Subject:	**Traffic Impact Analysis (Final Draft)**
Project feature:	Site Development and Logistics
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
Prepared by:	Delta Conveyance Design and Construction Authority (DCA)
Copies to:	File
Date/Version:	December 23, 2021
Reference no.:	EDM_SD_CE_TMO_Traffic-Impact-Analysis_000969_V02_FD_20211223

1. Introduction

This technical memorandum documents the methodology used to evaluate the effectiveness of a wide range of logistics strategy options. The work performed was not a California Environmental Quality Act (CEQA) analysis; instead, it was intended to help the DCA engineering team, including the Engineering Design Manager (EDM),identify recommended logistics measures that should be included in the Delta Conveyance Project (project) description and footprint used in the Environmental Impact Report (EIR) stage. Ultimately, the CEQA process would be the final arbiter of recommended logistics improvements to manage traffic impacts.

The main analytical tool used was a spreadsheet model built in Microsoft Excel that represents traffic demand on roadways affected by the project. The model also compares demand to capacity for study roadways to identify locations where remedial action could be needed.

2. Traffic Counts

Traffic counts establish a baseline level of traffic to be used as a basis for forecasting traffic, as well as evaluating levels of congestion under existing conditions. Due to the global pandemic crisis, new traffic counts could not be collected as traffic patterns were disrupted and not representative of normal conditions. Instead, the best available traffic count data from previous studies were used, as well as California Department of Transportation (Caltrans) Performance Measurement System (PeMS) data (PeMS, 2020), which covers freeways and state routes.

An Environmental Impact Report (EIR) completed in 2016 for an earlier version of this project included traffic counts for most roadways included in the current planning effort (Fehr & Peers, 2016). According to the 2016 EIR, approximately half of the study roadway segments were counted between February and April 2012. The rest of the traffic counts used in the 2016 EIR were collected between 2008 and 2012 and obtained from other Caltrans transportation studies. Although these counts are older than would usually be used for traffic studies, the older counts were for the local roads that serve areas that have seen little if any development in the intervening period, so traffic levels would not have changed much. Recent, but pre-COVID, data were available for the main commute corridors that are more subject to traffic growth (State Route [SR]-4, SR-12, Interstate [I]-5) (PeMS, 2020).

The Traffic Impact Analysis (TIA) appendix of the EIR included charts showing weekday two-way total hourly counts from 6 a.m. to 7 p.m. for each location. Unfortunately, the original raw traffic counts were not available. Approximate hourly traffic counts were extracted from those charts directly.

The project team identified other recent studies that collected traffic counts. SR 12 traffic counts came from the technical memorandum for the SR 12/Bouldin Island Interchange as part of the California WaterFix Project (AECOM, 2018). Counts in the area of Byron Highway were taken from the Tri-link (SR 239) Traffic Engineering Performance Assessment (Caltrans, 2015).

For a few locations in southern Sacramento County, counts were taken from Sacramento Area Council of Governments' (SACOG's) Sacramento Regional Activity-Based Simulation Model (SACSIM19) (SACOG, 2019).

In the past decade or so, traffic volumes on the main commuter routes have fluctuated somewhat. During the 2008 recession, traffic volumes went down, returning to pre-recession level around 2012 and slowly increasing since (PeMS, 2020). Traffic counts were adjusted from the year they were collected to current day, with annual growth rates taken from regional travel models, as described in the following Forecasting Background Traffic section.

Due to these constraints, this analysis does not consider several factors, including festivals and large gatherings or events or the impacts of slow-moving or oversize agricultural traffic that could use local roads.

3. Construction Traffic

The logistics team provided the schedule for construction materials, trucks, and workers. Materials were specified by type needed at each construction site by month. The number of trucks of each type for each month traveling to each site was calculated by converting each type of material into an appropriate truck type. Construction worker trips per month were also provided for each site.

Figure 1 presents the total estimated trucks for all shafts and batch plants during the construction period. As shown, the construction schedule of this project spans 10 years, and the level of construction traffic would not be evenly distributed throughout the construction period. Instead, it has spikes related to specific phases of construction.

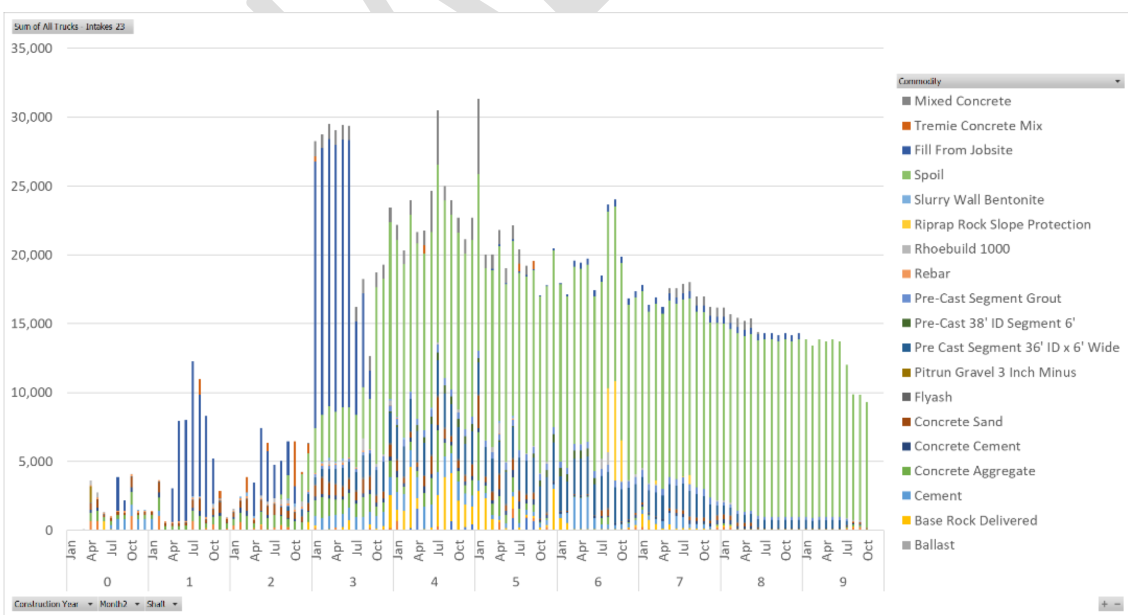

Figure 1. Estimated Truck Trips during Construction (All Sites Combined)

Unlike typical land development projects with one land use scenario, this type of construction traffic requires a different modeling approach dealing with a wide range of scenarios. For example, construction activity in each month is a scenario, as it varies month to month. Furthermore, the whole construction schedule was revised several times in response to preliminary traffic assessments, engineering challenges, and input from stakeholders.

Another unusual aspect of this project is the fact that project sites are widely spread throughout the Delta region, and the construction of shafts and tunnels in various locations does not occur at the same time. This means that the peak month of each site is different, so the roads serving any given work site or group of work sites would have a different peak as well. As examples of this, Figure 2 shows the construction truckload schedule for the intakes, batch plants, and shafts near Hood-Franklin Road, Lambert Road, and Twin Cities Road, while Figure 3 presents the construction truckload schedule for the Bouldin Island shaft. As shown, the peak month for each area differs. The peak month for the northern area is January of Year 5, for example, while that of the Bouldin Island shaft is April of Year 2.

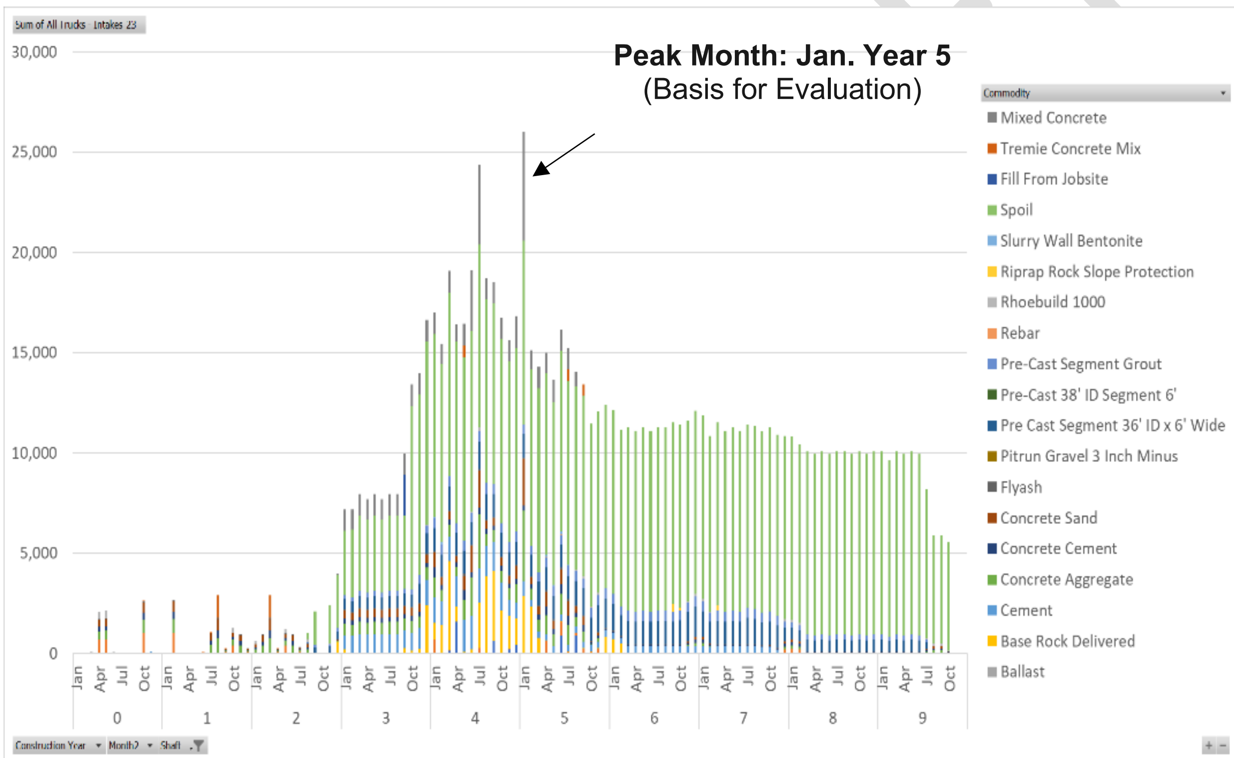

Figure 2. Peak Month in Northern Intakes Area

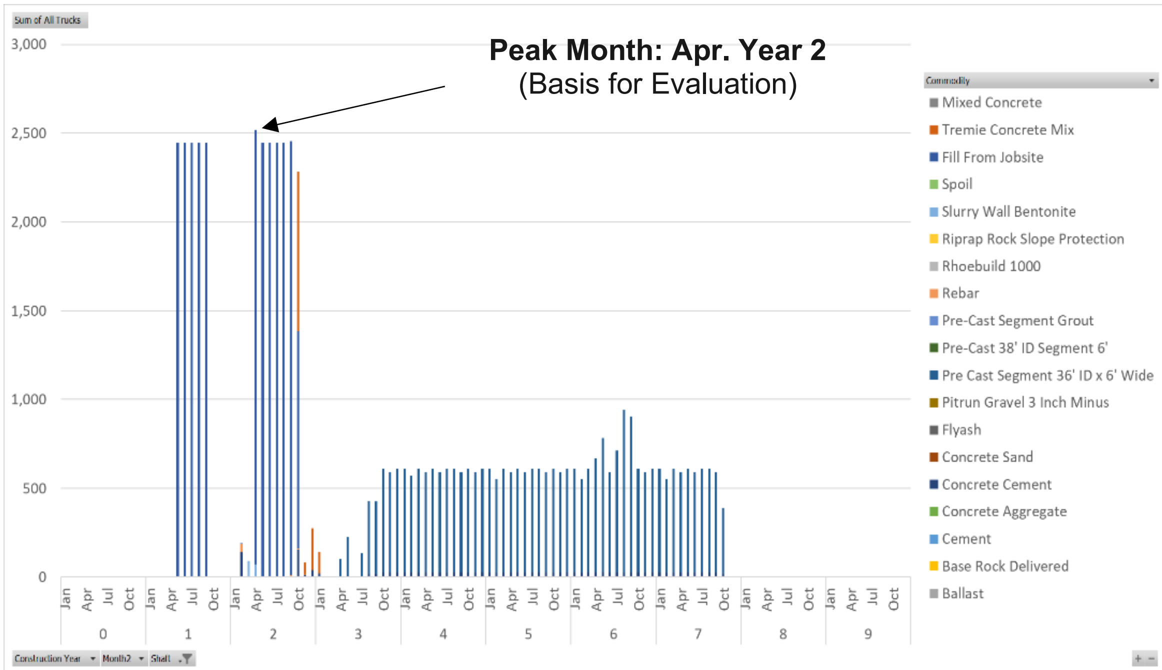

Figure 3. Peak Month of Bouldin Island Shaft Traffic

To manage these unique challenges of construction traffic modeling, a spreadsheet model was developed that can quickly update the assigned traffic as the user selects the peak month of each group of construction locations. This allowed a large number of permutations to be tested as the concept was developed.

4. Forecasting Background Growth

Traffic forecasts were performed in two steps. The first step was to estimate the future background traffic, and the second step was to account for the effect of construction traffic.

The future year was determined based on the peak construction month for a given scenario. To estimate the future background traffic, linear annual growth rates were developed using regional travel demand models, which include the study segments, namely the Three County Model (2015 Base) prepared for the Merced County Association of Governments, San Joaquin Council of Governments, and Stanislaus Council of Governments (TJKM, 2018) and SACOG's SACSIM19 model (SACOG, 2019). Linear annual growth rate varied by location. The traffic forecasting model calculates the background traffic using the count data and growth rates for the selected model year.

5. Construction Truck Trips

Adding the construction traffic to the future background traffic involved several calculation steps:

1) Monthly truck and worker data were converted to an average daily value assuming 21 working days per month.
2) Truck trips were doubled to account for round trips (i.e. trucks would be empty in one direction and full in the other).

3) Daily values were allocated to each time period with time-of-day factors based on the expected construction hours.
4) The month with the highest volume of construction-related traffic was selected, and truck volumes were converted to passenger car equivalent (PCE) values. Note that because the analysis is based on the peak month of construction traffic, in all other months of the construction period the project will have less effect on traffic.
5) Routes for trucks were developed based on a likely origin of each material delivered to each site.
6) Trucks (in PCE) for each route were added to each link of the route.

6. Forecasting Project Worker Trips

Construction worker commute trips were estimated for inclusion in the traffic forecasts. The number of daily workers for each month was provided by the logistics team as part of the construction schedule. The distribution of worker trips is described here.

First, the expected labor pool available for the project was identified. These are workers in the construction, mining, and utilities sectors residing within a realistic commute distance (1-hour of uncongested driving time) from project sites, with the catchment area shown on Figure 4. These data were taken from the United States (U.S.) Census Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) Residential Area Characteristics 2017 data at the County Subdivision geographic level (U.S. Census, 2017).

A gravity model was applied to determine the willingness of potential workers to travel to the project given the worker's residential location. Because the project sites are spread over a large area, two worker distributions were developed: one for sites north of the San Joaquin River, and one for sites south of the river. For each county subdivision, travel time and distance were determined for the most likely route to the northern and southern project sites. A gravity model, which follows the home-based-work commute distance curve described in the Transportation Research Board's (TRB's) National Cooperative Highway Research Program (NCHRP) Report 716, *Travel Demand Forecasting: Parameters and Techniques* (TRB, 2012), calculated the likelihood of traveling a given distance for a work commute. Using the distance curve and the number of workers available, the percentage of workers that would come from each county subdivision was calculated. The county subdivision percentages were then aggregated to study area gateways to access the northern and southern sites, as shown on Figure 5 and Figure 6.

The number of worker trips along each study segment was found by multiplying the number of workers for a given site and time period by the percentage of workers using each access route for the given site.

Figure 4. Catchment Area for Labor Force

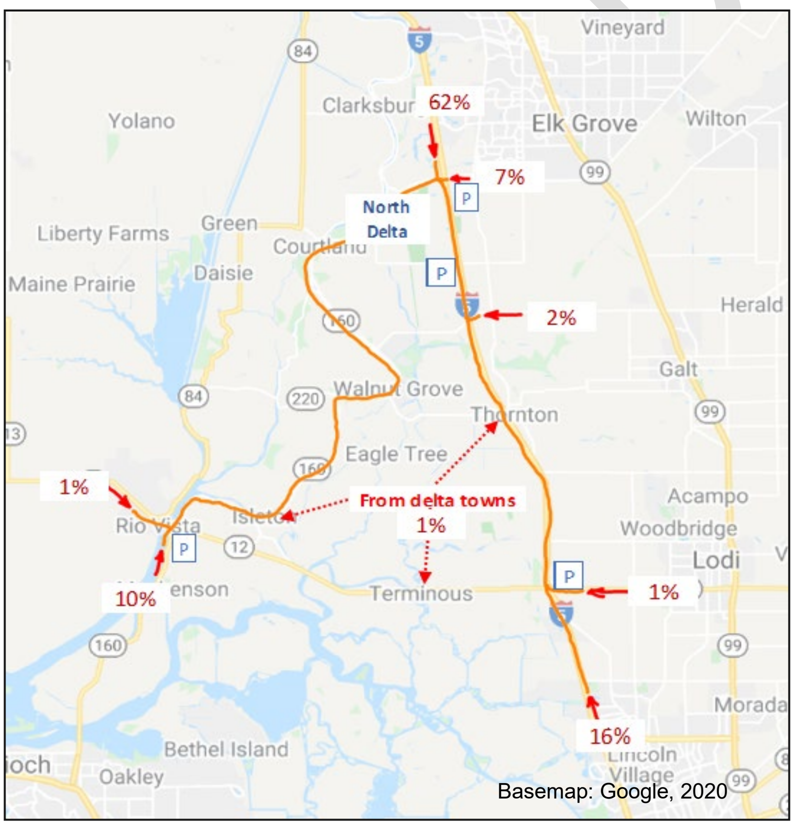

Figure 5. Worker Direction of Travel for Northern Sites

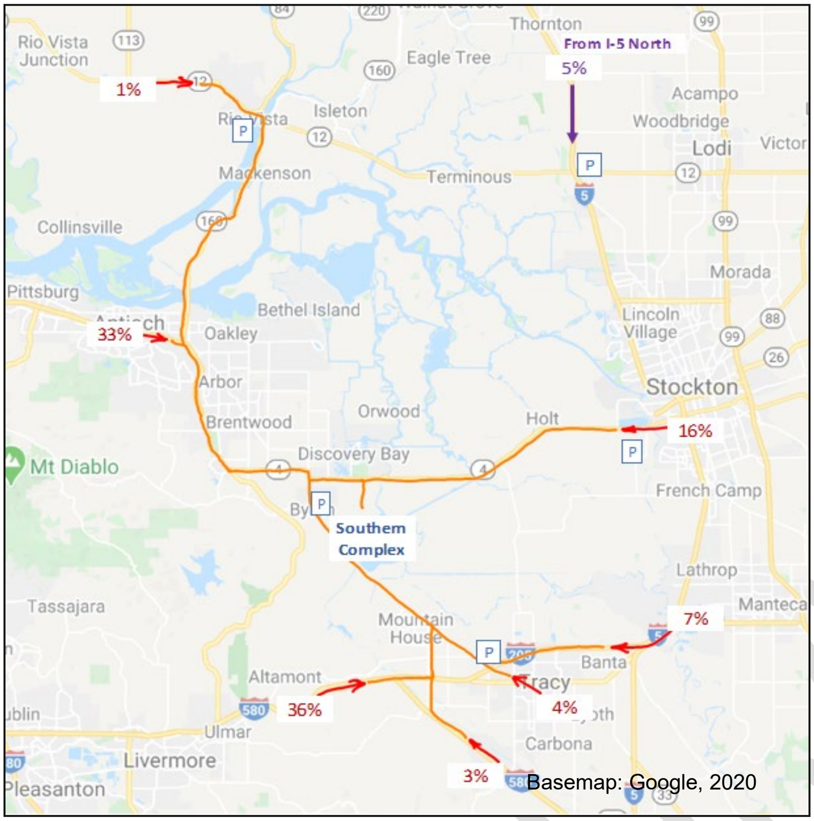

Figure 6. Worker Direction of Travel for Southern Sites

7. Park and Ride Lots

Some scenarios included the use of park and ride lots to reduce the traffic impacts of worker trips on some of the local roads within the Delta and to reduce the space required for parking at worksites. Many work sites have designated park and ride lots. A second set of routes for worker trips from each external gateway to each worksite was used. Workers were assumed to drive alone between their home location and the park and ride lot. For the trips between park and ride lot and worksite, workers could either carpool or, for designated pairs of park and ride lots and work sites, ride in a shuttle bus. The occupancy rates assumed for personal vehicles and shuttles were 1.5 and 10 workers per vehicle, respectively, for road segments between park and ride lots and worksites.

8. Capacity of Roadways

Roadway Level of Service (LOS) thresholds were established based on thresholds used in the previous EIR and Florida Department of Transportation (FDOT) roadway segment LOS thresholds[1] (FDOT, 2020). The thresholds are shown on Figure 7. Hourly segment volumes were compared to the thresholds to determine LOS.

[1] Florida DOT's thresholds were calculated using the *Highway Capacity Manual* (TRB, 2016) methodology. These thresholds are widely used for planning studies around the country.

Facility Type	LOS Threshold				
	A	B	C	D	E
Minor 2-lane Highway	90	200	680	1,410	1,740
Major 2-lane Highway	120	290	790	1,600	2,050
Major 3-lane Highway	1130	1905	2925	4080	4675
4-lane, Multilane Highway	2,140	3,520	5,060	6,560	7,300
2-Lane Arterial	-	-	970	1,760	1,870
4-Lane Arterial, Divided	-	-	1,920	3,540	3,740

Figure 7. Hourly Level of Service Thresholds by Facility Type
Note: Values shown are the maximum value for the given LOS.

9. Thresholds for Remedial Action

Acknowledging that this is a planning study, not an EIR, the thresholds were to serve as targets during iterative adjustments of the plans (that is, to assist with identifying which remedial actions to include). The term "remedial actions" refers to transportation infrastructure developed as part of the project to support a reasonable traffic LOS during the construction period. DWR would determine the methodology and significance thresholds used in the EIR during that phase of the project. Note that as a State agency, by law, DCA is not subject to local regulations, including local LOS standards.

The following thresholds were used as targets to determine whether remedial action was recommended:

1) The combination of background and project construction traffic results in an LOS worse than the target LOS, and the project's traffic is 10 percent or more of the total traffic volume.
2) The target LOS is:
   - LOS C for local roads
   - LOS D for major commute routes (SR-4, SR-12, Byron Highway)
   - LOS D for any new roads built for the project

Although DWR is not subject to San Joaquin and Sacramento County LOS standards, DCA, nevertheless, chose target LOSs consistent with the local LOS targets, but with the added consideration of the project's traffic in relation to existing traffic (that is, 10 percent threshold).

10. Traffic Impacts

Project traffic forecasts were generated by combining the forecasted background traffic with project worker and truck trips. The forecasts were then compared against the thresholds for remedial action to identify impacts. Traffic forecast histograms were prepared for each site, and the August 2020 set of results can be found in Attachment 1.

11. Recommended Follow-Up Analysis of Local and Intersection-Level Improvements

The analysis described herein focused on roadway segments and was sufficient for preliminary logistics planning. At some point in the future, either for a more advanced stage of planning or for the EIR, additional analysis would be required to address specific point improvements, such as new turn pockets or intersection control improvements. At that time, DCA would need to undertake the following types of analyses:

- Signal warrant analysis at locations with heavy left-turn movements
- Intersection LOS analysis to determine the need for turn pockets or control upgrades
- Sight distance analysis for intersections created by new driveways and haul roads

Specific intersection locations where further study is likely to be required include:

- Hood-Franklin Road and I-5 ramp terminal intersections
- Hood-Franklin Road and Intakes Haul Road
- Twin Cities Road and I-5 ramp terminal intersections
- Twin Cities Road and Franklin Boulevard
- Franklin Boulevard and Dierssen Road
- Lambert Road and Franklin Boulevard
- SR-12 and Terminous Shaft Road

12. References

AECOM. 2018. California Water Fix Project – SR12 / Bouldin Island Interchange Traffic Data Collection and Phase 1 Hours of Operation Memorandum – Draft. July 12.

California Department of Transportation (Caltrans). 2015. TriLink (SR 239) Traffic Engineering Performance Assessment. January.

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Esri. 2009. [Basemap]. Scale Not Given. "World Street Map". December 12. Accessed May 19, 2020. https://www.arcgis.com/home/item.html?id=3b93337983e9436f8db950e38a8629af.

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United States Census Bureau (U.S. Census). 2017. Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) Residential Area Characteristics. https://lehd.ces.census.gov/data/#lodes.

13. Document History and Quality Assurance

Reviewers listed have completed an internal quality review check and approval process for deliverable documents that is consistent with procedures and directives identified by the EDM and the DCA.

Approval Names and Roles			
Prepared by	**Internal Quality Control review by**	**Consistency review by**	**Approved for submission by**
Daniel Block / EDM Lead Planner	Don Hubbard / EDM Senior Supervising Planner	Gwen Buchholz / DCA Environmental Consultant	Terry Krause / EDM Project Manager

This interim document is considered preliminary and was prepared under the responsible charge of Don Hubbard, California Professional Engineering License TR2260.

Note to Reader

This is an early foundational technical document. Contents therefore reflect the timeframe associated with submission of the initial and final drafts. Only minor editorial and document date revisions have been made to the current Conformed Final Draft for Administrative Draft Engineering Project Report version.

Attachment 1
Traffic Impacts – August 2020

DCA

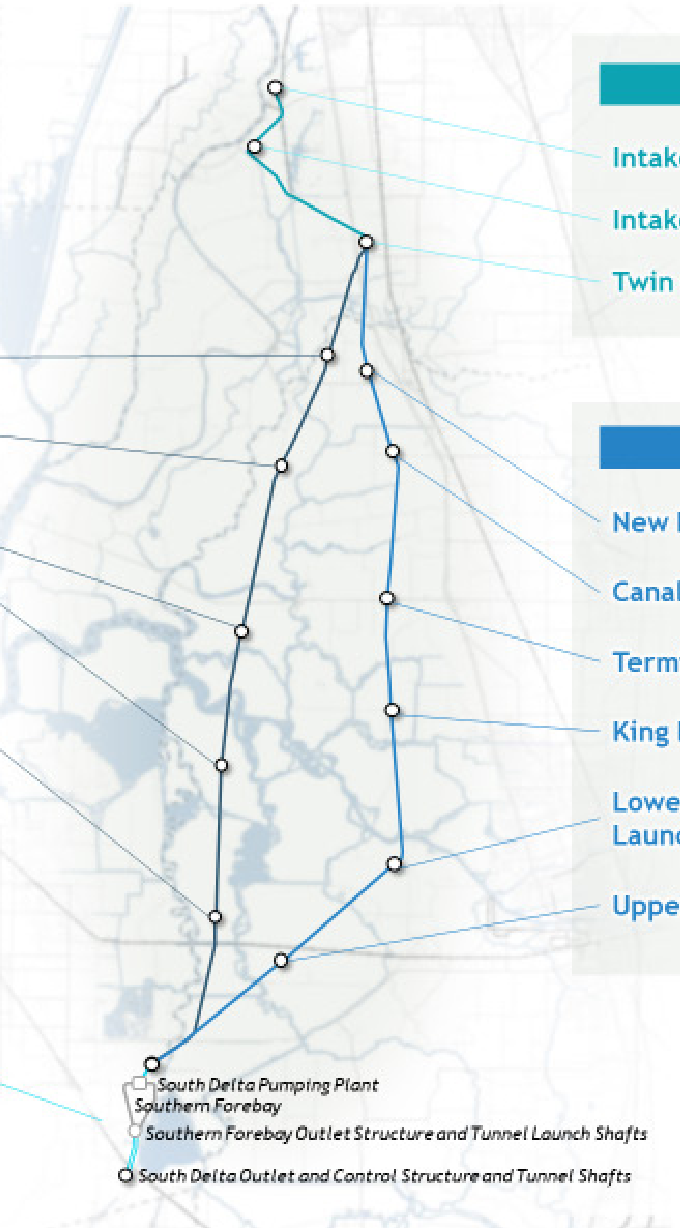
DELTA CONVEYANCE DESIGN
& CONSTRUCTION AUTHORITY

AUGUST 2020

Revised Traffic Impacts *(from April 2020 | to Current)*

NORTH INTAKES & SHAFTS | CENTRAL ALIGNMENT | EASTERN ALIGNMENT | SOUTHERN COMPLEX

Delta Conveyance Map



NORTHERN SITES

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- Intake 5 *page 6*
- Twin Cities Launch Shaft *page 8*

CENTRAL ALIGNMENT SITES

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- Mandeville Island Maintenance Shaft *page 17*
- Bacon Island Reception Shaft *page 19*

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- Southern Forebay Facilities
- South Delta Outlet & Control Structure *page 35*

Northern Intakes & Shaft Sites

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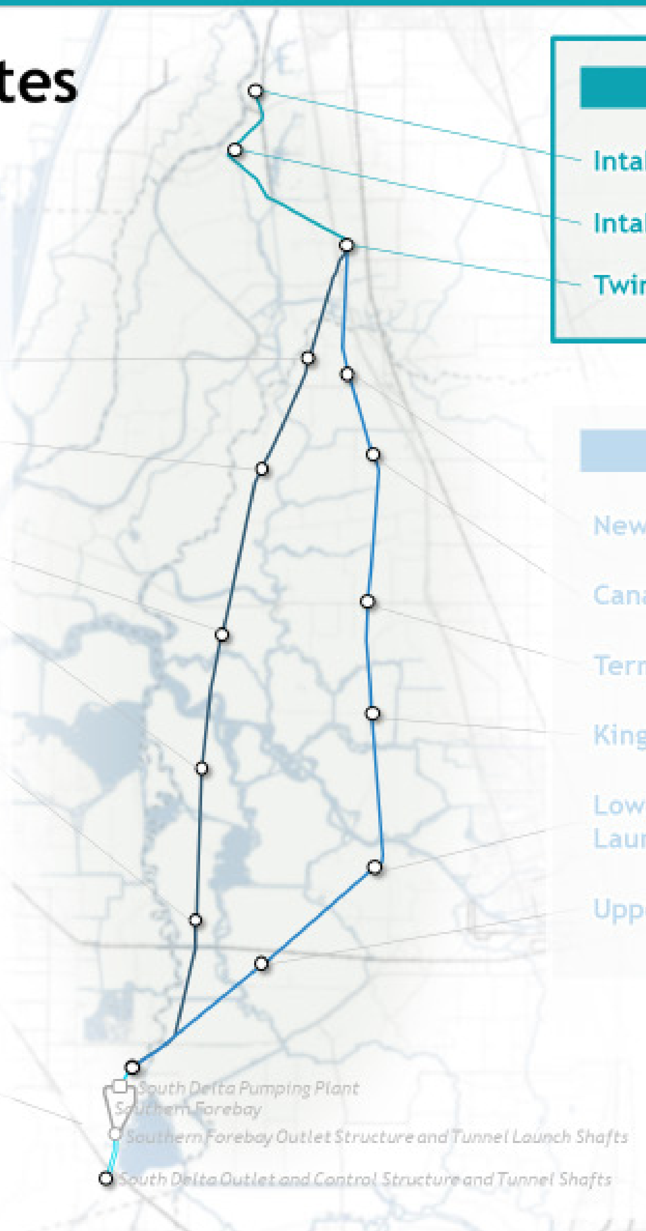

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Upper Jones Tract Maintenance Shaft *page 32*

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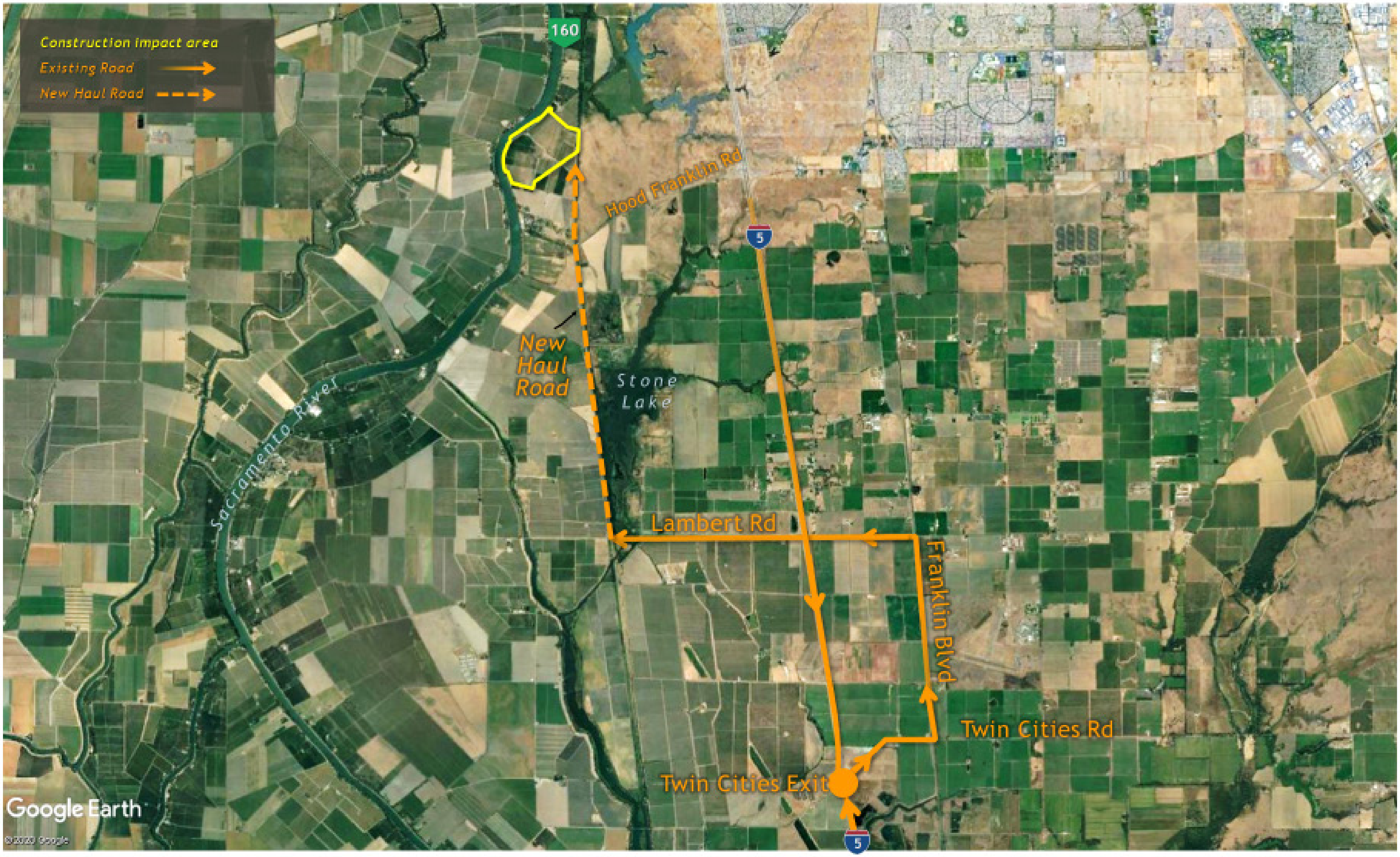
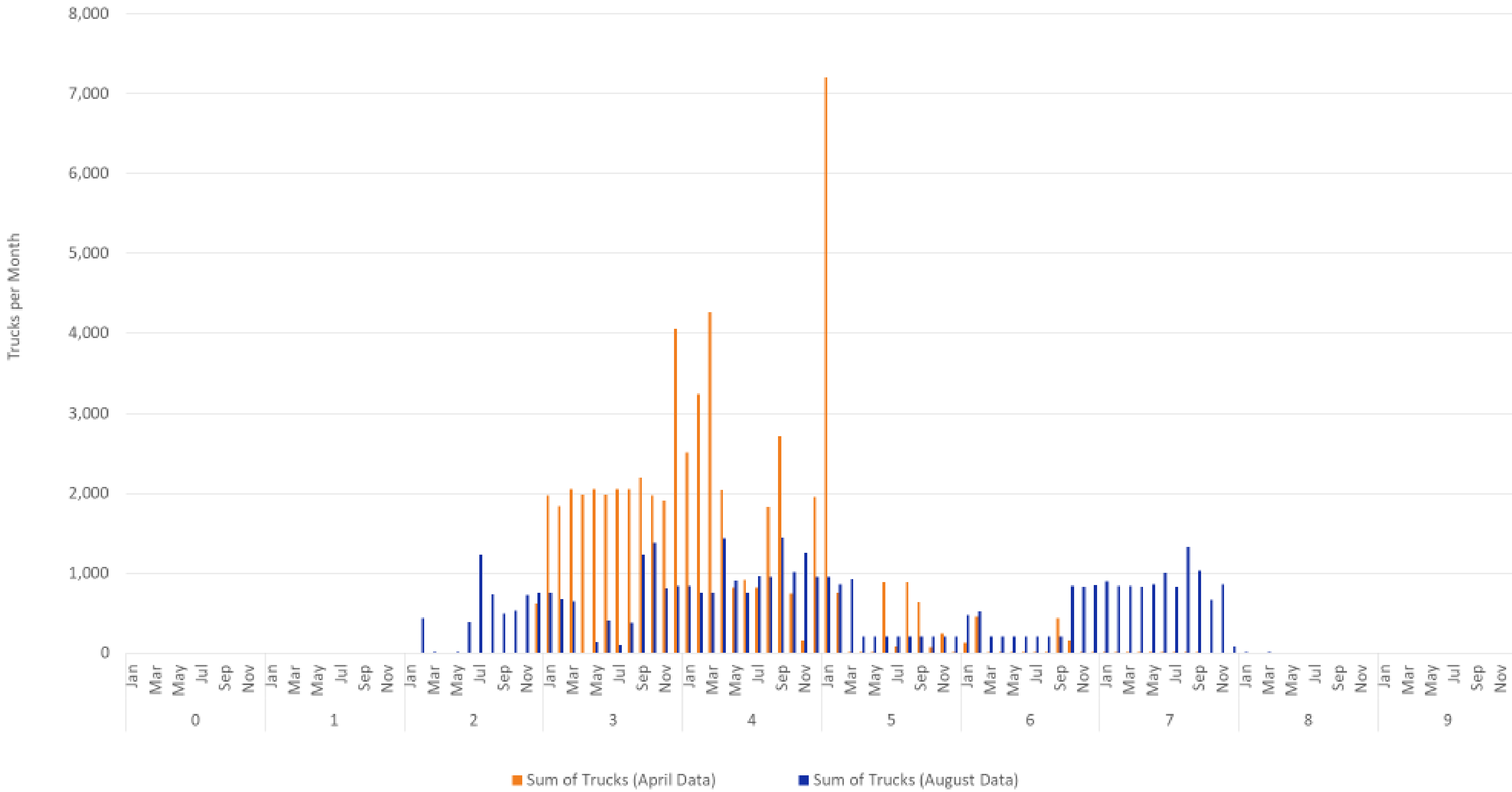
Southern Forebay Facilities

South Delta Outlet & Control Structure *page 35*

Intake 3 Site Access Routes



Intake 3 Site
Traffic Volume Histogram – *Change from April to Present*



Intake 5 Site Access Routes

NORTHERN SITES

Intake 5 Site
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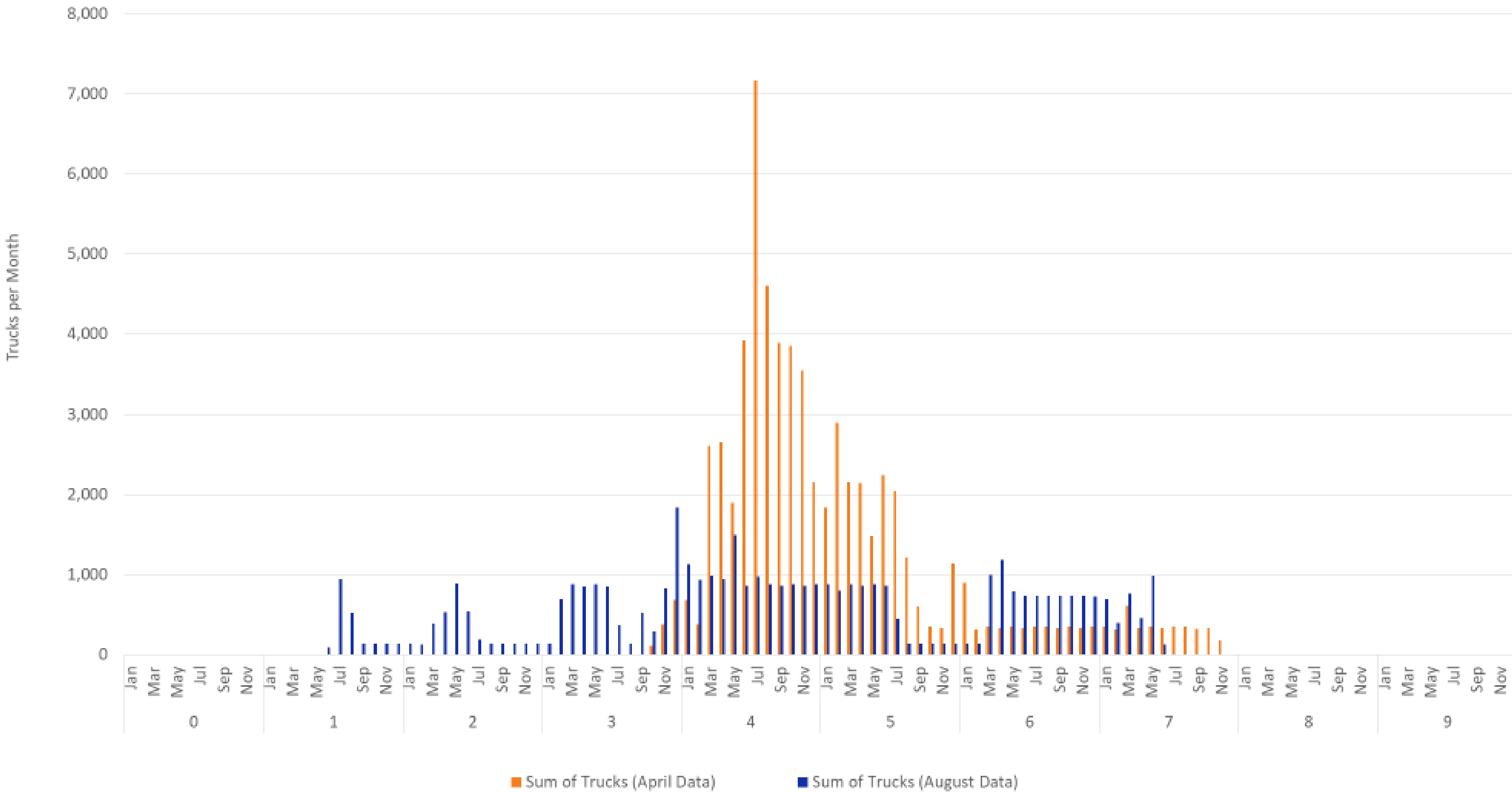
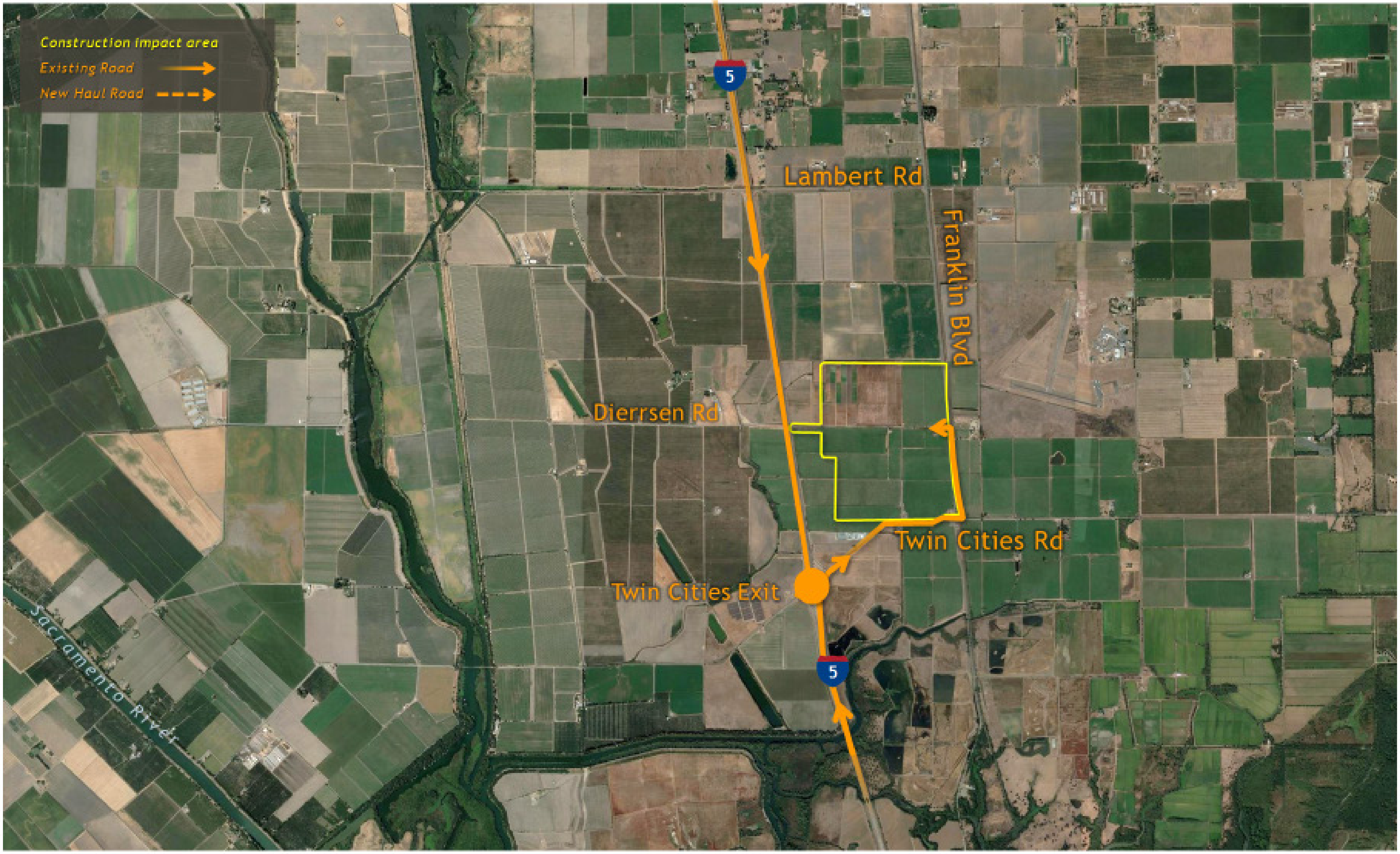
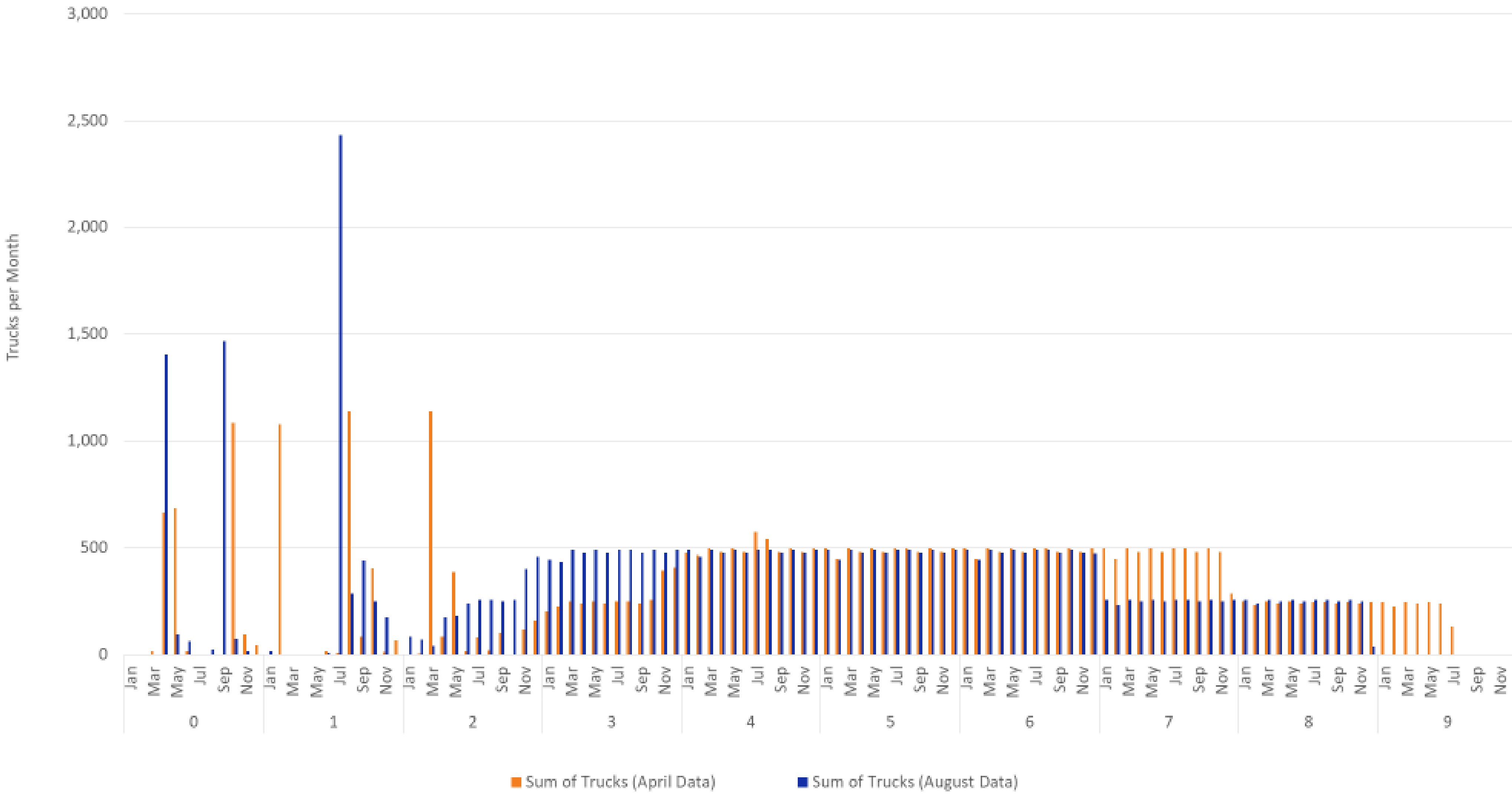


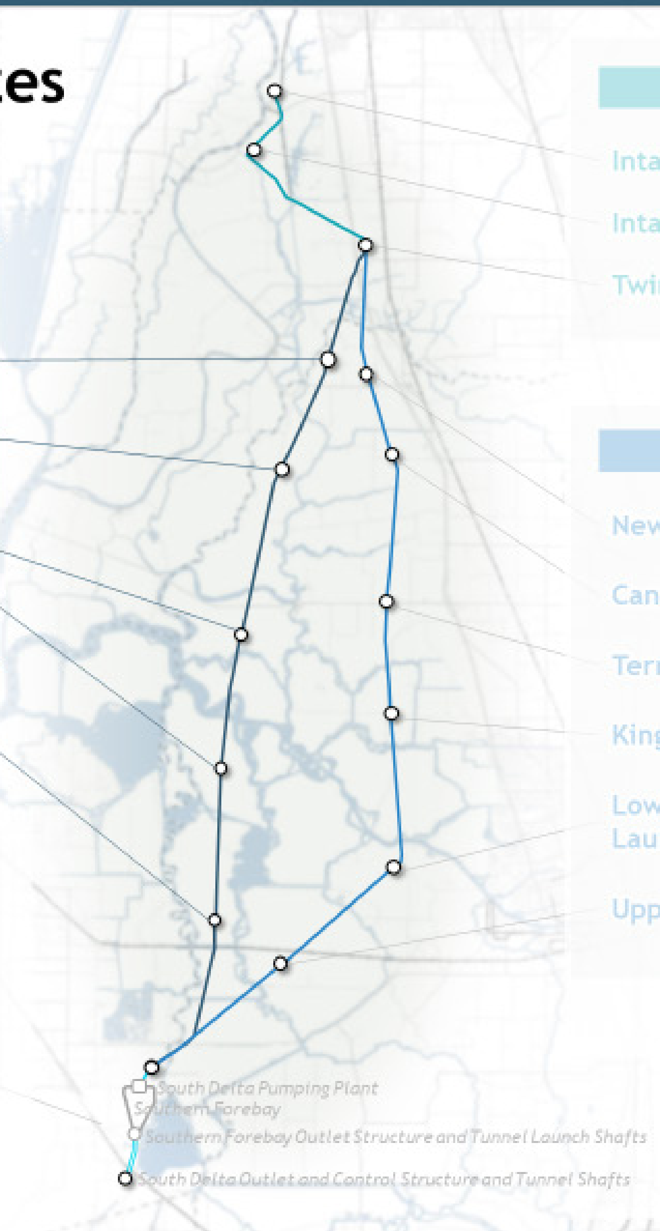
Twin Cities Launch Shaft Site Access Routes



Twin Cities Launch Shaft Site
Traffic Volume Histogram – *Change from April to Present*



Central Alignment Shaft Sites



CENTRAL ALIGNMENT SITES

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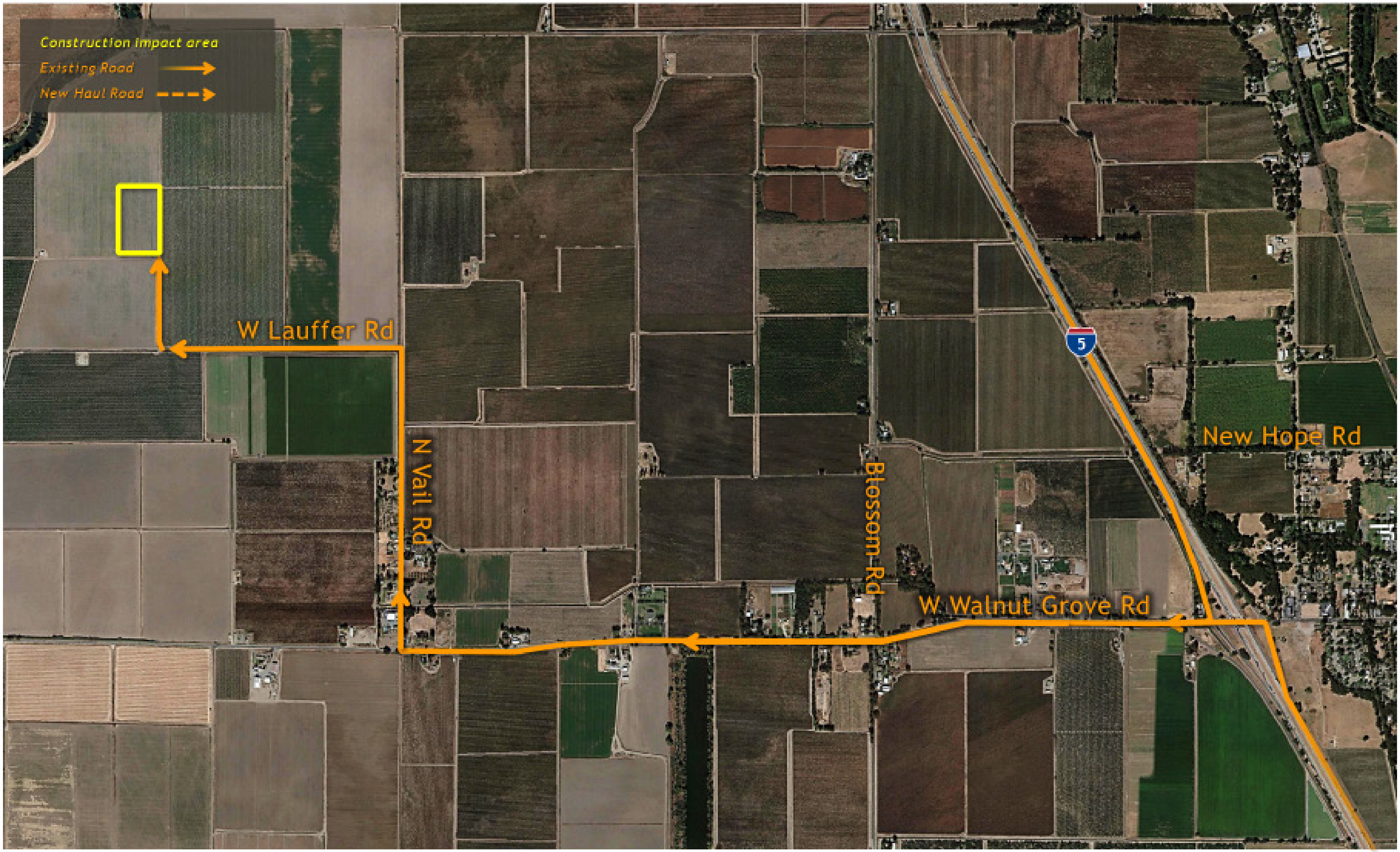
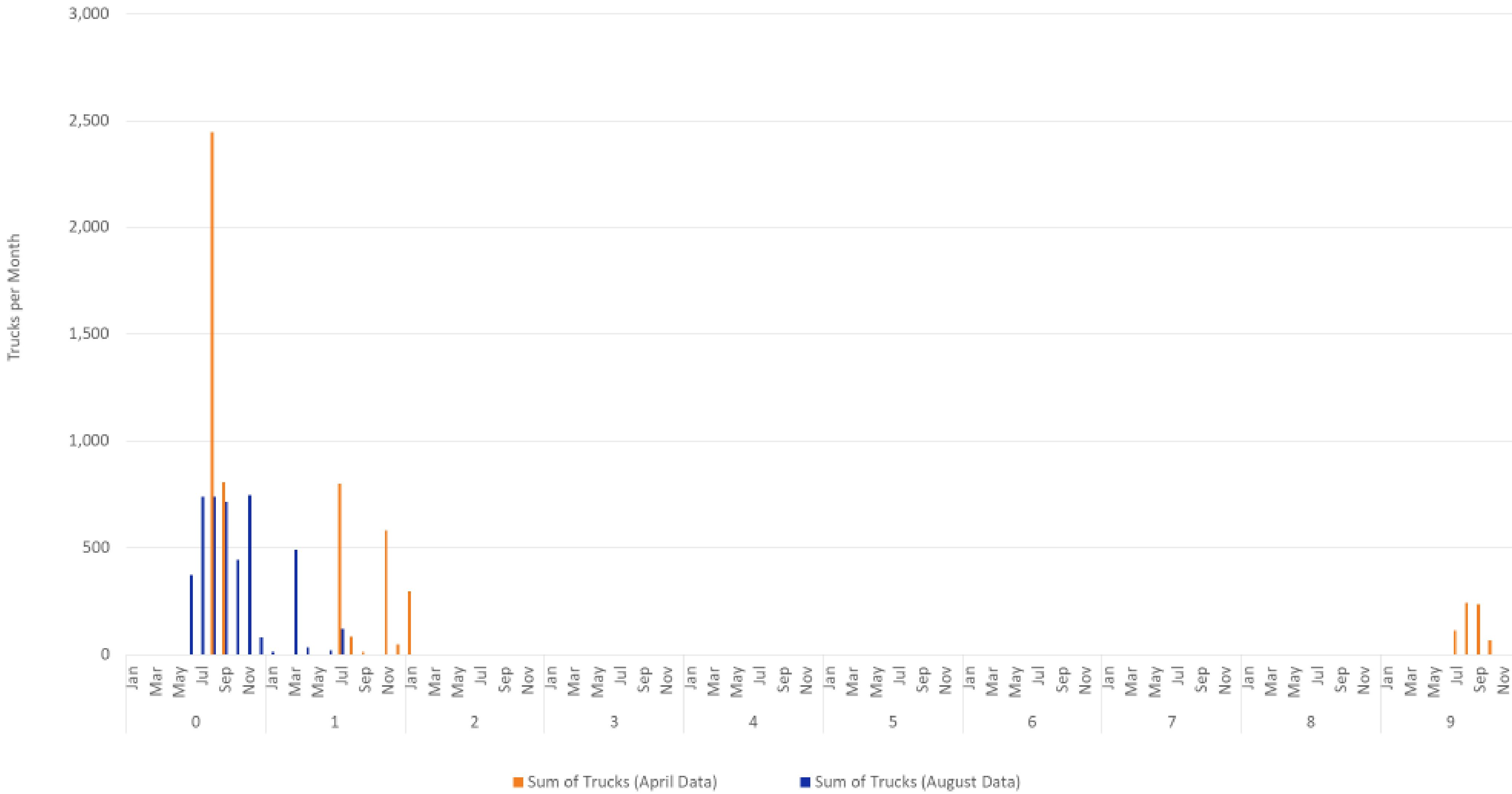
- South Delta Outlet & Control Structure *page 35*

New Hope Tract Maintenance Shaft Site Access Routes

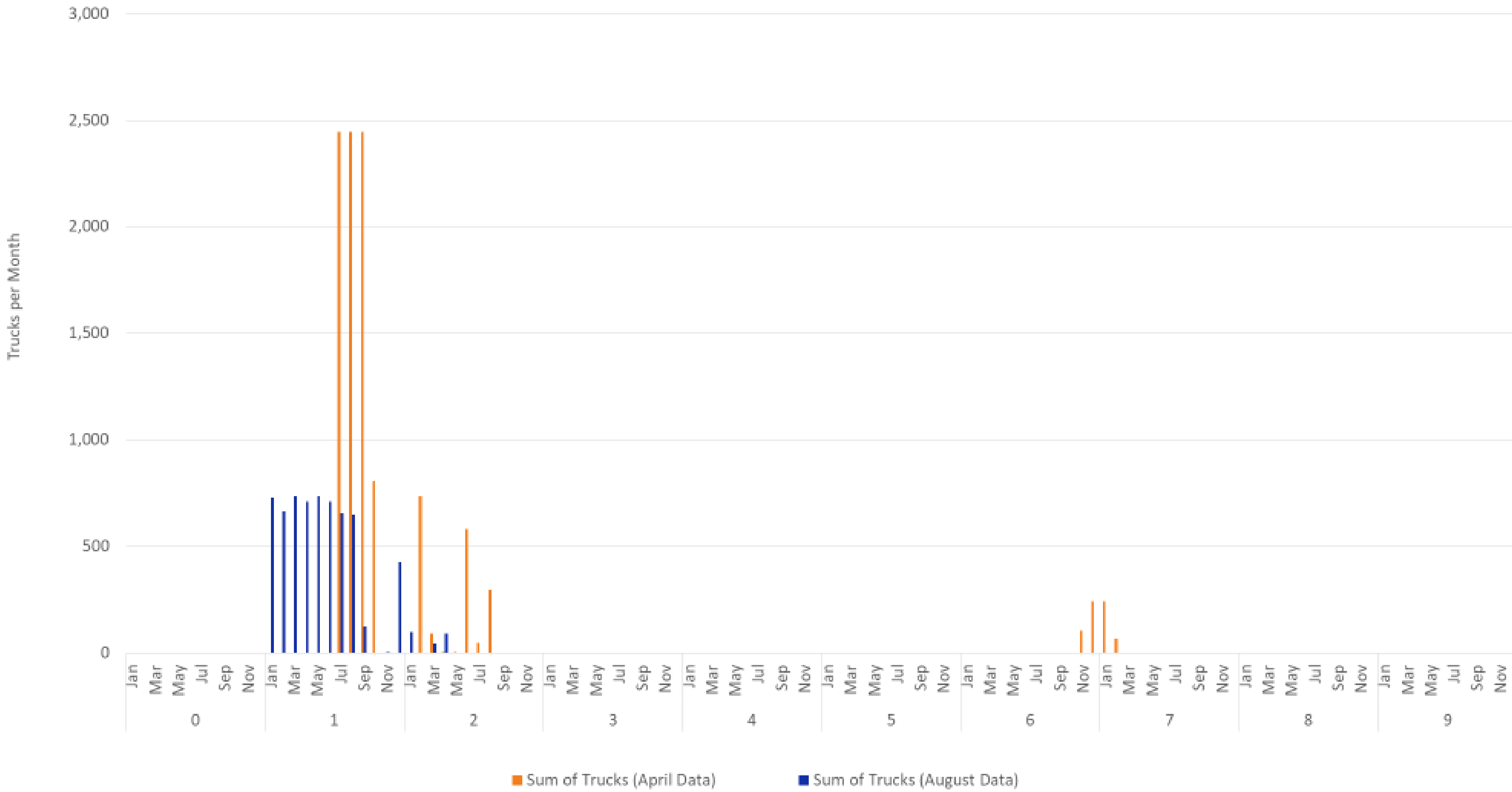


New Hope Tract Maintenance Shaft Site
Traffic Volume Histogram – *Change from April to Present*

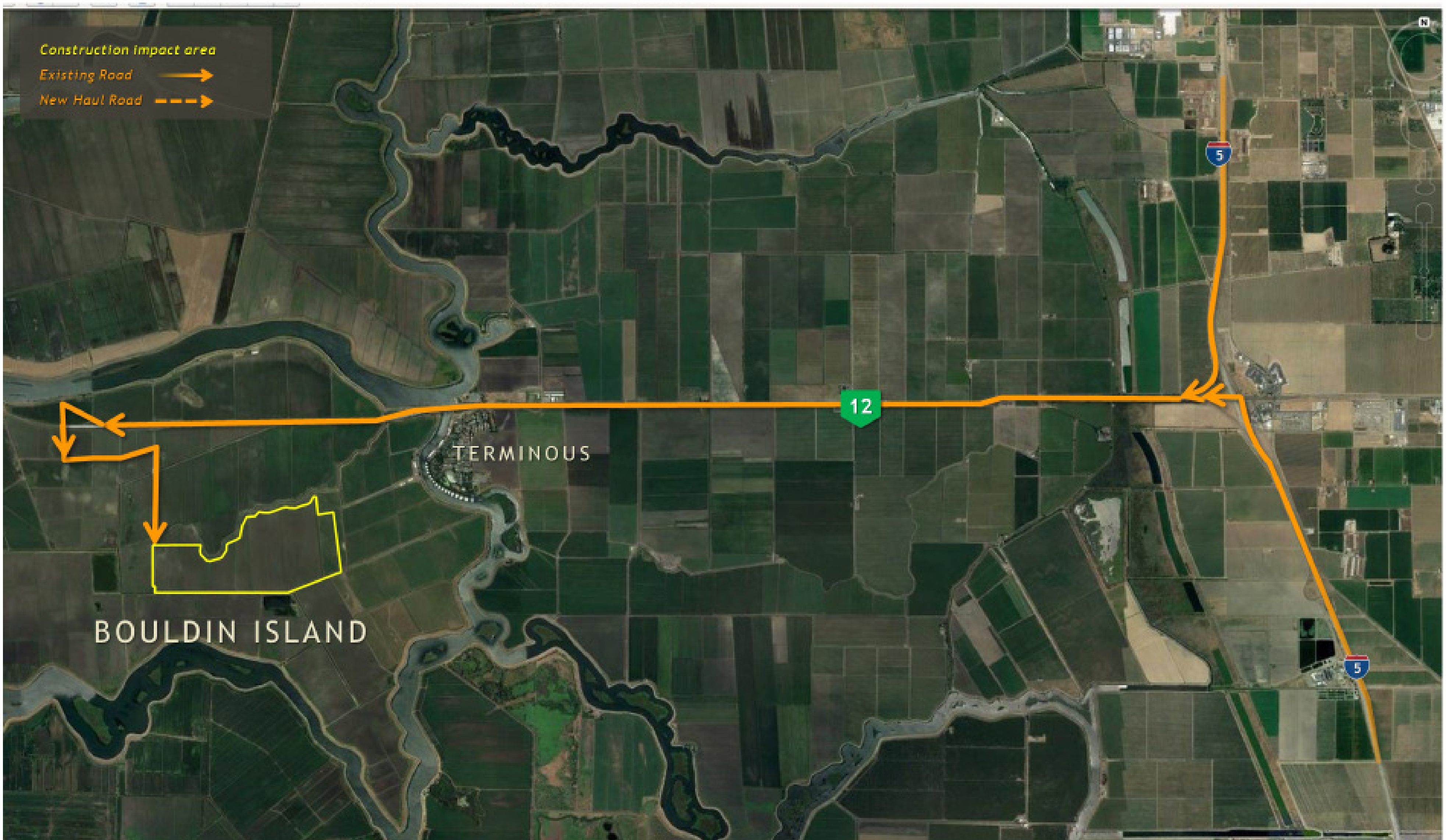


Staten Island Maintenance Shaft Site Access Routes

Staten Island Maintenance Shaft Site
Traffic Volume Histogram - *Change from April to Present*



Bouldin Island Launch Shaft Site Access Routes



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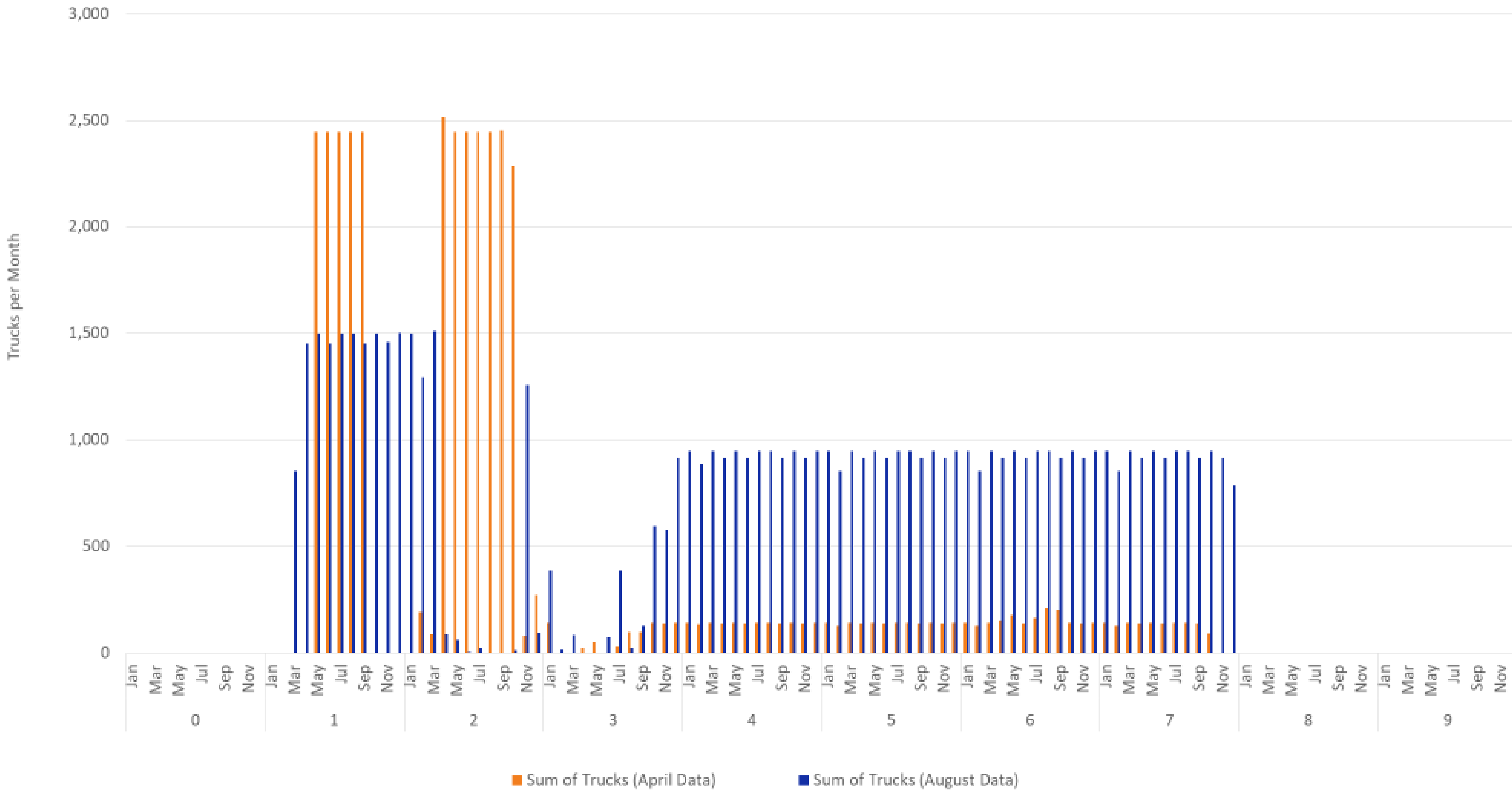
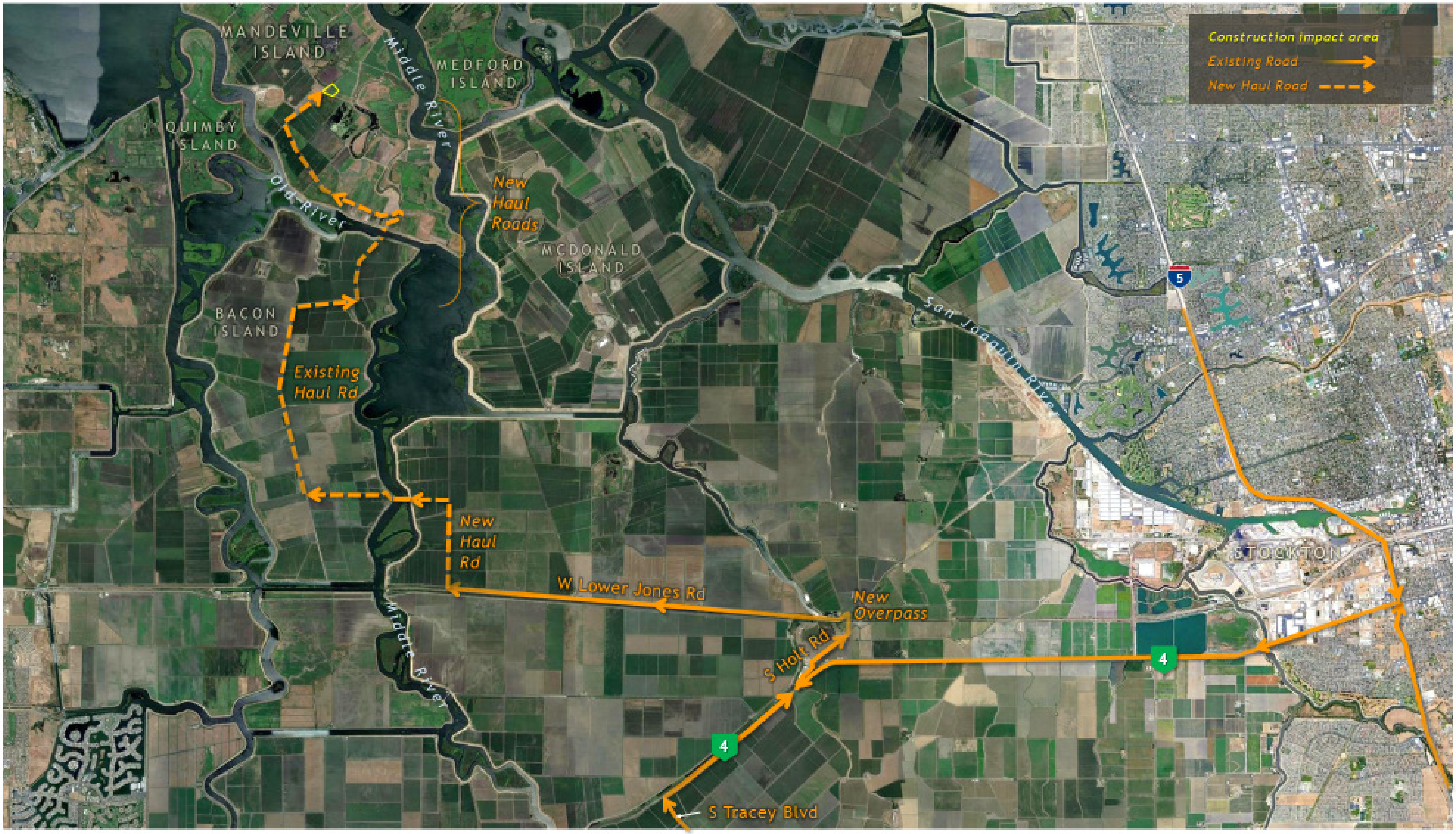
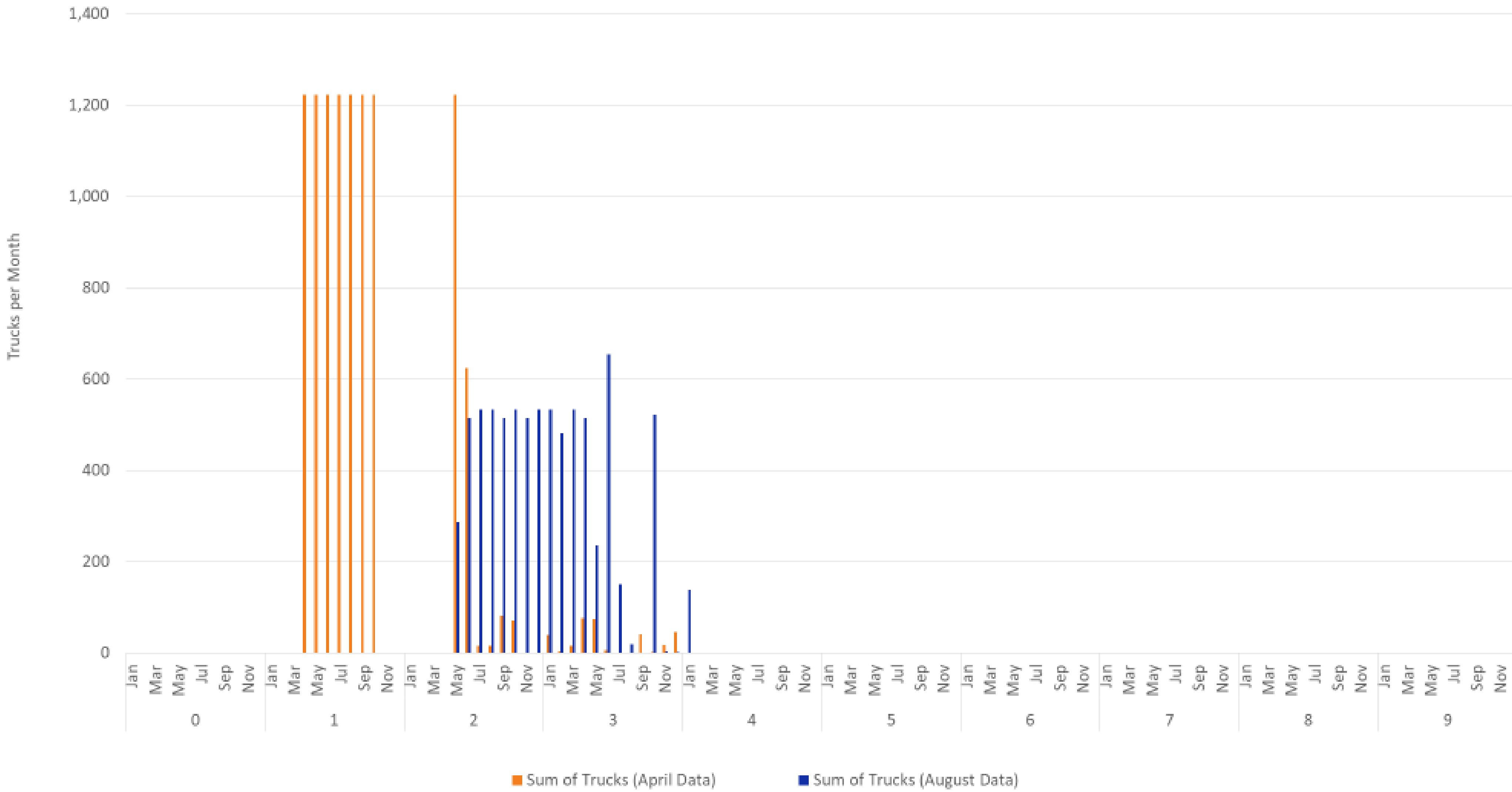


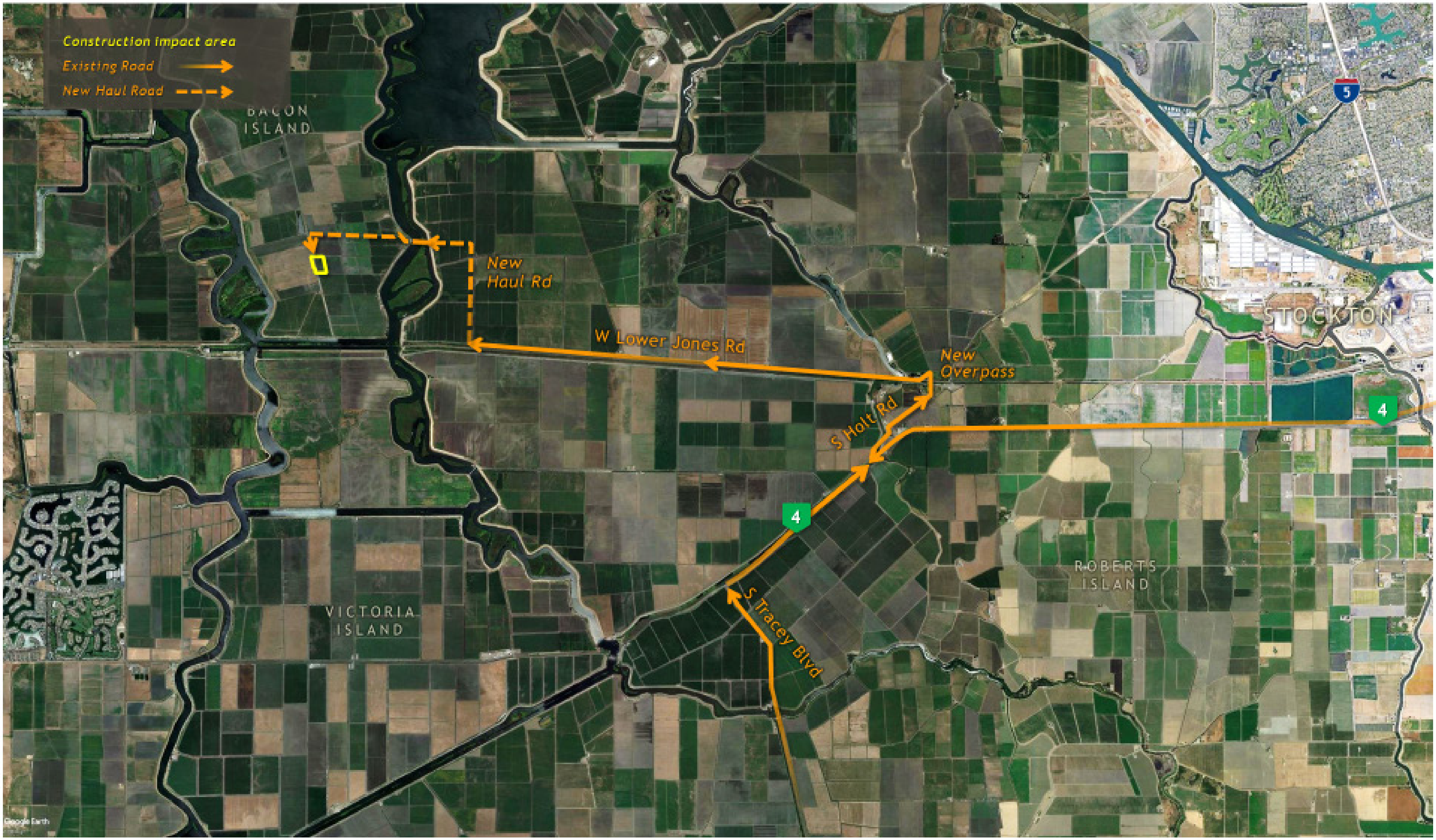
Mandeville Island Maintenance Shaft Site Access Routes



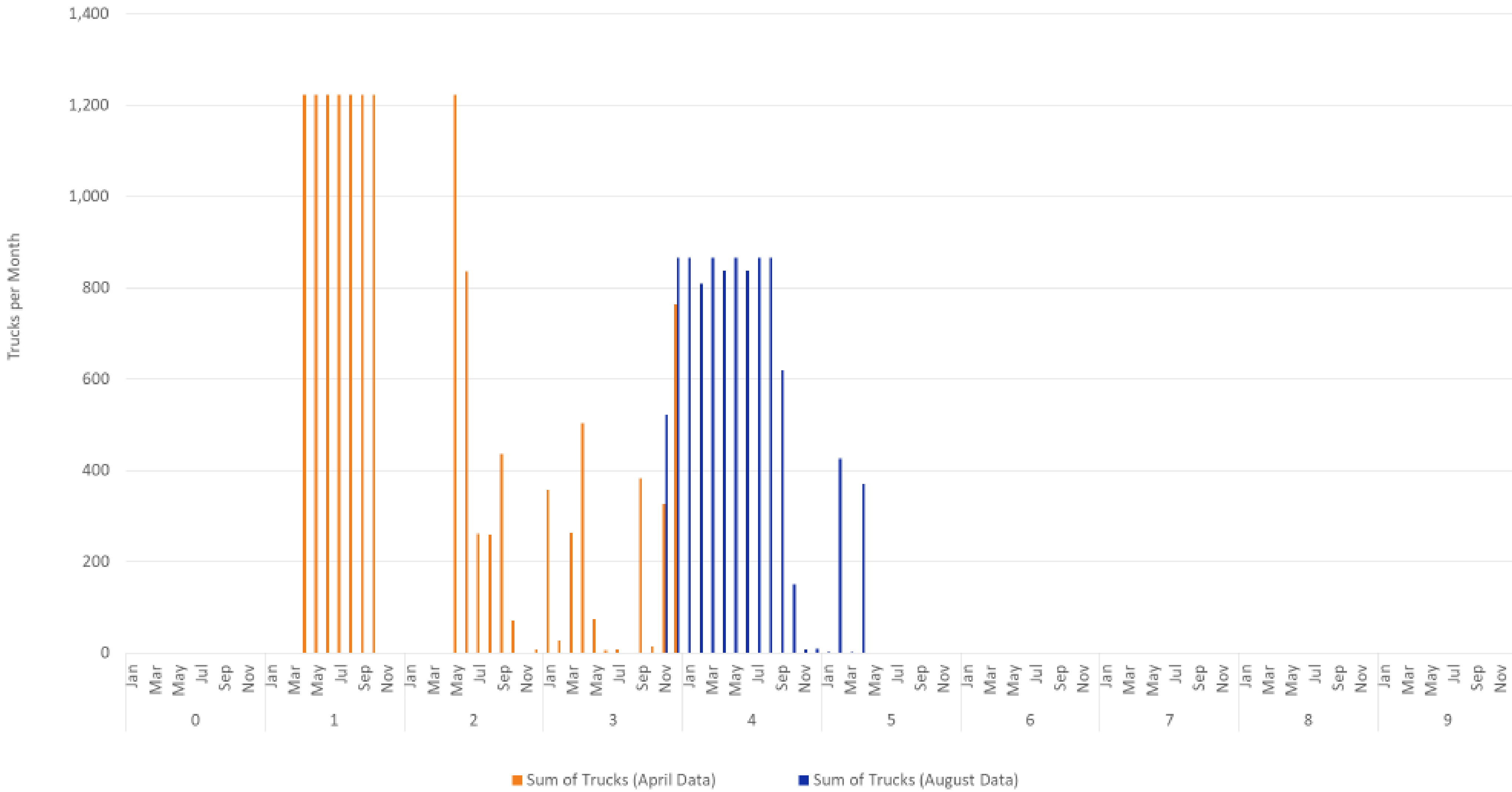
Mandeville Island Maintenance Shaft Site
Traffic Volume Histogram – *Change from April to Present*



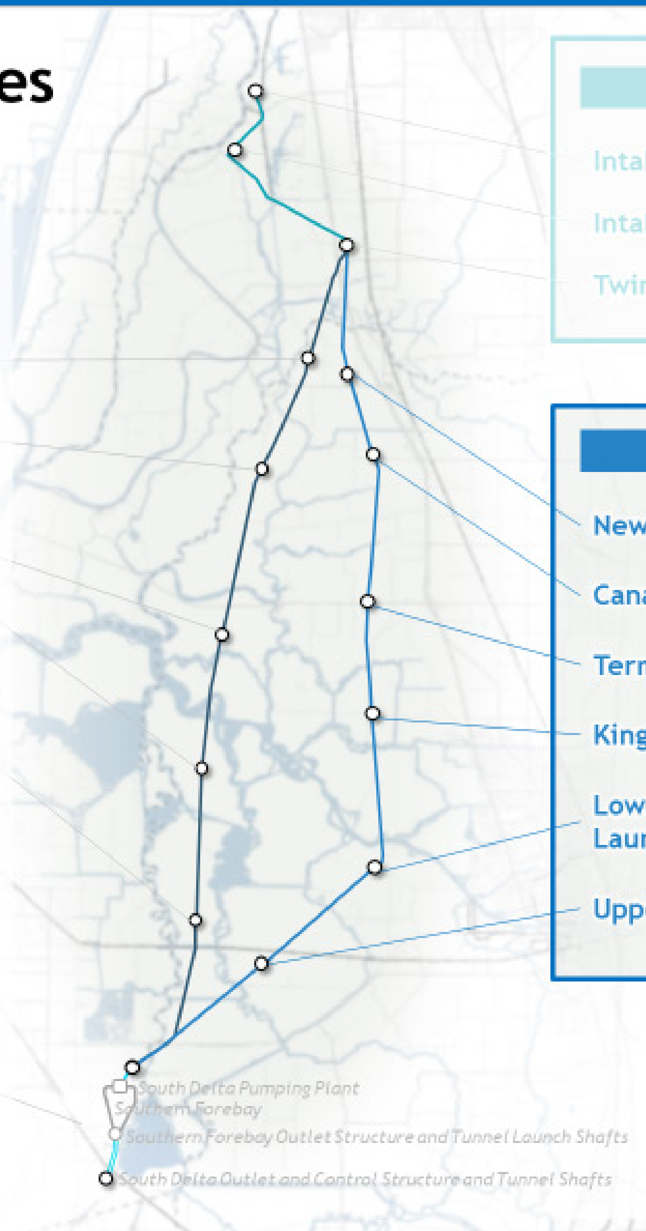
Bacon Island Reception Shaft Site Access Routes



Bacon Island Reception Shaft Site
Traffic Volume Histogram – *Change from April to Present*



Eastern Alignment Shaft Sites



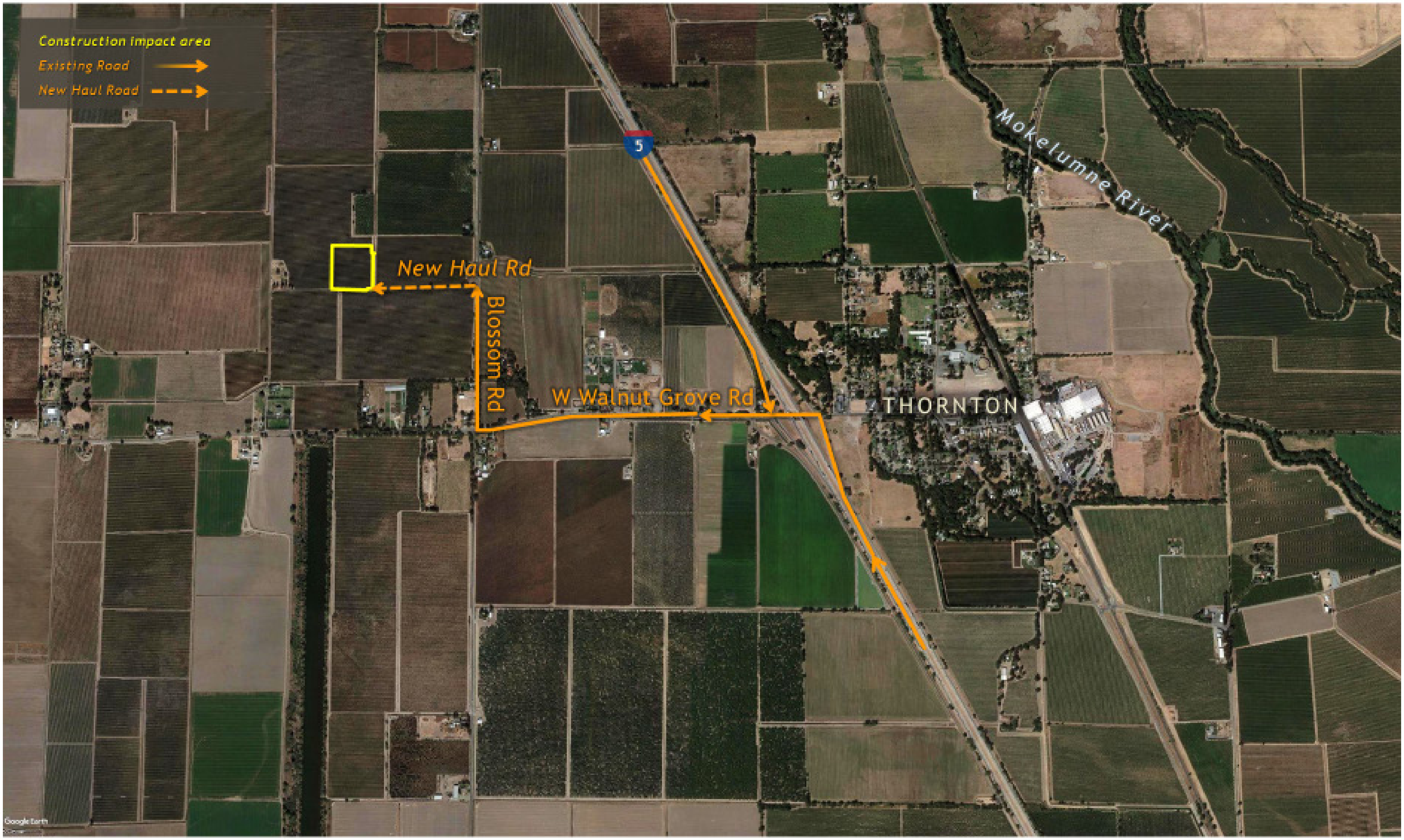
NORTHERN SITES

CENTRAL ALIGNMENT SITES

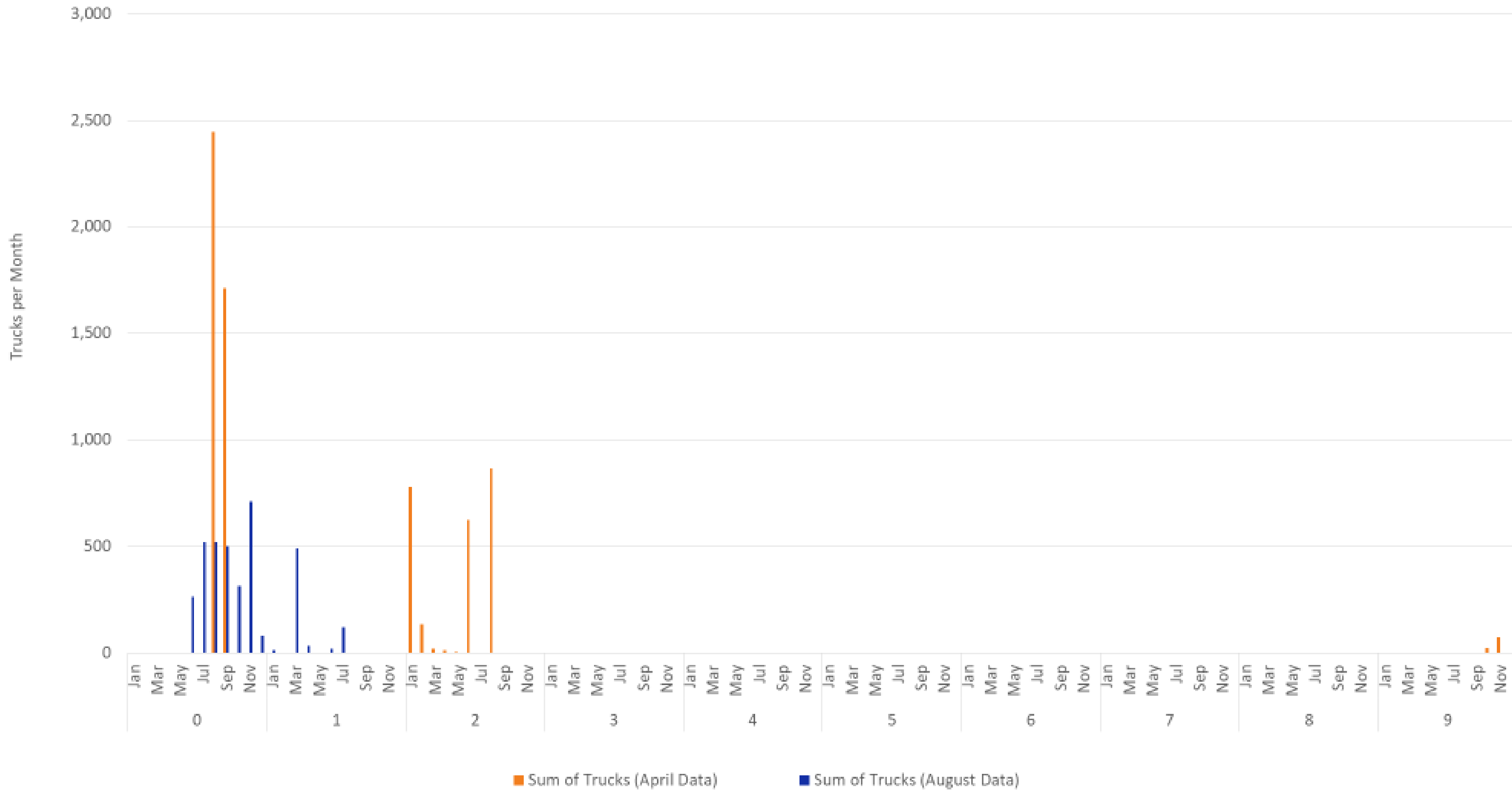
EASTERN ALIGNMENT SITES

SOUTHERN COMPLEX

New Hope Tract Maintenance Shaft Site

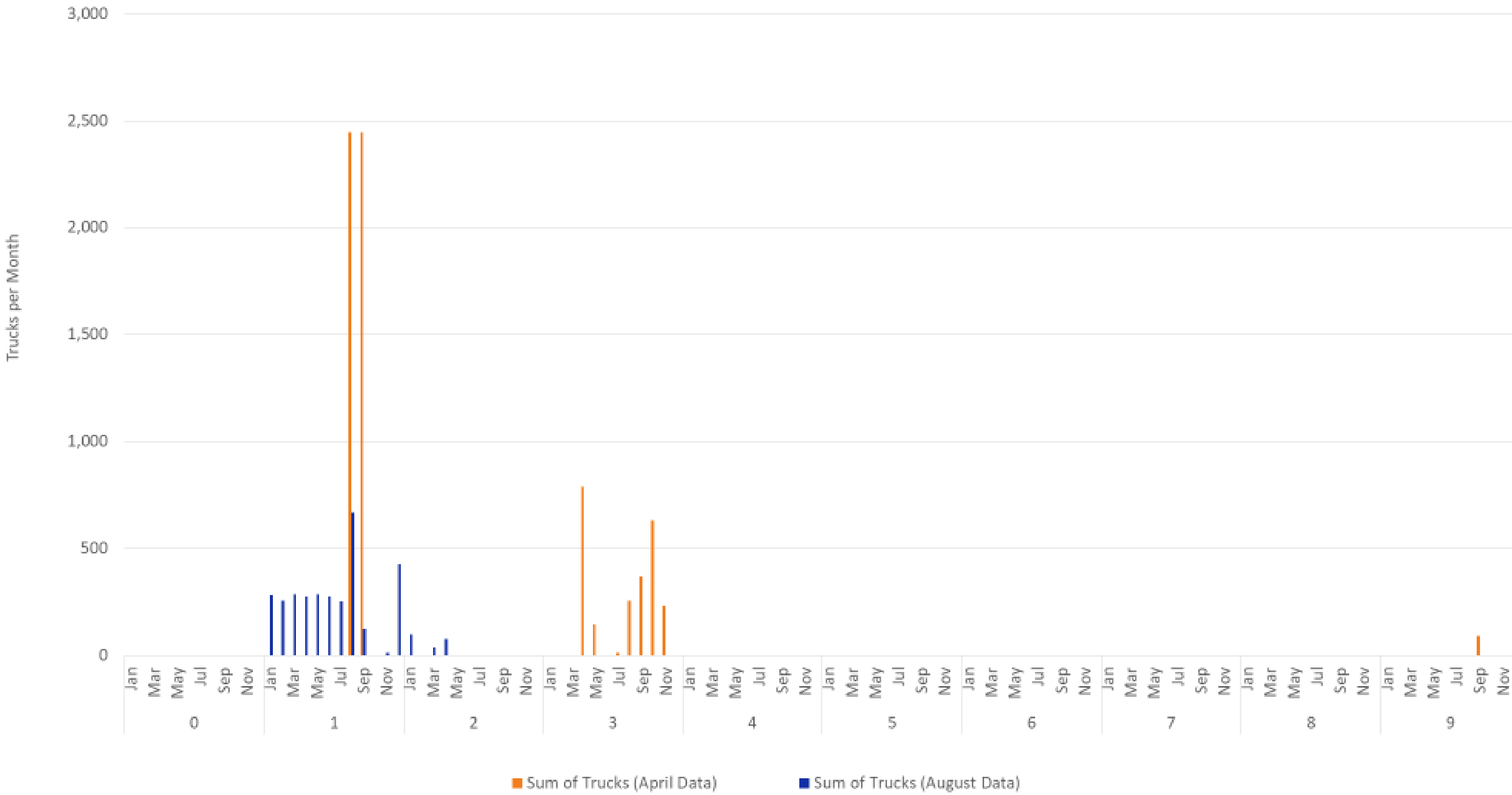


New Hope Tract Maintenance Shaft
Traffic Volume Histogram – *Change from April to Present*



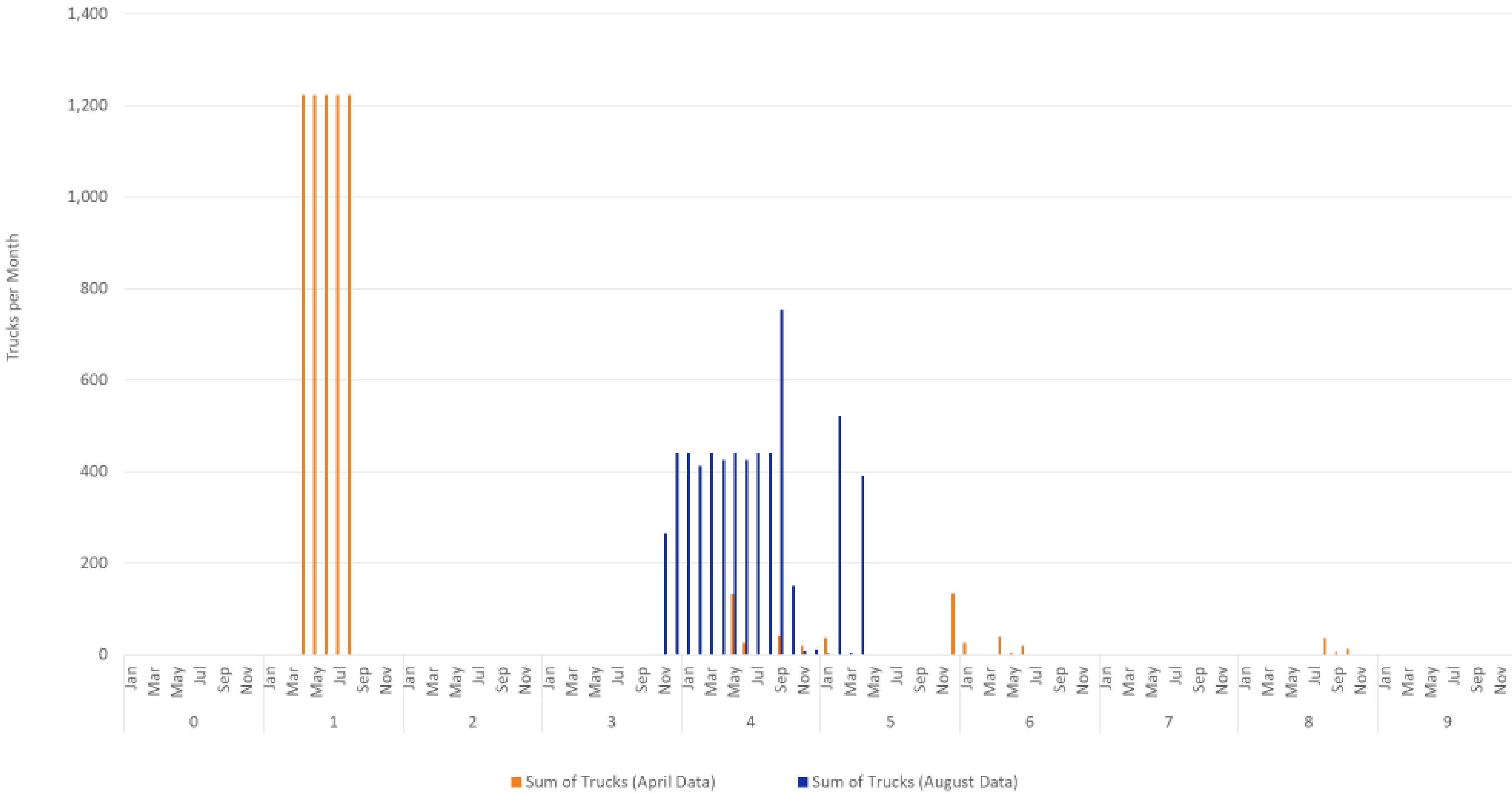
Canal Ranch Maintenance Shaft Site Access Routes

Canal Ranch Maintenance Shaft Site
Traffic Volume Histogram - *Change from April to Present*



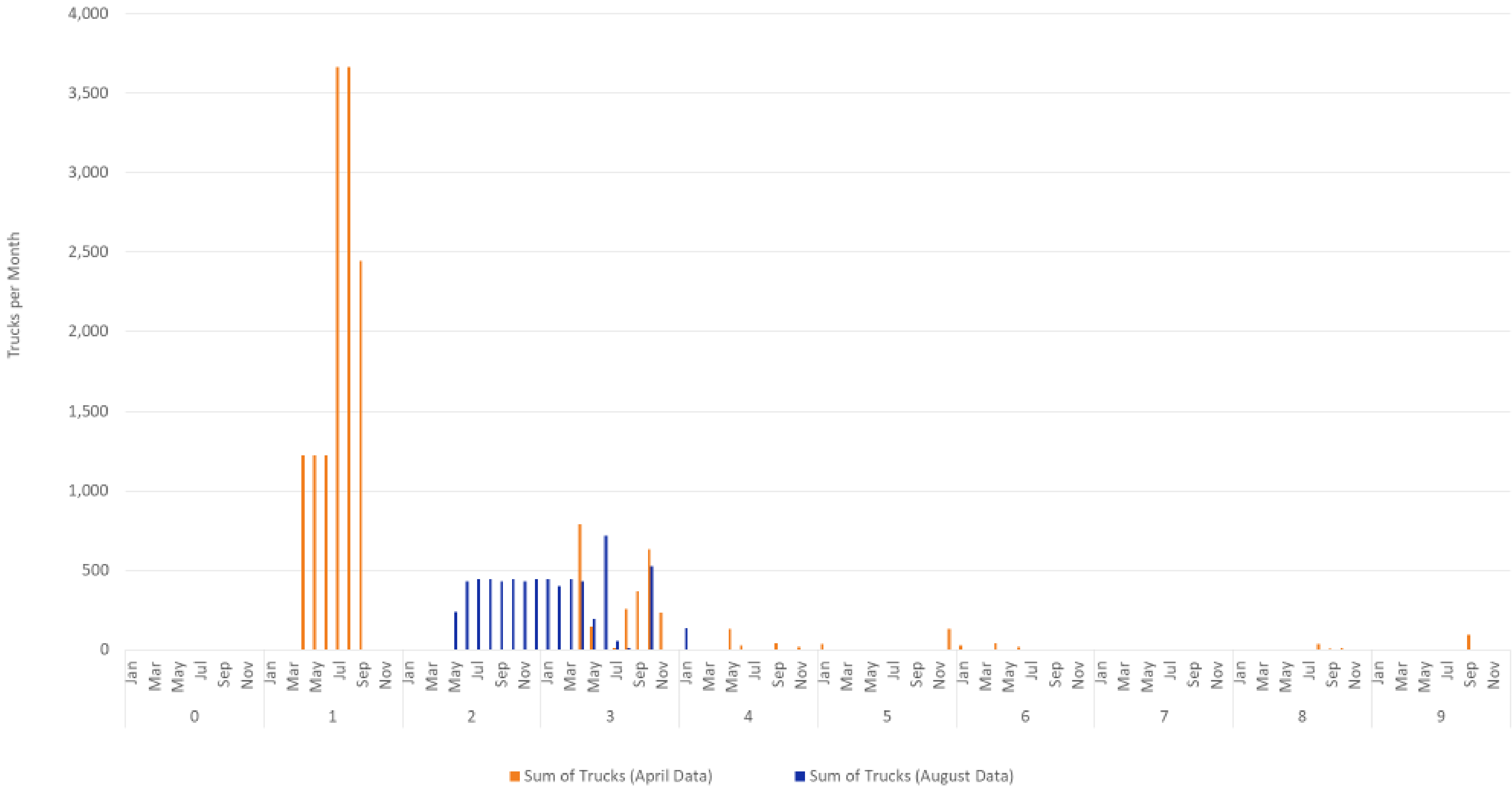
Terminous Tract Reception Shaft Site Access Routes

Terminous Tract Reception Shaft Site
Traffic Volume Histogram - *Change from April to Present*

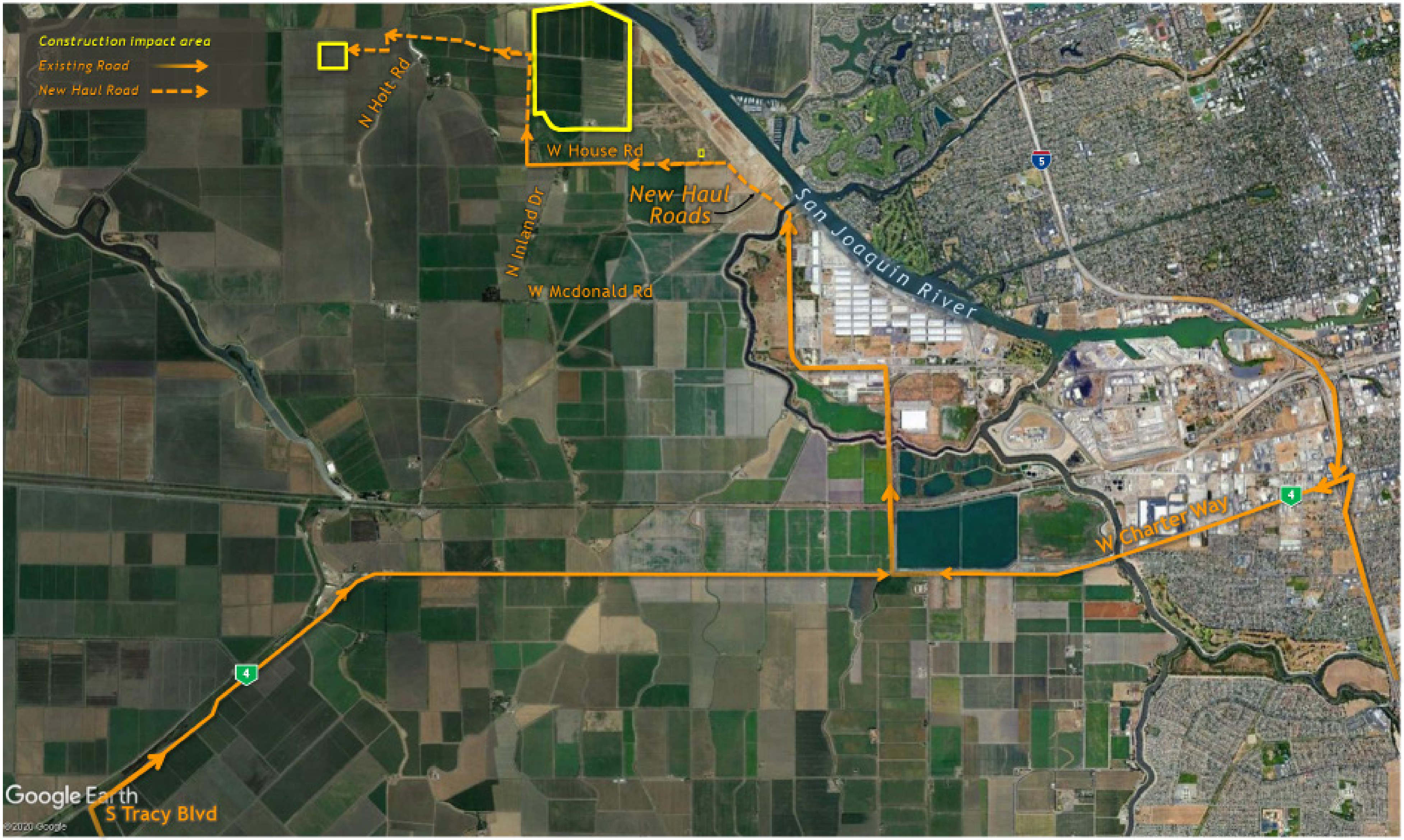


King Island Maintenance Shaft Site Access Routes

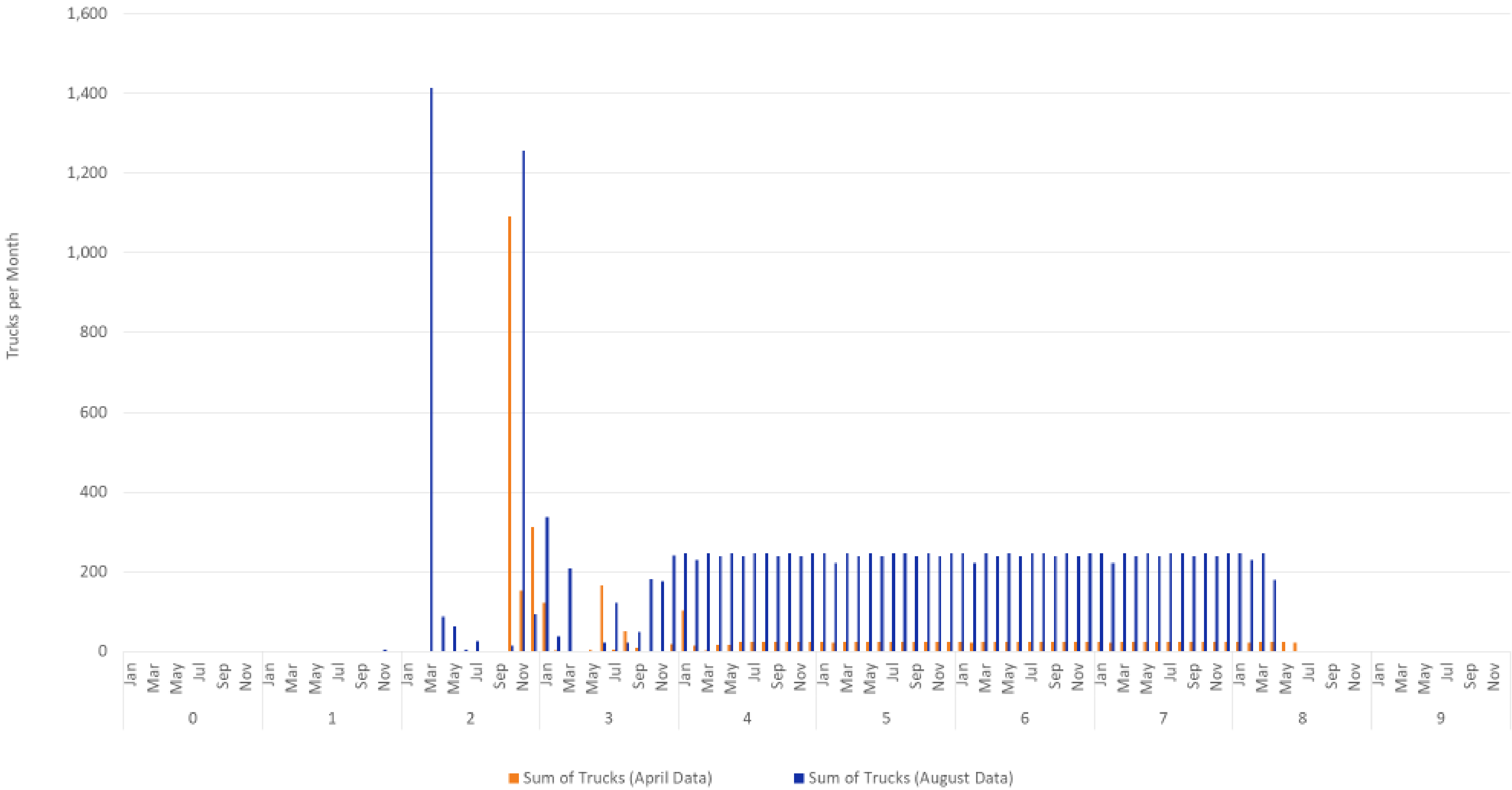
King Island Maintenance Shaft Site
Traffic Volume Histogram - *Change from April to Present*



Lower Roberts Island Launch Shaft Site Access Routes

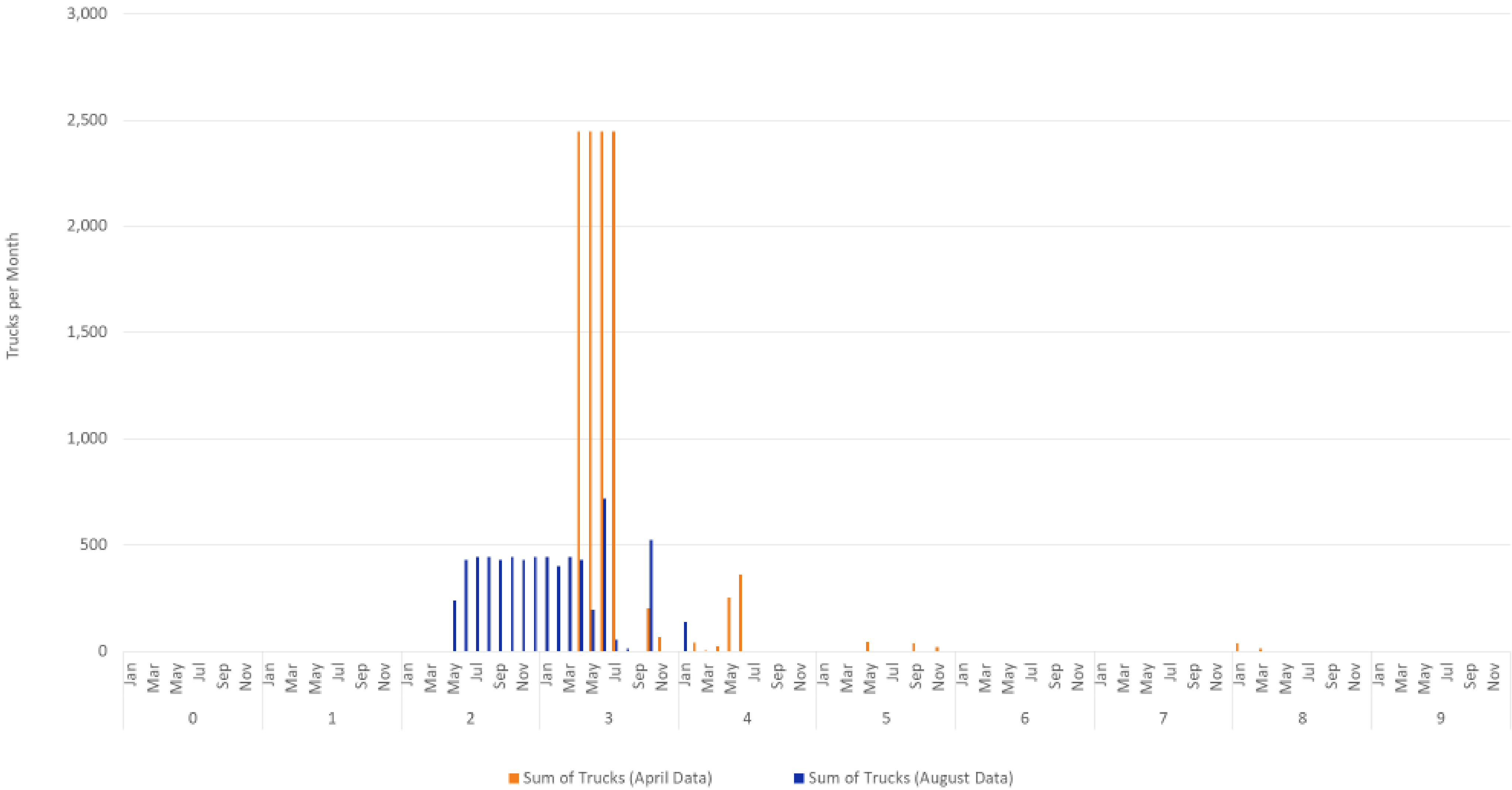


Lower Roberts Island Launch Shaft Site
Traffic Volume Histogram - *Change from April to Present*

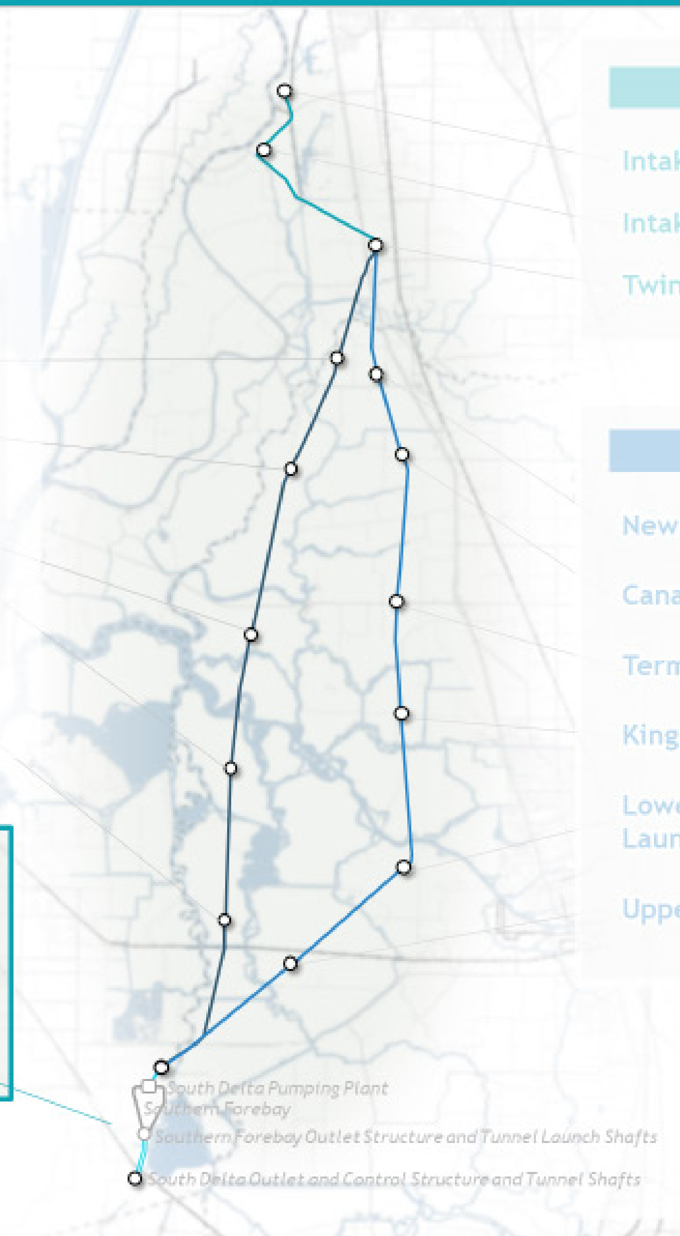


Upper Jones Launch Shaft Site Access Routes

Upper Jones Launch Shaft Site
Traffic Volume Histogram - *Change from April to Present*



Southern Complex Sites



NORTHERN SITES

Intake 3 *page 4*

Intake 5 *page 6*

Twin Cities Launch Shaft *page 8*

CENTRAL ALIGNMENT SITES

New Hope Tract Maintenance Shaft *page 11*

Staten Island Maintenance Shaft *page 13*

Bouldin Island Launch Shaft *page 15*

Mandeville Island Maintenance Shaft *page 17*

Bacon Island Reception Shaft *page 19*

EASTERN ALIGNMENT SITES

New Hope Tract Maintenance Shaft *page 22*

Canal Ranch Tract Maintenance Shaft *page 24*

Terminous Tract Reception Shaft *page 26*

King Island Maintenance Shaft *page 28*

Lower Roberts Island Launch/ Reception Shaft *page 30*

Upper Jones Tract Maintenance Shaft *page 32*

SOUTHERN COMPLEX

Southern Forebay Facilities

South Delta Outlet & Control Structure *page 35*

Southern Forebay Facilities & S Delta Flow Control Facilities Site Access Routes