STONYBROOK

August 12, 2020
File 60327

Ms. L. Musson
Town of Oakville
1225 Trafalgar Road
Oakville, Ontario, L6H 0H3

Re: Redoak/Capoak EIR/FSS Addendum Response Document
Third Submission, North Oakville East, Town of Oakville

The second submission of the Redoak/Capoak EIR/FSS Addendum was sent to your attention on October 31, 2019. That submission included both digital copies and hardcopy binders for Town, Region and Conservation Halton staff. The package included a full clean-copy of the Addendum, in addition to tracked changes and response matrices from the first submission. In response, we received comments on the Addendum from the Town of Oakville (April 30, 2020 and May 5, 2020) and Conservation Halton (June 6, 2020) and the Region of Halton (June 22, 2020). The attached Index for the Response Document outlines the content of this submission that addresses each of the agency comments.

Today's submission ('Response Document') is intended to be read in conjunction with the October 2019 Addendum, in that this resubmission is comprised of response matrices and only those portions of the Addendum (text and figures/drawings) that have been amended since October 2019. Digital copies are being provided to the Town for distribution to the Region and Conservation Halton, and only the Region will receive an additional hardcopy of these materials at this time. Once all agencies are satisfied with the Response Document content, the Final Redoak/Capoak EIR/FSS Addendum will be prepared and digital/hardcopies will be provided. This approach was confirmed by Trish Elliott (Capoak Inc. and Redoak G&A Inc.) in discussions with staff at the Town, Region and Conservation Halton.

It should be noted that this EIR/FSS Response Document is also being submitted in conjunction with the Redoak/Capoak Draft Plan of Subdivision application, and as such, includes revised figures/drawings reflecting the March 25, 2020 Draft Plan of Subdivision. Note that the extent of the Redoak/Capoak property limits and some street letters have been amended from the previous submission. Text in Section 6 of the Final Redoak/Capoak EIR/FSS Addendum will include reference to the March 25, 2020 Draft Plan. Section 7, Tab D, has been revised to note that there is no significant change to the overall imperviousness of the Redoak/Capoak lands (i.e., the change to the imperviousness of land draining to Pond 52 is less than 1%) and the total pond drainage area is unchanged. As a result, the Pond 52 design and the EIR/FSS Addendum SWMHYMO model requires no updates in support of the March 25, 2020 Draft Plan.

If you have any questions regarding the content of this document, please contact the undersigned.

Sincerely,

STONYBROOK CONSULTING INC.

Nancy Mather, P. Eng.

Attachments: Redoak/Capoak EIR/FSS Addendum Response Document
c. + attach. Ms. K. Schofield/Mr. P. Crosby/Ms. T. Elliott, Great Gulf
Mr. R. Kerr/Mr. B. Betts, DSEL

STONYBROOK CONSULTING INC.
1595 Sixteenth Ave, Suite 301
Richmond Hill, ON L4B 3N9
P 905.709.7454
F 905.709.7400

REDOAK/CAPOAK EIR/FSS ADDENDUM
RESPONSE DOCUMENT
AUGUST 12, 2020

I N D E X

---

* The only changes made include the revised property limits and/or the inclusion of the March 25, 2020 Draft Plan of Subdivision

---

TAB A

Response to Conservation Halton Comments

Redoak/Capoak EIR/FSS Addendum

RESPONSE TO CONSERVATION HALTON COMMENTS

The Conservation Halton (CH) letter dated June 6, 2020 provided comments on the Redoak G&A Inc. and Capoak Inc. Draft Plan of Subdivision dated February 28, 2019 and supporting studies including the *EIRIFSS Report: Redoak/Capoak Addendum #1 to Joshua's Creek Tributaries EIRIFSS, North Oakville East, Town of Oakville, prepared by Stonybrook Consulting Inc., David Schaeffer Engineering Ltd., Bird and Hale Ltd., R.J. Burnside & Associates Ltd., Beacon Environmental EXP and J.F. Sabourin & Associates Inc., dated October, 2019.*

We have reproduced below CH's comments from Appendix A from their letter followed by a response to each outstanding comment. For easy reference, the CH comment numbering has been followed. Responses have been provided by the EIR/FSS Study Team members.

Appendix A - Detailed Comments

6. **Section 6.1 General Description of Development Plans**, Comment partially addressed. The comment response matrix indicates that chain link fencing will be integrated into the design of the abutting trail and Village Square, but staff could find no mention of this in the Addendum. Recommend adding this text to the Addendum as well. This can be included in the final EIR/FSS Addendum.

   Response: This will be added to the Final EIR/FSS Addendum.

13. **General Comment** – Staff could not locate the text regarding stormwater pond landscaping in the section referenced in the response matrix. Please confirm its inclusion. This can be addressed in the final EIR/FSS Addendum.

    Response: Revised Section 7.12.1, sub-section "Pond Outlet," includes reference to Conservation Halton's Landscaping and Tree Preservation Guidelines for pond landscaping. See Tab F.

14. **Section 4.6.3 Hydraulic Conductivity**, *(pg.16)*: Based on field measured data in RC-4, SWM Pond 52 is located in an area of highly weathered shale. Also, hydraulic conductivity was estimated at 7.75 x 10-3 cm/s and groundwater level was measured some 1 metre above the proposed permanent pool level. The shale hydraulic conductivity and groundwater levels must be considered at the detail design of the Pond 52 and its liner. Options to install a SWM pond subdrain system with potential discharge to JC-36 should be also investigated.

    Response: Section 7.12, Pond Lining, of the Redoak/Capoak October 2019 EIR/FSS Addendum addressed the need for further investigation of the clay liner during detailed design, and the need for geotechnical engineering guidance regarding mitigating measures for subdrain network options.

15. **Section 7.0 Grading, Drainage and Stormwater Management***:* This section of the report should reference the proposed configuration of Pond 52 on the subject lands, which differs from the Final Joshua's Creek EIR/FSS.

    Response: Text has been added in Section 7 to note that the proposed Pond 52 configuration on the Capoak lands differs somewhat from that presented in the Final Joshua's Creek EIR/FSS, however the pond operating characteristics are consistent with the Final Joshua's Creek EIR/FSS. Although the pond layout differs in the figures compared to the Final Joshua's Creek EIR/FSS, the supporting information remains unchanged (i.e., the pond configuration reflected in this Addendum is consistent with the modeling presented in Appendix H-1 of the Final Joshua's Creek). The stage-storage-discharge curve and associated modeling in the Final Joshua's Creek EIR/FSS reflects the pond layout presented in this EIR/FSS Addendum. Text has been added to revised Sections 7.7 and 7.12

(Tab D) to note the different pond configuration and it's consistency with the Final Joshua's Creek EIR/FSS.

16. **Section 7.8.3 External Drainage**, (pg. 33)*:* This section should state the drainage area for Dundas Street External Area 2.

    Response: Revised Section 7.8.3, Tab F, includes the drainage area for Dundas Street External Area 2.

17. **Section 7.11 Preliminary Grading Plans***, (pg. 38):* This section should describe the proposed drainage path for the 0.4 ha property west of the proposed retaining wall at Street P, including the headwall shown on Drawing 7J.

    Response: Section 7.11 has been revised to add text describing drainage patterns for the property to the west. See Tab F. (Note: Street P has been relabeled Street C).

18. **Table 7.15: Pond 52 Inflow/Volume Characteristics***, (pg. 40):* CH staff request confirmation that the "Storage Provided" column is valid for the proposed configuration of Pond 52. If not, this column should be revised.

    Response: See response for Comment 15. The "Storage Provided" column is valid for the proposed Pond 52 configuration.

19. **Drawing 6A Trail Grading Plan***:*

    a. Grading between Section 2-2' and Section 1-1' should be revised to balance the grade difference between the NHS and development lands per NOCSS requirements.

    Response: Grading between Section 2-2' and Section 1-1' has been revised to balance the grade difference between the NHS and development lands. See revised Drawing 6A, Tab G.

    b. Proposed grades along the southwest edge of the Village Square should be revised where 0.4 m difference in elevation are proposed immediately adjacent to the NHS boundary.

    Response: The grading plan in the Village Square has been revised to reflect the latest Village Square concept plan. Note that the 0.4m of elevation difference is a result of the flat (< 2%) grading within the block, to provide the maximum usable space. Proposed sloping is within the park block and not within the NHS. The grading details of the park block and NHS interface can be further refined at detailed design in accordance with NOCSS grading requirements. See revised Drawing 6A, Tab G.

20. ***Drawing 8C Sections****:*

    a. The following sections should be revised to be consistent with the elevations and lot layouts shown on grading plans: Section 1-1', Section 2-2', Section 4-4', and Section 6-6'.

    Response: Sections 1-1', Section 2-2', Section 4-4', and Section 6-6' have been revised and are consistent with the elevations and lot layouts shown on the grading plans. See revised Drawing 8C, Tab G.

    b. Recommend revising proposed grading at Section 1-1' and 5-5' to balance the grade difference between the NHS and development per NOCSS requirements.

    Response: Grading at Section 1-1' and Section 5-5' has been revised to balance the grade difference between the NHS and development lands. See revised Drawing 6A, Tab G.

21. ***Appendix H1****:* CH staff request confirmation that the sizing calculations for Pond 52 are valid for the proposed configuration of Pond 52. If not, this appendix should be revised.

    Response: See response for Comment 15. No revisions to Appendix H1 are needed.

22. ***Appendix H5****: Redoak/Capoak Storm Design Sheets, Detailed Tributary Plans, and Cut-off Swale Sizing:* This appendix should include cut-off swale sizing, or the appendix should be renamed.

    Response: Appendix H5 has been revised to include cut-off swale sizing. See Tab F.

TAB B

Response to Town of Oakville Comments

Redoak/Capoak EIR/FSS Addendum

RESPONSE TO TOWN OF OAKVILLE COMMENTS

The Town of Oakville (Town) letters dated April 30, 2020, and May 5, 2020, provided comments on the Redoak G&A Inc. and Capoak Inc. Draft Plan of Subdivision dated February 28, 2019 and supporting studies including the *EIRIFSS Report: Redoak/Capoak Addendum #1 to Joshua's Creek Tributaries EIRIFSS, North Oakville East, Town of Oakville, prepared by Stonybrook Consulting Inc., David Schaeffer Engineering Ltd., Bird and Hale ltd., R.J. Burnside & Associates Ltd., Beacon Environmental EXP and J.F. Sabourin & Associates Inc., dated October, 2019.*

We have reproduced below the Town's comments followed by a response to each comment. For easy reference, the Town's comment numbering has been followed where available. Responses have been provided by the EIR/FSS Study Team members.

Engineering& Construction and Development Engineering Comments, May 5, 2020
General Comments:

a) The applicant is to investigate the land requirements for hydro appurtenances such as switch gears. This may require to include designated lands within the draft plan. Hydro infrastructure is to be located within town lands.

Response: This comment was discussed with the Town on June 4, 2020, The grading plan shows two potential locations for the switch gears. See Drawing 7J and 7K, Tab G. The preliminary locations shown on the grading plan are within the pond block and within the Village Square, south of the pond block. As discussed, these locations have not been endorsed by Oakville Hydro and are simply shown as a placeholder to be determined at detailed design.

b) Any streets that currently dead end and are not built in conjunction with the adjacent development lands, the street will require a temporary turnaround at the end of the street with a minimum radius of 13m and to the satisfaction of the Town. No roads shall dead end when more than one lot deep.

Response: Drawings 7J and 7K, Tab G, have been revised to illustrate how the roads can function prior to the adjacent development. With the current road layout, a combination of barricades and temporary lanes can be provided to allow for traffic movement without dead ends. It should be noted that the Dunoak property to the east is draft plan approved and has submitted a detailed design plan. As such, it is expected that roads in the adjacent plan will be constructed prior to or concurrent with the Redoak/Capoak development. A brief text explanation will also be added in Section 10 of the Final EIR/FSS Addendum.

c) The minimum roadway profile gradient is 0.5%

Response: Noted. All roadway profiles have a minimum gradient of 0.5%.

d) The berm in between the forebay and the main bay is to be submerged as to not be visible to the general

Response: Figure 7.3C, Drawing 7J, and Drawing 7K have been revised to show a submerged berm between the forebay and the main bay. This is also reflected in the detailed design of Pond 52 as part of the Dunoak subdivision.

Functional Servicing Report Comments:

Figure 7.1 - Conceptual Storm Servicing: Any servicing within the subject Redoak/Capoak lands road R.O.W. that is not within the scope of standard road sections (STD 7-20 to STD 7-24B) must have a detailed cross section showing all proposed services including all details such as depth, sizing, distances, utility locations, and lane dimensioning. If all servicing can be accommodated in accordance to the standards, provide a response to indicate as such.

Response: New Figure 10.6C, Tab G, has been added to illustrate maintenance details of the servicing within the Redoak/Capoak lands. The following text will be added to Section 10 in the Final EIR/FSS Addendum, "Figure 10.6C has been included to show a non-standard 17m ROW (i.e. a 17m ROW with a box sewer) that applies to Street B south of Street D where sewers are the deepest. As shown in Figure 10.6C, the storm sewer, sanitary sewer, and watermain can be accommodated within the roadway. The figure also shows how the box sewer can be accessed and maintained in the future. As shown, a temporary barrier can be placed between the trench excavation and travel lane to allow for maintenance on the sewer while still keeping a minimum 3.0m temporary travel lane."

Figure 7.3C – SWM Pond 52, Ultimate Expanded: A 10:1 bench is required in the 7.5m buffer, indicate as such.

Response: Figure 7.3C, Drawing 7J, and Drawing 7K, Tab G, have been revised to show a 10:1 bench in the 7.5m buffer.

Drawing 7J – Preliminary Grading Plan and Drawing 8C – Sections

a) Not enough detail is shown to indicate how the urban core blocks will be matching Dundas Street. This may require cross sections to provide more clarity. Region of Halton approval required to be forwarded to the Town.

   Response: This comment was discussed with the Town on Thursday June 4, 2020. The grading shown on the DUC block is temporary until the development of the site plan. The block is currently graded to provide drainage towards the control MH and match existing grades at Dundas Street. When the site plan is designed the Dundas Street road grades should be confirmed. Section 7.11 of the EIR/FSS, Tab D, has been revised to address transition grading concerns between the DUC and Dundas Street.

b) The grading along the RedOak/Capoak and Dunoak property line is not matching. What is the timing for the two developments? Provide a response as to what the timing is and match the grading accordingly.

   Response: Drawing 7J and 7K have been revised so grading along the Redoak / Capoak and Dunoak property lines are consistent. Dunoak is currently in detailed design and is anticipated to develop ahead of the Redoak / Capoak lands. The Redoak/ Capoak grading will match the adjacent grading on Dunoak.

c) Street I: The Town is protecting for the possibility to extend Street I to Eight Line in the future. To ensure the street can be extended, the applicant is required to provide a grading plan to show how the street grading can be accommodated by including a profile from Street I to Eight Line. Ensure the road is a maximum of 4.0%.

Response: Drawing 7J and 8C, Tab G, has been revised, with associated text in Section 7.11, Tab D, to include a plan and profile for the future extension of Street I (now Street D) to Eighth Line. The proposed road grade is less than 4%.

d) Street D: There is a proposed 3m retaining wall at the intersection of Street D and Dundas Street adjacent to a small remnant piece of land owned by the Region. Part of the remnant lands and will be required for a daylight triangle. The retaining wall will be a sight line issue, also the retaining wall will have a negative effect on the future development of the DUC and would be an unsightly visual for this area. The Town suggests that the remnant lands be incorporated into the DUC block and grading is adjusted to preferably eliminate the retaining wall or significantly lower the wall.

Response: Drawing 8C has been revised, with associated text in Section 7.11, to present two grading options for the current Region's property. The options include: providing a retaining wall on Street D (now Street B), and grading into the adjacent property. Discussions are ongoing with the Region to provide permission for grading on this property.

Development Engineering Memorandum, April 30, 2020
Second Submission Review

1. Minor and Major System Designs, Section 7.8

a. Comment addressed. We are satisfied that the ultimate (expanded) pond design is based on the Final Joshua Creek Tributaries EIR/FSS (Aug. 2019).

Response: Noted.

b. In addition to the information requested, Appendix H-1 also contains Conceptual Servicing Option 1 and Conceptual Servicing Option 2, both labelled Figure H-1A. Two separate servicing options were not discussed in Section 7.8.1 and we would appreciate clarification of the options. Appendix H-5 provides the requested storm sewer design sheet however the design sheet does not match the detailed tributary plans, Figure H-1A. For example, the sewer from MH.105 to MH. 106 is 1200mm diameter at 0.3% whereas on Figure H-1A it is 1200 x 1800 concrete box sewer. Furthermore, the design sheet provided does not indicate substandard (0.15%) sewer slopes on Street A from Dundas Street discussed in Section 7.8.1 of the EIR/FSS Addendum. All sewers in the design sheet reflect 0.3% slope. We also note that Appendix H-5 is missing the cut-off swale sizing information. Further review and comments to follow under separate cover.

Response: We assume that this comment relates to Street B, not Street A. Section 7.8.1 has been revised to explicitly discuss the separate storm sewer connection options. See Tab D. Conceptual Servicing Options 1 and 2 are illustrated under separate figures within Appendix H; labelled H-1A and H1-B. The design sheets in Appendix H-5 have been revised to reflect the two conceptual servicing options, and include cut-off swale sizing information. See Tab F for revised Appendix H-5.

c. Thank you for clarifying in Section 7.8.1 and inclusion of these areas in the storm sewer design sheet, Appendix H-5. However, we note that the design sheet only indicates capture and conveyance of the 5 year storm event. Please revise and resubmit accordingly.

Response: Appendix H-5 has been revised to include the capture and conveyance of the 100 year storm event. See Tab F.

2. **Grading Plans, Section 7.11, Dwg. 7J, 7K and 8C**

   a. The additional information provided in Section 7.11 describing the extent of retaining wall needed on Street B and Street I as well as the justification for the walls. Further review and comments to follow under separate cover.

      Response: Noted. Section 7.11 has been revised to add text further discussing the potential to grade into the adjacent property to the west. (Note: Street I is now labeled as Street D).

   b. This information was missing from Appendix H-5.

      Response: See response to Comment 1 c).

3. **SWM Pond Operating Characteristics, Section 7.12** – comment addressed.

   Response: Noted.

4. **Monitoring** – Comment addressed. We look forward to your submission prior to the commencement of the monitoring program. In order to ensure a timely start to the monitoring program, please submit the terms of reference to the Town prior to servicing.

   Response: Noted.

Draft Plan of Subdivision:

5. We appreciate the additional information provided on Drawings 6A and 8C. We note that Cross Section 2-2 does not match Dwg. 6A at that location. Please revise. We also note the potential to combine the propose trail with the sidewalk on the window road portion of Street P. Trails Planning and implementation are deferred to the Department of Parks & Open Space.

   Response: Cross-section 2-2 has been revised. See revised Drawing 6A, Tab G. Text to describe the potential combination of trail and sidewalk will be added to Section 6.1 in the Final EIR/FSS Addendum. The ultimate trail and sidewalk integration can be investigated further at detailed design. (Note: Street P has been relabeled Street C).

TAB C

Response to Region of Halton Comments

Redoak/Capoak EIR/FSS Addendum

RESPONSE TO REGION OF HALTON COMMENTS

The Region of Halton (Region) letter dated June 22, 2020 provided comments on the Redoak G&A Inc. and Capoak Inc. Draft Plan of Subdivision dated February 28, 2019 and supporting studies including the *EIRIFSS Report: Redoak/Capoak Addendum #1 to Joshua's Creek Tributaries EIRIFSS, North Oakville East, Town of Oakville, prepared by Stonybrook Consulting Inc., David Schaeffer Engineering Ltd., Bird and Hale ltd., R.J. Burnside & Associates Ltd., Beacon Environmental EXP and J.F. Sabourin & Associates Inc., dated October, 2019.*

We have reproduced below the Region's comments followed by a response to each comment. For easy reference, comment numbering has been provided for the Region's comments. Responses have been provided by the EIR/FSS Study Team members.

1. **Wastewater Servicing**

   The Addendum to the FSS notes that the wastewater servicing of this subdivision will be by an internal gravity sewer system that will convey flows southward through a sub-trunk sewer on the proposed Street B where a connection will be made to the existing sanitary trunk sewer located on Dundas Street East. None of the areas in this development will rely on draining flows to the adjacent developments external to this draft plan of subdivision.

   Response: Correct.

2. **Water Servicing**

   a) The Addendum to the FSS notes that the lands will be serviced for water from the existing 400 mm diameter watermain on Dundas Street East as well as connections to the existing watermain on Eighth Line. The main connection will be available to provide a feed to the lands from this existing watermain on Dundas Street and this connection will be at Street B. The secondary connections will be made at Streets A, K and J at Eighth Line. Additional future watermain connections will also be provided on the eastern side of the subdivision once the water system in the adjacent development is constructed.

      Response: Correct.

   b) The Addendum to the FSS does not address dead end watermains. The proposed road and lot fabric proposed for the subdivision will result in some streets being temporary dead ends until the adjacent lands to this subdivision are developed. The watermains on these streets that have temporary dead ends are a concern to the Region due to the water quality issues associated with dead end watermains and the Regional resources required to flush these mains on a regular basis. Consideration should be given in the Addendum to the FSS that addresses a program for flushing of dead end watermains or providing temporary looping of these mains. Some temporary looping of watermains may require external temporary easements on the adjacent lands.

      Response: The Redoak/ Capoak watermain system has been designed to connect to the adjacent Dunoak subdivision. The adjacent Dunoak lands are currently draft plan approved and are undergoing detailed design. Development on the Dunoak lands will proceed prior to or concurrent with the Redoak/Capoak lands. Therefore, the need for temporary dead ends is not anticipated. Section 9 has been revised to include discussion on the timing of development on adjacent lands and the potential need to address dead end watermains at detailed design. See Tab E.

c) The FSS indicates that no local watermain is required along the frontage of the Dundas Urban Core blocks. Typically, a local watermain is required on this frontage to provide fire protection and watermain looping for these blocks. There appears that there are insufficient existing hydrants located on the north side of Dundas Street across the frontage of these blocks. A local watermain or additional hydrants on the existing 400mm dia. watermain may be required across this frontage to provide fire protection for these blocks.

Response: Upon investigation, there is an existing hydrant on the north side of Dundas Street where the west edge of the DUC block meets the neighbouring property. This hydrant has been added to ***Figure 9.1****, Tab G. Text has also been added in revised Section 9, Tab D, to discuss the potential for an additional hydrant or hydrants on the existing 400mm diameter watermain. Potential locations for the additional hydrant have been identified on revised* ***Figure 9.2****, Tab G. The need for additional hydrants, and locations on Dundas Street can also be investigated further through the detailed design of the Dundas Urban Core Blocks.*

d) No water modeling or sizing of the proposed watermains was provided in the Addendum of the FSS.

Response: Water modelling has been provided in new Appendix V; Tab F, which addresses watermain sizing, flows, pressures, and the proposed water pressure zone realignment.

e) The proposed development will be located within the Region's Zone 4 pressure area and that no pressure zone interfaces will be located in the vicinity of this subdivision.

Response: Noted.

f) The proposed watermain system in this subdivision is comprised of local watermains with the largest sized main being 300mm diameter. No DC reimbursable watermains are located within this subdivision.

Response: Noted.

3. Water Pressure Zone Realignment

a) The Region is currently undergoing a program to realign the water pressure zones in the Region. As part of this program, it is proposed to implement both an interim zone condition and an ultimate zone condition within the Region's water distribution system. The timing of implementing the new pressure zone boundaries may take several years to complete. It is possible that the proposed development may be impacted by the changes to the pressure zones in both the interim and ultimate conditions depending on the timing of the implementation of these changes. Please note that minimum service levels for both water pressure and flow will be maintained throughout the Region during this process. Residents may notice changes to their water pressure when the zones are changed over from the existing zone to the interim zone and also when the interim zone is changed to the ultimate zone.

Response: Noted.

b) The Region requires that the Addendum of the FSS be revised prior to engineering drawing submission to include water modelling of the development that addresses watermain sizing, flows, pressures, dead-end watermains and the proposed water pressure zone realignment.

Response: See response to Comment 2 d). The watermain modeling is based off the latest model from the Region of Halton (May 2020).

4. Existing Private Water Well & Septic System Decommissioning

Any existing wells and septic systems, if present on the site are to be decommissioned and removed from the site according to the proper MOE guidelines.

Response: The Final Joshua's Creek EIR/FSS notes that any wells onsite will require decommissioning. There are no septic systems onsite.

5. Storm Water Drainage on Regional Roads

Dundas Street East that is adjacent to this subdivision was just recently reconstructed and urbanized in 2012. The Addendum to the FSS notes that there is small portion of one of the Dundas Urban Core blocks (0.2ha) that drains toward Dundas Street East. There is also a small area (0.7ha) of Dundas Street East that contributes storm drainage from the roadway that drains into this subdivision that eventually goes to the proposed SWM Pond 52 that is located in the adjacent subdivision to the east.

Response: Correct.

6. Grading on Street B at Dundas Street East

Please note that the Addendum to the FSS notes that a proposed 3.0m high retaining wall will be required on the west side of this roadway adjacent to the remnant parcel of property that is owned by the Region. This wall appears to be located within the future daylight triangle at this intersection and has potential impacts to this intersection as well as the DUC block. The status of this remnant Regional land holding should be reviewed by the Region to see if it can be incorporated into the DUC block.

Response: Section 7.11, Tab D, has been revised to add text discussing an option to grade into the adjacent property on Street B.

TAB D

Changes to Section 7, Stormwater Management

Redoak/Capoak EIR/FSS Addendum

7.0 GRADING, DRAINAGE AND STORMWATER MANAGEMENT

7.1 Introduction

Section 7.0 of the *Final Joshua's Creek EIR/FSS* addresses SWM requirements including discussion on OPA 272 and NOCSS recommendations, updated subcatchment boundaries, pre-development flows at Dundas Street, unit target flow rates, storm drainage criteria, drainage area modifications, management of external drainage, proposed SWM pond locations and designs, major/minor system designs, drainage to/from PSWs and preliminary grading plans.

This Addendum has not reproduced all of Section 7 matters from the *Final Joshua's Creek EIR/FSS*; rather, it includes key recommendations from the *Final Joshua's Creek EIR/FSS* affecting the Redoak/Capoak lands and provides updated analyses affecting grading and the design of SWM systems for the Redoak/Capoak lands and subcatchments JC17, JC17A, JC17B, JC17C and a small portion of EM4. In doing so, it reflects the *Final Joshua's Creek EIR/FSS* storm drainage designs in these subcatchments, including Pond 52 design.

The Redoak/Capoak lands are located within portions of subcatchments JC17, JC17A, JC17B and JC17C that drain to the western tributary of Joshua's Creek, as well as a small portion of EM4 which drains to the East Morrison Creek, as illustrated on **Figure 4.2**. The developable portions of the Redoak/Capoak lands lie within subcatchments JC17, JC17A, JC17B and EM4. Portions of Core 10 on the Redoak/Capoak lands lie within subcatchments JC17 and JC17C. Runoff from the Redoak/Capoak lands drains easterly though the adjacent Dunoak lands into Stream Reach JC-36. As set out on **Figure 7.1** from the *Final Joshua's Creek EIR/FSS* (Appendix P herein), the developable subcatchments JC17, JC17A, JC17B and EM4 are referred to as External Area 7. A portion of the Redoak/Capoak lands, within the EM4 subcatchment, is referred to as External Area 9.

The *Final Joshua's Creek EIR/FSS* describes the proposed stormwater management concept for developing lands draining to Stream Reaches JC-36/JC-27A. This includes proposed Pond 52 that will outlet to the upper end of Stream Reach JC-36, the Dundas Street box sewer and its independent outlet to JC-36, and a Core 10 clean water pipe that will outlet to Stream Reach JC-27A on the Dunoak lands.

This Redoak/Capoak EIR/FSS Addendum addresses Pond 52 design reflecting the requirements set out in the *Final Joshua's Creek EIR/FSS* and the proposed Redoak/Capoak Preliminary Development Plan. This Addendum does not change the Pond 52 design or the clean water pipe location from that shown in the *Final Joshua's Creek EIR/FSS*.

The following recommendations from the *Final Joshua's Creek EIR/FSS* were utilized to update the SWM requirements for the Redoak/Capoak lands.

a) The *Final Joshua's Creek EIR/FSS* Sections 7.2 and 7.3 address refined subcatchment boundaries and pre-development flows. That report updated all subcatchment boundaries based upon LiDAR mapping, compared them to NOCSS drainage area boundaries and concluded that the resulting change in EIR/FSS boundaries is small and that the NOCSS target unit flow rates for

Joshua's Creek subcatchments are valid for SWM pond design. This work remains valid and no changes are required to Sections 7.2 and 7.3.

b) *Final Joshua's Creek EIR/FSS* Section 7.1 notes that the NOCSS completed a preliminary assessment of the required numbers and locations of SWM ponds to meet the SWM design criteria. NOCCS and the *Final Joshua's Creek EIR/FSS* recommend SWM Pond 52 for the management of water quality and quantity in the JC17A and JC17B subcatchments that contain the Redoak/Capoak and Dunoak lands. The Redoak/Capoak Preliminary Development Plan reflects the Pond 52 Ultimate Expanded design presented in the *Final Joshua's Creek EIR/FSS*. No changes are made to the location, shape/size and operating characteristics of Pond 52 set out in the *Final Joshua's Creek EIR/FSS*. **Figure 7.3Cb** has been replaced with new **Figure 7.3C** illustrating the Ultimate Expanded Pond 52 design. Section 7.7 and 7.12 provide further discussion on Pond 52 design.

c) *Final Joshua's Creek EIR/FSS* Section 7.4 presents the SWM strategy. As outlined in the *Final Joshua's Creek EIR/FSS* Section 8.8, in addition to end-of-pipe SWM ponds, proposed Low Impact Development (LID) measures include, "…*designing grades to direct roof runoff towards pervious areas (e.g., lawns, side and rear yard swales) throughout the development, where possible, as well as construction of tree pits along all roads where technically feasible and 1,300m of swales in the NHS*." These types of LID measures will be implemented on the Redoak/Capoak lands. In doing so, the length of swales in the NHS will increase by an additional 180m to total 1,480m (the *Final Joshua's Creek EIR/FSS* did not include any NHS swales on the Redoak/Capoak lands). Section 8.8 describes the function of the LID swales within buffers to features as conveyance swales that provide water quality benefits.

d) *Final Joshua's Creek EIR/FSS* Section 7.5 outlines the need for Regional Storm controls; no changes are required to this Section.

e) The erosion exceedance-duration analysis in Section 7.6 of the *Final Joshua's Creek EIR/FSS* remains unchanged. Revised Section 7.12 included herein summarizes Regional Storm control requirements within SWM Pond 52.

f) *Final Joshua's Creek EIR/FSS* Sections 7.7 discusses SWM pond requirements and 7.8 discuss major and minor system design. Revised Sections 7.7 and 7.8 are included in this Addendum addressing Pond 52 and revisions to external drainage areas.

g) *Final Joshua's Creek EIR/FSS* Section 7.9 discusses drainage area modifications. This Addendum provides further detail/justification related to the drainage exchange between EM4 and JC17B.

h) *Final Joshua's Creek EIR/FSS* Section 7.10 addresses drainage into and out of adjacent PSWs. This section has been updated based on the field staking of PSW 27 and 28 boundaries and the review/confirmation of drainage conditions on the Redoak/Capoak lands. See Section 7.10 and revised Table 7.10.

i) *Final Joshua's Creek EIR/FSS* Section 7.11 includes discussion and drawings presenting preliminary grading on the Redoak/Capoak lands. The *Final Joshua's Creek EIR/FSS* did not provide a preliminary grading plan for the Redoak/Capoak lands. This Addendum adds new

Drawings **6A**, 7J, 7K and 8C presenting preliminary grading information for the Redoak/Capoak lands.

j) *Final Joshua's Creek EIR/FSS* Section 7.12.2, notes that NOCSS Addendum recommendations require that the surface storage volumes in topographic depressions be identified and comparisons made to SWM pond storage design. There are no depression storage/topographic depressions identified on the Redoak/Capoak lands. As such, no changes are required to Section 7.12.2.

k) There are no floodplains on the Redoak/Capoak lands. The *Final Joshua's Creek EIR/FSS* completed the floodplain analysis along Stream Reach JC-36/JC-27A which has not been replicated in this Addendum.

l) As noted in the *Final Joshua's Creek EIR/FSS,* with the Ultimate Expanded Pond 52 and the development of the Redoak / Capoak lands and the Dunoak Phase 1 lands, there is no increased flood risk downstream of the Dunoak property boundary. The Pond 52 design allows the Redoak/Capoak/Dunoak Phase 1 properties to develop without causing downstream increased flooding and without the need to finalize the clean water pipe outlet location, or the Argo EIR/FSS Addendum.

For the reasons noted above, the following sections are amended by this Addendum.

7.6 Erosion Control Analysis

Section 7.6 of the *Final Joshua's Creek EIR/FSS* presents methodologies and findings of the erosion threshold analyses, continuous simulation hydrologic modeling and erosion exceedance analyses completed to establish erosion control design criteria for all SWM ponds in the EIR Subcatchment Area.

Section 7.6.1 of the *Final Joshua's Creek EIR/FSS* discusses the erosion thresholds applicable to this assessment; it remains unchanged.

Section 7.6.2 of the *Final Joshua's Creek EIR/FSS* discusses the erosion exceedance analyses. The approach taken to the identification of the preferred pond designs and exceedance model results attempts to match post to pre-development cumulative effective work and cumulative effective discharge, while attempting to minimize, where possible, changes in post development time of exceedance and number of exceedances. Two post-development scenarios were simulated including:

- **Scenario A ("Theoretical SDS**") based on theoretical stage-discharge-storage curves for all eleven (11) SWM ponds in the Joshua's Creek subwatershed; and,
- **Scenario B ("Proposed SDS**") based on the proposed stage-discharge-storage curves with control structure designs for Ponds 48, 50, 52, 54, 55, and 56, and theoretical stage-discharge-storage curves for the remaining five (5) ponds where FSS level of detail is not available.

For each Scenario, erosion control storage volumes and detention times were determined (see Tables 7.7A and 7.7B, Section 7.6.2 of the *Final Joshua's Creek EIR/FSS*). Based on these assessments, ranges of volumes (Scenario A to B) were recommended for each pond design. Recommendations for Pond 52

were identified to be 160-179 m^3/imp. ha and a detention time of 46 to 48 hours. For a detailed description of the erosion modelling methodology, refer to Section 7.6.2 of the *Final Joshua's Creek EIR/FSS*.

There are no changes to the erosion control volume recommendations for Pond 52 from the *Final Joshua's Creek EIR/FSS.*

7.7 Proposed SWM Ponds

As noted in Section 7.0, NOCSS completed a preliminary assessment of the required numbers and locations of SWM ponds to meet the SWM design criteria. It presented preliminary locations for ponds in each subcatchment in North Oakville East. NOCSS Figure 7.4.6 illustrates nine potential SWM ponds in the EIR Subcatchment Area.

The Mediation Agreement on Ponds Outside of Cores and Linkages, dated June 19, 2007, was prepared to agree upon SWM ponds for incorporation into the NOCSS. It includes graphics and commentary on each proposed pond locations provided on NOCSS Figure 7.4.6. With reference to JC17A/JC17B Subcatchments, NOCSS identifies one proposed SWM pond (Pond 52) located at the upstream end of Stream Reach JC-36. The mediation agreement acknowledges that the ponds illustrated are conceptual only, illustrating the general number and location of ponds. It concluded that the number, location and size of ponds will be finalized through EIR studies. This EIR/FSS Addendum is consistent with the SWM Pond 52 design presented in the *Final Joshua's Creek EIR/FSS*, which has taken into account the drainage and grading analyses completed for the Redoak/Capoak lands. Revised **Figures 7.1, 7.2** and **7.3C** illustrate the location/size of SWM Pond 52, which is consistent with SWM Pond 52 Ultimate Expanded design and contributing drainage area.

The design of SWM Pond 52 is provided in this Addendum. Text in the *Final Joshua's Creek EIR/FSS*, Section 7.7 regarding Pond 52, is modified as outlined below:

- **Pond 52** is located largely on the adjacent Dunoak property and partially on the Redoak property. The *Final Joshua's Creek EIR/FSS* initially provided interim and ultimate conditions pond designs with and without development on the Redoak/ Capoak lands. The Redoak/Capoak lands intend to develop/construct SWM Pond 52 on their lands concurrent with the construction of SWM Pond 52 on the Dunoak lands. With the participation of the Redoak/ Capoak lands, this interim condition no longer needs to be addressed. The SWM Pond 52 design in this Addendum is the same as the "Ultimate Expanded" pond presented in the *Final Joshua's Creek EIR/FSS*.

  Figure 7.2 illustrates the ultimate drainage area to SWM Pond 52. **Figure 7.3C** presents the SWM Pond 52 Ultimate Expanded conditions pond design. **Figure 7.2** also reflects the Redoak/ Capoak Draft Plan of Subdivision dated March 25, 2020. The updates to the Draft Plan include a change to the limit of the DUC Blocks at the south end of the site. The total pond drainage area is unchanged as a result of the new draft plan and there is no significant change to the overall imperviousness of the catchment (i.e., the change to the imperviousness to the pond is less than 1%). As a result, the EIR/FSS Addendum SWMHYMO model requires no updates in support of the March 25, 2020 Draft Plan.

  The review of drainage from the EM4 catchment area east of Eighth Line has been completed. Section 7.9 presents the review of options to the diversion of runoff from a small area of EM4 to

JC-17B. Based on the review of options and the drainage proposal for a site plan application for a portion of the EM4 catchment currently before the Town, as shown on revised **Figure 7.**2 and **Figure 1.2**, the preferred approach to managing drainage from EM4 adjacent to the Capoak lands is to maintain drainage from 1.2ha of the 3.7ha catchment to the south (remains in the EM4 catchment) and directing the remaining 2.5ha easterly through the Redoak/Capoak lands into Pond 52 as shown on Drawing 9 in Appendix Q.

The SWM Pond 52 target release rates are described in the *Final Joshua's Creek EIR/FSS*. As described in that report, the target release rates are not simply a NOCSS unit release rate multiplied by drainage area for Pond 52. The combined outflow from Pond 52 and the Dundas Box Sewer must not exceed pre-development flows at the Argo property boundary (not accounting for the flows from the clean water pipe). Essentially, the pre-development flows to the Argo property line, minus the pre-development flows that are not tributary to Pond 52 sets a combined target outflow for Pond 52 and the Dundas Street Box. The combined target flows minus the "uncontrolled" flow from the Dundas box results in the target flow for Pond 52. Pond 52 provides over-control for the 2.5ha diversion from East Morrison Creek and the uncontrolled Dundas Street drainage through the box. **Table 7.15** presents the Pond 52 target outflow rates.

The *Final Joshua's Creek EIR/FSS* noted that there is also a 1.2ha area of Core 10 that's drainage pattern is unclear based on existing topographic information. As part of this EIR/FSS Addendum, additional topographic data was obtained that indicates that any surface water overflow from PSW 28 would drain southerly towards PSW 27. SWM Pond 52 sizing calculations conservatively assume that this 1.2ha of NHS drains out of Core 10 to Pond 52.

The layout of the pond on the Redoak/ Capoak lands has been revised from the *Final Joshua's Creek EIR/FSS.* However, the stage--storage--discharge relationship and associated modeling in Appendix H-1 remain consistent with the *Final Joshua's Creek EIR/FSS.*

Comment [NM1]: CH comment 15

7.8 Minor and Major System Designs

7.8.1 Minor System Design

The Subject Lands will be serviced by a conventional storm sewer system designed in accordance with the Town's standards. The storm sewers will be sized utilizing a 5-year return frequency and Town IDF curves.

The ultimate conditions conceptual storm servicing scheme is illustrated in **Figure 7.1** and SWM Pond 52 is illustrated in **Figure 7.3C**. The drainage area to SWM Pond 52 is illustrated on **Figure 7.2**.

As illustrated on **Figure 7.2**, all storm flows from within the developable area of the Redoak/Capoak lands will be directed to SWM Pond 52 with two exceptions:

- 0.23ha of rear roof and rear yard runoff in the PSW 29 catchment that will continue to be directed to PSW 29, as discussed in Section 7.10.2;

- 0.2 ha of the DUC fronting onto Dundas Street which will be directed to the box sewer used to provide storage for the Dundas Street drainage.

With the exception of the above noted 0.23ha, all other runoff from rear lots abutting the NHS will be captured in rear yard catchbasins and directed to SWM Pond 52. Despite the rear lot elevations frequently being lower than the centre line of the road elevations, the catchbasins are able to drain to the storm sewers within the right-of-ways.

The Village Square located adjacent to the NHS will be graded to drain into the NHS. While not designed to drain directly to Pond 52, drainage from the Village Square will feed the PSW 27, and any spillage from the PSW 27 will be captured with a 100-year intake and conveyed to Pond 52. As described above, Pond 52 has been sized for this drainage from the Village Square and NHS.

The minor system design will capture approximately 0.7ha of Dundas Street, and direct it to Pond 52. This reduces the drainage area to the box sewer in the Dunoak Phase 1 lands, allowing the combined release rates from Pond 52 and Dundas Box sewer to not exceed NOCSS targets as described in the *Final Joshua's Creek EIR/FSS.* Catchbasins at the intersection of Street 'A' and Dundas Street will capture 100-year flows on the surface as well.

There are two options for the storm sewer connection to existing sewers on Dundas Street at Street 'B' of the March 26, 2020 Draft Plan of Subdivision, to the pond. Due to the shallow invert elevations of the Dundas Street storm sewer system, and the fixed nature of the SWM Pond 52 permanent pool, a relatively flat trunk sewer is required to convey flows from Dundas Street to the Pond. As illustrated on Figure H-1A, Option 1 allows the storm sewer pipes to be connected from obvert to obvert (as is typical), and consequently the pipes will be sloped at 0.15% to the pond. Minimum velocities will be achieved as seen in the conceptual design sheets in Appendix I. If the Town of Oakville prefers, Option 2 can be implemented, as shown on Figure H-1B. With this option, the pipes could be steepened to 0.2% and the connection to the existing Dundas Street sewers can be made at spring-line. Both options work, and either option (or a combination of the two options) can be determined through detailed design of the subdivision.

Comment [NM2]: Town Comment 1b), April 30/20 memo

As previously noted, the storm drainage plan for the JC17 subcatchment includes a clean water pipe that will convey clean runoff from Core 10 through the Dunoak lands to Stream Reach JC-36/JC-27A. The majority of the clean water pipe will be installed when Phase 2 and 3 of the Dunoak lands are developed. This is not located on the Redoak/Capoak lands. The clean runoff from Core 10 enters Stream Reach JC-27A on the Argo property under existing conditions. Additional details on this are included in the *Final Joshua's Creek EIR/FSS*.

7.8.2 Major System Design

A continuous overland flow route has been provided through the FSS Study Area to safely convey major system flows in excess of the minor system up to the 100-year event. The excess flows will be contained within either the right-of-way or by other lands in the Town's ownership. For all classes of roads, the product of depth of water (m) at the gutter times the velocity of flow (m/s) shall not exceed $0.65m^2/s$. Should the major system flow exceed the conveyance capacity of any given road, the storm sewer will be sized to accommodate the excess flows such that the road capacity is not exceeded.

On the Redoak/Capoak lands, except for the 0.23ha noted above, all overland flow routes will be directed to SWM Pond 52. The Village Square will drain to the adjacent PSW 27 and a 100-year ditch inlet catchbasin will be provided to capture any ponding water under large storm events. The elevation of the capture point will generally be at existing grade of the current spill point from PSW 27 to the east to ensure the ponding depths do not exceed existing conditions.

The major system flows will be attenuated in SWM Pond 52 to achieve the allowable release rates as defined by the NOCSS.

7.8.3 External Drainage

As required by NOCSS, SWM requirements for areas external/adjacent to the FSS Study Area, within the EIR Subcatchment Area, have been investigated to ensure that they have been addressed and that the proposed SWM Plan does not negatively affect future development potential of these areas from a SWM perspective.

The *Final Joshua's Creek EIR/FSS* identifies drainage requirements/assumptions for numerous drainage areas external to the FSS Study Area. **Figure 7.2** illustrates contributing drainage areas to each proposed SWM Pond that includes drainage from the Subject Lands and some external areas. Brief descriptions of each external area, labelled on **Figure 7.1**, are provided in the *Final Joshua's Creek EIR/FSS*. Since this EIR/FSS Addendum now includes the Redoak/Capoak lands in the Subject Lands, this report modifies the discussion regarding External Areas 5, 6, 7 and 9, and adds a new External Area 10 as follows:

External Area 5 has been modified and now only includes areas external to the Subject Lands as defined in this Addendum.

External Areas 6 and 7 are deleted from the *Final Joshua's Creek EIR/FSS*. With the participation of the Redoak/Capoak lands, this area is no longer external to the FSS Study Area. Management of drainage from this area is addressed in this Addendum.

External Area 9 has been revised from the *Final Joshua's Creek EIR/FSS*. A portion of this area (2.1ha) is located on the Capoak Lands and is no longer shown as an external area. The remaining 1.2ha area (revised External Area 9), owned by others and illustrated on **Figure 7.1**, currently drains through a catchbasin and pipe system, south of Dundas Street that has only been sized to convey the pre-development flows. The Site Plan for the Oakville Urban Core Developments proposes to direct drainage from the revised External Area 9 to the existing system south of Dundas Street to Subcatchment EM4.

External Area 10 has been added covering the remaining 0.4ha of external area in EM4 (previously part of External Area 9), which, as illustrated on **Figure 7.1**, currently drains to a ditch on the Capoak lands before discharging to the roadside ditch on Dundas Street. Drainage from this area has not been included in the Oakville Urban Core Developments Site Plan application and as such, has been accounted for in Pond 52.

Dundas Street External Area 1 is an area of 0.7ha identified in the *Final Joshua's Creek EIR/FSS* that will drain through the Redoak/Capoak lands via the minor system to Pond 52. The drainage area was accounted for in Pond 52 but was not given the identifier of Dundas Street External Area 1 in the Final *Joshua's Creek EIR/FSS*.

Dundas Street External Area 2 was delineated in the *Final Joshua's Creek EIR/FSS*, but was not given a unique identifier. This 2.0ha area will drain to the Dundas Box Sewer as described in the *Final Joshua's Creek EIR/FSS* for quantity and quality control as described in Section 7.12.

Comment [NM3]: CH Comment 16

7.9 Joshua's Creek Subcatchment Drainage Area Modifications

The *Final Joshua's Creek EIR/FSS* investigates the impacts of drainage area exchanges and drainage area modifications for all EIR Subcatchment Areas including Subcatchment JC17. The analysis and impacts are not reproduced in this report. A copy of the drainage exchange **Drawing 9** from the *Final Joshua's Creek EIR/FSS* report is provided for reference (see Appendix Q).

As illustrated on **Drawing 9,** as a result of the drainage plan for the Oakville Urban Core Developments Site Plan, there is a proposed exchange of approximately 2.5ha of EM4 Subcatchment drainage that is proposed to be directed to Joshua's Creek Subcatchment JC17B. The increase of 2.5ha to Joshua's Creek West Branch represents an increase of approximately 1.9% of the total drainage area at Dundas Street. As discussed in Section 7.7, the additional area from EM4 catchment will be controlled to SWM Pond 52 target release rates set out in *Final Joshua's Creek EIR/FSS*. The target release rates for Pond 52 are based on not increasing flood risk to the Argo lands (subject to the location of Core 10 clean water pipe), and this is to mitigate any impacts of the 2.5ha exchange might have on Stream Reach JC-36.

As noted in Section 7.6, the *Final Joshua's Creek EIR/FSS* erosion assessment reflects the Pond 52 drainage area that includes the 2.5ha drainage exchange. The proposed drainage exchange does not have a negative impact on the Joshua's Creek system.

Investigation of Alternatives to the Proposed Drainage Exchange

The potential to maintain 2.5ha of East Morrison Creek drainage within the EM4 subcatchment under post development conditions to match pre-development drainage area flows was investigated. Under existing conditions, 2.5ha of land within the EM4 subcatchment (2.1 ha of the Redoak/Capoak lands and 0.4 ha of 3043 Eighth Line) drains southerly to a 500mm diameter culvert under Dundas Street where the drainage is conveyed through an existing subdivision to the south towards the existing SWM pond on Kestell Boulevard, which outlets to a tributary of East Morrison Creek. A storm drainage design sheet has been prepared to evaluate the conveyance capacity of the sewers downstream of the Dundas Street culvert to the pond on Kestell Boulevard (see Appendix S). This analyses shows that there is insufficient capacity to convey runoff from the 2.5ha area of post-development area north of Dundas Street in the existing sewer system south of Dundas Street. Replacement of existing sewers south of Dundas Street would involve replacing over 150m of existing pipe in the existing road right-of-way and is not a financially viable solution. To avoid replacing existing pipes south of Dundas Street, the proposed drainage areas from Redoak/Capoak lands would need to be 0.5ha at 0.9 runoff coefficient. Separating 0.5ha of the Dundas Urban Core block and directing it south will be difficult as the majority of the block needs to be graded to drain north to Pond 52 (as to not exceed downstream pipe capacity). Furthermore, the downstream pond is not designed to provide NOCSS controls. The downstream SWM pond provides 100-year storm quantity control and not Regional Storm quantity control as required for the lands north of Dundas Street.

Providing on-site quantity control storage for 2.5ha of the site on the privately-owned DUC block so as to not exceed capacity of the downstream system is also not recommended, as this would require providing

Regional Storm controls in a private facility. The Town has advised that they are not in favour of private facilities to provide Regional Storm controls to treat public drainage. Since there is not sufficient capacity in the downstream system for uncontrolled post-development flows from the 2.5ha, and the use of private Regional Storm controls is not recommended, the diversion of runoff from 2.5ha from the EM4 subcatchment to the JC17B subcatchment is considered to be the best alternative.

The 3.7ha area (2.1ha of the Capoak lands + 0.4ha of 3043 Eighth Line + 1.2ha of the Oakville Urban Core Developments owned by others) within East Morrison Creek was not identified as part of the *North Oakville East Final Drainage Area Exchange Report* (Rand 2017) (*Final DAE Report*). It showed the 3.7ha area as part of the Joshua's Creek subcatchment. **Tables 7.8** and **7.9** below summarize and update the pre and post-development drainage areas to Joshua's Creek and East Morrison Creek presented in the *Final DAE Report*. **Table 7.8** presents the *Final DAE Report* data; **Table 7.9** modifies the *Final DAE Report* data to correct the pre-development subcatchment areas and reflect the 2.5ha drainage area exchange. The 2.5ha drainage exchange from East Morrison Creek to Joshua's Creek would bring the post-development drainage area to each watershed north of Dundas Street closer to the pre-development drainage areas.

Table 7.8: East Morrison Creek and Joshua's Creek Drainage Area Exchange Summary (*Final DAE Report*)

Subwatershed	**In*** (ha)	**Out*** (ha)	**Net** (ha)	**Pre-Development Drainage Area** (ha)	**Post-Development Drainage Area** (ha)	**Percent Change** (%)
East Morrison Creek (EM1+EM4)	34.6	15.1	19.5	310.1	329.6	6.3%
Joshua's Creek (JC)	0.8	4.6	-3.8	1074.5	1070.7	-0.4%

*Note that the drainage area exchanges in and out are the total exchanges in and out of each subcatchment at Dundas Street expanded, inclusive of the exchanges with other subcatchments not included in this table (i.e. the drainage "in" and "out" of Joshua's Creek includes exchanges between Joshua's Creek and East Morrison Creek as well as exchanges between Joshua's Creek and Sixteen Mile Creek)

Table 7.9: Updated East Morrison Creek and Joshua's Creek Drainage Area Exchange Summary

Subwatershed	**In* (ha)**	**Out* (ha)**	**Net (ha)**	**Pre-Development Drainage Area (ha)**	**Post-Development Drainage Area (ha)**	**Percent Change (%)**
East Morrison Creek (EM1+EM4)	34.6	(15.1 + 2.5) = 17.6	17	(310.1 + 3.7) = 313.8	330.8	5.4%
Joshua's Creek (JC)	(0.8 + 2.5) = 3.3	4.6	-3.8	(1074.5 - 3.7) = 1070.8	1073.2	-0.1%

*Note that the drainage area exchanges in and out are the total exchanges in and out of each subcatchment at Dundas Street, inclusive of the exchanges with other subcatchments not included in this table (i.e. the drainage "in" and "out" of Joshua's Creek

includes exchanges between Joshua's Creek and East Morrison Creek as well as exchanges between Joshua's Creek and Sixteen Mile Creek)

As shown in **Tables 7.8** and **7.9**, that the exchange of the 2.5ha between East Morrison Creek and Joshua's Creek will bring the post-development drainage conditions closer to existing conditions when comparing to the approved *Final DAE Report*. Pond 52 over-controls peak flows to account for the drainage area exchange.

7.10 PSW Drainage

Specific design consideration has been given during the preparation of the SWM Plan for drainage into and out of PSWs. The *Final Joshua's Creek EIR/FSS* delineated the PSW drainage areas on the Subject Lands and outlet locations. **Drawing 6** and **Table 7.10** from the *Final Joshua's Creek EIR/FSS* have been updated with the Redoak/Capoak Preliminary Development Plan and the revised Core 10 boundary. As noted in Section 7.0, all or parts of PSWs 12, 27, 28, 29, 30, 31 and 60 are located on the Redoak/Capoak lands. The portion of **Table 7.10** relevant to the Redoak/Capoak lands is updated below identifying wetland features, summarizing their drainage condition, and describing where/how the SWM Plan addresses drainage into or out of the wetlands present on the Redoak/Capoak lands.

7.10.1 Drainage Out of PSWs

The *Final Joshua's Creek EIR/FSS* notes that, "*Localized swales and headwalls or equivalent will be utilized to intercept and capture overland flows draining out of Core 10 and 11 and onto the developable lands at points indicated on **Drawing 6** and **Drawings 7A** to **7I**.*"

Consistent with this requirement, storm sewer outlets and dedicated clean water pipes are proposed to convey drainage from wetlands to ponds or streams. Drainage out of PSWs 29 and 31 located on the Redoak/Capoak lands will discharge to the east through the Dunoak lands in a dedicated clean water pipe and outlet to Stream Reach JC-36/27A. Drainage out of the NHS from PSWs 27 and 28 will enter an inlet to the future storm sewer system and be directed to Pond 52. Refer to the *Final Joshua's Creek EIR/FSS* for additional details on this clean water pipe.

7.10.2 Drainage into PSWs

As noted in **Table 7.10**, no development is proposed on the Redoak/Capoak lands within the catchments of PSWs 12, 28, 30, 31 and 60. Only a small portion of the Redoak/Capoak lands are being developed in the catchment of PSW 29 (0.23ha). The *Final Joshua's Creek EIR/FSS* notes that these wetlands are supported by surface water drainage. Ponded surface water in the features recharges the shallow soils and maintains high water table conditions in these areas. As a result, it is important to maintain the contributing surface water drainage conditions. The *Final Joshua's Creek EIR/FSS* also identified that future developing areas, within the subcatchments of these PSWs located north of Core 10, are not located with the FSS Study Area, and that future FSS analyses should address how flows are maintained to these wetlands.

The Redoak/Capoak lands are now part of the FSS Study Area and the management of flows to these wetlands from their lands has been addressed. As illustrated on **Drawing 6**, there is a small area of PSW 29 catchment (0.39ha) and PSW 27 catchment (0.06ha) that extends beyond the NHS limits into the

developable area of the Redoak/Capoak lands. To maintain the drainage to PSW 29, drainage from rear roof and rear yard areas totalling 0.23ha at 0.66 runoff coefficient will be directed towards the NHS via sheet drain to PSW 29. To maintain the drainage to PSW 27, 0.06ha at 0.25 runoff coefficient will be directed towards the NHS from the Village Square via sheet flow. This will provide approximately the equivalent runoff volume to existing conditions. Refer to **Figure 7.1** illustrating drainage areas that will be directed to the NHS in the same general location as existing conditions.

Table 7.10: Conveyance of Minor System Flows in Vicinity of Wetlands*

PSW #	Wetland Area (ha)	Description of Wetland Drainage Patterns
27	0.11	• Existing contributing drainage area to PSW = 1.56ha • Drainage area to PSW is largely contained in Core 10; approximately 17% (0.26ha) is located on developable lands to west of the core outside this FSS; the *Dundas-Trafalgar Inc./Shieldbay Developments Inc. Final Environmental Implementation Report and Functional Servicing Study* (Urbantech, 2016) addressed maintenance of flows to this PSW. Approximately 4% (0.06ha) is located on Redoak/Capoak developable lands to south of the core • Runoff from a Village Square area of 0.06ha at 0.25 runoff coefficient will be directed towards the NHS via sheet drainage to PSW 27 in the same general location as existing conditions. This will provide approximately the equivalent runoff volume to existing conditions. Due to the small percentage of drainage area to PSW 27 affected, no further water balance analyses are warranted • Flows from this PSW drain easterly through the Redoak/Capoak lands; design of Redoak/Capoak subdivision accommodates flows from wetland at point A on Drawing 6
28	1.04	• Existing contributing drainage area to PSW = 1.97ha • Drainage area is entirely contained in Core 10 • No development is proposed in its catchment • Flows from PSW drain into PSW 27
12, 29 and 60	1.30	• Existing contributing drainage area to PSWs = 15.58ha • Drainage area is entirely contained in Core 10 for PSWs 12 and 60 • Drainage area to PSW 29 is largely contained in Core 10; approximately 2% (0.38ha) is located on Redoak/Capoak developable lands to the south of the core • Runoff from a rear yard area of 0.23ha at 0.66 runoff coefficient will be directed towards the NHS via sheet drainage to PSW 29 in the same general location as existing conditions. This will provide approximately the equivalent runoff volume to existing conditions. Due to the small percentage of drainage area to PSW 29 affected, no further water balance analyses are warranted • Flows from PSW 29 drain easterly through future development; design of Dunoak subdivision accommodates flows from wetland at Point B on Drawing 6
30	0.03	• Existing contributing drainage area to PSW = 1.97ha • Drainage area is entirely contained in Core 10 • No development is proposed in its catchment • Flows from PSW drain easterly through future development; design of the Dunoak subdivision accommodates flows from wetland at Point C on Drawing 6
31	0.52	• Existing contributing drainage area to PSW = 5.84ha • Drainage area to PSW 31 is largely contained in Core 10; approximately 23% (1.33ha) is located on developable lands to north of the core, outside the FSS Study Area; a future FSS for lands north of core is to address maintenance of flows to PSW 31 at point D on Drawing 6. The level of study required related to PSW 31 should be scoped in consultation with CH when EIR/FSS for the lands to the north of Core 10 is undertaken. Flows from PSWs drain easterly through future development; design of the Dunoak subdivision accommodates flows from wetland at Point C on Drawing 6

* Only PSWs located on the Redoak/Capoak lands are included.

7.11 Preliminary Grading Plans

The *Final Joshua's Creek EIR/FSS* includes preliminary grading plans for the FSS Study Area based on the engineering constraints such as NHS limits, SWM pond location and outlet elevations, and proposed road patterns. With the inclusion of the Redoak/Capoak lands, additional conceptual grading plans have been added; refer to new **Drawings 7J, 7K** and **8C**. Grading details are consistent with the Town's standards and compatible with the NOCSS recommendations for grading adjacent to the NHS. In this regard, preliminary grading of most of the lots, adjacent to Cores, match existing grades at the proposed lot line. Where this is not possible, the grading difference is shared between the development and NHS buffer in accordance with NOCSS.

The majority of grading within the NHS is associated with the trail system, as illustrated on **Drawings 6A, 7K** and **8C**. For a detailed explanation of the trail grading, refer to Section 6.3 and Appendix N. The trail grading respects the grading rules within the NHS; grading is permitted within the outer 9m of the 10m buffer to dripline and grading is permitted within the outer 20m of the 30m buffer to PSWs, with vertical differences shared between private property and NHS.

Grading along the common property boundary with the adjacent Dunoak lands has been coordinated and is consistent. The Dunoak lands are expected to develop prior to or concurrent with the Redoak/Capoak lands.

Comment [NM4]: Town Comment 8b; May 5/20 letter

Retaining walls are proposed to manage the grade transition resulting from fill needed to direct surface drainage easterly to Pond 52 and to connect to adjacent roadways.

- Street B: Two different grading options are possible along the Street B right-of-way (ROW) at the intersection with Dundas Street to transition from the ROW to the adjacent property owned by Halton Region. The Region property is up to 1.25m lower than the adjacent Dundas Street centerline (176.50m vs 177.75m). Street B has been graded to direct major overland flow to the pond and to connect to existing Dundas St. As a result, the road is up to 2.1m higher than the adjacent holdout property. Option 1 provides a retaining wall that is 40m in length with an average height of 2.1m along the Street B ROW. Alternatively, after discussions with Halton Region, it may be possible to eliminate the need for the retaining wall by grading onto the adjacent property by approximately 6.3m. The preferred option can be determined at detailed design. In the event the wall is installed, it will be within the right-of-way and can be removed at a later date by the developer of the Region property.

Comment [NM5]: Town Comment 8d) May 5/20 letter and Region Comment 6

- Street C: A retaining wall is proposed along Street C south of 3053 Eighth Line within the Street C right of way to transition from the ROW to the adjacent holdout property and neighbouring site plan. Street C has been graded to direct major overland flow to the pond and as a result the road is up to 3.8m higher than the adjacent properties. The proposed wall is 110m in length with an average height of 2.9m. The height of the southern portion of the wall will be reduced when the adjacent site plan develops (Oakville Urban Core Development). Alternatively, grading onto the adjacent property by approximately 8.4m is possible with permission from the adjacent landowner. Runoff from the 0.4ha area between 3053 Eighth Line and the future extension of Street ⊣D will sheet flow to the east towards the subject lands and be captured at the headwall. The headwall connects to the local storm sewers on Street ⊣D which will convey the flows to Pond 52. The

northern portion of the retaining wall can be removed in the future when a connection from Street ~~I~~ D to Eighth Line proceeds through the development of the hold-out property. The future road profile has been shown on **Drawing 8C**. The drainage for the future road extension will be determined by a future addendum for these lands.

The grading shown on the Dundas Urban Core (DUC) blocks is preliminary in nature, and designed to provide positive drainage towards the control MHs. The development of these blocks will proceed through site plan applications. Correspondingly, grading within these blocks will be refined at the time of site plan application, with consideration for the DUC blocks to transition and match the latest road grades from Dundas Street.

Comment [NM6]: Town Comment 8c (May 5/20 letter)

Comment [NM7]: Town Comment 8a (May 5/20 letter)

7.12 SWM Pond Operating Characteristics

One multi-function pond (Pond 52) is proposed within the Redoak/Capoak/Dunoak lands. The location of SWM Pond 52 is illustrated in **Figure 7.1**.

The SWM pond has been designed in accordance with directions of the NOCSS and the MOE SWM Design Manual. Consistent with the *Final Joshua's Creek EIR/FSS*, this includes the following features:

Sediment Forebay	• to improve sediment removal prior to entering the pond
Permanent Pool and Extended Detention Storage	• to provide water quality and erosion control; to satisfy Enhanced Level of protection requirements (i.e., capture of 80 percent Total Suspended Solids), and reduction of Phosphorus to existing levels; • to provide extended detention storage for erosion control requirements based on recommendations from erosion threshold analyses
Quantity Control Storage	• to attenuate post development flows to the unit flow release rates as per the NOCSS for the 2-year through 100-year storms and Regional Storm

Erosion control requirements for the SWM pond were determined through a continuous erosion analysis completed as part of the *Final Joshua's Creek EIR/FSS*. This assessment included field surveys of sensitive creek locations, determination of in-stream erosion threshold levels, and analysis of flow duration and flow exceedance between thresholds and bankfull conditions, under comparative existing and proposed conditions. Extended detention was utilized to meet targets on a system wide basis to ensure that erosion potential does not adversely increase under future development. It was determined, through continuous hydrology modeling, that variable storage and detention time requirements are proposed depending upon pond location. The analysis recommended that SWM Pond 52 provide between160 – 179 m^3/impervious ha storage with 46 - 48 hour detention to meet erosion targets. For further details on the erosion analysis, see Section 7.6 of this Addendum and Section 7.6 of the *Final Joshua's Creek EIR/FSS*.

Target outflows for the Pond 52 are based target release rates, as outlined in Section 7.7 and Section 7.12 of the *Final Joshua's Creek EIR/FSS*. As described in Section 7.9, Pond 52 will treat runoff from the Redoak/Capoak/Dunoak lands. Pond 52 has been sized to treat 2.5ha of drainage from the existing EM4 catchment, including 0.4 ha located outside of the Subject Lands. As noted, over-control is proposed for

this additional area external to the Joshua's Creek subcatchment JC17 area to not increase flood risk on downstream Argo Lands as outlined in the *Final Joshua's Creek EIR/FSS*.

The *Final Joshua's Creek EIR/FSS* included the Ultimate Expanded Pond 52 that reflects the Redoak/Capoak/Dunoak/EM4 contributing drainage area. This EIR/FSS Addendum includes the Ultimate Expanded Pond 52 as shown on **Figure 7.3C**. Although the pond layout on the Redoak/Capoak lands differs somewhat from that in the Final Joshua's Creek EIR/FSS (to fit into the Redoak/Capoak road/lot layouts), the pond's operating characteristics provided in Appendix H-1 remain consistent with the Ultimate Expanded SWM Pond 52 design in the *Final Joshua's Creek EIR/FSS*. **Tables 7.11** and **7.15** from the *Final Joshua's Creek EIR/FSS*, summarizing conceptual pond design parameters are copied below. No amendments to these tables are required. Note that **Table 7.14** (Pond 52 Interim Inflow/Volume Characteristics) and **Table 7.16** (Pond 52 Ultimate Inflow/Volume Characteristics) are deleted.

Comment [NM8]: CH Comment 15

Table 7.11: Summary of Required Stormwater Management Facility Characteristics

Pond I.D.	Pond Type	Drainage Area (ha)	Imp. Coverage (%)	Permanent Pool Volume* (m^3)	Water Quality Volume (m^3)**	Extended Detention Volume (m^3)***	100 Year Flood Volume (m^3)	Regional Storm Flood Volume (m^3)	SWM Pond Block Area (ha)
52	Wet	40.68	77	8,004	1,628	5,014	25,280	60,710	2.58

* Pond 52 volumes in this table are the required volumes, and not the provided volumes. The provided permanent pool volumes exceed the required permanent pool volumes and are illustrated on Figure 7.3C. Provided volumes are noted in Table 7.15 below.
** Quality control volume based on 40 m^3/ha.
*** Erosion control volume is to be provided in addition to quality control volume based on pond specific requirements from continuous erosion analysis as described above.

Table 7.15: Pond 52 Inflow/Volume Characteristics

Return Period (Yr)	Drainage Area (ha)	Imp. (%)	Target Outflow (m^3/s)	Actual Outflow (m^3/s)	Storage Requirements (m^3)	Storage Provided (m^3)
2	40.68	77	0.103	0.099	11,480	11,530
5	40.68	77	0.207	0.164	14,820	15,150
10	40.68	77	0.251	0.235	17,380	17,590
25	40.68	77	0.324	0.318	20,740	20,810
50	40.68	77	0.369	0.354	22,970	23,060
100	40.68	77	0.440	0.388	25,280	25,520
Regional	40.68	77	1.683	1.638	60,710	60,370*

*Note that storage provided is less than storage required. The "required" storage is not specifically required, but just the storage estimated to meet the target release rates for each return period exactly, without taking into account the actual stage-storage curve or limitations of real world controls. Typically this estimate generates a volume less than the actual stage-storage curve and outlet controls, and is therefore labelled as "required" or "minimum" to differentiate it from the "actual" storage. The 'Storage Provided" is based on a specific stage/discharge/storage curve and, in this case the outlet controls are such that the actual storage provides the required peak flow reduction and is less than the "required" storage.

The values in **Table 7.15** are consistent with the Ultimate Expanded conditions in the Final Joshua's Creek EIR/FSS. In the event that the Redoak/Capoak lands develop along with Dunoak Phase 1 lands to the east, but the Argo Lands do not advance, the above controls and pond size are to be used for this interim condition to not cause flooding on the Argo lands as described in the Final Joshua's Creek EIR/FSS.

7.12.1 Pond Design Elements

Sediment Forebay

SWM Pond 52 includes a sediment forebay to improve the pollutant removal by trapping larger particles near the inlet of the pond. The forebay has been designed with a length to width ratio of approximately 3:1 and does not exceed one third of the permanent pool surface area for wet ponds, as required in the MOE SWMP Design Manual. Furthermore, the forebays have a minimum depth of 1.5m to minimize the potential for re-suspension. The preliminary forebay sizing calculations are provided in Appendix H-1.

Permanent Pool

The permanent pool is approximately 1.5m deep, which falls within the 1m to 2m deep range recommended in the MOE SWMP Design Manual (2003).

The permanent pool has been sized to provide Enhanced Level protection in accordance with the MOE SWMP Design Manual (2003).

Slopes of 7:1 (H:V) will be provided for 3m (horizontally) on either side of the permanent pool wetted perimeter. Below this level, slopes will be graded at 3:1 (H:V).

Extended Detention/Flood Control Storage

The extended detention storage comprises two components: water quality and erosion control.

The water quality requirements are based on Enhanced Level controls (formerly Level 1) as per the MOE SWMP Design Manual (2003). The erosion control volume was determined based on analysis of critical downstream erosion thresholds utilizing a continuous hydrologic model, as described in Section 7.6 of the *Final Joshua's Creek EIR/FSS*. Based on the results of the continuous model described in Section 7.6, SWM Pond 52 is required to provide 160 - 179 m^3/impervious ha storage released over 46 - 48 hours to meet erosion targets.

The extended detention/flood control storage up to the 100-year event for all ponds will not exceed 2.0m in accordance with the MOE SWMP Design Manual (2003). As per the approved design standard for the Town, the Regional Storm water level does not exceed a maximum active storage depth of 3.5m, or an overall depth of 5.0m.

The extended detention/flood control component has been provided with side slopes of 5:1 (H:V) with minor localized variations, and in accordance with the Town's design criteria.

Pond Outlet

The extended detention volume, within the pond, will outlet through a reverse graded pipe. An orifice will be provided to discharge the water quality extended detention volume over a forty-eight (48) hour period or less per the above noted erosion control requirements.

Quantity control will be provided by a combination orifice/notched weir located in the outlet structure. Deep pools, along with reverse graded pipes, will be provided at the outlet to address thermal mitigation. The landscape plans should have regard for best management practices, such as the planting recommendations in the following reports: *Thermal Impacts of Urbanization Including Preventative and Mitigation Techniques,* and *Conservation Halton Landscaping and Tree Preservation Guidelines* (Conservation Halton, 2010; Credit Valley Conservation, 2011).

Comment [NM9]: CH Comment 13

The preliminary outlet location for SWM Pond 52 is provided on **Figure 7.3C**. A detailed discussion of the SWM Pond 52 outlet location is provided in the *Final Joshua's Creek EIR/FSS*, and has not been reproduced in this report.

This EIR/FSS Addendum provides Pond 52 Ultimate Expanded conditions design and modifies actual release rates based on the Redoak/Capoak Preliminary Development Plan land uses and a conceptual outlet control structure for Pond 52 in accordance with Ultimate Expanded Pond 52 design presented in the *Final Joshua's Creek EIR/FSS*. **Table 7.21** is revised as noted below.

Table 7.21: Summary of Required SWM Facility Target Release Rates

Pond I.D.	Imp. Area	Drainage Area (ha)	Unit Outflow Rates (m^3/s/ha)			Peak Outflow Rates (m^3/s)		
			Extended Detention*	100 Year **	Regional Storm **	Extended Detention	100 Year	Regional Storm
52	77%	40.68	0.0014	0.010	0.041	0.056	0.440	1.683

*Extended detention unit outflow rates are based on detention time between 24 and 48 hours as per continuous erosion control analysis described in Section 7.6.
** It should be noted that the unit outflow rates for the design storm events 2-year through, and including, Regional event are based on a combined release rate with the Dundas Box sewer described in the *Final Joshua's Creek EIR/FSS and listed in Table 7.15.*

Pond Lining

Shale bedrock is close to surface through the central portion of the EIR Subcatchment Areas. There are also areas, generally in the topographically lower areas close to the watercourses, where the water table elevation is close to surface. Considering these subsurface conditions, the base and/or walls of SWM ponds could occur in shale or along the shale/till contact and intersect the local groundwater table. The upper layers of the bedrock are weathered and may be fractured providing moderate hydraulic conductivity. Under such conditions, a pond liner is generally recommended to minimize groundwater infiltration into the pond or stormwater exfiltration from the pond. Clay or synthetic liners may be considered for pond design based on geotechnical recommendations for construction. The need for an impermeable liner and underdrains will be further assessed at detailed design.

Table 7.23 from the *Final Joshua's Creek EIR/FSS* notes estimated depth of average groundwater elevations at the bottom of ponds. It notes that estimated average groundwater elevations are 2m above the bottom of Pond 52.

Based on the native soil conditions within Joshua's Creek and experience in North Oakville in general, it is likely that migration of water, through the soil, will not necessitate mitigation measures to counteract groundwater pressures on the clay liner of the ponds. Typically, the clay liner thickness is designed to counteract upward pressures of groundwater when conditions are in the range of depths below groundwater noted above. The pond excavations should be carried out under full-time supervision of a geotechnical engineer and/or hydrogeologist to assess the need for mitigation measures.

If deemed necessary, some possible measures for mitigating against groundwater pressures acting on clay liners include:

- Utilizing a subdrain network installed at, and below the permanent pool with a gravity frost-free outlet. This subdrain network can be used to move water around the clay liner to not impede normal groundwater flow direction to avoid pressures on the upgradient side of the pond. It can also be utilized where there is concern over upward pressure on the clay liner exceeding the counter force of gravity from the volume of permanent pool water, and possibly puncturing the liner. The subdrain, in this case, would alleviate the upward pressure by controlling the amount of vertical head that could act on the clay liner, essentially controlling the groundwater elevation to a manageable level that would not exceed the clay liner design.

- A subdrain network can also be designed where there is less concern about groundwater flow direction and where the pond liner is stable under normal operating conditions (i.e. permanent pool is full). The purpose of this subdrain network is to allow for cleaning out of the permanent pool. As the permanent pool is pumped down, there is less force acting down on the clay liner to counteract the upward forces of groundwater. To alleviate the upward pressure, the groundwater is temporarily lowered by pumping during the clean-out operation and then allowed to normalize once permanent pool has re-filled.

Either subdrain system can be utilized, if determined necessary, during time of excavation by the geotechnical engineer and/or hydrogeologist.

Access Road

In accordance with the Town's standards, 4.0m wide access roads are provided to facilitate routine inspection and maintenance activities. The maximum slope of access roads is 10:1 (H:V). The preliminary location of the access road for SWM Pond 52 is presented on **Figure 7.3C**.

Emergency Overflows

In the event of a blockage or a storm greater than the design horizon, an emergency overflow weir will be provided and the overflow elevation will ensure that 0.3m freeboard is provided to the top of pond berm, and 0.1m from the Regional Storm water level to the emergency overflow weir. Refer to **Figure 7.3C** for conceptual location of emergency overflows.

Pond Stability

The *Final Joshua's Creek EIR/FSS* provides slope stability analysis of the proposed SWM ponds and adjacent valley walls for Ponds 48, 50, 52, 55 and 56. The report analyzed the ponds under four conditions; During Construction (Undrained Analysis), Normal Water Level (Drained Analysis), Regional Storm Water Level (Undrained Analysis), and Rapid Drawdown (Undrained Analysis) and confirmed that the ponds as well as the adjacent valley walls are stable under static conditions. These analyses are not affected by the Ultimate Expanded Pond 52 design and are not reproduced here. See Appendix L-5 of the *Final Joshua's Creek EIR/FSS*.

7.12.2 Comparison of Topographic Depression Volumes to SWM Pond Design

As discussed is Section 7.1 of this report, the NOCSS Addendum recommendations require that the surface storage volumes in topographic depressions be identified and comparisons made to SWM pond storage design. There are no depression storage areas topographic depressions identified on the Redoak/Capoak lands. As such, no further analysis on topographic storage is required for these lands.

TAB E

Changes to Section 9, Servicing

Redoak/Capoak EIR/FSS Addendum

9.0 WASTEWATER AND WATER SERVICING

The *Final Joshua's Creek EIR/FSS* addresses wastewater and water servicing requirements in the FSS Study Area. From a wastewater perspective, it identified wastewater design criteria, external wastewater requirements, existing infrastructure and future servicing requirements. Water supply design criteria, pressure zone boundaries, external water requirements and existing/proposed water infrastructure are also addressed. The proposed water and wastewater servicing strategies, outlined in the *Final Joshua's Creek EIR/FSS,* were prepared in accordance with the strategies put forth in the ASP and comments received from the Region on the proposed water and wastewater servicing in North Oakville.

Servicing requirements for the Redoak/Capoak lands do not alter overall servicing requirements presented in the *Final Joshua's Creek EIR/FSS.* **Figures 9.1, 9.2, 9.3** and **9.4** have been updated to include the Redoak/Capoak Preliminary Development Plan and internal servicing requirements. This Addendum also adds data to Appendix H-1 to provide wastewater design sheets and tributary areas for the Redoak/Capoak lands. A hydraulic analysis and preliminary watermain sizing for the site have been provided in **Appendix V**.

Comment [NM1]: Region Comment 2d)

Infrastructure to service the Redoak/Capoak lands includes:

- Two sub-trunk sanitary sewers, extending north from Dundas Street, are required to service the Subject Lands. The west sub-trunk, from Dundas Street/Prince Michael Drive northwards, will service the west portion of the Subject Lands by gravity including the Redoak/Capoak lands; and,
- Extensions of existing external supply and transmission watermains from Eighth Line and Dundas Street are required to service the Redoak/Capoak lands.
- A potential hydrant connection to the existing watermain on Dundas Street to provide fire protection for the DUC blocks. There is an existing hydrant within the northern boulevard of Dundas Street at the southwest corner of the site fronting the future DUC blocks; see **Figure 9.1**. Fire protection for the DUC blocks and the potential need for an additional hydrant will be investigated at detailed design. A preliminary location of a new hydrant (which would be connected to the existing 400mm watermain on Dundas Street) has been shown on **Figure 9.2**.

Comment [NM2]: Region Comment 2c)

The Draft Plan of Subdivision for the neighbouring Dunoak lands has been approved, and the detailed design of the property is on-going. It is expected that the Dunoak lands will be serviced prior to servicing of the Redoak/Capoak lands. In the unlikely event that the Redoak/Capoak lands proceed ahead of the Dunoak lands, interim solutions that address watermain water quality issues will be investigated. These solutions may include a temporary flushing program, or temporary watermain looping which may require easements on adjacent lands.

Comment [NM3]: Region Comment 2b)

TAB F

Revised Appendix H-5, Redoak/Capoak Storm Design Sheets
Detailed Tributary Plans and Cut-off Swale Sizing

New Appendix V, Watermain Analysis

Revised Appendix H-5, Redoak/Capoak Storm Design Sheets
Detailed Tributary Plans and Cut-off Swale Sizing

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	FALL IN PIPE SECTION (m)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)
Trunk 2																			
100Yr External Flow			0.74	0.82	0.61	0.61	200.80	338					Estimated Time =		10.00				
Urban Core	10200	102	0.07	0.90	0.06	0.06	114.21	358	30.5	0.15	825	556	1.04	0.49	10.49				
	102	156	0.17	0.90	0.15	0.22	111.32	405	53.0	0.15	1800x900	2112	1.37	0.64	11.13				
Dundas Urban Core	156	1050	1.47	0.90	1.32	1.54	107.74	799	22.0	0.15	1800x900	2112	1.37	0.27	11.40				
															12.31				
Dundas Urban Core			1.27	0.90	1.14	2.68									11.97				
	1050	105	1.03	0.90	0.93	3.61	101.80	1359	44.0	0.15	1800x900	2112	1.37	0.53	12.84				
			0.20	0.75	0.15	3.76													
			0.34	0.80	0.27	4.03									11.90				
			0.97	0.75	0.73	4.76									12.68				
	105	106	0.37	0.80	0.30	5.05	99.34	1733	77.5	0.15	1800x1200	3228	1.55	0.83	13.68				
	106	108	0.29	0.75	0.22	5.27	95.75	1741	73.0	0.15	1800x1200	3228	1.55	0.78	14.46				
Village Square			0.29	0.45	0.13	5.40									10.67				
	108	110	0.57	0.75	0.43	5.83	92.61	1838	83.5	0.15	1800x1200	3228	1.55	0.90	15.36				
															10.54				
	110	111 TEE	0.52	0.75	0.39	6.22	89.29	1881	88.5	0.15	1800x1200	3228	1.55	0.95	16.31				
	111 TEE	153	0.76	0.75	0.57	6.79	86.05	1961	91.5	0.15	1800x1200	3228	1.55	0.98	17.29				
	153	501			0.00	6.79	82.95	1903	11.0	0.15	1800x1200	3228	1.55	0.12	17.41				
Contribution To Trunk 1						6.79									17.41				
Trunk 1																			
			0.65	0.66	0.43	0.43													
			0.11	0.75	0.08	0.51													
			0.37	0.80	0.30	0.81													
Existing House			0.72	0.80	0.58	1.38									10.84				
Future Development			0.48	0.75	0.36	1.74									11.99				
External			0.38	0.82	0.31	2.06									12.29				
	146	147	0.35	0.75	0.26	2.32	101.92	656	60.5	0.35	975	1326	1.78	0.57	12.85				
															11.47				
	147	148	1.13	0.75	0.85	3.17	99.29	873	69.0	0.35	1050	1616	1.87	0.62	13.47				
100Yr capture - Singles			0.49	0.66	0.32	0.32	200.80	180							10.00				
			1.14	0.66	0.75	3.92									11.46				
	148	149	1.23	0.75	0.92	4.84	96.61	1479	80.0	0.30	1200	2135	1.89	0.71	14.18				
															11.96				
	149	150	1.44	0.75	1.08	5.92	93.72	3020	83.5	0.30	1800x1200	4566	2.20	0.63	14.81				
100Yr capture From NHS			1.21	0.25	0.30	0.30							Estimated Time =		18.84				
100Yr capture From NHS			1.58	0.25	0.40	0.70	136.70	265											
100Yr capture-Village Square			0.11	0.45	0.05	0.05	136.70	19											
100Yr capture - Rearyard			0.04	0.75	0.03	0.03	200.80	17							10.00				
100Yr capture - Singles			0.26	0.66	0.17	0.17	200.80	96											
100Yr capture-Village Square			0.17	0.45	0.08	0.08	200.80	43											
Total contribution from 100YR capture								439											
			0.56	0.66	0.37	0.37													
			0.63	0.75	0.47	0.84													
			0.74	0.75	0.56	1.40									13.70				
			2.13	0.66	1.41	2.80									13.35				
	150	151	0.94	0.80	0.75	9.47	91.29	3022	33.0	0.30	1800x1200	4566	2.20	0.25	15.06				
			0.49	0.80	0.39	9.87									11.57				
	151	152	0.22	0.75	0.17	10.03	90.36	3137	32.5	0.30	1800x1200	4566	2.20	0.25	15.31				
	152	501			0.00	10.03	89.47	3112	14.0	0.30	1800x1200	4564	2.20	0.11	15.41				
Contribution From Trunk 2						6.79									17.41				
	501	500			0.00	16.82	82.59	4817	26.0	0.30	2400x1200	6574	2.35	0.18	17.59				
	153	HW			0.00	16.82	82.04	4791	14.0	0.30	2400x1200	6574	2.35	0.10	17.69				
To SWM Pond 52						16.82									17.69				

NOTES:
Q = 2.78ACI L/s
C = Runoff Co-efficient:
I = Intensity (mm/hr)
A = Area (hectares)
n = 0.013

Minimum 10 min time of concentration.
Commercial 0.90
Park 0.25
Single 0.66
b2b/Rearlane Townhouse 0.80
Village Square 0.45
Townhouse 0.75

PROJECT: Redthorn Capobianco
PROJECT NO: 17-903
CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.
DESIGNED BY: S.L.
CHECKED BY: K.M.
DATE: Jul-20

REDOAK/CAPOAK

STORM SEWER DESIGN

SHEET 1 OF 1

Natural Heritage System
CORE 10
CORE 10 BOUNDARY
NHS
HEADWALL
CUT-OFF SWALE
Vista
P52
SWM Pond
PP 173.20
V.S.
FLOW SPLIT
OGS
TRUNK 1
TRUNK 2
EIGHTH LINE
Village Square
3053 Eighth Line
Future Development
Dundas Street Urban Core
Dundas Urban Core
DUNDAS STREET EAST
PRINCE MICHAEL DRIVE
KESTELL BOULEVARD
Ex. 500Ø HDPE CULVERT IN INV. ±175.90 AS PER MRC, PROPOSED WATERMAIN, SANITARY SEWER AND FORCEMAIN DUNDAS STREET
(Matching Obvert)
0 40 80 120 160 200
SCALE 1:4000

Legend

- Redoak/Capoak Lands
- Post Development Drainage Boundary
- Proposed Local Storm Sewer
- Proposed Storm Manholes
- Storm Sub Tributary Area
- Storm Trunk (By Others)
- Proposed Storm Trunk
- Pond Outfall
- 4.38Ha / 0.90 — Post Development Drainage Area Run-Off Coefficient
- 0.07Ha / 0.9 — External Drainage Area Run-Off Coeficient
- 100 Year Intake Areas

David Schaeffer Engineering Ltd.
Beacon Environmental
J.F. Sabourin and Associates Inc.
R.J. Burnside & Associates Limited
Stonybrook Consulting Inc.
EXP
Bird and Hale Limited

REDOAK/CAPOAK ADDENDUM #1 TO THE JOSHUA'S CREEK TRIBUTARIES EIR/FSS

FIGURE H-1A

Conceptual Storm Servicing (Option 1)

AUGUST 2020

Natural Heritage System
CORE 10
CORE 10 BOUNDARY
NHS
HEADWALL
CUT-OFF SWALE
Vista
P52
SWM Pond
PP 173.20
V.S.
FLOW SPLIT
OGS
TRUNK 1
TRUNK 2
1800x1200 CONC BOX
2400x1200 CONC BOX
1800x900 CONC BOX
Village Square
3053 Eighth Line
Future Development
Dundas Street Urban Core
Dundas Urban Core
(Matching Springline)
EIGHTH LINE
DUNDAS STREET EAST
PRINCE MICHAEL DRIVE
KESTELL BOULEVARD
EX. 500Ø HDPE CULVERT IN INV. ±175.90 AS PER MRC, PROPOSED WATERMAIN, SANITARY SEWER AND FORCEMAIN DUNDAS STREET
0 40 80 120 160 200
SCALE 1:4000

Legend

- Redoak/Capoak Lands
- Post Development Drainage Boundary
- Proposed Local Storm Sewer
- Proposed Storm Manholes
- Storm Sub Tributary Area
- Storm Trunk (By Others)
- Proposed Storm Trunk
- Pond Outfall
- 4.38Ha / 0.90 — Post Development Drainage Area Run-Off Coefficient
- 0.07Ha / 0.9 — External Drainage Area Run-Off Coeficient
- 100 Year Intake Areas

David Schaeffer Engineering Ltd.
Beacon Environmental
J.F. Sabourin and Associates Inc.
R.J. Burnside & Associates Limited
Stonybrook Consulting Inc.
EXP
Bird and Hale Limited

REDOAK/CAPOAK ADDENDUM #1 TO THE JOSHUA'S CREEK TRIBUTARIES EIR/FSS

FIGURE H-1B

Conceptual Storm Servicing (Option 2)

AUGUST 2020

Revised Appendix I, Wastewater Design Sheets

DAVID SCHAEFFER ENGINEERING LTD.
600 ALDEN ROAD, SUITE 700
MARKHAM, ONTARIO
L3R 0E7
TEL: (905) 475-3080
FAX: (905) 475-3081

THE REGIONAL MUNICIPALITY OF HALTON

SANITARY SEWER DESIGN

Residential	90	pph
Commercial	100	pph
Institutional	70	pph
Village Square	40	pph

n (PVC): 0.013

n (Conc): 0.013

Infil.Flow (INF): 0.286 L/s/ha

SHEET No.:	1 OF 1
LOCATION:	Redoak/Capoak
PROJECT No.:	17-903
DATE:	August 2020
DESIGNED BY:	R.Y.
CHECKED BY:	K.M.

STREET	MANHOLE		LENGTH	TRIBUTARY AREA HECTARE							POPULATION TRIBUTARY							AVG.	AVG.	PEAKING	MAX	INF.	MAX	SEWER					PIPE		REMARKS
						INCREMENT				TOTAL			INCREMENT				TOTAL	m^3/s	m^3/s		m^3/s	m^3/s	FLOW	SIZE	SLOPE	Q	VEL (m/s)				
	FROM	TO	(m)			RES	COMM	INST	V.S.				RES	COMM	INST	IND		INC.	TOTAL	FACTOR			EXP.			m^3/s	FULL	ACT.	TYPE	CLASS	
Trunk 1																															
	1A	2A				11.0			0.3	11.30			990			12	1002	0.0032	0.0032	3.80	0.0121	0.0032	0.0154	250	0.30	0.033	0.66	0.64			
External Contribution						0.1							9																		
	2A	MH40(B.O.)				8.2	2.8		0.3	22.70			738	280		12	2041	0.0033	0.0065	3.58	0.0233	0.0065	0.0297	300	0.20	0.043	0.61	0.65			
To Dundas Street 675mm Sanitary Sewer By Others										22.70							2041														

Natural Heritage System

CORE 10

CORE 10 BOUNDARY

NHS

Vista

Village Square

0.3Ha
40
12

11.0Ha
90
990

MH1A

250Ø

250Ø

250Ø

8.2Ha
90
738

P52
SWM Pond
PP 173.20

V.S.

NHS

EIGHTH LINE

3053 Eighth Line

Future Development

Future Development

MH2A

Village Square

0.3Ha
40
12

300Ø

300Ø

300Ø

Dundas Urban Core

1.3Ha
100
130

Dundas Street Urban Core
1.27 ha

0.1Ha
90
9

Dundas Street Urban Core
1.47 ha

1.5Ha
100
150

675Ø

MH40A

DUNDAS STREET EAST

EX. 500Ø HDPE CULVERT IN INV. ±175.90 AS PER MRC, PROPOSED WATERMAIN, SANITARY SEWER AND FORCEMAIN DUNDAS STREET

PRINCE MICHAEL DRIVE

0 40 80 120 160 200

SCALE 1:4000

Legend

- Redoak/Capoak Lands
- Proposed Wastewater Trunk
- Proposed Manholes
- Sanitary Drainage Area
- Proposed Wastewater Sewer (By Others)
- Proposed Forcemain (By Others)
- Proposed Wastewater Manholes (By Others)
- Proposed Local Wastewater Sewer

4.4Ha / 90 / 440 — Drainage Area, Density (PPU), Total Population

0.1Ha / 90 / 9 — External Drainage Area, Density (PPU), Total Population

David Schaeffer Engineering Ltd.
Beacon Environmental
J.F. Sabourin and Associates Inc.
R.J. Burnside & Associates Limited
Stonybrook Consulting Inc.
EXP
Bird and Hale Limited

REDOAK/CAPOAK ADDENDUM #1 TO THE JOSHUA'S CREEK TRIBUTARIES EIR/FSS

FIGURE IA

Conceptual Wastewater Servicing

AUGUST 2020

New Appendix V, Watermain Analysis

Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development

Technical Memorandum

FINAL

Prepared for:
David Schaeffer Engineering Ltd.
600 Alden Road, Suite 700
Markham, ON L3R 0E7

Prepared by:
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

Submission: July 22, 2020

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Re: Project 2020-021-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	July 14, 2020	Draft Submission	Ben Loewen	Werner de Schaetzen
R1	July 22, 2020	Final Submission	Ben Loewen	Werner de Schaetzen

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Contents

1 Introduction

GeoAdvice Engineering Inc. (GeoAdvice) was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for the Redoak/Capoak development (development) within the Joshua Creek subdivision, in the Region of Halton (Region) water distribution system.

The Redoak/Capoak development is located in the southwest corner of Joshua Creek subdivision, which is located between Burnhamthorpe Road East, Eighth Line and Dundas Street East. The site is shown in **Figure 1.1** on the following page, illustrating the connection points under the 2021 and 2031 scenarios as well as the proposed pipe diameters for the Redoak/Capoak development.

Redoak/Capoak is proposed to be developed with nine (9) proposed connections to the Region's water network:

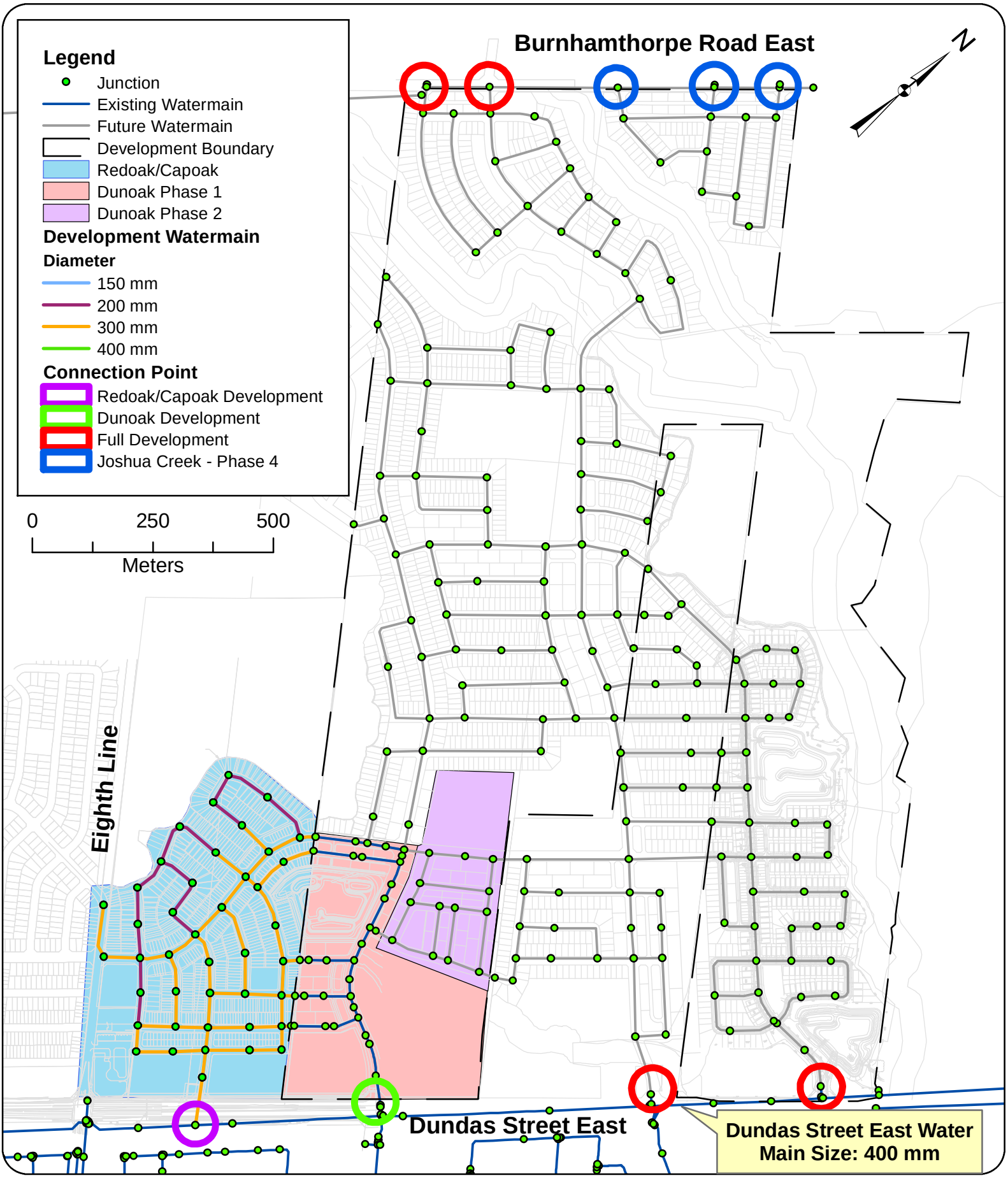
- Redoak/Capoak consists of one (1) proposed connection to the existing water main on Dundas Street East (existing and future scenarios) and is connected to the Dunoak development located to the east, which consists of one (1) proposed connection to the existing water main on Dundas Street East (existing and future scenarios).
- The Full Joshua Creek subdivision consists of two (2) proposed connections to the existing water main on Dundas Street East (future scenario only), two (2) proposed connections to the future water main on Burnhamthorpe Road East (future scenario only) and three (3) proposed connections to the Joshua Creek Phase 4 development (future scenario only).

As agreed with DSEL, the following scenarios were assessed for the Redoak/Capoak development.

- Interim 2021 with Redoak/Capoak + Dunoak Phase 1
- Future 2031 with Redoak/Capoak + Dunoak Phase 1
- Future 2031 with Full Joshua Creek Development

This memo describes the assumptions and results of the hydraulic modeling and capacity analysis using the latest Region's InfoWater water model (received on June 30, 2020). InfoWater (Innovyze Software) is a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

Site Layout and Proposed Pipe Diameters

Figure 1.1

2 Demands

2.1 Consumer Demands

Population densities were assigned according to the Region of Halton Design Guidelines (Oct. 2019). A summary of the demand unit rates relevant for this development are shown in **Table 2.1** below.

Table 2.1: Region of Halton Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	275	L/c/d
Institutional/School	11,000	L/Ha/d
Maximum Daily Demand		
Residential	2.25 x avg. day	L/c/d
Institutional/School	2.25 x avg. day	L/Ha/d
Peak Hour Demand		
Residential	4.00 x avg. day	L/c/d
Institutional/School	2.25 x avg. day	L/Ha/d

Water demand calculations are shown in **Table 2.2** and **Table 2.3** below. Detailed calculations of demands are shown in **Appendix A**. Demands were grouped and evenly applied to all the model nodes within each group. The locations of nodes do not necessarily represent hydrant locations.

Table 2.2: Residential Water Demand Calculations

Phase	Population	Average Day Demand	Maximum Day Demand	Peak Hour Demand
	(Cap)	(L/s)	(L/s)	(L/s)
Redoak/Capoak	3,382	10.76	24.22	43.06
Full Joshua Creek	20,443	65.06	146.38	260.23

Please Note: 33 additional residential units are expected to be added to the Redoak/Capoak development in the future that were not included in the initial analysis. It is anticipated that the additional demand contributed by these units (approximately 0.6 L/s and 1.1 L/s under the MDD and PHD, respectively) would not significantly impact pressure or fire flow results. However, no modeling was conducted to verify this prediction.

Table 2.3: Non-Residential Water Demand Calculations

Phase	Land Use	Area	Average Day Demand	Maximum Day Demand	Peak Hour Demand
	Type	(Ha)	(L/s)	(L/s)	(L/s)
Redoak/Capoak	Village Square	0.58	0.07	0.17	0.17
Full Joshua Creek	Village Square	2.67	0.34	0.76	0.76
	Mixed Use - Commercial	0.87	0.25	0.56	0.56
	Neighborhood Park	8.61	1.10	2.47	2.47
	Elementary School	2.40	0.31	0.69	0.69
	Public Elementary School	2.86	0.36	0.82	0.82

There is not currently enough information about the proposed schools to calculate the demand based on a per student water usage. As such, the demand was calculated based on the area of the proposed development land for each school. A rate of 11,000 L/Ha/d was used as per the Region of Halton Water and Wastewater Linear Design Manual.

2.2 Fire Flows

Fire flow demands are typically determined in accordance with the Fire Underwriters Survey's Water Supply for Public fire Protection guideline (1999). FUS calculations are based on the types of building, floor area, number of storeys, construction class, occupancy class and exposure factor. Due to the lack of design drawings available for the Redoak/Capoak development, the fire flow requirements were determined based on each building type from previous projects in the Region of Halton area, as agreed upon with DSEL. **Table 2.4** shows the agreed upon required fire flow for each building type in the development. Please note that once design drawings become available, the calculated FUS fire flows may vary from those shown below. Additionally, no fire walls were considered in determining or allocating the fire flow requirements.

Table 2.4: Fire Flow Requirements at 140 kPa (20 psi)

Development Type	Fire Flow (L/s)*	Description
Residential Low-Density	167	Detached Residential
Residential Medium-Density	250	Townhouse
Residential High-Density	317	Back-to-Back Townhouse
Institutional/Commercial	283	Dundas Urban Core

*Based on previous projects, as agreed upon with DSEL.

Fire flows requirements were only assessed at junctions within the Redoak/Capoak development.

3 Modeling Considerations

3.1 Water Main Configuration

The water main network was laid out based on a pipe network layout prepared by David Schaeffer Engineering and provided to GeoAdvice on July 8, 2020.

The Redoak/Capoak development consists of one (1) phase, as shown in **Figure 1.1.**

- Redoak/Capoak consists of 116 single detached dwelling, 385 townhomes, 74 back-to-back townhomes and two (2) multi-use (live-work) building areas (Dundas Urban Core). There is one (1) proposed connection to the existing water main on Dundas Street East (existing and future scenarios). The Redoak/Capoak development will also connected to the Dunoak development located to the east, which consists of one (1) proposed connection to the existing water main on Dundas Street East (existing and future scenarios).
- The Full Joshua Creek subdivision consists of approximately 7,000 residential units (including Redoak/Capoak). In addition to the proposed connection to the existing water main on Dundas Street East and to the Dunoak development to the east, there are two (2) proposed connections to the existing water main on Dundas Street East (future scenario only), and two (2) proposed connections to the future water main on Burnhamthorpe Road East (future scenario only) and three (3) proposed connections to the Joshua Creek Phase 4 development (future scenario only).

3.2 Pressure Requirements

As outlined in the Region of Halton Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 40 psi and 80 psi. The target pressure at any point in the distribution system is 45 psi. Pressure requirements are outlined in **Table 3.1**.

Table 3.1: Region of Halton Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	275	40	-	-
Peak Hour Demand (minimum allowable pressure)	275	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	550	80
Maximum Distribution Pressure (Halton)	-	-	690	100
Maximum Day Plus Fire	140	20	-	-

3.3 Elevations

Elevations of the modeled Redoak/Capoak development junctions were assigned according to a site grading plan prepared by David Schaeffer Engineering and provided to GeoAdvice on April 6, 2020. Modeled node elevations were assigned according to center line of road or the closest proposed grade. In the absence of updated elevation data for the revised water main layout (the addition of the street north of the DUC areas), the elevations were assumed based on the previously provided grading plan, as agreed upon with DSEL.

3.4 Pipe Characteristics

Pipe diameter and Hazen-Williams C factors were assigned in the model according to the Region of Halton Design Guidelines (Oct. 2019). Pipe characteristics used for the development are outlined in **Table 3.2** below. Sizing the pipes within the development is impacted in part due the Region of Halton's maximum velocity criteria of 3.5 m/s.

Table 3.2: Model Pipe Characteristics

Nominal Diameter (mm)	Hazen Williams C-Factor (/)*
150	130
200	130
300	130

*Region of Halton Design Guidelines (Oct. 2019)

4 Modeling Results

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for peak hour and maximum day plus fire flow using InfoWater. The proposed water main layout, as well as detailed pipe and junction tables can be found in **Appendix B**.

4.1 System Pressures

The modeling results indicate that the Redoak/Capoak development can be adequately serviced by the proposed water main layout. Modeled service pressures for the Redoak/Capoak development under the Interim 2021 and the Full Joshua Creek future 2031 scenarios are summarized in **Table 4.1** below. Detailed modeling results are found in **Appendix C**.

Table 4.1: Summary of Available Service Pressures (PHD)

Phase	Scenario	Maximum Pressure (psi)	Average Pressure (psi)	Minimum Pressure (psi)
Redoak/Capoak	Interim 2021	77	74	72
Redoak/Capoak	Future 2031	58	55	53
Full Joshua Creek	Future 2031	54	52	50

Based on the anticipated Interim 2021 scenario service pressures (<80 psi), pressure reducing valves or upsized service connections will not be required for buildings within the development.

4.2 Available Fire Flows

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. Fire flows were only assessed at the junctions within the Redoak/Capoak development. A summary of available fire flows under the Interim 2021 and the Full Joshua Creek future 2031 scenarios are shown below in **Table 4.2**. Detailed fire flow reports are found in **Appendix D**.

Table 4.2: Summary of Available Fire Flows (MDD + FF)

Phase	Scenario	Maximum Available Fire Flow* (L/s)	Average Available Fire Flow* (L/s)	Minimum Available Fire Flow* (L/s)
Redoak/Capoak	Interim 2021	825	621	357
Redoak/Capoak	Future 2031	733	522	286
Full Joshua Creek	Future 2031	851	616	295

*The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

4.3 Residual Pressures

A summary of the residual pressures in the Redoak/Capoak development under the Interim 2021 and the Full Joshua Creek future 2031 scenarios are shown below in **Table 4.3**.

Table 4.3: Summary of Residual Pressures (MDD + FF)

Phase	Scenario	Maximum Residual Pressure (psi)	Average Residual Pressure (psi)	Minimum Residual Pressure (psi)
Redoak/Capoak	Interim 2021	69	65	54
Redoak/Capoak	Future 2031	51	47	36
Full Joshua Creek	Future 2031	52	47	37

As shown in **Table 4.3**, the model predicts that all fire flow requirements can be met throughout the Redoak/Capoak development under the Interim 2021 and the Full Joshua Creek future 2031 scenarios with the proposed water main layout shown in **Appendix B**.

5 Conclusions

The proposed water main network for the Redoak/Capoak development under the Interim 2021 and the Full Joshua Creek future 2031 scenarios can deliver all domestic and fire flows as per the Ministry of Environment, Region of Halton, and Fire Underwriters Criteria as follows:

- The service pressures of the development are expected to range between 50 psi and 77 psi, which are within the Region of Halton guidelines for water distribution systems under the Interim 2021 and Future 2031 scenarios.
- All fire flow requirements are achievable within the development (residual pressures exceed 20 psi) under the Interim 2021 and Future 2031 scenarios.
- Based on the anticipated service pressures not exceeding 80 psi, pressure reducing valves will not be required for buildings within the development.
- Due to the lack of design drawings available for the Redoak/Capoak development, the fire flow requirements were determined based on each building type from previous projects in the Region of Halton area. Once design drawings become available, the calculated FUS fire flows may vary from those shown in this report. Additionally, no fire walls were considered in determining or allocating the fire flow requirements.

Submission

Prepared by:

Ben Loewen, E.I.T.
Hydraulic Modeler / Project Engineer

Approved by:

LICENSED PROFESSIONAL ENGINEER
W. E. F. de Schaetzen
100116349
PROVINCE OF ONTARIO

July 22, 2020

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review / Project Manager

Appendix A Demand Calculations

Consumer Water Demands - Redoak/Capoak

Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2.25 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 4 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)			
Single Detached	116	3.472	403	275	110,825	1.28	2.89	150	5.13
Traditional Townhome	385	2.555	984		270,600	3.13	7.05	250	12.53
Back-to-Back Townhome	74	2.555	190		52,250	0.60	1.36	317	2.42
Dundas Urban Core*	706	2.555	1,805		496,375	5.75	12.93	283	22.98
Subtotal	**1,281**		**3,382**		**930,050**	**10.76**	**24.22**		**43.06**

Non-Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day 2.25 x Avg. Day (L/s)	Fire Flow (L/s)	Peak Hour 2.25 x Avg. Day (L/s)
			(L/ha/d)	(L/d)	(L/s)			
Village Square	0.58		11,000	6,380	0.07	0.17	N/A	0.17
Subtotal	**0.58**			**6,380**	**0.07**	**0.17**		**0.17**

Total					**10.84**	**24.39**		**43.22**

*Based on a 254 unit/ha rate as calculated from the master site plan prepared by bnkc Architecture + Urban Design, received from DSEL (2.78 ha).

Consumer Water Demands - Full Joshua Creek Development

Residential Demands

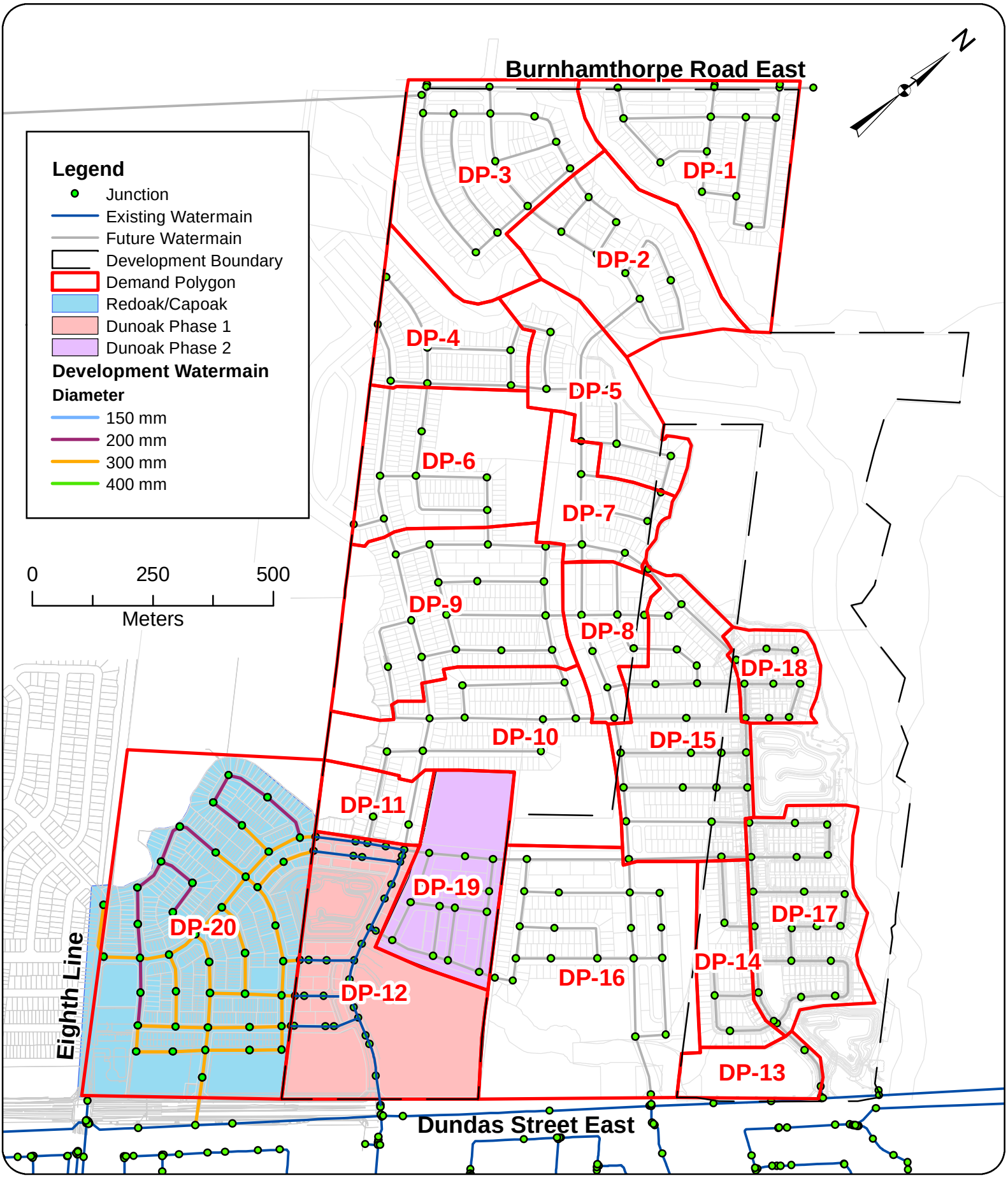
			Population		Average Day Demand			Max Day 2.25 x Avg Day (L/s)	Peak Hour 4.0 x Avg Day (L/s)
Demand Polygon	**Dwelling Type**	**Number of Units**	**Persons per Unit**	**Population**	**L/c/d**	**L/d**	**L/s**		
DP-1	Detached Residential	129	3.472	448	275	123,169	1.43	3.21	5.70
	Townhome	85	2.555	217	275	59,723	0.69	1.56	2.76
DP-2	Townhome	61	2.555	156	275	42,860	0.50	1.12	1.98
	Detached Residential	64	3.472	222	275	61,107	0.71	1.59	2.83
DP-3	Detached Residential	131	3.472	455	275	125,079	1.45	3.26	5.79
	Townhome	72	2.555	184	275	50,589	0.59	1.32	2.34
	Mixed Use - Residential*	53	3.472	184	275	50,604	0.59	1.32	2.34
DP-4	Detached Residential	99	3.472	344	275	94,525	1.09	2.46	4.38
DP-5	Detached Residential	75	3.472	260	275	71,610	0.83	1.86	3.32
	Townhome	22	2.555	56	275	15,458	0.18	0.40	0.72
DP-6	Detached Residential	134	3.472	465	275	127,943	1.48	3.33	5.92
	Townhome	27	2.555	69	275	18,971	0.22	0.49	0.88
DP-7	Detached Residential	42	3.472	146	275	40,102	0.46	1.04	1.86
	Townhome	32	2.555	82	275	22,484	0.26	0.59	1.04
DP-8	Detached Residential	24	3.472	83	275	22,915	0.27	0.60	1.06
	Townhome	87	2.555	222	275	61,128	0.71	1.59	2.83
DP-9	Detached Residential	191	3.472	663	275	182,367	2.11	4.75	8.44
	Townhome	105	2.555	268	275	73,776	0.85	1.92	3.42
DP-10	Detached Residential	155	3.472	538	275	147,994	1.71	3.85	6.85
	Townhome	18	2.555	46	275	12,647	0.15	0.33	0.59
DP-11	Detached Residential	30	3.472	104	275	28,644	0.33	0.75	1.33
	Townhome	35	2.555	89	275	24,592	0.28	0.64	1.14
DP-12	Townhome	132	2.555	337	275	92,747	1.07	2.42	4.29
	Dundas Urban Core**	541	2.555	1382	275	380,134	4.40	9.90	17.60
	Dundas Urban Core**	1209	2.555	3089	275	849,502	9.83	22.12	39.33
DP-13	Dundas Urban Core**	734	2.555	1876	275	515,769	5.97	13.43	23.88
DP-14	Detached Residential	74	3.472	257	275	70,655	0.82	1.84	3.27
	Townhome	36	2.555	92	275	25,295	0.29	0.66	1.17
DP-15	Detached Residential	238	3.472	826	275	227,242	2.63	5.92	10.52
	Townhome	25	2.555	64	275	17,566	0.20	0.46	0.81
DP-16	Detached Residential	97	3.472	337	275	92,616	1.07	2.41	4.29
	Townhome	169	2.555	432	275	118,744	1.37	3.09	5.50
	Mixed Use - Residential*	65	3.472	226	275	62,062	0.72	1.62	2.87
	Dundas Urban Core**	620	2.555	1583	275	435,459	5.04	11.34	20.16
DP-17	Detached Residential	149	3.472	517	275	142,265	1.65	3.70	6.59
	Townhome	15	2.555	38	275	10,539	0.12	0.27	0.49
DP-18	Detached Residential	55	3.472	191	275	52,514	0.61	1.37	2.43
DP-19	Detached Residential	24	3.472	83	275	22,915	0.27	0.60	1.06
	Townhome	167	2.555	427	275	117,338	1.36	3.06	5.43
DP-20	Detached Residential	116	3.472	403	275	110,757	1.28	2.88	5.13
	Townhome	385	2.555	984	275	270,511	3.13	7.04	12.52
	Back-to-Back Townhome	74	2.555	190	275	51,994	0.60	1.35	2.41
	Dundas Urban Core**	706	2.555	1805	275	496,138	5.74	12.92	22.97
	Total	**7302**		**20,443**		**5,621,048**	**65.06**	**146.38**	**260.23**

Non-Residential Demands

					Average Day Demand			Max Day 2.25 x Avg Day (L/s)	Peak Hour 2.25 x Avg Day (L/s)
Demand Polygon	**Dwelling Type**	**Area (ha)**			**L/ha/d**	**L/d**	**L/s**		
DP-1	Village Square	0.3			11,000	3,300	0.04	0.09	0.09
DP-2	Village Square	0.3			11,000	3,300	0.04	0.09	0.09
DP-3	Mixed Use - Commercial	0.39			24,750	9,653	0.11	0.25	0.25
DP-6	Neighborhood Park	4.15			11,000	45,650	0.53	1.19	1.19
	Elementary School	2.4			11,000	26,400	0.31	0.69	0.69
DP-7	Village Square	0.3			11,000	3,300	0.04	0.09	0.09
DP-10	Village Square	0.5			11,000	5,500	0.06	0.14	0.14
	Neighborhood Park	4.46			11,000	49,060	0.57	1.28	1.28
DP-19	Public Elementary School	2.86			11,000	31,460	0.36	0.82	0.82
DP-19	Village Square	0.29			11,000	3,190	0.04	0.08	0.08
DP-16	Mixed Use - Commercial	0.48			24,750	11880	0.14	0.31	0.31
DP-17	Village Square	0.4			11,000	4,400	0.05	0.11	0.11
DP-20	Village Square	0.58			11,000	6,380	0.07	0.17	0.17
Total		**17.41**				**203,473**	**2.36**	**5.30**	**5.30**

* Based on 135 cap/ha as agreed upon with DSEL.

**Based on a 254 unit/ha rate as used in previous projects and agreed upon with DSEL.



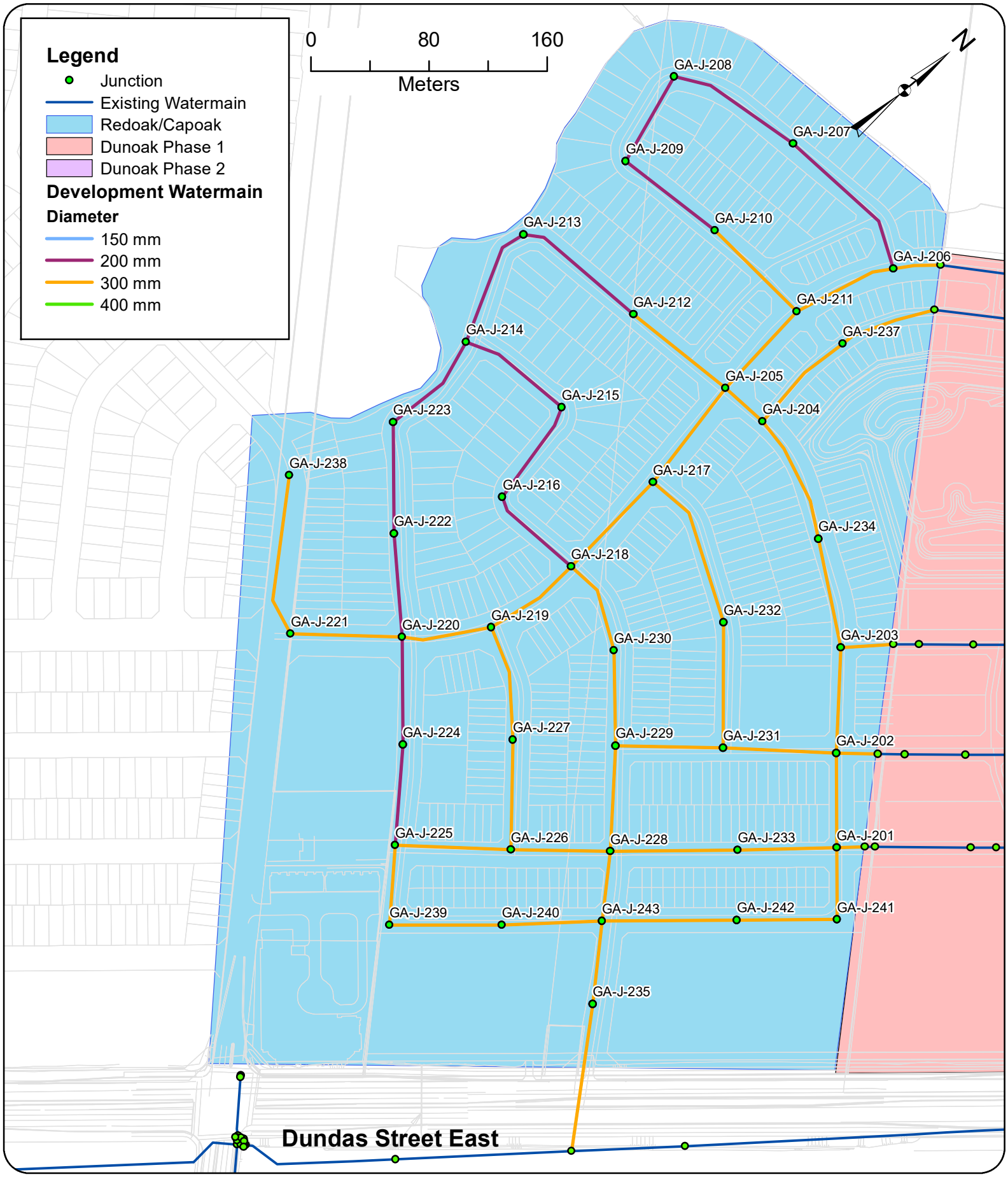
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

Demand Polygons

Figure A.1

Appendix B Modeling Schematics – Pipe and Junction Tables



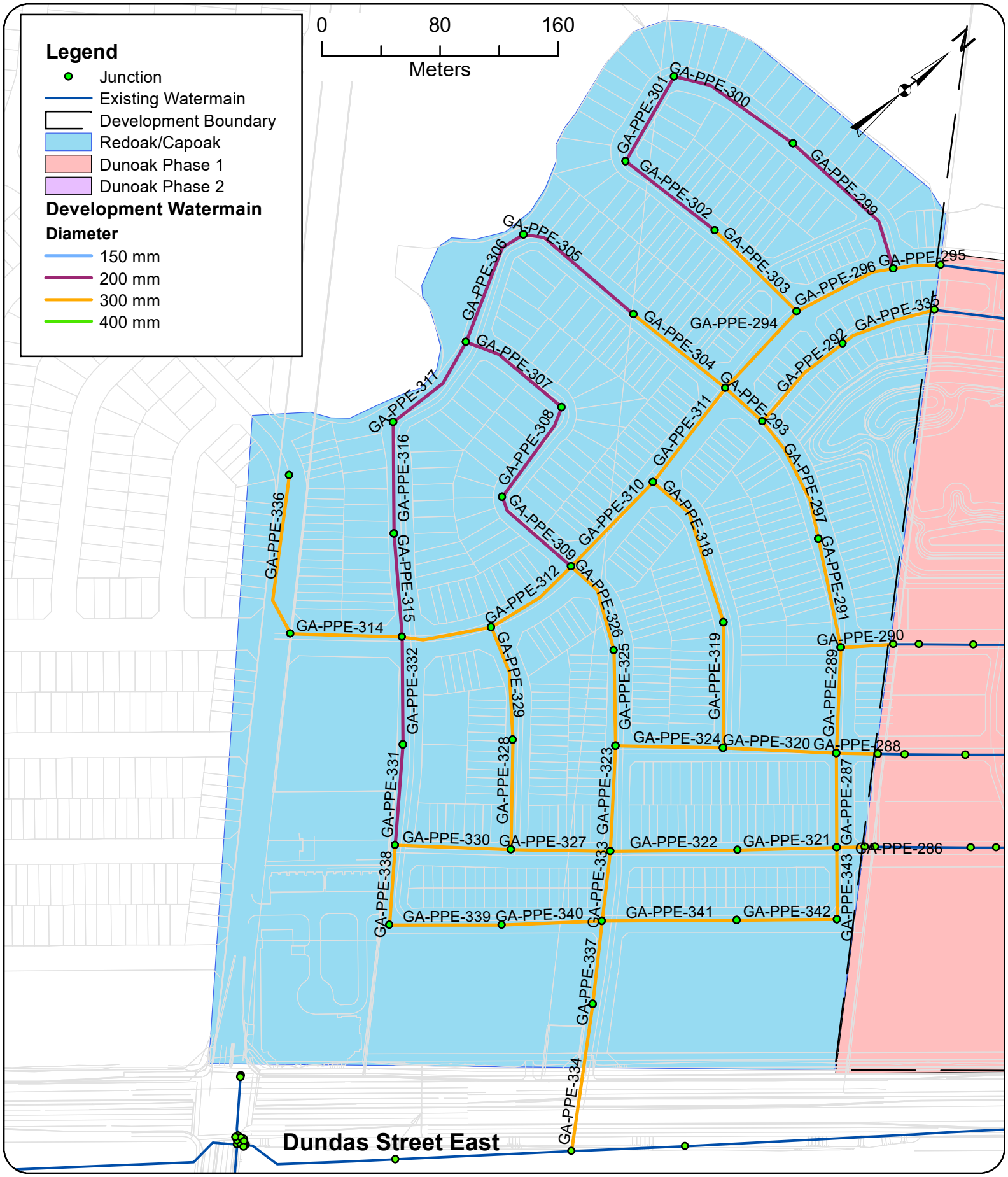
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Junction IDs

Figure B.1



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

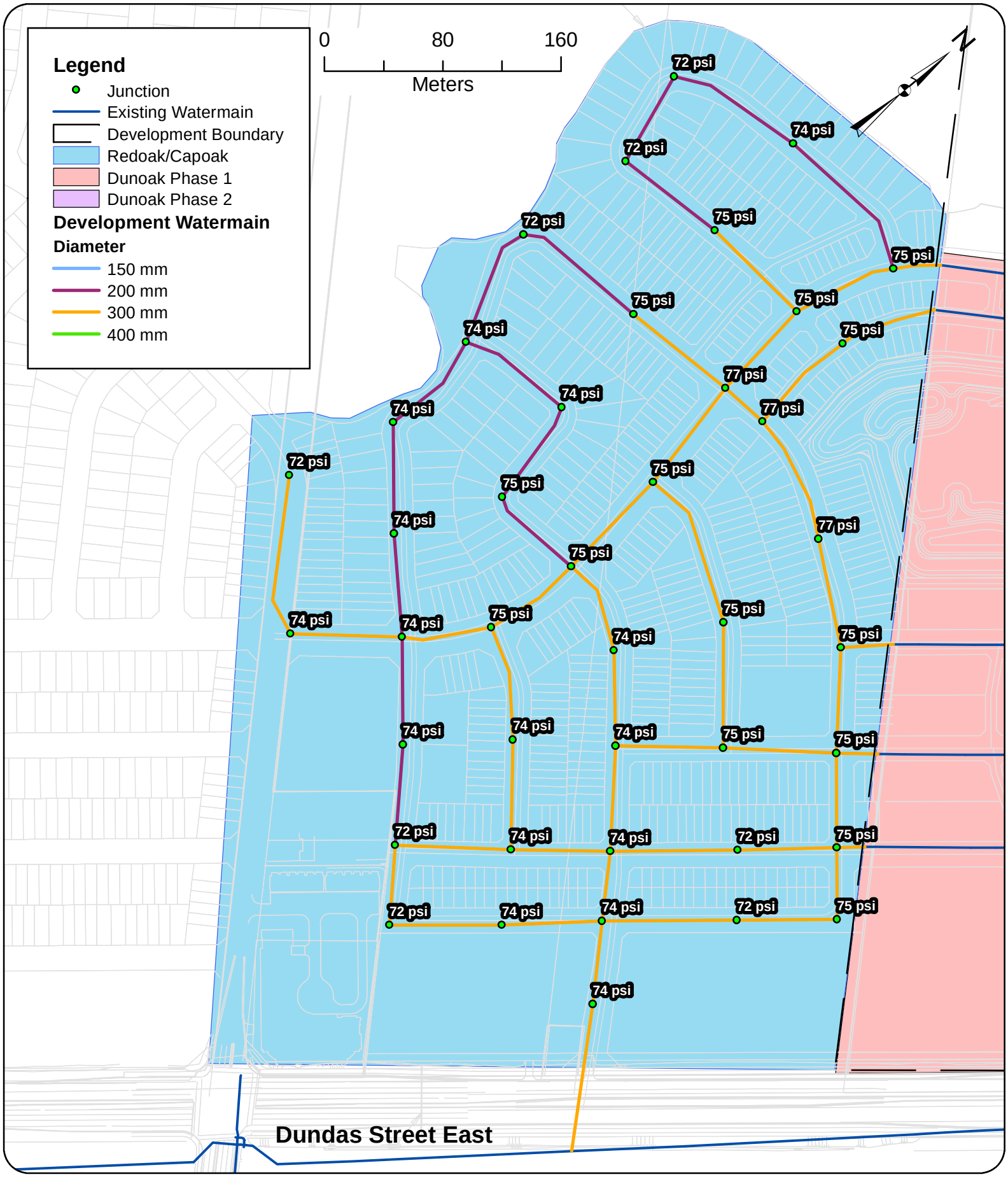
Pipes IDs

Figure B.2

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness
GA-PPE-286	GA-J-168	GA-J-201	19.26	300	130
GA-PPE-287	GA-J-201	GA-J-202	64.00	300	130
GA-PPE-288	GA-J-165	GA-J-202	27.94	300	130
GA-PPE-289	GA-J-202	GA-J-203	71.53	300	130
GA-PPE-290	GA-J-203	GA-J-164	35.42	300	130
GA-PPE-291	GA-J-203	GA-J-234	75.08	300	130
GA-PPE-292	GA-J-204	GA-J-237	76.08	300	130
GA-PPE-293	GA-J-204	GA-J-205	33.64	300	130
GA-PPE-294	GA-J-205	GA-J-211	70.67	300	130
GA-PPE-295	GA-J-206	GA-J-147	32.13	300	130
GA-PPE-296	GA-J-211	GA-J-206	72.04	300	130
GA-PPE-297	GA-J-234	GA-J-204	89.21	300	130
GA-PPE-299	GA-J-206	GA-J-207	111.73	200	130
GA-PPE-300	GA-J-207	GA-J-208	93.62	200	130
GA-PPE-301	GA-J-208	GA-J-209	65.92	200	130
GA-PPE-302	GA-J-209	GA-J-210	76.28	200	130
GA-PPE-303	GA-J-210	GA-J-211	78.07	300	130
GA-PPE-304	GA-J-205	GA-J-212	79.84	300	130
GA-PPE-305	GA-J-212	GA-J-213	93.79	200	130
GA-PPE-306	GA-J-213	GA-J-214	85.28	200	130
GA-PPE-307	GA-J-214	GA-J-215	79.23	200	130
GA-PPE-308	GA-J-215	GA-J-216	73.15	200	130
GA-PPE-309	GA-J-216	GA-J-218	67.23	200	130
GA-PPE-310	GA-J-218	GA-J-217	79.38	300	130
GA-PPE-311	GA-J-217	GA-J-205	80.56	300	130
GA-PPE-312	GA-J-218	GA-J-219	68.38	300	130
GA-PPE-313	GA-J-219	GA-J-220	61.21	300	130
GA-PPE-314	GA-J-220	GA-J-221	75.33	300	130
GA-PPE-315	GA-J-220	GA-J-222	70.27	200	130
GA-PPE-316	GA-J-222	GA-J-223	75.17	200	130
GA-PPE-317	GA-J-214	GA-J-223	74.91	200	130
GA-PPE-318	GA-J-217	GA-J-232	109.60	300	130
GA-PPE-319	GA-J-232	GA-J-231	84.88	300	130
GA-PPE-320	GA-J-231	GA-J-202	76.69	300	130
GA-PPE-321	GA-J-201	GA-J-233	66.97	300	130
GA-PPE-322	GA-J-233	GA-J-228	86.22	300	130
GA-PPE-323	GA-J-228	GA-J-229	71.60	300	130
GA-PPE-324	GA-J-229	GA-J-231	72.74	300	130
GA-PPE-325	GA-J-230	GA-J-229	64.41	300	130
GA-PPE-326	GA-J-230	GA-J-218	66.05	300	130
GA-PPE-327	GA-J-228	GA-J-226	67.27	300	130
GA-PPE-328	GA-J-226	GA-J-227	74.30	300	130
GA-PPE-329	GA-J-227	GA-J-219	78.45	300	130
GA-PPE-330	GA-J-226	GA-J-225	78.20	300	130
GA-PPE-331	GA-J-225	GA-J-224	68.29	200	130
GA-PPE-332	GA-J-220	GA-J-224	72.78	200	130
GA-PPE-333	GA-J-228	GA-J-243	47.42	300	130
GA-PPE-334	GA-J-235	GA-J-236	100.69	300	130
GA-PPE-335	GA-J-237	GA-J-146	66.63	300	130
GA-PPE-336	GA-J-221	GA-J-238	111.14	300	130
GA-PPE-337	GA-J-243	GA-J-235	56.37	300	130
GA-PPE-338	GA-J-225	GA-J-239	54.11	300	130
GA-PPE-339	GA-J-239	GA-J-240	76.15	300	130
GA-PPE-340	GA-J-240	GA-J-243	67.86	300	130
GA-PPE-341	GA-J-243	GA-J-242	91.10	300	130
GA-PPE-342	GA-J-242	GA-J-241	67.72	300	130
GA-PPE-343	GA-J-241	GA-J-201	48.50	300	130

ID	Elevation (m)	Required Fire Flow (L/s)
GA-J-201	178.00	317
GA-J-202	178.00	250
GA-J-203	178.00	250
GA-J-204	177.00	250
GA-J-205	177.00	250
GA-J-206	178.00	250
GA-J-207	179.00	167
GA-J-208	180.00	167
GA-J-209	180.00	167
GA-J-210	178.00	250
GA-J-211	178.00	250
GA-J-212	178.00	250
GA-J-213	180.00	167
GA-J-214	179.00	167
GA-J-215	179.00	167
GA-J-216	178.00	167
GA-J-217	178.00	250
GA-J-218	178.00	250
GA-J-219	178.00	250
GA-J-220	179.00	250
GA-J-221	179.00	250
GA-J-222	179.00	167
GA-J-223	179.00	167
GA-J-224	179.00	167
GA-J-225	180.00	317
GA-J-226	179.00	317
GA-J-227	179.00	250
GA-J-228	179.00	317
GA-J-229	179.00	250
GA-J-230	179.00	250
GA-J-231	178.00	250
GA-J-232	178.00	250
GA-J-233	180.00	317
GA-J-234	177.00	250
GA-J-235	179.00	283
GA-J-237	178.00	250
GA-J-238	180.00	250
GA-J-239	180.00	317
GA-J-240	179.00	317
GA-J-241	178.00	317
GA-J-242	180.00	317
GA-J-243	179.00	317

Appendix C Pressure and Flow Modeling Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

PHD Pressure 2021 Scenario Redoak/Capoak

Figure C.1

2021 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-286	GA-J-168	GA-J-201	19.26	300	130	-0.54	0.09	0.00	0.04
GA-PPE-287	GA-J-201	GA-J-202	64.00	300	130	1.09	0.18	0.01	0.14
GA-PPE-288	GA-J-165	GA-J-202	27.94	300	130	-0.92	0.15	0.00	0.10
GA-PPE-289	GA-J-202	GA-J-203	71.53	300	130	0.63	0.10	0.00	0.05
GA-PPE-290	GA-J-203	GA-J-164	35.42	300	130	0.54	0.09	0.00	0.04
GA-PPE-291	GA-J-203	GA-J-234	75.08	300	130	0.05	0.01	0.00	0.00
GA-PPE-292	GA-J-204	GA-J-237	76.08	300	130	0.28	0.05	0.00	0.01
GA-PPE-293	GA-J-204	GA-J-205	33.64	300	130	-0.32	0.05	0.00	0.01
GA-PPE-294	GA-J-205	GA-J-211	70.67	300	130	0.42	0.07	0.00	0.02
GA-PPE-295	GA-J-206	GA-J-147	32.13	300	130	0.17	0.03	0.00	0.00
GA-PPE-296	GA-J-211	GA-J-206	72.04	300	130	0.26	0.04	0.00	0.01
GA-PPE-297	GA-J-234	GA-J-204	89.21	300	130	0.01	0.00	0.00	0.00
GA-PPE-299	GA-J-206	GA-J-207	111.73	200	130	0.04	0.02	0.00	0.00
GA-PPE-300	GA-J-207	GA-J-208	93.62	200	130	0.00	0.00	0.00	0.00
GA-PPE-301	GA-J-208	GA-J-209	65.92	200	130	-0.04	0.01	0.00	0.00
GA-PPE-302	GA-J-209	GA-J-210	76.28	200	130	-0.08	0.03	0.00	0.01
GA-PPE-303	GA-J-210	GA-J-211	78.07	300	130	-0.12	0.02	0.00	0.00
GA-PPE-304	GA-J-205	GA-J-212	79.84	300	130	-0.08	0.01	0.00	0.00
GA-PPE-305	GA-J-212	GA-J-213	93.79	200	130	-0.12	0.05	0.00	0.02
GA-PPE-306	GA-J-213	GA-J-214	85.28	200	130	-0.17	0.06	0.00	0.03
GA-PPE-307	GA-J-214	GA-J-215	79.23	200	130	-0.09	0.03	0.00	0.01
GA-PPE-308	GA-J-215	GA-J-216	73.15	200	130	-0.13	0.05	0.00	0.02
GA-PPE-309	GA-J-216	GA-J-218	67.23	200	130	-0.17	0.06	0.00	0.03
GA-PPE-310	GA-J-218	GA-J-217	79.38	300	130	0.60	0.10	0.00	0.05
GA-PPE-311	GA-J-217	GA-J-205	80.56	300	130	0.70	0.11	0.00	0.06
GA-PPE-312	GA-J-218	GA-J-219	68.38	300	130	-0.53	0.09	0.00	0.04
GA-PPE-313	GA-J-219	GA-J-220	61.21	300	130	0.07	0.01	0.00	0.00
GA-PPE-314	GA-J-220	GA-J-221	75.33	300	130	0.08	0.01	0.00	0.00
GA-PPE-315	GA-J-220	GA-J-222	70.27	200	130	0.20	0.08	0.00	0.05
GA-PPE-316	GA-J-222	GA-J-223	75.17	200	130	0.16	0.06	0.00	0.03
GA-PPE-317	GA-J-214	GA-J-223	74.91	200	130	-0.12	0.04	0.00	0.02
GA-PPE-318	GA-J-217	GA-J-232	109.60	300	130	-0.14	0.02	0.00	0.00
GA-PPE-319	GA-J-232	GA-J-231	84.88	300	130	-0.18	0.03	0.00	0.00
GA-PPE-320	GA-J-231	GA-J-202	76.69	300	130	0.50	0.08	0.00	0.03
GA-PPE-321	GA-J-201	GA-J-233	66.97	300	130	-0.63	0.10	0.00	0.05

2021 Peak Hour Demand Modeling Results - Redoak-Capoak Development

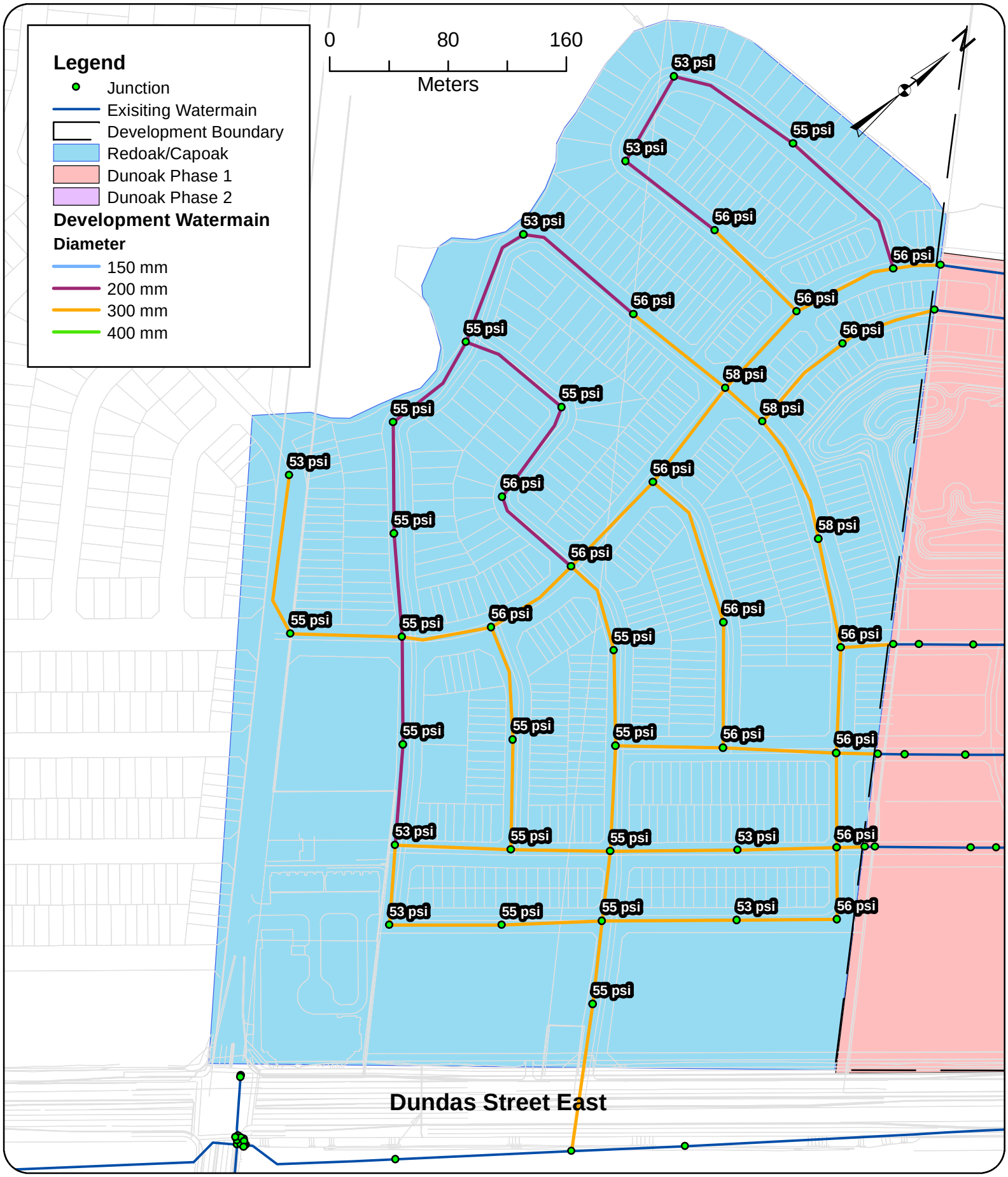
ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-322	GA-J-233	GA-J-228	86.22	300	130	-0.67	0.11	0.00	0.06
GA-PPE-323	GA-J-228	GA-J-229	71.60	300	130	1.08	0.18	0.01	0.14
GA-PPE-324	GA-J-229	GA-J-231	72.74	300	130	0.72	0.12	0.00	0.06
GA-PPE-325	GA-J-230	GA-J-229	64.41	300	130	-0.32	0.05	0.00	0.02
GA-PPE-326	GA-J-230	GA-J-218	66.05	300	130	0.28	0.05	0.00	0.01
GA-PPE-327	GA-J-228	GA-J-226	67.27	300	130	0.23	0.04	0.00	0.01
GA-PPE-328	GA-J-226	GA-J-227	74.30	300	130	0.69	0.11	0.00	0.06
GA-PPE-329	GA-J-227	GA-J-219	78.45	300	130	0.65	0.11	0.00	0.05
GA-PPE-330	GA-J-226	GA-J-225	78.20	300	130	-0.50	0.08	0.00	0.03
GA-PPE-331	GA-J-225	GA-J-224	68.29	200	130	0.30	0.11	0.01	0.09
GA-PPE-332	GA-J-220	GA-J-224	72.78	200	130	-0.26	0.09	0.00	0.07
GA-PPE-333	GA-J-228	GA-J-243	47.42	300	130	-2.02	0.33	0.02	0.44
GA-PPE-334	GA-J-235	GA-J-236	100.69	300	130	-6.14	1.00	0.34	3.41
GA-PPE-335	GA-J-237	GA-J-146	66.63	300	130	0.24	0.04	0.00	0.01
GA-PPE-336	GA-J-221	GA-J-238	111.14	300	130	0.04	0.01	0.00	0.00
GA-PPE-337	GA-J-243	GA-J-235	56.37	300	130	-4.11	0.67	0.09	1.62
GA-PPE-338	GA-J-225	GA-J-239	54.11	300	130	-0.84	0.14	0.00	0.09
GA-PPE-339	GA-J-239	GA-J-240	76.15	300	130	-0.88	0.14	0.01	0.09
GA-PPE-340	GA-J-240	GA-J-243	67.86	300	130	-0.92	0.15	0.01	0.10
GA-PPE-341	GA-J-243	GA-J-242	91.10	300	130	1.12	0.18	0.01	0.15
GA-PPE-342	GA-J-242	GA-J-241	67.72	300	130	1.08	0.18	0.01	0.14
GA-PPE-343	GA-J-241	GA-J-201	48.50	300	130	1.04	0.17	0.01	0.13

2021 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-201	0.48	178.00	230.90	75.20
GA-J-202	0.48	178.00	230.89	75.19
GA-J-203	0.48	178.00	230.89	75.18
GA-J-204	0.48	177.00	230.89	76.60
GA-J-205	0.48	177.00	230.89	76.60
GA-J-206	0.48	178.00	230.88	75.18
GA-J-207	0.48	179.00	230.88	73.76
GA-J-208	0.48	180.00	230.88	72.34
GA-J-209	0.48	180.00	230.88	72.34
GA-J-210	0.48	178.00	230.88	75.18
GA-J-211	0.48	178.00	230.89	75.18
GA-J-212	0.48	178.00	230.89	75.18
GA-J-213	0.48	180.00	230.89	72.34
GA-J-214	0.48	179.00	230.89	73.77
GA-J-215	0.48	179.00	230.89	73.77
GA-J-216	0.48	178.00	230.89	75.19
GA-J-217	0.48	178.00	230.89	75.19
GA-J-218	0.48	178.00	230.90	75.20
GA-J-219	0.48	178.00	230.90	75.20
GA-J-220	0.48	179.00	230.90	73.78
GA-J-221	0.48	179.00	230.90	73.78
GA-J-222	0.48	179.00	230.89	73.77
GA-J-223	0.48	179.00	230.89	73.77
GA-J-224	0.48	179.00	230.90	73.78
GA-J-225	0.48	180.00	230.91	72.37
GA-J-226	0.48	179.00	230.91	73.79
GA-J-227	0.48	179.00	230.90	73.78
GA-J-228	0.48	179.00	230.91	73.79
GA-J-229	0.48	179.00	230.90	73.78
GA-J-230	0.48	179.00	230.90	73.77
GA-J-231	0.48	178.00	230.89	75.19
GA-J-232	0.48	178.00	230.89	75.19
GA-J-233	0.48	180.00	230.90	72.36
GA-J-234	0.48	177.00	230.89	76.60
GA-J-235	23.45	179.00	231.02	73.95

2021 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-237	0.48	178.00	230.89	75.18
GA-J-238	0.48	180.00	230.90	72.36
GA-J-239	0.48	180.00	230.91	72.38
GA-J-240	0.48	179.00	230.92	73.81
GA-J-241	0.48	178.00	230.91	75.21
GA-J-242	0.48	180.00	230.91	72.38
GA-J-243	0.48	179.00	230.93	73.82



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

PHD Pressure
2031 Scenario
Redoak/Capoak

Figure C.2

2031 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-286	GA-J-168	GA-J-201	19.26	300	130	-0.67	0.11	0.00	0.06
GA-PPE-287	GA-J-201	GA-J-202	64.00	300	130	1.10	0.18	0.01	0.14
GA-PPE-288	GA-J-165	GA-J-202	27.94	300	130	-0.96	0.16	0.00	0.11
GA-PPE-289	GA-J-202	GA-J-203	71.53	300	130	0.64	0.10	0.00	0.05
GA-PPE-290	GA-J-203	GA-J-164	35.42	300	130	0.57	0.09	0.00	0.04
GA-PPE-291	GA-J-203	GA-J-234	75.08	300	130	0.03	0.00	0.00	0.00
GA-PPE-292	GA-J-204	GA-J-237	76.08	300	130	0.29	0.05	0.00	0.01
GA-PPE-293	GA-J-204	GA-J-205	33.64	300	130	-0.35	0.06	0.00	0.02
GA-PPE-294	GA-J-205	GA-J-211	70.67	300	130	0.43	0.07	0.00	0.03
GA-PPE-295	GA-J-206	GA-J-147	32.13	300	130	0.18	0.03	0.00	0.01
GA-PPE-296	GA-J-211	GA-J-206	72.04	300	130	0.27	0.04	0.00	0.01
GA-PPE-297	GA-J-234	GA-J-204	89.21	300	130	-0.01	0.00	0.00	0.00
GA-PPE-299	GA-J-206	GA-J-207	111.73	200	130	0.04	0.02	0.00	0.00
GA-PPE-300	GA-J-207	GA-J-208	93.62	200	130	0.00	0.00	0.00	0.00
GA-PPE-301	GA-J-208	GA-J-209	65.92	200	130	-0.04	0.02	0.00	0.00
GA-PPE-302	GA-J-209	GA-J-210	76.28	200	130	-0.08	0.03	0.00	0.01
GA-PPE-303	GA-J-210	GA-J-211	78.07	300	130	-0.12	0.02	0.00	0.00
GA-PPE-304	GA-J-205	GA-J-212	79.84	300	130	-0.09	0.02	0.00	0.00
GA-PPE-305	GA-J-212	GA-J-213	93.79	200	130	-0.13	0.05	0.00	0.02
GA-PPE-306	GA-J-213	GA-J-214	85.28	200	130	-0.18	0.06	0.00	0.03
GA-PPE-307	GA-J-214	GA-J-215	79.23	200	130	-0.09	0.03	0.00	0.01
GA-PPE-308	GA-J-215	GA-J-216	73.15	200	130	-0.13	0.05	0.00	0.02
GA-PPE-309	GA-J-216	GA-J-218	67.23	200	130	-0.17	0.06	0.00	0.03
GA-PPE-310	GA-J-218	GA-J-217	79.38	300	130	0.64	0.10	0.00	0.05
GA-PPE-311	GA-J-217	GA-J-205	80.56	300	130	0.73	0.12	0.01	0.07
GA-PPE-312	GA-J-218	GA-J-219	68.38	300	130	-0.56	0.09	0.00	0.04
GA-PPE-313	GA-J-219	GA-J-220	61.21	300	130	0.07	0.01	0.00	0.00
GA-PPE-314	GA-J-220	GA-J-221	75.33	300	130	0.08	0.01	0.00	0.00
GA-PPE-315	GA-J-220	GA-J-222	70.27	200	130	0.21	0.08	0.00	0.05
GA-PPE-316	GA-J-222	GA-J-223	75.17	200	130	0.17	0.06	0.00	0.03
GA-PPE-317	GA-J-214	GA-J-223	74.91	200	130	-0.13	0.05	0.00	0.02
GA-PPE-318	GA-J-217	GA-J-232	109.60	300	130	-0.13	0.02	0.00	0.00
GA-PPE-319	GA-J-232	GA-J-231	84.88	300	130	-0.18	0.03	0.00	0.00
GA-PPE-320	GA-J-231	GA-J-202	76.69	300	130	0.54	0.09	0.00	0.04
GA-PPE-321	GA-J-201	GA-J-233	66.97	300	130	-0.69	0.11	0.00	0.06

2031 Peak Hour Demand Modeling Results - Redoak-Capoak Development

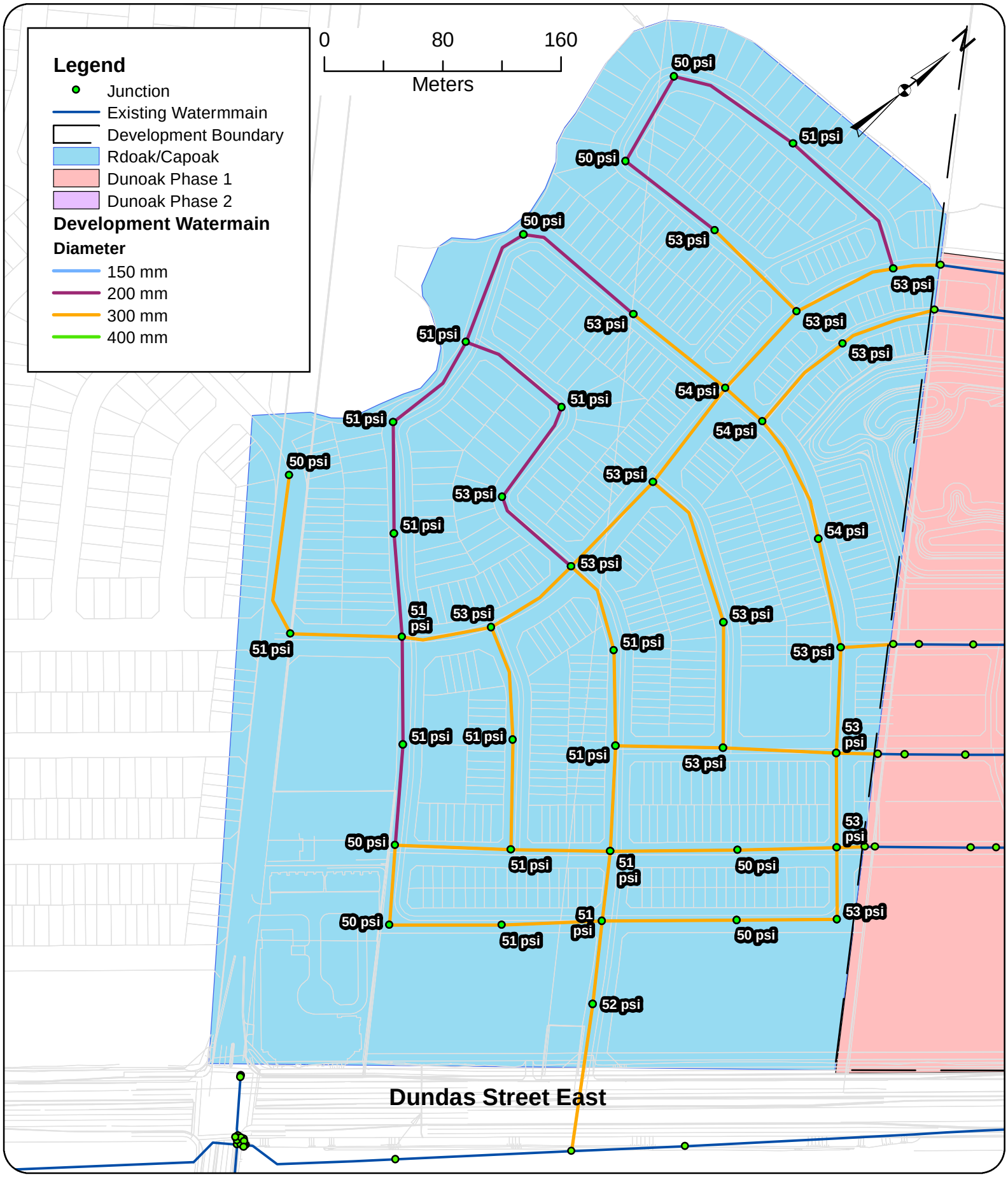
ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-322	GA-J-233	GA-J-228	86.22	300	130	-0.73	0.12	0.01	0.07
GA-PPE-323	GA-J-228	GA-J-229	71.60	300	130	1.13	0.19	0.01	0.15
GA-PPE-324	GA-J-229	GA-J-231	72.74	300	130	0.76	0.12	0.01	0.07
GA-PPE-325	GA-J-230	GA-J-229	64.41	300	130	-0.33	0.05	0.00	0.02
GA-PPE-326	GA-J-230	GA-J-218	66.05	300	130	0.29	0.05	0.00	0.01
GA-PPE-327	GA-J-228	GA-J-226	67.27	300	130	0.22	0.04	0.00	0.01
GA-PPE-328	GA-J-226	GA-J-227	74.30	300	130	0.71	0.12	0.00	0.06

2031 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-201	0.48	178.00	217.46	56.10
GA-J-202	0.48	178.00	217.46	56.09
GA-J-203	0.48	178.00	217.45	56.08
GA-J-204	0.48	177.00	217.45	57.51
GA-J-205	0.48	177.00	217.45	57.51
GA-J-206	0.48	178.00	217.45	56.08
GA-J-207	0.48	179.00	217.45	54.66
GA-J-208	0.48	180.00	217.45	53.24
GA-J-209	0.48	180.00	217.45	53.24
GA-J-210	0.48	178.00	217.45	56.08
GA-J-211	0.48	178.00	217.45	56.08
GA-J-212	0.48	178.00	217.45	56.09
GA-J-213	0.48	180.00	217.45	53.24
GA-J-214	0.48	179.00	217.46	54.67
GA-J-215	0.48	179.00	217.46	54.67
GA-J-216	0.48	178.00	217.46	56.10
GA-J-217	0.48	178.00	217.46	56.09
GA-J-218	0.48	178.00	217.46	56.10
GA-J-219	0.48	178.00	217.46	56.10
GA-J-220	0.48	179.00	217.46	54.68
GA-J-221	0.48	179.00	217.46	54.68
GA-J-222	0.48	179.00	217.46	54.68
GA-J-223	0.48	179.00	217.46	54.67
GA-J-224	0.48	179.00	217.47	54.69
GA-J-225	0.48	180.00	217.48	53.28
GA-J-226	0.48	179.00	217.47	54.69
GA-J-227	0.48	179.00	217.47	54.69
GA-J-228	0.48	179.00	217.47	54.69
GA-J-229	0.48	179.00	217.46	54.68
GA-J-230	0.48	179.00	217.46	54.68
GA-J-231	0.48	178.00	217.46	56.09
GA-J-232	0.48	178.00	217.46	56.09
GA-J-233	0.48	180.00	217.47	53.26
GA-J-234	0.48	177.00	217.45	57.51
GA-J-235	23.45	179.00	217.60	54.87

2031 Peak Hour Demand Modeling Results - Redoak-Capoak Development

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-237	0.48	178.00	217.45	56.08
GA-J-238	0.48	180.00	217.46	53.26
GA-J-239	0.48	180.00	217.48	53.28
GA-J-240	0.48	179.00	217.49	54.72
GA-J-241	0.48	178.00	217.47	56.11
GA-J-242	0.48	180.00	217.48	53.28
GA-J-243	0.48	179.00	217.50	54.73



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/CapoakDevelopment**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

PHD Pressure
2031 Scenario
Full Joshua Creek

Figure C.3

2031 Peak Hour Demand Modeling Results - Full Joshua Creek

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-286	GA-J-168	GA-J-201	19.26	300	130	0.32	0.05	0.00	0.01
GA-PPE-287	GA-J-201	GA-J-202	64.00	300	130	2.66	0.44	0.05	0.73
GA-PPE-288	GA-J-165	GA-J-202	27.94	300	130	-1.21	0.20	0.00	0.17
GA-PPE-289	GA-J-202	GA-J-203	71.53	300	130	2.05	0.34	0.03	0.45
GA-PPE-291	GA-J-203	GA-J-234	75.08	300	130	1.03	0.17	0.01	0.13
GA-PPE-292	GA-J-204	GA-J-237	76.08	300	130	1.58	0.26	0.02	0.28
GA-PPE-293	GA-J-204	GA-J-205	33.64	300	130	-0.63	0.10	0.00	0.05
GA-PPE-294	GA-J-205	GA-J-211	70.67	300	130	1.98	0.32	0.03	0.42
GA-PPE-295	GA-J-206	GA-J-147	32.13	300	130	1.73	0.28	0.01	0.33
GA-PPE-296	GA-J-211	GA-J-206	72.04	300	130	1.61	0.26	0.02	0.28
GA-PPE-297	GA-J-234	GA-J-204	89.21	300	130	0.99	0.16	0.01	0.12
GA-PPE-299	GA-J-206	GA-J-207	111.73	200	130	-0.17	0.06	0.00	0.03
GA-PPE-300	GA-J-207	GA-J-208	93.62	200	130	-0.21	0.08	0.00	0.05
GA-PPE-301	GA-J-208	GA-J-209	65.92	200	130	-0.25	0.09	0.00	0.07
GA-PPE-302	GA-J-209	GA-J-210	76.28	200	130	-0.29	0.11	0.01	0.09
GA-PPE-303	GA-J-210	GA-J-211	78.07	300	130	-0.34	0.06	0.00	0.02
GA-PPE-304	GA-J-205	GA-J-212	79.84	300	130	-0.44	0.07	0.00	0.03
GA-PPE-305	GA-J-212	GA-J-213	93.79	200	130	-0.48	0.18	0.02	0.22
GA-PPE-306	GA-J-213	GA-J-214	85.28	200	130	-0.52	0.19	0.02	0.26
GA-PPE-307	GA-J-214	GA-J-215	79.23	200	130	-0.24	0.09	0.00	0.06
GA-PPE-308	GA-J-215	GA-J-216	73.15	200	130	-0.28	0.10	0.01	0.08
GA-PPE-309	GA-J-216	GA-J-218	67.23	200	130	-0.32	0.12	0.01	0.10
GA-PPE-310	GA-J-218	GA-J-217	79.38	300	130	1.55	0.25	0.02	0.27
GA-PPE-311	GA-J-217	GA-J-205	80.56	300	130	2.21	0.36	0.04	0.52
GA-PPE-312	GA-J-218	GA-J-219	68.38	300	130	-1.23	0.20	0.01	0.17
GA-PPE-313	GA-J-219	GA-J-220	61.21	300	130	0.02	0.00	0.00	0.00
GA-PPE-314	GA-J-220	GA-J-221	75.33	300	130	0.08	0.01	0.00	0.00
GA-PPE-315	GA-J-220	GA-J-222	70.27	200	130	0.41	0.15	0.01	0.16
GA-PPE-316	GA-J-222	GA-J-223	75.17	200	130	0.37	0.14	0.01	0.13
GA-PPE-317	GA-J-214	GA-J-223	74.91	200	130	-0.33	0.12	0.01	0.11
GA-PPE-318	GA-J-217	GA-J-232	109.60	300	130	-0.70	0.12	0.01	0.06
GA-PPE-319	GA-J-232	GA-J-231	84.88	300	130	-0.75	0.12	0.01	0.07
GA-PPE-320	GA-J-231	GA-J-202	76.69	300	130	0.64	0.10	0.00	0.05
GA-PPE-321	GA-J-201	GA-J-233	66.97	300	130	-0.71	0.12	0.00	0.06
GA-PPE-322	GA-J-233	GA-J-228	86.22	300	130	-0.75	0.12	0.01	0.07

2031 Peak Hour Demand Modeling Results - Full Joshua Creek

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (ML/d	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
GA-PPE-323	GA-J-228	GA-J-229	71.60	300	130	2.19	0.36	0.04	0.51
GA-PPE-324	GA-J-229	GA-J-231	72.74	300	130	1.42	0.23	0.02	0.23
GA-PPE-325	GA-J-230	GA-J-229	64.41	300	130	-0.72	0.12	0.00	0.06
GA-PPE-326	GA-J-230	GA-J-218	66.05	300	130	0.68	0.11	0.00	0.06
GA-PPE-327	GA-J-228	GA-J-226	67.27	300	130	0.49	0.08	0.00	0.03
GA-PPE-328	GA-J-226	GA-J-227	74.30	300	130	1.34	0.22	0.02	0.20
GA-PPE-329	GA-J-227	GA-J-219	78.45	300	130	1.30	0.21	0.02	0.19

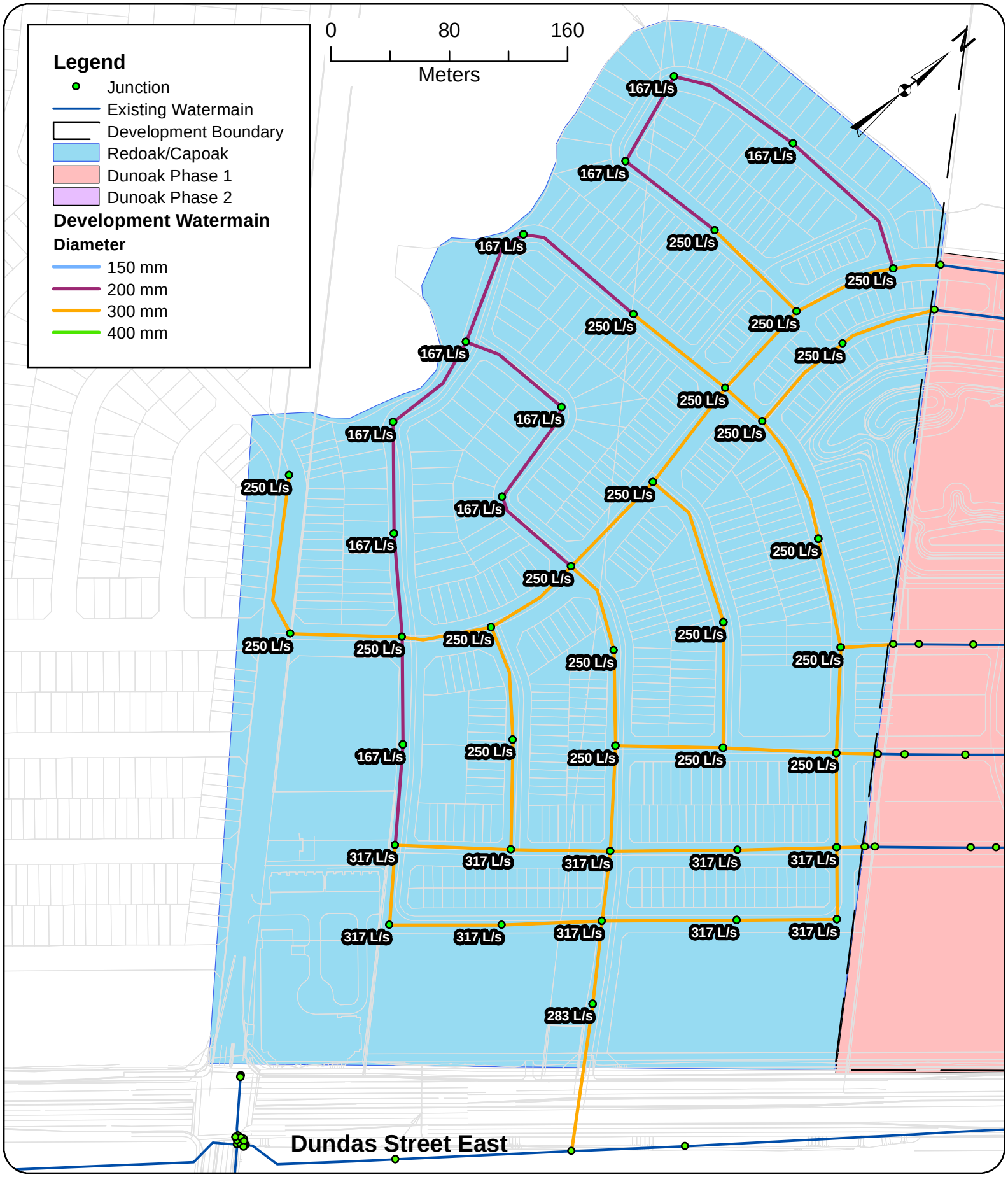
2031 Peak Hour Demand Modeling Results - Full Joshua Creek

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-201	0.48	178.00	215.16	52.82
GA-J-202	0.48	178.00	215.11	52.76
GA-J-203	0.48	178.00	215.08	52.71
GA-J-204	0.48	177.00	215.06	54.10
GA-J-205	0.48	177.00	215.06	54.11
GA-J-206	0.48	178.00	215.01	52.61
GA-J-207	0.48	179.00	215.01	51.20
GA-J-208	0.48	180.00	215.02	49.78
GA-J-209	0.48	180.00	215.02	49.79
GA-J-210	0.48	178.00	215.03	52.64
GA-J-211	0.48	178.00	215.03	52.64
GA-J-212	0.48	178.00	215.06	52.69
GA-J-213	0.48	180.00	215.08	49.87
GA-J-214	0.48	179.00	215.10	51.33
GA-J-215	0.48	179.00	215.11	51.33
GA-J-216	0.48	178.00	215.12	52.76
GA-J-217	0.48	178.00	215.10	52.74
GA-J-218	0.48	178.00	215.12	52.77
GA-J-219	0.48	178.00	215.13	52.79
GA-J-220	0.48	179.00	215.13	51.37
GA-J-221	0.48	179.00	215.13	51.37
GA-J-222	0.48	179.00	215.12	51.35
GA-J-223	0.48	179.00	215.11	51.34
GA-J-224	0.48	179.00	215.15	51.39
GA-J-225	0.48	180.00	215.17	50.00
GA-J-226	0.48	179.00	215.16	51.41
GA-J-227	0.48	179.00	215.15	51.39
GA-J-228	0.48	179.00	215.17	51.41
GA-J-229	0.48	179.00	215.13	51.36
GA-J-230	0.48	179.00	215.13	51.36
GA-J-231	0.48	178.00	215.11	52.76
GA-J-232	0.48	178.00	215.11	52.75
GA-J-233	0.48	180.00	215.16	49.98
GA-J-234	0.48	177.00	215.07	54.12
GA-J-235	23.45	179.00	215.46	51.83

2031 Peak Hour Demand Modeling Results - Full Joshua Creek

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
GA-J-237	0.48	178.00	215.04	52.65
GA-J-238	0.48	180.00	215.13	49.95
GA-J-239	0.48	180.00	215.19	50.02
GA-J-240	0.48	179.00	215.20	51.47
GA-J-241	0.48	178.00	215.17	52.84
GA-J-242	0.48	180.00	215.19	50.03
GA-J-243	0.48	179.00	215.22	51.49

Appendix D Fire Flow Modeling Results

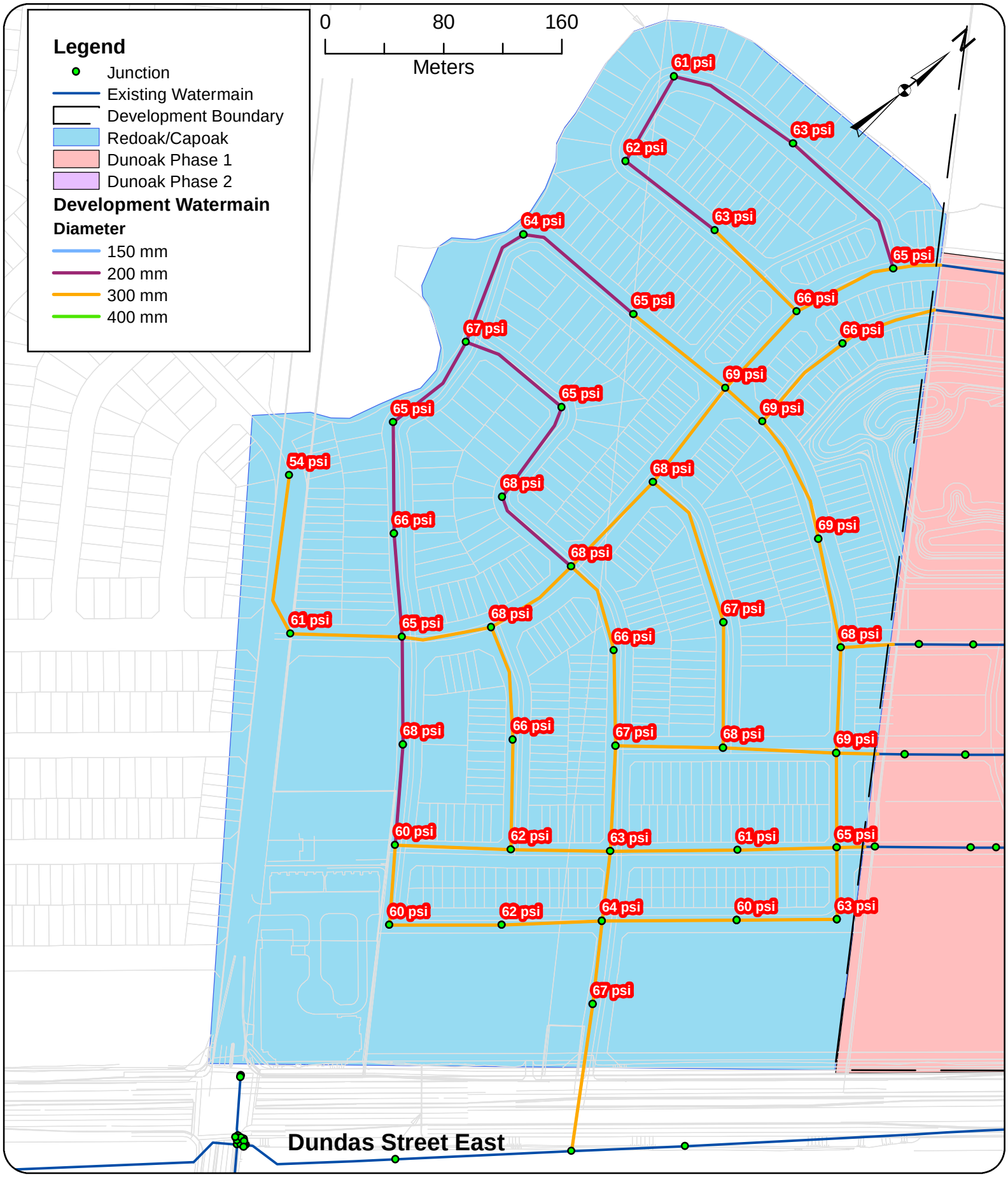


GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

Required Fire Flow

Figure D.1



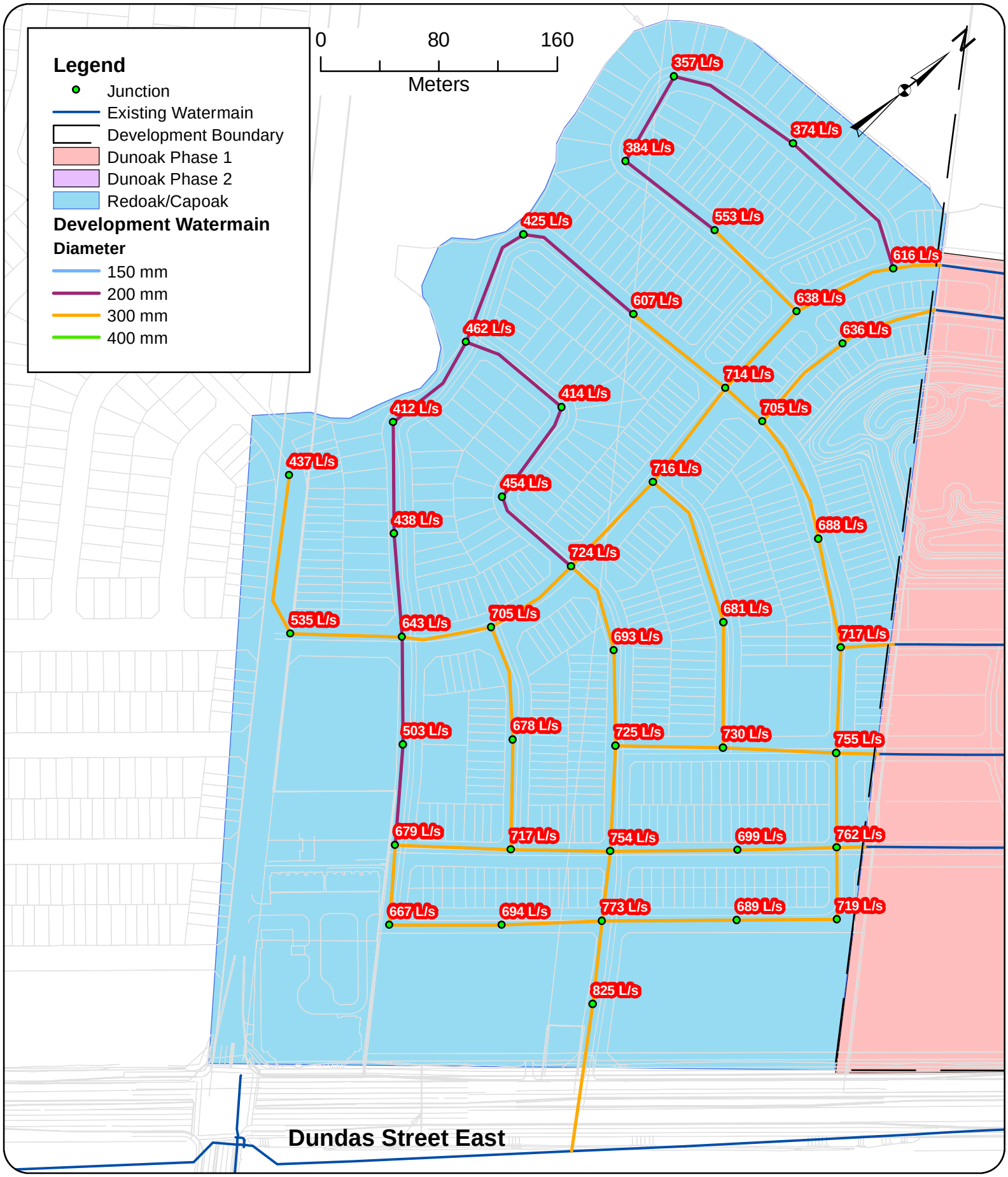
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Residual Pressure 2021 Scenario Redoak/Capoak

Figure D.2



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

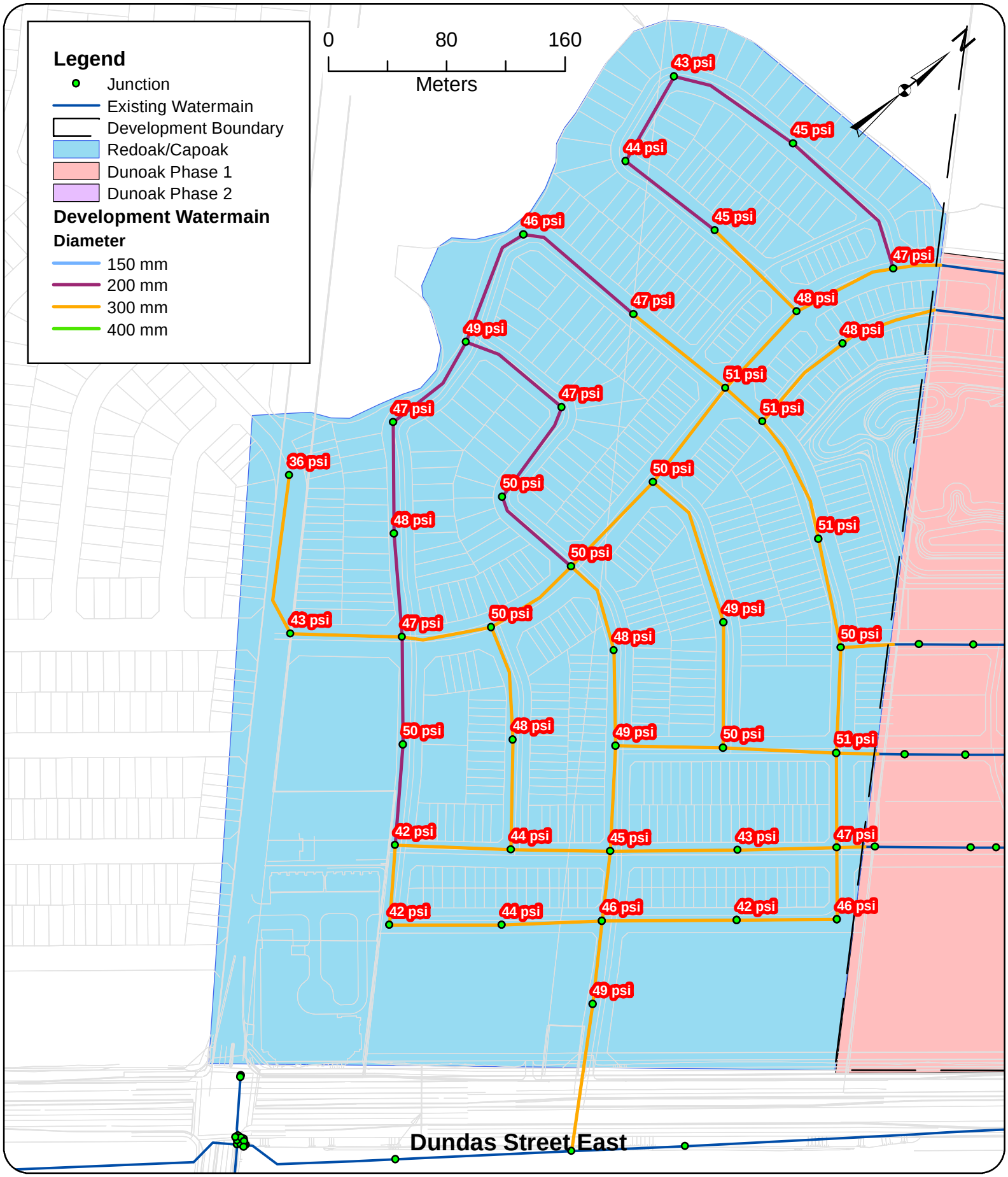
DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Available Fire Flow 2021 Scenario Redoak/Capoak

Figure D.3

2021 Maximum Day Demand Plus Fire Flow Modeling Results - Redoak-Capoak Development

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
GA-J-201	0.27	78	233	317	65	762	20
GA-J-202	0.27	78	233	250	69	755	20
GA-J-203	0.27	78	233	250	68	717	20
GA-J-204	0.27	79	233	250	69	705	20
GA-J-205	0.27	79	233	250	69	714	20
GA-J-206	0.27	78	233	250	65	616	20
GA-J-207	0.27	76	233	167	63	374	20
GA-J-208	0.27	75	233	167	61	357	20
GA-J-209	0.27	75	233	167	62	384	20
GA-J-210	0.27	78	233	250	63	553	20
GA-J-211	0.27	78	233	250	66	638	20
GA-J-212	0.27	78	233	250	65	607	20
GA-J-213	0.27	75	233	167	64	425	20
GA-J-214	0.27	76	233	167	67	462	20
GA-J-215	0.27	76	233	167	65	414	20
GA-J-216	0.27	78	233	167	68	454	20
GA-J-217	0.27	78	233	250	68	716	20
GA-J-218	0.27	78	233	250	68	724	20
GA-J-219	0.27	78	233	250	68	705	20
GA-J-220	0.27	76	233	250	65	643	20
GA-J-221	0.27	76	233	250	61	535	20
GA-J-222	0.27	76	233	167	66	438	20
GA-J-223	0.27	76	233	167	65	412	20
GA-J-224	0.27	76	233	167	68	503	20
GA-J-225	0.27	75	233	317	60	679	20
GA-J-226	0.27	76	233	317	62	717	20
GA-J-227	0.27	76	233	250	66	678	20
GA-J-228	0.27	76	233	317	63	754	20
GA-J-229	0.27	76	233	250	67	725	20
GA-J-230	0.27	76	233	250	66	693	20
GA-J-231	0.27	78	233	250	68	730	20
GA-J-232	0.27	78	233	250	67	681	20
GA-J-233	0.27	75	233	317	61	699	20
GA-J-234	0.27	79	233	250	69	688	20
GA-J-235	13.19	76	233	283	67	825	20
GA-J-237	0.27	78	233	250	66	636	20
GA-J-238	0.27	75	233	250	54	437	20
GA-J-239	0.27	75	233	317	60	667	20
GA-J-240	0.27	76	233	317	62	694	20
GA-J-241	0.27	78	233	317	63	719	20
GA-J-242	0.27	75	233	317	60	689	20
GA-J-243	0.27	76	233	317	64	773	20



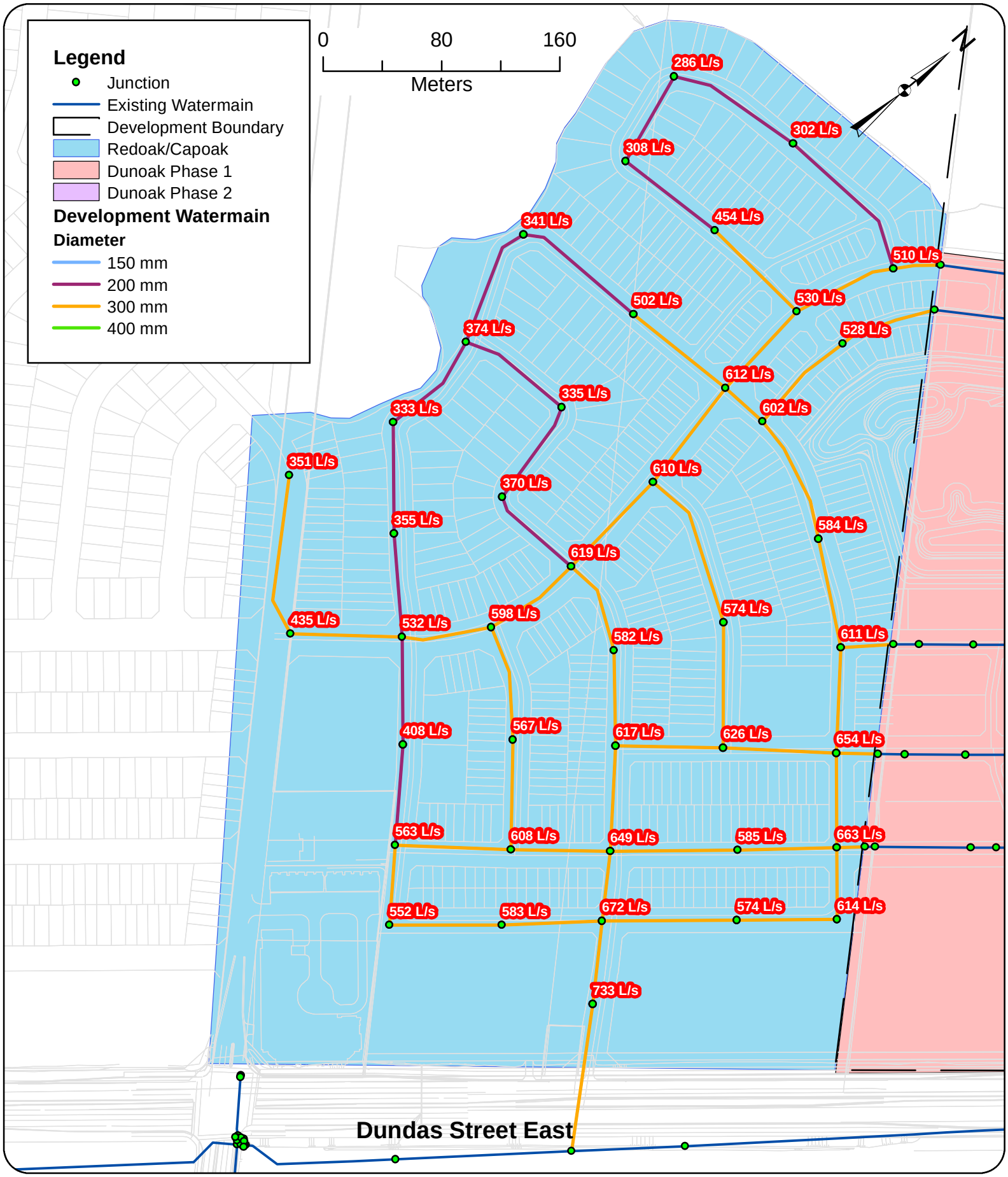
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Residual Pressure 2031 Scenario Redoak/Capoak

Figure D.4



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

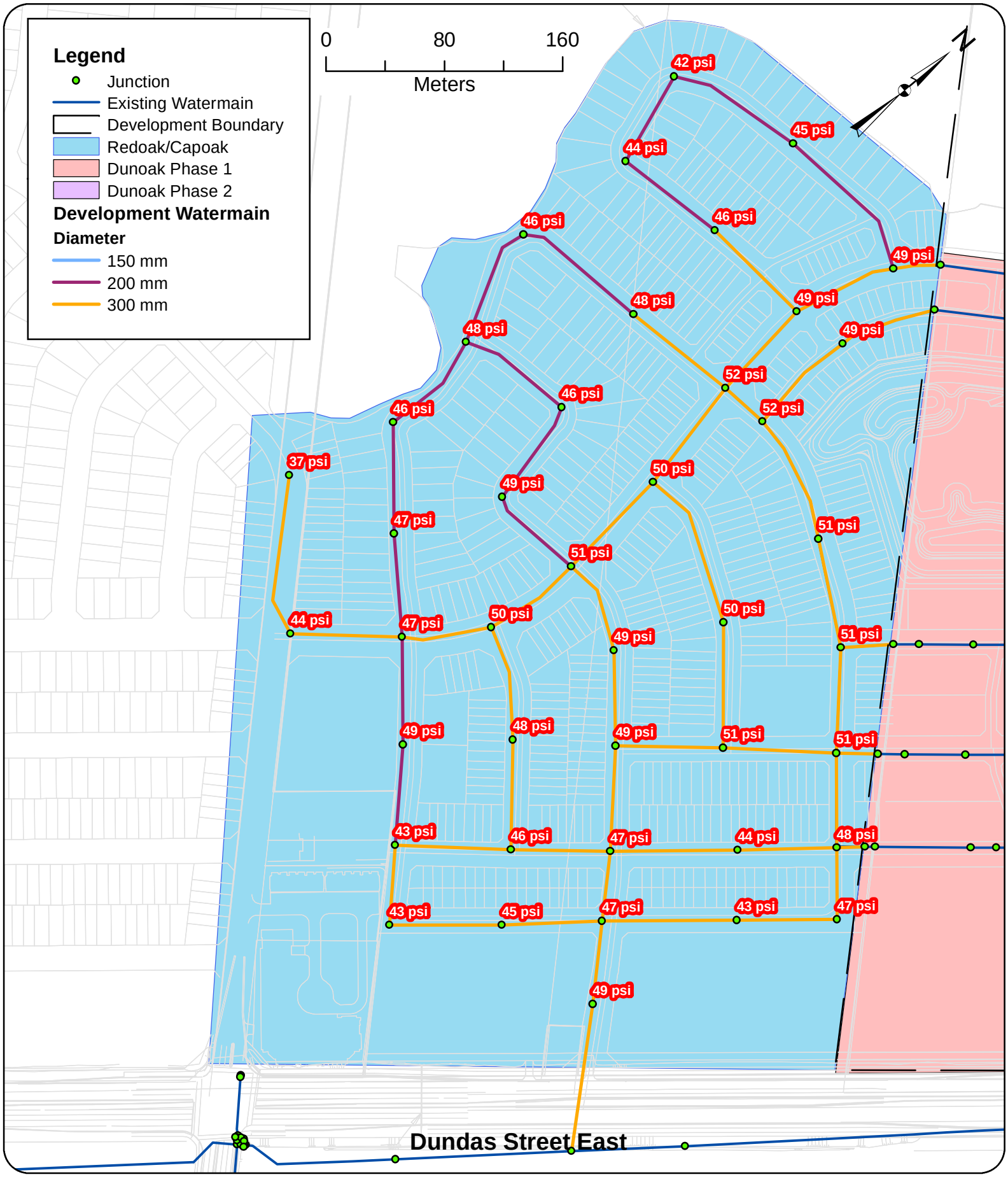
DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Available Fire Flow 2031 Scenario Redoak/Capoak

Figure D.5

2031 Maximum Day Demand Plus Fire Flow Modeling Results - Redoak-Capoak Development

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
GA-J-201	0.27	61	221	317	47	663	20
GA-J-202	0.27	61	221	250	51	654	20
GA-J-203	0.27	61	221	250	50	611	20
GA-J-204	0.27	62	221	250	51	602	20
GA-J-205	0.27	62	221	250	51	612	20
GA-J-206	0.27	61	221	250	47	510	20
GA-J-207	0.27	59	221	167	45	302	20
GA-J-208	0.27	58	221	167	43	286	20
GA-J-209	0.27	58	221	167	44	308	20
GA-J-210	0.27	61	221	250	45	454	20
GA-J-211	0.27	61	221	250	48	530	20
GA-J-212	0.27	61	221	250	47	502	20
GA-J-213	0.27	58	221	167	46	341	20
GA-J-214	0.27	59	221	167	49	374	20
GA-J-215	0.27	59	221	167	47	335	20
GA-J-216	0.27	61	221	167	50	370	20
GA-J-217	0.27	61	221	250	50	610	20
GA-J-218	0.27	61	221	250	50	619	20
GA-J-219	0.27	61	221	250	50	598	20
GA-J-220	0.27	59	221	250	47	532	20
GA-J-221	0.27	59	221	250	43	435	20
GA-J-222	0.27	59	221	167	48	355	20
GA-J-223	0.27	59	221	167	47	333	20
GA-J-224	0.27	59	221	167	50	408	20
GA-J-225	0.27	58	221	317	42	563	20
GA-J-226	0.27	59	221	317	44	608	20
GA-J-227	0.27	59	221	250	48	567	20
GA-J-228	0.27	59	221	317	45	649	20
GA-J-229	0.27	59	221	250	49	617	20
GA-J-230	0.27	59	221	250	48	582	20
GA-J-231	0.27	61	221	250	50	626	20
GA-J-232	0.27	61	221	250	49	574	20
GA-J-233	0.27	58	221	317	43	585	20
GA-J-234	0.27	62	221	250	51	584	20
GA-J-235	13.19	59	221	283	49	733	20
GA-J-237	0.27	61	221	250	48	528	20
GA-J-238	0.27	58	221	250	36	351	20
GA-J-239	0.27	58	221	317	42	552	20
GA-J-240	0.27	59	221	317	44	583	20
GA-J-241	0.27	61	221	317	46	614	20
GA-J-242	0.27	58	221	317	42	574	20



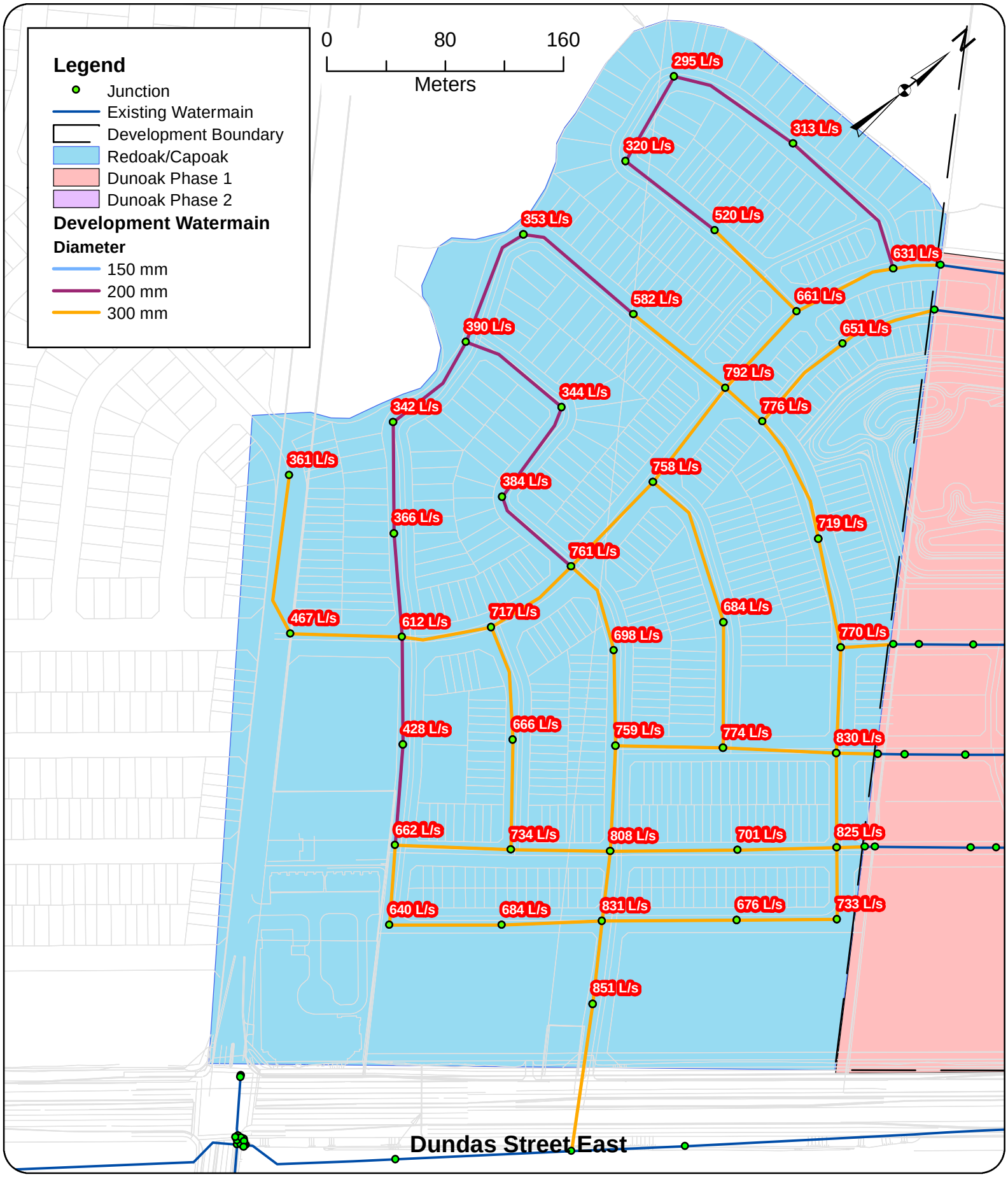
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Residual Pressure
2031 Scenario
Full Joshua Creek

Figure D.6



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Redoak/Capoak Development**
Client: **David Schaeffer Engineering Ltd.**
Date: **July 2020**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Available Fire Flow
2031 Scenario
Full Joshua Creek

Figure D.7

2031 Peak Hour Demand Modeling Results - Full Joshua Creek

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
GA-J-201	0.27	60	220	317	48	825	20
GA-J-202	0.27	60	220	250	51	830	20
GA-J-203	0.27	60	220	250	51	770	20
GA-J-204	0.27	61	220	250	52	776	20
GA-J-205	0.27	61	220	250	52	792	20
GA-J-206	0.27	59	220	250	49	631	20
GA-J-207	0.27	58	220	167	45	313	20
GA-J-208	0.27	57	220	167	42	295	20
GA-J-209	0.27	57	220	167	44	320	20
GA-J-210	0.27	59	220	250	46	520	20
GA-J-211	0.27	59	220	250	49	661	20
GA-J-212	0.27	59	220	250	48	582	20
GA-J-213	0.27	57	220	167	46	353	20
GA-J-214	0.27	58	220	167	48	390	20
GA-J-215	0.27	58	220	167	46	344	20
GA-J-216	0.27	60	220	167	49	384	20
GA-J-217	0.27	60	220	250	50	758	20
GA-J-218	0.27	60	220	250	51	761	20
GA-J-219	0.27	60	220	250	50	717	20
GA-J-220	0.27	58	220	250	47	612	20
GA-J-221	0.27	58	220	250	44	467	20
GA-J-222	0.27	58	220	167	47	366	20
GA-J-223	0.27	58	220	167	46	342	20
GA-J-224	0.27	58	220	167	49	428	20
GA-J-225	0.27	57	220	317	43	662	20
GA-J-226	0.27	58	220	317	46	734	20
GA-J-227	0.27	58	220	250	48	666	20
GA-J-228	0.27	58	220	317	47	808	20
GA-J-229	0.27	58	220	250	49	759	20
GA-J-230	0.27	58	220	250	49	698	20
GA-J-231	0.27	60	220	250	51	774	20
GA-J-232	0.27	60	220	250	50	684	20
GA-J-233	0.27	57	220	317	44	701	20
GA-J-234	0.27	61	220	250	51	719	20
GA-J-235	13.19	58	220	283	49	851	20
GA-J-237	0.27	59	220	250	49	651	20
GA-J-238	0.27	57	220	250	37	361	20
GA-J-239	0.27	57	220	317	43	640	20
GA-J-240	0.27	58	220	317	45	684	20
GA-J-241	0.27	60	220	317	47	733	20
GA-J-242	0.27	57	220	317	43	676	20
GA-J-243	0.27	58	220	317	47	831	20