interchange; however, no potential natural habitat is found in the project area due to the extent of development. Exhibit 2 illustrates environmental features within the study area.

Review for environmental features at either proposed park and ride location were limited because both sites have been part of past development. The area identified along Business Campus Way is currently maintained grass. During the site visit, no potential environmental resources were observed. The Sheetz property, which was previously a car wash facility, has been vacant for several years. The car wash building has been removed and the roadway and stormwater drainage facilities remain. Environmental resources were not observed, and the PADEP eMapper did not identify potential waste issues.





**EXHIBIT 2**  
 SR 11/15 and SR 274 TRAFFIC ANALYSIS  
 ENVIRONMENTAL EVALUATION MAP  
 DUNCANNON, PENNSYLVANIA

Source: Basemapping provided by PEMA 2018. Local parks and trails provided by DCNR. Streams provided by PADEP. NWI wetlands provided by USFWS. Core and supporting habitat was georeferenced in using mapping provided by PNHP conservation report. Date Saved: 3/15/2023 1:00 PM

**Data Collection**

The data collection effort for the project consisted of obtaining 24-hour traffic counts, intersection turning movement counts, and crash data for the study area.

**Average Daily Traffic Volumes**

Automatic traffic recorders (ATRs) captured 24-hour vehicle volumes at several locations on SR 849: over the Juniata River and at SR 11/15. The counters captured data over a 24-hour period on Wednesday, September 14, 2022. Exhibit 3 provides a tabular summary of the 24-hour Average Daily Traffic (ADT) volumes for each location. Refer to exhibit 4 on the following page for an overview of the ATR locations.

**Exhibit 3: 24-hr Volume Summary**

Location	Direction	Time Period	Hourly/Daily Volume	Location	Direction	Time Period	Hourly/Daily Volume
ATR 1 – SR 849 Duncannon Bridge	EB	AM	308	ATR 2 – SR 849 / Newport Rd	NB	AM	27
		MID	114			MID	56
		PM	177			PM	136
		24-hr	2296			24-hr	944
	WB	AM	124		SB	AM	133
		MID	173			MID	52
		PM	343			PM	70
		24-hr	2736			24-hr	950
ATR 3 – 11 / 15 SB Off Ramp	SB	AM	56	ATR 4 – 11 / 15 NB Off Ramp Turn	NB	AM	121
		MID	67			MID	140
		PM	82			PM	327
		24-hr	942			24-hr	2629
ATR 5 – SR 22 NB Left Turn	WB	AM	93				
		MID	133				
		PM	290				
		24-hr	2129				

ATR 2

ATR 1

ATR 5



**EXHIBIT 4**

**LOCATION MAP**

Duncannon, PA

NOT TO SCALE - Page 1/2



**EXHIBIT 4**

**LOCATION MAP**

Duncannon, PA

NOT TO SCALE - Page 2/2

### **Intersection Turning Movement Volumes**

---

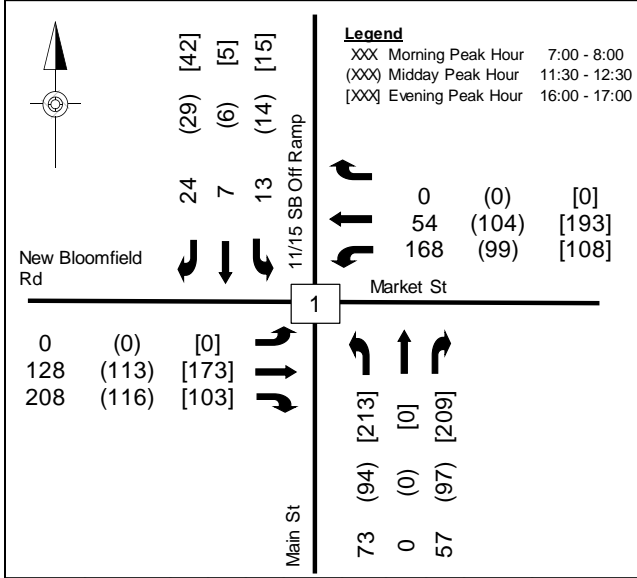
Intersection turning movement counts (TMCs) were conducted at the following locations to establish peak period traffic volumes:

1. New Bloomfield Rd (SR 274) / Market St and Main St / SR 11/15 SB Off Ramp
2. Market St and SR 11/15 NB On Ramp / Beer Company Dr
3. Market St and Newport Rd/Juniata Rd (SR 849)

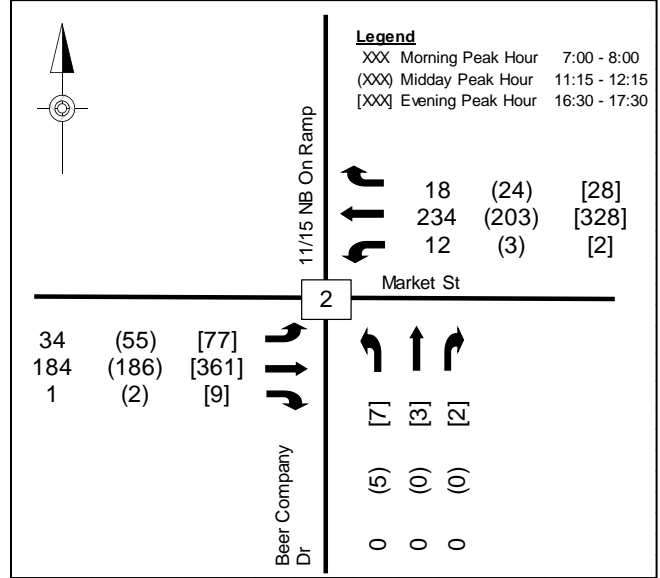
The TMCs were conducted during the morning (7:00-9:00), midday (11:00-1:00), and evening (3:30-5:30) peak hours on Wednesday, September 14, 2022. Automatic traffic recorders (ATRs) also recorded turning traffic volumes at the intersection of SR 849 and SR 22/322. The existing peak hour traffic volume diagrams are summarized in exhibit 5 on the following page.

**Exhibit 5: Existing Volume Diagrams**

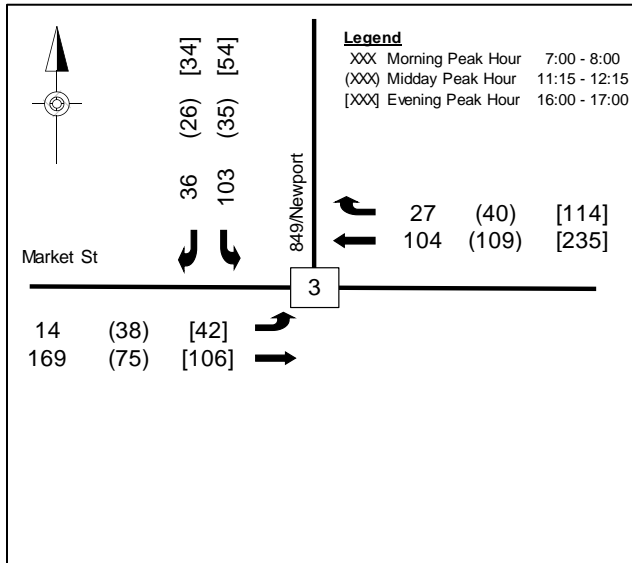
**New Bloomfield Rd/Market St and Main St / SR 11/15 SB Off Ramp (Intersection #1)**



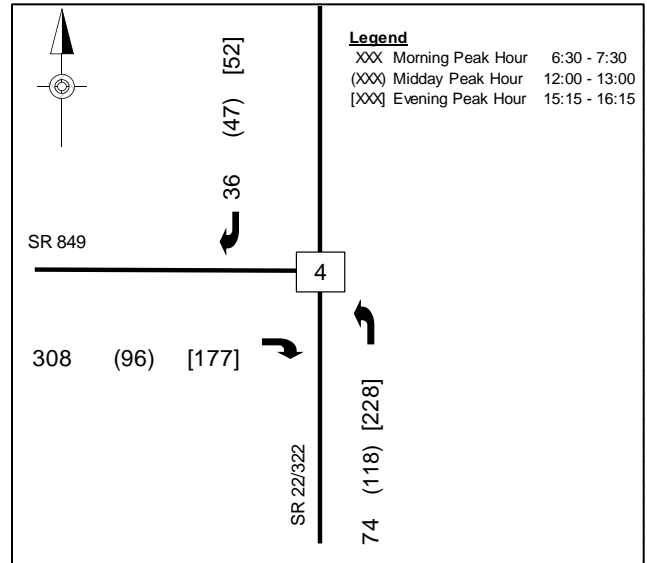
**Market St and SR 11/15 NB On Ramp / Beer Company Dr (Intersection #2)**



**Market St and SR 849 / Newport (Intersection #3)**



**Market St and SR 849 / Newport (Intersection #4)**



**Crash Analysis**

A crash analysis was conducted for four (4) intersections to determine if a significant crash history or crash pattern exists that may be attributable to the existing geometrics or operation of the intersection. The most recent five years of available crash data was obtained for the years 2017 through 2021. A crash summary is provided below.

<b>Intersection</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>TOTAL</b>
New Bloomfield Rd/Market St and Main St / SR 11/15 SB Off Ramp	0	1	1	1	0	3
SR 849 and US 22	5	4	5	3	3	20
Market St and SR 849 / Newport	0	0	1	0	0	1
Market St and SR 11/15 NB On Ramp / Beer Company Dr	0	0	0	0	0	0

At the intersection of New Bloomfield Rd/Market St and Main St / SR 11/15 SB Off Ramp there were a total of 3 crashes for the reported period. All crashes were reported as angle crashes and one of these was a suspected minor injury.

At the intersection of SR 849 and US 22 there were a total of 20 crashes for the reported period. The crash data showed that angle and rear-end crashes were the most predominant crash type accounting for 40% each (80% of the total crashes). Of the 20 total crashes, 9 resulted in possible or suspected injury while there was 1 fatality in 2019. It is anticipated that the median barrier project would address these crashes.

There was only one reported crash at the Market St and SR 849 / Newport intersection during the reported period and it did not result in any injuries.

No crashes were reported at the Market St and SR 11/15 NB On Ramp / Beer Company Dr intersection during the period.

## Traffic Safety Audit

This section discusses the studied intersections inclusive of observations and short-term suggestions that could be made to address some deficiencies.

### Existing Conditions and Observations

#### 1. New Bloomfield Rd (SR 274) / Market St and Main St / SR 11/15 SB Off Ramp

Eastbound Approach (New Bloomfield Rd)



Westbound Approach (Market St)



Northbound Approach (Main St)



Southbound Approach (SB 11 / 15 Off Ramp)








Photo	Observation/Suggestion
	<p><b>Observation:</b>          The Oncoming Traffic Does Not Stop plaque mounted below the eastbound approach STOP sign is not compliant since it uses a white background. The position of the STOP sign is potentially hazardous for pedestrians and motorists.</p> <p><b>Suggestion:</b>          Replace the Oncoming Traffic Does Not Stop plaque with the standard W4-4bP plaque as shown below. Relocate the STOP sign to the location highlighted by the red arrow in the photo to the left. Ensure the sign is mounted to a height of 7 feet from the ground to the bottom of the sign.</p> <div style="text-align: center;">             W4-4bP         </div>
	<p><b>Observation:</b>          A tight turning radius at the southwest corner causes large vehicles to off-track when making right turns from New Bloomfield Road onto Market Street.</p> <p><b>Suggestion:</b>          Widen the radius to accommodate all vehicle types making this right turn.</p>


Photo	Observation/Suggestion
	<p><b>Observation:</b> The eastbound approach crosswalk striping does not lead to the sidewalk/DWS at the southwest corner of the intersection. The curb ramp at the NE corner (bottom photo) is covered with debris. There is inadequate lighting for the crosswalks.</p> <p><b>Suggestion:</b> Ideally, the eastbound approach crosswalk should be modified to lead directly to the end of the sidewalk at the southwest corner of the intersection. The DWS should also be relocated to meet at the crosswalk end. At a minimum, install a luminaire at the NW corner of the intersection. Additional lighting can be installed to help better illuminate the crosswalks and intersections.</p>

Photo	Observation/Suggestion
	<p><b>Observation:</b> Pavement markings throughout the intersection are marginal to faded. The northbound approach turn lanes are unmarked and unsigned.</p> <p><b>Suggestion:</b> Ensure this intersection is restriped the next time pavement markings are replaced in this area.</p> <p>Install a stop line for the left turn lane on the south leg. A stop line is not needed for the northbound right turn lane. Install left turn lane use arrows and 'ONLY' legends in the leftmost lane and right turn lane use arrows and 'ONLY' legends in the rightmost lane for the northbound approach. Install a LEFT ONLY and RIGHT ONLY sign adjacent to the full-width portion of the mandatory turn lane.</p> 

Photo	Observation/Suggestion
	<p><b>Observation:</b>          The DO NOT ENTER and STOP signs for the southbound approach are mounted back-to-back which blocks the silhouette of the STOP sign. The Low Clearance sign shown in the photo to the left is obstructed by the STOP sign.</p> <p><b>Suggestion:</b>          Install the STOP sign and DO NOT ENTER sign on their own posts. Remove the Low Clearance sign as it is not necessary since signage is posted on the bridge.</p>
	<p><b>Observation:</b>          Sight distance is limited for vehicles using the SR 11/15 SB exit ramp when looking to their left. This is primarily caused by the bridge piers shown in the photo. Vehicles proceeding east along New Bloomfield Road also have obstructed line of sight to vehicles along the northbound approach. Currently, NB right traffic does not have to stop at the intersection. NB left turning traffic does stop and causes the line of sight of the NB right traffic to be blocked for traffic at the New Bloomfield Road approach, especially a problem during peak periods.</p> <p><b>Suggestion:</b>          The bridge combined with the geometry of this intersection cause the sight distance deficiency with no feasible short-term solution. Some alternatives discussed later in this report will help to improve sight distance.</p>

**2. Market St and NB 11/15 On Ramp / Beer Company Dr**

**Eastbound Approach**



Image Source: Google Earth

**Westbound Approach**



**Northbound Approach**



Photo	Deficiency/Corrective Action
	<p><b>Observation:</b>  A DWS is missing at both ends of the crosswalk and there is inadequate crosswalk lighting.</p> <p><b>Suggestion:</b>  When the intersection is upgraded, install a DWS at each end of the crosswalk. At a minimum, install a luminaire at the NE corner of the intersection. Additional lighting can be installed to help better illuminate the crosswalks and intersection.</p>
	<p><b>Observation:</b>  There are no pedestrian warning signs for the uncontrolled crossing on the north leg.</p> <p><b>Suggestion:</b>  Install a Pedestrian (W11-2) sign with a supplemental Downward Diagonal Arrow (W16-7P) plaque at the point where the crossing occurs at the NE corner of the intersection.</p> <div style="text-align: center;">  <span style="margin-left: 10px;">W11-2</span>   <span style="margin-left: 10px;">W16-7PL</span> </div>

**3. Market St and SR 849 / Newport**

**Eastbound Approach**




**Westbound Approach**



**Southbound Approach**



Photo	Deficiency/Corrective Action
	<p><b>Observation:</b> The centerline markings are marginal to faded throughout the intersection.</p> <p><b>Suggestion:</b> Ensure this intersection is restriped the next time pavement markings are replaced in this area.</p>



4. SR 849 and SR 22/322

Eastbound Approach



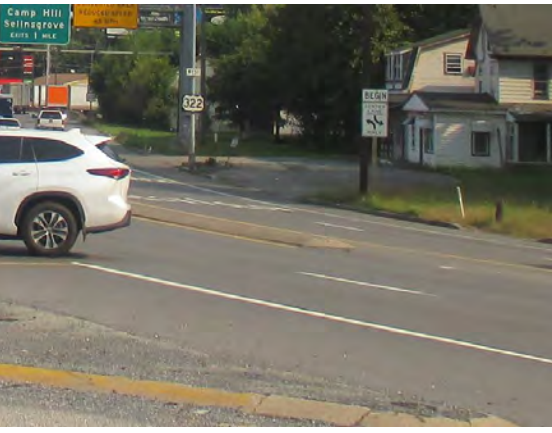


Northbound Approach




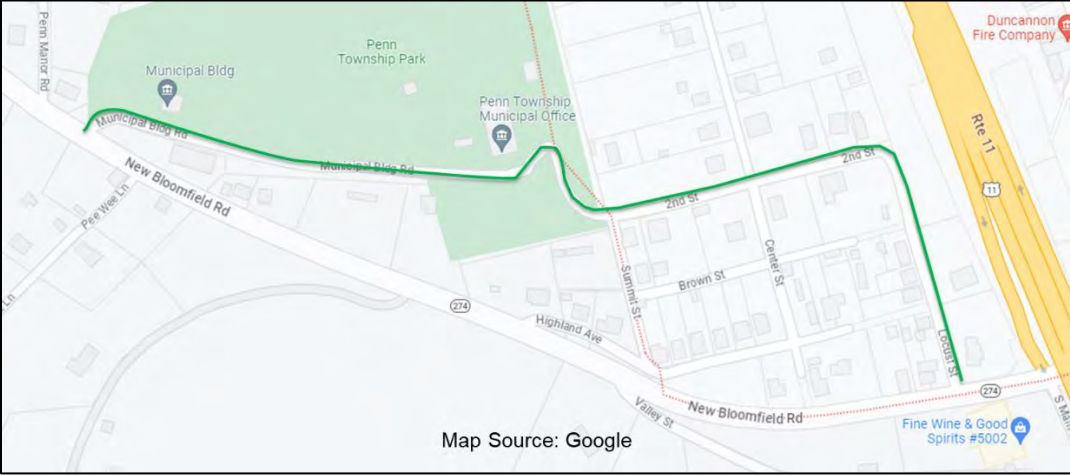
Southbound Approach




Photo	Deficiency/Corrective Action
	<p><b>Observation:</b>            The overhead clearance warning sign along SR 849 is obstructed by tree branches.</p> <p><b>Suggestion:</b>            Trim the tree branches to allow for sign visibility.</p>
 	<p><b>Observation:</b>            The median island noses at this intersection are not delineated.</p> <p><b>Suggestion:</b>            Install an Object Marker or KEEP RIGHT R4-7 sign at the nose of the two medians along SR 22/322 (bottom photo) and the one along SR 849 (top photo).</p>

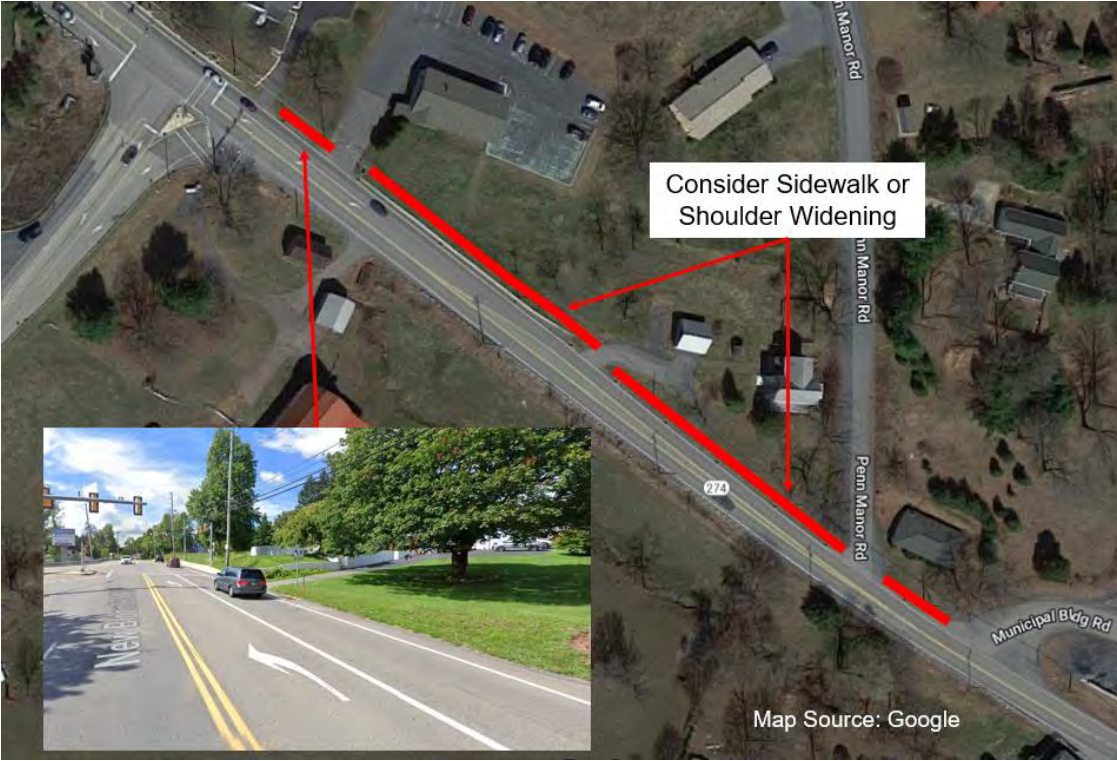
### 5. SR 274 Pedestrians

The Appalachian Trail traverses through Duncannon and is considered the approximate halfway point of the trail. Hikers sometimes divert from the trail and walk west along SR 274 to the Karns shopping center for food. Although not a focus of this study, a cursory review of pedestrian access was conducted, and some general recommendations provided.

Photo	Deficiency/Corrective Action
	<p><b>Observation:</b>                      As shown at left (looking west along SR 274 towards Locust Street) there is minimal shoulder width along SR 274. Due to the terrain and grades shoulder widening is not practical.</p> <p><b>Suggestion:</b>                      Install signage to direct pedestrians along Locust Street, 2<sup>nd</sup> Street, and Municipal Building Road. See green route below.</p>
 <p>Map Source: Google</p>	

**Tri-County Regional Planning Commission SA#2**  
**SR 15/SR 274 Traffic Analysis | Watts Twp Access Road Evaluation**

Photo	Deficiency/Corrective Action
	<p><b>Observation:</b>            From the Municipal Road intersection and westward the shoulder is still narrow but there is a flat roadside (see photo at left looking west along SR 274 from Penn Manor Road).</p> <p><b>Suggestion:</b>            Widen the shoulder or install sidewalk up to the signalized intersection at Business Campus Way, where access to the Karns Shopping Center is provided. See photo below.</p>



Consider Sidewalk or  
Shoulder Widening

Map Source: Google

## **Travel Projections**

With installation of the median barrier at the SR 22/322 and SR 849 intersection, westbound traffic along SR 22/322 will be prohibited from making a left turn onto SR 849. This traffic would need to be diverted to an alternate route to get to the desired destination. Therefore, all northbound left traffic was rerouted. Three alternate routes were identified which traffic would use once the median barrier is installed:

- Route 1: Traffic would continue west along SR 22/322 to the interchange with SR 11/15. Traffic would use two loop ramps to then turn around and proceed south along SR 22/322 back to the intersection at SR 849 to make a right and proceed towards Duncannon.
- Route 2: Traffic would divert to NB SR 11/15 and would exit at SR 274. This traffic would then make a right turn into Duncannon to access the borough or SR 849 and points west.
- Route 3: Traffic would divert to NB SR 11/15 and would exit at SR 274. This traffic would then make a left turn to proceed west.

Through engineering judgment and the use of traffic volumes from turning movement counts and automatic traffic recording devices, the study team was able to estimate the percentage of traffic that would divert to each of the three routes listed above. Exhibit 6 shows each alternate route and the percentage of traffic that was estimated to divert to that route.

Exhibit 6: Alternate Traffic Routes



## **Operational Analysis**

An analysis was conducted to determine the existing, future no-build, and future build (2033) operational conditions at the intersection of SR 274 and SR 11/15 SB Ramps and at SR 849 and Market Street, with the diverted traffic. Future build conditions include a 1.06 background/growth factor. This value was calculated by taking the PennDOT growth factor of 0.54 for a rural non-interstate in Perry County. This value was then extrapolated over ten years (2033) resulting in a 1.06 factor.

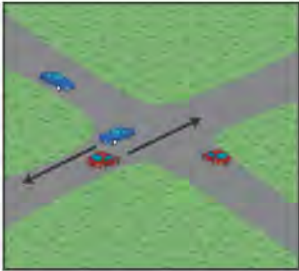
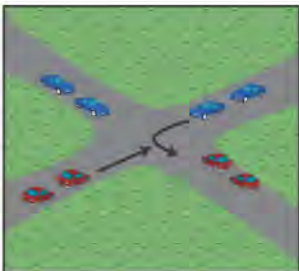

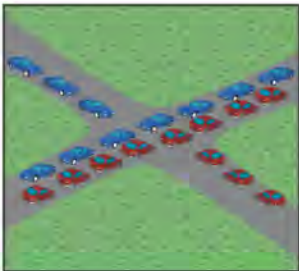
New multi-family housing units (75 total) are proposed along SR 849 north of Market Street. The ITE Trip Generation Manual (11<sup>th</sup> edition) was utilized to estimate the number of vehicle trips that would be created due to these housing units. The additional trips were distributed for the study area and are included in the future build conditions. The Perry County Business Park owners were contacted regarding proposed development in the park. As of April 2023 any future construction was 3 years away and the only known development was a fish hatchery that would generate minimal traffic. It was assumed that the background growth applied above would account for any of the future growth for this park.

Synchro Traffic Analysis Software (Version 11) was used for the analysis. Each table includes level of service (LOS), delay, and 95<sup>th</sup> percentile queues for each lane group at the intersection. Note that queue lengths less than 25 feet were rounded up to 25 feet if greater than zero since the assumed length of a vehicle is 25 feet.

LOS describes the operational condition of an intersection and usually falls into one of six categories: A through F. LOS A represents operating conditions with relatively little traffic and no congestion, while LOS F represents relatively high traffic and unpredictable operating conditions, including high delay and driver discomfort. Generally, a facility operating at or better than LOS D is considered acceptable. Exhibit 7 on the following page details and graphically shows examples and definitions of LOS A through F.

For the future build condition four (4) improvement alternatives were evaluated at SR 274 and SR 11/15 to identify which would provide for acceptable operations in the short and long term. Note, volumes in Synchro were balanced prior to analyzing each scenario causing some volumes to differ from what is shown in the volume diagrams. This was necessary primarily due to differing peak hours by intersection.

**Exhibit 7: Level of Service Definitions**

LOS	INTERSECTIONS		
	SIGNALIZED		UNSIGNALIZED
<b>A</b>	<ul style="list-style-type: none"> <li>✓ Very low delay, average less than 10.0 seconds per vehicle (spv)</li> <li>✓ Most vehicles arrive during green phase</li> <li>✓ Most vehicles do not need to stop</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delays less than 10.0 spv</li> <li>✓ Little or no delay to minor street traffic</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>✓ Average delay in range of 10.1-20.0 spv</li> <li>✓ More vehicles stop than LOS A</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delay in range of 10.1-15.0 spv</li> <li>✓ Short traffic delays to minor street traffic</li> </ul>
<b>C</b>	<ul style="list-style-type: none"> <li>✓ Average delay in range of 20.1-35.0 spv</li> <li>✓ Number of vehicles stopping is significant</li> <li>✓ Cycle failures may begin to appear</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delay in range of 15.1-25.0 spv</li> <li>✓ Average traffic delays to minor street traffic</li> </ul>
<b>D</b>	<ul style="list-style-type: none"> <li>✓ Average delay in range of 35.1-55.0 spv</li> <li>✓ Congestion more noticeable</li> <li>✓ Many vehicles stop</li> <li>✓ Cycle failures noticeable</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delay in range of 25.1-35.0 spv</li> <li>✓ Long traffic delays to minor street traffic</li> </ul>
<b>E</b>	<ul style="list-style-type: none"> <li>✓ Average delay in range of 55.1-80.0 spv</li> <li>✓ Cycle failures frequent</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delay in range of 35.1-50.0 spv</li> <li>✓ Very long delays to minor street traffic</li> </ul>
<b>F</b>	<ul style="list-style-type: none"> <li>✓ Average delay in excess of 80.0 spv</li> <li>✓ Delay unacceptable to most drivers</li> <li>✓ Many cycle failures</li> </ul>		<ul style="list-style-type: none"> <li>✓ Average delay in excess of 50.0 spv</li> <li>✓ Extreme delays with queuing</li> <li>✓ Congestion affects other intersections</li> <li>✓ Warrants improvement to intersection</li> </ul>



**Existing and Future No Build Operational Analysis**

**SR 274 and SR 11/15 SB Ramps**

Existing

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue (ft)
EB Thru/Right	C (24.6) / 130	C (29.3) / 88	F (318.8) / 498
WB Left	A / 0	A / 0	A / 0
WB Thru	A / 0	A / 0	A / 0
NB Left	A (8.2) / 25	A (8.1) / 25	A (8.9) / 25
NB Right	A / 0	A / 0	A / 0
SB Left/Thru/Right	C (15.1) / 25	C (15.5) / 25	E (39.1) / 50
Overall	B (11.7)	A (9.2)	F (79.3)

Future No-Build with Diverted Traffic

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue (ft)
EB Thru/Right	E (42.7) / 205	D (33.0) / 148	F (2,247) / 900
WB Left	A / 0	A / 0	A / 0
WB Thru	A / 0	A / 0	A / 0
NB Left	A (8.4) / 25	A (8.2) / 25	A (9.3) / 28
NB Right	A / 0	A / 0	A / 0
SB Left/Thru/Right	C (19.3) / 25	C (20.0) / 25	F (152.0) / 123
Overall	C (16.9)	B (12.4)	F (427.0)

Based on diverted traffic volume estimates, this change in traffic pattern due to the median barrier installation causes a significant impact at the intersection of SR 274 and the SR 11/15 SB ramps. Improvement alternatives will be discussed on the following pages.

**SR 849 and Market Street**

No Build with Diverted Traffic

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue (ft)
EB Left/Thru	A (7.4) / 25	A (7.4) / 25	A (7.7) / 25
WB Thru/Right	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
SB Left/Right	B (11.8) / 25	A (9.9) / 25	B (11.7) / 25
Overall	A (4.9)	A (4.4)	A (4.5)

The intersection of SR 849 and Market Street operates adequately, and no improvements are needed.

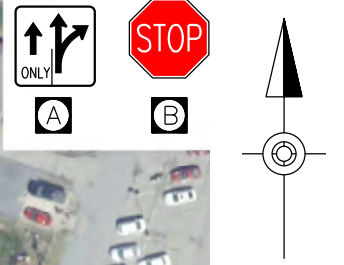
**Option 1 - Future Build SR 274/SR 15 SB Ramp (EB Approach Widening and 2-Way Stop Control N/S) Operational Analysis**

The first alternative evaluates widening the SR 274 eastbound approach to provide an additional lane. This would allow for a through and a through/right lane configuration. The leftmost lane would drop as a left only at the SR 11/15 NB on ramps, while the rightmost through lane would continue into Duncannon. In conjunction with this widening, conventional two-way stop control would be in place on the northbound and southbound approaches. Note the American Legion access at the southwest corner of the intersection would need closed and parking would be slightly impacted. The table below summarizes the operational analysis for Option 1 during 2033.

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue / (ft)
EB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
EB Thru/Right	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
WB Left	A (9.6) / 28	A (8.4) / 25	A (8.5) / 25
WB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
NB Left	F (112.5) / 153	E (37.7) / 93	F (385.7) / 583
NB Right	B (11.3) / 25	B (11.1) / 33	C (21.3) / 180
SB Left/Thru/Right	C (22.2) / 25	C (15.3) / 25	D (32.2) / 45
Overall	C (17.1)	B (10.2)	F (82.3)

Based on the analysis, the northbound left turn would operate at a LOS F (with PM delay of 385.7 sec/veh) during both the AM and PM peak periods, while having an overall LOS F (delay of 82.3 sec/veh) during the PM peak period. This however is a significant improvement from the future no-build operations (82.3 sec/veh versus 427.0 sec/veh overall). The conceptual design is provided as exhibit 8. The estimated cost for this alternative is \$95,000.

BACKGROUND IMAGERY PROVIDED BY PASDA



PA 274 NEW BLOOMFIELD RD

S MARKET ST

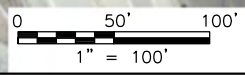
11/15 STATE RD

S MAIN ST

EXHIBIT 8

OPTION 1  
TWO-WAY STOP CONTROL  
WITH EB WIDENING

DUNCANNON, PENNSYLVANIA



**Option 2 - Future Build SR 274/SR 15 SB Ramp (2-Way Stop Control N/S with Existing Lane Configurations) Operational Analysis**

Option 2 is similar to Option 1 in that the north/south approaches would operate under conventional 2-way stop control, except there is no widening. The operational analysis is shown in the table below.

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue / (ft)
EB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
EB Thru/Right	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
WB Left	A (9.5) / 28	A (8.4) / 25	A (8.4) / 25
WB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
NB Left	F (94.8) / 140	D (34.7) / 88	F (344.4) / 555
NB Right	B (11.8) / 25	B (11.7) / 35	D (29.0) / 238
SB Left/Thru/Right	D (29.6) / 33	C (19.4) / 25	F (183.9) / 140
Overall	C (15.7)	B (10.2)	F (84.3)

Based on the analysis, the intersection would operate at an overall LOS F (84.3 sec) for the PM peak period which is similar to Option 1. However, the southbound approach LOS would worsen from a LOS D to LOS F during the PM peak period. There is no significant cost to this option since there is no physical work associated with it.

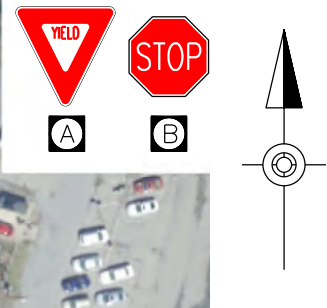
**Option 3 - Future Build SR 274/SR 15 SB Ramp (EB/SB Channelized Rights with 2-Way Stop Control N/S) Operational Analysis**

Option 3 includes two-way stop control while constructing channelized right turns for the eastbound and southbound directions. This will help improve LOS on the southbound approach, as well as overall LOS when compared to Options 1 and 2, as shown in the following table. Note that the American Legion access at the southwest corner of the intersection would need closed for this option and parking would be impacted.

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue /(ft)
EB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
EB Thru/Right	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
WB Left	A (8.2) / 25	A (7.8) / 25	A (8.0) / 25
WB Thru	A (0.0) / 0	A (0.0) / 0	A (0.0) / 0
NB Left	F (71.2) / 120	D (31.2) / 78	F (304.4) / 525
NB Right	B (11.8) / 25	B (11.7) / 35	D (29.0) / 238
SB Left/Thru/Right	C (18.0) / 25	B (13.6) / 25	F (125.6) / 118
Overall	B (12.3)	A (9.2)	F (74.0)

Based on the analysis, the intersection would operate at a LOS F for the northbound left turn movement during both the AM and PM peak periods. The SB approach during the PM peak period also operates at a LOS F as does the overall intersection. This, however, is a significant improvement from the future no-build operations and a slight improvement from the previous two alternatives. The conceptual improvement is provided as exhibit 9. Estimated cost for this alternative is \$150,000.

BACKGROUND IMAGERY PROVIDED BY PASDA



PA 274 NEW BLOOMFIELD RD

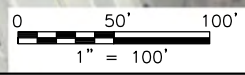


EXHIBIT 9  
OPTION 3  
TWO-WAY STOP CONTROL  
WITH CHANNELIZING RIGHTS  
DUNCANNON, PENNSYLVANIA



**Option 4 - Future Build SR 274/SR 15 SB Ramp (Roundabout)**  
**Operational Analysis**

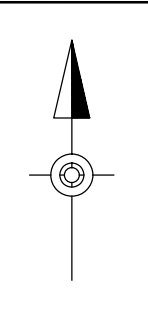
---

Option 4 involves constructing a one-lane roundabout at the intersection. This alternative would require a larger footprint, while being the costliest. The operational analysis is shown below. The American Legion access at the southwest corner of the intersection would need closed like the other options but parking lot impacts would be more significant. Left turns out of the American Legion and onto New Bloomfield Road would be prohibited with a “pork chop” island as shown in the concept. The splitter island cannot be used to prohibit these turns since left turn access to and from Locust Street on the north side of SR 274 needs maintained since there are no other access options for homes along this street. A circulation road behind the American Legion would be provided for additional access options on the south side of SR 274.

Movement	AM Peak LOS/95% Queue (ft)	MID Peak LOS/95% Queue (ft)	PM Peak LOS/95% Queue (ft)
EB Left/Thru/Right	A (9.8) / 75	A (6.3) / 25	A (6.3) / 25
WB Left/Thru/Right	A (6.2) / 25	A (5.6) / 25	A (8.9) / 50
NB Left/Thru/Right	A (6.3) / 25	A (6.9) / 50	D (32.4) / 375
SB Left/Thru/Right	A (5.9) / 0	A (5.4) / 0	A (7.7) / 0
Overall	A (7.6)	A (6.3)	C (21.0)

Based on the analysis, the intersection would operate at an adequate LOS during all peak periods. This alternative provides markedly improved LOS when compared to Options 1-3. The conceptual design for the roundabout is provided as exhibit 10. Estimated cost for this alternative is \$910,000.

BACKGROUND IMAGERY PROVIDED BY PASDA



PA 274 NEW BLOOMFIELD RD

LOCUST ST

S MARKET ST

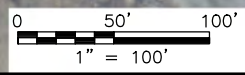
11/15 STATE RD

S MAIN ST

EXHIBIT 10

OPTION 4  
ROUNDAABOUT

DUNCANNON, PENNSYLVANIA



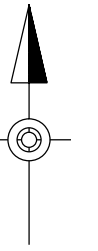


## Park and Ride Evaluation

This section identifies two potential park and ride locations that encompass the studied area for part 1. The locations are listed below along with a map provided on the following pages as exhibit 11.

Location 1 – Along SR 11/15 just west of the Sheetz. There is an old car wash facility that is no longer in use which would make for a good location. Discussion would have to take place with Sheetz, however. The estimated cost is approximately \$210,000 excluding right of way.

Location 2 – Along Business Campus Way just south of Penn Lane. There is open land that is available under a mile to the west of the SR 11/15 and SR 274 interchange within the Business Park. The estimated cost is approximately \$270,000 excluding right of way.

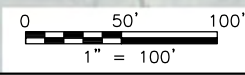


11/15 STATE RD

EXHIBIT 11

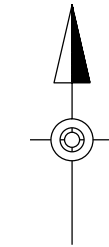
11/15 NEAR SHEETZ  
PARK AND RIDE  
LOCATION

DUNCANNON, PENNSYLVANIA



1/2

BACKGROUND IMAGERY PROVIDED BY PASDA



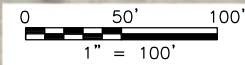
BUSINESS CAMPUS WAY

PENN LANE

EXHIBIT 11

BUSINESS CAMPUS WAY  
PARK AND RIDE  
LOCATION

DUNCANNON, PENNSYLVANIA



2/2

## PART 2: ACCESS ROAD EVALUATION IN WATTS TOWNSHIP

This section will provide design concepts for access roads along SR 11/15 just to the northeast of the SR 22-322 and SR 11/15 interchange, along with an environmental evaluation and traffic analysis of the area.

### Environmental Evaluation

The study area includes the area from the US 22/322 and US 11/15 interchange north to the intersection of US 11/15 with Old Trail Road. The study area also covers the Susquehanna River northwest to Amity Road. Land use within this study limits consists of rural residential, farmlands, and scattered commercial, surrounded by forested habitat. The forested habitat is located on steep slopes or as riparian buffers. Forested habitat to the north and west of Amity Road is zoned as Forest/Conservation. The land between US 11/15 and Amity Road, and Taylor Road and US 22/322 is zoned commercial and is slated to be developed for warehouse use.

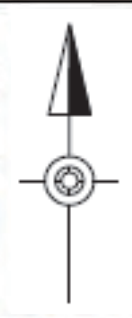
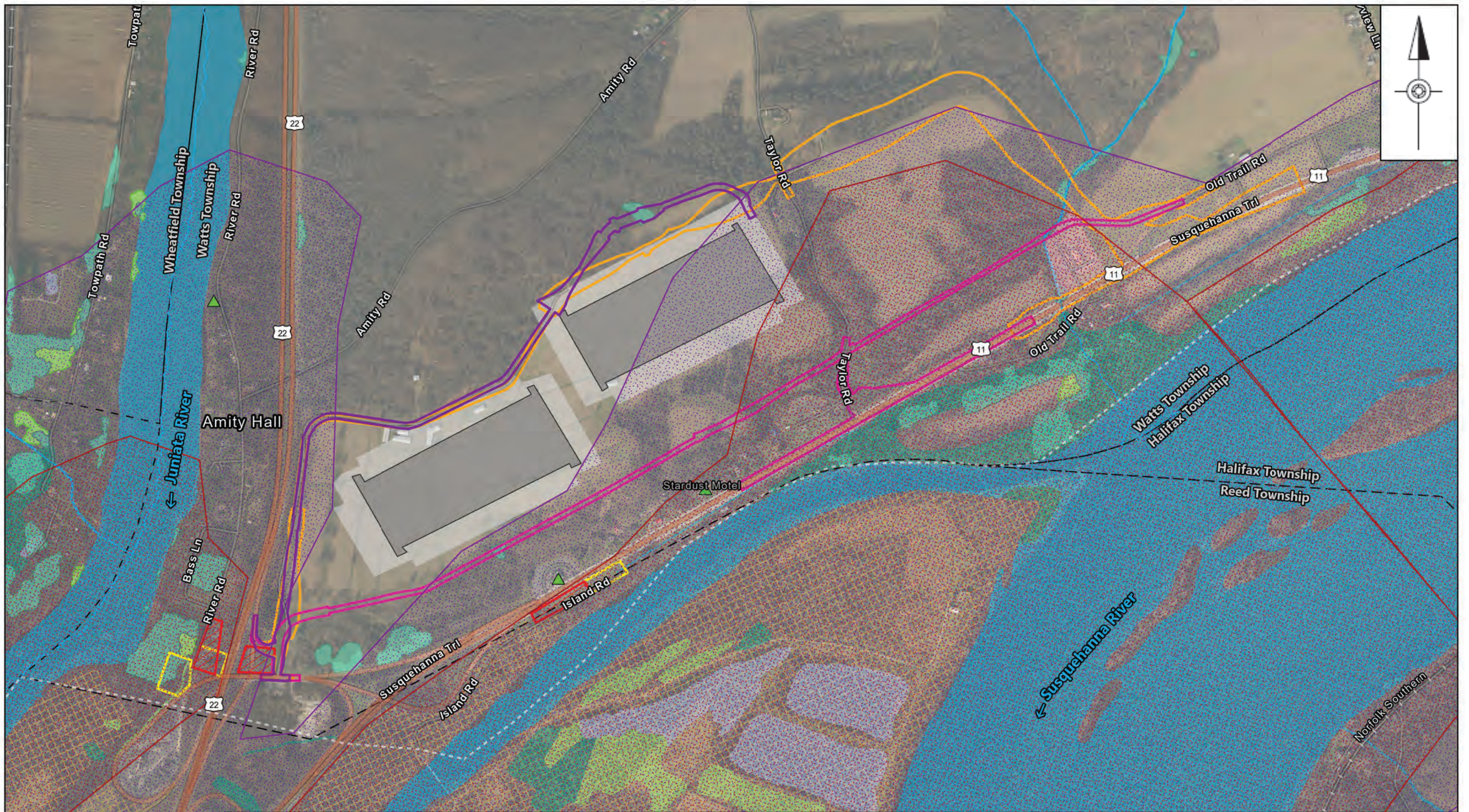
A review of the DCNR, Conservation Planning Report identified one Natural Heritage Area within the study limits. The core habitat encompasses the Susquehanna River and the Juniata River, with the supporting habitat buffering the core. Habitat buffering the core habitat extends up into the proposed warehouse property and proposed roadway access.

The protected habitat is the Aqueduct Bluffs, Juniata River Scour. This site along the Juniata River supports two plant species of concern. The jeweled shooting star (*Dodecatheon radicum*) occupies moist limestone cliffs on the west side of the Juniata, associated with maidenhair spleenwort, columbine, and poison ivy. The flat stemmed spike rush (*Eleocharis compressa*) occurs along a scoured area of riverbank, growing on sparsely populated bedrock ridges at the water's edge. Also occurring with the spike rush is the lance fog fruit (*Phyla lanceolata*), which has been delisted since the 2000 report. Exhibit 12 depicts identified environmental features within the study area.

Several drainage features, unnamed tributaries, are located within the study area. The potential for wetlands exists within these areas and within the Juniata River and Susquehanna River floodplains. Unnamed tributaries to the Susquehanna River and Juniata River are classified as warm water fisheries (WWF) in Title 25, Chapter 93. The unnamed tributaries are neither stocked with trout, nor listed as containing wild trout populations.

In addition to the environmental studies for the access road, three potential park and ride locations are being considered. Locations 1 and 2 are at the US 22/322 interchange between River Road and US 22/322 and the existing US 22/322 on ramp. The area along the ramp has the potential for palustrine wetlands. Both sites are within the core habitat

or supporting landscape for the Aqueduct Bluffs, Juniata River Scour. However, both sites have been disturbed. The site between River Road and US 22/322 contains macadam that was a parking lot for a hotel. Based on a review of the PADEP eMap did not identify potential waste in the vicinity of these two sites. Location 3 is located between Island Road and US 11/15 across from the Ranch House restaurant. This site is currently maintained grass.



0 375 750 1,500 Feet

Legend	
Alternative 1	Proposed Warehouse Parking Lots
Alternative 2	Community Facilities
Alternative 3	Potential Jug Handle Locations
Proposed Warehouse	Potential Park and Ride Sites
Streams	Core Habitat
Municipalities	Supporting Habitat
State Gamelands	EPA Waste Sites
Freshwater Emergent Wetland	NWI Wetlands
Freshwater Forested/Shrub Wetland	Freshwater Pond
Freshwater Pond	Lake
Lake	Riverine
Forested	PA Modeled Wetlands
Scrub/Shrub	Emergent

**EXHIBIT 12**  
**WAREHOUSE ACCESS ROAD**  
**ENVIRONMENTAL EVALUATION MAP**  
**DUNCANNON, PENNSYLVANIA**

Source: Basemapping provided by ESRI online. Municipal boundaries provided by PASDA. Warehouse locations georeferenced using preliminary concept plans submitted to Watts Township. State Game Lands provided by PAGC (2019). PA Modeled Wetlands provided by PA DEP (2013). NWI wetlands provided by USFWS. Perry County Zoning was georeferenced in using county zoning maps. Core and supporting habitat was georeferenced in using mapping provided by PNHP conservation report. Date Saved: 3/15/2023 1:43 PM

## Conceptual Roadway Design

### Introduction

The purpose of this study was to develop and evaluate alternative access road design concepts along SR 11/15 with the intent to minimize conflict points on SR 11/15 by providing controlled movements for potential future development. The alternatives were developed considering planned development, environmental resources, residential impact, traffic analysis, and overall improved roadway safety. Each alternative includes connections with other roads and several jug handle locations. These locations are subject to further evaluation and exact locations may change if and when any such alternative moves forward.

### Design Criteria

Design criteria for the alternatives are based on PennDOT Publication 13M Design Manual 2 and AASHTO 2018 A Policy on Geometric Design of Highways and Streets. The Functional Classification used for each alternative is Rural Local Roads with a Typology of Rural Local Places. AASHTO 2018 criteria encourages a minimum design speed of 40 mph for local rural roads with an ADT of over 400, while Publication 13M lists 20-30 mph. Engineering judgement was used to follow Publication 13M and select a design speed of 30 mph for all alternatives due to the rolling terrain and winding nature of the alignments.

	Required by Publication 13M Criteria	Required by AASHTO 2018 Criteria
Lane Width <sup>1</sup>	9' to 11'	10'
Shoulder Width	2' to 8'	3'
Min. Vertical Grade	0.5%	N/A
Max. Superelevation	8.0%	8.0%
Max. Vertical Grade	10%	10%
Desired Operating Speed (Design Speed)	20-30 mph	40 mph

<sup>1</sup> 11' to 12' recommended for industrial districts.

**Table 1: Design Criteria for Alternative Access Roads - Rural Local Road with 30-mph design speed**

### Alternatives

Three alternatives were developed using the design criteria established above. The alternatives are located on the north side of SR 11/15 between Amity Hall and Old Trail Road and are designed to create connectivity between Old Trail Road and Amity Hall with controlled access points to SR 11/15 and SR 322.

Alternative 1 connects to Old Trail Road and is aligned to parallel SR 11/15. It is to the south of and at a lower elevation than the distribution center but higher than SR 11/15. This alternative utilizes Taylor Road as the primary access to SR 11/15. The

alignment continues west of Taylor Road, connecting to SR 11/15 and SR 322 at Amity Hall.

Alternative 2 connects to Old Trail Road and is aligned to parallel SR 11/15 at a higher elevation, north of the future distribution center. The location was chosen to minimize impacts to residences along SR 11/15 as well as minimize excavation compared to Alternative 1. The alignment continues west and connects to SR 11/15 and SR 322 at Amity Hall.

Alternative 3 connects to SR 11/15 at Amity Hall with access to SR 322. It is aligned to the north to utilize the future access to the proposed distribution center and to avoid impact to Taylor and Old Trail Road.

The initial concepts were developed using a roadway design program called Concept Station. This program allows for the calculation of excavation quantities at an accurate level for a planning study such as this, shown as brown (cut) and green (fill). The overall alignments for each alternative developed in Concept Station are shown in exhibits 13-15.

**Alternative 1:**

Alternative 1 begins connects to Old Trail Road before heading west where it connects with an improved intersection with SR 11/15 and ramp to 322 at Amity Hall (see exhibit 13). The purpose of this alternative is to eliminate the existing conflict point at the intersection of Old Trail Road and SR11/15 and to utilize Taylor Road as the primary access by proposing a new jug handle to replace the existing intersection. This alternative was aligned along the south side of the proposed distribution center property staying lower in elevation to achieve flatter vertical grades, to minimize potential environmental impact to aquatic resources, and to minimize project cost.

A comparison between the required design criteria and the provided design criteria can be found in Table 2. The estimated cost for Alternative 1 is \$9.2 M.

	<b>Required by Publication13M Criteria</b>	<b>Required by AASHTO 2018 Criteria</b>	<b>Provided by Design</b>
Lane Width	9' to 11'	10'	12'
Shoulder Width	2' to 8'	3'	6'
Min. Vertical Grade	0.5%	N/A	1.0%
Max. Superelevation	8.0%	8.0%	8.0%
Max. Vertical Grade	10%	10%	8.0%
Desired Operating Speed (Design Speed)	20-30 mph	40 mph	30 mph

**Table 2: Alternative 1 - Provided Design Criteria**



The alignment is approximately 1.63 miles long and consists of four horizontal curves (R1 = 500-ft, R2 = 500-ft, R3 = 500-ft, R4 = 235-ft). The proposed vertical alignment consists of four crest curves, two sag curves, a maximum longitudinal slope of 8.0%, and a minimum longitudinal slope of 1.0%. The geometry of the vertical alignment was designed to follow as closely to the existing ground as possible, while achieving reasonable grades to minimize the limits of disturbance and cost of the project.

**Alternative 2:**

Alternative 2 connects to Old Trail Road and turns north before heading west where it connects with an improved intersection and ramp to 322 at Amity Hall (see exhibit 14). The intent of this alternative is to regulate future truck traffic to the proposed alternative, avoid major improvements to Taylor Road, and eliminate conflicts on SR11/15 by providing access through a new proposed jug handle to replace the intersection of Old Trail Road and SR 11/15.

This alternative was aligned along the north side of the proposed distribution center, staying higher in elevation to achieve minimized impact to residential areas.

The alignment is approximately 2.1 miles long and consists of six horizontal curves, each with a radius of 235.0-ft. The proposed vertical alignment consists of five crest curves, four sag curves, a maximum longitudinal grade of 7.0%, and a minimum longitudinal slope of 1.0%. The geometry of the vertical alignment was designed to follow as closely to the existing ground as possible, while achieving reasonable grades to minimize the limits of disturbance and cost of the project.

A comparison between the required design criteria and the provided design criteria can be found in Table 3 below. The estimated cost for Alternative 2 is \$13.8 M.

	<b>Required by Publication 13M Criteria</b>	<b>Required by AASHTO 2018 Criteria</b>	<b>Provided by Design</b>
Lane Width	9' to 11'	10'	12'
Shoulder Width	2' to 8'	3'	6'
Min. Vertical Grade	0.5%	N/A	1.0%
Max. Superelevation	8.0%	8.0%	8.0%
Max. Vertical Grade	10%	10%	7.0%
Desired Operating Speed (Design Speed)	20-30 mph	40 mph	30 mph

**Table 3: Alternative 2 - Provided Design Criteria**

**Alternative 3:**

Alternative 3 begins connected with an improved intersection and ramp to 322 at Amity Hall before heading north and ending at the most easterly distribution facility, following the proposed access for the distribution center (see exhibit 15). The intent of this alternative is to showcase a simplified option that fully utilizes the proposed access to the distribution center and minimize limits of disturbance and project cost.

This alternative was aligned to match the future proposed distribution center’s access and alignment and offer an upgraded single point of access with ramp to 322 at Amity Hall.

The alignment is approximately 1.25 miles long and consists of five horizontal curves (R1 = 235-ft, R2 = 500-ft, R3 = 500-ft, R4 = 250-ft, and R5 = 250-ft.) The proposed vertical alignment consists of two crest curves, one sag curve, a maximum longitudinal grade of 7.0%, and a minimal longitudinal grade of 1.0%. The geometry of the vertical alignment was developed to follow as closely to existing ground as possible, while achieving reasonable grades to minimize the limits of disturbance and cost of the project.

A comparison between the required design criteria and the provided design criteria can be found in Table 4 below. The estimated cost for Alternative 3 is \$7.4 M.

	<b>Required by Publication13M Criteria</b>	<b>Required by AASHTO 2018 Criteria</b>	<b>Provided by Design</b>
Lane Width	9’ to 11’	10’	12’
Shoulder Width	2’ to 8’	3’	6’
Min. Vertical Grade	0.5%	N/A	1.0%
Max. Superelevation	8.0%	8.0%	8.0%
Max. Vertical Grade	10%	10%	7.0%
Desired Operating Speed (Design Speed)	20-30 mph	40 mph	30 mph

**Table 4: Alternative 3 - Provided Design Criteria**

**Evaluation**

The driving factors used in the evaluation of each alternative are the limits of disturbance, impact to residential property, and overall safety improvement. Table 5, below, documents the pros and cons of each alternative.

ALT	PROS	CONS	COST
<b>1</b>	<ul style="list-style-type: none"> <li>• Terminates existing intersection at Old Trail Road</li> <li>• Offers potential for improved access to church</li> <li>• Shorter alignment (1.6 miles)</li> <li>• Overall flatter grades</li> </ul>	<ul style="list-style-type: none"> <li>• Increased impact to residential property</li> <li>• Increased potential environmental impact</li> <li>• Major improvements to Taylor RD</li> <li>• Truck traffic on Taylor RD</li> </ul>	<ul style="list-style-type: none"> <li>• \$9.2 M</li> </ul>
<b>2</b>	<ul style="list-style-type: none"> <li>• Terminates intersection at Old Trail Road</li> <li>• Offers potential for improved access to church</li> <li>• Minimal improvements to Taylor Road</li> <li>• Discourages truck traffic on Taylor Road</li> <li>• Decreased impact to residential property</li> </ul>	<ul style="list-style-type: none"> <li>• R/W acquisition</li> <li>• Increased earth disturbance</li> </ul>	<ul style="list-style-type: none"> <li>• \$13.8 M</li> </ul>
<b>3</b>	<ul style="list-style-type: none"> <li>• Least potential environmental impact</li> <li>• Least impact on residential property</li> <li>• Most cost efficient</li> </ul>	<ul style="list-style-type: none"> <li>• Single point of access</li> <li>• No safety improvements along SR 11/15</li> </ul>	<ul style="list-style-type: none"> <li>• \$7.4 M</li> </ul>

**Table 5: Pros and Cons for Alternative Access Roads**

### **Alternatives Summary**

---

Alternative 2 is the preferred alternative due to the maximized safety improvements along SR 11/15, minimized potential environmental impact, decreased impact on residential property, and minimum impact to Taylor Road. This alternative was developed in further detail and is shown as exhibit 16.

Alternative 1 was dismissed due to the potential environmental features that would be affected by this alternative. In addition, the impact on residential property associated with the alignment is undesirable. Watts Township also commented that encouraging truck traffic on Taylor Road resulting from future development would be undesirable.

Alternative 3 was dismissed due to the repercussions of a single access point and lack of safety improvements along SR 11/15.

If this alternative moves forward, future ownership of roadway would need to be determined. It is likely that Watts Township would need to take on that ownership.

### **Other Considerations**

---

Note that median barrier along SR 11/15 should be considered in this area in the future. The concepts and jug handles provided as part of this report would allow median barrier to be installed; however, additional jug handles, and evaluation of access further north would be necessary.

Preliminary jug handle possibilities are shown on Exhibit 16.

BACKGROUND IMAGERY PROVIDED BY PASDA



LEGEND



- INDICATES CUT/FILL  
EXCAVATION

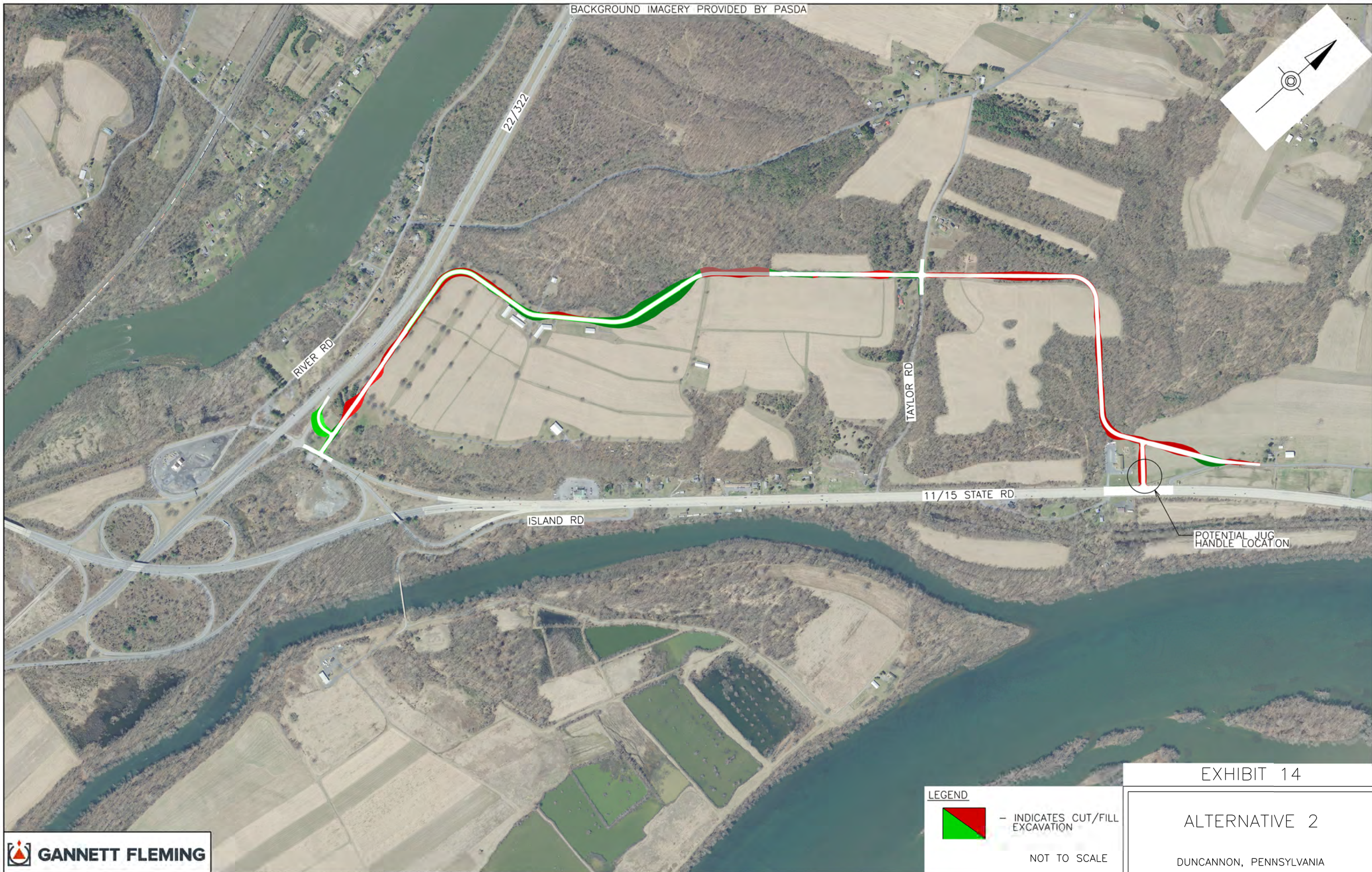
NOT TO SCALE

EXHIBIT 13

ALTERNATIVE 1

DUNCANNON, PENNSYLVANIA

BACKGROUND IMAGERY PROVIDED BY PASDA



LEGEND



- INDICATES CUT/FILL EXCAVATION

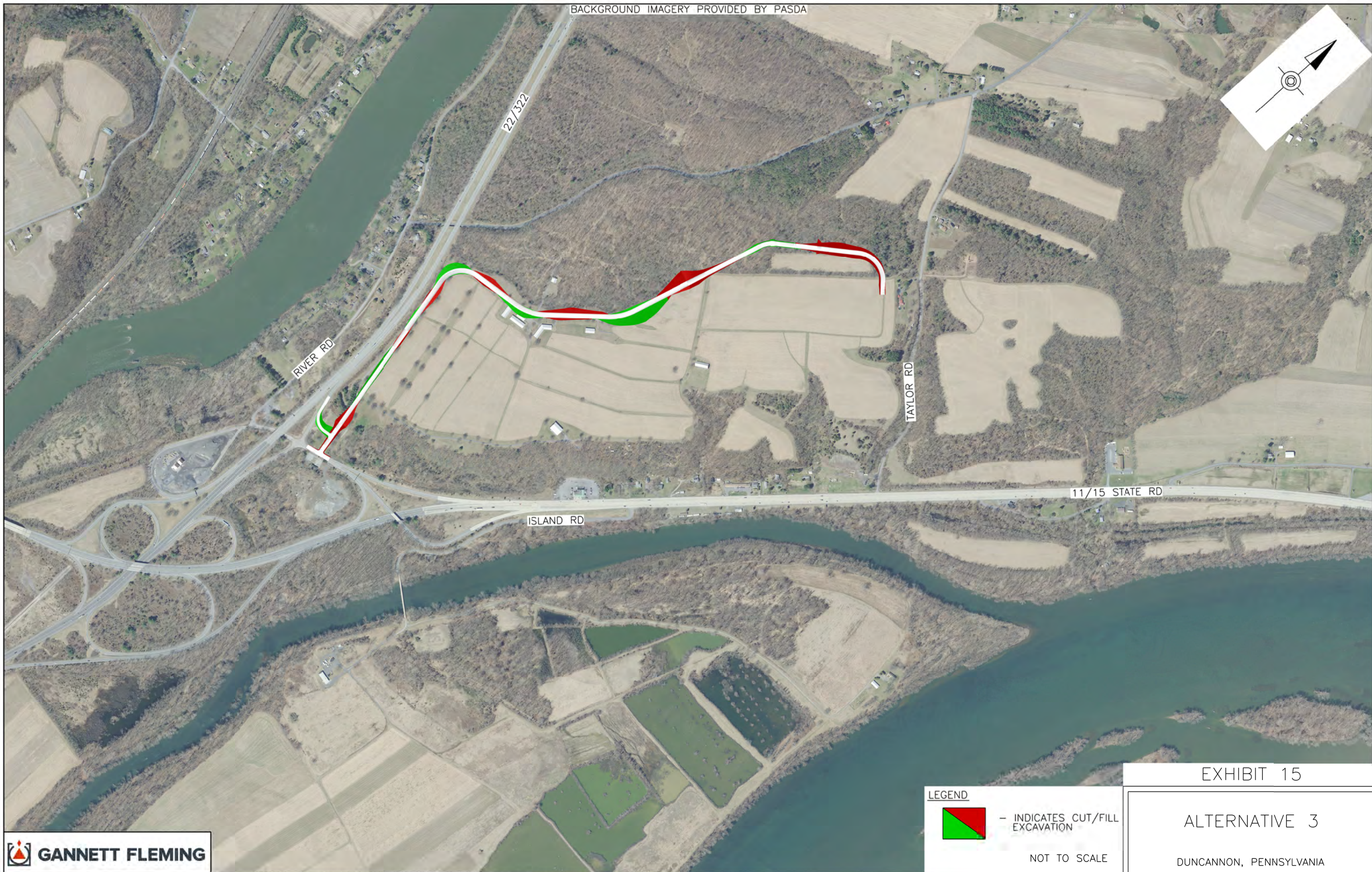
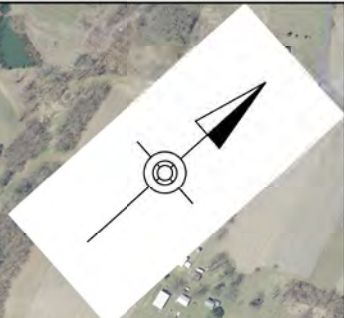
NOT TO SCALE

EXHIBIT 14

ALTERNATIVE 2

DUNCANNON, PENNSYLVANIA

BACKGROUND IMAGERY PROVIDED BY PASDA



LEGEND



- INDICATES CUT/FILL  
EXCAVATION

NOT TO SCALE

EXHIBIT 15

ALTERNATIVE 3

DUNCANNON, PENNSYLVANIA

BACKGROUND IMAGERY PROVIDED BY PASDA



POTENTIAL JUG HANDLE LOCATION

SHEET 2 OF 2

ISLAND RD

11/15 STATE RD

POTENTIAL JUG HANDLE LOCATION

POTENTIAL JUG HANDLE LOCATION

POTENTIAL JUG HANDLE LOCATION



NOT TO SCALE

1/2

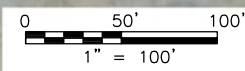
EXHIBIT 16  
ALTERNATIVE 2  
OVERALL  
CONCEPT DESIGN  
DUNCANNON, PENNSYLVANIA



BACKGROUND IMAGERY PROVIDED BY PASDA



FILENAME: pw://gfnet-pw.bentley.com:gfnet-pw-01/Documents/Projects/67466/SHEETS/RDWAY/ROAD/067466\_Duncannon\_RDPN56.dgn  
PLOTTED: 9/27/2023 3:12:18 PM



2/2

EXHIBIT 16  
ALTERNATIVE 2  
CONCEPT DESIGN  
DUNCANNON, PENNSYLVANIA

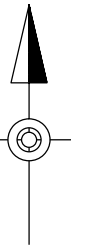
## Park and Ride Evaluation

This section identifies a total of three potential park and ride locations that encompasses the studied area for part 2 in Watts Township. The locations are listed below along with a map provided as exhibit 17 on the following pages.

Location 1 and 2 – Just north of the SR 22/322 and SR 11/15 interchange. One park and ride is provided on each side of SR 22/322. The estimated cost for the western option is \$385,000; the estimated cost for the eastern option is \$420,000, each excluding right of way.

Location 3 – Along SR 11/15 and adjacent to Island Road. This is located adjacent to the Ranch House. The estimated cost is approximately \$150,000 excluding right of way.

BACKGROUND IMAGERY PROVIDED BY PASDA

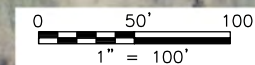


RIVER RD

22/322

POSSIBLE IF RAMP IS RELOCATED

11/15 RAMPS



1/2

EXHIBIT 17  
22/322 & 11/15  
INTERCHANGE  
PARK AND RIDE  
LOCATION  
DUNCANNON, PENNSYLVANIA

BACKGROUND IMAGERY PROVIDED BY PASDA

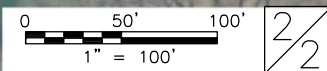
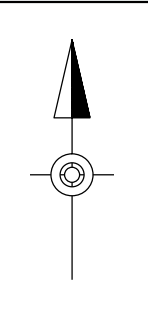


EXHIBIT 17

ISLAND ROAD  
PARK AND RIDE  
LOCATION

DUNCANNON, PENNSYLVANIA