the road was abandoned, or reconstruction activities were underway. The select data from the inventory that were used for this study to evaluate the effects of the road network on the riparian and aquatic system included:

- road segments in critical locations
- stream crossings and their condition
- drainage structures and their condition
- connectivity of road segments to streams
- potential barriers to fish passage
- prism stability
- road surface drainage conditions

Overall, road conditions on inventoried road segments on ODF lands are good. Surface drainage on about 71 percent of the road miles are either functioning properly, or are currently a low priority and do not need immediate attention (see Figure 16). Only one road segment was identified as needing immediate attention to address non-functioning surface drainage. It is a hundred foot section of spur route #15200 where it intersects with the upper end of the Diamond Creek Road near a small seep above a steep slope. Water at this site is actively eroding the road surface. The remaining 29 percent of the inventoried road miles were identified by the RIMS as priority segments where surface drainage should be improved. In the lower Miami and frontal subwatersheds most of these sites are associated with spur roads. In the upper Miami these primarily include the Miami River Road, the Diamond Creek Road, and the upper portion of the Fire Break 3 Road.

RIMS ratings of the general stability of ODF roads indicate that 99 percent of the inventoried miles are stable or exhibit only a minor stability problem (see Figure 17). Currently, there are no road segments that are closed due to a landslide. There are however, about 0.6 miles of road segments affected by a landslide or that have significant slide related erosion. These segments are identified in the discussion below of critical locations.

4.4.3.1 Critical Locations

Critical Locations are used to describe the inherent risk of the road segment to potentially affect aquatic and riparian resources. Critical road locations include slopes in close proximity or in streams, and slopes that are steep or otherwise at risk of landslides. Critical locations have an inherent risk of sediment delivery or direct impact to waterbodies (pers. comm. K. Mills 2005). Slopes under 50 percent, away from streams, lakes, wetlands and landslide terrain are classified as non-critical locations. In these locations, if roads are well surfaced, vegetated and drained there is very low risk of sediment delivery to streams. The greatest effects of roads in critical locations occur during unusually severe storms. Road risk in critical locations can be very difficult to reduce significantly. Most other road conditions (surface drainage, fish and flow passage through structures, and surface erosion) can be corrected by maintenance or repair.

Critical locations are either road segments with a high potential to impact channels, or where there are slope and stability related concerns. As displayed in Figure 18, the RIMS data indicates that the majority (68%) of the surveyed road miles on ODF land are rated as non-critical. Due to the location and condition of these segments, the risk for

unwanted impacts to affect aquatic and riparian resources as a result of road conditions is rated to be slight.

Table 1. Miles of Road Segment by Critical Location Category and Risk Rating

	Critical Location Type	Miles	Risk Rating
Stream Related	Canyon Fill	3.0	Highest
	Channel Fill	4.0	High
	Stream in Ditch	<0.1	High
	Stream Parallel	2.5	Moderate
Slope Related	Cut/Fill Slides	0.4	Highest
	Fill Slides	2.7	High
	Deep Active Slides	0.1	High
	Steep Fill	10	Moderate
	Steep Full Bench	1.5	Low
	Non Critical	52.3	Lowest

Conditions on an estimated 3.4 miles of road are rated as the highest risk to aquatic and riparian resources because there are notable segments that are immediately adjacent to a stream where the prism encroaches directly upon the channel. Original construction positioned these segments of road in the valley bottom. In places the fill slope portion of the road prism constricts the original channel. They are subject to surface erosion, washouts, and in places inundation as a result of periodic flooding. Segments that are rated as the highest risk include (see Figure 18):

- Miami River Road – A 3 mile segment between the South Fork confluence and the North Fork crossing where the original channel has been heavily modified as a result of the road prism being located directly in the bottom of the canyon. This segment impinges directly on a reach designated as critical habitat.

Conditions on about 0.4 miles of road are rated as the highest risk to aquatic and riparian resources because there are notable segments where slope stability is a primary concern. These segments are located on steep slopes where cut/fill slides have been observed and the stability of the prism is questionable. The potential for a storm to result in a road-related failure is very high. These include:

- Diamond Creek Road – A steep 0.2 mile grade that traverses up a wet and narrowly confined small drainage at about milepost (MP) 0.8 where three cut/fill slide locations have been identified. Sediment from road related failures along this segment are deliverable to a stream that is tributary to river reaches designated as critical habitat.

- Foley Road – About a 160-foot segment of road at the first switchback up from the bottom where a cut/fill slide is located adjacent to a stream crossing. The subject drainage is a tributary to critical habitat on the river.

- Foley Peak Road – There are several cut/fill slides along a 0.1 mile long segment that traverses across a steep dissected slope in the headwaters of Buehner Creek near the top of the ridge. It is located about 0.9 miles west of the Foley Road

intersection. Sediment from failures would be deliverable to contributing headwater tributaries to the fish bearing reaches of Buehner Creek.

- Minich – A tenth of a mile segment on the Minich loop road (Minich Spur 1) that traverses an unstable area in a small wet headwater drainage where there have been recurring failures. Sediment from failures would be deliverable to contributing headwater tributaries to the fish bearing reaches of Minich Creek.

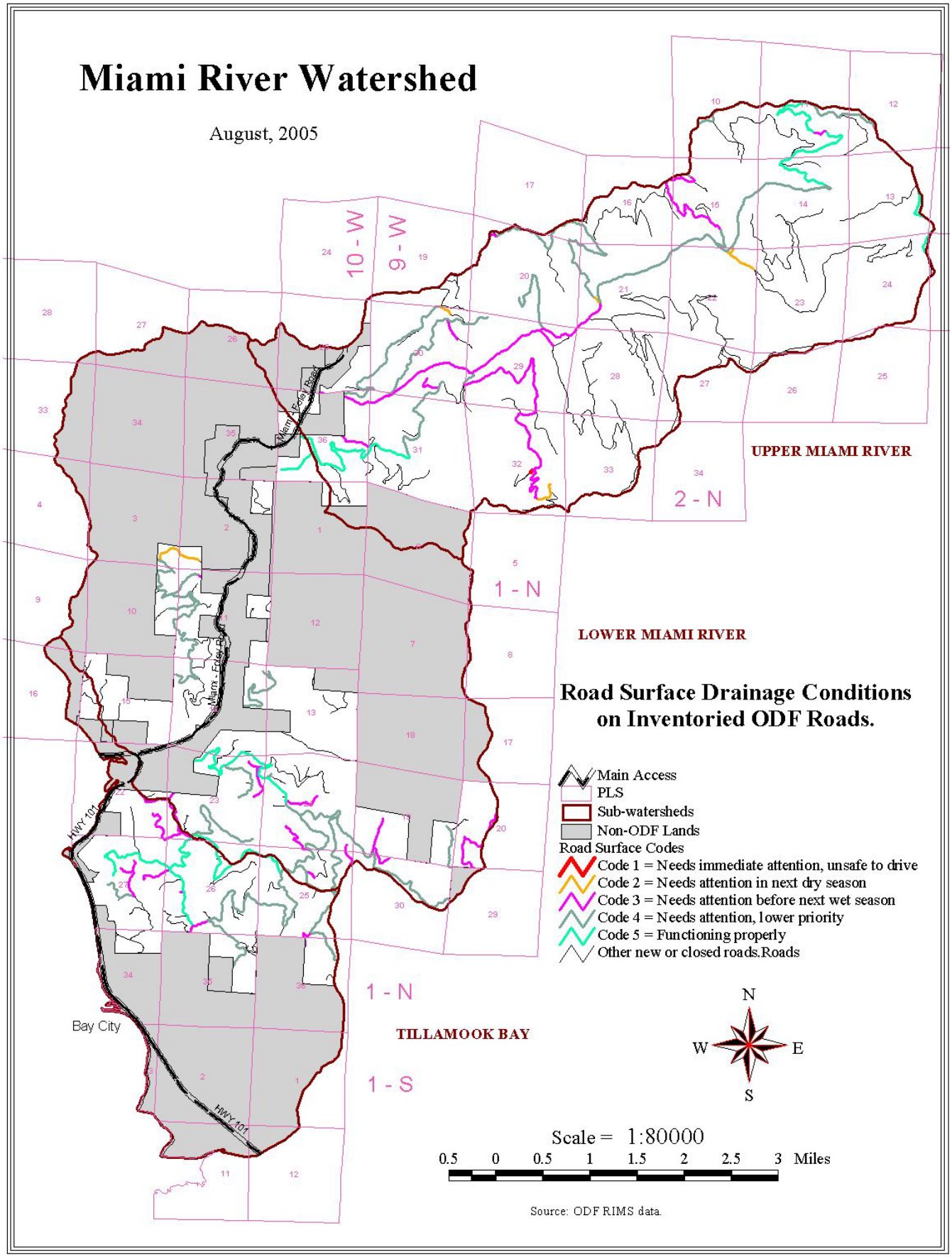

Figure 1. Road surface drainage conditions on inventoried ODF roads within the Miami River Watershed Project Area.

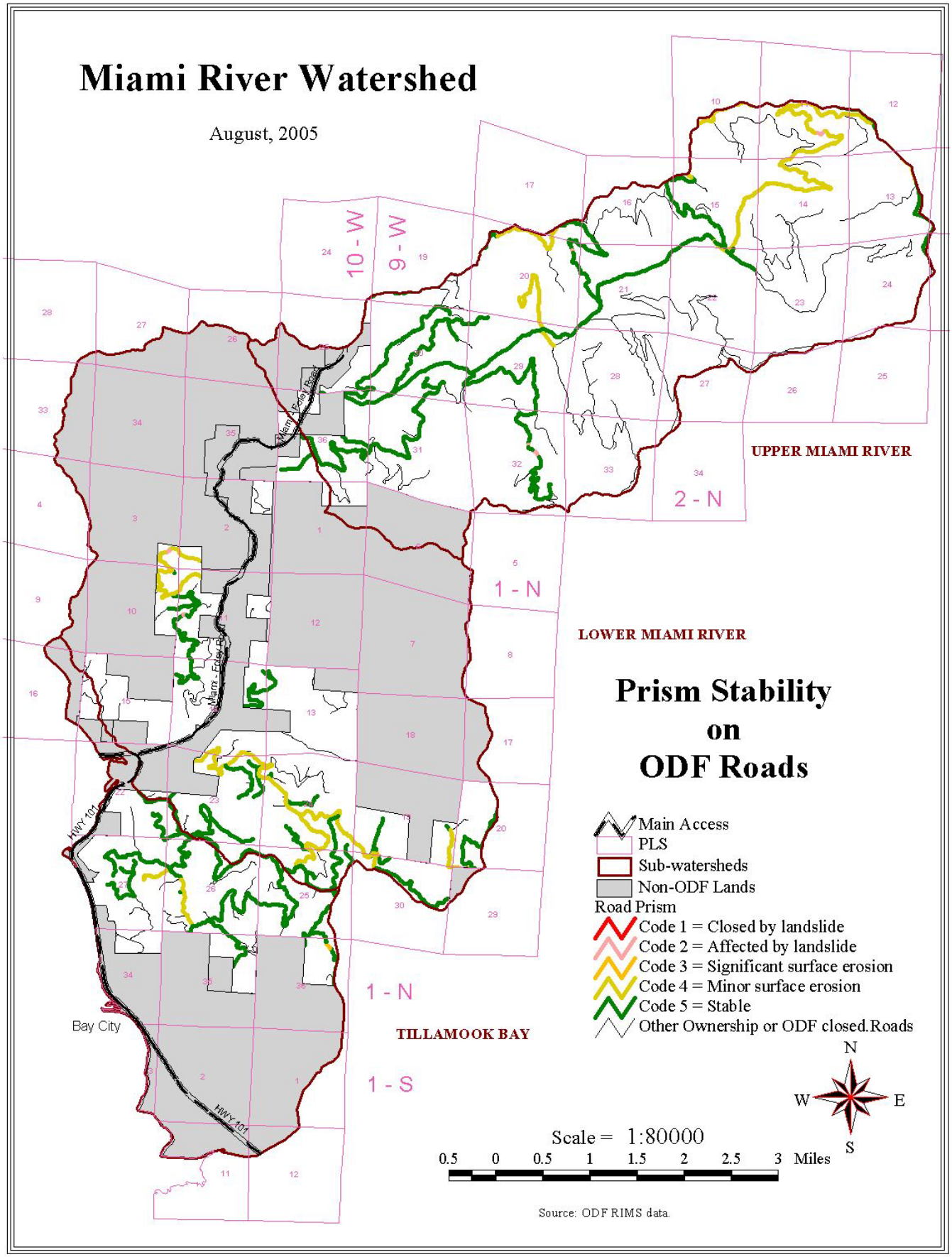

Figure 2. Road prism stability on inventoried ODF roads within the Miami River Watershed Project Area.

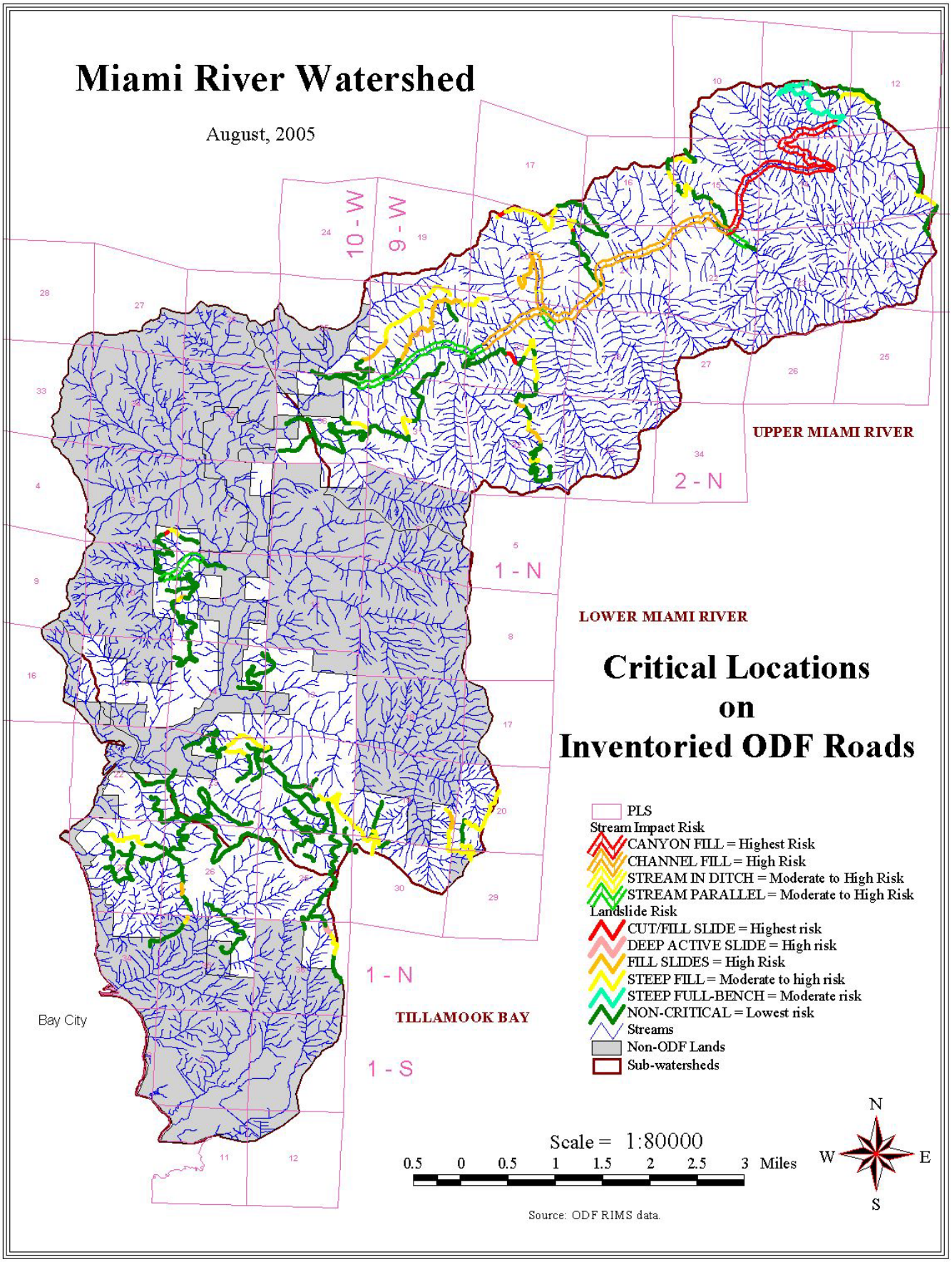

Figure 3. Road segments rated as critical locations for risk to aquatic and riparian resources on ODF lands in the Miami River Watershed Project Area.

There are nearly 7 miles of critical road locations where conditions are rated as a high risk to aquatic and riparian resources. These are segments susceptible to damage from flood events such as fill erosion and prism failures. They are identified as segments where either streamflow has been diverted onto the road or in the ditch, or where fill material has been eroded, or where there are deep-seated slide features. Segments rated as high include:

- Buehner Creek – Multiple problems plague the first 0.6 miles of this road including fill slopes that encroach upon the channel, streams running down the inboard ditch, and failing fill slopes. Sediment from this road enters directly into a fish bearing stream, which is an immediate tributary to a high priority reach designated as critical habitat. Due to this road segment's proximity to critical habitat and it's multitude of problems, it is believed that it could present a risk as high or greater than any of the other segments designated with the highest risk rating, except for the upper segment of the Miami Road.

- The 3.4 mile segment along the river between Diamond Creek and the South Fork confluence. In places the fill slope of this road encroaches upon the channel or is located directly in the active floodplain. It is located immediately adjacent to critical habitat reaches.

- Diamond Creek Road – Eroded fill slopes high up a very steep, highly dissected hillslope. Sediment deliverable to fish-bearing reaches of Diamond Creek.

- East Moss Road – An eroded fill slope high up a very steep headwater slope. Sediment deliverable to fish-bearing reaches of Moss Creek

- Electric Creek Road – An eroded fill slope on a steep headwater slope that is tributary to Larsen Creek. Sediment potentially deliverable to a fish-bearing reaches.

- Fire Break 3 Road – Site of a past failure where a log truck drove off the road causing a fill failure. Sediment deliverable to critical habitat.

- Miami North Road – About a 1.2 mile segment of potentially unstable fill on steep highly dissected slopes. Sediment deliverable to critical habitat.

- Miami West Road – About a 0.3 mile segment of potentially unstable fill on steep highly dissected slopes. Sediment deliverable to critical habitat.

- Minich Ridge Road (MRG) – A small fill failure where eroded sediment is deliverable to South of Minich Creek, a tributary to critical habitat in the lower Miami.

- Vaughn Creek Road – Deep seated landslide feature continually causes deformation of the road prism. High failure potential. Sediment is deliverable to Vaughn Creek and fish-bearing reaches downstream.

4.4.3.2 Washout Risk

There were 156 stream crossings on ODF land surveyed for the RIMS inventory. Only crossings where annual channel scour and deposition was evident were inventoried. Of

the 156 locations inventoried, there were 89 (57%) which were either functioning properly or that exhibited a minor degree of flow impairment due to a partial blockage. The risk of these crossings being washed out as a result of high flow was rated to be low (condition code 4 & 5). There were 39 (25%) crossings where a blockage impeded flow and drainage was slow, or where a structure was damaged and weakened, and the risk of a washout was rated to be moderate (condition code 3).

Structures at 25 stream crossings were in poor condition, barely functional, and in the process of failure (condition code 2). The risk of washout at these locations was rated as high. At two locations, the stream crossing has been heavily damaged, or failure has resulted in a washout (condition code 1), both are located on steep slopes in the frontal subwatershed where a road segment crosses a steep first order stream (Table 19). The Electric Creek road site has since undergone repair. All 27 of the crossing locations where there is a high risk of washout are displayed on Figure 19.

Table 2. Inventoried Road Washouts at Stream Crossings on ODF Land.

Subwatershed	Road Segment
Tillamook Bay	Electric Ck road @ unnamed trib to Larsen Ck
	Larsen Ck spur #1-10-27.3 @ unnamed trib. to bay

The inventory also included surveys of 342 cross drains. These primarily were culvert cross drains. However, other types such as waterbars were also inventoried, but only where they were functioning poorly and there was noteworthy erosion as a result. Sixty-four percent (220) of the surveyed cross drains were functioning properly. They posed no immediate erosion hazard (condition codes 4 and 5).

There were 90 (26%) cross drains where flow is partially blocked (condition code 3). These are sites where storm flow could become impeded resulting in overflow or rerouting that could potentially lead to accelerated erosion. These sites are considered to be a moderate erosion hazard.

There were 28 inventoried cross drains that were either not functional, or were mostly blocked, and resultant erosion was evident (condition codes 1 and 2). Four other sites were observed where the installation of a cross drain structure could avert recurring erosion. All 32 of these sites are considered to be a high erosion hazard, and represent a potential risk to fill slopes (Table 20). Their locations are displayed on Figure 19. Another cross drain site, which failed after the road condition inventory had been completed but was observed during field reconnaissance, is located in the Upper Miami on the Miami River road just uphill from the junction of recently decommissioned spur #2-9-11.