MUNICIPALITY OF EAST HANTS

Construction and Demolition Debris (C&D) Cell Analysis

Final Report

October 2024– 24-8663

DILLON
CONSULTING

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October 29, 2024

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Attention: Andrea Trask
Manager of Solid Waste

Construction and Demolition Debris (C&D) Landfill Cell Analysis

Dillon Consulting Limited (Dillon) is pleased to submit this final version of the Construction and Demolition Debris (C&D) Landfill Cell Analysis report to the Municipality of East Hants (MEH). This report details an analysis outlining the remaining airspace and site life of the existing C&D cells, as well a completed preliminary design and Class 'C' opinion of probable costs to construct a new C&D cell at the East Hants Waste Management Center (EHWMC), located in Upper Kennetcook, Nova Scotia.

This report was finalized based on discussions with MEH and confirmation of necessary revisions to our submitted draft report. Thank you for the opportunity to assist with this project. Should you have any comments or questions regarding this document, please contact the undersigned.

Sincerely,

DILLON CONSULTING LIMITED

Stuart King, P.Eng.
Project Manager

Rebecca Acker, EIT

RMAA:lmk

Our file: 24-8663

Dillon Consulting
Limited

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Tables

Executive Summary

Dillon Consulting Limited (Dillon) was engaged by the Municipality of East Hants (MEH) to provide an airspace and site life analysis, and preliminary design services in support of the proposed expansion of the Construction and Demolition Debris (C&D) Landfill at the East Hants Waste Management Centre (Facility). The active waste management facility is located at 1306 Georgefield Road in Upper Kennetcook, Nova Scotia.

In 2005, Dillon was engaged by the Municipality to develop a closure plan for a first-generation landfill and to design the C&D landfill. Dillon delivered a conceptual layout of eight landfill cells and a detailed design for Cell 1. Dillon currently understands that Cell 1 has reached capacity, and waste is being placed in Cells 2 and 3.

Considering this, Dillon has conceptualized horizontal and vertical expansions for the Municipality's C&D landfill in accordance with the updated July 2023 requirements of Nova Scotia Environment and Climate Change (NSECC)'s *Solid Waste Management Facility Guidelines for Construction and Demolition Debris Storage, Transfer, Process and Disposal* (Guidelines).

The proposed horizontal expansion aims to redefine the eight landfill cells introduced in 2005. Dillon understands that waste has been placed in the footprint of Cells 4, 5 and 6 (proposed in 2005). The horizontal expansion accommodates this by redefining the footprint of Cells 1, 2, and 3, in addition to relocating Cells 4 and 5 such that the landfill will consist of five larger cells in contrast to the eight smaller cells from the original conceptual design. The benefits to this approach include:

- Financial Economies of Scale;
- Reduced Operational Complexity;
- Improved Resource Utilization;
- Extended Lifespan;
- Efficient Regulatory Compliance; and
- Reduced Construction Disruption.

The proposed vertical expansion will increase airspace by raising the top of waste by approximately 5 m, to a new top of waste elevation of approximately 160 m. The vertical expansion is limited by a top of waste pile that provides an area approximately 50 m x 50 m of slope relief for operational and (future) cap construction considerations.

The Municipality has provided Dillon with weigh scale records from 2010 to 2024. This information was used to determine the average annual tonnage received by the C&D landfill (approximately 3,300 tonnes/year). A topographic survey of the C&D landfill was completed by Gallant Land Surveyors Incorporated (Gallant Surveyors) in August 2024. This data was used to determine the volume of airspace consumed by the landfilled material (approximately 61,814 m^3). The above values were used to determine an average in-situ density of landfilled material (approximately 617 kg/m^3). Evaluating this information with a model of the proposed horizontal and vertical expansions indicates a remaining site life of approximately 47 years.

To further analyze the site life of the C&D landfill, Dillon has used Statistics Canada *Census of Population* data to evaluate three population growth scenarios. The three population growth scenarios are:

- Low Growth (2% increase per 5-year period);
- Maintained Growth (6% increase per 5-year period); and
- High Growth (10% increase per 5-year period).

The site life of the C&D landfill was calculated to be approximately 44 years with low population growth, 39 years with maintained population growth, and 34 years with high population growth.

Prior to receiving approval to construct or expand a C&D landfill, the required documentation must be prepared in accordance with the updated Guidelines. The typical documentation required to support the application package includes, but is not necessarily limited to, the following:

- Liner System;
- Separation Distances;
- Topographic Survey;
- Archaeological Resource Impact Assessment;
- Natural Habitat and Biophysical Assessment;
- Geotechnical Investigation;
- Hydrogeological and Surface Water Assessment;
- Surface Water Run-Off Control;
- Leachate Management; and
- Detailed Engineering Drawings and Technical Specifications.

Dillon's total Class 'C' estimated opinion of probable costs for the detailed design and construction of Cell 4 is approximately **$1,400,000**.

1.0 Introduction

Dillon Consulting Limited (Dillon) was engaged by the Municipality of East Hants (MEH) to complete an airspace analysis to determine the remaining airspace and site life, as well as to provide preliminary design services to support the proposed expansion of the Construction and Demolition Debris (C&D) Landfill at the East Hants Waste Management Centre (EHWMC), located at 1306 Georgefield Road in Upper Kennetcook, Nova Scotia.

The EHWMC plays a critical role in managing the region's solid waste, ensuring that solid waste management is conducted in a safe and environmentally responsible manner in accordance with the site's Nova Scotia Environment and Climate Change (NSECC) Approval.

This report provides an analysis of the C&D landfill's airspace and site life capacity, based on the annual tonnage of C&D waste currently being accepted at the EHWMC, while also including projections based on three population growth scenarios: low, high, and maintained. These scenarios help forecast potential future waste generation and allow the MEH to plan and provide adequate landfill capacity.

Following the airspace analysis, the report presents a preliminary design for the proposed Cell 4 expansion at the landfill, developed in accordance with the *Solid Waste Management Facility Guidelines for Construction and Demolition Debris Storage, Transfer, Process and Disposal* (Guidelines) issued by NSECC in July 2024. The conceptual design is supported by preliminary design drawings, a Class 'C' Opinion of Probable Costs, and a description of the necessary work and documentation required for submitting an Application for Approval for the landfill cell construction to NSECC. The proposed expansion of the C&D landfill is essential to accommodate future waste volumes so that the MEH can continue providing efficient and economic waste management services to the region.

The objectives of this project report are to:

- Determine the remaining airspace and expected site life of the existing C&D landfill cells;
- Present a preliminary design for the expansion of the landfill that complies with regulatory requirements; and to
- Provide detailed cost estimates and descriptions of the recommended next steps for the MEH.

By addressing these objectives, this report aims to support the MEH in making informed decisions surrounding the future of the EHWMC and the long-term sustainability of its C&D waste management operations.

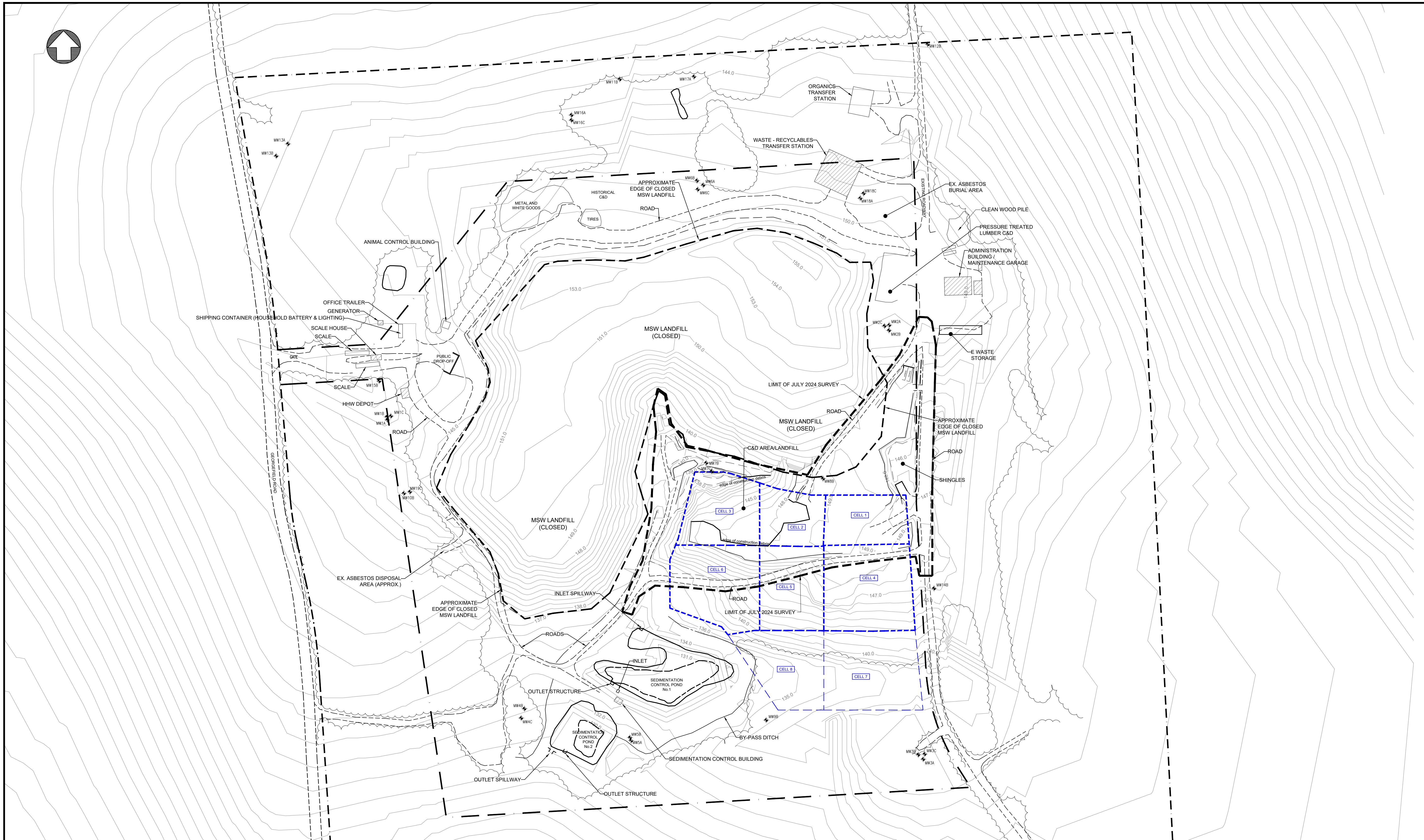
2.0 Background Information

The EHWMC is a comprehensive waste management facility spanning 61.2 hectares. In 2005, the EHWMC revised its operations to comply with the amended *Municipal Solid Waste Landfill Guidelines* issued by NSECC. Consequently, on January 1, 2006, the MEH began transferring MSW to a new second-generation landfill in West Hants, Nova Scotia. The facility currently includes:

- A scale house with incoming and outgoing scales;
- Various site infrastructure including but not limited to roadways, drainage ditches, and overhead power lines;
- An administration and maintenance building;
- A residential household hazardous waste (HHW) depot;
- A drop-off facility for electronic waste (e-waste);
- Metal, tire and clean wood stockpiles;
- A MSW and recyclables transfer station;
- An organics transfer station;
- A closed and capped first-generation municipal solid waste (MSW) landfill;
- An active C&D landfill; and
- Sediment and effluent control ponds.

Dillon was engaged by the MEH in 2005 to design the closure of the first-generation landfill and to design the C&D landfill. Dillon provided a conceptual layout for the landfill for Cells 1 to 8 and completed the detailed design for Cell 1, which finished construction in 2007. Cells 2 and 3 were subsequently constructed in 2008 and 2010, respectively. The existing conditions and layout of the site are shown in **Figure 1** on the following page.

Cell 1 has now reached its capacity, and waste is currently being placed in Cells 2 and 3. The MEH seeks to determine the remaining site life of these active cells and to obtain an opinion of probable costs for expanding the existing C&D landfill through the construction of Cell 4. This expansion must comply with the updated Guidelines issued by NSECC in July 2023, which notably include enhanced design requirements for the soil liner system and additional specifications for leachate collection and management.



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MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROJECT NO. 24-8663

EXISTING CONDITIONS

SHEET NO. 1

3.0 Annual C&D Landfill Tonnages

Weigh scale records were provided by the MEH from 2010 to 2024 (the time of this assessment). The provided records indicated that a total of 38,135 tonnes of C&D waste has been landfilled in the C&D landfill footprint. The total annual tonnages of C&D waste received and landfilled from 2010 to 2024 are presented below in **Table 1**.

Table 1 – Annual Tonnages of C&D Waste (2010-2024)

Year	C&D Waste (tonnes)	Average
2010-2011	2,642	
2011-2012	2,622	
2012-2013	2,344	
2013-2014	2,076	
2014-2015	2,094	
2015-2016	3,245	
2016-2017	2,132	
2017-2018	1,969	
2018-2019	2,062	
2019-2020	2,173	**3,215**
2020-2021	2,341	
2021-2022	4,694	
2022-2023	3,167	
2023-2024	3,698	
2024-2025[1]	876	
Total	**38,135**	

[1]The 2024-2025 tonnages are only inclusive of April 2024 to June 2024.

For this analysis, Dillon assumed that the average annual tonnage of C&D waste received would be the average of the annual tonnages from the last five fiscal years with complete records (2019-2020 to 2023-2024). This was calculated to be an average annual tonnage of 3,215 tonnes per year. To be conservative with this assumption, this value was rounded up to approximately **3,300 tonnes per year**.

4.0 C&D Landfill Airspace and Site Life Analysis

The figures referenced in this section (**Figure 2** to **Figure 6**) are meant to be read in conjunction with this text and are provided on the succeeding pages for reference. The C&D landfill airspace and site life analysis is based on the following critical assumptions:

- **Final Design Top of Waste Contours:** The final design top of waste contours are based on the original approved Cell 1 record drawings completed by Dillon in 2007. These top of waste elevation contours are illustrated in **Figure 2**;
- **Average C&D Waste Tonnage:** An average of 3,300 tonnes per year of C&D waste is assumed to be placed and compacted, with waste composition and in-situ compaction density consistent with the existing site conditions; and
- **Infilled Shingles:** The shingles that were used as infill between Cell 1 and the closed MSW landfill do not need to be relocated (NSE approved placement of shingles outside of disposal cell in August 2011).

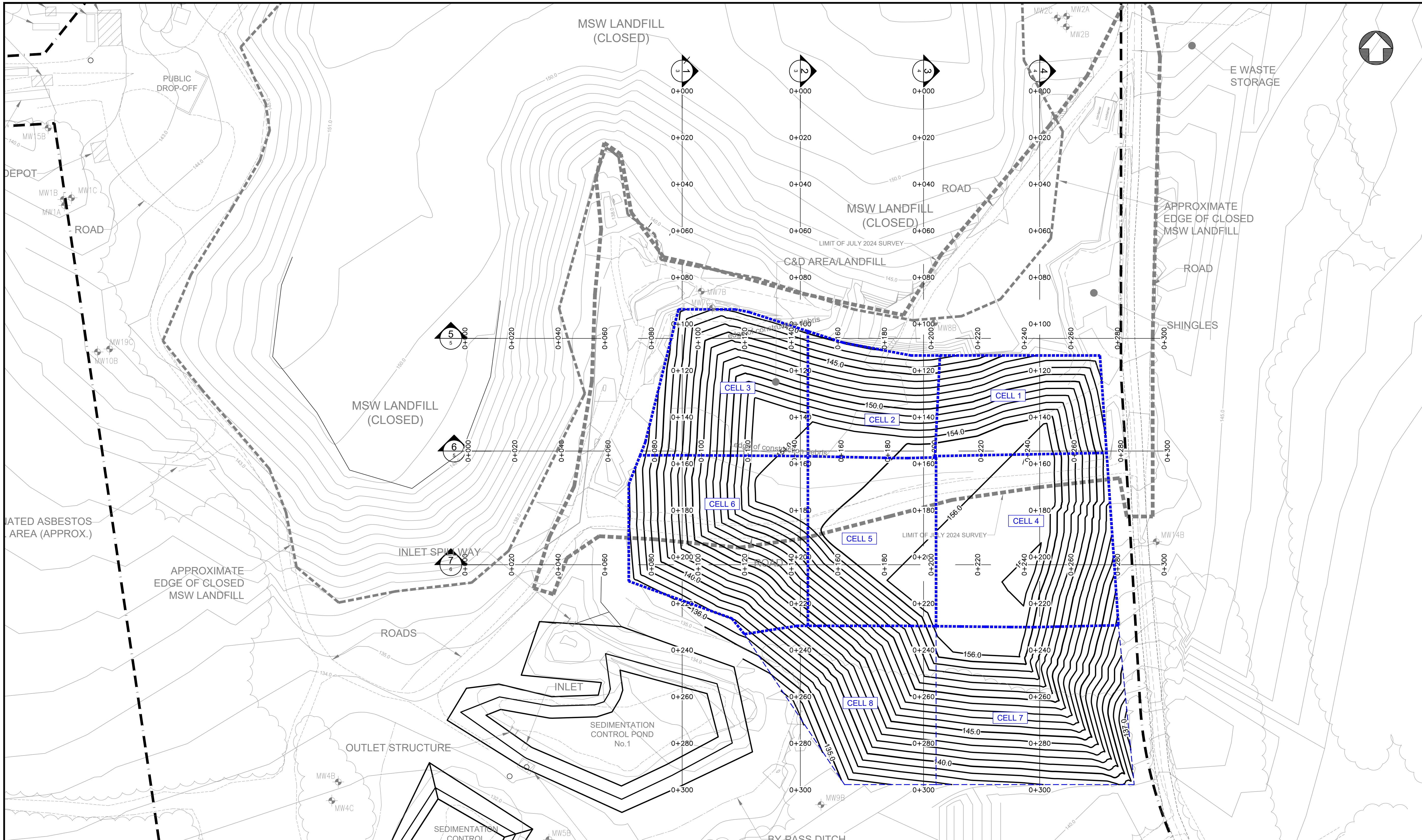
In August 2024, Gallant Land Surveyors Incorporated (Gallant Surveyors) conducted a topographic survey of the C&D landfill. The topographic survey data was analyzed in conjunction with the assumed top of waste and top of liner boundary conditions mentioned above. The analysis determined the following:

- **Total Volume of Airspace Consumed:** The total volume of airspace consumed to date by C&D waste in Cells 1, 2 and 3 is approximately 61,814 m^3, with a density of 617 kg/m^3 (38,135 tonnes of waste placed divided by 61,814 m^3 of airspace consumed); and
- **Remaining Airspace:** There is approximately 17,667 m^3 of remaining airspace collectively in Cells 1, 2 and 3 based on the cell design volumes. However, there is currently an additional 16,197 m^3 of waste that has been placed beyond the footprint these cells (primarily within the conceptual layout of Cells 4, 5 and 6. When accounting for this excess volume, the remaining airspace in Cells 1, 2 and 3 is approximately 1,470 m^3. Although theoretically, this waste should be relocated to fit within the footprint of Cells 1, 2 and 3, Dillon understands that this is impractical. Therefore, this volume is accounted for in the preliminary design of the landfill expansion Cell 4 discussed in **Section 5.1**.

The volume of waste consumed, and the remaining airspace are illustrated in **Figure 3** to **Figure 6**.

Assuming a constant waste density of 617 kg/m^3, the annual waste placement of 3,300 tonnes per year correlates to an annual airspace consumption of approximately 5,400 m^3 per year. Based on this consumption rate, the estimated remaining site life of the C&D landfill is:

- **With Relocating Waste Beyond the Footprint of Cells 1, 2 and 3:** Approximately 3 months; and
- **Without Relocating Waste Beyond the Footprint of Cells 1, 2 and 3:** Approximately 3.5 years.



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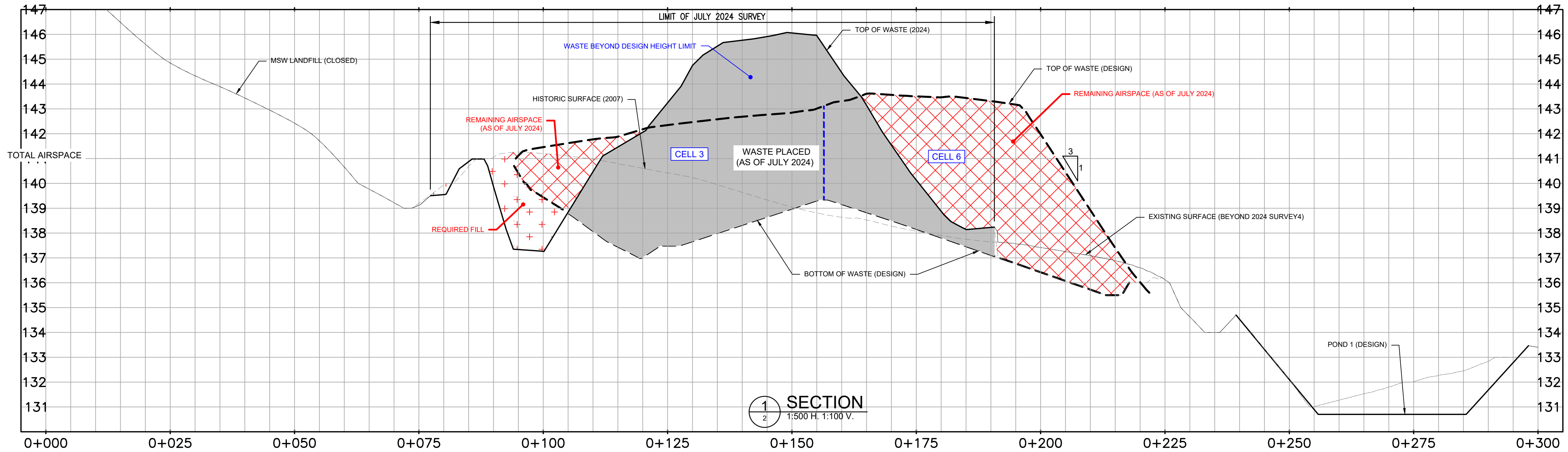
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

DESIGN TOP OF WASTE

PROJECT NO. 24-8663
SHEET NO. 2

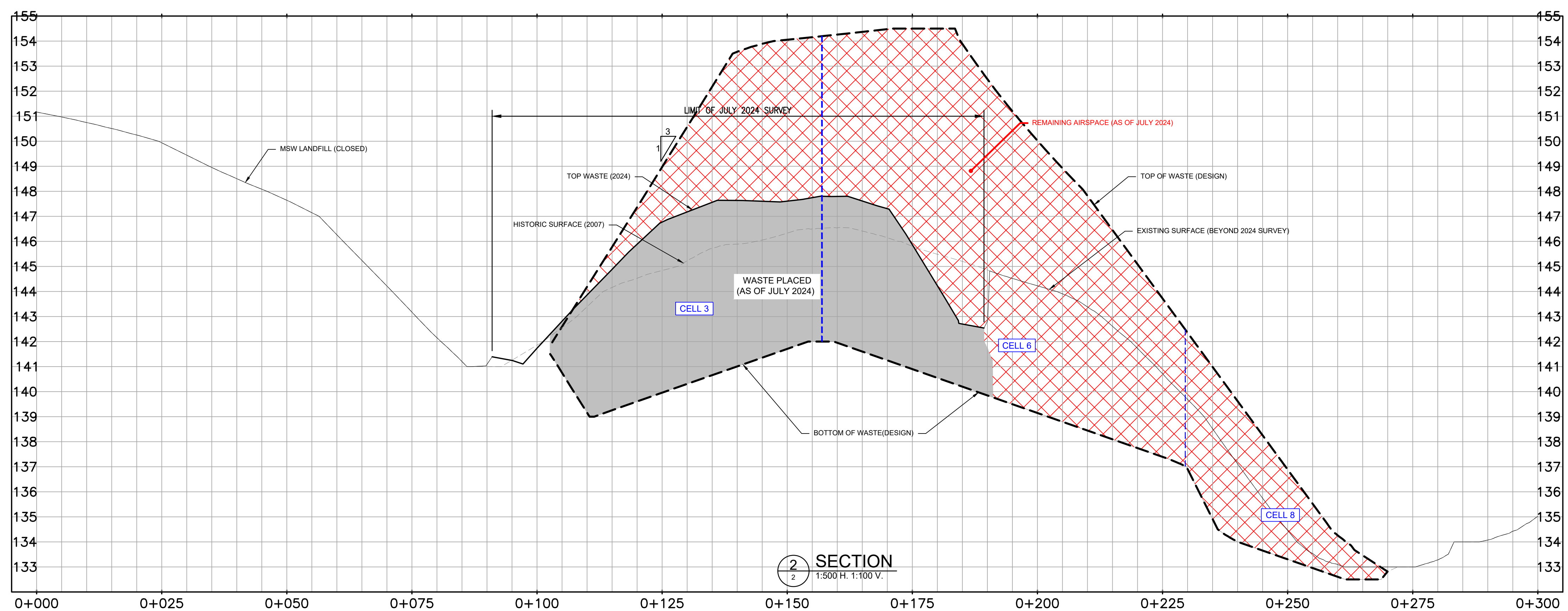


CELL	TOTAL DESIGN CAPACITY (m^3)	VOLUME PLACED INSIDE CELL (m^3) *	VOLUME PLACED OUTSIDE CELL (m^3) *	AIRSPACE REMAINING INSIDE CELLS (m^3) *
1	17,135	10,630		6,505
2	19,320	15,527		3,793
3	28,829	19,460	1000	8,369
4	55,243	2,408		52,835
5	51,369	5,582		45,787
6	35,747	8,207		26,699
7	48,986	0		48,986
8	32,024	0		32,024
TOTAL	**288,653**	**61,814**		**225,998**

SHINGLES

Volume: * 29,670 m^3

*** – VOLUMES AS OF JULY 2024**



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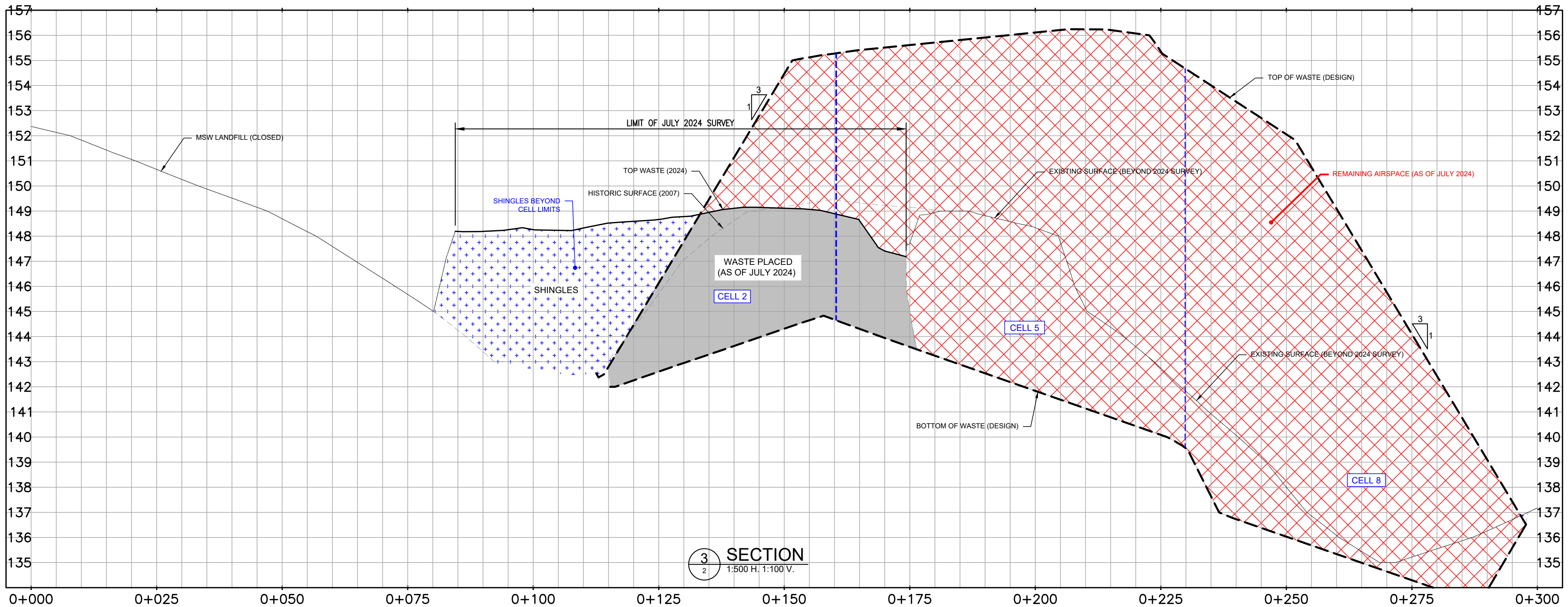
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTIONS 1 AND 2

PROJECT NO. 24-8663

SHEET NO. 3



3 SECTION
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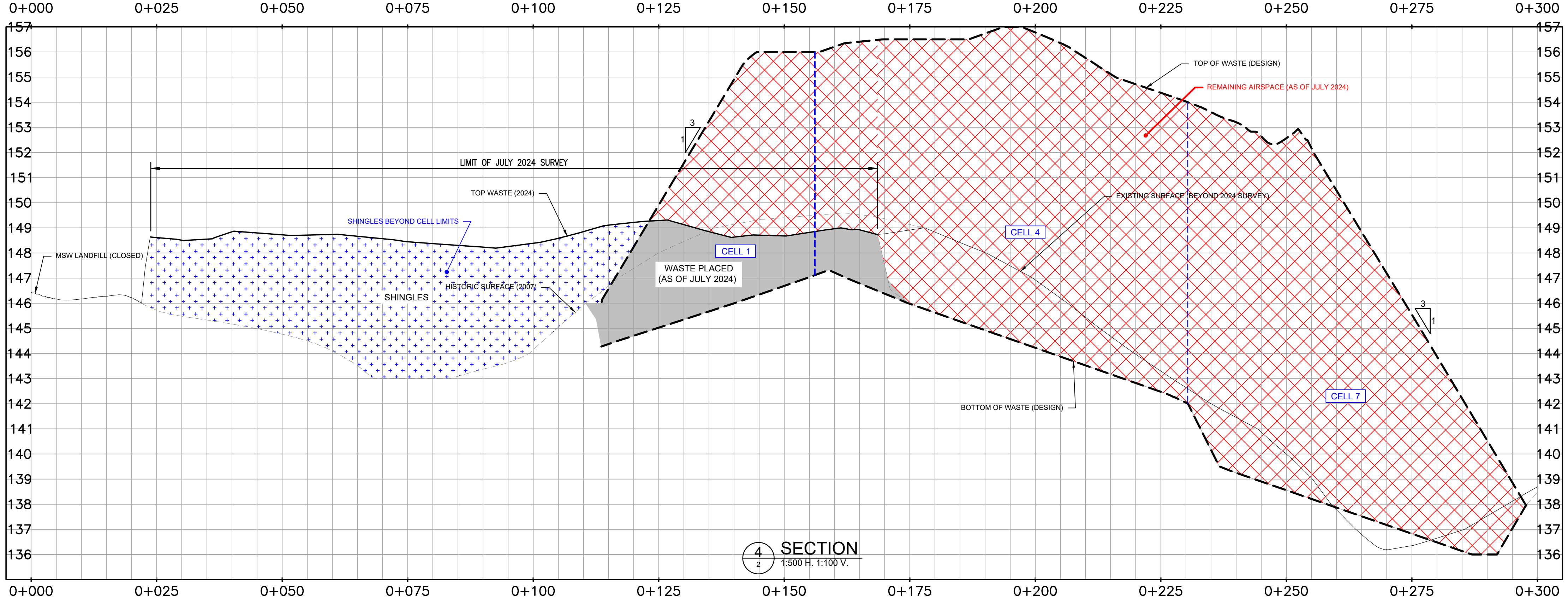

4 SECTION
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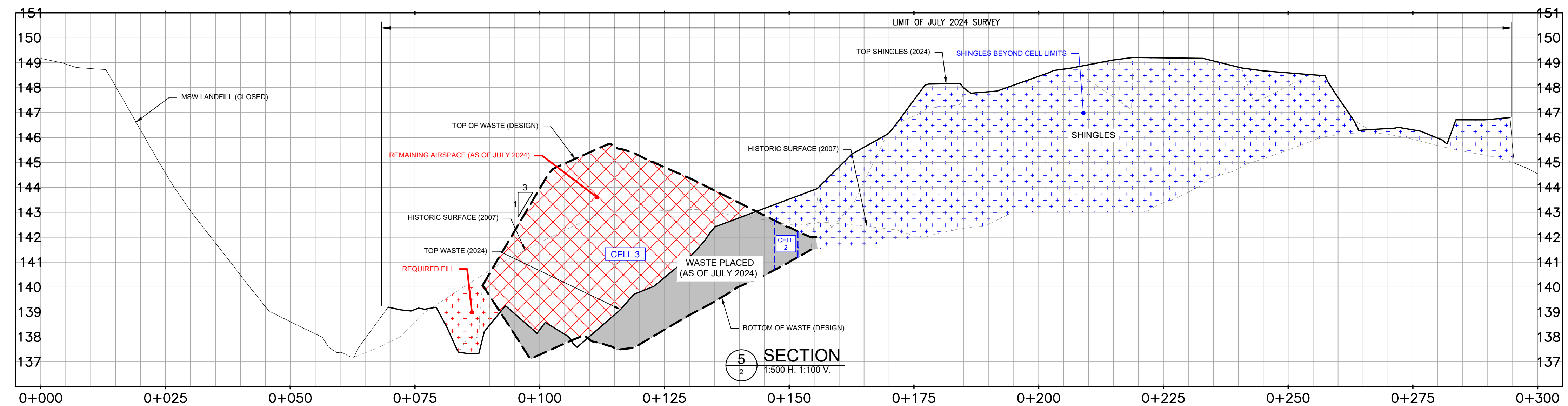
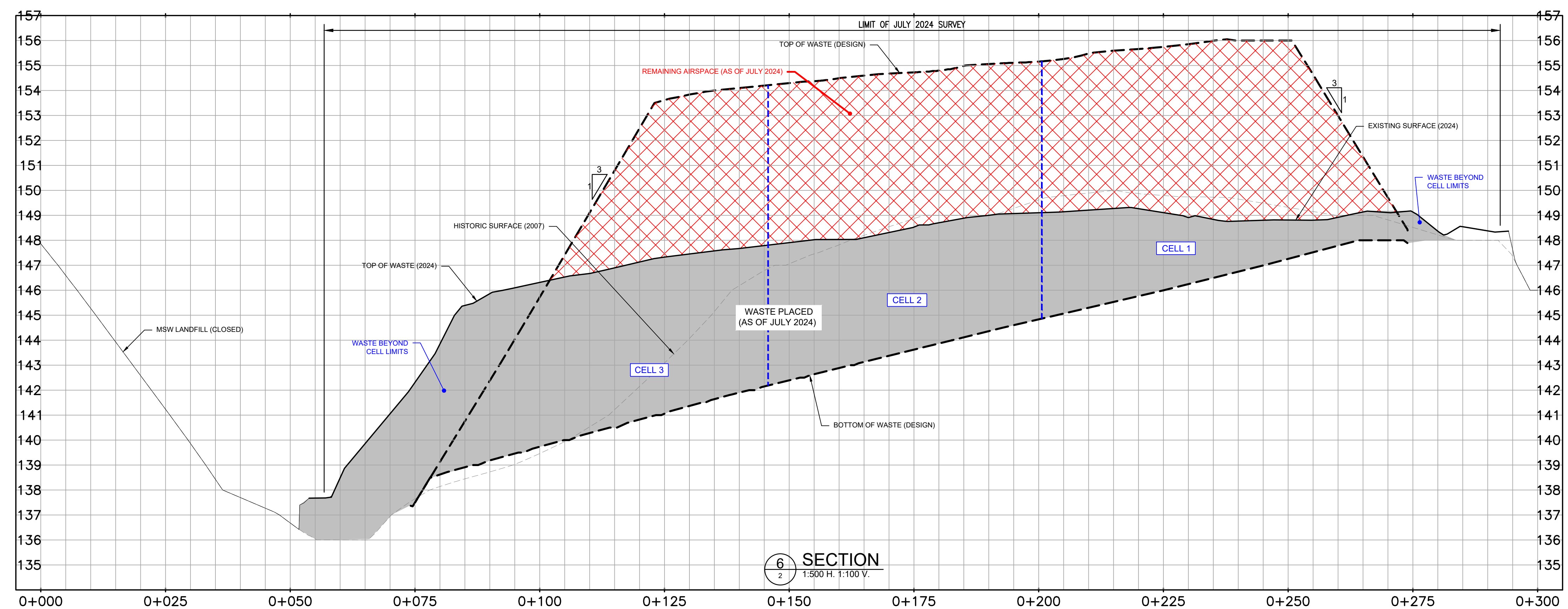
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTIONS 3 AND 4

PROJECT NO. 24-8663

SHEET NO. 4





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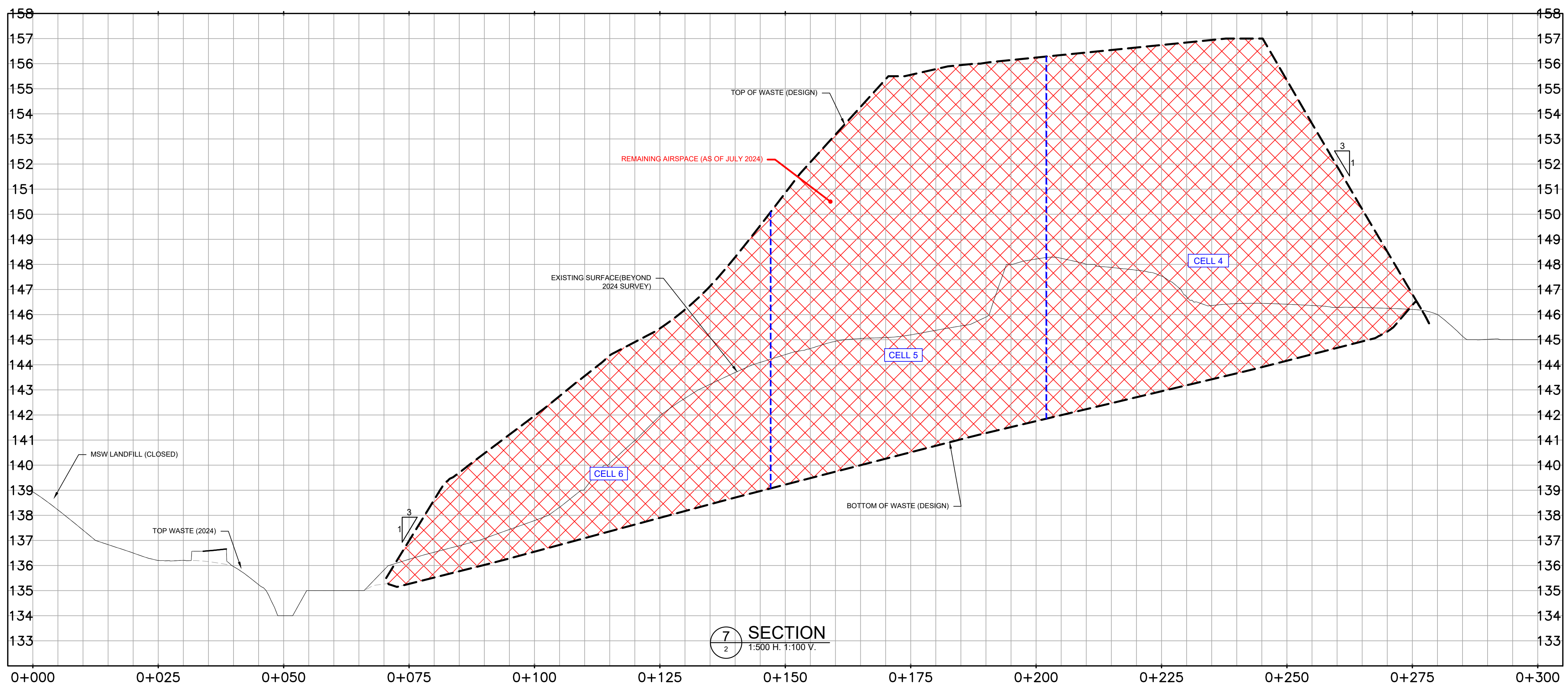
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROJECT NO. 24-8663

SECTIONS 5 AND 6

SHEET NO. 5



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MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROJECT NO. 24-8663

SECTION 7

SHEET NO. **6**

5.0 Cell 4 Preliminary Design Overview

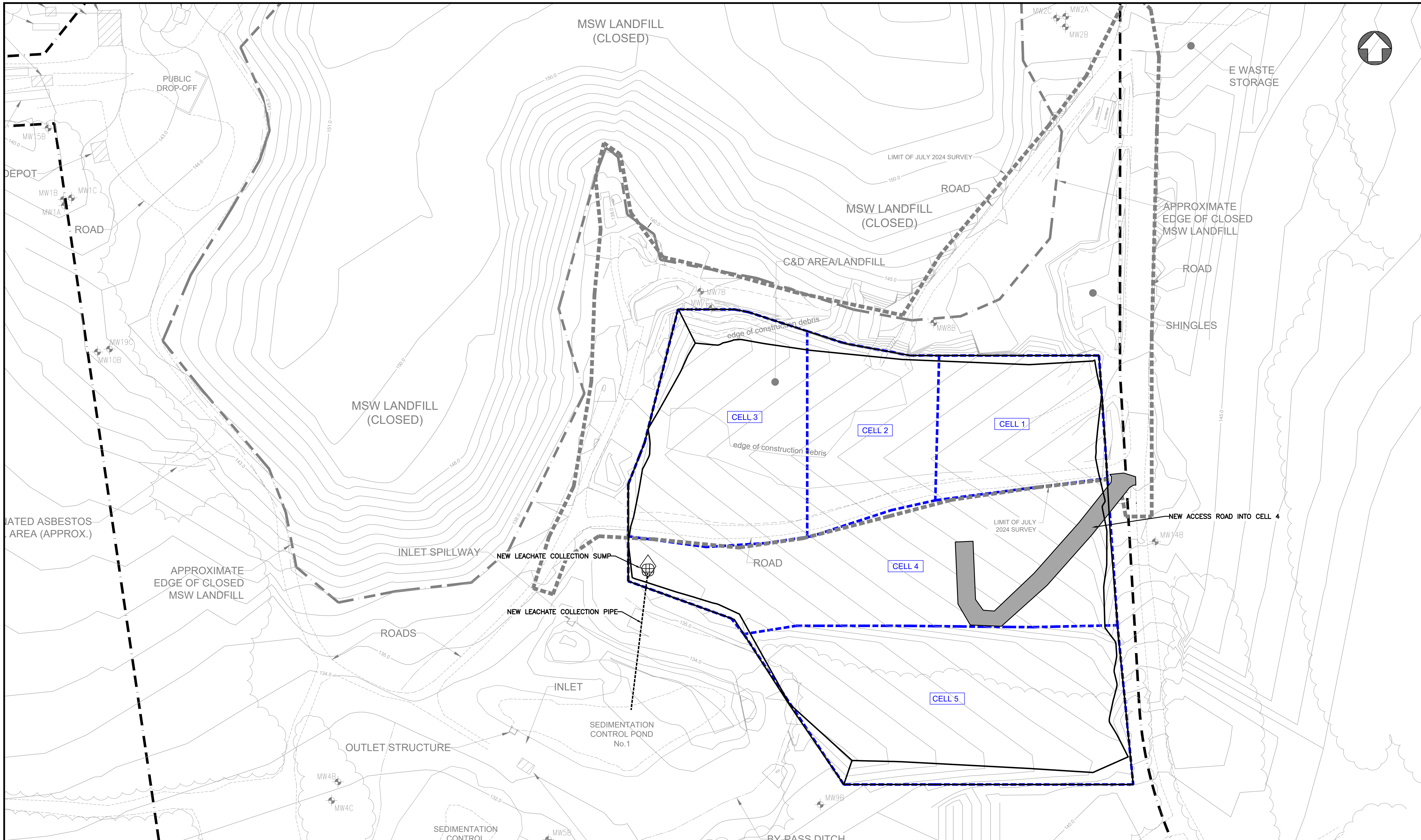
This section provides an overview of the design considerations and strategies for the expansion of the C&D landfill. The conceptual design encompasses features and components to manage surface water runoff, collect generated leachate, and comply with NSECC's Guidelines.

5.1 Horizontal Expansion

The conceptual design of the proposed horizontal expansion consists of an additional two cells, Cell 4 and Cell 5, along with the required infrastructure (cell access road and leachate collection), as illustrated in **Figure 7** on the following page. This layout differs from Dillon's original 2005 design, which comprised Cells 1 to 8. The original design was altered because waste has already been placed in the footprint of the previously proposed Cells 4, 5 and 6. The proposed conceptual design of building fewer, larger cells versus multiple smaller cells is based on the following considerations:

- **Financial Economies of Scale** – Larger landfill cells can benefit from economies of scale with respect to design and construction costs. The cost per unit of waste disposed of can be lower because the fixed costs (such as design, permitting, and construction) are spread over a smaller amount of projects and a larger volume of waste;
- **Reduced Operational Complexity** – Managing larger cells can be simpler than managing multiple smaller cells. This can lead to more efficient operations, reduced administrative overhead, and fewer potential logistical challenges;
- **Improved Resource Utilization** – Larger cells can make more efficient use of resources such as liners and leachate collection systems. These systems can be more effectively designed and implemented on a larger scale with less future connections and re-work needed;
- **Extended Lifespan** – Larger cells could have a longer operational lifespan before it reaches capacity, reducing the frequency of constructing new cells. This can lead to long-term planning and stability in landfill operations;
- **Regulatory Compliance** – Larger cells can be designed to meet regulatory requirements more efficiently. For example, the design and implementation of environmental protection measures can be more robust and comprehensive during the construction of a larger cell; and
- **Reduced Construction Disruption** – Building larger cells can minimize the disruption caused by construction activities. Multiple smaller cells would require multiple construction efforts, which can be disruptive to ongoing landfill operations.

The proposed horizontal cell construction aims to optimize the landfill's operational efficiency, cost-effectiveness, and environmental compliance. Acknowledging the cash flow implications of larger construction projects, Dillon's preliminary design layout includes two larger cells in an effort to balance the perceived benefits with the trade-off of larger capital projects.



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MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROPOSED EXPANSION LAYOUT

PROJECT NO. 24-8663

SHEET NO. 7

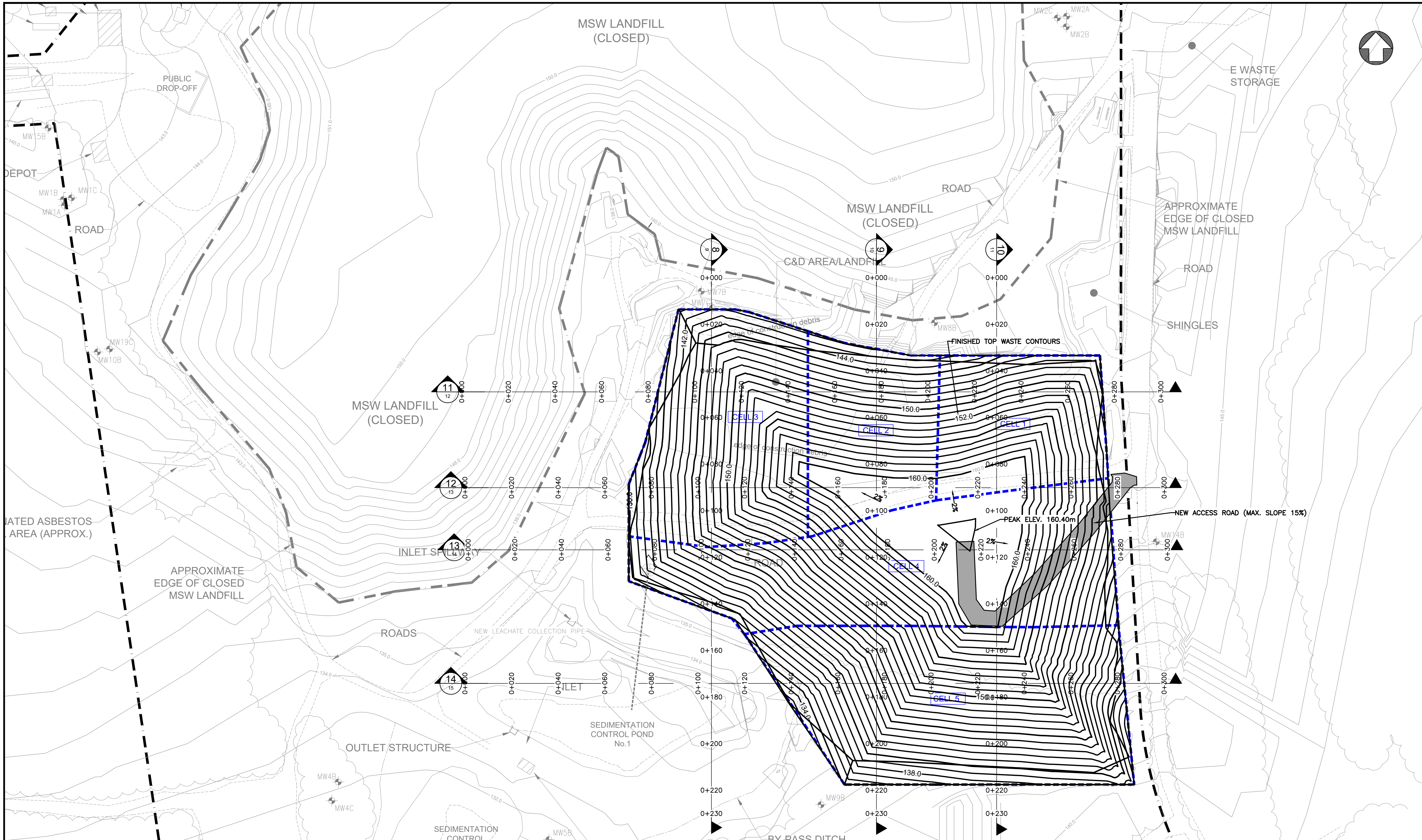
5.2 Vertical Expansion

In addition to the horizontal expansion, Dillon has also assessed the viability of increasing the final design elevation for the landfill. The figures referenced in this section (**Figure 8** to **Figure 15**) are meant to be read in conjunction with this text and are provided on the succeeding pages for reference.

The additional key considerations for vertical expansion include:

- **Structural Integrity**: Stability of the landfill is vital. Engineering measures to maintain the integrity of the landfill as the height increases need to be incorporated into the design;
- **Slope Stability**: Proper slope design is crucial to prevent landslides and ensure safe operations;
- **Leachate Management**: As the landfill height increases, the leachate collection system must also be more robust to handle the additional loading; and
- **Surface Water Management**: Proper surface water management is essential to prevent erosion, sediment transport, and to manage surface water runoff. Measures such as berms, drainage channels, and retention ponds to control surface water need to be incorporated into the design.

The new design top of waste for a potential vertical expansion of the C&D landfill is illustrated in **Figure 8**. The design includes raising the top of waste by approximately 5 m, resulting in a new top of waste elevation of approximately 160 m. The proposed new top of waste assumes 3H:1V (horizontal:vertical) side slopes and is limited by a top of waste pile that provides an area of approximately 50 m by 50 m of slope relief for operational and (future) cap construction considerations. The additional airspace gained from the vertical expansion is illustrated in **Figure 9** to **Figure 15**.



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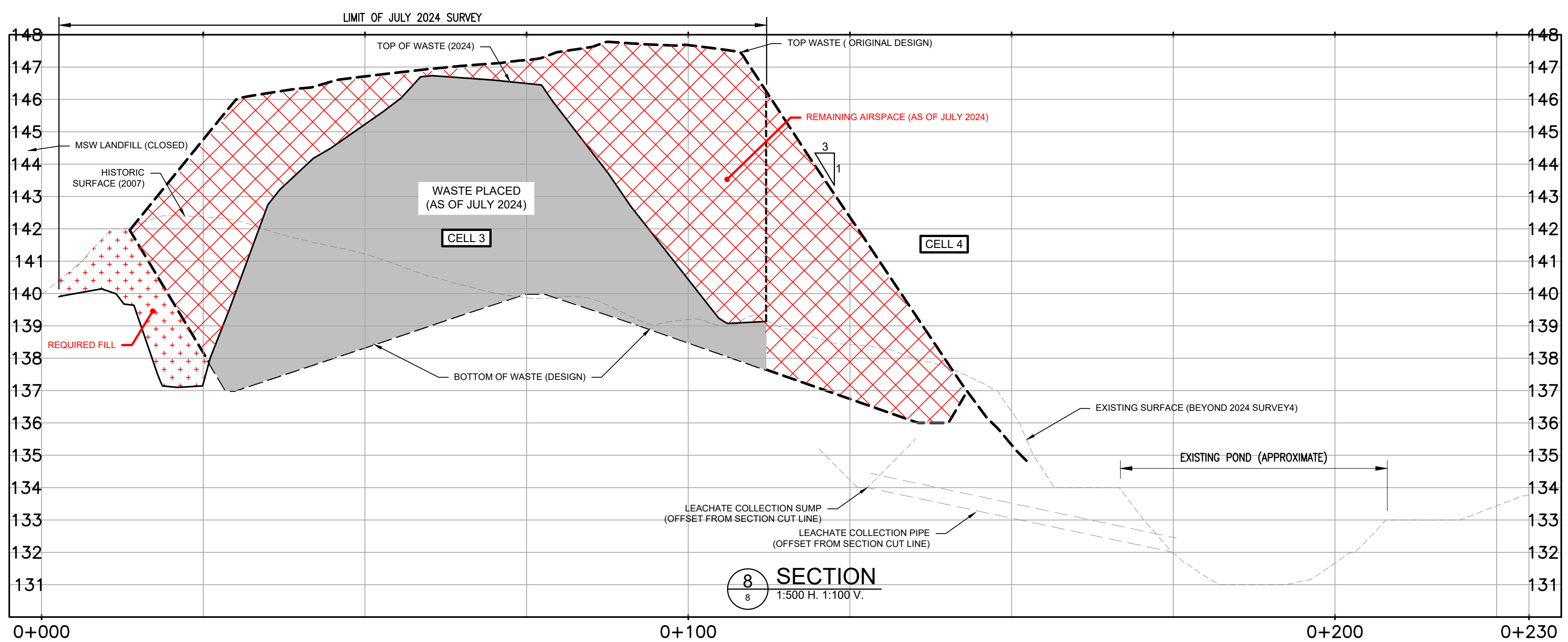
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

NEW DESIGN TOP OF WASTE

PROJECT NO. 24-8663

SHEET NO. 8



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SECTION
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CELL	TOTAL DESIGN CAPACITY (EXISTING) m^3	VOLUME PLACED INSIDE CELLS (EXISTING) m^3 *	VOLUME PLACED OUTSIDE CELLS (EXISTING) m^3 *	AIRSPACE REMAINING INSIDE CELLS (EXISTING) m^3 *	AIRSPACE EXPANSION INSIDE CELLS (PROPOSED) m^3 *
1	26,652	13,203		13,449	3.345
2	37,077	20,983		16,094	6,673
3	52,489	27,628	1000	23,861	2,090
4	91,067	0		91,067	11.670
5	81,368	0		81,368	592
TOTAL	**288,653**	**61,814**		**225,839**	**24,370**
			TOTAL	**250,209 (AIRSPACE REMAINING)**	

SHINGLES

Volume: * 29,670 m^3

* – VOLUMES AS OF JULY 2024

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1	DRAFT	2024/10/24	R.A.

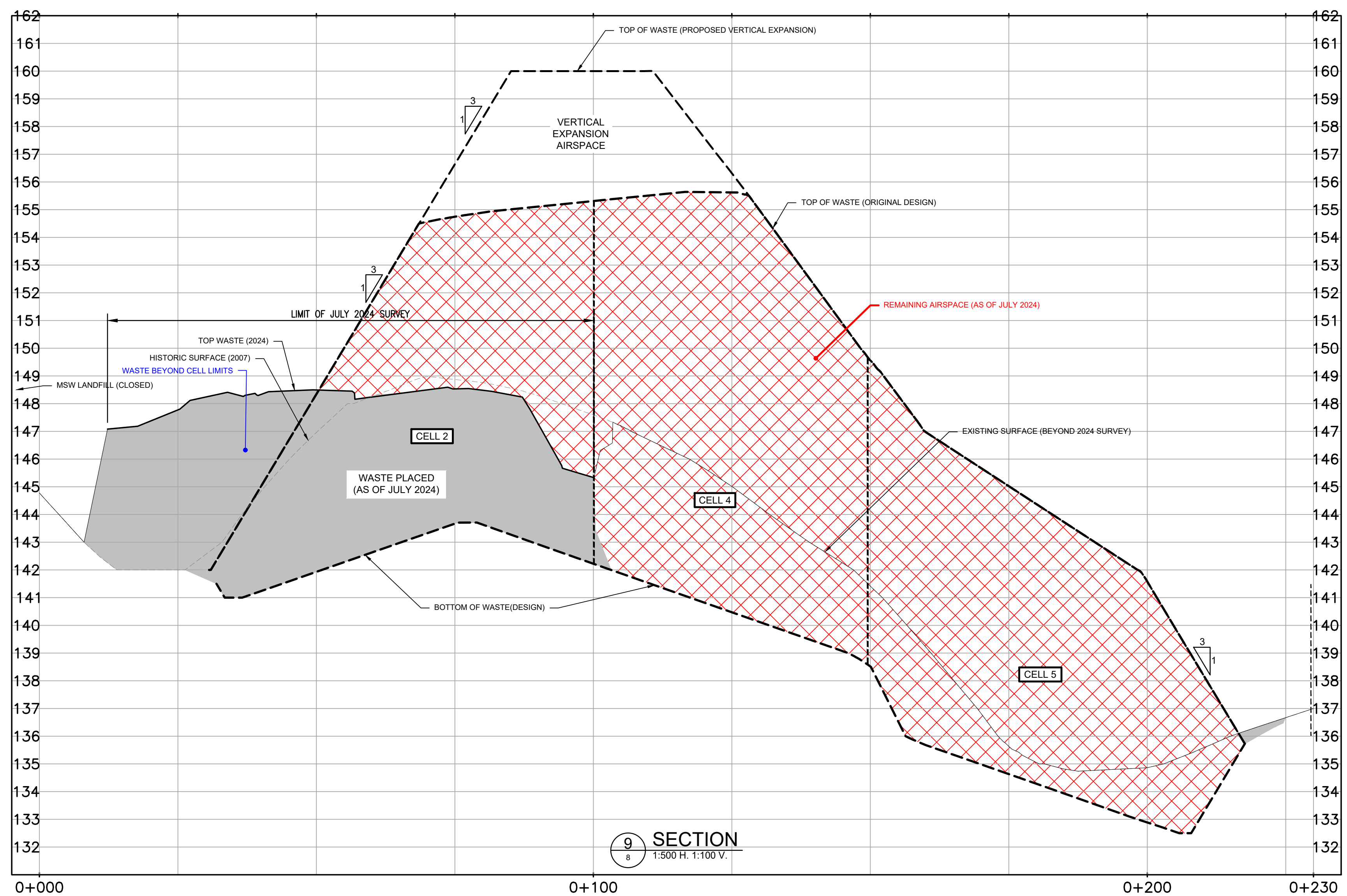
DESIGN R.A. | REVIEWED BY R.A.
DRAWN N.B. | CHECKED BY S.T.K.
DATE OCTOBER 2024
SCALE AS NOTED

MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTION 8

PROJECT NO. **24-8663**

SHEET NO. **9**



9
8
SECTION
1:500 H. 1:100 V.

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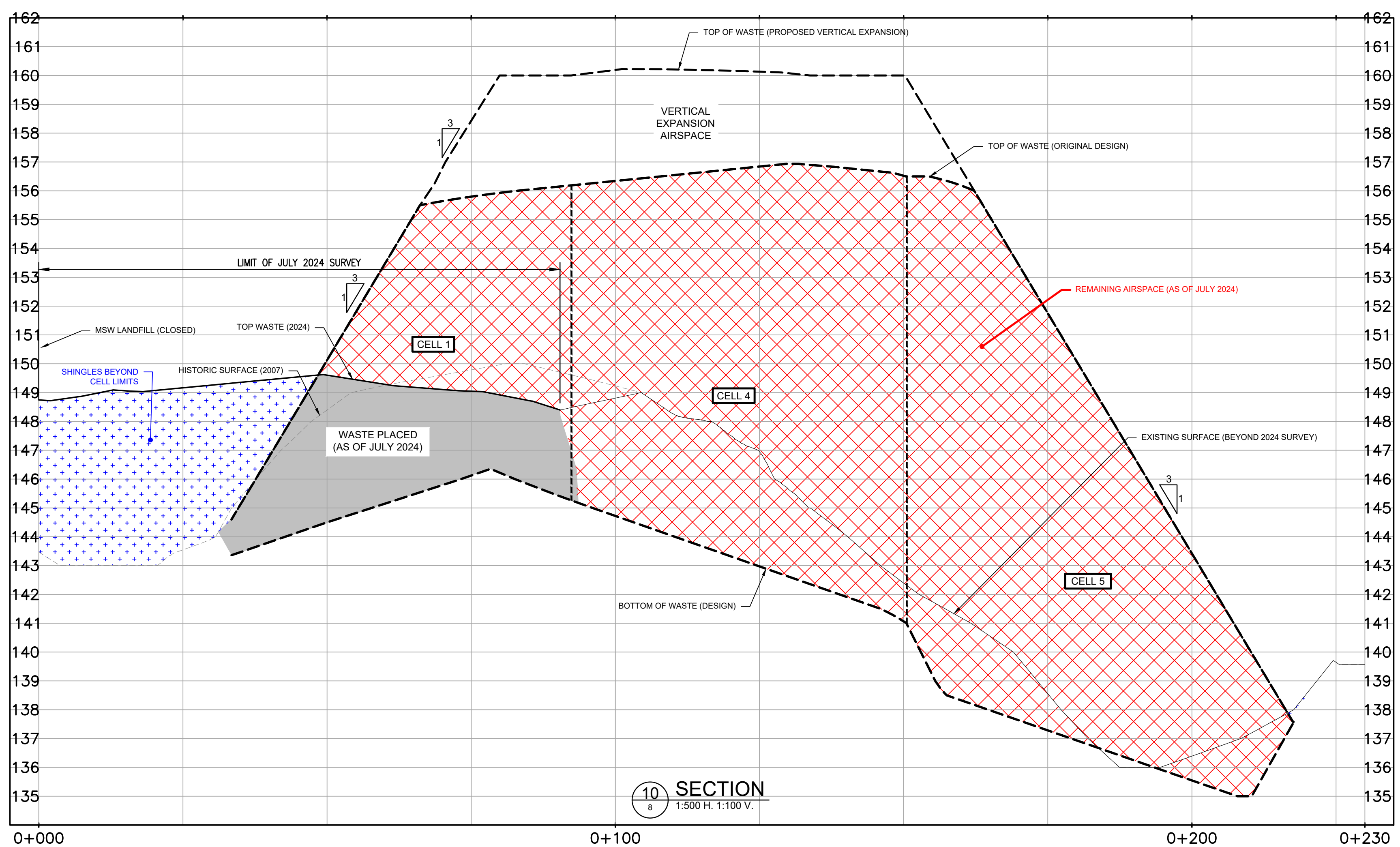
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROJECT NO. 24-8663

SECTION 9

SHEET NO. **10**



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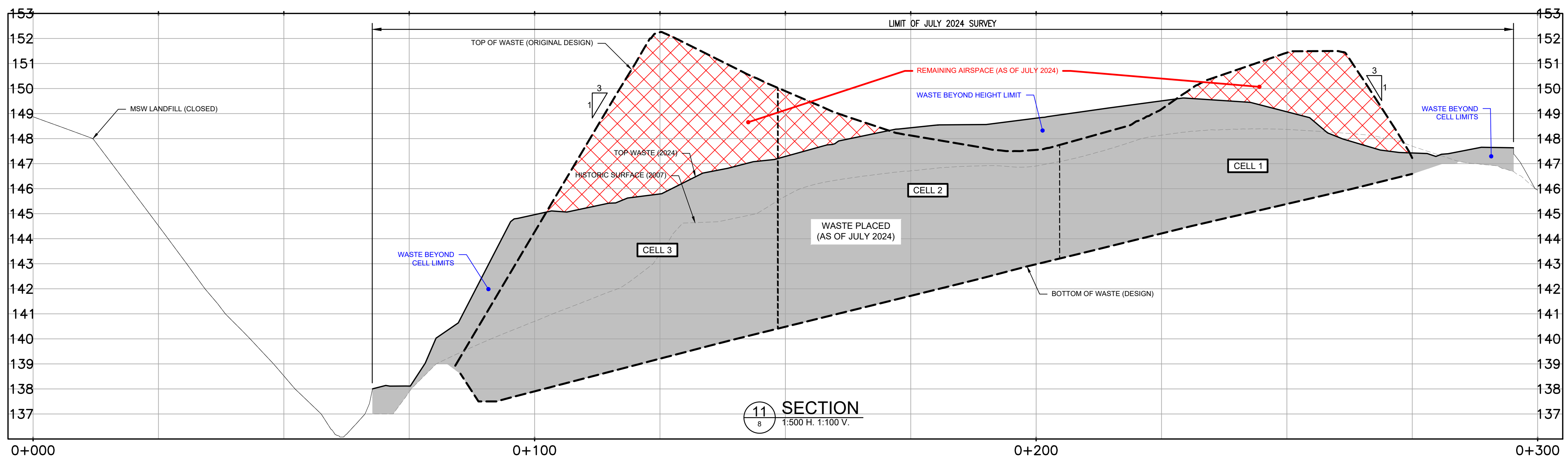
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTION 10

PROJECT NO. 24-8663

SHEET NO. 11



11
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SECTION
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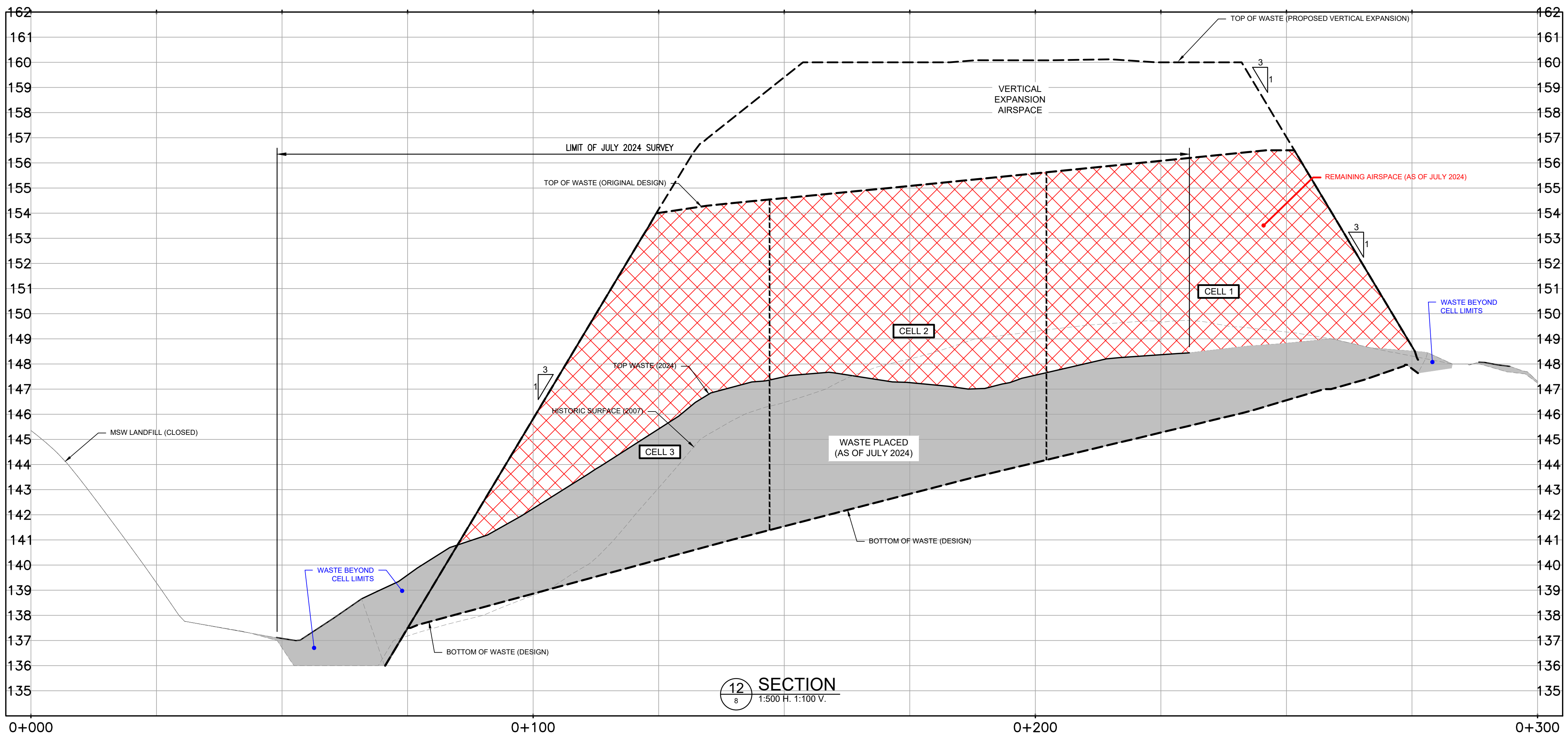
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

PROJECT NO. 24-8663

SECTION 11

SHEET NO. **12**



12 / 8 SECTION
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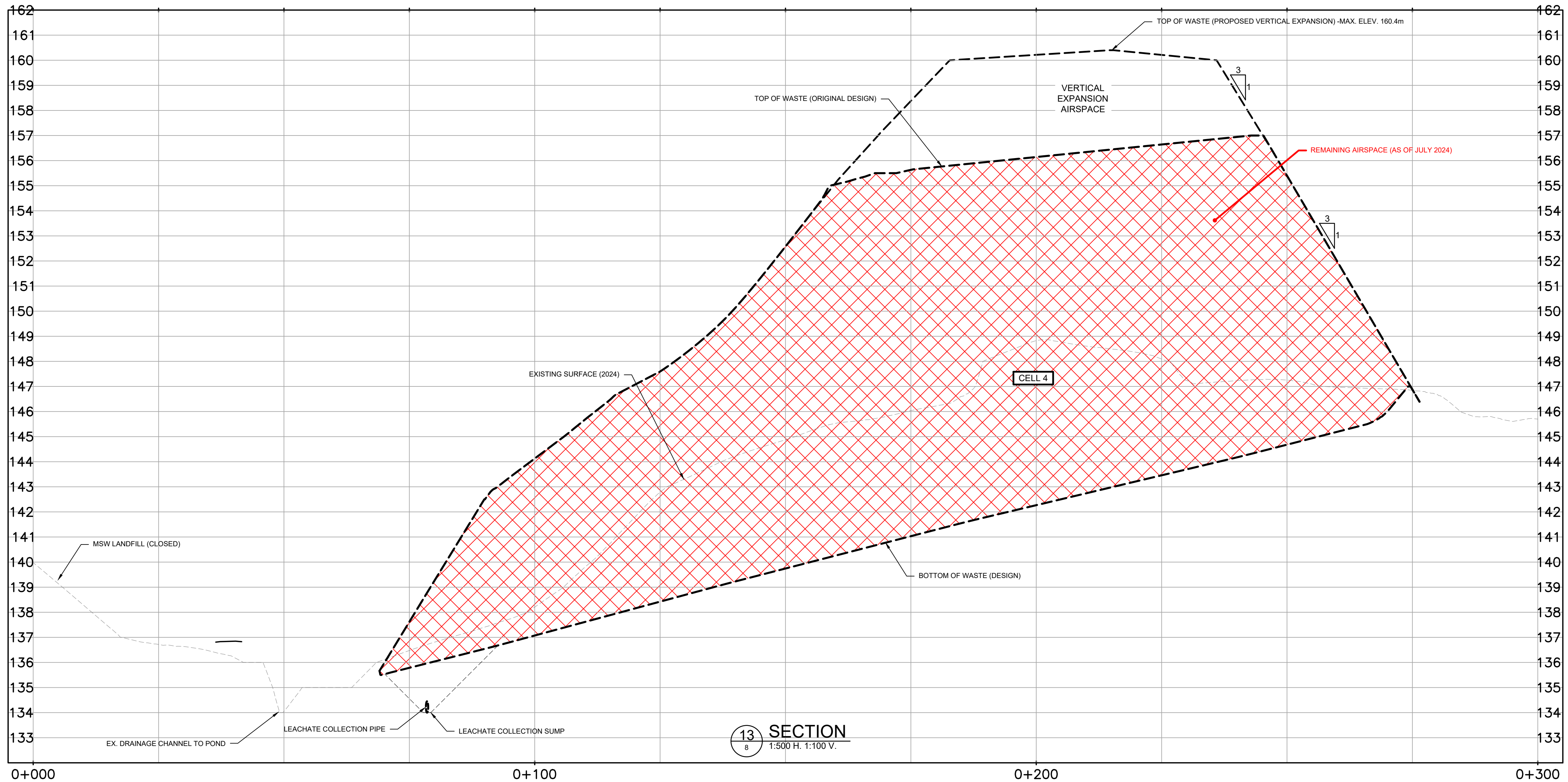
MUNICIPALITY OF EAST HANTS
CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTION 12

PROJECT NO. 24-8663
SHEET NO. 13



13
8
SECTION
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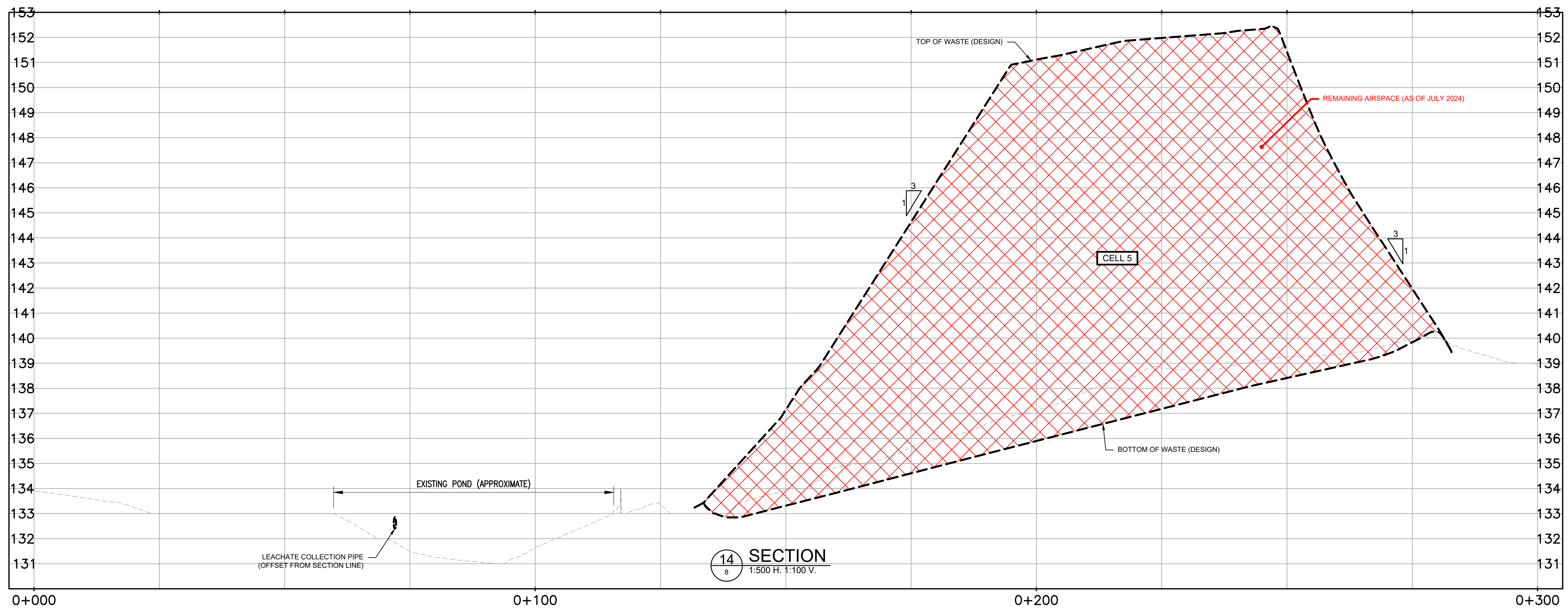
SECTION 13

PROJECT NO. 24-8663

SHEET NO. 14



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CONSTRUCTION & DEMOLITION CELL ANALYSIS

SECTION 14

PROJECT NO. 24-8663

SHEET NO. 15

5.3 Estimated Site Life of Proposed Horizontal and Vertical Expansion

Using the same assumptions mentioned in **Section 4.0** – a constant waste density of 617 kg/m^3 and an annual waste placement rate of 3,300 tonnes per year – it is estimated that the remaining site life of the C&D landfill following both the proposed horizontal and vertical expansion is approximately 47 years. More specifically, the site life of Cells 1,2, and 3 following the expansion is approximately 12 years. Once developed, Cell 4 will have an approximate site life of 19 years and Cell 5 will have an approximate site life of 15 years.

This estimate considers the additional airspace gained from both the horizontal expansion (Cells 4 and 5) and the vertical expansion, which raises the top of waste by approximately 5 m. The combined effect of these expansions significantly extends the operational lifespan of the landfill so that it can continue to serve the C&D waste management needs of the MEH for several decades.

The extended site life offers several advantages:

- **Long-Term Planning**: With an estimated site life of 47 years, the MEH can engage in long-term planning and resource allocation, ensuring that waste management strategies are sustainable and cost-effective;
- **Reduced Frequency of New Cell Construction**: The extended lifespan reduces the need for frequent construction of new cells, minimizing disruption to landfill operations and reducing construction-related costs;
- **Enhanced Operational Stability**: A longer site life provides operational stability, allowing for more consistent and predictable waste management practices; and
- **Environmental Benefits**: By maximizing the use of existing landfill space, the need for additional land acquisition and disturbance is minimized, preserving surrounding ecosystems and reducing the environmental footprint of the landfill.

It is important to note that this estimated site life is based on current waste generation rates and density assumptions. Any significant changes in waste generation patterns, composition, or compaction practices could impact the actual site life. Regular monitoring and periodic reassessments will be essential to ensure that the landfill continues to operate efficiently and in compliance with regulatory requirements.

Population growth factors significantly influence the lifespan of a landfill by affecting the volume of waste generated and subsequently disposed of at the facility. The following section incorporates the potential impact of population growth factors into the estimated site life of the landfill.

5.4 Population Growth Scenarios

Three population growth scenarios were used to provide a more comprehensive analysis of the potential variability in the estimated site life of the C&D landfill. Statistics Canada's *Census of Population* data from the three most recent censuses (2011, 2026, and 2021) indicated that the MEH's population grew 6.0% over a 5-year period, or a 1.2% population increase annually. Low and high population growth percentages were determined based on an assumed 4% decrease or increase from the maintained census population growth rate of 6%, respectively, as presented below in **Table 2**.

Table 2 – Population Growth Scenarios

Population Growth Scenario	Population Increase (5-Year Period)	Population Increase (Annual)
Low	2%	0.4%
Maintained	6%	1.2%
High	10%	2%

Using each of the annual population increases, along with the assumption that the amount of C&D waste generated per person remains constant (approximately 142 kg/person), the population and annual tonnages of C&D waste were projected. A snapshot of this data (averaged for each scenario over a 25-year forecast window) is presented below in **Table 3**.

Table 3 – Landfill Site Life based on Population Growth Scenarios

Population Growth Scenario	Average Population	Average Annual Tonnage of C&D Waste	Cells 1,2,3 Site Life (Years)	Cell 4 Site Life (Years)	Cell 5 Site Life (Years)	Total Site Life (Years)
Low	24,414	3,477	11	18	15	**44**
Maintained	27,826	3,963	10	16	13	**39**
High	31,801	4,530	9	14	11	**34**

These projections illustrate how different population growth rates can influence the landfill's site life:

- **Low Growth Scenario**: With a low population growth rate of 0.4% annually, the average annual tonnage of C&D waste is projected to be 3,477 tonnes. Under this scenario, the estimated site life of the landfill is approximately 44 years. More specifically, Cells 1,2, and 3 have an approximate site life of 11 years, Cell 4 has an approximate site life of 18 years, and Cell 5 has an approximate site life of 15 years;

- **Maintained Growth Scenario**: With a maintained population growth rate of 1.2% annually, the average annual tonnage of C&D waste is projected to be 3,963 tonnes. Under this scenario, the estimated site life of the landfill is approximately 39 years. More specifically, Cells 1,2, and 3 have an approximate site life of 10 years, Cell 4 has an approximate site life of 16 years, and Cell 5 has an approximate site life of 13 years; and
- **High Growth Scenario**: With a high population growth rate of 2% annually, the average annual tonnage of C&D waste is projected to be 4,530 tonnes. Under this scenario, the estimated site life of the landfill is approximately 34 years. More specifically, Cells 1,2, and 3 have an approximate site life of 9 years, Cell 4 has an approximate site life of 14 years, and Cell 5 has an approximate site life of 11 years.

These scenarios provide valuable insights into how population growth can impact the landfill's capacity and operational planning. Regular monitoring and reassessments will be essential to ensure that the landfill continues to meet the waste management needs of the MEH while also adhering to regulatory requirements and environmental standards as they (may) change in the future.

6.0 Approval Requirements

Prior to receiving NSECC Approval to construct or expand a C&D landfill, the required documentation must be prepared and submitted to NSECC in accordance with the updated Guidelines. The typical documentation required to support the application package includes, but is not necessarily limited to, the following:

- **Liner System:** Detailed design and specifications of the landfill liner system to provide adequate containment of leachate and protection of groundwater;
- **Separation Distances:** Documentation demonstrating compliance with the required separation distances from sensitive receptors, such as water bodies, residential areas, and other environmentally sensitive areas;
- **Topographic Survey:** A comprehensive topographic survey of the site to provide accurate elevation data and inform the design of the landfill;
- **Geotechnical Investigation:** A thorough geotechnical investigation to assess soil and subsurface conditions, ensuring the structural stability of the landfill;
- **Surface Water Run-Off Control:** Design and specifications for surface water run-off control measures to reduce erosion and manage stormwater;
- **Leachate Management:** Detailed plans for the collection and management of leachate to prevent potential contamination of soil and water resources; and
- **Detailed Engineering Drawings and Technical Specifications:** Comprehensive engineering drawings and technical specifications for the construction and operation of the landfill.

The following are also typically necessary, however NSECC may make exceptions, provided these documents were previously provided to the Department.

- **Archaeological Resource Impact Assessment:** An assessment to identify and mitigate any potential impacts on archaeological resources within the proposed expansion area;
- **Natural Habitat and Biophysical Assessment:** An evaluation of the natural habitat and biophysical conditions of the site to assess potential environmental impacts and propose mitigation measures; and
- **Hydrogeological and Surface Water Assessment:** An assessment of groundwater and surface water conditions to evaluate potential impacts and design appropriate management measures.

Dillon has assumed these three studies are not required for construction of Cell 4 (within the previously approved C&D landfill footprint). The applicable requirements noted above are further described in the following subsections for reference. Public/community/Indigenous engagement or other items to address the social implications of expanding a landfill may also be required by NSECC.

6.1 Liner System

The Guidelines outlined by NSECC specify the minimum requirements for a soil liner system. As such, the liner system would consist of 1 m of a low permeability soil with a hydraulic conductivity $\leq 1.0 \times 10^{-6}$ cm/sec or an equivalent. The liner would be graded to allow for leachate generated from the landfill to be collected and directed towards a common discharge location. The bottom of the soil liner must also be a minimum of 1 m above the maximum seasonal high elevation of the groundwater table. Previously, the C&D waste material itself needed to be 1 m above the maximum seasonal high elevation of the groundwater table. Water table elevations must undergo hydrogeological monitoring for a one-year period, followed by review and acceptance by NSECC prior to construction. Dillon has assumed this information is already being gathered by the MEH through the site's current environmental monitoring program. As such, no additional costs for hydrogeological monitoring are included in the Opinion of Probable Costs provided in **Section 7.0**.

6.2 Separation Distances

Applications seeking Approval to construct or expand a C&D facility must include a letter confirming compliance with all relevant zoning regulations, planning restrictions and other applicable by-laws. Expansions of active sites must also meet the separation distances outlined in **Table 1** below.

Table 4 – Separation Distances

Feature	Horizontal Distance (m)
Watercourse (top of bank), wetland (boundary) or marine water body	30
Property line of C&D Facility (PID(s))	30
Municipal drinking water supply	See below
Foundation of any off-site structure used for commercial, industrial, or residential purpose	90
Off-site dug or drilled drinking water supply well (other than municipal drinking water supply)	90

Minimum separation distances for municipal drinking water supplies include being outside of the municipal drinking water supply's Source Water Protection Area and the boundary of any provincially designated Protected Water Area. These separation distances could be illustrated on a sheet within the detailed engineering drawings.

6.3 Topographic Survey

A survey of the proposed development area and access road would be required. The survey would include a topographic survey of the proposed expansion area (approximately 2 ha), identifying general undisturbed topography, roads, ditches, culverts, water features, treelines and general site features. Based on the survey, an updated base plan of the site would be developed. A comprehensive survey would need to be completed prior to (or as part of) progression of the detailed engineered drawings.

6.4 Geotechnical Investigation

A geotechnical investigation must be completed to support the proposed development at the subject property. It is anticipated that the geotechnical investigation would include the following:

- Initial site visit;
- Geotechnical investigation program and laboratory analysis; and
- Reporting.

An initial site visit would be undertaken to confirm the current site conditions and the approach for the proposed geotechnical investigation. It is anticipated that the geotechnical investigation would include test pitting and geotechnical personnel logging the conditions encountered, as well as collecting representative samples of the various soil layers. Geotechnical laboratory testing would be carried out on select samples to assess and confirm the engineering properties of the soils.

Based on the results of the investigation, a geotechnical report would be issued detailing the findings with respect to the subsurface conditions and providing recommendations regarding the landfill development.

6.5 Surface Water Run-Off Control

Surface water run-off control is crucial for environmental protection, regulatory compliance, and operational efficiency. For the expansion of Cells 4 and 5, it is assumed that the existing sedimentation ponds on site have the capacity to accommodate the additional surface water run-off, as the footprint of Cells 4 and 5 (formerly Cells 4, 5, 6, 7, and 8) were included in the original design completed in 2005.

If an additional sedimentation pond or expansion to the existing sedimentation pond would be required, it would be designed based on a 1:25 year 24-hour storm, using intensity duration curves from the area of the Municipality of East Hants. The amount and rate of runoff would be estimated using the Rational Method in sizing the ponds. The equation for the Rational Method is as follows:

$$Q = C \cdot i \cdot A$$

Where Q is the runoff rate (m^3/sec), C is the runoff coefficient, a factor reflecting watershed characteristics including topography, soil type, vegetation and land use, it is the precipitation intensity (mm/hr), and A is the area of the watershed area (ha). Surface water control features would be detailed in the engineering drawings and technical specifications.

6.6 Leachate Management

Leachate is defined as liquid that has contacted solid waste, generating primarily from precipitation, surface water, or groundwater. Leachate percolates through the landfill and infiltrates through the waste. Leachate must be managed due to potential environmental, health regulatory implications.

A desktop area development plan would allow for the estimation of annual leachate generation quantities for the proposed expansion area. This would include active cells, cells with temporary cover (soil or synthetic) and closed cells (at final elevation and capped).

Based on these estimates, leachate management infrastructure would be assessed for capacity/size to accommodate the estimated volumes. It is anticipated that the following infrastructure will be considered:

- Leachate collection gravity piping system, discharging to the existing sedimentation pond.

The quality of the facility's leachate must also be established to determine the type of leachate treatment required. Potential treatment options could potentially include on-site treatment or pumping and transfer of the leachate off-site for treatment. Currently, based on the recent experience of Dillon on related assignments, NSECC is defining leachate treatment/discharge obligations on a site-specific basis, with the potential for significant capital and operating cost implications depending on the determination of the applicable regional office. The leachate collection system would be detailed in the engineering drawings and specifications. Analytical data would be required before determination of the treatment requirements (if any). For the purposes of this assessment, Dillon has assumed that the existing sedimentation pond is sufficient treatment for collected leachate from Cells 4 and 5.

6.7 Detailed Engineering Drawings and Technical Specifications

Technical specifications would be prepared and conform to the National Master Specification (NMS), as well as the current edition of the Standard Specifications for Municipal Services as published by the Joint Committee on Contract Documents in association with the Nova Scotia Road Builders Association, Consulting Engineers of Nova Scotia, and Landscape Nova Scotia. Stamped electronic and hard copies of drawings would be prepared in Civil 3D. A schedule of quantities including a measurement and payment specification would be included in the Application for Approval package. The drawings would depict proposed works, existing features identified by the topographic survey, and existing infrastructure. A Class B cost estimate for the development of the site could be prepared for the MEH at this time.

7.0 Opinion of Probable Cost

A 'Class C' Opinion of Probable Cost presenting the estimated capital costs associated with the design, permitting, and construction of Cell 4 is presented below. **Table 5** details the estimated costs associated with design and approval, while the estimated construction costs are detailed in **Table 6**. Note that all costs are presented in 2024 dollars.

Table 5 – Opinion of Probable Cost for Detailed Design of Cell 4

Item	Quantity	Units	Unit Price	Budget
Topographic Survey	1	LS	$15,000	$15,000
Geotechnical Investigation	1	LS	$15,000	$15,000
Engineering Design, Approval, Tender and Construction Services	1	LS	$120,000	$120,000
			Estimated Price (Excluding HST)	**$150,000**

Table 6 – Opinion of Probable Cost for Cell 4 Construction

Item	Quantity	Units	Unit Price	Budget
Clearing & Grubbing	11,200	m^2	$5	$56,000
Excavation	38,330	m^3	$20	$766,600
Geotextile	9,500	m^2	$3	$28,500
Leachate Collection Layer (300 mm)	3,000	m^3	$15	$45,000
Leachate Collection Discharge Pipe	60	m	$425	$25,500
Perimeter Berm	300	m	$125	$37,500
Cell Access Road	130	m	$645	$83,850
Erosion & Sedimentation Control	1	LS	$25,000	$25,000
Materials Testing Allowance	1	LS	$15,000	$15,000
			Subtotal	$1,082,950
			Contingency (15% of Subtotal)	$162,443
			Total Estimated Price (Excluding HST)	**$1,245,393**

Dillon's total Class 'C' estimated opinion of probable costs for the detailed design and construction of Cell 4 is approximately **$1,400,000**.

Table 7 on the following page presents a potential timeline that the MEH could follow outlining the phases related to the landfill expansion project. Assuming MEH submits request for proposals in April 2025, the landfill could be open for use in early 2027.

Table 7 – Project Timeline

Time	Description
April 2025	MEH Issues RFP for Detailed Design & Engineering Services
May 2025 to August 2025	Detailed Design, Topographic Survey, Geotechnical Investigation
September 2025 to December 2025	NSECC Approval
January 2026 to March 2026	MEH Issues Tender for Construction Contract (Awarded Prior to May 2026)
May 2026 to October 2026	Project Construction
November/December 2026	Project Closeout & Final Approval
January/February 2027	Landfill Open for Use

8.0 Closing

Dillon would like to thank the MEH for the opportunity to collaborate on this project and trusts that the information contained in this report is sufficient for the MEH's needs at this time. Should the MEH have any further questions about this report, please contact Stuart King, P.Eng. by phone at 902-233-4873, or by email at sking@dillon.ca.