4 ENVIRONMENTAL IMPACTS

This section describes the potential impacts of the TDLE alternatives on wetlands, aquatic resources, and terrestrial resources, including threatened and endangered species and areas protected under local critical areas ordinances.

The permanent and construction footprints developed for this analysis represent Sound Transit's best estimates of the areas that may be affected by the TDLE alternatives. These estimates are conservative. For example, clearing of all areas within the construction footprint may not be necessary. In addition, the permanent impact footprint may include some areas where project components could be scaled down or eliminated as the project design progresses from its current, preliminary status. Moreover, not all areas within the project footprint would be converted to structures or hard surfaces. Some vegetated areas, for example, would be converted to other land cover types, such as landscaping or stormwater facilities; in other areas, existing hard surfaces may be converted to vegetation. By applying a consistent set of assumptions for all the alternatives, these footprints allow analysts to evaluate the relative degree of the potential impacts of the alternatives on ecosystem resources. Actual anticipated impacts would be determined when a preferred alternative has been selected and the project design is sufficiently advanced to undergo permitting review.

Analyses of impacts assume that appropriate measures would be implemented and would perform as expected to avoid and minimize project-related impacts (see Section 5.1). For each resource area, analyses of direct impacts are divided between long-term (operational) impacts and short-term (construction-related) impacts. The impacts of the alternatives within each segment are evaluated and compared. In all segments, the station design options would have no appreciable differences in their impacts on ecosystem resources; therefore, the analyses of the impacts of the alternatives incorporate all station design options equally. Indirect effects are evaluated in Section 4.6, and cumulative impacts are evaluated in Section 4.7.

4.1 Aquatic Species and Habitat

Analyses in this subsection address the potential long-term and construction-related impacts of each alternative on aquatic species and habitat. Actual impacts would depend on the location and design of the final alternative, the construction footprint and methods, the BMPs implemented during construction (see Section 4.8), and the performance of post-construction restoration.

Sound Transit considered the following potential impacts on aquatic resources:

- Permanent loss or modification of physical aquatic habitat (e.g., fill in wetlands, constructed features in streams or the Puyallup River).
- Permanent degradation of instream physical habitat, such as shading, chronic sedimentation, removal of boulders or LWD from the channel, and loss of riparian vegetation function (loss of nutrient inputs, LWD recruitment, and shade).
- Impacts on fish passage.
- Altered hydrology (higher peak flows result in increased scour/deposition downstream; decreased percolation from impervious surfaces result in lower base flows). Streams in urban areas with lots of impervious surface often exhibit flashiness as a result of stormwater runoff being delivered to the stream much faster than would occur in an undeveloped/natural

condition, where stormwater runoff delivery to streams would occur at slower rate due to roughened surface of overland flow, infiltration into groundwater, and hyporheic exchange.

- Temporary or permanent degradation of water quality (increased temperature, increased turbidity, increased loading of heavy metals and hydrocarbons).
- Temporary loss of physical habitat (dewatering).
- Temporary degradation of habitat (sedimentation, removal of riparian vegetation, disturbance to stream banks).
- Temporary increase in underwater noise caused by in-water pile driving.

To the extent that impacts cannot be avoided or minimized through project design development or use of BMPs, Sound Transit would implement additional measures to reduce adverse effects and provide compensatory mitigation measures where adverse effects are unavoidable. Sound Transit has committed to achieving no net loss of ecosystem function on a project-wide basis (Sound Transit 2007). As discussed in Section 5, compensatory mitigation would be implemented in accordance with applicable Tribal, federal, state, and local requirements and guidelines.

4.1.1 Long-Term Impacts

Direct long-term impacts on aquatic resources would occur where permanent features such as project facilities permanently alter in-stream habitat (including habitat accessibility), wetlands, or riparian functions. Additional impacts may occur where surface waters receive stormwater runoff from impervious surfaces created or replaced by project construction. These potential effects are described in greater detail below. Impacts associated with each alternative are discussed in the subsections that follow.

Operation of TDLE would not be expected to increase nighttime illumination of fish-bearing waters (which could increase the risk of predation on juvenile salmonids) because the tracks would have no overhead lighting and the train headlights would be directed parallel to the tracks.

In-Stream Habitat Alteration

The construction of light rail guideways and other facilities could permanently or temporarily alter in-stream habitat in areas where such structures run close to or cross streams. In addition to affecting fish and other aquatic organisms within the impact footprint, the loss or degradation of stream habitat could reduce the availability of prey (e.g., benthic invertebrates) for fish and other aquatic species in reaches downstream of the study area. Unavoidable impacts on streams are evaluated in the discussions of the impacts of the alternatives, below.

Sound Transit has committed to minimizing the need to place existing streams in new culverts and has designed the TDLE alternatives to avoid new stream piping whenever possible. The majority of TDLE alternatives would be on elevated guideways where they cross surface-flowing streams. At most crossings, the elevated structure would span the stream, and the support columns would be placed on either side, beyond the stream banks and outside the OHWM. Unavoidable impacts on streams (i.e., where full span would not be possible or where a stream channel would need to be realigned) are described and evaluated in the discussions of the impacts of the alternatives, below. If any culverts on fish-bearing or potentially fish-bearing streams must be replaced, or if any new culverts need to be installed, the new or replacement structures would be designed and installed in accordance with WDFW’s Water Crossing Design Guidelines (Barnard et al. 2013).

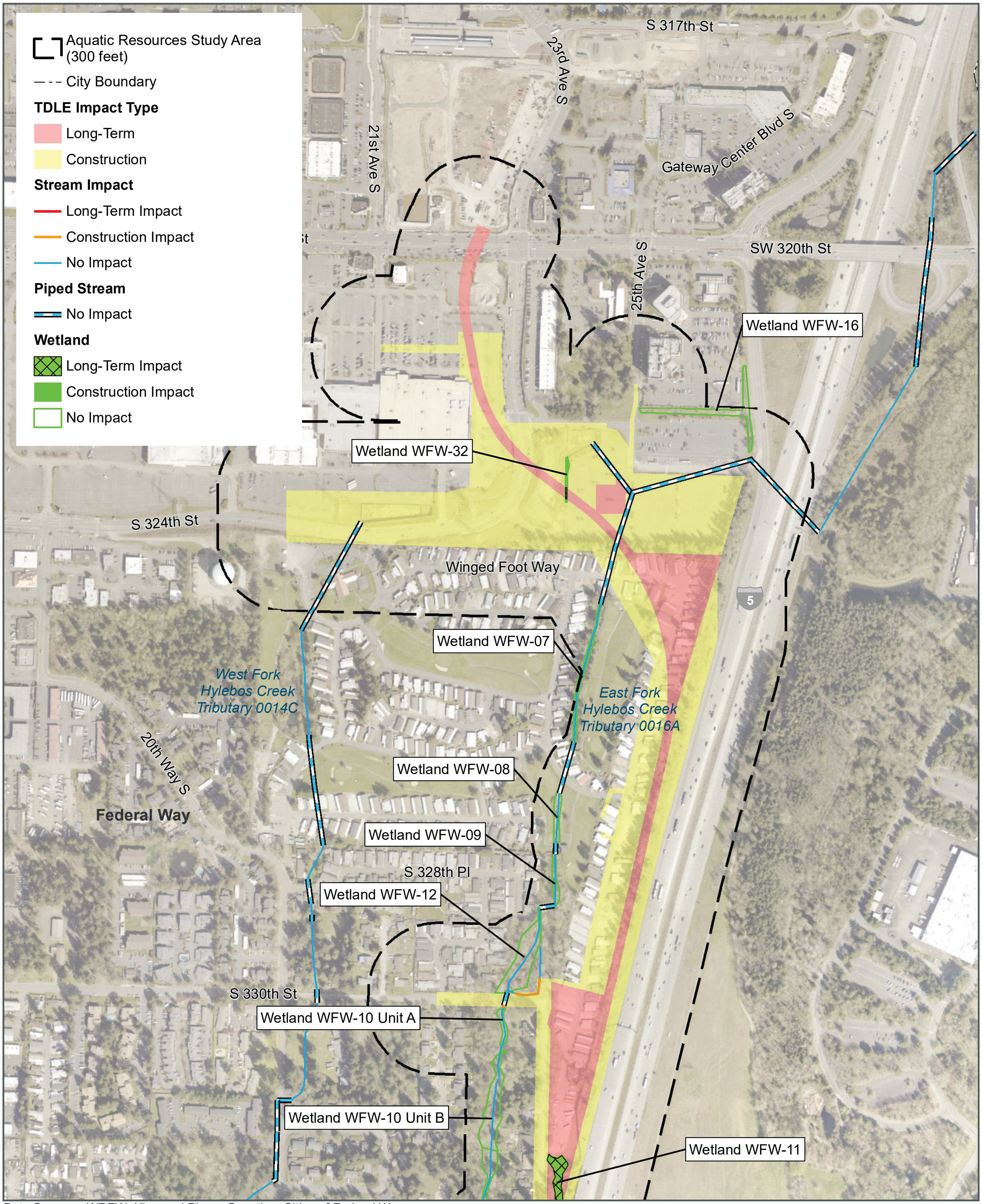
Any work within the OHWM of any streams or that may otherwise affect fish in the study area would be conducted in accordance with the terms of the Hydraulic Project Approval (HPA) and other applicable permits and reviews (e.g., CWA Section 404 permit, Tribal permits, ESA Section 7 consultation, shoreline substantial development permits, critical areas alteration approvals) for this project.

Additional impacts may occur where elevated segments of connecting track pass over surface-flowing streams and rivers. In addition to affecting riparian habitat and vegetation (see the discussion of Vegetation Removal and Habitat Alteration, below), shade from structures placed over streams may affect the behavior of fish and the productivity of the food web in the affected stream segments. Outmigrating juvenile salmonids may respond to shadows from overwater structures by pausing at the upstream end of the darkened area or moving into deeper waters, potentially increasing their vulnerability to predation (Kemp and Williams 2008; Moore et al. 2013). Shade from overwater structures may also provide hiding cover for potential predators. Where elevated track segments run parallel to a stream, the placement of support columns may constrain options for natural or human-induced modifications to channel configuration (e.g., meander creation, daylighting).

Evaluations of the potential impacts of the alternatives on in-stream habitat conditions are based on the length of surface-flowing streams within the permanent impact footprint (Table J4.4-1). Impacts are depicted in Figures J4.4-1 through J4.4-11.

Impact area numbers in Table J4.4-1 reflect potential long-term impacts to streams and aquatic resources, based on the overlap between streams or stream buffers and the permanent impact footprint for each alternative. Impacts to aquatic resources within the permanent impact footprint could take several forms. For example, in some areas, project features (e.g., elevated guideways) would be built near or over surface-flowing stream channels. In such areas, no ground-disturbing work would take place in the stream channel, but the presence of those structures could have long-term effects on riparian and/or aquatic habitats. In other areas, an existing stream channel would need to be relocated and realigned to accommodate project features. Relocation and realignment could include constructing a new stream channel along approximately the same alignment as the existing channel, or it could entail moving the channel to a new alignment several dozen feet from the existing channel. Relocated stream segments would include meanders and other features that enhance the availability and diversity of aquatic habitats.

As discussed in Section 2.4.5, Analysis Assumptions, the impact values and areas in the table and figures represent conservative estimates of the impacts of the alternatives. Actual anticipated impacts would be determined when an alternative is selected to be built and the project engineering design is advanced.

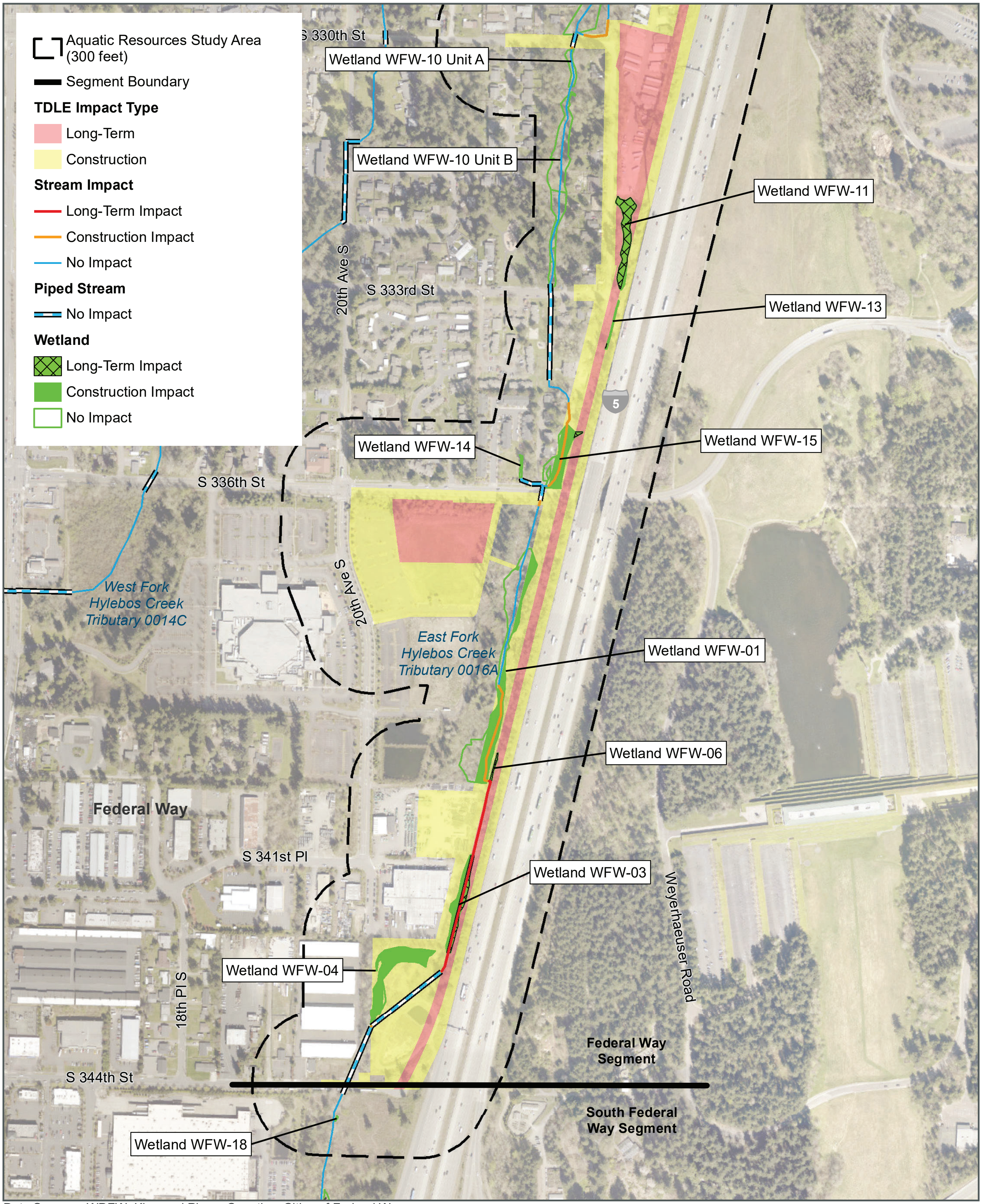


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-1A
Wetland and Stream Impacts
Preferred FW Enchanted Parkway Alternative
Tacoma Dome Link Extension

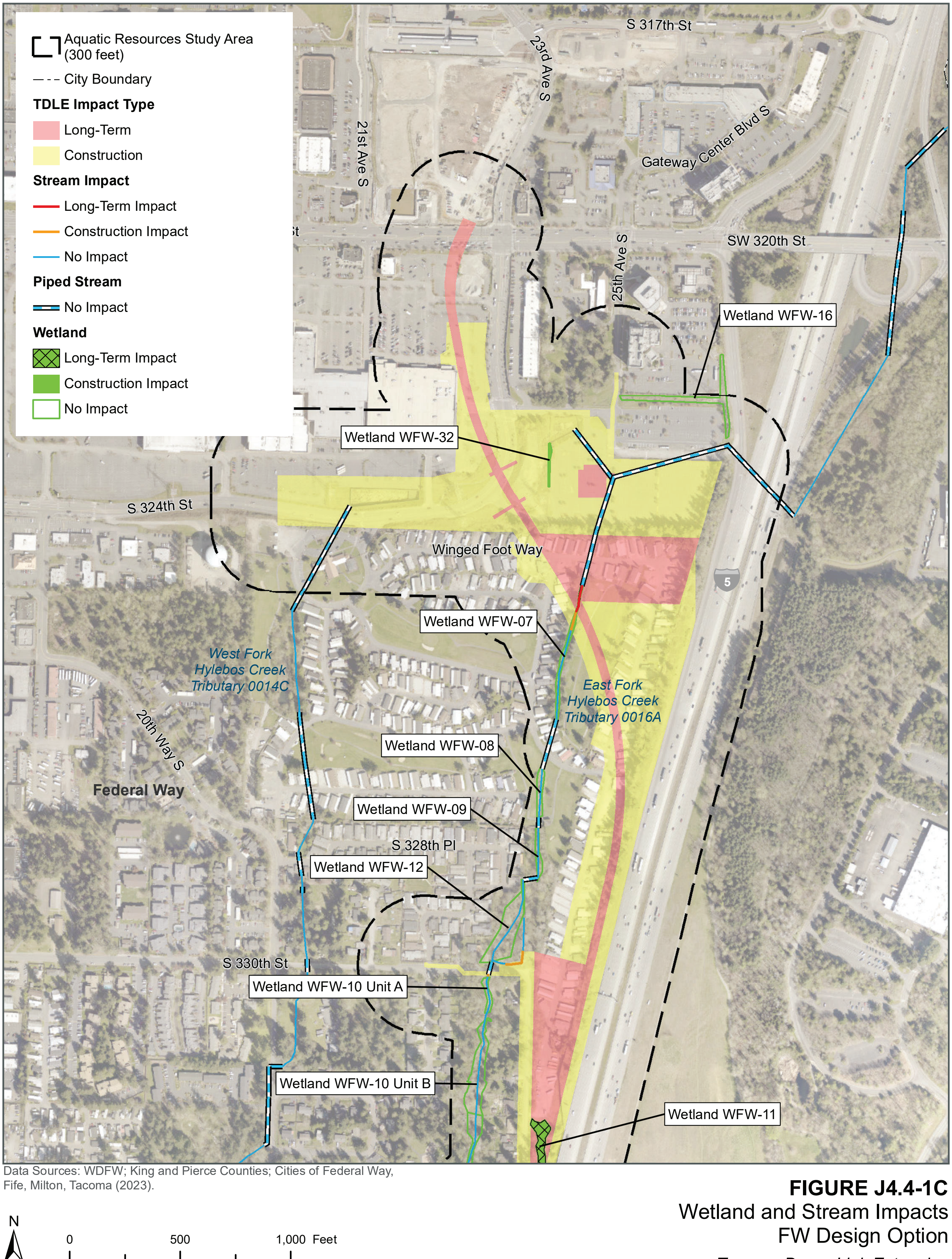


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

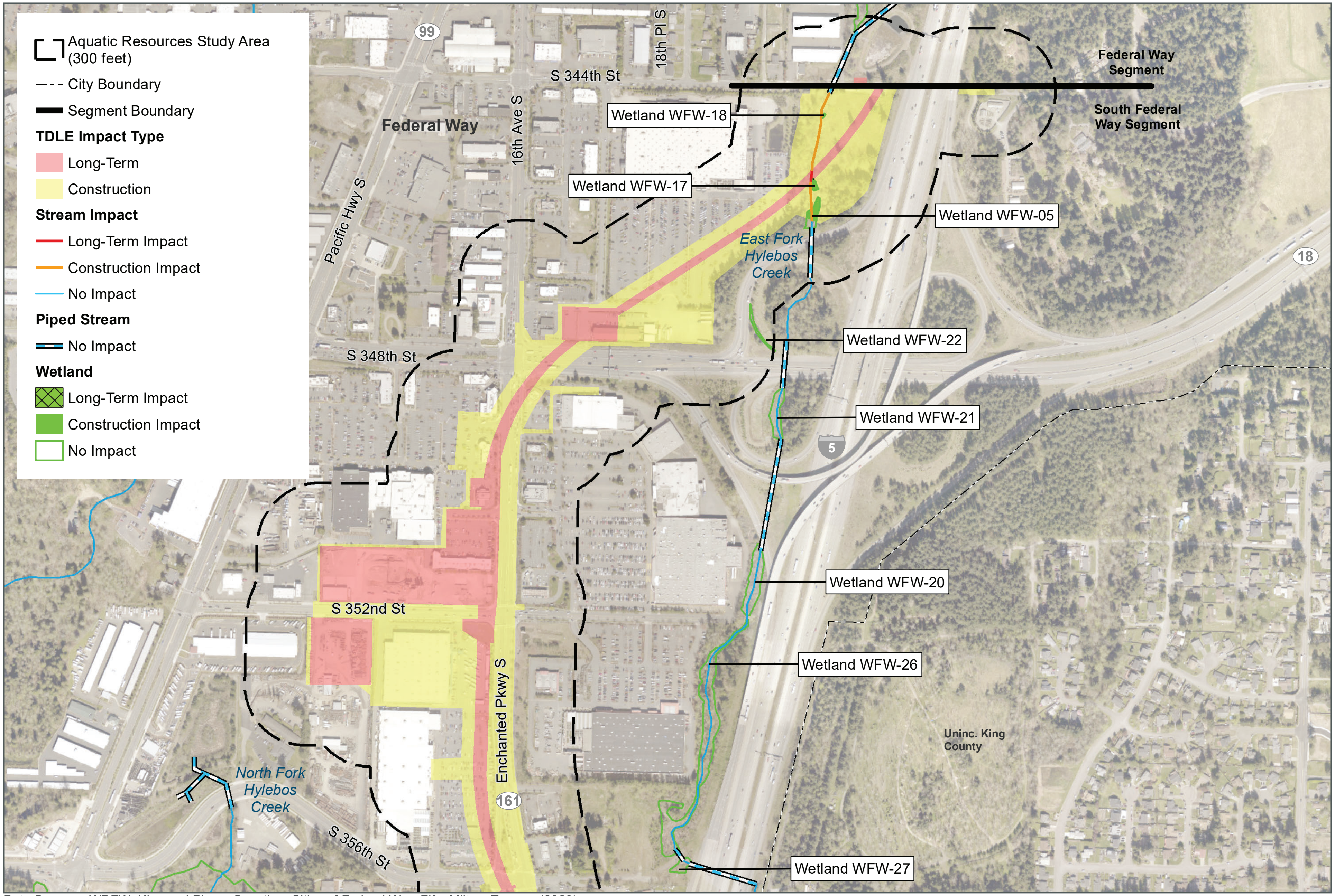
FIGURE J4.4-1B
Wetland and Stream Impacts
Preferred FW Enchanted Parkway Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

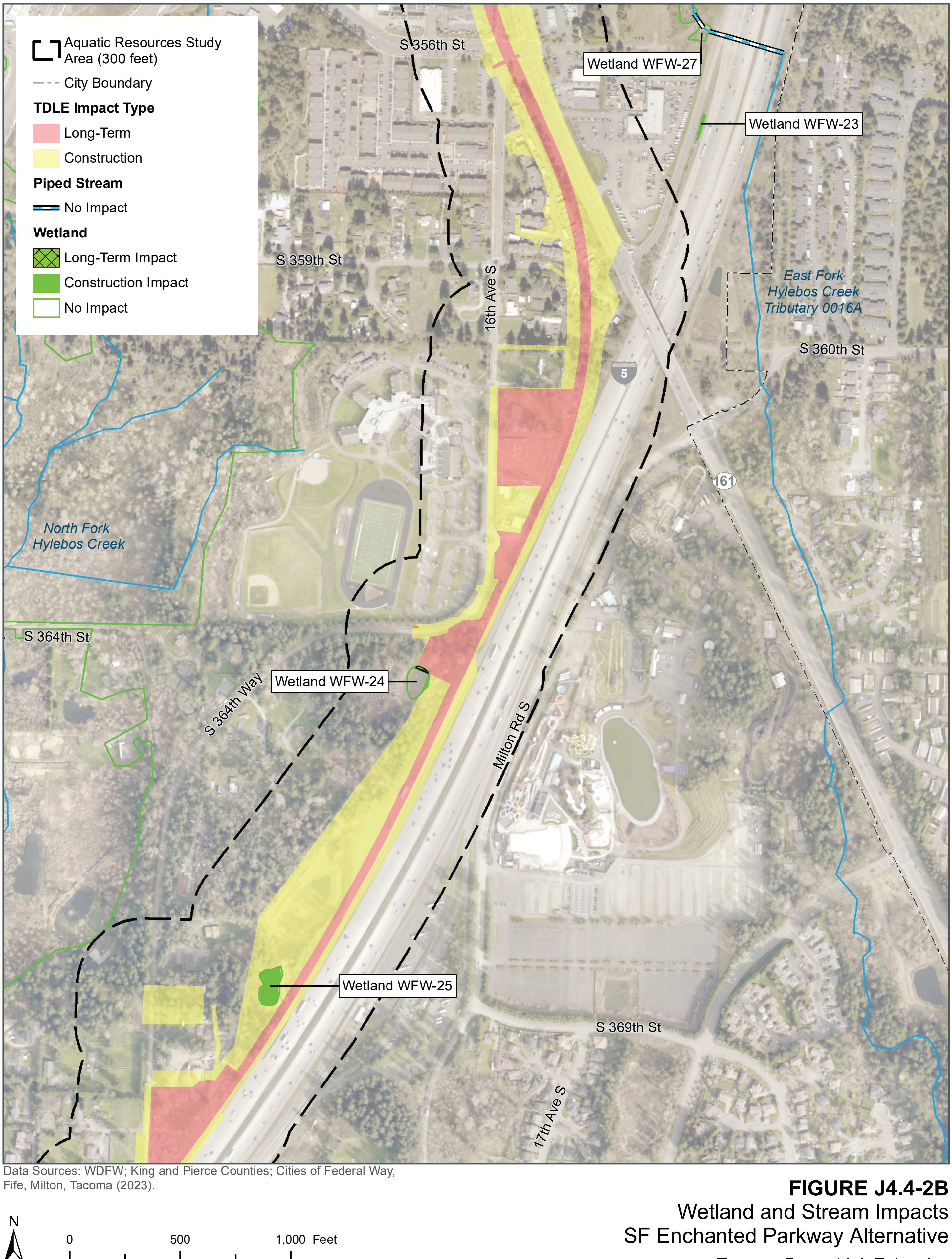
FIGURE J4.4-1C
Wetland and Stream Impacts
FW Design Option

Tacoma Dome Link Extension



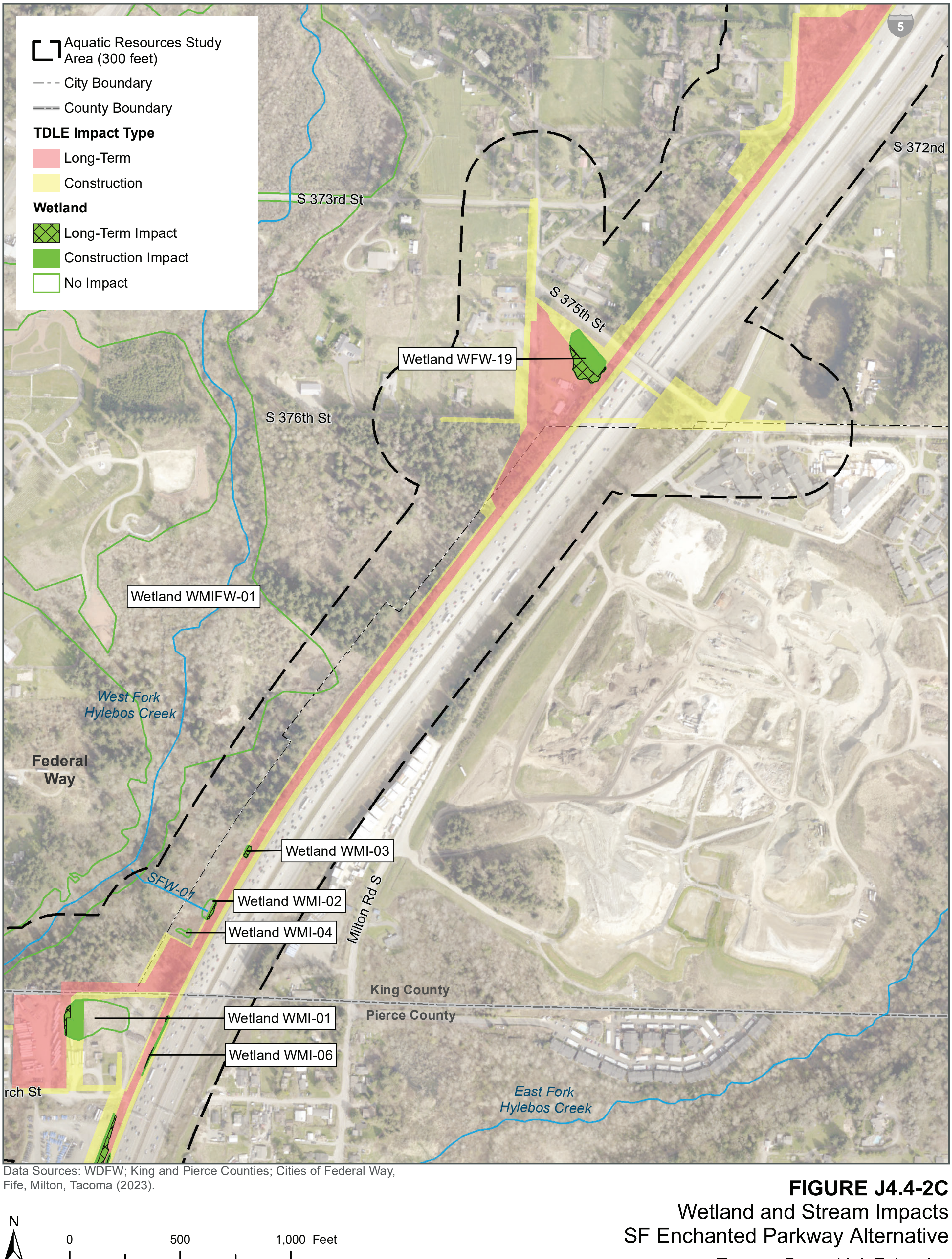
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-2A
Wetland and Stream Impacts
SF Enchanted Parkway Alternative
Tacoma Dome Link Extension



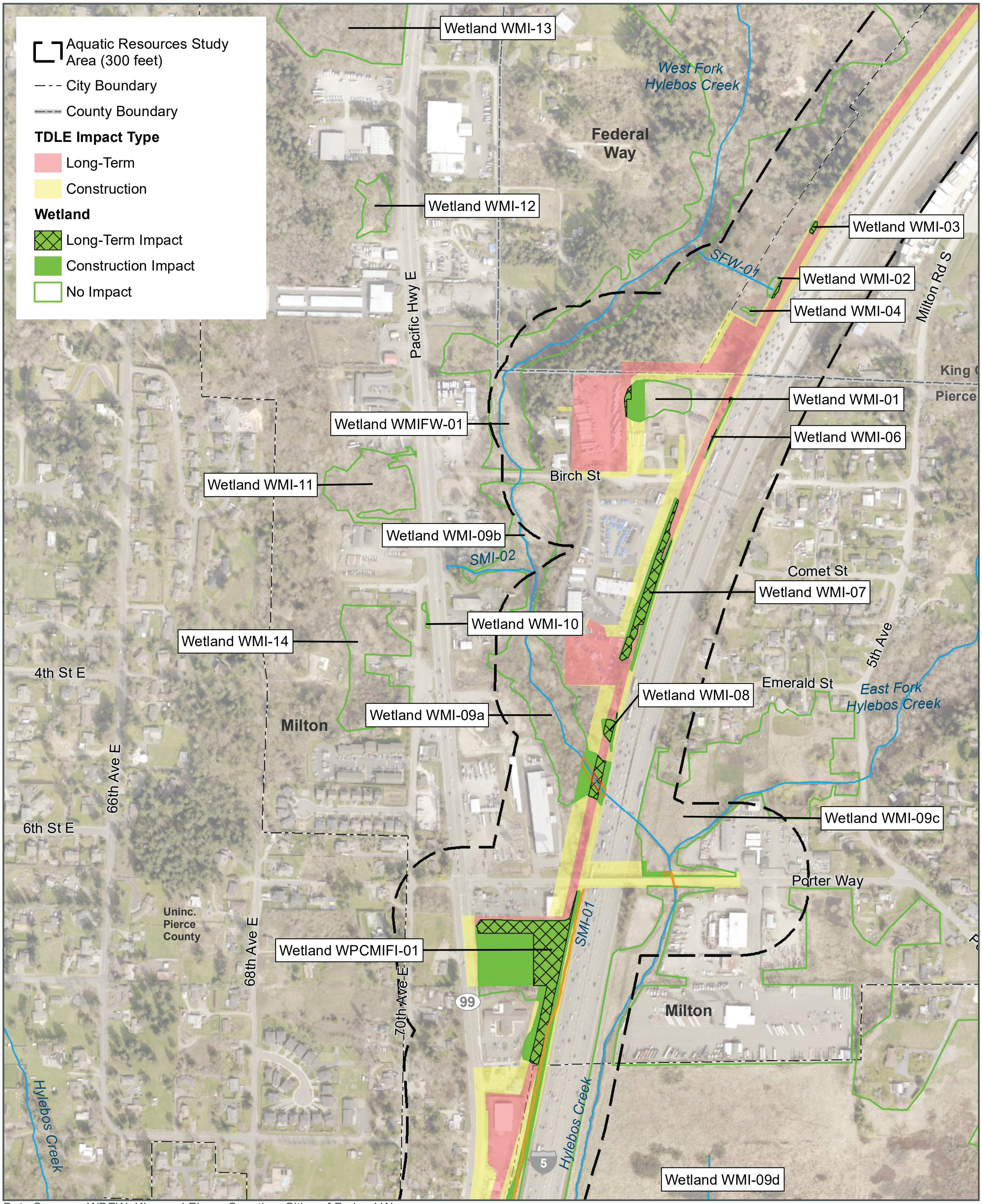
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-2B
Wetland and Stream Impacts
SF Enchanted Parkway Alternative
Tacoma Dome Link Extension



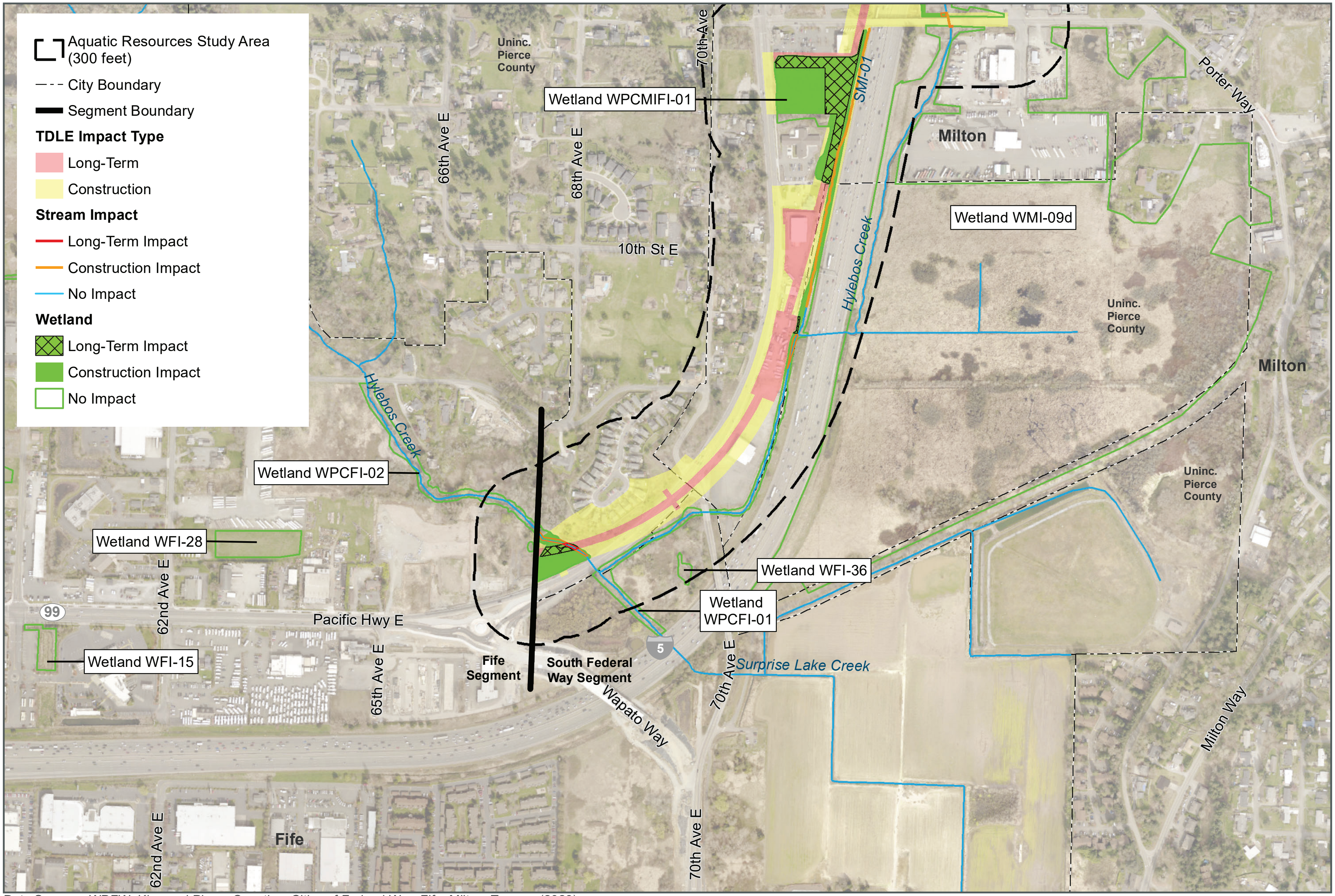
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-2C
Wetland and Stream Impacts
SF Enchanted Parkway Alternative
Tacoma Dome Link Extension



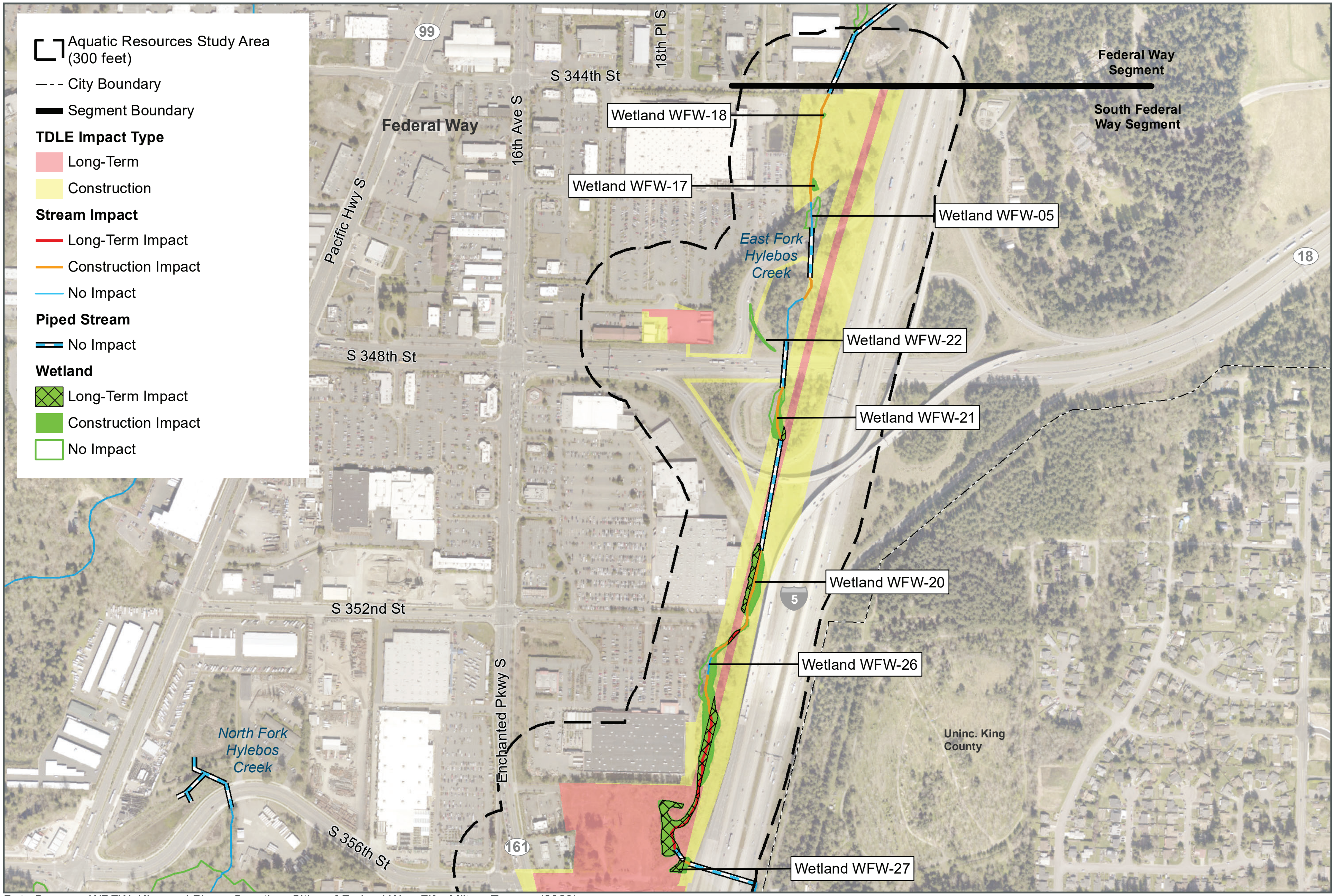
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-2D
Wetland and Stream Impacts
SF Enchanted Parkway Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-2E
Wetland and Stream Impacts
SF Enchanted Parkway Alternative
Tacoma Dome Link Extension

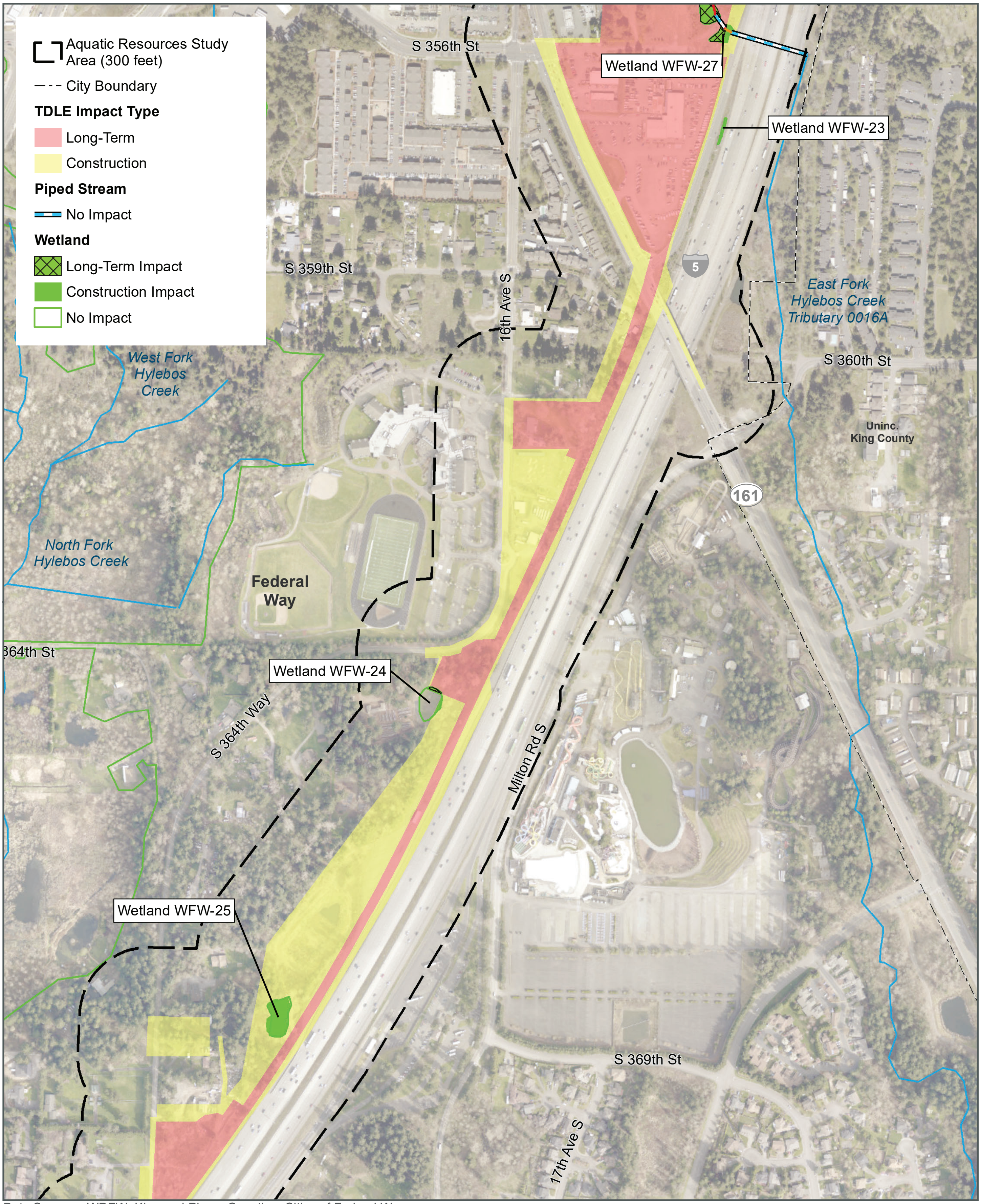


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-3A
Wetland and Stream Impacts
SF I-5 Alternative
Tacoma Dome Link Extension

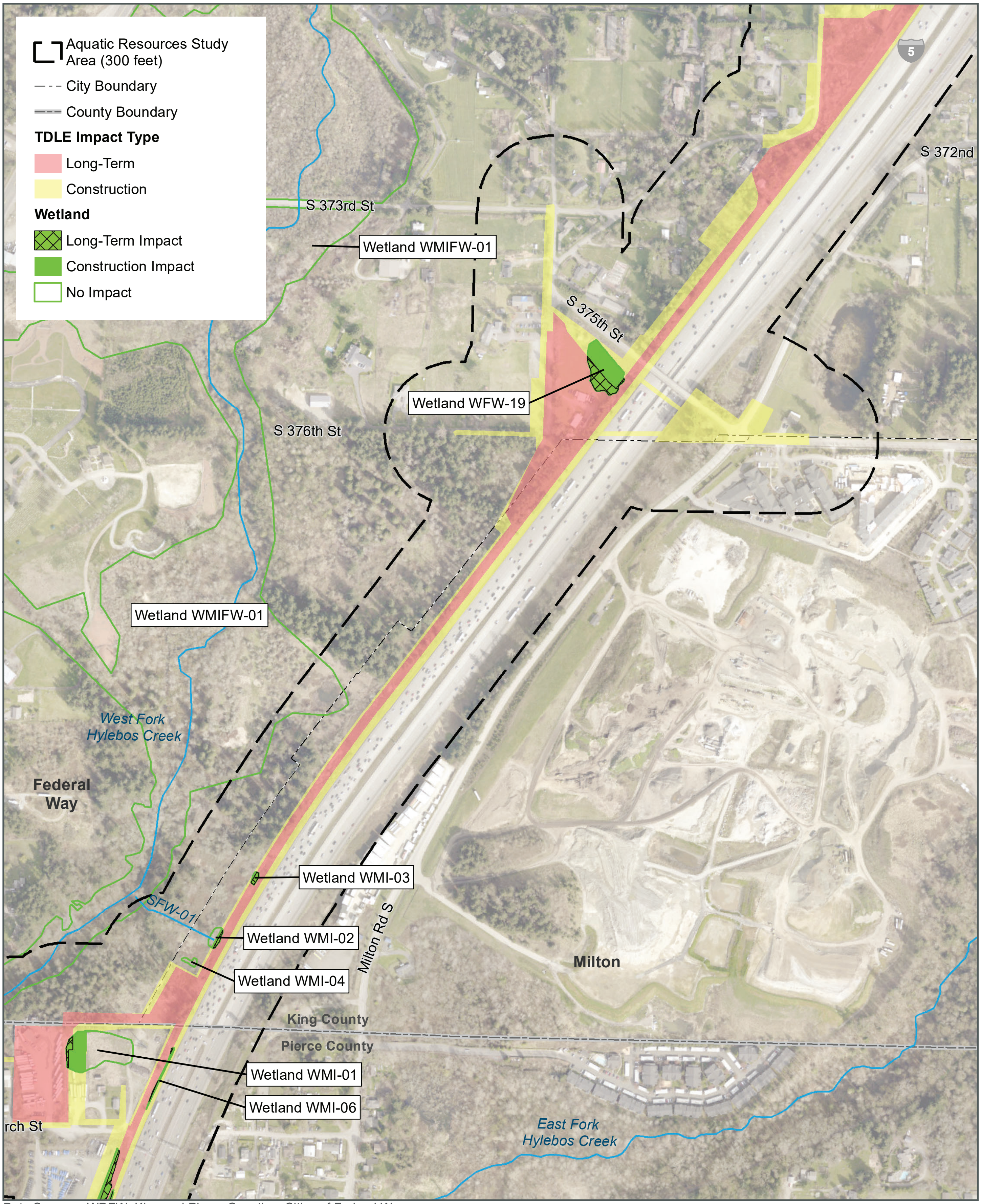


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-3B
Wetland and Stream Impacts
SF I-5 Alternative
Tacoma Dome Link Extension

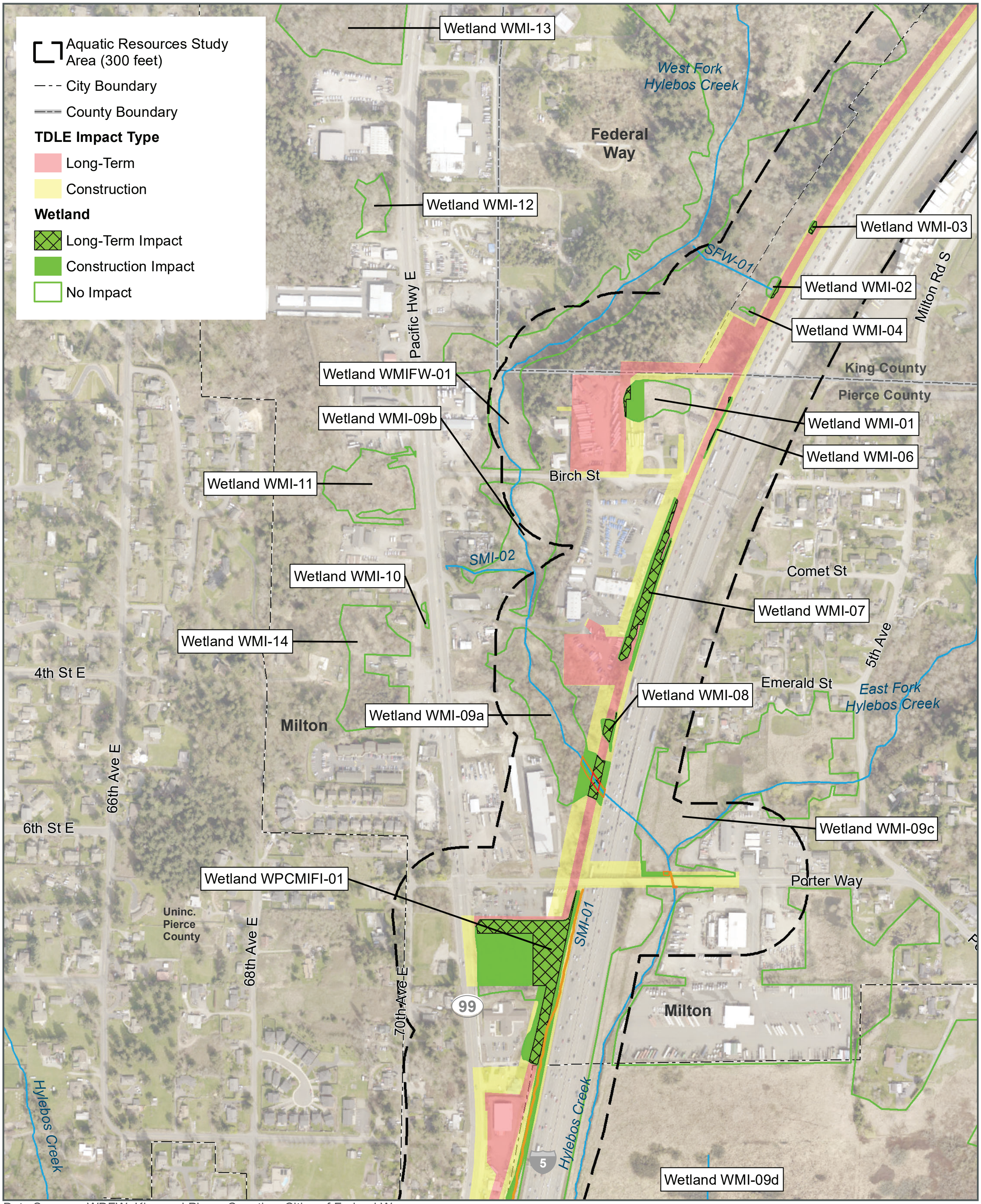


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-3C
Wetland and Stream Impacts
SF I-5 Alternative
Tacoma Dome Link Extension



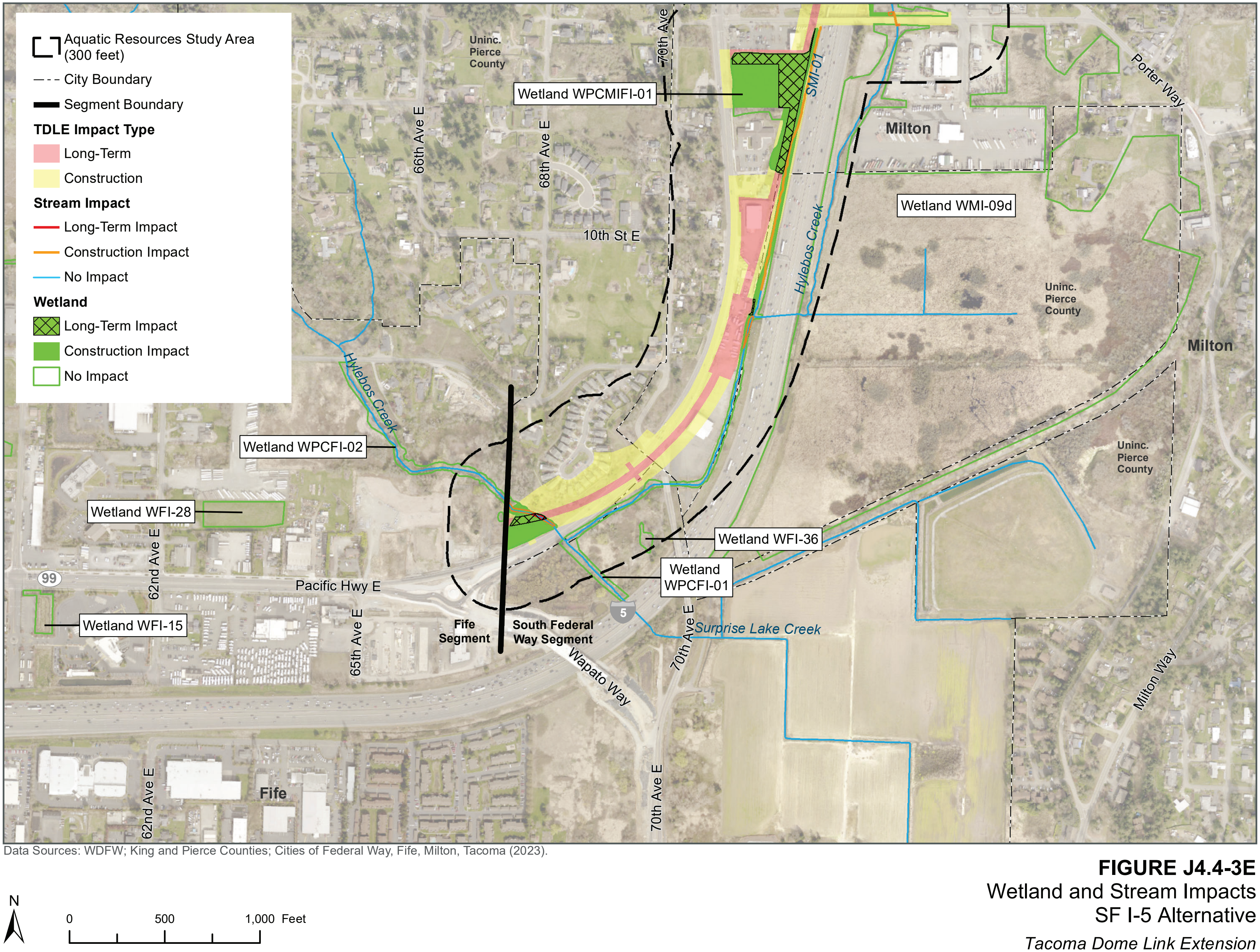
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

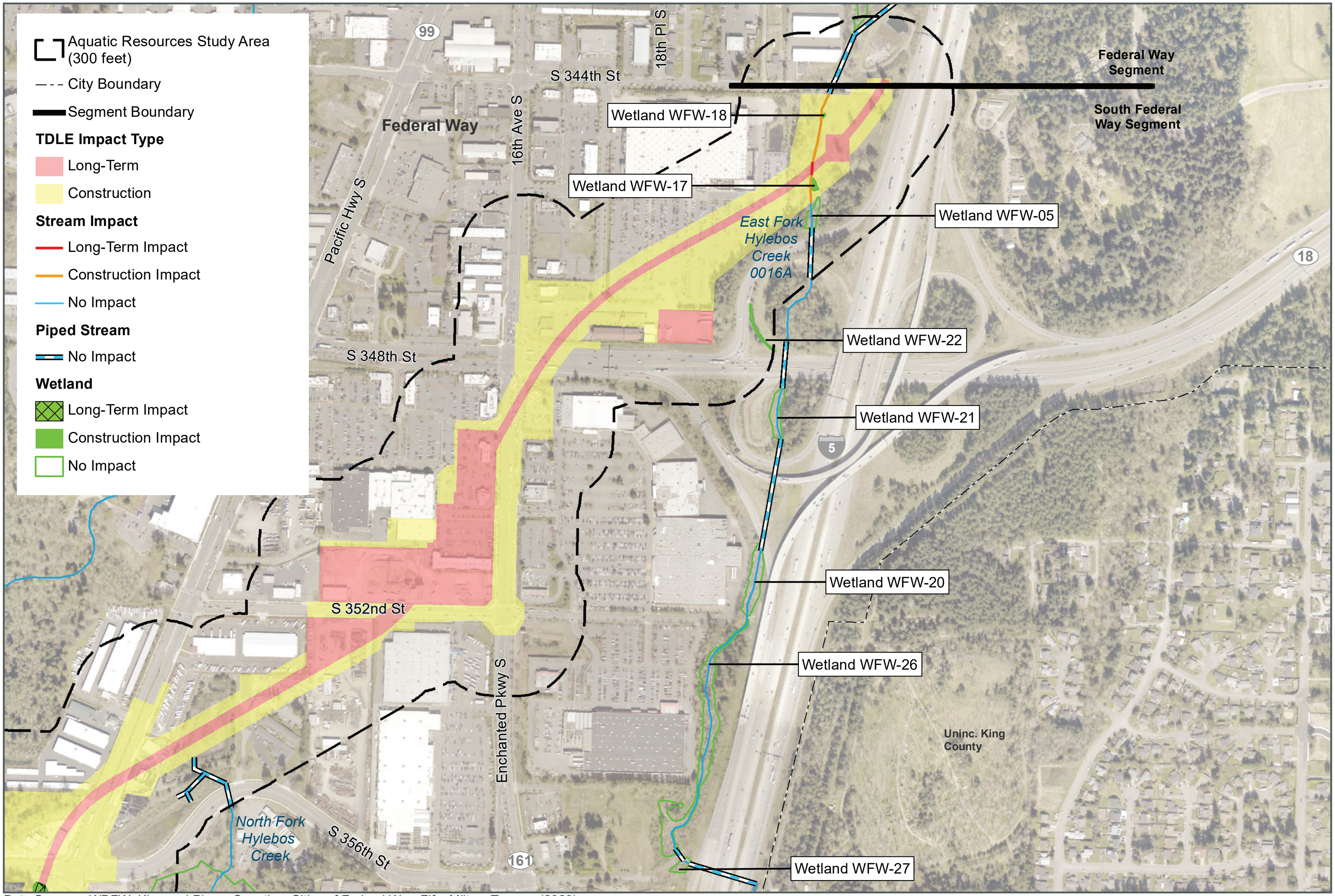
FIGURE J4.4-3D
Wetland and Stream Impacts
SF I-5 Alternative

Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-3E
Wetland and Stream Impacts
SF I-5 Alternative
Tacoma Dome Link Extension

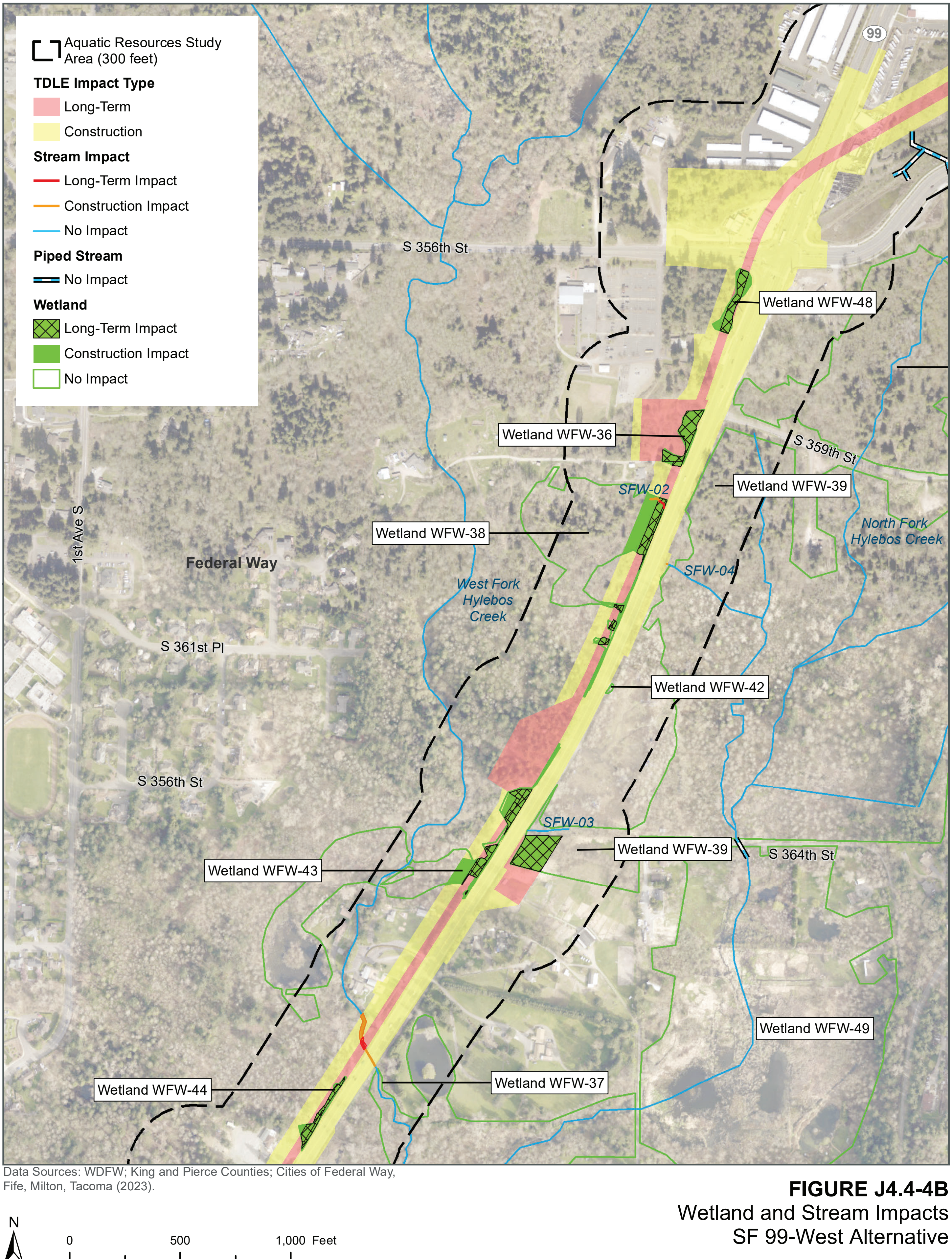


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

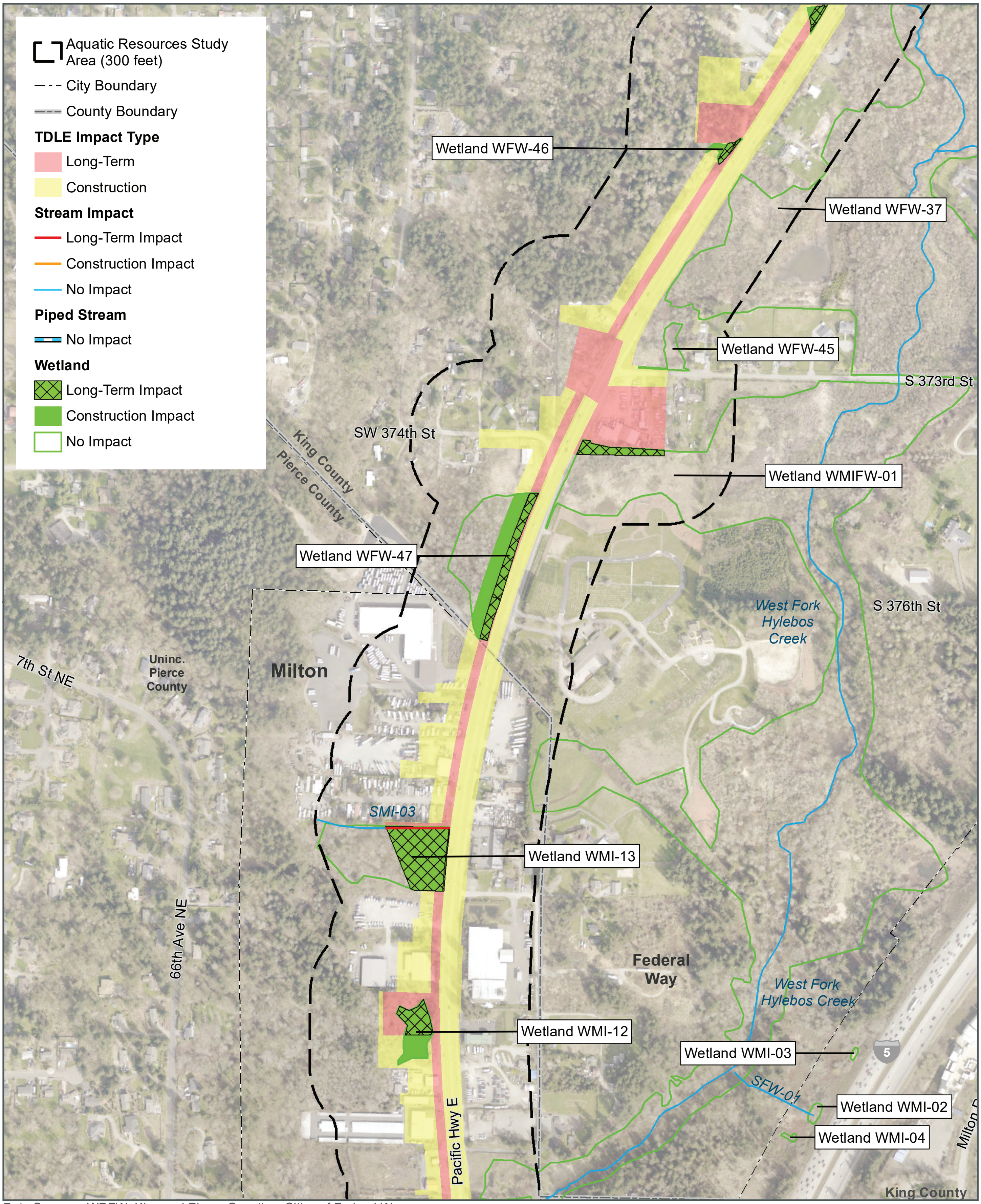
0 500 1,000 Feet

FIGURE J4.4-4A
Wetland and Stream Impacts
SF 99-West Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-4B
Wetland and Stream Impacts
SF 99-West Alternative
Tacoma Dome Link Extension

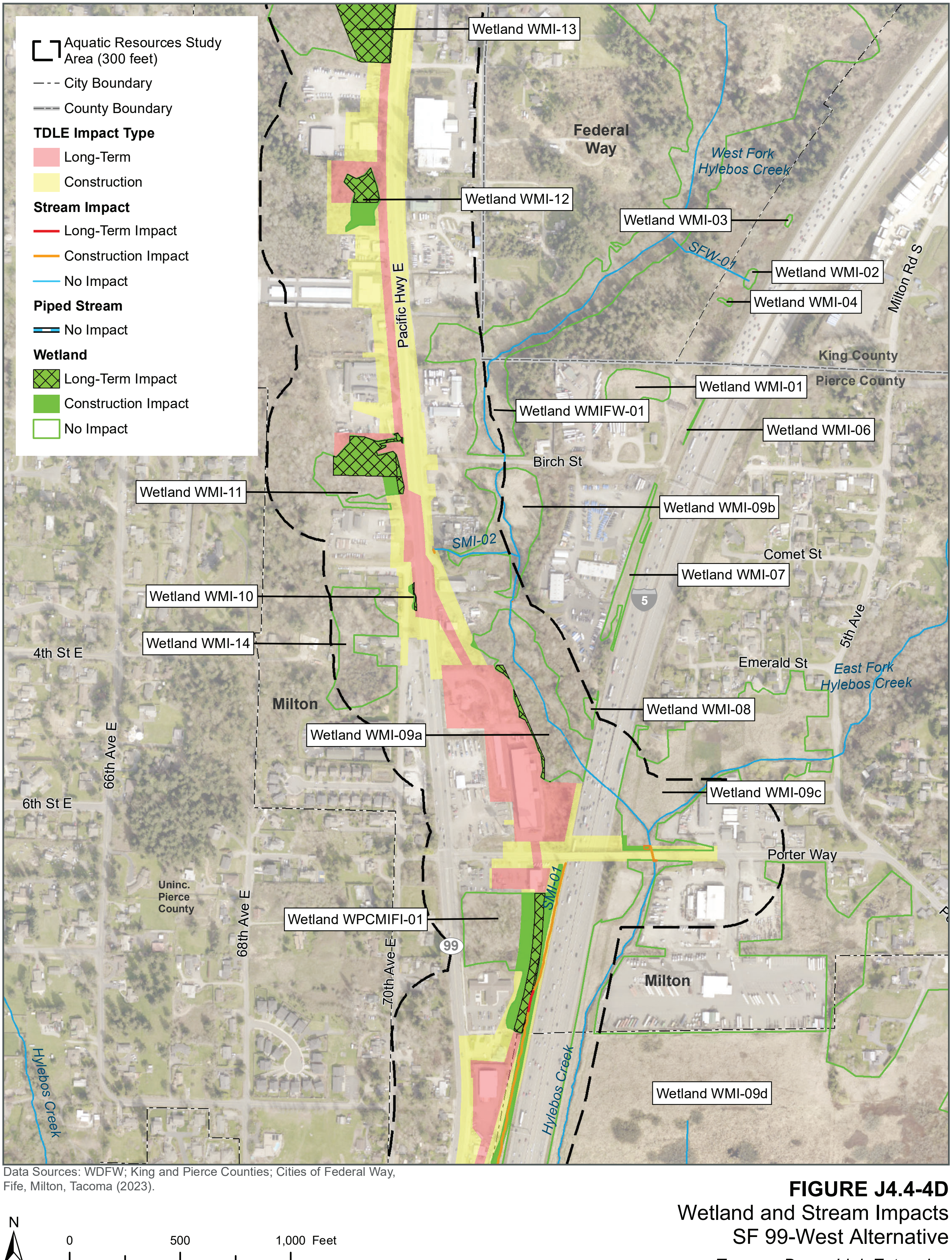


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-4C
Wetland and Stream Impacts
SF 99-West Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-4D
Wetland and Stream Impacts
SF 99-West Alternative
Tacoma Dome Link Extension

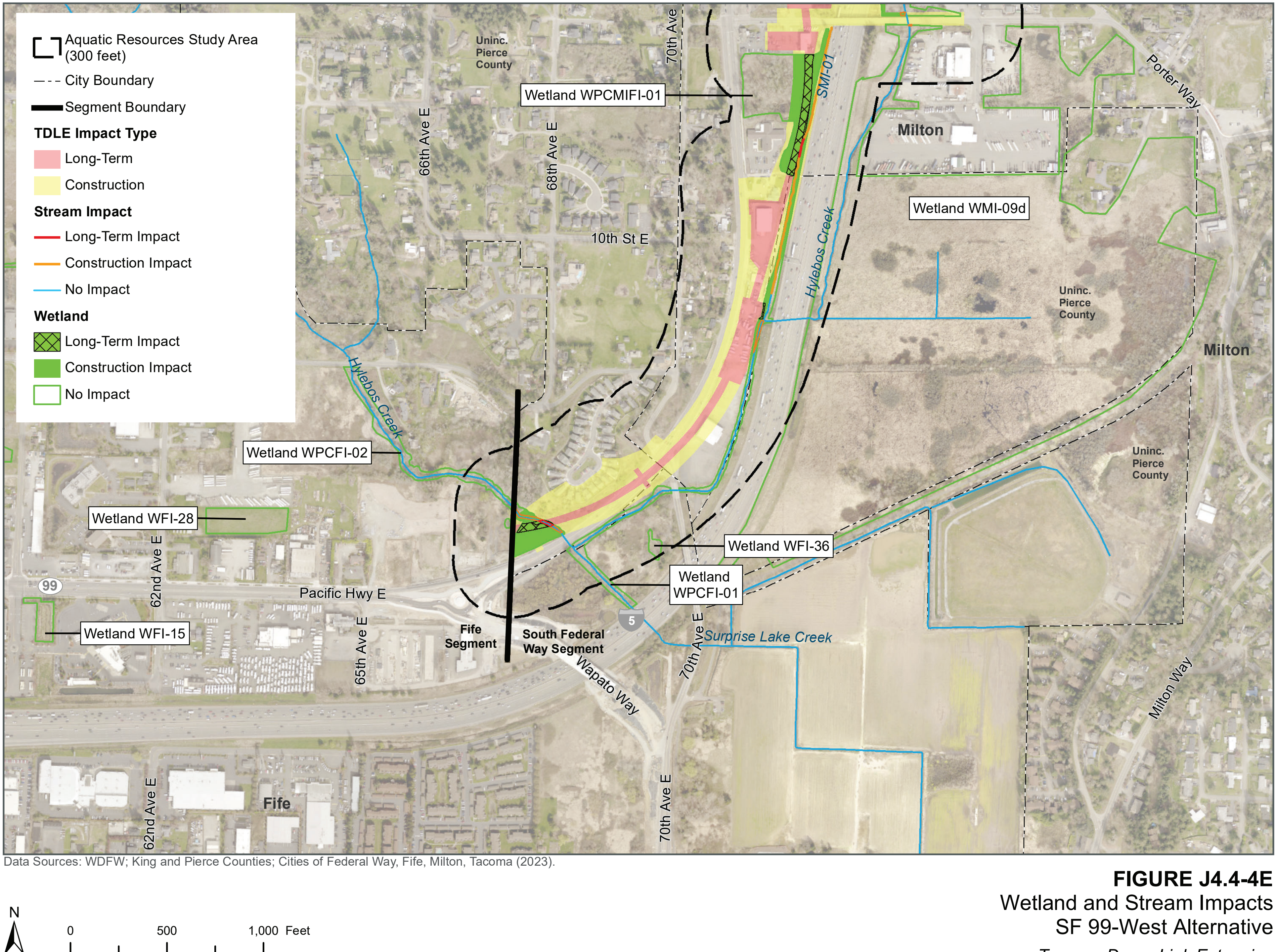
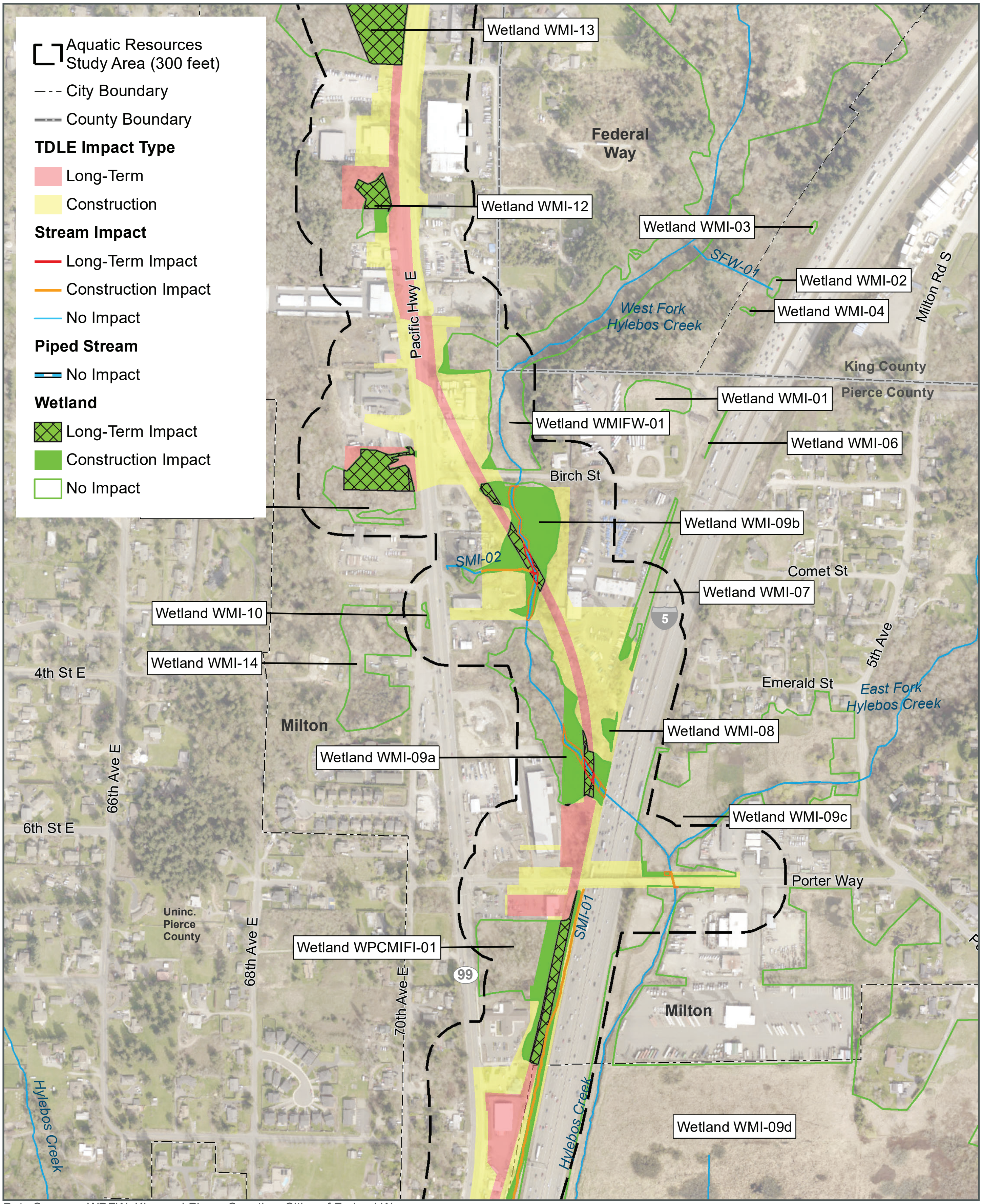


FIGURE J4.4-4E
Wetland and Stream Impacts
SF 99-West Alternative

Tacoma Dome Link Extension



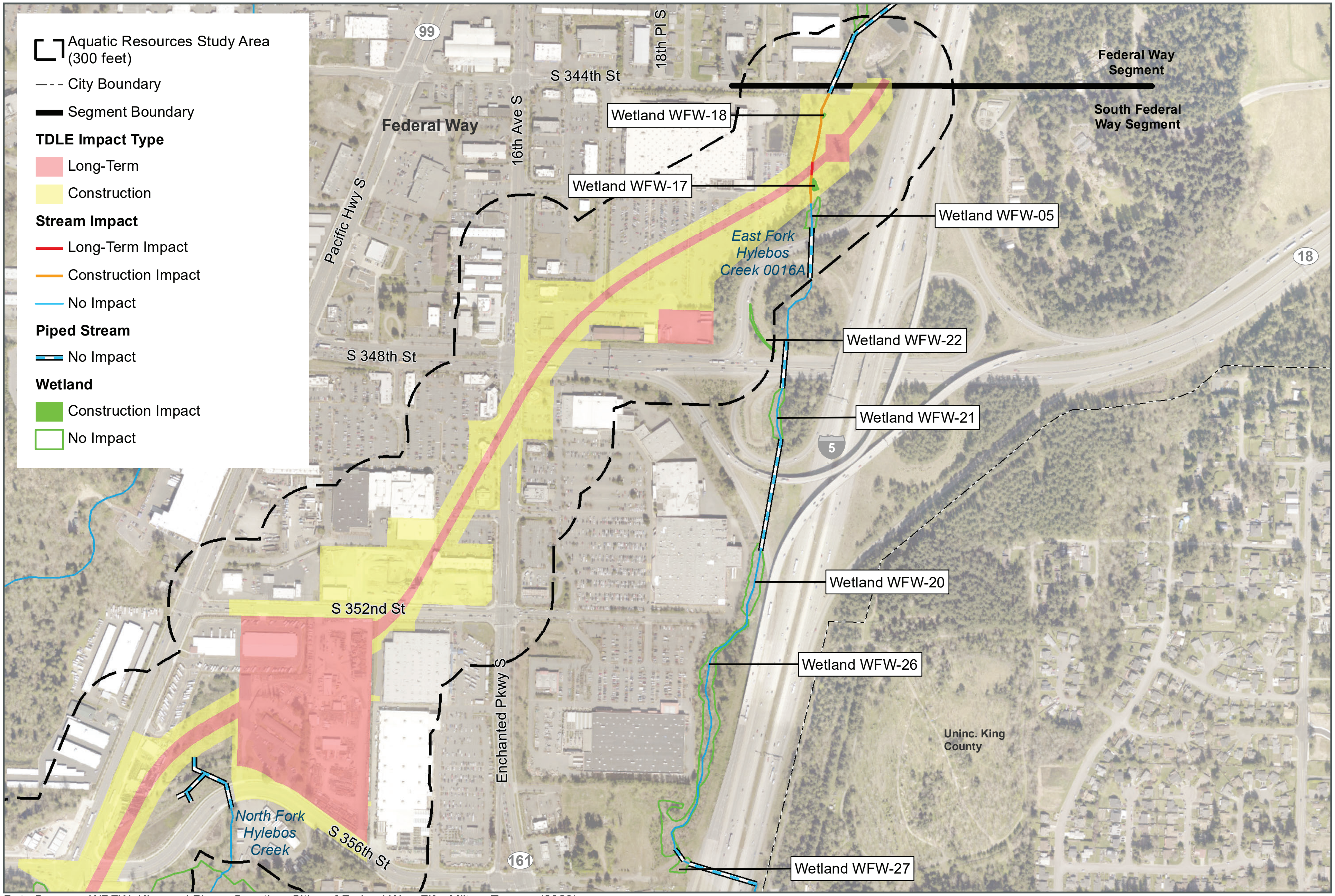
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-4F
Wetland and Streams Impacts
SF 99-West Alternative with Porter Way Design Option

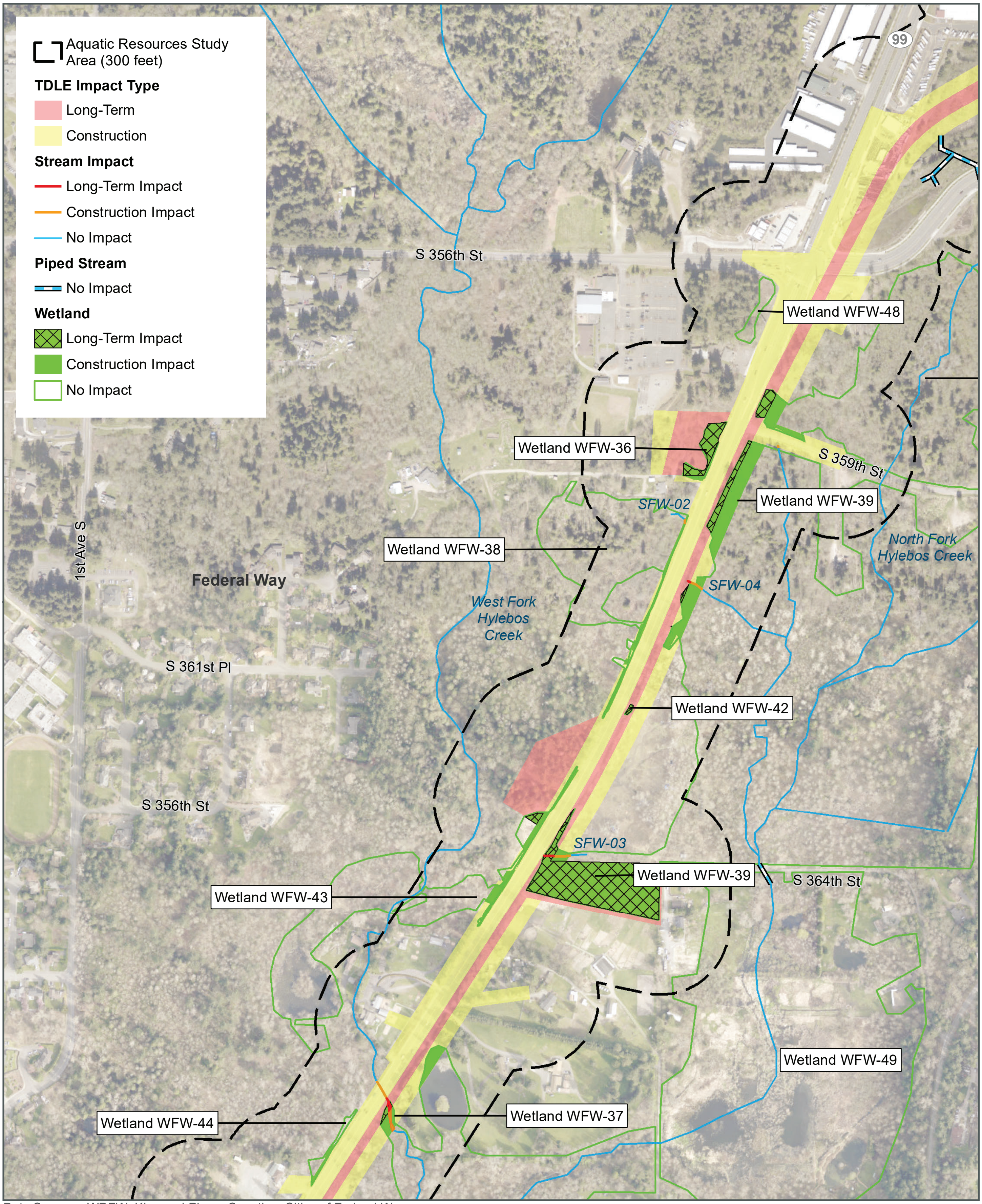
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

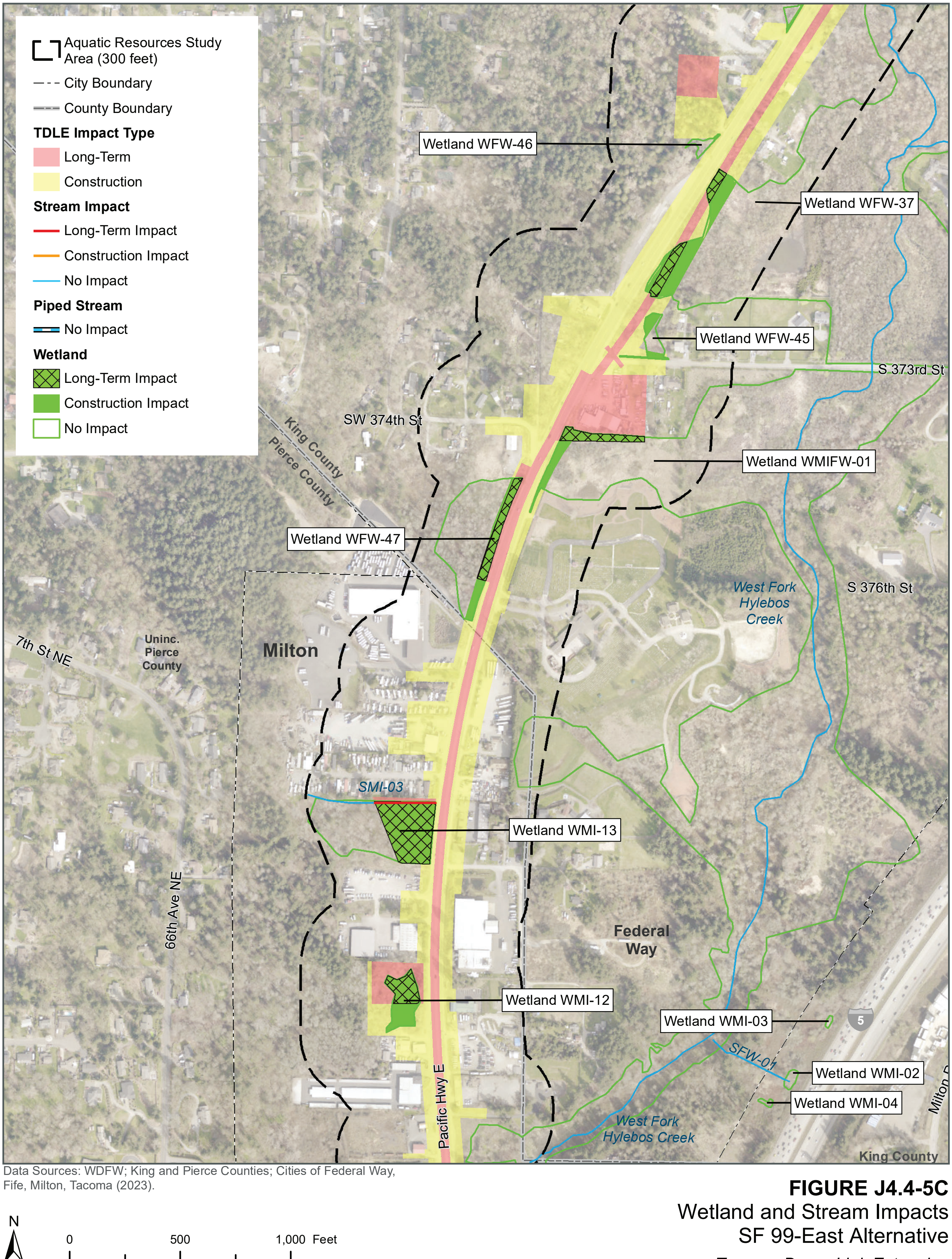
FIGURE J4.4-5A
Wetland and Stream Impacts
SF 99-East Alternative

Tacoma Dome Link Extension



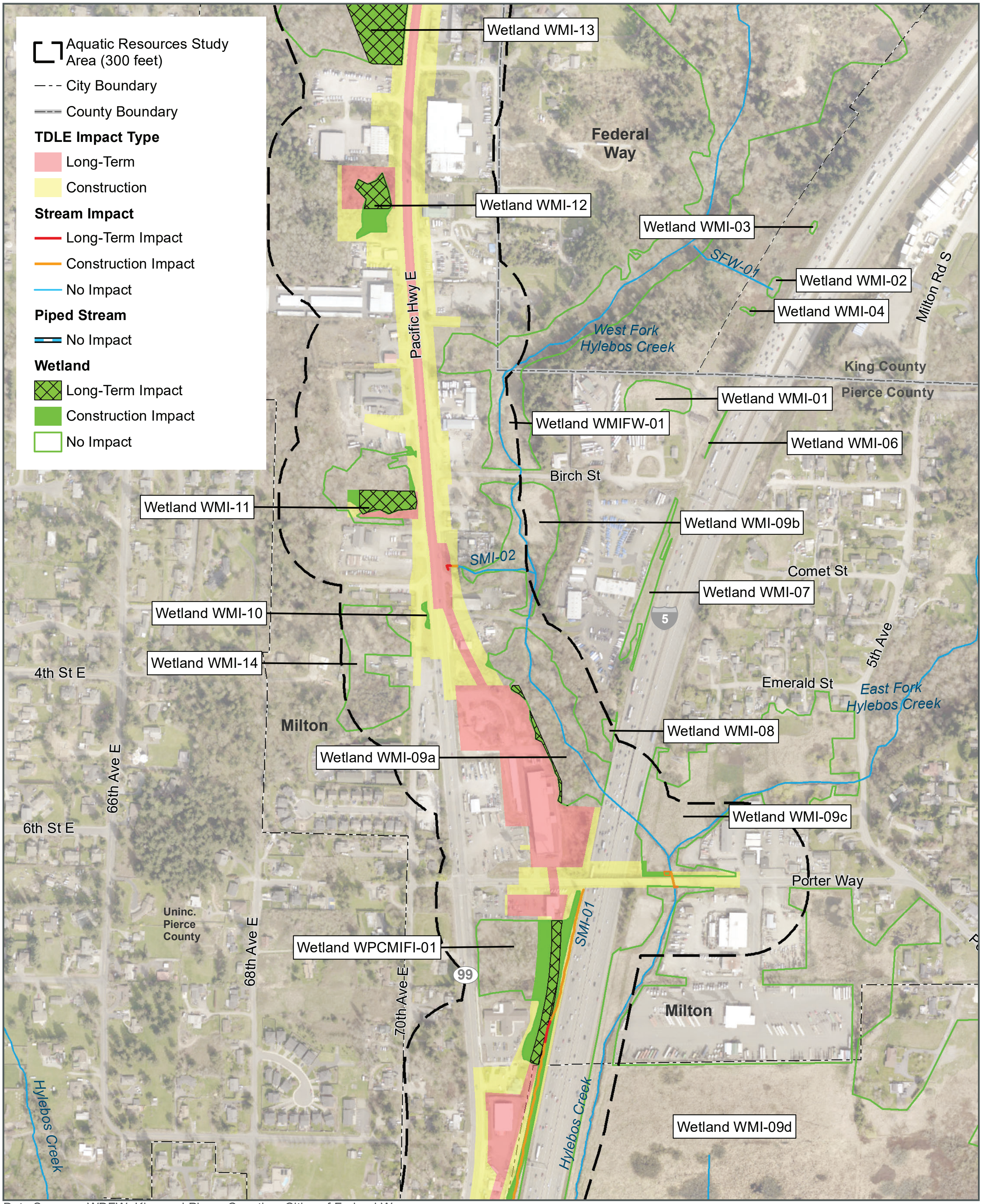
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-5B
Wetland and Stream Impacts
SF 99-East Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-5C
Wetland and Stream Impacts
SF 99-East Alternative
Tacoma Dome Link Extension



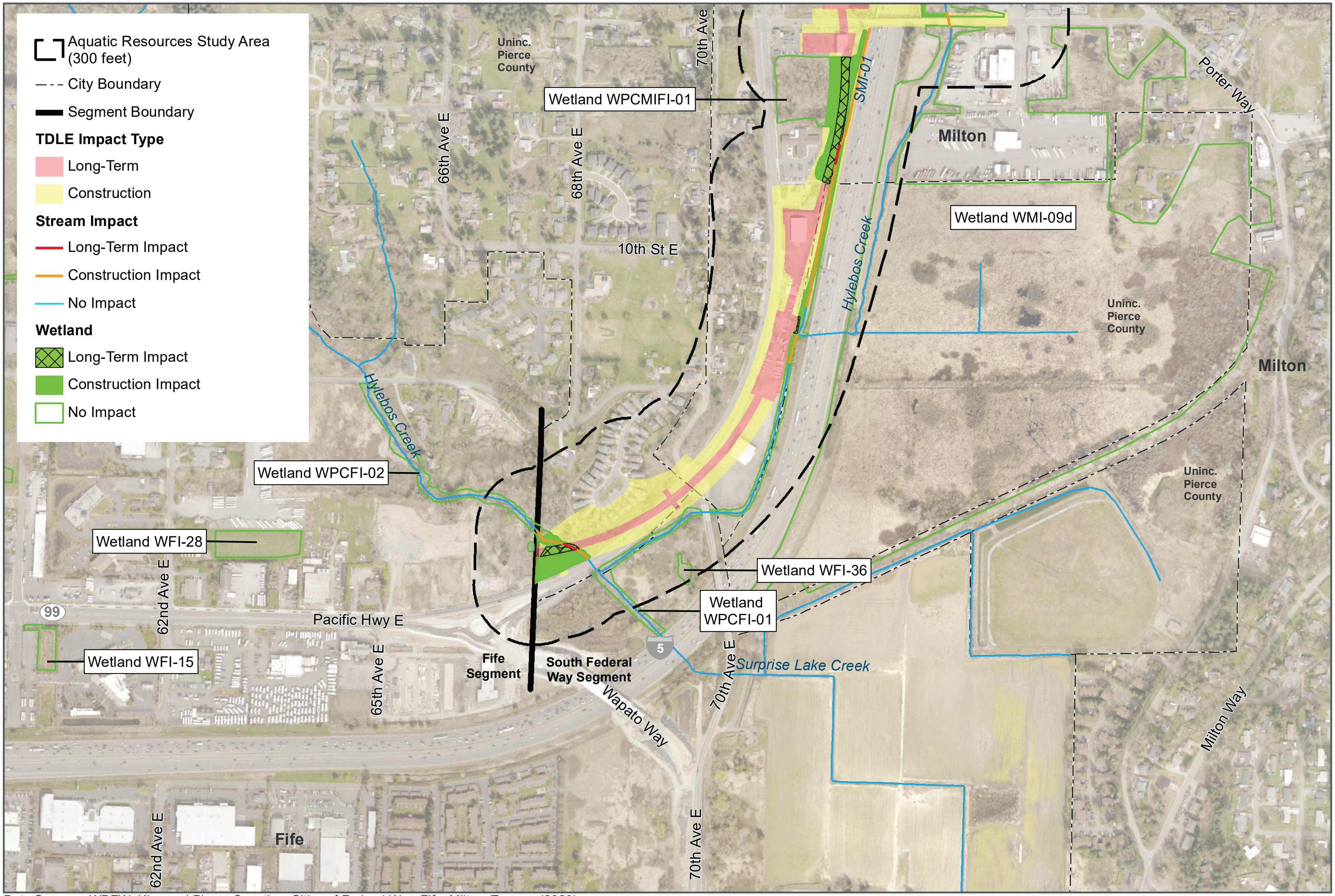
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-5D
Wetland and Stream Impacts
SF 99-East Alternative

Tacoma Dome Link Extension

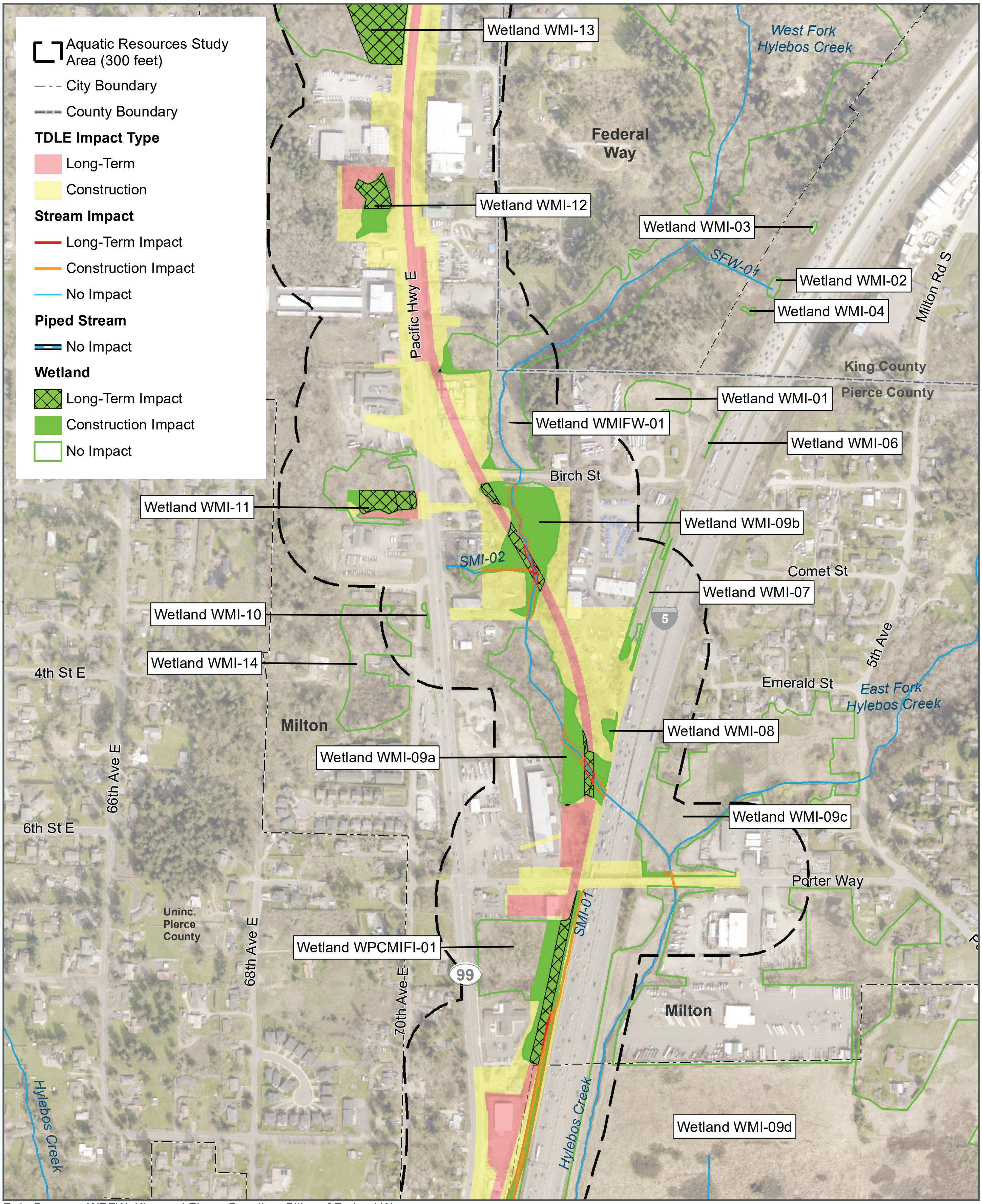


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

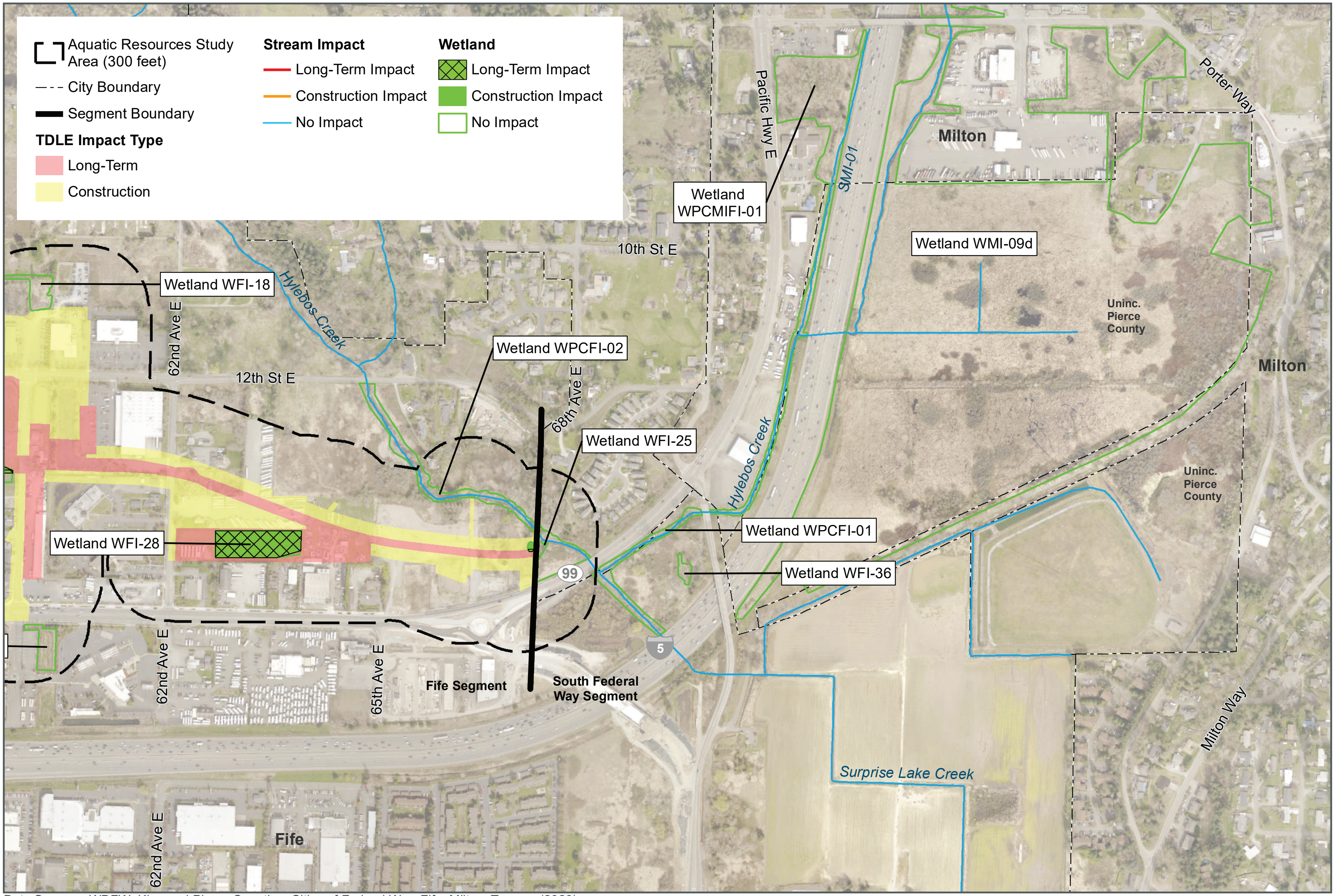
FIGURE J4.4-5E
Wetland and Stream Impacts
SF 99-East Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

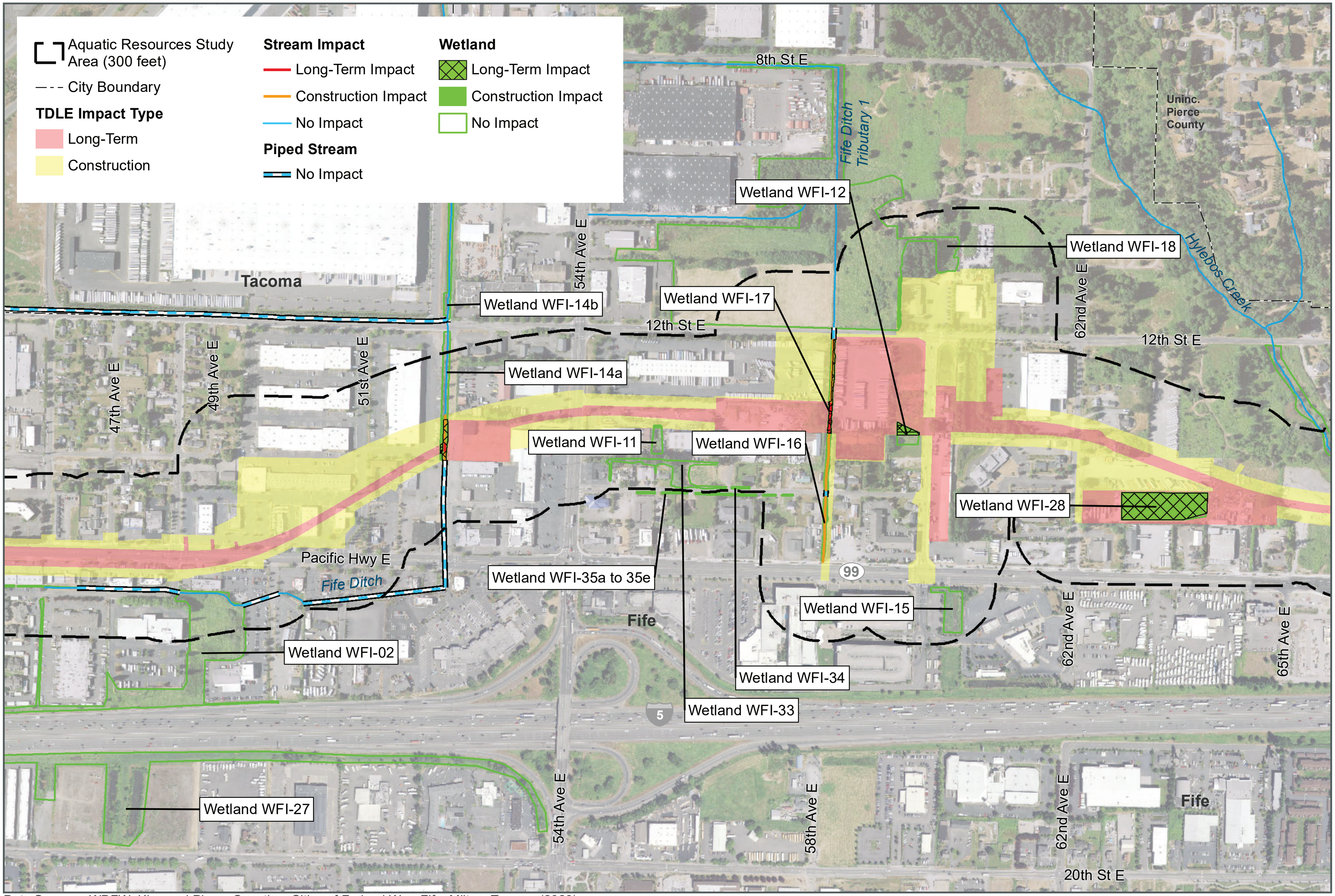
FIGURE J4.4-5F
Wetland and Streams Impacts
SF 99-East Alternative with Porter Way Design Option

Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-6A
Wetland and Stream Impacts
Fife Pacific Highway Alternative
Tacoma Dome Link Extension

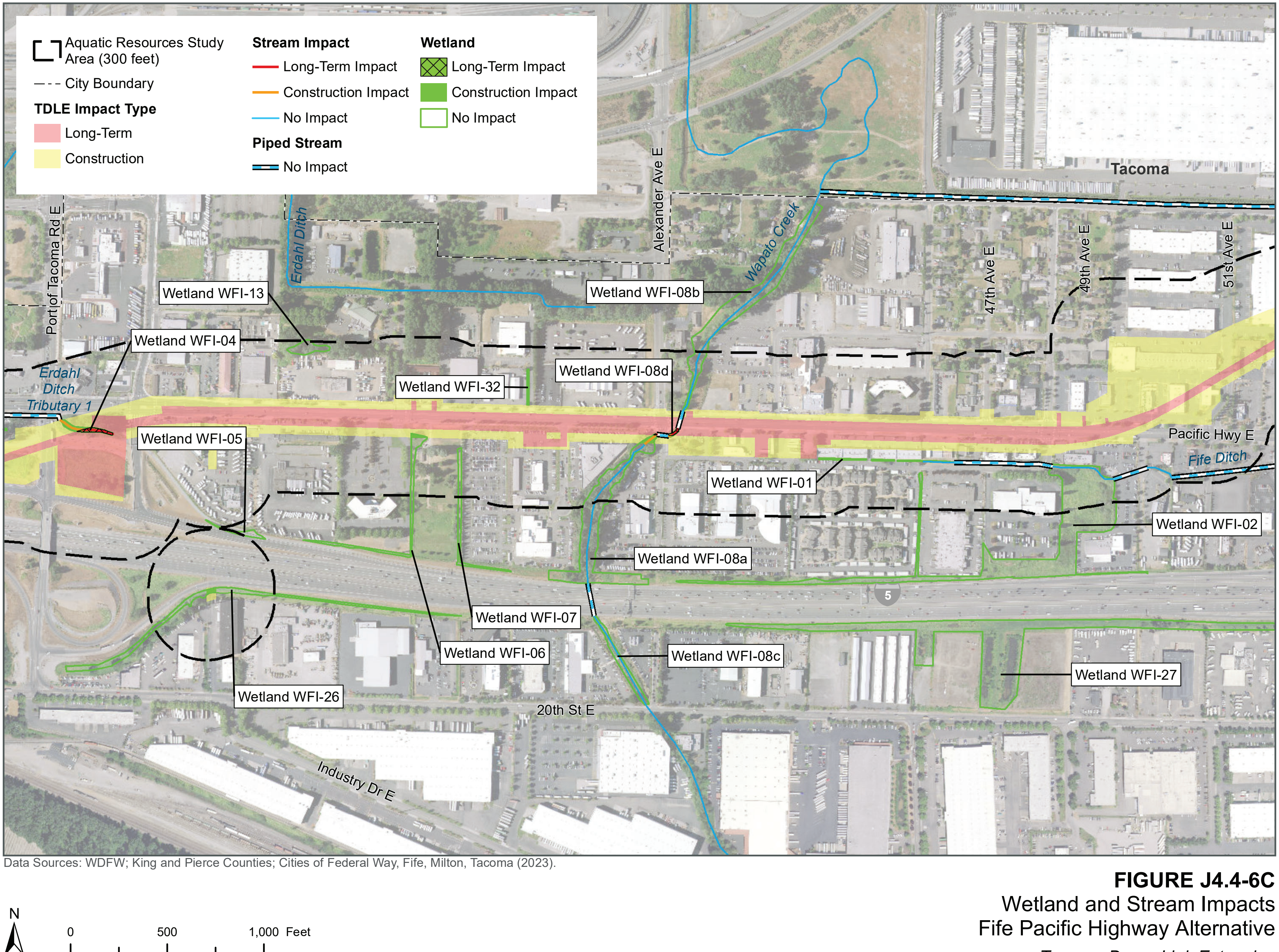


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

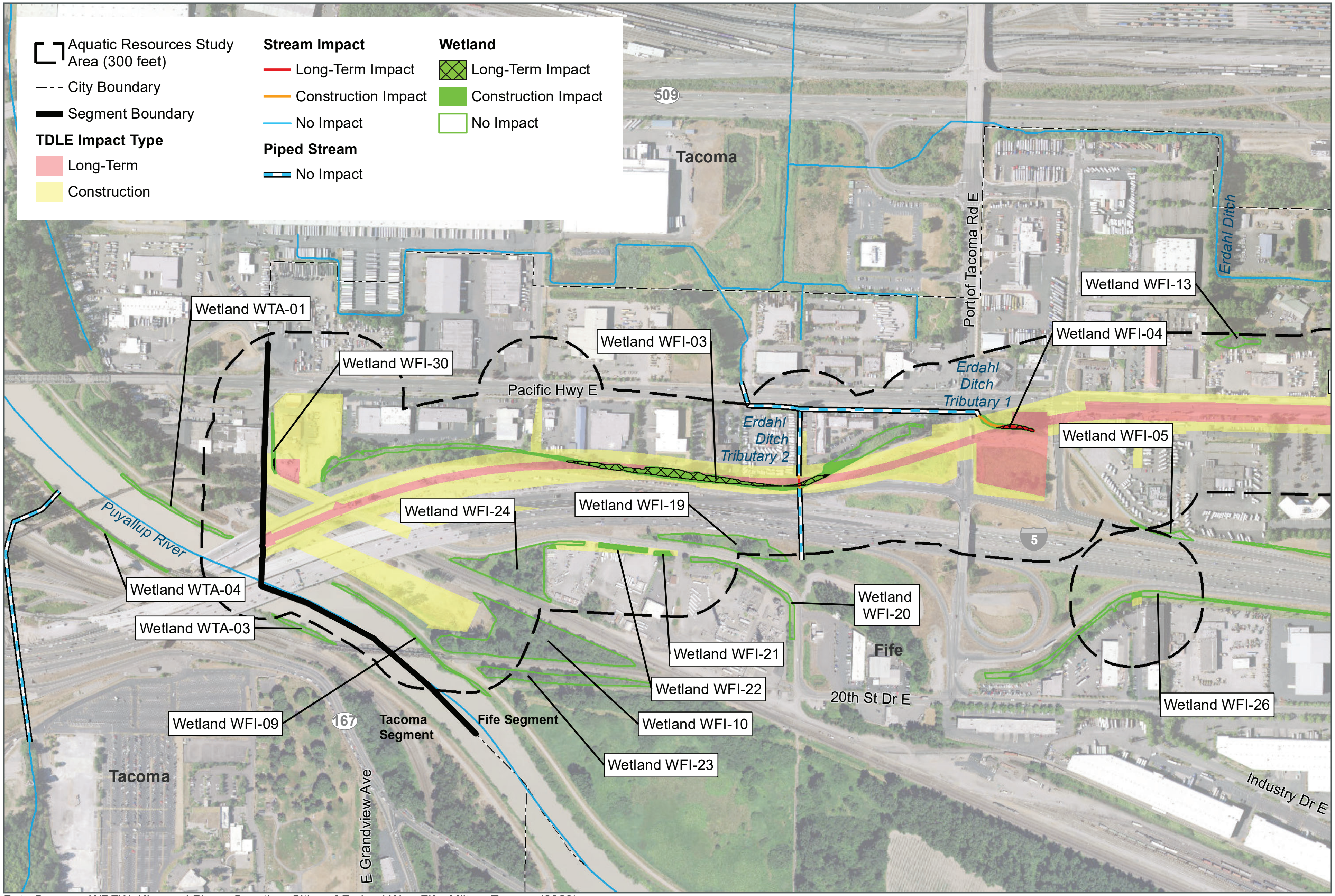
0 500 1,000 Feet

FIGURE J4.4-6B
Wetland and Stream Impacts
Fife Pacific Highway Alternative
Tacoma Dome Link Extension



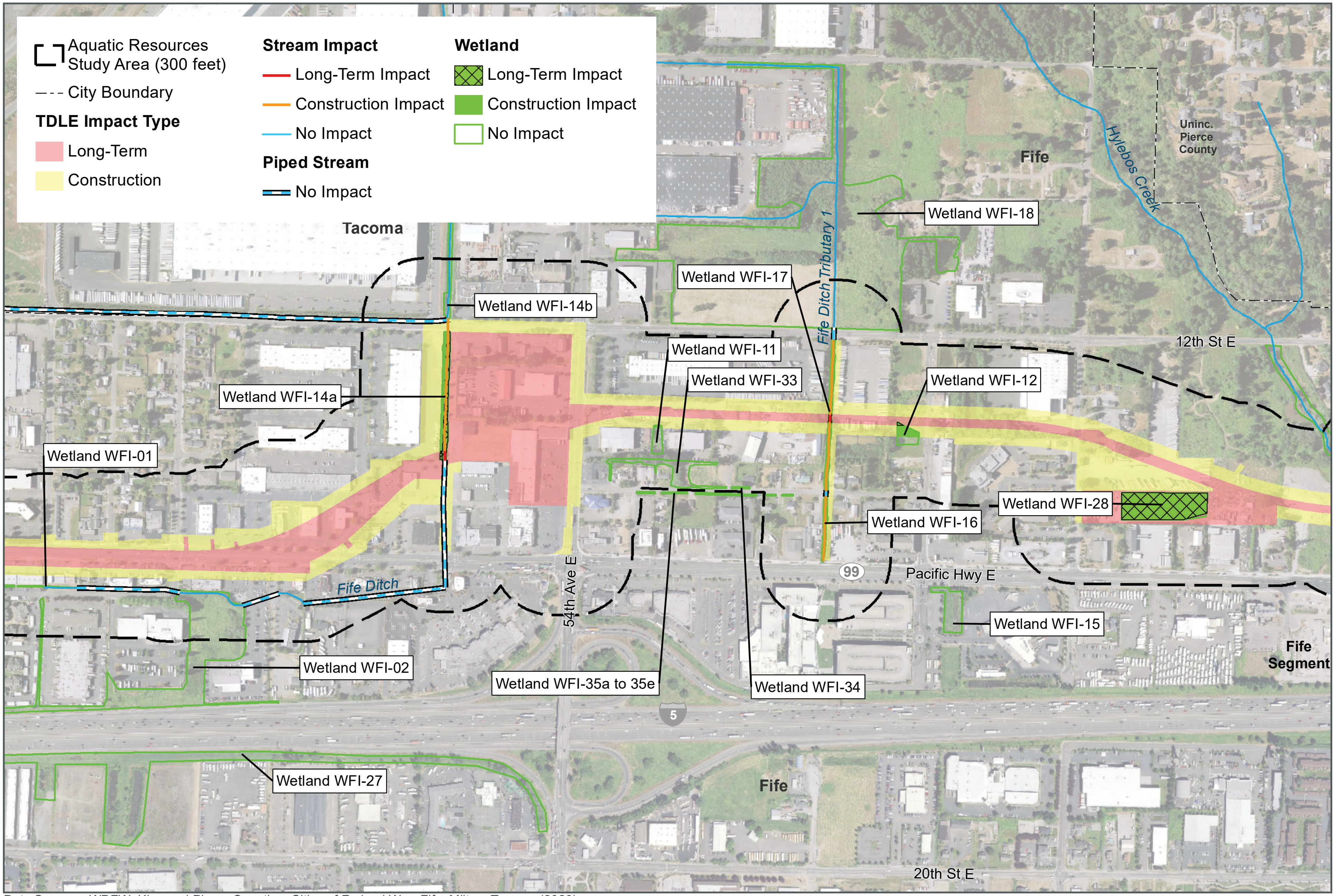
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-6C
Wetland and Stream Impacts
Fife Pacific Highway Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-6D
Wetland and Stream Impacts
Fife Pacific Highway Alternative
Tacoma Dome Link Extension

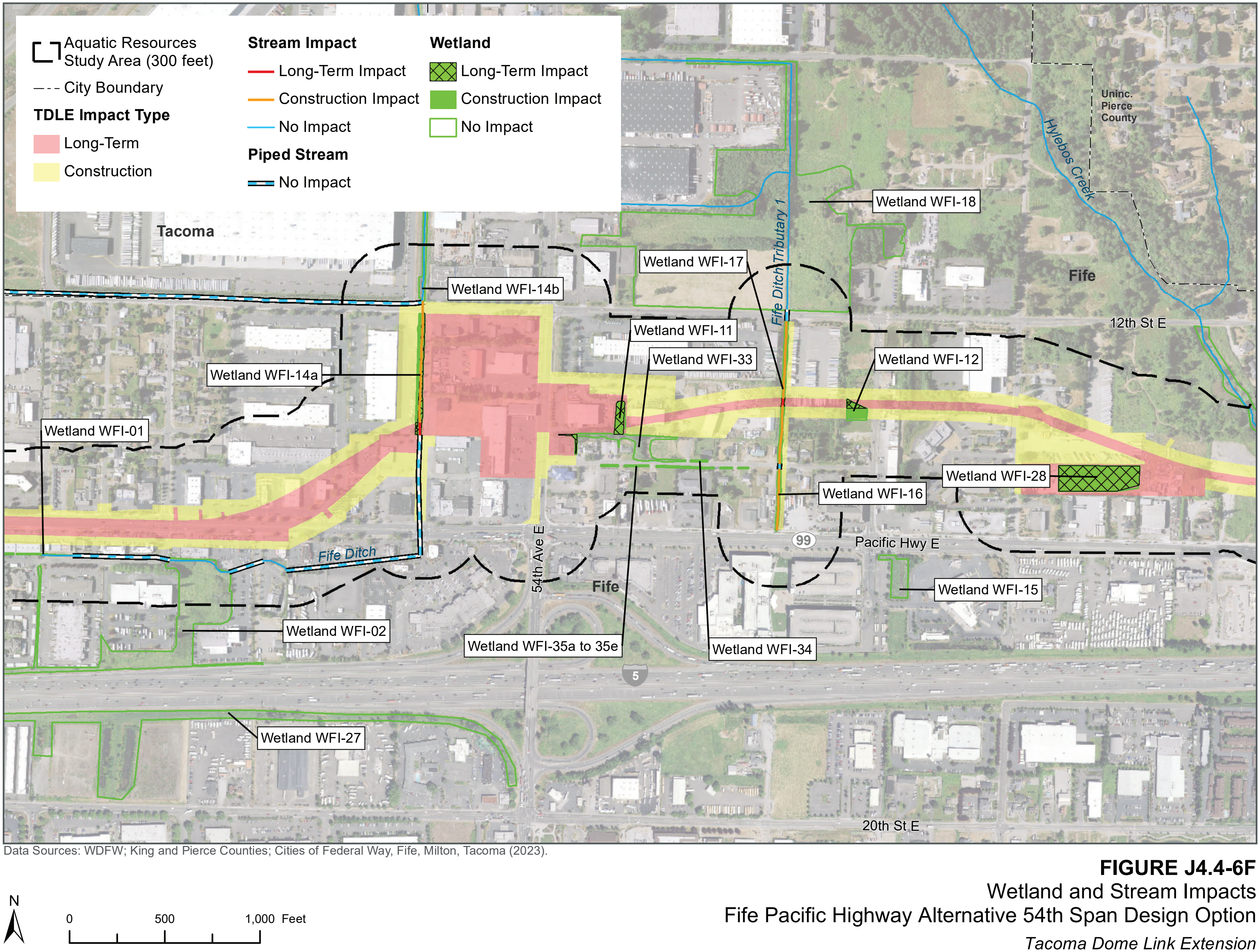


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

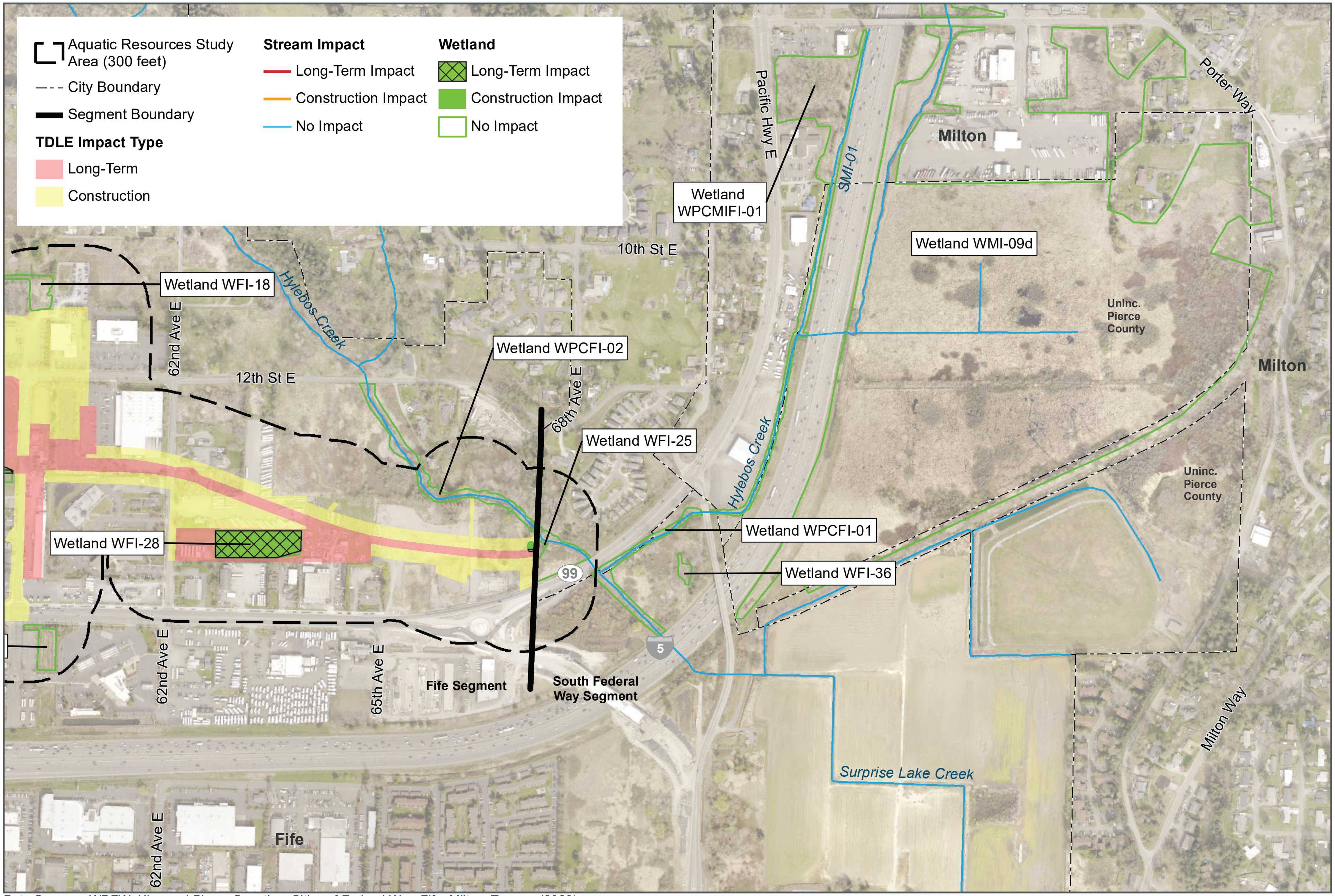
0 500 1,000 Feet

FIGURE J4.4-6E
Wetlands and Stream Impacts
Fife Pacific Highway Alternative 54th Avenue Design Option
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

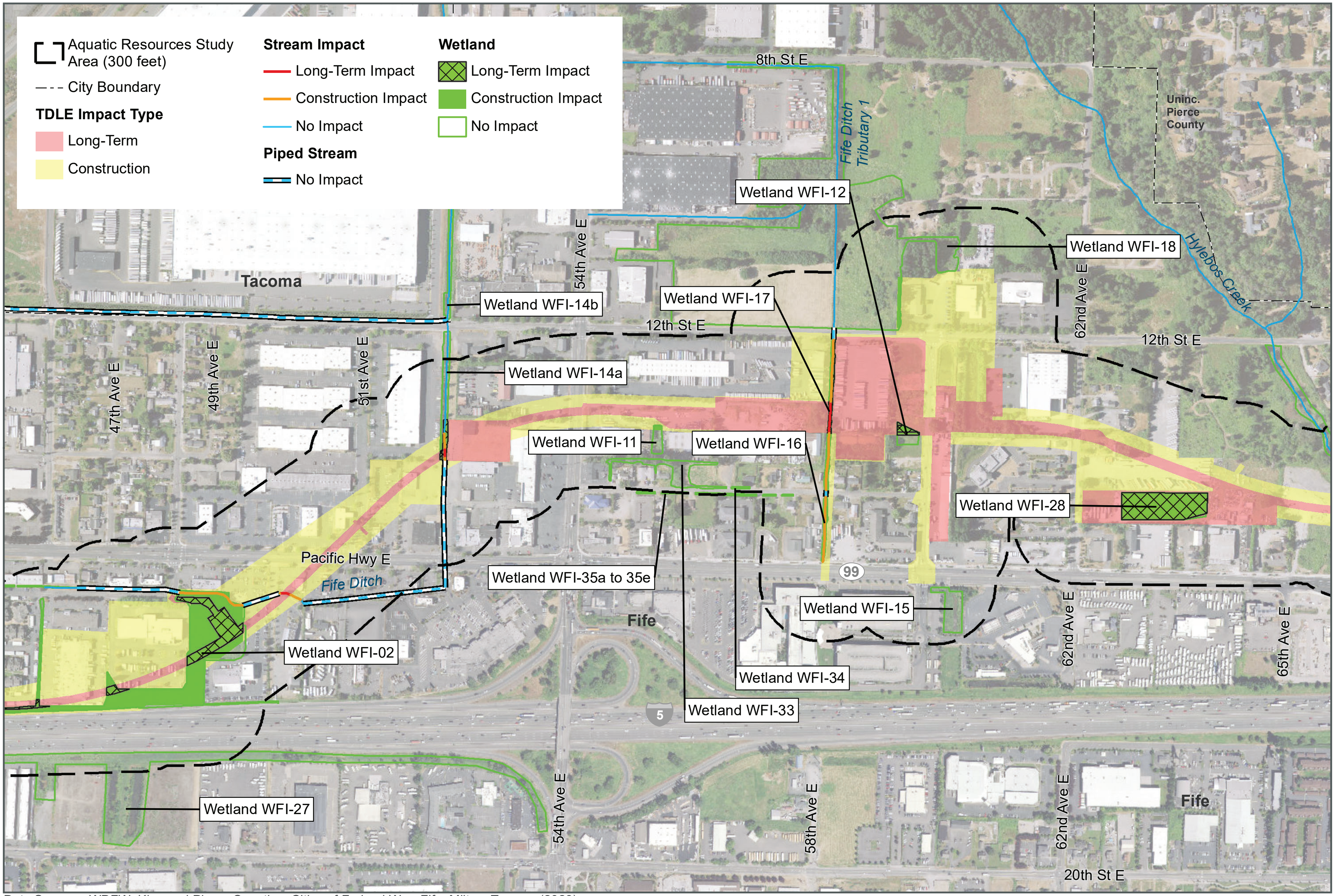
FIGURE J4.4-6F
Wetland and Stream Impacts
Fife Pacific Highway Alternative 54th Span Design Option
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-7A
Wetland and Stream Impacts
Fife I-5 Alternative

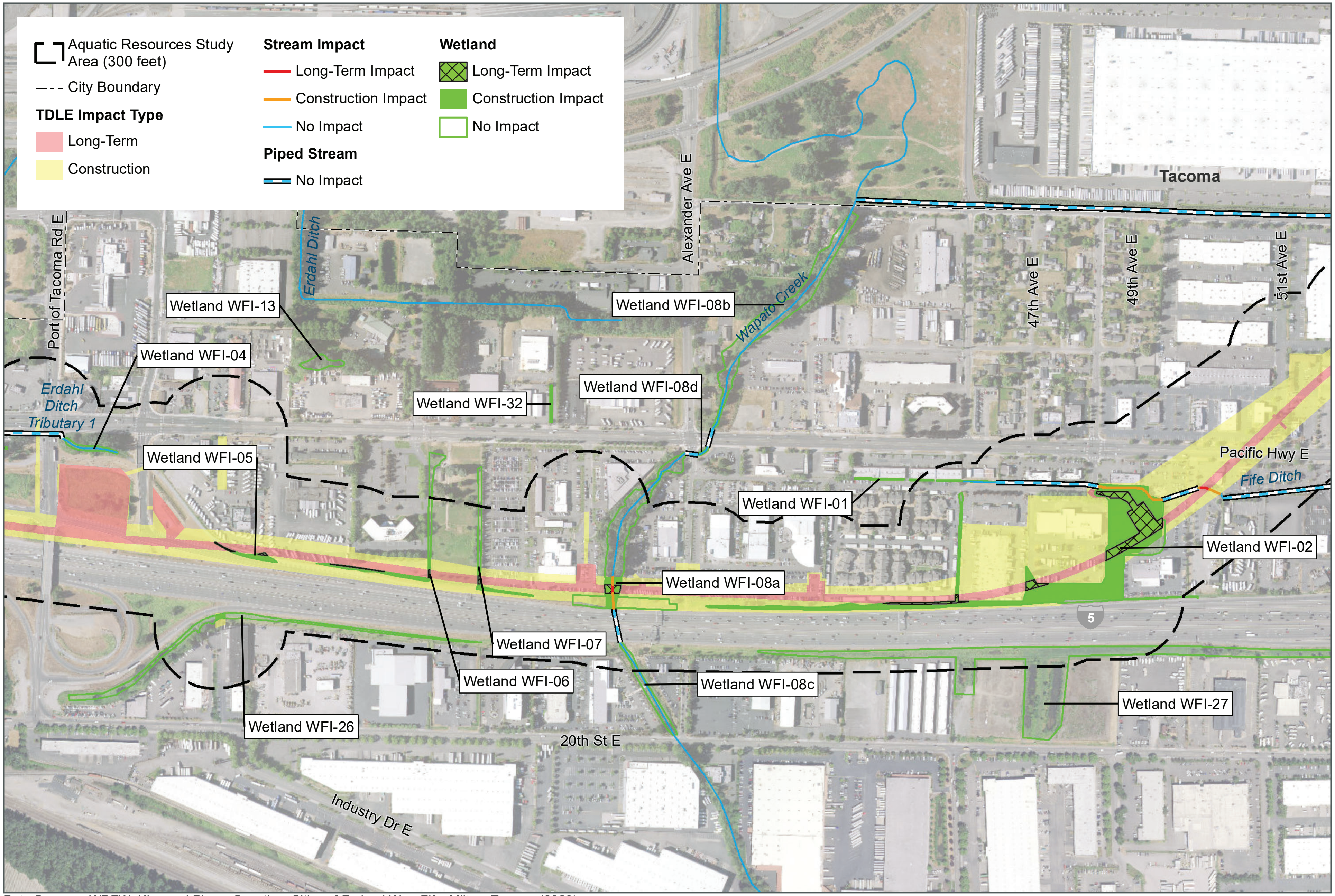
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-7B
Wetland and Stream Impacts
Fife I-5 Alternative

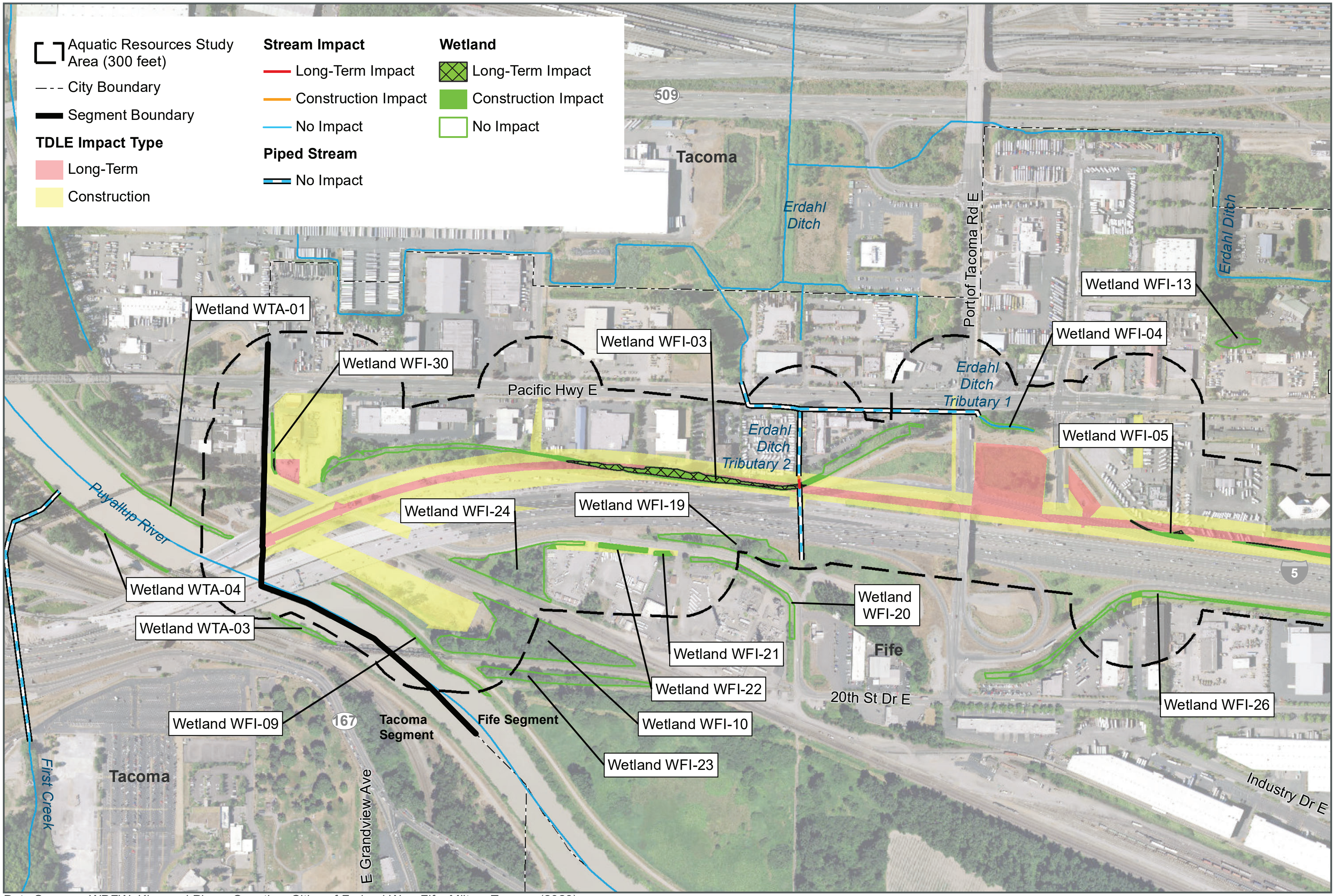
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

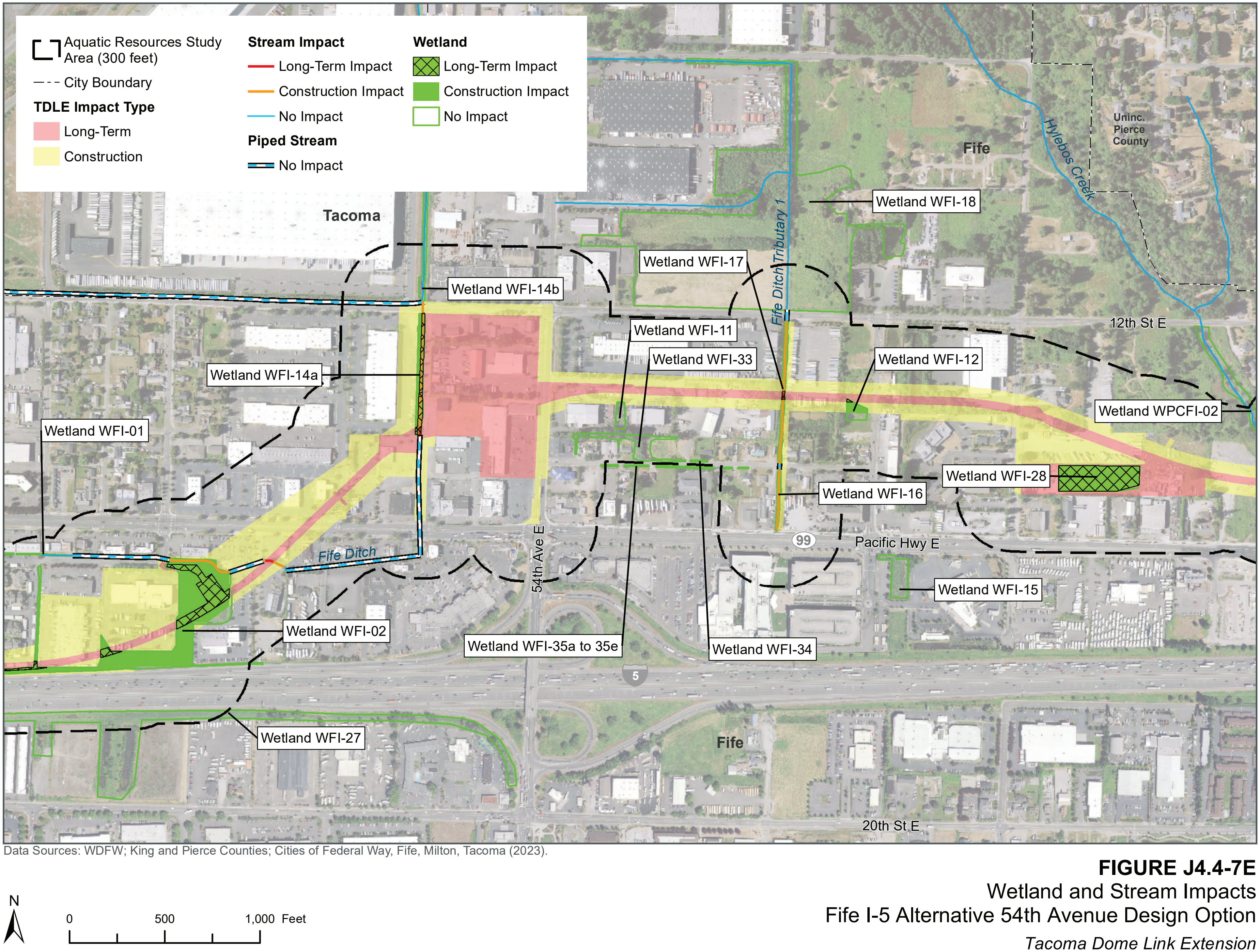
FIGURE J4.4-7C
Wetland and Stream Impacts
Fife I-5 Alternative

Tacoma Dome Link Extension



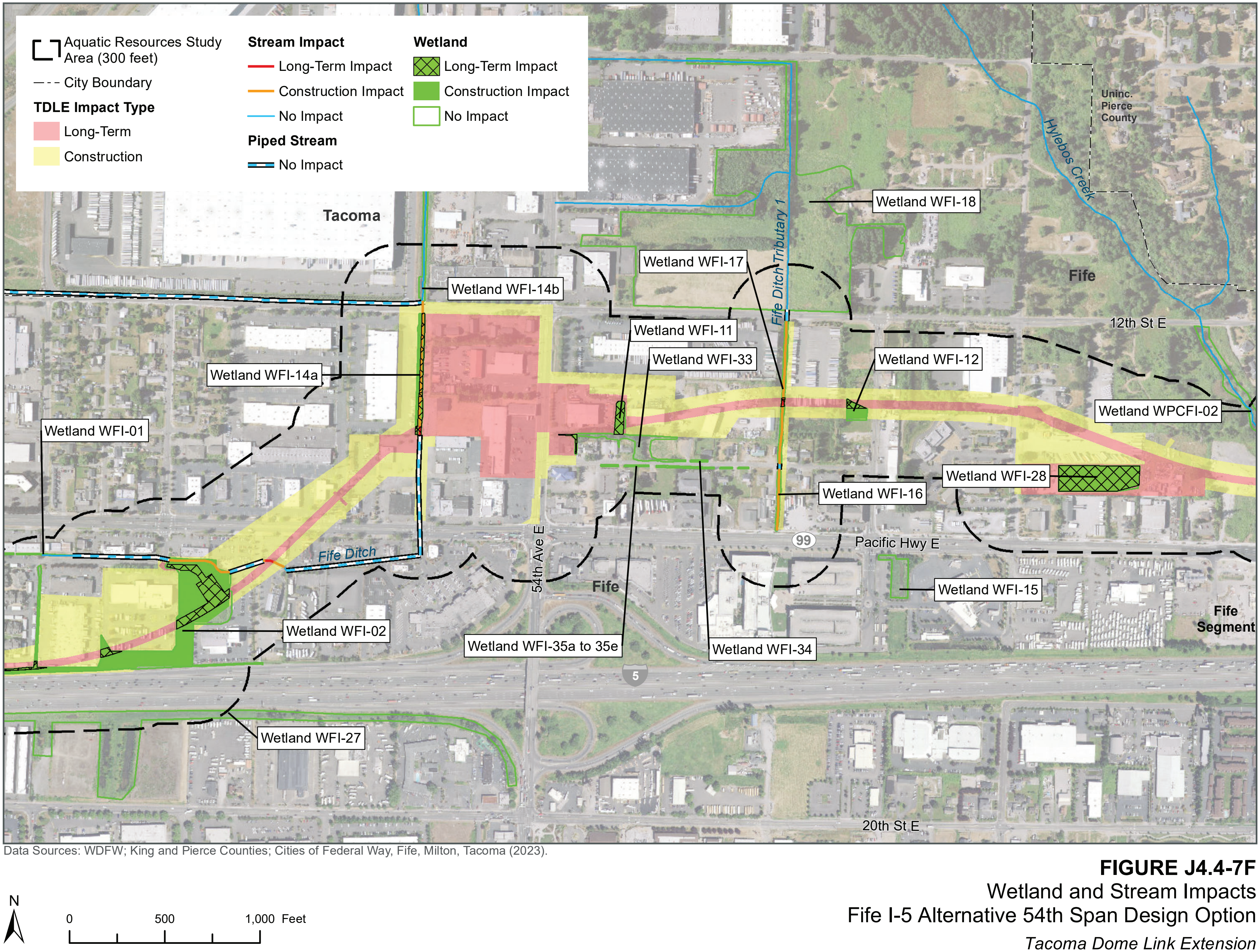
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-7D
Wetland and Stream Impacts
Fife I-5 Alternative
Tacoma Dome Link Extension



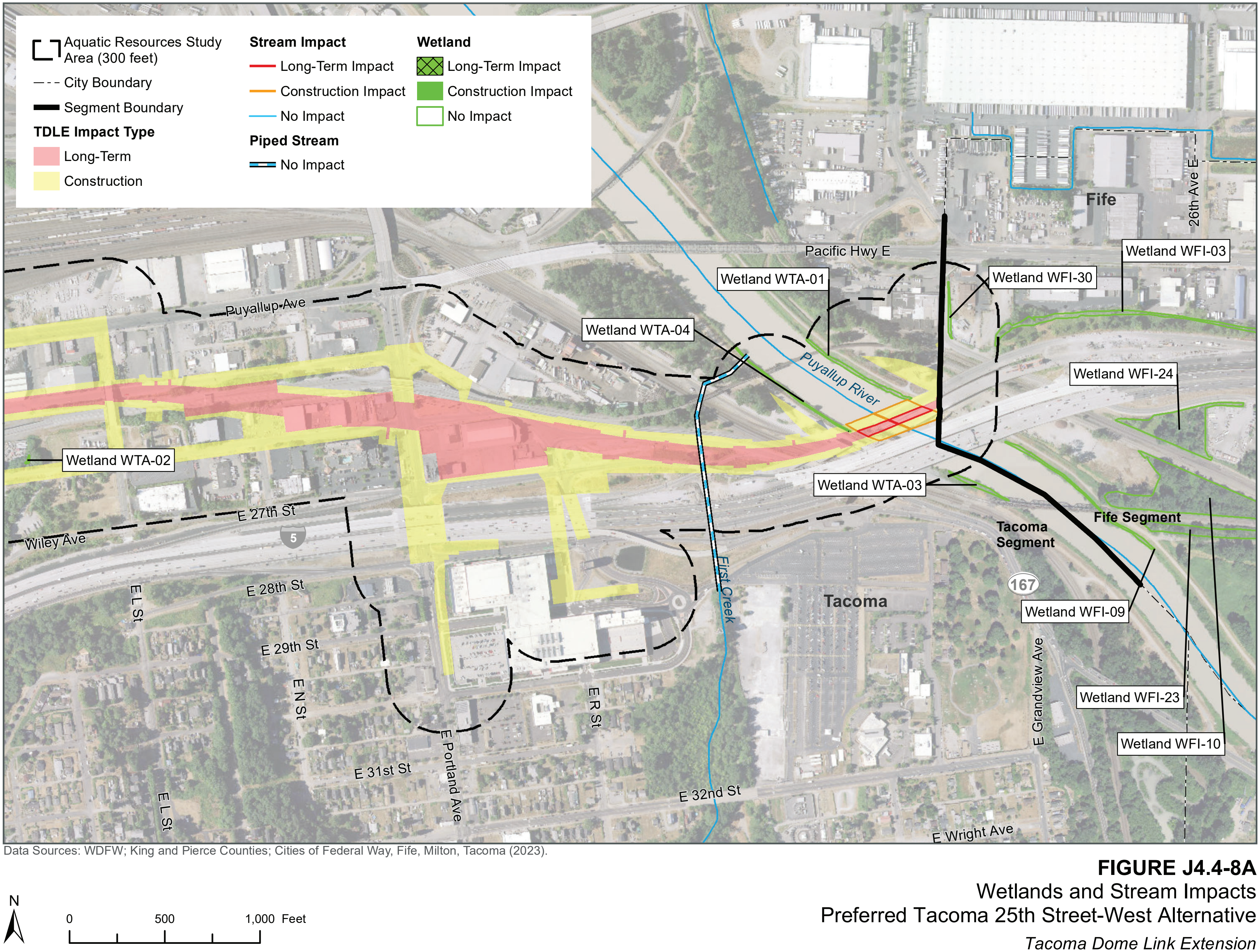
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-7E
Wetland and Stream Impacts
Fife I-5 Alternative 54th Avenue Design Option
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

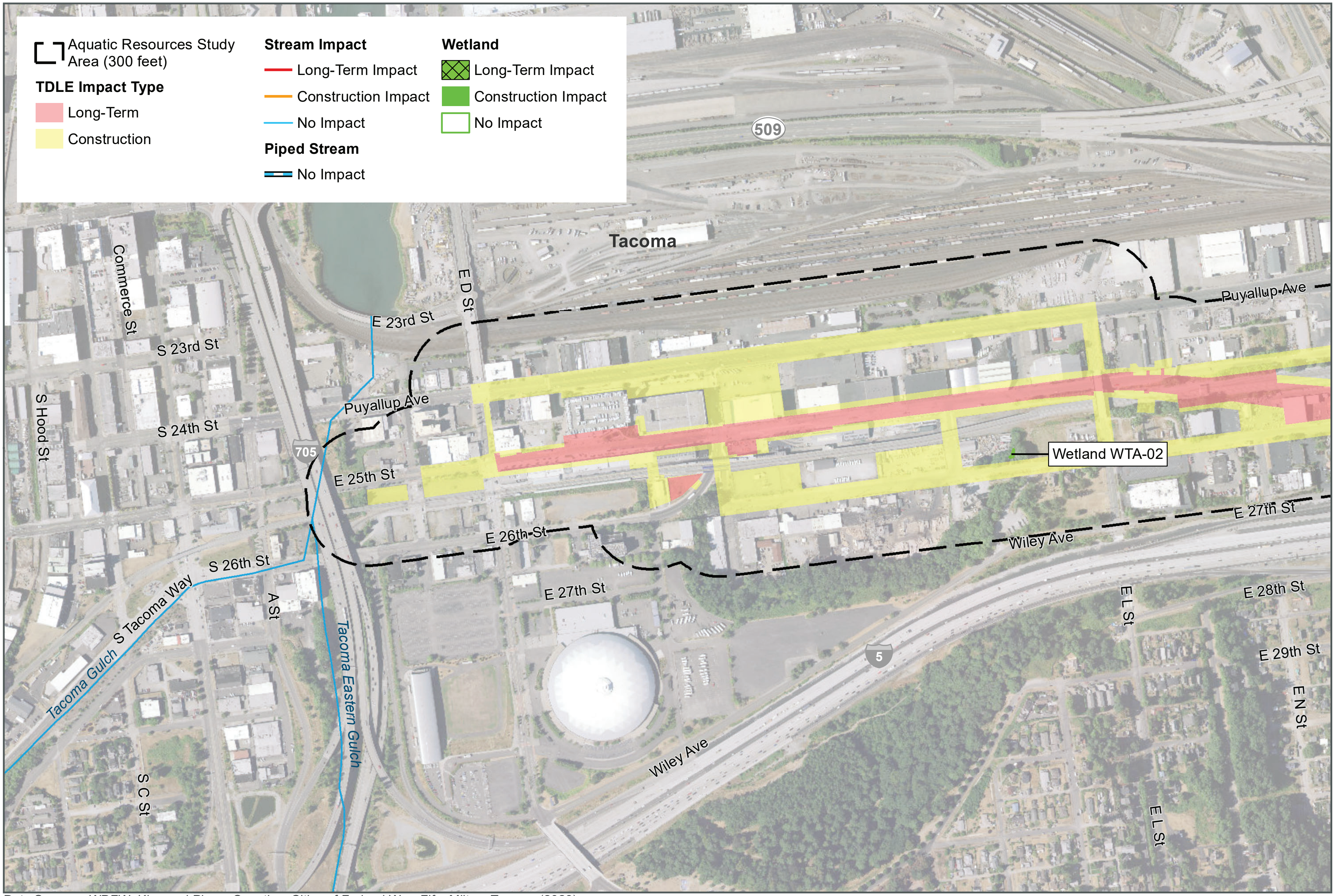
FIGURE J4.4-7F
Wetland and Stream Impacts
Fife I-5 Alternative 54th Span Design Option
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-8A
Wetlands and Stream Impacts
Preferred Tacoma 25th Street-West Alternative

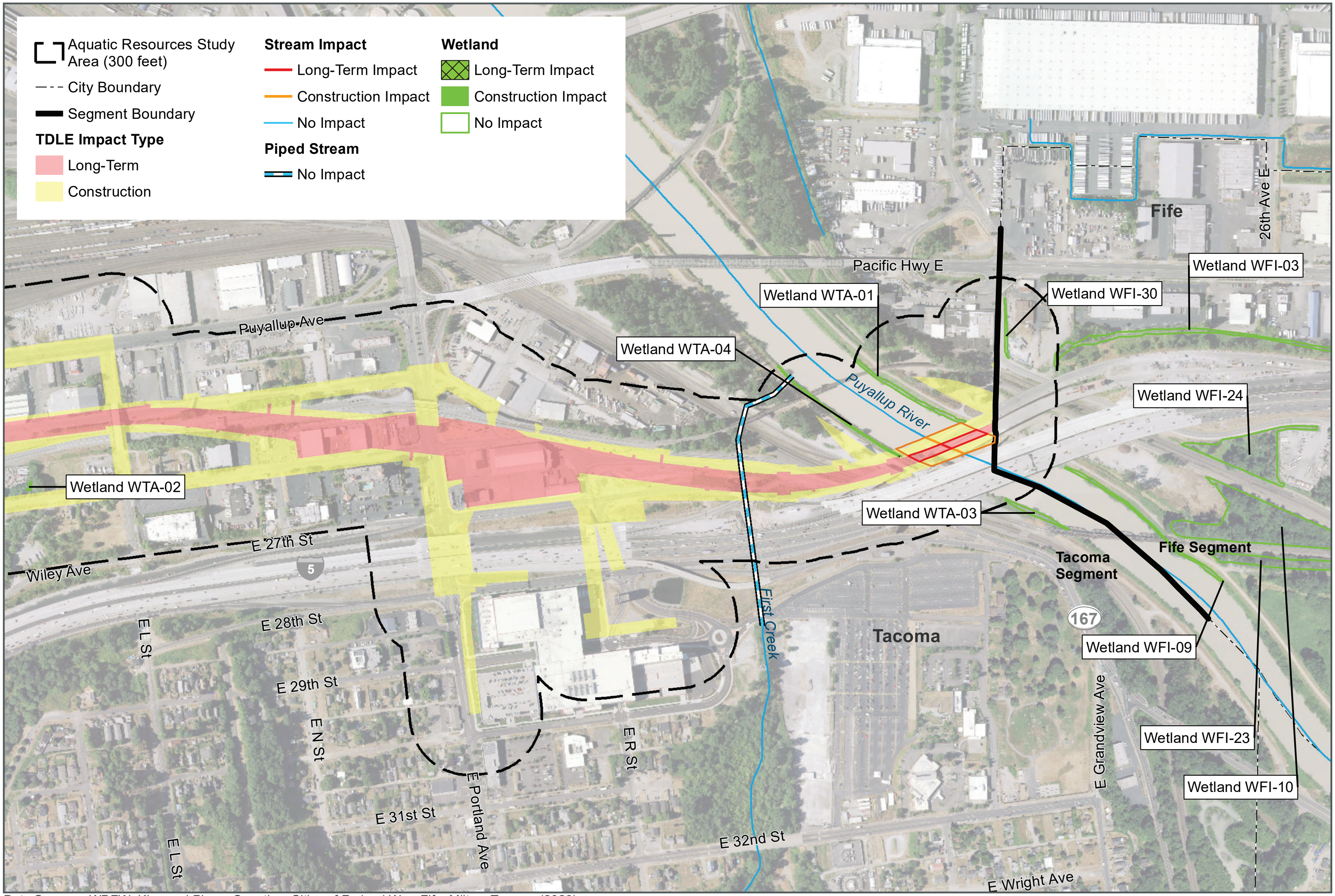
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

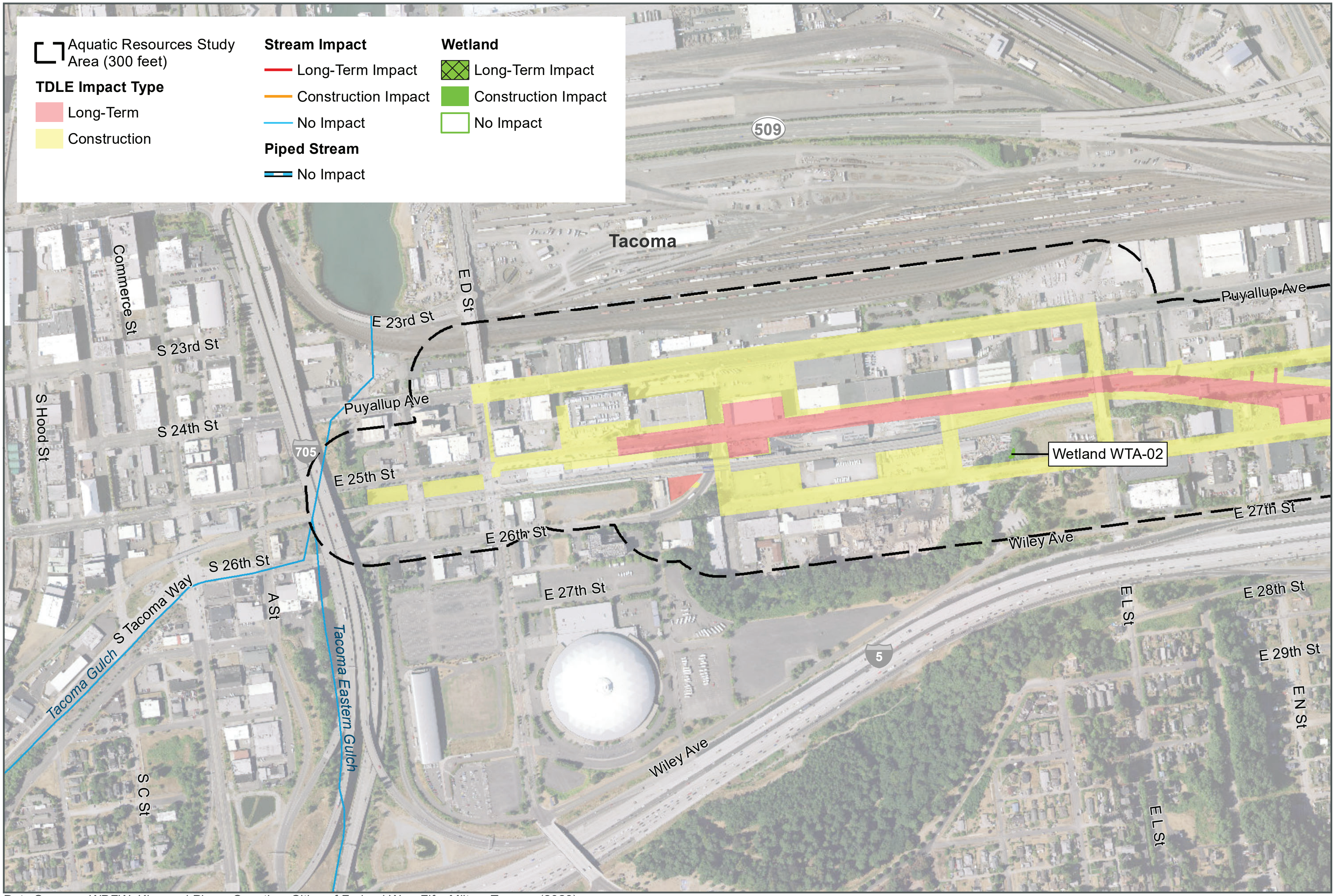
FIGURE J4.4-8B
Wetlands and Stream Impacts
Preferred Tacoma 25th Street-West Alternative

Tacoma Dome Link Extension



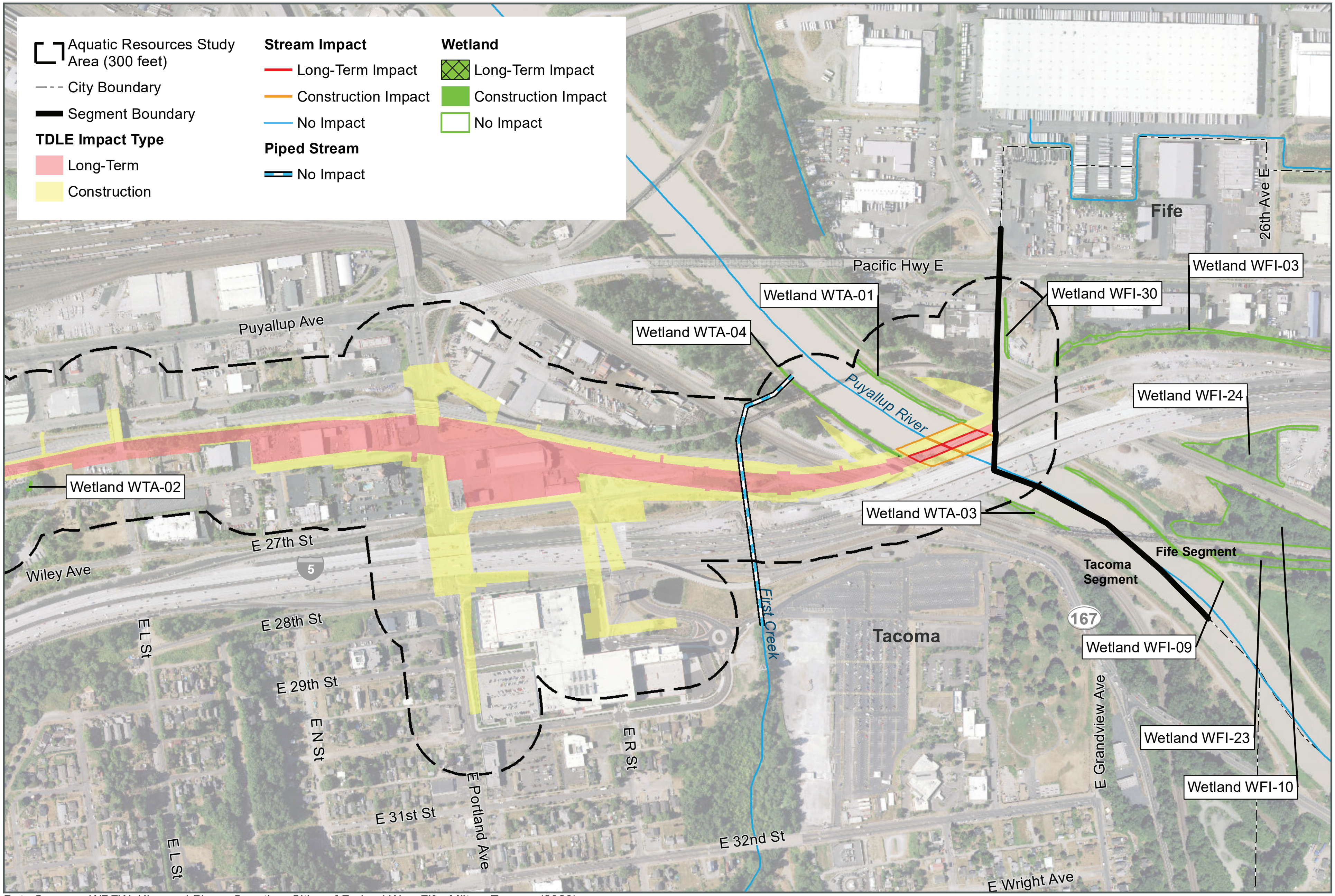
Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-9A
Wetlands and Streams Impacts
Tacoma 25th Street-East Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-9B
Wetlands and Streams Impacts
Tacoma 25th Street-East Alternative
Tacoma Dome Link Extension

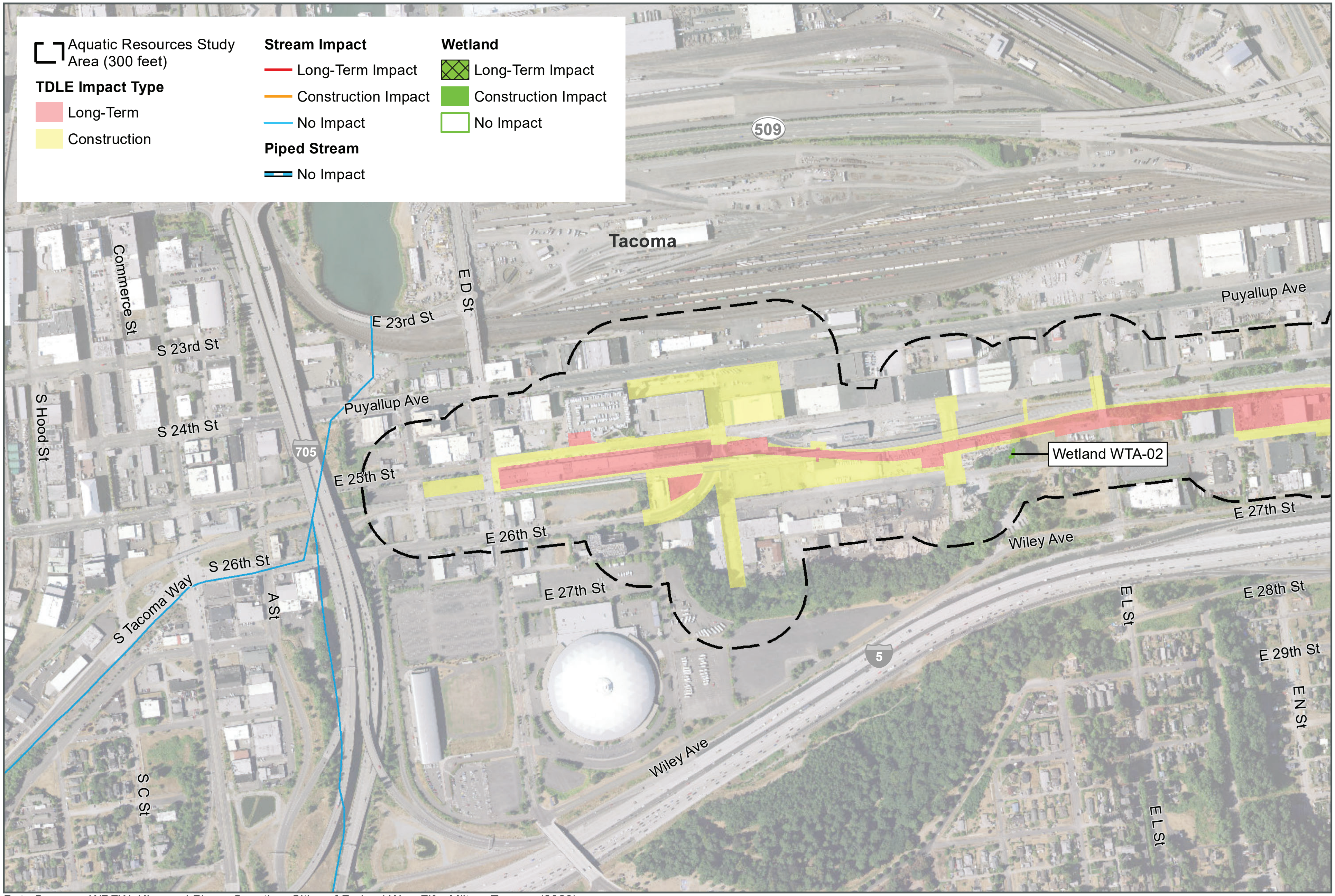


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

0 500 1,000 Feet

FIGURE J4.4-10A
Wetland and Stream Impacts
Tacoma Close to Sounder Alternative
Tacoma Dome Link Extension

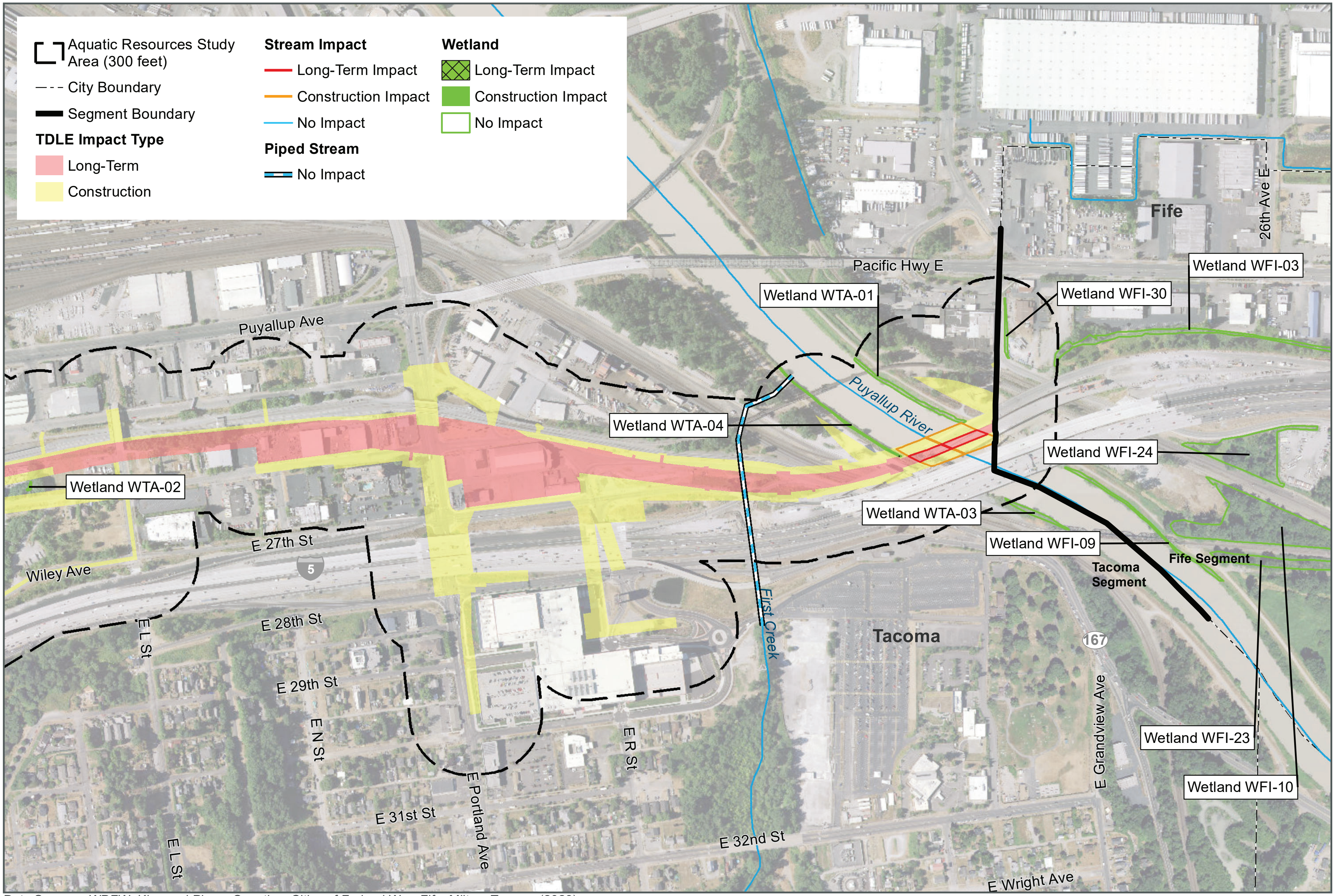


Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

N

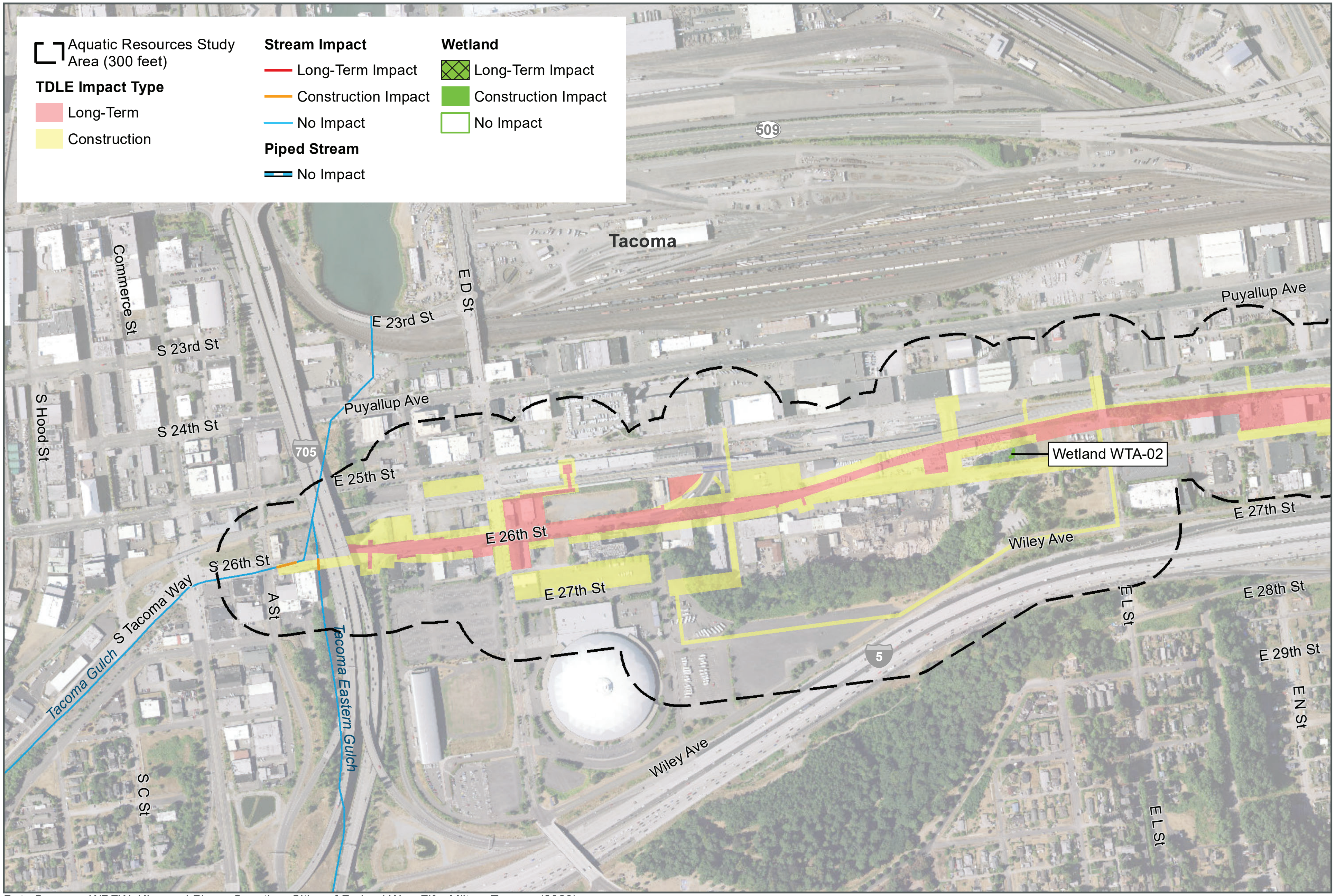
0 500 1,000 Feet

FIGURE J4.4-10B
Wetland and Stream Impacts
Tacoma Close to Sounder Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

FIGURE J4.4-11A
Wetland and Stream Impacts
Tacoma 26th Street Alternative
Tacoma Dome Link Extension



Data Sources: WDFW; King and Pierce Counties; Cities of Federal Way, Fife, Milton, Tacoma (2023).

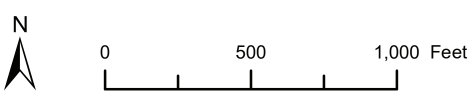


FIGURE J4.4-11B
Wetland and Stream Impacts
Tacoma 26th Street Alternative

Tacoma Dome Link Extension

Table J4.4-1 Potential Long-Term Impacts on Aquatic Resources by Alternative

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
Federal Way Segment				
Preferred FW Enchanted Parkway	Type F: 900 linear feet	East Fork Hylebos Creek Tributary 0016A	2.0	East Fork Hylebos Creek Tributary 0016A
Preferred FW Enchanted Parkway with Design Option	Type F: 1,000 linear feet	East Fork Hylebos Creek Tributary 0016A	2.6	East Fork Hylebos Creek Tributary 0016A
South Federal Way Segment				
SF Enchanted Parkway	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	2.8	Hylebos Creek East Fork Hylebos Creek Tributary 0016A SFW-01 West Fork Hylebos Creek SMI-01
	Type F: 100 linear feet (0.03 acre for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek		
SF I-5	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	5.6	Hylebos Creek East Fork Hylebos Creek Tributary 0016A SFW-01 West Fork Hylebos Creek SMI-01
	Type F: 900 linear feet (0.03 acres for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek		
SF 99-West	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	3.7	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 200 linear feet (0.02 acres for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek		
	Type Ns: 350 linear feet	SFW-02 SMI-03		
SF 99-West with Porter Way Design Option	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	4.3	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 350 linear feet (0.12 acre for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SMI-02		
	Type Ns: 350 linear feet	SFW-02 SMI-03		

Table J4.4-1 Potential Long-Term Impacts on Aquatic Resources by Alternative (continued)

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
SF 99-East	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	4.3	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SMI-03
	Type F: 300 linear feet (0.01 acres for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02		
	Type Ns: 250 linear feet	SMI-03		
SF 99-East with Porter Way Design Option	Type S: 50 linear feet (0.02 acre)	Hylebos Creek	4.7	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SMI-03
	Type F: 400 linear feet (0.11 acre of impact for West Fork Hylebos Creek)	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-02		
	Type Ns: 250 linear feet	SMI-03		
Fife Segment				
Fife Pacific Highway/ Fife Median	Type F: 50 linear feet	Wapato Creek	0.2	Hylebos Creek Wapato Creek
	Type Np 400 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 1 Erdahl Ditch Tributary 2		
Fife Pacific Highway/ Fife Median with 54th Avenue Design Option	Type F: 50 linear feet	Wapato Creek	0.2	Hylebos Creek Wapato Creek
	Type Np 300 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 1 Erdahl Ditch Tributary 2		

Table J4.4-1 Potential Long-Term Impacts on Aquatic Resources by Alternative (continued)

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
Fife Pacific Highway/ Fife Median with 54th Avenue Span Design Option	Type F: 50 linear feet	Wapato Creek	0.2	Hylebos Creek Wapato Creek
	Type Np 300 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 1 Erdahl Ditch Tributary 2		
Fife I-5	Type F: 50 linear feet	Wapato Creek	0.2	Hylebos Creek Wapato Creek
	Type Np 300 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 2		
Fife I-5 with either 54th Avenue Design Option(5)	Type F: 50 linear feet	Wapato Creek	0.2	Hylebos Creek Wapato Creek
	Type Np 200 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 2		
Tacoma Segment[4]				
Preferred Tacoma 25th Street-West	Type S: 0.4 acre	Puyallup River	0.1	Puyallup River
Tacoma 25th Street-East	Type S: 0.4 acre	Puyallup River	0.1	Puyallup River
Tacoma Close to Sounder	Type S: 0.4 acre	Puyallup River	0.1	Puyallup River
Tacoma 26th Street	Type S: 0.4 acre	Puyallup River	0.1	Puyallup River

Notes:

(1) Impacts on most streams are reported as the length of the stream's centerline that falls within the permanent impact footprint, rounded to the nearest 50 linear feet. Based on the size and breadth of the Puyallup River, impacts on that watercourse are reported as the area (in acres) of the river that falls within the permanent impact footprint. The values in this table do not necessarily represent actual anticipated impacts, such as filling stream channels or enclosing them in pipes. Instead, these values indicate the relative degree of potential impacts on streams and stream buffers. See text for discussion.

(2) Stream typing in accordance with WAC 222-16-030.

(3) Buffer impact values represent all affected areas inside functional stream buffers, including areas that overlap wetland buffers.

(4) Under any of the Tacoma Segment alternatives, the design options for the bridge crossing the Puyallup River would have different impacts that are not reflected in the permanent impact footprint. See text for discussion.

Fish Passage

This analysis considers impacts that could affect the potential availability and accessibility of stream habitats in the future if access is restored through the removal of downstream fish passage barriers.

If existing culverts must be modified or replaced to accommodate new light rail facilities, or if new culverts need to be installed, the new or replacement structures would be designed and installed in accordance with WDFW's Water Crossing Design Guidelines (Barnard et al. 2013) and with WDFW's climate change guidance for water crossings (Wilhere et al. 2016). Decisions about culvert design would be based on the assumption that all surface-flowing stream segments in the study area have the potential to support fish use in the future. As such, culverts replaced for project construction would not be expected to impede fish access through the study area in the future, if access is restored in the future through the removal of downstream fish passage barriers. In addition, Sound Transit would coordinate with WSDOT to ensure that the development of TDLE provides adequate space for any future replacement of WSDOT-owned culverts that are currently barriers to fish passage.

Riparian Vegetation Removal and Habitat Alteration

Comparisons of the impacts on riparian habitat between the alternatives are based on the overlap between the project limits[6] and functional stream buffers. As discussed in Section 2.5.1, functional stream buffers are defined as standard regulatory buffers for streams that have been trimmed at the edge of developed areas. For the 20 streams addressed in this analysis, these functional buffers extend 30 to 165 feet from surface-flowing stream segments. It is widely recognized that the loss of forest habitat can adversely affect riparian functions — the recruitment of wood in particular (Knutson and Naef 1997). However, some riparian areas in the study area are interrupted by roads, buildings, and industrial uses that reduce the capacity of riparian functions and processes.

Where the permanent impact footprint overlaps a stream's riparian buffer, the ecological function of that buffer would be diminished or eliminated. Substantial decreases in current riparian function would occur where areas of tree or shrub cover in a stream's riparian zone are converted to facilities or to vegetation types (e.g., lawns, ornamental landscaping) with less structural or compositional diversity. Where riparian vegetation, regardless of current condition, is removed altogether, potential future riparian functions would be eliminated. Potentially affected riparian functions and processes include fish and wildlife habitat provision; food chain support; water temperature maintenance; infiltration; groundwater recharge and discharge; sediment delivery, transport, and storage; organic matter input; nutrient and pathogen removal; and stream channel formation and maintenance. In all four TDLE project segments, none of the alternatives would entail the construction of at-grade guideways immediately adjacent to streams or their associated riparian areas.

Permanent project-related impacts on riparian habitat would also occur where elevated guideways span areas of riparian vegetation. For operational safety, trees and other tall vegetation would not be allowed to grow near track segments. Where elevated structures are built over critical areas and buffers, disturbed areas would be revegetated with native species. Where the track alignments pass through areas with trees and tall shrubs, vegetation would be converted to short-statured shrubs and herbaceous vegetation. Trees and other tall vegetation underneath and within 15 feet of elevated track segments would be permanently cleared for construction and maintained with low-stature vegetation for track safety. In addition, the long-term presence of structures above vegetation would reduce the amount of water the vegetation receives from precipitation. Finally, elevated structures with low clearance (generally, less than 15 feet) would limit sunlight. In some areas, vegetation cleared from beneath such structures may not grow back. The presence of elevated structures would preclude the development of forest habitat in such areas, reducing the potential for the recruitment of LWD to

[6] This would include areas within the 15-foot zone that would be cleared and maintained on either side of the guideway.

nearby streams. Because the elevated structures would be relatively narrow (typically 20 to 30 feet wide) and generally more than 15 feet above the ground surface, shading impacts on riparian vegetation would be limited.

Under the project alternatives, Sound Transit would use native vegetation to replant areas temporarily disturbed by construction. At sites where riparian zones are currently dominated by non-native species, the reintroduction of native vegetation could lead to long-term improvements in riparian habitat conditions.

Water Quality/Quantity

The development of any of the project alternatives would entail the creation of new impervious surfaces and the replacement of existing impervious surfaces. New impervious surfaces would include light rail stations, parking areas, new tracks and guideways, and roadways used for emergency or maintenance access. In some cases, these new surfaces would replace a mix of existing impervious and pervious surfaces. In other cases, new paved surfaces would replace existing vegetated areas, some of which are forested. Impervious surfaces are associated with negative effects on receiving waters, affecting water quality and flow regimes, which in turn can have negative effects on aquatic life and aquatic habitat.

The study area currently includes large amounts of pollution-generating impervious surfaces (PGIS), primarily parking lots and access roads that were developed before modern stormwater management requirements were in place. Stormwater runoff from these sites currently receives little or no detention or treatment. Development of light rail facilities in most areas would replace some existing untreated PGIS with fully detained and treated PGIS, increasing the amount of PGIS receiving treatment.

Under any of the build alternatives, runoff from impervious surfaces created or replaced for construction and operation of TDLE would be detained and/or treated, as appropriate, in accordance with the Sound Transit Design Criteria Manual and applicable local, state, and federal requirements. Appropriate treatment of runoff from PGIS would reduce the concentration of contaminants that enter receiving waters. However, water that passes through stormwater management facilities may still contain contaminants (albeit in reduced concentrations) that can harm fish in receiving waters. These contaminants could extend a considerable distance downstream, potentially affecting fish, including ESA-listed species, in stream reaches outside of the study area.

Recent research has found 6PPD-quinone, a contaminant found in runoff from highways or roadways, to be a major contributor to pre-spawning mortality in coho salmon (Tian et al. 2021). 6PPD-quinone is a chemical associated with tire dust. Other harmful contaminants in stormwater runoff include polycyclic aromatic hydrocarbons, which have been found to cause reduced growth, increased susceptibility to infection, and increased mortality in salmonids (Meador et al. 2006; Varanasi et al. 1993). Another common component of stormwater runoff is copper, which can impair the olfactory system of salmonids and hinder their predator avoidance behavior (Sandahl et al. 2007).

Ecology has evaluated the effectiveness of stormwater facilities in providing treatment that prevents or reduces the toxicity of contaminants in receiving waters (Ecology 2022). Under any of the build alternatives, treatment effectiveness would be a key consideration in the selection and design of stormwater management facilities. Stormwater ponds or a combination of vaults and ponds may be considered to provide effective treatment. Construction of stormwater ponds could result in additional impacts on streams. For example, if ponds are located in vegetated stream buffers, pond construction could result in the temporary or permanent degradation of riparian habitat.

See EIS Section 4.8, Water Resources, for additional analysis of potential impacts on water quality.

Based on Sound Transit's commitment to design the proposed project to meet all applicable stormwater management requirements, none of the alternatives would be expected to have long-term adverse effects on flow regimes in streams. Peak stream flows would not increase because the stormwater systems built for the proposed project would be designed to simulate predevelopment hydrology and detain/retain stormwater runoff. Additional measures to reduce stormwater runoff, such as low-impact development or other on-site measures, would be considered at a more advanced phase of project development. Based on the above, none of the alternatives would be expected to have adverse effects on aquatic species and habitat as a result of altered peak or base flows.

4.1.1.1 No-Build Alternative

The No-Build Alternative (which includes full build-out of the Sound Transit 3 System) would not have any direct long-term impacts on aquatic species or habitats in most of the study area. Conversely, implementing the No-Build Alternative would preclude potential beneficial environmental effects over the long term, such as tempering increases in motor vehicle traffic in the region and facilitating the concentration of residential and commercial growth in planned growth centers.

The No-Build Alternative includes the planned OMF South project. Under the OMF South project, ecosystem resources in the northern portion of the TDLE Federal Way Segment would be affected by construction and operation of OMF South. Effects of guideway extension for the OMF South project would include the realignment of the channel of East Fork Hylebos Creek Tributary 0016A, as well as degradation of stream functions and values as a result of decreased forest cover in the stream's riparian buffer.

Construction of the Preferred Alternative for OMF South would entail removing approximately 420 feet of East Fork Hylebos Creek Tributary 0016A near S 344th Street from culverts and restoring the stream to a surface-flowing channel. Daylighting this segment would increase the amount of aquatic habitat available in the stream system and would increase the amount of functioning aquatic and riparian habitat available in the stream system.

The planned area for WSDOT's SR 167 Completion Project intersects the TDLE study area. The SR 167 Completion Project is considered part of the No-Build Alternative and is currently under construction. The SR 167 Completion Project includes the creation and/or restoration of approximately 2.6 miles of stream habitat and 110 acres of wetland and riparian buffer associated with Hylebos Creek, Surprise Lake Creek, and Wapato Creek. Based on a review of maps in the environmental reevaluation document for that project, some areas proposed for riparian habitat restoration and stream relocation fall within the TDLE study area (FHWA and WSDOT 2018).

Phase 1 of the SR 167 Completion Project will also enlarge or replace existing stream crossing structures on SMI-01, Hylebos Creek, Surprise Lake Creek, Fife Ditch Tributary 1, and Fife Ditch. The crossings on SMI-01, Hylebos Creek, and Surprise Lake Creek are in the TDLE study area. These structures will allow for continued fish passage or provide additional fish passage into stream reaches to which access is currently impeded. The new structures also provide additional movement opportunities for terrestrial wildlife, including under I-5 (FHWA and WSDOT 2018).

4.1.1.2 Federal Way Segment Alternatives

The potential long-term impacts to streams and stream buffers for alternatives in the Federal Way Segment are compared in Table J4.4-1. The alignment of the Preferred FW Enchanted Parkway Alternative would parallel East Fork Hylebos Creek Tributary 0016A for approximately 0.5 mile, from near S 336th Street to near S 344th Street. Approximately 900 linear feet of East Fork Hylebos Creek Tributary 0016A (surface-flowing) fall within the permanent impact footprint of this alternative.

The guideway in this area would be elevated. Nearly all of the existing forested riparian habitat along that stretch of stream would be cleared for construction, and trees would not be allowed to grow back within 15 feet of the guideway and associated facilities. Impacts in this reach would include the permanent conversion of forested riparian habitat to scrub-shrub-dominated habitats, degradation of stream functions and values because of loss of forested riparian cover, and channel relocation and reconfiguration.

Approximately 1,700 feet of the stream channel in this area would be realigned and relocated approximately 40 to 70 feet west of the elevated guideway. Currently, much of East Fork Hylebos Creek Tributary 0016A in this area is confined within a straight and narrow channel that lacks complexity. The design for the realigned stream channel is expected to include meanders and other features to enhance the availability and diversity of aquatic habitats. The new channel would be designed to maintain flows and water quality conditions. LWD would be placed in and near the stream channel to provide additional habitat complexity. The actual layout of the stream channel would be developed as the design advances in consultation with Tribes, permitting agencies, and other stakeholders.

Some segments of the stream in this area would be within the permanent impact footprint but would not be relocated. Long-term impacts to those stream segments would be associated with reductions in the width of the vegetated riparian zone, as described below.

The interim design indicates that some of the relocated channel would be routed through a parcel that is currently filled and unvegetated and is used for storage of heavy equipment and construction materials. Under current conditions, the length of the stream channel in the area between that parcel and I-5 is approximately 320 feet, and the vegetated riparian area is confined to an approximately 80-foot-wide strip. Upon project completion, the length of the stream channel in that area would be more than 300 feet. It is assumed for this analysis that trees and other woody vegetation would be planted as allowable in this area (e.g., shrubs but not trees would be allowed within 15 feet of light rail facilities). As a result, a wider area would be available to support riparian functions, but those functions would be limited in some parts of that area because trees and other tall vegetation would not be allowed to grow near the light rail alignment.

Although realigning the stream channel would have some beneficial effects, changing the physical characteristics of the stream could adversely affect its hydrology and downstream sediment regimes. In addition, the presence of the light rail guideway east of the stream would further reduce the width of the already limited area available to support riparian functions. From S 336th Street to the southeastern corner of the Christian Faith Center property (a straight-line distance of approximately 0.25 mile), the vegetated riparian zone between neighboring properties the guideway would be approximately 100 to 180 feet wide. Compared to the existing width of the vegetated riparian zone in this area (200 to 300 feet), this zone would amount to a 10 to 40 percent reduction in the width of the vegetated riparian zone along approximately 1,400 linear feet of stream channel.

Farther south, the stream would be confined to an approximately 80-foot-wide corridor between the Ellenos Yogurt parcel and I-5. This area would include about 400 linear feet of stream channel. Much of the stream in this area would be beneath or immediately adjacent to the guideway. The presence of support columns near the stream would constrain options for natural or human-created modifications to channel configuration in the future. In addition, existing forested riparian vegetation would be cleared and replaced with lower-growing vegetation or converted to hard surfaces, substantially reducing riparian functions along this stream segment.

The permanent stream buffer impact areas (Table J4.4-1) reflect the assumption that all of the existing forested riparian habitat along the affected stretch of stream would be cleared. It may be possible to retain existing vegetation (including riparian forest) in some areas; the actual extent of riparian clearing and planting would be determined by the design-build contractor in consultation with Sound Transit. Where safety constraints allow, riparian areas cleared for construction would be restored with native vegetation, with an emphasis on trees and shrubs. As discussed in Section 2.5.4, trees and other tall vegetation would not be allowed to grow back near the light rail alignment. In those areas, some riparian habitat functions would be restored through revegetation with native shrubs and other low-growing species. In areas where mixed deciduous and coniferous forest is replaced with project features and non-forested vegetation, the capacity of those areas to support riparian functions for this stream would be permanently reduced.

The Design Option at the northern end of the mainline tracks would affect approximately 100 linear feet more of East Fork Hylebos Creek Tributary 0016A than would the Preferred FW Enchanted Parkway Alternative (Table J4.4-1). The Design Option would intersect the northern end of the stream in Belmor; the Preferred FW Enchanted Parkway Alternative would avoid it altogether.

4.1.1.3 South Federal Way Segment Alternatives

The potential long-term impacts to streams and stream buffers for alternatives in the South Federal Way Segment are compared in Table J4.4-1. South of S 344th Street, the SF I-5 Alternative would continue to follow the course of East Fork Hylebos Creek Tributary 0016A for another 0.6 mile south of the Federal Way Segment, affecting forested riparian habitat in the I-5/SR 18 interchange and immediately upstream of the culvert where the stream passes under I-5. This alternative would also likely require the realignment of approximately 1,500 feet of the stream, where it would parallel the guideway south of the I-5/SR 18 interchange. By turning westward and following SR 161 or SR 99 through this area, the other alternatives would avoid most of these impacts. Compared to the other alternatives, the SF I-5 Alternative would affect substantially more of the stream and its buffer (Table J4.4-1).

Due to the length of stream that falls within the alternative’s permanent impact footprint, the SF I-5 Alternative would affect more stream channel and buffer habitat than any of the other alternatives. As a result of stream crossings along SR 99, the SF 99-West and SF 99-East alternatives would affect more stream and stream buffer habitat than would the SF Enchanted Parkway Alternative. The Porter Way Design Option for the SF 99-West and SF 99-East alternatives would parallel West Fork Hylebos Creek for approximately 1,700 feet and would add a stream crossing, resulting in greater impacts on streams and stream buffers (Table J4.4-1).

The differences between the South Federal Way Segment alternatives’ impacts on individual streams and stream buffers are summarized below.

Shorelines of the state:

- Hylebos Creek – All of the alternatives would cross this stream at approximately the same location and would affect equivalent amounts of the stream and its buffer.

Fish-bearing streams:

- East Fork Hylebos Creek Tributary 0016A – The SF I-5 Alternative would affect substantially more of this stream and its buffer than any of the other alternatives, as discussed above.
- West Fork Hylebos Creek – The SF 99-West and SF 99-East alternatives with Porter Way Design Option would affect substantially more of this stream and its buffer than would any of the other alternatives, all of which would have similar impacts. The Porter Way Design Option would cross West Fork Hylebos Creek two times, whereas the SF 99-East and SF 99-West alternatives would cross the creek only once. As discussed in Section 3.1.2.3, West Fork Hylebos Creek is considered to contain the highest-quality habitat in the Hylebos Creek system.
- SFW-03 – The SF 99-East Alternative would cross this stream and its buffer. The SF 99-West Alternative would not cross this stream but would affect its buffer; inclusion of the Porter Way Design Option would not change the amount of the stream or its buffer that falls within the permanent impact footprint. The SF Enchanted Parkway and SF I-5 alternatives would not affect this stream or its buffer.
- SFW-04 – This stream and its buffer would be affected by the SF 99-East alternative only; inclusion of the Porter Way Design Option would not change the amount of the stream and stream buffer that falls within this alternative's permanent impact footprint.
- SMI-01 – None of the alternatives would cross this stream, but they would all affect its buffer. The SF Enchanted Parkway and SF I-5 alternatives would affect more of the stream's buffer than would the SF 99-West or SF 99-East alternatives; inclusion of the Porter Way Design Option would not change the amount of the stream's buffer that falls within the permanent impact footprint.
- SMI-02 – The permanent impact footprints of the SF 99-West and SF 99-East alternatives with the Porter Way Design Option would overlap this stream near its confluence with West Fork Hylebos Creek. The SF 99-West and SF 99-East alternatives would not cross this stream, but they would affect its buffer. The SF Enchanted Parkway and SF I-5 alternatives would not affect this stream or its buffer.

Non-fish-bearing streams:

- SFW-02 – The SF 99-West Alternative would affect this stream and its buffer; inclusion of the Porter Way Design Option would not change the amount of the stream or its buffer that falls within the permanent impact footprint. None of the other alternatives would affect this stream or its buffer.
- SMI-03 – The SF 99-West and SF 99-East alternatives would affect equivalent amounts of this stream and its buffer; inclusion of the Porter Way Design Option would not change the amount of the stream or its buffer that falls within the permanent impact footprint.

Where they cross West Fork Hylebos Creek and Hylebos Creek (both of which are documented salmon-bearing streams), all the South Federal Way Segment alternatives would permanently reduce forested habitat in the streams' riparian buffers. The Porter Way Design Options for SR 99 would permanently reduce riparian forest the most along West Fork Hylebos Creek due to its proposed location within the riparian area. Also, project impacts could affect the future riparian restoration areas along Hylebos Creek for the SR 167 Completion Project planned by WSDOT (see Section 4.7, Cumulative Impacts). Construction within 200 feet of Hylebos Creek would require permanent vegetation removal within the shoreline jurisdiction.

Both the SF 99-West Alternative and the SF 99-East Alternative would affect parcels near SR 99 that have been acquired or that are planned for acquisition by the City of Federal Way for conservation and restoration of West Fork Hylebos Creek. In addition, both alternatives would cross one federally owned parcel dedicated to the Puyallup Tribe. This parcel, which is currently held in open space, contains wetlands and riparian habitat associated with West Fork Hylebos Creek. The other alternatives would avoid city-owned or Tribal parcels that are identified as conservation priorities, as would the SF 99-West and SF 99-East alternatives with the Porter Way Design Option.

4.1.1.4 Fife Segment Alternatives

The potential long-term impacts to streams and stream buffers for alternatives in the Fife Segment are compared in Table J4.4-1. Riparian habitat conditions in the Fife Segment are generally degraded, consisting primarily of willow, reed canarygrass, and Himalayan blackberry, with few trees present at some sites. As such, the impacts of the alternatives on aquatic habitats and species in the Fife Segment would be less severe than other segments. However, the presence of light rail structures in all of these areas would limit options for riparian habitat restoration in the future.

Under all three alternatives, construction and operation of the elevated preferred Fife Station and associated ground-level facilities would require approximately 150 linear feet of Fife Ditch Tributary 1 to be relocated and/or placed in a new culvert. These impacts would not occur if either of the station design options at 54th Avenue E is implemented. Fife Ditch and Fife Ditch Tributary 1 are considered non-fish bearing and function only as stormwater conveyance.

The Fife Pacific Highway, Fife Median, and the Fife I-5 alternatives and associated design options would be on elevated guideways throughout the Fife Segment. As such, long-term impacts on most streams would be associated only with shading from overhead structures and with riparian vegetation clearing. Other than the impacts of the Fife Station on Fife Ditch Tributary 1, no in-water work, relocation of streams, or alteration of in-stream habitat is anticipated for any of the alternatives in the Fife Segment.

The Fife Pacific Highway and Fife Median alternatives are addressed together because they share the same analysis footprint. Similarly, the two design options (54th Avenue and 54th Span) are addressed together because their impacts on aquatic resources would be indistinguishable.

All of the Fife Segment alternatives would have the same amount of impact on the one fish-bearing stream (Wapato Creek) that they would cross. In addition, all of the alternatives would affect the same amount of stream buffer on fish-bearing streams (Hylebos Creek and Wapato Creek). Under any of the alternatives, neither of the design options would modify the effects of the alternatives on fish-bearing streams or their buffers (Table J4.4-1).

4.1.1.5 Tacoma Segment Alternatives

The long-term impacts of the Tacoma Segment alternatives on aquatic resources would be essentially identical (Table J4.4-1) and would be associated with shading and placement of permanent in-water structures. Under all four alternatives, the construction of elevated guideway over a piped segment of First Creek would not be expected to affect that stream. Under any of the alternatives, the long-span and pier-supported options for the bridge crossing the Puyallup River would have markedly different impacts.

All four alternatives would cross the Puyallup River downstream (northwest) of the I-5 bridge. If the long-span bridge option is selected, the impacts of the bridge on aquatic habitats would be minimal since in-water piers would not be required. The bridge would be narrower and substantially higher above the water than the existing I-5 bridge. A long-span bridge for TDLE would be about 110 feet above the water, approximately 60 feet higher than the I-5 bridge. As a result, the shadow it casts on the water would be smaller and more diffuse than that of the existing bridge. No in-water structures would be needed to support a long-span bridge.

In contrast, a pier-supported bridge would not be as high above the water as a long-span bridge (approximately 60 feet, compared to 110), and the presence of piers in the river would affect in-stream habitat conditions for fish, including ESA-listed Chinook salmon, steelhead, and bull trout. Shade from the bridge could increase the risk of predation on juvenile salmonids. In addition, predators may be able to wait in areas of slow water created by the piers. The addition of the light rail bridge would increase the amount of river habitat affected by piers and overhead structures.

In-water piers would permanently displace benthic (riverbed) habitat, as well as affect patterns of scour and deposition within the channel, which can affect prey resources for fish. As discussed in Section 3.1.2.13, however, the Puyallup River in the study area serves primarily as a migratory corridor for salmonids. For this reason, combined with the footprint of the piers, impacts on riverbed habitat would not be expected to have appreciable adverse effects on salmonids. The primary risks to fish would be during construction associated with in-water work for installation of temporary work trestles and support piers. Impacts of these activities are described in Section 4.1.2, Construction Impacts.

Construction near the Puyallup River would permanently affect riparian vegetation in the shoreline jurisdiction.

4.1.2 Construction Impacts

Temporary, construction-related impacts on aquatic resources would occur where stream buffers (i.e., riparian habitat) are affected by clearing and ground-disturbing work but are revegetated following construction. In addition, ground-disturbing work and equipment use in or near surface-flowing waters would present the risk of delivering sediment or contaminants (e.g., fuel, hydraulic fluids) to streams, temporarily degrading water quality.

The duration of temporary impacts on riparian habitat can vary depending on the type of vegetation that is affected. For instance, temporary impacts on grasses and areas dominated by fast-growing invasive species would generally be short-lived, with functions typically returning to pre-impact performance within one growing season. In areas where invasive species are replaced with native species, construction-related impacts may result in improved habitat function. In contrast, temporary impacts on woody vegetation generally last longer because trees and/or shrubs require several years or decades to achieve the size and stature necessary to provide pre-impact functions, such as canopy habitat.

Construction of TDLE parking facilities at the stations in South Federal Way and Fife could be delayed up to 3 years after initial service opens. If that occurs, the construction-related effects described above would occur at these two station locations at the time the parking facilities are built.

The following sections outline the range of potential temporary construction impacts on streams and aquatic resources that could occur under the alternatives for each segment of TDLE. Actual impacts would depend on the final configuration and design, construction footprint and methods, BMPs implemented during construction (see Section 4.8.1, Avoidance and Minimization During

Design Development), and performance of post-construction restoration. Direct construction impacts would be identified and quantified during final design and permitting. Although detailed construction limits have not yet been defined at this phase in the project design, potential project construction limits have been estimated (see Section 2.5). These impact areas are summarized in Table J4.4-2 (Potential Construction-related Impacts on Aquatic Resources, by Alternative) and would be in addition to the long-term direct impacts described in Section 4.1.1.

Table J4.4-2 Potential Construction-Related Impacts on Aquatic Resources by Alternative

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
Federal Way Segment				
Preferred FW Enchanted Parkway	Type F: 850 linear feet	East Fork Hylebos Creek Tributary 0016A	5.0	East Fork Hylebos Creek Tributary 0016A
Preferred FW Enchanted Parkway with Design Option	Type F: 950 linear feet	East Fork Hylebos Creek Tributary 0016A	5.3	East Fork Hylebos Creek Tributary 0016A
South Federal Way Segment				
SF Enchanted Parkway	Type S: 450 linear feet	Hylebos Creek	6.9	Hylebos Creek East Fork Hylebos Creek Tributary 0016A SFW-01 West Fork Hylebos Creek SMI-01
	Type F: 2,200 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SMI-01		
SF I-5	Type S: 450 linear feet	Hylebos Creek	11.5	Hylebos Creek East Fork Hylebos Creek Tributary 0016A SFW-01 West Fork Hylebos Creek SMI-01
	Type F: 3,200 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SMI-01		

Table J4.4-2 Potential Construction-Related Impacts to Aquatic Resources by Alternative (continued)

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
SF 99-West	Type S: 450 linear feet	Hylebos Creek	7.1	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 2,050 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-04 SMI-01 SMI-02		
	Type Ns: 50 linear feet	SFW-02 SMI-03		
SF 99-West with Porter Way Design Option	Type S: 450 linear feet	Hylebos Creek	12.9	Hylebos Creek East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 2,950 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-04 SMI-01 SMI-02		
	Type Ns: 50 linear feet	SFW-02 SMI-03		
SF 99-East	Type S: 450 linear feet	Hylebos Creek	7.4	Hylebos Creek East Fork Hylebos Creek Tributary 0016A North Fork Hylebos Creek West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 2,150 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02		
	Type Ns: <50 linear feet	SFW-02 SMI-03		
SF 99-East with Porter Way Design Option	Type S: 450 linear feet	Hylebos Creek	13.2	Hylebos Creek East Fork Hylebos Creek Tributary 0016A North Fork Hylebos Creek West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02 SFW-02 SMI-03
	Type F: 3,000 linear feet	East Fork Hylebos Creek Tributary 0016A West Fork Hylebos Creek SFW-03 SFW-04 SMI-01 SMI-02		
	Type Ns: <50 linear feet	SFW-02 SMI-03		

Table J4.4-2 Potential Construction-Related Impacts to Aquatic Resources by Alternative (continued)

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
Fife Segment				
Fife Pacific Highway/ Fife Median	Type S: <50 ft	Hylebos Creek	0.5	Hylebos Creek Wapato Creek
	Type F: 100 linear feet	Wapato Creek Hylebos Creek		
	Type Np 1,250	Fife Ditch Fife Ditch Tributary 1 Erdahl Ditch Tributary 1 Erdahl Ditch Tributary 2		
Fife Pacific Highway/ Fife Median with either 54th Avenue Design Option	Type S: <50 ft	Hylebos Creek	0.5	Hylebos Creek Wapato Creek
	Type F: 100 linear feet	Wapato Creek Hylebos Creek		
	Type Np 1,750 linear feet	Fife Ditch Fife Ditch Tributary 1 Erdahl Ditch Tributary 1 Erdahl Ditch Tributary 2		
Fife I-5	Type S: <50 ft	Hylebos Creek	1.0	Hylebos Creek Wapato Creek
	Type F: 100 linear feet	Wapato Creek Hylebos Creek		
	Type Np 1,400 linear feet	Fife Ditch Tributary 1 Fife Ditch Wapato Creek Erdahl Ditch Tributary 2		
Fife I-5 with either 54th Avenue Design Option	Type S: <50 ft	Hylebos Creek	1.0	Hylebos Creek Wapato Creek
	Type F: 100 linear feet	Wapato Creek Hylebos Creek		
	Type Np 2,000 linear feet	Fife Ditch Tributary 1 Fife Ditch Erdahl Ditch Tributary 2		

Table J4.4-2 Potential Construction-Related Impacts to Aquatic Resources by Alternative (continued)

Alternative	Stream Impact by Water Type[1,2]	Affected Stream(s)	Stream Buffer Impact (acres)[1,3]	Affected Stream Buffer(s)
Tacoma Segment[4]				
Preferred Tacoma 25th Street-West	Type S: 1.0 acre	Puyallup River	0.1	Puyallup River
Tacoma 25th Street-East	Type S: 1.0 acre	Puyallup River	0.1	Puyallup River
Tacoma Close to Sounder	Type S: 1.0 acre	Puyallup River	0.1	Puyallup River
Tacoma 26th Street	Type S: 1.0 acre	Puyallup River	0.1	Puyallup River

Notes:

(1) Impacts on most streams are reported as the length of the stream's centerline that falls within the construction impact footprint, rounded to the nearest 50 feet. Based on the size and breadth of the Puyallup River, impacts on that watercourse are reported as the area (in acres) of the river that falls within the construction impact footprint. As discussed in the introduction to Chapter 4, the values in this table do not necessarily represent actual anticipated impacts, such as filling stream channels or enclosing them in pipes. Instead, these values indicate the relative degree of potential impacts on streams and stream buffers. See text for discussion.

(2) Stream typing in accordance with WAC 222-16-030.

(3) Buffer impact values represent all affected areas inside functional stream buffers, including areas that overlap wetland buffers.

(4) Under any of the Tacoma Segment alternatives, the design options for the bridge crossing the Puyallup River would have different impacts that are not reflected in the construction-related impact footprint. See text for discussion.

4.1.2.1 No-Build Alternative

The No-Build Alternative would not have any temporary, construction-related impacts on aquatic areas and habitat. Areas temporarily affected by construction of the planned OMF South project would be restored separately from TDLE.

4.1.2.2 Federal Way Segment Alternatives

Most impacts on aquatic resources would be long term and are discussed in Section 4.1.1. Approximately 850 linear feet of East Fork Hylebos Creek Tributary 0016A would fall within the temporary impact footprint (see Table J4.4-2). Impacts would include temporary loss of riparian habitat function and an elevated risk of water quality degradation, as described above. Approximately 5 acres of the stream's buffer would fall within the temporary impact footprint for this alternative.

The FW Design Option would temporarily impact approximately 100 linear feet more of East Fork Hylebos Creek Tributary 0016A and approximately 0.3 acre more of its buffer (Table J4.4-2).

4.1.2.3 South Federal Way Segment Alternatives

The overall construction-related impacts of the South Federal Way alternatives on streams would follow a pattern similar to that seen for permanent impacts. The SF I-5 Alternative would affect more linear feet of streams than any of the other alternatives or design options, largely due to the SF I-5 Alternative's impacts on East Fork Hylebos Creek Tributary 0016A (Table J4.4-2). The SF Enchanted Parkway Alternative and the SF 99-West and SF 99-East alternatives (without the Porter Way Design Option) would all affect approximately 1,000 fewer linear feet of stream than the SF I-5 Alternative, largely because they would avoid most segments of East Fork Hylebos Creek Tributary 0016A south of S 344th Street. The SF 99-West and SF 99-East alternatives with the Porter Way Design Option would affect about 100 fewer linear feet of streams overall, compared to the SF I-5 Alternative.

Although the SF I-5 Alternative would affect more linear feet of streams than the other alternatives, most of this alternative's impacts would affect a stream (East Fork Hylebos Creek Tributary 0016A) that is not known to support fish populations due to seasonal flow conditions and the presence of numerous fish passage barriers. In contrast, the SF 99-West and SF 99-East alternatives with the Porter Way Design Option would affect approximately 750 to 800 linear feet more of West Fork Hylebos Creek (a major salmonid stream that supports ESA-listed fish), compared to the SF I-5 Alternative.

The alternatives' construction-related impacts on stream buffers are grouped similarly to their impacts on streams. The SF I-5 Alternative and the versions of the SF 99-West and SF 99-East alternatives that include the Porter Way Design Option would affect about 12 to 13 acres of stream buffers. Compared to the other alternatives, the SF I-5 Alternative would affect substantially more stream buffer habitat along East Fork Hylebos Creek Tributary 0016A (approximately 7 acres, versus 2 to 3 acres), including areas with comparatively high-quality habitat, such as native forest and wetlands. The SF Enchanted Parkway Alternative and the SF 99-West and SF 99-East alternatives (without the Porter Way Design Option) would affect about 7 acres of stream buffers overall (Table J4.4-2).

Compared to the SF 99-West and SF 99-East alternatives without the Porter Way Design Option, the SF 99-West and SF 99-East alternatives with the Porter Way Design Option would affect approximately 6 more acres of stream buffer habitat associated with West Fork Hylebos Creek — including high-quality habitats such as mature native forest. Overall, the SF 99 Porter Way Design Options would have an appreciably greater impact on West Fork Hylebos Creek and associated riparian habitat. West Fork Hylebos Creek supports sensitive species such as Chinook salmon and steelhead, which are listed as threatened species under the ESA.

4.1.2.4 Fife Segment Alternatives

The potential construction-related impacts on streams and stream buffers for alternatives in the Fife Segment are compared in Table J4.4-2. As with long-term impacts, the Fife Pacific Highway and Fife Median alternatives are addressed together because they share the same analysis footprint. Similarly, the two design options (54th Avenue and 54th Span) are addressed together because their impacts on aquatic resources would be indistinguishable.

The construction footprint of the Fife I-5 Alternative would overlap approximately 200 more linear feet of streams than would the construction footprint of the Fife Pacific Highway and Fife Median alternatives (Table J4.4-2). This difference is attributable primarily to impacts on Fife Ditch. All alternatives would affect Fife Ditch near 52nd Ave E. In contrast to the Fife Pacific Highway and Fife Median alternatives, the Fife I-5 Alternative would also cross Fife Ditch south of Pacific Highway E, resulting in additional construction-related impacts on that stream and its buffer. The construction footprints of the 54th Avenue and 54th Span design options would have an additional 600 feet of stream impacts. This difference is attributable entirely to the design options' impacts on Fife Ditch Tributary 1, which would account for the majority of temporary stream impacts under any of the alternatives or design options.

The temporary impacts of the Fife Segment alternatives on stream buffers would fall within a narrow range, largely due to the limited amount of vegetated stream buffer habitat available in this part of the study area. The Fife I-5 Alternative would affect about 0.5 acre more stream buffer habitat than would the Fife Pacific Highway and Fife Median alternatives (Table J4.4-2). This difference arises from the Fife I-5 Alternative's impacts on native brush and scrub-shrub wetland habitat in the buffer on Wapato Creek immediately north of I-5. The construction footprints of the 54th Avenue and 54th Span design options do not include any areas near Hylebos Creek or Wapato Creek. For this reason, the impacts of these design options on stream buffer habitat would not differ from the impacts of the alternatives without the design options.

4.1.2.5 Tacoma Segment Alternatives

As with long-term impacts, the construction-related impacts of the Tacoma Segment alternatives on aquatic resources would be essentially identical (Table J4.4-2), but the long-span and pier-supported options for the bridge crossing the Puyallup River would have markedly different impacts. None of the alternatives would have any construction-related impacts on First Creek, which is enclosed in pipes through the study area.

The greatest potential for construction-related impacts on aquatic areas and aquatic life would occur if a pier-supported crossing of the Puyallup River is chosen instead of a long-span structure. Construction of a pier-supported structure would involve either the construction of temporary work trestles in the river or the assembly of one or more floating barge systems anchored to the shore and riverbed. In addition, cofferdams or steel casings would be installed in the river to allow the construction of in-water piers. Pile driving would be required for the construction of temporary work trestles and may be needed for construction of the in-water piers. Reinforcement or armoring of the in-water slopes of the levees near the bridge site may also be necessary. No in-water work would be required for construction of a long-span bridge.

Between 2015 and 2019, WSDOT installed temporary work trestles and in-water piers to support new bridges for I-5 over the Puyallup River in the study area. The environmental documentation for that project identified adverse impacts on aquatic resources, including the following:

- Mortality or injury of fish during implementation of in-water work area isolation measures (e.g., installation of coffer dams and steel casings around drilled shafts for support piers).
- Mortality or injury of fish exposed to potentially injurious levels of underwater sound pressure levels associated with in-water pile driving.
- Shade from overwater work trestles.
- Temporary, localized increases in turbidity during installation and removal of in-water structures.

Similar impacts would be expected to result from in-water work for construction of a pier-supported bridge over the Puyallup River for TDLE. The extent and severity of impacts would depend upon the duration of in-water work, size of the piles, the type of piles, substrate type, currents, and other factors that affect the propagation of sound waves under water. WSDOT's ESA Section 7 consultation with NMFS and USFWS for the I-5 bridges included determinations of adverse effects on ESA-listed Chinook salmon, steelhead, and bull trout in the Puyallup River. Based on the findings of that analysis, it is likely that construction of in-water support piers for TDLE would adversely affect these and other fish species in the river. These and other project-related impacts (including effects on critical habitat, as appropriate[7]) would be

[7] The bed and banks of the Puyallup River are owned by the Puyallup Tribe of Indians and, as such, were excluded from the designations of critical habitat for Puget Sound Chinook salmon, Puget Sound steelhead, and bull trout.

analyzed in the biological assessment prepared to support consultation with NMFS and USFWS during the Final EIS phase of this project. The assessment would also include a review of potential effects on essential fish habitat.

Underwater noise and in-water construction activities may also affect marine mammals. Seals and sea lions forage in the Puyallup River near the existing highway bridges. Noise from pile driving and other in-water construction work could injure or cause harassment of seals and sea lions in the river. As required under the MMPA, Sound Transit would work with NMFS to prepare an incidental harassment authorization for work that has the potential to affect marine mammals. The terms and conditions of the authorization would include measures to minimize adverse effects on seals and sea lions.

4.2 Vegetation, Wildlife, and Wildlife Habitat

Construction and operation of TDLE could adversely affect vegetation and terrestrial wildlife. Analyses in this subsection address the potential long-term and construction-related impacts of each alternative on vegetation, wildlife, and wildlife habitat. All the project alternatives are near existing highways and commercial or industrial areas and have relatively disturbed habitats compared to less-developed sites in rural areas. Despite the overall matrix of sparse ecosystem resources in the study area, remnant patches of natural vegetation may provide travel corridors or islands of habitat, allowing some wildlife populations to persist in the urban landscape. Actual impacts would depend on final alternative selection and design, construction footprint and methods, BMPs implemented during construction (see Section 4.8.2, Construction Best Management Practices), and performance of post-construction restoration, including revegetation of disturbed areas and mitigation measures for areas protected under local critical areas ordinances.

As discussed in Section 3.4.1, no ESA-listed or state-listed plant or wildlife species are known or expected to be present in the study area. Similarly, WDFW (2023a) does not identify any documented occurrences of state priority species in the study area. Priority species with potential to occur are identified in Section 3.4.3.1. Forested areas may provide suitable habitat for some priority species (see Section 3.4.3). Reductions in the amount of the forested cover type could have adverse effects on those species.

The only priority habitats known or expected to be present in the study area are mature forests, riparian areas, and wetlands. Potential impacts on mature forests are discussed in the following subsections. Potential impacts on riparian areas are analyzed in Section 4.1. Potential impacts on wetlands are analyzed in Section 4.3.

4.2.1 Long-Term Impacts

Potential direct long-term impacts would occur where project construction converts vegetation or other wildlife habitat features to project facilities. Noise, light, and human activity associated with operation of TDLE may also have long-term impacts on wildlife, and the presence of light rail structures may impede the movement of wildlife through the study area. Impacts associated with each alternative are discussed in the subsections that follow.

Vegetation Removal and Habitat Alteration

Any of the project alternatives would affect vegetation and wildlife through the loss or degradation of habitat. Existing vegetation within the limits of the permanent impact footprint would be removed and replaced with guideways, stations, and other project features.