4.20 Priority Site #18 – Lateral Risk to Sanitary Sewer Upstream of Forest Grove Drive

Priority Site #18 is located immediately upstream of the Forest Grove Road Crossing, along Reach N2 of Newtonbrook Creek, where a 675 mm diameter sanitary trunk sewer and multi-use trail system runs parallel to Newtonbrook Creek. Ongoing erosion along the outside edge of a very sharp meander bend, that reroutes the channel into the Forest Grove Drive culvert, has created a lateral erosion risk to both the sanitary sewer as well as the adjacent multi-use trail system. The risk to the trail at this site is noteworthy, with the top of bank encroaching into the edge of the trail. This segment of the creek is unprotected and the bank is composed of highly erodible materials.

The estimated depth of lateral cover between the sewer and the edge of the channel is approximately 6.00 metres with a projected time to contact of 23.42 years. Given that this priority site is located on the outside edge of a very tight meander bend, there is significant potential for exacerbated rates of localized erosion, thereby increasing the overall lateral risk to both the sanitary trunk sewer and the multi-use trail. It is strongly recommended that at minimum, localized engineered bank works be implemented to provide erosion control protection. A photo illustrating the site-specific channel conditions and actively eroding bank encroaching into the multi-use trail is presented in **Figure 4-94**.

Figure 4-94: Degraded Channel Conditions at Priority Site #18. The Actively Eroding Bank has Created a Lateral Risk to a 675 mm Diameter Sanitary Sewer

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-21** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-95**.

Table 4-21: Summary of Priority Site #18 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4034031
Year of Construction	1960
Diameter	675
Lateral Depth of Cover	6.00 m
Estimated Time to Contact	23.42 years
Condition of Bank Protection Works	N/A – No Bank Protection Works Present

4.20.1Priority Site #18 – Description of Restoration Alternatives

Alternative 1: Do Nothing –The estimated depth of the sewer at this location, indicates the sewer is positioned below the existing channel bed affording the sewer both lateral and vertical cover. Nevertheless, over time as the channel continues to widen & deepen, the sanitary sewer may become exposed. Future emergency works may be required if the exposed sewer begins to show signs of structural degradation (i.e., spalling, cracking, slumping, etc.). More immediately, continued widening of the channel also represents a significant risk to the multi-use trail system at this priority site. As the banks continue to erode, the trail system will start to become undermined creating risks to public safety.

Alternative 2: Local Works – Apply natural channel design works for a length of approximately 40 metres along Reach N2, immediately upstream of the Forest Grove Drive Culvert inlet. The natural channel design will establish riffle-pool morphology through the placement of engineered substrate. Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. An armourstone retaining wall with vegetated boulder toe protection will be constructed along the outside edge of the meander bend to provide lateral erosion protection to the 675 mm sanitary trunk sewer and the adjacent pedestrian trail system. Slopes behind the proposed channel works will be infilled with approved materials as needed, regraded to tie-into existing conditions and then stabilized through the application of coir-matting and restoration plantings.

Alternative 3: Sub-Reach-Based Works – Apply extended natural channel design works for approximately 240 metres of channel length with riffle-pool morphology and engineered bank treatments. Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. The proposed works will look to realign the creek away from the sanitary sewer & multi-use trail, and will also implement a series of armourstone retaining walls and vegetated buttresses as bank protection works, in order to further reduce the lateral erosion risk to the sanitary sewer & multi-use trail system. Implementation of this sub-reach-based works solution will have the added benefit of eliminating the sharp bend in the existing channel alignment that leads into the Forest Grove Drive culverts, establishing a smoother transition that should improve conveyance, reduce backwatering and mitigate inlet scour. Selection of this alternative would also address an additional lateral risk site, identified as Priority Site #16, as part of the same sub-reach-based works project. Roughly 220 metres of trail would also be re-built / restored as part of these proposed works.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-96.**

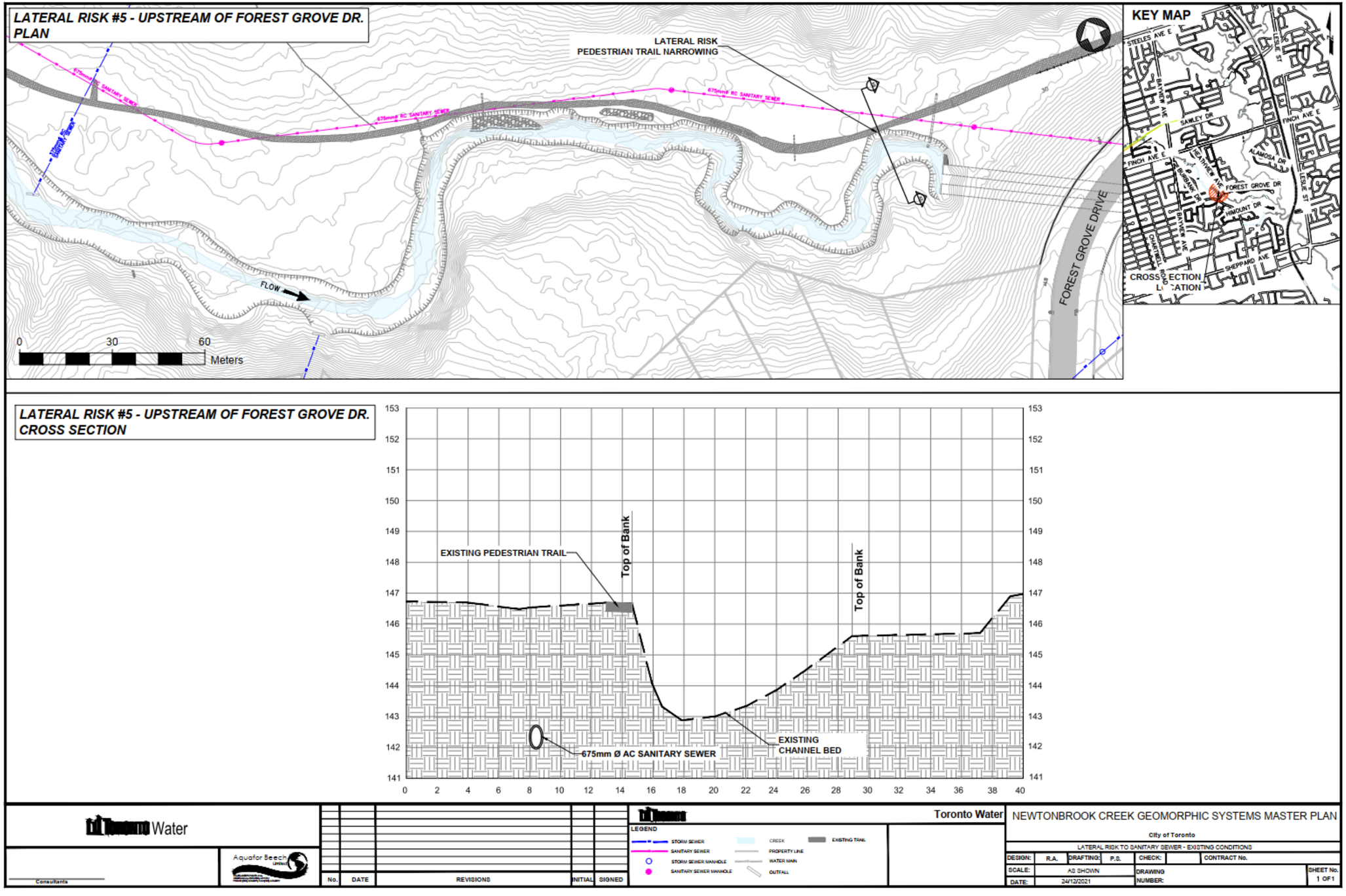

Figure 4-95: Existing Conditions – Priority Site #18

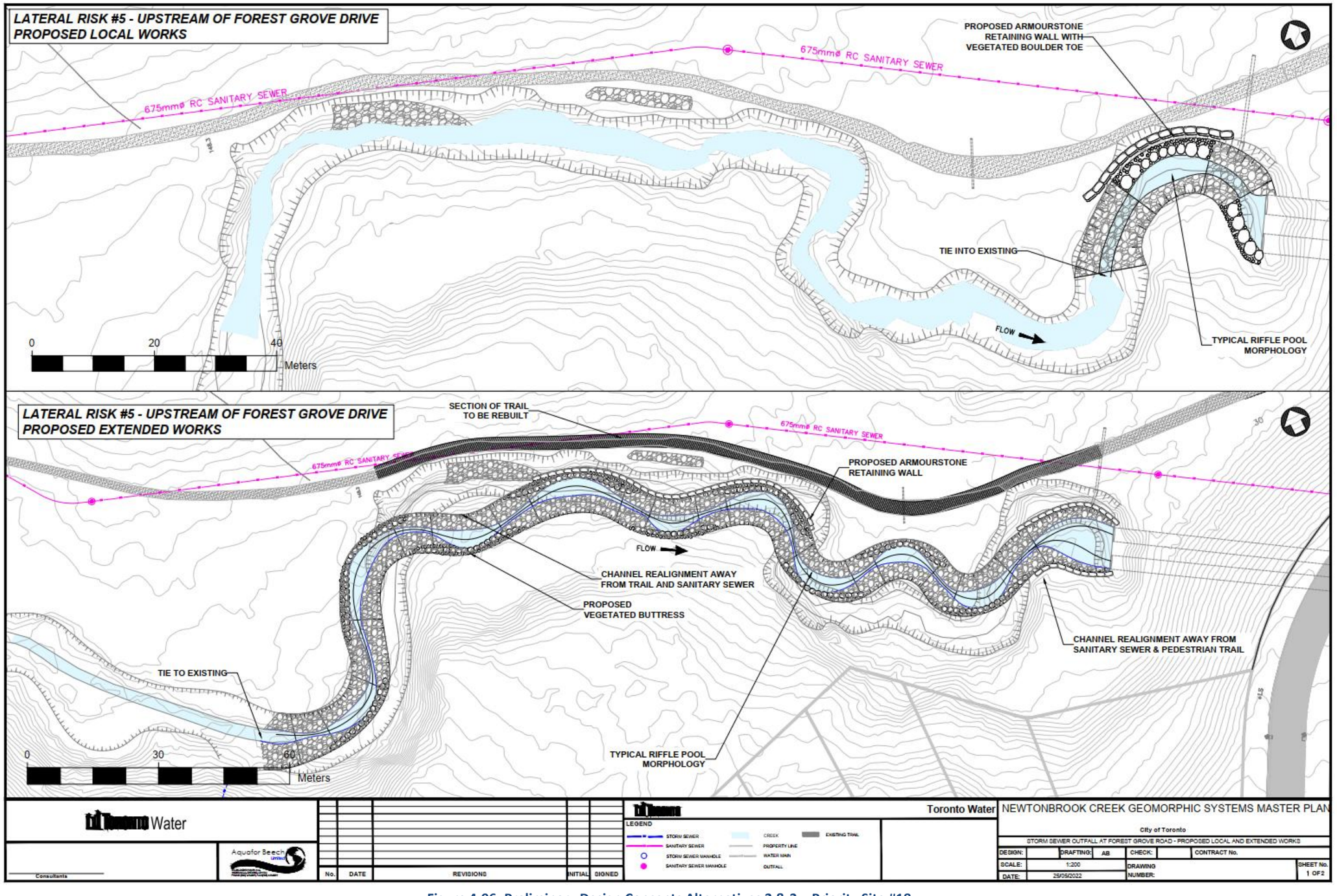

Figure 4-96: Preliminary Design Concepts Alternatives 2 & 3 – Priority Site #18

4.20.2Priority Site #18 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #18 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 3 - Sub-Reach-Based Works was selected as the preferred alternative.

4.20.3Priority Site #18 – Selection of the Preferred Alternative

As per the evaluation table, the Sub-Reach-Based Works option was selected as the preferred alternative for Priority Site #18 with a total score of 80.73/100. The local works solution was the second preferred alternative with a total score of 63.60/100 while the Do Nothing alternative was the least preferred alternative with a total score of 42.33/100.

Key elements of the Sub-Reach-Based Works alternative include:

- Removal of channel debris, and any remnants of failed erosion control structures (i.e., gabion baskets).
- Apply approximately 240 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Infill erosion scars using compacted native materials or approved engineered fill as determined at the detailed design phase.
- Mitigate the identified lateral erosion risk to sanitary sewer infrastructure through channel realignment and the construction of an armourstone retaining wall.
- Address an additional lateral erosion risk site to sanitary sewer infrastructure (Priority Site #16 - SL4033585) through channel realignment works.
- Undertake 220 metres of trail restoration work upstream of Forest Grove Drive, including minor adjustments to the trail alignment in planform.
- Selectively apply vegetated buttress and armourstone retaining wall bank treatments to mitigate lateral erosion risks to the multi-use trail system and private properties.
- Establish a geomorphically stable transition into existing channel conditions upstream.
- Apply channel realignment works to reduce the sharp bend at the entrance to the Forrest Grove Drive Culvert, thereby establishing a smoother and more geomorphically stable transition into the downstream culvert with the intent of reducing scour and improving conveyance hydraulics.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.21 Priority Site #19 – Lateral Risk to Sanitary Sewer at Finchgate Court

Priority Site #19 is located in Reach N2 of Newtonbrook Creek, approximately 530 metres downstream of the Finch and Bayview intersection. Erosion of the channel along the outside edge of a long meander bend has created a lateral erosion risk to the 675 mm diameter sanitary trunk sewer that runs through the Newtonbrook Creek valley corridor. The estimated depth of lateral cover between the sewer and the edge of the channel is 0.75 m, with an estimated time to contact of approximately three (3) years.

The eroding bank is unprotected and is composed of highly erodible materials further exacerbating the risk to the sanitary sewer infrastructure. A multi-use trail runs through the valley corridor at this location following a similar alignment to the sanitary sewer. There is an opportunity to concurrently address lateral erosion risks to both the trail system and sanitary sewer infrastructure through the implementation of channel restoration works along this portion of Reach N2. A photo illustrating the site-specific channel conditions and actively eroding bank encroaching into the multi-use trail is presented in **Figure 4-97**.

Figure 4-97: Degraded Channel Conditions at Priority Site #19. The Actively Eroding Bank has Created a Lateral Risk to a 675 mm diameter Sanitary Sewer

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-22** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-98**.

Table 4-22: Summary of Priority Site #19 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4032401
Year of Construction	1960
Diameter	675
Lateral Depth of Cover	0.75 m
Estimated Time to Contact	2.93 years
Condition of Bank Protection Works	N/A – No Bank Protection Works Present

4.21.1Priority Site #19 – Description of Restoration Alternatives

Alternative 1: Do Nothing – Over time as the channel continues to widen the sanitary sewer will become exposed. Given the height of the sewer within the bank, there is potential for the sewer to become damaged as the toe of the bank continues to erode. Future emergency works may be required if the exposed sewer begins to show signs of structural degradation (i.e., spalling, cracking, slumping, etc.). Continued widening of the channel also represents a significant risk to the multi-use trail system at this priority site. As the banks continue to erode, the trail system may become undermined creating risks to public safety.

Alternative 2: Local Works – Apply natural channel design works for a length of approximately 60 metres along Reach N2, centered around the point of minimum lateral cover. The natural channel design will establish riffle-pool morphology through the placement of engineered substrate. Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. An armourstone retaining wall will be constructed along the outside edge of the meander bend to provide lateral erosion protection to the 675 mm sanitary trunk sewer and the adjacent pedestrian trail system. Slopes behind the proposed channel works will be infilled with approved materials as needed, regraded to tie-into existing conditions and then stabilized through the application of coir-matting and restoration plantings.

Alternative 3: Sub-Reach-Based Works – Apply 650 metres of channel restoration works including significant realignment of the channel near this priority site to mitigate the lateral erosion risk at this site by increasing the erosion buffer between the sanitary sewer and the edge of channel. These works will have the added benefit of increasing the depth of cover over four (4) sanitary sewer crossings (priority sites #5, #6, #7, and #9), while mitigating lateral erosion risks to sanitary sewer infrastructure at four (4) additional locations (priority sites #8, #20, #22 & #26), and allowing for the rehabilitation of two (2) storm sewer outfalls (priority sites #53 & #65). Targeted realignment of the channel coupled with the implementation of engineered bank treatments will also help to alleviate potential erosion related risks to the pedestrian trail system. The proposed channel restoration works will include a combination of cascade-pool and riffle-pool morphology, coupled with engineered bank treatments (vegetated buttresses, and armourstone retaining walls), designed with the intent of building the creek up to establish a minimum of 1.0 metres of additional cover overtop of all applicable sanitary sewer crossings. Implementation of this solution may require the acquisition of easements or land from private property owners.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-99.**

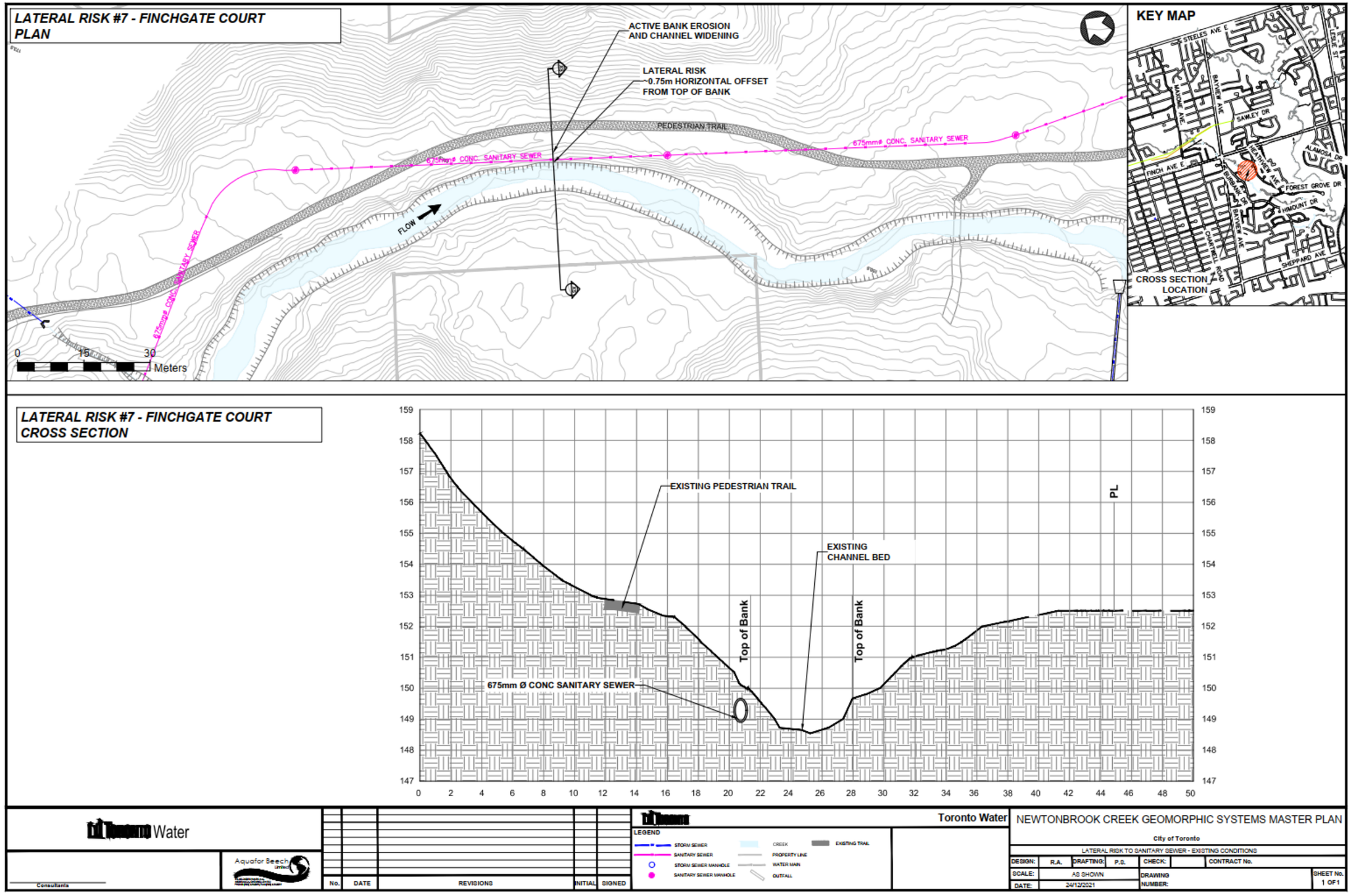

Figure 4-98: Existing Conditions – Priority Site #19

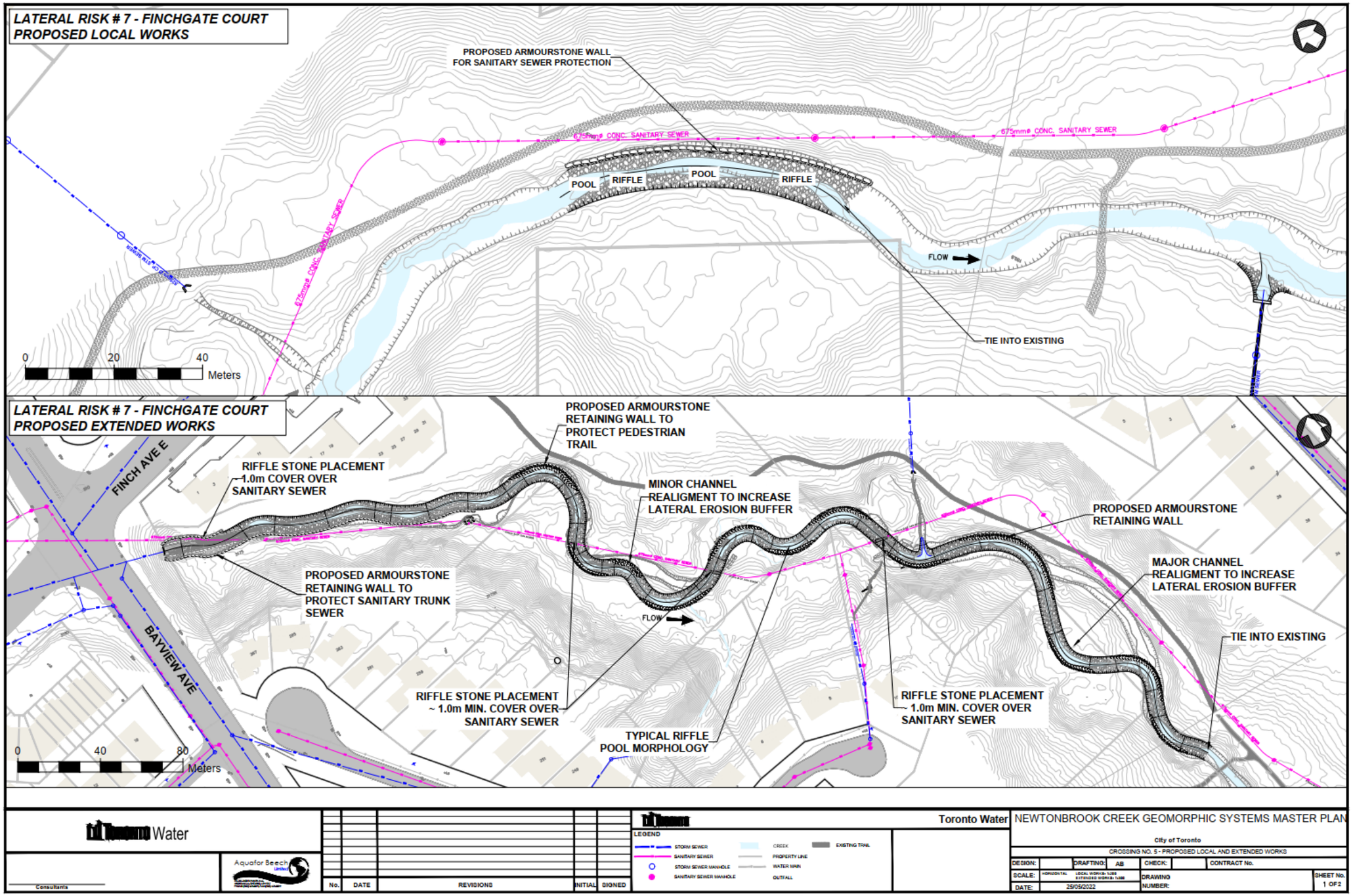

Figure 4-99: Preliminary Design Concepts Alternatives 2 & 3 – Priority Site #19

4.21.2Priority Site #19 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #19 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 3 - Sub-Reach-Based Works was selected as the preferred alternative.

4.21.3Priority Site #19 – Selection of the Preferred Alternative

As per the evaluation table, the Sub-Reach-Based Works option was selected as the preferred alternative for Priority Site #19 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 64.13/100 while the Do Nothing alternative was the least preferred alternative with a total score of 40.93/100.

Key elements of the Sub-Reach-Based Works alternative include:

- Removal of channel debris and failed erosion control structures (i.e., armourstone grade control structures, armourstone retaining walls, and gabion baskets).
- Apply approximately 650 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Mitigate the identified lateral erosion risk to sanitary sewer infrastructure through major channel realignment works.
- Mitigate a major lateral erosion risk to an exposed sanitary sewer maintenance hole (Priority Site #8 - SL4033483) through a combination of minor channel realignment and construction of an armourstone retaining wall.
- Mitigate three additional secondary lateral risk sites (Priority Site #20 - SL4031887, Priority Site #22 - SL4033483, MH4918613545, SL4031888 and Priority Site #26 - SL4031857) through a combination of channel realignment and the construction of vegetated buttress bank protection works.
- Increase the depth of cover overtop of four exposed sanitary sewer crossings (Priority Site #5 - SL4031857, Priority Site #6 - SL4031887, Priority Site #7 - SL4031887 and Priority Site #9 - SL4033483) to a minimum of 1.0 m.
- Address potential future erosion related risks to the pedestrian trail system and private properties through the construction of toe erosion protection works at select locations.
- Rehabilitation of two storm sewer outfalls and their associated outfall channels (identified as priority sites #53 and #65 in the Risk Assessment Report).
- Establish a geomorphically stable transition into existing channel conditions at the upstream and downstream tie-in points.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.22 Priority Site #20 – Lateral Risk to Sanitary Sewer at Brucedale Crescent

Priority Site #20 is located in Reach N2 of Newtonbrook Creek, between two exposed sanitary sewer crossings (Priority Sites #6 & #7). Widening of the channel has created a lateral erosion risk to the 675 mm diameter sanitary trunk sewer that runs through the Newtonbrook Creek valley corridor. The estimated depth of lateral cover between the sewer and the edge of the channel is 0.25 m. While the depth of lateral cover is minimal, the channel bank is protected by a coating of engineered rip-rap. The rip-rap protection works along the top of the bank have washed out, leaving only the toe of the bank protected. Factoring in the existing rip-rap bank protection, the estimated time to contact is roughly six (6) years. However, it is highly probable that if the rip-rap lining the toe of the bank begins to wash out the bank will begin to erode more rapidly, potentially resulting in the exposure of the sanitary sewer. A photo illustrating the site-specific channel conditions and actively eroding bank encroaching towards the sanitary sewer line is presented in **Figure 4-100**.

Figure 4-100: Degraded Channel Conditions at Priority Site #20. The Actively Eroding Bank has Created a Lateral Risk to a 675 mm Diameter Sanitary Sewer

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-23** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-101**.

Table 4-23: Summary of Priority Site #20 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4031887
Year of Construction	1960
Diameter	675
Lateral Depth of Cover	0.25 m
Estimated Time to Contact	5.98 years
Condition of Bank Protection Works	Poor – Rip-Rap Protection at Toe of Bank

4.22.1Priority Site #20 – Description of Restoration Alternatives

Alternative 1: Do Nothing – Over time as the channel continues to widen, and the rip-rap bank protection continues to fail, the sanitary sewer will become exposed. Given the height of the sewer within the bank, there is potential for the sewer to become damaged as the toe of the bank continues to erode. Future emergency works may be required if the exposed sewer begins to show signs of structural degradation (i.e., spalling, cracking, slumping, etc.).

Alternative 2: Local Works – Apply natural channel design works for a length of approximately 55 metres along Reach N2, centered around the point of minimum lateral cover. The natural channel design will establish riffle-pool morphology through the placement of engineered substrate. Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. An armourstone retaining wall will be constructed along the outside edge of the meander bend to provide lateral erosion protection to the 675 mm sanitary trunk sewer. Slopes behind the proposed channel works will be infilled with approved materials as needed, regraded to tie-into existing conditions and then stabilized through the application of coir-matting and restoration plantings.

Alternative 3: Sub-Reach-Based Works – Apply 650 metres of channel restoration work including minor realignment of the channel near this priority site to mitigate the lateral erosion risk at this site by increasing the erosion buffer between the sanitary sewer and the edge of channel. A vegetated buttress will also be constructed along the edge of the meander bend to provide additional lateral erosion protection. These works will have the added benefit of increasing the depth of cover over four (4) sanitary sewer crossings (priority sites #5, #6, #7, and #9), while mitigating lateral erosion risks to sanitary sewer infrastructure at four (4) additional locations (priority sites #8, #19, #22 & #26), and allowing for the rehabilitation of two (2) storm sewer outfalls (priority sites #53 & #65). Targeted realignment of the channel coupled with the implementation of engineered bank treatments will also help to alleviate potential erosion related risks to the pedestrian trail system. The proposed channel restoration works will include a combination of cascade-pool and riffle-pool morphology, coupled with engineered bank treatments (vegetated buttresses, and armourstone retaining walls), designed with the intent of building the creek up to establish a minimum of 1.0 metres of additional cover overtop of all applicable sanitary sewer crossings. Implementation of this solution may require the acquisition of easements or land from private property owners.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-102.**

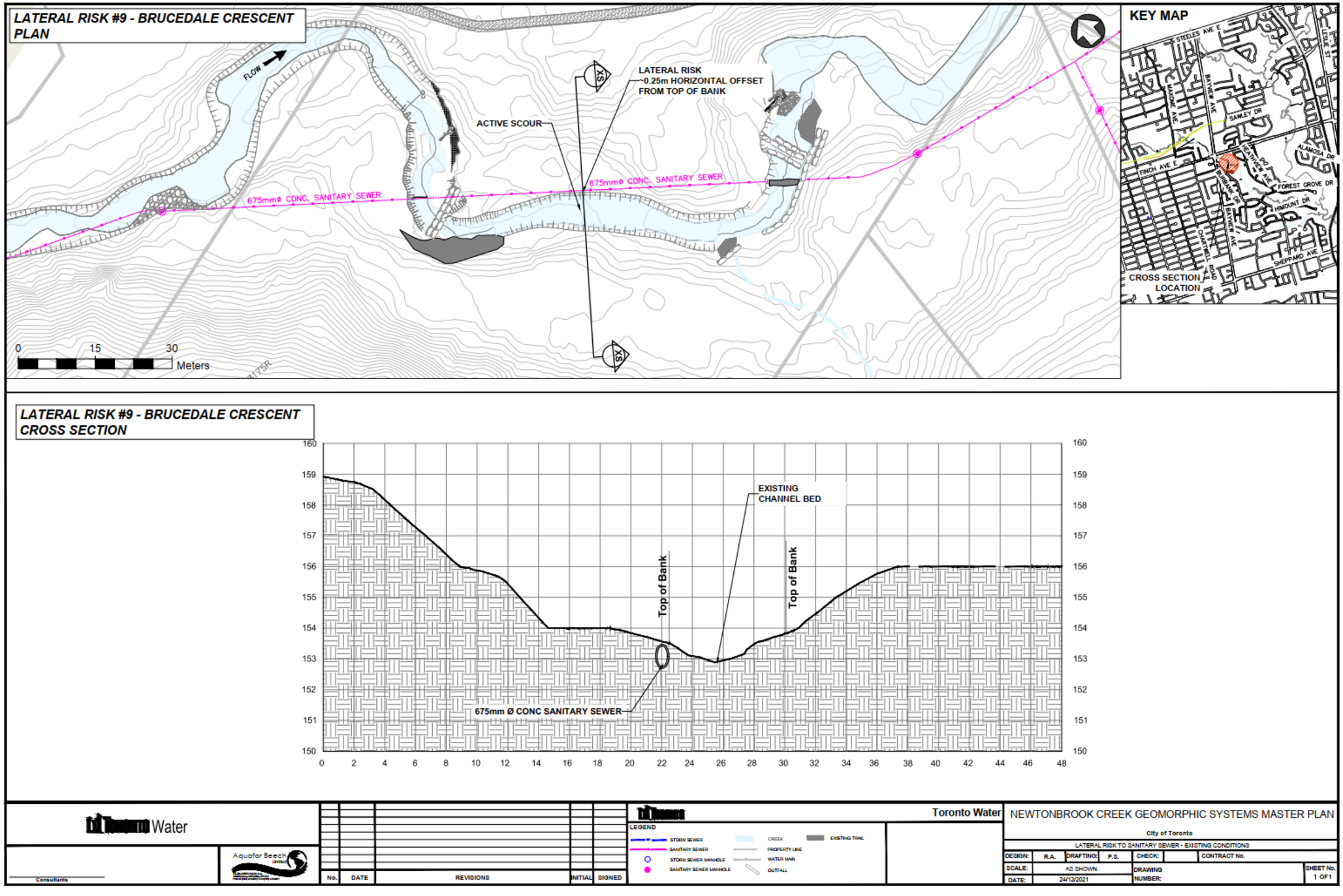

Figure 4-101: Existing Conditions – Priority Site #20

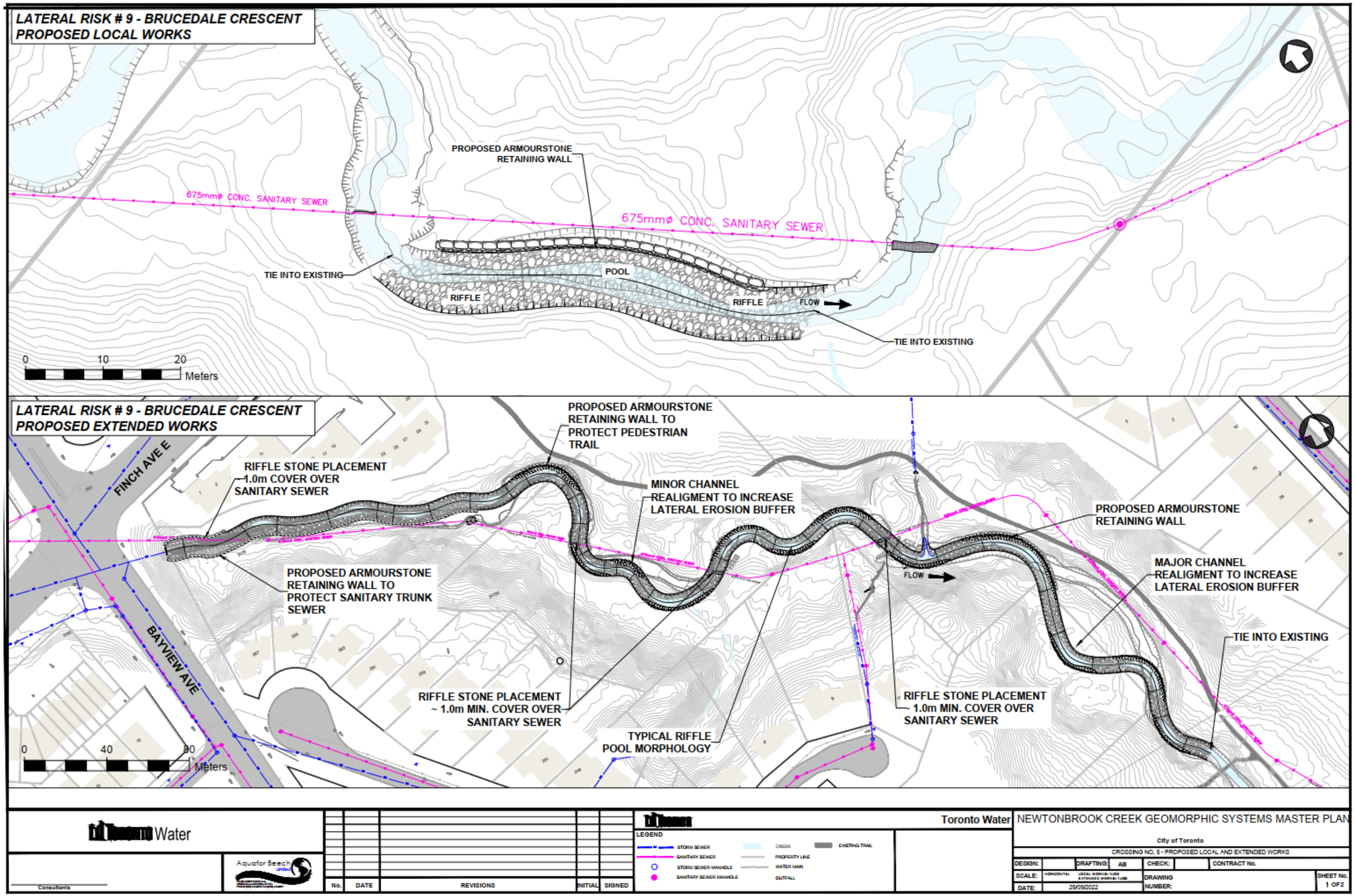

Figure 4-102: Preliminary Design Concepts Alternatives 2 & 3 – Priority Site #20

4.22.2Priority Site #20 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #20 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 3 - Sub-Reach-Based Works was selected as the preferred alternative.

4.22.3Priority Site #20 – Selection of the Preferred Alternative

As per the evaluation table, the Sub-Reach-Based Works option was selected as the preferred alternative for Priority Site #19 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 58.00/100 while the Do Nothing alternative was the least preferred alternative with a total score of 42.93/100.

Key elements of the Sub-Reach-Based Works alternative include:

- Removal of channel debris and failed erosion control structures (i.e., armourstone grade control structures, armourstone retaining walls, and gabion baskets).
- Apply approximately 650 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Mitigate the identified lateral erosion risk to sanitary sewer infrastructure through minor channel realignment and the construction of erosion control protection works (i.e., vegetated buttress).
- Mitigate a major lateral erosion risk to an exposed sanitary sewer maintenance hole (Priority Site #8 - SL4033483) through a combination of minor channel realignment and construction of an armourstone retaining wall.
- Mitigate three additional secondary lateral risk sites (Priority Site #19 - SL4032401, Priority Site #22 - SL4033483, MH4918613545, SL4031888 and Priority Site #26 - SL4031857) through a combination of channel realignment and the construction of vegetated buttress bank protection works.
- Increase the depth of cover overtop of four exposed sanitary sewer crossings (Priority Site #5 - SL4031857, Priority Site #6 - SL4031887, Priority Site #7 - SL4031887 and Priority Site #9 - SL4033483) to a minimum of 1.0 m.
- Address potential future erosion related risks to the pedestrian trail system and private properties through the construction of toe erosion protection works at select locations.
- Rehabilitation of two storm sewer outfalls and their associated outfall channels (Priority Site #53 - OF4902413782 and Priority Site #65 - OF4907413839).
- Establish a geomorphically stable transition into existing channel conditions at the upstream and downstream tie-in points.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.