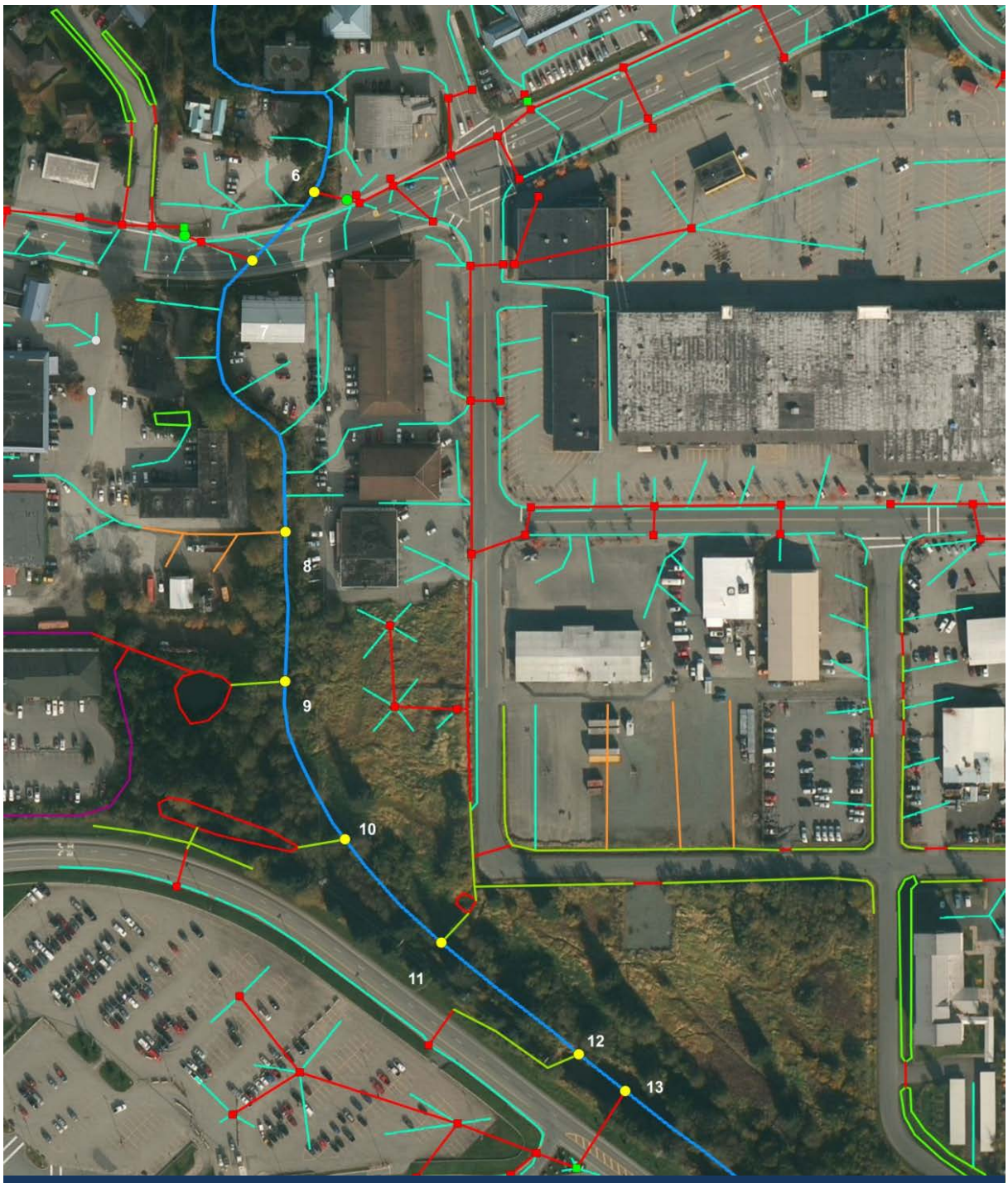


Stormwater in the Lower Jordan Creek Watershed

Stormwater maps and recommendations for managing stormwater to improve habitat and water quality in Jordan Creek

U.S. Fish and Wildlife Service, Juneau
November 2015

ABSTRACT

Stormwater runoff from urban areas contains a variety of pollutants such as petroleum hydrocarbons, heavy metals, and sediment. These pollutants can negatively impact water quality and habitat for fish and other aquatic organisms. Additionally, the impervious surfaces in urban areas tend to accelerate runoff rates above natural levels resulting in increased flood risk and erosion. Managing stormwater runoff to reduce or eliminate these impacts requires an understanding of stormwater source areas and fates. The U.S. Fish and Wildlife Service inventoried and mapped stormwater infrastructure and flow paths in the Lower Jordan Creek watershed, a densely urbanized 106-acre area between Egan Drive and Yandukin Drive. Stormwater runoff in the watershed originates on roofs, parking lots, driveways, roads, and streets. Most stormwater from impervious surfaces is conveyed by a stormwater system (e.g. curb/gutter-catch basin- pipe) directly to Jordan Creek at one of 13 pipe or ditch outfalls. Some of the stormwater systems contain devices or earthen basins that are designed to remove certain types of pollutants or reduce runoff rates. However, none of the devices are able to remove all pollutants and most basins do not reduce runoff rates. This report identifies stormwater management practices and potential modifications to existing stormwater systems that will help reduce or eliminate stormwater impacts on Jordan Creek.

BACKGROUND

Jordan Creek is an anadromous fish stream on the east side of the Mendenhall Valley in Juneau, Alaska (Figure 1). The stream drains a 3-square mile watershed and flows 3.8 miles from its headwaters on the slopes of Thunder Mountain into an estuary at the Mendenhall Wetlands State Game Refuge. Jordan Creek supports a diverse fish assemblage that includes pink, chum, and coho salmon, steelhead and coastal cutthroat trout, Dolly Varden char, threespine stickleback, sculpin and flounder. Although land development has occurred throughout the watershed, most development is concentrated in the lower watershed downstream of Egan Drive.

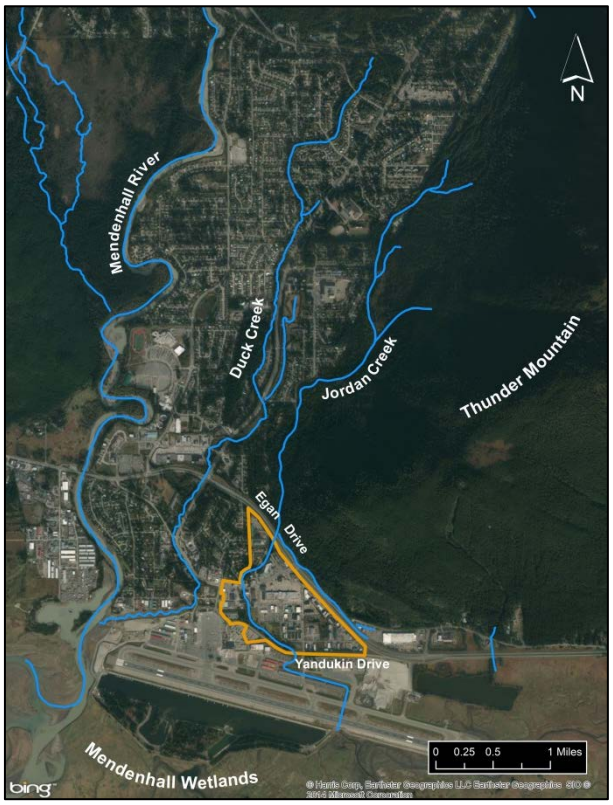


Figure 1. Map of Jordan Creek showing the assessment area boundary in the lower watershed.

Jordan Creek was listed as an impaired water body by the State of Alaska in 1998 for non-attainment of sediment, dissolved gas (i.e. oxygen), and residue (debris) standards. Sediment sources include land development sites, road runoff, off-road vehicle trails, snow storage areas, and natural sources such as stream bank erosion and landslides. Sediment inputs to a

stream that exceed natural background levels can adversely impact fish and other aquatic species. High levels of fine sediment are believed to contribute to low interstitial dissolved oxygen levels in parts of Jordan Creek.

The Alaska Department of Environmental Conservation established a Total Maximum Daily Load (TMDL) to address sediment and dissolved oxygen problems in Jordan Creek in 2008. The sediment TMDL establishes a daily limit on the amount of sediment that can enter the stream to ensure compliance with state water quality standards. Urban stormwater runoff is a common source of sediment in Jordan Creek, particularly in the highly developed lower portion of the watershed between Egan Drive and the Mendenhall Wetlands.

Stormwater is generated during precipitation events or from melting snow and ice. Stormwater that does not infiltrate the ground or evaporate typically flows as runoff into streams and other water bodies. Stormwater runoff can carry sediment and other pollutants from rooftops, roads, parking lots and other surfaces into surface water bodies such as streams and wetlands (Figure 2). In addition to sediment, stormwater can contain heavy metals, pesticides, petroleum hydrocarbons, de-icing chemicals, and fecal coliforms. These pollutants can adversely impact fish and other aquatic organisms, both directly and indirectly. Mapping the origin and fate of stormwater is an essential first step towards reducing or eliminating the impacts of stormwater on aquatic species and their habitats.

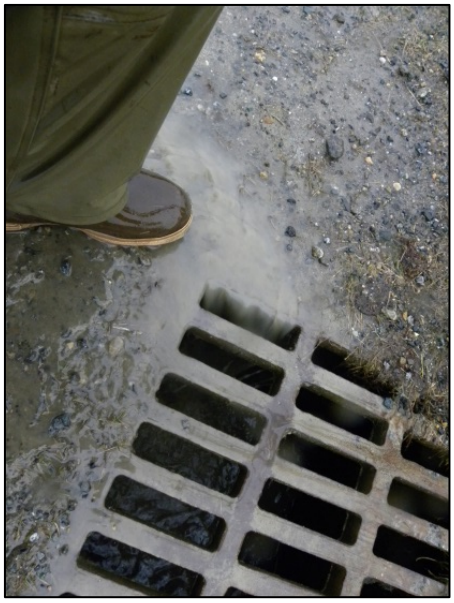


Figure 2. Stormwater containing suspended sediment flows into a catch basin in the Lower Jordan Creek Watershed.

PROJECT GOALS

The goals of this project were to:

1. Inventory and map the stormwater network in the Lower Jordan Creek Watershed
2. Identify opportunities to manage stormwater to improve water quality and habitat in Jordan Creek
3. Recommend projects and practices to reduce or eliminate stormwater and snow storage impacts on Jordan Creek

METHODS

Assessment Area

The assessment area consisted of the land encompassed by Egan Drive, Yandukin Drive, Shell Simmons Drive, Glacier Highway (between Shell Simmons Drive and Jordan Avenue) and Jordan Avenue north of Glacier Highway (Figure 3). This area includes all of the land between Egan Drive and Yandukin Drive that contributes runoff to Jordan Creek.

Figure 3. Assessment area.

Most of the assessment area consists of commercial properties, parking lots, and roads; residential properties comprise only a small portion of the assessment area. Much of the stream channel within the assessment area has been relocated and straightened to accommodate land development, and many wetlands in the area have been filled. Between Egan Drive and Glacier Highway the riparian zone is relatively narrow with parking lots, streets, and buildings encroaching to within a few feet of the stream bank in several places (Figure 4). Between Glacier Highway and Yandukin Drive approximately one-third of the riparian zone has been developed with the remaining riparian designated as a greenbelt and owned by the City and Borough of Juneau (CBJ). Despite these impacts to the stream channel and riparian zone, salmon and other fishes use lower Jordan Creek for spawning, rearing, and as a migration corridor between the Mendenhall Wetlands and high quality habitat upstream of Egan Drive.

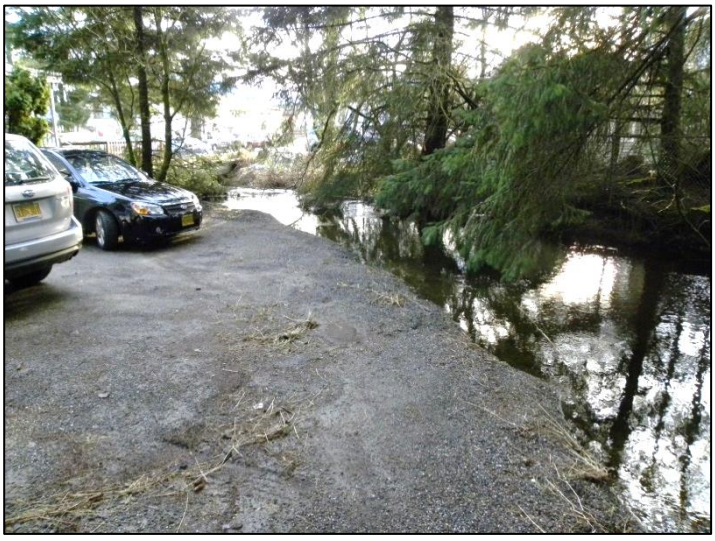


Figure 4. A gravel parking lot on the banks of Jordan Creek between Glacier Hwy. and Jordan Avenue. View looking downstream.

Stormwater Mapping

Individual stormwater systems within the assessment area compose the Lower Jordan Creek stormwater network. These systems are comprised of interconnected components that collect, treat, and convey stormwater to the stream or to a swale or wetland.

Typical stormwater system components are described in the next section.

The components of each stormwater system and the direction and path of stormwater flow were mapped in the field or determined from road design or as-built drawings. Surface flow paths were annotated on aerial images in the field based on observations of flowing water during rain and snow-melt events or from visual inspection of topographic relief. The locations of system components were annotated on aerial imagery or obtained from a handheld GPS unit. The direction of subsurface flow paths (i.e. pipe flow) was determined from design drawings or through visual inspection of flow direction inside catch basins.

As-built or design drawings depicting stormwater infrastructure were obtained for Glacier Highway, Jordan Avenue, Mallard Street, Crest Street, Airport Boulevard, and portions of Old Dairy Road from CBJ. Field maps, drawings, GPS data, and satellite imagery were used to digitize stormwater systems in ArcGIS 10.1. Runoff in the form of sheet flows and streamlets that flowed directly into Jordan Creek (i.e. bypassing the stormwater network) was also mapped in certain areas. Fates of stormwater from rooftop stormwater systems were not mapped.

Stormwater system components

The components of the Jordan Creek stormwater network include:

- **Curb and gutter** – a concrete channel constructed at the edge of a street or road to collect stormwater runoff and convey the runoff to catch basins, ditches, or swales (Figure 5).

- **Catch basin** – a subsurface vault with a grated inlet (Figure 5); installed in curb and gutter systems, parking lots, and swales to convey stormwater runoff to a subsurface pipe system.

Figure 5. Curb and gutter systems are commonly used to direct runoff from roads and parking lots into catch basins.

Figure 6. A ditch on the west side of South Jordan Avenue carries stormwater southward to Jordan Creek.

- **Pipe** – a subsurface conduit that conveys stormwater from a catch basin to the stream, a swale, or a ditch.

- **Ditch** – a narrow channel along a street or road that receives stormwater from pipes or from adjacent impervious surfaces in the form of sheet flows or streamlets (Figure 6). Ditches convey stormwater to swales, retention and infiltration basins, or directly to the stream. Some ditches are functionally swales when vegetation is allowed to persist.

- **Culvert** – a plastic or metal pipe that conveys stormwater from ditches under roads, streets, or driveways.

- **Swale** – a grass covered depression designed to slow water velocity and allow surface runoff to infiltrate the ground (Figure 7).
- **Hydrodynamic separator** – a stormwater treatment device designed to trap sediment, floatables, and oils.
- **Retention basin** – a permanently ponded water body that temporarily stores stormwater to reduce flooding and to capture sediment and associated pollutants.

Figure 7. A swale at the south end of Alpine Avenue.

Figure 8. An infiltration basin at the north end of Jordan Avenue during a runoff event.

- **Infiltration basin** – a basin that temporarily stores stormwater until it infiltrates the ground (Figure 8).
- **Outfall** – the point at which a ditch or pipe discharges stormwater to a water body, stormwater basin, or swale.
- **French drain** – a trench containing perforated pipe, gravel, and rock that directs surface and groundwater away from an area.

FINDINGS

Stormwater fate

Seventeen stormwater systems were identified in the assessment area (Figure 3, Table 1). Thirteen (13) of these systems discharge stormwater from a 106 acre area directly into Jordan Creek (Map A-14). Three systems direct stormwater into the ground and one system discharges stormwater to an estuary channel outside of the assessment area (Map A-13).

Several of the stormwater systems include components apparently intended to improve water quality or

Table 1. Stormwater systems in the Lower Jordan Creek Watershed.

Stormwater System Outfall	Outfall Type	Stormwater BMP	Stormwater Fate	Lat., Long. (DD)	Map
1. North Jordan Avenue #1	ditch	Infiltration basin	groundwater[1]	58.3661, -134.5779	A-1
2. North Jordan Avenue #2	ditch	Infiltration basin	groundwater[1]	58.3660, -134.5780	A-1
3. Trout Street	pipe		Jordan Creek	58.3652, -134.5781	A-2
4. Jordan Creek Center	pipe		Jordan Creek	58.3650, -134.5783	A-2
5. North Jordan Avenue #3	pipe		Jordan Creek	58.3641, -134.5804	A-3
6. East Glacier Highway	pipe	Hydrodynamic separator	Jordan Creek	58.3631, -134.5807	A-4
7. West Glacier Highway	pipe	Hydrodynamic separator	Jordan Creek	58.3628, -134.5813	A-5
8. East Airport Shopping Center	ditch		Jordan Creek	58.3618, -134.5810	A-6
9. Hotel Retention Basin	ditch	Retention basin, swale, french drain	Jordan Creek	58.3612, -134.5810	A-6
10. West Yandukin Dr. #1	ditch	Retention basin	Jordan Creek	58.3607, -134.5805	A-6
11. South Nugget Mall	ditch	Retention basin	Jordan Creek	58.3603, -134.5799	A-7
12. West Yandukin Dr. #2	ditch		Jordan Creek	58.3599, -134.5791	A-8
13. Airport Parking Lot	ditch		Jordan Creek	58.3597, -134.5787	A-8
14. West Airport Boulevard	ditch		Jordan Creek	58.3590, -134.5766	A-9
15. Crest Street	ditch		Jordan Creek	58.3587, -134.5750	A-10, A-11
16. Airport Boulevard Wetland Complex	ditch	swale	groundwater	58.3586, -134.5718	A-10
17. Old Dairy Road	ditch		Mendenhall Wetlands	58.3586, -134.5664	A-12, A-13

[1]basins overflow into ditches connected to Jordan Creek

moderate runoff rates. Six (6) of these systems discharge stormwater directly into Jordan Creek from a retention basin or hydrodynamic separator located upstream of the outfall. Three systems near the end of Jordan Ave. convey runoff into retention basins before discharging water into Jordan Creek (Map A-6). Two systems receiving stormwater from Glacier Highway and adjacent areas are equipped with hydrodynamic separators (Maps A-4 & A-5). Road design plans indicate another separator located near the intersection of Crest Street and Old Dairy Road (Map A-11).

Two stormwater systems at the north end of Jordan Avenue were designed with infiltration basins (Figures 9 and 10; Map A-1). During periods when runoff rates exceed infiltration rates, stormwater overflow from these basins enters ditches that connect to Jordan Creek.

One of the stormwater systems in the assessment area consists of a natural wetland (Figures 25 and 26). The wetland is bisected by the east end of Airport Boulevard (Map A-10), and receives runoff from impervious surfaces on the back side of several business fronting Old Dairy Road. The runoff mixes with surface water in the wetland and flows south into a swale on the north side of Yandukin Drive where it infiltrates the ground. The swale is connected to a large swale on the south side of Yandukin Drive by two culverts; however, the culvert invert elevations are higher than the surrounding grade and there is no evidence that water flows through these culverts.

Not all runoff in the assessment area enters a stormwater system. Throughout the assessment area, runoff in the form of sheet flow or streamlets on impervious surfaces travels short distances to the edge of the surface where it infiltrates the ground or a swale. Some of these flow paths are shown on the stormwater maps despite not being associated with a stormwater system.

One of the stormwater systems within the assessment area conveys stormwater to a discharge point outside of the assessment area. The contributing area for this system includes the east end of Airport Boulevard and the south end of Old Dairy Road. Stormwater from this system is discharged into an intertidal slough (locally known as Zig-zag Slough) within the boundary of the Juneau International Airport (Maps A-12 & A-13).

Throughout the assessment area, meltwater from snow storage areas, which commonly contains debris, sediment and other pollutants, was observed flowing directly into Jordan Creek (Figure 27), into stormwater networks that discharged to Jordan Creek (Figure 29), and into swales or ditches that function as swales. Descriptions of some of these snow storage sites are provided below along with recommendations for managing snow storage to protect riparian habitat and water quality.

Stormwater Systems in the Lower Jordan Creek Watershed – Descriptions and Recommendations

Stormwater discharged from an outfall originates as precipitation or meltwater on impervious or semi-impervious surfaces. Each outfall in a stormwater network is associated with a contributing area - the various surfaces (e.g. roads, parking lots, sidewalks, rooftops, and vegetated ground) that collect and shed runoff into a stormwater system. The size of the contributing area and the activities and land uses

that occur in the area influence the quality and quantity of water discharged from the outfall. Descriptions of each outfall, its associated stormwater system, and the contributing area are provided below. Recommendations for practices and system modifications to improve stormwater quality or to direct stormwater away from Jordan Creek are also provided. Stormwater system maps are provided in Appendix A.

Outfall 1. North Jordan Avenue Outfall #1 (Map A-1) – This ditch outfall is located on the west side of Jordan Creek near a pedestrian bridge immediately downstream of Egan Drive. The ditch extends northwest from the outfall along the west side of Egan Drive and receives runoff from the south bound lane and a paved cul-de-sac and parking area at the north end of Jordan Avenue. Runoff from paved and unpaved surfaces in the North Jordan Avenue area enters the stormwater system through six storm drains before flowing into a 150 square-foot infiltration basin (Figure 9). Overflow from the basin enters a vegetated ditch on the south side of Egan Drive and flows 250 feet to Jordan Creek.

Figure 9. An infiltration basin near the north end of Jordan Avenue. The outlet pipe (lower right) connects the basin to a ditch along Egan Drive.

Comments and Recommendations:

- ***Monitor infiltration capacity by noting the surface area of pooled water relative to the size of the basin between runoff periods. An enlarging area of pooled water indicates reduced infiltration capacity and the need to excavate fines from basin to enhance infiltration rates.***

Outfall 2. North Jordan Avenue Outfall #2 (Map A-1) – This ditch outfall is located on the west bank of the Jordan Creek, approximately 80 feet downstream of Egan Drive. The contributing area includes approximately 200 feet of Jordan Avenue, the rooftops of a self-storage facility and surrounding pavement. Runoff from this area flows to an infiltration basin (Figure 10) before entering Jordan Creek through a 50-foot long cobble-lined overflow ditch.

Figure 10. An infiltration basin located near the north end of Jordan Ave receives stormwater runoff from roof tops and asphalt surfaces (view looking south).

Comments and Recommendations:

- ***Monitor infiltration capacity by noting the surface area of pooled water relative to the size of the basin between runoff periods. An enlarging area of pooled water indicates reduced infiltration capacity and the need to excavate fines from basin to enhance infiltration rates. Vegetation and sediment was removed from the basin in the fall of 2014.***

Figure 11. Stormwater containing trash compactor effluent mixes with water in Jordan Creek upstream of the Trout Street Bridge.

Outfall 3. Trout Street Ditch (Map A-2) – This ditch outfall is located on the east side of Jordan Creek, immediately upstream of the Trout Street Bridge. The ditch extends along the north side of Trout Street and receives stormwater from most of Trout Street and adjacent parking lots and rooftops on the east and southwest sides of the street. Stormwater runoff enters the ditch via surface flows and through two outfalls connected to catch basins located in the McDonald's (2285 Trout Street) and Breeze-In (2200 Trout Street) parking lots.

Comments and Recommendations

- ***Effluent from the McDonalds' trash compactor sump has been observed mixing with stormwater and flowing into the Trout Street ditch (Figure 11). Large accumulations of litter and a dark residue are frequently observed in the ditch (Figure 12). Prevent trash compactor effluent from mixing with stormwater.***

- ***The potential for hydrocarbon contamination of stormwater is high in this area due to high levels of vehicle use in a small contributing area. A hydrodynamic separator should be installed at the downstream end of the ditch to capture petroleum hydrocarbons, sediment, and debris (Figure 12).***
- ***Construct a biofiltration swale within the ditch.***

Figure 12. Litter from the Trout Street ditch accumulates at a culvert outfall (Outfall 3) next to Jordan Creek.

Outfall 4. Jordan Creek Center (Map A-2) – This pipe outfall is located 75 feet downstream of the Trout Street Bridge on the east bank of Jordan Creek. At the time of this survey, the system consisted of a single catch basin that received runoff from ten parking spaces at the north end of Jordan Creek Center. The catch basin was removed or paved over in 2015. Two additional catch basins are located in this area. Dye tablets were placed into these basins during a rain storm in spring 2015. No dye was apparent at Outfall 4 after 30 minutes.

Comments and Recommendations

- ***The fate of stormwater entering two catch basins in this area is unknown. Investigate the fate of stormwater entering these basins.***

Outfall 5. North Jordan Avenue Outfall #3 (Map A-3) – This pipe outfall is part of a stormwater system that receives runoff from streets and parking areas in the Jordan Creek Office Condominiums complex as well as from adjacent portions of Jordan Avenue. Eight catch basins in the system direct runoff to an outfall pipe on the north bank of Jordan Creek, approximately 140 feet downstream of Jordan Avenue. A 340-foot long swale on the east side of Jordan Avenue and south of Trout Street receives runoff from the adjacent road and parking lot. All runoff entering the swale appears to infiltrate the ground.

Comments and Recommendations

- ***Shorten outfall pipe (Figure 13) and construct a retention or infiltration basin between Jordan Avenue and the outfall to remove sediment and other pollutants from runoff. Thin or prune adjacent trees to ensure adequate light levels for wetland vegetation.***

- ***Four catch basins in this system are located in grass swales which provide an opportunity for sediment capture and runoff infiltration before excess runoff enters the basin. However, the basins are located near the ends of the swales – a few feet from impervious surfaces - providing minimal space for infiltration or sediment capture to occur. When catch basins are installed in swales, place basins as far from the swale edge as possible to maximize opportunity for infiltration and pollutant capture.***

Figure 13. North Jordan Avenue Outfall #3.

Figure 14. Suspended sediment in stormwater from the Glacier Highway East Outfall (upper right of photo) mixes with clear water in Jordan Creek upstream of Glacier Highway.

Outfall 6. East Glacier Highway (Map A-4) – This pipe outfall is located on the east side of Jordan Creek immediately upstream of Glacier Highway (Figure 14). The outfall is connected to a stormwater network of 27 catch basins that receive runoff from Glacier Highway and from parking lots on the south side of Jordan Creek Center (8800 Glacier Highway) and First National Bank (8990 Glacier Highway), the west side of Breeze In, and the northwest edge of the Nugget Mall parking lot. Runoff from this system passes through a hydrodynamic separator located approximately 50 feet from the outfall.

Comments and Recommendations

- ***Identify sites along Glacier Highway where stormwater can be diverted away from catch basins into infiltration areas (e.g. tree trenches, planters, swales) constructed in green spaces between sidewalks and parking lots.***

- ***Inspect the hydrodynamic separator two times per year and within 48 hours of a major storm event. (Refer to the Maintenance Checklist for Hydrodynamic Separators (Table C-7) and maintenance schedule in the CBJ Manual of Stormwater Best Management Practices).***

Outfall 7. West Glacier Highway (Map A-5) – Jordan Creek flows under Glacier Highway through two culverts. The pipe outfall of this stormwater system is located in the sidewall of the westernmost culvert. The stormwater system includes seven catch basins along Glacier Highway and adjacent properties. The contributing area consists of Glacier Highway between Shell Simmons Drive and Jordan Creek, the Cascade Street intersection, and portions of parking areas near Valley Auto Parts (9151 Glacier Highway) and Denali Alaska Federal Credit Union (9101 Glacier Highway). Stormwater runoff passes through a hydrodynamic separator located between the last two catch basins upstream of the outfall.

Comments and Recommendations

- ***Inspect the hydrodynamic separator two times per year and within 48 hours of a major storm event (refer to the maintenance checklist and schedule for hydrodynamic separators in the CBJ Manual of Stormwater Best Management Practices).***
- ***Identify sites along Glacier Highway where curb and gutter stormwater can be diverted away from catch basins into infiltration areas (e.g. tree trenches, planters, swales) constructed in green spaces between sidewalks and parking lots.***

Figure 15. Stormwater runoff from a portion of the Airport Shopping Center parking lot flows over an unpaved area used to train truck drivers next to Jordan Creek. (view looking east).

Outfall 8. East Airport Shopping Center (Map A-5) – This outfall is the terminus of a short ditch that delivers runoff to Jordan Creek from paved and unpaved surfaces in the southeast quadrant of the Glacier Mall Subdivision (Airport Shopping Center) . Immediately upstream of the ditch, stormwater acquires fine sediment as it passes through an unpaved area used for parking large trucks for a driver training school (Figures 15 and 16).

There are seven catch basins located in the Airport Shopping Center parking lot (Maps A-5 and A-6). These catch basins, which are not connected to an outfall, convey stormwater into the local groundwater table.

Comments and Recommendations

- ***Construct an infiltration basin on a portion of the gravel parking area to promote stormwater infiltration and trap sediment and other pollutants before they reach the stream (Completed fall 2015).***

- ***Pave the remaining portion of the gravel parking area to eliminate sediment sources.***

Figure 16. Sediment laden runoff flows into Jordan Creek at ditch outfall #8.

- ***Use fencing to establish a 25 foot wide riparian setback from the outfall upstream to Glacier Highway to protect riparian area (Completed fall 2015).***

Outfall 9. Hotel Retention Basin (Map A-6) – This outfall is the terminus of a short ditch between a retention basin and Jordan Creek. The basin is located east of the Extended Stay America Hotel (1800 Shell Simmons Drive) and receives stormwater and groundwater from french drains surrounding the hotel (Figure 17). Runoff from each drain flows through pipes into a concrete vault between the pond and the hotel. From the vault, runoff flows through a pipe to the retention pond.

The area above the drain on the north side of the hotel was cleared of dense trees and shrubs that were salvaged from the hotel footprint prior to construction.

Figure 17. This shallow ditch on the north side of the Extended Stay Hotel is underlain by a french drain (view looking west).

Comments and Recommendations

- ***This hotel serves as a demonstration of effective stormwater management practices that can be incorporated into future commercial lot designs. The building and parking lot footprint were kept to a minimum to minimize impacts to wetlands. Native plant communities outside the footprint were not disturbed or destroyed. Runoff from the French drain system flows through a retention basin before entering Jordan Creek.***

- ***During an inspection of the vault following a period of heavy rain on January 17, 2014, water from the south side drain was clear while water from the north side drain was turbid. The source of the turbidity appears to be runoff from bare soil over the north side drain and an adjacent unpaved parking area (Figure 17). The creation of a vegetated strip over the north side drain was a requirement of the 404 permit. Restore the strip of trees and other native vegetation on the north side of the building to reduce stormwater runoff rates and improve water quality.***

Outfall 10. West Yandukin Drive #1 (Map A-6) – This ditch outfall drains a retention basin located in a stand of spruce trees on the north side of Yandukin Drive, across from the airport parking lot. The basin receives stormwater from a 200 foot long section of Yandukin Drive via a catch basin on the south side of the road.

Figure 18. Constructing a filter strip on the south side of West Yandukin Drive would eliminate stormwater runoff into Jordan Creek from this section of road.

Comments and Recommendations

- ***Stormwater runoff to Jordan Creek from this portion of West Yandukin Drive can be eliminated by constructing a vegetated filter strip along the toe of an existing grass-covered embankment, between the road and the airport parking lot (Figure 18). To create the strip, excavate a shallow ditch at the toe of the slope that is below the grade of the road edge. Design the strip so that stormwater inputs that exceed infiltration capacity overflow into the existing catch basin.***

Outfall 11. South Nugget Mall (Map A-7) – This ditch outfall is located in CBJ parkland near the south end of Jordan Avenue. The stormwater network includes six catch basins on south Jordan Avenue, twelve catch basins on Mallard Street, and ditches and ditch swales on both sides of west Teal Street and the west side of north Alpine Avenue. The contributing area includes the streets as well as impervious surfaces on adjacent commercial properties. Parking areas on the south and west sides of Nugget Mall also contribute stormwater to this outfall ditch. Runoff from these areas enters the ditch from a pipe outfall located on the west side of Jordan Avenue, approximately 350 feet south of the Mallard Street intersection. Stormwater flows from the ditch into a 300-square foot retention basin before entering Jordan Creek (Figure 19). A new development was constructed near the south end of Jordan Avenue in 2015.

Figure 19. The Nugget Mall South stormwater ditch conveys stormwater from the south side of the mall into a small retention basin (center left in photo) before it flows into Jordan Creek at the south end of Jordan Avenue (view looking north from Jordan Creek).

Comments and Recommendations

- ***The size of the retention basin is not sufficient to capture sediment from the volume of runoff in this stormwater system and the basin is short-circuited (the inlet and outlet are in close proximity). To enhance sediment capture, reduce runoff rates, and improve the quality of water entering Jordan Creek from this outfall, divert the ditch into a constructed wetland in CBJ parkland on the south side of Teal Street.***

- ***Identify sites where runoff from parking lots and curb/gutter can be diverted from catch basins into infiltration areas.***

- ***The contributing area is almost entirely impervious and experiences high levels of vehicle use. In addition to suspended sediment, stormwater runoff from this area likely contains high levels of petroleum hydrocarbons and other pollutants associated with vehicles. Periodic maintenance (i.e. excavation and removal of sediment) from this ditch exposes soil to erosion and removes vegetation that may trap sediment before it reaches the stream. Educate CBJ Streets Division personnel on ditch cleaning practices that minimize impacts to water quality.***

Outfall 12. West Yandukin Drive #2 (Map A-7) – This pipe outfall is located on the north side of west Yandukin Drive and is connected to a catch basin on the south side of the road. Stormwater from the outfall flows through a short ditch before entering Jordan Creek where a pond has been excavated in the channel. The contributing area is a 580 foot long section of Yandukin Drive.

Comments and Recommendations

- ***Stormwater runoff from this portion of West Yandukin Drive can be eliminated by constructing a vegetated filter strip along the toe of an existing grass-covered embankment between the road and the airport parking lot (Figure X). To create the strip, excavate a shallow ditch at the toe of the slope that is below the grade of the road edge. Stormwater inputs to the strip that exceed infiltration capacity will overflow into the existing catch basin.***

Outfall 13. Airport Parking Lot (Map A-8) – This pipe outfall discharges to an excavated pond in Jordan Creek. Eight catch basins receive stormwater from Juneau International Airport property. The contributing area consists of the employee parking lot, the eastern half of the long-term parking lot, and a 300 foot long section of Shell Simmons Drive.

Comments and Recommendations

- **Install a hydrodynamic separator between the last two catch basins in this network (in a grass covered area near the east edge of the parking lot) to prevent transport of fine sediment, debris, and pollutants to Jordan Creek.**

Outfall 14. West Airport Boulevard (Map A9) – This culvert outfall is located on the south side of Airport Boulevard at its junction with Alpine Avenue Stormwater from the outfall flows 150 feet through a densely vegetated greenbelt before entering an excavated pond in Jordan Creek. The stormwater network consists primarily of swales and ditches along the east side of Alpine Avenue (south of Teal Street) and along the north side of Airport Boulevard (west of Crest Street). The ditches north of West Airport Boulevard are well vegetated and appear to function as swales. Most of the runoff originates from commercial properties north of Airport Boulevard. It appears that the ditches and swales in this network transfer all water into the ground with the possible exception of those periods when the ground is frozen.

Figure 20. A swale at the south end of Alpine Avenue (view looking north).

Comments and Recommendations

- ***The grass-covered swale along the south end of Alpine Avenue provides an example of how to construct and manage swales (Figure 20). However, very little runoff flows into the swale. Direct stormwater from ditches on the north end of Alpine Avenue and the east end of Teal Street to this swale. Currently, these ditches convey stormwater to the Crest Street stormwater system which discharges runoff into Jordan Creek.***

Outfall 15. Crest Street (Maps A-10 & A-11) – This is the most downstream stormwater outfall in the assessment area discharging runoff directly to Jordan Creek. The contributing area of the system is larger than any other in the assessment area. The outfall is a ditch located on the east side of the channel immediately

Figure 21. Turbid stormwater from the Crest Street stormwater system flows into Jordan Creek west of the Yandukin Drive and Crest Street intersection (view looking west).

upstream of Yandukin Drive (Figure 21). The ditch receives stormwater from a pipe outfall on the west side of Crest Street, approximately 70 feet north of Yandukin Drive. The stormwater system is extensive reaching to Glacier Highway, Alpine Avenue, and Old Dairy Road and includes 49 catch basins. The contributing area is comprised of Crest Street, Old Dairy Road between Glacier Highway and Juneau Urgent Care (8508 Old Dairy Road), the east side of Alpine Avenue (north of Teal Street), the north and south sides of Teal Street (east of Alpine Avenue), Mallard Street between Alpine Avenue and Crest Street, and most of the east end of Airport Boulevard between Crest Street and Aspen Suites Hotel (8400 Airport Boulevard), as well as commercial properties adjacent to these streets, including the eastern half of Nugget Mall. The fate of stormwater flowing into 4 catch basins near the north end of this system (8585 Old Dairy Road) was not assessed.

Comments and Recommendations

- ***A catch basin located at the northeast corner of the Nugget Mall parking lot receives stormwater from the northeast quadrant of the lot (Figure 22). Direct parking lot runoff into an infiltration basin in this area to reduce or eliminate runoff into the catch basin.***

Figure 22. Stormwater flows into a catch basin in the northeast corner of the Nugget Mall parking lot.

Figure 23. Turbid stormwater from a gravel parking area flows into a catch basin at the intersection of Crest Street and Airport Blvd.

- ***Two catch basins on the east side of the Nugget Mall parking lot are located in grass-covered swales. Construct infiltration basins in these swales to enhance infiltration and pollutant capture.***

- ***This stormwater system receives turbid runoff from gravel covered surfaces on several properties along Crest Street and east Airport Boulevard (Figure 23). Encourage property owners to pave gravel surfaces or convey runoff away from catch basins and into swales or infiltration basins.***

- ***A commercial property at the northeast corner of Airport Boulevard and Crest Street has large areas of gravel and bare soil. Runoff from the west side of the property flows into a shallow swale along Crest Street between Teal Street and Airport***

Boulevard. Vehicles passing through the swale have destroyed vegetation, disturbed soils, and created ponds of turbid water which flows into this stormwater system. Construct a new vegetated swale with steep banks to discourage access by vehicles between Teal Street and Airport Boulevard

- ***This stormwater system receives highly turbid runoff from a lumberyard, which is covered with gravel. Work with the owners to direct stormwater runoff away from catch basins.***

- ***This stormwater system is the largest in the assessment area and discharges directly to Jordan Creek. Move the outfall to a 1,400-foot long grassy swale on the south side of Yandukin Drive east of Crest Street (Figure 24). If necessary, elevate the inlet of an existing catch basin (part of the Old Dairy Road Stormwater System) in the center of the swale to increase swale capacity.***

Figure 24. A 1,500 foot long swale at the east end of Yankukin Drive. If feasible, stormwater from the Crest Street stormwater system - the largest system in the assessment area - could be routed to this swale instead of flowing directly into Jordan Creek.

Outfall 16. Airport Boulevard Wetland Complex (Map A-10) – Although most wetlands in the assessment area have been filled, there is a 4.2 acre palustrine wetland on the east side of the assessment area (Figure 25). The wetland is bisected by Airport Boulevard and is the remnant of a larger wetland. The wetland receives stormwater from a short section of east Airport Boulevard and adjacent commercial properties, and from the back side of commercial lots fronting Old Dairy Road.

Figure 25. A wetland/meadow complex on the east side of the assessment area conveys groundwater and stormwater runoff into a swale on the north side of Yandukin Drive.

The wetland complex does not have a surface connection to Jordan Creek. Water flows south through the wetland and discharges to a swale on the north side of Yandukin Drive east of Crest Street. Two culverts under Yandukin Drive connect the swale to a large swale on the south side of Yandukin Drive (Figure 24). Stormwater was not observed flowing through these culverts during periods of heavy rain.

Figure 26. Snow stored on the edge of a palustrine wetland on the south side of Airport Boulevard near its eastern end.

Comments and Recommendations

- ***Protect the wetlands from development through purchase or a conservation easement.***

- ***Snow pushed from adjacent properties into the wetland damages vegetation and introduces sediment and other pollutants (Figure 26). Encourage property owners to store snow in upland areas.***

Outfall 17. Old Dairy Road (Maps A-12, A-13) – This stormwater system discharges runoff into an estuary channel within the Juneau International Airport boundary. The outfall is located at the headwaters of an intertidal slough (locally known as Zig-zag Slough) near the Temsco heliport (1650 Maplesden Way). The contributing area includes Old Dairy Road between Valley Paint Center (8461 Old Dairy Road) and Airport Boulevard and the east end of Airport Boulevard, including adjacent commercial

properties. There are eleven catch basins in this stormwater system. Five catch basins are located on the west side of Old Dairy Road and five catch basins are located in a parking lot at 8390 Airport Boulevard. Another catch basin is located in a large swale on the south side of Yandukin Drive (Figure 24). Stormwater flow into the Yandukin Drive swale is infrequent and infiltrates the ground before reaching the catch basin.

Figure 26. Grass-covered swales at the intersection of Airport Boulevard (left) and Old Dairy Road (right) promote infiltration of stormwater runoff when the ground is unfrozen.

Comments and Recommendations

- ***A vacant lot at the corner of Airport Boulevard and Old Dairy Road was developed into retail and office space in 2008. Ditches alongside the two roads were converted to grass-covered swales (Figure 26). Stormwater from five catch basins in the parking lot is directed into a grassy swale at the east end of Airport Boulevard; runoff from a series of catch basins and ditches along Old Dairy Road flows into the other swale. Although it is not known to what degree these swales reduce runoff rates and trap pollutants, the site provides an example of how to implement stormwater BMPs in new developments.***

- ***Stormwater ponding occurs in the two swales that connect at the intersection of Airport Boulevard and Old Dairy Road (Figure 26); this stormwater then flows through a culvert under Airport Boulevard. Assess the potential for increasing infiltration rates in these swales.***

Universal Recommendations for Stormwater Management and Snow Storage Practices

A large quantity of sediment, including fine sediment that remains suspended in stormwater, accumulates on streets over the course of the winter and is transported into the stormwater network in spring runoff.

- **To reduce the amount of fine sediment transported to Jordan Creek by springtime runoff, clean roads, parking lots, and streets in the assessment area at the earliest opportunity in late winter/early spring.**

- **Clean and maintain catch basins and hydrodynamic separators regularly to prevent transport of sediment and other pollutants to Jordan Creek.**

Snow is stored within the Jordan Creek riparian zone or pushed into the stream channel at numerous locations in the assessment area (Figure 27). This practice damages or destroys riparian vegetation and introduces gravel, fine sediment, and pollutants into the stream. Riparian plant communities provide habitat for fish and wildlife, buffer the stream from the urban environment, and provide a variety of ecological functions (e.g. nutrient and energy cycling).

- **To protect riparian habitat, avoid storing snow within 25 feet of the stream channel. Use fences or snow barrier walls to prevent snow storage in the stream channel and riparian zone (Figure 28).**

- **Construct snow barrier fences or walls at least 25 feet from the stream bank in locations where snow is stored on riparian habitat or pushed into the stream channel.**

Figure 27. Storing snow on stream banks can damage or destroy riparian vegetation and introduce sediment and other pollutants into the stream channel. Snow from the airport is routinely stored on the banks of Jordan Creek north of Yandukin Drive (left). Snow storage on the banks of Jordan Creek downstream of Glacier Highway damages or destroys vegetation resulting in bank erosion (right).

Figure 28. A snow barrier constructed of precast concrete blocks prevents snow from being plowed onto riparian habitat at a business parking area next to Jordan Creek.

Meltwater from snow storage areas, which may contains debris, sediment and other pollutants, was observed flowing directly into Jordan Creek, into stormwater networks that discharged to Jordan Creek, or into swales and ditches that were functioning as swales.

- **Avoid storing snow where meltwater will flow directly into the stream or a catch basin (Figure 29). Store snow where meltwater flows to a swale, retention basin, or infiltration basin.**

Figure 29. Suspended sediment from a snow pile is carried by meltwater runoff into catch basins within the West Glacier Highway stormwater system.

- **Identify opportunites for diverting runoff away from catch basins and into existing or constructed swales, filter strips, and infiltration basins (Figures 30 and 31).**

Figure 30. Route curb and gutter stormwater away from catch basins and into filtration strips constructed in green spaces next to roads (view looking east along Glacier Hwy. near Jordan Avenue).

Figure 31. Infiltration basins under construction near Pullen Creek in Skagway. Curb cut-outs intercept runoff in the gutter allowing stormwater to flow into the basins rather than flowing directly into Pullen Creek.

Ditch maintenance activities that remove vegetation and accumulated sediment expose soils to erosion resulting in sediment transport to streams (Figure 32).

- **Avoid removing vegetation from ditches and swales. If ditches must be cleaned, remove the vegetated mat and replace it after excess sediment has been removed, or use check dams to reduce erosion.**

Figure 32. Ditch cleaning removes vegetation that prevents soil erosion and promotes sedimentation (view looking north from the south end of Jordan Avenue).

- **Construct check dams in ditches to promote sedimentation by slowing water velocity.**

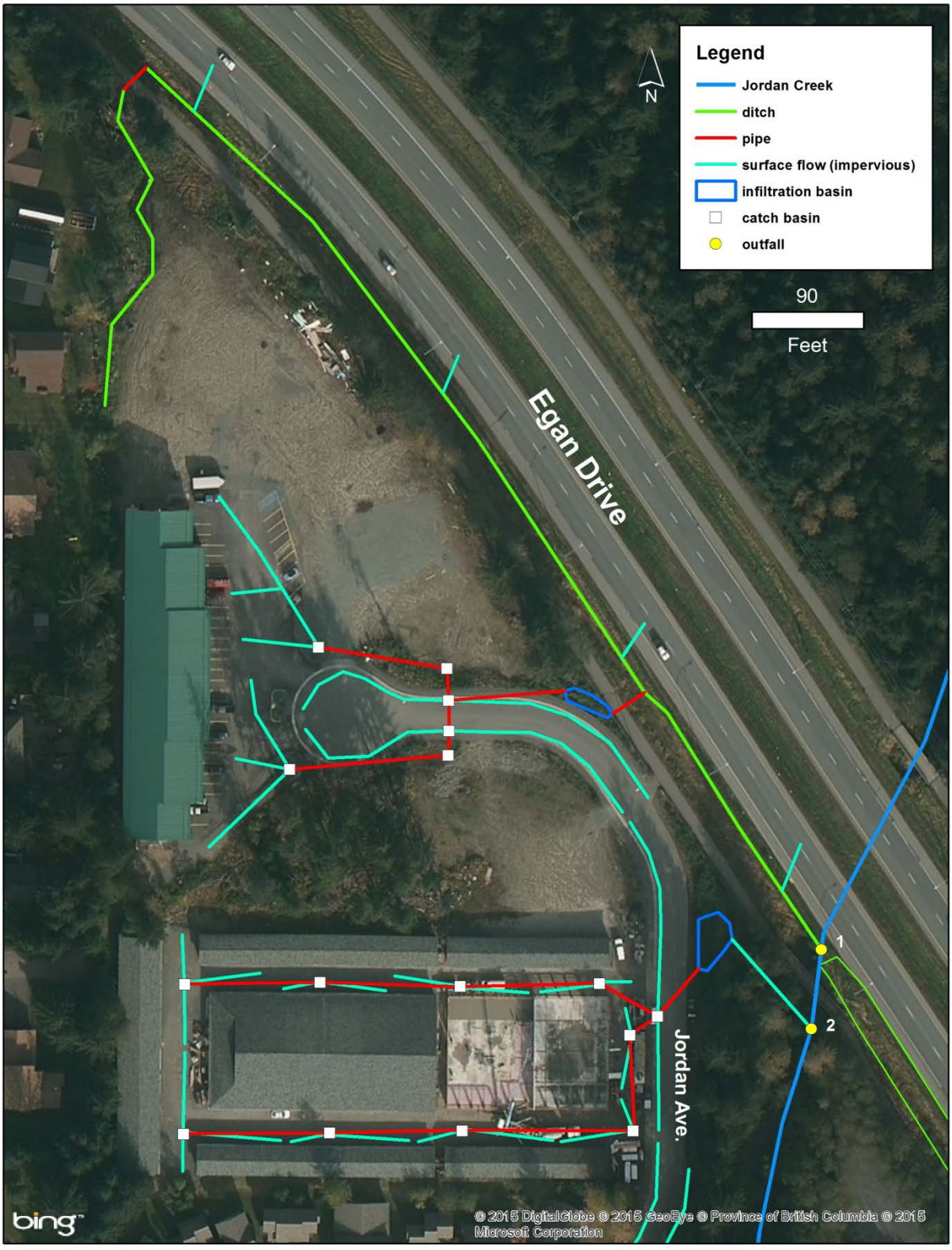
Ditches on the west side of Alpine Drive (north of Teal Street) and the north side of Teal Street (east of Alpine Drive) (Figure 33) are routinely clearned and convey runoff containing fine sediment and potentially other pollutants into the Crest Drive stormwater system.

- **Replace the ditches with biofiltration swales containing perforated pipe to convey treated runoff to the Crest Drive stormwater system.**

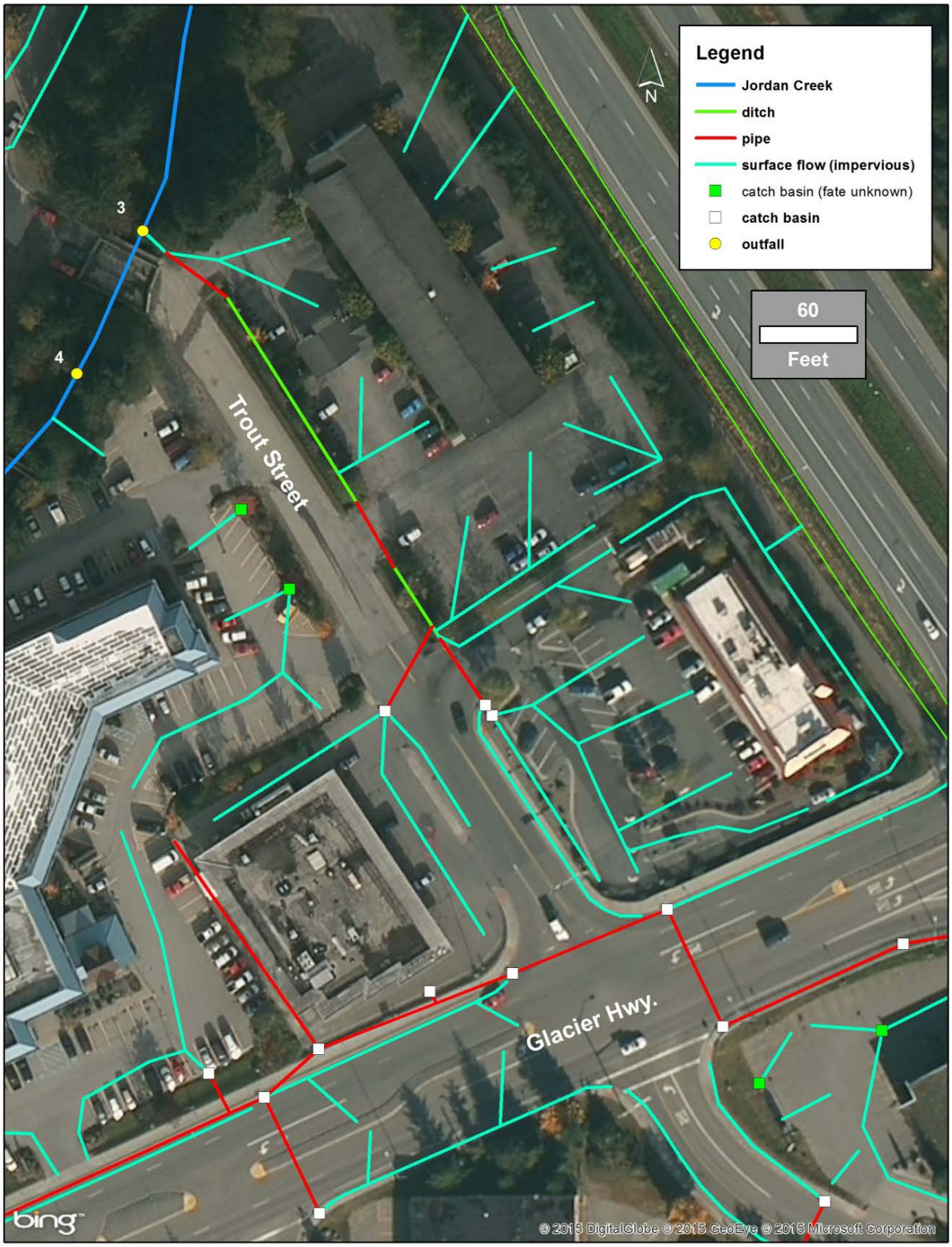
Figure 33. A ditch on the north Side of Teal Street (view looking west from Crest Drive).

Appendix A

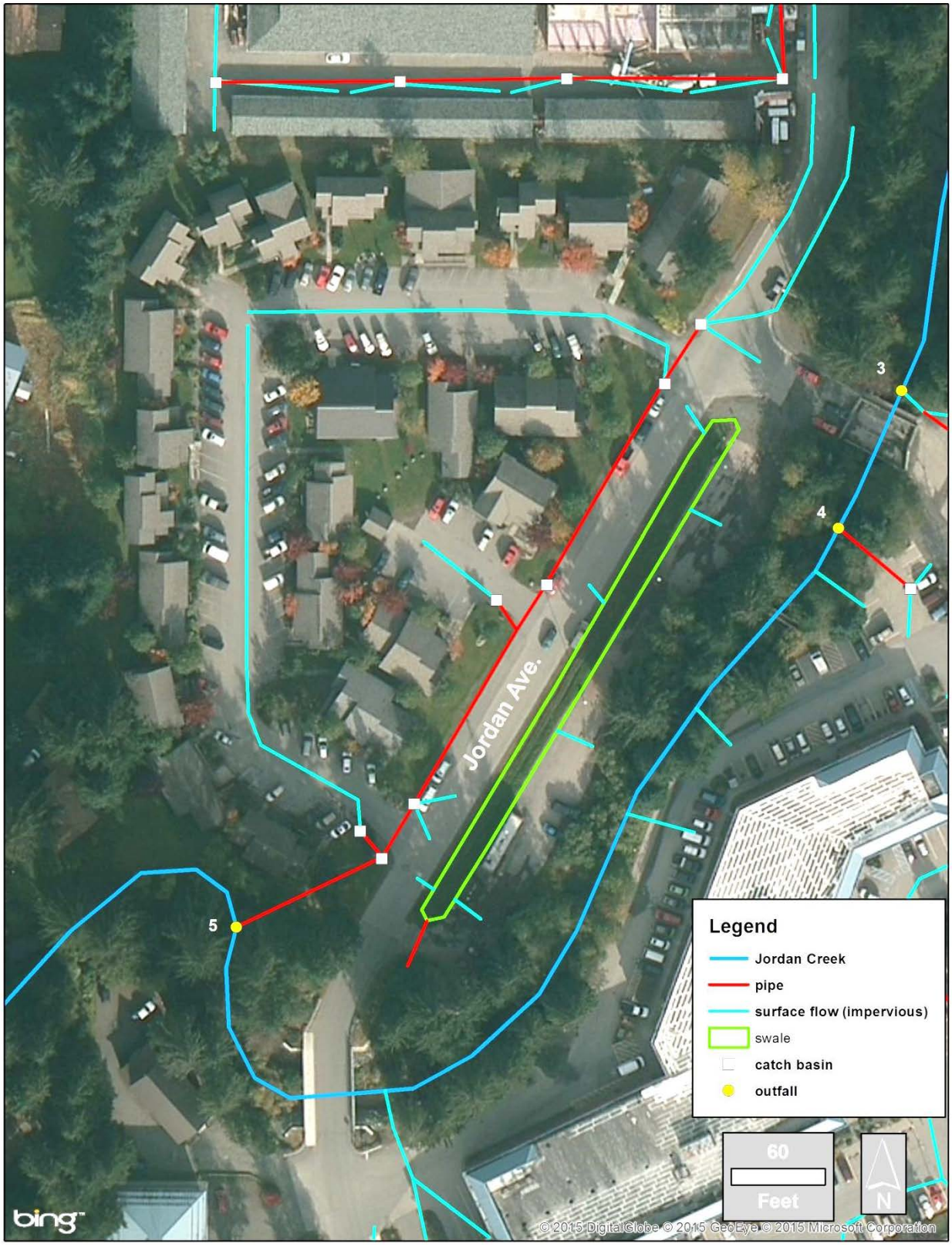
Stormwater System Maps



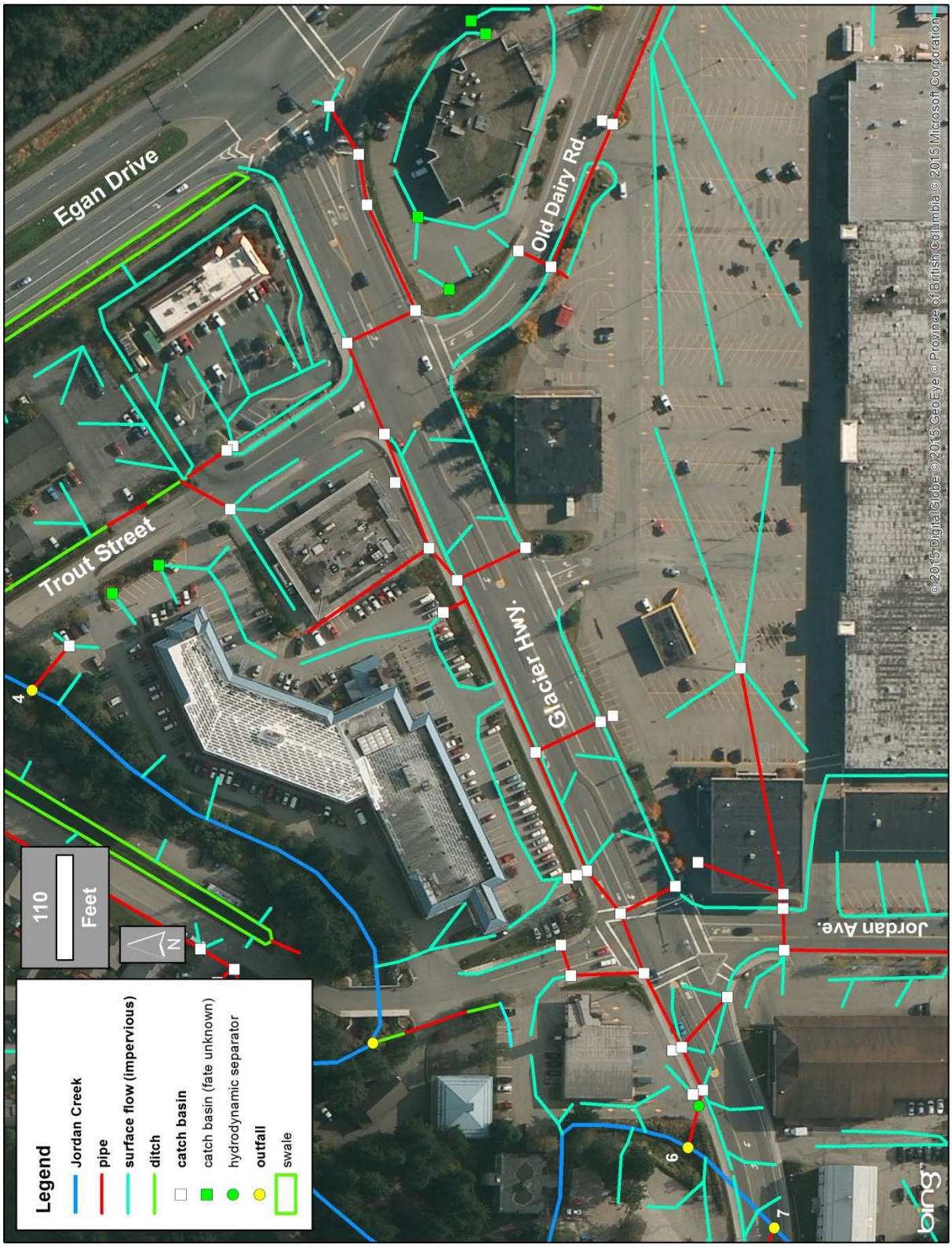
Map A-1. Outfalls 1 and 2 and associated stormwater systems at the north end of Jordan Avenue.



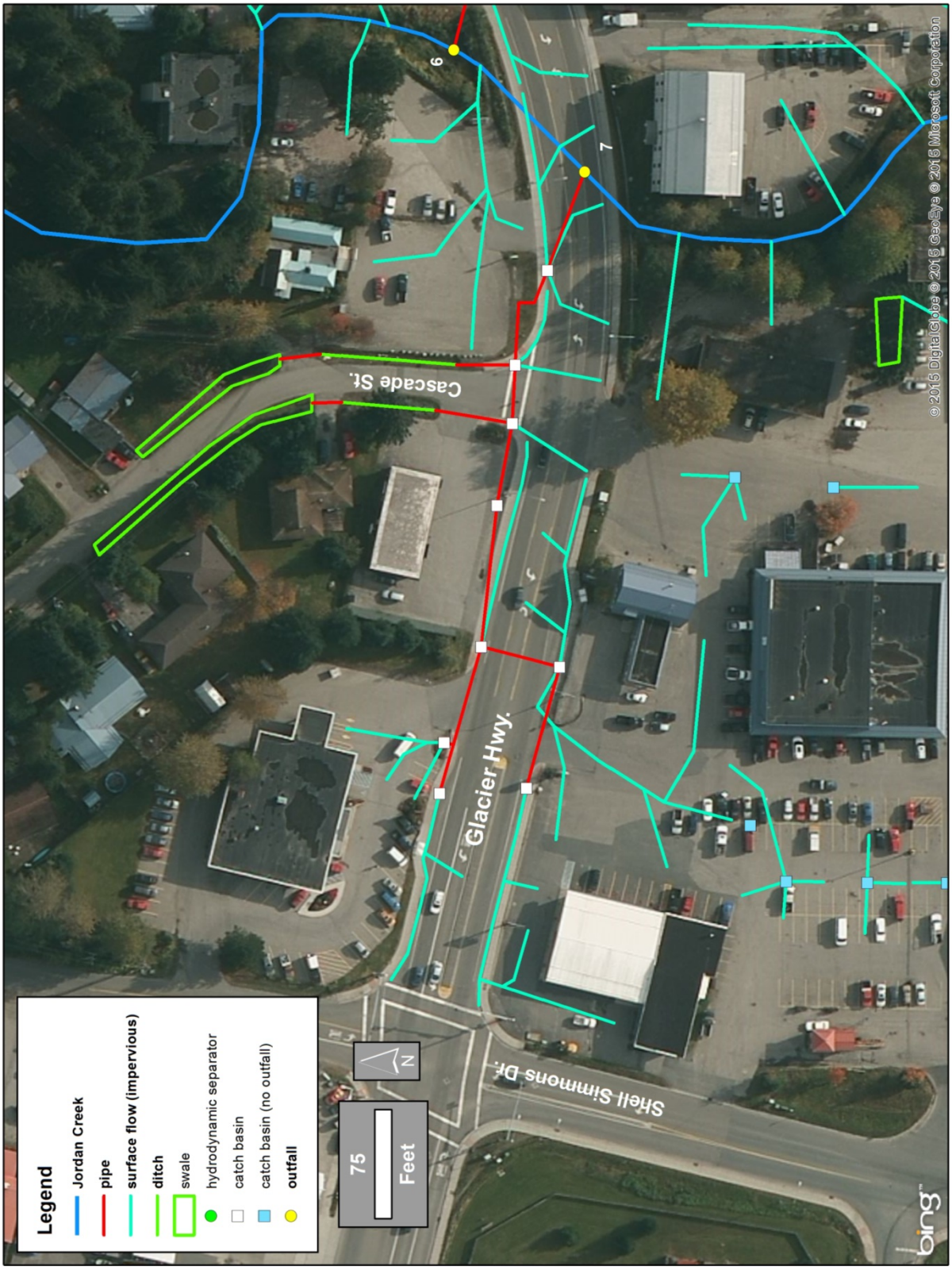
Map A-2. Outfalls 3 and 4 and associated stormwater systems at north end of Trout Street.



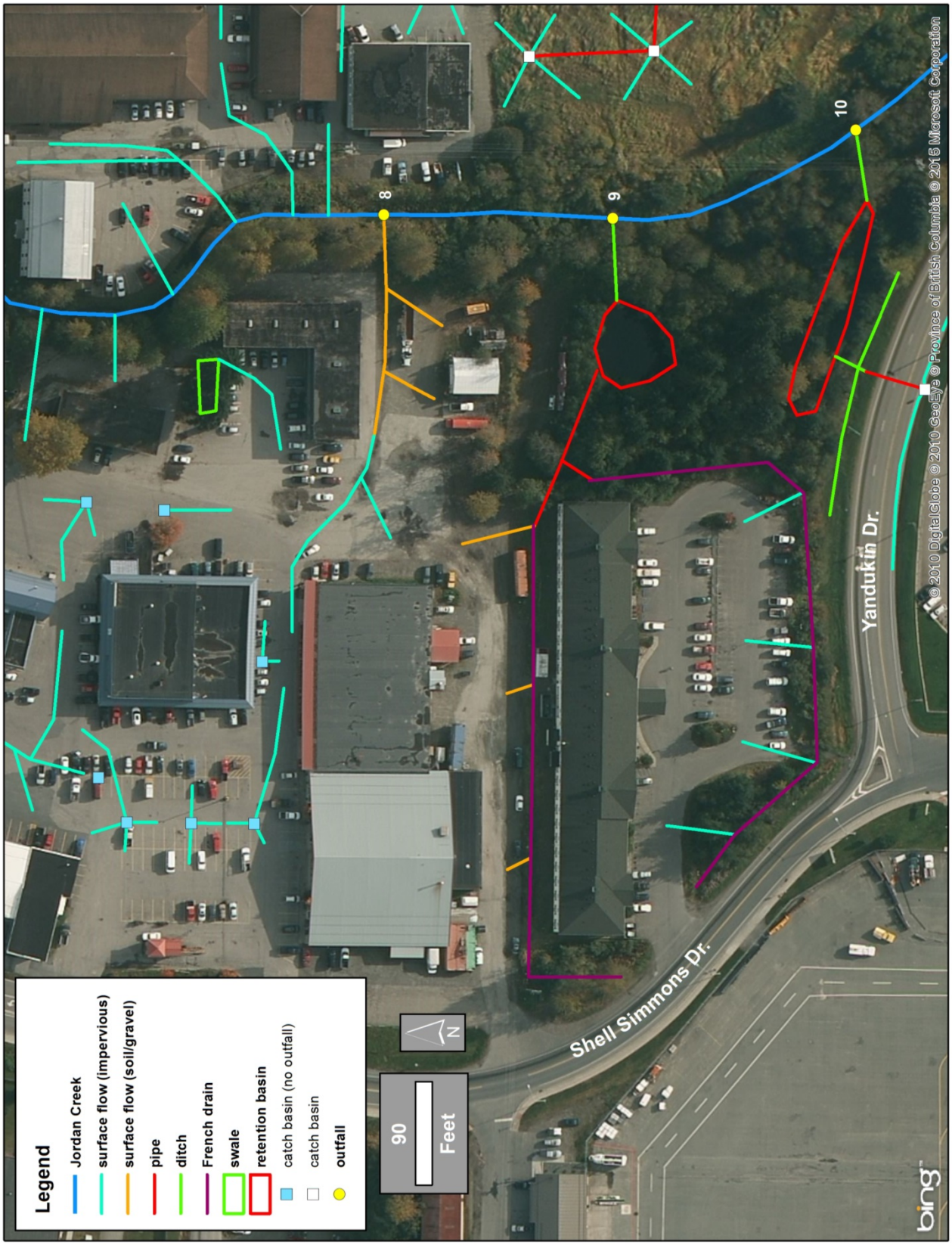
Map A-3. Outfall 5 and associated stormwater system near the north end of Jordan Avenue.



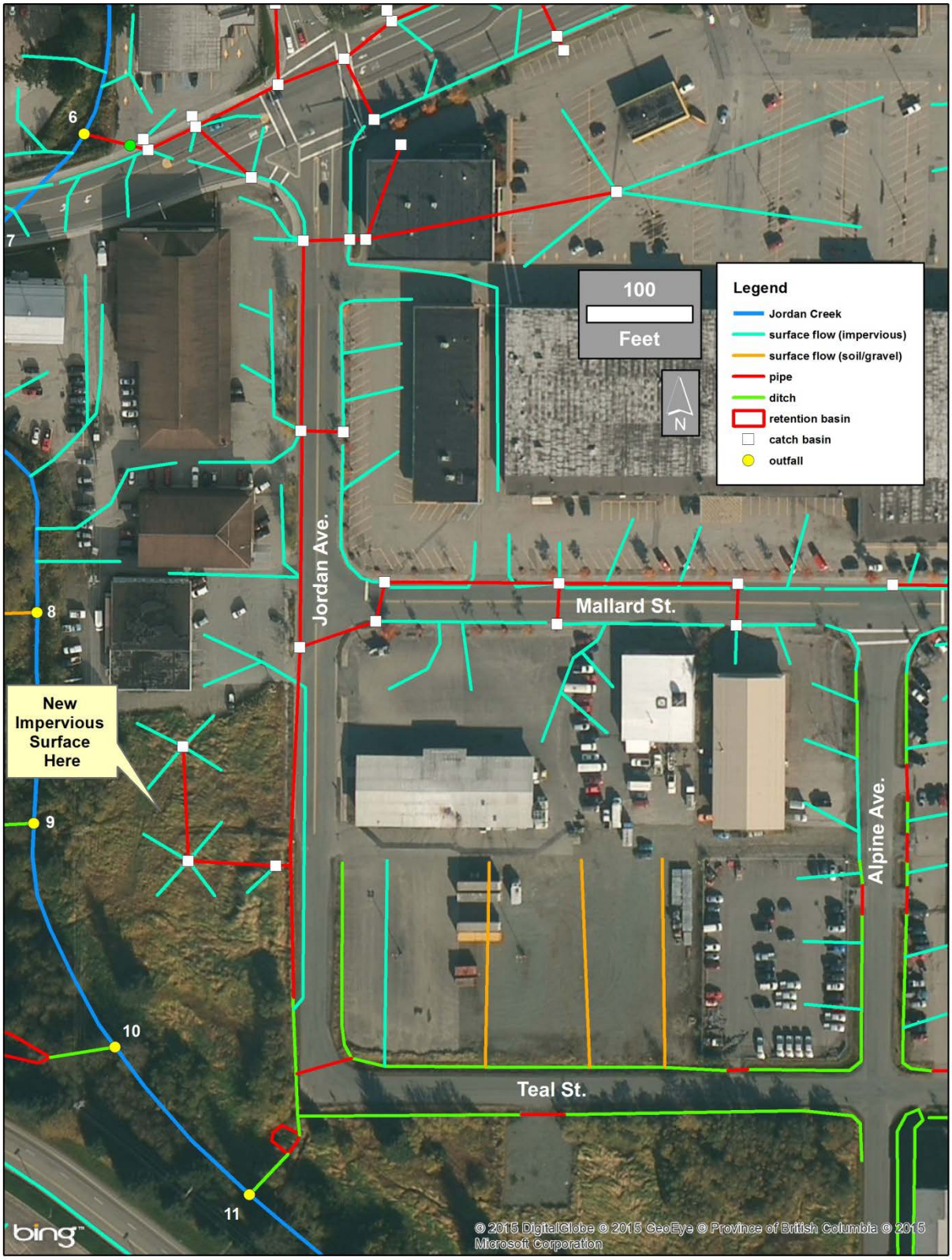
Map A-4. Outfall 6 and associated stormwater system in the Glacier Hwy. corridor east of Jordan Creek.



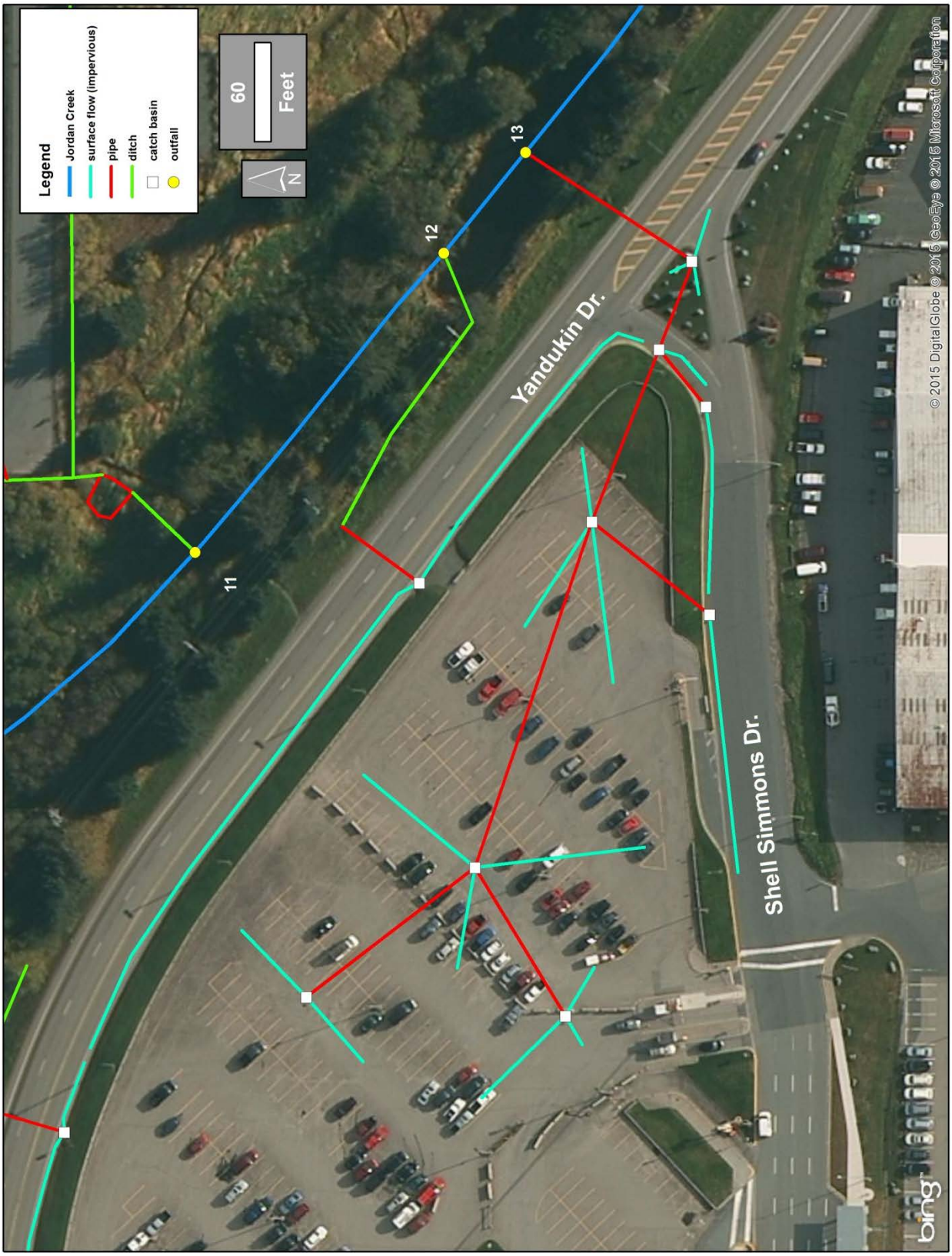
Map A-5. Outfall 7 and associated stormwater system in the Glacier Hwy. corridor west of Jordan Creek.



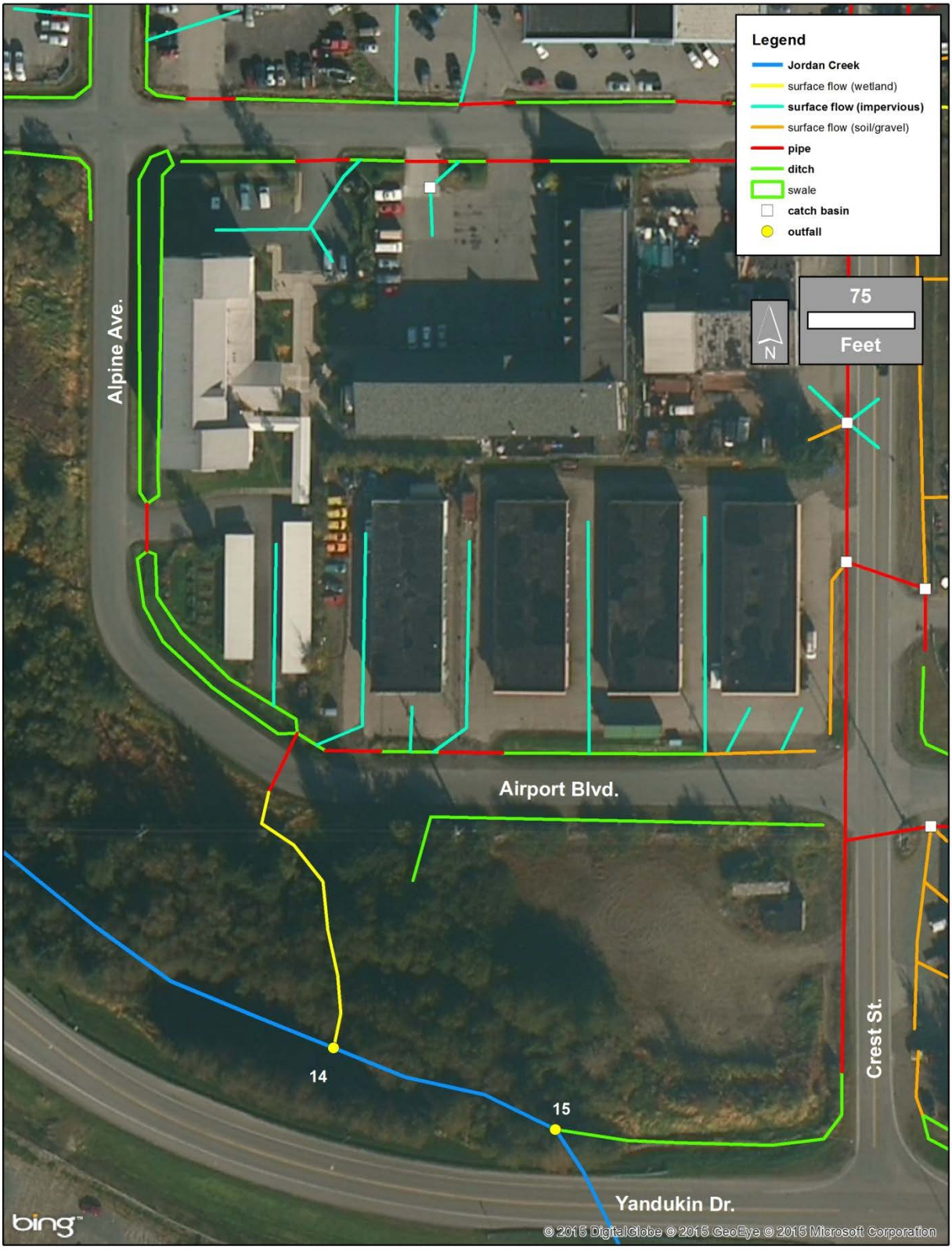
Map A-6. Outfalls 8, 9, and 10 and associated stormwater systems in the Airport Shopping Center area.



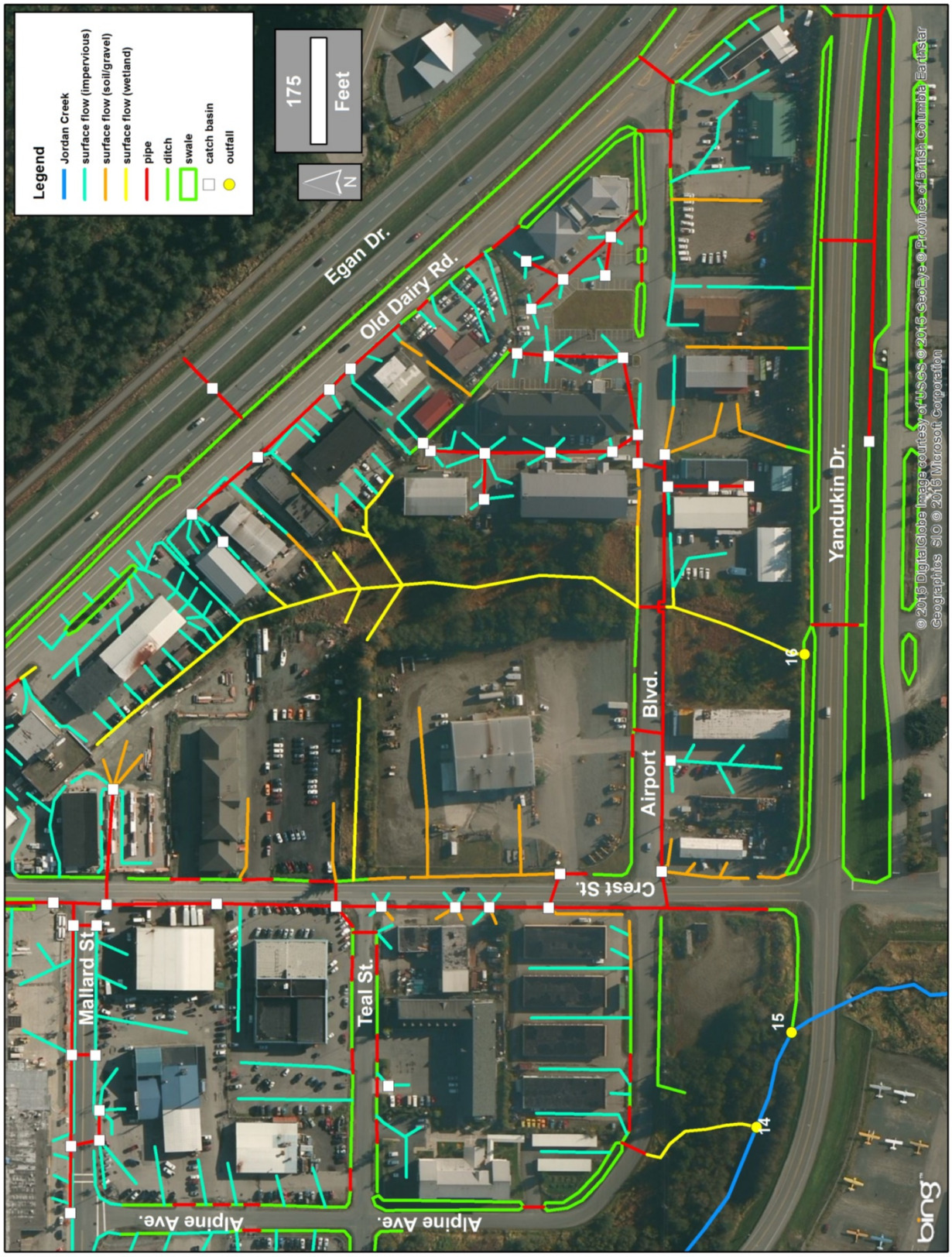
Map A-7. Outfall 11 and associated stormwater system at the south end of Jordan Avenue.



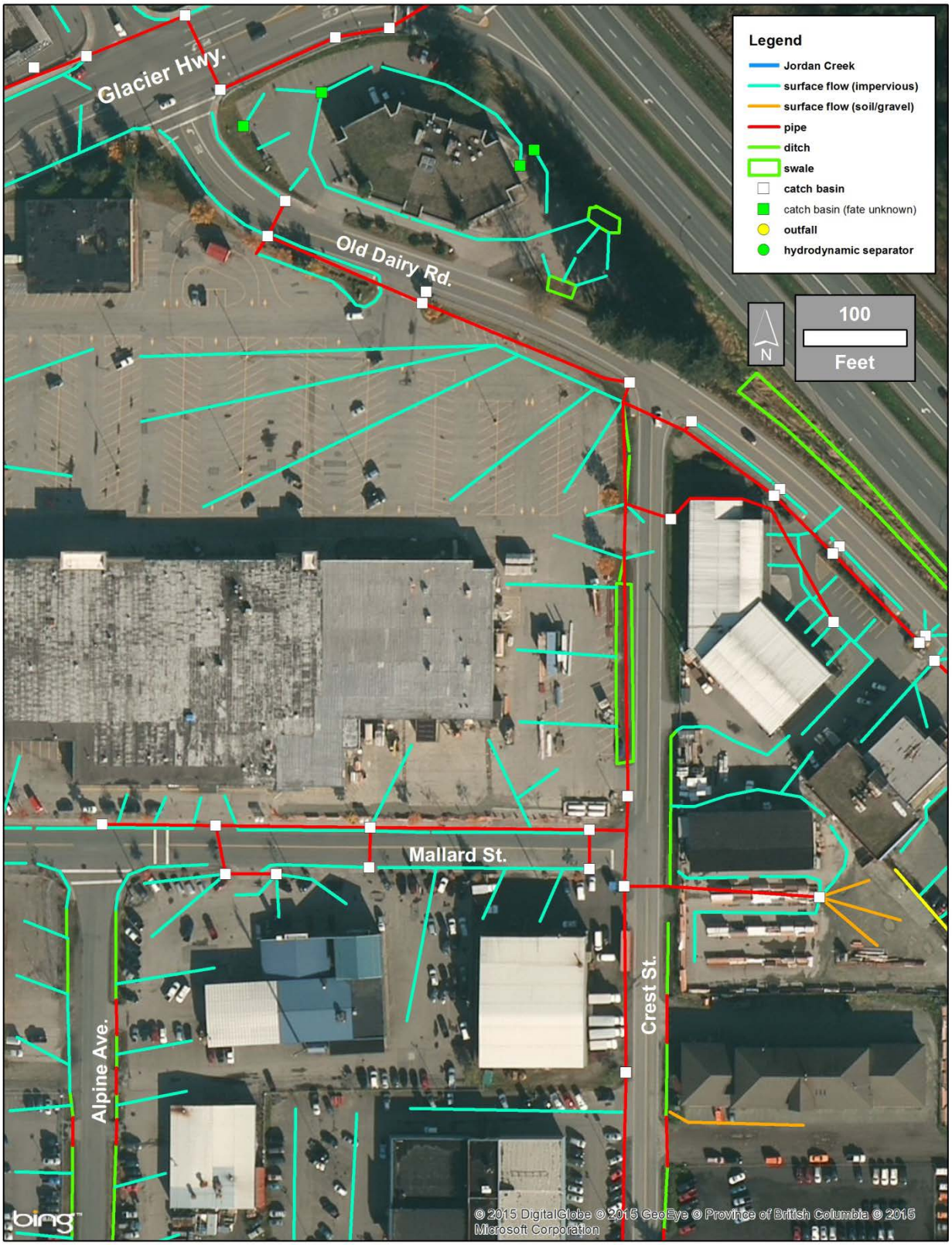
Map A-8. Outfalls 12 and 13 and associated stormwater systems at the west end of Yandukin Drive.



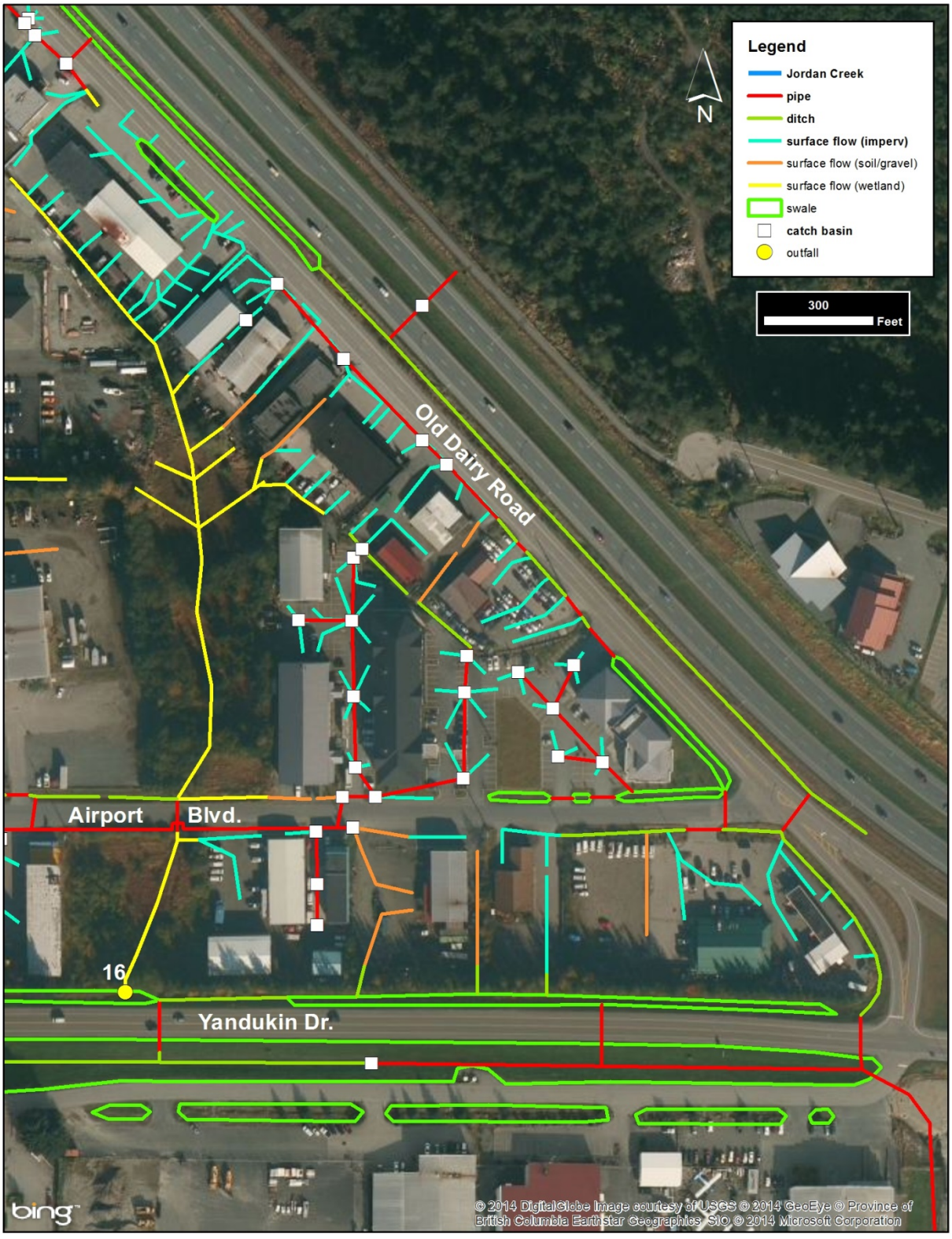
Map A-9. Outfall 14 and associated stormwater system at the west end of Airport Blvd.



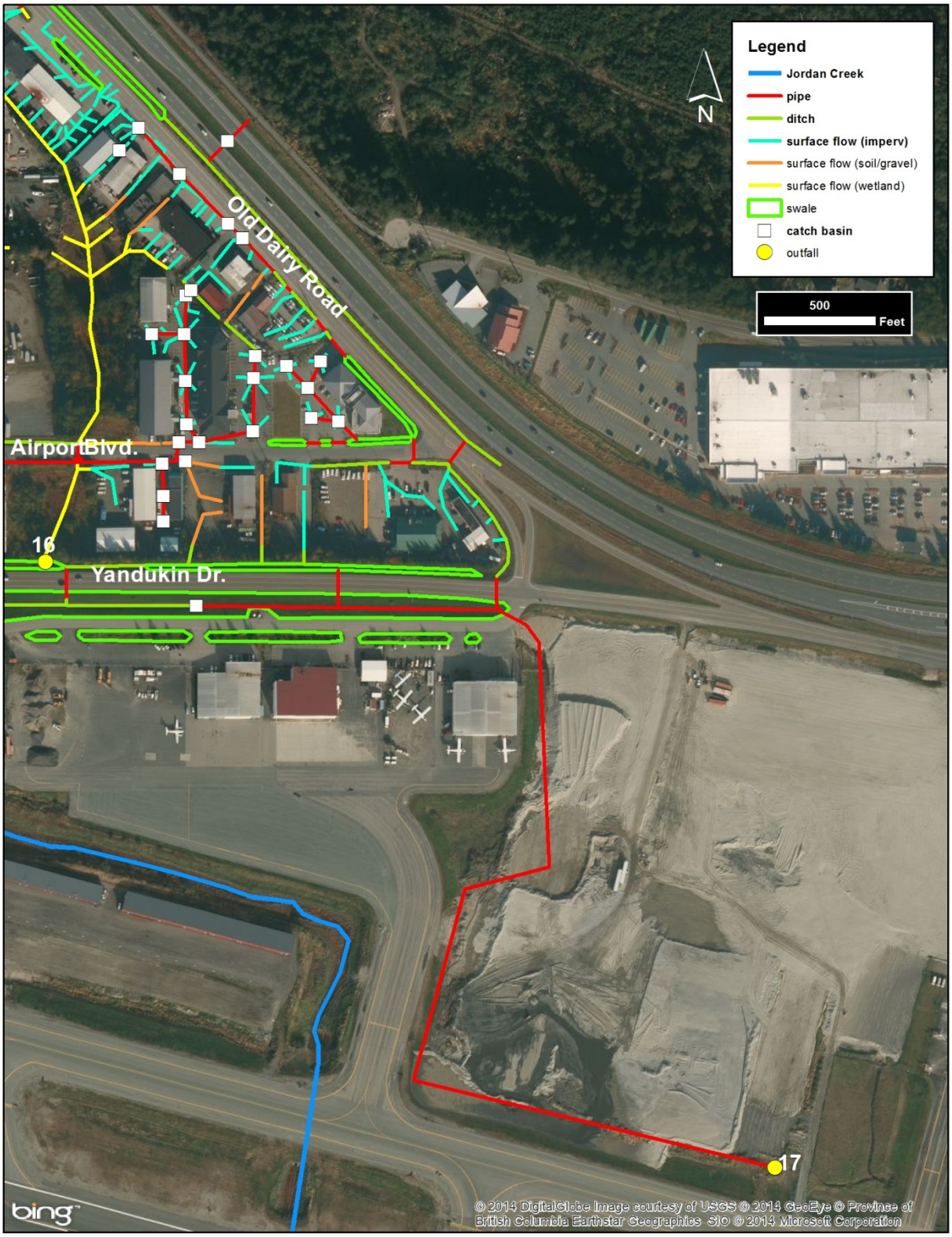
Map A-10. Outfalls 15 and 16 and associated stormwater systems. Refer to Map A-11 for the northern half of the outfall 15 system.



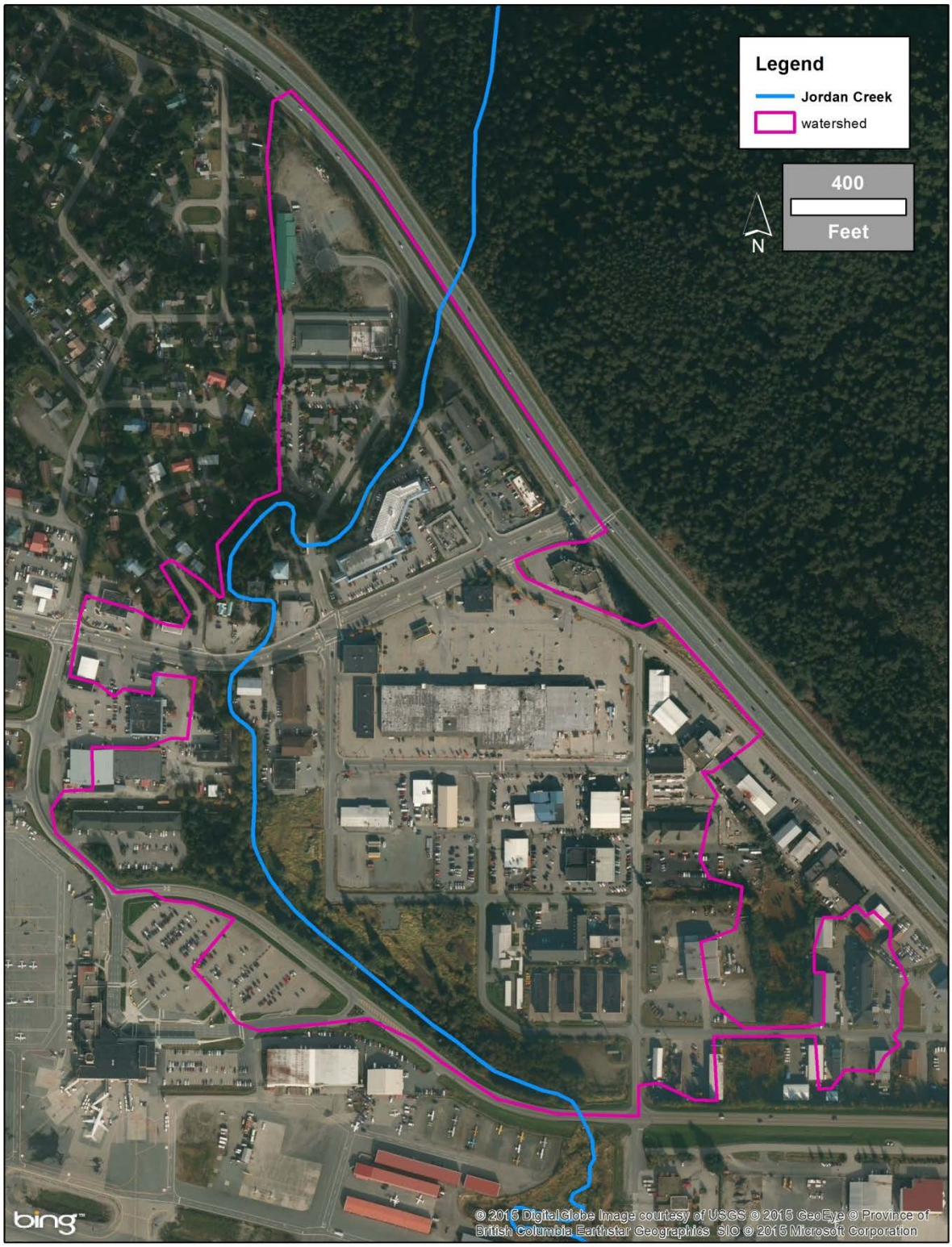
Map A-11. The northern half of the outfall 15 stormwater system (Crest St., Mallard St., Old Dairy Rd.). Refer to map A-10 for the southern half of this system.



Map A-12. Outfall 17 stormwater system. System exits the map view in lower right corner. Refer to Map A-13 for a view of the outfall location.



Map A-13. Outfall 17 and associated stormwater system.



Map A-14. The portion of the assessment area (106 acres) contributing stormwater runoff to the ground or directly to Jordan Creek.