TROLLEY MODERNIZATION

ROUTE 11 AND ROUTE 13: DELAWARE COUNTY ALTERNATIVES

JULY 2021

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REGIONAL
PLANNING COMMISSION

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SEPTA is preparing for a complete replacement of its trolley fleet, Trolley Modernization, which will fundamentally change the way SEPTA's eight trolley routes operate. New vehicles will trigger changes to the trolley system as a whole, including streetscape alterations, construction of accessible stations, and consolidation of existing stop locations. DVRPC has assisted SEPTA with Trolley Modernization analysis in several projects in recent years.

This project focuses on trolley operations in and around Darby Transportation Center including the two city trolley routes (11 and 13) that currently serve this area, as well as creating a new track to SEPTA's suburban trolley routes (101 and 102). Since 1995, Route 13 has provided limited service to Darby Transportation Center. This report examines the consequences of providing more consistent Route 13 service to Darby Transportation Center, or ending all Route 13 passenger service at Yeadon Loop, as most Route 13 trips do today.

Based on a review of existing documents and interviews with subject matter experts in eight SEPTA departments, we find ***substantial challenges to providing all-day Route 13 service to Darby***, including a limited ridership base and significant capital improvements. We also find that ***a connection between Route 102's endpoint at Sharon Hill and Darby Transportation Center is feasible***, offering opportunities for a new passenger service connection between Philadelphia and eastern Delaware County. We conclude by itemizing tasks for future studies, including:

+ ***Route 102 Ridership and Transfer Study***
+ ***Operations Study for Main Street/Chester Pike/North 9th Street Intersection***
+ ***On-street Station Location Study***
+ ***Darby Transportation Center Redesign***

Figure 1: A graphic rendering of a modernized SEPTA trolley station

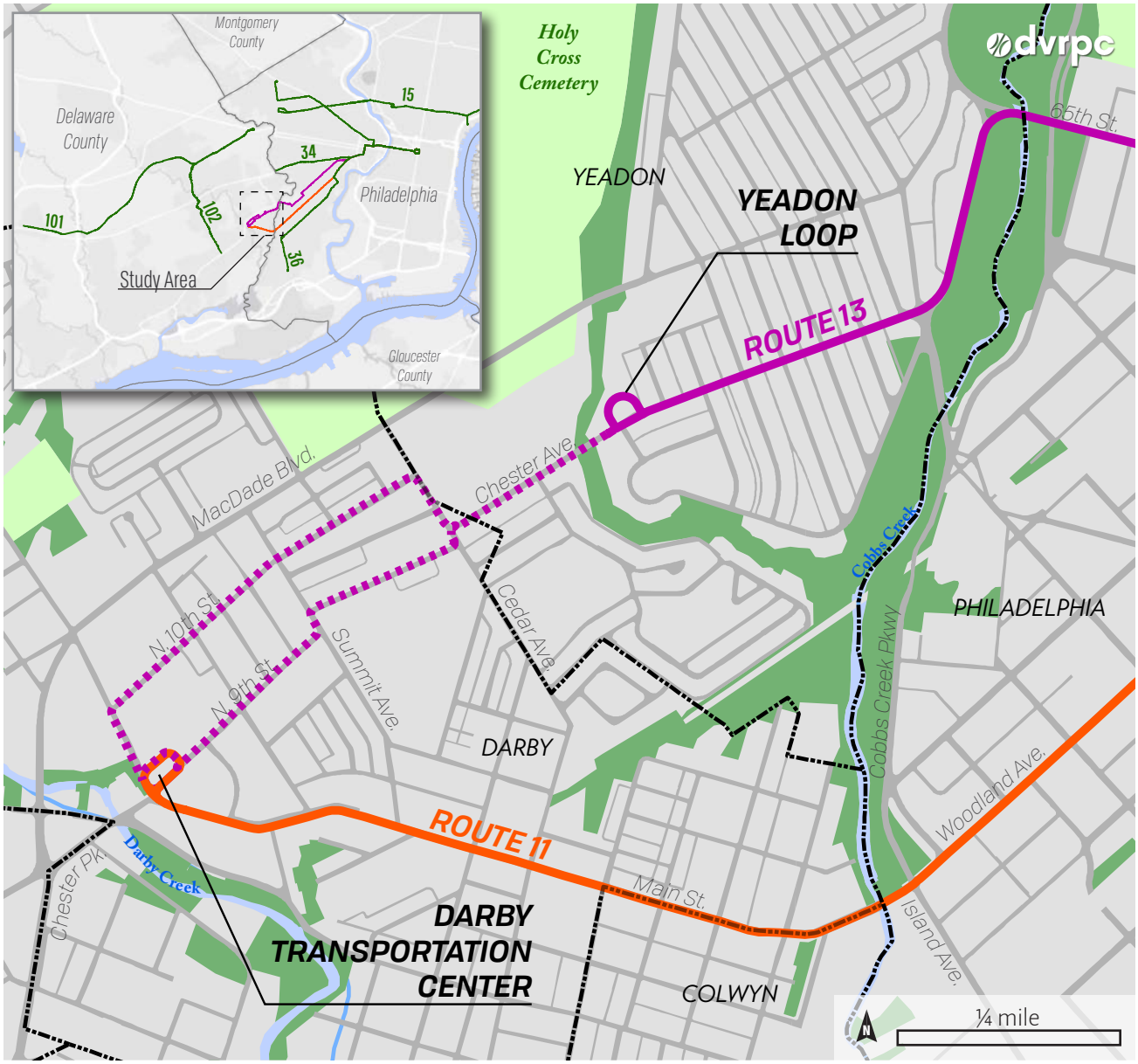

Figure 2: Study area map

Project Introduction

This project focuses on the portions of trolley Routes 11 and 13 in Delaware County. These two routes connect Center City Philadelphia, providing subway access to the region's economic and transportation hub, and Darby Transportation Center (DTC), in Darby Borough, running roughly parallel through West and Southwest Philadelphia.

Figure 3: Route 13 outbound pull-in at North 9th & Main Streets

Route 11 passes through Darby and Colwyn Boroughs en route to Philadelphia, and Route 13 passes through Darby and Yeadon Boroughs en route to Philadelphia. DTC offers connections between trolley Routes 11 and 13 and bus Routes 113, 114, and 115, three of SEPTA's most popular suburban bus routes. This makes DTC a critical connection between SEPTA's urban and suburban transit networks, with 4,370 passengers boarding or alighting on an average weekday among the bus and trolley stops.

Trolley Route 13 has several operational qualities that set it apart from SEPTA's other trolley routes, requiring special planning attention. Track configuration prevents SEPTA from providing round-trip service between Darby Transportation Center and Center City Philadelphia. As a result, the majority of Route 13 trips terminate at the Yeadon Loop, in Yeadon Borough. The rest end their passenger service on Main Street, just outside DTC before continuing on to the Elmwood Depot storage and maintenance facility (see ***Figure 3***). Route 13 also runs on parallel one-way streets through Darby Borough.

DTC is one of only a few locations where SEPTA's City Transit Division trolley routes (Routes 10, 11, 13, 15, 34, and 36) operate near SEPTA's Suburban Transit Division trolley routes (Routes 101 and 102). Today, the City and Suburban trolley systems have separate storage and maintenance facilities, which are inaccessible to each other because there are no trolley tracks connecting them. With Trolley Modernization, SEPTA seeks to consolidate its maintenance and storage facilities for trolley vehicles into a single location. This would enable maintenance efficiencies, and would allow vehicles to be used interchangeably on the City and Suburban systems. DTC is just over one mile from the MacDade Boulevard and Sharon Hill Stations on Route 102, making the City/Suburban connection relevant for this project.

Project Scope

SEPTA asked the DVRPC project team to document existing operations for Routes 11 and 13 in Delaware County in preparation for Trolley Modernization. Specifically, we were asked to investigate property access or ownership issues in the study area, track and switch constraints, and right-of-way limitations. In addition, we were asked to do a preliminary evaluation of a track connection between the city and suburban trolley systems so that they can share maintenance facilities.

Based on existing opportunities and constraints, this report investigates the following topics:

+ Potential alignments and service patterns for Route 13 in Delaware County
+ Potential stop locations for modern trolley service on Routes 11 and 13 in Delaware County
+ End-of-line needs for Routes 11 and 13
+ Needs and potential flaws for a track connection between Route 102 and Route 11 or 13

For each of these topics, the project team reviewed documents and interviewed SEPTA staff to understand the needs and constraints that will affect Trolley Modernization. With this information, we recommend a series of next steps to make final technical determinations about trolley operations within the study area, and note the appropriate stakeholders to consult in the process (see "Next Steps" on page 29).

Figure 4: A passenger approaches a Route 11 trolley at Darby Transportation Center

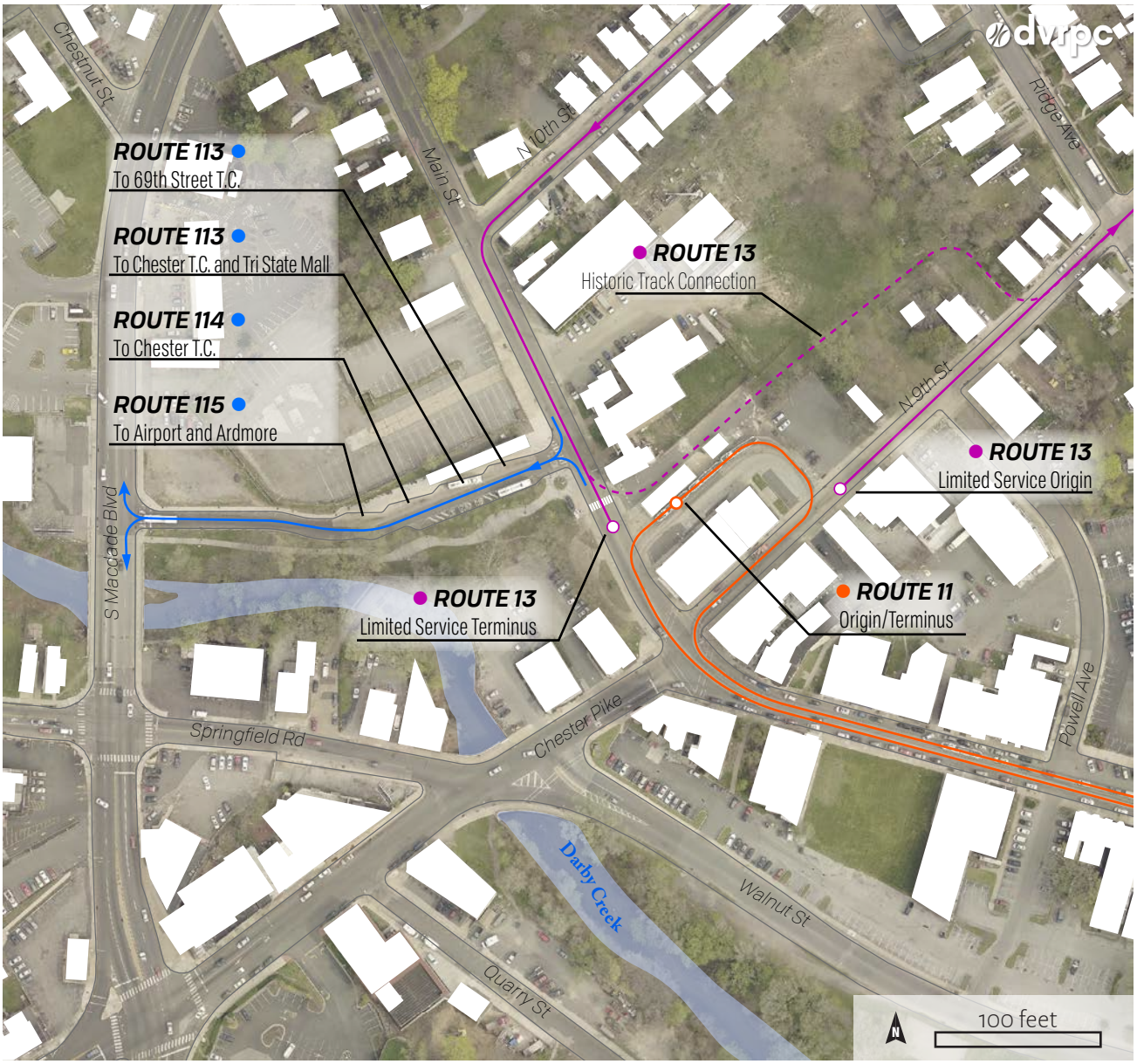

Figure 5: Darby Transportation Center aerial view
Source: Aerial imagery, building footprints: City of Philadelphia 2017

Darby Transportation Center

Darby Transportation Center (DTC) is the eighth busiest transportation center in SEPTA's system, and is served by two trolley routes and three bus routes. DTC functions as a key point of connection between SEPTA's city and suburban transit networks.

DTC is located at the corner of Main Street and North 9th Street in Darby Borough and is composed of a trolley loop east of Main Street and a busway to the west. The two parts of the transportation center are connected by a midblock, uncontrolled pedestrian crossing.

Figure 6: Darby Transportation Center, SEPTA-owned parcels
Source: Aerial imagery, building footprints: City of Philadelphia 2017; Parcel data: Delaware County, 2019

The trolley loop is the end-of-line layover location for Trolley Route 11. It contains a large, partially enclosed shelter for customers and a small building with bathrooms for operators.

SEPTA owns the land on which the current Route 11 trolley loop sits and the land under the busway and waiting facilities across Main Street. SEPTA also owns several parcels on the same block as the trolley loop, including a large vacant parcel northwest of the loop and a parcel facing North 9th Street which historically made up the right-of-way for Route 13 trolleys as they began their inbound trips from DTC (See ***Figure 6***).

Figure 7: Darby Transportation Center trolley loop and platform

Figure 8: Trolley entrance to DTC loop

Figure 9: DTC busway viewed from across Main Street

Route 11 enters the trolley loop from the east, turning right from Main Street onto North 9th Street, then left into a SEPTA-only entrance using a switch approximately 200 feet northeast of the 9th Street/ Main Street intersection (see ***Figure 8***). Once in the loop, vehicles make a 90 degree turn before laying over in front of the shelter area. The loop has two parallel sets of tracks that allow trolley vehicles to layover next to one another.

SEPTA provides Route 13 service to DTC only on a limited basis. Route 13 follows a split, one-way alignment on North 9th Street (inbound to Philadelphia) and North 10th Street (outbound to Darby) before meeting at Cedar and Chester Avenues. The majority of Route 13 trips end at Yeadon and do not serve DTC.

Figure 10: Yeadon Loop

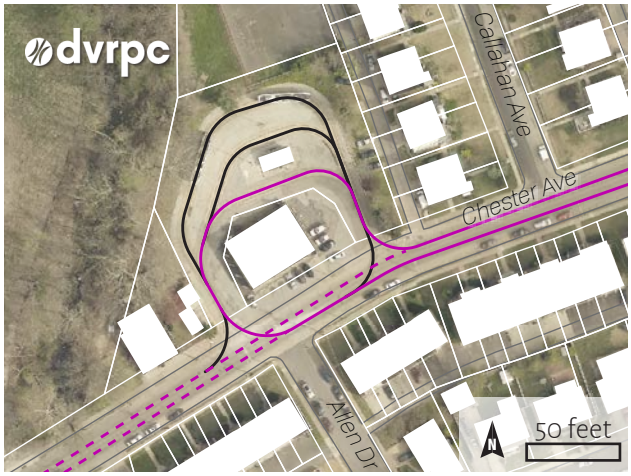

Figure 11: Yeadon Loop aerial view
Source: Aerial imagery, building footprints: City of Philadelphia 2017; Parcel data: Delaware County, 2019

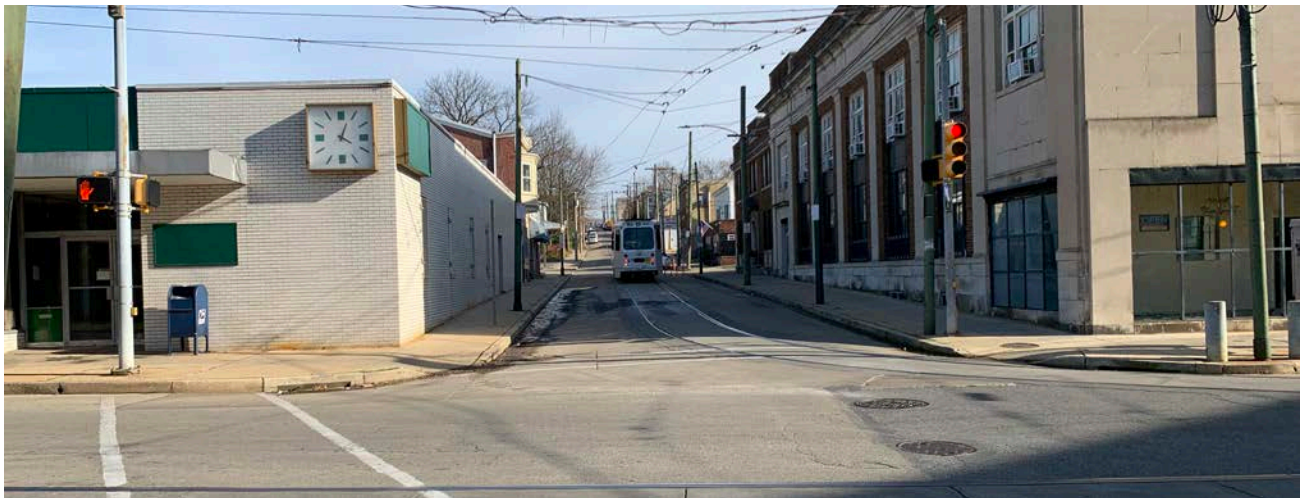

Figure 12: A trolley prepares to enter the DTC trolley loop from North 9th Street

Round-trip Route 13 service to the DTC loop is not currently feasible because there are no usable trolley tracks connecting Route 13's tracks and the loop property. As a result, Route 13 trips ending at Darby Transportation Center stop on Main Street, then continue along Main Street (without passengers) to SEPTA's Elmwood Depot facility, where they are taken out of service.

Similarly, Route 13 trips beginning at Darby arrive from the Elmwood Depot (without passengers), turn onto North 9th Street, then proceed towards Philadelphia. The first passenger stop for Philadelphia-bound Route 13 trips from Darby is at North 9th Street and Ridge Avenue.

Like all stops on SEPTA's subway-surface trolley routes, the DTC trolley stops and the other on-street trolley stops in this project's study area are not ADA-compliant.

Figure 13: Darby Transportation Center, circa 1972
Source: SEPTA

Figure 14: Unused rail for former Route 13 track connection

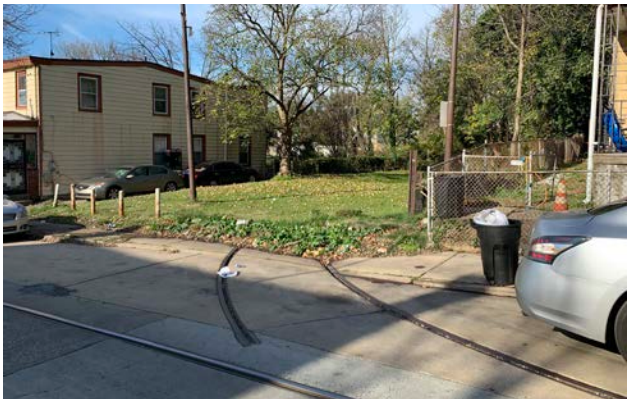

Figure 15: Unused Route 13 tracks enter North 9th Street

Until 1995, there was a switch and additional track area that made round-trip Route 13 service possible; however, these were removed due to low ridership and operator difficulty in making the turning movement at the switch (see ***Figure 13***, with Route 13 trolleys at left, Route 11 trolley at right). At the time, Route 13 trolleys used a single track that ran from the DTC loop northbound through a now-vacant SEPTA-owned property, and entered North 9th Street approximately 500 feet northeast of Main Street.

In 2010, SEPTA performed an internal feasibility study and cost estimate for reestablishing regular Route 13 round-trip service to DTC. That study found that a proposed new track switch at the corner of Main and North 9th streets—which would allow Route 13 trolleys to use the same loop as Route 11 trolleys—would be infeasible due to the acuteness of that turn's angle. The 2010 study also estimated the cost to reestablish the track and switch at $605,000 (in 2010 dollars).

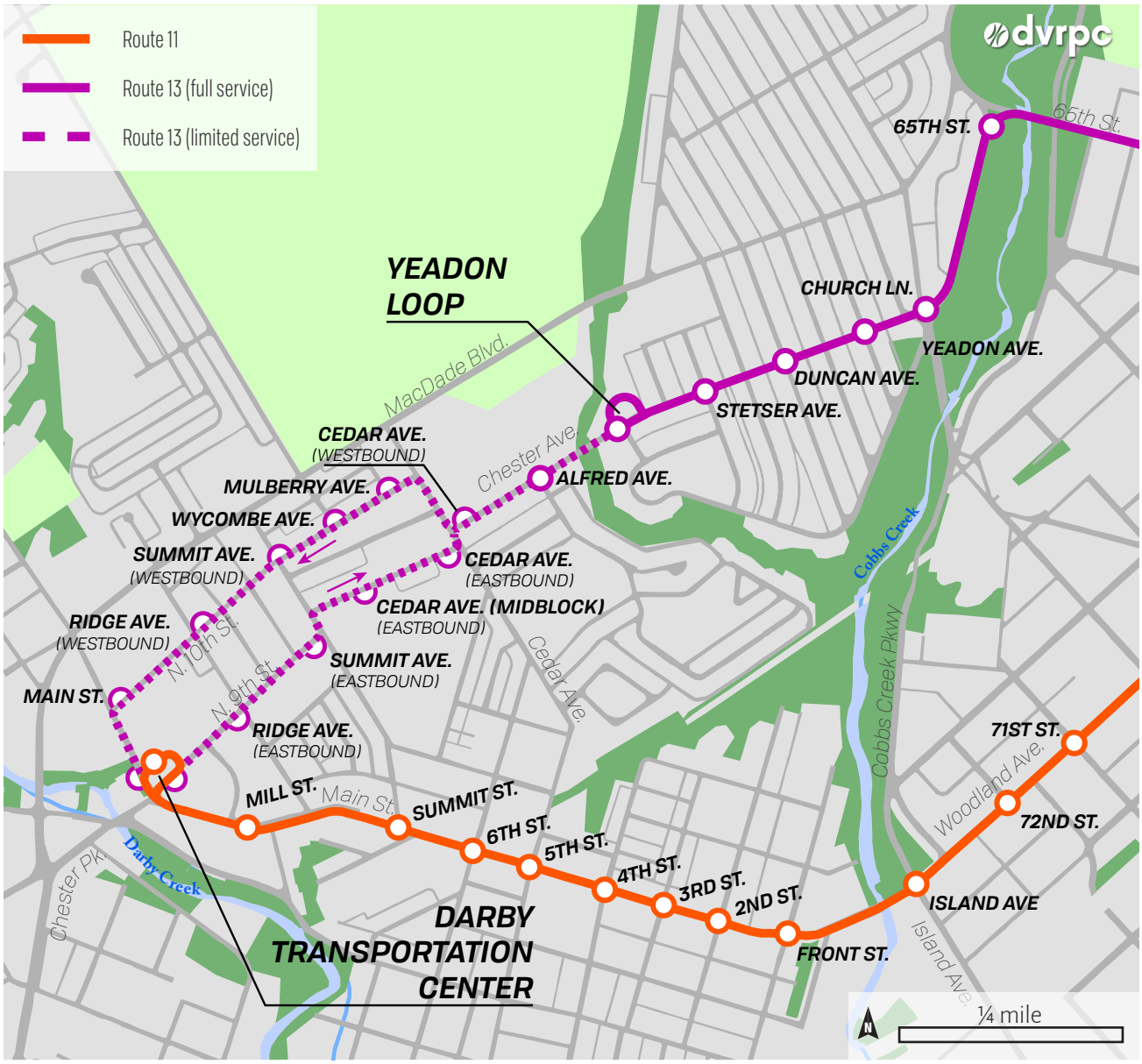

Figure 16: Trolley stop program

Trolley Service Profile

Both Trolley Routes 11 and 13 are part of SEPTA's 15-minute transit network, routes that provide service every 15 minutes or less, 15 hours per day (6:00 a.m. to 9:00 p.m.), 5 days per week (Monday through Friday).

During peak travel periods, the routes see even higher frequency service, with peak service as frequent as every four minutes on portions of Route 13.

Between Darby Transportation Center and Yeadon Loop, however, Route 13 provides only limited service as vehicles enter or exit service *en route* to or from Elmwood Depot.

Limited service trips on Route 13 are not spaced evenly throughout the day. Weekday limited service trips eastbound from Darby to Center City occur mostly between 4:30 a.m. and 7:30 a.m., and again between 2:30 p.m. and 4:00 p.m. Weekday limited service trips westbound from Center City to Darby occur mostly between 9:15 a.m. and 10:15 a.m. and again between 5:15 p:m. and 9:00 p.m.

While these trips are predictable in the sense that they are scheduled daily, they are not scheduled to meet peak travel demand periods, and would not be predictable to someone unaccustomed to riding Route 13. These trips' primary function is best understood as operational support. Passenger service on these trips is incidental.

Table 1: Route 13 Service Patterns

Route and Pattern		Weekday Trips *per Direction*	Saturday Trips *per Direction*	Sunday Trips *per Direction*
11	All Service	**244**	**146**	**124**
13	All Service	**149**	**78**	**62**
	To/From Yeadon Only	***121***	***66***	***52***
	To/From Darby Transportation Center	***28***	***12***	***10***

Note:

Service frequency and ridership information is discussed here in pre-COVID-19 pandemic terms. While the ridership implications of the pandemic are uncertain, we believe this route analysis is best performed using more robust pre-pandemic data. We also note that Trolley Modernization's multi-year time horizon may offer a chance for recent ridership declines to reverse.

Indicators of Potential Disadvantage and Access to Essential Services

In Delaware County, 22 percent of individuals are under 18 years of age; compared to 33 percent in this census tract. Percentage of youth is used as an indicator because higher percentages are often correlated with economic disadvantage and youth are seen as a particularly vulnerable group that require more specialized resources. Ninety-four percent of residents identify as one or more racial minority compared to the county average of about 31 percent. Fifty-two percent are low-income (meaning residents live in households with an income below 200 percent of the national poverty level), more than twice the county average of 23 percent. More than 40 percent of individuals living in this area commute to work using public transportation (see *Figure 17*).

Based on these statistics, we can ascertain that this area, which is home to several vulnerable groups, may benefit from improved transit access and facilities. The high poverty rate and number of users commuting via transit from this area suggests that not all members of this community may have access to personal vehicles and may have children in tow. Changes to trolley service could provide more convenient and equitable access to essential services such as the grocery store and pharmacy in the Yeadon Shopping Center at the corner of Chester and Cedar Avenues, the Darby Borough Recreation Center at MacDade and Ridge, and the Darby Free Library at 10th and Main Streets.

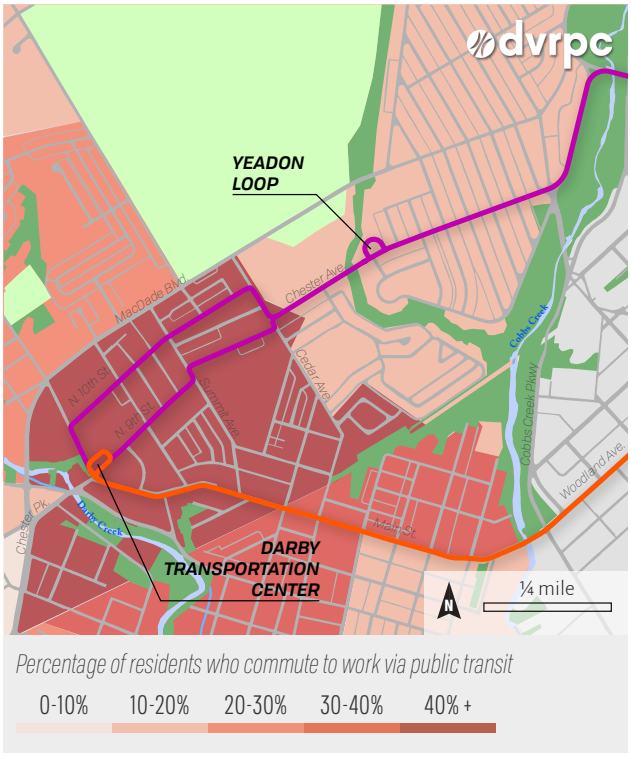

Figure 17: Commuters using public transit
Source: US Census Bureau ACS 2018 5-year estimates

Figure 18: A Route 13 trolley enters Yeadon Loop

Operational Considerations

DVRPC took part in a series of Subject Matter Expert (SME) interviews with SEPTA staff from several departments with a role in Trolley Modernization. Interviewees included staff from the following SEPTA departments:

+ Bridges and Buildings
+ Civil Engineering
+ Operations
+ Project Innovation
+ Power
+ Service Planning
+ Track

These interviews helped DVRPC staff to better understand the existing conditions of infrastructure at and around DTC. These interviews also helped staff to highlight possibilities and constraints associated with returning Route 13 service to DTC trolley loop as well as extending the Route 102 to create a track connection with Routes 11 and 13. The following sections summarize SEPTA staff members' comments on these potential issues along with additional explanation from the DVRPC project team.

Ridership

As an end-of-line station with several transfer opportunities, Darby Transportation Center's ridership is very high relative to other SEPTA trolley stops. With nearly 2,600 trolley boards and alights per weekday, its ridership is the second highest among aboveground trolley stops.

Ridership on Route 13 is significantly lower on the portion of the route that receives limited service. This is to be expected, given how infrequently Route 13 serves each stop, but ridership at these stops is low even by this standard. Comparing Route 13 stops to Route 11 trips on a per-trip basis is instructive. Excluding DTC, no Route 13 limited-service stop serves more than one boarding or alighting passenger per trip.

Route 13 limited-service stops, on average, see 0.54 boards or alights per trip on an average weekday, while Route 11 stops in Delaware County see 2.03 boards or alights per trip on an average weekday. Across SEPTA's system, surface stops serve 1.62 passengers per trip on an average weekday.

Table 2: Route 11 Weekday Ridership by Station

Stop	Eastbound		Westbound		Total Ridership
	Boards	Alights	Boards	Alights	
Darby Transportation Center	1563	2	0	965	2530
Mill St/Powell St	42	6	5	86	91
Summit St	40	13	7	85	145
6th St	87	48	18	124	277
5th St	137	43	23	129	332
4th St	129	45	20	134	328
3rd St	118	31	16	130	295
2nd St	63	19	10	53	145
Front St	59	23	11	66	159
Island Av	117	69	53	109	348
72nd St	56	16	9	72	153
71st St	117	33	20	125	295

Source: SEPTA, Spring 2018

Table 3: Route 13 Weekday Ridership by Station

	Stop	Eastbound		Westbound		Total Ridership
		Boards	Alights	Boards	Alights	
	Darby Transportation Center	49	0	0	5	54
Westbound via 10th St	Main St	Stops westbound only		1	25	26
	Ridge Av			0	5	5
	Summit St			1	12	13
	Wycombe Av			1	11	12
	Mulberry Av			0	5	5
	Cedar Av			1	27	28
Eastbound via 9th St	Ridge Av	12	0	Stops eastbound only		12
	Summit St	14	1			15
	Summit St (Midblock)	1	0			1
	Cedar Av	15	2			17
	Alfred Av	16	1	2	25	44
	Yeadon Loop	376	7	7	47	437
	Stetser Av	25	1	1	25	52
	Duncan Av	63	4	5	90	162
	Yeadon Av	1	1	4	54	60
	Church LA	223	44	16	185	468
	65th St	62	5	5	85	157

Source: SEPTA, Spring 2018

The bulk of riders in the study area use Route 11 to begin or end their trip. Many others transfer between Route 11 and one of the three bus routes (113, 114, or 115) that stop in the bus loop portion of DTC. These bus routes are important sources of mobility within Delaware County, providing access to 69th Street Transportation Center, Chester Transportation Center, and Delaware County Community College, among other destinations.

A substantially smaller number of riders use Route 13 to begin or end their trip or transfer at DTC.

Table 4: Route 11 Transfers at Darby Transportation Center

From Route	To Route	Average Daily Transfers
11	113	112
11	114	47
11	115	21
11	13	2
113	11	143
114	11	62
115	11	46
Total transfer activity between Route 11 and all other DTC routes:		433

Source: SEPTA, Spring 2019

Table 5: Route 13 Transfers at Darby Transportation Center

From Route	To Route	Average Daily Transfers
13	113	8
13	114	2
13	115	2
13	11	2
113	13	1
114	13	1
115	13	1
Total transfer activity between Route 13 and all other DTC routes:		17

Source: SEPTA, Spring 2019

Close Clearance and Parking Removal

Close clearance, when trolleys operate close to parked vehicles or other objects, is the most important everyday hazard to smooth trolley operations. SEPTA staff report that all of Routes 11 and 13 in Delaware County are considered close clearance, with trolleys routinely operating within 1–2 feet of parked or idling vehicles. Stopped vehicles can sometimes halt trolley service entirely if they block a trolley's path.

Close clearance issues are especially problematic where trolleys turn, as drivers parking cars cannot always estimate the dynamic envelope of a trolley as it turns. In some locations, such as the intersection of 65th Street and Chester Avenue, close clearance prevents two trolleys traveling in opposite directions from passing each other as they turn because the sets of tracks are too close together.

If left unmitigated, these close clearance issues could become worse under Trolley Modernization, as trolley operators will be in an enclosed cab and not as easily able to step out and check clearance distances. With this in mind, SEPTA operations staff recommend that any opportunities to remove on-street parking should be built into any restoration of Route 13 service to Darby. Fixing close clearance issues would also improve reliability for passengers in either scenario, likely attracting new riders.

Parking removal would also be necessary for any modern trolley stations built between Yeadon Loop and DTC. The footprint of a modern trolley station would use approximately 120 linear feet of a parking lane, meaning 5–6 parking spaces would be removed per station platform[1]. If modern trolley stations were constructed every 1,000 to 1,500 feet—in line with station spacing on modern US light rail and streetcar systems—we would expect SEPTA to build 5–7 modern trolley station platforms between Yeadon Loop and DTC, reducing the on-street parking supply by 25–42 spaces for stations alone.

The properties surrounding Route 13's path between Darby and Yeadon are mostly rowhouse or twin residences, very few of which have off-street parking spaces. It is reasonable to expect some amount of local resistance to removing parking for transit operations.

1 See DVRPC's *Modern Trolley Station Design Guide* (2017) for conceptual station designs and discussion of parking related trade-offs in Trolley Modernization.

Figure 19: A trolley waits for a driver to move a vehicle

Figure 20: Close clearance on North 9th Street

Operational Flexibility

Incidents such as disabled vehicles, severe weather, or other obstructions can strand trolleys on their routes, causing delays for passengers. SEPTA uses turnbacks (where a trolley can leave the street to reverse direction) and diversionary track (where trolleys can follow track off of a normal route, avoiding obstructions) to mitigate this issue. With an investment like Trolley Modernization, strategic track network changes may enable reliability improvements.

For Route 13, restoring regular service to DTC could create a redundant route from Darby into Philadelphia. Subject matter experts in SEPTA's Operations department reported to the project team that, before 1995, Route 13 ran to and from DTC at 30-minute intervals, and passengers appreciated the flexibility of two routes towards Center City. An alternate route from DTC to Philadelphia could also mitigate delays when Route 11 trolleys are blocked by CSX freight trains at 6th and Main Streets in Darby.

Creating a track connection between the City trolley routes and the Media/Sharon Hill lines could also allow for more efficient sharing of City and Suburban fleets. Today, trolleys used on city routes are stored, maintained, and repaired across three facilities, Woodland Shop, Elmwood Depot, and Callowhill Shop. Trolleys used on the Media/Sharon Hill lines are stored and partially maintained at 69th Street Transportation Center. Without a track connection between the city and suburban trolley routes, suburban trolleys must be transported to Woodland Shop on a flatbed truck when they need heavy repairs that cannot be performed at 69th Street. It is not feasible to transport 80-foot-long modern vehicles by truck in this way.

SEPTA's goal with Trolley Modernization is to purchase a vehicle that will be interoperable on the city and suburban systems. SEPTA is currently evaluating properties to be used as a consolidated maintenance and storage facility for both city and suburban trolleys.

A track connection between the city and suburban systems would not just make the necessary link to a single maintenance facility, it would offer greater flexibility. Trolleys could be allocated to any of SEPTA's eight routes to improve frequency or address delays, regardless of whether they are city or suburban routes.

Figure 21: Traffic waits as a CSX train crosses Main Street
Source: SEPTA

Figure 22: Route 102 tracks passing under CSX freight line

Power

Restoring regular Route 13 service to DTC would likely require upgrades to SEPTA's electrical infrastructure. SEPTA Power staff report that additional feeder cable and breakers would be necessary to power the line and the station facility.

If, in addition to Route 13 service restoration, a track connection was made to Route 102 at Darby, Power staff expect that a new substation would be necessary.

Flooding

Much of downtown Darby Borough is within a FEMA-designated floodplain of Darby Creek. Most of the DTC loop is in the 500-year floodplain, while the DTC bus facilities are mostly within the 100-year floodplain. A new substation at this location would need to be either flood rated or elevated above the floodplain.

In addition to concerns for future electrical facilities, flood risk also presents operational issues at DTC. Flood events can prevent trolleys or buses from using DTC in its current configuration, a topic that should be a key factor in any redesign of the DTC facility.

Likewise, flooding frequently disrupts service on Route 102 between MacDade Boulevard and Sharon Hill stations. Route 102's tracks here pass under the same CSX freight line that crosses Main Street in Darby Borough. To clear this underpass, the Route 102 tracks are lower than the surrounding area, and can become inundated during heavy rainfall.

SEPTA Operations and Civil Engineering staff recommend that, if it is not possible to successfully mitigate flood risk in this location, any new track connection to Route 102 should be sited with consideration for flood risk.

When considering the extension of the 102 along Chester Pike as a redundancy for the suburban lines, consideration should be given to whether flooding can be curtailed. If not possible to fix the flooding, it should be considered whether this regular inaccessibility disqualifies an extension of the 102 to DTC. Scenarios for extending Route 102 to Darby are presented in the Appendix of this report.

Figure 23: Trolleys at DTC

Alternatives

SEPTA provides frequent, all-day service on Route 11 to Darby Transportation Center, and frequent, all-day service on Route 13 to Yeadon Loop. Route 13 service to DTC is provided only on a limited basis. Existing Route 13 service to DTC is not timed to peak travel periods, nor is it frequent enough to be a reliable transportation option for Darby and Yeadon residents. In this section, we discuss two alternatives that address this shortcoming.

Alternative A proposes eliminating all Route 13 stops between Yeadon Loop and DTC. All Route 13 passenger service would end at Yeadon Loop, but SEPTA would continue to use the existing trolley tracks between Yeadon Loop and DTC for non-revenue operation, such as traveling to maintenance facilities.

Alternative B proposes restoring regular revenue service on Route 13 to DTC with every third trip beginning or ending at DTC. Several existing stops would be modernized between Yeadon Loop and DTC to provide ADA-compliant boarding, and DTC would itself be reconfigured to accommodate Route 13 vehicles.

A third alternative for Route 13, following MacDade Boulevard from 65th Street to DTC was considered but not developed for three reasons. First, the intersection of South 65th Street and MacDade Boulevard does not appear to be feasible for trolley turns. Second, this route would mean losing access to Yeadon Loop, which SEPTA staff report is critical for use as a turnback in either alternative. Last, a large part of this route would run alongside Holy Cross Cemetery, a ridership "dead zone."

We discuss the strengths and weaknesses of each alternative, but leave the decision over which alternative to pursue to SEPTA, to be made in consultation with local stakeholders. Costs of each alternative are discussed generally, but specific cost estimates will need to be identified in the future.

Modernized stop locations are proposed for Alternative B only. These stop locations are meant to provide an expectation of stop spacing under a realistic Trolley Modernization stop consolidation scenario. They are based on peer agency best practices for stop spacing and on a 2019 workshop where SEPTA staff and stakeholders from Delaware County, Darby and Yeadon Boroughs worked together to identify feasible modern station locations. They are not final proposals for stop locations. Stop consolidation is likely to happen on the full-service portions of Routes 11 and 13, but specific station siting will be determined in the future.

This section also discusses extending Route 102 from Sharon Hill to Darby to connect the City and Suburban trolley routes. This connection is not tied to either Alternative A or B, and would not exclude those options.

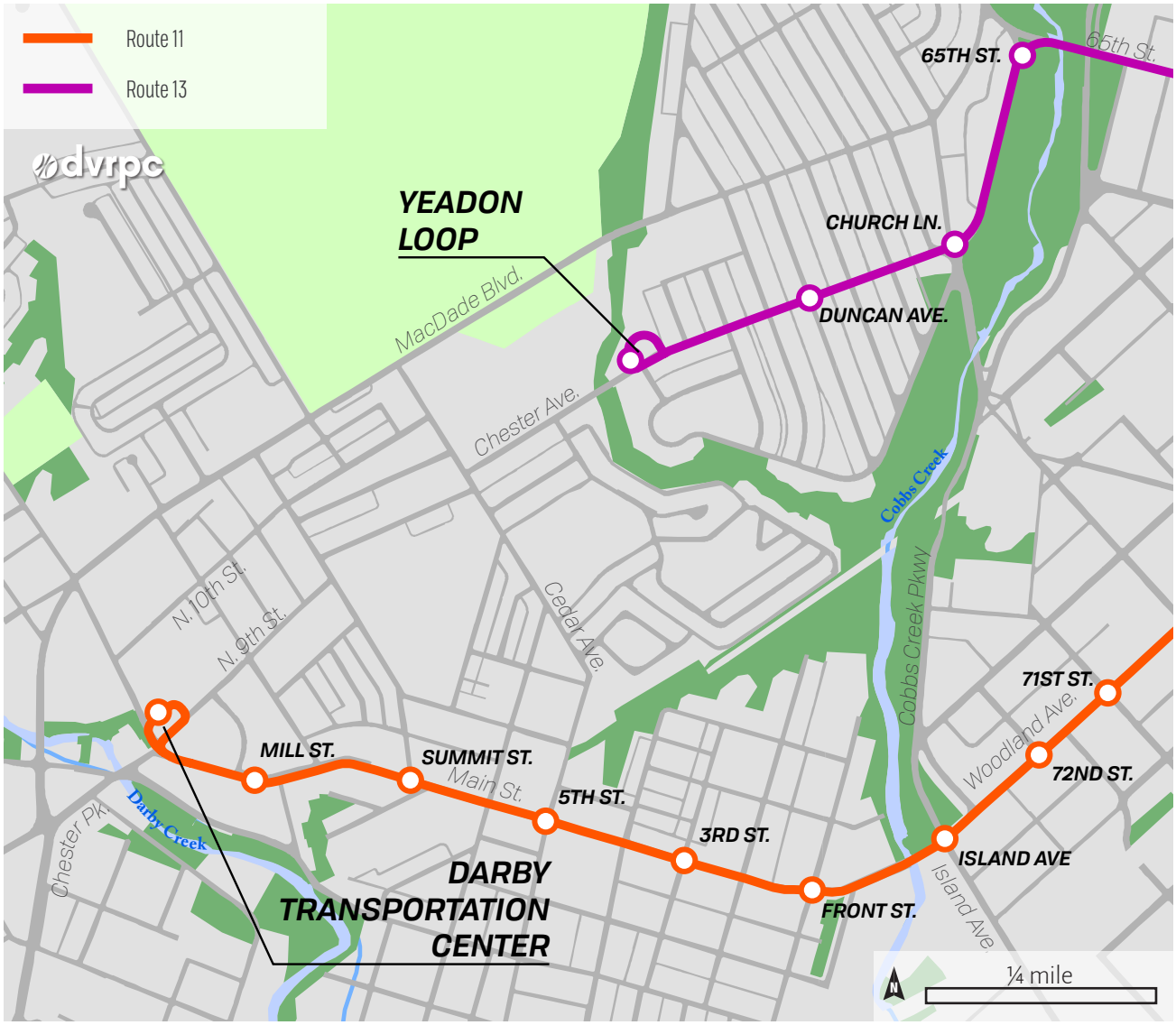

Figure 24: Alternative A map

Alternative A

This alternative proposes:

+ Frequent service to / from DTC on Route 11
+ Frequent service to / from Yeadon Loop on Route 13
+ No Route 13 passenger service to DTC

Table 6: Alternative A Service Patterns

Route and Pattern		Trips *per Direction* Wkday.	Sat.	Sun.
11	All Service	244	146	124
13	All Service	149	78	62

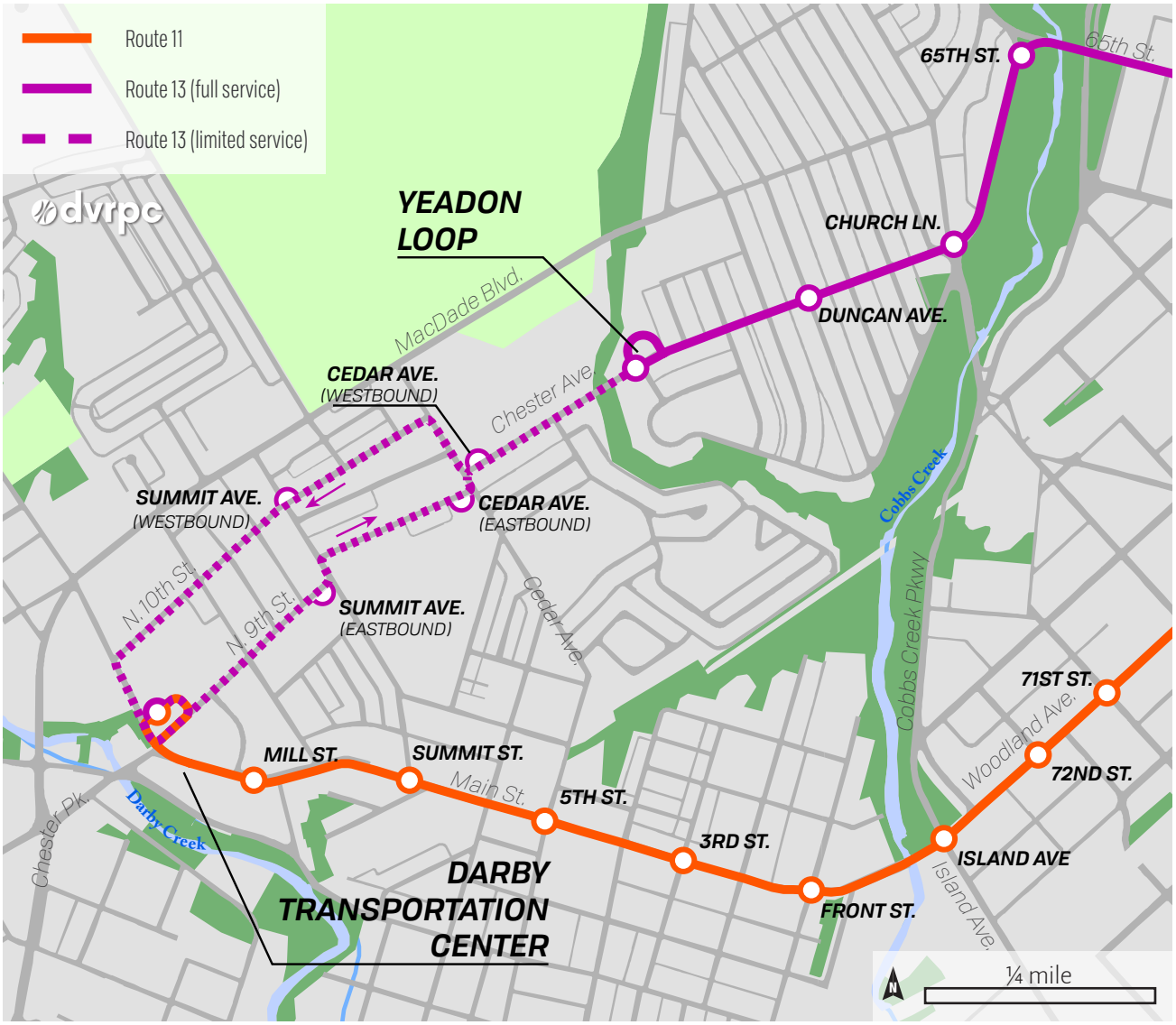

Figure 25: Alternative B map

Alternative B

This alternative proposes:

+ Frequent service to / from DTC on Route 11
+ Frequent service to / from Yeadon Loop on Route 13
+ Route 13 passenger service to DTC with approximately 15-minute peak and 30-minute midday frequency on weekdays

Table 7: Alternative B Service Patterns

Route and Pattern		Trips *per Direction* Wkday.	Sat.	Sun.
11	All Service	244	146	124
13	All Service	149	78	62
	To/From Yeadon Only	*104*	*39*	*31*
	To/From DTC	*45*	*39*	*31*

Capital Improvements Comparison

In both Alternatives A and B, Trolley Modernization will require capital improvements to DTC's infrastructure to meet ADA guidelines. To effectively serve its customers, however, SEPTA should redesign DTC for the appropriate combination of trolley service, ensuring both adequate passenger facilities and improved operations.

Currently, the trolley loop at DTC can accommodate Route 11's frequent passenger service, with an additional track for vehicles not in service. Alternative A would allow a similar track configuration, though additional storage capacity may be necessary to accommodate longer, modern vehicles.

Alternative B would substantially increase the capital cost of overhauling the DTC loop property to accommodate modern vehicles. These capital improvements would include additional platform space for Route 13 passengers and new trackwork to bring Route 13 trolleys into the DTC property and out to North 9th Street.

This report also investigates extending Route 102 from Sharon Hill to Darby. A DTC redesign must consider the implications of this potential connection on vehicle storage and passenger facilities.

Under either alternative, a segment of track currently used by Route 13 trolleys along the 900 block of Main Street in Darby should be relocated from its current position straddling two travel lanes into the eastbound travel lane (see ***Figure 26***). This would improve safety and could make a trolley turn from eastbound Main Street onto North 9th Street more feasible.

Each of these issues requires further study, with guidance offered in this report's Next Steps section.

Figure 26: Route 13 tracks on Main Street, Darby
Note: the proposed track location is highlighted in purple.

Operations Comparison

Removing Route 13 passenger service to Darby would eliminate about three-quarters of a mile of revenue service through close clearance areas, where trolleys are likely to experience delays. Route 13 trolleys in non-revenue service would still encounter close clearance-related problems, but these problems would not immediately affect passengers on board a trolley. An obstructed trolley could still create delays for passengers if it were not able to reach Yeadon Loop in time to begin its route as it enters service.

Restoring Route 13 service to the DTC loop would also require trolleys to make a new turn, either at the signalized intersection of 9th and Main Streets, or at the unsignalized historic Route 13 entrance to DTC. Creating an additional unsignalized trolley turn into traffic could cause delays and present a safety hazard. The 9th and Main intersection is often congested with vehicular traffic, which could cause delays for additional trolleys if that option were selected.

In either scenario, introducing Route 102 trolleys would complicate congestion and safety issues around DTC for all roadway users. This report recommends items for further study by traffic engineers, including a capacity analysis and signal timing evaluation of the Main Street/North 9th Street/Chester Pike intersection.

Figure 27: 9th and Main Streets, Darby

Passenger and Community Impacts

Selecting Alternative A would reduce transit access for those passengers who currently ride Route 13 on its limited-service trips. *Figure 28* shows a quarter-mile buffer applied to each existing trolley stop in the study area.

The purple and orange buffers cover locations that would remain within a quarter mile of a Route 13 or Route 11 trolley stop, respectively, even if limited service to DTC were removed, as in Alternative A. The blue buffer covers locations that would no longer be within

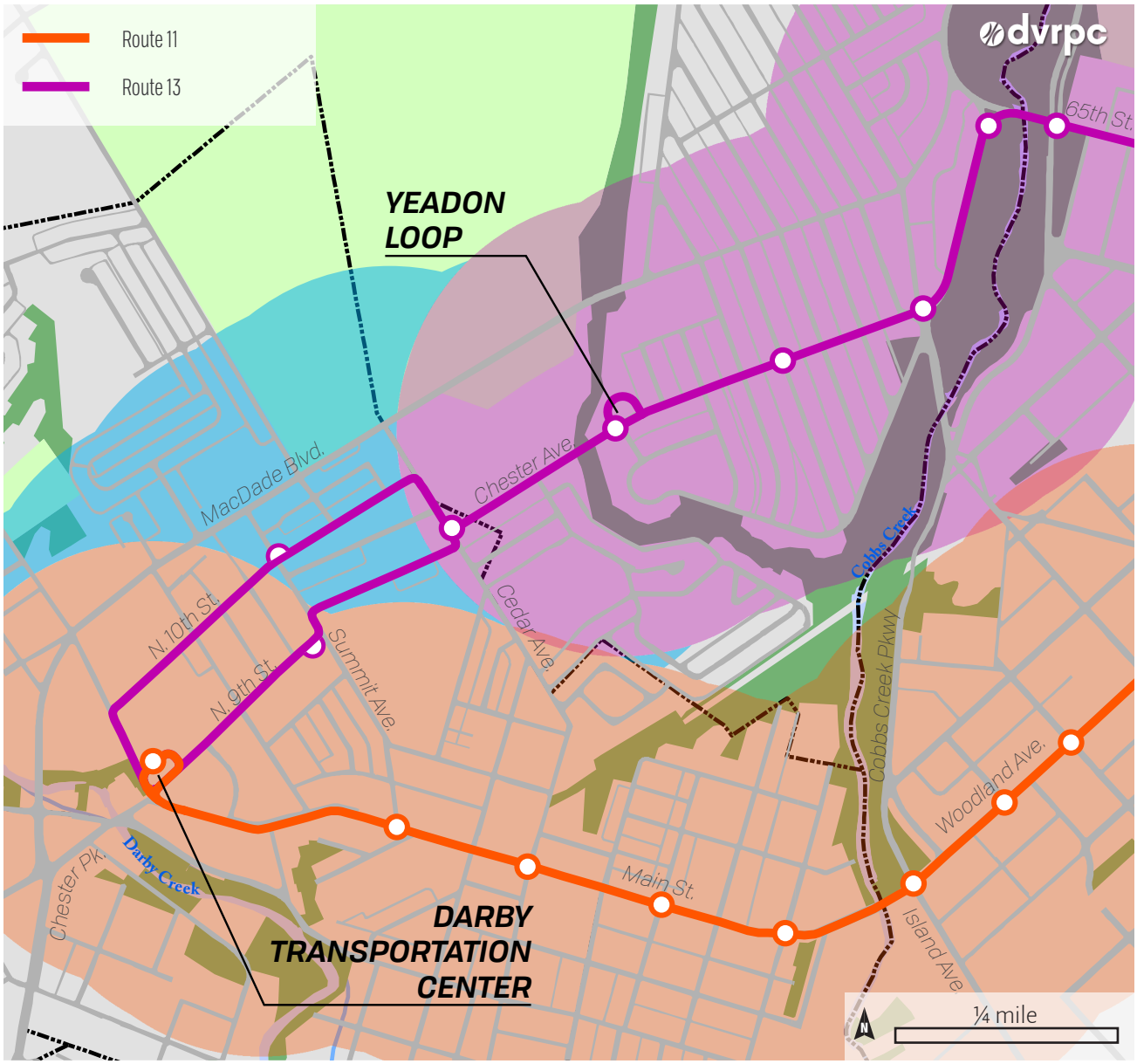

Figure 28: Stop access impacts map

a quarter mile of a trolley stop under Alternative A. Approximately one third of the area covered by the blue buffer is a cemetery or other open space.

Loss of trolley service between DTC and Yeadon Loop would certainly be meaningful for those riders who use it regularly—likely about 60-65 people on an average weekday, according to SEPTA's 2018 ridership data. Though these riders would not be stranded without a transit option, they *would* have to walk a longer distance to reach Yeadon Loop, DTC, or another Route 11 stop on Main Street, up to one third of a mile at the longest. It is notable, however, that the ridership on this segment is a very small fraction of the nearly 80,000 trips made per average pre-pandemic weekday on SEPTA trolleys.

If Route 13's limited-service stops were not modernized along with Trolley Modernization, other interventions can alleviate the impact of a loss of service. First, improving accessibility throughout Darby Borough, by building ADA-compliant curb ramps and by repairing deteriorating sidewalks, would make residents' journeys to a trolley stop safer and easier. This will be particularly important when Trolley Modernization opens the trolley system to riders with disabilities for the first time. Second, SEPTA's upcoming redesign of its bus network can take this trolley service gap into account, ensuring Darby residents have the mobility options they need.

While its existing and potential riders are SEPTA's primary concern, other community members may not be supportive of restoring Route 13 service through Trolley Modernization. New stations would reduce the on-street parking supply, more frequent service would create noise, and more service in close clearance areas would make conflicts between autos and trolleys more common. These concerns may not seem relevant to SEPTA's mission of improving mobility in its service area, but SEPTA will have to contend with them as political realities if the agency pursues Alternative B.

Figure 29: An intersection on North 10th Street with ADA-noncompliant curb ramps

Connection to Route 102

SEPTA, with its consultant, AECOM performed a high-level analysis of potential alternatives to connect the Media-Sharon Hill Lines (MSHL) with the City Transit Division trolley routes. This connection, along with a planned shared maintenance facility, would allow for more efficient storage and maintenance operations.

AECOM identified four potential connection locations:

+ Darby Transportation Center via MacDade Boulevard
+ Darby Transportation Center via Chester Pike
+ Darby Transportation Center via Springfield Road
+ Callowhill via 69th Street Complex

AECOM developed eight suitability criteria to reflect considerations ranging from track geometry to impacts on existing infrastructure, such as bridge loads. Of the proposed alternatives, Darby Transportation Center via MacDade Blvd and Darby Transportation Center via Chester Pike were found to be the most suitable of the possible connections (see *Figure 30*).

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Could the alignment meet desired SEPTA sustained vertical gradient requirements (6%)?	Yes	Yes	No	Yes
Could the alignment be developed within the SEPTA desired minimum streetcar horizontal curve radius (33')?	Yes	Yes	Probably[1]	Yes
Is the proposed route/right-of-way completely publicly owned (PaDOT/City/SEPTA, etc.)?	Yes	Yes	Yes	Yes
Are roadways on the proposed route wide enough to accommodate streetcar clearances?	Yes	Yes	Yes	Yes
Would a streetcar on this route adversely impact existing vehicular parking?	N/A	No	N/A	No
Would this route significantly impact existing vehicular traffic signal cycles / timing?	No	No	Yes	Possibly[2]
Would any property / buildings / structures need to be modified and/or demolished to implement this alternative?	No	Possibly[3]	No	No
Would any significant new overhead or undergrade structures / bridges be required in order to implement this alternative?	No	No	No	Yes

1 The hairpin turn at Springfield Road gets very close to minimum acceptable radius.
2 Changes made to the traffic signalization at Market Street and 63rd Street may be significant.
3 The bridge at Chester Pike and Laurel Road may need to be augmented for streetcar loadings.

Figure 30: AECOM design criteria matrix

AECOM's memo describes the technical needs and challenges of each alternative connection in detail. Those needs and challenges informed this report's Next Steps section.

The MacDade Boulevard and Chester Pike options would each be just over a mile long, would operate on PennDOT-owned roads, and would require turnouts and signal modifications to allow them to leave the Route 102 right-of-way and enter the street.

Either of these options would allow Route 102 trolleys to pull into the DTC loop via the entrance on North 9th Street, or to continue along Route 11 tracks towards Philadelphia and the storage and maintenance facility (see ***Figure 32***, next page). Track work associated with this option would be integrated with any track work needed to improve access for Routes 11 and 13.

The MacDade Boulevard option would address the flooding issues on Route 102 (see "Flooding," page 18), and would travel past a mix of residential and commercial land uses.

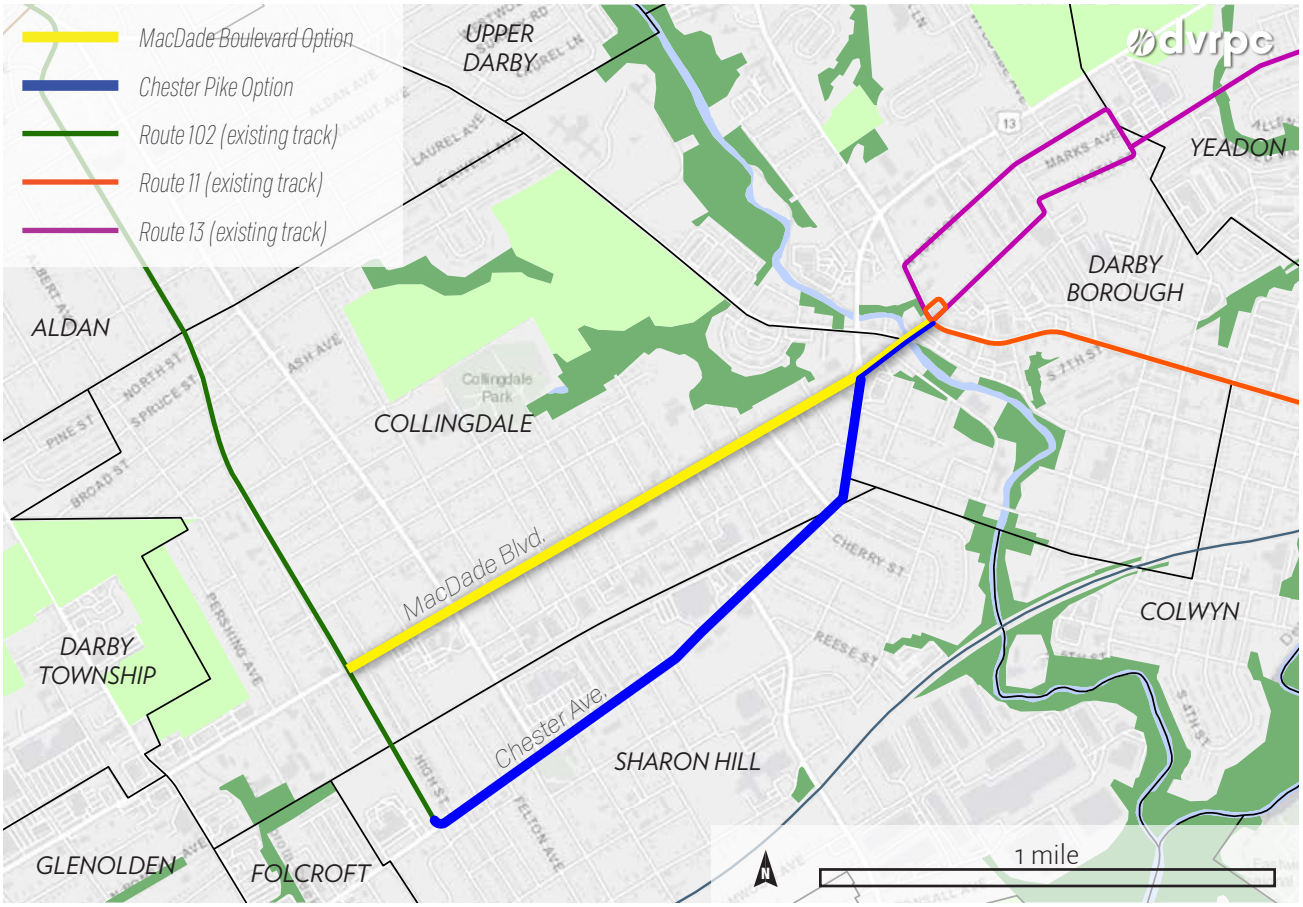

Figure 31: Route 102 connection options

The Chester Pike option would not address flooding, and potentially exacerbate its impacts because trolleys could not reach their storage and maintenance location during flood events. Chester Pike's right-of-way is wider than MacDade Boulevard, and may offer an opportunity for a dedicated trolley right-of-way between Sharon Hill Station and Ridley Avenue.

Each of these connections could be implemented for either revenue or non-revenue service. Revenue service could enable greater connectivity through Delaware County and reinforce DTC as a key link between SEPTA's City and Suburban transit routes. Revenue service would require building ADA-compliant stations between Route 102 and DTC.

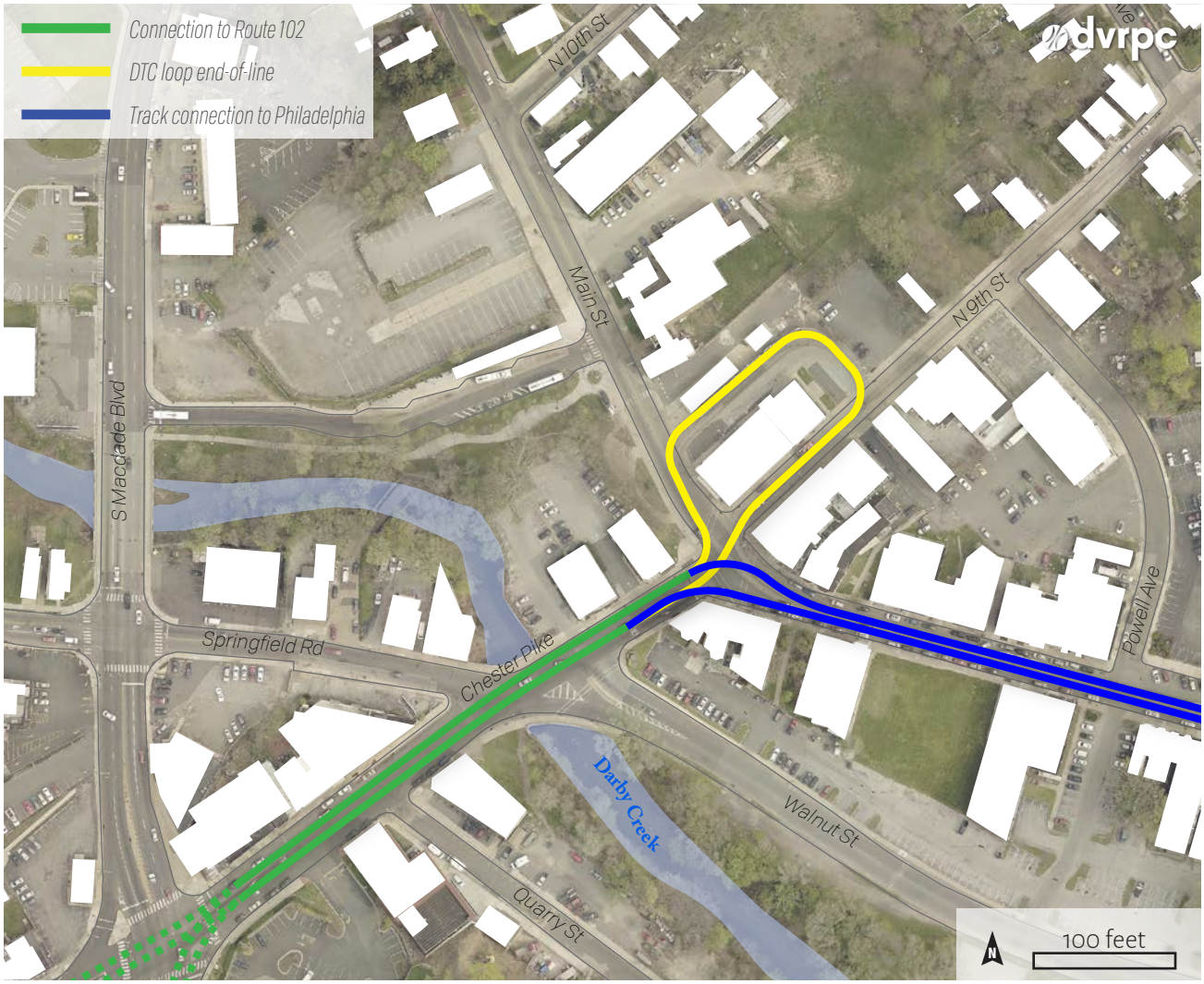

Figure 32: Route 102 connection at DTC

Next Steps

This memo has collected the comments of SEPTA staff to identify the technical issues surrounding Trolley Modernization in Delaware County. Equipped with this technical review, SEPTA should pursue further study and community outreach on the following four topics:

+ Route 102 ridership and transfer potential
+ Main Street/Chester Pike/North 9th Street intersection operations
+ On-street station locations
+ Darby Transportation Center design needs

These topics are presented below as proposed studies, with detailed task lists and the key stakeholders with whom SEPTA should engage. Where relevant, we note which studies or tasks should precede others.

Route 102 Ridership and Transfer Study

A track connection between SEPTA's city and suburban trolley routes is essential to maintenance and storage of a new trolley fleet. But a new track connection may also present opportunities for improved service. A Route 102 Ridership and Transfer Study would identify what type of passenger service would be appropriate on this connection, and what operational implications that service would have for SEPTA.

Task	Key Stakeholders
Determine whether a track connection is most appropriate on either Chester Pike or MacDade Boulevard, based on both the operational issues identified here (see "Connection to Route 102" on page 26), and on a comparison of potential ridership. Potential ridership factors to consider include existing ridership of bus Routes 113 and 114, potential stop locations, and land use.	SEPTA, Delaware County, PennDOT, Sharon Hill Borough, Collingdale Borough, Darby Borough
Identify appropriate headways for any passenger service between Sharon Hill and Darby.	SEPTA, Delaware County, PennDOT, Sharon Hill Borough, Collingdale Borough, Darby Borough
Determine how many additional vehicles would be needed to provide passenger service between Sharon Hill and Darby while maintaining desired service levels on Routes 102, 11, and 13. This task should be considered in SEPTA's vehicle procurement for Trolley Modernization.	SEPTA
Identify storage needs at DTC for additional vehicles associated with a Route 102 extension (see "Darby Transportation Center Redesign" on page 31).	SEPTA

Operations Study for Main Street/Chester Pike/North 9th Street Intersection

The intersection of Main Street, Chester Pike, and North 9th Street is vital to trolley operations now and in the future. This intersection has been noted for congestion and safety issues that should be resolved before Trolley Modernization.

Task	Key Stakeholders
Conduct a study of existing approaches, entries, and exits at DTC to develop a track plan for routing Routes 13 and 102 into and out of DTC. This study should consider appropriate track geometry and potential real estate acquisitions that would allow for better operations.	SEPTA, Delaware County, PennDOT, Darby Borough
Conduct a traffic study for Main/Chester/9th intersection that includes a capacity analysis to address congestion, delay implications of any new trolley service, and recommendations for changes to traffic controls.	SEPTA, Delaware County, PennDOT, Darby Borough

On-street Station Location Study

Trolley Modernization will require some degree of stop consolidation to speed service for customers and control costs for SEPTA. New service extensions, such as the potential Route 102 connection would require new stops. An On-street Station Location Study should consider the following topics:

Task	Key Stakeholders
Identify a stop consolidation program for existing service along Route 11 based on ridership, key destinations, and station area accessibility.	SEPTA, Delaware County, Darby Borough, Colwyn Borough, City of Philadelphia
Identify a permanent service level and endpoint for Route 13.	SEPTA, Delaware County, Darby Borough, Yeadon Borough
Identify a stop consolidation program for existing service along Route 13 based on ridership, key destinations, and station accessibility.	SEPTA, Delaware County, Darby Borough, Yeadon Borough
Identify appropriate station locations for revenue service on Route 102 between Sharon Hill Station and Darby Transportation Center based on results of "Route 102 Ridership and Transfer Study" on page 29.	SEPTA, Delaware County, Darby Borough, Collingdale Borough, Sharon Hill Borough

Darby Transportation Center Redesign

Modernized and/or new trolley service at Darby Transportation Center will require a significant redesign of existing facilities. To effectively serve SEPTA riders, these upgrades demand more than basic ADA compliance at platforms. A Darby Transportation Center Redesign should consider the following topics:

Task	Key Stakeholders
Determine appropriate service levels for existing and future trolley service (see Route 102 Ridership and Transfer Study).	SEPTA, Delaware County, municipalities along routes 11, 13, 101, and 102
Design ADA-compliant platforms at Darby Transportation Center to accommodate existing and future trolleys service.	SEPTA
Create safe transfer opportunities between trolley and bus services, either at one consolidated transportation center, or via a safe pedestrian crossing.	SEPTA, Darby Borough
Identify flood risk and mitigation strategies for trolley and bus infrastructure in the Darby Creek floodshed.	SEPTA, Darby Borough
Identify electric power needs for existing and future trolley service.	SEPTA
Identify on-site operations needs for trolleys, including storage potential.	SEPTA
Evaluate potential use or disposition of land not needed for Trolley Modernization at Darby Transportation Center.	SEPTA, Darby Borough

Route 11 and 13 Trolley Modernization: Delaware County Alternatives

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Abstract

SEPTA is preparing for a complete replacement of its trolley fleet, Trolley Modernization. This report uses Trolley Modernization as an opportunity to evaluate service on Trolley Route 13 in Delaware County, which provides limited service to Darby Transportation Center.

We evaluate the implications of either restoring consistent Route 13 service to Darby, or ending all Route 13 passenger service at Yeadon Loop. We outline opportunities to improve operations on both Routes 11 and 13, as well as a potential track connection to suburban Trolley Route 102.

Project Team

Logan Axelson, Senior Transportation Planner
Thom Stead, Senior Transportation Planner

Staff Contact

Logan Axelson
Senior Transportation Planner
(215) 238-2833
laxelson@dvrpc.org

Delaware Valley Regional Planning Commission
190 N Independence Mall West, 8th Floor
Philadelphia, PA 19106-1520
Phone: (215) 592-1800
Fax: (215) 592-9125
Web: www.dvrpc.org

DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

190 N Independence Mall West, 8th Floor
Philadelphia, PA 19106-1520
Phone: (215) 592-1800 | Fax: (215) 592-9125
www.dvrpc.org

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