4.6 Priority Site #4: Exposed Storm Water Outfall at Canary Crescent

Priority Site #4 is located in Reach N2 of Newtonbrook Creek, east of Burbank Drive at Canary Crescent. A medium sized storm sewer outlets to a rip-rap lined outlet channel through a concrete headwall, set back approximately five (5) meters from the main channel (**Figure 4-19**). A combination of structural degradation of the inletting storm sewer and erosion within the creek corridor has contributed to the failure of this outfall structure.

The outlet channel is heavily eroded and down cut, destabilizing the base of the outfall structure and leading to slumping of the concrete headwall (**Figure 4-20**). The headwall has become completely detached from the inletting CMP pipe (**Figure 4-21**). Field assessments and CCTV inspections of the inletting storm sewer pipe also confirm several upstream detachments and obstructions of flow (**Figure 4-22**). Instances of localized erosion and gullying are visible upslope and are expected to worsen if the storm sewer and outfall structure are left if a state of disrepair.

Figure 4-19: Storm Sewer Outfall Setback Approximately 5 m from Newtonbrook Creek

Figure 4-20: Eroded and Down-cut Outfall Channel Contributing to the Slumping of the Upstream Concrete Headwall Structure

Figure 4-21: Detachment of Headwall From Inlet Pipe

Figure 4-22: Obstructions and Detachments Within Upstream Pipe Segment

Storm sewer outfall parameters relevant to this priority site are summarized in **Table 4-7** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-23**.

Table 4-7: Summary of Priority Site #4 Outfall Parameters

Parameter	Outfall
Toronto Water Asset ID	OF4884313907
Year of Construction	1956
Diameter	Medium (250 – 1200 mm)
Shape	Circular
Material	CMP
Headwall	Concrete
Outfall Condition	Failed
Erodibility of Adjacent Substrate	High

4.6.1 Priority Site #4 – Description of Restoration Alternatives

Alternative 1: Do Nothing – If left unaddressed the slope behind the failed outfall will continue to erode due to storm flows discharging part way up the unprotected slope where the CMP has become detached or damaged. Additional pipe segments may become exposed and dislodged and continued gullying may create risks to private properties on Burbank Drive. The concrete headwall will also continue to slump and may eventually fall into the creek and become an obstruction to flow.

Alternative 2: Local Works – Repair/replace two segments of failed/damaged CMP (total length of approximately 92.4 m), as per the City's recommendation, maintaining the same pipe alignment in planform. Care must be taken to construct the pipes with appropriate bedding and backfill materials, as per City standards, to prevent future failure. All sewer repair/replacement works must be coordinated with other City departments / basement flooding projects.

Erosion sinkholes and gullies along the slope should be infilled with engineered fill and appropriately compacted. At the detailed design stage, consideration should also be given to completing a slope stability assessment, with slope stabilization measures (i.e., soil anchors, coir logs, etc.) to be applied as required. The failed concrete headwall should also be replaced with a new equivalent structure, discharging to a newly engineered scour pool and outfall channel.

Alternative 3: Sub-Reach-Based Works – Repair/replace two segments of failed/damaged CMP (total length of approximately 92.4 m), as per the City's recommendation, maintaining the same pipe alignment in planform. All sewer repair/replacement works must be coordinated with other City departments / basement flooding projects. A new maintenance hole will be installed allowing for the realignment of the storm sewer such that a new concrete headwall, scour pool and outfall channel can be constructed to discharge flows to the creek at a more oblique angle. This realigned outfall channel will allow for a smoother transition of storm water flows into the main channel of Newtonbrook Creek, mitigating local scour and erosion. The banks around the outfall channel will be lined with vegetated buttresses to mitigate erosion. Erosion sinkholes and gullies along the slope are to be infilled with engineered fill and appropriately compacted and stabilized through the application of coir-matting and slope restoration plantings.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-24**.

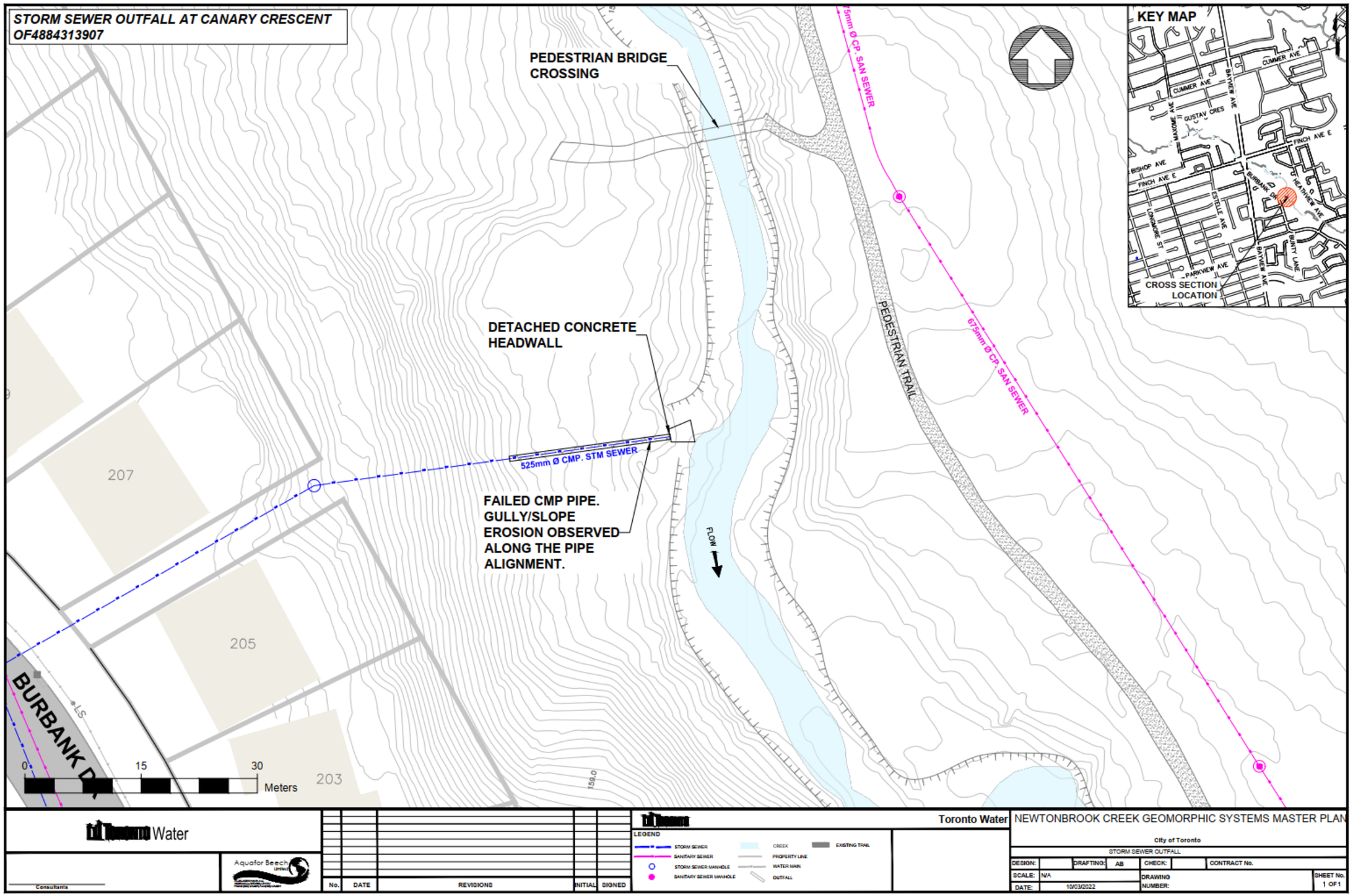

Figure 4-23: Existing Conditions - Priority Site #4

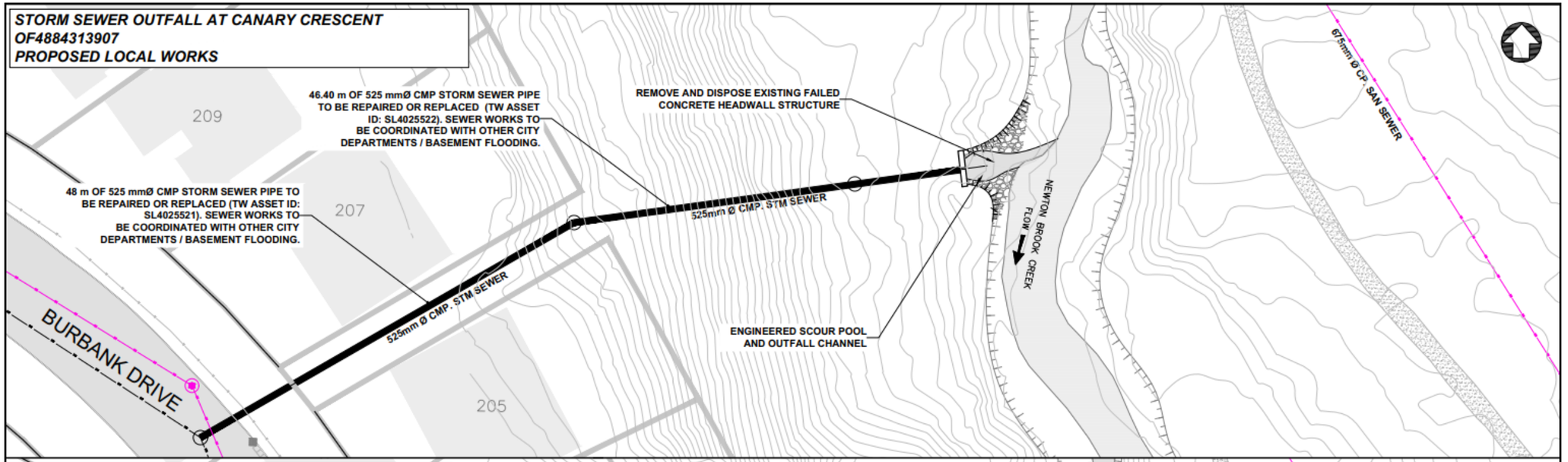

Figure 4-24: Preliminary Design Concepts Alternative 2 & 3 – Priority Site #4

4.6.2 Priority Site #4 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #4 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 2 - Local Works was selected as the preferred alternative.

4.6.3 Priority Site #4 – Selection of the Preferred Alternative

As per the evaluation table, the Local Works option was selected as the preferred alternative for Priority Site #4 with a total score of 77.53/100. The Sub-Reach-Based works solution was the second preferred alternative with a total score of 71.93/100, while the Do Nothing alternative was the least preferred alternative with a total score of 37.73/100.

Key elements of the Local Works alternative include:

- Removal of channel debris and failed Toronto Water Infrastructure (i.e., failed outfall and storm sewer pipe segments).
- Repair/Replace approximately 92 metres of failed corrugated metal storm sewer pipe, maintaining the same general pipe alignment in planform. All sewer repair/replacement works must be coordinated with other City departments / basement flooding projects.
- Restore the failed slope through regrading and infilling of observed sinkholes and gullies with appropriately compacted fill materials. Apply additional slope stabilization measures (i.e., soil anchors, coir logs, etc.) as defined at the detailed design phase.
- Replace the failed outfall structure.
- Construct an engineered scour pool with a rip-rap lined outfall channel that transitions into the main branch of Newtonbrook Creek.
- Establish a geomorphically stable transition into existing channel conditions where engineered works adjoin the natural channel corridor.
- Undertake construction along a steep valley slope, including working between private properties on Burbank Drive.
- Given the local nature of the proposed solution, consideration to be given to accessing the site from both the top of slope (i.e., off of Burbank Drive) as well as from the toe slope (i.e., by using the pedestrian trail system and crossing Newtonbrook Creek). Preferred access approach to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.7 Priority Site #5: Exposed Sanitary Sewer Crossing at Farmingdale Road

Priority Site #5 is located in Reach N2 of Newtonbrook Creek, approximately 420 metres downstream of the Finch & Bayview crossing. Incision and widening of the channel have exposed the concrete encasement surrounding a 675 mm diameter sanitary Trunk Sewer (**Figure 4-25**). The concrete encasement, which exhibits signs of degradation due to spalling, is protruding above the bed of the creek creating a slight backwater effect upstream. This exposed sewer crossing is situated just upstream of an armourstone grade control structure that facilitates a near vertical drop of approximately 2.0 metres along the longitudinal profile of the creek. The grade control structure is in a state of poor repair with a number of stones starting to slump and become dislodged (**Figure 4-26**).

Two (2) storm outfalls outlet to Newtonbrook Creek downstream of the armourstone grade control structure. Both outfalls are setback from the main channel, draining into the creek via steeply sloped outlet channels that are in various states on disarray. One outfall, draining a 525 mm diameter storm sewer, is located on the north side of the channel at the edge of a pedestrian trail (**Figure 4-27**). The corresponding outfall channel is in fair condition with some minor degradation due to erosion. The second outfall, which drains a 250 mm storm sewer, is situated on the south side of the channel near the top of the valley slope. The outfall protrudes out of an unprotected bank with no visible headwall or wingwall structure. The downstream outfall channel is severely eroded having formed an incised gully full of accumulated debris (**Figure 4-28**). This southern outfall is located on private property (10 Farmingdale Road), consequently a permission to enter agreement or easement may need to be obtained to facilitate repairs to this structure.

Figure 4-25: Exposed Concrete Encasement Surrounding 675 mm Ø Sanitary Trunk Sewer

Figure 4-26: Armourstone Grade Control Structure Downstream of Exposed Sanitary Sewer Crossing

Figure 4-27: Northern Storm Sewer Outfall at Edge of Pedestrian Trail

Figure 4-28: Southern Storm Sewer Outfall at Top of Slope and Associated Outfall Channel

Sanitary Sewer & Storm sewer outfall parameters relevant to this priority site are summarized in **Table 4-8** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-29**.

Table 4-8: Summary of Priority Site #5 Sanitary Sewer and Outfall Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4031857
Year of Construction	1960
Diameter	675
Depth of Cover	Exposed
Estimated Time to Contact	0
Erodibility of Adjacent Substrate	Low

Parameter	Southern Outfall	Northern Outfall
Toronto Water Asset ID	OF4902413782	OF4907413839
Year of Construction	1956	1956
Diameter	Small (< 250 mm)	Medium (250 – 1200 mm)
Shape	Circular	Circular
Material	CMP	Concrete
Headwall	None	Concrete
Outfall Condition	Poor	Fair
Erodibility of Adjacent Substrate	High	High

4.7.1 Priority Site #5 – Description of Restoration Alternatives

Alternative 1: Do Nothing – The sanitary sewer crossing will continue to be at risk of failure due to channel downcutting and the potential future failure of the downstream armourstone grade control structure. Failure of the grade control structure would likely cause rapid downcutting of the channel immediately upstream, potentially damaging the sewer where it crosses Newtonbrook Creek. The storm sewer outfalls and outlet channels will also continue to degrade overtime, potentially leading to the formation of significant erosion gullies (similar to what has occurred at priority sites #3 & #4).

Alternative 2: Local Works – Apply channel engineering works for about 35-40 metres of channel length within reach N2, focused on a fixed engineered riffle centered overtop of the exposed sanitary sewer crossing to provide a minimum of 0.3 metres depth of cover. The riffle will be bounded on either side by a series of armourstone ribs designed to replace the function of the existing armourstone grade control structure. Engineered pools will be constructed at the upstream and downstream extents of the proposed local works solution allowing for a smooth transition into existing channel conditions. Implementation of this solution also includes rehabilitation of the southern outfall channel. Accumulated debris will be removed and the channel infilled, regarded and relined with engineered substrate to mitigate erosion.

Alternative 3: Sub-Reach-Based Works – Apply natural channel design principles for an extended length, including riffle-pool morphology and bioengineered bank treatments (vegetated buttresses), to build the creek up, establish a minimum of 1.0 metres of cover overtop of the exposed sewer crossing, and limit the protection of the sewer crossing's dependence on the long-term stability of any downstream grade control structures. Both storm sewer outfalls and their outfall channels will be also be rehabilitated and realigned/regraded to transition smoothly into the proposed reach-based works. This solution is part of a proposed 650 metres of channel restoration work intended to increase the depth of cover over three (3) additional sanitary sewer crossings (priority sites #6, #7, and #9), mitigate lateral erosion risks to sanitary sewer infrastructure at five (5) locations (priority sites #8, #19, #21, #22 & #26), and allow 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.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-30**.

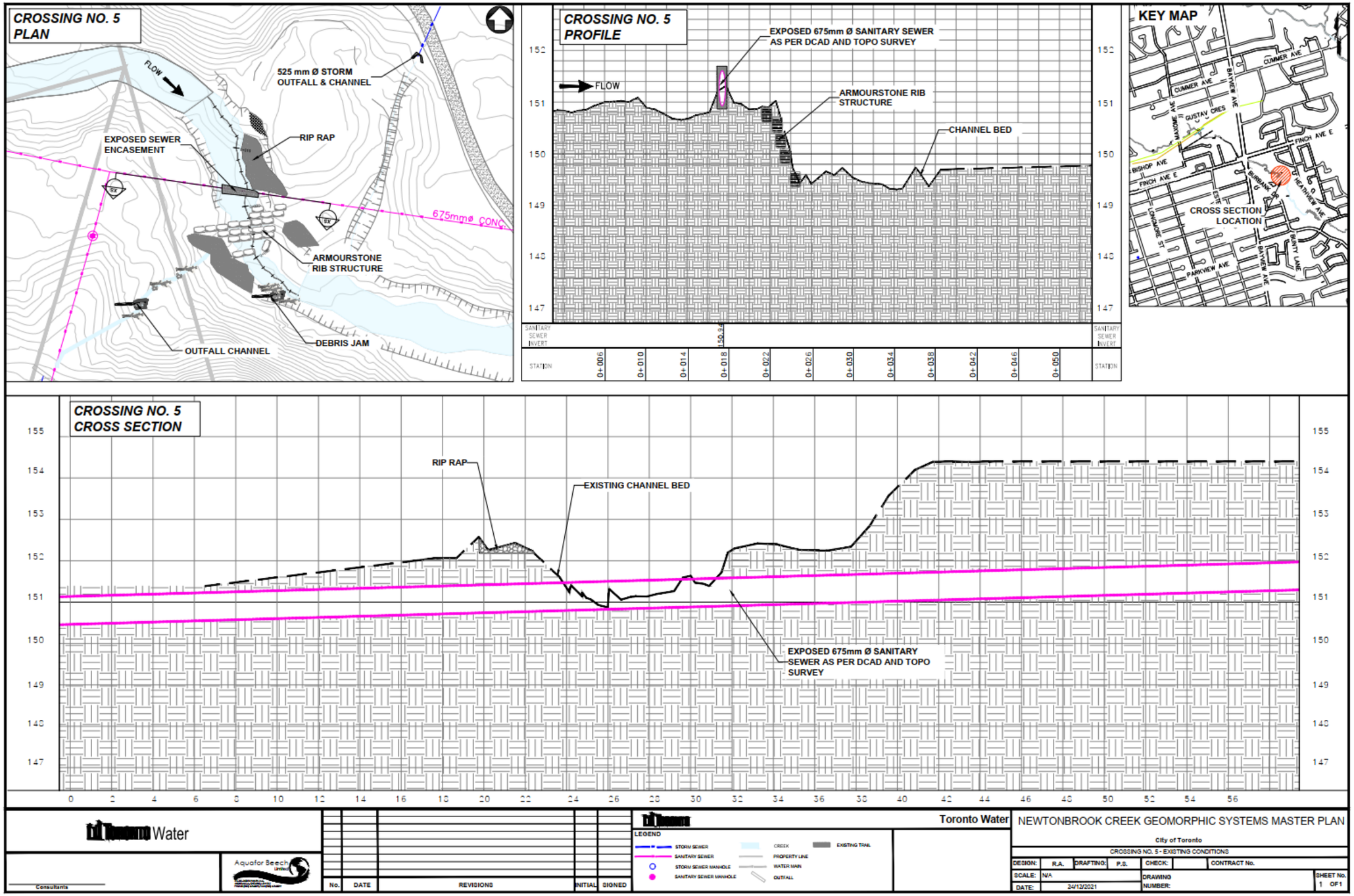

Figure 4-29: Existing Conditions - Priority Site #5

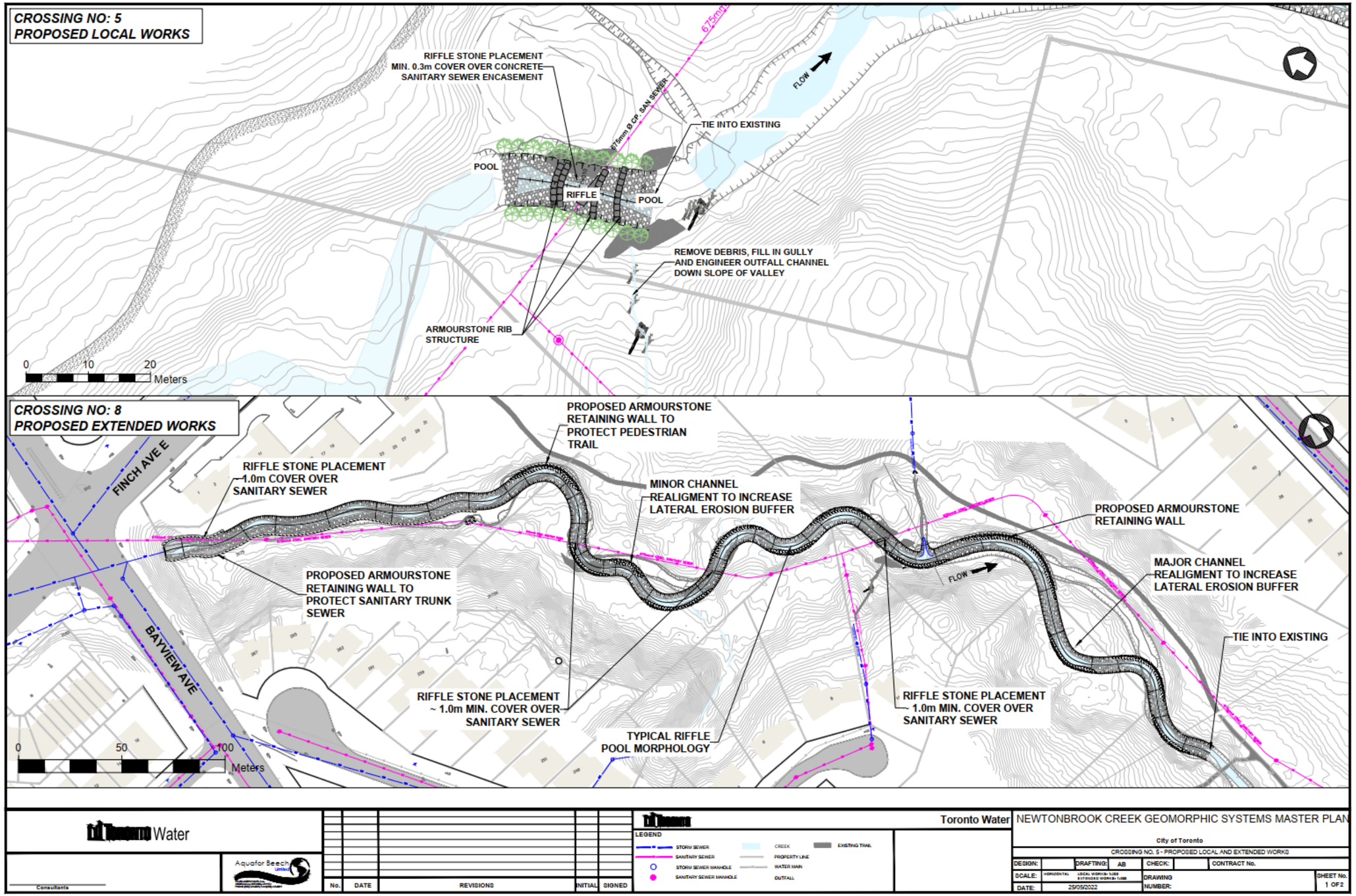

Figure 4-30: Preliminary Design Concepts Alternative 2 & 3 – Priority Site #5

4.7.2 Priority Site #5 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #5 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.

4.7.3 Priority Site #5 – 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 #5 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 59.73/100 while the Do Nothing alternative was the least preferred alternative with a total score of 36.93/100.

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.
- Provide a minimum of 1.0 metres of cover overtop of the exposed 675 mm diameter sanitary sewer crossing.
- Increase the depth of cover overtop of an additional three exposed sanitary sewer crossings (identified as Priority Sites #6, #7 and #9 in the Risk Assessment Report) to a minimum of 1.0 m.
- Mitigate a major lateral erosion risk to an exposed sanitary sewer maintenance hole (identified as Priority Site #8 - MH4915013638) through a combination of minor channel realignment and construction of an armourstone retaining wall.
- Mitigate secondary lateral risk sites (Priority Site #19 - SL4032401, 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.
- 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.
- Coordinate permission to enter agreements and/or land/easement acquisitions as required to facilitate construction. Private property impacts to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.8 Priority Site #6: Exposed Sanitary Sewer Crossing upstream of Farmingdale Road

Priority Site #6 is located in Reach N2 of Newtonbrook Creek, approximately 100 metres upstream of Priority Site #5. Channel incision and widening has exposed the concrete encasement surrounding a 675 mm diameter sanitary trunk sewer. Similar to Priority Sites #5 and #7 located upstream and downstream of Priority Site #6, the exposed sewer crossing is situated upstream of a multi-tier armourstone grade control structure, which is still intact but in poor condition (**Figure 4-31**). An armourstone wall with eroded riprap toe protection is in fair condition, protecting the outer banks of the channel (**Figure 4-32)**. Along the inner, unprotected, bank a point bar has formed.

Upstream of the encasement is a large pool with a maximum depth of roughly 1.0 metres (**Figure 4-33**). This site is setback from the main pedestrian trail and private properties. The exposed encasement here is beginning to undermine due to the continued deepening of the upstream scour pool, with a noticeable gap having formed underneath it. If left unaddressed, the encasement could potentially become undermined and eventually fail. The armourstone wall ends ~8 metres downstream of the encasement **(Figure 4-34**).

Figure 4-31: Armourstone Grade Control Structure and Armourstone Bank Protection

Figure 4-32: Armourstone Bank Protection along Outer Downstream Bank

Figure 4-33: Exposed Encasement with Upstream Scour Pool

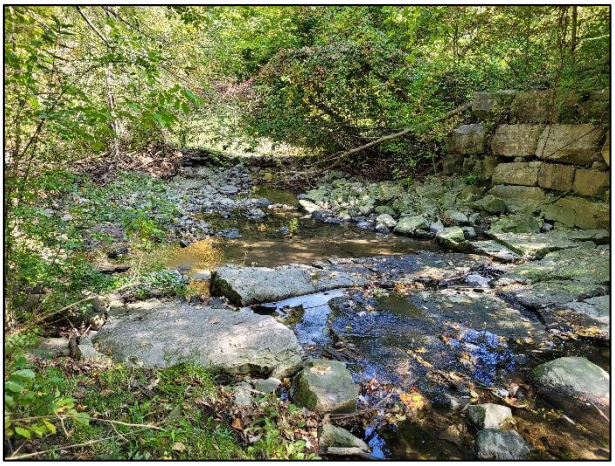

Figure 4-34: Armourstone Bank Protection and Grade Control Downstream of Exposed Encasement

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-9** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-35**.

Table 4-9: Summary of Priority Site #6 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4031887
Year of Construction	1960
Diameter	675
Depth of Cover	Exposed
Estimated Time to Contact	0 years
Erodibility of Adjacent Substrate	low

4.8.1 Priority Site #6 – Description of Restoration Alternatives

Alternative 1: Do Nothing – The sanitary sewer crossing will continue to be at risk of failure due to channel downcutting and the potential future failure of the downstream armourstone grade control structure. Failure of the grade control structure would likely cause rapid downcutting of the channel immediately upstream, potentially damaging the sewer where it crosses Newtonbrook Creek. Emergency works may need to be undertaken in the future if the sanitary sewer fails.

Alternative 2: Local Works – Apply channel engineering works for about 35-40 metres of channel length within reach N2, focused on a fixed engineered riffle centered overtop of the exposed sanitary sewer crossing to provide a minimum of 0.3 metres depth of cover. Downstream of the riffle a series armourstone ribs will be implemented to replace the function of the existing armourstone grade control structure. Engineered pools will be constructed at the upstream and downstream extents of the proposed local works solution, allowing for a smooth transition into existing channel conditions. The existing armourstone retaining wall will be retrofitted/repaired to continue to provide erosion protection along the outer bend of the channel.

Alternative 3: Sub-Reach-Based Works – Apply natural channel design principles for an extended length, including riffle-pool morphology and bioengineered bank treatments (vegetated buttresses), to build the creek up, establish a minimum of 1.0 metres of cover overtop of the exposed sewer crossing, and limit the protection of the sewer crossing's dependence on the long-term stability of any downstream grade control structures. This solution is part of a proposed 650 metres of channel restoration work intended to increase the depth of cover over three (3) additional sanitary sewer crossings (priority sites #5, #7, and #9), mitigate lateral erosion risks to sanitary sewer infrastructure at five (5) locations (priority sites #8, #19, #20, #22 & #26), and allow 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.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-36**.

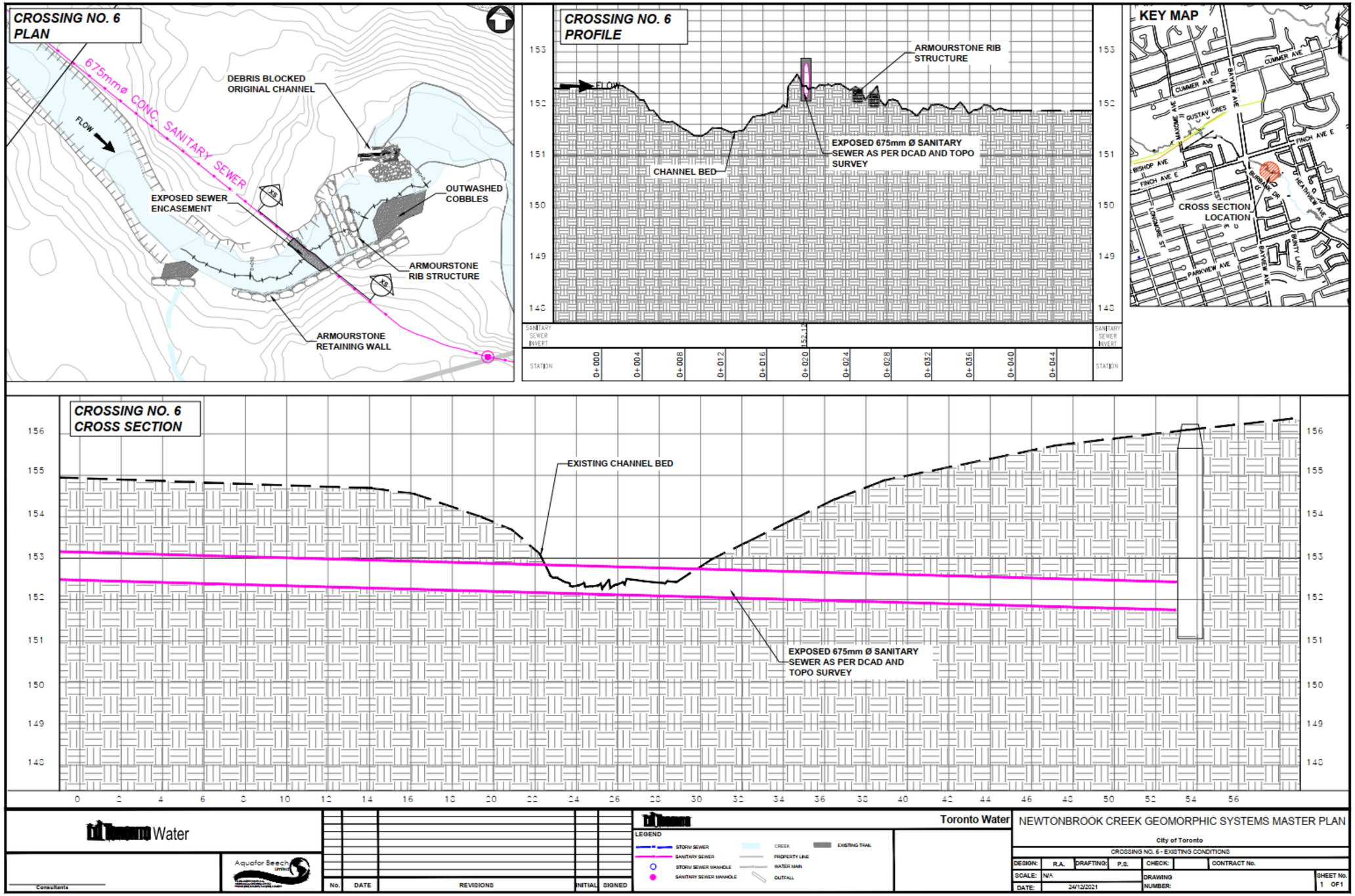

Figure 4-35: Existing Conditions - Priority Site #6

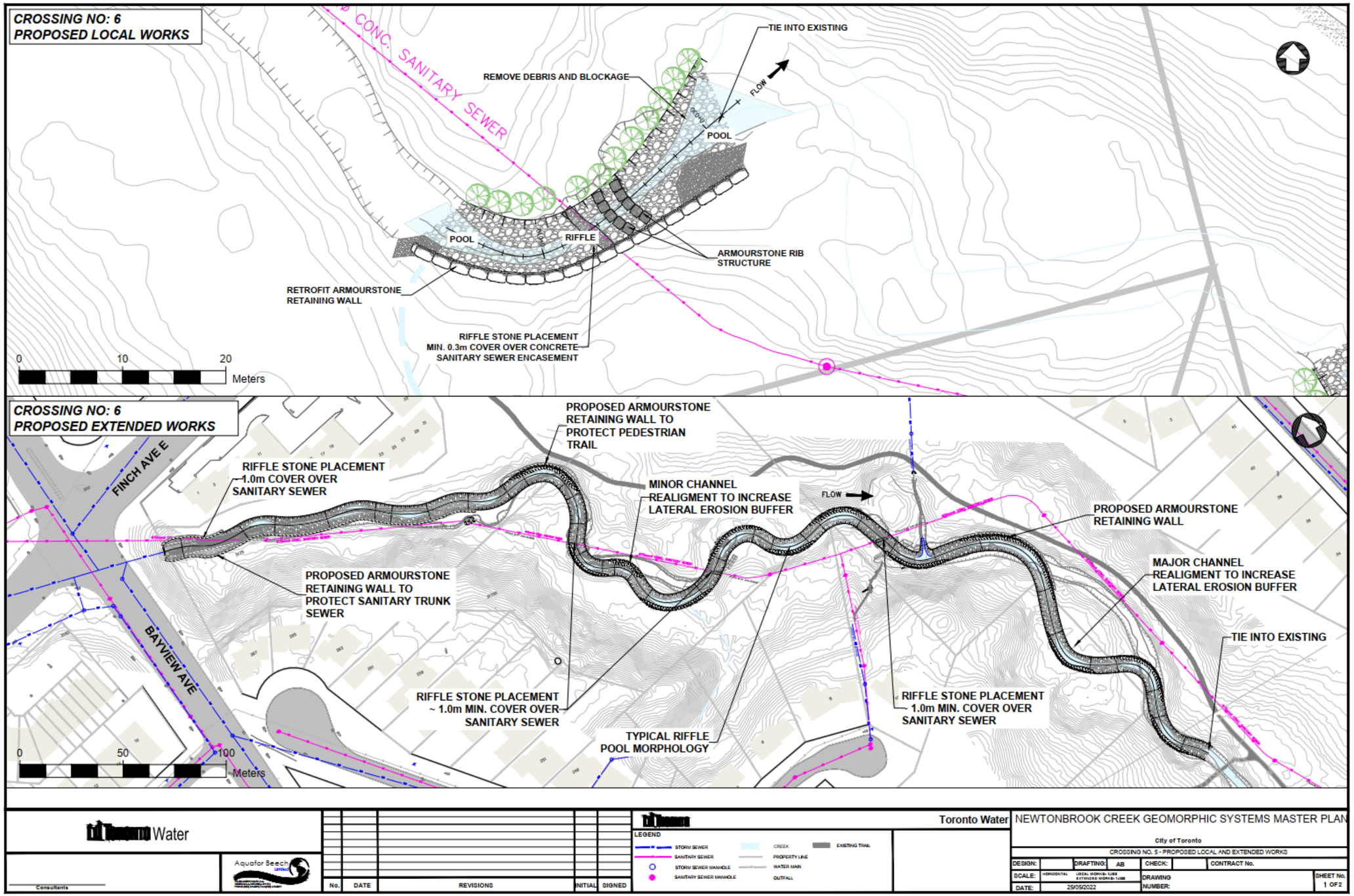

Figure 4-36: Preliminary Design Concepts Alternative 2 & 3 – Priority Site #6

4.8.2 Priority Site #6 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #6 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.

4.8.3 Priority Site #6 – 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 #6 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 58.13/100 while the Do Nothing alternative was the least preferred alternative with a total score of 36.93/100.

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.
- Provide a minimum of 1.0 metres of cover overtop of the exposed 675 mm diameter sanitary sewer crossing.
- Increase the depth of cover overtop of an additional three 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.
- 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 secondary lateral risk sites (Priority Site #19 - SL4032401, 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.
- 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.
- Coordinate permission to enter agreements and/or land/easement acquisitions as required to facilitate construction. Private property impacts to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.9 Priority Site #7: Exposed Sanitary Sewer Crossing Downstream of Finch Avenue and Bayview Avenue

Priority Site #7 is located in Reach N2 of Newtonbrook Creek, roughly 80 metres upstream of Priority Site #6. Similar to Priority Sites #5 and #6, channel incision and widening along Reach N2 has resulted in the exposure of the concrete encasement surrounding the 675 mm diameter sanitary trunk sewer that runs through the Newtonbrook Creek valley corridor. Erosion due to widening is apparent starting well upstream of the encasement where a large erosion scar has formed along the outer bend in the channel (**Figure 4-37**).

The encasement itself shows sign of significant degradation and spalling (**Figure 4-38**), that may eventually necessitate emergency repairs. Similar to the downstream sewer crossings identified as priority sites #5 & #6, the exposed sewer is upstream of a multi-tier armourstone grade control structure, which while still intact is in poor condition (**Figure 4-39**). Some armourstone and riprap bank protection has been implemented along the banks downstream of the exposed encasement (**Figure 4-40**). This site is not associated with any lateral erosion risks to the pedestrian trail system or private property, however, lateral risk site #9 (priority site #19) is located approximately 35-40 metres downstream of the exposed sewer crossing. As a result of the close of proximity of these risk sites, consideration should be given to addressing multiple priority sites as part of a single restoration project/contract.

Figure 4-37: Erosion Scar Along Outer Bank Immediately Upstream of Exposed Sewer Encasement

Figure 4-38: Exposed Concrete Encasement Exhibiting Degradation and Spalling

Figure 4-39: Armourstone Grade Control Structure Downstream of the Exposed Encasement

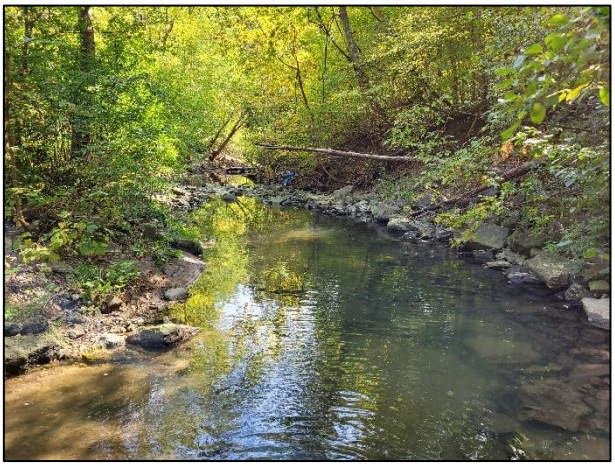

Figure 4-40: Channel Conditions Downstream of the Armourstone Grade Control Structure

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-10** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-41**.

Table 4-10: Summary of Priority Site #7 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4031887
Year of Construction	1960
Diameter	675
Depth of Cover	0 m
Estimated Time to Contact	0 years
Erodibility of Adjacent Substrate	Low

4.9.1 Priority Site #7 – Description of Restoration Alternatives

Alternative 1: Do Nothing – The sanitary sewer crossing will continue to be at risk of failure due to channel downcutting and the potential future failure of the downstream armourstone grade control structure. Failure of the grade control structure would likely cause rapid downcutting of the channel immediately upstream, potentially damaging the sewer where it crosses Newtonbrook Creek. Emergency works may need to be undertaken in the future if the sanitary sewer fails.

Alternative 2: Local Works – Apply channel engineering works for about 25 metres of channel length within reach N2, focused on a fixed engineered riffle centered overtop of the exposed sanitary sewer crossing to provide a minimum of 0.3 metres depth of cover. Immediately downstream of the crossing an armourstone rib will be implemented to replace the function of the existing armourstone grade control structure. Engineered pools will be constructed at the upstream and downstream extents of the proposed local works solution allowing for a smooth transition into existing channel conditions. Existing erosion scars along the banks of the channel will be infilled, regraded and stabilized through the application of coir-matting and restoration plantings.

Alternative 3: Sub-Reach-Based Works – Apply natural channel design principles for an extended length, including riffle-pool morphology and bioengineered bank treatments (vegetated buttresses), to build the creek up, establish a minimum of 1.0 metres of cover overtop of the exposed sewer crossing, and limit the protection of the sewer crossing's dependence on the long-term stability of any downstream grade control structures. This solution is part of a proposed 650 metres of channel restoration work intended to increase the depth of cover over three (3) additional sanitary sewer crossings (priority sites #5, #6, and #9), mitigate lateral erosion risks to sanitary sewer infrastructure at five (5) locations (priority sites #8, #19, #20, #22 & #26), and allow 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.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-42**.

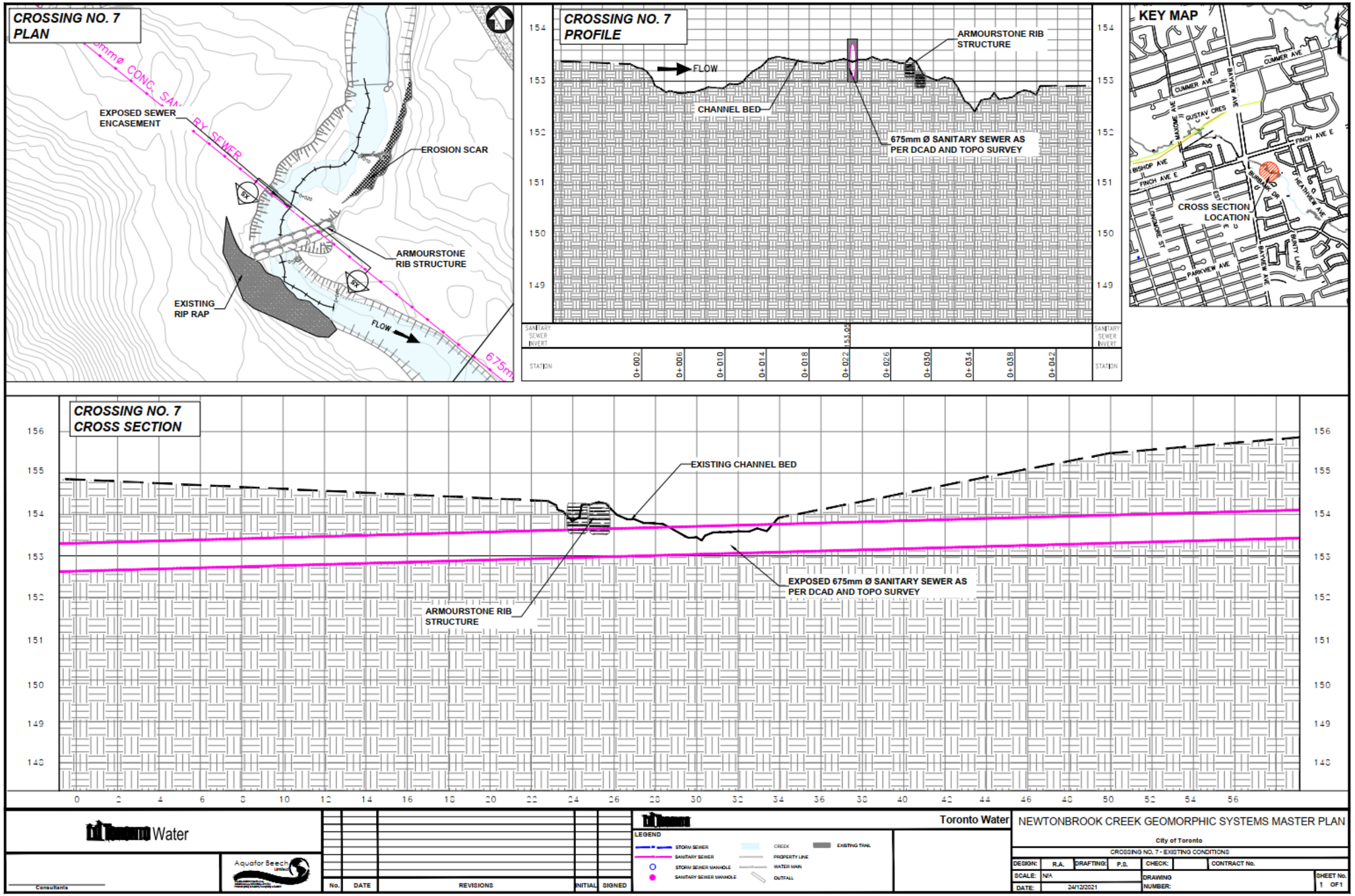

Figure 4-41: Existing Conditions - Priority Site #7

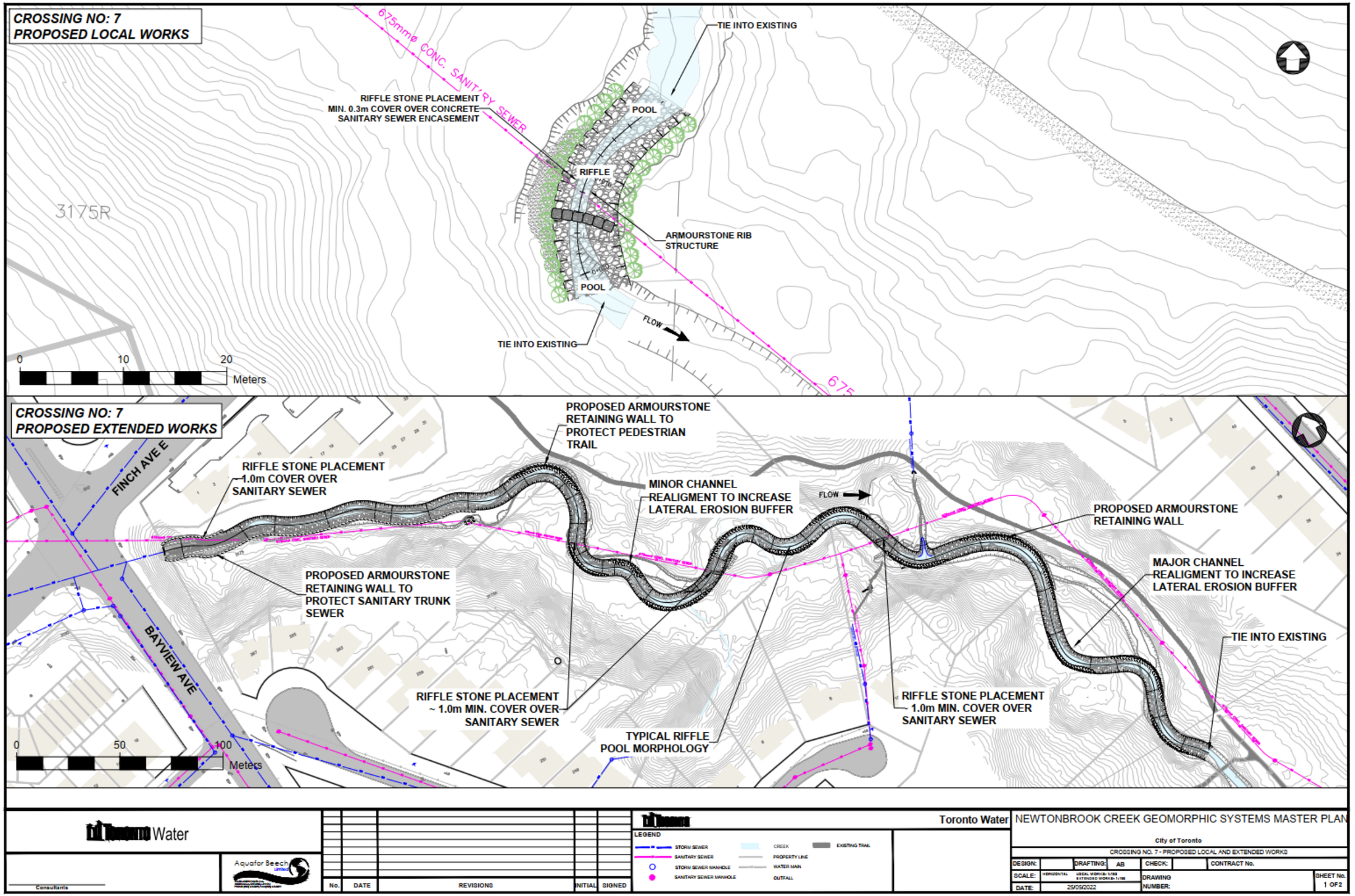

Figure 4-42: Preliminary Concepts Alternative 2 & 3 – Priority Site #7

4.9.2 Priority Site #7 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #7 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.

4.9.3 Priority Site #7 – 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 #7 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 56.00/100 while the Do Nothing alternative was the least preferred alternative with a total score of 36.93/100.

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.
- Provide a minimum of 1.0 metres of cover overtop of the exposed 675 mm diameter sanitary sewer crossing.
- Increase the depth of cover overtop of an additional three 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.
- 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 secondary lateral risk sites Priority Site #19 - SL4032401, 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.
- 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.
- Coordinate permission to enter agreements and/or land/easement acquisitions as required to facilitate construction. Private property impacts to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.